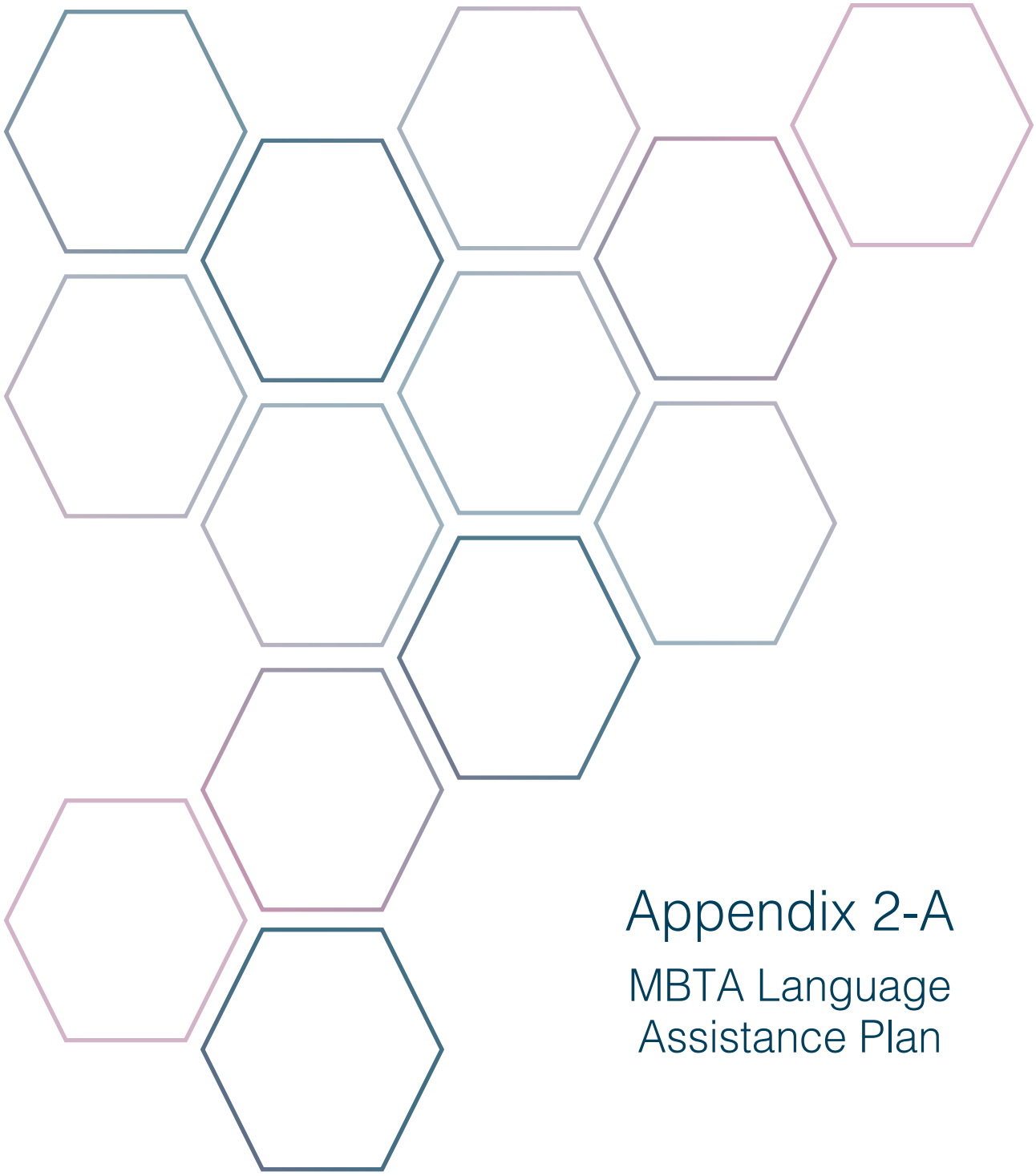

Appendix 2-A

MBTA Language Assistance Plan

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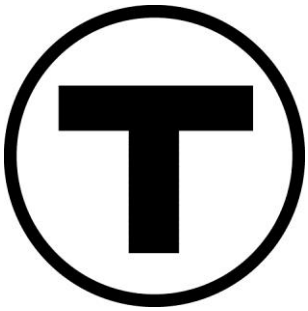
MASSACHUSETTS BAY TRANSPORTATION AUTHORITY



LANGUAGE ASSISTANCE PLAN:

PROVIDING ACCESS TO PROGRAMS AND SERVICES FOR PEOPLE WITH LIMITED ENGLISH PROFICIENCY

Revised August 2017

The purpose of the MBTA's Title VI Program is to ensure that no person shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance. Towards this end, the MBTA has developed policies and procedures to provide meaningful access to programs and services for people with limited English proficiency.

Meaningful access goes beyond offering translation and interpretative services to limited-English-proficient (LEP) riders. It also includes encouraging public input and engagement in MBTA projects, understanding community impacts, and recording and making available institutional knowledge gathered during those efforts.

This Language Assistance Plan is updated every three years to improve its policies in accordance with federal regulations and according to the changing needs of the region's diverse communities.

The MBTA adheres to the current Federal Transit Administration (FTA) definition of LEP individuals, which is as follows:

> Limited English Proficient (LEP) persons refers to persons for whom English is not their primary language and who have a limited ability to read, write, speak, or understand English. It includes people who reported to the US Census that they speak English less than very well, not well, or not at all.

The MBTA uses this definition, the latest available US Census American Community Survey (ACS), along with additional local information such as information from community-based organizations (CBOs), to update the Language Assistance Plan. The ACS includes the US Census defined groups of LEP individuals who indicate they speak English less than "very well."

The US Department of Transportation guidance outlines four factors that agencies should apply to the various kinds of contacts they have with the public to assess language needs and decide what reasonable steps they should take to ensure meaningful access for LEP persons:

1. **LEP Population Size**: The number or proportion of LEP persons likely to be served in our programs. This includes:
    a. How LEP persons interact with our programs, activities, and services;
    b. Identification of LEP communities and assessment of LEP persons from each language group to determine appropriate language services for each group;

c. The literacy skills of LEP populations in their native languages to determine whether translation of documents will be an effective practice; and

d. Whether LEP persons are underserved due to language barriers.

2. **Frequency of Contact:** The frequency with which LEP persons come into contact with our programs, activities, and services. This includes assessments of:

    a. MBTA service use

    b. Pass and ticket purchases through vending machines, outlets, websites, and over the phone

    c. Public meeting participation

    d. Customer service interactions

    e. Ridership surveys

    f. Operator surveys

3. **Importance:** The nature and importance of the program, activity, or service provided to people's lives. This is informed through:

    a. Feedback from LEP groups about effective means of providing meaningful information about services, programs, and public outreach

    b. Information obtained from public, facilitated meetings with LEP persons and stakeholders

    c. Analysis of surveys to determine the needs of LEP persons respective to different regions and communities

    d. Analysis of programs, activities, and services to ensure they are providing meaningful access to LEP persons

4. **Resources:** The resources available for LEP outreach and the costs associated with that outreach. This means addressing cost and resource issues by investigating:

    a. Technological advances

    b. Reasonable business practices

c. The sharing of language assistance materials and services among and between recipients, advocacy groups, LEP populations, and federal agencies

The first two of the four factors are used to identify individuals who need language assistance. The third factor determines what needs to be translated, and the fourth factor identifies translation resources and costs. The MBTA has followed FTA guidance in completing a four-factor analysis to identify and document the number and geographic distribution of potential LEP customers within the MBTA's 175-municipality service area and to evaluate the need for language assistance.

I. Identification of LEP individuals for whom language assistance may be needed

Factor 1: The Number and Proportion of Persons in the Service Population Who Are LEP

Quantitative Analysis

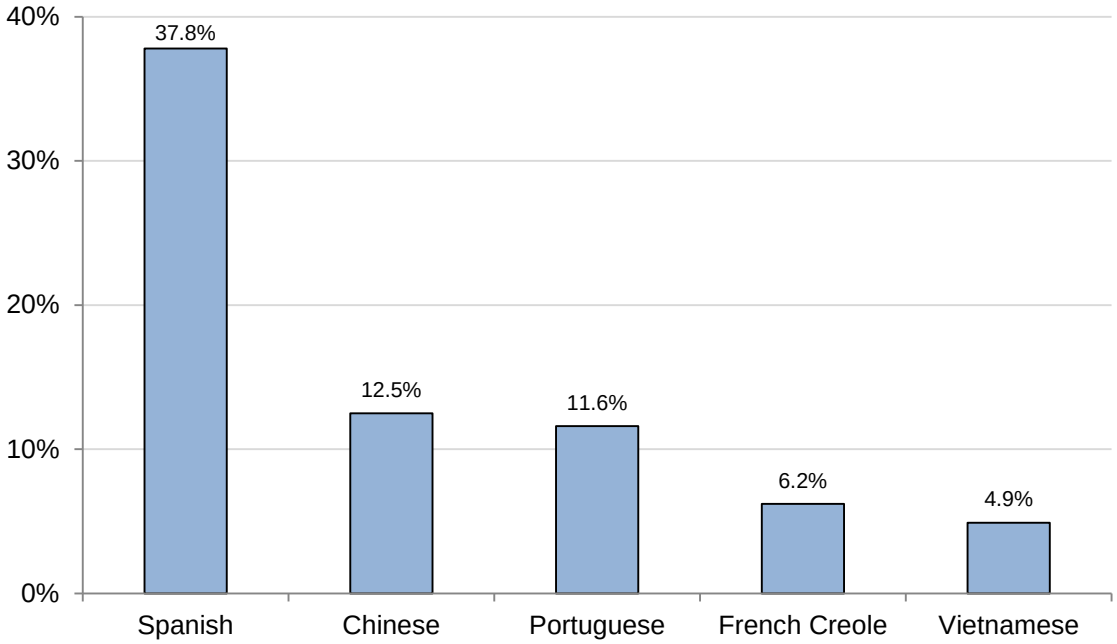
Data from the 2010–14 ACS five-year estimates were used to analyze the number of LEP persons living in the MBTA service area. The US Census table, "Language Spoken at Home by Ability to Speak English for the Population 5 Years and Over" was used to estimate the number of LEP people for all census tracts within the MBTA's 175-town service area. To calculate the number of people with limited English proficiency, the counts of people who self-reported to speak English less than "very well" were summed.

The total LEP population in the MBTA's 175-town service area is 446,974 people, or approximately 9.81 percent of the total population above the age of five. The largest single group of LEP persons is composed of Spanish speakers, which represent 37.8 percent of the LEP population of the service area; approximately 168,863 people in the service area are limited-English Spanish speakers. The top five language groups of LEP persons within the service area make up nearly 73 percent of the total LEP population:

- Spanish/Creole (168,863)
- Chinese (55,757)
- Portuguese/Portuguese Creole (51,817)
- French Creole (27,818)
- Vietnamese (21,960)

Figure 1 presents the percentage of total LEP persons that each of the top five languages represent in the MBTA's 175-town service area.

Figure 1
Percentage of Total LEP Persons in the MBTA Service Area by Language for the Top Five Languages Spoken



Source: 2010–14 ACS five-year estimates

The MBTA mapped the ACS data to provide a geographic representation of where concentrations of LEP persons live and to show what languages are spoken at home in those areas. Figures 2a and 2b show the percentage of LEP persons by census tract, regardless of the language spoken at home. Figure 2a shows the percentage of LEP persons in the 175 municipalities of the MBTA commuter rail service area, and Figure 2b shows the percentage of LEP persons in the 65 municipalities of the MBTA's core service area, where the majority of MBTA transit services are located. Most of the areas with the highest LEP percentages are urban areas.

To identify locations containing large concentrations of LEP individuals that belong to the top five language groups, municipalities were selected that had an overall LEP population larger than five percent of the total population, and where any of the top five language groups comprised more than 25 percent of the municipality's LEP population, or more than 1,000 persons. As the following information shows, it is apparent that some languages are spoken primarily in and around Boston, while others are more broadly distributed.

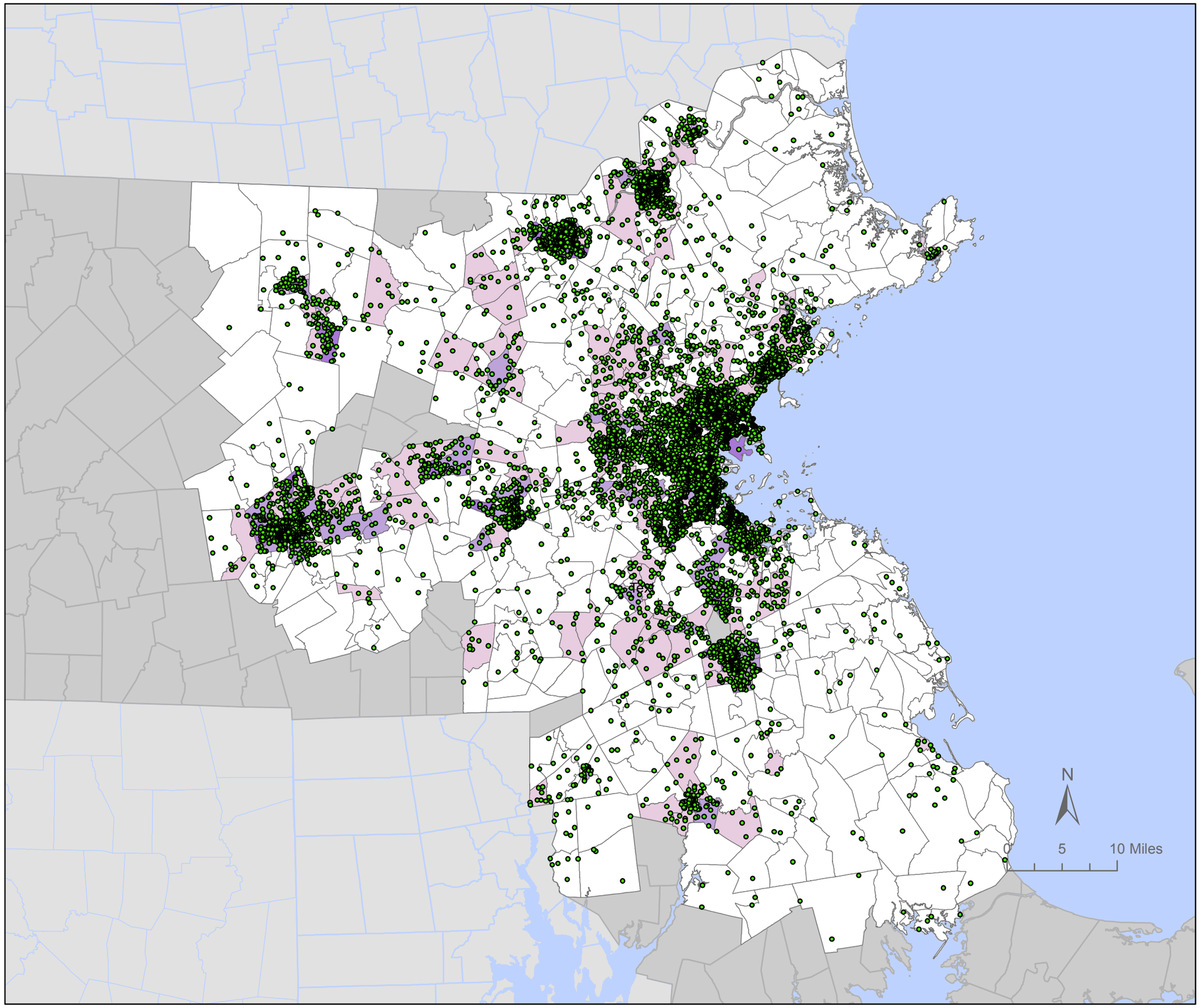


FIGURE 2-A
MBTA Language Assistance Plan

Limited English Proficiency: All LEP Individuals
MBTA Commuter Rail Service Area

All speakers who speak English "less than very well"

(1 dot = 50 speakers)

Percentage of all tract residents Speaking English "less than very well"

- 5 percent or less
- > 5 to 9.81 percent
- > 9.81 to 15 percent
- >15 to 30 percent
- >30 percent
- Statewide_Towns
- Outside MBTA 175 town service area

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as "well", "not well", or "not at all" in the 2014 American Community Survey five-year summary file.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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FIGURE 2-B
MBTA Language
Assistance Plan

Limited English Proficiency:
All LEP Individuals
MBTA Core Service Area

All speakers who speak English "less than very well"

(1 dot = 50 speakers)

Percentage of all tract residents Speaking English "less than very well"

- 5 percent or less
- > 5 to 9.81 percent
- > 9.81 to 15 percent
- >15 to 30 percent
- >30 percent
- Statewide_Towns
- Outside MBTA 175 town service area

N

0 2.75 5.5 Miles

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as "well", "not well", or "not at all" in the 2014 American Community Survey five-year summary file.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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Spanish-Speaking LEP Populations

The Spanish-speaking population is the largest LEP population in the MBTA's 175-town service area. Spanish is also the language spoken by the largest group of LEP people in many of the largest municipalities of the MBTA service area.

Spanish-speaking individuals in the MBTA service area come from a variety of regions, predominantly from Puerto Rico and the Dominican Republic, in addition to a range of countries in Central and South America. This population speaks a variety of regional dialects, each of which has its own idiomatic expressions, slang, and colloquialisms, although these different dialects of written and spoken Spanish are generally understood between most speakers.

Spanish-speaking LEP individuals are served by nearly every line of the MBTA system. The largest four of these populations in the MBTA service area are in Boston, Lawrence, Worcester, and Lynn. Boston is well served by numerous bus routes, and it is a terminus point for all MBTA rapid transit lines as well as the commuter rail lines. Lynn is served by numerous MBTA bus routes and by the Newburyport/Rockport commuter rail line. Worcester and Lawrence are both served by the Haverhill commuter rail line.

Lowell, Lynn, Brockton, and Haverhill have all seen significant increases in their Spanish-speaking LEP populations between 2011 and 2014, which is depicted both in the maps and tables below. Worcester, Boston, and Lawrence have all seen declines in their populations of Spanish-speaking LEP people.

Tables 1a and 1b provide a list of municipalities containing relatively large concentrations of Spanish-speaking LEP individuals, as identified using the previously described methodology. Table 1a provides information on the total number of Spanish-speaking individuals in each municipality along with their percentage of the municipality's total population and LEP population. Table 1b provides information on the changes in Spanish-speaking LEP population for each municipality. Figure 3a displays the concentration of Spanish-speaking LEP individuals in the 175 municipalities of the MBTA commuter rail service area, and Figure 3b displays the concentration of Spanish-speaking LEP individuals in the 65 municipalities of the MBTA's core service area. Municipalities outlined in Figures 3a and 3b are those identified as containing relatively large concentrations of Spanish-speaking individuals. Figures 4a and 4b show the change in Spanish-speaking LEP population in both MBTA service areas.

Table 1a
Representation of the Spanish-Speaking LEP Population by Municipality

Municipality	Spanish-Speaking LEP Population	Spanish-Speaking LEP Population - Percentage of Total Population	Spanish-Speaking LEP Population - Percentage of LEP Population
Boston	42,887	7.3%	43.4%
Lawrence	24,715	35.3%	92.8%
Worcester	13,999	8.3%	47.4%
Lynn	12,348	14.8%	65.1%
Chelsea	11,622	36.2%	85.3%
Lowell	6,414	6.5%	30.6%
Revere	6,086	12.5%	54.1%
Everett	3,981	10.3%	34.6%
Framingham	3,680	5.8%	34.5%
Waltham	3,128	5.4%	43.4%
Brockton	2,962	3.4%	18.3%
Methuen	2,848	6.4%	63.7%
Haverhill	2,614	4.6%	70.3%
Somerville	2,225	3.1%	25.3%
Fitchburg	2,205	5.9%	70.8%
Leominster	2,134	5.6%	61.7%
Malden	1,880	3.4%	12.4%
Salem	1,775	4.5%	59.4%
Marlborough	1,607	4.5%	38.1%
Cambridge	1,236	1.2%	15.5%
Peabody	1,017	2.1%	29.4%
Attleboro	896	2.2%	39.5%
Dedham	445	1.9%	37.4%
Shirley	381	5.5%	71.6%
Westborough	312	1.8%	29.9%
Holbrook	256	2.5%	47.5%

Table 1b
Changes in Spanish-Speaking LEP Population by Municipality

Municipality	2011 Spanish-Speaking LEP Population	2014 Spanish-Speaking LEP Population	Absolute Change in Spanish-Speaking LEP Population	Percentage Change in Spanish-Speaking LEP Population
Boston	43,313	42,887	-426	-1.0%
Lawrence	25,126	24,715	-411	-1.6%
Worcester	16,318	13,999	-2,319	-14.2%
Lynn	11,529	12,348	819	7.1%
Chelsea	11,269	11,622	353	3.1%
Lowell	5,100	6,414	1,314	25.8%
Revere	6,223	6,086	-137	-2.2%
Everett	3,539	3,981	442	12.5%
Framingham	3,542	3,680	138	3.9%
Waltham	3,235	3,128	-107	-3.3%
Brockton	2,305	2,962	657	28.5%
Methuen	2,841	2,848	7	0.2%
Haverhill	2,123	2,614	491	23.1%
Somerville	2,244	2,225	-19	-0.8%
Fitchburg	2,581	2,205	-376	-14.6%
Leominster	2,260	2,134	-126	-5.6%
Malden	1,804	1,880	76	4.2%
Salem	2,176	1,775	-401	-18.4%
Marlborough	1,443	1,607	164	11.4%
Cambridge	1,065	1,236	171	16.1%
Peabody	919	1,017	98	10.7%
Attleboro	749	896	147	19.6%
Dedham	249	445	196	78.7%
Shirley	341	381	40	11.7%
Westborough	227	312	85	37.4%
Holbrook	98	256	158	161.2%

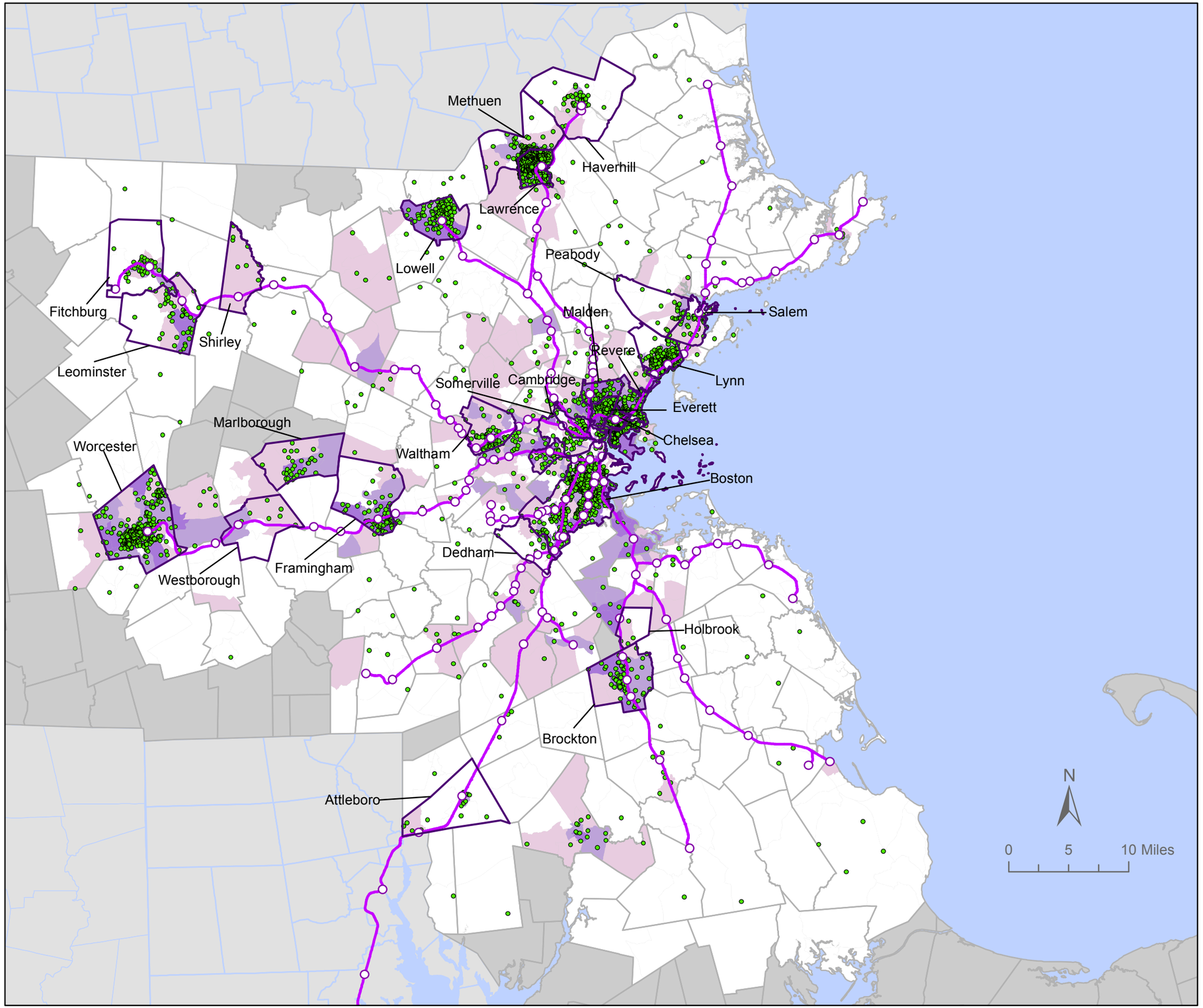

FIGURE 3-A
MBTA Language Assistance Plan

Limited English Proficiency: Spanish Speakers
MBTA Commuter Rail Service Area

Spanish speakers who speak English less than "very well"
(1 dot = 50 speakers)

Percentage of census tract residents speaking English less than "very well"

- 0.0% - 5.0%
- 5.1% - 9.8%
- 9.9% - 15.0%
- 15.1% - 30.0%
- 30.1% - 72.2%
- Outside MBTA 175 town service area
- Significant Spanish-speaking populations

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Spanish-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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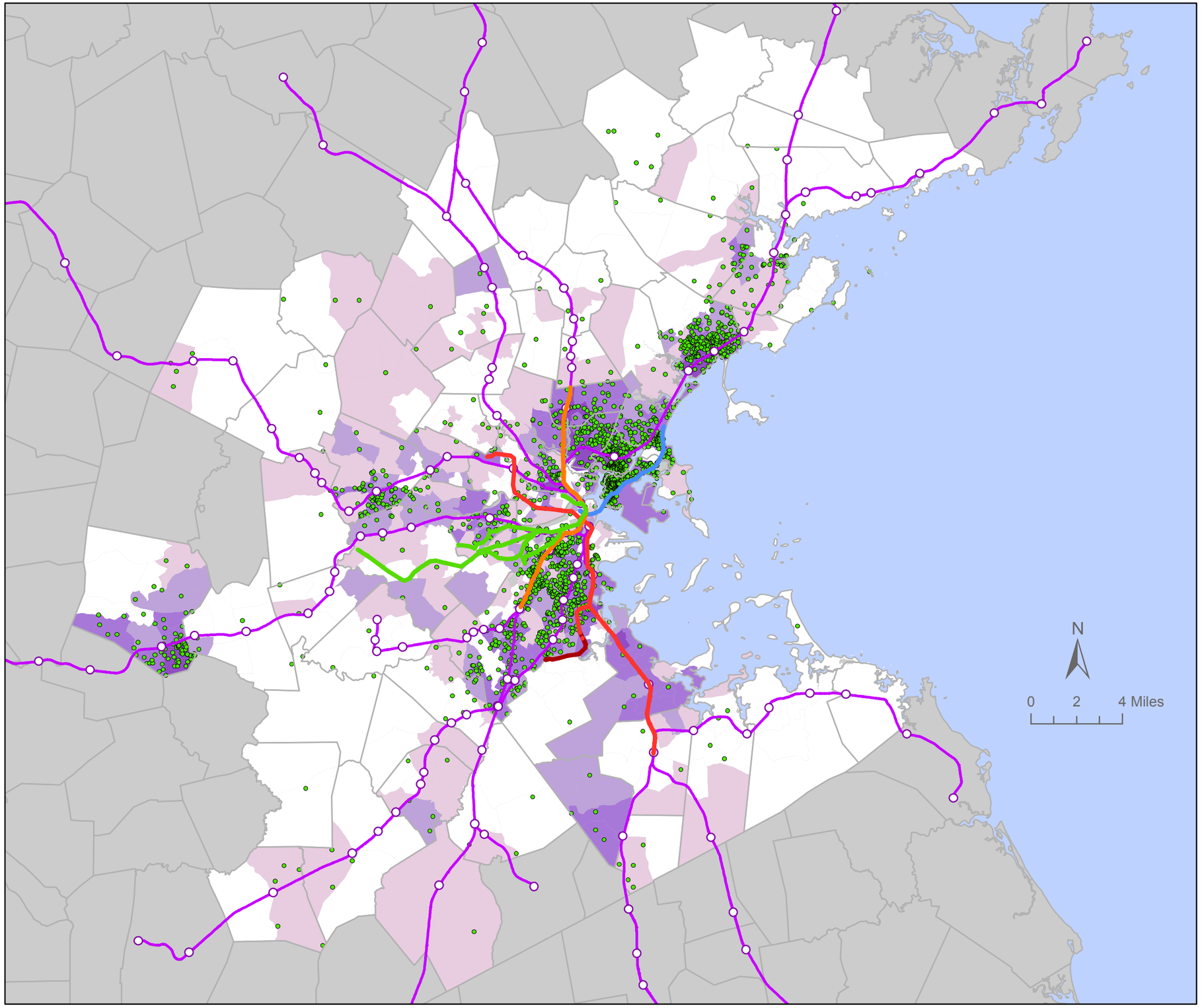

FIGURE 3-B
MBTA Language Assistance Plan

Limited English Proficiency: Spanish Speakers
MBTA Core Service Area

Spanish speakers who speak English less than "very well"
(1 dot = 50 speakers)

Percentage of census tract residents speaking English less than "very well"

- 0% - 5%
- 5.1% - 9.8%
- 9.9% - 15%
- 15.1% - 30%
- 30.1% - 72.2%
- Outside MBTA core service area

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Vietnamese-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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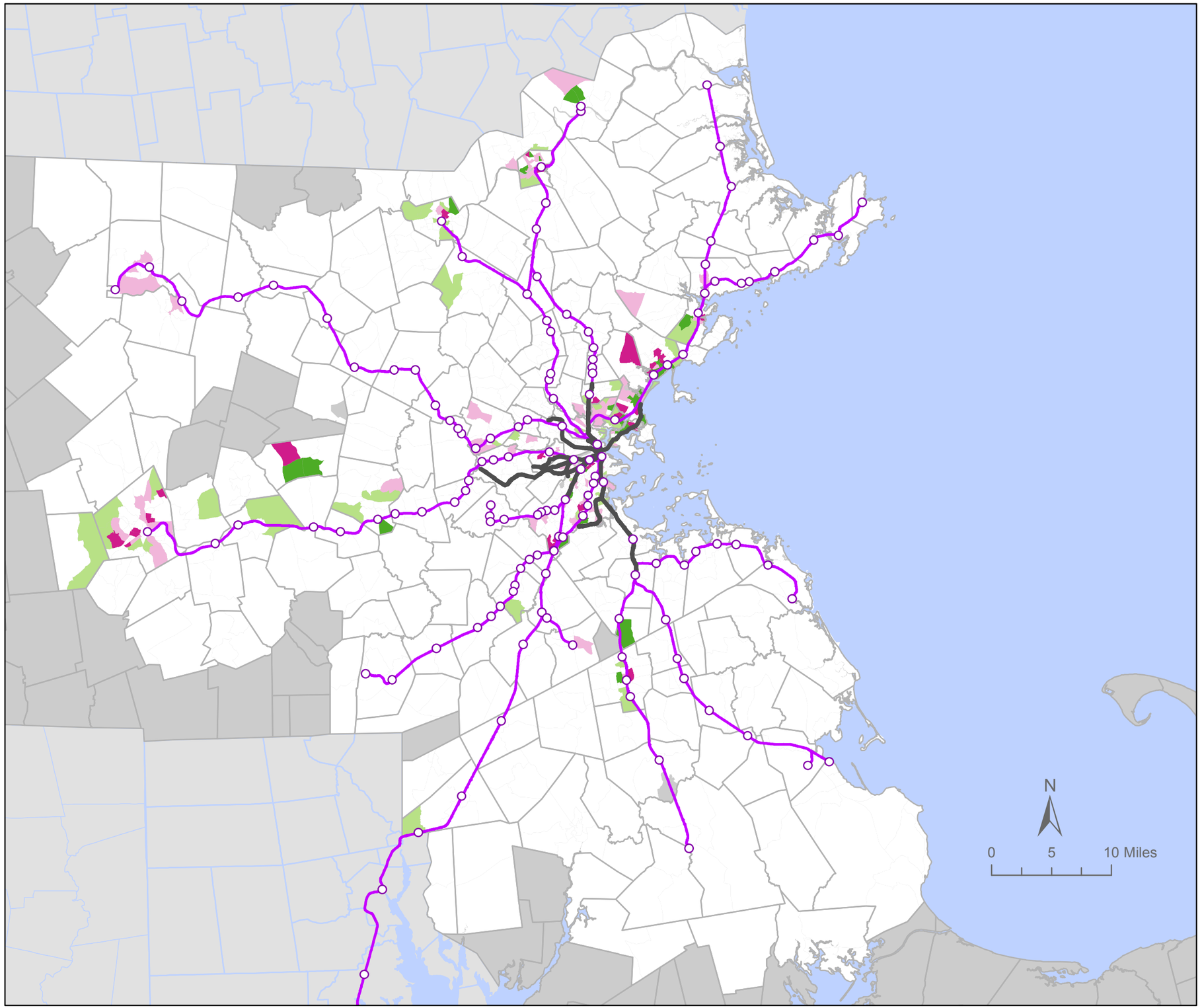

FIGURE 4-A
MBTA Language Assistance Plan

Limited English Proficiency: Change in Spanish Speakers MBTA Commuter Rail Service Area

Change in Spanish-speaking LEP population

- -843 to -200
- -199 to -100
- -99 to 100
- 101 to 200
- 201 to 491
- Outside MBTA commuter rail service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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FIGURE 4-B
MBTA Language Assistance Plan

Limited English Proficiency: Change in Spanish Speakers MBTA Core Service Area

Change in Spanish-speaking LEP Population

- -843 to -225
- -224 to -62
- -61 to 40
- 41 to 160
- 161 to 491
- Outside MBTA core service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

N

0 2 4 Miles

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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Chinese-Speaking LEP Populations

The Chinese-speaking population is the second largest LEP population in the MBTA's 175-town service area. Chinese is the top language of LEP people in several municipalities that are adjacent to Boston, and it is a significant proportion of the LEP languages in Boston and some of its suburbs.

The Chinese-speaking population in Massachusetts is comprised of speakers of the dialects Cantonese, Mandarin, Taiwanese, Fukien, and Shanghai. Two different writing systems, Traditional Chinese and Simplified Chinese, are used within the Chinese-speaking population, and do not correspond directly to spoken dialects.

The largest four Chinese-speaking LEP populations in the MBTA service area are in Boston, Quincy, Malden, and Newton. Boston is well served by numerous bus routes, and it is a terminus point for all the rapid transit lines as well as the commuter rail lines. Quincy is served by numerous bus routes, three Red Line stops (North Quincy, Wollaston, and Quincy Center), and the Quincy Center commuter rail station, which serves as a stop for the Middleborough/Lakeville, Plymouth/Kingston, and Greenbush commuter rail lines. Malden is served by several bus routes, the Orange Line at Malden Center and Oak Grove, and the Haverhill commuter rail line at Malden Center. Newton is well served by buses, numerous stops on the B and D branches of the Green Line, and the Newtonville, West Newton, and Auburndale stops of the Worcester commuter rail line.

Boston, Quincy, Malden, and Newton have all seen significant increases in their Chinese-speaking LEP populations between 2011 and 2014, depicted both in the maps and tables below. Populations of Chinese-speaking LEP people have declined slightly in Brookline and Cambridge.

Tables 2a and 2b provide a list of municipalities containing relatively large concentrations of Chinese-speaking LEP individuals, as identified using the previously described methodology. Table 2a provides information on the total number of Chinese-speaking individuals in each municipality along with their percentage of the municipality's total population and LEP population. Table 2b provides information on the changes in Chinese-speaking LEP population for each municipality. Figure 5a displays the concentration of Chinese-speaking LEP individuals in the 175 municipalities of the MBTA commuter rail service area, and Figure 5b displays the concentration of Chinese-speaking LEP individuals in the 65 municipalities of the MBTA's core service area. Municipalities outlined in Figures 5a and 5b are those identified as containing relatively large concentrations of Chinese-speaking individuals. Figures 6a and 6b show the change in Chinese-speaking LEP population in both MBTA service areas.

Table 2a
Representation of the Chinese-Speaking LEP Population by Municipality

Municipality	Chinese-Speaking LEP Population	Chinese-Speaking LEP Population - Percentage of Total Population	Chinese-Speaking LEP Population - Percentage of LEP Population
Boston	14,119	2.4%	14.3%
Quincy	10,586	12.1%	65.5%
Malden	5,856	10.5%	38.5%
Newton	2,171	2.7%	34.3%
Brookline	1,556	2.8%	30.0%
Cambridge	1,485	1.5%	18.6%
Worcester	1,353	0.8%	4.6%
Waltham	1,002	1.7%	13.9%
Lexington	875	2.9%	41.0%
Belmont	676	2.9%	32.9%
Braintree	641	1.9%	33.1%
Acton	609	2.9%	41.0%
Winchester	595	3.0%	55.5%
Andover	521	1.7%	29.3%
Westford	506	2.4%	45.3%
Sharon	451	2.7%	40.1%
Westborough	277	1.6%	26.5%
Boxborough	131	2.7%	46.3%

Table 2b
Changes in the Chinese-Speaking LEP Population by Municipality

Municipality	2011 Chinese-Speaking LEP Population	2014 Chinese-Speaking LEP Population	Absolute Change in Chinese-Speaking LEP Population	Percentage Change in Chinese-Speaking LEP Population
Boston	13,353	14,119	766	5.7%
Quincy	8,016	10,586	2,570	32.1%
Malden	4,776	5,856	1,080	22.6%
Newton	1,670	2,171	501	30.0%
Brookline	1,687	1,556	-131	-7.8%
Cambridge	1,685	1,485	-200	-11.9%
Worcester	1,144	1,353	209	18.3%
Waltham	929	1,002	73	7.9%
Lexington	926	875	-51	-5.5%
Belmont	460	676	216	47.0%
Braintree	584	641	57	9.8%
Acton	452	609	157	34.7%
Winchester	469	595	126	26.9%
Andover	498	521	23	4.6%
Westford	344	506	162	47.1%
Sharon	244	451	207	84.8%
Westborough	241	277	36	14.9%
Boxborough	111	131	20	18.0%

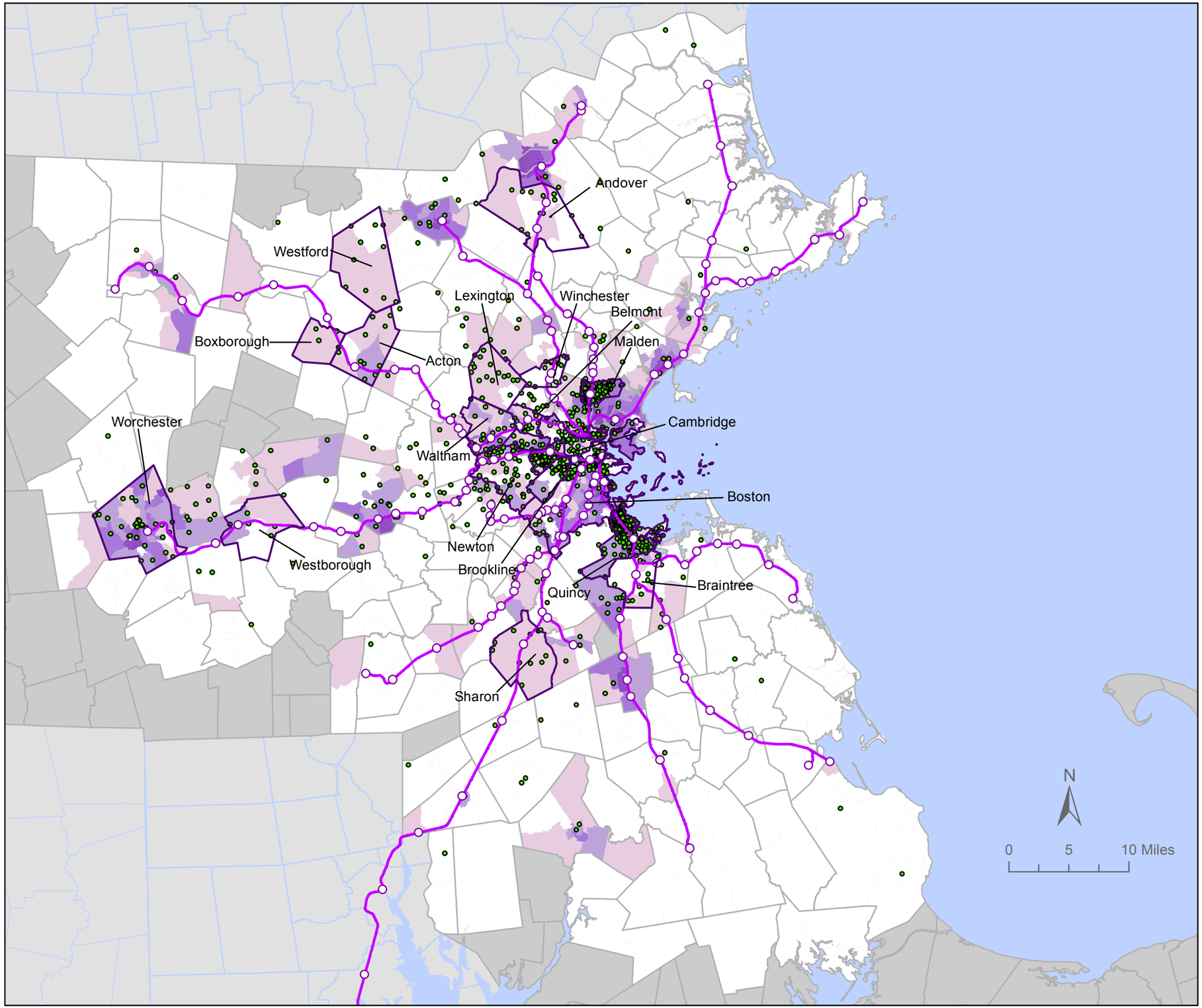

FIGURE 5-A
MBTA Language Assistance Plan

Limited English Proficiency: Chinese Speakers
MBTA Commuter Rail Service Area

Chinese speakers who speak English less than "very well"
(1 dot = 50 speakers)

Percentage of census tract residents speaking English less than "very well"

- 0.0% - 5.0%
- 5.1% - 9.8%
- 9.9% - 15.0%
- 15.1% - 30.0%
- 30.1% - 72.2%
- Outside MBTA commuter rail service area
- Significant Chinese-speaking populations

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Chinese-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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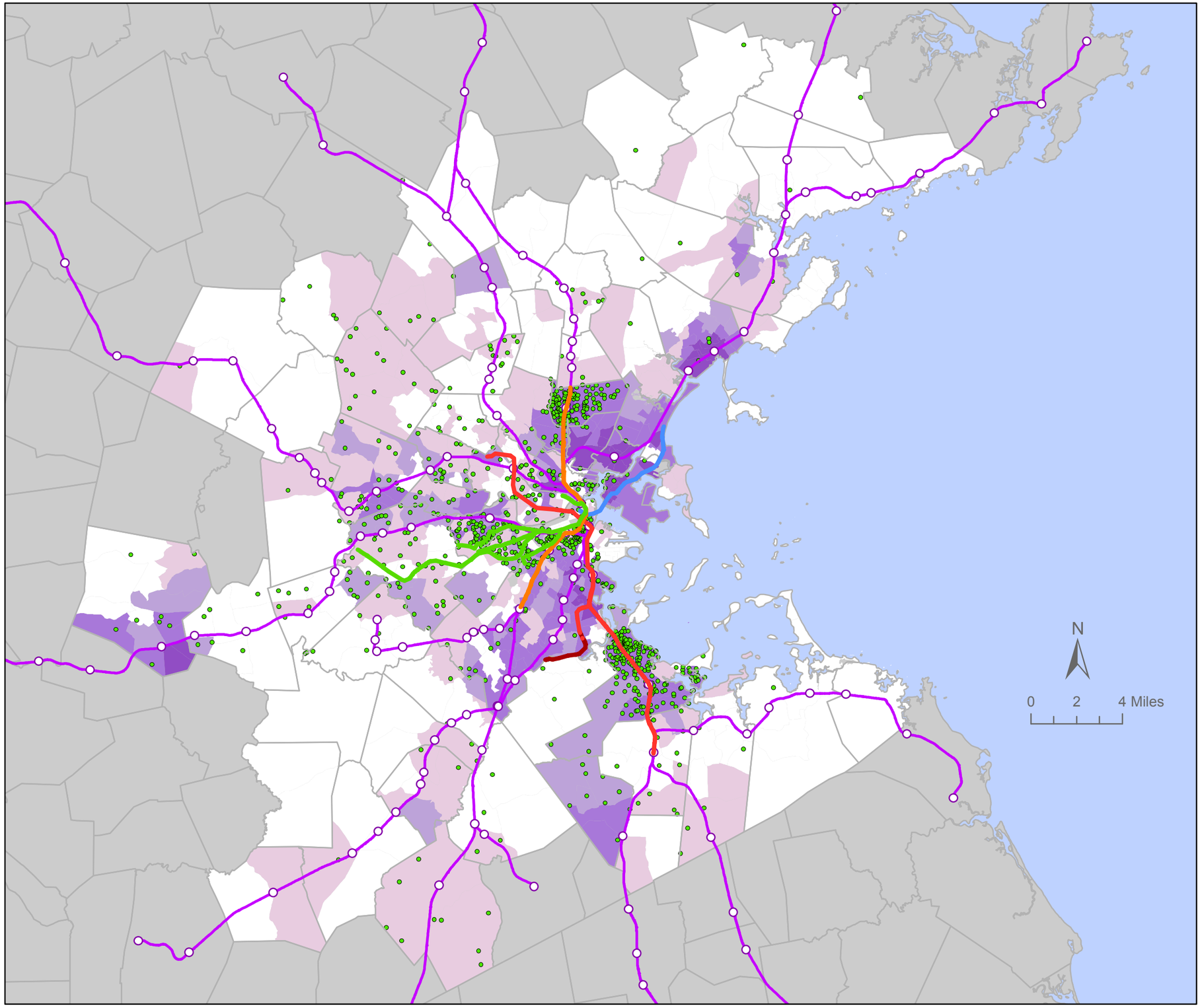

FIGURE 5-B
MBTA Language
Assistance Plan

Limited English Proficiency:
Chinese Speakers
MBTA Core Service Area

Chinese speakers who speak English less than "very well"
(1 dot = 50 speakers)

Percentage of census tract residents speaking English less than "very well"

- 0% - 5%
- 5.1% - 9.8%
- 9.9% - 15%
- 15.1% - 30%
- 30.1% - 72.2%
- Outside MBTA core service area

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Vietnamese-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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FIGURE 6-A
MBTA Language Assistance Plan

Limited English Proficiency: Change in Chinese Speakers MBTA Commuter Rail Service Area

Change in Chinese-speaking LEP population

- -384 to -113
- -112 to -21
- -20 to 39
- 40 to 151
- 152 to 400
- Outside MBTA commuter rail service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

N

0 5 10 Miles

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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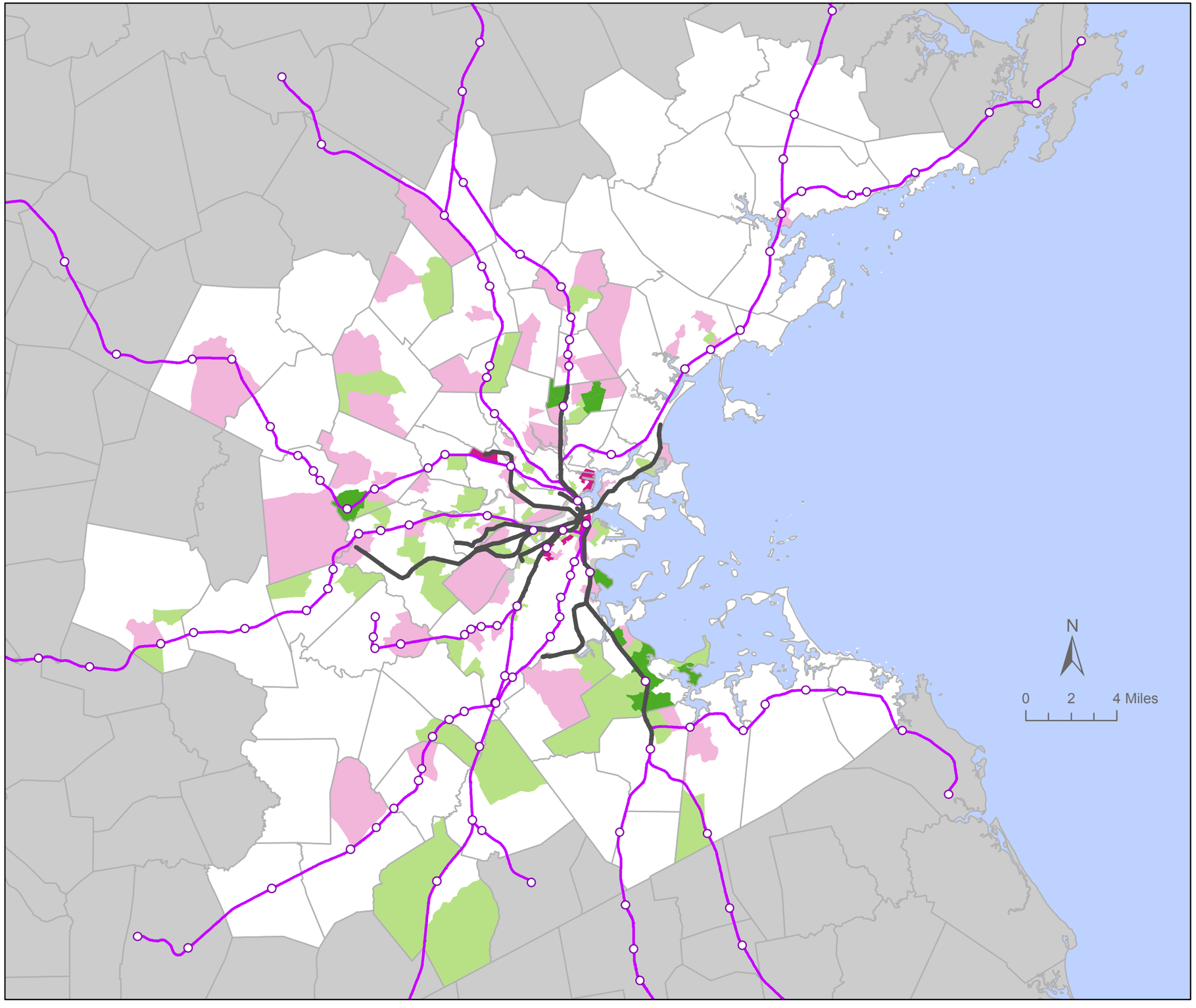

FIGURE 6-B
MBTA Language Assistance Plan

Limited English Proficiency: Change in Chinese Speakers MBTA Core Service Area

Change in Chinese-speaking LEP Population

- -384 to -187
- -186 to -31
- -30 to 51
- 52 to 169
- 170 to 400
- Outside MBTA core service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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Portuguese-Speaking LEP Populations

The Portuguese-speaking population, including Portuguese Creole, is the third largest LEP population in the MBTA's 175-town service area. Portuguese is the top language of the LEP populations of Brockton, Framingham, and Somerville, and is spoken by significant proportions of the LEP populations of other cities in the Boston metropolitan area, North Shore, and in the Merrimack River Valley.

Portuguese speakers in Massachusetts generally can be grouped as speaking one of three dialect categories: Brazilian Portuguese, European Portuguese, and Cape Verdean (Portuguese Creole). Although these three spoken dialects differ significantly, written Brazilian and European Portuguese are mostly understood by speakers within each of these groups. Brazilian and European Portuguese, however, have some differences in spelling and vocabulary.

The largest four Portuguese-speaking LEP populations in the MBTA service area are in Brockton, Boston, Framingham, and Everett. The Middleborough/Lakeville Line of the MBTA commuter rail passes through Brockton with stops at Campello, Montello, and Brockton stations. Boston is well served by numerous bus routes, and it is a terminus point for all MBTA rapid transit lines as well as the commuter rail lines. Framingham is served by the Framingham/Worcester commuter rail line at Framingham Station. Everett is served by several bus routes that run through the bus-hub Everett Square.

Brockton, Somerville, and Lowell have all seen significant increases in their Portuguese-speaking LEP populations between 2011 and 2014, depicted both in the maps and tables below. Boston, Framingham, Malden, and Worcester have all seen declines in their populations of Portuguese-speaking LEP people.

Tables 3a and 3b provide a list of municipalities containing relatively large concentrations of Portuguese-speaking LEP individuals, as identified using the previously described methodology. Table 3a provides information on the total number of Portuguese-speaking individuals in each municipality along with their percentage of the municipality's total population and LEP population. Table 3b provides information on the changes in Portuguese-speaking LEP population for each municipality. Figure 7a displays the concentration of Portuguese-speaking LEP individuals in the 175 municipalities of the MBTA commuter rail service area, and Figure 7b displays the concentration of Portuguese-speaking LEP individuals in the 65 municipalities of the MBTA's core service area. Municipalities outlined in Figures 7a and 7b are those identified as containing relatively large concentrations of Portuguese-speaking individuals. Figures 8a and 8b show the change in Portuguese-speaking LEP population in both MBTA service areas.

Table 3a
Representation of the Portuguese-Speaking LEP Population by Municipality

Municipality	Portuguese-Speaking LEP Population	Portuguese-Speaking LEP Population - Percentage of Total Population	Portuguese-Speaking LEP Population - Percentage of LEP Population
Brockton	7,387	8.5%	45.6%
Boston	4,952	0.8%	5.0%
Framingham	4,105	6.4%	38.5%
Everett	3,567	9.2%	31.0%
Taunton	2,771	5.3%	64.1%
Somerville	2,755	3.8%	31.4%
Lowell	2,580	2.6%	12.3%
Malden	1,828	3.3%	12.0%
Marlborough	1,744	4.9%	41.4%
Worcester	1,597	0.9%	5.4%
Peabody	1,454	3.0%	42.0%
Stoughton	910	3.6%	43.8%
Woburn	658	1.8%	28.5%
Seekonk	247	1.9%	43.3%

Table 3b
Changes in Portuguese-Speaking LEP Population by Municipality

Municipality	2011 Portuguese-Speaking LEP Population	2014 Portuguese-Speaking LEP Population	Absolute Change in Portuguese-Speaking LEP Population	Percentage Change in Portuguese-Speaking LEP Population
Brockton	5,388	7,387	1,999	37.1%
Boston	6,875	4,952	-1,923	-28.0%
Framingham	4,515	4,105	-410	-9.1%
Everett	3,511	3,567	56	1.6%
Taunton	3,009	2,771	-238	-7.9%
Somerville	2,481	2,755	274	11.0%
Lowell	2,444	2,580	136	5.6%
Malden	2,555	1,828	-727	-28.5%
Marlborough	1,732	1,744	12	0.7%
Worcester	2,251	1,597	-654	-29.1%
Peabody	1,618	1,454	-164	-10.1%
Stoughton	1,156	910	-246	-21.3%
Woburn	719	658	-61	-8.5%
Seekonk	339	247	-92	-27.1%

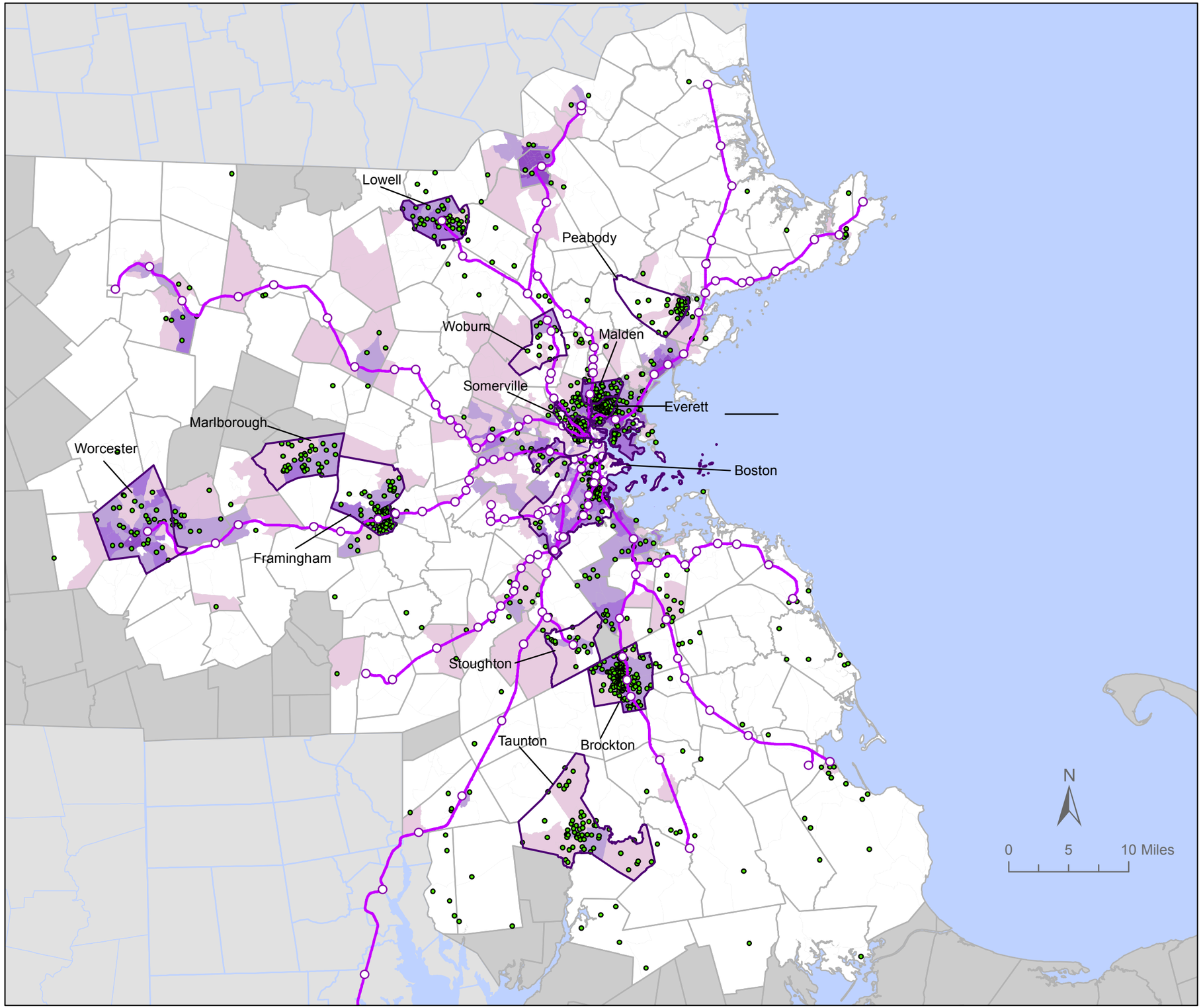

FIGURE 7-A
MBTA Language Assistance Plan

Limited English Proficiency: Portuguese Speakers MBTA Commuter Rail Service Area

Portuguese speakers who speak English less than "very well"
(1 dot = 50 speakers)

Percentage of census tract residents speaking English less than "very well"

- 0.0% - 5.0%
- 5.1% - 9.8%
- 9.9% - 15.0%
- 15.1% - 30.0%
- 30.1% - 72.2%
- Outside MBTA commuter rail service area
- Significant Portuguese-speaking population

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Portuguese-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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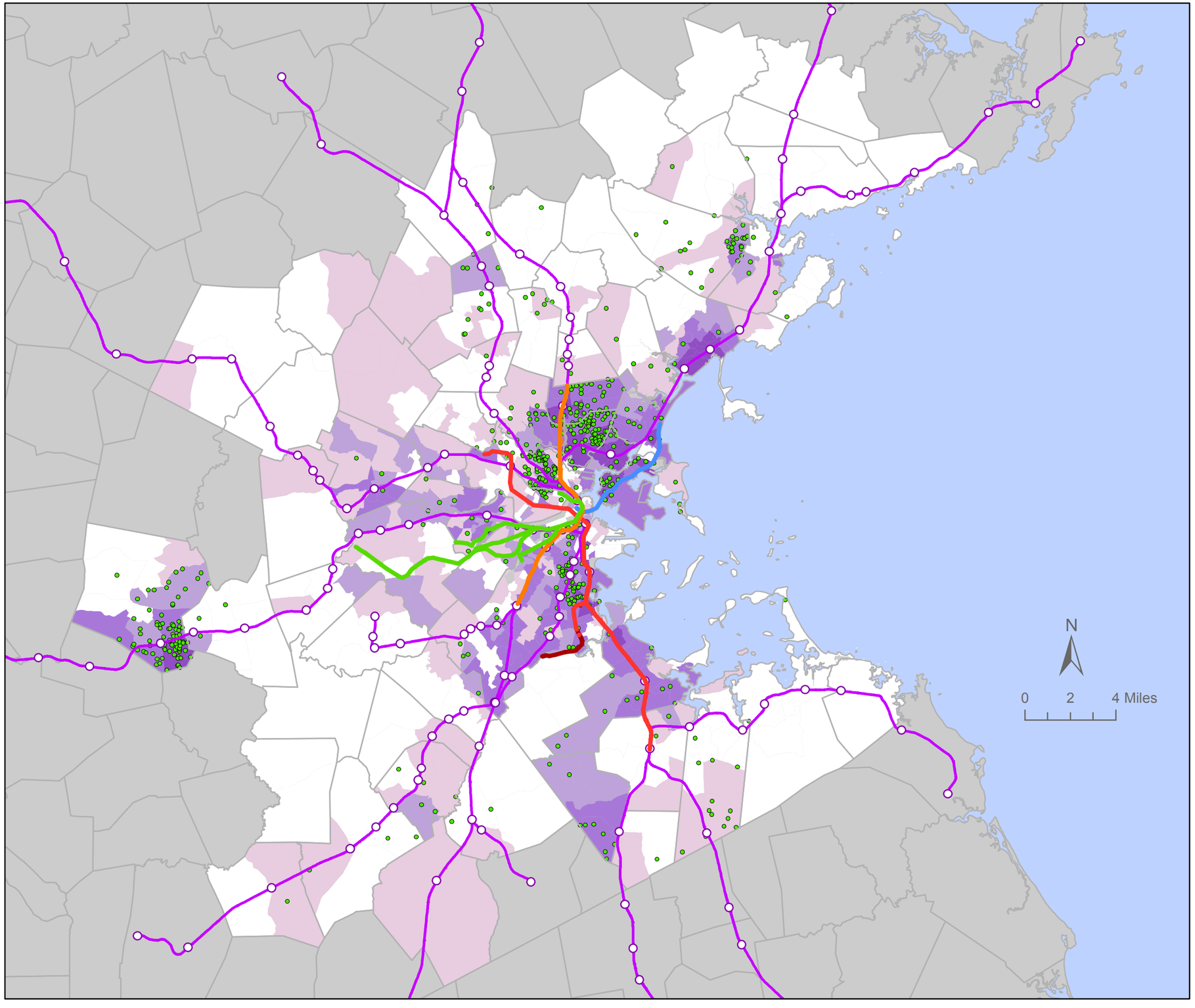

FIGURE 7-B
MBTA Language Assistance Plan

Limited English Proficiency: Portuguese Speakers
MBTA Core Service Area

Portuguese speakers who speak English less than "very well"
(1 dot = 50 speakers)

Percentage of census tract residents speaking English less than "very well"

- 0% - 5%
- 5.1% - 9.8%
- 9.9% - 15%
- 15.1% - 30%
- 30.1% - 72.2%
- Outside MBTA core service area

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Vietnamese-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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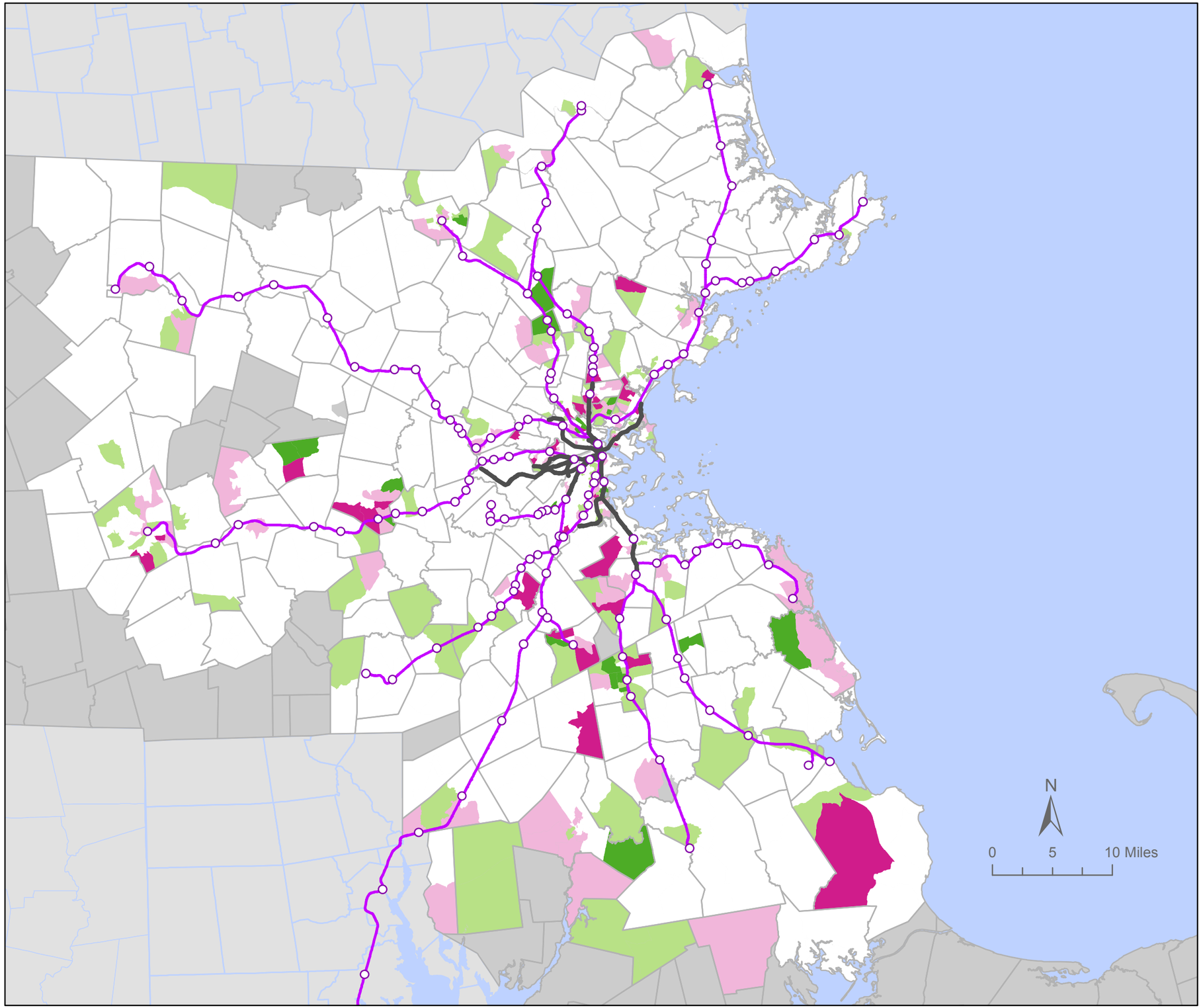

FIGURE 8-A
MBTA Language Assistance Plan

Limited English Proficiency: Change in Portuguese Speakers
MBTA Commuter Rail Service Area

Change in Portuguese-speaking LEP Population

- -353 to -146
- -145 to -39
- -38 to 30
- 31 to 129
- 130 to 427
- Outside MBTA commuter rail service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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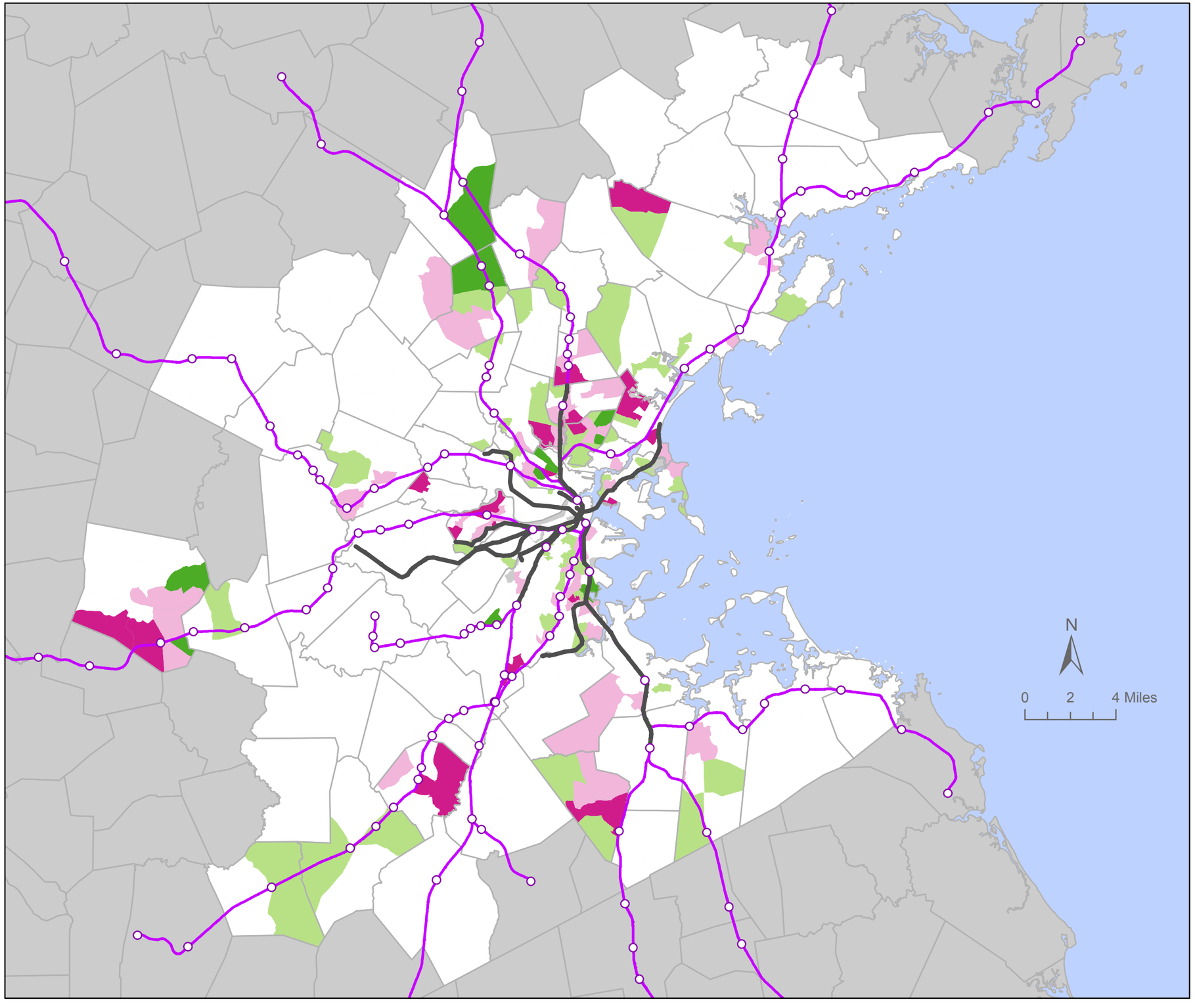

FIGURE 8-B
MBTA Language Assistance Plan

Limited English Proficiency: Change in Portuguese Speakers
MBTA Core Service Area

Change in Portuguese-speaking LEP Population

- -353 to -161
- -160 to -48
- -47 to 28
- 29 to 116
- 117 to 320
- Outside MBTA core service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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French Creole–Speaking LEP Populations

The French Creole-speaking population is the fourth largest LEP population in the MBTA's 175-town service area. French Creole is the predominate language spoken by LEP people in Randolph, and it is spoken by significant proportions of LEP people in some of the municipalities within the MBTA service area.

The primary dialect of French Creole spoken across Massachusetts is Haitian Creole. Although Haiti recognizes both French and Haitian Creole as its official languages, significant changes have been made to the way these languages are used and taught. Haitian Creole was not introduced formally to Haitian school systems until 1978; the language is still considered a primarily informal language, while French has a more formal connotation. Haitian Creole-speaking individuals who were formally educated in French may not be able to read Haitian Creole. Conversely, written French may be a less easily understood language for those who communicate primarily in Haitian Creole.

French Creole-speaking LEP individuals are served by nearly every line of the MBTA system. The largest of these populations in the MBTA service area are in Boston, Brockton, Everett, Randolph, and Malden. Boston is well served by numerous bus routes, and it is a terminus point for all MBTA rapid transit lines as well as the commuter rail lines. The Middleborough/Lakeville Line of the MBTA commuter rail passes through Brockton with stops at Campello, Montello, and Brockton stations. Everett is served by several bus routes that run through the bus-hub Everett Square. Randolph is served by two bus routes and the Holbrook/Randolph stop on the Middleborough/Lakeville commuter rail line. Malden is served by several buses, the Haverhill commuter rail line, and the Orange Line at Malden Center and Oak Grove.

Boston and Everett have both seen significant increases in their French Creole-speaking LEP populations between 2011 and 2014, depicted both in the maps and tables below.

Tables 4a and 4b provide a list of municipalities containing relatively large concentrations of French Creole-speaking LEP individuals, as identified using the previously described methodology. Table 4a provides information on the total number of French Creole-speaking individuals in each municipality along with their percentage of the municipality's total population and LEP population. Table 4b provides information on the changes in French Creole-speaking LEP population for each municipality. Figure 9a displays the concentration of French Creole-speaking LEP individuals in the 175 municipalities of the MBTA commuter rail service area, and Figure 9b displays the concentration of French Creole-speaking LEP individuals in the 65 municipalities of the MBTA's core service area. Municipalities outlined in Figures 9a and 9b are those identified as containing relatively large concentrations of French Creole-speaking

individuals. Figures 10a and 10b show the change in French Creole-speaking LEP population in both MBTA service areas.

Table 4a
Representation of the French Creole–Speaking LEP Population by Municipality

Municipality	French Creole-Speaking LEP Population	French Creole-Speaking LEP Population - Percentage of Total Population	French Creole-Speaking LEP Population - Percentage of LEP Population
Boston	11,634	2.0%	11.8%
Brockton	4,461	5.1%	27.5%
Everett	2,006	5.2%	17.4%
Randolph	1,619	5.3%	35.5%
Malden	1,051	1.9%	6.9%

Table 4b
Changes in the French Creole–Speaking Population by Municipality

Municipality	2011 French Creole-Speaking LEP Population	2014 French Creole-Speaking LEP Population	Absolute Change in French Creole-Speaking LEP Population	Percentage Change in French Creole-Speaking LEP Population
Boston	8,889	11,634	2,745	30.9%
Brockton	4,113	4,461	348	8.5%
Everett	1,387	2,006	619	44.6%
Randolph	1,321	1,619	298	22.6%
Malden	1,234	1,051	-183	-14.8%

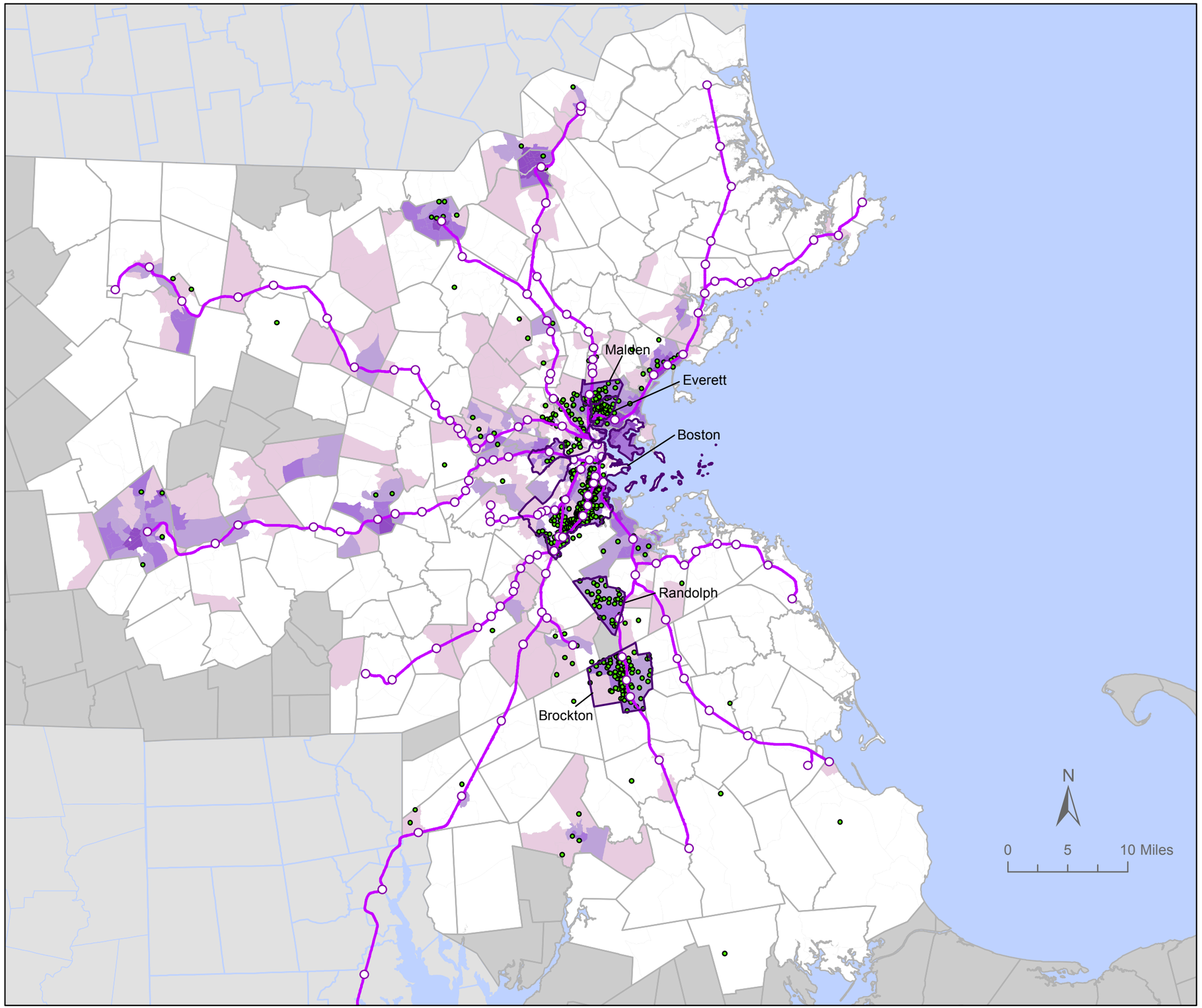

FIGURE 9-A
MBTA Language Assistance Plan

Limited English Proficiency: French Creole Speakers MBTA Commuter Rail Service Area

French Creole-speakers who speak English less than "very well"
(1 dot = 50 speakers)

Percentage of census tract residents speaking English less than "very well"

- 0.0% - 5.0%
- 5.1% - 9.8%
- 9.9% - 15.0%
- 15.1% - 30.0%
- 30.1% - 72.2%
- Outside MBTA commuter rail service area
- Significant French Creole-speaking population

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Chinese-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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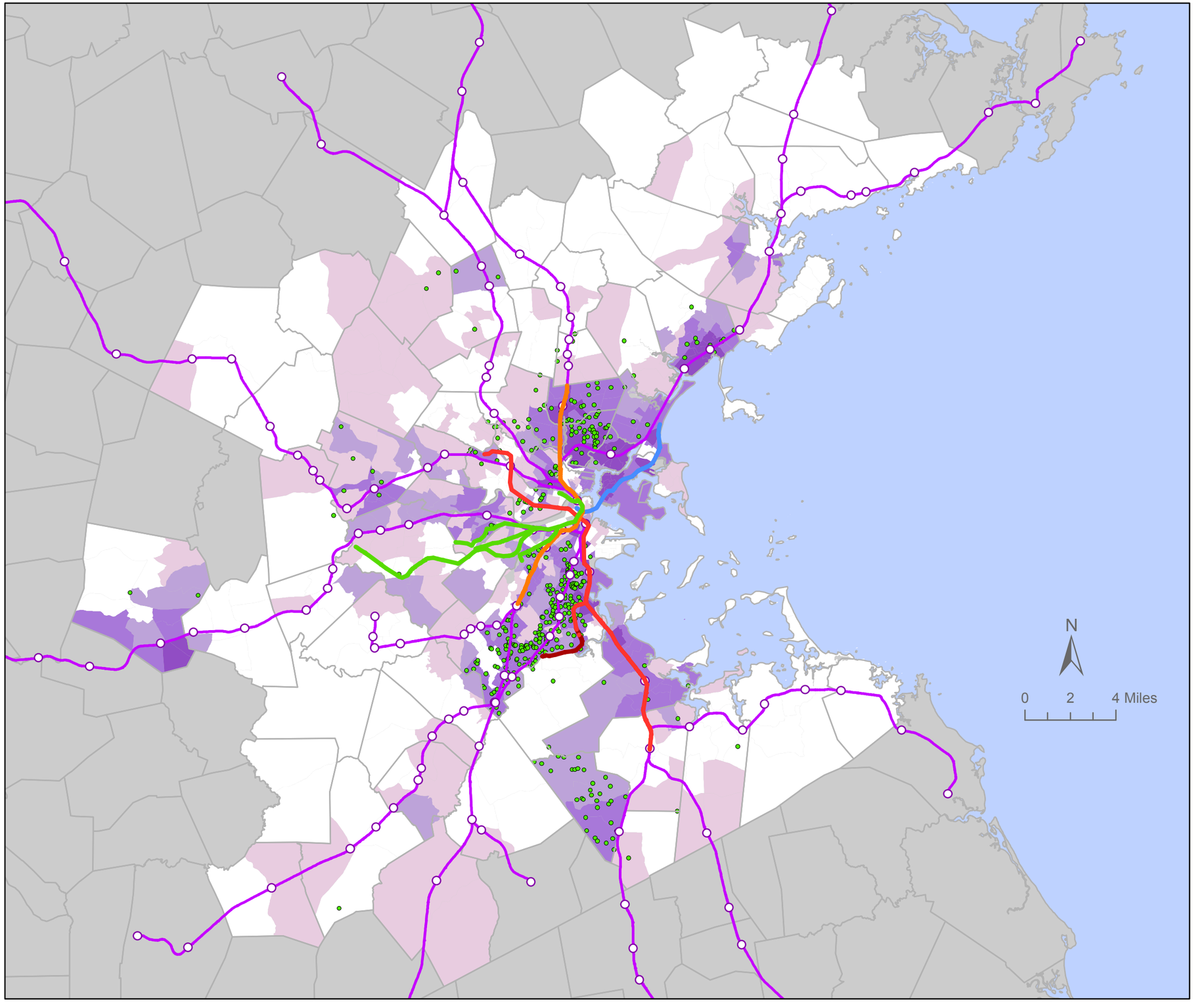

FIGURE 9-B
MBTA Language Assistance Plan

Limited English Proficiency: French Creole Speakers
MBTA Core Service Area

French Creole speakers who speak English less than "very well"
(1 dot = 50 speakers)

Percentage of census tract residents speaking English less than "very well"

- 0% - 5%
- 5.1% - 9.8%
- 9.9% - 15%
- 15.1% - 30%
- 30.1% - 72.2%
- Outside MBTA core service area

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Vietnamese-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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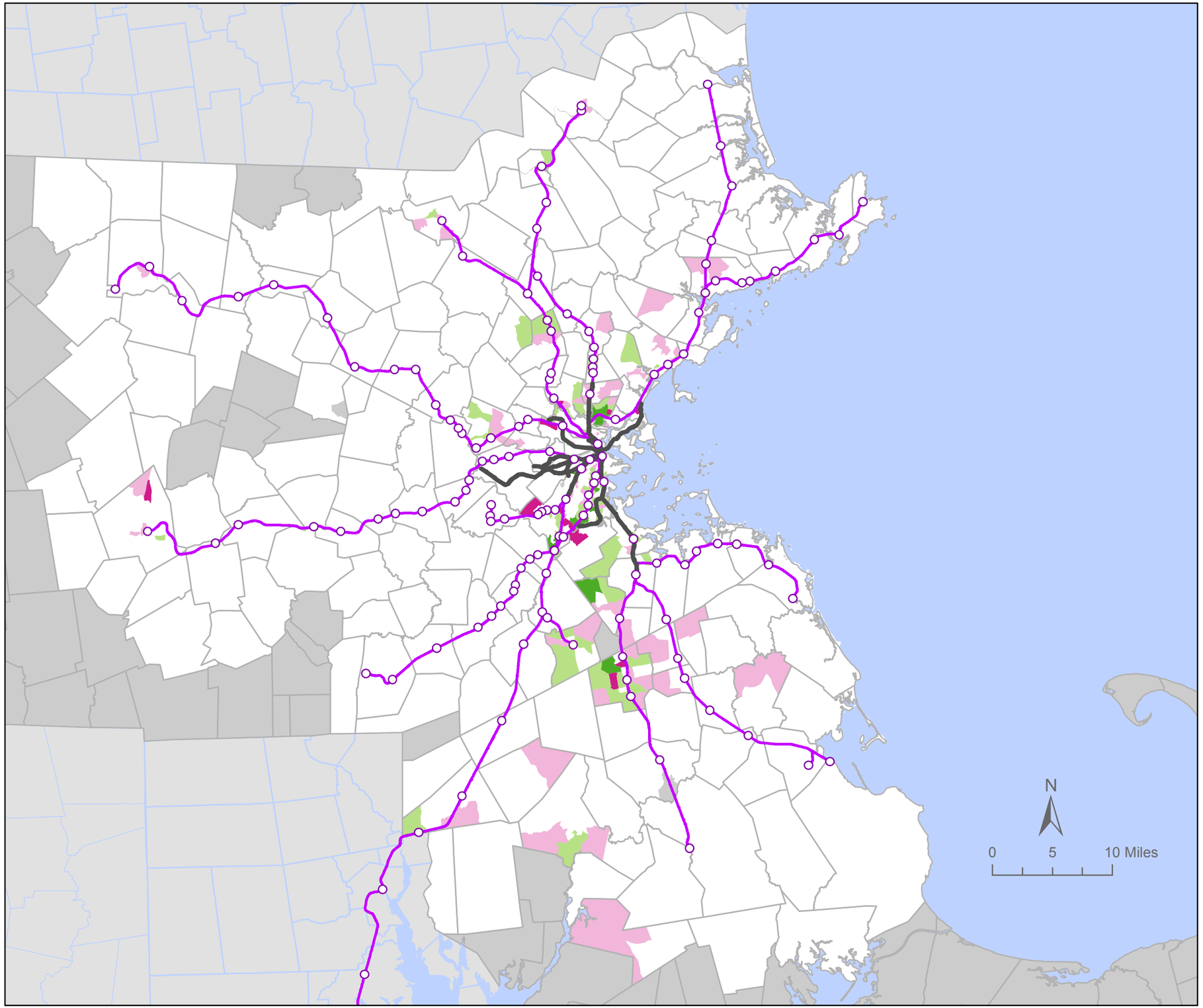

FIGURE 10-A
MBTA Language Assistance Plan

Limited English Proficiency: Change in French Creole Speakers
MBTA Commuter Rail Service Area

Change in French Creole-speaking LEP Population

- -296 to -97
- -96 to -19
- -18 to 38
- 39 to 145
- 146 to 302
- Outside MBTA commuter rail service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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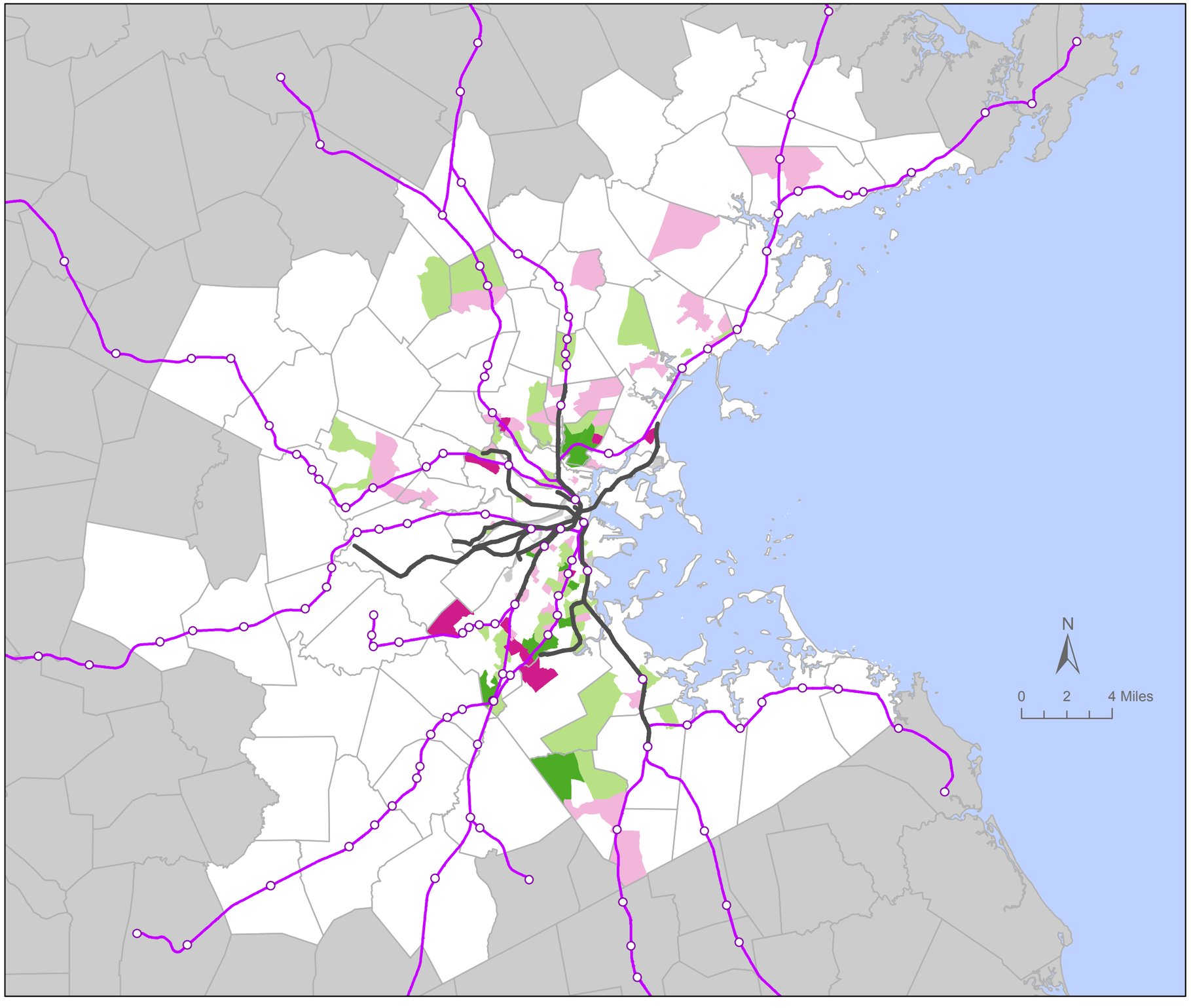

FIGURE 10-B
MBTA Language Assistance Plan

Limited English Proficiency: Change in French Creole Speakers
MBTA Core Service Area

Change in French Creole-speaking LEP Population

- -231 to -100
- -99 to -19
- -18 to 38
- 39 to 145
- 146 to 302
- Outside MBTA core service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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Vietnamese-Speaking LEP Populations

The Vietnamese-speaking population is the fifth largest LEP population in the MBTA's 175-town service area. Vietnamese is not one of the top LEP languages in any municipality in the MBTA service area; however, there are significant proportions of LEP people who speak Vietnamese throughout the MBTA service area.

Vietnamese can generally be grouped into North, Central, and South Vietnamese dialect regions, which differ slightly in vocabulary and grammar, and more significantly in sound.

The largest four of these populations in the MBTA service area are in Boston, Lowell, Quincy, and Worcester. Boston is well served by numerous bus routes, and it is a terminus point for all MBTA rapid transit lines as well as the commuter rail lines. Lowell is served by the Lowell commuter rail line. Quincy is served by numerous bus routes, three Red Line stops (North Quincy, Wollaston, and Quincy Center), and the Quincy Center commuter rail station, which serves as a stop for the Middleborough/Lakeville, Plymouth/Kingston, and Greenbush commuter rail lines. Worcester is served by the Framingham/Worcester commuter rail line at Union Station.

Boston and Lowell have both seen minor increases in their Vietnamese-speaking LEP populations between 2011 and 2014, which is depicted both in the maps and tables below. Worcester and Quincy have experienced minor declines in their populations of Vietnamese-speaking LEP people.

Tables 5a and 5b provide a list of municipalities containing relatively large concentrations of Vietnamese-speaking LEP individuals, as identified using the previously described methodology. Table 5a provides information on the total number of Vietnamese-speaking individuals in each municipality along with their percentage of the municipality's total population and LEP population. Table 5b provides information on the changes in Vietnamese-speaking LEP population for each municipality. Figure 11a displays the concentration of Vietnamese-speaking LEP individuals in the 175 municipalities of the MBTA commuter rail service area, and Figure 11b displays the concentration of Vietnamese-speaking LEP individuals in the 65 municipalities of the MBTA's core service area. Municipalities outlined in Figures 11a and 11b are those identified as containing relatively large concentrations of Vietnamese-speaking individuals. Figures 12a and 12b show the change in Vietnamese-speaking LEP population in both MBTA service areas.

Table 5a
Representation of the Vietnamese-Speaking LEP Population by Municipality

Municipality	Vietnamese-Speaking LEP Population	Vietnamese-Speaking LEP Population - Percentage of Total Population	Vietnamese-Speaking LEP Population - Percentage of LEP Population
Boston	7,527	1.3%	7.6%
Worcester	3,151	1.9%	10.7%
Quincy	1,316	1.5%	8.1%
Lowell	1,143	1.2%	5.5%

Table 5b
Changes in the Vietnamese-Speaking LEP Population by Municipality

Municipality	2011 Vietnamese-Speaking LEP Population	2014 Vietnamese-Speaking LEP Population	Absolute Change in Vietnamese-Speaking LEP Population	Percentage Change in Vietnamese-Speaking LEP Population
Boston	7,178	7,527	349	4.9%
Worcester	3,373	3,151	-222	-6.6%
Quincy	1,424	1,316	-108	-7.6%
Lowell	1,124	1,143	19	1.7%

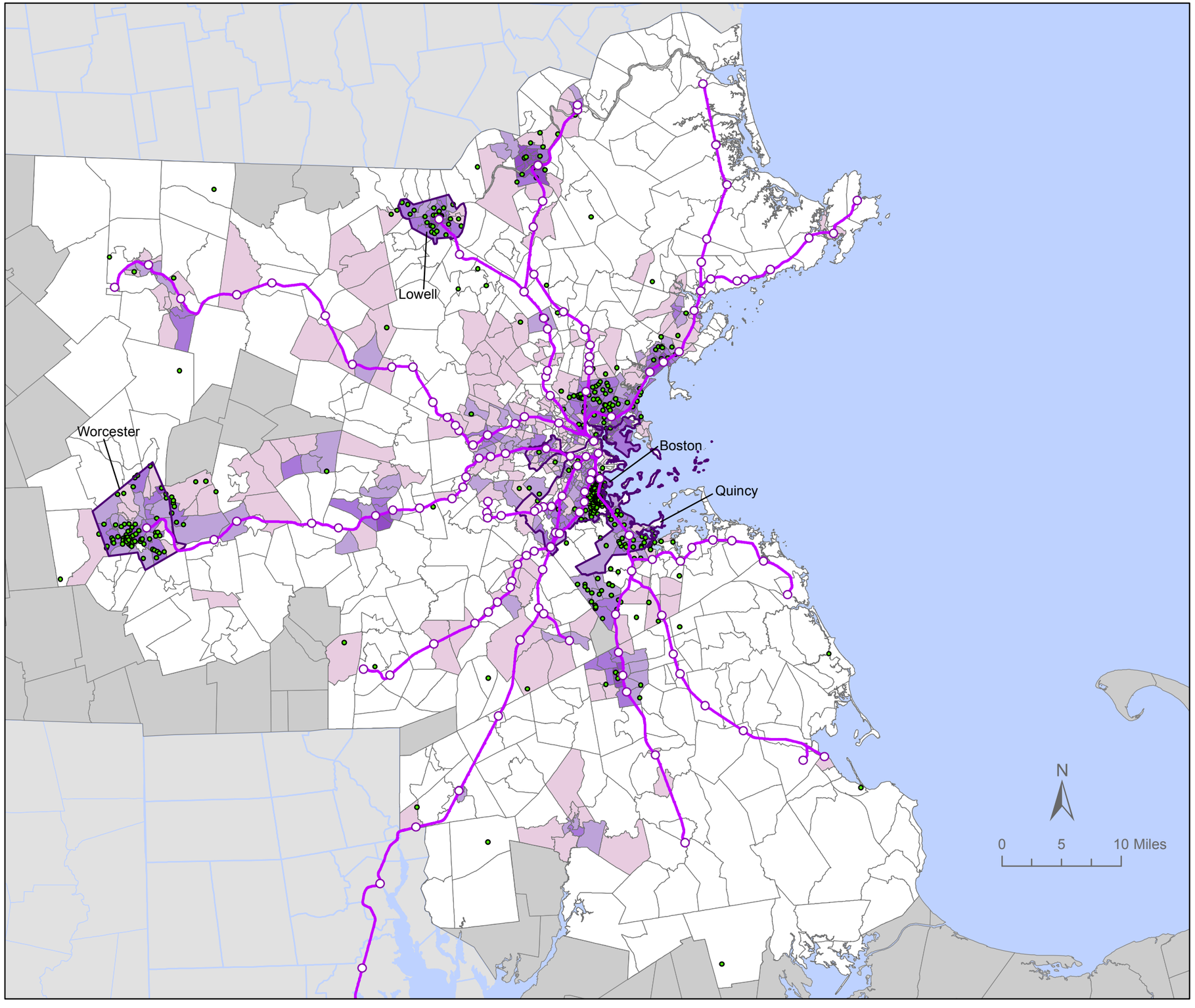

FIGURE 11-A
MBTA Language Assistance Plan

Limited English Proficiency: Vietnamese Speakers MBTA Commuter Rail Service Area

Vietnamese speakers who speak English less than "very well"

(1 dot = 50 speakers)

Percentage of all tract residents speaking English less than "very well"

- 5 percent or less
- > 5 to 9.81 percent
- > 9.81 to 15 percent
- >15 to 30 percent
- >30 percent
- Outside commuter rail service area
- Significant Vietnamese-speaking populations

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Vietnamese-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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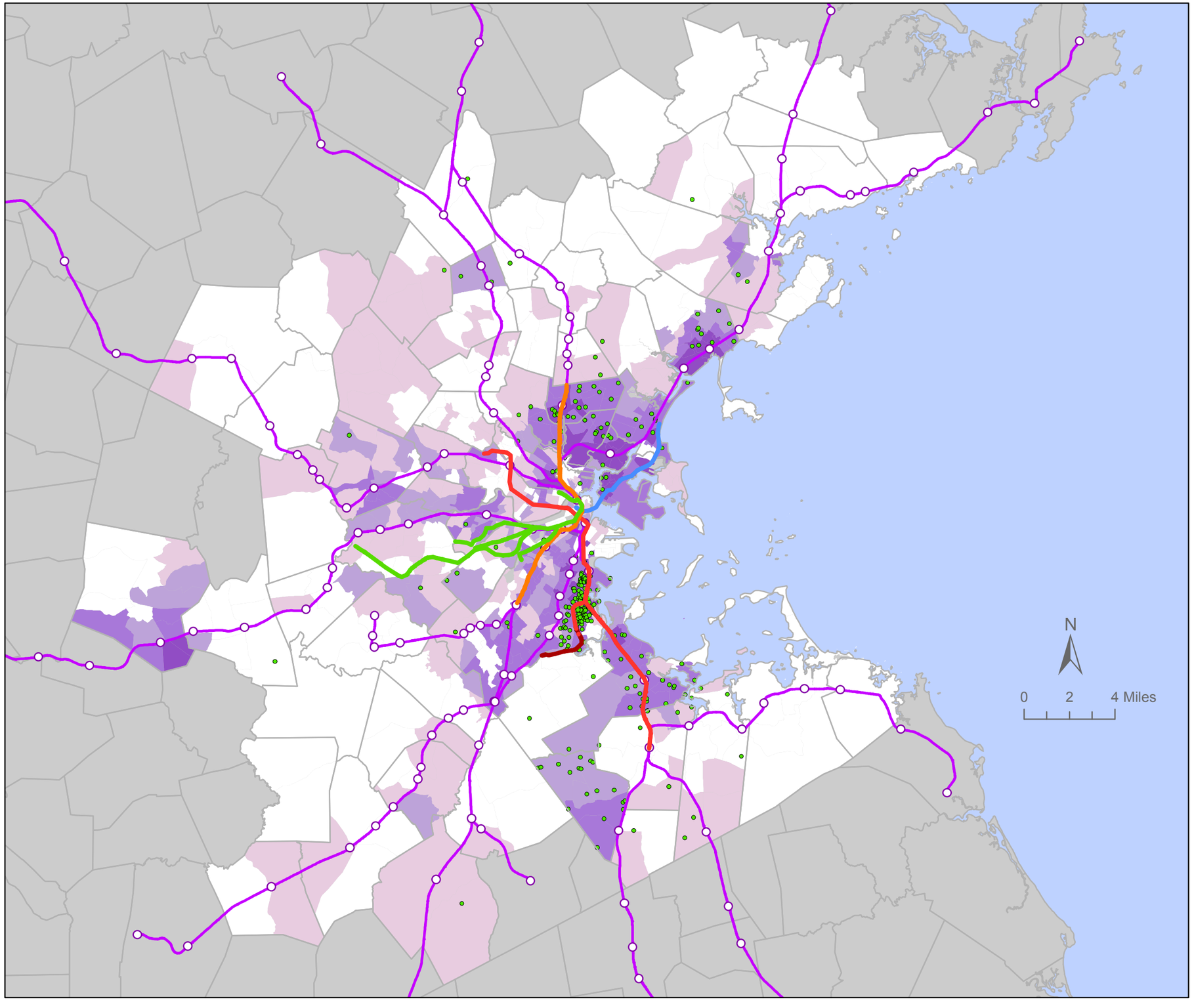

FIGURE 11-B
MBTA Language Assistance Plan

Limited English Proficiency: Vietnamese Speakers
MBTA Core Service Area

Vietnamese speakers who speak English less than "very well"
(1 dot = 50 speakers)

Percentage of census tract residents speaking English less than "very well"

- 0% - 5%
- 5.1% - 9.8%
- 9.9% - 15%
- 15.1% - 30%
- 30.1% - 72.2%
- Outside MBTA core service area

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

Significant populations are identified in this map where the general LEP population in a municipality is over 5% and the Vietnamese-speaking population is either over 1,000 individuals or over 25% of the municipality's LEP population.

Dots are placed randomly within census tracts to indicate the number of LEP speakers.

The percentage of LEP persons in the MBTA 175 town service area is 9.8 percent.

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FIGURE 12-A
MBTA Language Assistance Plan

Limited English Proficiency: Change in Vietnamese Speakers
MBTA Commuter Rail Service Area

Change in Vietnamese-speaking LEP population

- -237 to -80
- -79 to -19
- -18 to 24
- 25 to 103
- 104 to 256
- Outside MBTA commuter rail service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

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0 5 10 Miles

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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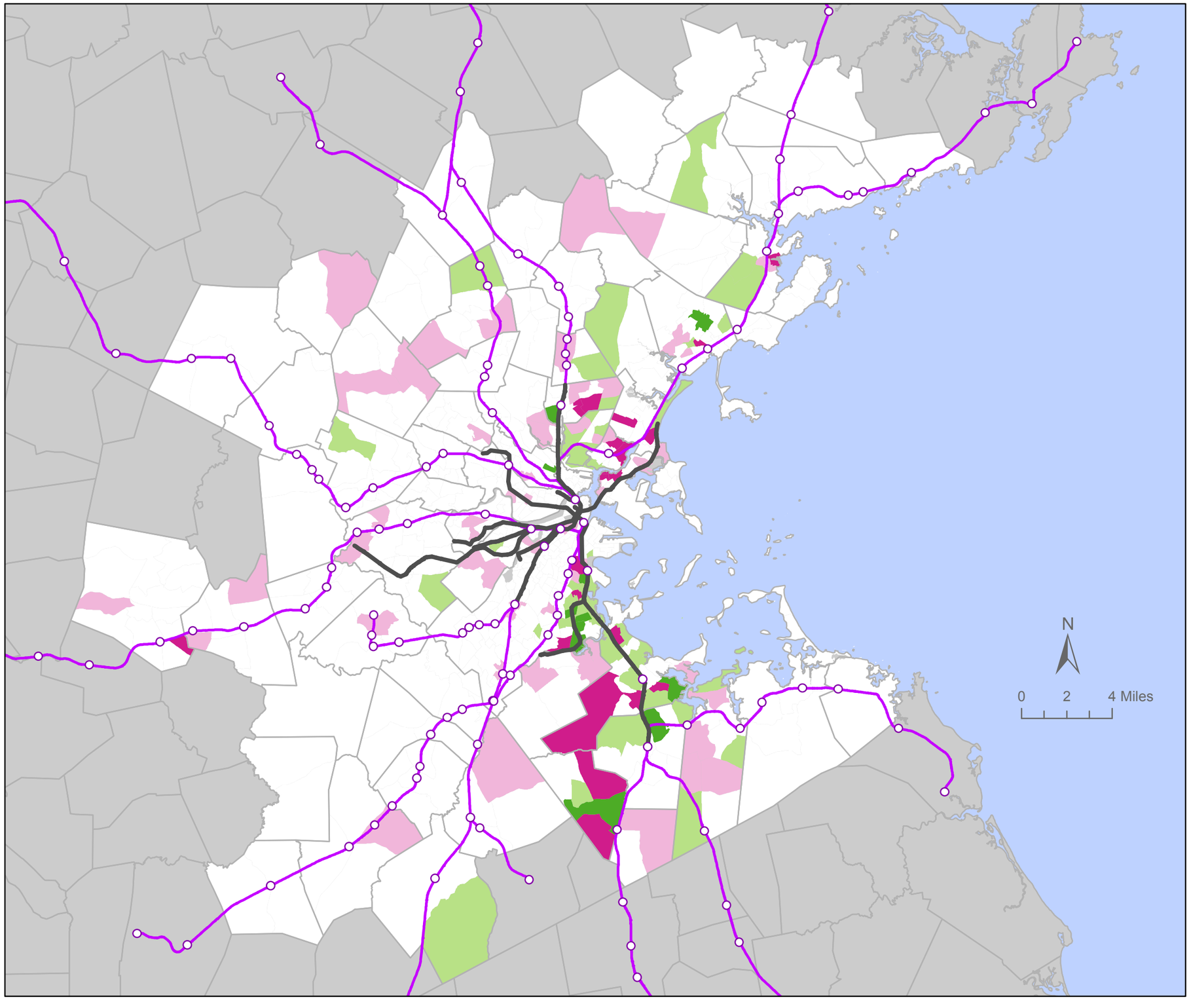

FIGURE 12-B
MBTA Language Assistance Plan

Limited English Proficiency: Change in Vietnamese Speakers
MBTA Core Service Area

Change in Vietnamese-speaking LEP individuals

- -197 to -74
- -73 to -15
- -14 to 26
- 27 to 103
- 104 to 256
- Outside MBTA core service area

MBTA Services

- Rapid transit line
- Commuter rail line
- Commuter rail station

Residents with limited English proficiency are defined for Title VI purposes as persons aged five and older whose ability to speak English was self-identified as less than "very well" in the 2014 American Community Survey five-year summary file.

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Qualitative Analysis Techniques

In addition to performing the quantitative analyses discussed above, the MBTA continues to refine its understanding of the locations of LEP populations through qualitative analyses. The MBTA works with CBOs, state legislators, and other government entities or interested parties to identify LEP populations that may need translation services for specific programs or activities. The MBTA conducts outreach to CBOs that work with LEP populations, such as neighborhood community service centers, community development corporations, and ethnic and cultural organizations. These organizations provide information that is not included in the census or state and local resources, such as the existence of pockets of the LEP populations relative to specific projects or public participation efforts, population trends, and what services are most frequently sought by the LEP population. Many of these organizations have resources that include language assistance, neighborhood knowledge, and expertise useful in communications with residents and customers. The MBTA's experience in this area shows that the greatest need for language assistance is in Spanish, but that there is also a need for assistance in a diverse range of primary languages, including Chinese, Haitian Creole, Portuguese, and Vietnamese.

Language Nuance Considerations

Within the top five languages in the MBTA service area there are some distinctions to be made between the different dialects, writing systems, vocabularies, and formal/informal use of each language. Based on MBTA research and the request and advice of both individuals and groups of speakers, the MBTA assigns dialect-specific translators and makes translation services as available as possible. However, there are some policies in place for each language that serve as guidelines to best serve those unique populations.

In general, the MBTA ensures that translations of vital documents are reviewed by internal and external speakers of multiple dialects of a language to ensure clarity for as many speakers of that language as possible. Blue Line announcements in Spanish, for example, were reviewed by a large number of MBTA staff and customers with many different Spanish-speaking backgrounds to minimize confusion for riders. Moreover, the MBTA often contracts for language translation or interpretation with organizations or firms that have expertise across language dialects.

The MBTA's current policy as regards Chinese written translation is to translate documents into both Traditional and Simplified Chinese, and to provide translators of requested regional dialects to community meetings as is possible.

In order to assist the Haitian Creole-speaking LEP population within the service area, the MBTA generally translates vital documents into French, which research has indicated a large number of Haitian Creole-speaking adults can read. However, Haitian

Creole translators and translations are available by request of individuals or communities.

In general, Cape Verdean (Portuguese Creole)-speakers are also familiar with written and spoken Portuguese, although, once again, translations and translators for Portuguese Creole are available as is possible.

For Vietnamese speakers, while dialect distinctions are not as significant as for the differences within the other top four languages, speakers of specific dialects may be provided on request as is possible. In addition, the MBTA makes an effort to translate documents for the greatest possible clarity across speakers of Vietnamese in the area.

Conclusions for Factor 1

The MBTA has used quantitative, qualitative, and spatial analyses to estimate the total number and proportion of LEP people in its service area and to identify areas that have high concentrations of LEP people. The top five languages—Spanish, Portuguese and Portuguese Creole, Chinese, French Creole, and Vietnamese—represent nearly 73 percent of the total LEP population.

Factor 2: The Frequency of Contact

The FTA requires that the MBTA analyze the frequency of contact that the agency has with people with limited English proficiency. The MBTA used the following data and analysis methods to evaluate the frequency with which LEP individuals come into contact with the MBTA:

- Evaluation of Customer Communications Call Center metrics
- Evaluation of website browser primary language requests
- Analysis of paratransit records

Customer Communications Call Center

The Customer Communications Call Center houses a bilingual staff; each person is bilingual in English and at least one of several languages, including Spanish, Haitian French Creole, Cape Verdean Creole, and both Cantonese and Mandarin Chinese. The call center provides telephone translation service in all of those languages and functions as an in-house document translation center. For a major planned service interruption in 2013, telephone services were requested and provided in Mandarin Chinese and in Cantonese Chinese. During the same major planned service interruption, a written translation was requested and provided in Spanish. While the Customer Communications Call Center had received requests for Haitian French Creole translation in previous years, there were no requests in 2013.

Below is a table of the number of Spanish calls by year handled by the MBTA Communications Call Center between 2012 and June 2017. The number of Spanish-speaking callers has remained mostly stable, with a significant drop in 2016. This drop coincided with a reduction in hours at the call center, but use of the MBTA website in many languages other than English increased after the reduction.

Table 6
Customer Communications Calls in Spanish (2012–17)

Year of Operation	Calls in Spanish
2012	8,452
2013	7,829
2014	8,055
2015	8,209
2016	6,531
2017 (Jan-June)	2,277

In May 2017, the MBTA entered into a contract with Global Contact Services (GCS) to assume operations of the MBTA customer communications center. Since the transition in June, GCS has offered weekday, weekend, and evening hours of service. GCS has also made a commitment to hire bilingual staff, particularly in Spanish and Creole languages. For the month of June 2017, GCS reported that they've received 172 calls in Spanish, 2 calls in Portuguese, 1 call in Mandarin, 1 call in Tamil, and 1 call in Russian.

Website Analytics Based on Preferred Language and Locale Settings

The MBTA is able to distinguish between categories of visitors to its website by the language that the Web browser requests as its primary language. Data from the MBTA website analytics for calendar year 2016 indicate that the overwhelming majority of visits (97.29 percent) to the MBTA's website are on browsers that request English as the primary language. The next two most commonly requested languages are Spanish (0.74 percent of all visits) and Chinese (0.48 percent of all visits), followed by French, German, Japanese, Portuguese, and Korean.

While there has been a decrease in non-English-language requests to the MBTA website in 2016, this is also true for English-language speakers, and the total number of visitors overall to the website.

This ranking reveals a different statistical representation of LEP persons using technology than might be expected from the population data from the ACS. One potential reason is that website data reveal the preferences of people living outside of the MBTA's service area, including visitors to the region who are interested in using

public transit as part of their transportation. This may be the case for French and German, languages that show higher percentages in this particular data set than in the data sets from prior years.

Beyond the website as an access point for LEP persons, a number of mobile transit applications (apps) for accessing and navigating the MBTA transit system have been developed by third-party developers. Among the many apps that the MBTA lists as resources on its Online Trip Planning Tools page, the MBTA has officially endorsed the Transit App, which is available in English, French, German, Italian, Portuguese, and Spanish. The Transit App, which has been popular and well received by users, offers passengers real-time updates for buses and trains, step-by-step navigation, trip planning, transit schedules, and city maps. This app has also integrated methods of accessing bike-sharing, carsharing, and ride hailing when public transit is unavailable.

Table 7
Number and Percentage of Visits by the Browser Setting for Preferred Language during Visits to the MBTA Website

Language	Number of Visits (2014)	Percentage of Visits (2014)	Number of Visits (2015)	Percentage of Visits (2015)	Number of Visits (2016)	Percentage of Visits (2016)
English	307,198,14	97.10%	33,675,076	97.09%	28,207,942	97.29%
Spanish	213,083	0.67%	246,682	0.71%	214,771	0.74%
Chinese	164,674	0.52%	175,214	0.51%	139,499	0.48%
French	102,403	0.32%	100,756	0.29%	87,288	0.30%
German	69,434	0.22%	72,183	0.21%	72,163	0.25%
Japanese	58,729	0.19%	64,030	0.18%	53,595	0.18%
Portuguese	43,838	0.14%	47,742	0.14%	41,908	0.14%
Korean	40,233	0.13%	37,847	0.11%	28,683	0.10%
Italian	29,168	0.09%	29,522	0.09%	27,463	0.09%
Russian	21,181	0.07%	27,041	0.08%	17,763	0.06%
Arabic	19,451	0.06%	9,971	0.03%	10,810	0.04%
Turkish	10,431	0.03%	10,883	0.03%	9,293	0.03%
Swedish	7,626	0.02%	8,125	0.02%	7,200	0.02%
Vietnamese	3,556	0.01%	6,163	0.02%	8,103	0.03%
Polish	5,835	0.02%	5,971	0.02%	5,529	0.02%
Hebrew	4,983	0.02%	5,543	0.02%	5,252	0.02%
Danish	4,912	0.02%	5,118	0.01%	5,155	0.02%
Greek	2,920	0.01%	3,261	0.01%	3,013	0.01%
Czech	3,057	0.01%	2,880	0.01%	2,520	0.01%
Finnish	2,873	0.01%	3,023	0.01%	2,612	0.01%
Thai	2,745	0.01%	2,313	0.01%	2,264	0.01%
Hungarian	2,192	0.01%	2,404	0.01%	2,096	0.01%
Norwegian	114	0.00%	2,615	0.01%	2,919	0.01%
Catalan	1,648	0.01%	1,718	0.00%	1,489	0.01%
Indonesian	1,525	0.00%	1,444	0.00%	2,096	0.01%
Farsi	1,198	0.00%	742	0.00%	719	0.00%
Romanian	1,193	0.00%	1,169	0.00%	1,246	0.00%
Other Languages	99,991	0.32%	135,472	0.39%	29,656	0.10%
Non-English Visits	918,993	2.90%	1,009,832	2.91%	785,105	2.71%
Total	31,638,807	100.00%	34,684,908	100.00%	28,993,047	100.00%

Paratransit (THE RIDE) Records

According to the MBTA's paratransit contractors, less than 1 percent of all paratransit riders need translation assistance.

Conclusions for Factor 2

Though LEP people represent a small percentage of all riders on the MBTA system, significant numbers of Spanish-speaking LEP customers request translation services through MBTA customer information channels, including the website and customer communications call center.

Factor 3: The Importance to LEP Persons of the Program, Activity, or Service Provided by the MBTA

The MBTA performed a quantitative analysis using the results of interviews performed by Boston Region Metropolitan Planning Organization (MPO) staff, surveys of bus operators and CSAs, and responses from the MBTA's Rider Oversight Committee to identify issues that LEP customers encountered while riding on the MBTA. This analysis showed the services that were deemed the most critical to LEP persons: fares and tickets, routes and schedules, and safety and security. These areas were chosen because language barriers could limit a person's ability to fully benefit from MBTA services or, in some cases, they could place a person in physical danger.

The quantitative analysis indicated that:

- MBTA programs and services are very important to LEP people, many of whom are transit dependent. A cross-tabulation of the data for zero-vehicle households and the ability to speak English using the 2010–14 five-year public-use microdata sample shows that 14.8 percent of the people who speak English "less than very well" live in zero-vehicle households. Further, this percentage increases to 26.1 percent when the data are limited to people who speak English "less than well."

- LEP customers experience frustrations similar to those of other MBTA riders, but are at risk of experiencing specific difficulties if they are unable to find assistance from MBTA staff (the survey results from Factor 2 show that MBTA staff does not often have difficulty assisting LEP customers). LEP customers in particular are susceptible to having problems when something unusual happens or when a service is changed to respond to an incident, and only an operator's audio announcement is made. Examples of this are when a bus or train switches to express service or drop-off only, or when a bus replacement service is deployed. LEP customers could potentially become endangered or lost if they are unable to understand emergency announcements.

- Finally, LEP customers often rely on traveling companions, such as family members or friends, to use the MBTA.

Conclusions for Factor 3

From the results of the quantitative analysis, it is apparent that the MBTA has an important role to play in the lives of people with limited proficiency in English, many of whom are transit dependent. Further, staff members familiar with riders with limited English proficiency have noted that riders who have difficulty communicating in English struggled with respect to receiving correct information on fares and tickets, routes and schedules, and safety and security.

Factor 4: The Resources Available to the MBTA and Costs of Providing a Program, Activity, or Service

The fourth and final factor looks at associated costs and resources available to the MBTA to provide language assistance services considering the language needs identified in Factor 3 in the context of the MBTA's available and projected resources.

The MBTA in-house resources available to departments in meeting the needs of LEP customers include:

- Machine-translated content for the MBTA's website via Google Translate with Spanish, Chinese, Portuguese, Italian, and French highlighted on the MBTA home page. Google's machine-based translation is also able to provide translations for all of the "safe harbor" languages in the MBTA's service area.
- Trained bilingual staff in the Customer Communications and Marketing Department fluent in Spanish, Haitian French Creole, Cape Verdean Creole, and both Cantonese Chinese and Mandarin Chinese.
- On-demand translation and interpretation service contracts for interpretation at meetings, and interpretation and translation of written materials.
- MBTA and MassDOT employee training programs for new hires and existing employees, which include modules on Title VI Responsibilities, LEP Policies and Procedures, and Anti-discrimination and Harassment Prevention.
- "Engage" mapping software that allows MBTA staff, MPOs, and outreach coordinators to make instant comparisons of construction projects, transportation services, demographics (including populations of LEP individuals), and the proximity of accessible meeting places. This software is important to assess community impact and to assist with public participation planning. The software is located at: http://gis.massdot.state.ma.us/maptemplate/engage.
- Established communications and interactions with a number of community organizations in service activities, community relations, and planning efforts.

Many of these community organizations directly serve LEP households and have working knowledge of neighborhood conditions and specific needs. They can be important resources in communicating with LEP individuals and engaging minority and low-income groups in MBTA policy-making and planning initiatives.

Conclusions for Factor 4

The MBTA maintains in-house resources for providing language services to the LEP community. It also has on-demand access to resources for interpretation at meetings and for translation of written materials. Both of these factors, combined with interactions and relationships that the MBTA has with CBOs that serve LEP communities, allow the MBTA to serve the LEP community with appropriate language services.

Concluding Remarks

The MBTA is committed to providing meaningful access to LEP persons. Given the results of the four-factor analysis, the MBTA will continue to place a premium on providing language access via oral and electronic (website) channels. The MBTA will focus on enhanced language access for speakers of Spanish, who are the majority of LEP persons with whom the MBTA engages. The MBTA will continue its efforts in enhancing its language services to the speakers of Portuguese, Chinese (Mandarin and Cantonese), Haitian French Creole, and Vietnamese, who account for significant concentrations of LEP persons in the MBTA service area. The MBTA will provide language assistance upon request at minimum for all languages meeting the “safe harbor” threshold, and attempt to address those outside of that threshold as is possible.

The remainder of this document describes:

- Methods and measures the MBTA uses to communicate with customers with limited proficiency in English
- Training programs for educating staff about the Authority’s Title VI obligations, including providing accessible service to customers who are not proficient in English
- Methods the Authority uses to provide notice to the public of the Authority’s Title VI obligations, including providing language assistance to customers who are not proficient in English
- MBTA’s plans for monitoring and updating the Language Assistance Plan

II. Language Assistance Measures

Language assistance services available at the MBTA to minimize barriers for transit service access to customers with limited proficiency in English include the following oral and written assistance:

- CSAs have been equipped with tablets that access Google Translate, and are using “I speak” cards, which are supported by the Language Line. In addition, a private service called Block By Block has been contracted to provide multilingual Transit Ambassadors who will be equipped in the same way as CSAs, and deployed at stations with a high concentration of a particular language group, such as Chinatown, to serve language communities in more focused ways.
- Subway station announcements provide service and safety information in Spanish orally and visually via LED signs at stations.
- Safety and security information, including wayfinding, is provided at stations using universal symbols.
- Automated fare kiosks provide fare media and information in Spanish and Chinese, in addition to English.
- The MBTA website uses Google Translate to provide trip planning, schedules, and information on how to use the MBTA’s system in multiple languages. Spanish, Chinese, Portuguese, Italian, and French are highlighted on the MBTA’s home page. Currently the site is being developed to better represent the changing demographics of LEP populations in the region. Google’s machine-based translation is also able to provide translations for more than 100 languages, covering most of the languages in the MBTA’s service area.
- Major-service-change and fare-change information is distributed in multiple languages, including Spanish, Portuguese, Chinese, Haitian Creole, Cape Verdean Creole, and Vietnamese.
- The MBTA Transit Police, in fulfilling a policy of quick and courteous response to all persons on a 24-hour basis, has contracted with on-call vendor Language Line Services to provide interpreter services. All officers, including Transit Police dispatchers, have 24-hour access to the service, which provides immediate translation service in more than 170 languages.
- In addition, the MBTA Transit Police have a number of police officers able to communicate in multiple languages. At present, 16 officers on staff are able to speak Spanish. Other language capabilities within the department are Italian, French, Haitian Creole, Vietnamese, Portuguese, Chinese (Cantonese and Toisanese), and American Sign Language.

- Brochures and notices of Title VI rights and complaints procedures are translated in multiple languages.
- Service diversion notices are posted in Spanish and other languages, as appropriate.
- Interpretation and translated materials are offered at community public meetings, as appropriate.
- MBTA departments may obtain work orders with private vendors that provide translation services. MBTA staff is advised to make arrangements for translator services at least five business days prior to an event.
- The MBTA, through the MassDOT Community Affairs Office, provides outreach, including notice and press information using local media. Among the prominent media publications serving minority and non-English-speaking communities are *El Mundo*, *El Planeta*, *Dorchester Reporter*, *Haitian Reporter*, *Sampan*, and *The Bay State Banner*.
- The Office of Diversity and Civil Rights (ODCR) provides technical assistance and guidance for all departments on Title VI issues, including assistance in serving LEP customers. Information and general assistance is available through ODCR at 617-222-3305.
- In April 2017, the MBTA embarked on a pilot program of bilingual Spanish and English audio announcements and digital messages in Blue Line stations and vehicles. The program is currently running at Maverick Station and on all buses out of the Lynn Garage, chosen because they serve areas with particularly large populations of Spanish speakers. After several months of program development, revision, and public feedback, the MBTA intends to fully implement the program across all Blue Line Stations and the entire Blue Line fleet. This program will be used as a way to study the effectiveness of announcements and receive feedback on them as the MBTA begins expanding the program to Red and Orange Lines. (For bilingual announcements currently being used in the pilot, please refer to Proposed Bilingual Station and Vehicle Announcements in the Language Assistance Plan Appendix.)

MBTA Vital Materials for Translation

Vital materials are defined as information or documents that are critical for accessing MBTA services, programs, and activities, and they are prioritized for translation and distribution. The MBTA has identified the following vital documents and materials:

- Communications affecting health and safety
- Security announcements and signage
- Emergency related public announcements
- Materials regarding Title VI rights and complaint procedures
- Basic critical customer information on how to use and access the MBTA system such as ticket/pass purchase instruction
- Information and notices affecting a rider's ability to access and use the system safely and effectively (for example, major station changes, renovations, and permanent major changes in fares, service, or service routes)

The ODCR Title VI Unit developed a strategic plan to ensure any vital information considered critical for customers to access MBTA services are translated into the most commonly spoken languages in the service area. The MBTA has prioritized documents and other communications for translation across the following three tiers:

- Tier 1: Safety, Security, and Legal Rights Information
- Tier 2: Vital Customer Access Information
- Tier 3: Information Critical to Customer Involvement and Outreach

Tier 1—Safety, Security, and Civil Rights:

The documents listed in Tier 1 have been prioritized because the information to be shared is considered the most vital to customers, according to the four-factor analysis in the MBTA's 2014 Language Assistance Plan, which is also influenced by guidance from the Department of Justice (DOJ) on LEP Implementation. In February 2017 the MBTA Safety Department initiated a robust process to overhaul and improve all emergency and safety signage inside of each light- and heavy-rail vehicle. In taking on this task, the Safety Department has partnered with a multi-disciplinary team comprised of staff members from operations (for example, light-rail and heavy-rail engineers and vehicle maintenance) the Office of System-Wide Accessibility, the Customer Experience Department, MBTA Wayfinding, and the ODCR. The redesign of the emergency and safety signage included simplifying content, adding universal symbols, and meeting ADA and Title VI requirements, specifically as it relates to the Authority's language access obligations.

Below is a list of the documents the MBTA has translated throughout this triennial period:

MBTA Heavy- and Light-Rail Vehicles

- Subway Emergency Instructions
- Emergency Brake and Door Release Instructions
- Passenger Emergency Intercom
- Press for Ramp (Accessibility Instructions)
- MBTA Title VI Notice to the Public
- ADA Priority Seating Signage

MBTA Transit Stations

- MBTA Title VI Notice to the Public
- Elevator Out of Service Notice

Available on the MBTA Website

- MBTA Title VI Complaint Procedures
- MBTA Title VI Complaint Forms
- Title VI Notice to the Public

Tier 2—Information Critical to Access:

Tier 2 includes materials that are not essential to ensure customer safety, security, or legal rights but are critical to support customer access to the MBTA's transit system. These documents include information about the MBTA system, fare information, major service and fare changes, routes and schedules, service alerts, and paratransit information. This tier is also consistent with the vital document concept in that most people with limited proficiency in English share concerns about receiving information on fares and tickets, routes and schedules, and accessibility accommodations. The documents found in Tier 2 are consistent with changes made to improve the system. The MBTA will translate all documents resulting from any fare, service, or seasonal change, such as the winter resiliency program. The MBTA has defined the following materials as providing system access information:

- Service and fare change information
- Automated fare vending machines
- Americans with Disabilities Act reduced fare program application
- THE RIDE acceptance letter
- Information about the On-Demand Paratransit Pilot Program
- System maps
- Winter service impact poster (seasonal)

Tier 3—General Information for Customer Involvement:

Tier 3 provides information that is critical to customer participation in the decision-making process to improve the system and maintain its state of repair. For example, this

tier includes information that notifies customers of opportunities to attend events such as board meetings and public meetings about capital improvement projects, and/or regarding fare or major service changes. These documents will help customers play a role in the short- and long-term decision-making processes that can empower community groups to voice their opinions or concerns about the quality of transit service in their communities. The MBTA has defined the following materials as providing general information for public involvement:

- Charlie Card Store documents
- Publications of MBTA policies and procedures
- Public meeting flyers and outreach material
- MBTA website promoting 15 Languages with others available

Other Materials

Other materials considered non-vital may be translated by MBTA departments upon request. Examples of non-vital materials are:

- Planning studies and reports
- Budget reports, including capital investment program
- General advertisements
- General announcements

III. Training Programs for MBTA Personnel

The following section provides a summary outline of the human resource training programs that the MBTA has in place. All include a reference to the Authority's Title VI obligations, including providing access to service for customers with limited proficiency in English. Each Title VI element of the training extended to employees is facilitated with the overall goal of informing, supporting, and providing the necessary information, tools, and guidance in understanding and appreciating the Title VI requirements.

New-Hire Orientation

The MBTA's Human Resources Department provides orientation training for all new MBTA employees. Included within the orientation is a presentation by the ODCR of the Authority's policies and obligations to promote fairness, diversity, and inclusion for all employees and customers to ensure compliance with federal and state civil rights laws and regulations.

The Title VI element of the presentation provided by ODCR's Title VI Unit is primarily focused on providing information regarding staff responsibilities, including the need to provide appropriate language services that eliminate barriers to transit service access

for MBTA customers. New hires are trained in the importance of being professional, sensitive, and responsive, as well as on the need to treat all customers with equal respect regardless of language spoken.

Anti-Discrimination and Harassment Prevention (ADHP)

The MBTA's ADHP training focuses on civil rights and MBTA policies. One goal of the training is to have employees gain an understanding of supervisors' responsibilities, employees' rights and responsibilities, and customers' rights under the laws and MBTA policies. Another goal is to develop skills and best practices for focusing on legitimate reasons for all employment decisions, and accountability regarding the same; to review best practices for maintaining excellence in customer service; and to learn when to seek assistance and/or partner with ODCR and/or other appropriate representatives at the MBTA.

This mandatory training is offered in separate sessions for supervisors and non-supervisory employees. Managers and supervisors are required to take the training every two years; all frontline employees must complete the one-day training every three years. The training includes a discussion of workplace scenarios, including interactions with customers who are unable to speak English.

Training of Customer Service Representatives

The objective of this training is to help Customer Service Representatives (CSRs) raise their awareness of the policies and procedures regarding Title VI requirements. CSRs are employees who operate the MBTA's Customer Communications Call Center.

This training provides practical tips and tools for supervisors to develop best-practice skills in areas of Title VI language access, anti-discrimination, and harassment prevention regulations. Participants gain hands-on experience in how to recognize and handle caution areas, the rules for maintaining a discrimination-free workplace, and an awareness of the LEP customer environment.

This training provides CSRs with the necessary awareness and best-practice skills for providing excellent customer service. Representatives learn the LEP policies and procedures for working with customers with limited English language skills. Employees are also taught how to identify Title VI concerns and make appropriate referrals to connect customers with ODCR. In addition, this training raises their understanding and sensitivity to their responsibilities in helping to provide meaningful access to information and services to all customers.

OCDR provided this training to newly contracted employees of GCS for the Call Center in spring of 2017.

"How Can I Help You Today?" Customer Service Training

All frontline MBTA Operations employees, including crew members and ticketing agents operating the MBTA commuter rail system, are required to complete customer service training. The one-day training program provided by the MBTA Human Resources Department includes a module on confronting stereotypes and on employee obligations with regard to Title VI, including tools and materials for communication with customers who have limited English proficiency.

All the training programs mentioned above include:

1) A summary of responsibilities under the LEP guidance
2) A summary of the MBTA's Language Assistance Plan
3) A summary of the Four-Factor Analysis of language assistance needs prepared by the MBTA (Number of LEP persons, frequency of contact, importance of program, and cost factor)
4) A description of the language assistance services made available by the MBTA and how staff can access these services

Media resources available to be used in MBTA training programs include:

1) LEP videos accessed on the FTA's website, including www.lep.gov
2) Links to policy information, including webinars produced by the FTA's Office of Civil Rights, available at www.transit.dot.gov/regulations-and-guidance/civil-rights-ada/title-vi-civil-rights-act-1964
3) Best practices in engaging LEP customers, available at www.fhwa.dot.gov/planning/publications/low_limited/index.cfm

IV. Providing Notices to LEP Persons

The MBTA incorporates multiple methods and media in communicating with its customers and the general public. These include:

- Public meetings and hearing notices
- Postings on www.mbta.com and www.massdot.state.ma.us/
- Postings on the Boston Region MPO's website at www.bostonmpo.org and distributions via email
- Distribution through community-based neighborhood organizations including those serving or representing minority and low-income groups. (A listing of

these organizations is included in the MBTA's Public Participation Plan, in Appendix 2-B.)

- Customer Communications Call Center phone line
- Transit Police dispatch phone line
- Press releases, including distribution to outlets serving minority and low-income neighborhoods (for example, to the publications *El Mundo, The Bay State Banner, El Planeta, Mattapan Reporter, Dorchester Reporter, Sampan,* and *Haitian Reporter*)
- Brochures available in multiple languages (English, Spanish, Chinese, Portuguese, Haitian Creole, and Italian), informing customers of their Title VI rights and the MBTA's complaint process
- Bilingual announcements in stations and on vehicles. In summer 2017, the MBTA has begun a pilot program on the Blue Line, using Spanish language announcements with the intention of expanding that program in the future

V Monitoring and Updating the Language Assistance Plan

The MBTA has designated ODCR to provide oversight and coordination of the implementation of the LEP Policy and Procedure. ODCR directs the ongoing monitoring and periodic assessment of the LEP Plan's effectiveness with assistance of the interdepartmental MBTA Title VI Working Group and technical assistance from the Central Transportation Planning Staff (CTPS).

ODCR, on an ongoing basis, reviews the effectiveness of the LEP Plan using strategies that may include, but are not limited to the following:

- Solicit direct feedback from CBOs and other stakeholders by distributing a questionnaire or holding focus group sessions on communicating with LEP individuals;
- Assess the demographic composition of the MBTA service area using the most current census data or data collected from community organizations;
- Measure the actual frequency of contact by LEP persons by collecting information from the Customer Care Call Center, the MBTA website translation, and frontline operations staff interviews;
- Partnership with other Boston-region organizations and participation in regional forums and events focused on issues of diversity and social equity.

Such regional collaborations include the MetroFuture planning workshops and task forces headed by the Metropolitan Area Planning Council; and

- Changes by the MBTA to this Language Assistance Plan as needed; at a minimum every three years. The three-year update will coincide with the MBTA's Title VI Program submittal to the FTA.

Table 8 shows the MBTA's Language Assistance Implementation Schedule.

Table 8
Language Assistance Plan Implementation Scheduled (as of September 2017)

Key
( ) = Progress made during this triennial cycle; - = Ongoing (Completed & Maintain); X = Completed; √ = Target Completion;

Activity/Task	Responsibility	(FY 15)	(FY 16)	(FY 17)	FY 18	FY 19	FY 20	Status
1. Identification of LEP Individuals Who Need Language Assistance								
A. Update to MBTA Four Factor Analysis	CTPS; ODCR	-	-	X	-	-	√	Generally, the four factor analysis is updated every three years, but will be updated on an interim basis, if needed
B. Update inventory/ information from CBOs	Marketing, Community Affairs, ODCR	-	-	X	-	-	√	The MBTA maintains and regularly updates its lists of CBOs throughout the service area, particularly within minority and low-income neighborhoods.
2. Safety, Security, and Legal Rights Information								
A. Title VI Notices and Complaint Forms								
i. Rapid Transit Stations	ODCR, Customer Experience, Charlestown Sign Shop, Operations	-	-	X	-	-	√	The revised Title VI Notice is available inside of display cases in 28 rapid transit stations for this reporting cycle. Although, the previous notice is currently available inside of display cases at all other stations but will be replaced by the next triennial reporting period.
ii. Commuter Rail Stations	Keolis, ODCR			X	-	-	√	The Title VI Notice is currently available at South Station, North Station, Back Bay, and Ruggles Stations. Keolis is aiming to install notices at additional designated LEP/minority commuter rail stations.
iii. MBTA Major Bus Terminals	ODCR, Customer Experience, Charlestown Sign Shop, Operations	-	-	X	-	-	-	The previous notice will be replaced with the revised version.
iv. Ferry Terminals	Customer Experience, ODCR, Contracted Service Operations	-	-	X	-	-	-	The previous notice will be replaced with the revised version.
v. MBTA Heavy and Light Rail Vehicles	ODCR, Customer Experience, Subway Engineer Operations				√	-	-	The installation of the Title VI Notice inside of transit vehicles is a part of a broader effort by the MBTA Safety Department to update all safety signage inside

								of each heavy and light rail vehicle, which is currently in progress and scheduled to be completed January 2018.
vi. MBTA Buses	ODCR, Customer Experience, Subway Engineer Operations				√	-	-	Notices will be posted on all MBTA buses and updated as needed.
MBTA Title VI Complaint Forms	ODCR, IT	-	-	X	-	-	-	A revised Title VI complaint form is available online in the top 10 languages in the MBTA service area.
B. Emergency, Safety, and Security Information								
i. Station PA Announcements	ODCR, Customer Experience, Operations			√	-	-	√	Bilingual announcements are available at all Blue Line Stations (13 total). More stations will be added by the next reporting cycle.
ii. Bus PA Announcements	ODCR, Customer Experience, Engineering, and Subway Operations			√	-	-	√	All MBTA buses out of the Lynn garage will play bilingual schedule change announcements; the existing messages will play through the fall.
ii. Emergency and Safety Signage	MBTA Safety Department, Customer Experience, Subway Operations, System-Wide Accessibility, ODCR	X	-	-	√	-	-	MTBA Safety Department is in the process of updating all safety signage inside of heavy rail and light rail vehicles, which will continue to be maintained and updated as needed.
iii. ADA Priority Seating Signage	MBTA System-Wide Accessibility	-	-	-	√	-	-	The revised priority seating signs include both English and Spanish.
3. Vital Customer Access Information								
i. Fare and Major Service Changes	Marketing, Planning and Schedules, Operations	X	-	-	-	-	-	Updated as needed
ii. THE RIDE Guide	Office of Transportation Access	-	-	-	-	-	-	Translations of the guide are made upon request
iii. THE RIDE Acceptance Letter	Office of Transportation Access	-	-	-	-	-	-	Translations of the acceptance letter are made upon request
iv. Paratransit - Uber/Lyft Pilot Program	Department of Transportation Innovation			X	-	-	√	Information about the Uber/Lyft Pilot is available on the MBTA website in the top 14 languages used in the service area. For additional web language support, the MBTA will integrate

								Google Translate into the paratransit landing page for the Uber/Lyft program.
iv. Fare payment instructions	MBTA Customer Experience	X	-	-	-	-	-	Kiosk information in Spanish and Chinese
v. Ticket vending machines with multilingual functions	MBTA AFC Department	X	-	-	-	-	-	Fare vending machines offer instructions in English, Spanish, and Chinese
vi ADA Reduced Fare Application	MBTA System-Wide Accessibility	X	-	-	-	-	-	ADA Reduced Fare Applications are available online and at the Charlie Card Store in 14 languages
vii. Translated information on website	MBTA Customer Technology Department	X	-	-	-	-	-	The MBTA Website uses Google Translate
4. Outreach and General Information								
i. Translate meeting notices and press releases	Customer Experience and Relevant Department	X	-	-	-	-	-	As needed; languages for translation selected on the basis of the four-factor analysis
ii. Provide interpreters at public meetings	Relevant Department	X	-	-	-	-	-	As needed / upon request; languages for translation selected on the basis of the four-factor analysis
5. Monitoring and Updating the LEP Plan								
i. Conduct Language Assistance Plan and Public Participation Plan trainings for each department with public-facing responsibilities	ODCR	-	-	X	-	-	√	ODCR is in the process of training key public-facing MBTA/MassDOT departments on the Language Assistance Plan and Public Participation Plan
ii. Obtain feedback from CBOs and agency staff	ODCR	-	-	X	-	-	√	ODCR has structured an outreach plan to engage with CBOs to seek feedback and recommendation on the MBTA's language assistance measures
iii. Update Language Assistance Plan based on feedback and assessment	ODCR	-	-	X	-	-	√	Ongoing

ADD Appendix
Blue Line Station and Vehicle Bilingual Announcements

Proposed Bilingual Station and Vehicle Announcements

Emergency Station Announcements			
	Purpose	**English Version**	**Spanish Version**
1.	*Security Announcement*	Attention passengers: an emergency situation has been reported. Please remain calm and listen for any further instructions. We apologize for any delays and appreciate your cooperation.	Atención pasajeros: se ha reportado una emergencia. Por favor, mantenga la calma y escuche los anuncios para más información. Lamentamos cualquier inconveniente y agradecemos su cooperación.
2.	*Security Announcement*	In the event of an emergency please remain calm, listen to and follow instructions provided by MBTA employees. Thank you for your cooperation.	En caso de una emergencia, por favor mantega la calma, escuche y siga las instrucciones suplidas por el personal del MBTA. Gracias por su cooperación.

Safety and Security Station Announcements

	Purpose	English Version	Spanish Version
1.	*Safety Information*	See Something, Say Something: Please report any unattended bags or unusual behavior to an MBTA employee or transit police at 617-222-1212.	Spanish: Favor de reportar cualquier artículo desatendido o comportamiento inapropiado a algun empleado u oficial de tránsito del MBTA. Puede contactar a la polica de tránsito al 617-222-1212.
2.	*Safety Information*	No Smoking: Attention passengers: please remember that for the safety and comfort of all, there is no smoking on MBTA property or vehicles.	Atención pasajeros: por favor recuerde que para la seguridad y comodidad de todos, no se permite fumar en ningun vehiculo o propiedad del MBTA.

Bus PSAs

	Purpose	English Version	Spanish Version
1.	*Schedule Change*	The summer schedule begins on Saturday. Pick up a new bus schedule for details.	El horario/itinerario de verano comienza el sábado. Véase el horario nuevo para más detalles.
2.	*Schedule Change*	The fall schedule begins on Saturday. Pick up a new bus schedule for details.	El horario de otoño comienza el sábado. Véase el horario nuevo para más detalles.
3.	*General Information*	Please report any unattended bags or unusual behavior to the bus driver.	Por favor reporte cualquier artículo desatendido o comportamiento inapropiado al conductor del autobús
4.	*General Information*	Please make priority seating available to seniors and persons with disabilities	Por favor ceda los asientos de prioridad a personas mayores o personas con discapacidad
5.	*General Information*	If you have concerns or complaints regarding the cleanliness of this bus, please email us at cleanvehicle@mbta.com.	Si tiene alguna queja sobre el estado de limpieza del autobús, favor de mandarnos un correo electrónico a cleanvehicle@mbta.com.

Rapid Transit Vehicles PSA's			
	Purpose	**English Version**	**Spanish Version**
1.	*General Information*	This is the last stop - no passengers please.	Esta es la última parada. Por favor no pasajeros.
2.	*General Information*	Please take your personal belongings with you when you exit the train.	Favor de llevarse sus pertenencias al salir del tren.
3.	*General Information*	Federal law requires priority seats be available for seniors and or persons with disabilities.	La ley federal requiere que haya asientos disponibles para personas mayores o personas con discapacidad.
4.	*General Information*	Please watch your step while exiting the train.	Por favor tenga cuidado al salir del tren.

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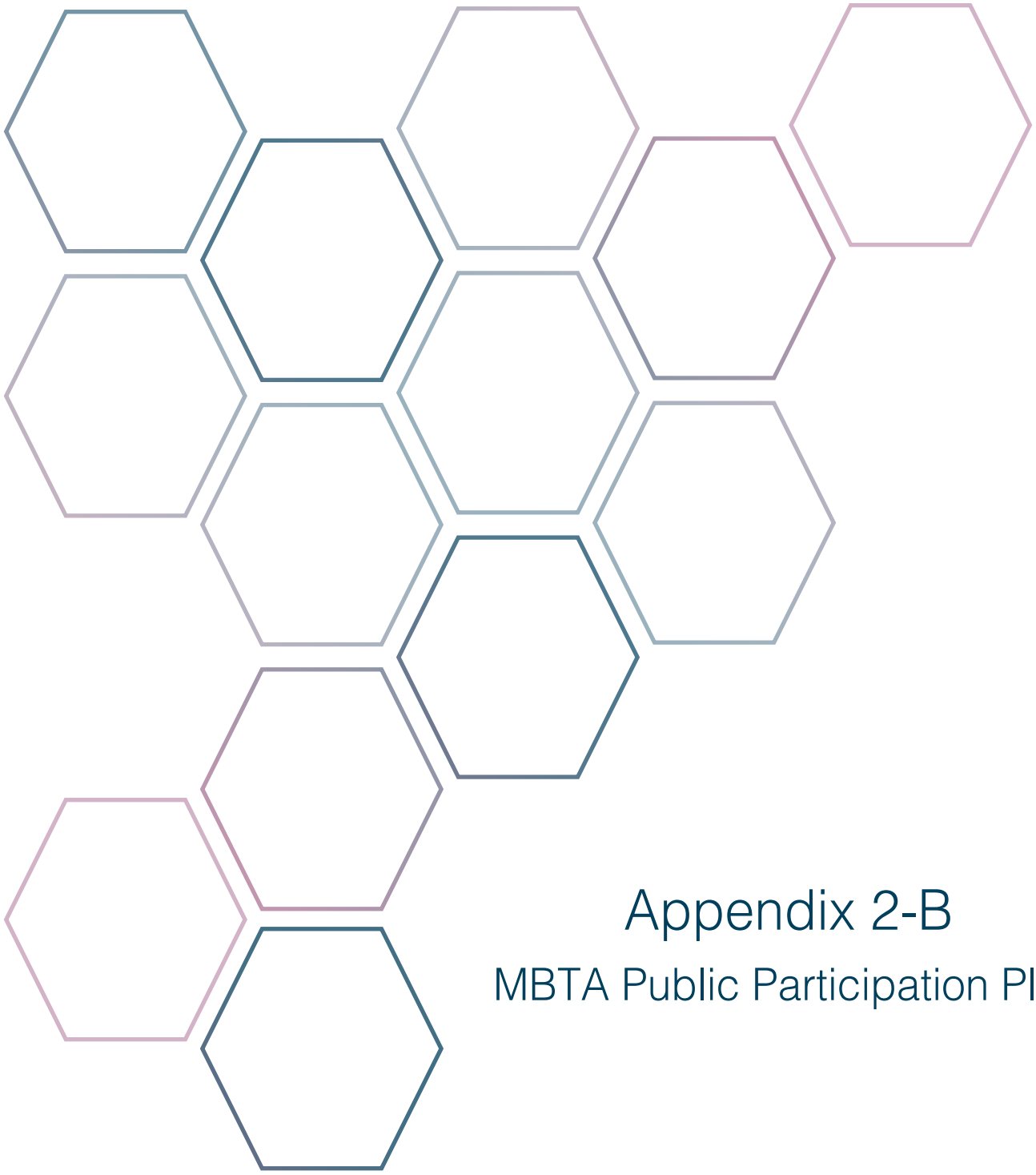

Appendix 2-B

MBTA Public Participation Plan

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Massachusetts Bay Transportation Authority

PUBLIC PARTICIPATION PLAN

Massachusetts Bay Transportation Authority

Driven by Customer Service

massDOT

Massachusetts Department of Transportation

Leading the Nation in Transportation Excellence

Table of Contents

1 INTRODUCTION

In accordance with state and federal law requirements[1], and to ensure inclusive and accessible public engagement processes for transportation decision making, the Massachusetts Bay Transportation Authority (MBTA) as a component of the Massachusetts Department of Transportation (MassDOT/MBTA) has developed this Public Participation Plan (PPP). This Plan serves to guide agency public participation efforts, including populations that have been underserved by the transportation system and/or have lacked access to the decision-making process. This Plan guides MassDOT/MBTA in its efforts to offer early, continuous, and meaningful opportunities for the public to help identify social, economic, and environmental impacts of proposed transportation policies, projects and initiatives across MassDOT/MBTA.

The Plan is based on federal and state requirements for encouraging and ensuring community participation. It describes MassDOT/MBTA's overall goals, guiding principles, and strategic approach to achieving stated objectives. The Plan also defines how MassDOT/MBTA incorporates public participation into its transportation decision-making processes, and how the agency ensures access for people with disabilities and the inclusion of low income and minority stakeholders. Specifically, the Plan states the methods that MassDOT/MBTA will use to reach out to persons who are low-income, minority, Limited English Proficient (LEP), or have a disability, and other traditionally underrepresented populations. Because different transportation decisions to be made require different techniques for reaching the public, this Plan provides a toolbox of techniques to be applied, as appropriate, to achieve effective participation.

This Plan is a living document which will change and grow to help MassDOT/MBTA deepen and sustain its work to engage diverse community members throughout the state. Therefore, MassDOT/MBTA will modify its public participation methods and activities over time, based on ideas and feedback from community members and MassDOT/MBTA's evaluation of our public participation effectiveness.

The Plan was developed through a collaborative effort between the MassDOT/MBTA Highway Division, the Rail and Transit Division (including the Massachusetts Bay Transportation Authority's Systemwide Accessibility Department), the Office of Transportation Planning and the Office of Diversity and Civil Rights. It is intended as a document that will govern MassDOT/MBTA's public

[1] The federal and state statutory and regulatory requirements are included at Attachment 1.

participation activities, but also serve as a useful guide for the metropolitan planning organizations and cities and towns MassDOT/MBTA works with, as well as for the consultants we contract with for public engagement support. The Plan also empower the public through its clear definition of how MassDOT/MBTA conducts it public participation activities, and sets a standard for our public facing departments, including managers and staff, to achieve. This Plan is not intended to be applied in a wooden manner, meaning that there may be occasions where the facts or circumstances may not allow for absolute compliance with the protocols and policies stated, but that we will make every effort to meet the standards we have set. Also, it is important to note that some areas within MassDOT/MBTA have pre-existing and approved policies for public engagement that are unique to the functions they carry out or the targeted audiences served, and in such instances (for example, Disadvantaged Business Enterprise goal setting), there may be departures from this Plan that are legitimate and reasonable.

In order for this Plan to take full effect, MassDOT/MBTA requires and will seek public comment, and make such changes and improvements on this Plan and related protocols and policies as will improve our ability to provide an equal opportunity for public input in our transportation decision making processes.

1.1 MassDOT/MBTA's Structure, Mission and Values

The MBTA is a separate legal entity but exists within the orgzanitationl structure of MassDOT. The MBTA operates within the Rail and Transit subdivision of the MassDOT structure.

- The Rail and Transit Division is responsible for overseeing, coordinating, and planning all transit and rail matters throughout the commonwealth. The division administers and manages the freight and rail programs of the department and the intercity bus capital assistance program, and oversees the Massachusetts Bay Transportation Authority (MBTA) and all regional transit authorities in the Commonwealth. The MassDOT/MBTA Board of Directors serves as the governing body of the MBTA.

MassDOT/MBTA's mission is to deliver excellent customer service to people who travel in the Commonwealth and to provide our nation's safest and most reliable transportation system in a way

that strengthens the Commonwealth's economy and quality of life. MassDOT/MBTA embraces the following values:

1. **Dedication**: We will provide service around the clock and under all circumstances.
2. **Respect**: We will treat the public as our valued customer, and treat one another as we would like to be treated.
3. **Innovation**: We will improve and integrate transportation services using creative thinking and the best available practices and technology, while minimizing disruption to the public.
4. **Diversity**: We will promote an inclusive workforce and a culture that serves employees and customers fairly.
5. **Honesty**: We will provide the public with accurate information that is understandable and accessible.

1.2 MassDOT/MBTA's Public Participation Goals

MassDOT/MBTA has the following public participation goals which agency representatives and those working in concert with MassDOT/MBTA on transportation projects and initiatives should strive to achieve:

1. *Obtain Quality Input and Participation*

   Comments received by MassDOT/MBTA are to be encouraged and reviewed to the extent they can be useful, relevant, and constructive, and contribute to better plans, projects, programs, and decisions.

2. *Establish Consistent Commitment*

   MassDOT/MBTA strives to communicate regularly and develop trust with communities, while helping build community capacity to provide public input, as needed.

3. *Increase Diversity*

   Participants who are encouraged to participate in public engagement processes should represent, as appropriate to a project or those impacted, a range of socioeconomic, ethnic, and cultural perspectives and include people from low-income and minority neighborhoods, people with limited English proficiency, and other traditionally underserved people.

4. *Ensure Accessibility*

   Every effort should be made to ensure that participation opportunities are physically, geographically, temporally, linguistically and culturally accessible.

5. *Provide Relevance*

   Issues are framed clearly and simply such that the significance and potential effect may be understood by the greatest number of participants.

6. *Foster Participant Satisfaction*

   MassDOT/MBTA should encourage the public to participate in project and initiative related discussions, recognizing that people who take the time to participate feel it is worth the effort to join the discussion and provide feedback.

7. *Clearly Define Potential for Influence*

   The process clearly identifies and communicates where and how participants can have influence and direct impact on decision making.

8. *Establish and Maintain Partnerships*

   MassDOT/MBTA develops and maintains partnerships with communities and community-based organizations through the activities described in the PPP.

9. *Provide Opportunities to Build Consensus*

   MassDOT/MBTA should ensure that discussions, particularly where there are conflicting views, are structured to allow for levels of compromise and consensus that will satisfy the greatest number of community concerns and objectives. MassDOT/MBTA recognizes that processes which allow for consensus to be achieved is critical to enable public support for recommended actions.

1.3 Guiding Principles for Public Participation at MassDOT/MBTA

To help MassDOT/MBTA achieve its goals for public participation, the following principles have been adopted:

1. *Promote Respect*

All transportation constituents and the views they promote should be respected. All feedback received should be given careful and respectful consideration. Members of the public should have opportunities to debate issues, frame alternative solutions, and affect final decisions.

2. *Provide Proactive and Timely Opportunities for Involvement*

   Avenues for involvement should be open, meaningful, and organized to let people participate comfortably, taking into consideration accessibility, language, scheduling, location and the format of informational materials. Meetings should be structured to allow informed, constructive dialogue, be promoted broadly and affirmatively; and be clearly defined in the early stages of plan or project development. Participation activities should allow for early involvement and be ongoing and proactive, so participants can have a fair opportunity to influence MassDOT/MBTA decisions.

3. *Offer Authentic and Meaningful Participation*

   MassDOT/MBTA should support public participation as a dynamic and meaningful activity that requires teamwork and commitment at all levels. Public processes should provide participants with purposeful involvement, allowing useful feedback and guidance. Participants should be encouraged to understand and speak with awareness of the many competing interests, issues, and needs that lead to transportation ideas and projects.

4. *Provide a Clear, Focused, and Predictable Process*

   The participation process should be understandable and known well in advance. This clarity should be structured to allow members of the public and officials to plan their time and use their resources to provide input effectively. Activities should have a clear purpose, the intended use of input received made clear, and all explanations described in language that is easy to understand.

5. *Foster Diversity and Inclusiveness*

   MassDOT/MBTA should proactively reach out to and engage people with disabilities, as well as low-income, minority, limited English proficient disabled and other traditionally underserved populations.

6. *Be Responsive to Participants*

MassDOT/MBTA meetings should facilitate discussion addresses participants interests and concerns. Scheduling should be designed to meet the greatest number of participants possible and be considerate of their schedules and availability. Informational materials provided should be clear, concise and responsive to known community concerns, while avoiding misleading or biased suggestions or solutions.

7. Record, Share and Respond to Public Comments ***

   Public comments, written and verbal, should be given consideration in MassDOT/MBTA decision making processes and reported in relevant documents. Specifically, public comments provide an opportunity for shared knowledge among MassDOT/MBTA departments and transportation partners, but also require clear responses that are documented to demonstrate that community input was in fact addressed. MassDOT/MBTA should communicate the impact of the public input on decisions at a broad summary level, describing the major themes, the decisions reached, and the rationales for the decisions.

8. *Self-evaluation and Plan Modification*

   The effectiveness of this Plan will be reviewed periodically to ensure it meets the needs of the public, and will be revised to include new strategies and approaches.

2. MassDOT/MBTA'S APPROACH TO PUBLIC PARTICIPATION

Transportation decision making and project development processes are regulated and follow set procedures, including the need to give the public opportunities to participate. These public involvement objectives are further shaped by MassDOT/MBTA's commitment to civil rights related obligations, such as removal of barriers to participation, diversity, and inclusive outreach. This Public Participation Plan describes participation opportunities generally and includes specific protocols and resources that are designed to facilitate diverse and inclusive public outreach and involvement. The plan is a flexible and evolving document. As necessary, MassDOT/MBTA will revise the PPP based on recurring assessments of successes and/or challenges associated with outreach, as well as suggestions made and the results of public engagement processes.

In this chapter, a general description of MassDOT/MBTA's public participation activities is presented. Chapter 3 contains the specific civil rights protocols utilized by MassDOT/MBTA for all public outreach activities, categorized by types of communication formats, including large group discussions targeted group engagement and one-on-one interactions. Chapter 3 also contains the MassDOT/MBTA Accessible Meeting Policy. Our view is that if these objectives and standards are consistently applied to the different types of public meetings MassDOT/MBTA convenes or participates in, the resulting discussions and resolution of issues will be inclusive and accessible to all.

In the subsequent chapters, specific opportunities to participate are described in the context of the development of:

- Fare Changes
- Service Planning and Operations
- Capital Project Development and Design

These outreach described for these specific activities should be read in concert with the civil rights protocols set forth in Chapter 3, as they are both congruent with and structured to facilitate inclusion in all MassDOT/MBTA public participation efforts.

In addition, relevant federal policy guidance, principles and techniques are referenced that enhance the potential for successful public participation processes. These ideas are derived from the U.S. DOT– sponsored guidance for systematically setting up and implementing a public

participation program for a specific plan, program, or project. See Appendix 2, U.S. DOT Guidance, *Public Involvement Techniques for Transportation Decision-Making.*

2.2 Public Participation Techniques

MassDOT/MBTA takes pride in its work to maintain a collaborative relationship with community and municipal stakeholders and has strategically developed this Public Participation Plan to foster collaboration in an all-inclusive manner. The MassDOT/MBTA public outreach effort rests on utilizing multiple communication channels to distribute information to and solicit input from affected constituencies. MassDOT/MBTA typically communicates with the general public through one or more of the following methods:

- MassDOT/MBTA website
- Public Media (including local minority and non-English newspapers, radio stations, and television stations)
- Press releases
- Posters, display boards, and flyers
- Project fact sheets
- Brochures
- Newsletters
- Public service announcements
- Mailing and email lists
- Information stands at local events
- Social media tools, including Twitter, the blog, Flickr, YouTube, email distribution lists, and other new media venues
- Legislative briefings
- Presentations, public meetings, public hearings, open houses, and workshops
- Civic advisory committees and working groups

MassDOT/MBTA Website Specifics:

Many people use the Internet as their main source of data and information. The MassDOT/MBTA website is a comprehensive resource for people wanting information about MassDOT/MBTA programs, projects, and activities. Public notices of all MassDOT/MBTA meetings, public hearings, and public comment periods are posted ton this site, along with information about MassDOT/MBTA programs, projects, and activities. Some programs and projects have dedicated web pages on the MassDOT/MBTA website that include:

- Information about upcoming meetings
- Project presentations and fact sheets
- Summary notes for meetings/workshops on the project
- A way to be added to the project's electronic distribution list

Project websites are important tools for people who cannot attend meetings. Members of the public can review presentations and meeting summaries and provide comments through emails and letters to the project team. People with disabilities that limit their ability to attend meetings can also review project information and provide comments on the website, and thereby have an alternative to physically attending a meeting.

Meeting Notice Content and Distribution:

MassDOT/MBTA announces all meetings, public hearings, open houses, workshops, and public comment periods through press releases, mailings, and/or the distribution of informational meeting flyers as well as placing meeting information on the MassDOT/MBTA website. Notices are published in local English newspapers, and if the project has an impact on low income or minority populations, an effort is made to place notices in media that serves local, minority and non-English communities in regions across the Commonwealth. In the greater Boston area, such publications include *El Mundo*, *El Planeta*, *Vocero Hispano, Mattapan Reporter*, *Haitian Reporter*, *Sampan*, and *The Bay State Banner*. Meeting notices will include information about getting to a meeting location using public transportation, when transit is available. MassDOT/MBTA notices also let people know they can request foreign language assistance, and that sign-language interpreters and other accommodations are available on request for people with disabilities (with timely notification). There is also information that lets people know who they can contact with questions or concerns. The information for these meetings and the informational materials provided at the meetings are translated into languages other than English, as needed.

2.2.1 Public Meetings, Open Houses, and Workshops

1) Public Meetings

Public meetings are held to present information to the public and obtain input from community residents. Meetings provide a time and place for face-to-face contact and two-way communication. They are generally tailored to specific issues or community groups and can be either informal or formal. Public meetings are used to disseminate information, provide a setting for public discussion, and receive feedback from the community.

2) Open Houses

Open houses are informal settings where people can obtain information about a plan, program, or project. They do not have formal agendas, and no formal discussions or presentations take place. At open houses, people receive information informally from exhibits and staff, and they are encouraged to give opinions, make comments, and state preferences to staff, orally or in writing. Informal presentations, slide shows, and one-on-one discussions take place continuously throughout the event, which usually includes a series of stations: a reception area; a presentation area for slide shows or short talks; areas for one-on-one discussions between community people and agency staff members; and displays of background information, activities to date, work flow, and anticipated next steps, accompanied by an array of primary subject panels. Since there is no fixed agenda, open houses are usually scheduled for substantial portions of a day or evening, so that people can drop in at their convenience and fully participate.

Note that Open Houses often involve one-on-one discussion of issues or concerns between meeting participants and project engineers or other MassDOT/MBTA representatives. The content and nature of these informal exchanges is not easily captured in documents such as meeting summaries or notes. Thus, those MassDOT/MBTA representatives that have such an exchange are instructed to relay the content to the Project Manager so that these issues are catalogued and tracked, as needed.

3) Workshops

Workshops are organized around a particular topic or activity and typically involve a relatively small group of people who want to participate intensively. These events are usually one to three hours in duration, and small groups work on a specific agenda. MassDOT/MBTA staff members provide

information, answer questions, and participate as individuals in workshops. Workshops are inherently participatory and encourage a "working together" atmosphere.

2.2.2 Public Hearings

A public hearing is more formal than a public meeting. The public hearing is an opportunity for members of the public to make recorded statements of their views immediately before project decision making and, in the case of an environmental impact statement (EIS), preparation of the final environmental impact statement (FEIS). MassDOT/MBTA views the hearing as a specific, observable administrative benchmark for public involvement.

A public hearing is held near the end of a process or subprocess, prior to a decision point, to gather community comments and hear the positions of all interested parties for the public record and input into decisions. Public hearings are required by the federal government for many transportation projects and have specific legal requirements.

2.2.3 Meeting Facilities and Accessibility

MassDOT/MBTA is required to hold public hearings, meetings, open houses, and workshops in accessible facilities that are, wherever possible, at locations close to or served by fixed-route transit service, to let people know that the meeting location is accessible. Meeting planners must conduct an analysis of the demographics of the area where the meeting is to be held to determine whether notices should be translated into languages other than English. The availability of handout materials in alternative formats—Braille, large print, and/or audio cassette, and languages other than English—as well as other accommodations (language interpreters, sign language interpreters, CART translators, etc.) must be indicated in the meeting notices along with specific information on how to request these accommodations.

MassDOT/MBTA meeting planners should research and make every effort to select the location, size, and setup of meeting facilities based on the specific characteristics of the audience and the type of information to be presented. Whenever possible, hearings, meetings, and workshops should be held in places that are centrally located to the project and likely to attract a cross section of the people and businesses representative of the community stakeholders. Public libraries, public schools, and community centers are often used.

MassDOT/MBTA meeting planners should strive to create a welcoming environment. The staff members charged with the coordination of any meeting are responsible for providing resources, including free accessibility assistance and language assistance, to ensure that the event is

accessible to all people and to provide the greatest opportunity for participation by interested parties.

2.3 Tailoring Outreach to Underserved People

Meeting planners should not only schedule a room, post notices and ensure that accommodations are in place for a meeting to be well attended. There is also an obligation to conduct outreach to encourage attendance, particularly among groups protected by the anti-discrimination laws MassDOT/MBTA has promised to comply with.

Many people in minority and low-income communities, as well as those with low literacy and/or limited English proficiency, have traditionally been underserved by conventional outreach methods. Outreach to traditionally underserved groups helps ensure that all constituents have opportunities to affect the decision-making process. It sets the tone for subsequent project activities and promotes a spirit of inclusion. The greater the consensus among all community members, the more likely the position agreed upon will aid in decision making for the plan, program, or project. Inclusive outreach efforts are particularly useful because they:

- Provide fresh perspectives to project planners and developers
- Give MassDOT/MBTA firsthand information about community-specific issues and concerns
- Allow MassDOT/MBTA to understand potential controversies
- Provide feedback to MassDOT/MBTA on how to get these communities involved
- Ensure that the solutions ultimately selected will be those that best meet all of the communities' needs

MassDOT/MBTA staff should strive to understand the full range of a community's needs in order to create more responsive and more innovative plans. By interacting with community members, MassDOT/MBTA staff will gain insight into the reasons why community members agree or disagree with proposed plans or projects. The perspective of traditionally underserved people can inform the goals and outcomes of planning and project development, and ignoring this input can seriously threaten a project from being approved. Such individuals can suggest fresh approaches to transportation issues that otherwise might not be raised. MassDOT/MBTA's public outreach efforts are designed to accommodate the needs of low-income, minority, Limited English Proficiency, and other traditionally underserved people throughout all phases of any public participation process. MassDOT/MBTA staff should recognize that traditional techniques are not

always the most effective with these populations. Staff and managers employ a variety of public involvement techniques when working with underserved populations and communicates with community leaders to find out the best techniques for working with a particular group (e.g., which approaches to use, where and when to hold events, how to recruit people, and what to avoid doing).

2.4 The MBTA Rider Oversight Committee (ROC)

The MBTA established the Rider Oversight Committee in 2004 to meet monthly and discuss customer-service improvements and service-quality issues. Through the ROC, the MBTA has institutionalized ongoing public participation in all aspects of the Authority's operations.

The MBTA Rider Oversight Committee's mission statement is:

> The MBTA ROC, a diverse group of riders, advocates, and MBTA employees, provides recommendations to the MBTA that communicate the needs and concerns of all riders in order to assist the MBTA in providing affordable, safe and quality service.

The MBTA and members of the ROC come together to address the concerns of public-transit customers. The 24-member committee addresses various transit-related issues, including but not limited to the MBTA's Fare Policy, fare structure, fare equity issues, service improvements, service-quality standards, ridership data collection, and alternative funding sources for both the capital program and the operating budget. In addition to monthly meetings, the committee meets quarterly with the MBTA's General Manager and Deputy General Manager/Chief Financial Officer, and the Secretary of Transportation, who also serves as Chairman of the MBTA board of Directors.

3 Title VI and ADA PROTOCOLS, POLICIES, AND RESOURCES

The civil rights protocols set forth in this document are a baseline for holding inclusive, accessible and responsive public meetings, hearings and the like. There are two primary sections in this chapter. Section 3.1 contains protocols and resources for ensuring diversity and inclusivity in public engagement. Section 3.2 contains protocols and resources for ensuring the accessibility of MassDOT/MBTA's public activities. These efforts are related and appropriate references are made between these sections, as needed.

3.1 Civil Rights Protocols for Public Engagement

Many MassDOT/MBTA departments and units conduct and participate in unique types of meetings and hearings within the course of their day to day operations. These Protocols have been designed with the intention of supporting and not supplanting the basic form and structure of existing operations. Further, these Protocols will provide links, resources and contacts for the purpose of achieving public engagement that is compliant with civil rights law. It is anticipated that these Protocols should be considered part of existing Standard Operating Procedures, Guidelines and Manuals, and that as these document are revised, these Protocols will be incorporated into the relevant portions of these documents.

The obligation to comply with these Protocols begins with the person(s) responsible for organizing and/or conducting the meeting or hearing, and because of the shared nature of many public processes between units, should be viewed as a shared responsibility. For example, in the 25% Design Public Hearing, there are multiple units involved in presenting information to the public, and each unit has specific civil rights obligations to ensure that Title VI/Nondiscrimination populations, including people with limited English proficiency and/or disabilities are able to participate equally in these meetings.

These Protocols include steps and strategies to implement prior to holding a public meeting or other such activity and during the course of the public process. Due to the varied nature of MassDOT/MBTA's engagement with the public, it is not the intention within these Protocols to include all required actions specific to varying stages of the planning process, or varying departmental standard operation procedures. However, where a Project Manager or other staff member encounters a difficult public involvement situation, he/she is advised to contact the Title VI Specialist and/or the Manager of Federal Programs to identify strategies and alternatives to address such situations.

Similarly, these Protocols should not be woodenly applied to every meeting/hearing. Meetings should be tailored to the special needs of the community, and/or the target audience and subject matter to be addressed. Effective public participation from a civil rights perspective includes awareness of the local population (demographics) or individuals to be engaged, including languages spoken, represented cultural groups, community organizations and leaders and key players. Equally critical to an effective meeting are well communicated (effectively circulated across types of media, and translated when needed) and timely notice, early response and coordination on requests for language assistance for limited English proficient individuals or reasonable accommodation for people with disabilities.

Federal nondiscrimination obligations, through Title VI of the Civil Rights Act of 1964, Section 504 and 508 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act (ADA) reach the categories of race, color, national origin (including LEP), age, sex, and disability. These protocols are designed to ensure that sufficient consideration of outreach to and inclusion of these groups is incorporated into MassDOT/MBTA's public engagement procedures. Adherence to these protocols will also sufficiently address State-level nondiscrimination obligations[2].

While the following protocols endeavor to highlight specific resources where available, past experience with the public can and should be considered a resource to identify individual and community needs, including civil rights related considerations such as language assistance needs, accessibility accommodations and inclusive public participation. Please use these Protocols as a guide and use good professional judgment in the decisions you make as you implement them.

3.1.1 Civil Rights Protocols by Type of Public Engagement

The following represent the four types of public engagement most commonly encountered by MassDOT/MBTA employees:

- Meetings for the general public
- Targeted outreach gatherings
- Open houses
- One-on-one interactions

[2] State level protections include the federal protections plus ethnicity, sexual orientation, gender identity or expression, religion, creed, ancestry, veteran's status (including Vietnam-era veterans), and background.

An introduction to each of these four types of public engagement is provided below. Familiarity with the following descriptions will help inform the user on how they should navigate the protocols set forth in this document.

Meetings for the General Public (Sec 2.1)

Public meetings and hearings, both at the project level and more broadly, are an opportunity for members of the public to engage in the transportation decision making process. The civil rights considerations described in this section are designed to inform and guide all MassDOT/MBTA staff involved in planning and conducting such events. Incorporation of these processes and utilization of these resources when planning or participating in public meetings/hearings will help ensure that these events are Title VI compliant.

Open Houses (Sec 2.2)

In the case that you are planning an open house session as a standalone event (such as a public information session) that will not precede a public meeting or hearing, see Sections 2.1.1 to 2.1.4.

MassDOT/MBTA staff and consultants regularly interact with members of the public through "open house" sessions prior to meetings/hearings. These sessions afford members of the public an opportunity to view design plans for projects that will be discussed at the formal public outreach event. MassDOT/MBTA staff and consultants (Designers, Planners, Right of Way Agents, Environmental Agents, etc.) are on hand to discuss particular details of interest with members of the public. While the interactions during these sessions are informal, critical issues are often raised. MassDOT/MBTA staff and consultants strive to address these issues accurately and effectively during these sessions. *[Practice Tip: Some attendees choose to forego the meeting/hearing satisfied with the information gained or with the opportunity to express concerns at the open house session.]* Due to the direct nature of interaction with members of the public at these open houses, there exist civil rights risk factors. These risks can be mitigated by adhering to the principles outlined in this section.

Targeted Outreach Gatherings (Sec 2.3)

At times, the complexity of a project, controversial issues, or the reality of having multiple large Title VI groups to address may require engaging targeted audiences of stakeholders. Similarly, MassDOT/MBTA may at times convene selected people within advisory committees, research efforts, focus groups and the like. The general work of understanding the demographics of people in a locality or project area still apply to determine what Title VI groups are impacted by an

initiative, as described above. However, there may be a need to include strong and possibly visible community leaders within Title VI populations; this can require more subtle and challenging efforts to secure their participation and needed contribution to discussions or deliberations.

One-on-One Interactions (Sec 2.4)

MassDOT/MBTA staff members interact directly with the public by virtue of the public facing programs, services, and activities the organization provides. These interactions can include planned meetings, such as those with property and business owners directly impacted by transportation projects, and spontaneous interactions with members of the public. These interactions, whether in person, over the phone, or electronic, present particular civil rights related risk factors that can be mitigated through the strategies articulated in Section 2.4.

3.1.2 Meetings for the General Public

3.1.2.1 Preliminary/Ongoing Considerations

1) Identify the population and composition of the individuals/communities impacted by the MassDOT/MBTA program, service, or activity by considering the following:
    a. Project parameters, such as location, areas that will be impacted by construction phases, areas that may benefit from the completed project, and the areas that may be burdened by the completed project
    b. The nature of the program, service, or activity (is it connected to the project development process? is it statewide, regional or local?)
2) Determine the Title VI features of the community to be engaged by reference to MassDOT/MBTA's Title VI maps, which include the limited English proficient (LEP) and minority populations across the Commonwealth. Consult the following maps and additional resources. *[Practice Tip: The first map (Figure 3) shows concentrations of LEP populations. You can identify the particular languages present in those areas by referencing the language specific maps. Foreign language services may be required for public outreach in these areas (see below).]*
    a. MassDOT/MBTA LEP Maps
        i. Percentage of LEP Speakers https://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/TitleVI/Item5/Fig3.pdf
        ii. Spanish Language Overlay https://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/TitleVI/Item5/Fig4.pdf

iii. Portuguese Language Overlay https://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/TitleVI/Item5/Fig5.pdf

iv. Chinese Language Overlay https://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/TitleVI/Item5/Fig6.pdf

v. French Creole Overlay https://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/TitleVI/Item5/Fig7.pdf

vi. Vietnamese Language Overlay https://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/TitleVI/Item5/Fig8.pdf

vii. Additional Languages Overlay https://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/TitleVI/Item5/Fig9.pdf

b. MassDOT/MBTA Minority Populations Map *[Practice Tip: This map shows the concentration of minority populations. This information can help you develop a strategy to publicizing public engagement opportunities and disseminating materials that effectively reaches representative and diverse stakeholders.]*https://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/TitleVI/Item5/Fig3-2.pdf

c. US Census Bureau Language Mapper http://www.census.gov/hhes/socdemo/language/data/language_map.html?eml=gd

3) Identify key Title VI-related and other community based organizations and community leaders. *[Practice Tip: You may already have well established connections with individuals and groups throughout the Commonwealth. You are encouraged to continue reaching out to those. These instructions provide you with steps to identify previously unknown points of contact to diversify outreach.]* There are several approaches meeting planners can take to accomplish this step:

a. Use the Civil Rights Constant Contact database that has been developed through IT, and codes organizations by e-mail, county. (pending completion)

b. Contact the MPO for the local area for a list of organizations by county and key leaders.

c. Consult tOffice of Transportation Planning MPO Liaisons who work with the individual MPOs and can support the effort to identify groups and individuals.

d. Consult the Office of Public Affairs which has conducted a variety of meeting outreach efforts across the state and can identify key groups and individuals in every city in the state.

e. For outreach in the Boston region, contact the Mayor's Office of Neighborhood Services. http://www.cityofboston.gov/ons/coor_list.asp *[Practice Tip: This office maintains liaisons in all of the Boston neighborhoods as well as liaisons to these demographic groups.]*

3.1.2.2 Meeting Location and Time

1) Title VI Considerations

a. Consult with community leaders and community based organizations to identify any aspects of the community which may be central in determining the time and location of the public engagement activity. *[Practice Tip: These individuals can help you understand the cultural, ethnic, religious, gender, and political histories/experiences of the demographic groups in the locale to better inform meeting planning.]*

b. Consider factors such as cultural sensitivities and/or professional and academic commitments in setting the number of meetings. Multiple meetings can be held at various locations and times if doing so promotes meaningful access to the public engagement opportunity.

c. Where possible, select a meeting location near public transportation options. *[Practice Tip: A general rule of thumb is within ½ mile walking distance.]*

2) ADA Considerations

a. Identify a venue for the public meeting that is ADA compliant and accessible to people with disabilities.

i. MassDOT/MBTA maintains an Accessible Facilities Database that contains updated information regarding venues that have been previously assessed for ADA compliance.

b. If an appropriate venue cannot be identified in the database, the following resources can identify public meeting venues that may be accessible:

i. The Massachusetts Office on Disability http://www.mass.gov/anf/employment-equal-access-disability/oversight-agencies/mod/

ii. The Disability Commissions (S:\Civil Rights\ADA\Disability Commissions)

iii. The Independent Living Centers
http://www.masilc.org/membership/cils

c. Take the opportunity afforded by early communication with venue staff to identify pre-existing accessibility accommodations, such as assistive listening devices and Communication Access Real-Time Translation (CART) equipment. *[Practice Tip: Even though you don't know if such devices will be needed yet, this is a good opportunity to take stock of what is available should the need arise.]* The need for these accommodations will be addressed in Section 2.1.4, below.

d. For a full treatment regarding ADA obligations in the public outreach context, consult the MassDOT/MBTA Accessible Meeting Policy in Section 3.2 below or online at: http://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/ADA/Attachment_13.pdf . The policy enumerates ADA obligations in the public meeting context and provides a checklist for holding an ADA accessible public meeting. *[Practice Tip: If you are planning on using a venue for the first time, this checklist can help you verify its accessibility. The completed checklist should be shared with ODCR's Manager of Federal Programs for incorporation into the database.]*

3.1.2.3 Coordinating Public Notice

1) Draft the public meeting notice document, either utilizing existing approved templates or creating a new one, ensuring that the following civil rights related components are included:

   a. Notice of Nondiscrimination

      i. (Insert Updated Notice Language Here)

   b. Availability of language services and reasonable accommodations

      i. (Insert Updated Notice Language Here)

   c. Contact information and procedures for requesting the above services, additional information, or to express a concern

      i. (Insert Updated Notice Language Here)

   d. International Symbol of Accessibility
   http://en.wikipedia.org/wiki/International_Symbol_of_Access

2) Public meeting notices must be accessible. For guidance, please refer to Section 2.1.4 §§ 3. *[Practice Tip: Since public meeting notices are disseminated in a variety of ways, including physical postings, website postings, and email blasts, it is*

important that the appropriate font and font size be used and that the electronic document be compatible for use with screen readers.]

3) Address language needs and utilize non-English language outreach resources in the dissemination area if individuals who have limited proficiency in English are present.

   a. Identify non-English language media (print, TV, radio, online, etc.) and sites with a strong presence of individuals who have limited proficiency in English (transportation facilities, community centers, libraries, commercial/employment/educational establishments, places of worship, cultural centers, etc.) that may be effective in communicating notice to individuals who have limited proficiency in English. *[Practice Tip: The reason you are identifying these resources first is to know what services actually exist to provide translated materials to.]* Consider consulting the following resources:

      i. MassDOT/MBTA Office of Diversity and Civil Rights http://www.MassDOT/MBTA.state.ma.us/OfficeofCivilRights.aspx

      ii. MassDOT/MBTA Public Affairs

      iii. Community Leaders

      iv. Metropolitan Planning Organizations (MPOs) http://www.MassDOT/MBTA.state.ma.us/Portals/17/Images/DataMaps/boundry/MPOs-RPAs-Statewide.pdf

      v. Regional Transit Agencies (RTAs) http://www.MassDOT/MBTA.state.ma.us/Portals/17/docs/MapCatalog/Maps/RTAs-Statewide.pdf

      vi. Public Libraries http://www.publiclibraries.com/massachusetts.htm

      vii. Schools/Universities http://en.wikipedia.org/wiki/List_of_colleges_and_universities_in_Massachusetts

      viii. Chambers of Commerce http://masshome.com/cofc.html

      ix. Local Legislators

   b. Develop translated version(s) of the notice document or other related announcements, as needed, based on the extent of LEP need and available media sources. *[Practice Tip: If you've identified a large population of individuals who are LEP in the meeting or project locale, consider translating the meeting notice in full. If you are less likely to encounter individuals who*

are LEP, you can consider including the single line of text into the languages other than English you may encounter.] This could include:

i. Full translation of the notice into the languages indicated

ii. The inclusion of the following statement translated into the appropriate languages into the English language version of the notice.

1. "*This notice describes the date, time, and location of a public meeting or hearing on a transportation project in this area. If you need this notice translated, contact MassDOT/MBTA's Title VI Specialist at 857-368-8580*."

iii. Translated versions of print, TV, radio, and online announcements related to the meeting, as applicable.

c. Consult the following resources for translation needs:

i. UMass Translation Center

1. Request Procedure: http://www.umasstranslation.com/services/request-an-estimate/

2. Rates: http://www.umasstranslation.com/services/rates/

ii. Statewide Language Services Contract

1. Contract Info: https://www.ebidsourcing.com/displayPublicContSummView.do?doValidateToken=false&docViewType=ACTIVE&docId=124184&docStatus=ACTIVE&docUserId=3155&userType=PUBLIC

2. Vendor Info: https://www.ebidsourcing.com/displayPublicContActiveSwcVendorList.do?doValidateToken=false&menu_id=2.4.4.1&docUserId=3155&docViewType=ACTIVE&docId=124184&userType=PUBLIC&docNumberText=PRF48

4) The final dissemination of public notice should incorporate the following:

a. The dissemination of public notice has occurred sufficiently in advance of meeting to ensure adequate processing time for language and accessibility accommodation requests. *[Practice Tip: Distributing notice three weeks in advance of a public engagement opportunity is generally regarded as appropriate, with two weeks or 10 business days considered the minimum limit for reasonable notice.]*

b. The public notice/announcement materials have been delivered to non-English language outreach resources and sites identified in Section 2.1.3 §§ 3; a.

c. The public notice has been delivered directly to individuals, organizations, and other stakeholders that represent Title VI populations in the region. You should consider sending notice to the entities below with the instruction that they forward the notice among their own distribution lists and/or post it.

   i. MassDOT/MBTA Office of Diversity and Civil Rights http://www.MassDOT/MBTA.state.ma.us/OfficeofCivilRights.aspx

   ii. MassDOT/MBTA Public Affairs

   iii. Community Leaders

   iv. Metropolitan Planning Organizations (MPOs) http://www.MassDOT/MBTA.state.ma.us/Portals/17/Images/DataMaps/boundry/MPOs-RPAs-Statewide.pdf

   v. Regional Transit Agencies (RTAs) http://www.MassDOT/MBTA.state.ma.us/Portals/17/docs/MapCatalog/Maps/RTAs-Statewide.pdf

   vi. Public Libraries http://www.publiclibraries.com/massachusetts.htm

   vii. Schools/Universities http://en.wikipedia.org/wiki/List_of_colleges_and_universities_in_Massachusetts

   viii. Chambers of Commerce http://masshome.com/cofc.html

   ix. Local Legislators

   x. Boston Mayor's Office of Neighborhood Services http://www.cityofboston.gov/ons/coor_list.asp

3.1.2.4 Preparation for the Meeting

1) While preparing for the meeting, consider the following questions: (1) are there civil rights implications in the background/history of the project, (2) what public involvement has already been accomplished and did it illuminate civil rights concerns, and (3) what are the known benefits and burdens of the MassDOT/MBTA program, service, or activity on Title VI populations? Consult the following resources:

   a. Public meeting/hearing transcripts

b. Written public comments

c. MassDOT/MBTA staff involved in planning and/or conducting prior related meetings

d. ProjectINFO comments

e. Public meeting demographics surveys

2) Meeting planners should maintain an ongoing dialogue with the individuals and organizations identified in Sections 2.1.3 §§ 3; a; i and 2.1.3 §§ 3; c; i in order to remain well informed on the level of community interest and likely involvement in the public outreach event.

3) Ensure that electronic documents related to the subject of the public meeting and intended for public dissemination and review are accessible, in compliance with the Americans with Disabilities Act and Section 508 of The Rehabilitation Act of 1973. *[Practice Tip: Adobe Acrobat Professional and Microsoft Word have built-in "accessibility checkers."]* This applies to documents produced by MassDOT/MBTA staff as well as consultants. Consult the following for instructions on developing accessible documents:

   a. Best practices for text and color contrast considerations when preparing hardcopy and electronic visual aids (such as maps, posters, plans, PowerPoint templates/graphics, charts, graphs, etc.) http://www.lighthouse.org/accessibility/design/accessible-print-design/

   b. Creating accessible Word documents: http://office.microsoft.com/en-us/word-help/creating-accessible-word-documents-HA101999993.aspx

   c. Creating accessible Excel workbooks: http://office.microsoft.com/en-us/excel-help/creating-accessible-excel-workbooks-HA102013545.aspx?CTT=3

   d. Creating accessible PowerPoint presentations: http://office.microsoft.com/en-us/powerpoint-help/creating-accessible-powerpoint-presentations-HA102013555.aspx?CTT=3

   e. Creating accessible PDFs with Microsoft Office products through "Tagging": http://office.microsoft.com/en-us/excel-help/create-accessible-pdfs-HA102478227.aspx?CTT=3

   f. General information on accessibility from Adobe: http://www.adobe.com/accessibility/

g. Adobe Acrobat X Accessibility Guide: http://www.adobe.com/content/dam/Adobe/en/accessibility/products/acrobat/pdfs/acrobat-x-accessible-pdf-from-word.pdf

h. Adobe Acrobat 9 Pro Accessibility Guide: http://www.adobe.com/content/dam/Adobe/en/accessibility/products/acrobat/pdfs/A9-accessible-pdf-from-word.pdf

i. Video on preparing accessible InDesign files: http://tv.adobe.com/watch/accessibility-adobe/preparing-indesign-files-for-accessibility/

4) The period between notice dissemination and the meeting date should be used to identify and arrange accommodations and produce meeting materials in alternate languages and formats (such as Braille and large-print), if requested.

a. Alternate formats can be obtained by contacting:

i. MassDOT/MBTA Copy and Print Center

ii. MBTA System Wide Accessibility http://www.mbta.com/riding_the_t/accessible_services/default.asp?id=16901

iii. The Central Transportation Planning Staff

1. Janie Guion, 617-973-7507 or jguion@ctps.org

b. The nature and extent of accommodations that may be needed can be identified through the following.

i. Direct requests

ii. Past experiences, both within the community and at specific meeting locations which can include previously encountered reasonable accommodation and language service requests

1. Meeting coordinators are required to submit demographic and accommodation summaries to ODCR. You can request this information from ODCR to better understand the past experiences of other meeting planners in the locale of your meeting.

iii. An understanding of community demographics

iv. Feedback from community leaders, CBOs, stakeholders, advocacy groups, etc.

v. MassDOT/MBTA Accessible Meeting Checklist

c. Foreign language document translation can be provided by:

i. UMass Translation Center

1. Request Procedure: http://www.umasstranslation.com/services/request-an-estimate/

2. Rates: http://www.umasstranslation.com/services/rates/

ii. Statewide Language Services Contract

1. Comm-PASS Info: https://www.ebidsourcing.com/displayPublicContSummView.do?doValidateToken=false&docViewType=ACTIVE&docId=124184&docStatus=ACTIVE&docUserId=3155&userType=PUBLIC

2. Vendor Info: https://www.ebidsourcing.com/displayPublicContActiveSwcVendorList.do?doValidateToken=false&menu_id=2.4.4.1&docUserId=3155&docViewType=ACTIVE&docId=124184&userType=PUBLIC&docNumberText=PRF48

d. To obtain accessibility accommodations not provided by the venue (Section 2.1.2 §§ 2; c), contact:

i. MassDOT/MBTA Facilities

1. Phone: (857) 368-9560

2. Email: dotgeneralservices@dot.state.ma.us

ii. MBTA System Wide Accessibility http://www.mbta.com/riding_the_t/accessible_services/default.asp?id=16901

iii. Metropolitan Planning Organizations http://www.MassDOT/MBTA.state.ma.us/Portals/17/Images/DataMaps/boundry/MPOs-RPAs-Statewide.pdf

iv. Massachusetts Office on Disability
http://www.mass.gov/anf/employment-equal-access-disability/oversight-agencies/mod/

e. If unsure how to provide a particular accommodation or for guidance on recommended accommodations, consult:

i. MassDOT/MBTA Office of Diversity and Civil Rights
http://www.MassDOT/MBTA.state.ma.us/OfficeofCivilRights.aspx

ii. MassDOT/MBTA Public Affairs

iii. MBTA System Wide Accessibility
http://www.mbta.com/riding_the_t/accessible_services/default.asp?id=16901

iv. The Massachusetts Office on Disability
http://www.mass.gov/anf/employment-equal-access-disability/oversight-agencies/mod/

v. The Disability Commissions (S:\Civil Rights\ADA\Disability Commissions)

vi. The Independent Living Centers
http://www.masilc.org/membership/cils

f. Funding Considerations

i. All accommodations must be provided to the public free of charge.

ii. For public outreach events which are necessitated by the project development process, each project contains an administration budget that should be utilized, if available.

iii. For all other requests, contact the MassDOT/MBTA Budget Office at (857) 368-9150.

3.1.2.5 Meeting Set-Up

1) ADA considerations in public outreach are fully articulated in the MassDOT/MBTA Accessible Meeting Policy in Section 3.2 below and online at: http://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/ADA/Attachment_13.pdf. Meeting setup is addressed in the "Accessibility Checklist for Meeting Planners" which should be used in order to verify the following:

a. If the main entrance to the building is not accessible, is the accessible entrance unlocked?

b. Are there integrated seating areas for individuals who use a wheeled mobility device in the meeting room? *[Practice Tip: Seating areas for individuals with disabilities should not be segregated from the rest of the audience or limited to just one area.]*

c. Is there seating available for attendees who are deaf or hard of hearing, and have requested an accommodation, near the front of the meeting room so that attendees may see the interpreter/captioner, or lip read?

d. Is the space allotted to sign language interpreters and/or the CART screen or monitor clearly visible?

e. Are the aisles at least three feet wide and clear of obstacles or tripping hazards?

f. If microphones are used during the public meeting, are adjustable microphone stands available for attendees? Can staff be used as floaters with microphones as an alternative?

g. If the main entrance to the building is not accessible, is there directional signage towards the accessible entrance?

h. Is the accessible entrance unlocked and able to be used independently? If the meeting is taking place at night, is the path leading to the alternate entrance well lit?

i. If a stage or platform will be used during the public meeting, is it accessible?

j. If a podium will be used during the public meeting, is the podium height adjustable? If not, is there a small table (between 28 and 34 inches in height) provided to the side of the podium?

k. Have assistive devices been tested for full functionality immediately prior to the start of the event?

l. Is there directional signage for accessible restrooms and/or emergency exits, if applicable?

2) Title VI considerations can be addressed through the following:

a. Based on identified or likely-to-be-encountered language needs, has signage in other languages been posted?

b. Is the space allotted to foreign language interpreters clearly visible to the entire audience?

c. Has space been given to foreign language interpreters to sit with individuals who need language assistance?

d. Have Title VI related materials been made available at the welcome desk and/or in the meeting packet? *[Practice Tip: Assistance is provided at the welcome desk, paying special attention to indications that meeting attendees may have literacy or non-English speaking issues.]* This should include:

   i. "I speak" language cards http://www.lep.gov/ISpeakCards2004.pdf

   ii. Translated versions of the written comment form, as applicable

   iii. Demographics survey (insert link)

3.1.2.6 During the Meeting

1) In the event that this public meeting/hearing is preceded by an open house, please refer to Section 2.2 regarding civil rights considerations in that setting.

2) At the official start of the meeting, make the following statements. If a foreign language translator(s) is present, instruct them to repeat.

   a. (Insert language here, address: general statement regarding nondiscrimination and availability of language and accessibility accommodations, including assistance in providing written comments and/or filing in forms such as the demographics survey)

   b. Include instructions on site-specific accessibility considerations, such as accessible emergency exits.

   c. Encourage attendees to complete the Demographics Survey, which can be either turned in during the event or mailed to MassDOT/MBTA after the fact.

3) MassDOT/MBTA is required to "demonstrate explicit consideration and response to public input" (23 CFR 450.210). During a public outreach event, this requires affording attendees with opportunities to voice comments, questions, and concerns and provide an adequate response at the event or by following up in writing (see Section 2.1.7) or at subsequent public outreach opportunities. *[Practice Tip: All MassDOT/MBTA staff in attendance should give their attention to oral comments made by the public during the meeting and during one-on-one interactions in order to relay general sentiments and/or particular issues to the Project Manager as part of post-meeting follow up.]*

3.1.2.7 Post Meeting

1) All public comments (written and oral), testimonials, and sentiments expressed during the public outreach event have been gathered/documented by

MassDOT/MBTA staff that attended the meeting and passed on to the Project Manager (or designee). *[Practice Tip: This can be accomplished through in-person debriefing sessions following the meeting or reviewing the meeting transcript, if available.]*

2) Once received, the Project Manager (or designee) catalogues all public comments.
3) The Project Manager is responsible for coordinating responses to public comments. *[Practice Tip: Remember: direct impacts require direct communication. 23 CFR 450.210]*
    a. Methods of responses can include:
        i. Individualized written responses
        ii. General distribution written statements (web, email, newsletter, newspaper, etc.)
        iii. Postings to project specific website, if available
        iv. In-person or telephonic follow-ups with individuals/organizations regarding the topics of discussion at the public outreach event *[Practice Tip: The protocols and tips found in Section 2.4 regarding one-on-one interactions can help you eliminate communication barriers you may encounter.]*
    b. The Project Manager (or designee) reviews the public comments to determine which MassDOT/MBTA program areas (such as Civil Rights, Right of Way, Design, Environmental, Planning, etc.) should be consulted with or assigned the responsibility of drafting a response that "demonstrate[s] explicit consideration… to public input" (23 CFR 450.210).
4) In instances where MassDOT/MBTA will draft a written response to a public comment, the content of the response itself can "demonstrate explicit consideration" by:
    a. Describing changes to the recommended design prompted/requested by the comment and how they will be considered
    b. Describing alternate designs prompted/requested by the comment and how they will be considered
    c. Describing mitigation measures prompted/requested by the comment and how they will be considered
    d. Describing the MassDOT/MBTA program areas that were consulted in formulating the response

e. Noting whether the comment is novel or previously encountered

f. Noting whether the comment has been received from a multitude of sources

5) Responses should also contain:

   a. Contact information for additional information and follow-up

   b. Notice of upcoming related public engagement opportunities

6) The Project Manager should note, through ProjectINFO "comments," civil rights considerations encountered through the planning and conducting of the outreach event, such as translation requests or foreign languages encountered. *[Practice Tip: For projects that have received a ProjectINFO number, the "comments" section can be used to highlight civil rights related comments or concerns from the public. The document database for these projects can also be used to store scans of comment forms.]*

7) The community leaders identified in Section 2.1.1 §§ 3 should be thanked for their assistance/efforts with a call or written correspondence.

3.1.3 Open Houses

3.1.3.1 Title VI Considerations

1) "I Speak" language cards have been provided at the welcome desk. http://www.lep.gov/ISpeakCards2004.pdf

2) If MassDOT/MBTA is providing interpretive services at the public meeting/hearing session, then they should also be available during the open house session and their availability should be made clear through signage and/or announcements. *[Practice Tip: Those running the meeting should ask interpreters to announce their presence and the availability of their services several times during the open house.]*

3) After the session, MassDOT/MBTA staff and consultants in attendance should relay the nature of questions and concerns identified through interaction with the public to the Project Manager (or designee). *[Practice Tip: It is important for MassDOT/MBTA staff working on all stages of project development to know community concerns. Sometimes these are made evident during informal open house interactions. Just because they don't make it onto a public hearing transcript doesn't mean we don't have an obligation to be aware of them and respond accordingly.]*

4) Written descriptions of items on display may need to be translated depending on requests received and/or the anticipated level of LEP participation.

3.1.3.2 ADA Considerations

1) The open house should be set up in an ADA compliant manner. Please see the MassDOT/MBTA Accessible Meeting Policy in Section 3.2 below or online at: http://www.MassDOT/MBTA.state.ma.us/Portals/0/docs/CivilRights/ADA/Attachment_13.pdf
2) Consider the following when setting up the open house venue:
    a. Consult the following guide on best practices for text and color contrast considerations when preparing hardcopy and electronic visual aids (such as maps, posters, plans, PowerPoint templates/graphics, charts, graphs, etc.) http://www.lighthouse.org/accessibility/design/accessible-print-design/ *[Practice Tip: Choose color schemes that are least likely to be problematic for individuals with common types of color blindness and visual impairments.]*
    b. Pathways that guide attendees to display materials or MassDOT/MBTA staff and consultants should be clear of obstructions. *[Practice Tip: Rule of Thumb: remove tripping hazards (such as electrical cords) and keep the pathway at least 3' wide.]*
    c. Proper heights and viewing angles of display materials to make them accessible. *[Practice Tip: Rules of Thumb: For display materials mounted on the wall, they should be no higher than 48" from the floor and provide clear floor space 30" wide and 48" wide. For tabletop displays, the table should be between 28 and 34" inches in height and there should be at least 27" of knee space from the floor to the underside of the table.]*
    d. Horizontal surfaces used for display should be at a height accessible to individuals that are short of stature and/or rely on assistive mobility devices.
    e. Similarly, materials displayed vertically should not be at an excessive height nor at an angle that makes them difficult to view.
3) MassDOT/MBTA staff and consultants should be prepared to describe displays to blind or visually impaired attendees.
4) Alternate versions (Braille, large print, etc.) of public documents (such as informational packets) should be available if requested.

3.1.4 Targeted Outreach Gatherings (Small Group Meetings/Committees/Task Forces/Studies)

3.1.4.1 Strategic Planning for Title VI Group and Individual Inclusion

Strategic planning for the involvement of Title VI community members on special purpose meeting groups or committees is essential to an inclusive and successful effort. Engaging the public in a targeted context is complex, political and always challenging, and ensuring diverse participation adds even more difficulty to meeting this objective.

Preliminary Steps:

1) Identify and analyze the location affected by the project or initiative at issue to determine the Title VI populations in the area.
2) Establish a clear objective and role for the envisioned targeted group, including the nature of community involvement and particular skills which may be needed for fruitful discussion or deliberations.
3) Create an outline or public participation matrix to identify the different types of community representation and interests that reflect the community affected by a project or initiative with careful attention to Title VI populations. Types of organizations or interests that may include representatives of Title VI populations:
    a. transit-dependent community
    b. affected businesses
    c. civic organizations (women, seniors, youth, people with disabilities)
    d. freight interests
    e. the disability community
    f. neighborhood association
    g. schools
    h. churches

Beyond demographic data and identification of the types of Title VI related groups or individuals in the community, there are certain key questions to help define the individuals or groups to invite. Consider meeting with a small group of internal staff and/or managers from among key MassDOT/MBTA departments who know the community and who can help answer these key questions:

1) Who can represent these diverse groups and constituencies in a credible and responsible way?
2) Who needs to be at the table for the work to be accomplished?
3) What is the history of relationships between stakeholder representatives and groups? Is there any past tension that may be a deterrent to participation? If so,

are there other community leaders who could help mediate to encourage participation despite differences?

4) If known from past experience, are there stakeholders critical to the process who may be reluctant to participate? How can this reluctance be alleviated? What would be the impact of their refusal to participate in the process? Is there an alternative to their participation?
5) What commitments do you want from participants?
6) Other than known stakeholders, what other individuals or groups could have an interest in the project that are not in the immediate project area, and/or are not otherwise represented in the outreach strategy?
7) Do any necessary parties have possible concerns about participating? How can those concerns be alleviated?
8) Do you have natural allies on an issue? Natural adversaries?

3.1.4.2 Consult MassDOT/MBTA and MBTA and State Resources

Based on MassDOT/MBTA and the MBTA's vast prior experience in communities across the Commonwealth, we have significant corporate knowledge of local groups, key individuals and community issues or concerns that can help answer these questions.

1) the Office of Diversity and Civil Rights (which does a range of outreach across the Commonwealth, responds to complaints and works with key Title VI leadership on transportation matters in contracting and employment)
2) Office of Transportation Planning (which conducts significant long-range studies that engage the public and builds knowledge of communities and has access to the Metropolitan Planning Organizations in all regions of Massachusetts)
3) Government and Public Affairs (which can reach out to state legislators and their aides for suggestions)
4) Design (which works directly with project proponents, especially in instances of municipally proposed projects, although there can be a risk of bias in favor of suggestions that support the project.)
5) Use the MassDOT/MBTA Title VI interactive mapping tool (currently under development) to identify community organizations that are associated with Title VI community members and interests

There may be other sources of contact in additional MassDOT/MBTA and MBTA departments or Divisions (Design, Environmental, Right of Way, Registry or Aeronautics)

that may have had experience with a location and or community representatives, which could also be helpful to explore.

3.1.4.3 Consult Statewide Resources

1) Reach out at the state level for help in identifying and possibly supporting our outreach to potential Title VI related groups and individuals to contact. These resources may also have particular information that is important to know about the locality, its history and community challenges or controversy which may be critical to support your outreach:

    a. Administration and Finance – Office of Access and Opportunity

        Office of Access & Opportunities
        State House, Room 373, Boston, MA 02133
        Phone: (617) 727-2040
        E-mail: Ronald.Marlow@state.ma.us

    b. Massachusetts Office on Disability

        One Ashburton Place #1305
        Boston, MA 02108
        (617) 727-7440 or (800) 322-2020 toll free (both V/TTY)
        E-mail: Myra.Berloff@state.ma.us

3.1.4.4 Conduct Targeted Research on the Leads you Gather

Conduct a Google-type search on the communities involved and the groups and individuals who have been identified. This effort is potentially time consuming, but will both educate the meeting convener and potentially identify “landmines” that could complicate the effort to organize a group.

Tip: In carrying out this task, it is useful to limit searches which can be done through linking key words to a query such as a year, a past issue or individual words like “bio,” “biography,” “background,” “transportation,” “complaint” and the like.

If a meeting planner is not aware of the racial, ethnic or national origin background of the individual or group being engaged, it is similarly possible to research Title VI groups individually, using query strings to the group or individuals and Massachusetts, the regional area or the locality where the group or individual is based. This information is useful in gaining a basic understanding of traditions and holidays which may impact participation, through to a more thorough understanding of complex considerations like values, beliefs and relationship to government and/or transportation.

3.1.4.5 Reaching out to Potential Title VI Group Members – Anticipating Potential Obstacles to Participation

1) Outreach approaches:
    i. Look for formal and informal opportunities to engage, collaborate, and build relationships, including calls of introduction made by volunteers you identify who are trusted in the community.
    ii. Use multiple outreach methods and do not rely on e-mail or websites alone
    iii. Tailor materials to the audience, including translations
    iv. Identify existing channels of communication through communities
    v. Experiment and reflect on the effectiveness of new approaches

In Title VI communities, there are a range of factors leading to reluctance to participate for individuals and groups that could be helpful in a transportation planning or development process. For example, many times natural leaders are either the heads or well-placed leaders of agencies or community groups; this causes limits their ability to participate because there are many demands on their time, resources and commitment.

2) Think through and identify the factors which would encourage participation and involvement before reaching out, to be in the best position to explain how it is important for this individual or group to participate. If there is a possibility of grant funding to support participating groups, this can certainly provide an incentive for participation, but such ideas should only be shared if the possibility is real.

3) The following are some common barriers to participation, and reasonable responses that a meeting planner should anticipate, understand and be able to articulate to encourage potential participants to get involved:
    a. **Limited English language skills and/or limited literacy** – it is first important to know that MassDOT/MBTA has the ability and obligation to fund translation and interpretation support and to convey this message. It would be ideal to have a colleague or staff person who speaks the language or is of the culture in question to support the outreach effort, or to use a translator as an intermediary.
    b. **Lack of trust due to past experiences** - it is important to be in a position to respond with as much information as will demonstrate that both participation and the project are being honestly and openly addressed.
    c. **Lack of experience with transportation decision making processes** – if this process is not well understood or the meeting convener has a difficult

time explaining the process, it is important to have a representative from Planning involved to explain the process.

d. **Economic barriers** – transportation costs, work schedules – meetings should be sited in the community to avoid cost factors, and they should be timed to meet the schedule of the majority of participants, after due consideration of all schedules, suggested alternatives and needs.

e. **Cultural barriers** – there may be intergroup dynamics that make bringing groups together problematic due to class, racial ethnic or political differences. Early research will help build understanding of this possibility, and suggest whether a mediated way of bringing the groups together is an option, or there is a need to have separate meetings.

f. **Common barriers** – time, other demands. The key to this element is making sure that the importance of an effort is clear and well stated to the candidate, including the benefit toan individual or group representative being recruited.

3.1.4.6 Responding to a Refusal to Participate from a Potential Title VI Participant

1) If a person or group declines to participate in a particular effort, it is important not to get frustrated and to handle the refusal diplomatically because that same group might be the subject of an outreach effort in the future, and may wish to participate on another occasion.

2) In responding to a decision not to participate, thank the person or group for considering the invitation and suggest that they might accept an invitation for a different opportunity in the future. In this way, no feelings are hurt, doors are left open and the person or group remains feeling that they are valued into the future.

3) Consider sending the individual or organizations updates on the effort that are sent to others. This effort could be informative and demonstrate a good faith effort to be inclusive.

3.1.4.7 Documenting the Effort to Achieve Diversity and Next Steps

It may be impossible to achieve a perfectly diverse committee for purposes of transportation planning, given the difficulty of recruitment and obstacles to participation, Simply put, the concept of diversity in transportation planning is elastic - it will change based on the geographic location, the issue under study or discussion or the nature of the need for input. Nonetheless, our federal partners, and even community members will

expect to know about our efforts and may wish to question whether MassDOT/MBTA truly conducted outreach for Title VI inclusion purposes. For Title VI purposes, this documentation is good evidence of the opportunity that was given to the public, such that complaints after the fact about the lack of inclusion can be responded to Our Title VI obligation requires us to provide an equal opportunity to participate in transportation planning exercises; ultimately, it is the exercise of trying and proving that MassDOT/MBTA has been thoughtful and reached out effectively to increase diversity in our community engagement.

For purposes of proving that an outreach effort was genuine and reached out to diverse communities, there are steps that the meeting convener or planner should take:

1) The meeting planner should keep a file on available resources and methods used to identify individuals and groups, the nature of the outreach effort, the people invited and the results of a recruitment effort. Possible resources:
    a. Lists of potential invitees who were considered and/or accepted
    b. Samples of research conducted and/or consultations made for recruitment
    c. Copies of invitation e-mails or other correspondence
    d. Group membership lists, with indications of the Title VI communities represented
    e. Meeting sign in sheets
    f. Correspondence from invited individuals
2) The meeting planner should make the list of actual participants easily available and strive to secure a means for the public to reach out to these individuals should they have question, comments or concerns that they may not be willing to air publicly.
3) Meeting planners should plan to discuss with the members of the group that is ultimately recruited the efforts made to reach out and recruit individuals, including the potential need that may remain after the fact for additional participation by certain Title VI group members or related organizations.
4) Effective management of the group that is ultimately formed is key to the productivity and longevity of relationships with Title VI community members. Following-through with stakeholders to demonstrate that input was considered and/or had an impact on project parameters, study outcomes, and planned activities can demonstrate to participants the value added to their interests and communities through continued involvement in these activities.

3.1.5 One-on-One Interactions

3.1.5.1 Communicating with Individuals with Limited English Proficiency (LEP)

If a member of the public is attempting to interact with you but there is a language barrier, the following procedures are recommended based on the types of interactions.

1) In-person (such as MassDOT/MBTA reception areas, district offices, construction sites, RMVs, E-ZPass service centers, etc.)
    a. The first step is to identify the preferred language of the individual. The following resources are available:
        i. "I Speak" cards, http://www.lep.gov/ISpeakCards2004.pdf
        ii. Google Translate (http://translate.google.com/) or a similar real-time free online language translator can be used to identify the language. *[Practice Tip: If the member of the public is directed to type (or speak into the computer's microphone, if available) on the webpage in a language other than English, the software can "Auto-Detect" which language is being used and provide real-time translations. Please note that the accuracy and effectiveness of these translation systems is not complete and should not be relied on as an exclusive means of providing language access to LEP individuals.]*
        i. Assistance from co-workers in your unit that may be able to identify the language.
        ii. Language Line (https://www.languageline.com/)
    b. Once the language has been identified, the methods you use to address the needs of the individual will change depending on the circumstances.
        i. You may be able to address simple inquires informally on-the-spot with the aid of multi-lingual staff or Google Translate (http://translate.google.com/) or a similar product. *[Example: providing directions around the building/office to an LEP individual.]*
            1. If you work in one of the MassDOT/MBTA Highway units that has been surveyed for multi-lingual staff (ROW, OTP, Environmental, Design, and OREAD), refer to the corresponding database to identify a co-worker in your unit that can assist. *[Practice Tip: Assisting in this way is purely voluntary and the nature of the communication should be incidental.]*

a. S:\Civil Rights\Title VI\Staff Language Directory

2. An employee and an LEP individual can type or speak into Google Translate software and carry out a rudimentary conversation. This should remain limited to incidental interactions.

ii. If the conversation turns to more complex issues or you have reached the limitations of the technology or your knowledge of the subject at issue, the MassDOT/MBTA staffer providing informal translations or Google Translate should inform them that professional language services are available that may be better suited to meeting their need. More complex issues may require professional translators/interpreters. *[Example: An LEP individual who needs assistance to engage in the complaint resolution process or to participate in a MassDOT/MBTA program, service, or activity that requires an application process. (such as a driver's licenses, E-ZPass, etc.]* Complex issues are those that affect the legal rights of the individual and therefore depend on the accuracy of translations/interpretations. The following services are available in those instances:

1. Language Line (https://www.languageline.com/)
2. Statewide Language Services Contract
    a. Comm-PASS Info: https://www.ebidsourcing.com/displayPublicContSummView.do?doValidateToken=false&docViewType=ACTIVE&docId=124184&docStatus=ACTIVE&docUserId=3155&userType=PUBLIC
    b. Vendor Info: https://www.ebidsourcing.com/displayPublicContActiveSwcVendorList.do?doValidateToken=false&menu_id=2.4.4.1&docUserId=3155&docViewType=ACTIVE&docId=124184&userType=PUBLIC&docNumberText=PRF48

iii. Should you require time to secure professional language services (such as scheduling a meeting with an interpreter or sending out documents to be translated) then you should try to make this clear to the individual on-the-spot with the aid of multi-lingual staff or Google Translate. *[Practice Tip: Using Google Translate to convey this information allows you to include details such as expected turnaround times, meeting dates and locations, and contact information.]*

2) Over the Phone

a. If you are able to identify the language of the caller and you work in one of the MassDOT/MBTA Highway units that has been surveyed for multi-lingual staff (ROW, OTP, Environmental, Design, and OREAD), refer to the corresponding database to identify a co-worker in your unit that can assist.
    i. S:\Civil Rights\Title VI\Staff Language Directory
b. If you are unable to identify the language of the caller and/or you do not work in ROW, OTP, Environmental, Design, and OREAD, contact Language Line for real-time over the phone interpretation services (https://www.languageline.com/)

3) Electronically (includes email, website comment form, etc.)
    a. If you receive such correspondence in a language other than English, use Google Translate (http://translate.google.com/) or similar product to determine the language and nature of the interaction
    b. Once the language and the nature of the interaction has been identified, the methods you use to address the needs of the individual will change depending on the circumstances.
        i. You may be able to address simple inquires informally with the aid of multi-lingual staff or Google Translate (http://translate.google.com/) or a similar product. *[Example: emailing a link to requested web content.]*
            1. If you work in one of the MassDOT/MBTA Highway units that has been surveyed for multi-lingual staff (ROW, OTP, Environmental, Design, and OREAD), refer to the corresponding database to identify a co-worker in your unit that can assist.
                a. S:\Civil Rights\Title VI\Staff Language Directory
        ii. If the conversation turns to more complex issues or you have reached the limitations of the technology or your knowledge of the subject at issue, the MassDOT/MBTA staffer providing informal translations or Google Translate should inform them that professional language services are available that may be better suited to meeting their need. More complex issues may require professional translators/interpreters. *[Practice Tip: Complex issues are those that affect the legal rights of the individual and therefore depend on the accuracy of translations/interpretations.] [Example: An LEP individual who needs assistance to engage in the complaint resolution process or to participate in a MassDOT/MBTA program, service, or activity that requires an application process. (such as a driver's licenses, E-ZPass, etc.)]* The following services are available in those instances:
            1. Language Line (https://www.languageline.com/)

2. Statewide Language Services Contract
    a. Comm-PASS Info: https://www.ebidsourcing.com/displayPublicContSummView.do?doValidateToken=false&docViewType=ACTIVE&docId=124184&docStatus=ACTIVE&docUserId=3155&userType=PUBLIC
    b. Vendor Info: https://www.ebidsourcing.com/displayPublicContActiveSwcVendorList.do?doValidateToken=false&menu_id=2.4.4.1&docUserId=3155&docViewType=ACTIVE&docId=124184&userType=PUBLIC&docNumberText=PRF48

3.1.5.2 Communicating with People with Disabilities

1) Outlined below are tips to help you in communicating with persons with disabilities. *[Practice Tip: For more information visit: http://www.labor.state.ny.us/workforcenypartners/forms/communication.pdf.]*
    a. General Tips:
        i. When introduced to a person with a disability, it is appropriate to offer to shake hands. People with limited hand use or who wear an artificial limb can usually shake hands. (Shaking hands with the left hand is an acceptable greeting.)
        ii. If you offer assistance, wait until the offer is accepted. Then listen to or ask for instructions.
        iii. Relax. Don't be embarrassed if you happen to use common expressions such as "See you later," or "Did you hear about that?" that seem to relate to a person's disability.
        iv. Don't be afraid to ask questions when you're unsure of what to do.
    b. Tips for Communicating with Individuals who are Blind or Visually Impaired:
        i. Speak to the individual when you approach him or her.
        ii. State clearly who you are; speak in a normal tone of voice.
        iii. When conversing in a group, remember to identify yourself and the person to whom you are speaking.
        iv. Never touch or distract a service dog without first asking the owner.
        v. Tell the individual when you are leaving.

vi. Do not attempt to lead the individual without first asking; allow the person to hold your arm and control her or his own movements.

vii. Be descriptive when giving directions; verbally give the person information that is visually obvious to individuals who can see. For example, if you are approaching steps, mention how many steps.

viii. If you are offering a seat, gently place the individual's hand on the back or arm of the chair so that the person can locate the seat.

c. Tips for Communicating with Individuals who are Deaf or Hard of Hearing:

i. Gain the person's attention before starting a conversation (i.e., tap the person gently on the shoulder or arm).

ii. Look directly at the individual, face the light, speak clearly, in a normal tone of voice, and keep your hands away from your face. Use short, simple sentences.

iii. If the individual uses a sign language interpreter, speak directly to the person, not the interpreter.

iv. If you telephone an individual who is hard of hearing, let the phone ring longer than usual. Speak clearly and be prepared to repeat the reason for the call and who you are.

d. Tips for Communicating with Individuals with Mobility Impairments:

i. If possible, put yourself at the wheelchair user's eye level.

ii. Do not lean on a wheelchair or any other assistive device.

iii. Never patronize people who use wheelchairs by patting them on the head or shoulder.

iv. Do not assume the individual wants to be pushed —ask first.

v. Offer assistance if the individual appears to be having difficulty opening a door.

vi. If you telephone the individual, allow the phone to ring longer than usual to allow extra time for the person to reach the telephone.

e. Tips for Communicating with Individuals with Speech Impairments:

i. If you do not understand something the individual says, do not pretend that you do. Ask the individual to repeat what he or she said and then repeat it back.

ii. Be patient. Take as much time as necessary.

iii. Concentrate on what the individual is saying.

iv. Do not speak for the individual or attempt to finish her or his sentences.

v. If you are having difficulty understanding the individual, consider writing as an alternative means of communicating, but first ask the individual if this is acceptable.

f. Tips for Communicating with Individuals with Cognitive Disabilities:

i. If you are in a public area with many distractions, consider moving to a quiet or private location.

ii. Offer assistance completing forms or understanding written instructions and provide extra time for decision-making. Wait for the individual to accept the offer of assistance; do not "over-assist" or be patronizing.

iii. Be patient, flexible and supportive. Take time to understand the individual and make sure the individual understands you.

2) Additional information can be provided by:

a. MassDOT/MBTA Office of Diversity and Civil Rights http://www.MassDOT/MBTA.state.ma.us/OfficeofCivilRights.aspx

b. MBTA System Wide Accessibility http://www.mbta.com/riding_the_t/accessible_services/default.asp?id=16901

c. Massachusetts Office on Disability http://www.mass.gov/anf/employment-equal-access-disability/oversight-agencies/mod/

d. Commonwealth of Massachusetts - Office of Access and Opportunity http://www.mass.gov/anf/employment-equal-access-disability/diversity-access-and-opportunity/access-and-opportunities/

3.2 MassDOT/MBTA Accessible Meeting Policy

1.0 Purpose

This policy outlines criteria that must be fulfilled in order to ensure that all MassDOT/MBTA public meetings are fully accessible to persons with disabilities. This document will also address issues related to attendees with limited English proficiency.

The ability to access and participate in state government, including participating in public meetings, is a fundamental right protected by both State and Federal law. The Massachusetts Public Accommodation Law and the Americans with Disabilities Act mandate that persons with disabilities must not be denied participation in public meetings, and that reasonable accommodation requests made by attendees shall be honored. For these reasons, when planning and executing public meetings, MassDOT/MBTA personnel must ensure that all aspects of the meeting are accessible to persons with disabilities.

Under Title VI of the Civil Rights Act of 1964 and Commonwealth Executive Order 526, MassDOT/MBTA must also ensure that programs and activities do not discriminate based on race, color or national origin, age, disability and sex, among other protected categories. A public participation plan is being developed for Title VI purposes, which should be consulted by meeting planners in coordination with this Accessible Meeting Policy to ensure that MassDOT/MBTA includes Title VI constituencies in transportation programs and activities. The method for determining whether and/or what non-English languages need to be translated or interpreted is called a “four factor analysis.” Essentially, to determine whether translation is needed, meeting planners must analyze the number of limited English proficiency persons (LEP) by language group where a meeting will be held, the frequency of contacts with the program, the importance of the program and cost factors.

This document will provide guidelines for ensuring the accessibility of public meetings hosted by MassDOT/MBTA. Components such as the meeting location, room setup, alternate formats and translations of handouts, and the requirement to provide CART and/or sign language and/or foreign language interpreters upon request will be discussed.

2.0 Definitions

2.1 *Public Meeting*

Any meeting open to the general public, hosted by or on behalf of the MassDOT/MBTA, during which information is shared.

2.2 *Attendee*

An individual attending a public meeting.

2.3 *Reasonable Accommodation*

Any reasonable service, aid, modification or adjustment to the public meeting that gives a person with a disability the opportunity to be an active participant in the meeting process.

2.4 *Path of Travel*

A continuous, unobstructed way of pedestrian passage by means of which an area may be approached, entered, and exited.

2.5 *TTY (Text Telephone)*

An electronic device for text communication via a telephone line, used when one or more of the parties has a hearing or speech-related disability. Public payphones equipped with TTY have a small keyboard that pulls out underneath the phone. Note: TTYs are gradually phasing out for many people due to the increased use of voice and video relay, but they will remain in use for some period into the future.

2.6 *Clear floor space*

The minimum unobstructed floor or ground space required to accommodate a single, stationary wheelchair and occupant.

2.7 *Wheeled mobility device*

Means by which some individuals with physical disabilities travel throughout their environment. Commonly refers to such devices as wheelchairs (manual and motorized) and scooters. Non-traditional wheeled mobility devices may include Segways and bicycles.

2.8 *American Sign Language (ASL) Interpreter*

An individual trained to facilitate communication between a deaf American Sign Language user and hearing individuals via American Sign Language.

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2.9 *Assistive Listening Device*

An electronic device used by individuals who are hard of hearing to amplify sound. The assistive listening device is usually used as a system where the audio source is broadcast wirelessly over an FM frequency. The person who is listening may use a small FM Receiver to tune into the signal and listen at their preferred volume. There are other forms of Assistive Listening Devices that exist and could be used as alternatives.

2.10 *CART (Computer Assisted Real-time Transcription)*

A trained operator uses keyboard or stenography methods to transcribe spoken speech into written text. This may be done either on site or remotely by using a voice connection such as a telephone, cell phone, or computer microphone to send the voice to the operator and the real-time text is transmitted back over an Internet connection. For meeting rooms without an internet connection, it is possible to establish connectivity via a WIFI router connection or by using a wireless “hot spot.”

2.11 *Video Remote Interpreting*

A contracted video service that allows individuals who are Deaf to communicate over webcams/video phones with hearing people in real-time, via a sign language interpreter.

2.12 *Video and Telecommunication (Voice) Relay Services*

Video Relay Service (VRS) is a form of Telecommunications Relay Service (TRS) that enables persons with hearing disabilities who use American Sign Language (ASL) to communicate with voice telephone users through video equipment, rather than through typed text. Video equipment links the VRS user with a TRS operator – called a "communications assistant" (CA) – so that the VRS user and the CA can see and communicate with each other in signed conversation. The VRS caller, using a television or a computer with a video camera device and a broadband (high speed) Internet connection, contacts a VRS CA, who is a qualified sign language interpreter. They communicate with each other in sign language through a video link. The VRS CA then places a telephone call to the party the VRS user wishes to call. The VRS CA relays the conversation back and forth between the parties – in sign language with the VRS user, and by voice with the called party. No typing or text is involved.

Telecommunications Relay Service (TRS) is a telephone service that allows persons with hearing or speech disabilities to place and receive telephone calls. TRS uses operators, called communications assistants (CAs), to facilitate telephone calls between people with hearing and speech disabilities and other individuals. A TRS call may be initiated by either a person with a hearing or speech disability, or a person without such disability. When a person with a hearing or speech disability initiates a TRS call, the person uses a teletypewriter (TTY) or other text input device to call the TRS relay center, and gives a CA the number of the party that he or she wants to call. The CA in turn places an outbound traditional voice call to that person. The CA then serves as a link for the call, relaying the text of the calling party in voice to the called party, and converting to text what the called party voices back to the calling party. VRS and TRS are overseen by the Federal Communications Commission and private contractors who perform the intermediary communication service are reimbursed for this service.

2.13 *Closed Captioning*

A term describing several systems developed to display text on a television, computer or video screen to provide additional or interpretive information to viewers/listeners who wish to access it. Closed captions typically display a transcription of the audio portion of a program (either verbatim or in edited form), sometimes including non-speech elements.

2.14 *Descriptive Video/Described Narration*

A feature that makes television programs, videos, films, and other visual media accessible to people who are blind or visually impaired by providing descriptive narration of key visual elements in programs. Key visual elements in a program that a viewer who is visually impaired would ordinarily miss are described by voice. Actions, costumes, gestures and scene changes are just a few of the elements that, when described, engage the blind or visually impaired viewer with the story.

2.15 *Limited English Proficient (LEP)*

Individuals who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English can be limited English proficient, or "LEP." These individuals may be entitled to language assistance with respect to a particular type of service, benefit, or encounter.

2.16 *Four Factor Analysis*

Federal DOT guidance outlines **four factors** recipients should consider to assess language needs and decide what steps they should take to ensure meaningful access for LEP persons:

1) The number or proportion of LEP persons eligible to be served or likely to be encountered by a program, activity, or service of the recipient or grantee.
2) The frequency with which LEP individuals come in contact with the program.
3) The nature and importance of the program, activity, or service provided by the recipient to the LEP community.
4) The resources available to the MassDOT/MBTA and overall cost.

In each instance, this analysis will enable MassDOT/MBTA staff to determine the extent of language assistance that must be provided to enable LEP individuals to participate in a program or activity. For further information, including answers to specific situations that meeting planners may encounter, planners should consult the ADA Coordinator, the Title VI Specialist and/or the Language Access Plan.

2.17 *Vital Document*

A vital document is determined by the context of a program, service or activity, and can include but not be limited to an application, notice, complaint form, legal contract, and outreach material published by a covered entity in a tangible format that informs individuals about their rights or eligibility requirements for benefits and participation.

2.18 *Language Access Plan*

Under Federal Executive Order Executive Order 13166, each Federal agency is required to prepare a plan to improve access to its federally conducted programs and activities by eligible LEP persons. Each plan is required to be consistent with the standards set forth in related guidance, and shall include the steps the agency will take to ensure that eligible LEP persons can meaningfully access the agency's programs and activities. Just as federal agencies must have LEP Plans, as a condition of receiving federal financial assistance, they must establish guidelines for recipients such as MassDOT/MBTA to comply with Title VI and LEP requirements, including the provision of language assistance, as needed.

3.0 Scope

All public meetings hosted by, or on behalf of, MassDOT/MBTA.

4.0 Responsibilities

It is the responsibility of the MassDOT/MBTA staff or Department(s) charged with the coordination of the public meeting to ensure that the public meeting is accessible to all. The local contacts for the meeting facility, in conjunction with the responsible MassDOT/MBTA staff, are responsible for filling out the "Accessibility Checklist for Meeting Planners" in Attachment 6.1 to ensure the space is accessible prior to the meeting.

5.0 Policy

5.1 General Considerations

5.1.1 Public meeting planners shall identify at least one person who is responsible for making sure that the public meeting is accessible for all attendees. This individual shall serve as the contact for attendees requesting reasonable accommodations. See, Attachment 6.1 for a Checklist for Meeting Planners.

5.1.2 Public meetings should be planned and publicized as early as possible—ideally, at least 21 calendar days, but no less than 14 days in advance.

5.1.2.1 Meeting notices should include a date by which attendees should request reasonable accommodations—typically ten days before the meeting.

Note: After the cutoff date, staff must still try to provide an accommodation but should not guarantee the provision of the requested accommodation. Since it is so difficult to schedule CART and/or sign language interpreters with less than 2-3 weeks' notice, most meetings should be publicized with 21 days' notice. This allows attendees ample opportunity to request and receive appropriate reasonable accommodations.

5.1.3 Attendees shall not be charged for any reasonable accommodation provided.

5.2 Choosing a Location

5.2.1 Access to Nearby Transportation. All public meetings shall be within ¼ mile of an accessible bus stop or rail station, where feasible.

5.2.1.1 The path of travel from the transit stop to the meeting location shall be accessible. Specifically, it should be:

5.2.1.1.1 At least three feet wide

5.2.1.1.2 Unobstructed (not blocked by trash cans, light poles, etc.)

5.2.1.1.3 Free of steps, drop-offs or curbs

5.2.2 Parking. If parking is available to meeting attendees, meeting planners shall ensure that the number of accessible parking spaces available complies with state and Federal regulations. See, Attachment 6.2 for state and Federal regulations regarding accessible parking.

5.2.2.1 The path of travel from the accessible parking to the meeting location shall be accessible. Specifically, it shall be:

5.2.2.1.1 At least three feet wide

5.2.2.1.2 Unobstructed (no trash cans, light poles, etc.)

5.2.2.1.3 Free of steps, drop-offs or curbs

5.2.3 Identifying the Accessible Entrance. If the main entrance to the building (in which the public meeting is being held) is not the accessible entrance, a sign containing the universal symbol of accessibility with an arrow appropriately pointing to the accessible entrance shall be posted at the main entrance.

5.2.4 Ensure the alternate accessible entrance is unlocked and available to be used independently and that the path of travel to the alternate entrance is well lit (if the meeting is taking place at night). If the door is locked and intercom service or another format is used to gain access, an attendant must be at the door to accommodate deaf or hard of hearing individuals, as well as others with disabilities.

5.2.5 Accessible Restrooms. If restrooms are available for use by the public then all public meetings shall have at least one accessible restroom for men and one accessible restroom for women, or one accessible gender neutral restroom. See, Attachment 6.3 for state and Federal regulations regarding accessible restrooms.

5.2.5.1 The accessible restrooms shall be within reasonable proximity to the meeting room.

5.2.6 Accessible Telephones. If two or more public payphones are available at the meeting facility, at least one should be:

5.2.6.1 Equipped with TTY

5.2.6.2 Mounted no higher than 48” from the floor and provide clear floor space 30” wide and 48” wide (so that attendees using wheeled mobility can properly access the phone).

5.2.6.3 MassDOT/MBTA should notify the facility owner if the facility does not comply with the accessible telephone requirement.

5.2.7 The Meeting Room: The meeting room in which the public meeting will take place shall be made accessible for persons with disabilities. The following shall be provided:

5.2.7.1 An integrated seating area for wheeled mobility device users shall be made available.

5.2.7.1.1 If possible, meeting planners should remove several chairs to accommodate potential attendees who use wheeled mobility devices.

Note: Remove a chair to the side and to the rear of the designated space to ensure enough room for the wheeled mobility device.

5.2.7.1.2 Such spaces for wheeled mobility device users shall be dispersed throughout the room, and not clustered all in one section (e.g. all in the front or all in the back). This allows attendees using wheeled mobility a variety of seating/viewing options.

5.2.7.2 Space for Sign Language, CART and Foreign Language Interpreters

5.2.7.2.1 A well-lit area and chairs facing the audience shall be made available for sign language interpreters at the front of the room (likely just off to one side of the main presentation area). If a CART provider is to be used, a small table for the laptop and space for a screen and projector should be provided near an electrical outlet.

5.2.7.2.2 Priority seating at the front of the audience and in direct line of sight of the interpreters/CART provider shall be provided for attendees who are deaf/hard of hearing.

5.2.7.2.3 For foreign language interpreters, there is a need for space where they can sit with the individuals who require language assistance.

5.2.7.3 Aisles within the meeting room shall be

5.2.7.3.1 Clear of tripping hazards (e.g. electric cords).

5.2.7.3.2 At least 3 feet wide.

5.2.7.4 Microphones. The microphones used at public meetings shall be available on a stand that is adjustable in height.

Note: While wireless microphones have become popular, some attendees with disabilities will not be able to hold a microphone independently. In this situation, allowing an attendee use of a microphone stand adjusted to their height is almost always preferable to holding the microphone for them. Alternatively, and particularly for larger meetings, staff with a floating microphone would be preferable to facilitate communication.

5.2.7.5 Podiums. If any attendee may have an opportunity to speak at a podium, meeting planners shall ensure that either:

5.2.7.5.1 The podium is height adjustable, or

5.2.7.5.2 A small table is provided to the side of the podium.

5.2.7.5.2.1 The table shall be between 28 and 34” inches in height.

5.2.7.5.2.2 There shall be at least 27” of knee space from the floor to the underside of the table.

5.2.7.5.2.3 If a microphone is provided at the podium, one shall also be provided at the small table.

5.2.7.6 Raised Platforms. If any attendee may have an opportunity to move onto a raised platform or stage during the meeting, the raised platform or stage shall be accessible by:

5.2.7.6.1 A ramp that

5.2.7.6.1.1 Is at least 3 feet wide.

5.2.7.6.1.2 Does not have a slope that exceeds 1/12.

5.2.7.6.2 Platform lift

5.2.7.7 High Speed internet Connection. Public meeting rooms shall provide for a high speed internet connection to allow attendees who rely on video remote interpreting or CART. There should also be a conference capable telephone with a speakerphone function available.

5.3 American Sign Language and Foreign Language Interpreters, Assistive Listening Devices, CART and Video Remote Interpreting.

5.3.1 American Sign Language and/or foreign language interpreters shall be provided at all public meetings upon request. See, Attachment 6.4 for information on how to request an interpreter.

5.3.1.1 To ensure their availability, interpreters should be requested at least two weeks in advance of the public meeting.

5.3.1.2 The cost associated with providing sign language or foreign language interpreters shall be paid for by the Department hosting the event.

5.3.2 Assistive Listening Devices. Assistive Listening Devices for attendees who are hard of hearing shall be provided at all public meetings upon request. See, Attachment 6.5 for information on how to provide assistive listening devices.

5.3.3 CART services shall be provided at all public meetings upon request (See Attachment 6.6 for information on how to provide CART services.). Staff should schedule or make requests for CART services at least two weeks in advance of the meeting, and preferably as soon as an attendee makes this need known. When remote CART services are to be used (the CART reporter is not in the room), staff should try to provide the reporter any technical terms or acronyms to be used, as well as the names of key meeting attendees before the meeting date.

5.3.4 Video Remote Interpreting shall be provided at all public meetings upon request via a computer/laptop with a webcam and high speed internet connection.

Note: Video Remote Interpreting is a relatively new form of technology and may be an adequate alternative to providing ASL interpreters in certain situations. However, if an attendee requests Video Remote Interpreting, ASL interpreters will be an adequate substitute, if the meeting planner cannot secure the requested technology.

5.4 Alternative Formats and Translation of Handouts/Presentation Material

Large print versions of all printed material shall be available at all public meetings. If requests for additional alternative formats are made in advance of the meeting (within the timeframes below), these formats must be available for the start of the meeting. If requests for alternative formats are made at or following the meeting, the alternative format must be provided within seven days of the request.

These requirements are the same with respect to translation into foreign languages, where the language requested is identified through application of the four factor analysis process, set forth in the MassDOT/MBTA Title VI Language Assistance Plan. When a language group is small, defined as 5% or 1,000, whichever is less, of the population of persons eligible to be served or likely to be affected or encountered, foreign language translations of “vital documents” should be provided,

and non-vital documents may be orally translated. This requirement does not affect the requirement to provide meaningful translation to one or more in a small group of LEP individuals through competent oral interpreters or translation where language services are needed and are reasonable.

5.4.1 Creating Alternative Formats

See attachment 6.7 for step by step instructions on creating alternative formats.

5.4.2 Large Print Version

5.4.2.1 At least five copies of any text-based printed material to be handed out during the meeting shall be in large print.

5.4.2.2 Large print meeting materials shall:

5.4.2.2.1 Be created using "Arial" font with a font size of 16 pt.

5.4.2.2.2 Have the same information as the original handout.

5.4.2.2.3 Have the highest contrast possible (e.g. black on white).

5.4.2.2.4 If graphics (such as images, tables, or graphs) are used in the original document, the same graphics shall be included in the large print version of the document.

5.4.2.2.4.1 If graphics are used in the large print document, a brief description of the image shall be provided. Image descriptions shall be brief and provide the viewer of the document with a general idea of what is in the image.

5.4.2.2.4.2 If tables or graphs are used in the large print document, a summary of the table or graph shall be provided.

5.4.3 Electronic Version

5.4.3.1 If an electronic version of materials is requested within 24 hours in advance of the meeting, this version shall be available for the meeting, if no advance request is made but rather is requested at or after the meeting, then meeting materials shall be made available electronically, within 7 calendar days of the request.

Note: Whenever possible, meeting planners should bring several copies of an electronic accessible version of the meeting material to the public meeting. Some individuals with visual

impairments or other disabilities may attend with portable screen reading software that would allow them to access electronic material during the meeting.

5.4.4 Braille Version

5.4.4.1 If a Braille version of materials is requested within one week in advance of the meeting, this version shall be available for the meeting, if no advance request is made but rather is requested at or after the meeting, then Meeting materials shall be made available in Braille within 7 calendar days of the request.

5.4.5 Audible Version

5.4.5.1 If an audible version of materials is requested within one week in advance of the meeting, this version shall be available for the meeting, if no advance request is made but rather is requested at or after the meeting, then meeting materials shall be made audible, within 7 calendar days of the request.

5.4.6 Foreign Language Version

5.4.6.1 If a common foreign language version of materials is requested within one week in advance of the meeting, this version shall be available for the meeting, if no advance request is made but rather is requested at or after the meeting, then Meeting materials shall be made available in the language requested within 7 calendar days of the request.

5.4.7 Other requests for alternate formats

5.4.7.1 Individual attendees may have unique specifications for alternate formats. All reasonable requests for alternate formats shall be honored upon request, within 7 calendar days of the request.

5.4.8 Meeting attendees will not be charged for any cost affiliated with the creation of alternate formats of meeting material.

5.5 Publicizing the Meeting

5.5.1 Public meetings shall be publicized as early as possible—ideally, at least 21 calendar days in advance, but never less than 14 days in advance. This allows attendees time to submit requests for reasonable accommodations and for meeting planners to set deadlines for accommodation requests to be made

in a timely manner. The meeting publicity also needs to be translated into the languages that are identified through application of the four factor analysis set forth in the MassDOT/MBTA Title VI Language Assistance Plan.

5.5.2 In addition to any other means, all public meetings shall be posted on www.mbta.com or http://www.MassDOT/MBTA.state.ma.us

5.5.3 All meeting notices shall include:

5.5.3.1 The statement "This location is accessible to persons with disabilities"

5.5.3.2 A brief listing of accessibility features that either are available or may be made available upon request during the public meeting (e.g. sign language, CART, assistive listening devices and/or foreign language interpreters).

5.5.3.3 Information on how to request reasonable accommodations by phone, e-mail or fax and the deadline for requests.

5.5.3.4 Information on how to request foreign language interpreter assistance.

5.5.3.5 See Attachment at section 6.7 for a sample meeting posting.

5.6 Additional Considerations

5.6.1 Within 48 hours, meeting planners shall follow-up with attendees who have requested reasonable accommodations to let them know their request has been received and will be honored to the extent possible.

Note: Especially in the case of ASL interpreters, the meeting planner may not know of their availability until 24 hours prior to the meeting. It is reasonable to let people know their request has been received and that it is in the process of being put in place, however if no interpreter is available people need to be notified and alternate plans must be made – such as CART or Video Relay.

5.6.2 Emergency Preparedness

5.6.2.1 In the event of an emergency, some attendees with disabilities may not be able to evacuate independently. Meeting planners shall familiarize themselves with the evacuation plan for the meeting space.

5.6.2.2 At the beginning of each meeting, meeting presenters shall announce the safety briefing--including information regarding where those attendees who would require assistance should wait during an emergency.

5.6.3 When opening a public meeting, presenters shall announce:

5.6.3.1 The presence and function of sign language interpreters (if interpreters are in the room), and/or CART providers

5.6.3.2 That assistive listening equipment is available

5.6.3.3 The location of accessible restrooms

5.6.3.4 The safety briefing (see 5.6.2.2).

5.6.4 When presenting, presenters at public meetings shall:

5.6.4.1 Speak slowly and clearly so that the sign language interpreters have time to interpret.

5.6.4.2 Verbally describe information presented visually (e.g. PowerPoint) so that attendees with visual impairments can access the information.

5.6.4.3 Ensure that any videos/DVDs shown during the meeting are encoded with closed captioning and are shown on a closed caption compatible device. Subtitles are an acceptable alternative.

5.6.4.3.1.1 Provide an alternate version of the video/DVD with descriptive video/described narration. (See Attachment 6.9 for captioning resources.)

Note: It may not always be a good choice to use a described video in an open meeting as this can be a problem for other viewers.

6.0 Attachments

6.1 Accessibility Checklist for Meeting Planners

Meeting Date:
Meeting Time:
Subject of Meeting:
Location:

MassDOT/MBTA
Attendees:

☐ Is there at least one person or Department who is responsible for ensuring that the public meeting is accessible for all attendees?
Print Name/Department: _____

Publicizing Meeting:

☐ Has the public meeting been publicized at least 3 weeks in advance?

☐ Has the meeting been publicized on the MassDOT/MBTA or MBTA website?

☐ Has the meeting been publicized in the required foreign languages and ethnic newspapers for the relevant populations in the community where the meeting is to be held?

☐ Does the public meeting notice include accessibility information, how to request a reasonable accommodation, relevant dates for making requests and information on whom to contact to request a reasonable accommodation?

☐ Does the public meeting notice include information on how to request foreign language interpreters?

Facility:

Date of Facility Assessment: _____

☐ Where applicable (in areas where public transportation is available), is the meeting location 1/4 mile or less from the nearest accessible bus stop or rail station?

☐ Where applicable, is there an accessible path of travel provided from the public transportation stop to the meeting location and meeting room?

☐ If parking will be available at the meeting location, are there accessible parking spaces available (review # of car and van accessible spaces)?

☐ Is there an accessible path of travel provided from the accessible parking area to the meeting area?

☐ If the main entrance to the building is not accessible, is there directional signage towards the accessible entrance?

☐ Is the accessible entrance unlocked and able to be used independently? If the meeting is taking place at night, is the path leading to the alternate entrance well lit?

☐ If there are restrooms that are open to the public, is there a pair of accessible restrooms available within close proximity of the meeting area? If not, is there at least one accessible gender neutral restroom?

☐ If there are public phones, is there at least one accessible (TTY and within appropriate height range) telephone available?

☐ If a stage or platform will be used during the public meeting, is it accessible?

☐ If a podium will be used during the public meeting, is the podium height- adjustable? If not, is there a small table (between 28 and 34 inches in height) provided to the side of the podium?

☐ Is there a high speed internet connection within the meeting space?

Ensuring Appropriate Accommodations:

☐ Have sign language and foreign language interpreters, if requested, been reserved for the public meeting?

☐ Have CART services, if requested, been reserved for the public meeting?

☐ Are Assistive Listening Devices available for the public meeting? Does someone know how to use the device? Have you checked the devices at least 24 to 48 hours before the meeting and

rechecked immediately before the meeting starts? (Note: For large meetings, to avoid the loss of equipment, it is reasonable to ask for a driver's license or other ID as collateral.)

☐ Are at least five large print copies of meeting handouts available?

☐ Are printed materials available upon request, in alternative formats and/or relevant foreign languages?

☐ Are film or video presentations closed captioned and audio described?

Facility/Room Setup (prior to meeting):

☐ If the main entrance to the building is not accessible, is the accessible entrance unlocked?

☐ Is there an integrated seating area for individuals who use a wheeled mobility device in the meeting room?

☐ Is there seating available for attendees who are deaf or hard of hearing, and have requested an accommodation, near the front of the meeting room so that attendees may see the interpreter/captioner, or lip read?

☐ Is there an appropriately lit area in the front of the room for sign/foreign language interpreters and/or CART providers?

☐ Are the aisles at least three feet wide and clear of obstacles or tripping hazards?

☐ If microphones are used during the public meeting, are adjustable microphone stands available for attendees? Can staff be used as floaters with microphones as an alternative?

For recordkeeping and reporting purposes, please submit a copy of this completed checklist to:

Massachusetts Department of Transportation
Office of Diversity and Civil Rights
10 Park Plaza, Suite 3170
Boston, MA 02116
(For MassDOT/MBTA hosted or sponsored meetings)

Or

Department of System-Wide Accessibility
MBTA
10 Park Plaza, Suite 4470
Boston, MA 02116
(For MBTA hosted or sponsored meetings)

6.2 Ensuring adequate accessible parking

6.2.1 See http://www.mass.gov/Eeops/docs/dps/aab_regs/521023.pdf for Massachusetts Architectural Access Board (MAAB) regulations

6.2.2 See http://www.access-board.gov/ada-aba/final.cfm#a502 for Americans with Disabilities Act Architectural Guidelines (ADAAG)

6.3 Accessible Restrooms

6.3.1 See http://www.mass.gov/Eeops/docs/dps/aab_regs/521030.pdf for Massachusetts Architectural Access Board (MAAB) regulations

6.3.2 See http://www.access-board.gov/ada-aba/final.cfm#a603 for Americans with Disabilities Act Architectural Guidelines (ADAAG)

6.4 How to request sign language, CART Providers or foreign language interpreters

6.4.1 Sign Language Interpreters

- Complete and submit an on-line request for interpreting services through the Massachusetts Commission for the Deaf and Hard of Hearing's (MCDHH) website
  - Go to http://mass.gov/mcdhh
  - Click on "Interpreter/CART referral services"
  - Select "Request an Interpreter on-line"
  - Note: A copy of the Request Form is attached at 6.7, for reference.

- Requests should be submitted within 21 days, but no later than 14 calendar days in advance of the meeting to ensure interpreter availability.

- If the meeting is cancelled or rescheduled, interpreter requests must be canceled at least 48 hours advance in order to avoid being billed for the service. CART providers must be cancelled no later than 72 hours in advance of the event.

- Interpreters invoices are billed as a minimum of two hours.

- For meetings that are anticipated to last more than 75 minutes, two interpreters shall be provided. In most situations, one CART provider is sufficient if the meeting is no longer than three hours.

6.4.2 How to reserve CART Providers

Complete and submit an on-line request for interpreting services through the Massachusetts Commission for the Deaf and Hard of Hearing's (MCDHH) website

Go to http://mass.gov/mcdhh

Click on "Interpreter/CART referral services"

Click on "CART (Communication Access Realtime Translation) Providers"

Click on "Request a CART Provider" and follow listed directions

Note: A copy of the Request Form is attached at 6.7, for reference.

6.4.3 Foreign Language Interpreters/Translators

- MassDOT/MBTA's policy combines the use of bilingual staff, interpreter services and translated materials to communicate effectively with persons who are not fluent in English. When a request for oral interpretation is made, or a significant language speaking population is expected to attend a public meeting, the following steps should be reviewed and carried out to ensure compliance with Title VI requirements.

- Conduct a four-factor analysis as to the kind of meeting in question and the populations that are in the affected communities, using the language group maps that are contained in the Language Assistance Plan. Identify the languages that are likely to be needed and consult with the Office of Diversity and Civil Rights Title VI Coordinator and/or Specialist for assistance with any problems concerning the language groups that may require interpreter services.

- Identify the source for interpreter services, recognizing that most providers require one-two weeks advance notice of a meeting, based on the language(s) to be interpreted.

6.4.2.1 Interpreter Resources

Projects should have a line item in the budget allocating funds for translation/interpretive services for public meetings. When additional resources are needed for unexpected or unanticipated documents or meetings, there may be funds available. Please contact your department manager to make a request through Budget to secure state or federal funds, as needed. For shared services or internal operations where there may not be a project number, please contact the Chief Administrative Officer of MassDOT/MBTA to secure the funds.

6.4.2.2 Request and cancellation timeframes

- Requests should be submitted at least 14 calendar days in advance of the meeting to ensure interpreter availability
- If the meeting is cancelled or rescheduled, interpreter requests must be canceled at least 48 hours advance in order to avoid being billed for the service
- Interpreter invoices vary by provider but may have a minimum of two to three hours.
- For meetings that are anticipated to last more than 75 minutes, two interpreters shall be provided.

6.5 How to reserve assistive listening devices

6.5.1 Contact MassDOT/MBTA Facilities at 857-368-9560.

6.5.2 Departments that frequently host public meetings are encouraged to purchase Assistive Listening Devices so that they are readily available.

6.5.3 Currently OTA/THE RIDE owns Assistive Listening Devices that other departments can reserve and sign out for a public meeting.

Contact:

Carol Joyce-Harrington, OTA/THE RIDE

617-222-2256 or CJoyce-Harrington@MassDOT/MBTA.com

6.6 How to Create Alternate Formats

6.6.1 Electronic Version

6.6.1.1 Accessible electronic formats include email, and Microsoft Word Document (DOC or DOCX), a text file (TXT), or Rich Text Format (RTF).

Note: Some attendees requesting material electronically may have a visual impairment and use screen reading software. The formats referenced above are most compatible with such software.

6.6.1.2 Public meeting materials that are created electronically shall:

6.6.1.2.1 Be created using "Arial" font and a font size of 16 pt.

6.6.1.2.2 Shall have the same information as the original document and shall have the highest contrast possible.

6.6.1.2.3 If graphics (such as images, tables, or graphs) are used in the original document, the same graphics shall be included in the electronic version of the document.

6.6.1.2.4 If images are used in the electronic document, a brief description (providing the viewer of the document with a general idea of what's in the image) shall be provided.

6.6.1.2.5 If tables or graphs are used in the electronic document, a summary of the table or graph shall be provided.

6.6.2 Braille Version

6.6.2.1 Meeting materials that are in Braille shall:

6.6.2.1.1 Be created using contracted Braille (Grade 2) and single-spaced.

6.6.2.1.2 Braille documents shall have the same information as the non-accessible handout.

6.6.2.1.3 If tables or graphs are used in the regular document, a summary of the table or graph shall be provided in the Braille document.

6.6.2.2 In order to create a Braille document:

MassDOT/MBTA's Central Planning Transportation Services (CTPS) currently owns and operates a Braille printer.

Contact:

Janie Guion, CTPS

617-973-7507 or jguion@ctps.org

6.6.3 Audible Version

6.6.3.1 Public meeting material that is recorded audibly shall:

6.6.3.1.1 Have the same information that's printed on the original handout.

6.6.3.1.2 Be spoken clearly.

6.6.3.1.3 Shall describe images used in the original handout.

6.6.3.1.4 Shall provide an explanation of any table or graph is used in a meeting document. The meeting planner shall ensure that the audible explanation of the table/graph is clearly explained and represents the table or graph on the printed document.

6.7 Sample meeting posting (in an MBTA context)

Meeting Date	September 21, 20__
Meeting Time	1:00 P.M.-3:00 P.M.
Subject of Meeting	Judge Patrick King's Update on MBTA/BCIL Settlement Agreement
Location	State Transportation Building, 2nd Floor, Conference Rooms 2-3
MBTA Attendees	Department of System-Wide Accessibility

Sample Text

Meeting Purpose - Judge Patrick King will be hosting a public meeting to discuss his assessment of the MBTA's progress towards compliance with the MBTA/BCIL settlement agreement. Please come to share your questions and comments regarding accessibility at the T.

Notice: This location is accessible to people with disabilities. MassDOT/MBTA provides reasonable accommodations and/or language assistance free of charge upon request (including but not limited to interpreters in American Sign Language and languages other than English, open or closed captioning for videos, assistive listening devices and alternate material formats, such as audio tapes, Braille and large print), as available. For accommodation or language assistance, please contact MassDOT/MBTA's Chief Diversity & Civil Rights Officer by phone at (857) 368-8580, TTD/TTY at (857) 266-0603, fax (857) 368-0602 or by email to MASSDOT/MBTA.CivilRights@dot.state.ma.us. Requests should be made as soon as possible prior to the meeting, and for more difficult to arrange services including sign-language, CART or language translation or interpretation, requests should be made at least ten business days before the meeting.

(Note: This notice should be translated into the languages other than English that are identified to be necessary for the Limited English Proficient populations represented in the area of the project or initiative to be invited to participate.)

6.8 Resources for adding closed captioning and/or described narration to your video

- WGBH - http://main.wgbh.org/wgbh/pages/mag/services/captioning/
- 3 Play Media - http://www.3playmedia.com/
- Line 21 - http://www.line21.tv/
- TelePrint Digital Media - http://www.tele-print.com/
- Broadcast Captioning & Consulting Services - http://www.closedcaptioning.com/

6.9 Document History (Reserved)

4. Public Participation during the Fare Change process

4.1 Public Process for Fare Increase

The MBTA followed its most recent Policy on Public Process for Fare Increases, updated in 2009.

"Proposed changes to a fare restructuring, and/or a fare increase will be developed with significant public input and will be adopted after consultation with the Rider Oversight Committee, public workshops, public comment and at least one designated public hearing, and MBTA Board of Directors approval[3]. In addition, this public process shall be followed, to the extent applicable, for proposed major service reductions, defined as a systemwide reduction of 10% or more, as measured by typical daily usage. Proposed changes in fares and service reductions may be consolidated for purposes of this public process[4]

The public process shall include (but is not limited to) the following steps:

1. The MBTA will provide public notification of proposals of any of the following types:

- Changes to the fare structure
- A fare increase
- Major service reductions.

At the time of notification, the MBTA will issue a schedule for a public outreach process, provide background information on the reasons for the proposed changes, and provide preliminary summary documents (including preliminary and summary impact analyses that address revenue and ridership).

2. The MBTA will hold public workshops to discuss the proposed changes and solicit direct input from the public. For major changes to the fare structure, or a system wide fare increase of 10% or more (or a system-wide fare increase of less than ten percent that results in a cumulative increase

[3] The MBTA may, without action by the MBTA Board of Directors, determine and, from time to time, adjust or suspend fares for occasional, short-term service related to special events, to promote the use of a particular service, or where, in the judgment of the General Manager, such action is required by considerations of the public safety or convenience. The MBTA may also provide pilot programs to test the effectiveness of different types of fare discounts before seeking Board approval for permanent implementation.

[4] The Public Process described herein is intended to apply primarily to service reductions that may be proposed and/or considered in conjunction with changes in fare levels or fare structure. Nothing herein is intended to alter the process applicable to general service planning as described in the MBTA's Service Delivery Policy, adopted January 14, 2009.

of ten percent or more within a three year period)[5], at least ten workshops will be held in the following areas:

- Downtown Boston – 2 meetings
- Metropolitan Urban Neighborhoods – 3 meetings
- Metropolitan Suburban Communities – 4 meetings
- I-495 corridor – 1 to 3 meetings

For minor changes to the fare structure, or for a fare increase of less than 10%, the MBTA will hold up to five public workshops, to be located where feasible in areas most affected by the changes. The public workshops will be followed by a public comment period, during which the public can submit feedback in writing via mail, email or the MBTA website. The MBTA may designate one or more of the public workshops as a public hearing or hearings for purposes of 3.

3. As part of the public process, the MBTA will make available via the MBTA website its most recent § 11 reports to the Governor, Legislature, and Advisory Board, as well as any draft report or analysis addressing revenue, ridership, air quality, and environmental justice impacts Following the availability or posting of such materials, the MBTA will hold at least one public hearing, which shall be held in a central location or locations within the MBTA service district. At any such hearing, the MBTA will make a formal presentation regarding the proposed changes, and the public will have the opportunity to provide testimony on the proposals for the public record.

4. Following the public workshops and hearing(s), the MBTA may make revisions to the draft documents, based on the comments received through the public workshops, comment period and hearing(s). The revised drafts and a summary of the public comments will be submitted to the MBTA Advisory Board and Board of Directors for review. The summary of comments, with MBTA responses, will be made available to the public on the MBTA website.

5. In connection with a proposed system-wide fare increase of ten percent or more, the MBTA Board of Directors will make environmental findings. Such findings will include: the purpose and need of a fare increase; actions taken to avoid a fare increase; the impacts of the fare increase, including economic, transportation, air quality, and environmental justice; alternatives to a fare increase, including impacts of no fare increase; and measures to reduce impacts. Environmental consideration of major service reductions shall be conducted in accordance with applicable law.

[5] The percent of fare increase represents the percent of additional fare revenue realized by the MBTA as a result of increased fares. Thus, with a system-wide fare increase of ten percent, riders on some services may experience an increase of more than ten percent and others less.

6. The Board of Directors will make a final vote on the proposed changes after considering the overall financial condition of the MBTA, the ridership and revenue implications of the changes, the staff's summary of public comments, the air quality and environmental justice analyses, and comments from the MBTA Advisory Board. Except where the Board of Directors determines that the condition of the MBTA requires prompt action, the Board of Directors vote will not take place until at least 15 days after the summary of public comments has been made available.

Public notifications will be placed in citywide and community newspapers, on the MBTA website, on transit vehicles, and via station signage. Documents will be made available electronically on the MBTA website (formatted for easy download) and in hard copy at local libraries throughout the service area. Reasonable measures will be taken to assure that notifications are made to appropriate groups of persons with limited English proficiency (LEP).

Public workshops and hearing(s) will be scheduled Monday – Thursday, will be held at times that are convenient for commuters and transit dependent riders, and will take place at locations that are within walking distance of MBTA services.

5. Public Participation during the Capital Project Development and Design Process

5.1 Project Development

The project development process covers a range of activities extending from the identification of a project need to a finished set of contract plans, through construction and project completion. The sequence of decisions made through the project development process progressively narrows the project focus and, ultimately, leads to a project that addresses the identified needs. The MBTA coordinates all project planning with the Office of Transportation Planning (OTP).

The MBTA is committed to providing ample opportunities for public participation throughout the entire project development process. This work and coordination follow the planning phase to take advantage of research already conducted on the communities impacted by a project and the level of public support, measured through the public participation process.

The procedures MassDOT/MBTA has adopted for project development are intended to be implemented in conformity with the MassDOT/MBTA Title VI and Americans with Disabilities Act protocols, policies and procedures for inclusive and accessible public participation provided in this document.

5.1.1 Need Identification

The project development process is initiated in response to an identified need in the transportation system. This need can result from suggestions or concerns about a regularly maintained asset or by the operation of a performance-management system, such as MassDOT/MBTA's bridge management system, or a recent corridor or area planning process. Problem, need, or opportunity identification can also occur through the regional planning initiatives of a planning organization or arise from community, legislative, or citizen input.

The development of solutions to address identified needs often involves input from transportation planners, community leaders, citizens, environmental specialists, landscape architects, natural resource agencies, local public works officials, permitting agencies, design engineers, financial managers, and agency executives. Solutions might target a single mode of transportation, or address the range of road users including pedestrians, bicyclists, transit operators, automobile drivers, and truckers moving freight and goods. It is important to engage from the beginning of project development.

Transportation decision making is complex and can be influenced by legislative mandates, environmental regulations, financial limitations, agency programmatic commitments, and partnering opportunities. Decision makers and reviewing agencies, when consulted early and often during the project development process, can ensure that all participants understand the potential impact these factors can have on project implementation.

5.1.2 Project Planning

Upon identification of a transportation improvement need, the planning process commences. As part of the planning process, the project proponent must conduct a public participation outreach and involvement program, provide information regarding the project, and decide, based on the totality of information gathered during the planning process as well as public input, whether to continue the project development process.

In the planning phase, the proponent identifies issues, impacts, and potential required approvals in order to determine which design and permitting processes are called for. This phase also helps to define project responsibilities and benefits.

Public participation in a project should begin early in project planning and before there is a recommended course of action. Consultation with public involvement specialists on early and long-term efforts is recommended wherever a broad-based public involvement effort is planned and

implemented. The initial public outreach process starts with an early informational meeting and continues at strategic milestones during the planning process. Substantial effort should be made to reach a broad spectrum of interested parties at this early project stage and throughout the project.

Public meetings are conducted during the planning phase in order to relay information to the general public and to solicit input to the project. The public meetings serve as forums at which MassDOT/MBTA can learn about and respond to community concerns. A public meeting typically begins in an open house format to allow individuals to speak one-on-one with MassDOT/MBTA staff regarding their concerns and questions with respect to the project, and then formal presentations are made to share information and elicit public comments and suggestions.

During the scoping of projects, MassDOT/MBTA coordinates with the affected metropolitan planning organizations (MPOs), regional planning agencies (RPAs), regional transit authorities (RTAs), and municipalities to determine the amount and type of public outreach that will be required for the project. These entities maintain Public Participation Plans of their own and should be contacted directly for a copy of said plans.

Following review by all constituents and by environmental agencies of the alternatives and proposed project, the Project Planning Report can be completed and made ready for review. The report documents the need for the project, existing and future conditions, alternatives considered, public participation outcome, and solution recommended.

5.1.4 Construction

After a construction contract is awarded, the proponent and the contractor will need to develop a construction management plan. The permitting agencies, local authorities, businesses, and affected members of the general public need to be informed of the plan. These entities should also be notified as changes in detours, traffic operations, and construction areas and activities occur throughout the project.

Before construction activities begin, the proponent and construction manager must determine the appropriate type of public notification and participation needed. Different projects result in different types of disruption to transportation and other nearby activities. For simple projects, including resurfacing, a minimal degree of public participation may be needed. For these projects, the proponent should, at a minimum, notify abutters (in languages other than English, if appropriate) of the impending construction activity.

For complex projects, the proponent may need to schedule a construction management plan meeting with abutters and other project participants (local boards, interest groups, business associations, etc.). At this meeting, the proponent can describe the types of construction activity needed, construction phasing, and durations. Issues and concerns associated with the construction period can be identified and adjustments made to the construction management program to minimize community impacts.

It is critical to remain in contact with stakeholders, neighbors, abutters, legislators, and municipal officials throughout the duration of a project, including the construction phase. Monthly or quarterly stakeholder and abutter meetings should be held when the size or location of a project calls for them. In addition, MassDOT/MBTA will utilize the following communication tools to share project information and receive feedback.

- MassDOT/MBTA website: By the time construction is underway, many projects already have their own project page on the MassDOT/MBTA website. The project page should be a clearinghouse for accurate, up-to-date information. It is important that the Project Manager or a Public Affairs staff person assigned to the project page update the content regularly throughout the duration of the project. In addition, any public meetings scheduled for a project should always be posted in the MassDOT/MBTA website calendar.
- Media: MassDOT/MBTA utilizes press releases, advisories, alerts, and other traditional forms of media outreach.
- Social media tools: MassDOT/MBTA currently usesTwitter, MassDOT blog, Flickr, email distribution lists, and other new media venues for project updates, traffic advisories, and notices of upcoming project meetings.
- Public Affairs email account: MassDOT/MBTA has an email account that is used to send meeting notices and traffic advisories to the project contact lists and to receive public input.

6. Public Participation Process for Service Planning & Operations

6.1 Service Planning/ Operations

The MBTA Board of Directors adopted the *Service Delivery Policy* in September 1996. This policy defined service standards and outlined a process to evaluate and modify service. Standards relate to:

- Span of Service
- Frequency of Service
- Vehicle Loading
- Schedule Adherence
- Net Cost per Passenger

6.2 Service Planning Outreach Process

After the MBTA releases its draft proposal for service changes, the MBTA holds a series of meetings to solicit feedback and comments on the proposed changes. In addition, the MBTA has established an e-mail (serviceplanning@mbta.com) to receive public comment on proposed service plans. The first Service Plan was implemented in 1998, and since then major service changes have been implemented in 2002, 2004, 2006 and 2009, using the same Service Plan process. The Service Delivery Policy itself has also been refined since 1996, as a part of the process.

Public participation in the service planning process varies somewhat by mode and occurs as both an on-going process and as a Service Plan specific process. The purpose of public involvement in the service planning process is to promote a regular dialogue with existing and potential riders, elected officials, and communities regarding their ever-changing service needs

On-Going Public Outreach

The MBTA provides avenues for on-going communication through the MBTA's website, as well as the customer complaints phone line and comments sent to individual MBTA officials. Service related comments/requests are directed to the appropriate department for consideration and response. Upon request, MBTA staff also attend public meetings held by municipalities and meetings with public officials to address specific service issues. In addition, from time to time, the MBTA may conduct specific market or route-based surveys to gather direct input on a major service change or potential new service.

Biennial Service Plan Public Outreach

Service Plan outreach efforts are intended to provide members of the public with the opportunity to submit service requests to the MBTA for consideration in development of the Biennial Service Plan. To this end, the MBTA solicits ideas for service changes through written comments (submitted on-line or via the mail), as well as through public meetings throughout the service area, before a draft plan is written.

Upon completion of the draft biennial Service Plan, the MBTA schedules a second round of public meetings in appropriate locations. At these open meetings the MBTA presents the analysis and issues behind the proposed service changes and solicits public comments on them. In addition, at least one Public Hearing is held to receive formal public comments on the draft Biennial Service Plan. MBTA staff then assess and analyze the suggestions made through the public comments and, as appropriate, incorporate them into the final recommendations that go to the MBTA Board of Directors for approval before implementation.

All Service Plan public notifications, meetings, and hearings will conform to the requirements of the Americans with Disabilities Act, Title VI of the Civil Rights Act of 1964, and MBTA policies associated with these laws.

APPENDIX 1

Federal Public Participation Mandates

23 CFR 450

The federal regulations concerning public participation in statewide transportation decision making are specified in Title 23, Section 450.210, of the Code of Federal Regulations (CFR). These regulations require that public involvement processes be proactive and provide complete information, timely public notice, full public access to key decisions, and opportunities for early and continuing involvement; they leave the choice of methods for facilitating participation to the discretion of each state. The regulations specify that participation processes must provide:

- Early and continuing opportunities for public involvement
- Timely information on transportation issues and decision-making processes
- Reasonable access to technical and policy information
- Electronically accessible public information on the Web
- Adequate notice of involvement opportunities and time for review and comment at key decision points
- Procedures for demonstrating explicit consideration of and responses to public input
- A process for soliciting and considering the needs of traditionally underserved populations
- Periodic review and evaluation of the participation process
- Public meetings at convenient and accessible locations and convenient times
- Visualization techniques to describe the proposed plans and studies
- 45 calendar days for public review of and written comment on public participation procedures in the development of the Long-Range Statewide Transportation Plan (LRSTP) and the Statewide Transportation Improvement Program (STIP) before new procedures and any major revisions to existing procedures are adopted

Title 23, Section 450.212, specifies the public participation requirements for systems-level, corridor, and subarea planning studies.

Title 23, Section 450.214, specifies the public participation requirements for development of the Long-Range Statewide Transportation Plan.

Title 23, Section 450.216, specifies the public participation requirements for development of the Statewide Transportation Improvement Program.

Title 23, Section 450.218, specifies that the transportation-planning process is to be carried out in accordance with all of the applicable requirements of:

- 23 USC 134 and 49 USC 5303 regarding metropolitan transportation planning, 23 USC 135 and 49 USC 5304 regarding statewide transportation planning, and 23 CFR 450 regarding planning assistance and standards.
- Title VI of the Civil Rights Act of 1964, as amended (42 USC 2000d–1), and 49 CFR part 21 regarding nondiscrimination in federally-assisted programs of the Department of Transportation.
- 49 USC 5332, prohibiting discrimination on the basis of race, color, creed, national origin, sex, or age in employment or business opportunity
- Section 1101(b) of SAFETEA-LU (Pub. L. 109–59) and 49 CFR part 26, regarding the involvement of disadvantaged business enterprises in U.S. DOT–funded projects
- 23 CFR part 230, regarding implementation of an equal employment opportunity program on federal and federal-aid highway construction contracts
- Americans with Disabilities Act of 1990 (42 USC 12101 *et seq.*) and 49 CFR parts 27, 37, and 38
- In states containing air pollutant nonattainment and maintenance areas, Sections 174 and 176 (c) and (d) of the Clean Air Act, as amended (42 USC 7504, 7506 [c] and [d]) and 40 CFR part 93
- Older Americans Act, as amended (42 USC 6101), prohibiting discrimination on the basis of age in programs or activities receiving federal financial assistance
- Section 324 of Title 23 USC, regarding the prohibition of discrimination based on gender
- Section 504 of the Rehabilitation Act of 1973 (29 USC 794) and 49 CFR part 27, regarding discrimination against individuals with disabilities

Americans with Disabilities Act of 1990 (ADA)

The Americans with Disabilities Act of 1990 (ADA) states that "no qualified individual with a disability shall, by reason of such disability, be excluded from participation in or be denied the benefits of services, programs, or activities of a public entity, or be subjected to discrimination by any such entity." Therefore, ADA requires that locations for public participation activities, as well as the information presented, must be accessible to persons with disabilities.

ADA requires specific public participation efforts for the development of paratransit plans:

- Hold a public hearing
- Provide an opportunity for public comment
- Consult with disabled individuals

Title VI of the Civil Rights Act of 1964

Title VI of the Civil Rights Act of 1964, together with related statutes and regulations, provides that "no person in the United States shall, on the ground of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." The entire institution, whether educational, private or governmental, must comply with Title VI and related Federal civil rights laws, not just the program or activity receiving federal funds.

FTA C 4702.1A, Title VI and Title VI-Dependent Guidelines for Federal Transit Administration Recipients, provides guidance on promoting inclusive public participation. This circular recommends the seeking out and consideration of the viewpoints of minority, low-income, and LEP populations when conducting public outreach and involvement activities. It identifies the following effective practices for fulfilling the inclusive public participation requirement:

- Coordinate with individuals, institutions, or organizations and implement community-based public involvement strategies to reach out to members of the affected minority and/or low-income communities.
- Provide opportunities for public participation through means other than written communication, such as personal interviews or use of audio or video recording devices to capture verbal comments.

- Use locations, facilities, and meeting times that are convenient and accessible to low-income and minority communities.
- Utilize different meeting sizes or formats or vary the type and number of news media used to announce public participation opportunities, tailoring communications to the particular community or population.
- Implement DOT's policy guidance concerning recipient's responsibilities to LEP persons to overcome barriers to participation.

Executive orders regarding environmental justice and outreach to persons with limited English proficiency are also regulated under Title VI of the Civil Rights Act:

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994

This executive order states that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Traditionally underserved groups such as low-income and minority populations must be identified and given increased opportunity for involvement in order to ensure effective participation.

Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, 2000

This executive order requires that recipients of federal financial aid ensure that their programs and activities that are normally provided in English are accessible to persons with limited English proficiency.

23 USC 109(h)

The U.S. Secretary of Transportation is required by 23 USC 109(h) to promulgate guidelines to ensure that possible adverse economic, social, and environmental effects relating to any proposed project on any federal-aid system have been fully considered in developing such project, and that the final decisions on the project are made in the best overall public interest, taking into consideration the need for fast, safe, and efficient transportation, public services, and the costs of eliminating or minimizing such adverse effects as the following:

- Air, noise, and water pollution

- Destruction or disruption of manmade and natural resources, aesthetic values, community cohesion, and the availability of public facilities and services
- Adverse employment effects, and tax and property value losses
- Injurious displacement of people, businesses, and farms
- Disruption of desirable community and regional growth

23 CFR 771

The joint FHWA/FTA regulations of 23 CFR 771 prescribe the policies and procedures for implementing the National Environmental Policy Act of 1969 as amended (NEPA) and the Council on Environmental Quality (CEQ), 40 CFR 1500-1508. It sets forth all FHWA, FTA, and U.S. DOT requirements under NEPA for the processing of highway and urban mass transportation projects and sets forth procedures to comply with 23 USC 109(h), 128 and 138, and 49 USC 303, 1602(d), 1604(h), 1604(i), 1607a, 1607a-1, and 1610.

Section 771.111 discusses early coordination, public involvement, and project development.

Section 771.111 (h) specifies (for the federal-aid highway program) that each state must have procedures approved by the FHWA to carry out a public involvement/public hearing program pursuant to 23 USC 128 and 40 CFR parts 1500 through 1508.

State public involvement/public hearing procedures must provide for:

- Coordination of public involvement activities and public hearings with the entire NEPA process.
- Early and continuing opportunities during project development for the public to be involved in the identification of social, economic, and environmental impacts, as well as impacts associated with relocation of individuals, groups, or institutions.
- One or more public hearings or the opportunity for hearing(s)[6] to be held by the state highway agency at a convenient time and place for any federal-aid project that requires significant amounts of right-of-way, substantially changes the layout or functions of connecting roadways or of the facility being improved, has a substantial adverse impact on

[6] An “opportunity for hearing(s)” is when the public is given the opportunity to request that one or more hearings be held so that members of the public can give formal comments on the public record.

abutting property, otherwise has a significant social, economic, environmental, or other effect, or for which the FHWA determines that a public hearing is in the public interest.

- Reasonable notice to the public of either a public hearing or the opportunity for a public hearing. Such notice will indicate the availability of explanatory information. The notice shall also provide information required to comply with public involvement requirements of other laws, executive orders, and regulations.

49 CFR 24.8(b)

This section requires that the implementation of uniform relocation assistance and real property acquisition for federal and federally-assisted programs is in compliance with Title VI of the Civil Rights Act of 1964.

APPENDIX 2

The development of an effective public participation program for a transportation plan, program, or project is a strategic effort that requires techniques designed to meet the particular needs involved. MassDOT/MBTA has considered and based its public participation approaches on the following guidance from the United States Department of Transportation, to systematically set up and implement a public participation program for a specific plan, program, or project:

1. ***Set goals and objectives for your public participation program.*** *The goals and objectives derive from the specific circumstances of a given transportation plan, program, or project. What decisions, formal or informal, are to be made? When? By whom? What public input is needed? Public input can be in the form of a consensus on a plan or a buildable project. Consensus does not mean that everyone has to agree enthusiastically but that all influential groups and individuals can live with a proposal. Public input can be in the form of information used by staff or decision makers. Agencies use the objectives to form the public involvement program. The more specific the objectives, the better they will guide the involvement program.*

2. ***Identify the people to be reached.*** *The general public and those directly affected, such as abutting property owners, are some of those who should be reached. If the public is not included or there is no proof of our attempt to reach out, there may be grounds for concerned individuals to challenge the fairness of a project development process. Review who is affected directly and indirectly, as well as those who have shown past interest. Look for people who do not traditionally participate, such as minorities and low-income groups. What information do they need to participate? What issues or decisions affect which specific groups or individuals? How can their ideas be incorporated into decisions? New individuals and groups appear throughout a public involvement program; there should be a way to identify and involve them. Conceptualize the public as a collection of discrete groups, individuals, and the general public; each has different interests and different levels of energy for participation. Most importantly, we must be clear that every member of the public we serve has a right to be part of any transportation planning process, and we are obligated to create real opportunities in support of that right.*

Usually, setting the goals and objectives for a public participation program and identifying the people to be reached should interact and are conducted simultaneously. In addition to brainstorming and analysis by agency staff, MassDOT/MBTA staff should ask members of the public for their input on goals, objectives, and names of people who might be interested. This can be done through key person interviews or focus groups or public opinion surveys.

3. ***Develop a general approach or set of general strategies that are connected to the goals and objectives of the participation program and the characteristics of the target audiences.*** *For example, if an objective is to find out what people think about a proposal, use several techniques for eliciting viewpoints. Strategies fit the target audience in terms of what input is desired and the level of interest or education. General approaches respect agency resources of time, money, and staff. A general approach can be visualized in terms of a principal technique; for example, a civic advisory committee. It could be visualized as a stream of different activities connected to specific planning or project decisions. Alternatively, a general approach could be viewed as a focus on one or more public groups or interests. Be sure to check with members of the public for ideas on your general approach and whether the public to be reached finds the approach acceptable.*

4. ***Flesh out the approach with specific techniques.*** *Consult past experience for what works and does not work. Look at manuals of techniques, such as* Public Involvement Techniques for Transportation Decision-Making *(http://www.fhwa.dot.gov/reports/pittd/cover.htm) and the International Association for Public Participation's* Public Participation Toolbox *(provided in Appendix A). Choose techniques that fit your specific purpose and your public. Target individual groups with appropriate techniques. Approaches that fit the general public often do not fit specific groups well and result in lack of attendance at meetings. Do not isolate groups; provide a way for them to come together and for the general public to review what groups have contributed. This linkage can be essential for building consensus, when needed.*

5. ***Assure that proposed strategies and techniques aid decision-making to close the loop.*** *Ask agency staff the following questions: Are many people*

participating with good ideas? Are key groups participating? Is the public getting enough information as a basis for meaningful input? Are decision-makers getting adequate public information when it is needed? If a consensus is needed for decision-making, consensus-building techniques like negotiation and mediation or collaborative task forces may be useful. Ask participants who is missing from the participation process. How can missing participants be attracted? Do participants think discussion is full and complete? Do they think the agency is responsive? Is participation rewarding? If not, why not? Continually evaluate and make mid-course corrections.

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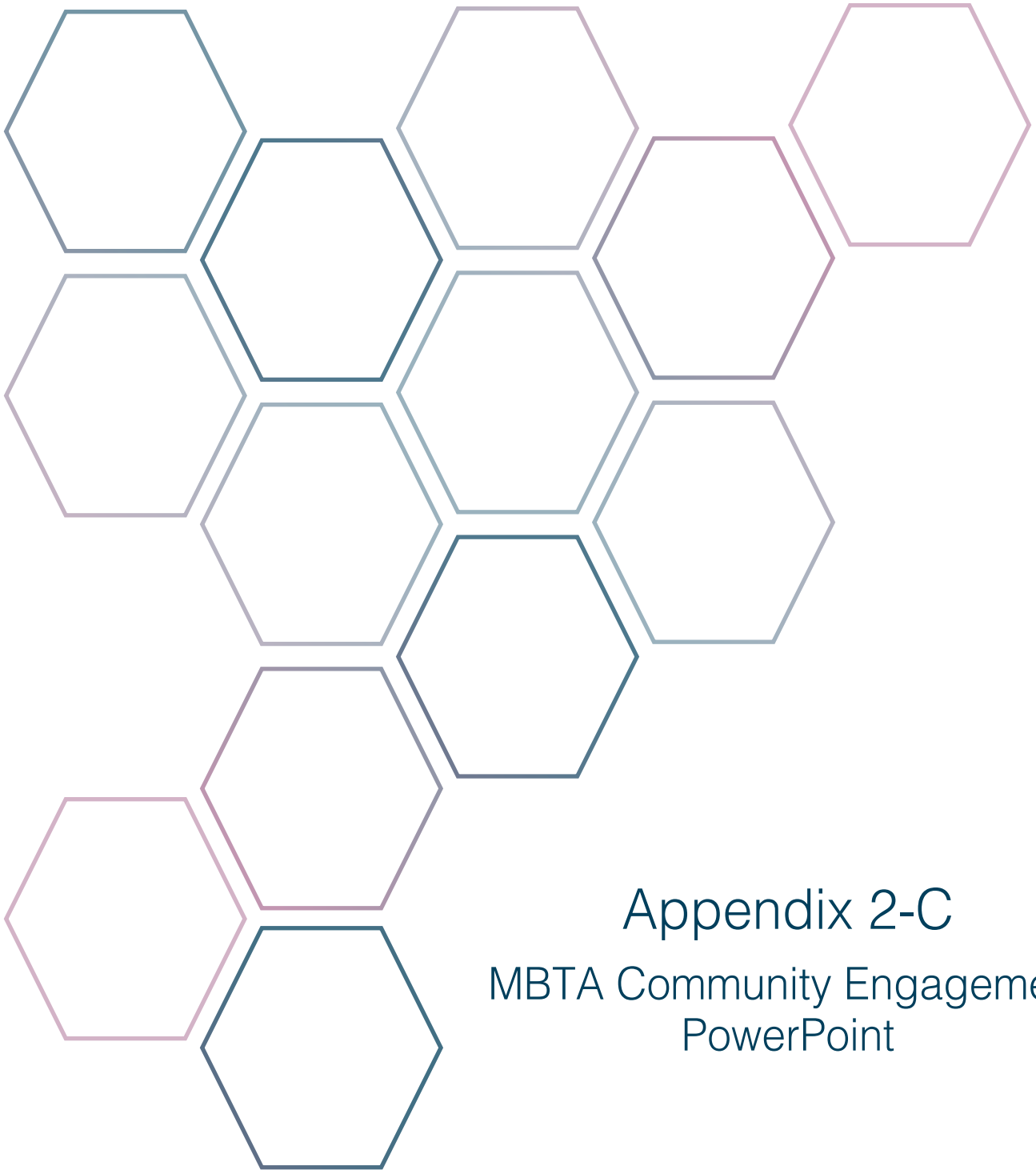

Appendix 2-C

MBTA Community Engagement PowerPoint

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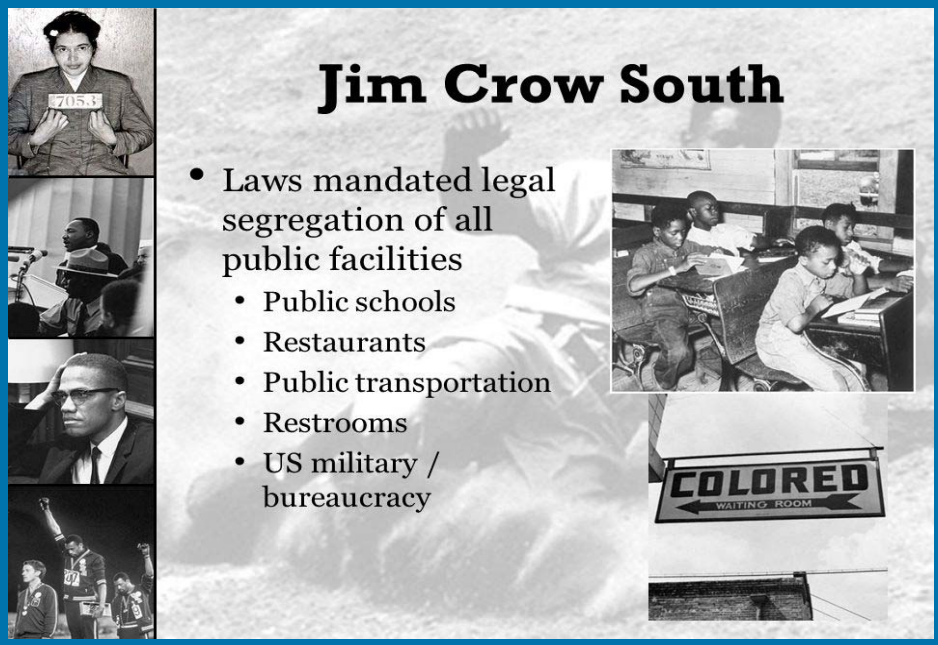
MBTA/MassDOT
Office of Diversity and Civil Rights

Title VI Overview

Presentation Objectives

- To encourage more strategic understanding and discussion of civil rights that impact the public in relation to the MBTA, this presentation will focus on:
  - Transit related Title VI/Nondiscrimination fundamentals, including complaints, public participation, language and disability access.
  - Progress that MassDOT/MBTA are making to build anti-discrimination strategies and tools
  - Opportunities for community involvement

Transportation and Civil Rights



Title VI Basic Principles

- Civil Rights Act of 1964 established prohibition against public facing discrimination nationwide.
- Section 601 defines non-discrimination
- Section 602 directs agencies (such as USDOT) to implement the law, and to take action against recipients who are non-compliant.

Title VI and Executive Order Requirements

"No person in the United States shall on the ground of race, color, or national origin be excluded from participation in, denied the benefits of, or subjected to discrimination under any program or activity receiving Federal financial assistance."

Objective: Ensure that public funds are not spent in ways that encourage, subsidize, or result in discrimination.

Nondiscrimination Law Expansion: Age, Sex (1987), Disability (1990)

Executive Orders expanded nondiscrimination obligations to:

- Environmental Justice (Low-Income and Minority)
- Improve Access to Services for Persons with Limited English Proficiency

Transit Related Federal Civil Rights Regulatory Framework

1964	• Title VI of the Civil Rights Act of 1964
1987	• Civil Rights Restoration Act of 1987
1994	• Executive Order 12898-Environmental Justice
2000	• Executive Order 13166-Limited English Proficiency
2007	• FTA Circular 4702.1A
2012	• FTA Circular 4702.1B

Theories for Alleging Title VI Claims

- Disparate treatment alleges an individual of a protected group has been singled out and treated less favorably than others similarly situated on the basis of a Title VI protected class.
- Disparate impact alleges that practice or policy has a disproportionately adverse effect on members of the protected class as compared with non-members of the protected class. Requires a valid statistical framework.
- Defense to prima facie claim is based showing a legitimate nondiscriminatory justification that is not pretext. FTA requires transit providers to consider alternatives or mitigation, even where there is a justification.

Environmental Justice

- Executive Order 12898 was established by Presidential action in 1994.
- Key difference from Title VI is lack of private standing to allege EJ violations
- Title VI jurisdiction can used to alleged that the activities funded that adversely affect human health and/or the environment, do so on the basis of race, color, or national origin.

Theories of Review Under EJ

- Can use different treatment theory under Title VI to allege intentional discrimination?
- Can use impact theory, called “Disproportionate Burden” under EJ – a statistical based claim that the impact of a policy or practice that adversely affects low income and/or minority populations.
- MBTA must consider EJ along with Title VI in analysis of major service and fare changes.

Federal Agency Title VI Oversight

- FTA Circular 4702.1B, established by Federal Transit Administration (FTA) in 2012
  - Provides compliance guidance to transit providers and other recipients on Title VI; incorporates EJ principles
  - Metropolitan Planning Organizations (MPOs) are a critical recipient of federal funding because of financial, planning and that must include the public in planning discussions on use of federal dollars for transportation, including transit.`
  - Specific requirements are stated for providers of 50 or more fixed route vehicles in peak service located in urbanized areas of 200,000 or more in population.
  - Nature of compliance – build data to shape all policies that are relevant for CR

Required Title VI Program Elements

- Establishing Civil Rights Unit
- Signed Assurance of Title VI Compliance
- Notice of Title VI Obligations to Subrecipients and Rights of Beneficiaries
- Complaint Processing
- Inclusive Public Participation
- Ensuring Meaningful Access to Individuals with Limited English Proficiency
- Conducting Internal Compliance Reviews and Reporting
- Subrecipient Monitoring and Reporting
- Technical Assistance and Training
- Demographic Data Collection and Analysis

Title VI Complaints and Procedures

- MBTA has established procedures for complaints
  - Investigative unit established to handle complaints
  - Title VI complaint form (translated)
  - Complaint procedures are posted on website
- MBTA includes a report on allegations of discrimination in the Title VI Program:
  - Title VI Specialist audits and analyzes complaints for trends and possible training needs.

MassDOT Public Participation Plan (PPP)

- Transit providers must create public participation for Title VI compliance, including opportunity for public comment, mandated board approval and federal review and concurrence.
- FHWA and FTA concurred with MassDOT's Public Participation Plan in 2014, for both Highway and Rail & Transit Divisions
- MBTA has adapted the MassDOT PPP to meet its requirement, which is part of the 2014 MBTA Title VI Program.
- Key public participation opportunities in transit include disparate impact/disproportionate burden, service delivery, major service change, and mitigation in cases of adverse disparate impact (on fare and major service changes).

Key Title VI Public Engagement Elements

- Diverse and effective outreach
- Accessible location and reasonable accommodations
- Language support
- Timely response to public questions and consideration of public comments
- Effective information dissemination across demographics

Board Role and Responsibility:

- The FTA requires board approval in a range of areas, such as:
  - The Title VI program, including the disparate impact/disproportionate burden policy
  - Service delivery policy
  - Major service change policy
  - Results of any service and fare equity analyses
  - Results of service monitoring

Collection and Use of Data

- MBTA collects data on service area and customer demographics, profile maps and operational data, as well as travel patterns.
- FTA requires data collection on crowding, wait times, delays, on time performance, access to service
- Data is used to set system-wide standards and policies.
- Key MBTA Data Challenge: Ridership survey data can be weak due to poor public response rate; Census data becomes aged over 10 year cycle
- Reliability of data becomes problematic when matched to unique circumstances and changes.

Service and Fare Equity

- Required for any proposed “major service change” and fare changes
- Definition and analysis of major service changes are based on ridership data, and are defined by providers, with public input.
- Analytical framework requires comparing impacts on minority and low-income to non-minority, non-low-income populations.
- FTA required data is considered in defining changes through analysis of equity impacts on customer experience

Adverse Service or Fare Equity Analysis Finding

- Identify disparity and alternatives; share with Board to determine next steps
- If alternatives are not available, consider whether mitigation can be achieved
- Seek public input on mitigation
- Modify proposal, as needed
- Conduct an equity analysis of the proposed option(s)

Language Access

- Based on US Supreme Court decision (Lau v. Nichols) declaring that language based discrimination is effectively national origin discrimination.
- Definition of “Limited English Proficient” – changes slightly between USDOT agencies. FTA definition:

  “*Limited English Proficient (LEP) persons refers to persons for whom English is not their primary language and who have a limited ability to read, write, speak, or understand English. It includes people who reported to the U.S. Census that they speak English less than very well, not well, or not at all*.”

Language Access Plan (LAP)

- Compliance is based on creation and implementation of a Language Assistance Plan, an analysis identifying critical documents, interactions and other supports needed for equal access. Components include:

  1. Number or proportion of LEP individuals eligible to be served or likely to be encountered
  2. Frequency of contact with LEP persons
  3. Importance of programs, services, and activities. Vital documents include: notice of right to access language assistance free of charge; consent and complaint forms; intake and application forms; written notice of rights; notices of denials, losses or decreases in benefits or services.
  4. Resources

- LAP protocols, resources, and schedules of language access provisions reaches all MassDOT units; updated triennially.

MassDOT's Accessible Public Meeting Policy

- MassDOT is committed to ensuring that all public meeting are fully accessible to persons with disabilities.
- MassDOT Accessible Meeting Policy, signed by Secretary Davey in 2013, frames the obligations and protocols for accessible interactions with the public and provides resources, like checklists, to ensure accessibility
- Guidelines and checklists exist for the following strategies:
  - Accessibility of location, room, and set-up
  - Alternate formats
  - Sign language and real-time transcription

massDOT
Massachusetts Department of Transportation
Rail & Transit Division

Questions?

Appendix 2-D

MBTA List of Public Engagement Activities

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MBTA Public Engagement Activities May 2014 - May 2017

DATE	MEETING TITLE
5/14/2014	GLX Project – Community Path Public Meeting
6/10/2014	Judge King's Update on Compliance with MBTA/BCIL Accessibility Settlement
7/10/2014	Morton Street Bridge Project Informational Meeting
7/31/2014	Green Line Extension Project: Medford Street Bridge Construction
7/31/2014	Green Line Extension Project: Medford Street Bridge Construction Location
8/18/2014	Silver Line Gateway Public Meeting
9/9/2014	Fares Policy Meeting
9/15/2014	Blue Hill Ave Station Construction Contract Open House and Public Meeting
9/18/2014	Green Line Extension Project: Pre-Construction Public Meeting
9/30/2014	Green Line Extension Project: Phase 2 of the GLX Integrated Art Program
10/2/2014	Green Line Extension Project: GLX Working Group
10/23/2014	Comm. Ave. Green Line Improvements Public Meeting
10/28/2014	Green Line Extension Project: Lechmere Station Design
10/30/2014	MBTA and KEOLIS Commuter Services
11/6/2014	Green Line Extension Project: Washington Street and Union Square Station Designs
11/18/2014	MassWIN GLX Program Access & Opportunity Committee Meeting
11/18/2014	MBTA Community Meeting Guild Street Bridge Reconstruction
11/19/2014	Future RIDE program service design change discussion
12/4/2014	Standing Committee on Audit and Finance
12/11/2014	MassDOT Board of Directors Meeting
12/12/2014	Judge King's Update on Compliance with MBTA/BCIL Accessibility Settlement
12/16/2014	Special Meeting of the Board of Directors
12/16/2014	Access and Opportunity Committee
1/6/2015	Standing Committee on Audit and Finance
1/20/2015	MassDOT Board Meeting
2/5/2015	Standing Committee on Audit and Finance
2/11/2015	MassDOT Board Meeting
2/13/2015	Emergency Special Board Meeting
2/23/2015	Green Line Extension Project: GLX Working Group
2/25/2015	AACT Executive Board Meeting
2/25/2015	AACT Membership Meeting

DATE	MEETING TITLE
3/2/2015	The Future of Late-Night Service Informational Meeting
3/3/2015	Standing Committee on Audit and Finance
3/4/2015	The Future of Late-Night Service Informational Meeting
3/9/2015	The Future of Late-Night Service Informational Meeting
3/10/2015	The Future of Late-Night Service Informational Meeting
3/11/2015	The Future of Late-Night Service Informational Meeting
3/11/2015	Standing Committee on Compensation and Labor
3/11/2015	MassDOT Board Meeting
3/25/2015	AACT Executive Board Meeting
3/25/2015	AACT Membership Meeting
4/15/2015	Standing Committee on Audit and Finance
4/15/2015	MassDOT Board Meeting
4/22/2015	AACT Executive Board Meeting
4/22/2015	AACT Membership Meeting
5/4/2015	Green Line Extension Project: Community Path Design
5/5/2015	Standing Committee on Audit and Finance
5/13/2015	MassDOT Board Meeting
5/14/2015	Green Line Extension Project: Ball Square & College Avenue Stations
5/18/2015	Meeting of the MBTA's Rider Oversight Committee (ROC)
5/27/2015	AACT Executive Board Meeting
5/27/2015	AACT Membership Meeting
6/2/2015	Wollaston Station Improvements
6/9/2015	Standing Committee on Audit and Finance
6/9/2015	MassDOT Board Meeting
6/15/2015	CIP Public Meeting - Quincy
6/15/2015	CIP Public Meeting - Amherst
6/16/2015	CIP Public Meeting - Boston
6/16/2015	CIP Public Meeting - Springfield
6/16/2015	Green Line Extension Project: Lowell Street & Gilman Square Stations
6/17/2015	CIP Public Meeting - Framingham
6/17/2015	MassDOT Board Meeting
6/18/2015	CIP Public Meeting - Taunton
6/22/2015	CIP Public Meeting - Gloucester

DATE	MEETING TITLE
6/22/2015	CIP Public Meeting - Worcester
6/22/2015	Meeting of the MBTA’s Rider Oversight Committee (ROC)
6/22/2015	Judge King's Update on Compliance with MBTA/BCIL Accessibility Settlement
6/23/2015	CIP Public Meeting - Arlington
6/23/2015	CIP Public Meeting - Roxbury
6/24/2015	AACT Executive Board Meeting
6/24/2015	AACT Membership Meeting
6/25/2015	Green Line Extension Project: GLX & Tufts University Joint Design Update for College Avenue Station
6/29/2015	MassDOT Board Meeting
6/15/2015	CIP Public Meeting - Quincy
6/15/2015	CIP Public Meeting - Amherst
6/16/2015	CIP Public Meeting - Boston
6/16/2015	Green Line Extension Project: Lowell Street & Gilman Square Stations
6/16/2015	CIP Public Meeting - Springfield
6/17/2015	CIP Public Meeting - Framingham
6/18/2015	CIP Public Meeting - Taunton
6/22/2015	Judge King's Update on Compliance with MBTA/BCIL Accessibility Settlement
6/22/2015	CIP Public Meeting - Gloucester
6/22/2015	CIP Public Meeting - Worcester
6/23/2015	CIP Public Meeting - Roxbury
6/23/2015	CIP Public Meeting - Arlington
9/19/2015	Everett Village Fest
9/23/2015	MBTA Bus Meeting Notice
9/30/2015	MBTA Bus Meeting Notice
10/1/2015	MBTA Community Meeting - Gloucester
10/15/2015	MBTA Community Meeting - Newton Highlands
10/19/2015	Capital Conversations - Boston
10/19/2015	Capital Conversations - Boston
10/21/2015	Capital Conversations - Worcester
10/21/2015	Capital Conversations - Leominster
10/22/2015	Capital Conversation - Cambridge
10/23/2015	Kathleen O'Brien, Everett Community Health Partnership
10/26/2015	Capital Conversation - Braintree

DATE	MEETING TITLE
10/26/2015	Capital Conversation - Amherst
10/27/2015	Capital Conversation - Fall River
10/27/2015	Capital Conversation - Lowell
10/28/2015	Capital Conversation - Peabody
10/28/2015	Capital Conversation - Natick
10/29/2015	Capital Conversation - Pittsfield
10/29/2015	Capital Conversation - Plymouth
11/2/2015	Capital Conversation - Mansfield
11/5/2015	Capital Conversation - Springfield
11/5/2015	Capital Conversation - West Barnstable
11/16/2015	Notice of Hearing - Reg 703 CMR 2.00
11/16/2015	Everett Transit Action Plan - Community Open House
11/16/2015	MBTA and MassDOT Discuss Waverley Commuter Rail Station at Board of Selectmen Meeting
12/8/2015	Informational Meeting – Draft Fare Policy
1/14/2016	Wollaston Station Improvements
1/19/2016	Late-Night Service Changes Public Meeting - Boston
1/19/2016	Late-Night Service Changes Public Meeting - Boston
1/20/2016	Late-Night Service Changes Public Meeting - Cambridge
1/25/2016	Fare Proposal and Commuter Rail Schedule Changes Public Meeting - Lynn
1/26/2016	Fare Proposal Public Meeting - Brockton
1/27/2016	Fare Proposal & Commuter Rail Schedule Changes Public Meeting - Malden
1/28/2016	Fare Proposal & Commuter Rail Schedule Changes Public Meeting - Concord
2/1/2016	Fare Proposal Public Meeting - Boston
2/1/2016	Fare Proposal & Commuter Rail Schedule Changes Public Meeting - Worcester
2/2/2016	Fare Proposal Public Hearing - Boston
2/3/2016	Commuter Rail Schedule Changes Public Meeting - Natick
2/3/2016	Commuter Rail Schedule Changes Public Meeting - Mansfield
2/4/2016	Fare Proposal Meeting - Newton
2/9/2016	Fare Proposal Public Meeting - Chelsea
2/10/2016	Fare Proposal Public Meeting - Roxbury
2/11/2016	Wollaston Station Improvements
2/11/2016	Everett Transit Action Plan - Community Open House
2/11/2016	Fare Proposal Public Meeting - Weymouth

DATE	MEETING TITLE
2/22/2016	Commuter Rail Schedule Changes Public Meeting - Norwood
2/22/2016	Commuter Rail Schedule Changes Public Meeting - Woburn
2/24/2016	Alewife Russell Field Path Flooding Community Meeting
2/24/2016	Fare Proposal Meeting - East Boston Neighborhood Association
3/2/2016	Late Night Service Elimination - Boston
3/4/2016	Late Night Service Elimination - Boston
3/9/2016	Late Night Service Elimination - Cambridge
3/10/2016	Late Night Service Elimination - Boston
3/11/2016	Late Night Service Elimination - Boston
3/11/2016	Everett Transit Action Plan - Joint Committee on Children's Healthcare in Everett Partners
	Everett Transit Action Plan - Whidden Hospital Briefing
3/21/2016	Government Center Station Ribbon Cutting
3/23/2016	Green Line Extension Project - Medford
3/30/2016	Green Line Extension Working Group - Somerville
4/13/2016	Everett Transit Action Plan - Community Meeting
4/13/2016	Green Line Extension Project - Somerville
4/14/2016	Commuter Rail Extension to Buzzards Bay - Public Meeting
4/25/2016	CIP Meeting - Fitchburg
4/26/2016	CIP Meeting - Framingham
4/27/2016	CIP Meeting - Barnstable
4/27/2016	CIP Meeting - Greenfield
4/27/2016	Green Line Extension Project - Cambridge
4/28/2016	CIP Meeting - New Bedford
5/2/2016	CIP Meeting - Boston
5/3/2016	CIP Meeting - Quincy
5/4/2016	CIP Meeting - Boston
5/4/2016	CIP Meeting - Lynn
5/5/2016	CIP Meeting - Pittsfield
5/9/2016	CIP Meeting - Mansfield
5/10/2016	CIP Meeting - Worcester
5/10/2016	CIP Meeting - Westfield
5/11/2016	CIP Meeting - Andover
5/11/2016	Back Bay Station Development Public Meeting w/ BRA

DATE	MEETING TITLE
5/12/2016	CIP Meeting - Cheslea
5/23/2016	Heart to Hub - Worcester Express Train Event
5/24/2016	Focus40 Kickoff Event
6/7/2016	South Station Expansion Public Meeting
6/29/2016	MBTA Community Meeting - Mattapan Station Parking Lot Developement
9/7/2016	South Coast Rail Public Meeting
9/12/2016	South Coast Rail Public Meeting
9/14/2016	South Coast Rail Public Meeting
9/15/2016	South Coast Rail Public Meeting
9/17/2016	Everett Transit Action Plan - Village Festival
9/19/2016	South Coast Rail Public Meeting
9/21/2016	Everett Transit Action Plan - Public Meeting/Open House
9/22/2016	South Coast Rail Public Meeting
9/26/2016	MBTA Rider Oversight Committee Public Meeting
9/26/2016	Back Bay Station Concourse Project
9/28/2016	Waverly Station Discussion w/ Belmont Board of Selectmen
10/5/2016	Blue Hill Ave Station Construction Contract
10/24/2016	MBTA Rider Oversight Committee Public Meeting
10/26/2016	South Boston Bus Stops and Service Improvements Project Public Meeting
11/15/2016	Joint Public Meetings on the MBTA Service Delivery Policy and Title VI Disparate Impact/Disproportionate Burden (DI/DB) Policy
11/16/2016	Joint Public Meetings on the MBTA Service Delivery Policy and Title VI Disparate Impact/Disproportionate Burden (DI/DB) Policy
11/17/2016	Joint Public Meetings on the MBTA Service Delivery Policy and Title VI Disparate Impact/Disproportionate Burden (DI/DB) Policy
11/21/2016	MBTA Rider Oversight Committee Public Meeting
11/30/2016	Replacement of the East Street Bridge, Westwood
12/7/2016	Public Meeting on Green Line Extension Project
12/8/2016	Working Group on Water Transportation
12/14/2016	Are Changes to the MBTA Fair? (Service Delivery and Title VI Disparate Impact)
12/14/2016	Public Meeting on Green Line Extension Project
12/16/2016	Public Meeting on Green Line Extension Project
1/11/2017	Focus 40 Public Meeting - Newton
1/31/2017	Worcester Schedule Proposal - Newton
2/1/2017	Worcester Schedule Proposal - Worcester
2/6/2017	Worcester Schedule Proposal - Natick

DATE	MEETING TITLE
2/27/2017	Andover Board of Selectmen - Idling Trains
3/6/2017	Public Information Meeting for Ruggles Station Commuter Rail Platform Project
3/15/2017	Focus40 event: The Ideas of March
3/16/2017	Braintree Station 100% Design Public Meeting
4/3/2017	Mattapan-Ashmont Trolley Line Public Meeting
4/3/2017	Quincy City Council Meeting - Red Line Investments
4/4/2017	Wollaston Station Improvements
4/4/2017	Wollaston Station Improvements
4/6/2017	Quincy Center Garage Demolition
4/11/2017	Quincy Adams Garage Renovation
4/13/2017	South Coast Rail Public Meeting - MEPA Filing
4/13/2017	Mattapan-Ashmont Trolley Line Public Meeting
4/24/2017	Mattapan-Ashmont Trolley Line Public Meeting
5/3/2017	Back Bay Station Ventilation Project
5/5/2017	Fairmount Sponsored Service Kickoff Event w/ Congressman Capuano

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Appendix 2-E

GLX Public Engagement Plan

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1 Introduction

1.1 Introduction

The Green Line Extension Project is an initiative of the Massachusetts Department of Transportation (MassDOT) and the Massachusetts Bay Transportation Authority (MBTA) to enhance transit services in order to improve mobility and regional access for residents in the communities of Cambridge, Somerville and Medford. The Project is required by the State Implementation Plan (SIP) and fulfills a longstanding commitment of the Central Artery/Tunnel project to increase public transit. The Massachusetts Air Pollution Control Regulations (310 CMR 7.36) require that MassDOT complete this Project by December 31, 2014.

On October 15, 2009, MassDOT filed the Green Line Extension Project *Draft Environmental Impact Report/Environmental Assessment* (DEIR/EA) with the Massachusetts Environmental Policy Act (MEPA) Office. The submission of the DEIR/EA was a major milestone in the development of the Green Line Extension Project. After an extensive public review and comment period, the Secretary of the Executive Office of Energy and Environmental Affairs (EEA) issued a Certificate on the DEIR on January 15, 2010, requiring the preparation of a Final Environmental Impact Report (FEIR) of limited scope for the Proposed Project.

MassDOT expects Project funding will come both from the Federal Transit Administration (FTA) and from Commonwealth bonding. Because MassDOT is seeking funding through the FTA, the Project also requires review under the National Environmental Policy Act (NEPA). At the request of the FTA, MassDOT is preparing a separate Final EA.

The Green Line Extension Project is proposed to be built in two phases with an initial operating segment (the "Proposed Project") being constructed to College Avenue in Medford and a spur to Union Square in Somerville, as described and evaluated in the DEIR/EA as Alternative 1. The second phase of this Project, the

"Future Full-Build Alternative" will include extending the Project from College Avenue Station to Mystic Valley Parkway/Route 16 Station in the future, as described and evaluated in the DEIR/EA as Alternative 2. Although the extension to Mystic Valley Parkway/Route 16 was considered for the Green Line Extension Project, limitations on available funding prohibit the Commonwealth from extending the Green Line beyond College Avenue at this time. This second, future phase is not currently part of the Proposed Project and is not the subject of this FEIR.

As required by the Secretary's Certificate on the DEIR (hereafter referred to as the Secretary's Certificate), this FEIR provides additional analyses of the Proposed Project, including:

- Quantitative environmental analysis of both the Option L and Mirror H Maintenance Facility locations including, for comparative purposes, the prior analysis of Yard 8 (see Chapter 2);
- Narrative discussion clarifying air quality modeling (see Chapter 3);
- Impacts associated with College Avenue Station as a terminal station (see Chapter 4);
- Refined conceptual design of Lechmere Station (see Chapter 5);
- A Public Involvement Plan (PIP) for community participation beyond the environmental process (see Chapter 6);
- Summary of Proposed Project impacts (see Chapter 7); and
- Mitigation measures and Section 61 Findings for Project impacts (see Chapter 8).

The DEIR/EA, available on the Project website, www.mass.gov/greenlineextension, provides the full description of existing conditions and environmental resources affected by the Green Line Extension, as well as a full impacts analysis, methodology assumptions and definitions of applicable terminology for each resource.

1.2 Project Background

Numerous studies over the last 40 years have explored extending transit from Lechmere Station (the current terminus of the Green Line) along the existing MBTA Lowell or MBTA Fitchburg Line commuter rail rights-of-way (Figure 1-1). More recently, the 2005 *Beyond Lechmere Northwest Corridor Study* generated a Major Investment Study/Alternatives Analysis that evaluated a wide range of technologies and operating plans for a future extension. The *Beyond Lechmere Northwest Corridor Study* did not identify a preferred alternative, but rather

investigated a range of cost-effective transit solutions that would increase transit accessibility, improve corridor mobility, increase transit services, and support opportunities for smart growth initiatives and sustainable development.

An Expanded Environmental Notification Form (EENF) was submitted to the EEA on October 10, 2006. The Secretary of EEA issued a Certificate on the EENF on December 1, 2006, requiring a DEIR for the Proposed Project.

After the submission of the EENF, the Project Area was expanded to include the relocation of Lechmere Station. Relocating Lechmere Station was previously reviewed under MEPA as part of the NorthPoint development project (EEA # 12651), but was not previously reviewed under NEPA. The October 2009 DEIR/EA included an evaluation of relocating Lechmere Station to the location previously reviewed under MEPA. The DEIR/EA evaluation included the need to relocate the station, documented the alternatives evaluated, and evaluated the environmental consequences of moving the station.

On Lechmere Station, the January 15, 2010 Secretary's Certificate required the FEIR to:

- "Explore ways to reduce the proposed parking program (in light of the station no longer functioning as a terminus) and consider other design refinements to reduce impacts of the relocated Lechmere Station on abutting land uses (notable the Glass Factory Condominiums)."
- "The FEIR should clarify modeling assumptions, and proposed station layout and mitigation measures that will be implemented to effectively and safely convey bus passengers, pedestrians, and cyclists from the neighborhood to the relocated Lechmere Station."

This information is provided in FEIR Chapter 5, *Lechmere Station*.

Another topic that has been extensively studied has been the vehicle maintenance and storage facility that must be constructed to support the operations of the Green Line Extension. The DEIR/EA stated that the area referred to as "Yard 8 with Adjacent Parcel" (Yard 8) was selected as the preferred location for the construction of a Green Line vehicle maintenance and storage facility, based on the combination of size, configuration, and adjacency to the Green Line Extension tracks. The selection of the Yard 8 site prompted local opposition from some municipal officials, elected representatives, and abutting residents. To try to address and resolve these concerns, MassDOT then qualitatively analyzed two additional possible sites for the facility, Option L and Mirror H, in December 2009.

The January 15, 2010 Secretary's Certificate required MassDOT to "provide a quantitative environmental analysis of both the Mirror H and Option L locations and include for comparative purposes the existing analysis of Yard 8." In response, MassDOT completed the required analysis in April 2010, as provided in the *Environmental Analysis of Additional Maintenance Facilities* technical memorandum[1], summarized in FEIR Chapter 2 and provided in full in Appendix B. The full environmental analysis for Yard 8 was conducted for and included in the DEIR/EA, and was repeated in the April 2010 technical memorandum for comparison purposes.

1.3 The Proposed Project

The Proposed Project is envisioned to provide service to College Avenue in Medford and Union Square using a two-branch operation, both in existing commuter rail rights-of-way. The 3.4-mile Medford Branch would operate from a relocated Lechmere Station to College Avenue in Medford along the MBTA Lowell Line commuter rail right-of-way. This branch would begin at relocated Lechmere Station and head northwest, meeting the MBTA Lowell Line just south of Washington Street in Somerville. From Washington Street, the alignment would run parallel to the MBTA Lowell Line to Medford, terminating its route at College Avenue in Medford. The 0.9-mile Union Square Branch would operate along the MBTA Fitchburg Line commuter rail right-of-way from relocated Lechmere Station into a terminus at Union Square in Somerville.

Seven stations would be constructed for the Proposed Project:

- Relocated Lechmere Station, Cambridge (relocated to east side of O'Brien Highway/Route 28);
- Brickbottom Station, Somerville;
- Gilman Square Station, Somerville;
- Lowell Street Station, Somerville;
- Ball Square Station, Medford;
- College Avenue Station, Medford; and
- Union Square Station, Somerville.

The primary infrastructure improvements of the Proposed Project would include relocating existing commuter rail lines, constructing approximately four miles of new light rail track and systems, four multi-span viaducts, a vehicle maintenance and storage facility, and reconstructing 11 bridge structures to support the extended service.

1 Massachusetts Department of Transportation, *Green Line Extension Project, Environmental Analysis of Additional Maintenance Facilities*, April 21, 2010.

The Proposed Project is expected to generate the MBTA's anticipated daily ridership at the Project's seven stations (boardings and alightings) by approximately 52,000 by the year 2030, with approximately 90 percent of these trips to take place in the Project's opening year of 2014. The Green Line would also see an increase of 30,700 boardings and the entire MBTA system would see an increase of 7,900 new daily linked transit trips as a result of the extension of the Green Line service. Of these new transit rips, approximately 70 percent of these riders are projected to switch from using their automobiles to using transit. The Proposed Project would reduce vehicle miles travelled (VMTs) by 25,018 per day (projected to the year 2030).

Estimated travel time between College Avenue Station and Lechmere Station for the proposed Green Line Medford Branch is 9.5 minutes. Green Line service beyond Lechmere Station for the Medford Branch would operate on headways equal to that of the existing Green Line D branch service: five minutes in the morning and evening peak periods and ten minutes during off-peak periods.

Estimated travel time between Union Square and Lechmere Station for the proposed Green Line Union Square Branch is 4.5 minutes. Green Line service beyond Lechmere Station for the Union Square Branch would operate on headways equal to that of the existing Green Line E branch service: six minutes in the morning peak period, five minutes in the evening peak period, and between nine and ten minutes during off-peak periods.

Fares for the Green Line Medford Branch and Union Square Branch would be $1.70 for one-way adult trips, based on current MBTA subway fares.

1.3.1 Stations

Seven stations would be constructed as part of the Proposed Project, as described in more detail in DEIR/EA Section 3.7.3, *Stations*, and DEIR/EA Appendix B. Station locations for the Green Line Extension were identified through an evaluation process and in working with the public and local officials. Important considerations in station siting and configuration included operations and access, as well as impacts to area properties. Stations are intended to function as neighborhood stations with no provisions for parking.

Stations were designed to meet the Project's goals of improved transit access and accessibility, and to minimize impacts to the community associated with land acquisition, traffic, and loss of local parking. The design for each station is envisioned to provide a headhouse with automated fare lines, vending machines, an information booth, and restrooms. Entry to and exit from the platforms would be by elevators, escalators, and stairs. Station access and platform design were based on requirements and guidance provided by the Americans with

Disabilities Act (1990) (ADA) and the Commonwealth of Massachusetts Architectural Access Board (AAB), as well as requirements of the MBTA. In addition to station amenities and access requirements, station criteria also considered "green" or sustainable design.

1.3.2 Vehicle Requirements

The Green Line Extension Project vehicle fleet will include a mix of three vehicle types: the two current vehicles (Type 7 high-floor cars and Type 8 low-floor cars) and a new "Type 9" low-floor car, which is currently under development. All three vehicle types would be able to operate within the existing system and along the Green Line Extension.

In general, the current Green Line trainsets (or "consists") include two or three cars. For the purpose of calculating the number of required cars, two-car Green Line trains were conservatively assumed. Based on the 2006 MBTA's Service Delivery Policy, the seating capacity of each Green Line car is 44 to 46 seats, depending on the car type, and the maximum peak load standard is 225 percent of the seated capacity for the peak periods. This translates into a peak period train capacity of 198 to 207 passengers per trainset. Utilizing the projected ridership and proposed operating plan for the Proposed Project, as well as working with the MBTA, it was determined that 24 additional Green Line cars would be needed to accommodate the proposed headways and projected ridership for the Green Line Extension Project.

1.3.3 Capital Improvements

Capital improvements for the Medford Branch include construction of light rail tracks and overhead catenary system (OCS) along the existing railroad right-of-way between the relocated Lechmere Station and College Avenue in Medford. Improvements also include use of the MBTA's portion of the "Yard 8" right-of-way between relocated Lechmere Station and Washington Street and along the MBTA Lowell Line between Washington Street and College Avenue. The service would end immediately north of the College Street overpass. A support facility for storage and servicing of the Green Line fleet would be constructed to accommodate the existing north-side Green Line service fleet and the additional fleet of 24 vehicles. In addition to the track construction, some of the existing bridges along the right-of-way would need to be reconstructed to accommodate the additional tracks. The structures that would need to be reconstructed include the former Red Bridge, Washington Street, Walnut Street, Medford Street, School Street, Lowell Street, Cedar Street, Broadway, Harvard Street, and College Avenue. Existing track and signal equipment would also need to be relocated in order to accommodate the planned light rail tracks. Since

College Avenue would be the terminus for the line, additional track lengths would be required north of the station for short-term storage and operational flexibility.

The Union Square Branch would also require light rail tracks and OCS to be constructed along the MBTA Fitchburg Line between the former Red Bridge and the proposed Union Square Station near Prospect Street. The alignment to Union Square would require reconfiguration of the existing signal equipment as well as the commuter rail and freight rail tracks between the MBTA's Boston Engine Terminal (BET) and Webster Avenue. In addition, the existing rail bridge over Medford Street along the right-of-way would need to be reconstructed to accommodate the additional tracks.

New signal, communications, and electrical systems will be required for the Green Line Extension Project. The Proposed Project would require Automatic Wayside Block Signals to govern Green Line train operations for both the Medford Branch and the Union Square Branch.

As described in the DEIR/EA, multiple communication systems are proposed for MBTA operations, MBTA staff communications, mechanical system monitoring, passenger communications, and emergency reporting.

Traction power for the Green Line is provided by 600 volts direct current (VDC) through an OCS. The Proposed Project will require traction power substations to supply direct current (DC) power to both the Medford Branch and the Union Square Branch. New substations would be required at the proposed maintenance facility site and at Ball Square Station. The traction power feeders and returns will be installed in underground electrical conduits. The OCS will consist of an overhead auto-tension catenary system registered and supported on cantilever-type assemblies, span wire assemblies, and portal bents.

1.3.4 Construction

The Proposed Project has been designed to minimize impacts to the corridor municipalities by reducing the footprint of the Project and maximizing the use of existing transportation corridors.

Construction staging and sequencing strategies are critical to achieving an efficient construction project while minimizing the impacts to vehicular traffic, pedestrian traffic, on-street parking, public access, emergency access to local businesses and residences, and general quality of life. This corridor presents several construction challenges including narrow roadways, urban traffic volumes, and a variety of commercial, industrial, and residential land uses that require continuous access, limited space for construction zones and lay down

areas within or near the rail corridor, and existing rail service that must be maintained throughout construction.

The current level of construction staging and sequencing developed for the Project addresses the constraints of the corridor, impacts to abutters, and other construction issues. More detailed evaluation and staging recommendations will be developed as design progresses and through coordination with the City of Cambridge, City of Somerville, and City of Medford, and their respective Fire and Police Departments. This effort would include public input. A comprehensive construction staging and sequencing plan will be developed and included in the final construction contract documents and communicated to the public.

1.3.5 Estimated Cost

During the development of the DEIR/EA, 10-percent concept plans for the Proposed Project were designed and detailed capital cost estimates were developed. The capital improvements include, but are not limited to, construction of track, stations, structures, systems, drainage, utilities, and the maintenance facility. Additional costs include property acquisitions and relocations as well as the cost for vehicle acquisition. The cost of the Proposed Project includes the cost to reconstruct Lechmere Station. The overall cost of the Proposed Project is currently estimated to be approximately $844.5 million in 2009 dollars, including $79.3 million for the 24 Green Line vehicles. Annual operating and maintenance costs would be approximately $22.1 million in 2009 dollars. The total costs for the Proposed Project were increased to include inflation for the time period in which the Project is to be implemented. Therefore, the "Year-of-Expenditure" (YOE) capital costs for the Proposed Project were calculated to be approximately $953.7 million in YOE dollars.

1.4 Public Involvement

The Green Line Extension Project has received significant public input throughout the planning process, as documented in DEIR/EA Section 1.5, *Public Involvement and Agency Coordination*. The public hearing for the DEIR, attended by over 400 people, was held in November 2009. As noted in the Secretary's Certificate, the approximately 400 comment letters (with more than 2,400 individual comments) on the DEIR/EA reflect a substantial interest in the future of the corridor from elected officials and municipal representatives; city, state, and regional agencies; environmental, bicycle, and pedestrian advocacy groups; neighborhood groups; groups that represent the disabled; businesses; residents; and the general public. Table 1-1 provides a summary of substantive comments received, by topic.

Table 1-1 Summary of DEIR/EA Comments

Topic	Number of Comments
Accessibility	98
Acquisitions and Relocations	39
Air Quality	46
Alternatives	184
Community Paths	137
Construction Impacts	31
Coordination (Agency and Public, Other Projects)	240
Costs and Funding	42
Environmental Justice	24
Fish, Wildlife and Plants	4
General Opposition	2
General Support	32
Hazardous Materials	11
Historical and Archaeological Resources	17
Indirect and Cumulative Effects	20
Land Use/Transit Oriented Development	80
Maintenance and Storage Facility	343
MEPA/NEPA Process	154
Mitigation/Section 61 Findings	148
Noise and Vibration	82
Open Space/Parks and Recreation/Section 4(f)	5
Purpose and Need	3
Rail Operations	53
Ridership	12
Safety	15
Schedule	5
Socioeconomics	33
Soils/Groundwater	1
Station Design	392
Stormwater/Surface Water	19
Sustainability	7
Terminus Impacts	48
Track and System Design	37
Traffic and Parking	38
Utilities	11
Visual Environment	10
Wetlands	1

During the review of the DEIR/EA comments, a number of key concerns and issues were raised including, but not limited to:

- **Station Design** – Members of the public were concerned with station design issues. The greatest number of station design comments focused on the relocated Lechmere Station (approximately 200 comments). Comments included the location of the track near the Glass Factory Condominiums; parking at the station; bus circulation and bus stop locations; the pedestrian crossing at O'Brien Highway; and general station layout, access, and

architectural character. Several comments expressed support for adaptive reuse of parts of the existing Lechmere Station, particularly the bus shed. Several comments requested reconsideration of the Mystic Valley Parkway/Route 16 station layout and its inclusion in the Proposed Project.

- **Access –** Stakeholder comments expressed general support for prioritizing pedestrian, bicycle, and bus access to the Project stations. Members of the public were concerned with locations of drop-off and pick-up areas and their impacts on traffic; platform locations; bicycle/pedestrian access; and ADA accessibility at station approaches, within the stations, and between the platforms and vehicles.
- **Maintenance and Storage Facility –** Members of the public were concerned with the location of the maintenance and storage facility. Of all comments received, the majority (including over 225 petition signatures) opposed the siting of the light rail maintenance and storage facility at Yard 8. Most maintenance facility commenters were in favor of the Option L site. Lechmere Station-area stakeholders expressed general opposition to the Mirror H location, while Somerville stakeholders generally preferred Mirror H but also welcomed Option L.
- **Continued Coordination with Agencies and Interested Parties –** Members of the public requested that MassDOT and the MBTA continue public involvement during design and construction. Several requested a construction field office where stakeholders could speak in person with Project representatives regarding construction impacts and mitigation.
- **Alternatives –** Members of the public were predominantly in favor of the Proposed Project. A large number of comments requested that the Project continue to Mystic Valley Parkway/Route 16 in one phase. Few expressed support for a College Avenue terminus of the Medford Branch. Approximately 70 comments expressed concern about traffic and neighborhood parking impacts at College Avenue. Several other comments expressed concern that the College Avenue terminus would not adequately serve Medford Hillside residents. Approximately 50 comments requested that the Project not preclude future extensions or additions of the Green Line. Most of these comments supported a future extension of the Union Square Branch to Porter Square; several comments supported a possible future station on one or both branches near the Brickbottom Artists Building and/or Boynton Yards.
- **Mitigation/Section 61 Findings –** Members of the public were concerned and/or interested with proposed mitigation measures for potential impacts from noise, vibration, traffic, and the maintenance facility. A large number of comments pertained to noise, vibration, and visual impacts at the Glass Factory Condominiums near the proposed Lechmere Station. Most of the comments from Brickbottom Artists Building stakeholders expressed

concern about noise and visual impacts of a maintenance and storage facility at Yard 8; others expressed concern about impacts from railroads and proposed light rail along the south side of the Brickbottom Artists building.

- **Community Path –** Members of the public requested that the design and construction of the Somerville Community Path be included in the Green Line Extension Project (over 125 comments and 175 petition signatures). Many of these comments requested that the Path extend to Lechmere Station as part of the Project.
- **Construction Impacts –** Members of the public expressed concerns with regards to impacts during construction, including noise and vibration, vehicular traffic, detours during bridge reconstruction, pedestrian traffic, on-street parking, public access, and emergency access to local businesses and residences.

1.4.1 Public Involvement since the DEIR/EA

This section discusses public involvement activities that have occurred since the release of the DEIR/EA, including a public meeting in December 2009 to release the results of the operational analysis on the maintenance facility alternatives; municipal meetings with Cambridge, Somerville and Medford; Land Use Workshops, and the creation of a design working group for later phases of the Proposed Project.

Meetings

MassDOT held one public meeting in Cambridge in December 2009 to present the Option L and Mirror H alternatives for siting, design, and construction of a Green Line vehicle maintenance and storage facility. Yard 8, as fully analyzed in the DEIR/EA, was also presented for comparison purposes. The meeting included a presentation by MassDOT and a questions and answer session. The presentation provided an overview of the operational analysis, property acquisition needs, and schedule implications, as well as a preliminary evaluation of potential environmental impacts and costs of the three sites under consideration. Attendance was over 125 people.

Beginning in March 2010, MassDOT and the Project Team have been meeting biweekly with municipal leaders of the corridor communities. These meetings have focused on a wide range of project-related issues, including developing the public involvement approach for the Preliminary Engineering phase of work and planning the municipal Land Use workshops for May and June 2010.

MassDOT, working with the local municipalities, has hosted a series of Land Use Planning Workshops associated with the Green Line Extension Project. After an overview presentation about the Green Line Extension project, participants were given a chance to share knowledge about their neighborhoods and to express their priorities and concerns about future land uses around the station areas. These workshops focused on areas around the planned stations, with the intention that future workshops would focus on the stations themselves. Workshops were held in Medford on May 19, 2010, in Cambridge on May 26, 2010, and in Somerville on June 12, 2010.

MassDOT and the Project Team are committed to reaching out to environmental justice populations. The team sent notifications to these communities to ensure their participation throughout the FEIR process to achieve compliance with state and Federal guidelines.

Fact Sheets

The Project Team prepared a Project Fact Sheet in advance of the DEIR/EA release in the Fall of 2009. This fact sheet outlined the contents of the DEIR/EA, provided a summary of Project impacts, Project cost and funding, an overview of Project components (stations and maintenance and storage facility) and information on providing comments on the DEIR/EA.

The Project Team prepared a Fact Sheet in advance of the FEIR release in Spring 2010. The fact sheet outlined the anticipated content of the FEIR, discussed ongoing survey work and data collection that will be used to advance the design of the Green Line, and discussed upcoming public workshops on station area land use planning and station design.

Website/Emails

MassDOT continually updates the interactive Project website, www.mass.gov/greenlineextension with new information as it becomes available. Interested individuals have signed up to be part of the Green Line Extension mailing list (more than 4,500 names) and have also sent inquiries about the Project to MassDOT and the Project Team.

Since the release of the DEIR/EA, MassDOT has sent weekly notifications to the Project email distribution list concerning on-going data collection efforts, which include survey and geotechnical investigations.

Design Working Group

As part of the planning for the Preliminary Engineering phase, MassDOT is convening a Green Line Extension (GLX) Design Working Group. This group will assist MassDOT by reaching out to local residents, businesses, and institutions to gather input on the design of six new stations proposed for the neighborhoods of Brickbottom, Gilman Square, Lowell Street, Ball Square, College Avenue, and Union Square, as well as the relocation of Lechmere Station. In addition, MassDOT will seek public input on design issues related to the proposed Somerville Community Path and the Green Line Extension vehicle maintenance and storage facility.

On April 1, 2010, MassDOT distributed an application for membership on the GLX Design Working Group to the project database and announced its availability in local newspapers and libraries. Applications were accepted until April 30, 2010. MassDOT announced the members of the Working Group prior to the filing of this FEIR. The list of members is also available on the project website.

1.5 Requirements of Secretary's Certificate

The Secretary's Certificate on the DEIR (January 15, 2010) stated that the DEIR adequately and properly complied with MEPA and with its implementing regulations. The Secretary required MassDOT to prepare and submit for review a limited FEIR in response to those items identified in the scope, summarized in Table 1-2. The limited FEIR focuses on these six main topics:

- Maintenance facility location (Chapter 2);
- Air quality modeling (Chapter 3);
- Impacts associated with College Avenue Station as a terminal station (Chapter 4);
- Redesign of the conceptual layout for Lechmere Station (Chapter 5);
- Development of a plan for community involvement as the Project advances (Chapter 6);
- Summary of Proposed Project impacts (Chapter 7); and
- Mitigation measures and Section 61 Findings for Project impacts (Chapter 8).

The requirements of the Secretary's Certificate, and the sections of this FEIR that address these requirements, are provided in Table 1-2. Detailed, point-by-point responses to the Secretary's Certificate are provided with the other responses to comments in Volumes 2 and 3 (provided on CD) of this document.

Table 1-2 Requirements of the Secretary's Certificate on the DEIR

Category	Requirement	Addressed In FEIR
General	Follow Section 11.07 of MEPA regulations for outline and content, as modified by Certificate.	Throughout
	Identify, describe and assess environmental impacts of any Project changes since the DEIR.	Chapter 7
	Include a copy of Secretary's Certificate and each comment letter received. Respond fully to each substantive comment received to the extent within MEPA jurisdiction.	Appendix A
	Circulate hard copy of the FEIR to each State and city agency from which MassDOT will seek permits or approvals and to each City agency that submitted comments.	Chapter 9
	Circulate a copy of the FEIR to those that submitted individual written comments. MassDOT may circulate FEIR in CD-ROM format, making available a reasonable number of hard copies, to accommodate those without convenient access to a computer to be distributed upon request, first come, first served.	Chapter 9
	Send FEIR notice of availability to those who signed petition and for which addresses are available.	Chapter 9
	A copy of the FEIR should be made available for public review at Cambridge, Medford and Somerville public libraries.	Chapter 9
Maintenance and Storage Facility	Expand upon December 9, 2009 technical memorandum and provide quantitative environmental analysis of Mirror H and Option L and include for comparative purposes the existing analysis of Yard 8. Provide comprehensive analysis of Maintenance Facility siting and operations for: land uses, (including environmental justice), impervious area, parking, stormwater, hazardous materials, traffic, land acquisition, noise, vibration, air quality, open space, historic and archaeological resources, the Community Path, and construction period impacts.	Sections 2.4, 2.5, Appendix B
	Provide a detailed assessment of Maintenance Facility sizing, and in exploring alternatives seek to minimize project footprint and potentially reduce land acquisitions through innovative design.	Section 2.4
	Evaluate impacts to freight operations for each design alternative, noting operational or deed restrictions that may hinder flexibility in Maintenance Facility siting or operations.	Section 2.3
	Comments received from Pan Am Railways (PAR) on the DEIR and concerns raised regarding potential impact of MassDOT's use of Yard 8 on PAR operations should be addressed in Maintenance Facility portion of the FEIR.	Section 2.3
Air Quality	Include narrative discussion clarifying air quality modeling assumptions, challenges associated with inherent evolution of modeling programs and input data, and how air quality modeling results were conducted in manner that sufficiently demonstrated consistency with the SIP.	Chapter 3
College Avenue – Terminus Station	Revisit DEIR models, revise as necessary to accurately assess predicted functions of the College Avenue Station, and describe difference in operations and mitigation measures between DEIR and the FEIR, if any.	Chapter 4
	Clarify how College Avenue Station, functioning as a terminus, will impact traffic, parking, pedestrian, and bicycle operation within the Study Area and outline sufficient mitigation measures to offset identified negative impacts.	Section 4.3

Table 1-2 Requirements of the Secretary's Certificate on the DEIR (continued)

Category	Requirement	Addressed In FEIR
College Avenue – Terminus Station (continued)	Describe Green Line operations at the proposed terminus and how the facility has been designed to accommodate terminal station ridership demand.	Sections 4.2, 4.3, 4.6
	Clarify how train operations at College Avenue Station may impact sensitive noise and vibration receptors, and present appropriate mitigation measures.	Sections 4.5, 4.6
Lechmere Station	Explore ways to reduce the proposed parking program (in light of station no longer functioning as terminus) and consider other design refinements to reduce impacts of relocated Lechmere Station on abutting land uses (notably Glass Factory Condominiums).	Chapter 5
	Clarify modeling assumptions, and proposed station layout and mitigation measures that will be implemented to effectively and safely convey bus passengers, pedestrians and cyclists from neighborhood to the relocated Lechmere Station.	Sections 5.2, 5.4
	Level of information presented in the FEIR should be of sufficient conceptual design to reflect anticipated station layout and operations, relationships to broader transportation network, existing and permitted buildings, and where mitigation measures would be implemented.	Sections 5.2, 5.3, 5.4
Public Involvement Plan	Develop a Public Involvement Plan for Project that clearly outlines how a broad range of participants will continue to provide a meaningful community involvement throughout duration of entire project, including detailed design, engineering, construction phases.	Chapter 6
	Build on lessons learned from previous Advisory Groups, consider ideas presented as part of the Community Corridor Planning Project, reflect comments received on DEIR, and represent a serious commitment by both MassDOT and the MBTA to actively engage public upon completion of MEPA review.	Section 6.1
	Provide plan for procedural engagement of various participants and outline primary substantive topics that are anticipated to be addressed through PIP process.	Sections 6.2, 6.3
	Integrate components of conceptual mitigation plan into broader framework of PIP to provide forum for information sharing between future MassDOT studies and data and interested and affected parties.	Chapter 6
Mitigation and Section 61 Findings	Include separate chapter on mitigation measures. This chapter should include distinct draft Section 61 findings for each State Agency action, clear commitment on mitigation, schedule for implementation, estimate of individual costs of proposed mitigation and identification of parties responsible for implementing mitigation.	Chapter 8
	Include conceptual plan for evaluating, monitoring, and compensating affected parties along corridor with specific emphasis on, but not limited to, noise, vibration, and land acquisition impacts. Conceptual plan should address not only mitigation associated with future ongoing operations of Green Line Extension, but impacts uniquely limited to construction period.	Section 8.1
	Construction period mitigation measures must seek to minimize impacts to vehicular traffic, pedestrian and bicycle traffic, on-street parking, public access, and emergency access to local businesses and residences.	Section 8.4

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Maintenance Facility Alternatives Analysis

2.1 Introduction

A vehicle maintenance and storage facility must be constructed to support the operations of the Green Line Extension. The DEIR/EA stated that the area referred to as "Yard 8 with Adjacent Parcel" (Yard 8) was selected as the preferred location for the construction of a Green Line vehicle maintenance and storage facility, based on combination of size, configuration, and adjacency to the Green Line Extension tracks. The selection of the Yard 8 site prompted local opposition from some municipal officials, elected representatives, and abutting residents. To try to address and resolve these concerns, MassDOT qualitatively analyzed two additional possible sites for the facility in December 2009.[1] Option L, a site identified by MassDOT, is immediately adjacent to the MBTA commuter rail maintenance facility, also referred to as the BET. Mirror H, a site proposed by the City of Somerville, straddles the Inner Belt area of Somerville and the NorthPoint area of Cambridge. All three maintenance facility alternatives are shown on Figure 2-1.

The December 2009 *Additional Maintenance Facility Alternatives Analysis*[2] included an analysis of operations, property acquisition needs, and schedule implications, as well as a preliminary evaluation of potential environmental impacts and costs. It did not include an in-depth environmental analysis of the type presented in the DEIR/EA for the Yard 8 site. This qualitative analysis concluded that both Yard 8 and Option L remained viable locations for the Green Line Extension Project support facility, while the Mirror H site rated lower in a number of categories.

Following an extensive public review and comment period on the DEIR/EA, the January 15, 2010 Secretary's Certificate required MassDOT to prepare a FEIR for the Green Line Extension Project, including a more detailed, quantitative analysis of the environmental and operational impacts associated with Option L and Mirror H.

1 Massachusetts Department of Transportation. *Green Line Extension Project, Additional Maintenance Facility Alternatives Analysis*. December 9, 2009.
2 *Ibid.*

In response, MassDOT conducted that analysis as documented in the April 2010 *Environmental Analysis of Additional Maintenance Facilities*.[3] The full environmental analysis for Yard 8 was conducted for and included in the DEIR/EA, but was repeated in that document for comparison purposes.

MassDOT reviewed and considered the DEIR/EA comments on the maintenance facility together with the outcome of the April 2010 analysis to decide whether to substitute either Option L or Mirror H for Yard 8 as the preferred site for the maintenance and storage facility for the Green Line Extension Project. After balancing all operational and environmental benefits and impacts of the three maintenance facility alternatives, combined with discussions with the local communities, MassDOT has selected Option L as the preferred maintenance facility site for the Green Line Extension Project.

2.2 Requirements of the Secretary's Certificate

The Secretary's Certificate required the FEIR to provide additional information on the Green Line maintenance and storage facility to address comments received during the public comment period. Specific requirements include:

- Expand upon the December 9, 2009 technical memorandum and provide quantitative environmental analysis of Mirror H and Option L and include for comparative purposes the existing analysis of Yard 8.
- Provide a comprehensive analysis of Maintenance Facility siting and operations for: land uses (including environmental justice), impervious area, parking, stormwater, hazardous materials, traffic, land acquisition, noise, vibration, air quality, open space, historic and archaeological resources, the Community Path, and construction period impacts.
- Provide a detailed assessment of Maintenance Facility sizing, and explore alternatives to minimize the project footprint and potentially reduce land acquisitions through innovative design.
- Evaluate impacts to freight operations for each design alternative, noting operational or deed restrictions that may hinder flexibility in Maintenance Facility siting or operations.
- Comments received from Pan Am Railways (PAR) on the DEIR and concerns raised regarding potential impact of MassDOT's use of Yard 8 on PAR operations should be addressed in Maintenance Facility portion of the FEIR.

3 Massachusetts Department of Transportation. *Green Line Extension Project, Environmental Analysis of Additional Maintenance Facilities.* April 21, 2010.

The following sections provide a summary of the supplemental analysis of the three maintenance facility alternatives and respond to the requirements of the Secretary's Certificate.

2.3 Description of Alternatives

This section provides a description of the three locations evaluated as part of the analysis of additional maintenance facility alternatives for the Green Line Extension Project – Yard 8, Option L and Mirror H (Figure 2-1). A summary of the program, operational plan, real estate impacts and cost for each maintenance facility alternative is provided. The complete description of the alternatives is provided in full in Appendix B.

2.3.1 Yard 8

Yard 8 is an approximately six-acre railroad yard adjacent to the proposed Green Line alignment and accessed from Inner Belt Road in Somerville (Figure 2-2). The yard is partially owned by the MBTA and by Pan Am Railways. The Pan Am Railways' portion of the yard is currently used for freight operations while the MBTA portion of the yard is currently inactive. This site, combined with an adjacent undeveloped parcel at 200 Inner Belt Road, was previously determined to be the preferred maintenance facility site that could accommodate the necessary maintenance facility components for the Green Line Extension Project. A detailed environmental analysis of the Yard 8 site was provided in the DEIR/EA.

Program

Yard 8 accommodates the defined support facility program including, but not limited to: storage for 80 Green Line vehicles, two pit tracks, two lift tracks, one wheel truer track, support shops, Green Line vehicle wash, administrative office space, and an approximately 100-space employee parking lot.

Combining the MBTA and Pan Am Railways' portions of Yard 8 would provide sufficient area to accommodate the Green Line Extension tracks and a five-track storage facility that could store 70 vehicles. The shape of Yard 8 is well-suited to provide a double-ended storage yard, with lead tracks at each end feeding ladder tracks which fan out to the five storage tracks.[4]

The layout of Yard 8 allows for a single storage yard north of the maintenance building. Total capacity of the storage yard is 70 cars. It is assumed that, at any one

4 A lead track is a primary track that provides access from a main line track to a yard, and from which a series of yard tracks can be connected via a turnout or switch within the yard. Multiple storage tracks that are connected to the lead track in a "ladder" configuration are referred to as ladder tracks.

time, 10 additional cars would be in the maintenance shop building or temporarily stored on the tracks just outside the building. The building and the yard are proposed to be approximately at the existing grade of the site.

Both the building and the storage yard have double-ended access, which provides redundancy so that operations can be maintained even if a train should derail in the yard. With only single-ended access, a derailment at a critical location in the yard could block trains from entering or leaving the yard, resulting in serious impacts to Green Line service.

This alternative could accommodate potential future air rights development.

Operational Plan

The following includes a brief description of the operational interface of the Yard 8 alternative with future Green Line Extension operations and of the potential impact to existing railroad operations. A more detailed description of the operating plan for the Yard 8 facility is included in FEIR Appendix B.

Yard Interface with Green Line Extension Operations

The Yard 8 facility layout consists of a double-ended yard, which provides the necessary redundant connections to the mainline of the Green Line Extension. Light rail vehicles can directly enter and exit the yard from both the north and south ends of the yard, eliminating the need for any reverse moves[5] or switchbacks for access to the mainline, providing optimal operational efficiencies.

The Yard 8 facility layout includes three lead tracks (Medford Lead, Lechmere Station Lead, and Maintenance Lead) that provide access into and out of the maintenance and storage facility, providing access in both directions on the Medford Branch mainline between Lechmere Station and College Avenue. Reverse moves from the yard would be needed in order for vehicles to access the Union Square Branch.

On the Union Square Branch, there is only the terminal station on this line, so trains on this service would continue to deadhead (i.e., run without picking up passengers) to Union Square. Trains from Union Square to the yard would need to proceed inbound and reverse direction either at Lechmere Station or at the Brattle Loop at Government Center Station.

In the morning, trains would leave the storage yards for Medford Hillside, Union Square and inbound towards Lechmere Station. Prior to the start of revenue

5 A reverse move is when the operator would have to stop the train, leave the control cab at one end of the train and walk to the other end of the train and enter the control cab to operate the train.

operations at 5 AM, the initial trains would deadhead to their respective origin stations. After 5 AM, trains for Medford Hillside could either deadhead or enter revenue service at Brickbottom Station.

Trains would continue to leave the yard until all peak hour service trains are in operation. Toward the end of peak service (approximately 9 AM), some trains would come out of service and return to the yard. In the afternoon, prior to the evening peak, these cars would leave the yard and return to service. After the evening peak, a number of cars would again return to the yard while the remainder would handle the night service schedule. At the end of the service day, the remaining trains would return to the yard, with the last ones arriving after the end of revenue service at 1 AM.

Impacts to Existing Railroad Operations

The construction of a Yard 8 facility would remove all existing freight tracks within Yard 8 and would remove the Wiley Track, a connecting track between the south end of Yard 8 and the Valley Tracks. Thus, this option would require some revisions to current freight operations by Pan Am Railways. There is no impact to CSX freight rail operations with this option. With a Green Line maintenance facility at Yard 8, CSX freight trains could continue to operate as they do today.

The main impact to freight operations would be the reconstruction of Yard 8, converting it from a freight rail yard to the Green Line maintenance and storage yard. Currently, Pan Am Railways has two tracks in the yard: one through track and one storage track. Pan Am Railways' freight trains that operate via the MBTA Lowell Line and through Yard 8, occasionally store freight cars in the yard.

Pan Am Railways' freight trains reach Boston via the MBTA Lowell Line. Typically, there are about three to four round-trips per week for the local switching operation, which serves Somerville as well as Chelsea, Salem, and Peabody via other MBTA routes. In addition, the "sand and gravel unit train" to Boston Sand and Gravel in Charlestown makes another three to four round-trips a week. Most freight trains operate in the evening or night, when MBTA commuter rail operations are less frequent. If Yard 8 were dedicated to the Green Line, it would still be possible for Pan Am Railways to access the Boston area and store freight cars in other nearby locations. Alternative routes exist within the MBTA system to support Pan Am Railways' operations. Based on on-going discussions with Pan Am Railways, existing overall freight rail operations into the Boston area would not be precluded.

Additionally, the Yard 8 facility site would not preclude the future North-South Rail Link project or the ability to expand the BET facility within existing MBTA property limits.

Real Estate Impacts

The maintenance yard for Yard 8 fits within existing rail yards owned by the MBTA and Pan Am Railways. The maintenance facility building would be on private land (the undeveloped portion of 200 Inner Belt Road) that is currently vacant and, therefore, no buildings, structures or businesses would need to be removed or relocated. Maintenance facility uses are consistent with the existing industrial zoning for the area. Table 2-1 provides a list of properties that would need to be acquired for Yard 8. This alternative requires the acquisition of approximately 5.8 acres of land, which is estimated at approximately $15 million.

Table 2-1 Potential Property Acquisitions for Yard 8

Address	Owner/Occupant	Acreage	Full or Partial Lot Acquisition
200 Inner Belt Road, Somerville	Fine Arts Storage Partners	3.9	Partial (undeveloped portion)
0 Inner Belt Road, Somerville	Pan Am Railways (rail yard)	1.9	Full
TOTAL		*5.8 acres*	

The undeveloped parcel at 200 Inner Belt Road (also referred to as 150 Inner Belt Road) that would be acquired for the maintenance facility has an existing land use permit for the construction of a proposed 190,000-square-foot building approximately 64 feet high. The proposed building and the proposed maintenance facility cannot share the site due to space constraints. Therefore, the maintenance facility would require voiding the existing land use permit. If the MBTA acquired the land within the footprint of the facility (tracks and buildings) in fee, this would represent a loss of current tax revenue to Somerville as the MBTA is exempt from local property taxes. This alternative could result in the loss of potential tax revenue which would be generated by future development at this location.

As part of the amendment to the original NorthPoint development agreement, the MBTA has an option to acquire the portion of Yard 8 that is currently owned by Pan Am Railways. Although the Commonwealth would still need to pay for the land, acquisition of this site could be easier than under typical circumstances because of the proposed agreement.

Order-of-Magnitude Capital Costs

An Order-of-Magnitude conceptual capital cost estimate for the proposed maintenance and storage facility at Yard 8 was developed and is estimated to be approximately $79 million in 2008 dollars. Since the publication of the DEIR, the design of Yard 8 was refined to make it more operationally consistent with the other

two alternatives. Table 2-2 provides a breakdown of the conceptual capital cost estimate for Yard 8.

Table 2-2 Order-of-Magnitude Conceptual Capital Cost Estimate for Yard 8

	Cost ($2008)
Real Estate Acquisition	$ 15 M
Building	$ 38 M
Track	$ 22 M
Infrastructure	$ 2 M
Earthwork	$ 2 M
Total	Approx. $ 79 M

2.3.2 Option L

The proposed Option L facility, so called because of its "L" shape configuration, is located immediately adjacent to and northwest of the MBTA's commuter rail maintenance facility, also referred to as the BET (Figure 2-3). Option L is situated along the southern and southeastern fringe of the existing Inner Belt industrial area of Somerville and adjacent to the Valley Tracks just north of the MBTA's BET.

Program

Option L accommodates the same defined support facility program as Yard 8, including but not limited to: storage for 80 Green Line vehicles, two pit tracks, two lift tracks, one wheel truer track, support shops, Green Line vehicle wash, administrative office space, and an approximately 100-space employee parking lot. The maintenance building and associated trackwork are proposed on land adjacent to and northwest of the existing BET facility. That land is currently occupied by two businesses at 20 Third Avenue and 44-48 Third Avenue. The vehicle storage yard is proposed at the southern end of Inner Belt Road just north of the MBTA Fitchburg Line on vacant private property and land that is currently an unused parking lot for 70 Inner Belt Road.

The layout of Option L includes two storage yards and the maintenance building. The south yard is immediately south of the hook in Inner Belt Road. This yard includes eight storage tracks and a runaround track. The south yard would store up to 40 cars. The east yard is east of the maintenance building and just south of Third Avenue. This yard provides eight vehicle storage tracks and has a total capacity of 27 cars. Total capacity of the storage yards is 67 cars. For Option L, 13 cars would need to be stored in the building or tracks just outside the buildings at any given time in order to meet program storage requirements.

The maintenance building for Option L would be identical in size and layout to the building proposed for Yard 8 and Mirror H. The main difference is the location of the building. For Option L, it would be south of Third Avenue and east of the existing building at 70 Inner Belt Road.

To provide double-ended access to the maintenance building, a loop track is added, which provides access to the north side of the building from a runaround track to the east of the building and the east storage yard. This alternative could also accommodate potential future air rights development.

Operational Plan

The following includes a brief description of the operational interface of the Option L alternative with future Green Line Extension operations and of the potential impact to existing railroad operations. A more detailed description of the operating plan for the Option L facility is included in Appendix B.

Yard Interface with Green Line Extension Operations

Option L is the only one of the three alternatives that provides a direct connection to the Union Square Branch and the storage yard. This advantage allows trains to be dispatched directly from the yard to both termini, at Medford Hillside and at Union Square, without the need to perform a reverse move (a move that would impact revenue operations). Option L has two lead tracks (Medford Lead and Union Square Lead) that provide direct access into and out of the storage yards and maintenance facility. This direct connection is not possible with Yard 8 or Mirror H.

Similar to the Yard 8 discussion, in the morning trains would leave the storage yards destined for Medford Hillside, Lechmere Station and Union Square. Prior to the start of revenue operations at 5 AM, the initial trains would deadhead to their respective terminal stations. After 5 AM, trains for Medford Hillside could either deadhead or enter revenue service at Brickbottom Station. On the Union Square Branch, there is only one terminal station so trains on this service would continue to deadhead to Union Square.

Trains would continue to leave the yard until all peak hour service trains are in operation. Toward the end of peak service (approximately 9 AM), some trains would come out of service and return to the yard. In the afternoon, prior to the evening peak, these cars would leave the yard and return to service. After the evening peak, a number of cars would again return to the yard while the remainder handled the night service schedule. At the end of the service day, the remaining trains would return to the yard, with the last ones arriving after the end of revenue service at 1 AM.

Impacts to Existing Railroad Operations

The construction of an Option L facility would impact Pan Am Railways' freight operations to the same degree as the Yard 8 alternative. Similar to Yard 8, the Option L alternative would require the removal of the Wiley Track that connects the south end of Yard 8 to the Valley Tracks. Without the Wiley Track, Yard 8 would be a two-track single-ended yard that would have little utility to Pan Am Railways' operations. There is no impact to CSX freight rail operations with this option. With a Green Line maintenance facility at Yard 8, CSX freight trains could continue to operate as they do today.

If Option L were utilized for the Green Line facility, it would still be possible for Pan Am Railways to access the Boston area and to store freight cars in other nearby locations. Alternative routes exist within the MBTA system to support Pan Am Railways' operations. Based on on-going discussions with Pan Am Railways, existing overall freight rail operations into the Boston area would not be precluded. However, M.S. Walker, a current freight customer of Pan Am Railways and located within the proposed Option L footprint, is a business that would potentially have to be relocated to a location with freight provisions.

Option L would not have any impacts on revenue passenger operations or on other operations associated with the MBTA (e.g., vehicle maintenance and storage, maintenance-of-way). Additionally, Option L would not preclude the future North-South Rail Link project or the ability to expand the BET facility within existing MBTA property limits.

Real Estate Impacts

Option L would require the complete acquisition of two parcels and partial acquisition of two other parcels. The land required for the yard and maintenance facility includes the building and parking at 44-48 Third Avenue; the building and parking lot at 20 Third Avenue; the isolated parking lot for 70 Inner Belt Road; plus the southern corner of 200 Inner Belt Road. M.S. Walker Wholesale Distribution, a wholesale manufacturer/distributor of wine and spirits located at 20 Third Avenue, provides jobs for approximately 74 people (based on parking occupancy). The building located at 44-48 Third Avenue (formerly occupied by Digital Publishing Solutions, Inc.) is being leased temporarily by a Federal agency as an indoor parking/storage facility for confiscated vehicles.

This alternative requires the acquisition of approximately 10.2 acres of land and buildings which has been estimated at approximately $51 million (including building demolition and site cleanup). This cost could be refined with additional research. If the MBTA acquired the land within the footprint of the facility (tracks and buildings) in fee, this would represent a loss of current tax revenue to Somerville as the MBTA is exempt from local property taxes. This alternative could result in the loss of

current and potential tax revenue which would be generated by future development at this location. Table 2-3 provides a list of properties that would need to be acquired for the Option L location. Option L does not use any portion of the Pan Am Railways' owned land at Yard 8.

Table 2-3 Potential Property Acquisitions for Option L

Address	Owner/Occupant	Acreage	Full or Partial Lot Acquisition
20 Third Avenue, Somerville	M.S. Walker Wholesale Distribution	4.6	Full
44-48 Third Avenue, Somerville	APCA Third Avenue, LLC	2.8	Full
70 Inner Belt Road, Somerville	CRG West Parking Lot	1.2	Partial
200 Inner Belt Road, Somerville	Fine Arts Storage Partners	1.6	Partial (undeveloped portion)
TOTAL		*10.2 acres*	

Order-of-Magnitude Capital Costs

An Order-of-Magnitude conceptual capital cost estimate for the proposed maintenance and storage facility at Option L was developed and is estimated to be approximately $129 million in 2008 dollars. Table 2-4 provides a breakdown of the conceptual capital cost estimate for Option L.

Table 2-4 Order-of-Magnitude Conceptual Capital Cost Estimate for Option L

	Cost ($2008)
Real Estate Acquisition	$ 51 M
Building	$ 38 M
Track	$ 33 M
Infrastructure	$ 2 M
Earthwork	$ 5 M
Total	Approx. $ 129 M

Suggestions for Refinements to Option L

Suggestions for refinements to the Option L site were received during the DEIR/EA public comment period. The Project Team reviewed and considered conceptual plans/materials that were received from members of the public for a revised version of Option L deemed "Mirror L," as described in DEIR/EA comment letters from Mr. Stephen Kaiser, dated January 7, 2010 and January 8, 2010. This option was determined infeasible based on discussion with the MBTA operations:

- The Mirror L plan proposes to eliminate one of the Valley Tracks. The Valley Tracks are the main hub of regional freight movements to and from the north, south, east and west. Eliminating either of these tracks would compromise MBTA's ability to store and dispatch work trains daily and impact track rights that have been granted to Pan Am Railways and CSX. The current Option L concept provides two Valley Tracks. The two Valley Tracks between the BET and M.S. Walker are used daily for overnight storage and staging of maintenance-of-way equipment, ballast cars, etc.
- The Mirror L plan would eliminate the only roadway connection to BET and there are no other available connections. Shifting the BET access road grade crossing north would impact Pan Am Railways and BET vehicle storage. Relocating this access would require reconfiguration of existing materials storage areas, relocation of an existing above ground storage tank, and relocation of existing storage structures. In addition, the new access would require construction of approximately five hundred feet of new roadway and at least three new grade crossings. Similarly, the route would require four sharp turns that could eliminate the ability of tractor-trailers to enter BET.
- The Mirror L plan would locate the maintenance facility on an existing BET parking facility. Mitigating for the loss of this existing parking would require construction of a multi-level parking facility. Construction and staging the construction of this facility would impact costs and schedule for the Green Line Extension. At least one of the buildings that are proposed to be taken for Option L would need to be raised for BET temporary parking facilities while the parking deck is being constructed.
- The new Callaghan Track (not shown on the Option L conceptual plan) would be impacted by the proposed parking deck shown in the Mirror L plan (provided in subsequent materials received from Mr. Stephen Kaiser). The new Callaghan Track is north of the shop entry tracks on the south end of the Mirror L proposed parking deck.
- The Mirror L plan would eliminate the northern connection of the BET runaround track to Valley Tracks on the northwest side of the BET maintenance facility. This track and its spur are currently used for movements and storage.
- Although the Mirror L plan would allow the Wiley Track to remain, negotiations regarding Option L are on-going with Pan Am Railways and MassDOT for alternative routes that exist within the MBTA system that could support Pan Am Railways' service to other customers.

2.3.3 Mirror H

Mirror H straddles portions of the NorthPoint site (which includes portions of Cambridge, Somerville and Boston) and a portion of MBTA land (Figure 2-4). This alternative locates the facility at the north side of the proposed NorthPoint

development and partly on MBTA land south of the BET, and represents a plan that places new light rail facilities next to existing MBTA commuter rail facilities.

The technical report refers to Mirror H as the option previously proposed by the City of Somerville, and then enhanced by the Project Team to optimize proposed operations. The enhancements represent layout modifications to provide operational equivalency to the original "Scheme H" as presented in the November 6, 2008 *Green Line Support Facility Alternatives Analysis* for the location of the support facility. The specific enhancements include:

- Extending the double-track lead and adding switches so that trains can operate on either lead track in either direction;
- Providing a 300-foot tail track so that trains to/from Lechmere Station can make the reverse move off the mainline tracks;
- A loop east of the maintenance shop plus a shop runaround track are included to provide access to the east side of the building; and
- Various minor layout modifications to make this option as operationally equivalent as possible to Yard 8 and Option L.

Program

Mirror H accommodates the same defined support facility program as Yard 8 including, but not limited to: storage for 80 Green Line vehicles, two pit tracks, two lift tracks, one wheel truer track, support shops, Green Line vehicle wash, administrative office space, and an approximately 100-space employee parking lot.

The layout of Mirror H includes a single storage yard of six tracks west of the maintenance building. Total storage is 70 cars. It is assumed that, at any time, 10 additional cars would be in the maintenance shop building or temporarily stored on the tracks just outside the building. The maintenance building and most of the storage tracks are in Somerville. Some of the employee automobile parking, as well as the tail tracks and loop east of the maintenance building, are in Boston.

The maintenance building at Mirror H would be identical in size and layout to the building proposed for Yard 8. To provide double-ended access to the maintenance building, a loop track is added that provides access to the east side of the building from a runaround track to the north of the building. This alternative could also accommodate potential future air rights development.

Operational Plan

The following includes a brief description of the operational interface of the Mirror H alternative with future Green Line Extension operations and of the potential impact to existing railroad operations. A more detailed description of the operating plan for the Mirror H facility is included in Appendix B.

Yard Interface with Green Line Extension Operations

Mirror H is the only one of the three alternatives with a single point of access from the yard to the revenue service tracks. Since a stalled or derailed train on a single yard lead track would prevent other trains from entering or leaving the yard, a second lead track was proposed for movements to and from Medford Hillside. All storage tracks in the yard would have direct movements (i.e., no reversing required) to and from the double-track lead when traveling to or from Medford Hillside. However, for trains traveling to/from Lechmere Station or the Central Subway, direct connections would not be available and would require some reverse moves within the yard and/or operations along the mainline tracks to access the yard.

The Mirror H facility does not have a direct connection to Union Square. Trains destined to or from Union Square would need to make a variety of complex moves, some of which would require reversing direction on revenue tracks. A detailed description the Mirror H operations can be found in Appendix B.

Similar to the other alternatives, in the morning trains would leave the storage yards for Medford Hillside and inbound towards Lechmere Station. Prior to the start of revenue operations at 5 AM, the initial trains would deadhead to their respective terminal stations. After 5 AM, trains for Medford Hillside could either deadhead or enter revenue service at Brickbottom Station.

Trains would continue to leave the yard until all peak hour service trains are in operation. Toward the end of peak service (approximately 9 AM), some trains would come out of service and return to the yard. In the afternoon, prior to the evening peak, these cars would leave the yard and return to service. After the evening peak, a number of cars would again return to the yard while the remainder handled the night service schedule. At the end of the service day, the remaining trains would return to the yard, with the last ones arriving after the end of revenue service at 1 AM.

Impacts to Existing Railroad Operations

The proposed Mirror H facility would have no impact on existing freight railroad operations. Pan Am Railways' operations through Yard 8 would remain as would the Wiley Track connection from Yard 8 to the Valley Tracks. Pan Am Railways'

operations would continue as they do today with this option. This option would also not impact CSX freight rail operations. CSX freight trains could continue to operate as they do today with a Green Line maintenance facility at the Mirror H site.

However, construction of the Mirror H facility would preclude the future North-South Rail Link project and the ability to expand the BET facility within existing MBTA property limits.

Real Estate Impacts

Mirror H would be partly in Somerville and partly in Cambridge, with some portions in Boston. If the MBTA acquired the land within the footprint of the facility (tracks and buildings) in fee, this would represent a loss of current tax revenue to the municipalities as the MBTA is exempt from local property taxes. This alternative could also result in the loss of potential tax revenue which would be generated by future development at this location. This alternative requires the acquisition of approximately 4.3 developable acres of Pan Am Railways' owned properties, which is estimated at a value of approximately $11 million. Table 2-5 provides a list of properties that would need to be acquired for Mirror H. At the time of this analysis, discrepancies in City property limits between Somerville and Cambridge were identified and are being reviewed. The amount and cost of property acquisition for Mirror H are subject to change based on the resolution of the city boundary issue.

Table 2-5 Potential Property Acquisitions for Mirror H

Address	Owner/Occupant	Acreage	Full or Partial Lot Acquisition
NorthPoint Development Lots A/B & C/D/E/F	Pan Am Railways	4.3	Partial

Order-of-Magnitude Capital Costs

An Order-of-Magnitude conceptual capital cost estimate for the proposed maintenance and storage facility at Mirror H was developed and is estimated to cost approximately $82 million in 2008 dollars. Since the publication of the February 18, 2009 *Green Line Support Facility – Review of Mirror Scheme H, Addendum to the Alternatives Analysis*, the design of Mirror H has been more fully developed and refined to make it operationally comparable to Yard 8 and Option L. Table 2-6 provides a breakdown of the conceptual capital cost estimate for Mirror H, based on the current design.

Table 2-6 Order-of-Magnitude Conceptual Capital Cost Estimate for Mirror H

	Cost ($2008)
Real Estate Acquisition	$ 11 M
Building	$ 38 M
Track	$ 25 M
Infrastructure	$ 2 M
Earthwork	$ 6 M
Total	Approx. $ 82 M

2.3.4 Summary of Operation Analysis

In comparing the Yard 8, Option L and Mirror H alternatives for the Green Line Extension maintenance and storage facility, each of the alternatives meets the MBTA's desired program and would have similar functionality in terms of hours of operations and start-up service.

However, some alternatives offer a better operating plan for vehicles entering and leaving the MBTA's system to access the yard. While the Yard 8 facility layout has a fully functional layout, Option L offers some improvements beyond Yard 8 in its direct connection to Union Square and without the need to reverse direction to access either the main line or the branch line. Mirror H has the least desirable operating plans of the alternatives in that it requires a number of complex movements in and around the yard to access the mainline and branch line tracks.

Mirror H is the only alternative that does not impact freight operations. However, while both Yard 8 and Option L impact Pan Am Railways' current tracks in Yard 8 and at the Wiley Track, it is understood that their operations would not be substantially affected and that their Boston customers could continue to be served.

Neither Yard 8 nor Option L would preclude future construction of the North-South Rail Link project or the future expansion of the MBTA's BET within existing property limits. Mirror H would preclude both of these projects from occurring.

2.4 Responses to DEIR Comments on the Maintenance and Storage Facility

This section addresses the main questions and concerns received during the public comment period, as required in the Secretary's Certificate. A detailed discussion of the program and requirements for the Maintenance Facility is presented in FEIR Section 2.3, *Description of Alternatives*, and in the technical memorandum titled *Environmental Analysis of Additional Maintenance Facilities* dated April 21, 2010.

The recent flooding and washout of the tracks on the Green Line D Riverside Branch illustrates the importance of well-dispersed maintenance facilities to ensure service reliability. This one breach of the D Branch severed the Riverside Shops, the principal maintenance facility, from the majority of the Green Line that remained in service. Adding a new maintenance facility for the Green Line extension would provide dispersed redundancy, particularly in the event of a service interruption that prevents access to one of the other major shops.

2.4.1 Minimizing Maintenance Facility Footprint

All three alternatives, Yard 8, Option L, and Mirror H, were designed within a compact layout, facilitated by the inherent flexibility of light rail vehicles to negotiate tighter curves. A comparison to other recently constructed light rail facilities around the nation revealed that each of these layouts are highly efficient on the basis of vehicles maintained per acre of land.

While the layouts of the three options are relatively efficient when compared to similar facilities, still, in consideration of the higher demand for land in the urban areas which encompass these three alternative sites, a number of strategies were employed to minimize the site footprint.

- MassDOT worked with the MBTA to identify only those items that were necessary to support the Green Line Extension Project. This was done to keep this facility on the scale of a "local shop" and not become a major shop like the Riverside maintenance facility.
- In all three locations, a significant portion of the site would be on land currently owned by the MBTA.
- Transportation functions (e.g., train operators and their supervisors) would be housed in the same building as vehicle maintenance.
- Offices and employee welfare facilities (restrooms, locker rooms, breakroom, etc.) would be included on a second floor between the two cathedral ceiling sections of the maintenance building, where inspection and repair work is performed.
- Employee parking would be located in scattered locations on the site, locations that are not occupied by tracks or buildings.
- For Option L and Mirror H, a loop track would be used on the "dead end" side of the maintenance building, as the loop would be a more compact layout than if a dead end tail track was used. Thus, using the loop track in these options would require less land for the facility. (This would not be required for the Yard 8 layout which would be completely doubled ended and has no "dead end.")

- Building program requirements were streamlined based on discussions with the MBTA in order to minimize impacts while still providing the operational integrity needed for Green Line operations when the extension is in service.

2.4.2 Minimizing Land Acquisitions

The Secretary's Certificate suggested other possible approaches to minimize land acquisitions necessary for a maintenance facility including:

- Consolidating employee parking areas (the Green Line maintenance facility with the MBTA's BET commuter rail maintenance facility);
- Shifting the MBTA office out of the Cobble Hill area property; and
- Splitting maintenance and storage operations.

Consolidating Employee Parking Areas

Public comments received since the DEIR/EA requested that the proposed employee parking area for the Green Line maintenance facility be combined with the existing BET commuter rail maintenance facility parking area. When designing a rail transit maintenance and storage facility, the layout of the tracks and buildings determines the overall size of the site required. Employee parking is a secondary consideration and spaces are located in scattered "infill" locations around the site that are not required for track or buildings. Thus, the addition of parking within these three site layouts does not add significantly to the size of the site required.

A concern with consolidating parking is that the existing BET commuter rail facility parking lot is sized for the peak demand of that facility. The MBTA states that all existing parking is needed at the BET and that there is no extra capacity to include Green Line parking or any other Green Line functions at the BET facility. Similarly, 100 spaces for MBTA Green Line parking at the maintenance facility is considered the absolute minimum required – MBTA currently has parking problems at Riverside, Reservoir and Lake Street Green Line facilities. To add employee parking at the BET for the Green Line facility would require the construction of a parking deck over the existing lot. This would add significant cost and time to the construction of the Green Line Extension Project since a temporary parking facility would need to be provided while the parking deck is being constructed, whereas the parking requirement may be better met by in-filling in and among the buildings and yard tracks.

For example, if the employee parking were completely removed from any of the three sites, there would be about one acre less land required. But the unneeded land would be in small, unconnected, and irregularly shaped areas, which would not represent buildable lots or useful additions to existing adjacent lots. From a practical

standpoint, if the majority of the parcel is required, MassDOT would take the entire parcel, as the leftover portions would have little to no real estate value.

Nevertheless, during Preliminary Engineering, the exact size of the lot required for rail operational needs would be re-evaluated. If there are leftover sliver parcels not required for the facility, they would be examined to determine if there represent any value as an "add-on" to an adjacent parcel. In such cases, a more beneficial use of the excess slivers of land may be as a landscape or screening buffer between the facility and adjacent private parcels.

Shifting the MBTA Office out of the Cobble Hill Area

Currently, the MBTA occupies a building in the Cobble Hill area in Somerville for its commuter rail system operations. This is occupied by staff from the MBTA and Massachusetts Bay Commuter Railroad (MBCR), the contractor that operates the commuter rail system. The Secretary's Certificate requested MassDOT respond to requests to consolidate the MBCR Cobble Hill commuter railroad operations facility into the new MBTA Green Line maintenance facility.

To shift the MBTA offices out of Cobble Hill, an equivalent amount of floor area would need to be added to the Green Line maintenance building and additional parking demand would be added. As the objective is to minimize the footprint of Green Line facility building and site, the only way to add floor area would be to build it taller. Comparing the footprints of the existing Cobble Hill MBTA/MBCR building and the proposed Green Line maintenance building, it is estimated that it would add two to three stories or (assuming a 12 to 13-foot floor height) about 24 to 36 feet of additional height.

For Yard 8, such added height would be a significant visual impact to the nearby Brickbottom residents. For Option L, the adjacent land uses are all low-rise industrial. A taller Green Line maintenance building would be more visible to the surrounding neighborhood. For Mirror H, such added height would visually block views of the commuter rail maintenance facility from residential structures such as the Glass Factory Condominiums. However, it would add a tall mixed industrial and office structure closer to those residents.

The existing Cobble Hill functions are vital to the commuter rail operations. All dispatching of north side operations is performed at this location. A significant effort and cost would be required to relocate operations out of the existing facility and into a new one.

Splitting Maintenance and Storage Operations

Consideration of scenarios for splitting maintenance and storage operations onto separate sites were included in the initial alternatives analysis (dated November 8, 2008) for the siting of the maintenance facility. Option D2 was the best example of a split operations layout. However, this layout required about 25 percent more land than a single compact site, such as Yard 8, Option L or Mirror H. A split layout requires additional tracks. A consolidated layout allows for the use of common ladder tracks for maintenance and storage building access. A split facility adds to the number and length of such ladder tracks.

Also, a split facility would require a second building. In a consolidated layout, the transportation staff (e.g., train operators and their supervisors) could be located in the maintenance building. In a split layout, a separate building would need to be added to the storage yard site for the transportation staff (welfare facilities for operators and offices for supervisors). This could also increase the overall site footprint.

In summary, the split operations sites would require more land than the current compact consolidated layout with the maintenance and storage on the same site.

2.5 Environmental Resource Analysis

This section discusses the human and environmental resource impacts of the three maintenance facility alternatives (also provided in Appendix B). The human and environmental resource categories considered in this analysis included:

- Air quality
- Noise
- Vibration
- Traffic
- Socioeconomic impacts
- Title VI/Environmental justice
- Visual resources
- Wetlands
- Stormwater management
- Hazardous materials
- Historic and archaeological resources
- Public parks, recreation areas, and conservation land

- Consistency with Federal, state and local planning
- Compatibility with the Community Path

2.5.1 Air Quality

This section compares direct impacts of the three maintenance facility alternatives on air quality. None of the three maintenance facility alternatives would have a measurable impact on air quality. Any maintenance facility alternative, in conjunction with the Project, would remain compliant with the SIP and Air Pollution Control Regulations (310 CMR 7.36).

The three maintenance facility alternatives are not anticipated to generate substantial emissions because the Green Line vehicles that would be stored there would be electric and would not generate air pollution in the Study Area. The proposed maintenance facility itself would be an open building with no heating-related emissions.

The mobile source emissions, generated by automobiles accessing the sites, for all three alternatives would be minimal. The proposed maintenance facility would provide approximately 100 parking spaces. The majority of these trips would occur during off-peak periods when there is little congestion in the Study Area.

2.5.2 Noise

This section compares the direct noise impacts of the three maintenance facility alternatives in combination with the Green Line Extension mainline operations. The noise impact analysis for the Green Line Extension Project is based on the methodology defined in the FTA guidance manual *Transit Noise and Vibration Impact Assessment*.[6] Noise impact has been assessed at sensitive receptors and includes contributions from mainline operations and maintenance facility operations including train movements in and out of the yard, increases in noise from special trackwork, potential wheel squeal, the traction power substation, and the employee parking lot. Figures 2-5 through 2-7 show the noise study measurement locations. Figures 2-8 through 2-10 show the buildings impacted by noise prior to mitigation. Background information on noise and vibration fundamentals, descriptors, impact criteria, land use categories, existing noise conditions and sensitive land use in areas other than near the proposed maintenance facilities are presented in DEIR/EA Section 4.8, *Noise*. Further detail on the reference noise levels, principal modeling assumptions and impact analyses for Option L and Mirror H is available in the

6 Federal Transit Administration. *Transit Noise and Vibration Impact Assessment* (Report FTA-VA-90-1003-06). May 2006.

maintenance facility noise assessment technical memoranda.[7,8] The full noise analysis for Yard 8 was conducted for and included in the DEIR/EA.

The proposed maintenance facility would introduce new noise sources into the surrounding areas and would contribute to the future noise exposure conditions at sensitive receptors. Potential noise impact has been assessed at sensitive receptors near Yard 8, Option L and Mirror H including the Brickbottom Artists Building (northeast and southwest sides), the Hampton Inn Hotel, the Glass Factory Condominiums, proposed NorthPoint development properties, a residential development planned at 22 Water Street, and two planned Archstone residential developments (Phase II – Sites 1 and 2). Based on the current NorthPoint development plan, eight sites have been assumed to be noise-sensitive including the existing Tango and Sierra residential properties and future planned properties shown in Figure 2-10 (Site 1, Site 2, Site 3, Site 4, Site 5 and a park). Based on the current Archstone Development Phase II plan, two sites have been assumed to be noise-sensitive including a future building east of East Street (Site 1) and a building west of Leighton Street (Site 2).

Potential noise impact is assessed by comparing the existing noise conditions with future conditions. Existing noise conditions were measured at five locations near these sensitive properties. A summary of the measurement sites and results is shown in Table 2-7 and the measurement locations are shown in Figures 2-5 through 2-7. Short-term measurement site ST-1 was conducted on the northeast side of the Hampton Inn Hotel and is representative of the existing noise conditions on the northeast sides of the Glass Factory Condominiums, the Hampton Inn Hotel, the northeast side of the Brickbottom Artists Building, and the proposed residential property at 22 Water Street. Short-term measurement site ST-2, on the southwest side of the Brickbottom Artists Building, is representative of the existing noise conditions for the southwest side of the Brickbottom Artists Building. The dominant noise source at ST-2 is commuter train activity on the MBTA Fitchburg Line. Short-term measurement site ST-8, at the end of Water Street, is representative of existing noise conditions at the five future NorthPoint properties and the park. Long-term measurement site LT-10, on the southwest side of the Glass Factory Condominiums, is representative of the existing noise conditions at the existing Tango and Sierra NorthPoint properties (adjusted for relative distances to O'Brien Highway). Short-term measurement site ST-9 was conducted at the planned Archstone properties (Phase II) and is representative of the existing noise for those two sites.

Future noise sources associated with the Project include mainline Green Line operations, MBTA commuter train operations (southwest side of Brickbottom Artist Building only), the relocated bus transit center at Lechmere Station and maintenance facility noise sources. Maintenance facility noise sources include train movements in and out of the yards, increases in noise from special trackwork (crossovers or turnouts), potential wheel squeal on tight radius curves, stationary cars in the yards

7 Harris Miller Miller & Hanson Inc., *Option L Maintenance Facility Noise and Vibration Assessment*, April 2010.
8 Harris Miller Miller & Hanson Inc., *Mirror H Maintenance Facility Noise and Vibration Assessment*, April 2010.

operating with auxiliary equipment on, the traction power substation, and the employee parking lot. Noise from the bus transit center is based on current activity from the MBTA Bus Routes 69, 80, 87 and 88 which total 79 buses departing the station during nighttime hours (10 PM to 7 AM) and 324 buses departing during daytime hours (7 AM to 10 PM).

Table 2-7 Existing Noise Measurement Results

Measurement Site	Location	Existing Day-Night Average Sound Level (Ldn)	Existing Peak-Transit Hour Sound Level (Leq)	Commuter Train Noise Level (Lmax)[d]	Distance to Near Track (feet)
ST-1	Water Street (Cambridge) – Hampton Inn Hotel (northeast side of building)	58[b]	60	N/A	N/A
ST-2	Fitchburg Street (Somerville) – Brickbottom Artists Building (southwest side of building facing Fitchburg Line)	64[a]	61	78	65[c]
ST-8	End of Water Street between O'Brien Highway and Boston Engine Terminal	62[b]	65	N/A	N/A
ST-9	Archstone Parcel on O'Brien Highway (proposed Phase II development)	65[b]	67	N/A	N/A
LT-10	Glass Factory Condominiums [c] (southwest side of building)	65[c]	63 [c]	N/A	N/A

Source: HMMH, 2010 & 2008 and Lechmere Station Relocation Project (November, 2006).
a Ldn estimated by comparing SEL levels of train events to long-term sites whose noise environment is dominated by train noise.
b Ldn estimated according to FTA guidance for short-term measurements conducted between 7 AM and 7 PM.
c Measurement conducted March, 2006 and reported in Environmental Assessment for the Lechmere Station Relocation Project (November, 2006).
d Commuter train noise level is average of all events at site

Train movements in and out of the yards are non-revenue operations between the proposed yards to and from the closest stations (Union Station, Lechmere Station and Brickbottom Station). These "pull in" and "pull out" movements are required to bring trains into service or to take trains out of service for maintenance or at the end of the service day. These movements are in addition to the standard revenue service train operations. Often these additional train movements represent the most significant noise source associated with the maintenance facilities.

Maintenance lead tracks and yard tracks often include special trackwork (crossovers or turnouts) or tight-radius curves which can increase noise levels associated with train movements into and out of the yards. Special trackwork introduces gaps into the rail running surface which would increase noise levels from the train as the wheels impact these gaps. Tight-radius curves, typically 400-foot radius or less, may cause wheel squeal which is a high-frequency tonal noise generated by the wheels.

Another potentially significant noise source associated with the maintenance facilities are stationary cars in the storage yards operating with auxiliary equipment on. Cars are typically operated under this condition in the early morning to heat or cool the interior and prepare the trains for revenue service as well as at other times during the day when cars are in the yards but would be required to return to service. The contribution of noise from such operation of cars in the storage yards is generally

not as significant as the train movements unless receptors are much closer to the storage yards than the mainline tracks. Maintenance operations within the building such as wheel truing, using pneumatic tools and the car wash are not expected to be significant noise sources in the community as the building would shield these activities. The heating, ventilation and air-conditioning (HVAC) system for the maintenance building is also not expected to be a significant noise source. Unlike maintenance buildings for diesel-electric locomotives which require more substantial HVAC systems to handle the train exhaust, this building would only require normal levels of airflow for storing electric Green Line vehicles.

Table 2-8 presents a summary of the potential noise impact at sensitive receptors near the proposed maintenance facilities prior to mitigation. This table shows the results for Yard 8, Option L and Mirror H. Potential noise impact locations for the three alternatives are also shown in Figures 2-8 through 2-10. This table includes the sensitive receptors, which side of the tracks it is on, the future distances between the receptor and the near track centerlines of the mainline Green Line and MBTA Fitchburg commuter line, the existing noise condition (Ldn), the moderate and severe impact criteria, the contribution of noise from mainline operations (which include noise from the bus transit center), the contribution from maintenance facility noise sources, the future noise level (which include maintenance facility, mainline operations and existing noise sources), the increase in noise between the existing and future conditions and whether the potential impact would be moderate or severe.

Table 2-8 Potential Project Noise Impact at Sensitive Receptors (Prior to Mitigation)

Noise Sensitive Receptor Location	Side of Tracks	Distance to Near Track (feet)		Existing Noise Level (Ldn)	Impact Criteria		Future Noise Level from Mainline (Ldn)	Future Noise Level from Yard Sources (Ldn)	Total Future Noise Level (Ldn)[a]	Increase	Total Number of Impacts (buildings)	
		Comm.	Green Line		Mod.	Sev.					Mod.	Sev.
Maintenance Facility - Yard 8												
Brickbottom Artists Building (northeast façade)	West	n/a	18	57.6	60.0	63.5	75.3	69.9	76.4	18.8		1
Brickbottom Artists Building (southwest façade)	West	88	n/a	64.1	65.5	67.9	67.9	59.9	69.9	5.8		-- [b]
Hampton Inn Hotel (northeast façade)	West	n/a	41	57.6	60.0	63.5	66.8[h]	57.3	67.7[c]	10.1		1
Glass Factory Condominiums (northeast façade)	West	n/a	43	57.6	60.0	63.5	70.0[h]	56.9	70.4[c]	12.8		1
NorthPoint Properties (Tango and Sierra)	East	n/a	109	61.0	62.8	65.6	60.5	n/a[d]	63.8	2.8	2	
22 Water Street (Proposed)	East	n/a	60[g]	57.6	60.0	63.5	74.9[e,h]	55.9	75.0[e]	17.4		1
Archstone (Proposed Phase II- Site 1)	East	n/a	15[g]	69.2	70.3	72.1	75.1	n/a[d]	76.1	6.9		1
Total noise impacts prior to mitigation for Yard 8											2	5

Table 2-8 Potential Project Noise Impact at Sensitive Receptors (Prior to Mitigation) (continued)

Noise Sensitive Receptor Location	Side of Tracks	Distance to Near Track (feet)		Existing Noise Level (Ldn)	Impact Criteria		Future Noise Level from Mainline (Ldn)	Future Noise Level from Yard Sources (Ldn)	Total Future Noise Level (Ldn)[a]	Increase	Total Number of Impacts (buildings)	
		Comm.	Green Line		Mod.	Sev.					Mod.	Sev.
Maintenance Facility - Option L												
Brickbottom Artists Building (northeast façade)	West	n/a	18	57.6	60.0	63.5	75.3	69.9	76.4	18.8		1
Brickbottom Artists Building (southwest façade)	West	88	n/a	64.1	65.5	67.9	67.9	60.5	69.9	5.8		-- [b]
Hampton Inn Hotel (northeast façade)	West	n/a	41	57.6	60.0	63.5	66.8[h]	57.8	67.8	10.2		1
Glass Factory Condominiums (northeast façade)	West	n/a	43	57.6	60.0	63.5	70.0[h]	57.3	70.5	12.9		1
NorthPoint Properties (Tango and Sierra)	East	n/a	109	61.0	62.8	65.6	60.5	n/a[d]	63.8	2.8	2	
22 Water Street (Proposed)	East	n/a	60[g]	57.6	60.0	63.5	74.9[e, h]	59.3	75.1	17.5		1
Archstone (Proposed Phase II- Site 1)	East	n/a	15[g]	69.2	70.3	72.1	75.1	n/a[d]	76.1	6.9		1
Total noise impacts prior to mitigation for Option L											2	5
Maintenance Facility - Mirror H												
Brickbottom Artists Building (northeast façade)	West	n/a	18	57.6	60.0	63.5	79.2[d]	69.9[e]	80.9	23.3		1
Brickbottom Artists Building (southwest façade)	West	88	n/a	64.1	65.5	67.9	67.9	56.2	69.6	5.5		-- [b]
Hampton Inn Hotel (northeast façade)	West	n/a	41	57.6	60.0	63.5	66.8[h]	58.8	67.9	10.3		1
Glass Factory Condominiums (northeast façade)	West	n/a	43	57.6	60.0	63.5	70.0[h]	57.5	70.5	12.9		1
NorthPoint Properties (Tango and Sierra)	East	n/a	109	61.0	62.8	65.6	60.5	54.7[e]	64.3	3.3	2	
NorthPoint Properties Site 1	East	n/a	300	61.5	63.2	66.0	50.7	66.4[f]	67.7	6.2		1
NorthPoint Properties Site 2	East	n/a	300	61.5	63.2	66.0	49.9	66.5[f]	67.8	6.3		1
NorthPoint Properties Site 3	East	n/a	500	61.5	63.2	66.0	51.1	64.8[f]	66.6	5.1		1
NorthPoint Properties Site 4	East	n/a	700	61.5	63.2	66.0	48.7	65.1[f]	66.8	5.3		1
NorthPoint Properties Site 5	East	n/a	700	61.5	63.2	66.0	48.7	58.5[f]	63.4	1.9	1	
22 Water Street (Proposed)	East	n/a	60[g]	57.6	60.0	63.5	74.9[e,h]	64.6[f]	75.3	17.7		1
Archstone (Proposed Phase II- Site 1)	East	n/a	15[g]	69.2	70.3	72.1	75.1	n/a[d]	76.1	6.9		1
Total noise impacts prior to mitigation for Mirror H											3	9

Source: HMMH, April 2010.
a Total future noise level includes future mainline noise, future yard noise sources and existing noise sources.
b Brickbottom Artists Building impact is counted under listing for Brickbottom Artists Building (northwest).
c Future noise level reported in DEIR for this receptor does not include yard noise sources.
d n/a = Not Applicable. Receptor does not have significant contribution from maintenance facility noise sources (such as stationary cars operating with auxiliary equipment running). Receptor is not exposed to noise from non-revenue maintenance facility operations (pull ins and pull outs) because it is east of Lechmere Station and all train pass bys would be for revenue service.
e Noise includes contribution from crossover in front of building.
f Most significant yard noise source is stationary vehicles operating with auxiliary equipment running.
g Distance to alignment estimated for future proposed property.
h Future noise level from mainline includes contribution from bus transit center at Lechmere Station.

Yard 8

A total of two buildings would be exposed to moderate impact and five buildings would be exposed to severe noise impact prior to mitigation for Yard 8. Future noise conditions are primarily a function of the mainline train operations and maintenance facility noise sources only increase future noise levels a relatively small amount. Future noise levels from all yard sources are five to 19 decibels lower than noise from mainline operations. As an example of the effect of maintenance facility noise sources, future noise from mainline operations at the northeast façade of the Brickbottom Artists Building would be Ldn 75.3 dBA and noise from the maintenance facility operations would be Ldn 69.9 dBA. The future noise level would be Ldn 75.3 dBA without any contribution from the maintenance facility and would be Ldn 76.4 dBA including the maintenance facility. Therefore, the Yard 8 maintenance facility would only increase future noise levels by 1.1 decibel compared to the mainline operations alone. At the other receptors potentially impacted under Yard 8 (Hampton Inn, Glass Factory Condominiums, two existing NorthPoint properties Tango and Sierra and the proposed developments at 22 Water Street and Archstone Phase II Site 1), the contribution of noise from maintenance facility operations is even less than at Brickbottom Artists Building.

Although there are locations that require mitigation for the Proposed Project, the contribution of noise from the Yard 8 maintenance facility would only increase future noise levels one decibel or less. Therefore, no additional noise mitigation is required specifically due to the proposed Yard 8 maintenance facility option.

Option L

The noise impact assessment results for Option L are very similar to the results for Yard 8. A total of two buildings would be exposed to moderate impact and five buildings would be exposed to severe noise impact prior to mitigation for Option L. Future noise conditions are primarily a function of the mainline train operations and maintenance facility noise sources only increase future noise levels a relatively small amount. Future noise levels from all yard sources are five to 15 decibels lower than noise from mainline operations. Noise from train movements in and out of the yard at Option L would be slightly higher at the southwest façade of the Brickbottom Artists Building than Yard 8 due to the presence of a tight radius curve on the Medford Lead track. Noise from train movements in and out of the yard at Option L would be slightly higher at the Hampton Inn Hotel and the Glass Factory Condominiums due to stationary cars in the south yard operating with auxiliary equipment on.

As an example of the effect of maintenance facility noise sources, future noise from mainline operations at the northeast façade of the Brickbottom Artists Building would be Ldn 75.3 dBA and noise from the maintenance facility operations would be Ldn 69.9 dBA. The future noise level would be Ldn 75.3 dBA without any

contribution from the maintenance facility and would be Ldn 76.4 dBA including the maintenance facility. Therefore, the Option L maintenance facility would only increase future noise levels by 1.1 decibel compared to the mainline operations alone. At the other receptors potentially impacted under Option L (Hampton Inn, Glass Factory Condominiums, two existing NorthPoint properties Tango and Sierra and the proposed developments at 22 Water Street and Archstone Phase II - Site 1), the contribution of noise from maintenance facility operations is even less than at Brickbottom Artists Building.

Although there are locations that require mitigation for the Proposed Project, the contribution of noise from the Option L maintenance facility would only increase future noise levels one decibel or less. Therefore, no additional noise mitigation is required specifically due to the proposed Option L maintenance facility option. Noise mitigation for the Proposed Project including Option L at receptors near Lechmere Station is presented in Section 5.5.1, *Noise*.

Mirror H

For Mirror H, a total of three buildings would be exposed to moderate impact and nine buildings exposed to severe impact prior to mitigation. The relative contribution of noise from maintenance operations versus mainline operations is similar to Yard 8 and Option L at the Brickbottom Artists Building, Hampton Inn, Glass Factory Condominiums and the proposed developments at Archstone Phase II Site 1 with this alternative. At the proposed development at 22 Water Street, there is a greater contribution of noise for the Mirror H option compared to Yard 8 and Option L due to the contribution of noise from stationary cars operating with auxiliary equipment running in the storage yards; however, the total future noise at this proposed property is still primarily a function of mainline operations. Noise from train movements in and out of the yard and mainline operations would be higher at the northeast façade of the Brickbottom Artists Building for Mirror H than Yard 8 or Option L due to the presence of a double crossover and a turnout between the northbound mainline and the maintenance lead track directly in front of the building. For the existing NorthPoint properties Tango and Sierra, future noise conditions also depend primarily on the mainline operations. For the future planned NorthPoint properties (Sites 1 to 5), which are more set back from the mainline (300 to 700 feet) and are closer to the Mirror H storage yards, future noise conditions depend primarily on the stationary cars operating in the yards with auxiliary equipment running. For the proposed development at Archstone Phase II Site 1, there is no considerable contribution of noise from the Mirror H maintenance facility.

At the Brickbottom Artists Building, Hampton Inn Hotel, Glass Factory Condominiums, existing NorthPoint properties Tango and Sierra and proposed developments at 22 Water Street and Archstone Phase II - Site 1, the contribution of noise from the Mirror H maintenance facility would only increase future noise levels less than one decibel. Therefore, no additional noise mitigation is required

specifically due to the Mirror H maintenance facility option for these properties. At the proposed development at NorthPoint (Sites 1, 2, 3 and 4) potential noise impact prior to mitigation is primarily due to the Mirror H maintenance facility and potential mitigation would be associated with this maintenance facility option. It is assumed that future properties at the NorthPoint development would have noise-sensitive receptors at upper-floor residences, which would not benefit from a noise barrier for potential mitigation of noise from stationary cars in the storage yard. Since the proposed development is not currently under construction and is assumed to be completed by 2030, after the completion of the Green Line Extension Project, the buildings could be designed with consideration of the noise environment (i.e. windows with high transmission loss or sound transmission class [STC] ratings) to mitigate potential impact.

2.5.3 Vibration

This section documents direct vibration impacts from the three maintenance facility alternatives. The vibration impact analysis for the Green Line Extension Project is based on the methodology defined in the FTA guidance manual *Transit Noise and Vibration Impact Assessment*.[9] Vibration impacts are assessed for maximum levels, as vibration — unlike noise — is not a cumulative metric. To assess the potential effect of the three maintenance facility alternatives for vibration, the maximum vibration levels from both mainline operations and any movements to or from the maintenance facility are reported for all impacted receptors. The FTA criterion for vibration impacts for residential spaces such as the Brickbottom Artists Building is 72 VdB (vibration velocity level in decibels). The FTA impact criterion does not distinguish between "moderate" and "severe" vibration impacts. Figures 2-5 through 2-7 show the vibration study measurement locations. Figures 2-8 through 2-10 show buildings impacted by vibration prior to mitigation.

The proposed maintenance facilities would introduce new vibration sources into the surrounding areas and may cause potential vibration impact prior to mitigation. Potential vibration impact has been assessed at sensitive receptors near the proposed Yard 8, Option L and Mirror H including the Brickbottom Artists Building (northeast and southwest sides), a residential development planned at 22 Water Street, the Hampton Inn Hotel, the Glass Factory Condominiums, NorthPoint development properties and two planned Archstone (Phase II) residential developments. Based on the current NorthPoint development plan, seven sites have been assumed to be vibration-sensitive including the existing Tango and Sierra residential properties and future planned properties shown in Figure 2-10 (Site 1, Site 2, Site 3, Site 4 and Site 5). Based on the current Archstone development plan, two sites have been assumed to be vibration-sensitive including a future building east of East Street (Site 1) and a building west of Leighton Street (Site 2).

9 Federal Transit Administration. *Transit Noise and Vibration Impact Assessment* (Report FTA-VA-90-1003-06). May 2006.

Vibration generated by trains depends on several factors including the speed of the train, the presence of special trackwork (crossovers and turnouts) and whether the track alignment is at-grade or on an aerial structure. Special trackwork introduces gaps into the rail running surface which would increase vibration levels, similar to noise, from the train as the wheels impact these gaps. Although maintenance lead tracks and yard tracks often include special trackwork, these tracks are typically further away from sensitive receptors. An aerial structure reduces vibration significantly (10 VdB) compared to at-grade alignments because the vibration must propagate through the structure to the support columns and then into the ground and into surrounding buildings.

Table 2-9 shows the potential vibration impact prior to mitigation near the proposed maintenance facility alternatives. This table includes the vibration-sensitive receptor, the distance the mainline and yard track centerlines generating the highest levels of vibration, the maximum vibration velocity in any 1/3-octave band between four and 80 Hz for both mainline and maintenance facility movements and the number of buildings impacted. For all three alternatives, the Brickbottom Artists Building is the only receptor projected to be exposed to vibration impact prior to mitigation. For all maintenance facility alternatives, the maximum vibration generated by any yard movements is lower than the respective mainline operations. Mirror H is the only alternative projected to have potential vibration impact from yard movements. While the future proposed Archstone Site 1 building will be approximately 15 feet from the relocated Green Line alignment, train speeds are expected to be relatively slow (20 mph) and vibration impact is not expected.

Table 2-9 Potential Vibration Impacts at Sensitive Receptors (Prior to Mitigation)

Vibration Sensitive Receptor Location	Side of Tracks	Distance to Track Centerline (feet)		Maximum Vibration Velocity Level in any 1/3-Octave band from 4 to 80 Hz (VdB re: 1 micro-in.sec)		Total Number of Impacted Buildings
		Green Line Mainline	Green Line Yard Tracks	Green Line Mainline	Green Line Yard Tracks	
Maintenance Facility - Yard 8						
Brickbottom Artists Building (northeast façade)	West	18 [a]	46	77	67	1
Total vibration impacts prior to mitigation for Yard 8						*1*
Maintenance Facility - Option L						
Brickbottom Artists Building (northeast façade)	West	18 [a]	60 [b]	77	71	1
Total vibration impacts prior to mitigation for Option L						*1*
Maintenance Facility - Mirror H						
Brickbottom Artists Building (northeast façade)	West	33 [b, c]	50 [b]	84	75	1
Total vibration impacts prior to mitigation for Mirror H						*1*

Source: HMMH, April 2010.

a Green Line is on elevated structure at this location.

b Increased vibration from special trackwork is included at these locations.

c The maximum vibration generated for this alternative and receptor is from the far mainline track due to the presence of a double crossover.

As stated in the DEIR/EA, resilient rail fasteners, which are specially-designed fasteners between the rails and the ties, are one option for mitigating potential vibration impact at the Brickbottom Artists Building. Resilient rail fasteners can reduce vibration by five to 10 VdB at frequencies above 30 to 40 Hz. Approximately 500 feet of vibration mitigation along the length of the Brickbottom Artists Building would be effective in mitigating potential vibration impact. During the next phase of the project, vibration measurements would be conducted at additional sensitive locations to refine vibration mitigation recommendations.

Yard 8

For Yard 8, the maximum vibration level (77 VdB) at the Brickbottom Artists Building is projected to be generated from trains on the elevated near mainline track approximately 18 feet away. The highest vibration generated by yard movements is 67 VdB. Therefore, no vibration impact is projected at any receptors directly from yard movements for Yard 8.

Option L

For Option L, the maximum vibration level (77 VdB) at the Brickbottom Artists Building is projected to be generated from trains on the elevated near mainline track approximately 18 feet away. The highest vibration generated by yard movements is 71 VdB. Therefore, no vibration impact is projected at any receptors directly from yard movements for Option L.

Mirror H

For Mirror H, the maximum vibration level (84 VdB) at the Brickbottom Artists Building is projected to be generated from trains on the elevated far mainline track approximately 33 feet away because this track includes a double crossover to the maintenance tail track. The maximum vibration generated by yard movements is 75 VdB due to the presence of a double crossover on the maintenance yard tail track approximately 50 feet away from the Brickbottom Artists Building.

2.5.4 Traffic

This section discusses existing conditions and impacts to automobile traffic and parking operations as a result of each of the three maintenance facility alternatives. Figures 2-5 through 2-7 show the traffic study intersections.

Yard 8

Yard 8 would have no measurable impact to automobile parking or traffic operations. Access to the facilities would be via Washington Street and Inner Belt Road.

Parking Impacts

There is no existing public or private parking supply at Yard 8. Parking for approximately 100 vehicles would be constructed in concert with the Yard 8 facility. These spaces would be available only to MBTA employees serving either the maintenance facility or the Green Line. There would be no impact to the public parking supply. MBTA Lechmere Station parking would also be unaffected.

Traffic Impacts

All MBTA personnel parking at the maintenance facility would arrive and depart outside of the peak commuting hours and would not impact the peak hour vehicular traffic patterns or traffic operations. There would also be no adverse impact to pedestrians or bicyclists in the vicinity of the facility.

Option L

Similar to Yard 8, locating the maintenance facility at Option L would have no measurable impact to parking or traffic operations. No changes to the conceptual design and circulation plan for Brickbottom Station are envisioned under Option L. Access to the Option L maintenance facility would be via Washington Street and Inner Belt Road.

Parking Impacts

There is an existing unused parking lot on 70 Inner Belt Road, which has 97 striped parking spaces available. This unused parking lot would serve as employee parking for Option L. Existing parking spaces along each building would be removed. Similar to the Yard 8 analysis, Option L would have no impact to the public parking supply.

Traffic Impacts

All MBTA personnel parking at Option L would arrive and depart outside of the peak commuting hours and would not impact the peak hour vehicular traffic patterns or traffic operations. There would also be no adverse impact to pedestrians or bicyclists in the vicinity of Option L.

The two existing building uses on the Option L site include a wholesale liquor distribution center and a building temporarily leased as an indoor parking/storage facility for federally confiscated vehicles (formerly occupied by Digital Publishing Company). It is assumed that these buildings and their associated parking would be removed entirely. Since the majority of vehicle trips associated with these buildings occur during the peak hours, there would be a slight reduction in traffic volumes on Washington Street and Inner Belt Road under Option L. Since the reduction is slight and would likely have no noticeable impact on traffic operations, no reduction in peak hour traffic volumes was assumed in the traffic analysis for the Washington Street/Inner Belt Road intersection.

Mirror H

Similar to Yard 8 and Option L, locating the maintenance facility at Mirror H would have no measurable impact on parking or traffic operations. There may be isolated impacts regarding access to/from the facility as discussed further.

Parking Impacts

There is no existing public or private parking supply at the Mirror H site. New parking for approximately 100 vehicles would be constructed in concert with the Mirror H facility. These spaces would be available only to MBTA employees serving either the maintenance facility or the Green Line Extension. Similar to Yard 8 and Option L, Mirror H would have no impact to the public parking supply. MBTA Lechmere Station parking would also be unaffected.

Traffic Impacts

All MBTA personnel parking at Mirror H would arrive and depart outside of the peak commuting hours and would not impact the peak hour vehicular traffic patterns or traffic operations. There would also be no adverse impact to pedestrians or bicyclists in the vicinity of Mirror H.

Access to the Mirror H Facility and Circulation at Lechmere Station

Regional access to Mirror H would be via Monsignor O'Brien Highway. Traffic to/from the north would use Water Street as a connection from O'Brien Highway to the Mirror H facility. Traffic entering the facility from the south would also be provided via O'Brien Highway and Water Street. This requires the existing median along O'Brien Highway to be cut and a traffic signal installed at Water Street. This improvement is currently proposed as part of the relocation of Lechmere Station. Timing of the construction of this improvement could be impacted if access to Mirror H is needed prior to completion of Lechmere Station construction.

To accommodate pedestrians crossing O'Brien Highway at Water Street, no left turns would be allowed out of Water Street. Therefore, traffic exiting the facility would use North First Street to O'Brien Highway southbound. The construction of North First Street is also proposed as part of the relocation of Lechmere Station. As with Water Street, timing of construction could be impacted if access to Mirror H is needed prior to completion of station construction.

In order to provide access to/from all directions, a roadway connection between Water Street and North First Street would be required. This connection could be provided as part of the Lechmere Station construction, or could be a separate private way behind the station until such time that the NorthPoint development is complete and the accompanying roadway infrastructure is constructed in its entirety.

2.5.5 Socioeconomic Impacts

This section compares the socioeconomic impacts in terms of projected tax effects and job loss for the three maintenance facility alternatives. Two buildings would be purchased and demolished under Option L. All other acquisitions would involve strips of land or vacant lots and would not require building demolition. Table 2-10 lists the current annual property taxes for the areas to be acquired.

Table 2-11 summarizes the annual tax value decreases by city. Somerville would have a annual tax loss of $116,064 (0.12 percent of total city revenue) for Yard 8, $322,440 (0.33 percent of total city revenue) for Option L and $56,222 (0.05 percent of total annual city revenue) for Mirror H. Cambridge and Boston would only experience tax loss under Mirror H, an annual tax loss of $78,411 (0.03 percent of total city revenue) and $2,993 (0.0002 percent of total city revenue), respectively.

Table 2-10 Property Tax Effects of Yard 8, Option L, and Mirror H

Property	Type	Annual Property Taxes on Acquired Area[a, b, c, d]	Estimated Jobs Displaced or Relocated[e]	Acquisition
Yard 8				
200 Inner Belt Road, Somerville	Commercial/industrial building	$80,533	0	Partial (undeveloped portion)
0 Inner Belt Road, Somerville	Pan Am Railways track	$35,531	0	Full
SUBTOTAL		*$116,064*	*0*	
Option L				
20 Third Avenue, Somerville	Commercial/industrial building	$120,420	74	Full
44-48 Third Avenue, Somerville	Commercial/industrial building	$138,005	0	Full
70 Inner Belt Road, Somerville	Commercial/industrial lot	$30,976	0	Partial (parking lot)
200 Inner Belt Road, Somerville	Commercial/industrial lot	$33,040	0	Partial (southern Corner)
SUBTOTAL		*$322,440*	*74*	
Mirror H				
NorthPoint Development Lot 17/A/2, Somerville	Pan Am Railways track	$56,222	0	Partial
NorthPoint Development Lot 1A-102, Cambridge	Pan Am Railways track	$78,411	0	Partial
NorthPoint Development Lot 0202190050, Boston	Pan Am Railways track	$2,993	0	Partial
SUBTOTAL		*$137,627*	*0*	

a Annual property taxes for partial acquisitions are prorated based on the square footage taken from each parcel.
b Somerville Assessor's Office: Fiscal Year 2010 tax rate = $20.44 per $1,000 assessed value (commercial).
c Cambridge Assessor's Office: Fiscal Year 2010 tax rate = $18.75 per $1,000 assessed value (commercial).
d Boston Assessor's Office: Fiscal Year 2010 tax rate = $29.38 per $1,000 assessed value (commercial).
e Jobs estimated based on data from InfoUSA and publicly-available data. Municipal buildings are assumed to relocate within the same city and cause no net change. Vacant buildings are assumed to have no jobs under existing conditions.

Table 2-11 Property Tax Decreases by City for Yard 8, Option L, and Mirror H

	Somerville		Cambridge		Boston	
Alternative	Tax revenue decrease	% of City total	Tax revenue decrease	% of City total	Tax revenue decrease	% of City total
Yard 8	$116,064	0.12	$0	0.00	$0	0
Option L	$322,440	0.33	$0	0.00	$0	0
Mirror H	$56,222	0.05	$78,411	0.03	$2,993	0.0002

Table 2-12 summarizes the job displacements or relocations for each city. Option L would displace or relocate 74 jobs in Somerville. Many of the jobs displaced would likely be relocated or replaced within Somerville. Cambridge and Boston would lose zero jobs for either maintenance facility alternative selected.

Table 2-12 Estimated Job Decreases or Relocations for Yard 8, Option L, and Mirror H

Alternative	Somerville	Cambridge	Boston	TOTAL
Yard 8	0	0	0	0
Option L	74	0	0	74
Mirror H	0	0	0	0
Work Force in City	*47,026*	*55,737*	*347,611*	

Source: U.S. Census Bureau, 2006-2008 American Community Survey
(Total work force included to demonstrate scale of impacts.)

Yard 8

The total estimated annual property tax value of the land and buildings acquired for Yard 8 is $116,064. These acquisitions would reduce annual property tax revenue by 0.12 percent in Somerville.

Yard 8 would not require the displacement or relocation of any jobs. Table 2-12 summarizes the job displacements or relocations for each city.

Option L

The total estimated annual property tax value of the land and buildings acquired for Option L is $322,440. These acquisitions would reduce annual property tax revenue by 0.33 percent in Somerville.

Table 2-12 summarizes the job displacements or relocations for each city. Option L would displace or relocate approximately 74 jobs in Somerville. Many of the jobs displaced would likely be relocated or replaced within Somerville.

This change would not represent a significant fraction of the jobs in Somerville. By comparison, the 2006-2008 U.S. Census estimated the workforce of Somerville at 47,026 workers. Although it is uncertain how many of the jobs displaced under Option L are held by local residents rather than commuters, the small scale of the job displacements relative to the workforce makes it clear that the jobs at stake represent at most a minor economic impact.

Mirror H

The total estimated annual property tax value of the land and buildings acquired for Mirror H is $137,627. These acquisitions would reduce annual property tax revenue by 0.05 percent ($56,222) in Somerville, 0.03 percent ($78,411) in Cambridge and 0.0002 percent ($2,993) in Boston. At the time of this analysis, discrepancies in City property limits between Somerville and Cambridge were found and are being reviewed. These annual tax revenue estimates are subject to change based on the resolution of city limits.

Mirror H would not require the displacement or relocation of any jobs.

2.5.6 Title VI and Environmental Justice

The EEA established an Environmental Justice Policy in 2002, in accordance with Title VI of the Civil Rights Act of 1964, to help address the disproportionate share of environmental burdens experienced by lower-income people and communities of color who, at the same time, often lack environmental assets in their neighborhoods. The policy is designed to help ensure their protection from environmental pollution as well as promote community involvement in planning and environmental decision-making to maintain and/or enhance the environmental quality of their neighborhoods. All major elements of the proposed Green Line Extension Project must meet the standards set forth by this Policy.

The Project must also comply with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directing Federal agencies to address environmental injustices in their operations and in communities across the country. The Executive Order requires that each Federal agency shall, to the greatest extent allowed by law, administer and implement its programs, policies, and activities that affect human health or the environment so as to identify and avoid "disproportionately high and adverse" effects on minority and low-income populations.

The U.S. Department of Transportation (DOT) also established its own policy to actively ensure nondiscrimination under *Title VI of the 1964 Civil Rights Act* in Federally funded activities, *DOT Order on Environmental Justice to Address Environmental Justice in Minority Populations and Low-Income Populations (DOT Order 5610.2)*, which the Project must comply with. *DOT Order 5610.2* summarizes and expands on the requirements of *Executive Order 12898* and describes the process for incorporating environmental justice principles into all DOT existing programs, policies, and activities. As shown on Figure 2-11, all three maintenance facility alternatives are within designated environmental justice areas, as is much of the overall Green Line Extension Project corridor.

Yard 8

Yard 8 would require acquiring two pieces of land on Inner Belt Road: the existing Yard 8 at 0 Inner Belt Road and an undeveloped area at 200 Inner Belt Road. Like all other maintenance facility sites considered, this site is within a designated environmental justice area. However, no buildings would be acquired or demolished and no residential land would be acquired, resulting in no direct effect on local environmental justice populations.

The Yard 8 maintenance facility site is in an existing industrial area in between the MBTA Fitchburg and Lowell Lines. The noise from the maintenance facility is included in the overall noise analysis presented in DEIR/EA Section 5.7, *Noise*, and in Section 3.3, *Noise*, of this FEIR Appendix B. Potential severe noise impact is projected at the Brickbottom Artists Building, the Hampton Inn Hotel, the Glass Factory Condominiums, the future 22 Water Street residential development and the future Archstone Phase II – Site 1. Potential moderate noise impact is projected at the existing NorthPoint Tango and Sierra properties, prior to mitigation. Noise from the mainline operations is the dominant factor in future noise levels at these receptors.

Sound insulation of residences to improve the outdoor-to-indoor noise reduction or noise barriers are potential mitigation measures for these existing properties. The need and effectiveness of building sound insulation for interior spaces would be assessed in the next phase of project development. There would be no moderate or severe impacts from noise after mitigation is implemented. With no other residential populations nearby, there would be no disproportionate impact to environmental justice populations due to the Yard 8 maintenance facility.

The building for the maintenance facility would result in a moderate change to the local visual environment by introducing an additional industrial building to this largely commercial/industrial neighborhood. In the absence of the proposed maintenance facility, the site selected may be redeveloped for other uses that would have similar or greater impacts on the local neighborhood. The proposed maintenance facility building site is zoned for industrial use and other related uses.

Overall, the placement of the maintenance facility in an existing industrial district would not result in any substantial changes to the local environment. There would be no disproportionate impact to environmental justice populations due to Yard 8.

Option L

Two buildings would be acquired and demolished as part of Option L. However, no residential land would be acquired, resulting in no direct effect on local environmental justice populations.

Under Option L, 74 jobs would be displaced in an environmental justice area. While the analysis cannot assume that the employees of these businesses are local residents, the local racial makeup and economic status provides the best available indicator for the affected populations. As discussed in Section 3.6, *Socioeconomic Impacts*, of this FEIR Appendix B, the displacement of these jobs does not represent a substantial economic change for the local area.

The proposed maintenance facility site is in an existing industrial area in between the MBTA Fitchburg and Lowell Lines. The noise from the maintenance facility is included in Section 3.3, *Noise,* of this FEIR Appendix B. Potential severe noise impact is projected at the Brickbottom Artists Building, the Hampton Inn Hotel, the Glass Factory Condominiums, the future 22 Water Street residential development and the future Archstone Phase II – Site 1. Potential moderate noise impact is projected at the existing NorthPoint Tango and Sierra properties, prior to mitigation. Noise from the mainline operations is the dominant factor in future noise levels at these receptors.

Sound insulation of residences to improve the outdoor-to-indoor noise reduction or noise barriers are potential mitigation measures for these existing properties. The need and effectiveness of building sound insulation for interior spaces would be assessed in the next phase of project development. There would be no moderate or severe impacts from noise after mitigation is implemented. Therefore, there would be no disproportionate environmental justice impacts from the proposed maintenance facility.

The building for the maintenance facility would change the local visual environment slightly by introducing an additional industrial building to this largely commercial/industrial neighborhood.

Overall, the placement of the maintenance facility in an existing industrial district would not result in any substantial changes to the local environment. There would be no disproportionate impact to environmental justice populations due to Option L.

Mirror H

Mirror H would require acquiring partial pieces of land owned by Pan Am Railways and planned for the future NorthPoint development project. However, no buildings would be acquired or demolished, and no residential land would be acquired, resulting in no direct effect on local environmental justice populations.

The proposed maintenance facility site is in an existing industrial area south of the MBTA Fitchburg Line. The noise from the maintenance facility is included in Section 3.3, *Noise,* of this FEIR Appendix B. Potential severe noise impact is projected at the Brickbottom Artists Building, the Hampton Inn Hotel, the Glass Factory Condominiums, four future properties in the NorthPoint development (Sites 1, 2, 3 and 4), the future 22 Water Street residential development and the future Archstone

Phase II – Site 1, prior to mitigation. Potential moderate noise impact is projected at one future property in the NorthPoint development (Site 5) and two existing properties (Tango and Sierra). Noise from the mainline operations is the dominant factor in future noise levels at the Brickbottom Artists Building, Hampton Inn Hotel, Glass Factory Condominiums, the existing NorthPoint properties Tango and Sierra and future residential development at 22 Water Street and Archstone Phase II – Site 1. Sound insulation of residences to improve the outdoor-to-indoor noise reduction or noise barriers are potential mitigation measures for these existing properties. The need and effectiveness of building sound insulation for interior spaces would be assessed in the next phase of project development. There would be no moderate or severe impacts from noise after mitigation is implemented. Therefore, there would be no disproportionate environmental justice impacts from the proposed maintenance facility.

Noise from Mirror H is the dominant project-related noise source at the five future NorthPoint properties (Sites 1, 2, 3, 4 and 5). It is assumed that future properties at the NorthPoint development would have noise-sensitive receptors at upper-floor residences, which would not benefit from a noise barrier for potential mitigation of noise impact from stationary cars in the storage yard. Since the proposed development is not currently under construction and is assumed to be completed by 2030, after the completion of the Green Line Extension Project, the buildings could be designed with consideration of the noise environment (i.e. windows with high transmission loss or STC ratings) to mitigate potential impact.

The building for the maintenance facility would change the local visual environment slightly by introducing an additional industrial building to this largely commercial/industrial neighborhood. In the absence of the proposed maintenance facility, the site selected may be redeveloped for other uses that would have similar or greater impacts on the local neighborhood.

Overall, the placement of the maintenance facility in an existing industrial area would not result in any substantial changes to the local environment. There would be no disproportionate impact to environmental justice populations due to Mirror H.

2.5.7 Visual Resources

This section compares the direct visual impacts from the three maintenance facility alternatives. The support facility would be an enclosed building, resulting in minimal light exposure to the surrounding area. Any outdoor lighting would be directed downward and towards the building with fixture hoods to prevent any direct lighting impacts at night on neighboring buildings.

Moreover, the aesthetic features of the exterior of the maintenance facility structure would enhance the possibility of quality redevelopment nearby. Heavy visual screening by landscaping or walls would be considered, especially adjacent to the

outdoor rail car storage area. Consideration would be given to the development of a deck for parking or other purposes over the storage yard, which would provide weather protection to the Green Line cars while screening the visual impacts.

Yard 8

Yard 8 has been in continuous use as a rail facility since 1835, and train cars would use the layover tracks mostly at night. The support facility building would be directly across the right-of-way from the Brickbottom Artists Building. The building would be easily visible from the east-facing windows of the Brickbottom Artists Building. Given the existing industrial and commercial buildings visible from this area, the support facility would result in a moderate change to the local landscape by adding a new industrial building.

Option L

Option L is immediately adjacent to the MBTA's BET, on the northwest. Option L is along the southern and southeastern fringe of the existing Inner Belt industrial area. The vehicle storage yard is proposed at the southern end of the Inner Belt Road just north of the MBTA Fitchburg Line on vacant private property and land that is currently an unused parking lot for 70 Inner Belt Road. The maintenance building would be south of Third Avenue and east of the existing building at 70 Inner Belt Road.

A maintenance facility at Option L would require the demolition of two buildings and the construction of a new building. The building would be less visible from the Brickbottom Artists Building than would Yard 8. Given the existing industrial and commercial buildings visible from this area, the support facility would result in a minor change to the local landscape.

Mirror H

Mirror H straddles portions of the NorthPoint site and a portion of MBTA-owned land. This alternative locates the facility at the north side of the proposed NorthPoint development and partly on MBTA land south of the BET, and represents a plan that places new light rail facilities next to existing MBTA Commuter Rail facilities. A support facility in this location would result in some visual changes to the local area. A single storage yard would be in Cambridge to the west of the maintenance building in Somerville. Some of the auto parking, as well as the tail tracks and loop east of the maintenance building, would be in Boston.

The support facility building would be directly across the right-of-way from the proposed NorthPoint buildings. The building would be easily visible from the

northern-facing windows of the proposed NorthPoint buildings. Given the existing industrial (MBTA's BET facility) and commercial buildings visible from this area, the support facility would result in a minor change to the local landscape by constructing a new building.

2.5.8 Wetlands

There are no state- or Federally-regulated wetlands within the Yard 8, Option L, or Mirror H sites. Therefore, there would be no wetland impacts created by developing any chosen maintenance alternative.

2.5.9 Stormwater Management

The proposed maintenance facility would be constructed in previously-developed areas and would be designed to meet the Massachusetts Stormwater Management Standards for redevelopment. Maintenance activities (such as light rail vehicle washing) would be conducted inside the maintenance building and are anticipated to contribute to stormwater. Stormwater from the site would discharge to an existing storm drain system and would not discharge directly to any wetlands.

The MBTA would need to apply for coverage under the EPA Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP) for the maintenance facility.[10] This general permit requires numerous control measures and operational plans to control spills, manage potential contaminant sources, and prevent the impairment of any water bodies receiving runoff from industrial facilities.

A new EPA National Pollutant Discharge Elimination System (NPDES) permit for an industrial use would be required. This permit would require a new Stormwater Pollution Prevention Plan (SWPPP) to address maintenance and monitoring and a Spill Prevention, Control, and Countermeasures (SPCC) plan to demonstrate vigilance and preparedness for hazardous spills. The storage tracks would have collection trays to catch any incidental drips, leaks, or spills of hazardous materials that may occur during maintenance or storage. The collection trays would be connected to an oil/water separator that would separate petroleum products from stormwater runoff prior to discharge. Any oil or other hazardous materials stored at the site would be secured with secondary containment structures to catch any spills. With the proposed containment measures in place, the maintenance and storage

10 The Multi-Sector General Permit for Stormwater Discharges (MSGP) is part of the National Pollutant Discharge Elimination System (NPDES), which requires permits for various stormwater and industrial discharges in order to prevent the contamination and impairment of receiving waters. The EPA is responsible for issuing NPDES permits in Massachusetts, and the permits are also reviewed by MA DEP. The MSGP covers most types of industrial discharges and requires general control measures as well as specific measures tailored to specific industrial uses. Industrial facilities applying for coverage under the MSGP must demonstrate compliance with all requirements and submit copies of their SWPPPs and SPCCs for review.

facility would not pose a significant risk to any surface or groundwater resources in the vicinity of either site.

Yard 8

Yard 8 would add 2.6 acres of impervious surfaces to the site. Approximately 54 percent of the new total impervious area (approximately 2.7 acres) would be roof area, which is expected to be clean. The stormwater management system would include many of the same features found in the station and railway drainage. Proposed management measures include:

- Deep sump catch basins to collect runoff from paved areas;
- Hydrodynamic particle separators to treat pavement runoff;
- Roof drains from building connected to an underground pipe storm drainage system;
- Underground infiltration chambers to store and infiltrate runoff; and
- Overflow outlets from the infiltration chambers to direct excess flow into the municipal storm drainage system in Inner Belt Road.

The stormwater system would be designed to ensure no net increase in peak flow to the existing municipal drain line in Inner Belt Road.

Option L

Option L would reduce existing impervious surfaces by about 3.2 acres. Approximately 40 percent of the new total impervious area (approximately 3.4 acres) would be roof area, which is expected to be clean. The stormwater management system would include many of the same features found in the station and railway drainage. Proposed management measures include:

- Deep sump catch basins to collect runoff from paved areas;
- Hydrodynamic particle separators to treat pavement runoff;
- Roof drains from building connected to an underground pipe storm drainage system;
- Underground infiltration chambers to detain and infiltrate runoff; and
- Overflow outlets from the detention chambers to direct excess flow into the existing MBTA Fitchburg Line Main Drain, which crosses the eastern portion of this site.

The stormwater system would be designed to ensure no net increase in peak flow to the existing MBTA drain line.

Mirror H

Mirror H would reduce existing impervious surfaces (pavement) by about 0.4 acres. Approximately 47 percent of the new total impervious area (approximately 2.2 acres) would be roof area, which is expected to be clean. The stormwater management system would include many of the same features found in the station and railway drainage. Proposed management measures include:

- Deep sump catch basins to collect runoff from paved areas;
- Hydrodynamic particle separators to treat pavement runoff;
- Roof drains from building connected to an underground pipe storm drainage system;
- Underground storage chambers to detain runoff;
- Underground filtration basin to provide additional TSS removal (in lieu of infiltration); and
- Overflow outlets from the detention chambers to direct excess flow into the existing MBTA Fitchburg Line Main Drain, which crosses the eastern portion of this site.

Infiltration is not advised, as there is ongoing groundwater remediation in this area. The stormwater system would be designed to ensure no net increase in peak flow to the existing MBTA drain line.

2.5.10 Hazardous Materials

This section discusses the potential presence of oil and/or hazardous materials (OHM) on or adjacent to the proposed maintenance facility alternatives for the proposed Green Line Extension Project.

To assess the potential for encountering OHM, Phase I Environmental Site Assessments (ESAs) were performed as per the American Society for Testing Materials (ASTM) 1527-05 Standard and All Appropriate Inquiries (AAI) pursuant to 40 CFR Part 312. The purpose of the Phase I ESAs is to identify Recognized Environmental Conditions (RECs) in connection with the properties, to the extent feasible pursuant to the process described in the Standard. The Phase I ESAs were completed utilizing the Standard as guidance.

The scope of services provided for the Phase I ESAs included the following:

- Performed a computer database search of Federal and state files. The Federal databases included the current Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS), National Priorities List (NPL), Resource Conservation and Recovery Act (RCRA) Transportation,

Storage and Disposal (TSD), RCRA Generators, and Emergency Response Notification System (ERNS) list. The state databases included the state equivalent CERCLIS list, spills, Underground Storage Tanks (USTs), Solid Waste Landfills (SWL), and public water supply lists.

- Reviewed available Massachusetts Department of Environmental Protection (MassDEP) files to provide more information about reported releases of OHM identified through the database search on or adjacent to the sites. The MassDEP files provided additional information regarding past ownership; historic site usage; past usage, storage and disposal of OHM on and adjacent to the subject site; and other evidence of potential environmental impacts.
- Reviewed available municipal and historic files to help confirm ownership history and past usage. Resources included tax records, aerial photographs, Board of Health Department records, Building Department records, Fire Department records, Conservation Commission records, and Sanborn fire insurance maps. The site history review also identified reports of historic spills, disposal areas, or other past releases of OHM on or adjacent to the properties.
- Reviewed previous site documents including an ESA, if applicable and/or available for review.
- Performed a partial site reconnaissance from public roadways to observe each site for overt evidence of a release or threat of release of oil and/or hazardous materials within exterior portions of the entire property. The uses of abutting properties were also documented. No interior inspections were conducted.
- Areas of property acquisition were assessed as discussed above. Properties already owned by the MBTA or the Commonwealth of Massachusetts were not assessed. Notable deviations from the standard include not inspecting interior portions of buildings, interviews with knowledgeable personnel were not conducted, and a user questionnaire was not completed.

The findings of the Phase I Environmental Site Assessments conducted for the three maintenance facility alternatives indicate that all of the proposed maintenance facilities encompass and abut sites of known and suspected OHM contamination. All three alternatives would likely be impacted by fill material present throughout the area, the historic use of the properties for railroad operations, present industrial use of the property, and several documented disposal sites detailed below. Asbestos containing materials (ACM) and/or lead-based paint may be present in site structures or fill piles in the location of the proposed maintenance facilities; therefore, a detailed survey is recommended prior to acquisition or demolition.

The purpose of this analysis was to identify and compare the number of RECs in connection with each maintenance facility site. RECs that are deemed to have a high potential impact consists of sites such as those confirmed with soil, groundwater, and/or indoor air impacts that were reported to the MassDEP and have undergone some type of cleanup or remain an active case. RECs that are deemed to have a

medium potential impact consist of properties such as those with potential sources of OHM with limited or inconclusive information.

It is recommended that upon selection of the preferred maintenance facility site, that subsequent investigation be conducted to identify specific contaminants and associated clean-up costs. On-site contamination encountered would be assessed and, if necessary, remediated prior to and during construction activities. Any necessary response actions would be performed in accordance with the Massachusetts Contingency Plan (MCP).

Yard 8

Based upon the research review conducted for the Phase I ESA, seven RECs are believed to be associated with Yard 8 (off-site releases were consolidated into one REC), comprised of the properties identified in Table 2-13.

Table 2-13 RECs and Potential Impacts for Yard 8

Station/Facility	REC(s)	RTN(s)	Relative Impact
Maintenance Facility	Historic Use of Site at Rail Yard (all Yard 8 parcels)	Not applicable	Medium
	Releases of Petroleum at Nearby Properties (all Yard 8 parcels)	See below[a]	Medium
	Releases of Hazardous Materials (Metals, PCBs, and Unknown Chemicals) at Nearby Properties	See below [b]	Medium
	Release of Petroleum at 100 Inner Belt Road and Petroleum Storage at 70 Inner Belt Road (Currently a portion of the same parcel)	RTN 3-974	Medium
	Release of Arsenic and PCBs at 120 Inner Belt Road	RTN 3-19075	Medium
	Releases of Petroleum at and Current use of MBCR Maintenance Facility at 70R Third Avenue	See below[c]	Medium
	Releases at Yard 8 (Phosphorous trichloride, PCBs, and petroleum)	RTN 3-4222	High

a RTN 3-11444, 3-13082, 3-23562, 3-21316, 3-13535, 3-11570, 3-18392, 3-13854 , 3-11570
b RTN 3-23246, 3-3364, 3-13471, 3-16583, 3-2312, 3-2534
c N90-1956, N90-0236, N90-1810, N93-0627, N93-0705, RTNs 3-24428, 3-22276, 3-26988, 3-22964, 3-23114, 3-18363

Option L

Based upon the research review conducted for the Phase I ESA, seven RECs are believed to be associated with Option L, comprised of the properties identified in Table 2-14.

Table 2-14 RECs and Potential Impacts for Option L

Station/Facility	REC(s)	RTN(s)	Relative Impact
Maintenance Facility	Historic Use of Site as Railroad Yard (all Option L parcels)	Not applicable	Medium
	Use of 48 Third Avenue as a Printing Facility	Not applicable	Medium
	Release of Petroleum at 100 Inner Belt Road and Petroleum Storage at 70 Inner Belt Road (Currently same parcel)	RTN 3-974	High
	Former Condition of 140-200 Inner Belt Road	Not applicable	Medium
	Release of Arsenic and PCBs at 120 Inner Belt Road	RTN 3-19075	Medium
	Releases at Yard 8 (Phosphorous trichloride, PCBs, and petroleum)	RTN 3-4222	High
	Releases of Petroleum at and Current use of MBCR Maintenance Facility at 70R Third Avenue	See below[a]	Medium

a N90-1956, N90-0236, N90-1810, N93-0627, N93-0705, RTNs 3-24428, 3-22276, 3-26988, 3-22964, 3-23114, 3-18363

Mirror H

Based upon the research review conducted for the Phase I ESA, six RECs are believed to be associated with Mirror H, comprised of the properties identified in Table 2-15.

Table 2-15 RECs and Potential Impacts for Mirror H

Station/Facility	REC(s)	RTN(s)	Relative Impact
Maintenance Facility	Historic Use of Site as Railroad Yard (all Mirror H parcels)	Not applicable	Medium
	Fill Material Associated with Millers River (all Mirror H parcels)	Not applicable	Medium
	Current Condition of the Site	Not applicable	Medium
	Release of Petroleum at MBTA Commuter Rail maintenance facility, 29 East Street	RTN 3-2534	High
	Releases of Petroleum at and Current use of MBCR maintenance facility at 70R Third Avenue	See below[a]	Medium
	Releases at the former B&M Railroad Yard (now Pam Am Railways)(all Mirror H parcels)	RTN 3-12277 and RTN 3-11533	High

a N90-1956, N90-0236, N90-1810, N93-0627, N93-0705, RTNs 3-24428, 3-22276, 3-26988, 3-22964, 3-23114, 3-18363

2.5.11 Historic and Archaeological Resources

The Green Line Extension Project Area of Potential Effects (APE) for historic resources includes the area extending approximately 125 feet, or one assessor's lot, on either side of the Proposed Project's Medford and Union Square Branch routes, associated proposed station locations, and maintenance and/or interim train storage facilities.

The APE for historic resources, in accordance with 36 CFR 800.16(d) is defined as "the area or areas within which an undertaking may directly, indirectly, or cumulatively cause changes in the character or use of historic properties (defined as

resources listed or eligible for listing in the National Register), if any such properties exist there."[11] Therefore, the APE includes other areas where the undertaking could cause changes in land use, traffic patterns, or other aspects that could affect historic properties. Factors with potential to cause changes are noise, vibration, visual (setting), traffic, atmospheric, construction, indirect, and cumulative impacts. Different project factors may produce more than one APE for a given undertaking.

The APE for archaeological resources is limited to the construction areas for the proposed maintenance facility alternatives.

There are no historic resources or recorded archaeological sites located within the APE for any alternative site. However, the presence of deeply buried archaeologically sensitive strata below the railroad and modern fill soils is considered possible at all of the proposed maintenance facility alternatives. Further research including a review of soil borings is recommended prior to construction to determine if archaeologically sensitive strata may be impacted by the construction of the maintenance facility.

2.5.12 Public Parks, Recreation Areas, and Conservation Land

There are no public parks, recreation areas or conservation land areas within or adjacent to the proposed Yard 8, Option L, or Mirror H maintenance facility areas; therefore, there would be no impacts to parks or conservation land.

2.5.13 Consistency with Federal, State, and Local Planning

This section compares the consistency and compatibility of each maintenance facility site to other planned Federal, state and local planning initiatives. Figures 2-5 through 2-7 show the existing land uses in the vicinity of the maintenance facility alternatives, and Figure 2-12 shows a generalized zoning map for the communities of Cambridge and Somerville.

Yard 8 and Option L would be compatible locations for the maintenance facility because these alternatives are in the middle of an industrial area. Option L would likely have the least transit oriented development (TOD) potential since it is the farthest away from proposed stations. Option L, in terms of future land use impacts, would likely be the most consistent with local development plans. Mirror H would be less compatible with state and local planning initiatives.

11 Advisory Council on Historic Preservation. United States 36 Code of Federal Regulations, Part 800 – *Protection of Historic Properties.* http://www.achp.gov/regs-rev04.pdf.

Yard 8

Yard 8 is compatible with the potential future Urban Ring project, the Somerville Community Path, and the North-South Rail Link project. Yard 8 within the City of Somerville is zoned Industrial A (IA).

The proposed vehicle maintenance building and overnight rail car storage area are compatible with much of the existing industrial land uses along this segment of the railroad corridor. However, its development character and impacts may potentially affect future non-industrial development opportunities in adjacent areas.

The facility would be similar in appearance to other MBTA maintenance facilities serving the Green Line (e.g., Riverside and Reservoir). To encourage planned mixed use development near the Brickbottom Station and in the Inner Belt area, consistent with City of Somerville planning policies for the area, mitigation measures may be necessary. The design of an aesthetic building facade, the enabling of potential air rights development (perhaps through zoning amendments), and dense screening landscaping may be necessary to create a more compatible facility with future non-industrial land uses.

Option L

Option L does not preclude the potential future Urban Ring project, the Somerville Community Path, or future North-South Rail Link project. Option L within the City of Somerville is zoned Industrial A (IA).

The vehicle maintenance building and overnight rail car storage area are compatible with much of the existing industrial land uses along this segment of the railroad corridor. However, its development character and impacts may potentially affect future non-industrial development opportunities in adjacent areas.

The facility would be similar in appearance to other MBTA maintenance facilities serving the Green Line (e.g., Riverside and Reservoir). To encourage planned mixed use development near the Brickbottom Station and in the Inner Belt area, consistent with City of Somerville planning policies for the area, mitigation measures may be necessary. The design of an aesthetic building facade, the enabling of potential air rights development (perhaps through zoning amendments), and dense screening landscaping may be necessary to create a more compatible facility with future non-industrial land uses.

Mirror H

Mirror H does not preclude the potential Urban Ring and Somerville Community Path projects. However, Mirror H could preclude the future North-South Rail Link

project and the future expansion planned for the BET facility, both of which are programmed within the MBTA's existing property limits. The portion of Mirror H within Somerville is zoned Industrial B (IB). The portion of Mirror H within Cambridge is designated as zoned NorthPoint Residence District PUD (NP PUD-6). Zoning in the NorthPoint District is primarily residential, with retail, office uses and community services. The land in Boston that is adjacent to the proposed NorthPoint development is zoned as a Local Industrial Subdistrict (LI). Mirror H would be less compatible to local planning initiatives than Option L or Yard 8 as the industrial use of this facility would be adjacent to a lot of zoned residential developments.

Most of the underused land between the Mirror H site and the proposed relocated Lechmere Station site, however, is already programmed as part of the NorthPoint development project, which is projected to occupy 46.3 acres and 20 buildings when completed. Full build-out of these developments would be made more attractive by construction of the Green Line Extension, which would make the area more accessible to a larger region.

Farther east and adjacent to the NorthPoint project is the Charles E. Smith/Archstone residential development. Phase I, which includes 437 rental units, was completed in 2007. Phase II is permitted for 426 units. Construction had not yet begun on Phase II as of March 2010.

Directly adjacent to Mirror H is the 2.4 acre site for a 392 unit triple-tower residential/parking/open space project proposed by Catamount Holdings. The development would occupy the vacant site of the former headquarters of the Mac Gray Company at 22 Water Street, behind the Hampton Inn Hotel on O'Brien Highway. The project has been approved by the Cambridge Planning Department.

Additional land use impacts in the station area are uncertain, as there are few other vacant sites available for development. However, the improved Lechmere Station and the proposed future developments are likely to increase land values in the area, making existing underused parcels attractive sites for potential redevelopment.

The vehicle maintenance building and overnight rail car storage area are compatible with much of the existing industrial land uses along this segment of the railroad corridor. However, its development character and impacts would affect future non-industrial development opportunities in adjacent areas.

2.5.14 Community Path

The choice of maintenance facility site would have no impact on the feasibility of the Somerville Community Path extension between Lowell Street and Inner Belt Road, as described in Appendix E of the DEIR/EA.

MassDOT is committed to completing all planning, design, and engineering work - including the identification of necessary property acquisitions - for the proposed extension of the Somerville Community Path between Lowell Street and Inner Belt Road. The limits of the path were predicated on the connections to Lechmere being made through the Inner Belt area via Inner Belt Road and the proposed Urban Ring Bridge into the Lechmere area. However, the cessation of planning for the Urban Ring project has changed this anticipated connection. MassDOT is unable to assume responsibility for designing the Urban Ring Bridge as part of the Green Line Extension Project. That being said, MassDOT is committed to working with the City of Somerville, residents and businesses in the Brickbottom and Inner Belt neighborhoods, and Community Path advocates to design the Path in such a way so as to create improved connectivity within the Brickbottom and Inner Belt neighborhoods and between the Community Path and the Green Line Extension.

2.5.15 Summary of Environmental Findings

Table 2-16 summarizes the findings of the environmental findings of the three maintenance facility alternatives – Yard 8, Option L and Mirror H. None of the maintenance facility alternatives are expected to impact air quality, parking or traffic operations, wetlands, historic and archaeological resources, public parks, recreation areas, or conservation land.

Two existing NorthPoint buildings (Tango and Sierra) would be moderately impacted by noise, prior to mitigation, under each alternative. In addition, Mirror H would moderately impact noise levels at one future NorthPoint property (Site 5). Three existing buildings (Brickbottom Artists Building, Hampton Inn Hotel, and Glass Factory Condominiums) and two future buildings (the proposed 22 Water Street and the proposed Archstone Development - Phase II, Site 1) would be severely impacted by noise, prior to mitigation, under each alternative. In addition, Mirror H would severely impact noise levels at four future NorthPoint properties (Sites 1, 2, 3 and 4).

The Brickbottom Artists Building would be impacted by vibration due to the presence of a double crossover at Mirror H, approximately 50 feet away, between the mainline and maintenance tail track. There are no vibration impacts projected at any receptors directly from yard movements at Yard 8 or Option L.

Table 2-10 provides the property tax effects of Yard 8, Option L, and Mirror H. The total estimated annual property tax value of the land and buildings acquired for Yard 8 is $116,064. These acquisitions would reduce annual property tax revenue by 0.12 percent in Somerville. Yard 8 would not require the displacement or relocation of any jobs.

The total estimated annual property tax value of the land and buildings acquired for Option L is $322,440. These acquisitions would reduce annual property tax revenue

by 0.33 percent in Somerville. Option L would displace or relocate approximately 74 jobs in Somerville. Many of the jobs displaced would likely be relocated or replaced within Somerville.

The total estimated annual property tax value of the land and buildings acquired for Mirror H is $137,627. These acquisitions would reduce annual property tax revenue by 0.05 percent ($56,222) in Somerville, 0.03 percent ($78,411) in Cambridge and 0.0002 percent ($2,993) in Boston. Mirror H would not require the displacement or relocation of any jobs.

Given the existing industrial and commercial buildings visible from this area, the Yard 8 support facility would result in a moderate change to the local landscape. Option L and Mirror H would result in a minor change to the local landscape.

The stormwater system at Yard 8 would be designed to ensure no net increase in peak flow to the existing municipal drain line. The Option L and Mirror H stormwater systems would be designed to ensure no net increase in peak flow to the existing MBTA drain line. Yard 8 would increase the amount of impervious area by approximately 2.6 acres, while Option L and Mirror H would reduce impervious area by approximately 3.2 acres and 0.4 acres, respectively.

All three maintenance facility sites encompass and abut sites of known and suspected OHM contamination. All three alternatives would likely be impacted by fill materials present throughout the area, the historic use of the properties for railroad operations, present industrial use of the property, and several documented disposal sites. Seven RECs are believed to be associated with Yard 8 and Option L, while six RECs are believed to be associated with Mirror H.

Because ACM and/or lead-based paint may be present in site structures or fill piles in the location of the proposed maintenance facilities, a detailed survey is recommended prior to acquisition or demolition. It is recommended that upon selection of the preferred maintenance facility site, that subsequent investigation be conducted to identify specific contaminants and associated clean-up costs. On-site contamination encountered would be assessed, and, if necessary, would be remediated prior to and during construction activities. Any necessary response actions would be performed in accordance with the MCP.

Yard 8 and Option L would be compatible locations for the maintenance facility because these alternatives are in the middle of an industrial area. The land required for the Option L site would likely have the least TOD potential since it is the farthest away from proposed stations. Option L, in terms of future land use impacts, would likely be the most consistent with local development plans. Mirror H would be less compatible site to state and local planning initiatives. The choice of maintenance facility site would have no impact on the feasibility of any alternative alignment for the Community Path.

Table 2-16 Comparison of Yard 8, Option L, and Mirror H - Environmental Analysis

CRITERIA	YARD 8 Rationale	OPTION L Rationale	MIRROR H Rationale
Description	Adjacent to the proposed Green Line alignment and accessed from Inner Belt Road in Somerville	Adjacent to BET, outside the current BET fence line - along the southern and southeastern fringe of the existing Inner Belt industrial area	Partly on NorthPoint parcels C/D/E/F and storage on parcels A/B, and partly on MBTA land currently used for storage by BET
Capital Cost Estimate ($2008)	$79 million	$129 million	$82 million
Total acreage needed	11 acres	11 acres	11 acres
Property Acquisitions			
Number of Parcels	2 Parcels (200 Inner Belt Road, Somerville - partial; 0 Inner Belt Road, Somerville - full)	4 parcels (20 Third Avenue, Somerville [full]; 44-48 Third Avenue, Somerville [full]; 70 Inner Belt Road, Somerville [partial]); 200 Inner Belt Road, Somerville [partial]	NorthPoint Development lots A/B and C/D/E/F [partial], located partly in Cambridge and Somerville
Acreage to be Acquired	5.8 acres	10.2 acres	4.3 acres
Estimated Acquisition Cost	Approx. $15 M	Approx. $51 M	Approx. $11 M
Air Quality	No difference	No difference	No difference
Noise Impacts (cumulative = mainline operations and maintenance facility)			
Potential Moderate Impacts (prior to mitigation)	Two buildings (NorthPoint Properties - Tango and Sierra)	Two buildings (NorthPoint Properties - Tango and Sierra)	Two existing buildings (NorthPoint Properties - Tango and Sierra) and 1 future building (NorthPoint Properties - Site 5)
Potential Severe Impacts (prior to mitigation)	Three existing buildings (Brickbottom Artists Building, Hampton Inn Hotel, Glass Factory Condominiums) and two future buildings (22 Water Street and Archstone-Smith Development –Phase II, Site 1)	Three existing buildings (Brickbottom Artists Building, Hampton Inn Hotel, Glass Factory Condominiums) and two future buildings (22 Water Street and Archstone-Smith Development –Phase II, Site 1)	Three existing buildings (Brickbottom Artists Building, Hampton Inn Hotel, Glass Factory Condominiums) and six future buildings (NorthPoint Properties - Sites 1, 2, 3, and 4; 22 Water Street and Archstone-Smith Development – Phase II, Site 1)
Vibration (from maintenance facility only)	No difference	No difference	Presence of double crossover between mainline and maintenance tail track would impact Brickbottom Artists Building (50 feet away)
Traffic and Access	No measurable impact to parking or traffic operations. Access via Washington Street and Inner Belt Road.	No measurable impact to parking or traffic operations. No changes to Brickbottom Station. Access via Washington Street and Inner Belt Road.	No measurable impact to parking or traffic operations. Possible isolated impacts from access improvements to/from facility (extension of Water Street from O'Brien Highway to Mirror H). Timing of construction could be impacted if access required prior to Lechmere Station construction.
Socioeconomics			
Estimated Annual Tax Loss	Approx. $116,064 (reduction of 0.12 percent in Somerville)	Approx. $322,440 (reduction of 0.33 percent in Somerville)	Approx. $137,627 (reduction of 0.05 percent [$56,222] in Somerville, 0.03 percent [$78,411] in Cambridge and 0.0002 percent [$2,993] in Boston)
Estimated Job Displacement	0 jobs	74 jobs (minor overall economic impact compared to total Somerville workforce)	0 jobs
Title VI and Environmental Justice	No difference	Option L would displace or relocate approximately 74 jobs within Somerville (a minor economic impact relative to total Somerville workforce).	No difference
Visual Resources	Moderate visual change to current landscape	Minor visual change to current landscape	Minor visual change to current landscape
Wetlands	No difference	No difference	No difference
Stormwater Management	Stormwater system would be designed to ensure no net increase in peak flow to the existing municipal drain line in Inner Belt Road	Stormwater system would be designed to ensure no net increase in peak flow to the existing MBTA drain line	Infiltration not advised, ongoing groundwater remediation in area. Stormwater system would be designed to ensure no net increase in peak flow to the existing MBTA drain line.
Impervious Area	Increase of approximately 2.6 acres	Reduction of approximately 3.2 acres	Reduction of approximately 0.4 acres
Hazardous Materials	7 Recognized Environmental Conditions	7 Recognized Environmental Conditions	6 Recognized Environmental Conditions
Historic and Archaeological Resources	No difference	No difference	No difference
Public Parks, Recreation Areas, and Conservation Land	No difference	No difference	No difference
Consistency with Federal, State and Local Planning	Compatible location	Compatible location	Less compatible to state and local planning initiatives. Could preclude future North-South Rail Link project and the ability to expand the BET facility within existing MBTA property limits. Industrial architecture of building may be incompatible with intended residential/mixed-use developments already planned.

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2.6 Construction Impacts

This section discusses potential construction impacts related to the three maintenance facility alternatives. Construction impacts at any of the alternative sites would be generally the same. Table 2-17 provides a summary of anticipated construction impacts. Table 2-18 summarizes construction mitigation measures for the maintenance facility alternatives.

Table 2-17 Construction Impacts of Yard 8, Option L and Mirror H

Traffic ■ No impacts. ■ Temporary lane closures and temporary traffic detours could be required along O'Brien Highway during construction of Mirror H. However, this construction would also be necessary to construct the new Lechmere Station and would occur regardless of the alternative selected.
Air Quality ■ Dust and debris from construction of the maintenance facility. ■ Carbon dioxide emissions from diesel equipment used on-site during construction.
Noise ■ Noise emissions from construction equipment.
Vibration ■ Vibration from heavy construction equipment (e.g., pile drivers).
Water Quality/Stormwater ■ Temporary alterations to the existing stormwater drainage infrastructure during construction. ■ Potential oil/fuel leaks from construction equipment.
Hazardous Materials and Solid Waste ■ Hazardous, contaminated or special wastes could be generated during construction.
Historic and Archaeological ■ Archaeologically sensitive strata below the fill are possible at all the proposed maintenance facility alternatives. An intensive (locational) archaeological survey is recommended prior to construction to determine if archaeologically sensitive strata may be impacted by the construction of the maintenance facility.

Temporary, short-term impacts from construction activities would be mitigated to the extent practicable. Appropriate construction mitigation measures would be incorporated into the contract documents and specifications governing the activities of contractors and subcontractors constructing elements of the Green Line Extension Project, including the maintenance facility and storage yard. On-site resident engineers and inspectors would monitor all construction activities to ensure that mitigation measures are properly implemented. The construction mitigation measures are summarized in Table 2-18.

Table 2-18 Summary of Construction Mitigation Measures

Traffic
■ Temporary detours would be established to minimize traffic disruption due to construction.
Air Quality
■ Apply water to dry soil to prevent dust production. ■ Use water for compaction in the fill areas and as a dust retardant in both the soil cut areas and haul roads. ■ Follow existing MBTA retrofit procedures for construction equipment to reduce emissions.
Noise
■ Use specially quieted equipment with enclosed engines and/or high-performance mufflers. ■ Avoid nighttime construction. ■ Keep truck idling to a minimum. ■ Route construction equipment and vehicles through areas that would cause the least disturbance to nearby receptors where possible. ■ Fit any air-powered equipment with pneumatic exhaust silencers. ■ Locate stationary construction equipment as far as possible from noise-sensitive sites. ■ Construct noise barriers, such as temporary walls or piles of excavated material, between noisy activities and noise-sensitive receivers.
Vibration
■ Avoid nighttime construction. ■ Use alternative construction methods to minimize the use of impact and vibratory equipment (e.g. pile drivers and compactors).
Water Quality/Stormwater
■ Develop and implement a SWPPP in accordance with NPDES and MassDEP standards. ■ Stabilize any highly erosive soils with erosion control blankets and other stabilization methods, as necessary. ■ Reinforce slopes using a hydroseed mix with a resin base, native vegetation, or other approved methods. ■ Use dewatering controls, if necessary. ■ Install a gravel entrance to prevent sediment from being tracked onto roadways and potentially discharged to surface waters. ■ Maintain construction equipment to prevent oil and fuel leaks.
Hazardous Materials and Solid Waste
■ Implement special management procedures for any hazardous, contaminated or special wastes generated during construction, including special handling, dust control, and management and disposal of contaminated soil. Procedures should protect both workers and nearby receptors. ■ Perform subsurface investigations for any planned excavation to test for possible contamination. ■ Prepare a site-specific Health and Safety Plan. ■ Conduct pre-demolition inspections to identify any hazardous materials such asbestos and lead-based paint.

2.7 Summary

As described in the technical memorandum, the operational and environmental analyses indicated that both the Yard 8 and Option L sites were viable locations for a support facility for the Green Line Extension Project. Of the two, each has operational and environmental advantages and disadvantages.

The Secretary's Certificate noted that comments submitted on the DEIR expressed a widespread lack of support for the Yard 8 maintenance facility location. Comments on the DEIR expressed preferences for further evaluation of both Mirror H and Option L, as required by the Secretary's Certificate. Based on the information and comments submitted, MEPA believed "that the Option L may be the most feasible alternative and the one with fewest potential conflicts and impacts."

MassDOT reviewed and considered the comments received on the DEIR/EA along with the results of the environmental analysis and operational analysis to determine whether to substitute an alternative option for Yard 8 as the preferred site for the maintenance and storage facility. Option L was selected by MassDOT as the preferred site for the maintenance and storage facility for the following reasons:

- Option L received the greatest support from the public and local municipal representatives.
- Option L met the MBTA's program requirements for the Green Line maintenance and storage facility.
- Option L provides the most operational flexibility for the MBTA as it provides a direct connection to the Union Square Branch. Neither Yard 8 nor Mirror H would provide this operation.
- Option L is located adjacent to similar railroad land uses (the BET commuter rail maintenance facility).
- Option L would have more separation from existing and proposed residential areas than would Yard 8 or Mirror H.
- Option L would not preclude future development of the Inner Belt area and future roadway connections from the Brickbottom area to the Inner Belt area.

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3 Air Quality

3.1 Introduction

The Secretary's Certificate stated that the FEIR should include a narrative discussion clarifying the air quality modeling assumptions documented in the DEIR/EA, challenges associated with the inherent evolution of modeling programs and input data, and confirming that the air quality modeling results were conducted in a manner that sufficiently demonstrated consistency with the SIP.

The SIP is a comprehensive document, approved by the U.S. Environmental Protection Agency (EPA) that demonstrates that Massachusetts can comply with the National Ambient Air Quality Standards (NAAQS) for air pollutants regulated by the Federal Clean Air Act. Specific requirements of the SIP regarding transit improvements are incorporated into the Massachusetts Air Quality Regulations at 310 CMR 7.36(2) and were approved by the EPA on July 31, 2008.[1] This chapter addresses these requirements identified in the Secretary's Certificate.

3.2 Background

As discussed and further defined in the DEIR/EA, the Federal Clean Air Act contains provisions to ensure that major transportation projects improve air quality. These Transportation Conformity provisions of the Federal Clean Air Act are intended to integrate transportation and air quality planning. Guidance from both the EPA and MassDEP define the air quality modeling and review criteria for analyses prepared pursuant to the Federal Clean Air Act, Transportation Conformity, and the SIP.

1 Federal Register (Vol. 73, page 44654). *Approval and Promulgation of Air Quality Implementation Plans: Massachusetts - Amendment to Massachusetts' State Implementation Plan for Transit System Improvements*.

The Federal Clean Air Act and the SIP require that a Proposed Project not:

- Cause any new violation of the NAAQS;
- Increase the frequency or severity of any existing violations; or
- Delay attainment of any NAAQS.

With respect to the Green Line Extension, the Project is included in the SIP and therefore conforms to the Federal Clean Air Act requirements. The Project also complies with the requirements of the Massachusetts Air Quality Regulations. The air quality analysis included in the DEIR/EA demonstrates that the Proposed Project meets the Transportation Conformity planning and project level requirements. The DEIR/EA also calculated the emissions reductions that would result from the proposed Green Line Extension to College Avenue and Union Square. This analysis showed that the emission reductions for the 2009 SIP package, which includes the Proposed Project and other transit projects, exceed the emission reductions established by the EPA for Massachusetts transit projects (the 2008 Federal Register *SIP Approved Projects Plus Ten Percent Package*). The emission reductions were calculated following the same modeling protocol and procedures required for all Transportation Conformity and SIP air quality analyses.

3.3 DEIR Modeling Assumptions

Transportation Conformity and SIP air quality analyses utilize traffic data from the statewide traffic model and the EPA's emission factor model MOBILE6.2. The statewide traffic model is maintained by the Central Transportation Planning Staff (CTPS), the technical staff of the Boston Region Metropolitan Planning Organization (MPO), which is responsible for SIP air quality submissions.

The statewide traffic model is the basis for determining existing and future traffic data for Federal Clean Air Act and NEPA submissions. The EPA requires that statewide traffic models used for SIP submissions be based upon the most recent approved planning-level data. As a result, statewide traffic models are periodically updated to include newly identified background projects, land use changes, and model enhancements. Statewide traffic models typically include the roadway network that exists at the time it is run and regionally significant projects (background projects) that are reasonably expected to be constructed by the design year (i.e., twenty years into the future). Similarly, the MPOs establish and periodically update the land use for existing and future years.

The statewide traffic model that CTPS uses for forecasting travel demand is based on procedures and data that have evolved over many years. It uses the most up-to-date information, transportation networks, and input data available to CTPS at the time of analysis. The statewide traffic model simulates existing travel modes for transit, automobiles, and walking/bicycling, and forecasts future year travel on the entire transportation system, spanning, in this instance, the majority of eastern Massachusetts. It uses population, employment, number of households, automobile ownership, highway and transit levels of service, as well as downtown parking costs, automobile operating costs and transit fares as important inputs in applying the model to the real world condition. As required by EPA, these inputs are constantly updated so that the model set simulates current travel patterns with as much accuracy as possible.

The greatest challenge to the air quality modeling is ensuring consistent results when the statewide traffic and the mobile source emission factor models are updated. For example, the statewide traffic model of 2006 was used to establish the 2008 Federal Register Replacement/Substitution Project package emissions criteria.[2] This air quality modeling used the most informative transportation network and input data available at that time. The air quality modeling presented in the DEIR/EA uses an improved statewide traffic model with an updated roadway network, more current land use data, and a newer version of EPA's mobile source emissions factor model (MOBILE6.2). All of these measures result in improved accuracy of the present day and future air quality estimates. These modeling assumptions and this real-time approach to air quality modeling results in emission values that are considered appropriate for the SIP process. In fact, this air quality modeling approach is required by EPA for evaluating Transportation Plans, Transportation Improvement Programs, and projects for SIPs and NEPA documents.

3.4 Consistency with the SIP

The Green Line Extension Project is a requirement of the SIP[3] and fulfills a longstanding commitment of the Central Artery/Tunnel Project to increase use of public transit. The Massachusetts Air Pollution Control Regulations (310 CMR 7.36), which implement the SIP, require that the MassDOT complete the Project by December 31, 2014.

The Massachusetts Transit System Improvements (MTSI) regulations (310 CMR 7.36) became effective in December of 1991 and were incorporated into

2 2008 Federal Register (59 FR 50495--50498). *SIP Approved Projects Plus Ten Percent Package*, October 4, 1994.

3 The SIP includes a list of transportation projects funded by the FHWA or FTA, which are consistent with the Statewide Long Range Transportation Plan and the Massachusetts Transportation Improvement Program that are needed to meet the NAAQS.

the Massachusetts SIP in October of 1994.[4] This regulation specified transit system improvement projects deemed necessary to mitigate the air quality impacts of the Central Artery/Tunnel Project. While a number of the projects included in the MTSI regulations have been completed, several others (i.e., Green Line Arborway Restoration; Blue Line Connection from Bowdoin Station to the Red Line at Charles Station; and Green Line Extension to Ball Square/Tufts University) have been delayed. With this in mind, MassDOT and the MassDEP have continued to address project implementation delays within the 2000 Administrative Consent Order and subsequent amendments in 2002 and 2005.

The MTSI anticipated and allows for the substitution of projects included in the original regulation and the approved SIP. In 2005, MassDOT initiated the process for the substitution of the original SIP projects with a new package of projects, including an extension of the Green Line to Medford Hillside with a spur to Union Square, improvements to the Fairmount Line, and the construction of 1,000 Park and Ride parking spaces.

Following a public process on the proposed substitute projects, MassDOT submitted a request to MassDEP to revise the MTSI and the SIP.[5] Air quality modeling was performed for these projects and reported in the 2008 Federal Register notice demonstrating that the current package of transit improvements (Green Line Extension to College Avenue with Union Square Spur; Fairmount; and additional Parking)[6] achieves the emission reductions established by the EPA of the prior *SIP Approved Projects Package Plus Ten Percent*.

Table 3-1 Comparison of Air Quality Benefits in the Year 2025

	Daily Emissions Benefits in Kilograms (kg)		
	Carbon Monoxide (CO)	Nitrogen Oxides (NOx)	Volatile Organic Compounds (VOCs)
SIP Approved Projects Plus Ten Percent Package (2008 FR)	321.2	8.8	12.1
2008 Replacement/Substitution Package: Green Line Extension to Medford Hillside with Union Square Spur; Fairmount; Parking	435	11	17
Current Replacement/Substitution Package: Green Line Extension to College Avenue with Union Square Spur; Fairmount; Parking	520	9.5	16

Sources: 2008 Federal Register (59 FR 50495--50498).*SIP Approved Projects Plus Ten Percent Package*, October 4, 1994; Central Transportation Planning Staff/MassDOT, 2009, State Implementation Plan Evaluation.

4 Federal Register (59 FR 50495--50498), dated October 4, 1994.
5 The Massachusetts Department of Protection adopted revisions to 310 CMR 7.36 on December 1, 2006 and submitted SIP revisions to EPA.
6 Central Transportation Planning Staff (at the request of MassDOT), 2009, *State Implementation Plan Evaluation.*

In 2009, at the request of MassDOT, CTPS conducted an updated air quality analysis of the currently-proposed Green Line Extension to College Avenue with Union Square Spur in combination with the proposed Fairmount Line improvements and additional MBTA parking, as required by 310 CMR 7.36(2). The results of this air quality analysis demonstrated that the emission reductions of carbon monoxide (CO), oxides of nitrogen (NOx) and volatile organic compounds (VOCs) are greater than the *SIP Approved Projects Plus Ten Percent Package* presented in the 2008 Federal Register notice.[7] These results are presented in Table 3-1. The MassDEP reviewed this air quality analysis and stated in their January 8, 2010 DEIR/EA comment letter that the Green Line Extension Project meets the emission reductions for 310 CMR 7.36 (8) *Determination of Air Quality Emission Reductions*, which are the requirements of the SIP.

7 2008 Federal Register (59 FR 50495-50498). *SIP Approved Projects Plus Ten Percent Package*, October 4, 1994, Table 1 - EOT Air Quality Analysis Comparison of Project Packages Benefits in the Year 2025.

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4

College Avenue Station

4.1 Introduction

College Avenue Station would be the terminal station for the first phase of the Green Line Extension Project (the Proposed Project) and would be an intermediate station during the second phase of the project (the Future Full-Build Alternative). The College Avenue Station is proposed to be located at the corner of College Avenue and Boston Avenue in Somerville, which primarily serves the residential neighborhoods adjacent to the station and the Tufts University community. Figure 4-1 shows the station and the surrounding neighborhood.

The January 15, 2010 Secretary's Certificate required the MassDOT in the FEIR to clarify and confirm impacts associated with the College Avenue Station operating as a terminal station. Specific analyses and information requested by the Secretary included:

- Description of Green Line operations at the proposed terminus (i.e. train reversals, temporary train storage, movement of personnel, etc.) and how the facility has been designed to accommodate terminal station ridership demand;
- Clarification of how the College Avenue Station, functioning as a terminus, would impact traffic, parking, pedestrian, and bicycle operations within the Study Area;
- Clarification of how train operations from the Proposed Project at the College Avenue Station may impact sensitive noise and vibration receptors; and,
- Revisions to DEIR models as necessary to accurately assess the predicted function of the station, presentation of appropriate mitigation measures to offset identified negative impacts, and description of differences in mitigation measures from those proposed in the DEIR, if any.

This Chapter includes a description of the College Avenue Station as a terminal station, describes the Green Line operations in the context of the Station, explains proposed access and circulation at the Station area (traffic, pedestrian and bicycle access), and potential environmental impacts and proposed mitigation measures. This Chapter includes the information required by the Secretary's Certificate.

4.2 Station Description

The College Avenue Station is described in DEIR/EA Section 3.7, *Project Description – Preferred Alternative*, for the Proposed Project (Alternative 1). For the Proposed Project, Green Line service would terminate at College Avenue Station. Figure 4-2 shows the station and Figure 4-3 shows access to the station. Daily ridership at this station is anticipated to be 2,420 boardings (projected to the year 2030) for the Proposed Project. In order to meet accessibility requirements and taking into consideration the eight percent grade along the College Avenue bridge, the station provides two points of access. One access point would be provided from the east side of the College Avenue bridge; the second access point would be provided from the west side along Boston Avenue. A sidewalk would be maintained along the College Avenue bridge for regular pedestrian access.

Vehicular drop-off/pick-up is currently planned along the northbound side of Boston Avenue, in the area where parking does not currently exist. Bicycle parking would also be provided at the station. Local MBTA Bus Routes 80, 94, and 96 would continue to provide service within close proximity of the station with existing bus stops located on College and Boston Avenues, as indicated on the figures.

With College Avenue Station as the terminus, an extension of tracks, known as tail tracks, would be constructed approximately 600 feet beyond the end of the proposed platform. A crossover (a special device allowing a train to move from one track to another) would be located approximately 300 feet beyond the end of the proposed platform. These tracks and the crossover would be required north of the station for short-term storage of vehicles for morning start-up of service (approximately one hour) and for operational flexibility (i.e., reverse direction and provide temporary storage for disabled trains). This track area would be open-air, therefore no additional structures are proposed.

The tail tracks and double crossover north of the proposed College Avenue Station platform would allow revenue trains to drop off passengers on the outbound side of the platform and then continue north out of the station. The crossover would enable the train to switch to the inbound track, reverse direction and then pull into the station on the inbound track and allow inbound passengers to board and then continue to Ball Square Station. Before revenue

service in the morning, up to four train sets may be dispatched to College Avenue and allowed to dwell north of the platform until each train is allowed to start service. MBTA train crews would start each day taking the trains from the Green Line maintenance and storage facility to College Avenue Station before the start of revenue service (approximately 5 AM). Similarly, at the end of each day trains would come out of service at the terminus and return to a storage facility after revenue service has ended (approximately 1 AM). Trains would not be stored overnight at the station and MBTA crews would not start or end their shift at this station.

4.3 Access and Circulation

This section discusses access and circulation in the vicinity of College Avenue Station. This analysis, documented in DEIR Section 5.5, *Traffic*, is provided to summarize College Avenue Station as a terminal station. No changes to the traffic model or analysis have occurred since the DEIR/EA was published.

Based on projected ridership, approximately 800 boardings are anticipated at College Avenue Station during peak hour operations under the Proposed Project. Approximately 40 riders are expected to access the College Avenue Station by vehicular drop-off/pick-up and approximately 40 riders are expected to access the station by bicycle. At a minimum, 40 bicycle parking spaces would be provided, based on the bicycle demand estimates. The remaining riders are assumed to access the station by walking or bus transfers. Traffic volume and pedestrian networks in the Medford Study Area intersections are presented in FEIR Figures 4-4a-b and 4-5a-b.

The information presented in the DEIR/EA for the Proposed Project, as well as the information presented in this chapter, assumes that the Green Line service would terminate at College Avenue Station. The ridership model was run separately for various alternatives both with and without Mystic Valley Parkway/Route 16 Station. When College Avenue is the terminal station, there will be approximately 320 additional boardings per day at this station. This translates into approximately 100 additional boardings at College Avenue per peak hour. The majority of additional trips (about 90 percent) are expected to be pedestrian trips. The balance is expected to arrive via bus, bicycle and drop-off/pick-up. The proposed College Avenue Station layout, as presented in the DEIR/EA, was designed to adequately accommodate the additional daily boardings.

As discussed in the DEIR/EA, the CTPS used its regional travel demand model to provide the traffic forecasts for this study. Future Build model runs for each DEIR/EA alternative were prepared separately by including the extended Green Line as a mode choice and quantifying the number of vehicle trips expected to

change mode from passenger car to transit service. Using the Build alternative model runs, peak hour turning movement volumes were developed for each alternative for a 2030 design year.

Vehicular drop-off/pick-up trips are assigned to each station based on the expected total boardings of that station. A survey completed by CTPS in 2007 indicates that approximately three to seven percent of daily boardings within the urban core originate from drop-offs. An average of five percent, or 120 total trips, was used for the purposes of this analysis. It is assumed that all of the drop-off/pick-up trips would occur during the morning and evening peak periods, with about 67 percent occurring during the morning and evening peak hour (40 trips per peak hour).

The Proposed Project has a measurable effect on both regional and local traffic volumes along Study Area roadways. Local traffic along Boston Avenue decreases under the Proposed Project due to a shift in travel mode from private automobile to transit, creating additional capacity at Study Area intersections. However, since many of the Study Area roadways also provide regional connections, the model results show that the capacity created on the roadway would be largely backfilled by regional traffic volume. It is important to note that the additional vehicles are *shifting* from local roadways through these communities where they do not belong (i.e. cut-through traffic) to the regional system. Therefore, while a large improvement in traffic operations is not seen on Study Area roadways, there are many other roadways outside the Study Area where this benefit would be realized.

Since the release of the DEIR/EA, a few stakeholders raised concerns that the proposed College Avenue Station, serving as a terminal station for the Proposed Project, would not adequately serve the Medford Hillside neighborhood, which was identified as part of the SIP description. To address and resolve these concerns, CTPS prepared a memorandum that demonstrates that the College Avenue Station location does adequately serve the walk market area for the Medford Hillside neighborhood. This memorandum is provided in Appendix C of this FEIR.

4.3.1 Traffic Operations

Intersections that degrade in level of service as a direct result of the Green Line Extension Project and more specifically as related to activity at the College Avenue Station are shown in Table 4-1. Changes in vehicular levels of service are attributable to both pedestrian signal timing changes and vehicular traffic related to drop-off/pick-up activity. Since the traffic modeling efforts in the DEIR/EA specifically evaluated the College Avenue Station as a terminal station, no new

mitigation is proposed beyond what was presented in the DEIR/EA. Mitigation to offset the adverse impacts is presented in Section 4.6, *Mitigation Measures*.

Table 4-1 College Avenue Station 2030 Build Signalized LOS Summary Comparison

	No-Build Morning Peak Hour			No-Build Evening Peak Hour			Proposed Project Morning Peak Hour			Proposed Project Evening Peak Hour		
Signalized Intersection	V/C [1]	Delay [2]	LOS [3]	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
Boston Avenue at Winthrop Street	1.10	65	E	1.09	75	E	1.09	69	E	1.19	91	F
Boston Avenue at College Avenue	0.98	71	E	0.94	60	E	1.04	81	F	0.94	62	E

Note: Intersections degrading by at least one level of service are denoted in **bold**.

1 Volume to capacity ratio
2 Delay in seconds per vehicle
3 Level of Service

4.3.2 Pedestrians and Bicycles

The Proposed Project would increase pedestrian activity in the vicinity of the College Avenue Station. Traffic signal timing and phasing changes at Study Area intersections would improve the pedestrian operations by reducing the amount of time pedestrians would be required to wait for the walk signal. However, pedestrian levels of service are not expected to change. All traffic signals in the Study Area would be improved to meet current standards set by ADA and related state regulations, and to be in compliance with the most recent version of the Manual of Uniform Traffic Control Devices (MUTCD).[1]

There are six intersections in the immediate vicinity of College Avenue Station that require mitigation to address adverse impacts of the Proposed Project on pedestrians. These intersections include Boston Avenue at North Street, Winthrop Street, and Harvard Street; College Avenue at George Street; and two existing midblock crossings, Boston Avenue between Winthrop Street and College Avenue and College Avenue between Boston Street and Frederick Avenue. Mitigation includes adjustments to traffic signal timings, installing warning signage to accommodate the expected increase in pedestrian volumes, and the potential of a new signalized crossing, as discussed in FEIR Section 4.6, *Mitigation Measures*.

The Proposed Project would attract bicyclists to the College Avenue Station. As discussed above, MassDOT is committed to providing as much bicycle parking as possible at College Avenue Station.

1 Federal Highway Administration. *Manual of Uniform Traffic Control Devices*, Washington DC, 2009.

4.3.3 Automobile Parking

No new parking is proposed for College Avenue Station, even as a terminal station. Many of the parking areas near the proposed College Avenue Station already see parking violations throughout the day and the available parking supply is limited. Increased enforcement would be necessary to ensure that parking areas would be used appropriately. MassDOT will work with the City of Medford in the next phase of project development to determine the most appropriate parking enforcement program (i.e. permits, meters, etc.) related to the new station.

Also as discussed in Section 4.6, *Mitigation Measures*, a proposed improvement to the intersection of Boston Avenue at Winthrop Street would require the elimination of a portion of the parking spaces along northbound Boston Avenue.

4.3.4 Bus Transportation

No impacts to bus transportation are anticipated from the Proposed Project. The MBTA may in the future consider the relocation of bus stops to encourage the use of the bus to access the station. The benefit of this action would be further evaluated during Preliminary Engineering.

4.4 Construction Impacts

Temporary access impacts associated with the construction of the College Avenue Station include temporary displacement of parking spaces required to ensure safety and equipment access/delivery during construction. These impacts are expected to be temporary and to terminate once construction is complete. Detours associated with the reconstruction of the College Avenue bridge are also anticipated. The College Avenue bridge is expected to remain open during construction; however, temporary bridge closures are possible and would be limited in time frame and duration. Care would be taken to ensure that adjacent bridges are not closed simultaneously.

Temporary noise impacts could result from construction activities associated with utility relocation, grading, excavation, track work and installation of systems components. Such impacts may occur in residential areas and at other noise-sensitive land use located within several hundred feet of the track alignment. The potential for noise impact would be greatest at locations near pile driving operations for the College Avenue Station structure.

Construction impacts are also expected to include air emissions, dust and vibration, as discussed in the DEIR/EA, and there have been no changes to these impacts since the DEIR/EA.

4.5 Environmental Impacts

This section describes the potential noise and vibration impacts associated with the proposed College Avenue Station, as a terminal station, as required by the MEPA Certificate.

4.5.1 Noise

Extending the Green Line would add a new noise source to the environment along the proposed corridor. While there is existing noise exposure from sources such as commuter trains and automobiles, introducing an additional noise source and relocating the commuter rail lines have the potential to increase future noise at some noise-sensitive receptors. The DEIR/EA, in the analysis of Alternative 1, evaluated noise levels along the entire route of the Green Line Extension, including noise levels associated with College Avenue Station as a terminal station.

Noise impacts are the result of several elements of the Proposed Project:

- Commuter Rail operations on the track shifted to the east, closer to residences;
- Green Line operations on the new western tracks;
- Green Line trains idling on the tail tracks north of the College Avenue Station; and

  Green Line trains operating on the crossover (turnout) switch at the tail tracks.

These noise sources are minor, do not cause potential impacts and are less significant than the noise generated by the commuter trains. As an example, the three residences on Burget Avenue which are closest to the proposed tail tracks, would be exposed to noise (62.1 dBA) from stationary trains on the tail tracks, 72.3 dBA from Green Line operations, and 74.7 dBA from commuter train operations. The total future noise (cumulative noise exposure) would be 76.8 dBA. This constitutes a moderate noise impact and is due primarily to commuter train operations. Other receptors on Burget Avenue would be exposed to even lower noise levels from sources associated with College Avenue as a terminal station.

4.5.2 Vibration

Potential vibration impact from the College Avenue Station was assessed using the methods described in the DEIR/EA (Section 5.8, *Vibration*). This analysis evaluated each vibration-sensitive receptor location taking into account the distances to the future commuter line and Green Line tracks and the presence of any special trackwork (crossovers or turnouts). A crossover on the Green Line tail tracks north of College Avenue Station is the only vibration source that is associated with College Avenue being a terminal station. There would be no vibration impact from Green Line trains near College Avenue Station.

A crossover south of College Avenue Station is required regardless of whether College Avenue Station is a terminal station or an intermediate station. No changes to noise and vibration impacts or proposed mitigation have occurred at this crossover location since the DEIR/EA.

Potential vibration impact prior to mitigation has been identified for residential receptors at Brookings Street due to the shifting of the commuter tracks beyond the College Avenue terminus station. Future vibration levels from the commuter trains would be 75 VdB (an increase from the existing 69 VdB). Since the commuter tracks would be shifted a similar distance closer to these receptors, whether or not College Avenue is a terminal, future vibration levels would be the same.

4.6 Mitigation Measures

This section presents a summary of the proposed mitigation options identified in the DEIR/EA to address adverse environmental impacts associated with construction and operation of the proposed College Avenue Station as the terminus of the Proposed Project. Potential permanent impacts resulting from constructing the station would be mitigated to the extent feasible, as summarized in Table 4-2.

4.6.1 Traffic Mitigation

Specific to College Avenue Station, two intersections require physical improvements to mitigate adverse impacts caused by project-related traffic: Boston Avenue at Winthrop Street and Boston Avenue at College Avenue. Impacts at Boston Avenue and Winthrop Street would be mitigated by restriping the Boston Avenue northbound approach (currently a single lane approach) to provide an exclusive left-turn lane and a shared through/right-turn lane. Signal timing and phasing changes would also be implemented. Approximately 12 parking spaces along Boston Avenue would be removed for this

improvement. It is anticipated that the level of service would improve at this intersection from LOS F to LOS D during the evening peak hour as a result of this mitigation.

Impacts to Boston Avenue at College Avenue would be mitigated by widening College Avenue westbound to provide an exclusive right-turn lane and a shared left-turn/through lane. Signal timing and phasing changes at this location would also be incorporated. To accommodate this improvement, the College Avenue bridge over the railroad tracks would be widened. Since the bridge is already slated for reconstruction as part of the Project, changes can be made without additional construction impacts. It is anticipated that level of service would improve at this intersection from LOS F to LOS D during the critical evening peak hour with this mitigation.

As shown in Table 4-2, pedestrian mitigation is proposed at six intersections surrounding College Avenue Station. This mitigation ranges from restriping crosswalk markings and increasing pedestrian crossing times to installing pedestrian crossing signals and ADA compliant wheelchair ramps.

4.6.2 Noise Mitigation

Noise mitigation is considered based on the need, feasibility, reasonableness and effectiveness of potential options. The FTA states that in considering potential noise impact, severe impacts should be mitigated if at all feasible. At the moderate impact level, more discretion should be used, and other project-specific factors should be included in considering mitigation. These factors include the predicted increase over existing noise levels, the types and number of noise-sensitive land uses affected, existing outdoor-to-indoor sound reduction, and the effectiveness of mitigation options and the cost-effectiveness of mitigating the noise. However, the FTA also states that there is a stronger need for mitigation if a project is proposed in an area currently experiencing high noise levels (Ldn above 65 dBA) from surface transportation sources. This is clearly the case at sensitive receptors adjacent to the College Avenue Station where existing Ldn levels range between 70 to 79 dBA. In view of this guidance by the FTA, the Project would mitigate both moderate and severe noise impacts wherever feasible and wherever existing noise levels are above 65 dBA. Noise impacts will also be mitigated for receptors with no significant outdoor land use if interior day-night sound levels (Ldn) are above 45 dBA from project sources or single-event maximum noise levels (Lmax) above 65 dBA.

To mitigate noise impact from train operations, noise control can be considered at the source, along the sound path, or at the receiver. Source noise control options, for example, may include special insulating hardware at turnout

locations,[2] relocating special trackwork away from sensitive areas and using continuous welded rail. Noise barrier construction is the most common sound path noise control treatment, which is being considered for the track alignment, as described in the DEIR/EA. It can be very effective at reducing noise levels in the community.

A noise barrier 1,000 feet long, approximately six feet in height on a retaining wall along the right-of-way would be effective in mitigating potential noise impact at receptors on Burget Avenue and Brookings Street. This noise barrier is required whether or not College Avenue is a terminal station. Future noise levels from both commuter and Green Line trains are expected to be reduced nine to 11 decibels with this barrier and future noise levels are expected to be lower than existing levels. Figure 4-6 shows the location of the proposed noise barrier.

4.6.3 Vibration Mitigation

The purpose of vibration mitigation is to minimize adverse effects from a project at sensitive locations. While the consideration of noise mitigation is well-defined, there is more variability in the approach to vibration mitigation and the specific measures that may be considered. The goal for mitigating potential vibration impact from the proposed Green Line Extension Project is to reduce future vibration below the impact criteria, which is 72 VdB for Green Line trains and 75 VdB for commuter trains. At some locations, close to the existing commuter trains, future vibration levels may not be able to be reduced below the impact criterion with reasonable mitigation measures. As stated in the DEIR/EA, these locations were identified as locations with potential residual impacts, however, additional measurements will be conducted in the next phase of Project development and mitigation measures could be refined. At these locations, mitigation measures that will reduce vibration levels 5 decibels or more will be considered reasonable and effective with the intention of keeping future vibration levels at or below existing vibration levels.

The effectiveness of specific vibration mitigation measures is dependent on several factors such as the component design, installation techniques, axle loads of the trains and frequencies of concern. Resilient rail fasteners, which are specially-designed fasteners between the rails and the ties, may reduce vibration by 5 to 10 VdB. Ballast mats may be effective in reducing vibration levels 10 to 15 VdB.

Generally, well-designed and properly-installed ballast mats or resilient rail fasteners would be effective in reducing vibration levels up to 15 VdB for the Green Line trains and up to 10 VdB for commuter trains, keeping future vibration levels generated from commuter trains at or below existing levels and

2 A turnout is a mechanical device that enables a train to switch from one track to another.

reducing vibration levels generated from Green Line trains below the impact criterion. Vibration mitigation generally performs better for light rail vehicles because they do not weigh as much as commuter trains.

Figure 4-7 shows the vibration mitigation location near College Avenue Station. A total of 250 feet (500 track-feet) of vibration mitigation (location #17) is proposed to mitigate potential impacts at receptors on Brookings Street. This mitigation is required whether or not College Avenue is a terminal station.

4.6.4 Visual Impact Mitigation

The Project would incorporate vegetation in and above fences, trees, and steep slopes on each side of the right-of-way at the College Avenue Station site to minimize the rail corridor's visibility. These would reduce the net loss of vegetation and reduce the visual impact of any tree removal on the neighborhood. The retaining wall design, including any vegetated features, would be developed in the final design for the Proposed Project.

The major materials used in the College Avenue Station structure would be masonry, steel and glass. Landscaping would be designed to provide protection from the elements without obscuring visibility. Landscaping would be inviting both to the users of the stations and to the passers-by, using small trees and low shrubs, which are easily maintained. The new College Avenue Station would be visible from their street access points and from nearby bridges.

The Proposed Project would require some degree of noise mitigation, as described above, such as noise barriers to protect sensitive receptors such as residences from increases in train noise. Noise barriers would reduce the visibility of the green space surrounding the right-of-way and it would also prevent any further visual impacts by obscuring the trains and rails that would otherwise be visible from residential back yards.

There have been no changes to the visual impact mitigation since the DEIR/EA.

4.6.5 Summary of Mitigation Commitments

This section summarizes the proposed mitigation options identified in the DEIR/EA to address adverse environmental impacts associated with construction and operation of the proposed College Avenue Station as the terminus of the Proposed Project.

Potential permanent impacts resulting from constructing the station would be mitigated to the extent feasible, as summarized in Table 4-2. MassDOT would be

responsible for ensuring that all mitigation commitments are implemented. There have been no changes to the impacts analysis or mitigation commitments since the DEIR/EA, but are summarized in Table 4-2.

Temporary, short-term impacts from construction activities would be mitigated to the extent feasible. Appropriate construction mitigation measures would be incorporated into the contract documents and specifications governing the activities of contractors and subcontractors constructing elements of the Proposed Project. On-site resident engineers and inspectors would monitor all construction activities to ensure that mitigation measures are properly implemented. Construction mitigation measures for the Proposed Project are summarized in DEIR/EA Table 6-2.

Table 4-2 College Avenue Station Mitigation Commitments

Environmental Categories	Mitigation Measure	Implementation Schedule
Traffic	Reconstruct the northbound Boston Avenue approach at the intersection of Boston Avenue at Winthrop Street to provide an exclusive left turn lane and a shared right-turn/through lane.	Completion of construction
	Reconstruct the westbound College Avenue approach to provide an exclusive right-turn lane and shared left-turn/through lane.	Completion of construction
	Upgrade pedestrian signal heads and provide increased pedestrian crossing time at the intersection of Boston Avenue at North Street.	Completion of construction
	Restripe crosswalk markings at the intersections of Boston Avenue/Winthrop Street and Boston Avenue/Harvard Street.	Completion of construction
	Install warning signage at the existing Boston Avenue midblock crossing between Winthrop Street and College Avenue.	Completion of construction
	Conduct a signal warrant analysis and, if warranted, install a pedestrian signal on College Avenue between Boston Avenue and Frederick Avenue.	Completion of construction
	Restripe crosswalk markings and install wheelchair ramps at the intersection of College Avenue at George Street.	Completion of construction
	Work with cities to develop station area parking enforcement plans.	Completion of construction
Noise	Provide noise mitigation in the form of sound insulation, special hardware at turnout locations, and/or rail lubrication to mitigate all moderate and severe noise impacts (see Figure 4-6 and Table 8-2).	Completion of construction
	Provide noise mitigation in the form of noise barriers on the east side of the College Avenue Station to mitigate noise impacts.	Completion of construction
	Install continuously welded rail for light rail tracks.	Completion of construction
Vibration	Provide vibration mitigation in the form of ballast mats and specially-engineered trackwork to mitigate vibration impacts (see Figure 4-7 and Tables 8-3 and 8-4).	Completion of construction
Water Quality/ Stormwater	Include maintenance and monitoring of stormwater management measures at the Station in the Proposed Project SWPPP. Include a detailed outline of inspection and cleaning schedules for stormwater management practices.	Completion of construction
	Implement all aspects of the SWPPP including recommendations in annual updates based on new or improved procedures or changes to operations.	Completion of construction
Visual	Provide vegetation on and/or above retaining walls to minimize visual changes.	Completion of construction
	Design station landscaping to provide protection from the elements without obscuring visibility.	
	Work with affected communities on design of noise barriers and vegetated walls.	Prior to construction

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5 Lechmere Station

5.1 Introduction

Since the filing of the EENF for the Green Line Extension, the Project Area was expanded to include the relocation of Lechmere Station. The relocation of Lechmere Station to the eastern side of Monsignor O'Brien Highway/Route 28 and associated roadway and busway improvements had previously been intended to be constructed as part of the NorthPoint development project. However, due to the uncertainty surrounding the NorthPoint project and because it is necessary to relocate the station in order to extend the Green Line, the Commonwealth added the relocation of Lechmere Station and area roadway improvements into the Green Line Extension Project during the development of the DEIR.

Relocating Lechmere Station was previously reviewed under MEPA as part of the NorthPoint development project (EEA # 12651), but was not reviewed under NEPA. The DEIR/EA included an evaluation of relocating Lechmere Station to the location and in the same alignment and configuration that was previously reviewed under MEPA. The DEIR/EA evaluation included the need to relocate the station, alternatives evaluated, and the environmental consequences of moving the station.

This chapter addresses the requirements of the January 15, 2010 Secretary's Certificate on the DEIR, which include:

- Reduce the proposed parking program (in light of the station no longer functioning as a terminus);
- Consider other design refinements to reduce impacts of the relocated Lechmere Station on abutting land uses (notably the Glass Factory Condominiums);
- Clarify modeling assumptions and proposed station layout and mitigation measures that would be implemented to effectively and safely convey bus

passengers, pedestrians and cyclists from the neighborhood to the relocated Lechmere Station; and

- Explore ways to improve integration of the Lechmere Station into the surrounding neighborhood.

To respond to these issues, and respond to comments on the DEIR/EA, this chapter presents the following information:

- A revised layout of the Lechmere Station, including an analysis of design alternatives that were evaluated in an attempt to minimize impacts to nearby properties, and design modifications considered to improve integration with the existing and proposed residential developments;
- A revised analysis of access and circulation, including bus, pedestrian, and bicycle access; and
- An updated analysis of the environmental impacts and mitigation measures based on the revised station concepts.

5.2 Revised Station Layout

Lechmere Station, located in East Cambridge, is currently the existing terminus of the Green Line on the northern end of the MBTA's system. The Green Line Extension Project would extend transit service from relocated Lechmere Station to Medford Hillside along the MBTA Lowell Line, with a branch line from relocated Lechmere Station to Union Square via the MBTA Fitchburg Line. The new elevated Lechmere Station would be relocated to the east side of O'Brien Highway with a new and realigned viaduct. Daily ridership at this station is anticipated to be approximately 10,900 boardings (projected to the year 2030).

The Lechmere Station layout shown in the DEIR was based upon the original NorthPoint development project concept for relocated Lechmere Station. Based on comments received on the DEIR and on the requirements of the Secretary's Certificate, the station design was revisited to evaluate opportunities to address concerns related to parking, access from the neighborhoods, pedestrian and bicycle safety, MBTA operations (both bus and Green Line), and impact on abutters.

Working closely with the MBTA, the City of Cambridge, and reviewing feedback from local interest groups and residents, a redesigned Lechmere Station has been developed that achieves many of the desired goals including reducing parking at the station, separating bus operations from vehicular and pedestrian movements, providing an improved station layout with access from two sides, accommodating requests for a wider crosswalk across O'Brien Highway, and providing dedicated bicycle lanes within the station area. Figure 5-1 shows the

revised station layout and the surrounding neighborhood. Figure 5-2 shows the revised station plan itself in detail, and Figure 5-3 shows routes of access for the station.

5.2.1 Refinements to Concept Design since the DEIR/EA

Modifications made to the Lechmere Station layout since the DEIR include:

- The proposed parking program has been reduced from approximately 234 parking spaces (as shown in the DEIR/EA) to approximately 180 parking spaces. These parking spaces would be provided in two separate parking lots and would replace some of the 347 parking spaces that exist today at Lechmere Station. It is anticipated that the remainder of the parking spaces that exist today will be replaced in the future within the NorthPoint project, as previously envisioned.
- The roadway improvements along O'Brien Highway proposed by the NorthPoint project and shown in the DEIR are still anticipated in the revised station layout. However, slight modifications to the roadways in this station layout include:
  - An exclusive busway with one-way circulation to accommodate local bus service, including MBTA Bus Routes 69, 80, 87, and 88, with access and egress from O'Brien Highway via Water Street.
  - Bus layover would be located further away from the Glass Factory Condominiums.
  - An access road would be provided to connect Water Street, North First Street, and East Street allowing vehicular access through the station limits.
  - Vehicular access to the north parking lot would be provided via Water Street and the one-way southbound segment of the station access road.
  - Vehicular access would be provided to the south parking lot via East Street with connections from Water Street and North First Street.
  - Curbside drop-offs for taxis, corporate shuttles, and station patrons would be provided at the station along the access road and also along new North First Street.
  - Bicycle lanes have been included along the access road so that bicycles can directly access the station and in order to make a continuous connection between the proposed 22 Water Street multiuse path on the north and the recently constructed NorthPoint path on the south.

- Pedestrian access would be provided by a wider (15 feet wide) crosswalk across O'Brien Highway/Route 28.

- The station layout has been redesigned to address many of the comments received by the public. While final station design will be explored further in the next phase of project development and in conjunction with the public involvement program, the following design elements at the station have been modified:
  - Access into the station headhouse from both the north and south sides of the building structure has been added. This would allow direct access to the station from the bus drop-off/pick-up area on the north and from the intersection of O'Brien Highway and North First Street on the south.
  - The automatic fare collection and other station amenities will be fully enclosed within the station headhouse and protected from the elements.
  - The revised station design proposes a canopy system starting along the perimeter of the headhouse, underneath the elevated structure, and extending to the northeast corner of the O'Brien Highway/ North First Street intersection. The canopy system would establish an architectural presence on O'Brien Highway and which would increase station visibility. This architectural feature is proposed originating at the station and running along North First Street to better define the station entry and direct users from O'Brien Highway to the station area.
  - Because the station will no longer function as a terminal station, the proposed center island platform length was reduced from 450 feet long to 225 feet long, which can adequately accommodate a typical three-car Green Line trainset (rather than two trainsets, as required in the terminal station layout). The platforms will continue to be accessed using elevators, escalators, and stairs.
  - Bicycle racks would continue to be provided to encourage use of this mode.
  - Once the relocation is complete, the existing Lechmere Station would be demolished and the existing station site would be made available for potential future redevelopment, including the potential inclusion of a public or community use.

In the next stages of the project, the visual identity of the station will be further explored and final design will be advanced. The station identity will be shaped by the design of platform and station elements (i.e. canopy, elevators, side walls, etc.). Visual qualities will be investigated that integrate station elements and Green Line infrastructure. Design elements will have to be balanced with

potential neighborhood impacts (such as those associated with extensive glass surfaces, including noise and light impacts). Additional aspects of the station that influence its appearance and will be evaluated in more detail are providing security, visibility, and noise mitigation.

5.2.2 Other Alternatives Considered

A number of station layouts were considered in an effort to attempt to shift the station and tracks further away from the Glass Factory Condominiums and/or improve the functionality of the station. Scenarios included shifting the tracks, relocating the headhouse to the south side of the station site, and providing two separate headhouses. A summary of this analysis follows.

- The track alignment through the station site is constrained on the south side by the Archstone development parcel at East Street and on the north side by the MBTA right-of-way between the Hampton Inn Hotel and the 22 Water Street development site. The MBTA's property around the station site is also constrained by its non-linear configuration, resulting in design challenges when trying to accommodate all of the station uses. Modifications intended to push the elevated track structure further to the east away from the Glass Factory Condominiums would require the use of curves that could impact train operations and could create additional noise impacts. Additionally, shifting the tracks from the current alignment would have a significant impact on the permitted NorthPoint development plans for this area. Based on potential noise impacts and feedback received from the MBTA and the City of Cambridge, it was determined that the track alignment would remain as proposed in the DEIR/EA.
- Two additional headhouse options were evaluated as part of the FEIR analysis. Headhouse alternatives were explored in response to stakeholder comments requesting MassDOT to consider the potential of a second station entrance for those MBTA customers accessing the station from other locations. The first option included a single headhouse location on the southern side of North First Street. The second option included two headhouses on the north and south side, respectively, of North First Street. Each option demonstrated some advantages and disadvantages compared to the DEIR/EA Lechmere Station conceptual design.
    - Single headhouse, South of North First Street - Under the single headhouse option, the main station entrance would be relocated to the southern portion of the MBTA parcel. This would move the building structure further away from the Glass Factory Condominiums, reducing potential impacts to abutting land uses. The single headhouse would also provide increased visibility from O'Brien Highway. However, a single headhouse at this location

would have a significant impact on the bus operations through the site. Since buses would still need to access the site via Water Street, buses could then operate as proposed, creating a significant distance between the bus berths and the station entrance and creating additional pedestrian/vehicle conflicts with bus transfers crossing North First Street to access the station. Another option that was evaluated was to provide a bus berthing/layover area on the south side of the site, between North First Street and East Street. This location presented many challenges for buses in terms of limited space, traffic operations and bus functionality. Additionally, the use of this parcel for the station and bus operations is not consistent with the permitted NorthPoint development plan.

- Two Headhouses, South and North of North First Street: The two headhouse option, with one on the north and one on the south side of North First Street, incorporates advantages found in the single headhouse option. The two entrances would provide equal opportunity for station access to all people, whether they walk from current and future land uses around the station, or use bus, car or bike to come to the Green Line. However, a second entrance would further reduce the MBTA's parking, for which there is significant demonstrated demand; require additional circulation and fare collection areas; and increase capital and operating costs with little additional benefit for the project. Additionally, the use of this parcel for the station's second headhouse is not consistent with the permitted NorthPoint development plan.

The evaluation of various station layout alternatives concluded in support of the DEIR/EA's single headhouse north of North First Street, as this location is compatible with the MBTA's bus operation needs, provides functionality and reasonable access to the surrounding areas for passengers arriving from a variety of modes, provides a fully accessible station in a cost-effective manner, and is consistent with the permitted NorthPoint development plan.

5.3 Access and Circulation

This section discusses refined access and circulation in the vicinity of relocated Lechmere Station based on the revised station layout present in this FEIR. Approximately 3,200 boardings are anticipated during the peak hour at the station by 2030. Because approximately 90 percent of the passengers using this station are expected to walk or bike to reach the station, pedestrian/bicycle circulation is critical to the success of the station. This section reevaluates the assumptions presented previously the DEIR and updates the analysis for traffic operations, pedestrian and bicycle access and parking needs based on the

modified station layout plan developed for the DEIR. Traffic volume and pedestrian networks in the Cambridge Study Area intersections are presented in FEIR Figures 5-5a-b and 5-6a-b.

5.3.1 General Station Access

Station surface-level connectivity to other modes of transportation is provided in the following ways:

- Four berths allow passengers to alight or board MBTA buses;
- Twelve to fifteen curbside drop-off/pick-up spaces for passengers carpooling to the station (kiss-and-ride), taxis and corporate shuttles;
- Two separate parking lots, one to the north and another to the south, accommodating 65 and 115 parking spaces, respectively, for a total of 180 spaces;
- Two major pedestrian connections with East Cambridge through the Water Street and First Street crossings of O'Brien Highway; and
- Several dedicated bicycle lanes integrated into the broader vehicular network and connected to a bike storage area adjacent to the headhouse.

As directed in the Secretary's Certificate, buses will be prohibited from idling in the bus layover and boarding area.

The proposed single headhouse on the north side of North First Street includes two entrances. One entrance services the bus passengers, a kiss-and-ride area and those pedestrians who are coming from the north. The other entrance services pedestrians coming from the west and south, another kiss-and-ride area along North First Street, and those who have parked in the two parking lots. The headhouse includes passenger circulation elements that are commonly found in MBTA Green Line stations, including:

- Enclosed unpaid areas for waiting and for purchasing of tickets;
- Automatic Fare Collection;
- A lobby area in the paid zone;
- An escalator and a stair connecting the lobby to the platform; and
- Two elevators.

Passengers would arrive from the surface street level at the northern end of a center island platform. The platform would be constructed 24 feet above street level and wide enough to safely accommodate inbound and outbound passengers. For passengers awaiting the train, a canopy as wide and as long as the platform would provide weather protection. At the south end of the center

platform, a second egress structure would allow passengers to exit the platform and reach the surface level in the case of an emergency.

The relocated Lechmere Station concept is consistent with design standards for roadways and for the station as defined by the local agencies including, but not limited to, MassDOT and the City of Cambridge. The station has been designed to be fully accessible, consistent with the ADA. The redesign of Lechmere Station with an exclusive busway will minimize conflicts with buses and vehicles in the station area and will provide a direct connection from the bus berthing area to the station, minimizing potential conflicts with bus riders and vehicles.

Careful attention has also been paid to minimizing conflicts with pedestrians and vehicles within the station area. The use of crosswalks and channelization techniques such as fencing will direct pedestrians to primary paths of travel. Specifically, the use of fencing along the western edge of the north parking lot will discourage pedestrians from walking directly into the access road, while fencing along the edge of the Glass Factory Condominiums property will discourage trespassing on private property. The use of pedestrian signals at primary station access points will also provide better pedestrian access at the roadways. A 15-foot wide crosswalk is now being provided on the north side of the intersection of O'Brien Highway and North First Street as a direct result of preferences articulated by the public. Finally, exclusive bicycle lanes are being provided in and around the station site for ease of access for bicycle commuters. Additional safety and design features can be considered as the station design moves into Preliminary Engineering.

5.3.2 Traffic Operations

This section discusses the consistency of the proposed station refinements for the relocated Lechmere Station with the area traffic operations. This section also discusses how traffic in the vicinity of the relocated Lechmere Station would operate in year 2030 under two different scenarios:

- The "Interim Condition," a scenario in which the Green Line Extension Project and other area development projects (i.e. 22 Water Street) are completed, but does not include the construction of the full NorthPoint development project and its associated internal roadway/busway improvements.

- The "Future Build Condition," which includes the final construction and implementation of the full NorthPoint development program.

The purpose of the evaluation of these two scenarios is to detail the impacts that the internal roadway system and busway will have on the O'Brien Highway corridor, during both the short (no additional NorthPoint construction) and long term (NorthPoint fully built).

Consistency with NorthPoint

The NorthPoint project includes proposals to construct of a number of mixed-use buildings and internal circulation roadways to be built on private property not currently owned by the MBTA or MassDOT. Because NorthPoint does not have a definitive schedule for construction, MassDOT has proposed a station layout that would include all of the Lechmere Station elements – including circulation roadways, station, parking and bus berthing/layover – all within the property limits owned by the MBTA.

To the extent feasible, the station layout includes the proposed roadway improvements along O'Brien Highway and within the station area. However, once NorthPoint is constructed, the station's internal circulation roadways would be modified, where appropriate, to match the roadway layout delineated as part of the City of Cambridge's special permit for the NorthPoint project. Modification to the portions of the busway, the north-south internal circulation road, and parking areas will be necessary to accommodate the NorthPoint development. However, the relocation of Lechmere Station as proposed for the Green Line Extension Project would not preclude the NorthPoint buildings or roadways from being constructed as permitted.

Since there are some differences in traffic circulation at the station with and without NorthPoint, this traffic analysis considers both future conditions as they relate to the Green Line Extension Project. However, it should be noted that the reconstruction of O'Brien Highway from Third Street to East Street is anticipated to be completed as part of the Green Line Extension Project prior to the opening of relocated Lechmere Station. General travel patterns from the East Cambridge neighborhood and access to the station headhouse would not change with NorthPoint completion and there would be no change in pedestrian or bicycle access. Therefore, only the difference in traffic operations and associated pedestrian crossings are discussed under the Interim Conditions.

Interim Conditions

The key difference in traffic circulation between the time the station is constructed and the time NorthPoint is fully constructed is access to and from the station at Water Street. Mitigation plans for this intersection, in both the Interim and Future Build Conditions, include breaking the median along O'Brien

Highway and signalizing the intersection to permit a left turn into Water Street from southbound O'Brien Highway.

Under the Interim Condition, to accommodate bus operations – specifically the Route 69 bus that operates via Cambridge Street – a left-turn movement out of Water Street would be permitted. The circulation road for the park-and-ride traffic associated with Lechmere Station between Water Street and North First Street is a one-way street. Therefore, none of the patrons parking at the station would egress from Water Street. However buses, existing Water Street traffic, and traffic related to the 22 Water Street development would be permitted to turn left until such time that NorthPoint is complete.

Once the busway and internal circulation road is reconstructed as part of NorthPoint, the intersection geometry and traffic signal timing and phasing would be revised to restrict left-turns from Water Street. In the final condition, no left-turns would be allowed out from Water Street. This restriction is necessary to control traffic queuing along O'Brien Highway between Water Street and North First Street and also to facilitate a better pedestrian crossing of O'Brien Highway at Water Street.

Table 5-1 presents the expected 2030 traffic operations at Study Area intersections in the vicinity of Lechmere Station under the Interim Condition, compared to the No-Build Condition. Since NorthPoint is not constructed in this scenario, traffic and pedestrian volumes related to the NorthPoint development have not been included in the analysis.

Table 5-1 Interim Condition Level of Service Results

	2030 No-Build Morning Peak Hour			Interim Condition Morning Peak Hour			2030 No-Build Evening Peak Hour			Interim Condition Evening Peak Hour		
Intersection	V/C[1]	Delay[2]	LOS[3]	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
O'Brien Highway at Third Street	1.15	>120	F	0.79	26	C	>1.20	>120	F	0.74	30	C
O'Brien Highway at Water Street	0.72	14	B	0.60	25	C	0.60	16	B	0.63	18	B
O'Brien Highway at North First Street	0.86	31	C	0.66	50	D	0.85	52	D	0.71	46	D
Cambridge Street at North First Street	0.72	28	C	0.70	29	C	0.81	63	E	0.77	44	D
O'Brien Highway at Charlestown Avenue	>1.20	>120	F	>1.20	>120	F	>1.20	>120	F	>1.20	>120	F

Source: Vanasse Hangen Brustlin, Inc. using Synchro 7 (Build 763) software
Note: Shaded cells denote Level-of-Service E/F conditions
1 V/C – Volume-to-capacity ratio
2 Delay – Control delay per vehicle, expressed in seconds
3 LOS – Level-of-Service

As shown in Table 5-1, assuming that all proposed area roadway improvements described in detail in the DEIR/EA and supplemented in this FEIR are made, acceptable traffic operations (LOS D or better) would occur under the Interim Condition at all locations except O'Brien Highway/Charlestown Avenue, which currently operates at LOS F and, therefore, would not be further degraded by the Green Line Extension Project.

Pedestrians at the intersection of O'Brien Highway and Water Street would be required to cross O'Brien Highway concurrently with the Water Street traffic phase. Lead pedestrian intervals, which are common throughout Cambridge, would be used to facilitate this crossing under the Interim Condition. A lead pedestrian interval allows pedestrians a few seconds to enter the crosswalk while all approaches have a red traffic signal indication, becoming visible to drivers before the light changes to green. The concurrent traffic movement (in this case the Water Street phase) then turns green so that traffic and pedestrians move together. Using the forecasted bus operations for the station and expected trip generation from the 22 Water Street development,[1] approximately 80 peak hour vehicles are expected to exit Water Street turning left; this equates to one to two vehicles per minute or two to three vehicles per traffic signal cycle. Therefore, the chance of conflict between pedestrians and vehicles is small and the majority of pedestrians would cross O'Brien Highway unimpeded.

2030 Future Build Condition

The impacts discussed in the DEIR/EA are based on the 2030 Future Build Condition, which includes the NorthPoint development, relocated Lechmere Station, and other area development plans. A revised analysis was completed as part of this FEIR to address changes in circulation and access. These results, which compare the Future Build conditions to the No-Build Condition, are shown in Table 5-2.

No major changes in levels of service are expected between the No-Build and Future Build Conditions due to the Proposed Project. As discussed in the following sections, pedestrian operations have been analyzed in more detail in response to the Secretary's comments on the DEIR/EA. Due to a slight modification in pedestrian distribution to/from the new station, traffic operations at the intersection of Cambridge Street and North First Street would degrade slightly (from LOS D to LOS E) from what was previously presented in the DEIR/EA. This is true for both the No-Build and Future Build Conditions. The analysis included the reconstruction of O'Brien Highway, as it is presented in Section 5.2, *Land Use*. No additional mitigation is proposed in the immediate vicinity of Lechmere Station.

1 Vanasse and Associates, *Transportation Impact Study for Proposed Residential Development at 22 Water Street*, November 2006.

Table 5-2 2030 Future Build Condition Level of Service Results

Intersection	2030 No-Build Morning Peak Hour			2030 Future Build Morning Peak Hour			2030 No-Build Evening Peak Hour			2030 Future Build Evening Peak Hour		
	V/C[1]	Delay[2]	LOS[3]	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
O'Brien Highway at Third Street	1.15	>120	F	0.87	67	E	>1.20	>120	F	0.89	63	E
O'Brien Highway at Water Street	0.72	14	B	0.73	19	B	0.60	16	B	0.65	18	B
O'Brien Highway at North First Street	0.86	31	C	0.90	40	D	0.85	52	D	0.89	53	D
Cambridge Street at North First Street	0.72	28	C	0.91	41	D	0.81	63	E	0.92	67	E
O'Brien Highway at Charlestown Avenue	>1.20	>120	F	>1.20	>120	F	>1.20	>120	F	>1.20	>120	F

Source: Vanasse Hangen Brustlin, Inc. using Synchro 7 (Build 763) software
Note: Shaded cells denote Level-of-Service E/F conditions
NA Not Available
1 V/C – Volume-to-capacity ratio
2 Delay – Control delay per vehicle, expressed in seconds
3 LOS – Level-of-Service

Supplemental Analysis: O'Brien Highway

At the request of commenters, an analysis was completed as part of the FEIR to determine whether the southbound side of O'Brien Highway could be reduced from three travel lanes to two from just north of Third Street to East Street. With two lanes southbound, the intersection of O'Brien Highway at North First Street is expected to operate at LOS F during the morning peak hour. Intersections at Water Street and Third Street during the morning peak hour and all three intersections during the evening peak hour would operate at overall LOS D or LOS E. During both peak hours, the southbound O'Brien Highway approach to Third Street is projected to operate at LOS E or LOS F.

The estimated queues in the southbound direction, particularly during the morning peak hour, are substantial. It is anticipated that queue spillback would have a significant effect on upstream intersections, blocking side street traffic from being able to enter the mainline traffic flow. Estimated queues at Third Street are expected to extend back to the Twin Plaza driveway. Based on projected levels of service and queuing, a reduction in the number of travel lanes is not recommended for the southbound direction. The level of service and queue results for this assessment are provided in Appendix D.

5.3.3 Pedestrians and Bicycles

The pedestrian crossings across O'Brien Highway were identified as a concern for East Cambridge residents during the DEIR/EA process. To address and resolve these concerns, a full examination of pedestrian trip patterns was completed. The 2008 Green Line passenger survey results for passengers boarding at Lechmere Station were used as a basis for this assessment. These

data are provided in Appendix D. As part of the survey, passengers were asked various questions about their trip to Lechmere Station and their point of origin. For the purposes of the pedestrian analysis, the focus was on those responding as walking to or parking at Lechmere Station.

Approximately 11 percent of passengers boarding at Lechmere Station currently either park at the station parking lot or originate on the northeast side of O'Brien Highway. These passengers cross O'Brien Highway today but would no longer need to cross in the future. The survey identifies that about 25 percent of passenger trips originate in East Cambridge, east of Second Street. These pedestrians are most likely to use the new pedestrian crossing at North First Street to access the relocated station. The remaining 64 percent of passengers originate along Cambridge Street, between Cambridge Street and O'Brien Highway, or west of Second Street. These pedestrians are most likely to use the pedestrian crossing at Water Street to assess the existing station. Some of these pedestrians may also choose to cross O'Brien Highway at Third Street.

All new crosswalks along O'Brien Highway and at Cambridge Street and First Street would be designed such that they provide pedestrian crossing times that are in compliance with the Federal Highway Administration's MUTCD, ADA (including associated state regulations) and associated state requirements. To the extent feasible, delays to pedestrians could be minimized by reducing vehicular levels of service slightly (i.e. vehicular traffic operates at a worse level of service), particularly at the intersection of O'Brien Highway and North First Street. In this case, the proposed traffic signal plans have been established to manage vehicle queuing and progression rather than vehicle delay. The operations of signalized pedestrian crossings would be further refined as part of the Preliminary Engineering process. This includes identifying the exact width and length of crosswalks and further refinements to signal timing and phasing. The crossings of O'Brien Highway would be shortened to the extent feasible and provide substantial improvement over the existing condition.

The proposed configuration, with new crossings and split phase signal operation for First Street and North First Street will increase protection for pedestrians crossing between Lechmere Station and East Cambridge. The North First Street phase will allow pedestrians to cross in the westerly crosswalk across O'Brien Highway without facing conflicting left turning vehicles. Likewise, the First Street phase will allow pedestrians to cross in the easterly crosswalk without conflicting left or right turns. This approach to pedestrian phasing allows full crossings of O'Brien Highway on both the east and west side of North First Street. Additional half-crossing phases have been included in the phasing plan. The half-crossings provide effective extensions of the pedestrian crossing phases and a higher pedestrian level of service. The provision of half-crossings to a center median is a typical, often used method of accommodating pedestrians in an urban setting. It allows for the maximum capacity utilization at an intersection while providing good pedestrian accommodation. This is

accomplished by allowing pedestrian movements to "overlap" between multiple phases. This "overlapping" has the result of effectively providing for a full crossing for the majority of pedestrian movements without having to lengthen phases unnecessarily. It also allows pedestrians to take advantage of every possible interval for crossing O'Brien Highway, while protecting pedestrians from higher volume and higher speed left-turn movements.

The proposed pedestrian overlap phasing with supplemental half-crossings is dependent upon the provision of a center median island of sufficient width to accommodate those pedestrians who do not make it across in a single movement. However, even under a design that only provides for full crossings, a median for pedestrian refuge is recommended given the high vehicle volume and occasionally high travel speeds experienced along O'Brien Highway. Regardless of the care in designing proper pedestrian signal indications and signage, some portion of the population will choose to initiate a crossing of O'Brien Highway beyond the time at which a full crossing can be made. To address the potential safety implications associated with these pedestrians, and to properly channel opposing left-turns (O'Brien Highway north to First Street), a median with a minimum width of 20 feet is recommended.

Proposed bicycle access to/from relocated Lechmere Station has been refined since the DEIR/EA. From the east side of the station, bicycle access from the south would continue to be provided via the existing bicycle path along the Charles River Basin and connection into NorthPoint. Access from the north would be via a proposed (non-MassDOT) multiuse path to Water Street. Since the DEIR/EA was published, additional bicycle lanes have been added to the internal circulation road within the station area. At Water Street, and along O'Brien Highway, the Project proposes the construction of on-street bicycle lanes. Access to/from Lechmere Station from the west side of the tracks would be via these on-street accommodations. Bicyclists entering from the north can choose to ride with roadway traffic, turning left to enter the station at Water Street or dismount and use pedestrian crosswalks at Water Street or North First Street. Bicycle parking (at a minimum of 110 spaces) would be provided near the northern entrance to the station concourse.

5.3.4 Automobile Parking

A parking demand analysis was performed to evaluate whether there is an opportunity to reduce parking at Lechmere Station with the planned extension of the Green Line through Somerville and Medford. The existing parking lot at Lechmere Station provides 347 marked parking spaces that are available for a daily parking rate of $5.50. The Lechmere Station parking lot is currently more than 95 percent full (about 330 vehicles) throughout the day, which suggests that a permanent reduction in parking supply may not be feasible. If parking demand is high, and the new Green Line service does not serve the people who currently park at Lechmere Station, a reduced parking supply could encourage drivers to

park on-street, where they can, or in area parking garages. A more detailed analysis was performed to determine whether current parkers at Lechmere Station would likely board the Green Line at other stations along the extension, thereby reducing the number of spaces needed at Lechmere.

Origin-Destination Research

A license plate survey was conducted at Lechmere Station in April 2010. The survey results were used to determine what municipalities the vehicles originated from. This information was used to estimate the number of riders who currently park at Lechmere who may change travel mode and walk to stations that would now be closer to their home, thereby reducing the number of parking spaces needed at Lechmere. With assistance from CTPS, the Registry of Motor Vehicles' database was used for this assessment.

A total of 367 license plates were recorded. Out of 336 Massachusetts plates recorded, almost 93 percent, or 312, were matched with an address. Combined with the 31 out-of-state plates, there were 343 usable results. This is virtually equal to the capacity of the lot. Table 5-3 summarizes the origins of the 343 usable plates.

Table 5-3 Lechmere Station Driver Origins

Origin	Number	Percent
Drivers from points north	194	57 %
Drivers currently living along Green Line Extension route	45	13 %
Out of state plates	31	9 %
Drivers from Boston and points South	73	21 %
Total	343	100%

Projected Parking Demand/Supply

Each of the four points of origin in Table 5-3 was analyzed to project how many drivers would likely continue to park at Lechmere Station after opening of the Green Line Extension. This demand was compared to the proposed parking supply of 180 spaces, which is the amount that can be provided prior to NorthPoint construction.

In the license plate survey, there were 194 vehicles that originated from communities north of Lechmere Station but not in the communities that would be directly served by the Green Line Extension. One can hypothesize that the drivers of these vehicles need parking to continue to use the Green Line. Since

none of the new stations along the planned extension would provide parking, drivers from communities to the north would still want to park at Lechmere.

Forty-five vehicles originated in neighborhoods along the Green Line Extension. Based on the proximity of the origin to the proposed stations, (using the methodology described in the DEIR) it was estimated that the drivers of 31 of those vehicles live close enough to a planned Green Line station to walk to it. The remaining 14 drivers would continue to drive and park at Lechmere Station or could potentially change modes and bike to a new station.

The 31 out-of-state plates were assumed to belong to regular parkers who are residents of the area but have not registered their vehicles in Massachusetts. Based on the projected diversion of vehicles registered in Massachusetts, it was assumed that the same share of vehicles registered out-of-state would change travel mode and chose one of the new Green Line stations. This would remove another four vehicles from the Lechmere Station parking area.

The behavior of drivers from Boston and points south is more difficult to project. Since Lechmere Station is the current end of the Green Line north of the Boston, everyone boarding at this station is destined for Boston and points south. It seems likely that drivers from Boston and points south are destined for downtown Boston but park at Lechmere Station and use the Green Line to save the cost of parking in expensive downtown garages. None of the new stations on the Green Line Extension would serve these drivers, who can be expected to continue using Lechmere Station.

Based on this analysis, only 35 vehicles currently parking at Lechmere Station are expected to change travel mode and use a station along the extension. Assuming no latent demand for parking at Lechmere Station, the demand for parking would be reduced to 295 or 115 spaces more than the planned supply of 180 spaces. Since the new station would be built on the site of the existing parking area, no parking is expected to be available during construction. During the design phase for the project, alternate parking locations for construction and during the Interim Condition would be evaluated and recommended.

Suggestions for temporary parking in the area have been made by commenters. Based on the analysis described above, it appears that the overall parking supply can be reduced by 35 to 50 spaces. This range encompasses the number of people who are likely to switch to a new station and those who may live too far to walk but are within a reasonable biking distance. However, a vast majority of those who drive and park at Lechmere Station today would continue to do so in the future since they live outside the pedestrian catchment area for the proposed stations. Those living in towns north of Boston have few alternate options and are unlikely to be able to change their travel patterns and still use public transit as a means of commuting. Therefore, the findings of this analysis are that the

existing Lechmere Station parking supply should be reestablished as currently planned in the NorthPoint special permit.

Because of limited available information and the difficulty in quantifying latent demand for parking in and around Lechmere, the analysis does not include the latent demand that exists anecdotally. The passenger surveys used to determine pedestrian routes were also used to determine whether passengers admit to parking in East Cambridge (either on-street or in a parking garage) to board at Lechmere Station. None of the survey respondents identified this as a mode choice. The likelihood of latent demand supports the need to reestablish a higher number of parking spaces as soon as it is reasonably feasible to do so.

5.4 Environmental Impacts

This section describes the potential environmental impacts associated with the proposed changes to the design of relocated Lechmere Station, as required by the MEPA Certificate. Impacts to abutting land uses, specifically noise and vibration impacts, were evaluated for the revised station design. All other environmental impacts related the station have not changed since the DEIR/EA and are described in detail therein.

5.4.1 Noise

This section compares the direct noise impacts of the relocated and redesigned Lechmere Station, including the Green Line operations in the vicinity of the station. The noise impact analysis for the Green Line Extension Project is based on the methodology defined in the FTA guidance manual *Transit Noise and Vibration Impact Assessment*.[2] Background information on noise and vibration fundamentals, descriptors, impact criteria, land use categories, existing noise conditions and sensitive land use in areas other than near Lechmere Station are presented in DEIR/EA Section 4.8, *Noise*. Buildings with potential noise impacts are shown in Figure 5-4.

The Proposed Project would introduce new noise sources into the surrounding areas and would contribute to the future noise exposure conditions at sensitive receptors. Potential noise impact has been assessed at sensitive receptors near Lechmere Station including a residential development planned at 22 Water Street, the Hampton Inn Hotel, the Glass Factory Condominiums, NorthPoint development properties and two planned Archstone residential buildings. Based on the current NorthPoint development plan, eight sites have been assumed to

2 Federal Transit Administration. *Transit Noise and Vibration Impact Assessment* (Report FTA-VA-90-1003-06). May 2006.

be noise-sensitive including the existing Tango and Sierra residential properties and future planned properties shown in Figure 2-10 (Site 1, Site 2, Site 3, Site 4, Site 5 and a park). Based on the current Archstone development plan, two sites have been assumed to be noise-sensitive including a future building east of East Street (Site 1) and a future building west of Leighton Street (Site 2).

Potential noise impact is assessed by comparing the existing noise conditions with future conditions. Existing noise conditions were measured at four locations near sensitive properties near Lechmere Station. A summary of the measurement sites and results is shown in Table 5-4 and the measurement locations are shown in Figures 2-5 through 2-7. Short-term measurement site ST-1 was conducted on the northeast side of the Hampton Inn Hotel and is representative of the existing noise conditions on the northeast sides of the Glass Factory Condominiums, the Hampton Inn Hotel and the proposed residential property at 22 Water Street. Short-term measurement site ST-8, at the end of Water Street, is representative of existing noise conditions at the five future NorthPoint properties and the park. Long-term measurement site LT-10, on the southwest side of the Glass Factory Condominiums, is representative of the existing noise conditions at the existing Tango and Sierra NorthPoint properties (adjusted for relative distances to O'Brien Highway). Short-term measurement site ST-9 was conducted at the planned Archstone properties (Phase II) and is representative of the existing noise for those two properties.

Future noise sources associated with the Project near Lechmere Station include mainline Green Line operations, maintenance facility noise sources and the bus operations at Lechmere Station. Noise from mainline Green Line operations near Lechmere Station includes an increase from radiated noise when on elevated structure. Maintenance facility noise sources include train movements in and out of the yards, increases in noise from special trackwork (crossovers or turnouts), potential wheel squeal on tight radius curves, stationary cars in the yards operating with auxiliary equipment on, the traction power substation, and the employee parking lot. Noise from buses is based on current activity from the MBTA Bus Routes 69, 80, 87 and 88, based on the MBTA's 2010 service schedules, which total approximately 162 buses arriving during daytime hours (7 AM to 10 PM) and approximately 40 buses arriving at the station during nighttime hours (10 PM to 7 AM).

Table 5-4 Lechmere Station Existing Noise Measurement Results

Measurement Site	Location	Existing Day-Night Average Sound Level (Ldn)	Existing Peak-Transit Hour Sound Level (Leq)
ST-1	Water Street (Cambridge) – Hampton Inn Hotel (northeast side of building)	58[b]	60
ST-8	End of Water Street between O'Brien Highway and Boston Engine Terminal	62[b]	65
ST-9	Archstone Parcel on O'Brien Highway (proposed Phase II development)	65[b]	67
LT-10	Glass Factory Condominiums [c] (southwest side of building)	65[c]	63

Source: HMMH, 2010 & 2008 and Lechmere Station Relocation Project (November, 2006).
a Ldn estimated by comparing SEL levels of train events to long-term sites whose noise environment is dominated by train noise.
b Ldn estimated according to the FTA guidance for short-term measurements conducted between 7 AM and 7 PM.
c Measurement conducted March, 2006 and reported in Environmental Assessment for the Lechmere Station Relocation Project (November, 2006).
d Commuter train noise level is average of all events at site.

5.4.2 Impact Assessment

Table 5-5 presents a summary of the potential noise impact at sensitive receptors near Lechmere Station prior to mitigation. This table shows the results for the Project including the preferred maintenance facility location at Option L described in detail in Chapter 2. This table includes the sensitive receptors, which side of the tracks it is on, the future distance between the receptor and the near track centerlines of the mainline Green Line, the existing noise condition (Ldn), the moderate and severe impact criteria, the contribution of noise from mainline operations (which includes bus noise), the contribution from maintenance facility noise sources, the total future noise level (which includes mainline operations, bus noise, maintenance yard and existing noise sources), the increase in noise between the existing and future conditions and whether the potential impact would be moderate or severe. Potential noise impact locations are also shown in Figure 5-4.

Near Lechmere Station, a total of two properties (NorthPoint Tango and Sierra) may be exposed to moderate noise impact and four properties (proposed 22 Water Street, Hampton Inn Hotel, Glass Factory Condominiums and the proposed Archstone Phase II Site 1 building) may be exposed to severe noise impact prior to mitigation. Future noise levels from mainline operations include a four decibel increase due to radiated noise from the structure at Glass Factory Condominiums, NorthPoint properties Tango and Sierra and the proposed building at Archstone Site 1. This increase in noise is not included for the Hampton Inn Hotel and 22 Water Street where the alignment is proposed to be on retained fill rather than on an elevated structure.

Table 5-5 Potential Noise Impact at Receptors Near Lechmere Station (Prior to Mitigation)

Noise Sensitive Receptor Location	Side of Tracks	Distance to Near Track (feet)	Existing Noise Level (dBA Ldn)	Impact Criteria		Future Noise Level from Mainline dBA (Ldn)	Future Noise Level from Yard Sources (Ldn)	Total Future Noise Level (Ldn)[a]	Increase (dBA)	Total Number of Exterior Impacts (buildings)	
		Green Line		Mod.	Sev.					Mod.	Sev.
22 Water Street (Proposed)	East	60[c]	57.6	60.0	63.5	74.9[d]	59.3	75.1	17.5		1
Hampton Inn Hotel (northeast façade)	West	41	57.6	60.0	63.5	66.8[d]	57.8	67.8	10.2		1
Glass Factory Condos (northeast façade)	West	43	57.6	60.0	63.5	70.0[d,e]	57.3	70.5	12.9		1
NorthPoint Properties (Tango and Sierra)	East	109	61.0	62.8	65.6	60.5[e]	n/a[b]	63.8	2.8	2	
Archstone (Proposed Site 1)	East	15[c]	69.2	70.3	72.1	75.1[e]	n/a[b]	76.1	6.9		1
Total noise impacts prior to mitigation for Option L										*2*	4

Source: HMMH, 2010.
a Total future noise level includes future mainline noise (including bus transit noise), future yard noise sources and existing noise sources.
b Receptor does not have significant contribution from yard noise sources.
c Distance to alignment estimated for future proposed property.
d Future noise level from mainline includes contribution from bus transit center at Lechmere Station.
e Noise from train operations includes increase due to radiation of elevated structure.

5.4.3 Vibration

This section documents direct vibration impacts from the Project to vibration-sensitive receptors near Lechmere Station. The vibration impact analysis for the Green Line Extension Project is based on the methodology defined in the FTA guidance manual *Transit Noise and Vibration Impact Assessment*.[3] Vibration impacts are assessed for maximum levels, as vibration — unlike noise — is not a cumulative metric. The FTA criterion for vibration impacts for residential spaces is 72 VdB. The FTA impact criterion does not distinguish between "moderate" and "severe" vibration impacts.

Potential vibration impact has been assessed at sensitive receptors near Lechmere Station including a residential development planned at 22 Water Street, the Hampton Inn Hotel, the Glass Factory Condominiums, NorthPoint development properties and two planned Archstone residential developments. Based on the current NorthPoint development plan, seven sites have been assumed to be vibration-sensitive including the existing Tango and Sierra residential properties and future planned properties shown in Figure 2-10 (Site 1, Site 2, Site 3, Site 4 and Site 5). Based on the current Archstone Phase II development plan, two sites

3 Federal Transit Administration. *Transit Noise and Vibration Impact Assessment* (Report FTA-VA-90-1003-06). May 2006.

have been assumed to be vibration-sensitive including a future building east of East Street (Site 1) and a building west of Leighton Street (Site 2).

Vibration generated by trains depends on several factors including the speed of the train, the presence of special trackwork (crossovers and turnouts) and whether the track alignment is at-grade or on an aerial structure. Special trackwork introduces gaps in the rail running surface which would increase vibration levels, similar to noise, from the train as the wheels impact these gaps. An aerial structure reduces vibration significantly (10 VdB) compared to at-grade alignments because the vibration must propagate through the structure to the support columns and then into the ground and into surrounding buildings.

The proposed Lechmere Station would not result in vibration impact for these properties. While the future planned Archstone Phase II Site 1 and 2 buildings would be approximately 15 feet from the relocated Green Line alignment, train speeds are relatively slow (20 mph) and vibration impact is not expected.

5.5 Mitigation Measures

This section discusses the proposed noise and vibration mitigation to address adverse environmental impacts associated with construction and operation of the proposed relocated Lechmere Station, as identified in the previous sections. MassDOT would be responsible for ensuring that all mitigation commitments are implemented.

5.5.1 Noise

Several options for mitigating potential impacts have been considered for properties near Lechmere Station including source treatments, path treatments and receiver treatments. Since the existing buildings near Lechmere Station, the Hampton Inn Hotel and Glass Factory Condominiums do not have any noise-sensitive exterior land use with frequent human activity, potential sound insulation mitigation has been considered to minimize potential impacts to interior spaces. The outdoor-to-indoor noise level reduction (OILR) of these buildings was measured by playing a high-amplitude broadband noise outside of the building and measuring the relative difference inside and outside of the building. Building facades, windows and doors generally reduce high-frequency noise more efficiently than low-frequency noise. Therefore, the frequency content (or spectrum) of the Green Line trains has been used to project the overall A-weighted noise level reductions of the buildings. Green Line trains on elevated structure generate more low frequency noise due to the radiation of the structure and, therefore, a spectrum from Green Line trains on elevated structure has been used accordingly.

The existing OILRs of the Hampton Inn and Glass Factory Condominiums range from 28 to 31 dBA and 27 to 35 dBA, respectively. These measurements show that the windows and walls of these buildings have relatively high existing noise reduction. Interior day-night sound levels (Ldn) from future transit noise sources (mainline operations, bus transit noise and maintenance facility noise) and maximum single-event (train pass-by on mainline) noise levels (Lmax) from the Proposed Project have been projected based on the lowest measured OILR at each building including a three decibel factor of safety. The noise criteria for interior spaces, when there is no outdoor land use with frequent human activity, are a day-night sound level (Ldn) of 45 dBA and a maximum single-event noise level (Lmax) of 65 dBA with windows closed. Table 5-6 presents the exterior Ldn and Lmax noise levels from project sources, the minimum OILR measured at each building, the interior noise levels from project sources and whether mitigation is required based on both interior noise level criteria at the Hampton Inn Hotel and Glass Factory Condominiums. Future interior noise levels at the Hampton Inn Hotel are projected to be 42.7 (Ldn) and 59.3 (Lmax) which are both below their respective criteria; therefore, noise mitigation is not required for this receptor. At the Glass Factory Condominiums, interior noise levels are projected to be 46.0 (Ldn) which is above the criterion for interior day-night sound levels. Therefore, noise mitigation is required for the Glass Factory Condominiums.

Since the Glass Factory Condominiums building has relatively good existing noise reduction performance (27 to 35 dBA), mitigation by means of barriers on the elevated guideway and the use of vibration track isolation (ballast mats or resilient rail fasteners) would be more effective than sound insulation in mitigating potential impact and would also provide benefit to other exterior areas near the relocated Lechmere Station.

Absorptive barriers on both the near edge of the elevated guideway and between the inbound and outbound tracks will be effective in reducing noise from Green Line trains at sensitive receptors even at upper floor receptors. The elevated guideway barrier between the inbound and outbound tracks is needed for reducing noise from trains on the far track. The heights of these barriers depend significantly on the guideway design and how close to the trains they can be constructed. Ideally, the barriers would be located within four feet of the near rail or closer. The heights of these barriers will be refined during the Preliminary Engineering phase of the Project.

Table 5-6 Interior Noise Levels at Existing Buildings Near Lechmere Station

Noise Sensitive Receptor	Exterior Future Noise Levels from Project Sources		Minimum Outdoor-to-Indoor Noise Level Reduction (dB)	Interior Future Noise Levels from Project Sources[a]		Mitigation Required due to Interior Noise Levels above 45 dBA Ldn or above 65 dBA Lmax
	Day-Night Sound Level (Ldn)	Single-Event Maximum Level (Lmax)		Day-Night Sound Level (Ldn)	Single-Event Maximum Level (Lmax)	
Hampton Inn Hotel	67.3	83.9	27.6	42.7	62.3	No
Glass Factory Condos	70.2	86.5	27.2	46.0	59.3	Yes

Source: HMMH, 2010.
a Interior future noise levels are calculated by subtracting the minimum outdoor-to-indoor noise level reduction from the exterior noise levels and subtracting a three decibel factor of safety.

Vibration isolation of the track by means of ballast mats (if ballast and tie track is installed on the elevated structure) or resilient rail fasteners (if direct fixation track is used) will minimize the contribution of noise radiated from the structure. While ballast mats or resilient fasteners are often intended to mitigate potential vibration impact, they would also be effective in this circumstance in reducing radiated noise from the structure.

Potential moderate noise impact has been identified for exterior land use at the existing Tango and Sierra residential properties at NorthPoint due to the proposed relocation of the Green Line near East Street. Since these are moderate noise impacts, existing noise levels are below 65 dBA (Ldn) and the relative increase in noise is low due to the proposed shifting of the Green Line structure, no mitigation is required for this property. If constructed, the Archstone Phase II buildings would provide acoustic shielding from Green Line operations.

Since the proposed developments at 22 Water Street and Archstone Phase II Site 1 are not currently constructed and are assumed to be completed concurrent with the Green Line Extension Project, the buildings could be designed with consideration of the noise environment (i.e. windows with high transmission loss or STC ratings) to mitigate potential impact. It is anticipated that the developments would be designed and constructed to address the impacts of the Green Line Extension and MassDOT would not be responsible for additional mitigation.

Table 5-7 summarizes the proposed noise mitigation for receptors near Lechmere Station including the Option L maintenance facility. Noise barriers totaling 900 feet in length (two barrier each 450 feet long) and 450 feet (900 track-feet) of ballast mat or resilient rail fasteners would be effective in minimizing the potential for noise impact at Glass Factory Condominiums. Figure 5-4

shows the location of the proposed noise mitigation near proposed relocated Lechmere Station.

Table 5-7 Proposed Noise Mitigation for Receptors Near Lechmere Station

Mitigation Number	Noise Mitigation	Station Number Location (Length)
1	Barriers on northeast edge of the elevated guideway and in between the inbound and outbound tracks.	90+50 to 95+00 (450 feet)
1	Ballast mats or resilient rail fasteners on inbound and outbound tracks	90+50 to 95+00 (450 feet)

Source: HMMH, 2010.

5.5.2 Vibration

No mitigation would be needed as no potential vibration impact has been identified for receptors near the proposed relocated Lechmere Station.

6

Public Involvement Plan

6.1 Requirements of the Secretary's Certificate

MassDOT and the MBTA are committed to active engagement with the public during completion of the Green Line Extension, through engineering, into construction and eventual Project completion. The Secretary's Certificate on the DEIR requires development of a PIP for the Project:

- To facilitate collaborative land use planning, review of advanced Project design elements (notably station design), and implementation of mitigation measures.
- To clearly outline how a broad range of participants (i.e., representatives of regional planning agencies, local government, business interests, community groups, representatives of environmental justice areas and the disabled community, abutters, and bicyclist and pedestrian groups) would continue to provide meaningful community involvement throughout the duration of the entire Project, including detailed design, engineering, construction phases.
- To build on the lessons learned from the previous Advisory Groups convened in association with the Project, to consider ideas presented as part of the Community Corridor Planning Project, to reflect on comments received on the DEIR, and to represent a serious commitment by both MassDOT and the MBTA to actively engage the public upon completion of MEPA review.
- To provide not only a plan for procedural engagement of the various participants, but that it would also outline the primary substantive topics that are anticipated to be addressed through the PIP process.

This chapter lays out strategies and tools for accomplishing MassDOT's goals and complying with the Secretary's Certificate.

6.1.1 Overview

MassDOT developed and implemented a robust program of community involvement during previous stages of planning for the Green Line Extension Project. The Project has benefitted from strong interest and involvement in Cambridge, Somerville and Medford, as well as neighboring communities. Local government officials, planners, community organizations, neighborhoods and hundreds of individuals have participated in the Project. They have shared their time, ideas and concerns at meetings, in letters and emails, on websites and in newspaper articles.

In partnership with the MBTA, MassDOT would continue this outreach through the design, engineering and construction of the Green Line Extension. This chapter lays out the elements of the PIP that would guide that outreach through the remaining phases of the Green Line Extension Project.

Public outreach for the Green Line Extension has four principal goals:

- To provide an interactive, collaborative and credible public process;
- To equip the design team with ideas and recommendations from the public that would inform the design of the Green Line Extension;
- To solicit input from local residents and businesses, local and regional government agencies and interest groups; and
- To provide methods to keep residents, business owners and municipal officials informed about construction, its potential impacts and schedule, and to lessen those impacts as much as possible.

The team has consulted with the corridor municipalities, community groups and many others in developing this plan. Suggestions made in the DEIR/EA comment letters were strongly considered, as were lessons learned from the public process undertaken during preparation of the DEIR/EA. While this plan outlines a set of approaches and topics, it is a flexible and evolving document. MassDOT plans to periodically update the PIP, to assess successes and/or challenges associated with the outreach and consider suggestions for changes or improvements.

6.1.2 Public Involvement Background and Lessons Learned

MassDOT established a public involvement process for the environmental review/conceptual engineering phase of the Green Line Extension Project in September 2007. This effort was, in some sense, a continuation of the work begun in 2004 during the *Beyond Lechmere Major Investment Study/Alternatives*

Analysis process. MassDOT formed a Green Line Extension Advisory Group (which included some participants from the *Beyond Lechmere* process), conducted public meetings and coordinated with staff and elected officials of Cambridge, Somerville and Medford, as well as other stakeholders and neighborhood interest groups along the corridor.

The public involvement effort during the environmental review/conceptual engineering phase included:

- Eleven Advisory Group meetings (between September 2007 and March 2009);
- Two rounds of public meetings (two meetings in January/February 2008 and two in March 2009, of which one round included more than 600 people);
- Five station workshops in January and February 2008; and
- Participation in numerous community and neighborhood briefings.

In response to public requests, the Green Line Extension team held technical tutorials on ridership modeling; conducted a technical tutorial and tour of the Green Line Riverside vehicle maintenance and storage facility; and in response to public concerns, produced a full study of the maintenance facility site selection process and added several new sites to the evaluation process. In response to suggestions from the public, MassDOT studied the possibility of constructing tunnel segments for the Green Line Extension. Also based on public concern about construction impacts, the Green Line Extension team developed a construction staging plan to help minimize potential future impacts, which would continue to be updated throughout the next phases of Project development.

MassDOT translated materials into languages spoken in the Project area, provided interpreters as requested and prepared audiotapes and large-print documents. An electronic and postal mail database was maintained and frequently updated. Email blasts updated the public on meetings and other Project-related activities; postal mail was used for people who do not use email.

The Project website provided and continues to provide easy access to current and archived documents, meeting notices and summaries, and reference materials; it also provides a way to sign up for the Project mailing list and to send questions to the Project Team. Between November 2007 and March 2009, the site attracted more than 23,000 new visitors and had a total of more than 145,775 page views.

Based on public comments received during the DEIR process, MassDOT understands that the next phase of public involvement should build upon past experiences and gained knowledge to meet the goals we have now set out. Furthermore, the Green Line Extension Project is now entering a fundamentally

new phase – one with a focus on physical and site-specific design rather than large-scale planning issues – requiring a different kind of public involvement process. In particular:

- Meetings of the Project Design Working Group should be scheduled on a regular and predictable basis so participants can plan in advance and have their time and commitments respected;
- Disagreements or conflicts should be addressed promptly and solutions or agreements shared publicly;
- Participants in the Design Working Group should be committed to and supportive of the planning process for the Green Line Extension Project;
- Topics raised and covered by the Design Working Group should be generally germane to the Green Line Extension Project as it has been defined and must not claim resources of the Project and the Design Working Group that could be better dedicated to pertinent and pressing issues;
- Options for mitigation must be understood and described effectively (mitigation is provided to prevent or remediate negative impacts caused by the Project); and
- MassDOT and the MBTA must be full partners in the process, with support from the corridor communities.

6.2 Topics

While it is not possible to predict all of the issues the corridor communities, residents and businesses would be interested in during the upcoming phases, the list below is based on the Green Line Extension planning process to date, DEIR comments and feedback from reviewers, comments on the process and documents and experience with transportation engineering and construction.

Before listing the primary topics on which MassDOT would be seeking public input during the upcoming phases of the Green Line Extension Project, it must be noted that special attention should be paid to the topic of mitigation, which has been cited frequently as a topic of interest. While the Green Line Extension Project is in general a low-impact project, the Green Line Extension team would outline avoidance or mitigation policies, construction mitigation, and mitigation for long-term operation of the system to the extent possible. These strategies would include vehicular, bicycle and pedestrian mitigation; traffic mitigation; and construction management and detour plans. Mitigation decisions would be made both on a corridor-wide basis (i.e., construction of sound walls) and an individual property basis (when there are impacts to be mitigated). The MBTA has existing policies on mitigation, which would be followed for the Green Line

Extension. MassDOT has pledged to work with the corridor municipalities to develop station–area parking enforcement plans as appropriate, although ultimate establishment and enforcement would be local responsibilities. Plans to mitigate noise and vibration would be presented to the public, with adherence to existing standards (in accordance with the FTA guidance) to serve as the goal. The design documents would detail how MassDOT would evaluate, monitor and compensate affected parties along the corridor with respect to noise and vibration and other impacts. FEIR Chapter 8 outlines Section 61 mitigation commitments as required by the FTA and state regulatory programs.

The following topics represent other key subject areas where MassDOT expects that members of the public are likely to comment. While MassDOT welcomes this input, topics related to building and operating the transit system safely must remain in the purview of MassDOT and the MBTA.

The sub-topics listed below are representative but not necessarily exhaustive. MassDOT and the MBTA would present them in the context of the financial, operational and program constraints within which the agencies operate.

6.2.1 Preliminary Engineering Topics

The Project Team anticipates that the topics listed below would be of interest to Project constituencies. While this interest is welcome, final determination of many elements of the transit system would be guided by regulation and established practice. In these cases, the Project Team would provide relevant explanations for policies and decisions.

Design

- Design, approaches to and use of each station in the corridor, including the look and feel of the stations (to be the subject of workshops in the communities);
- Access to each station, traffic management and approaches to the stations, safety, connectivity – for all modes;
- Accessibility (stations and the Community Path);
- Connectivity with bus service;
- Pedestrian access and safety;
- Bicycle approaches and storage;
- Design of the Community Path;
- Design of the Maintenance Facility, layover storage and yard layout;

- Mitigation of operations, noise, safety; and
- Bridge redesign.

Land Use

- Land use planning in the station areas: the topic of the first round of Green Line Extension Workshops; the results would be presented to the corridor municipalities for their use in local planning and zoning;
- Connections to the Community Path and other local destinations; and
- Siting and land acquisitions for stations and maintenance facility.

Operations and Maintenance

- MBTA station program elements and operation;
- Maintenance of stations;
- Protective fencing;
- Community Path maintenance and safety;
- Maintenance facility and yard use; and
- Mitigation of noise and vibration (noise walls, vibration mats and other mitigation).

Final Design, Construction Impacts and Testing

- Communication: Project schedule and updates, construction office and access to staff, progress updates, emails and notices to media;
- Management of right-of-way issues: noise, construction equipment and dust/dirt, safety;
- Permit management and compliance;
- Traffic management and detours; communication about detours and closings;
- Business operations (maintaining deliveries and customer access);
- Parking impacts;
- Effects on commuter rail (regional issue);
- Effects on bus travelers, pedestrians and bicyclists, if impacted by traffic detours; and

- Startup and operations.

Stakeholders and Constituencies

The Green Line Extension Project has benefitted from extraordinary public interest and support. The Secretary of the EEA received hundreds of comment letters and petitions expressing opinions on the Project during the DEIR phase. Almost all of the commenters supported the Proposed Project and had suggestions for improvements, enhancements or changes. The major stakeholders include:

- The FTA;
- The MBTA;
- The cities of Cambridge, Somerville and Medford, their municipal governments, elected officials and staff;
- Residents, businesses and property owners near the stations, maintenance facility and Community Path;
- Interested members of the general public;
- MBTA users; and
- Environmental justice populations in Cambridge, Somerville and Medford.

Throughout the Project, MassDOT has worked with and would continue to work with various local environmental justice community groups, including but not limited to:

- Affordable Housing Organizing Committee of Somerville
- Assembleia De Deus
- Bethel Evangelical Church
- Cambridge Council on Aging
- Cambridge East End House
- Cambridge Housing Authority
- Catholic Center at Tufts
- City of Medford Office of Human Diversity
- City of Somerville Multi-Cultural Commission
- Community Action Agency of Somerville
- Comunidade Evangelica Pentecostal Church
- Concilio Hispano, Inc.
- East Cambridge Planning Team
- East Somerville Main Streets
- East Somerville Neighborhood Association
- East Somerville Organizing Initiative
- First Church of Somerville

- Friends of the Community Path
- Green Line Advisory Group of Medford
- Groundwork Somerville
- Holy Cross Polish Church
- Igreja Presbiteriana De Boston
- Just a Start Corporation
- Latino Coalition of Somerville
- Massachusetts Alliance of Portuguese Speakers
- Medford Council on Aging
- Medford Green Line Neighborhood Association
- Medford Housing Authority
- Mission Church of Our Lord Jesus Christ
- Mystic Learning Center, Inc.
- Mystic Valley Elder Services
- Saint Ann's Parish
- SCM Community Transportation
- Somerville Climate Action
- Somerville Community Corporation
- Somerville Council on Aging
- Somerville Housing Authority
- Somerville Immigrant Service Providers Group
- Somerville Living Wage Committee
- Somerville Transportation Equity Partnership
- Somerville/Cambridge Welfare and Housing Coalition
- Somerville-Cambridge Elder Services
- Saint Clements Parish, Medford
- Saint Francis of Assisi Church
- Saint Joseph's Church
- Tri-City Community Action Program, Inc.
- Unity Church of God
- West Medford Community Center
- Zion Christian Fellowship Church

The Community Path

MassDOT has committed to completing 100-percent of the planning, design, and engineering for the proposed extension of the Somerville Community Path between Lowell Street and Inner Belt Road as part of the final design of the Green Line Extension Project (as described in the Secretary's Certificate, page 9). Planning for the Community Path would be part of the overall Green Line Extension outreach efforts, including:

- Focusing on connections between the stations and the Community Path at the public design workshops;

- Considering materials and design elements;
- Highlighting planning and design challenges ("pinchpoints," etc)
- Considering landscaping and "green" design components;
- Seeking input on access to the Path as a way to support pedestrian and off-road bicycle access to stations; and
- Providing information on design progress and seeking input at key milestones.

The Project Team would plan for access to bicycle parking facilities at stations (as part of the design workshops). MassDOT is committed to working with the City of Somerville, residents and businesses in the Brickbottom and Inner Belt neighborhoods, and Community Path advocates to design the Path in such a way as to create improved connectivity within the Brickbottom and Inner Belt neighborhoods and between the Community Path and the Green Line Extension. MassDOT notes Somerville's goal to secure funding for the simultaneous construction of the Community Path and the Green Line Extension. MassDOT is not able at this point to commit to funding the construction of the Community Path. However, MassDOT will continue to work with the City of Somerville to identify potential state and Federal funding opportunities for the construction of the Community Path.

6.3 Public Outreach Strategies

MassDOT and the MBTA share the goal of maintaining a collaborative relationship with the Green Line Extension stakeholders and municipalities during the upcoming engineering and construction phases. The agencies plan to continue and enhance effective outreach strategies and hope to involve new stakeholders and interests in the design review. During construction, the outreach approach would shift to providing frequent and accurate public information on construction progress, schedule, traffic and pedestrian detours, and other pertinent issues.

The methods for this engagement are described in this section. They include public information meetings; community briefings, meetings and presentations; formation of a Design Working Group; Design Public Workshops; maintenance of a website; production of Project fact sheets and information materials; email notices and communication; media outreach; coordination with ongoing projects; and outreach to environmental justice populations.

6.3.1 Public Information Meetings

MassDOT would host a number of public information meetings (with open houses before the formal meetings) to share milestone information and collect public comments and suggestions. These meetings are scheduled for non-work hours, in locations that are accessible and near public transportation. The meetings typically move among locations in Somerville, Cambridge and Medford and have attracted strong participation. The meetings would be held:

- To kick off the Preliminary Engineering work and introduce the MBTA's Station Design Program;
- Between the Schematic Design Update and Intermediate submittals (before designs are finalized for the facilities);
- Between the Intermediate and Pre-final Final submittals (when there are draft final materials for public review); and
- After the Pre-Final Submittal, but before the Design/Build construction contractor is procured, to present the preliminary design effort.

6.3.2 Community Meetings, Briefings and Presentations

MassDOT and the MBTA would respond to requests for meetings and briefings with community, civic, business and citizen groups in Cambridge, Somerville and Medford, and other municipalities as appropriate. These would include presentations to elected and municipal officials; briefings for chambers of commerce, environmental or community groups; to residents and business owners along the right-of-way. These meetings augment larger forums and help MassDOT speak directly to stakeholders in convenient neighborhood or group settings.

6.3.3 Design Working Group

MassDOT and the MBTA would convene a Green Line Extension Design Working Group. This group would advise MassDOT and the MBTA on the planning of public design workshops, participate in the workshops, share Project information with their neighborhoods, and serve as a corridor advisory group during engineering and construction. MassDOT and the MBTA invited the public to apply for membership with the goal of having representation from all of the neighborhoods adjacent to Green Line Extension facilities (the maintenance facility, Union Square, Lechmere, Brickbottom, Lowell Street, Ball Square and College Avenue, with interest in the Community Path as well). The group would include representatives from the MBTA and from Cambridge,

Somerville and Medford. The group would convene in June 2010 and at least quarterly, but potentially more often as engineering begins.

The Design Working Group would meet approximately quarterly for the duration of Preliminary Engineering and would advise MassDOT and the MBTA on issues related to station design, general construction, and other community-related concerns. Topics expected to be discussed in the meetings are described in Section 6.2, *Topics*. Meetings of the Design Working Group would be public, with a period at the end of each meeting for public comments and questions. Meetings of the group would be scheduled in advance with public notice. Summary meeting notes would be posted on the Project website and made available in print by request. A list of the Design Working Group members would be made available on the Project website once available.

If issues arise among the members of the Design Working Group that cannot be resolved, the members may bring concerns to the leadership of MassDOT and the MBTA. MassDOT and MBTA staff would endeavor to help resolve the issues if at all possible. A Green Line Extension Project Ombudsman would address issues that arise during construction; see Section 6.4, *Public Outreach During Construction*.

6.3.4 Green Line Extension Workshops

MassDOT and the MBTA would conduct a series of public workshops to gather input on land use and facility (stations, vehicle maintenance and storage facility, Community Path) design issues. The workshops would be organized around facility locations or groups of locations. All would be well-advertised, open to the public and in accessible venues. The workshops would be held in a series format in Cambridge, Somerville and Medford and would address the following topics:

- **Workshop Series 1**: Site issues and land uses around stations, the maintenance facility and the Community Path (late Spring 2010)
- **Workshop Series 2**: Station and facility elements (September 2010)
- **Workshop Series 3**: Design of each facility (November 2010)
- **Workshop Series 4**: Final review of Preliminary Engineering facility designs and the Community Path (Spring 2011)

MassDOT and the MBTA would organize the workshops and other events in consultation with city planners from each community, the Green Line Extension Design Working Group, and professional planners on the team. The workshops would include information on each facility location, maps and draft plans,

comment and review sessions, and other features. Information on the dates, agendas, etc., would be circulated using community resources, media, emails and flyers. Venues would be chosen in consultation with the communities and the Design Working Group.

Summaries of workshop materials and notes would be available on the Project website and presented to the communities. The workshops would include facilitated discussion groups, and interpreters would be available. The goals of the workshops are: (a) to gather opinions and ideas on facility issues in advance of key design milestones, (b) to present the facility designs for public review, and (c) to submit the designs for final public review in advance of final design and construction.

6.3.5 The Green Line Extension Website

The Green Line Extension website is www.mass.gov/greenlineextension. The site includes a Project overview, history and ways to participate; stores Project documents, current and archival; announces meetings and events and new activities; welcomes comments and questions via email and invites site visitors to sign up for Project information and emails. The site is updated frequently. Notes and presentations from Project meetings, workshops and other activities are posted on the site.

6.3.6 Project Fact Sheets

MassDOT and the MBTA would produce Project fact sheets during Preliminary Engineering to provide updates on Project status, key contracts, summaries of new reports or plans, schedule information and milestone descriptions. The fact sheets would be posted on the website for easy printing (in PDF format, so they can be downloaded and/or shared electronically) and distributed at Project meetings and presentations. The fact sheets would be available at all community and public meetings and in appropriate formats. Each issue would be translated into Spanish and made available in other languages on request.

6.3.7 Email, Communication and Notices

The Green Line Extension Project team would continue to use a number of methods for communicating with the public about Project meetings, issues and publications. In addition to the website, the team maintains an electronic database with contact information for over 4,500 people who have attended meetings, requested information, signed up online, written a comment letter, talked with a staff member, or are abutting property owners to the Green Line

Extension. The database contains emails and postal addresses. Emails are used regularly for notices; postal addresses for public meetings and others. The database would be updated after meetings and events. (Emails are not used for purposes other than sharing Green Line Extension information. Individuals can unsubscribe from the list upon request.)

In addition, the Project Team would continue to use the following communication strategies:

- Sending letters to right-of-way abutters notifying them of any upcoming field work and advising them how to stay informed on the schedule of work. For the field survey and boring work conducted February to June 2010, weekly updates were also mailed or emailed (as appropriate) to the database;
- Posting meeting information on the website and including it in emails to the database;
- When appropriate, preparing and distributing flyers at Lechmere and Haymarket Stations, at Orange Line Stations or door-to-door;
- Sharing meeting and Project information with community groups, the cities in the corridor, regional planning agencies, and translating them into Spanish (and other languages on request);
- Placing ads in local and regional publications for major meetings; and
- Using the MassDOT blog (*Commonwealth Conversations: Transportation*) and the MassDOT Twitter feed.

The team also provides materials in alternate formats on request (including large print and languages other than English). The Project Team welcomes suggestions on ways to continue to broaden communication and outreach.

6.3.8 Media Outreach

MassDOT and the MBTA would provide frequent updates to local and regional media to enhance communication with residents and business owners in Cambridge, Somerville and Medford. The team would distribute media advisories/press releases for all public meetings, workshops, major document releases and events of interest. In the past, this communication has enhanced the release of Project information. The Project Team would also invite local cable television stations to film major meetings to make them more accessible to corridor residents who find it difficult to attend meetings in person.

Advisories would be distributed to the following media outlets:

Newspapers

Boston Courant
Boston Globe
Boston Herald
Boston Metro
Boston Post-Gazette
Cambridge Chronicle
Daily Medford Mercury
El Mundo
El Planeta
Medford Transcript
Somerville Journal
Somerville News
Vocero Hispano

Radio Stations

WBMX 98.5 FM
WBOS 92.9 FM
WBUR 90.9 FM
WBZ 1030 AM
WERS 88.9 FM
WGBH 89.7 FM
WHRB 95.3 FM
WMBR 88.1 FM
WMKI 1260 AM
WRBB 104.9 FM
WRKO 680 AM
WTKK 96.9 FM
WUMB 91.9 FM
WXKS 107.9 AM
WZLX 100.7 FM

TV Stations

Cambridge Community Television
TV 3 Medford
Somerville Community Access Television
WBPX TV
WBZ CBS
WCEA TV
WCVB ABC
WGBH
WHDH NBC

WLVI CW

Other

State House News Service

6.3.9 Coordination with Ongoing Projects

The MBTA and MassDOT are continually coordinating the planning and engineering of the Green Line Extension Project with other projects. This is an issue of concern to stakeholders, who often express concern about Project coordination or are interested in obtaining more information about other projects. When appropriate, the Project Team would include updates on coordination with relevant projects in the communities or corridor that might affect or be impacted by the Green Line Extension. These may include proposed transit projects, such as changes to the Orange Line, implementation of the Urban Ring, commuter rail service expansion, or roadway, projects or issues related to the bicycle and pedestrian path networks.

6.3.10 Environmental Justice Populations

The Green Line Extension would benefit environmental justice communities by improving access to public transit. The Green Line Extension is not anticipated to disproportionately affect environmental justice populations through land acquisition or other impacts. During the next phases of Project development, the Project Team would continue to target efforts to reach this population. This outreach would include activities to:

- Widely distribute Design Workshop notices in multiple languages at local bus stops and to potential abutters, door-to-door (languages include Spanish, Portuguese and Haitian Creole; other requests would be accommodated);
- Provide information to city, community and neighborhood groups on the Project, on meetings and on how to participate;
- Provide interpreters, materials and flyers in multiple languages;
- Translate the fact sheet into Spanish and provide other languages, on request, and make these materials available on the website and in print;
- Provide accommodations such as taped meetings for the visually impaired and audio equipment at meetings and workshops for the hearing impaired; and
- Meet individually with community groups to present information on the Project and collect input and comments.

6.3.11 Accessibility

MassDOT and the MBTA would conduct all of their meetings in accessible location and would provide accommodations on request for participants, including interpreters, audio equipment and large print materials. Notices would include Spanish and Portuguese text, at minimum, describing the importance of the announcement.

6.4 Public Outreach During Construction

MassDOT and the MBTA are committed to continuing a robust public involvement process during the construction of the Green Line Extension. In general, MassDOT and the MBTA are committed to strategies that would (a) inform the public of construction plans, (b) provide regular updates on construction, traffic detours and other impacts, and (c) solve problems that arise during construction. MassDOT and the MBTA would achieve these goals in part by requiring the Green Line Extension construction contractor to commit to a spectrum of outreach activities and efforts to mitigate the impacts of construction. MassDOT and the MBTA would hold the construction contractor to these obligations. Working together, agency and contractor staff members would be dedicated to implementing these communication and problem-solving strategies.

- Establishing a **Project construction office** along the right-of-way that is accessible to the general public.
- Establishing the position of Green Line Extension Project **Ombudsman**; this staff member would be employed by the construction contractor and would field all construction-period comments and complaints, coordinate with the cities, and respond to public concerns.
- Providing a **Project phone number** for inquiries and setting up a **database tracking system** to respond to concerns.
- Continuing to maintain the **Project website** to post construction updates and bulletins, changes in schedules and traffic management updates.
- Meeting quarterly with the Design Working Group, which would become the **Construction Working Group**, to review issues associated with construction (e.g., notices, schedule, traffic management) and advise MassDOT and the MBTA on solving problems that often arise from unexpected conditions, weather or construction-related challenges.
- Hosting **construction kick-off meetings** for neighborhoods along the right-of-way before construction begins to outline work, schedules, detours, construction mitigation, etc. The team would schedule periodic briefings for

elected and municipal officials and coordinate technical issues with local and state agencies.

- Producing **quarterly construction updates** for website posting, emailing and sharing with communities. MassDOT and the MBTA would provide an annual summary of Project construction progress and schedule updates.
- Developing a **business outreach plan** to assist local businesses during construction. Assign construction management staff to work with the construction contractor(s) to keep businesses open.
- Implementing the MBTA's policies on mitigating construction impacts (such as dust, rodent control, pedestrian access, road detours and support for local businesses, as mentioned above).
- Providing **regular updates** on construction work to local and regional media. Update traffic management plan information through media advisories and Project update meetings (see above).
- Participating in **Project coordination meetings** to anticipate challenges, mitigation needs and solve problems that arise during construction. Meet with officials, residents and business owners to identify and solve problems.

MassDOT and the MBTA would review these communication and outreach plans in light of comments received on this document and the final Certificate from the Secretary of EEA, new ideas or proposals from the Design Working Group, communities, or individuals, and information that arises during the Preliminary Engineering phase. As always, MassDOT and the MBTA are committed to public outreach strategies that reflect the phase of the Project, that provide all interested individuals with an opportunity to give input and ask questions, and that assist the Project Team in its plans and designs for the Green Line Extension.

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Summary of Proposed Project Benefits and Impacts

The Secretary's Certificate on the DEIR required MassDOT to identify, describe and assess environmental impacts of any changes in the Project that have occurred between the preparation of the DEIR and the FEIR. This Chapter summarizes the benefits and impacts of the Proposed Project and highlights any changes since the DEIR was released.

7.1 Overview

The DEIR/EA evaluated the Proposed Project's impacts – both beneficial and adverse – on natural and human resources. Table 7-1 provides a summary of adverse permanent, temporary, and construction-related impacts to environmental resource categories from the entire Proposed Project. These impacts were compared to the effects of the No-Build Alternative, in the year 2030. The Green Line Extension Project offers tremendous benefits with minimal impact to the Project Area by virtue of the fact that it is being constructed along existing MBTA railroad rights-of-way, which would enable light rail service to serve pedestrian-oriented centers with minimal disruption to the surrounding community and without significant property or neighborhood impacts. Other benefits related to the Project's environmental impacts include:

- **Land Use, Social and Economic Resources –** The Proposed Project is expected to decrease low intensity commercial and light industrial uses in the Project corridor and increase mixed-use, high-density transit-oriented development, particularly at Union Square, Brickbottom Station, and Ball Square Station. Impacts to land, businesses and residences have been minimized as much as possible through the use of existing transportation corridors. The Proposed Project would provide socioeconomic benefits due

to increased transit access, which enhances both the potential for local commerce and the potential for area residents to commute to jobs elsewhere.

- **Environmental Justice** – According to the transit modeling performed for the Project, the Proposed Project would substantially increase transit access to environmental justice and disability populations. The Proposed Project would focus regional transportation investment funds in established environmental justice communities, connecting residents to jobs and services in Boston and Cambridge and strengthening business and residential districts in the corridor. There would be no disproportionate impacts to environmental justice areas from the Proposed Project.
- **Traffic –** The Proposed Project does not have an adverse impact on traffic operations throughout the Study Area and, in fact, makes improvements to many intersections for traffic and pedestrian movements. The Project would not physically alter designated bicycle facilities nor disrupt plans for future on-road or off-road facilities. When the opportunity is available, connections can be made from bicycle facilities directly to proposed stations. Ample bicycle parking would be provided at the Proposed Project station locations to accommodate and encourage commuting by bicycle. Minimal impacts to parking and recommendations for parking enforcement plans are expected as part of the Proposed Project.
- **Air Quality –** The Proposed Project represents a significant investment in urban mass transit which would provide important transportation, air quality, and urban redevelopment benefits and would fulfill a longstanding commitment to incorporate transit projects as an integral element of the Central Artery/Tunnel project. The air quality study performed for the Proposed Project demonstrates that the Green Line Extension Project complies with the Federal Clean Air Act and the SIP. The Proposed Project would reduce daily VMT by 25,018, improving air quality and providing zero-emission transportation capacity for anticipated growth.
- **Noise –** Although the Proposed Project would introduce a new noise source into the Project Study Area, proposed noise barriers, potential sound insulation, and rail lubrication would be effective in mitigating all potential noise impacts from the Proposed Project and no residual impacts would be expected. In fact, for locations along the existing commuter rail lines, the future noise levels would be substantially lower than the existing noise levels due to the introduction of noise barriers.
- **Vibration –** The proposed vibration mitigation for the Proposed Project – including ballast mats or resilient fasteners on the proposed Green Line tracks and the relocated commuter rail tracks and the relocation or use of specially-engineered trackwork – would be effective in keeping future vibration levels at or below existing levels for commuter trains and in

reducing future vibration from Green Line trains below the impact criteria (72 VdB for commuter rail and 75 VdB for Green Line trains).

- **Visual –** The Proposed Project would not have a significant effect on the local visual environment. The changes proposed would occur in urbanized areas within and adjacent to the existing right-of-way and would have little overall visual impact for the public. The most significant change would be the loss of forested areas along the right-of-way, reducing the green space visible from local residential areas. The addition of landscaping at the stations and both on and above the retaining walls would reduce the overall visual effect of vegetation losses. The proposed noise barriers would block the view of the right-of-way for adjacent homes and prevent any further visual impacts by obscuring the trains and rails that would otherwise be visible from residential back yards. Noise barriers can be designed in a manner to minimize the visual impacts on abutters.
- **Historic Resources –** The Proposed Project has impacts on a minimal number of historic or archeological resources, including the existing Lechmere Station (which is eligible for listing in the National Register), several domestic properties, and the industrial area surrounding Option L. However, a Memorandum of Agreement (MOA) has been developed that specifies measures to be implemented to mitigate adverse effects resulting from the Project.
- **Hazardous Materials –** The Proposed Project would have an environmental benefit by remediating several sites that currently contain contaminated soils. Mitigation measures during construction include special handling, dust control, and management and disposal of contaminated soil and groundwater in order to prevent construction delays and to provide adequate protection to workers and any nearby sensitive receptors. All response actions must ensure that any nearby or adjacent receptors are adequately protected.
- **Indirect and Cumulative Impacts –** The Green Line Extension Project is proposed for an area that is already densely developed. The extension of rail service through this area provides opportunities for the cities to modify their zoning and create infill development. The Proposed Project would support a number of major redevelopment projects that are currently planned and underway near the proposed station sites. It is not expected that the Green Line Extension would lead to an increase in the overall level of growth in the region. Rather, it would focus the growth into patterns that would increase the number of viable travel options available to corridor residents and employees, including transit, walking, and bicycling. The Proposed Project is also not likely to generate additional regional growth in jobs or population. However, it may affect where that growth occurs, the form of the growth, and the pace of redevelopment.

Table 7-1 Summary of Proposed Project Impacts

Environmental Categories	Impacts	Type/Timeframe
Land Use	Acquisition of 41 properties (approximately 16 acres), including eight buildings.	Permanent
Socioeconomics	Reductions in local commerce as affected/acquired businesses relocate.	Permanent to Temporary
	Reduction of annual property tax revenue by $6,527 in Cambridge, $15,777 in Medford, and $528,375 in Somerville from the Green Line extension (includes an increased tax revenue loss since the DEIR/EA of $322,440 in Somerville from the Option L maintenance facility).	Permanent
	Displacement or relocation of 92 jobs in Somerville for the Green Line extension (includes 74 jobs for the proposed maintenance facility).	Permanent to Temporary
Environmental Justice	Displacement or relocation of 92 jobs, all located in environmental justice areas.	Permanent to Temporary
	58 percent of noise impacts to sensitive receptors located in environmental justice areas.	Permanent (in absence of mitigation)
Traffic	Level of Service decreases at five intersections.	Permanent (in absence of mitigation)
	Minor modification of MBTA Routes 69, 80, 87 and 88 upon construction and completion of the Lechmere Station.	Permanent (in absence of mitigation)
	Removal of approximately 12 parking spaces on Boston Avenue near Winthrop Street	Permanent (in absence of mitigation)
	Road closures related to bridge reconstruction requiring traffic detours and resulting in some disruption to typical travel patterns.	Construction
	Temporary displacement of parking spaces, particularly in the immediate vicinity of station and bridge construction.	Construction
	Two bridges would be temporarily closed to traffic during construction.	Construction
Noise	Increase in noise levels for the Hampton Inn Hotel, Glass Factory Condominiums, and Brickbottom Lofts; 6 to 19 decibels higher than relatively quiet existing conditions.	Permanent (in absence of mitigation)
	Moderate noise impact projected at 121 single-family and multi-family residential buildings and severe noise impact projected at 43 residential buildings. Moderate noise impact projected at three institutional buildings (Science and Technology Center at Tufts University, Outside the Line Artist's Studio, and Bacon Hall at Tufts University) and severe noise impact projected at one institutional building (Walnut Street Center).	Permanent (in absence of mitigation)

Table 7-1 Summary of Proposed Project Impacts (continued)

Environmental Categories	Impacts	Type/Timeframe
	Future noise levels at the Brickbottom Artists Building, Hampton Inn Hotel, and Glass Factory Condominiums from maintenance facility range from 57.3 dBA to 69.9 dBA (non-revenue train operations to and from maintenance yard). Total future noise levels from maintenance facility, mainline operations and existing sources range from 67.8 dBA to 76.4 dBA.	Permanent (in absence of mitigation)
	Temporary noise impacts from construction activities associated with utility relocation, grading, excavation, track work and installation of systems components.	Construction
Vibration	Shifting the existing commuter rail lines closer to sensitive receptors resulting in increased vibration levels.	Permanent (in absence of mitigation)
	Vibration impact projected at 92 single-family and multi-family residential buildings and at three institutional buildings (Science and Technology Center at Tufts University, Outside the Line Artist's Studio, and Bacon Hall at Tufts University).	Permanent (in absence of mitigation)
	Temporary vibration impacts at locations near pile driving and vibratory compactor operations.	Construction
Stormwater Management	Two acres of new pavement and rooftops for the station structures and platforms.	Permanent (in absence of mitigation)
Fish, Wildlife and Plants	Direct impact to 2.6 acres of low-value habitat, including areas near Brickbottom Station (0.9 acres), Gilman Square Station (0.6 acres), and Lowell Street Station (1.1 acres).	Permanent (in absence of mitigation)
	Direct impact to approximately 1.1 acres of medium-value wildlife habitat near College Avenue Station, extending north of the station to approximately Winthrop Street.	Permanent (in absence of mitigation)
Parks and Recreation Areas	Trum Playground (Section 4(f) property), would be indirectly impacted by moderate noise level increases by 3.5 dBA, from 68.6 dBA [Leq] to 72.0 dBA [Leq]. Trum Playground is a Category 3 land use, which applies to recreational resources that are not sensitive to noise.	Permanent (in absence of mitigation)
Visual Resources	Minor changes to the local landscape from the proposed maintenance facility.	Permanent (in absence of mitigation)
	Visual changes from the removal of 3.7 acres of existing vegetation and numerous noise barriers (between Brickbottom Station and College Avenue Station.	Permanent (in absence of mitigation)

Table 7-1 Summary of Proposed Project Impacts (continued)

Environmental Categories	Impacts	Type/Timeframe
Historic and Archeological Resources	Alterations to the Cambridge steel elevated portion of the Lechmere Viaduct, eligible for listing in the National Register.	Permanent (in absence of mitigation)
	Removal of the existing Lechmere Station structure, recommended as National Register-eligible.	Permanent (in absence of mitigation)
Hazardous Materials	Potential exposure of soil and/or groundwater impacted with OHM during the Green Line extension and maintenance facility construction.	Construction

The following sections provide additional detail on the Project's impacts and benefits.

7.2 Land Use, Social, and Economic Resources

This group of categories evaluates the impacts on properties, types of land uses, jobs, neighborhoods, and property tax revenues. The increased transit access and ridership has the potential to increase commerce and encourage greater economic development along the Green Line Extension, which would increase property values and offset decreases in municipal property tax revenue.

Increases in projected land acquisitions have occurred since the development of the DEIR due to the required land acquisitions for the proposed maintenance facility Option L. Specifically, additional full land acquisitions are required at 20 Third Avenue (M.S. Walker Wholesale Distribution) and 44-48 Third Avenue (APCA Third Avenue, LLC) for construction of the Option L maintenance facility, totaling 7.4 acres. Additional partial land acquisitions at 70 Inner Belt Road (CRG West Parking Lot) and 200 Inner Belt Road (Fine Arts Storage Partners), totaling 2.8 acres, are also required.

Acquiring buildings and properties for the Project is unavoidable due to the dense urban character of the Project Area. Despite the relative abundance of commercial and industrial properties in the affected cities, the acquisition and demolition of existing businesses could result in temporary reductions in local commerce as the affected businesses relocate or permanent reductions if the businesses do not reopen locally or at all. The use of the existing right-of-way minimizes the property acquisitions, which would be much higher for an extension that involved establishing a new right-of-way through these cities.

The use of the existing right-of-way for most of the tracks also avoids dividing and segmenting any neighborhoods, which could otherwise cause significant changes to the local character. The proposed property acquisitions would not cut off access within any existing neighborhoods or block access from one neighborhood to another.

The Proposed Project is expected to decrease low intensity commercial and light industrial uses in the Project corridor and increase mixed-use, high-density transit-oriented development, particularly at Union Square, Brickbottom Station, and Ball Square Station. Impacts to land, businesses and residences have been minimized as much as possible through the use of existing transportation corridors.

Constructing the Proposed Project as currently designed would require approximately 16 acres of land acquisition from approximately 41 properties, and would require relocating seven businesses. Since the DEIR/EA, Option L has been designated as the preferred location for the Green Line maintenance and storage facility. The largest area acquisitions are for the Project's maintenance and storage facility at Option L in Somerville (four parcels totaling 10.2 acres). In terms of impact, the most substantial acquisitions are those that require the displacement and relocation of residences and active businesses. These are located at Ball Square (three businesses), Union Square (two businesses), and for the Option L maintenance facility (two businesses). No residences would be displaced. Tables 7-2 and 7-3 show the land acquisitions required for the extension to Medford Hillside and to Union Square, respectively.

Table 7-2 Land Acquisitions for Extension to Medford Hillside

Address	Description	Cause of Impact	Area (square feet)	Full or Partial Lot Acquisition
Cambridge:				
South of East Street	NorthPoint parcel	Viaduct	6,963	Partial
East Street	City-owned parcel	Viaduct	1,549	Partial
Water Street	City-owned parcel	Viaduct	1,366	Partial
Monsignor O'Brien Highway	NorthPoint parcel	Track junction	240	Partial
Lechmere Station	MBTA station	Station relocation	--	n/a
Somerville:				
1 McGrath Highway	Commercial (undeveloped portion)	Tracks	104	Partial
35 McGrath Highway	Commercial (undeveloped portion)	Tracks	295	Partial
Monsignor O'Brien Highway	Undeveloped area	Viaduct	35,703	Partial
20 Third Avenue	M.S. Walker Wholesale Distribution	Option L	200,972	Full
44-48 Third Avenue	APCA Third Avenue, LLC	Option L	121,540	Full
70 Inner Belt Road	CRG West Parking Lot	Option L	52,248	Partial
200 Inner Belt Road	Fine Arts Storage Partners	Option L	67,834	Partial

Table 7-2 Land Acquisitions for Extension to Medford Hillside (continued)

Address	Description	Cause of Impact	Area (square feet)	Full or Partial Lot Acquisition
Somerville: (continued)				
24 Joy Street	Vacant	Brickbottom Station	12,000	Full
30 Joy Street	Vacant	Brickbottom Station	6,000	Full
Medford Street	Electrical substation	Tracks	37,947	Full
350 Medford Street	The Homan's Building (vacant, city-owned)	Gilman Square Station	48,296	Full
20 Vernon Street	Factory/artist studios (parking lot)	Tracks	2,779	Partial
61 Clyde Street	Undeveloped portion	Tracks	4,348	Partial
42 Murdock Street #1, 2, 3	3-family residence/condo (yard)	Tracks	260	Partial
46 Murdock Street	2-family residence (yard)	Tracks	260	Partial
50 Murdock Street	Vacant lot (yard)	Tracks	260	Partial
Rear of 54/56 Murdock Street	N/A	Tracks	260	Partial
675 Broadway (Somerville part)	Lot 2: Veterinary office; Lot 3: Karate studio	Ball Square Station	7,555	Full
662 Boston Avenue (Somerville part)	Auto Repair	Ball Square Station	340	Full
664 Boston Avenue (Somerville part)	Bowling Alley	Ball Square Station	340	Full
Medford				
675 Broadway (Medford part)	Lot 2: Veterinary office	Ball Square Station	4,448	Full
662 Boston Avenue (Medford part)	Auto repair	Ball Square Station	5,927	Full
664 Boston Avenue (Medford part)	Bowling alley	Ball Square Station	5,927	Full
Boston Avenue	Street right-of-way (Commonwealth of MA)	Tracks	1,739	Partial
590 Boston Avenue	Gas station/car wash (lot)	Tracks	285	Partial
474 Boston Avenue	Student offices and café (lot)	Tracks	580	Partial
179 College Avenue	Street right-of-way (Commonwealth of MA)	Tracks	180	Partial
Boston Avenue	Street right-of-way (Commonwealth of MA)	Tracks	1,205	Partial
Total number of parcels: 31		Total Area:	629,750 square feet (14.5 acres)	

Note: N/A = Not Applicable

The Proposed Project would provide socioeconomic benefits due to increased transit access, which increases both the potential for local commerce and the potential for area residents to commute to jobs elsewhere. As a result of the land acquisition, the Proposed Project would result in a total decrease of $550,679 in municipal property taxes (includes land acquisition required for the Option L maintenance facility).

The Proposed Project would displace an estimated 92 jobs in Somerville (74 jobs would be displaced for the maintenance facility at Option L). Although it is uncertain how many of the jobs displaced are held by local residents rather than commuters, the small scale of the job losses relative to the Somerville workforce (47,656 workers [2000 U.S. Census]) makes it clear that the jobs at stake represent at most a minor economic impact. There is an inherent economic advantage to being located close to public transit and to educational and social centers such as

Tufts University and Union Square. Therefore, many of the jobs affected would not actually be eliminated but only relocated locally.

Table 7-3 Land Acquisitions for Extension to Union Square (via commuter rail right-of-way)

Address	Description	Cause of Impact	Area (square feet)	Full or Partial Lot Acquisition
Somerville:				
1 Fitchburg Street	Retail condominium (lot)	Tracks	954	Partial
McGrath Highway (under)	City-owned parcel	Tracks	954	Partial
120 McGrath Highway	Garage (lot)	Tracks	954	Partial
35 Charlestown Street	N/A (lot)	Tracks	1,132	Partial
174 Somerville Avenue	Shopping mall (lot)	Tracks	1,132	Partial
51 Allen Street	Auto repair	Tracks	31,761	Full
40 Bennett Street	Warehouse (lot)	Tracks	1,004	Partial
Rear of 50 Prospect Street	Storage lot for commercial building	Union Square Station	8,039	Full
50 Prospect Street	Commercial building	Union Square Station	13,037	Full
42 Prospect Street	Vacant	Union Square Station	3,021	Full
Total number of parcels: 10		Total Area:	61,988 square feet (1.4 acres)	

Note: N/A = Not Applicable

7.3 Environmental Justice

According to the transit modeling performed on the Project, the Proposed Project would increase transit access to environmental justice and disability populations. The Project connects low-income and environmental justice communities to the region's fixed-guideway network, thus improving access to jobs and services. The Project is designed to provide fair access to stations and economic development opportunities and avoid any disproportionate share of impacts. The Project complies with Federal DOT requirements for environmental justice as developed through Executive Order 12898, DOT Order 5610.2, and Title VI of the Civil Rights Act of 1964.

The proposed Option L maintenance and storage facility requires the acquisition of two commercial buildings and the displacement of an additional 74 jobs, all located within environmental justice areas. These acquisitions would reduce annual property tax revenue by 0.33 percent in Somerville. However, this change would not represent a significant fraction of the jobs in Somerville and many of the jobs displaced would likely be relocated or replaced within Somerville. Furthermore, no residential land would be acquired, resulting in no direct effect on local environmental justice populations.

The primary benefit of the Project for local residents and workers is improved access to transit. The Green Line Extension would improve transit access to jobs, on average, by 6.1 percent; access to colleges by 7.6 percent, and access to hospital beds by 9.8 percent.[1] While there are impacts of building acquisitions and noise on environmental justice populations, these impacts are unavoidable due to the proximity of the existing rail corridors to environmental justice areas. These impacts are neither severe nor disproportionate, and the impacts would be balanced by the transit benefits to environmental justice populations. While the exact economic benefits cannot be determined, providing increased transit access and economic opportunities to the same neighborhoods affected by the Project would offset any economic impacts to these neighborhoods.

In summary, the Proposed Project would result in the acquisition of seven commercial buildings and displace approximately 92 jobs in environmental justice areas. There would be no disproportionate noise impacts to environmental justice areas from the Proposed Project. Noise mitigation would be required for the residences affected, resulting in no residual adverse impacts due to noise.

7.4 Traffic

This section discusses the direct, indirect, and cumulative effects of the Proposed Project with respect to intersection, pedestrian, bicycle, public bus transportation, and parking systems in the Study Area. For the year 2030, the DEIR/EA analyzed future traffic volumes throughout the Study Area (both with and without the Project), the impacts of the Project on the transportation system in the surrounding communities, and any measures that would mitigate Project impacts. Potential impacts to traffic circulation, including pedestrian and bicycle use, from the Proposed Project would remain the same as those analyzed in the DEIR/EA.

The DEIR/EA analyzed traffic for the No-Build and Proposed Project in order to evaluate the effects of the Project on intersection levels of service and pedestrian and bicycle circulation. The DEIR/EA provides a detailed assessment of the impacts on the transportation system associated with the Proposed Project. The following conclusions were reached:

- **Traffic Operations** – With mitigation at four intersections, the Proposed Project would improve operations at ten intersections.

1 Improved access was evaluated only for the Full-Build Alternative (DEIR/EA Alternative 2), which provides similar benefits to the Proposed Project (DEIR/EA Alternative 1 and the subject of this FEIR). This analysis was provided in DEIR/EA Appendix G, *Transit Access for Environmental Justice and Disability Populations*.

- **Pedestrians –** Pedestrian improvements would be implemented at 33 locations throughout the Study Area to accommodate the expected number of pedestrians accessing proposed stations. Pedestrian delays throughout the Study Area would be improved and signals would be timed to ensure pedestrians have adequate time to cross the street.
- **Bicycles –** The Proposed Project would not physically alter designated bicycle facilities nor disrupt plans for future on-road or off-road facilities. When the opportunity is available, connections from bicycle facilities directly to proposed stations can be made. Ample bicycle parking (a minimum of 380 spaces) would be provided at the Proposed Project station locations to accommodate and encourage commuting by bicycle.
- **Parking –** A total of 12 parking spaces would be removed to accommodate mitigation at Boston Avenue and Winthrop Street. Enforcement would be necessary to ensure that on-street parking is being used appropriately. At the redesigned Lechmere Station there would be a loss of approximately 167 existing parking spaces during the Interim Condition. As the NorthPoint development project is currently permitted, these spaces would be replaced in full upon completion of the NorthPoint development project.
- **Bus Transportation –** Slight operational changes to bus service would occur at relocated Lechmere Station to facilitate the station relocation. No other bus routes or services would be impacted. The MBTA may in the future consider the relocation of bus stops to encourage the use of the bus to access the station. Additionally, once the Green Line Extension is constructed and operational, the MBTA would, as they do throughout their systems, continuously evaluate opportunities to optimize bus services. The benefit of this action would be further evaluated during Preliminary Engineering.
- **Construction Impacts –** Construction impacts would be related to construction and traffic detours and would be temporary. In the vicinity of the stations and bridges, available parking may be temporarily displaced. Construction staging would limit the number of temporary bridge closures and ensure that adjacent bridges are not closed at the same time.

7.5 Air Quality

The Proposed Project is a significant investment in urban mass transit which would provide important transportation, air quality, and urban redevelopment benefits and would fulfill a longstanding commitment to incorporate transit projects as an integral element of the Central Artery/Tunnel project. The DEIR/EA described the air quality benefits associated with the Green Line Extension Project and describes its consistency with the SIP and MassDEP's Transit Regulations. The DEIR/EA included a mesoscale and microscale air

quality analysis that evaluated emissions of VOCs, NO_x, carbon dioxide (CO_2), CO, and particulate matter (PM). The microscale (local or hotspot) analysis evaluated CO and PM. The regional (mesoscale) analysis evaluated ozone precursors (VOCs, NO_x, CO_2, CO, and PM).

Based on the origin-destination study and parking demand study conducted for Lechmere Station, there would continue to be a demand for parking in the vicinity of Lechmere Station, either at the Station or in parking facilities nearby. As such, the projected regional air quality is not expected to notably change because the parking demand is expected to continue through the construction and implementation of the Green Line Extension. It is anticipated that these vehicles would continue to travel their existing routes and park in the Lechmere Station area and, therefore, there would be no change in the air quality on a regional (mesoscale) level.

In addition, a hot spot (microscale) air quality analysis was conducted at the intersections of Cambridge Street at First Street, Monsignor O'Brien Highway at East Street/Cambridge Street, and Monsignor O'Brien Highway at Charlestown Avenue/Lands Boulevard. As major intersections in the Study Area, the emissions are not expected to considerably change at these hot spots. Although reduced parking would be available at Lechmere Station, the parking demand is expected to continue to be there and the number of vehicles through these intersections is expected to be the same in the area (although the movement of the vehicle [right, through, or left-turn] may be different). The emissions at these study intersections are, therefore, not expected to notably change from what was calculated in the DEIR/EA.

7.5.1 Microscale Analysis

The microscale analysis indicates that reductions in CO concentrations are expected to occur over time when compared to 2007 existing conditions. All of the calculated future CO concentrations are equal to or less than the 2007 existing conditions concentrations. These reductions can be attributed to more efficient automobiles with enhanced emissions control technologies and the benefits of the Massachusetts Vehicle Inspection and Maintenance program. The Proposed Project would not exceed the CO NAAQS.

The microscale analysis also calculated the 24-hour PM_{10} concentrations and the 24-hour and annual $PM_{2.5}$ concentrations for 2030. All of the 24-hour PM_{10} concentrations are well below the PM NAAQS of 150 ug/m^3. All of the annual $PM_{2.5}$ concentrations are well below the $PM_{2.5}$ NAAQS and all of the 24-hour $PM_{2.5}$ concentrations are below the $PM_{2.5}$ NAAQS.

7.5.2 Mesoscale Analysis

The air quality study included a mesoscale analysis that estimates the area-wide emissions of VOCs, NO_X, CO_2, CO, and PM emissions. The mesoscale analysis evaluated the changes in emissions based upon changes in the average daily traffic volumes, roadway lengths, and vehicle emission rates. The mesoscale analysis calculated the 2030 mobile source emissions from the major roadways in the Study Area. These emissions, estimated to be 22,687.5 kilograms per day (kg/day) of VOCs, 19,186.2 kilograms per day of NO_X, and 3,385.7 kg/day of PM_{10}, establish a baseline to which future emissions can be compared.

The results of the mesoscale analysis demonstrate that the Proposed Project would reduce emissions of VOC, NO_X, and PM_{10} as compared to the No-Build Alternative. The air quality study demonstrates that the Proposed Project for the Green Line Extension Project complies with the CAAA and the SIP.

7.5.3 Greenhouse Gas (CO_2) Analysis

The EEA has developed a policy that requires a Proposed Project to evaluate GHG emissions. The air quality study calculated the GHG emissions from mobile sources related to the Proposed Project. While GHG emissions include several gases, CO_2 was selected for evaluation because it is the most significant component of transportation-related GHG emissions. The year 2030 was selected as the future year of analysis to be consistent with the regional long-range transportation plan. The Proposed Project would reduce CO_2 by 17,115 kg/day in comparison to the No-Build Alternative and therefore not contribute to an increase in GHG emissions.

7.6 Noise

The Green Line Extension would add a new noise source to the environment along the proposed corridor. While there is existing noise exposure from sources such as commuter trains and automobiles, introducing an additional noise source and relocating the commuter rail lines have the potential to increase future noise at some noise-sensitive receptors. The Proposed Project involves relocating the commuter rail lines up to 18 feet along some portions of the corridor and introducing the proposed Green Line tracks on the west side of the corridor along the Medford Branch and on the south side on the Union Square Branch.

The noise analysis conducted for the FEIR for the proposed Option L maintenance facility showed a slight increase in overall noise impact from that reported in the DEIR/EA. Specifically, noise from train movements in and out of the yard at Option L would be slightly higher at the southwest façade of the Brickbottom Artists Building than would be Yard 8 due to the presence of a tight radius curve on the Medford Lead track. In addition, noise from train movements in and out of the yard at Option L would be slightly higher at the Hampton Inn Hotel and the Glass Factory Condominiums due to stationary cars in the south yard operating with auxiliary equipment on. At the northeast façade of the Brickbottom Artists Building, the Option L maintenance facility would only increase future noise levels by 1.1 decibels compared to the mainline operations alone. At the other receptors potentially impacted under Option L, the contribution of noise from maintenance facility operations is even less than at Brickbottom Artists Building.

Potential noise impact on the west side of the MBTA Lowell Line alignment is due primarily to the proximity of noise-sensitive receptors to the Green Line trains. At close distances (within approximately 50 feet) the contribution of noise from Green Line trains is more significant than from commuter trains. Future noise levels on the west side are projected to generally increase one to two decibels due to the close proximity of noise-sensitive receptors to the Green Line trains. At a few specific locations (Alston Street near Cross Street) the increase in noise levels is higher (five decibels) due to the close proximity (25 feet) to the near track centerline of the proposed Green Line trains.

Because existing noise levels are relatively high at locations along the existing commuter rail line, even small increases in future noise levels are considered to have the potential for moderate or severe noise impact. Moving the commuter rail closer to residences on the east side of the MBTA Lowell Line right-of-way would therefore have moderate to severe impacts in some locations. The areas of noise impacts are shown in Figures 7-1 through 7-5.

Temporary noise impacts could result from construction activities associated with utility relocation, grading, excavation, track work, and installation of systems components. Such impacts may occur in residential areas and at other noise-sensitive land uses located within several hundred feet of the alignment. The potential for noise impact would be greatest at locations near pile-driving operations for bridges and other structures, and at locations close to any nighttime construction activities.

The Proposed Project would expose 164 residential buildings to moderate (121) or severe (43) noise levels, and would expose three institutional buildings (Tufts Science and Technology Center, Outside the Line Artist's Studio, and Bacon Hall at Tufts University) to moderate noise levels and one severe institutional impact

(the Walnut Street Center, a non-profit support center for adults with developmental disabilities near Union Square).

With mitigation, there would be no severe noise impacts from the Proposed Project expected. Noise mitigation including noise barriers and potential sound insulation treatments would be feasible, reasonable, and effective in mitigating all potential noise impact due to the Proposed Project. During the next phase of the Project, the existing outdoor-to-indoor noise reduction of the buildings would be measured. Some of these large buildings, however, may have a greater outdoor-to-indoor sound reduction than for typical buildings (about 25 dB with windows closed). If it can be established that there is indoor activity only and that the performance of these windows is sufficiently better than normal, sound insulation mitigation may not be necessary. If sound insulation is required and the most effective mitigation option, it would be considered cost-effective if it can improve the noise reduction of the building by five decibels or more.

At most locations, the noise barriers would be effective in reducing noise levels from transit sources generally seven to 11 decibels and would result in substantial reduction in future noise levels in comparison to existing noise levels. The proposed noise barriers and potential sound insulation would be effective in mitigating all potential noise impacts from the Proposed Project and no residual impacts would be expected. In fact, for locations along the existing commuter rail lines, the future noise levels would be substantially lower than the existing noise levels due to the noise barriers. Therefore, with mitigation, there would be no severe noise impacts from the Project and noise improvements would be made along the corridor.

7.7 Vibration

The Green Line Extension Project would add a new vibration source to the environment along the proposed corridor. While there is existing vibration exposure from sources such as commuter trains and automobiles, introducing an additional vibration source and relocating the commuter rail lines have the potential to increase future vibration at some sensitive receptors. The Project involves relocating the commuter rail lines up to 18 feet to the east along some portions of the corridor and adding the proposed Green Line tracks on the west side of the corridor.

Vibration from the Option L maintenance facility would remain the same as that analyzed in the DEIR; at a maximum vibration level of 77 VdB at the Brickbottom Artists Building, generated from trains on the elevated near mainline track approximately 18 feet away.

Vibration impact from the commuter trains generally occurs within 60 feet of the future commuter rail near-track centerline and within 40 feet of the proposed Green Line near-track centerline. Most receptors projected to be exposed to vibration impact from commuter train activity are on the east side of the MBTA Lowell Line or the south side of the MBTA Fitchburg Line where the proposed commuter rail near track is planned to shift up to 18 feet closer than its current location. Shifting the existing commuter rail lines closer to sensitive receptors is expected to increase vibration levels. Most receptors projected to be exposed to vibration impact from Green Line train activity are located on the west side of the MBTA Lowell Line. The areas of vibration impacts are shown in Figure 7-6 through 7-10.

Temporary vibration impacts could result from construction activities associated with the Green Line Extension Project. The potential for vibration impact would be greatest at locations near pile driving and vibratory compactor operations.

The Proposed Project may potentially expose 95 vibration-sensitive buildings to impact without vibration mitigation. This includes 92 single-family and multi-family residential buildings and three institutional buildings (Tufts Science and Technology Center, Outside the Line Artist's Studio, and Bacon Hall at Tufts University).

The proposed vibration mitigation including 19,700 track-feet of vibration mitigation such as ballast mats or resilient fasteners on the proposed Green Line tracks and the relocated commuter rail tracks and the relocation or use of specially-engineered track (flange-bearing or moveable-point frogs) for 10 crossovers and turnouts would be effective in keeping future vibration levels at or below existing levels for commuter trains and in reducing future vibration from Green Line trains below the impact criteria of 72 VdB (commuter rail) or 75 VdB (Green Line trains).

7.8 Visual

The Proposed Project would require acquiring property, demolishing buildings, constructing new Green Line track and stations, and relocating the commuter rail track within the existing right-of-way. Some existing vegetation would be removed, and new retaining walls and noise barriers would be built. Noise barriers can be designed in a manner to minimize the visual impacts on abutters. Fences, trees, and steep slopes on each side of the right-of-way minimize the rail corridor's visibility. The right-of-way is only visible to the public from certain locations, such as from bridges or through fences. With the exception of the Lechmere Station area, which would be on an elevated structure, there would be

minimal visual impact on the area. Because the changes would occur in urbanized areas within and adjacent to the existing right-of-way, they would have little overall visual impact on the public. New planting and screening efforts along the right-of-way and atop the retaining walls would be done in coordination with abutting residents and businesses to ensure that no undue visual impacts are imposed on local neighborhoods. The Project would incorporate vegetation in and above these walls and at the stations in order to maximize the amount of vegetation along the expanded right-of-way. These would reduce the net loss of vegetation and reduce the visual impact of any tree removal on the neighborhoods.

The additional analysis of the proposed Option L showed that the Option L maintenance building would be less visible from the Brickbottom Artists Building than would have been the building at Yard 8. However, given the existing industrial (MBTA's BET facility) and commercial buildings visible from this area, the support facility would result in only a minor change to the overall local landscape.

The stations themselves generally have small footprints and are located along and within the right-of-way to the greatest extent possible, minimizing the overall visual impact. The major materials used in the station buildings would be masonry, steel, and glass. Landscaping would be designed to provide protection from the elements without obscuring visibility. Landscaping would be inviting both to the users of the stations and to the passers-by, using small trees and low shrubs which are easily maintained. The new stations would be visible from their street access points and from nearby bridges.

The Proposed Project would require noise mitigation, usually consisting of noise barriers, to protect sensitive receptors (such as residences) from increases in train noise. Noise barriers would range from six to 12 feet tall and would block the view of the right-of-way from adjacent homes. While this would reduce the visibility of the green space surrounding the right-of-way, it would also prevent any further visual impacts by obscuring the trains and rails that would otherwise be visible from residential back yards.

The Proposed Project would not have a significant effect on the local visual environment. The changes proposed would occur in urbanized areas within and adjacent to the existing right-of-way and would have little overall visual impact on the public. The most significant change would be the loss of forested areas along the right-of-way, reducing the green space visible from local residential areas. The addition of landscaping at the stations and both on and above the retaining walls would reduce the overall visual effect of vegetation losses. The proposed noise barriers would block the view of the right-of-way for adjacent

homes and prevent any further visual impacts by obscuring the trains and rails that would otherwise be visible from residential back yards.

7.9 Historic Resources

The FTA is the lead Federal agency for the Green Line Extension Project with responsibility for compliance with Section 106 of the NHPA of 1966 and other Federal statutes. The Draft Environmental Assessment filed under NEPA addresses compliance with Section 106 of the NHPA and Section 4(f) of the Department of Transportation Act of 1966. Potential impacts to historic resources from the Proposed Project would remain the same as those analyzed in the DEIR/EA.

The Proposed Project would impact historic resources by relocating the existing Lechmere Station, which is recommended in the *Historic and Archaeological Resources Reconnaissance Survey Technical Report*[2] as potentially eligible for the National Register of Historic Places, to the north side of the O'Brien Highway in Somerville. This constitutes an "adverse effect" under Section 106 and a "use" under Section 4(f). The DEIR/EA documented that there are no feasible and prudent alternatives to the use of the Lechmere Station, and that adverse effects cannot be avoided.

Relocated Lechmere Station and associated roadway and busway improvements have long been intended to be constructed as part of the NorthPoint development project. However, due to the uncertainty surrounding the future of the NorthPoint project, the Commonwealth has included the planning for the relocation of Lechmere Station and area roadway improvements into the Green Line Extension Project. The new Lechmere Station would be relocated and elevated, situated on a new and realigned viaduct on the east side of Monsignor O'Brien Highway/Route 28. Once the relocation is complete, the existing Lechmere Station would be demolished and cleared, and the area would be made available for potential future redevelopment.

A draft MOA has been developed that specifies the measures that would be implemented by the FTA to mitigate the adverse effects. Mitigation measures include archival photographic documentation for recording purposes and historical interpretation. In its comment letter on the DEIR/EA, the Massachusetts Historical Commission (MHC) requested that the FTA complete its identification, evaluation and consultation for the undertaking and make a

2 Public Archaeology Laboratory, *MBTA Green Line Extension Project, Historic and Archaeological Resources Reconnaissance Survey*, Volumes I and II. October 2008.

finding of effect prior to finalizing the MOA, which could be a programmatic agreement including a future extension to the Mystic Valley Parkway/Route 16.

Due to their location primarily within the existing right-of-way and their design, the remaining proposed stations would have no effect or no adverse effect on historic properties in the surrounding APE.

The Proposed Project would potentially affect one archaeological sensitive area needed for the proposed Brickbottom Station. This sensitive area is documented as having the potential to contain significant belowground remains associated with mid-late nineteenth-century worker housing that characterized the Joy Street section of Somerville during the late industrial period.

The Option L maintenance and storage facility may also contain deeply buried archaeologically sensitive strata that could be impacted by construction associated with the proposed new vehicle maintenance building. Mitigation measures for archaeological sites that would be adversely affected by construction activities would include an archaeological data recovery program designed in accordance with state and Federal guidelines and standards for the excavation of National Register-eligible archaeological sites. Should any significant and National Register-eligible archaeological resources be identified during the intensive survey or subsequent site evaluation testing, measures to avoid, minimize, or mitigate any adverse effects of the Project on the National Register-eligible resource(s) would need to be determined by the FTA and MassDOT, in consultation with the MHC and other consulting and interested parties.

7.10 Hazardous Materials

The Proposed Project would require construction in areas where contaminated soils or groundwater are likely to be present in the vicinity of the rail right-of-way or proposed stations and where soil and/or groundwater remediation may be required as the Project design progresses. The remediation includes removing contaminated soil and pumping contaminated groundwater in accordance with the provisions of the MCP, MGL Chapter 21E and 21C, and the Federal RCRA.

The analysis of proposed Option L maintenance and storage facility for the FEIR determined that construction at this site may encounter seven RECs hazardous releases.

The Proposed Project requires construction in seven areas which collectively contain 23 RECs. These include off-site properties where releases have occurred but have been cleaned up or where there are underground storage tanks that are unlikely to have leaked; properties such as those with potential sources of oil and hazardous material with limited or inconclusive information; and sites such as those with confirmed soil, groundwater, and/or indoor air impacts that were reported to MassDEP and have undergone some type of cleanup or remain an active case.

The Proposed Project would have an environmental benefit by remediating sites that contain "high impact" RECs. Three high-impact sites would be cleaned as part of the proposed Green Line Extension Project.

Mitigation measures during construction on sites with RECs include special handling, dust control, and management and disposal of contaminated soil and groundwater in order to prevent construction delays and to provide adequate protection to workers and any nearby sensitive receptors. All response actions must ensure that any nearby or adjacent receptors are adequately protected.

7.11 Indirect and Cumulative Impacts

The DEIR/EA evaluated the consistency of the Project with ongoing and planned projects and evaluated the indirect and cumulative effects of the Proposed Project by topic. Potential indirect and cumulative impacts from the Proposed Project would remain the same as those analyzed in the DEIR/EA.

Indirect impacts are defined as "effects which are caused by the [proposed] action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to changes in the pattern of land use, population density, or growth rate…" For this analysis indirect effects are defined as potential land use impacts of the Proposed Project. In comparison, direct land use impacts are displacements of properties required for the Project.

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time." Cumulative impacts include the direct and indirect impacts of a project together with the reasonably foreseeable future actions of others.

The Proposed Project is not likely to generate additional regional growth in jobs or population. However, it may affect where that growth occurs, the form of the growth, and the pace of redevelopment.

The Green Line Extension Project is proposed for an area that is already densely developed. The extension of rail service through this area provides opportunities for the corridor cities' to modify their zoning and create infill development, with opportunities for more housing and other changes that Somerville is already contemplating. The Proposed Project would support a number of major redevelopment projects that are currently planned and underway near the proposed station sites, particularly in the NorthPoint area of Cambridge. Improved mobility, access to a wider range of transportation options, and less traffic congestion would make these projects particularly appealing.

This section describes the potential indirect effects on land use within a ½-mile radius of each proposed station site. This represents the maximum distance riders are willing to walk.

Land Use – The Proposed Project is likely to result in higher density redevelopment, more TOD, and lower on-site parking requirements in areas that are within walking distance of the stations. The following station areas have the greatest potential for higher density redevelopment and TOD: relocated Lechmere, Brickbottom, and Union Square.

Transportation and Traffic – The Green Line Extension Project would provide a new transit option northwest of NorthPoint that would mitigate potential increases in automobile traffic from continued growth and redevelopment in the Project corridor. Combined with the Community Path and the Alewife Brook Parkway to Mystic Valley Path, the Green Line Extension would improve the regional transportation network and reduce regional traffic and congestion.

Property Values – Property values are likely to increase in areas within walking distance of the stations. However, the increases are likely to be relative, as the Project corridor is already highly desirable, and housing affordability is already a concern. The greatest increases are likely to occur in areas that are planned for significant redevelopment: Union Square, Boynton Yards, the Brickbottom District, and the Inner Belt District. Public policy to preserve affordability for moderate-income residents and small businesses should be implemented to mitigate transit-related increases in land values.

Economy – Continued transition away from the industrial and trade sectors toward the services, knowledge-based industries, life sciences, technology, and the arts is anticipated and is supported by public policy. Planned and Proposed

Projects that would expand employment centers in the corridor (redevelopments in East Cambridge, Brickbottom and Inner Belt districts, Union Square, and Boynton Yards) would support this trend and are more likely to proceed with the existence of the Green Line Extension.

Neighborhoods – Redevelopment of underused land in the Project corridor would be enhanced by the addition of a new and improved transit alternative. The greatest changes would likely occur in the Brickbottom and Inner Belt districts and in Boynton Yards, where planning is underway for potential redevelopment of these lower rent, commercial/industrial neighborhoods as mixed-use employment centers. Public policy to preserve affordability for moderate-income residents and small businesses should be implemented to minimize impacts of redevelopment on existing neighborhoods.

Environmental Justice – Environmental justice populations would benefit from the addition of a reliable transit alternative that would provide more opportunities to live and work in places throughout the region. However, increases in land values near new stations, particularly around Brickbottom and Union Square, may impact small businesses and limit affordable housing opportunities. Public policy to help preserve small businesses and maintain housing affordability should be implemented to help maintain diverse communities in the corridor.

7.12 Summary

The DEIR/EA evaluated the Project's impacts – both beneficial and adverse – on natural and human resources. The analysis of the proposed Green Line Extension with respect to the maintenance and storage facility, College Avenue Station, and Lechmere Station described in this FEIR shows that the benefits and impacts of the Proposed Project are as described in the DEIR/EA, with only minor changes.

As described in this FEIR, the Proposed Project consists of extending Green Line service along the Medford Hillside Branch from the relocated Lechmere Station to the College Avenue Station, with four intermediate stations (Brickbottom, Gilman Square, Lowell Street, and Ball Square). The Union Square Branch would have one station, at Union Square. The Green Line Extension would be constructed entirely within existing railroad rights-of-way, which would require that the existing commuter rail tracks be shifted and that several roadway bridges over the rail right-of-way be widened. A maintenance and storage facility would be constructed in Somerville at the Option L site. The Proposed Project, as analyzed in the DEIR/EA and this FEIR, meets the state Air Quality regulatory criteria and the requirements of the SIP.

Since the publication of the DEIR/EA, two substantive changes have been made to the Proposed Project:

- The maintenance facility is proposed at the Option L site, and is no longer proposed at the Yard 8 site.
- The relocated Lechmere Station has been redesigned in response to comments on the DEIR/EA, with reduced parking and modified access.

These changes have not substantively changed the project impacts, and have reduced impacts in some categories.

The Proposed Project would provide transportation benefits, unchanged since the DEIR/EA:

- Substantially increasing transit access to environmental justice and disability populations;
- Focusing regional transportation investment funds into established environmental justice communities, connecting residents to jobs and services in Boston and Cambridge and strengthen business and residential districts in the corridor;
- Making connections from bicycle facilities directly to proposed stations, when the opportunity is available and providing ample bicycle parking at the Proposed Project station locations to accommodate and encourage commuting by bicycle;
- Reducing daily VMT by 25,018, improving air quality and providing zero-emission transportation capacity for anticipated growth.

With the mitigation measures committed to by MassDOT and the MBTA, the Proposed Project would have measurable benefits in several categories:

- Improving many intersections for traffic and pedestrian movements;
- Lowering future noise levels at locations along the existing commuter rail lines due to the noise barriers;
- Keeping future vibration levels at or below existing levels for commuter trains and in reducing future vibration from Green Line trains below the impact criteria (72 VdB for commuter rail and 75 VdB for Green Line trains);
- Remediating several sites that contain contaminated soils.

The Proposed Project would also have indirect social and economic benefits:

- Decreasing low intensity commercial and light industrial uses in the Project corridor and increase mixed-use, high-density TOD, particularly at Union Square, Brickbottom Station, and Ball Square Station;
- Providing socioeconomic benefits due to increased transit access, which increases both the potential for local commerce and the potential for area residents to commute to jobs elsewhere.

Further analysis completed since the DEIR/EA filing, including an analysis of environmental impacts of the Option L maintenance and storage facility, the College Avenue Station as a terminus, and the relocated Lechmere Station, revealed the following changes in environmental impacts:

- Additional annual property tax revenue reduction of $322,440 in Somerville from the Option L maintenance and storage facility;
- Reduction of impervious surfaces by 3.2 acres, improvement in water quality and decrease in stormwater runoff from the Option L maintenance and storage facility;
- Displacement or relocation of 74 jobs in Somerville for the proposed Option L maintenance and storage facility;
- Slightly higher noise from train movements in and out of the yard at Option L at the southwest façade of the Brickbottom Artists Building than at Yard 8 due to the presence of a tight radius curve on the Medford Lead track.
- Slightly higher noise at the Hampton Inn Hotel and the Glass Factory Condominiums from train movements in and out of the yard at Option L due to stationary cars in the south yard operating using auxiliary equipment;
- An additional seven RECs hazardous releases to be remediated at the proposed Option L maintenance facility.

8

Draft Section 61 Findings and Mitigation Commitments

8.1 Introduction

The Secretary's Certificate requested that the FEIR include:

- A distinct draft Section 61 finding for each state agency action that contains:
  - A clear commitment to mitigation, a schedule for implementation;
  - An estimate of the individual costs of the proposed mitigation; and
  - An identification of the parties responsible for implementing the mitigation.
- A conceptual plan for evaluating, monitoring, and compensating affected parties along the corridor that includes:
  - A specific emphasis on, but not limited to, noise, vibration, and land acquisition impacts; and
  - Mitigation measures associated with the future ongoing operations of the Green Line Extension and impacts uniquely limited to the construction period.

This chapter presents MassDOT's proposed mitigation program to address adverse environmental impacts associated with construction and operation of the proposed Green Line Extension Project. This chapter also includes draft Section 61 Findings for the Proposed Project, as specified above.

Typically, transit projects such as the Green Line Extension Project evaluate the potential impacts of the Proposed Project using standard analytical measures and methods approved by the FTA and relevant state agencies, as was done in Chapter 5, *Environmental Consequences*, of the DEIR/EA and updated in Chapter 7, *Summary of Proposed Project Benefits and Impacts*, of the FEIR. Mitigation measures are typically developed based on these standard methods

and legal requirements, and are the basis for the Project's mitigation commitments (as articulated in Chapter 6, *Draft Section 61 Findings and Mitigation Commitments*, of the DEIR/EA and summarized in Chapter 7, *Summary of Proposed Project Benefits and Impacts,* of the FEIR).

Specific mitigation elements that are subject to FTA regulations and guidelines include noise, vibration, and land acquisition (which is governed by the Uniform Relocation Act). The Uniform Act stipulates how the value of property acquisition must be established, and requires FTA to compensate land owners for the fair market value of their property. MassDOT is required to follow the procedures established by the Uniform Act for any property acquisition.

This requirement of the Certificate appears to require MassDOT to monitor noise and vibration during and after construction (with the proposed mitigation measures in place), evaluate whether the actual noise and vibration levels correspond with the modeled values, and somehow compensate property owners for any noise or vibration in excess of the modeled mitigated values. Presumably, this implies that MassDOT would compensate property owners for any decrease in property value due to noise or vibration, rather than (as would normally be the case for MBTA projects) installing additional noise or vibration mitigation measures within the right-of-way or offering the homeowner additional sound insulation.

MBTA would monitor noise and vibration after service starts to determine future noise levels generated by the Green Line Extension and the relocated commuter rail. If noise levels are found to be higher than the projections, the MBTA would investigate the cause and take appropriate corrective action. It is worthwhile to note that when conducted for the Greenbush Line, projections made based on measurements of actual MBTA commuter rail trains on the Greenbush Line showed that there were no locations where actual noise levels exceeded the pre-construction modeled levels.

8.2 Project Benefits

The Proposed Project is expected to generate 52,000 new daily boardings and alightings at the Project's seven stations and generate new systemwide transit ridership of 7,900 boardings per day and a reduction of 25,018 VMTs per day (projected to the year 2030). The increased transit access and ridership would improve corridor mobility, improve traffic conditions, improve regional air quality, increase services to environmental justice populations, and support future smart growth initiatives and sustainable development.

8.3 Overview of Project Mitigation Measures

This section summarizes the mitigation measures proposed to prevent or reduce environmental impacts.

8.3.1 Traffic

By 2030, regardless of the Green Line Extension Project, traffic signal timing and phasing would be inadequate to accommodate the projected traffic demands at a number of locations. The Project would include optimizing traffic signal timing and phasing at all signalized study area intersections to maximize the efficiency of these locations.

Pedestrian Mitigation

Mitigation measures are necessary to accommodate efficient pedestrian access to the proposed Green Line Extension stations. Mitigation measures include:

- Installing crosswalks, wheelchair ramps, and appropriate warning signage;
- Increasing pedestrian walk time;
- Improving existing crosswalk markings and repairing existing pedestrian signal equipment;
- Signalizing side street crossings and increase walk time on main streets; and
- Conducting signal warrant analyses and, if warranted, installing signals.

Under existing conditions, 18 signalized intersections do not currently provide enough time (as defined in the MUTCD, the ADA and associated state regulations) for pedestrians to cross the street before the flashing "Don't Walk" signal ends. In total, pedestrian mitigation is proposed at 33 locations. In some cases, pedestrian mitigation is proposed at locations that were not otherwise studied as part of this analysis. These locations were identified for mitigation as part of the regional pedestrian analysis, as documented in DEIR/EA Appendix F. These measures are presented in Table 8-1.

Table 8-1 Proposed Project Pedestrian Mitigation Measures

Intersection	Proposed Mitigation
Boston Avenue at North Street	Upgrade pedestrian signal heads and increase pedestrian walk/flashing don't walk time
Boston Avenue at Winthrop Street	Restripe crosswalk markings
Boston Avenue between Winthrop Street and College Avenue (mid-block)	Install warning signage for mid-block crossing
Boston Avenue at Harvard Street	Restripe crosswalk markings
Powder House Rotary	Increase pedestrian walk/flashing don't walk time
Boston Avenue at Broadway	Install crosswalk across Broadway
College Avenue between Boston Street and Frederick Avenue (mid-block)	Conduct signal warrant analysis and install pedestrian signal for crossing
College Avenue at George Street	Restripe crosswalk markings and install wheelchair ramps
Main Street at George Street	Install crosswalk across George and install wheelchair ramps
Main Street at Mystic Valley Parkway Ramps	Restripe crosswalk markings
Main Street at Harvard Street	Restripe crosswalk markings
Main Street at Mystic Avenue	Restripe crosswalk markings
Medford Street at Broadway	Increase pedestrian walk/flashing don't walk time
Medford Street at Lowell Street	Install crosswalk across Medford Street (south)
Medford Street at Central Street	Repair pedestrian signal head and increase pedestrian walk/flashing don't walk time
Medford Street at School Street	Increase pedestrian walk/flashing don't walk time
Medford Street at Pearl Street	Conduct signal warrant analysis and if warranted install pedestrian signal for crossing
Medford Street at Walnut Street	Increase pedestrian walk/flashing don't walk time
Medford Street at Highland Avenue	Signalize side street crossings. Increase pedestrian walk/flashing don't walk time
Highland Avenue at Lowell Street	Increase pedestrian walk/flashing don't walk time
Highland Avenue at Central Street	Increase pedestrian walk/flashing don't walk time
Washington Street at McGrath Highway	Incorporate pedestrian crossings into traffic signal phasing and install appropriate equipment
Washington Street at Tufts Street	Conduct signal warrant analysis and if warranted install pedestrian signal for crossing
Washington Street at Inner Belt Road	Increase pedestrian walk/flashing don't walk time
Medford Street at Somerville Avenue/ McGrath Highway	Incorporate pedestrian crossings into traffic signal phasing and install appropriate equipment
Washington Street at Somerville Avenue/Prospect Street	Increase pedestrian walk/flashing don't walk time
Washington Street at Somerville Avenue/Webster Street	Increase pedestrian walk/flashing don't walk time
Washington Street at Kirkland Street	Increase pedestrian walk/flashing don't walk time
Prospect Street at Webster Street	Install a crosswalk across Prospect north. Increase pedestrian walk/flashing don't walk time. Incorporate unsignalized crossings into traffic signal and install appropriate equipment.
O'Brien Highway at Third Street	Provided updated pedestrian crossing timing and phasing
O'Brien Highway at Water Street	Install a new crosswalk across O'Brien Highway and provide a new signalized pedestrian crossing
O'Brien Highway at North First Street	Providing new pedestrian crossing timing and phasing
Cambridge Street at First Street	Providing new pedestrian crossing timing and phasing

Traffic Mitigation

Several intersections would require additional physical mitigation to address adverse impacts, caused by the Project's increased vehicular traffic, as described in the following sub-sections.

Boston Avenue at Winthrop Street

Impacts at Boston Avenue and Winthrop Street would be mitigated by restriping the Boston Avenue northbound approach (currently a single-lane approach) to provide an exclusive left-turn lane and a shared through/right-turn lane. Signal timing and phasing changes would also be implemented. Approximately 12 parking spaces along Boston Avenue would be removed for this improvement. It is anticipated that level of service would improve at this intersection from LOS F to LOS D during the evening peak hour as a result of this mitigation, which is when traffic operations at this location are at their worst. The improvement would improve queuing in the northbound direction at the intersection during other times of the day, but not substantially change level of service since it is expected to operate at an overall acceptable level (LOS D or better) during the rest of the day.

Boston Avenue at College Avenue

Boston Avenue at College Avenue would be mitigated by widening College Avenue westbound to provide an exclusive right-turn lane and a shared left-turn/through lane. Signal timing and phasing changes at this location would also be incorporated. To accommodate this improvement, the College Avenue bridge over the railroad tracks would be widened. Since the bridge is already slated for reconstruction as part of the Project, changes can be made without additional construction impacts. It is anticipated that level of service would improve at this intersection from LOS F to LOS D during the critical evening peak hour with this mitigation. The improvement would improve queuing at the intersection during other times of the day, but not substantially change level of service since it is expected to operate at an overall acceptable level (LOS D or better) during the rest of the day.

Washington Avenue at McGrath Highway

A new traffic signal phasing sequence is proposed at this intersection to incorporate a pedestrian phase into the traffic signal (although this is a signalized intersection, pedestrian crossings at this location are not part of the traffic signal). This change would likely require new traffic signal equipment and new wiring to connect the traffic signal heads to the control cabinet. With these improvements

in place, it is anticipated this intersection would remain at LOS E rather than degrade to LOS F during the morning and evening peak hours.

Prospect Street at Somerville Avenue

To accommodate Project-related pedestrian traffic at this location, pedestrian crossing times would increase, which would cause an adverse impact to overall vehicular traffic operations (i.e. increased delay) during at least one peak hour. There is no opportunity at this location to increase capacity by adding lanes or changing lane allocation. However, traffic and pedestrian signal timings could be further adjusted to balance the needs of pedestrians and motorists once the Project is in service.

Washington Street at Somerville Avenue/ Webster Street

To accommodate Project-related pedestrian traffic at this location, pedestrian crossing times would increase, which would cause an adverse impact to overall vehicular traffic operations (i.e. increased delay) during at least one peak hour. There is no opportunity at this location to increase capacity by adding lanes or changing lane allocation. However, traffic and pedestrian signal timings could be further adjusted to balance the needs of pedestrians and motorists once the Project is in service.

Medford Street at Pearl Street

This unsignalized intersection processes a high volume of traffic, currently operates at LOS F during the morning peak hour, and would degrade to LOS F during the evening peak hour by 2030, with or without the Project in place. The number of pedestrians crossing Medford Street would increase and would require a crosswalk to accommodate pedestrian demands.

A traffic signal would be installed to accommodate changes to this intersection as a result of the Project. Pearl Street would be controlled by the traffic signal and crosswalks would be striped on the south (Medford Street) and east (Pearl Street) approaches to the intersection. Due to the intersection's proximity with School Street, the two traffic signals would operate as a coordinated system. With the proposed improvement, the intersection of Medford Street and Pearl Street would operate at LOS B during both the morning and evening peak hour.

O'Brien Highway Reconstruction

The Future-Build NorthPoint development is assumed to be in place by 2030, the design year for the Green Line Extension transportation analysis. By 2030, it is also assumed that all mitigation associated with the NorthPoint development would be in place. This includes reconstructing O'Brien Highway from Third Street to Museum Way (including the midblock pedestrian crossing west of Land Boulevard) and constructing internal NorthPoint streets as delineated in the NorthPoint special permit.

A number of the mitigation measures associated with NorthPoint are necessary to support the relocation of Lechmere Station across O'Brien Highway. With the delay of the NorthPoint development, these mitigation measures would be undertaken by MassDOT as mitigation for the Green Line Extension. Specifically, the following measures are proposed:

- Reconstruct O'Brien Highway at its intersection with Third Street to restrict westbound left-turns from O'Brien Highway to Third Street, provide an upgraded pedestrian crossing, new signal timing, and new phasing.
- Reconstruct O'Brien Highway at its intersection with Water Street to remove the median and allow eastbound left-turns from O'Brien Highway to Water Street. Left-turns from Water Street would be allowed on an interim basis until NorthPoint is constructed and then restricted once NorthPoint is built. A new crosswalk would be provided on the south side of the intersection and the intersection would be signalized.
- Reconstruct O'Brien Highway at North First Street and East Street:
  - First Street would be extended to connect to O'Brien Highway, creating a new signalized intersection.
  - Eastbound left-turns onto North First Street (into the new station) would be prohibited. This movement would be accommodated at Water Street.
  - Westbound left-turns from O'Brien Highway to First Street and Cambridge Street would occur at this intersection under the proposed mitigation.
  - East Street would be reconstructed to be a right-turn in/right-turn out driveway and the median extended along O'Brien Highway to prohibit other movements. The existing traffic signal would be removed.
- Reconstruct the intersection of Cambridge Street and First Street, including new signal timing and phasing.
- Reconstruct First Street between Cambridge Street and O'Brien Highway to make the roadway one-way eastbound to O'Brien Highway southbound.

The proposed improvements are necessary to support vehicular traffic and pedestrian crossings associated with the relocation of Lechmere Station. Traffic signal wiring would extend roughly to East Street, to be tied into by the NorthPoint proponent in order to complete the mitigation measures committed to along O'Brien Highway as part of their special permit.

Parking Enforcement Mitigation

The lack of available long-term parking at the Green Line Extension stations may encourage some motorists to park on local streets. Increasing parking enforcement or changing local parking restrictions to restrict commuter parking would be effective in reducing neighborhood impacts. MassDOT would work with the affected communities to develop acceptable parking enforcement plans for the areas within one-half mile of the stations in order to limit potential impacts.

8.3.2 Noise

In the absence of mitigation, a total of 164 noise-sensitive receptors would be exposed to noise impact by the Proposed Project. These include 121 moderate impacts and 43 severe impacts at single-family and multi-family residential buildings, moderate impact at three institutional buildings (Tufts Science and Technology Center, Outside the Line Artist's Studio and Bacon Hall at Tufts University), moderate impact at Trum Playground and severe noise impact at the Walnut Street Center (a non-profit support center for adults with developmental disabilities) near Union Square.

MassDOT would mitigate both moderate and severe noise impacts wherever feasible and wherever existing noise levels are above 65 dBA, based on FTA noise mitigation guidance. At locations with no outdoor areas of frequent human use (as defined per FTA), noise mitigation would be considered for interior spaces. Some of the large buildings, however, may have a greater outdoor-to-indoor sound reduction than for typical buildings (about 25 dB with windows closed). If it can be established that there is indoor activity only and that the performance of these windows is sufficiently better than normal, sound insulation mitigation may not be necessary. Mitigation would be considered based on whether interior maximum single-event (train pass-by) noise levels (Lmax) are above 65 dBA or whether interior day-night sound levels from Project sources (Ldn) are above 45 dBA.

To mitigate noise impact from train operations, noise control would be considered at the source, along the sound path, or at the receiver. Source noise control options may include special hardware at turnout locations, relocating special trackwork away from sensitive areas and using continuous welded rail.

Noise barrier construction is the most common sound path noise control treatment and can be very effective at reducing noise levels in the community. Noise control at the receiver can also be achieved by using sound insulation treatments at residences and institutional buildings. Sound insulation would be considered an effective mitigation measure if it is possible to improve the noise reduction of the existing building by five decibels or more and provide interior noise levels of 65 dBA or less (Lmax or maximum noise level) from transit sources. Proposed mitigation recommendations would be refined further during the design process of the Project.

For many locations along the MBTA Fitchburg and Lowell Lines, noise barriers are a feasible and effective means of noise mitigation because the existing right-of-way is lower than sensitive receptors for substantial portions of the Project. Noise barriers would be constructed with an absorptive surface to minimize the potential of sound reflecting off barriers to sensitive locations on the opposite side of the tracks. Table 8-2 shows a summary of proposed noise barrier mitigation. This table includes the barrier length, side of tracks, barrier height, and range of noise reduction and the general location of the barrier. The areas of impact and proposed noise barrier locations are shown in Figures 7-1 through 7-5.

Noise barriers ranging between six and 12 feet in height would be effective in reducing noise levels from the Project by generally seven to 11 decibels. The 18 noise barriers (10,750 feet in length and approximately 90,000 square feet in area) would cost approximately $2.7 million dollars based on $30 per square foot of installed noise barriers not counting design and inspection costs.

Near College Avenue Station, a noise barrier 1,000 feet long, approximately six feet in height on a retaining wall along the right-of-way would be effective in mitigating potential noise impact at receptors on Burget Avenue and Brookings Street (noise barrier # 16). Since the additional noise at these sensitive receptors due to College Avenue Station being a terminal station is small, this noise barrier is not required specifically due to College Avenue Station being a terminal station for the Proposed Project. Future noise levels from both commuter and Green Line trains are expected to be reduced nine to 11 decibels with this barrier and future noise levels are expected to be lower than existing levels.

Additionally, refinements in mitigation related to the new Option L maintenance facility location in conjunction with the redesigned Lechmere Station have resulted in additional recommended mitigation including noise barriers totaling 900 feet in length (two barrier each 450 feet long) and 450 feet (900 track-feet) of ballast mat or resilient rail fasteners, which would be effective in minimizing the potential for noise impact at Glass Factory Condominiums. Since the contribution of noise from the proposed Option L maintenance and storage facility is low compared to mainline operations, this noise barrier is not required

due to the maintenance facility alone. The heights of these barriers depend significantly on the guideway design and how close to the trains they can be constructed. Ideally, the barriers would be located within four feet of the near rail or closer. The heights and effectiveness of these barriers would be refined during the Preliminary Engineering phase of the Project.

Table 8-2 Summary of Proposed Project Noise Barrier Mitigation

Barrier Number	Length (feet)	Side of Tracks	Barrier Height (feet)	Noise Reduction (dBA)	Location
1	450[b]	West	TBD	TBD	On elevated guideway edge and between inbound and outbound tracks
2	300	West	7	7 to 17	On existing retaining wall
3	500	East	7	7 to 14	Right-of-way limit
4	750	East	6 to 10	9 to 16	Right-of-way/Trackside
5	850	East	9	10 to 14	Right-of-way limit
6	300	West	7	7 to 14	Right-of-way limit
7	300	East	7	9 to 11	Right-of-way limit
8	250	West	6 to 12	7 to 9	On proposed retaining wall
9	1,050	East	7 to 10	10 to 15	Right-of-way limit
10	1,000	East	8	9 to 15	Right-of-way limit
11	400	West	8	8 to 12	On proposed retaining wall
12[a]	100	East	8	10 to 14	Right-of-way limit
13	400	East	8	10 to 14	Right-of-way limit
14	800	West	8	10 to 14	Right-of-way limit
15	1,200	East	10	6 to 15	On trackbed retaining wall
16	1,000	East	6	9 to 11	Right-of-way/retaining wall
17	250	South	8	10 to 14	Trackside
18	400	North	8	10 to 14	Trackside

Source: Harris Miller Miller & Hanson Inc., August 2010.
a There is an existing 6-foot barrier at this location.
b Barrier includes segment on guideway edge and in between inbound and outbound tracks (two segments 450 feet in length each)

At some locations projected to be exposed to noise impact, noise barriers as described above may not be a feasible or effective means of mitigation. These locations include the:

- Brickbottom Lofts;
- Apartment complex on Pearl Street (near Medford Street);
- Visiting Nurses Association;
- Tufts Science and Technology Center;

- Outside the Lines Art Studio;
- Tufts Bacon Hall; and
- Walnut Street Center in Union Square.

Some of these buildings have upper-floor residences that may not benefit from a potential noise barrier. For buildings that do not have significant outdoor land use, sound insulation mitigation would be considered during the Preliminary Engineering phase of the Project. Substantial improvements in building sound insulation (on the order of 5 to 10 dBA) can often be achieved by adding an extra layer of glazing to windows, by sealing any holes in exterior surfaces that act as sound leaks, and by providing forced ventilation and air conditioning so that windows do not need to be opened.

In order to best determine the most appropriate mitigation type for each of these individual properties, during the next phase of the Project, the existing outdoor-to-indoor noise reduction at these locations would be measured and assessed. An analysis would be made as to whether mitigation is required for buildings that do not have significant outdoor land use, if the noise reduction of the building could be improved by five decibels or more with sound insulation treatments or if noise barriers would be effective in reducing interior noise levels at these locations. Specific mitigation measures would be developed as they are appropriate to each individual structure during Preliminary Engineering.

Estimated costs for sound insulation depend on specific factors such as the existing noise reduction, existing HVAC systems and the number and size of windows and doors that would need to be replaced. The costs associated with potential sound insulation or noise barrier mitigation for these properties would be defined during the next phase of the Project.

The following mitigation measures would be applied where feasible to minimize temporary construction noise impacts:

- Avoiding nighttime construction in residential neighborhoods;
- Using specially quieted equipment with enclosed engines and/or high-performance mufflers;
- Locating stationary construction equipment as far as possible from noise-sensitive sites; and
- Constructing noise barriers, such as temporary walls or piles of excavated material, between noisy activities and noise-sensitive receivers.

The Secretary's Certificate included the requirement that the "FEIR should include a conceptual plan for evaluating, monitoring, and compensating affected parties along the corridor with a specific emphasis on, but not limited to, noise, vibration, and land acquisition impacts."

Typically, transit projects such as the Green Line Extension Project evaluate the potential impacts of the Proposed Project using standard analytical measures and methods approved by the FTA and relevant state agencies, as was done in Chapter 5 of the DEIR/EA and updated in Chapter 7 of the FEIR. Mitigation measures are typically developed based on these standard methods and legal requirements, and are the basis for the Project's mitigation commitments (as articulated in Chapter 6 of the DEIR/EA and summarized in Chapter 7 of the FEIR). The MBTA's experience is that this type of mitigation program is very successful and homeowners find that it provides a significant amount of noise reduction.

As was done for the Greenbush Line, the MBTA would monitor noise and vibration after service starts to determine noise levels generated by the Green Line Extension and the relocated commuter rail. If the levels are found to be higher than the projections, the MBTA would investigate the cause and take appropriate corrective action. It is worthwhile to note that when conducted for the Greenbush Line, projections made based on measurements of actual MBTA commuter rail trains on the Greenbush Line showed that there were no locations where actual noise levels exceeded the pre-construction modeled levels.

8.3.3 Vibration

The goal for mitigating potential vibration impact from the proposed Green Line Extension Project is to reduce future vibration below the impact criteria, which is 72 VdB for Green Line trains and 75 VdB for commuter trains. At some locations, mitigation measures that would reduce vibration levels five decibels or more would be considered reasonable and effective with the intention of keeping future vibration levels at or below existing vibration levels.

The effectiveness of specific vibration mitigation measures is dependent on several factors such as the component design, installation techniques, and axle loads of the trains and frequencies of concern. The following are vibration mitigation options proposed for locations along the proposed Green Line Extension Project shown in Table 8-3:

- Resilient rail fasteners connect the rails to the ties and may reduce vibration by 5 to 10 VdB.
- Ballast mats are rubber pads placed underneath the ballast and may reduce vibration levels 10 to 15 VdB.

- Resiliently supported ties are rubber pads placed underneath the ties and may reduce vibration 10 VdB.
- Floating slabs isolate train vibration from the surrounding ground with springs or rubber pads and may reduce vibration 15 VdB or more. Drawbacks towards floating slabs include difficulties in designing for heavy commuter trains, difficulties in designing for outdoor environments and the relatively high cost.
- Similar to noise, gaps in the rail increase vibration levels of the trains. Mitigation may include using special hardware or relocating turnouts and crossovers and using continuous-welded rail rather than jointed rail.
- Maintenance programs are important for controlling vibration. Rail grinding and wheel truing to maintain smooth rails and true wheels can be effective in reducing potential vibration impact.

The areas of impact and proposed vibration mitigation locations are shown in Figures 7-6 through 7-10. During the Preliminary Engineering phase of the Project, vibration measurements would be conducted at several properties expected to be impacted by vibration. These measurements would further refine the vibration reduction needed to mitigate potential impact. A vibration reduction goal for mitigation measures, such as ballast mats or resilient fasteners, would be specified in the bid documents. Suitable mitigation measures would be introduced into the Project to achieve the mitigation goal.

Assuming that both tracks of a particular rail line are mitigated, a total of 19,700 track-feet of vibration mitigation is proposed to mitigate potential impacts for the Proposed Project. An estimated cost for installed ballast mats is $3.5 million based on a cost of $180 per track-foot and an estimated cost for resilient fasteners is $5.9 million based on a cost of $300 per track-foot.

Special trackwork (turnouts and crossovers) cause local increase in vibration levels of up to 10 VdB. In addition to the locations of proposed vibration mitigation shown above, relocating special trackwork (turnouts and crossovers) away from sensitive receptors or using specially-engineered trackwork (flange-bearing or moveable-point frogs) would minimize potential vibration impact at some locations. Table 8-4 provides a summary of existing crossovers and turnout locations that are recommended for specially-engineered trackwork or relocation. These crossovers and turnout locations are shown on Figures 7-6 through 7-10.

Table 8-3 Summary of Proposed Project Vibration Mitigation[1]

Vibration Mitigation Location[2]	Length (feet)	Rail Line
1	450	Green Line
2	500	Green Line
3	300	Green Line
4	950	Commuter
5	800	Commuter
6	400	Green Line
7	200	Commuter
8	900	Commuter
9	600	Green Line
10	1,200	Commuter
11	400	Green Line
12	150	Commuter
13	1,100	Commuter
14	700	Commuter
15	200	Green Line
16	250	Commuter
17	250	Commuter
18	250	Green Line
19	250	Commuter

Source: Harris Miller Miller & Hanson Inc., August 2010.
1 Ballast mats or resilient fasteners.
2 See Figures 7-6 through 7-10

Table 8-4 Potential Vibration Mitigation Measures for Crossovers and Turnouts

Special Trackwork Location[1]	Type of Special Trackwork	Rail Line
A	Number 8 Double Crossover	Green Line
B	Turnout	Commuter
C	Number 8 Double Crossover	Green Line
D	Turnout	Commuter
E	Crossover	Commuter
F	Crossover	Commuter
G	Crossover	Commuter
H	Crossover	Commuter
I	Number 8 Double Crossover	Green Line
J	Turnout	Green Line

Source: Harris Miller Miller & Hanson Inc., August 2010.
1 See Figures 7-6 through 7-10

8.3.4 Water Quality/Stormwater

The Proposed Project would create approximately two acres of new impervious surfaces, including roofs, walkways, platforms, and other pavement for the new stations. Since the DEIR/EA, there has been a reduction in impervious surface for the overall Project as a direct result of the use of Option L for the maintenance facility location. Because part of the Option L site is currently covered by buildings and pavement but would be replaced with substantial areas of trackwork with pervious stone ballasted surface areas, the Option L maintenance facility would decrease impervious area by approximately 3.2 acres. Taking into consideration the increase in impervious surfaces at the station areas and the reduction in impervious surfaces at the maintenance facility, there would be no net increase in impervious surfaces as a result of the overall Proposed Project.

New and expanded stormwater management systems would be required to collect the runoff from these areas. These systems would discharge into the existing municipal stormwater drainage systems. Proposed stormwater management devices include:

- Deep sump catch basins to collect runoff from paved areas;
- Underdrains beneath the rail ballast to collect runoff within the rail corridor;
- Hydrodynamic particle separators to treat pavement runoff;
- Low Impact Development practices, where feasible, to maintain natural hydrology (e.g., raingardens to treat disconnected roof drainage and/or parking runoff);
- Underground infiltration/detention chambers to store and infiltrate runoff; and
- Overflow from the underground chambers to municipal storm drainage systems.

The proposed stormwater management system would include detention/ infiltration systems as needed to maintain existing flow rates at existing outfalls. The extent of infiltration for each system would be determined during a later phase of the design based on actual soil analysis at the proposed system location. The infiltration systems would be sized taking into consideration soil conditions, and the remaining volume of runoff would be stored and released through a controlled outlet to match the existing rate of flow. Where infiltration is not possible due to poor soils or high groundwater subsurface detention systems would be sized to maintain predevelopment flow rates at each design point**.**

The Massachusetts Stormwater Management Standards require controlling flow rates to prevent flooding and removing total suspended solids (TSS) to improve water quality. The proposed drainage system would include

detention/infiltration systems to maintain existing flow rates at existing outfalls. The extent of infiltration for each system would be determined for the final design based on actual soil analysis at the proposed system location. The remaining volume of runoff would be stored and released through an outlet control structure to match the existing rate of flow at each design point. Where infiltration/exfiltration is not possible due to poor soils or high groundwater, the subsurface detention system would be sized to maintain predevelopment flow rates at each design point. Maintaining existing flow rates would avoid exacerbating the existing effects of combined sewer overflows (CSOs) on the receiving waters.

TSS removal would not be necessary since the right-of-way would generate negligible TSS as it is not salted or sanded as roads and parking lots are. Where needed, TSS removal would be accomplished by way of proprietary water quality devices such as Vortechs units, which use whirlpool-like chambers to remove floating and suspended solids. These units would be installed prior to the proposed detention systems or before each connection to the existing drainage system. Each device would be sized to treat the 10-year flow rate at the proposed outfall and to maintain the predevelopment rate of flow in the existing drainage system.

With these measures in place, no increases in flooding or impairment of the receiving waters are expected.

MassDOT would prepare a detailed long-term operations and maintenance plan for the Proposed Project's stormwater management system. MassDOT would design a drainage system to meet MassDEP Stormwater Standards to the extent feasible, including meeting any applicable Total Maximum Daily Load (TMDL) requirements. MassDOT also acknowledges that the Proposed Project would be required to achieve requisite NPDES permit obligations, including MS4 requirements to implements construction site runoff controls, post-construction runoff controls, and pollution prevention/good housekeeping measures.

8.3.5 Historic Resources

The south end of the Project Area that intersects with the Cambridge steel elevated portion of the Lechmere Viaduct, which is eligible for listing in the National Register as part of the Viaduct, and would be impacted by the Proposed Project. In addition, removing the existing Lechmere Station structure and constructing a new station on the east side of O'Brien Highway/Route 28 would affect a property that is recommended as National Register-eligible. This work would require mitigation as stipulated in the MOA. The proposed Gilman Square Station would have an indirect effect on the Gilman Square Area and Central Hill Area through the introduction of new visual elements.

With the exception of these areas, direct permanent impacts from work within the existing railroad right-of-way is not likely to directly affect significant historic resources, as no significant resources are found inside the railroad right-of-way. However, a number of historic architectural resources immediately abut the right-of-way and would be indirectly affected by noise and vibration. Impacts to these historic structures could occur as a result of soundproofing, if the noise study found that noise mitigation was required.

Noise mitigation would include noise walls and sound insulation, treatments which in themselves have the potential for adverse effect. Noise walls that are proposed adjacent to the Susan Russell House, Michael Cotter House, and Hill-Michie Co. Auto Garage would be of a material and color that is compatible with the historic character of the properties to minimize any additional visual affect from noise walls. The introduction of new doors, windows, or other insulating treatments would be appropriate for the historic property and meet the Secretary of the Interiors Standards for Rehabilitation.

Mitigation would be provided for individual and district historic resources that are listed or eligible for listing in the National Register and that would be adversely affected by permanent aspects of the Project. Attention to the historic character of Somerville would be integrated into the design of stations, although the stations would not adversely affect historic properties. Mitigation at Lechmere Station, which is proposed to be demolished, would consist of archival documentation and consideration of salvage of architectural elements. Historic interpretive signage may also be included.

Affected historic properties proposed to be subject to sound insulation mitigation consist of the A & P Warehouse (Brickbottom Lofts) and Warner and Childs Garage (Tufts Bacon Hall). Vibration mitigation would consist of measures incorporated into the rail bed, ballast, and track design and therefore there would be no effects and no need for additional mitigation.

The Proposed Project would affect one archaeologically sensitive area, a potential mid-late nineteenth-century worker housing site at the proposed Brickbottom Station. There is also the potential for archaeologically sensitive strata below railroad and upper fill deposits in the Option L maintenance and storage facility area where the new vehicle maintenance building is proposed.

For archaeological resources, final design of the Proposed Project would seek to avoid the archaeologically sensitive areas discussed above. If avoidance through Project redesign is not possible, then subsurface testing as part of an intensive (locational) archaeological survey may be warranted in consultation with the FTA, MassDOT, and MHC. The intensive survey would be designed to locate and identify any potentially significant archaeological resources that may be impacted by the Project. The intensive survey would be conducted under a state

archaeological permit issued by the MHC/State Archaeologist following a research design and testing strategy developed specifically for each sensitive area according to the type of expected archaeological resource(s).

Should any significant and National Register-eligible archaeological resources be identified during the intensive survey or subsequent site evaluation testing, then measures to avoid, minimize, or mitigate any adverse effects of the Project on the National Register-eligible resource(s) would need to be determined by the FTA and MassDOT, in consultation with the MHC and other consulting and interested parties. Mitigation measures for archaeological sites that would be adversely affected by construction activities would include an archaeological data recovery program designed in accordance with state and Federal guidelines and standards for the excavation of National Register-eligible archaeological sites.

8.4 Section 61 Findings

These proposed Section 61 Findings for the Project have been prepared to comply with the requirements of Massachusetts General Laws, Chapter 30, Section 61, and in accordance with the MEPA regulations at 301 CMR 11.07(6)(k), which requires state agencies and authorities to review, evaluate, and determine the impacts on the natural environment of all projects or activities requiring permits issued by the state, and to issue findings describing the environmental impacts, if any, and certifying that all feasible measures have been taken by the Project Proponent to avoid or minimize these impacts. As described below, MassDOT has reviewed the environmental effects of the Proposed Project. Based on the review, MassDOT finds that all feasible measures have been taken first to avoid and then minimize those effects.

8.4.1 Project Description

The Green Line Extension Project is envisioned to provide service to Union Square and to Medford using a two-branch operation, both in existing commuter rail rights-of-way. One branch would operate from relocated Lechmere Station to Medford along the MBTA Lowell Line. This branch would begin at relocated Lechmere Station and head northwest, meeting the MBTA Lowell Line just south of Washington Street in Somerville. From Washington Street, the alignment would run parallel to the MBTA Lowell Line to Medford, terminating its route at Medford Hillside in the vicinity of College Avenue. The second branch would operate along the MBTA Fitchburg Line from Lechmere Station into a terminus at Union Square in Somerville. The Union Square Branch would begin at relocated Lechmere Station and head northwest, following the MBTA Fitchburg Line to Prospect Street in the Union Square area.

The route length would be about three miles to Medford Hillside with an approximately one-mile spur to Union Square. The primary infrastructure improvements of the Proposed Project would include relocating existing commuter rail lines, and constructing approximately four miles of new light rail track and systems, 11 bridge structures and a maintenance facility to support the extension service. The environmental impacts of the Proposed Project have been fully evaluated and are described in detail in the DEIR/EA, with supplemental information provided in this FEIR.

The Project would include one relocated Green Line station, six new Green Line stations, and a maintenance and storage facility (Option L). The stations include:

- Relocated Lechmere Station, Cambridge (relocated to the east side of O'Brien Highway);
- Union Square Station, Somerville;
- Brickbottom Station, Somerville;
- Gilman Square Station, Somerville;
- Lowell Street Station, Somerville;
- Ball Square Station, Medford; and
- College Avenue Station, Medford.

The Proposed Project for the Green Line Extension Project has been selected as it provides a balance of cost, ridership, and environmental impacts. MassDOT also believes that the Proposed Project would help the Commonwealth achieve its goal of providing expanded transportation services and improve regional air quality. The Proposed Project would meet all Project goals, would be operationally feasible, and would generate a high number of new systemwide transit trips.

8.4.2 History of MEPA Review

An EENF was submitted to the EEA on October 10, 2006. The Secretary of EEA issued a Certificate on the EENF on December 1, 2006, requiring a DEIR for the Proposed Project.

The DEIR/EA was submitted to the EEA on October 15, 2009, in compliance with the MEPA regulations (301 CMR 11.00). The MEPA Certificate was issued on January 15, 2010. This FEIR responds to the requirements of the Secretary's Certificate.

8.4.3 Related Permits and Approvals

The Proposed Project would require permits and approvals from several local, state and Federal agencies. Table 8-5 below lists the permits and approvals that are anticipated for the Proposed Project.

Table 8-5 Possible Permits or Approvals

Agency	Approval or Permit
FTA	Finding of No Significant Impact Section 4(f) Determination Section 106 Finding Memorandum of Agreement with MHC Federal funding approval
U.S. Environmental Protection Agency Region I	Compliance with NPDES Construction General Permit for stormwater discharges during construction Compliance with NPDES Small Municipal Separate Storm Sewer System (MS4) General Permit
Massachusetts Water Resource Authority (MWRA)	Direct Connect Permit for sewer connections Compliance with MWRA NPDES permit for stormwater discharges through the Combined Sewer Overflow system (Somerville CSO areas only) Massachusetts General Laws Chapter 30, Section 61 Finding
Massachusetts Historical Commission (MHC)	Review of Project for impacts to historic and archaeological properties and approval for compliance with M.G.L. Chapter 9, Sections 26-27C Memorandum of Agreement (with FTA and MassDOT) Section 61 Finding
MassDOT	State funding approval Section 61 Finding Memorandum of Agreement with MHC Access permits Approval and access permit for intersection and signal modifications, as appropriate
City of Medford	Approval for reconstruction of bridges and associated temporary closings/detours for construction Building permits as needed for station construction Approval and access permit for intersection and signal modifications, as appropriate
City of Somerville	Approval for reconstruction of bridges and associated temporary closings/detours for construction Building permits as needed for station construction Approval and access permit for intersection and signal modifications, as appropriate
City of Cambridge	Building permits as needed for station construction Approval and access permit for intersection and signal modifications, as appropriate

8.4.4 Summary of Mitigation Commitments

Potential permanent impacts resulting from constructing the Proposed Project would be mitigated to the extent feasible, as described in Chapter 5 of the DEIR/EA and summarized in Table 8-6. Anticipated, known costs related to each mitigation measure are also identified in this table.

Table 8-6 Project Mitigation Commitments

Human and Environmental Resources	Mitigation Measure	Implementation Schedule	Cost Estimate	Implementation Responsibility
Traffic	Provide roadway and signal modifications at ten specific intersections in order to prevent adverse traffic impacts from the Project. Revisit opportunities to reduce vehicular traffic associated with the addition of new stations during design.	Completion of construction[1]	$10 M	MassDOT/MBTA
	Provide pedestrian improvements at 33 specific locations to improve pedestrian flow and safety.	Completion of construction[1]	$800,000	MassDOT/MBTA
	Work with cities to develop station-area parking enforcement plans.	Completion of construction[1]	N/A	MassDOT/MBTA
	Work with the MBTA to evaluate opportunities to improve connections between the new stations and existing bus connections.	Prior to/Completion of construction[1]	N/A	MassDOT/MBTA
	Work with cities and applicable emergency personnel during design of intersection mitigation measures, as well as establishment of construction management and detour plans.	Prior to/Completion of construction[1]	N/A	MassDOT/MBTA
Noise	Provide noise mitigation in the form of noise barriers or sound insulation to mitigate severe noise impacts. Provide noise mitigation for moderate noise impact where existing noise levels are above 65 Ldn. Provide noise mitigation for impacts with no significant outdoor land use if interior day-night sound levels (Ldn) are above 45 dBA from Project sources or single-event maximum noise levels (Lmax) above 65 dBA.	Completion of construction[1]	$2.7 M (noise barriers), costs for sound insulation or noise barriers to be determined in next phase	MassDOT/MBTA
Vibration	Provide vibration mitigation in the form of ballast mats or resilient rail fasteners and relocated or specially-engineered special track to mitigate vibration impacts.	Completion of construction[1]	$3.5 M (mats), $5.9 M (fasteners)	MassDOT/MBTA
Hazardous Materials	Consult with MassDEP during design and commencement of construction to ensure planning and implementation of demolition and management of contaminated soils is consistent with applicable MassDEP regulations and recommendations.	Completion of construction[1]	N/A	MassDOT/MBTA

Table 8-6 Project Mitigation Commitments (continued)

Human and Environmental Resources	Mitigation Measure	Implementation Schedule	Cost Estimate	Implementation Responsibility
Land Use	Work with the community for the area of the future Mystic Valley/Route 16 to consider land use and station design elements.	Prior to construction	N/A	MassDOT/MBTA
	Complete the final design for the proposed Somerville Community Path between Lowell Street and the Inner Belt area. Work with City of Somerville to identify opportunities for state and Federal funding for construction of Community Path.	Prior to construction	$2 M	MassDOT/MBTA
Water Quality/ Stormwater	Prepare a Stormwater Pollution Prevention Plan (SWPPP).	Prior to construction	N/A	MassDOT/MBTA
	Install detention and infiltration systems to infiltrate peak runoff and to prevent any increase in peak flows to municipal stormwater drainage systems and to remove TSS from stormwater runoff prior to discharge.	During construction[2]	$455,000	MassDOT/MBTA
	Install hydrodynamic particle separators to treat pavement runoff.	During construction[2]	$255,000	MassDOT/MBTA
	Install Low Impact Development practices, where feasible, to maintain natural hydrology (e.g., raingardens to treat disconnected roof drainage and/or parking runoff).	Completion of construction[1]	TBD	MassDOT/MBTA
	Update the Operation and Maintenance (O&M) plan in the SWPPP to include a detailed outline of inspection and cleaning schedules for stormwater management practices, including detention areas and deep sump catch basins.	Completion of construction[1]	N/A	MassDOT/MBTA
	Implement all aspects of the SWPPP including recommendations in annual updates based on new or improved procedures or changes to operations.	Post-construction	N/A	MassDOT/MBTA
Visual Environment	Provide vegetation on and/or above retaining walls to minimize visual changes.	Completion of construction[1]	TBD	MassDOT/MBTA
	Work with affected communities on design of noise barriers and vegetated walls.	Prior to construction	N/A	MassDOT/MBTA

Table 8-6 Project Mitigation Commitments (continued)

Human and Environmental Resources	Mitigation Measure	Implementation Schedule	Cost Estimate	Implementation Responsibility
Historical and Cultural Resources	Perform archival documentation of historic structures to be removed or altered.	Prior to demolition	$30,000	MassDOT/MBTA
	Construct noise barriers with materials and colors compatible with adjacent historic properties.	Completion of construction[1]	N/A	MassDOT/MBTA
	Provide noise mitigation (sound insulation) for sensitive historic structures that cannot be protected using noise barriers.	Completion of construction[1]	N/A	MassDOT/MBTA
	Perform intensive archaeological survey before disturbing any archaeologically-sensitive areas.	Prior to construction	$50,000	MassDOT/MBTA
Public Involvement	Continue civic engagement opportunities during the design process. Provide transparent public information and outreach process once construction commences.	Completion of construction[1]	N/A	MassDOT/MBTA
	Engage interested parties in a station Design Working Group.	Prior to construction	N/A	MassDOT/MBTA
	Conduct land use workshops with affected communities to further identify community needs and issues near the proposed station areas.	Prior to construction	N/A	MassDOT/MBTA
Design	As design advances, facilitate future transit projects such as light rail expansion or connections to existing infrastructure to the extent possible.	Prior to construction	N/A	MassDOT/MBTA
	Include “green” design component (recycled or recyclable materials or incorporate vegetation) in design of proposed retaining walls.	Prior to construction	N/A	MassDOT/MBTA
	During design, refine Project designs to further minimize temporary and permanent impacts on local neighborhoods and property owners.	Prior to construction	N/A	MassDOT/MBTA
	Design all stations in compliance with ADA standards, Massachusetts AAB standards; MBTA’s settlement agreement with the Boston Center for Independent Living; applicable National Fire Protection Association standards.	Prior to construction	N/A	MassDOT/MBTA

1 Completion of construction (12/31/2014)
2 During construction (11/11/2011 – 12/31/2014)
TBD = To be determined during final design
N/A = Cost not applicable for this item

Temporary, short-term impacts from construction activities would be mitigated to the extent feasible. Appropriate construction mitigation measures would be incorporated into the contract documents and specifications governing the activities of contractors and subcontractors constructing elements of the Project. Prior to construction, MassDOT would prepare a detailed plan to address various construction period impacts through coordination with cites and appropriate emergency personnel. This plan would seek to avoid, minimize and mitigate potential impacts to vehicular traffic, pedestrian and bicycle traffic, on-street parking, public access, emergency access to local businesses and residences, dust, noise, odor, rodents and construction-related nuisance conditions. MassDOT would work with contractors to establish construction protocols. On-site resident engineers and inspectors would monitor all construction activities to ensure that mitigation measures are properly implemented. The construction mitigation measures are summarized in Table 8-7, and described in Section 3.7.6 of the DEIR/EA.

Table 8-7 Summary of Construction Mitigation Measures

Environmental Categories	Mitigation Measure	Implementation Schedule	Implementation Responsibility
Traffic	Temporary detours would be established to minimize traffic disruption due to construction.	During construction[1]	MassDOT/MBTA
	Bridge reconstruction would be timed so as to minimize temporary bridge closures and to ensure that adjacent bridges were not closed simultaneously.	Completion of construction[2]	MassDOT/MBTA
Noise	Use specially quieted equipment with enclosed engines and/or high-performance mufflers.	During construction[1]	MassDOT/MBTA
	Avoid nighttime construction in residential neighborhoods.	During construction[1]	MassDOT/MBTA
	Keep truck idling to a minimum.	During construction[1]	MassDOT/MBTA
	Route construction equipment and vehicles through areas that would cause the least disturbance to nearby receptors where possible.	During construction[1]	MassDOT/MBTA
	Fit any air-powered equipment with pneumatic exhaust silencers.	Prior to construction	MassDOT/MBTA
	Locate stationary construction equipment as far as possible from noise-sensitive sites.	During construction[1]	MassDOT/MBTA
	Construct noise barriers, such as temporary walls or piles of excavated material, between noisy activities and noise-sensitive receivers.	Prior to construction	MassDOT/MBTA
Vibration	Avoid nighttime construction in residential neighborhoods.	During construction[1]	MassDOT/MBTA
	Use alternative construction methods to minimize the use of impact and vibratory equipment (e.g. pile drivers and compactors).	During construction[1]	MassDOT/MBTA

Table 8-7 Summary of Construction Mitigation Measures (continued)

Environmental Categories	Mitigation Measure	Implementation Schedule	Implementation Responsibility
Water Quality/ Stormwater	Develop and implement a SWPPP in accordance with NPDES and MassDEP standards.	Prior to construction	MassDOT/MBTA
	Stabilize any highly erosive soils with erosion control blankets and other stabilization methods, as necessary.	During construction[1]	MassDOT/MBTA
	Reinforce slopes using a hydroseed mix with a resin base, native vegetation, or other approved methods.	During construction[1]	MassDOT/MBTA
	Use dewatering controls, if necessary.	During construction[1]	MassDOT/MBTA
	Install a gravel entrance to prevent sediment from being tracked onto roadways and potentially discharged to surface waters.	During construction[1]	MassDOT/MBTA
	Maintain construction equipment to prevent oil and fuel leaks.	During construction[1]	MassDOT/MBTA
Air Quality	Apply water to dry soil to prevent dust production.	During construction[1]	MassDOT/MBTA
	Use water for compaction in the fill areas and as a dust retardant in both the soil cut areas and haul roads.	During construction[1]	MassDOT/MBTA
	Follow existing MassDEP's Solid Waste and Air Quality Control regulations and MBTA retrofit procedures for construction equipment to reduce emissions.	During construction[1]	MassDOT/MBTA
	Comply with MassDEP's idling regulations. Post idling restriction signage on Project construction sites.	During construction[1]	MassDOT/MBTA

1 During construction (11/11/2011 – 12/31/2014)
2 Completion of construction (12/31/2014)

8.4.5 Proposed Section 61 Findings

The language in the following paragraphs is a proposed Section 61 Finding that extends to cover all potential impacts of the Project and could be adopted by the MassDOT, MHC, Massachusetts Water Resource Authority (MWRA), or other state agency.

Project Name: Green Line Extension Project
Project Location: Boston, Cambridge, Somerville, and Medford, Massachusetts
Project Proponent: Massachusetts Department of Transportation
EEA Number: 13886

The potential environmental impacts of the Project have been characterized and quantified in the EENF, DEIR, and summarized in this FEIR, which are incorporated by reference into this Section 61 Finding. Throughout the planning and environmental review process, the proponent has been working to develop measures to mitigate significant impacts of the proposed action. With the

mitigation proposed and carried out in cooperation with state agencies, the agency finds that there are no significant unmitigated impacts.

The proponent has summarized Project Mitigation and Construction Mitigation measures (Tables 8-6 and 8-7) that specify the mitigation measures that the proponent would provide.

Therefore, [AGENCY], having reviewed the MEPA filings for the Green Line Extension Project, including the mitigation measures summarized in Section 8.3, finds pursuant to M.G.L. C. 30, S. 61 that, with the implementation of these mitigation measures, all practicable and feasible means and measures would have been taken to avoid or minimize potential damage from the Project to the environment.

9 Distribution List

In accordance with Section 11.16 of the MEPA regulations at 301 CMR 11.00 and the MEPA DEIR Certificate, this FEIR is being distributed to the following governmental agencies and other parties.

It is expected that notice of the availability of this FEIR will be published in *The Environmental Monitor* on or about June 23, 2010. Per Section 11.06(1) of the MEPA regulations, the public review period for a FEIR lasts 30 days. Thus, written comments are due by July 23, 2010.

Copies of this report will also be posted on the Project website (http://www.mass.gov/greenlineextension) and also made available at the listed libraries. A notice of availability will be sent to those who signed petitions, for which addresses are available. To request a copy of this document, please contact Regan Checchio at (617) 357-5772 or at rchecchio@reginavilla.com.

9.1 Federal Agencies and Elected Officials

Senator John Kerry
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Senator Scott Brown
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Representative Michael Capuano
110 First Street
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Representative Edward Markey
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Federal Transit Administration, Region 1
Attn: Peter Butler
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Federal Transit Administration, Region 1
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9.2 State and Regional Agencies and Elected Officials

Senator Patricia Jehlen
State House, Room 513
Boston, MA 02133

Senator Anthony Petrucelli
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Senator Steven Tolman
State House, Room 312-C
Boston, MA 02133

Representative William Brownsberger
State House, Room 276
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Representative Paul Donato
State House, Room 540
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Representative Sean Garballey
State House, Room 134
Boston, MA 02133

Representative Jonathan Hecht
State House, Room 22
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Representative Denise Provost
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Representative Byron Rushing
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Representative Timothy Toomey, Jr.
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Department of Conservation and Recreation
Division of Urban Parks
Attn: Dan Driscoll, Mystic River Planning Director
251 Causeway Street, Suite 600
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Department of Conservation and Recreation
Attn: Ken Kirwin, Traffic Engineering
251 Causeway Street, Suite 600
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Department of Conservation and Recreation
Attn: Richard Sullivan, Commissioner
251 Causeway Street, Suite 600
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Department of Environmental Protection
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Boston, MA 02108

Department of Environmental Protection
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Massachusetts Highway Department
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District Highway Director - District 4
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Massachusetts Highway Department
Attn: MEPA Coordinator
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Massachusetts Highway Department
Attn: Luisa Paiewonsky, Commissioner
10 Park Plaza, Suite 3170
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Massachusetts Historical Commission
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Attn: Brona Simon, Executive Director
220 Morrissey Boulevard
Boston, MA 02125

Massachusetts Water Resources Authority
Marianne Connolly, Program Manager, Regulatory Compliance
Charlestown Navy Yard
100 First Avenue, Building 39
Boston, MA 02129

Metropolitan Area Planning Council
Attn: Eric Bourassa
60 Temple Place
Boston, MA 02111

Metropolitan Area Planning Council
Attn: Marc Draisen, Executive Director
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Boston, MA 02111

9.3 Municipalities

Somerville

Somerville City Hall
Attn: Honorable Joseph A. Curtatone
93 Highland Avenue
Somerville, MA 02143

Somerville Board of Aldermen
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93 Highland Avenue
Somerville, MA 02143

Somerville Board of Aldermen
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Somerville Board of Health
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Somerville, MA 02143

Somerville Conservation Commission
Attn: Elizabeth Pyle
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Somerville Office of Strategic Planning and Community Development
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Cambridge

Cambridge City Hall
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Cambridge City Clerk
Attn: Margaret Drury
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Cambridge Community Development Department
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Cambridge Community Development Department
Attn: Beth Rubenstein, Assistant City Manager for Community Development
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Medford

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Medford Board of Health
Attn: Karen L. Rose, Director of Public Health/Director of Elder Affairs
Medford City Hall
85 George P. Hassett Drive, Room 311
Medford, MA 02155

Medford City Clerk
Attn: Edward P. Finn
85 George P. Hassett Drive, Room 103
Medford, MA 02144

Medford City Council
Attn: Paul A. Camuso
85 George P. Hassett Drive, Room 207
Medford, MA 02155

Medford City Council
Attn: Frederick Dello Russo, Vice President
85 George P. Hassett Drive, Room 207
Medford, MA 02155

Medford City Council
Attn: Breanna Lungo-Koehn
85 George P. Hassett Drive, Room 207
Medford, MA 02155

Medford City Council
Attn: Michael J. Marks
85 George P. Hassett Drive, Room 207
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Medford City Council
Attn: Robert Maiocco, President
85 George P. Hassett Drive, Room 207
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Medford City Council
Attn: Stephanie Muccini Burke
85 George P. Hassett Drive, Room 207
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Medford, MA 02155

Medford Department of Public Works
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85 George P. Hassett Drive, Room 300
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Medford Energy and Environment Office
Attn: Alicia Hunt, Energy Efficiency Coordinator
Medford City Hall
85 George P. Hassett Drive, Room 209
Medford, MA 02155

Medford Fire Department
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120 Main Street
Medford, MA 02155-4510

Medford Office of Community Development
Attn: Lauren DiLorenzo, Director
Medford City Hall
85 George P. Hassett Drive, Room 308
Medford, MA 02155

Medford Office of Building Commissioner
Attn: Paul Mochi, Building Commissioner
Medford City Hall
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Medford, MA 02155

Medford Office of Veterans' Services
Attn: Earnest L. Lindsay, Director of Veterans Services
Medford City Hall
85 George P. Hassett Drive, Room 100
Medford, MA 02155

Medford Police Department
Attn: Leo A. Sacco, Jr., Chief of Police
100 Main Street
Medford, MA 02155

Medford Office of Human Diversity and Compliance
Medford City Hall
85 Geroge P. Hassett Drive, Room 214
Medford, MA 02155

9.4 Libraries

The State Library of Massachusetts
Government Documents Department
State House, Room 341
Boston, MA 02133

State Transportation Library
10 Park Plaza, 2nd Floor
Boston, MA 02116

Somerville Public Library – Central Library
79 Highland Avenue
Somerville, MA 02143

Attn: Reference Desk
Somerville Public Library – East Branch
115 Broadway
Somerville, MA 02145
Attn: Reference Desk

Somerville Public Library – West Branch
40 College Avenue
Somerville, MA 02144
Attn: Reference Desk

Cambridge Public Library – Main Library
449 Broadway
Cambridge, MA 02139
Attn: Reference Desk

Cambridge Public Library – Boudreau Branch
245 Concord Avenue
Cambridge, MA 02138
Attn: Reference Desk

Cambridge Public Library – Central Square Branch
45 Pearl Street
Cambridge, MA 02139
Attn: Reference Desk

Cambridge Public Library – Collins Branch
64 Aberdeen Avenue
Cambridge, MA 02138
Attn: Reference Desk

Cambridge Public Library – O'Connell Branch
48 Sixth Street
Cambridge, MA 02141
Attn: Reference Desk

Cambridge Public Library – O'Neill Branch
70 Rindge Avenue
Cambridge, MA 02140
Attn: Reference Desk

Cambridge Public Library – Valente Branch
826 Cambridge Street
Cambridge, MA 02141
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- David Adriaansen
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- Tania Ahmed
- Ruth Alfasso
- Matthew Alford
- Jeff Altepeter
- Rebecca Altepeter
- Susan Altman
- David Anderson
- KyAnn Anderson
- Terri Anderson
- Tori Antonino
- Chandace Arledge
- Derek Arledge
- Arlington Transportation Advisory Committee, Edward Starr
- Sherry Autor
- Azize
- Christopher Bader
- John Baehrend
- Cheryl Bakey
- Jason Baklavas
- Ellen Band
- Sarah Bapst
- Susanna Barry and Seth Boyd
- Edward Batista, Jr.
- Jenny Bauer
- John Bay
- Elizabeth Bayle
- Belmont Citizens Forum, John Dieckmann (petition with 175 signatures)

- Laurinda Bedingfield
- Christopher Beland
- James and Christine Bennett
- Lois Bennett
- Melissa Bennett
- William Bennett
- Tom Bent
- Sarah Bergstrom
- Dan Berman
- Fred Berman and Lori Segall
- Nancy Bernhard
- Michael Bernstein
- Jane Fair Bester
- Jack Beusmans
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- Chris Braiotta
- Donna Brallier
- Len Brault
- Brickbottom Artists Building/Condominium Trust (petition with 231 signatures)
- Alan Brody
- Paula Brody
- Peter Bronk
- Barbara Broussard
- Francis Brown
- Susan Brown
- John Buckley
- Andres Bueno
- Joelle Bueno
- Ramon Bueno
- Natasha Burger and Jasper Vicenti
- Donald Burgess
- Lee Busch
- Samantha Butler
- Charles Cameron
- Roberta Cameron
- Irving Camiel and Lawrence E. Johnson
- Stuart and Lana Camiel
- James Campen

- Doug Carr
- Krogen Carreno
- Rolando Carrera
- Catamount Holdings LLC, Christopher P. Kaneb
- Patty Caya
- Adam Chamberlain
- Samir Charnalia
- Change.org (petition with 158 signatures)
- Patrick Chasse
- Chadi Chemaly
- Lucy Chen
- Priscilla Chew
- Adam Chiavoli
- Dorie Clark
- Scott Clark
- Theodora Clark
- Sara Cohen
- Stacy Colella
- Fernando Colina
- Community Corridor Planning Project (petition with 144 signatures)
- W. Scott Cooledge
- Conservation Law Foundation, Rafael Mares
- Kevin Costello and Bethany Morris
- Paul Cote
- Gerard Cronin
- David Crosbie
- Sam Crosbie
- Courtney Croteau
- Cummings Foundation, Inc., Joel B. Swets
- Cummings Properties, LLC, Dennis A. Clarke
- David and Jane Dahlbacka
- Maria Daniels
- M. Susanna Darling
- Deborah Davidson
- Marc Davidson
- Cornelia Davis
- Jeffrey Davis
- John F. Deacon
- Keelin Deasy
- Christopher DesAutels
- Jennifer DesAutels
- Tom Devlin
- Chris Dewing
- Damien DiBona

- Rebecca Didier
- Tai Dinnan
- Darlene Domain
- Rita Donnelly
- Frances Donovan
- David Douglas
- Downtown North Association, Robert O'Brien
- Driscoll Electric Co., Inc., Brendan Driscoll
- Dennis Dunn
- Catherine D'Urso and Deborah Silva
- East Cambridge Planning Team, Barbara Broussard
- John Roland Elliott
- Marwa Elsabbahy
- Elias El-Wadi
- Alex Epstein
- Lourdes Esparragoza
- Anthony Espy
- April Evans
- Phyllis Ewen
- Matthew Fallon
- Keith Fallon
- Robert Feigin
- Alex and Ami Feldman
- James Feldman
- Friends of Community Path, Joel Bennett
- Neil Fennessey
- David Filimon
- Max Fine
- Norman Fine
- Charles Fineman
- Lois Fiore
- Brian Flynn
- George Gabin
- Florence Gates
- Peter Gee
- Diane Georgopulos
- Louis Geppetti
- Hans Geuns-Meyer
- Stephanie Geuns-Meyer
- Celia Gilbert
- Thomas Gilbert
- William Gilligan
- Sheila Gilmartin
- Ethan Gilsdorf

- Sharman Gingrich and Christopher Harris
- Glass Factory Condominium Trust
- Phil Goff
- Marsha Goldberg
- Rex Gonsalves
- Lisa Gordon
- Steve Gottlieb
- Linda Goulet
- Kyle Grady
- Lanna Grady
- Green Line Advisory Group for Medford (GLAM), Carolyn Rosen et al
- Alan Greene
- Stephanie Groll
- Gabrielle Rossmer Gropman
- Alice Grossman
- Bathsheba Grossman
- Lois Grossman
- Groundwork Somerville, Jennifer Lawrence
- Anthony Guarciariello and Benice Costanzo
- Kevin Guiney
- Melissa Glenn Haber
- Daniel Hamalainen
- Margery Hamlen
- John Harding
- John Haroutunian
- Jennifer Harris
- Michael and Jacqueline Heath
- Michael Hegarty
- Lana Hermann
- Jonathan Herzog
- Peter Hill
- Brian Hilliard
- Ally Hines
- Lisa Hodsdon
- Heather Hoffman
- Karen Holtzman and Thomas Gardon
- John Howe
- Olivia Huval
- Jared Ingersoll
- Institute for Human Centered Design, Valerie Fletcher
- Sal Islam
- Shuba Rajashri Iyengar
- Erik Jacobs
- Joseph Jaquinta

- Mark Jaquith
- Roger Johnsen
- Robin Johnson
- Justine Kahn
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- Stephanie and Ravi Kamath
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- Tami Kaplan
- Grace Karg
- Rob Kassel
- Elissa Katler
- Satish Katpally
- Donna Keefe
- Priscilla Lamb Kennedy
- Jeremy Kessler
- Umair Khan
- Ulandt Kim
- Stephen and Gail King
- Bill Kipp
- Michael Korcynski
- Chantel and Gregory Kosmidis
- Sandra Kosta
- Kenneth Krause
- Elaine Krohn
- Enid Kumin
- Jayme Lacour
- Donna Laquidara-Carr
- Jerry Lauretano
- Jennifer Lawrence
- Chris Leary
- Scott Lever
- Jeffrey Levine
- Pauline Lim
- Thomas Lincoln
- Stephen Paul Linder
- Suzanne Lipsky
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- Anthony Lorenzo
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- Maia Mamulashuili
- Robert Mantell

- Charles Marquardt
- Peter Marquez
- Robert G. Martel
- Kenneth Martin
- Mass Central Rail Trail Coalition, Craig Della Penna
- Lena Matranga
- Chris and Taco Matthews
- Cynthia Maurice
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- Jean McCarvill
- Sarah McClellan
- Gail McCormick
- Steven McDonald
- Jim McGinnis
- Lynn McWhood
- Marc McLaro
- Diane McLeod
- Charles McNeil
- Tom Meek
- Eve Melnechuk
- Chris Mesarch
- Peter Micheli
- Kevin Mitchell
- Karen Molloy
- Barbara Monagle
- Steve Mulder
- K. Tracy Munn
- Angela Murphy
- Mystic River Watershed Association, EkOngKar Singh Khalsa
- Raymond Nagem
- Shriram Nallamshetty
- Nelson/Nygaard Consulting Associates, Stephanie Groll
- Bob Nesson
- Aaron Nevin
- Nilsson Associates, Ltd, Richard Nilsson
- John J. O'Donoghue
- James O'Keefe
- Debra Olin
- Kevin Oliver
- Chip Olson
- Crispin Olson
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- Harpreet Pall
- Pan Am Railways, Roger D. Bergeron
- Marilyn Pappas
- Piotr Parda
- Christopher Park
- Taeshin Park
- Bhupesh Patel
- John Paul
- Cynthia Pellegrini
- George Perkins
- Catherine and Alan Peterson
- David Phillips
- Nancy Phillips
- Ruth Piscitelli
- Matthew Podrer
- Miki Ann Polumbaum
- Cvetiva Popu
- Professional Services Corporation, PC (on behalf of the Brickbottom Condominium)
- Jordana Psiloyenis
- Michael Quinn
- Barry Rafkind
- John Read
- Vaughan Rees
- Jeffrey Reese
- Felice Regan
- Mary Anne Regan
- Arnold Reinhold
- Ellin Reisner
- Jill Richard
- Rachel Rockenmacher
- Jeffrey L. Roelofs, P.C. (on behalf of Brickbottom Condominium Trust)
- Juliette Rooney-Varga
- Lynn Rosenbaum
- Sara Rosenfeld
- Carolyn Ross
- Sallyann Roth
- Stephanie and Michael Rubino
- Dina Rudick
- Roy Rudolph
- Laurel R.T. Ruma
- Kimberly Rzepecki
- Betty Lee Saccoccio
- Lynn Sahaida

- Carole Samworth
- Michael Sandler
- Susan Schmidt
- Alyson Schultz
- Lori Segall
- Amy Semmes
- Robin Severino
- John Shayeb
- Julia Shepley
- David Sholl
- Laurel R.T. Siegel
- Sierra Club, John Kyper
- Maria Simoneau
- Bette Skandalis
- Beverly Sky
- Naomi Slagowski
- Jill Slosburg-Ackerman
- Josh Smift
- Sam Smiley
- Adelaide Smith
- Kate Snodgrass
- Somerville Climate Action, Vanessa Rule
- Somerville Community Corporation, Danny LeBlanc
- Somerville Community Health Agenda, Lisa Brukilacchio
- South Bay Properties, LLC, Patricia J. Mason
- Rachel Stark
- Sotiris Stefanopoulos
- Barry Steinberg
- Barbara Steiner
- Martha Stone
- Jessica Straus
- Susan Strauss (Fitchburg Street, Somerville)
- Susan Strauss (Willoughby Street, Somerville)
- Pamela Su
- Anita Suhanin
- Maura Swan and Ben Lavery
- Brian Sylvain
- Linda Tamulaites
- Ayesha Tariq
- Anne Tate
- Randal Thurston
- Charles Tolson
- David Tonnesen
- Caroline Traugott

- David Tremblay
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- Steven Troian
- Catherine Truman
- Trustee of University Place Condominium
- Tufts University, Lawrence Bacow
- Tufts University, Mary R. Jeka
- Ivy Turner
- Peter Ungaro
- Union Square Main Streets, Livingston Parsons
- William Uricchio
- Tara Urspruch
- Heather Van Aelst
- Pete Varga
- Diolinda Vaz
- Marc Verhagen and Ann Gallager
- Maggie Villiger
- Sylvie Vincent
- Wachusett Greenways, Edward P. Yaglou
- Walk Boston, Robert Sloane
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- Nicholas Watson and Amy Appleford
- Joel Weber
- Karen Weber
- Margaret Webster
- Margaret Weigel
- Debra Weisburg
- Jurgen Weiss
- Lynne Weiss
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- Alec Wysoker
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- William Yuricchio
- Wig Zamore
- David Zawacki
- Stephanie Zawacki

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- Alden Zecha
- Jessica Zeigler
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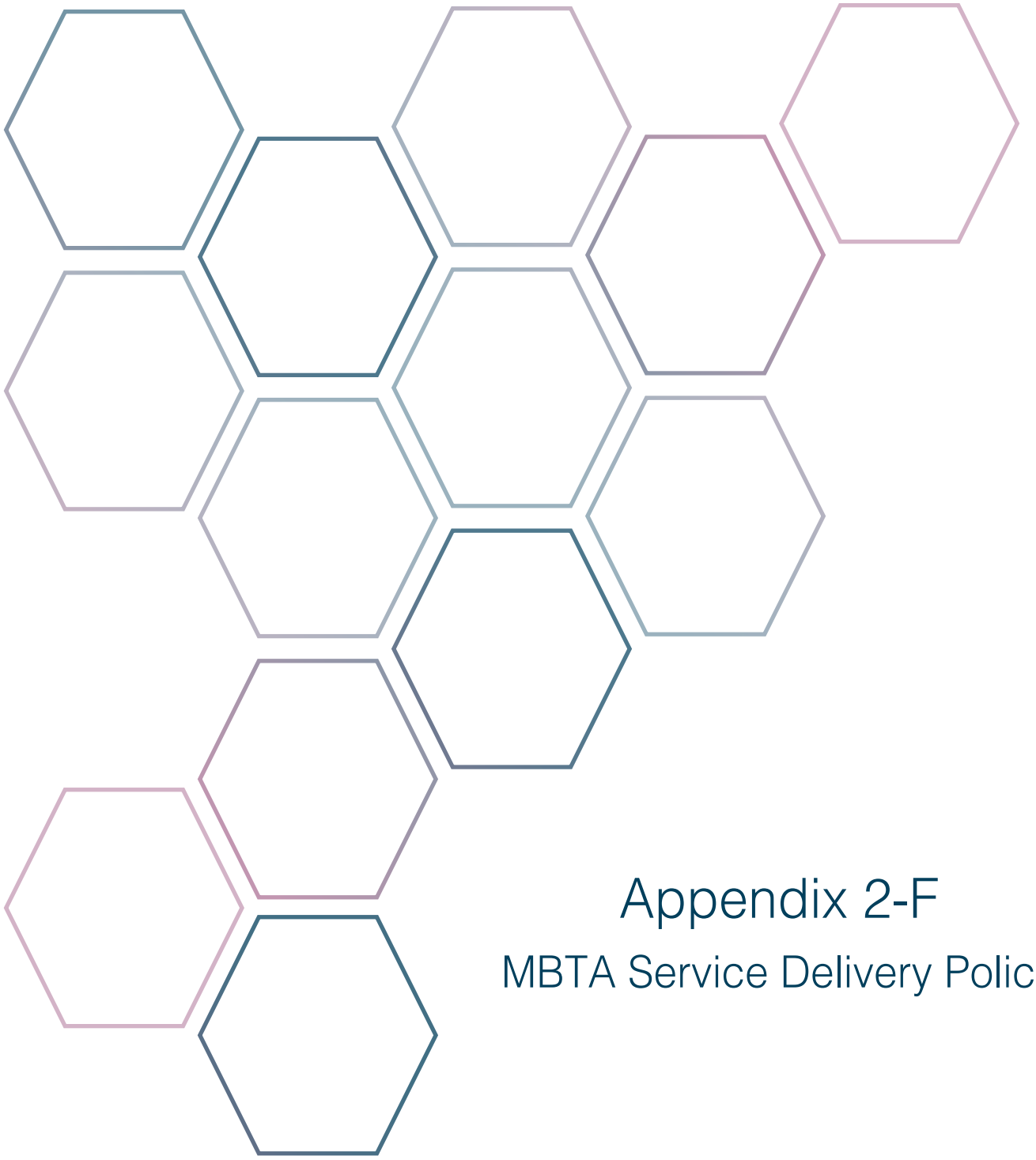

Appendix 2-F

MBTA Service Delivery Policy

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Service Delivery Policy

MBTA Fiscal and Management Control Board
Approved January 23, 2017

Massachusetts Bay Transportation Authority

Table of Contents

Chapter 1: Introduction

Purpose

The Service Delivery Policy sets how the MBTA evaluates service quality and allocates transit service to meet the needs of the Massachusetts Bay region. It is consistent with the MBTA's enabling legislation and other external mandates, such as Title VI of the Civil Rights Act of 1964 (Title VI), and the Americans with Disabilities Act of 1990 (ADA). As such, the Service Delivery Policy:

- Establishes the aspects that define service availability and sets parameters for levels of provided service
- Establishes objectives that define the key performance characteristics of quality transit services
- Identifies quantifiable standards that are used to measure whether the MBTA's transit services achieve their objectives, within the context of federal, state, and local regulations
- Outlines a service planning process that applies the service standards in an objective, uniform, and accountable manner
- Sets the priorities for the service planning process by setting minimum levels and targets for the service standards
- Involves the public in the service planning process in a consistent, fair, and thorough manner

Background

This document is the 2017 update of the MBTA's Service Delivery Policy. The 2017 Service Delivery Policy takes advantage of the capabilities offered by newer technologies to collect and analyze data and to take the first steps towards creating standards from a passenger perspective. To this end, the MBTA worked with two committees to produce this document: 1) a policy advisory committee tasked with developing the service objectives, and 2) a technical advisory committee tasked with establishing standards, metrics, and thresholds designed to address the service objectives. These committees included staff from the MBTA, the Massachusetts Department of Transportation (MassDOT), and the Central Transportation Planning Staff (CTPS), along with members of academia, and various planning and advocacy groups. In addition, the MBTA engaged members of the public through a series of workshops throughout the region, via an online survey, and through public meetings.

This policy is intended to be updated regularly as the MBTA expands its ability to collect and analyze data, build out metrics, and define service parameters and targets. In addition, as priorities for service change, this policy can be updated to reflect these new priorities. Future updates will have a public input component and will be adopted by the MBTA governing board.

Document Structure

Chapter 2 lays out the service *objectives*. The service objectives include service availability and service quality. Service availability objectives describe where, when, and how often service is available to residents of the service area, and the ADA accessibility of the MBTA network. Service quality objectives describe the quality of the delivered service, from a passenger perspective whenever possible.

Since the MBTA offers a number of different types of service that play different roles in the overall network, and services also vary by time period during the service day, Chapter 2 also defines each type of service provided by the MBTA and the time periods of the service day.

Chapter 3 sets the quantifiable *standards* used to measure the objectives. These standards are divided into two categories: service planning standards used in the service planning process to evaluate and allocate service, and accessibility standards that fall outside the service planning process. The service planning standards will be evaluated in the Service Monitoring portion of the MBTA Title VI Program.

The standards for accessibility that fall outside the service planning process are set within the context of the ADA. These standards are used to inform capital and operating decisions outside of the service planning process.

Each standard has a number of components. The *definition* describes what conditions are considered passing for that standard. Within a single standard, the definition changes depending on the type of service or time period. The pass/fail condition is measured at different levels of aggregation depending on the standard. For example, whether a bus is considered on-time is measured at each time point on the route.

All standards are designed in the positive direction, so 100% would be perfect performance. This means improvement is always measured by increasing the percentage. Depending on the standard, performance can be measured at the route level, at the mode level, or for the entire network.

Each standard has a target. The targets provide a medium term goal for improving service; targets can be updated on a yearly basis as progress is made.

In addition the bus service planning standards have a *minimum;* since service planning requires trade-offs between standards the minimums are used to set priorities. If performance at a route or mode level falls below the minimum level on a standard, that

standard becomes a priority to address in the service planning process as appropriate. This document includes the 2016 performance on each of the standards to provide context for the minimums and targets.

In addition, Chapter 3 describes the methodology the MBTA uses to assess the cost-benefit ratio of bus routes. This metric is used to identify bus routes that are providing a high value for their cost and those providing a low value for their cost. This allows the MBTA to understand the characteristics of high-performing routes to emulate, and identify changes to modify or otherwise improve low-performing routes.

Chapter 4 lays out the service planning process. It includes the quarterly changes, the rolling service plan process and the annual gap analysis. Within the rolling service planning process Chapter 4 describes how the service standard minimums and targets are used to prioritize service changes.

The appendices provide additional information used to calculate the standards. Appendix D summarizes the standards and the targets, minimums, and 2016 performance levels.

Chapter 2: Services and Service Objectives

Service Objectives

The MBTA, in collaboration with stakeholders and passengers, identified the following service objectives representing the most important characteristics of a high-quality transit system. These objectives also address the requirements of the MBTA's enabling legislation.

Service Availability (Convenience)

People should be able to use the MBTA to travel throughout the service area at convenient times and frequencies.

Accessibility
As many people as possible should be able to use the entire system and all of the MBTA's services regardless of their abilities.

The MBTA will comply with ADA precepts to ensure that its services are accessible to the extent possible.

Reliability
The MBTA should operate the services it schedules.

Passengers should experience consistent headways on frequent services and on-time performance on infrequent services. Passengers should not experience excessive wait times.

Comfort
Passengers should have a reasonable amount of personal space during their trips.

Communication
Passengers should receive accurate and relevant information about the services they use in languages consistent with the MBTA's Language Access Plan (LAP) in a timely manner and in alternative formats if requested.

Safety and Security
Passengers should experience safe and secure traveling conditions.

The MBTA should operate and maintain the system with the highest regard for the safety of passengers and employees.

Rider Satisfaction
Passengers should be satisfied with the service the MBTA provides.

Environmental Benefit
The MBTA should reduce its own environmental impact and should offer passengers a

service experience that supports travel choices other than single-occupancy vehicle trips.

Service Standards

For the service planning and accessibility objectives cited above, the MBTA established quantifiable standards that allow the MBTA to evaluate the performance of its services relative to each objective. Not all objectives are addressed in this Service Delivery Policy.

Specifically, the standards for safety and security are set with the MBTA's state and federal regulatory partners and are monitored and reported outside of this policy. The standards for communication are currently being developed and will be adopted at a later date.

The MBTA monitors rider satisfaction through a monthly customer opinion panel and other survey efforts. These results are reported on the MBTA Performance Dashboard monthly. The MBTA Environmental and Energy Department monitors the MBTA's environmental impact, including measures of greenhouse gas emissions per unlinked passenger trip and greenhouse gas displacement. These results are published in the MBTA Sustainability Report.

Table 1 summarizes the remaining service objectives and standards, what types of tools the MBTA has to improve them, and the Title VI implications; Chapter 3 discusses the service standards in detail.

Table 1: MBTA Service Objectives and Standards

Service Objective	Standards	Tools to address	Title VI Implication
Service Availability	Span of service Frequency of service Coverage: • Coverage of the service area • High-frequency service coverage for high-density areas • Coverage for low-income households	Service planning	Service monitoring and equity analyses for major service changes
Reliability	Schedule adherence Passenger wait time Service operated	Service planning, operational changes, municipal partnerships	Service monitoring
Comfort	Vehicle load	Service planning, operational changes, municipal partnerships	Service monitoring
Accessibility	Platform accessibility Vehicle accessibility	Capital budget, operational changes	Elevators included in service monitoring

Source: MBTA.

Services

The MBTA operates a comprehensive set of transit services. This policy addresses all of the MBTA's fixed-route services including bus, light rail, heavy rail, commuter rail, and boat, as described below[1].

Contracts with the service providers who operate The RIDE, the MBTA's paratransit service, include performance standards. Appendix C: The RIDE Service lists these requirements.

Bus

For the purposes of this policy, "bus" includes all rubber-tire vehicles regardless of the vehicle's power source. The MBTA operates several different types of bus services including:

Local Bus Routes provide full weekday service that extends beyond the morning and afternoon peak travel hours. Local routes are not necessarily designed to target any specific trip purpose. In general, stops on local routes are closely spaced, and pick-ups/drop-offs are allowed at all stops across the entire route; however, some local routes, such as the crosstown routes, operate with limited stops.

Key Bus Routes are similar to local routes, but generally operate longer hours and at higher frequencies to meet high levels of passenger demand in high-density travel corridors. Key bus routes are identified in maps and schedules.

Silver Line routes meet or exceed the characteristics of key bus routes and operate on dedicated right-of-ways for a portion of the routes.

In concert with light rail and heavy rail (discussed below), the key bus routes ensure geographic coverage of frequent service in the densest areas of Greater Boston's core, and offer intermodal connections to other MBTA services that extend throughout the region.

Commuter Bus Routes provide a limited number of peak-direction trips during periods when commuters would use the services. Commuter routes include **express bus routes**, which are identified as such in schedules and are characterized by a limited number of stops that are provided only near the ends of the routes. Some stops may be drop-off or pick-up only. Some commuter routes include closely spaced stops.

[1] Service standards also apply to all contracted services. The MBTA will take steps in all future contracts to ensure the collection of all data necessary to calculate the standards.

Community Bus Routes provide weekday service between the morning and afternoon peak hours primarily for non-work travel. Stops are closely spaced (where practical) and pick-ups/drop-offs are allowed at all stops across the entire route.

Supplemental Bus Routes either provide limited service early in the morning or are designed to support other bus routes.

Tables showing the route type for each route is in the attached Appendix A: Route Types, which is updated as changes to route designations occur.

Rapid Transit

The MBTA's rapid transit system includes its heavy rail and light rail services, described below. For the purposes of this policy the Silver Line is evaluated on Key Bus Route standards.

Light Rail

The MBTA's primary light rail system, the Green Line, provides local service in outlying areas via its surface operations and core subway services in the heart of the city. In addition, the MBTA operates the Mattapan High Speed Line, which serves as a Red Line extension from Ashmont Station to Mattapan Station via light rail.

Heavy Rail

The MBTA operates three heavy rail lines—the Red Line, the Blue Line, and the Orange Line—that provide core subway services.

Commuter Rail

The MBTA's commuter rail lines provide long-haul, primarily commuter-oriented services that link the outer portions of the region with Downtown Boston.

Boat

The MBTA provides Inner Harbor Ferry services for travel between destinations in Boston, and Commuter Boat services from the South Shore to Downtown Boston and Logan Airport.

The RIDE

The MBTA's paratransit program, The RIDE, is mandated under the ADA. It provides door-to-door, shared-ride transportation to eligible passengers who cannot use fixed-route all or some of the time because of a physical, cognitive or mental disability. The service area currently covers 58 cities and towns in and around Boston. The program provides ADA trips (trips with origins and destinations within three-quarter miles of a

fixed-route service) at one fare rate and non-ADA trips (trips with origins and destinations greater than three-quarter miles away from a fixed-route service or for same-day trip request) at a higher fare rate.

Time periods

The MBTA provides different levels of services depending on the time of day and days of the week. Table 2 provides the time periods for weekdays. Saturdays and Sundays are measured separately for most standards.

This time periods are designed for the purposes of bus service planning. Due to the different nature of the service Commuter Rail has different time periods. Its AM Peak includes all trains that arrive in their final Boston terminal between 6:00AM to 10:00AM and its PM Peak is all trains that originate in Boston and depart between 3:30PM and 7:00PM.

Table 2: MBTA Weekday Time Period Definitions

Time Period	Definition
Sunrise	3:00 AM – 5:59 AM
Early AM	6:00 AM – 6:59 AM
AM Peak	7:00 AM – 8:59 AM
Midday Base	9:00 AM – 1:29 PM
Midday School	1:30 PM – 3:59 PM
PM Peak	4:00 PM – 6:29 PM
Evening	6:30 PM – 9:59 PM
Late Evening	10:00 PM – 11:59 PM
Night	12:00 AM – 2:59 AM

Source: MBTA.

Chapter 3: Standards and Planning Tools

The service standards perform two important functions. First, they establish the acceptable levels of service that the MBTA must provide to achieve the service objectives. Second, the standards provide a framework for measuring the performance of MBTA services as a part of the service planning process, which is discussed in Chapter 4. Through the service planning process, performance data collected on MBTA services are compared against the service standards to determine whether individual existing services perform at acceptable levels and to evaluate the need for service changes. The service planning process also uses the service standards to prioritize and reallocate resources within the system.

There are a multitude of factors that can impact the performance of the MBTA services. Service planning is one of the tools the MBTA uses to improve performance. In addition, the MBTA works with our municipal partners to address factors that are in our mutual control.

The service planning process is designed to use the service standards to help ensure a cost-effective allocation of service and basic availability throughout the region within the overall amount of operations funding, which is determined through the annual budget process. This policy also provides a service planning tool to measure the cost-efficiency of bus routes. In addition, the service planning process also documents the resource gap between meeting all of the service standards at the target levels and the performance of the operated service each year.

The progress towards the performance targets is reported in the Massachusetts Department of Transportation annual performance report *Tracker*. This allows the MBTA to track progress toward targets regularly and revisit them as necessary. All of the service standard targets and minimums are listed in Appendix D: Service Standard Targets. Appendix D also lists the time frame for all the reported 2016 performance data.

Some of these standards are evaluated over a relatively short period (for example, daily or quarterly), and others are evaluated when the MBTA considers modifying service. How often each standard is evaluated is listed in Table 14.

The following is a discussion of the MBTA service standards, in the context of the service objective to which each applies. These standards address the fixed-route modes as described in Chapter 2.

Service Availability Standards

The availability standards define the levels of service that will provide meaningful access to the transit system, in terms of the length of the service day (span of service)

and the frequency of service. Each of these standards varies by mode. In addition, the MBTA measures geographic access to the system using a coverage standard with three components.

Many of the service standards differ depending on the time of day the service is offered. Table 2 defines the weekday service time periods. Because weekend travel patterns differ from weekdays, specific periods are not defined for Saturdays and Sundays.

Span of Service

Span of service refers to the hours during which service is available. The MBTA has established span of service standards that define the expected hours that any given service will operate. This provides passengers with the confidence that particular types of services will be available throughout the day. The MBTA may extend a service's span beyond the expected hours in response to customer demand.

The span of service standards, stated in Table 3 below, vary by mode and by day of the week, reflecting the predominant travel flows in the region. The standards require that the first trip in the morning in the peak direction of travel must arrive in downtown Boston, or the route terminal if the route does not serve downtown Boston, at or before the beginning span of service time (for example, 7:00 AM for local bus). At the end of the service day, the last trip in the evening in the peak direction of travel must depart downtown Boston, or the route terminal if the route does not serve downtown Boston, at or after the ending span of service time (for example, 7:00 PM for local bus).

For example, the Orange Line serves downtown Boston, so the standard requires that the first northbound and southbound trips must each reach Downtown Crossing by 6:00 AM. On the other hand, Key Bus Route 66 does not serve downtown Boston, and more passengers travel towards Harvard in the AM Peak period, so the standard requires that the first trip in the morning must arrive at Harvard before 6:00 AM.

If Table 3 does not specify an expected span of service for a mode or time period, then there is no respective standard. Service hours are set based on demand.

Table 3: Span of Service

Mode	Day	Expected Span of Service
Bus		
Local	Weekday	7:00 AM – 7:00 PM
	Saturday[1]	8:00 AM – 6:30 PM
	Sunday[1]	10:00 AM – 6:30 PM
Community	Weekday	10:00 AM – 4:00 PM
Commuter	Weekday	7:00 AM – 9:00 AM 4:00 PM – 6:30 PM
Supplemental	Weekday	No minimum span
Key Bus Routes	Weekday	6:00 AM – midnight
	Saturday	6:00 AM – midnight
	Sunday	7:00 AM – midnight
Heavy Rail	Weekday	6:00 AM – midnight
	Saturday	6:00 AM – midnight
	Sunday	7:00 AM – midnight
Light Rail	Weekday	6:00 AM – midnight
	Saturday	6:00 AM – midnight
	Sunday	7:00 AM – midnight
Commuter Rail	Weekday	7:00 AM – 10:00 PM
	Saturday	8:00 AM – 6:30 PM
Boat	Weekday	7:00 AM – 6:30 PM
	Saturday[2]	8:00 AM – 6:30 PM

[1] This is a standard for high-density areas. There is no span standard for low-density areas on weekends.

[2] Memorial Day–Columbus Day

Note: The RIDE generally operates from 5:00 AM to 1:00 AM. The MBTA provides extended hours for trips starting and ending within 0.75 miles of a fixed-route service that operates outside of these hours.

Source: MBTA.

During the service planning process the MBTA will evaluate vehicle loads at the beginning and end of the service day to determine whether expanding the span of service is warranted.

The MBTA's performance on this measure is weighted by ridership; passenger trips taken on services that operate at least during the expected span are counted as "passing", while trips taken on services that operate less than the expected span are counted as "failing". This weighting prioritizes meeting the expected span of service on routes and services with high ridership. Performance is evaluated for each mode.

Table 4: Span of Service Targets and Performance

Standard	Minimum	Target	2016 weekday performance
Bus	90%	95%	93%
Heavy Rail	—	100%	100%
Light Rail	—	100%	100%
Commuter Rail	—	100%	100%
Boat	—	100%	100%

Bus performance data from Spring 2016. Other data from Dec. 2016.
Source: MBTA.

Frequency of Service

To maintain access to the transportation network within a reasonable waiting time, the MBTA established expected frequency of service levels for each mode, by time of day. On less heavily-traveled services, these expected levels set the standard for the frequency of service, regardless of customer demand. Frequency of service standards are measured using either headway (minutes between trips) or frequency (trips per time period).

If Table 5 does not specify an expected frequency for a mode or time period, then there is no respective standard. Frequencies for these services are set based on demand.

Table 5: Service Frequency

Mode	Weekday Time Periods	Expected Frequency or Headway
Bus Local, Community	AM and PM Peak	Every 30 minutes
	All other periods	Every 60 minutes
	Saturday and Sunday	Every 60 minutes
Commuter	AM Peak	3 trips in the peak direction
	PM Peak	3 trips in the peak direction
Key Bus Routes	AM and PM Peak	Every 10 minutes
	Early AM and Midday Base/School	Every 15 minutes
	Evening and Late Evening	Every 20 minutes
	Saturday and Sunday	Every 20 minutes
Rapid Transit	AM and PM Peak	Every 10 minutes
	All other periods	Every 15 minutes
	Saturday and Sunday	Every 15 minutes
Commuter Rail	AM Peak	3 trips in peak direction
	PM Peak	4 trips in peak direction
	All other periods	Every 3 hours in each direction
	Saturday	Every 3 hours in each direction
Boat	AM and PM Peak	3 trips in the peak direction
	Off-Peak periods	Every 3 hours

Note: There is no frequency standard during the Sunrise or Night times or for supplemental bus service. AM Peak and PM Peak are defined differently for Commuter Rail.
Source: MBTA.

The frequency of service levels may not be sufficient to meet passenger demand on heavily used services or on services with peak ridership that is outside the traditional peak hours. When load levels indicate that additional service is warranted on a particular route, as defined in the crowding standard, the MBTA may increase that service's frequency or provide larger vehicles to provide sufficient capacity to accommodate passenger demand.

MBTA's performance on this measure is weighted by ridership in each time period; passenger trips taken on services that operate at least at the expected frequency are counted as "passing", while trips taken on services that operate less than at the expected frequency are counted as "failing". This weighting prioritizes meeting the expected frequency at peak periods and on routes and services with high ridership. Performance is evaluated for each mode.

Table 6: Service Frequency Targets and Performance

Standard	Minimum	Target	2016 weekday performance
Bus	90%	95%	90%
Rapid Transit	—	100%	100%
Boat	—	100%	100%

Bus performance data from Spring 2016. Other data from Dec. 2016.
Note: This version of the Service Delivery Policy has focused on bus service planning; future versions will address Commuter Rail service planning once more granular ridership data is available.
Source: MBTA.

Coverage Standard

An important aspect of providing the region with adequate access to transit services is the system's geographic coverage. The MBTA recognizes that coverage means different things to different markets. To address these different groups, the MBTA measures coverage in three ways:

- Base Coverage
- Frequent Service in Dense Areas Coverage
- Low-income Household Coverage

Because of constraints such as topography and street network restrictions, it is not always possible to achieve uniform geographic coverage. In addition, demand for transit does not exist uniformly across the service area; high population density and low-income households create higher demand and need for transit access.

The MBTA prioritizes high frequency service in high density area and service to areas with high proportions of low-income households, while maintaining an acceptable level of base coverage. For the coverage standard, the MBTA will set a minimum for the base coverage and targets for the coverage of frequent service in dense areas and coverage of low-income households[2].

The MBTA will monitor the effect of proposed service modifications on all three components of the coverage standard as part of its service planning process, described in Chapter 4.

[2] The base coverage will be evaluated as part of the Title VI Service Monitoring.

In order to calculate the coverage the MBTA uses walkshed distances to bus stops, rail stations, or boat docks. This means the half-mile distance is calculated based on the walking distance using the street network instead of a straight line distance that is usually impossible for pedestrians to travel. This means that another way to increase the coverage is by changes to the street network to shorten walking distances.

Base Coverage

People expect the MBTA to provide a basic level of coverage throughout its service area. Some of this service may be relatively infrequent for some or all of the service day; but people throughout the service area expect and should have a minimum level of service.

The MBTA will measure the:

> *Percent of the population that lives no more than 0.50 miles from a bus stop, rapid transit station, commuter rail station, or boat dock in the municipalities in the MBTA's service area, excluding municipalities that are members of a regional transit authority (RTA).*

Supplemental bus routes will not be counted in the base coverage calculations.

Frequent Service in Dense Areas

Beyond a basic level of service throughout the entire service area, there are dense, urban areas where people expect frequent service. Within these urban areas, people can be reasonably sure that if they want to make a trip, they will have convenient access to frequent service.

In this section, frequent transit service is defined to include all bus stops along key bus routes, all rapid transit stations, and any bus stop that receives frequent service during its span of service.

A bus stop in the MBTA bus network is considered to receive frequent service if the average headway at that bus stop during the hours when any route serves the bus stop is less than a headway of:

- 15 minutes on weekdays (set to the expected headway for key bus routes during the midday base time period) *and*
- 20 minutes on Saturdays and Sundays (set to the expected headway for key bus routes on Saturdays and Sundays)

A bus stop can only be considered to receive frequent service if the span of service of all routes serving the bus stop meets or exceeds the span of service definitions for key bus routes.

The MBTA will measure the:

> *Percent of the population that lives no more than 0.50 miles away from high-frequency service in the census block groups within the MBTA's service area that have densities greater than or equal to 7,000 people per square-mile, excluding census block groups within municipalities that are members of an RTA.*

The goal of this standard is to identify mostly contiguous, dense areas in the MBTA's service area that would support sufficiently effective frequent bus services. Choosing census block group densities below approximately 7,000 people per square mile creates many noncontiguous high-density "islands" throughout the MBTA's service area. At approximately 7,000 people per square mile, few high density islands remain.

Low-income Households

To reflect the importance of transit service to people who live in lower income households, the MBTA will measure the percentage of low-income households in its service areas that are located near transit.

The MBTA will measure the:

> *Percent of the low-income households that are located no more than 0.50 miles away from any stop or station in the municipalities in the MBTA's service area, excluding municipalities that are members of an RTA.*

For all three components of the coverage standard, the MBTA will use the smallest census-based geography that is available and reliable. The distance to a transit stop will be measuring using walking distances.

Summary of Coverage Standard

Table 7: Summary of Coverage Standards

	Numerator	Denominator	Minimum/ Target	2016 performance
Base	Population living in census block groups within 0.50 miles of transit	Population of the MBTA service area	Minimum 75%	80%
Frequent service in dense areas	Population living no more than 0.50 miles away from high-frequency service in the census block groups that have densities greater than or equal to 7,000 people per square-mile	Population living in the census block groups that have densities greater than or equal to 7,000 people per square-mile	Target 85%	80%
Low-income households	Number of low-income households located in census block groups within 0.50 miles of transit	Households in the MBTA service area	Target 85%	83%

Performance data from Fall 2016.
Note: All populations include people living in municipalities in the MBTA's service area, excluding people living in municipalities that are members of an RTA.
Source: MBTA.

Accessibility Standards

Platform Accessibility Standard

If elevators are not available to people who need or want to use them, they may not be able to gain access to MBTA services. The MBTA's goal is for people to be able to access the platforms in each station at all times service is offered.

The MBTA will measure the:

Percent of the total platform-hours[3] that are accessible.

The MBTA will measure this separately for rapid transit stations, commuter rail stations, and boat docks; and it will continue to measure progress towards this standard. The minimum will always be set as the current annual performance.

Vehicle Accessibility Standard

The MBTA should provide at least one ADA-compliant vehicle on each trip it operates. The MBTA will measure the:

Percent of trips that the MBTA provides with at least one ADA-compliant vehicle.

A trip on Commuter Rail is considered compliant if at least one ADA-compliant car/coach in the trainset matches the location of each high-level platform at stations served by the trip. ADA-compliant Commuter Rail coaches must include ADA-compliant restrooms. Trips on the Green Line are considered noncompliant if none of the vehicles in a train set is ADA-compliant. Bus trips are not measured since ramps can be deployed manually. Heavy rail and boat trips are covered in the platform standard.

The minimum will always be set as the current annual performance and the MBTA will continue to measure progress toward this standard.

Table 8: Accessibility Standards Targets and Performance

Standard	Minimum	Target	2016 performance	2016 data
Platform Accessibility (Rapid Transit stations)	92%	100%	92%	Apr 2015–Mar 2016
Vehicle Accessibility (Green Line)	98.6%	100%	98.6%	Jul 2015–Jun 2016

Rapid Transit stations, include gated Silver Line Waterfront stations, but exclude surface-level stops on Green and Silver lines.
Source: MBTA.

[3] One hour of service offered to trains traveling each direction at a station. For each hour of service, a station can provide two accessible platform-hours, one hour for trains traveling in each direction. Stations with multiple platforms serving multiple branches or lines can have more than two accessible platform-hours per hour.

Reliability Service Standards

Reliability standards vary by mode and provide tools to evaluate the on-time performance of individual MBTA lines and routes. Reliability standards also vary based on frequency of service; passengers using high-frequency services generally are more interested in regular vehicle arrivals than in strict adherence to published timetables, whereas passengers who use less-frequent services expect arrivals/departures to occur as published.

Bus Reliability

Bus Timepoint Tests

To determine whether a bus is on time at an individual timepoint, such as the beginning of a route, end of a route, or a scheduled point in between, the MBTA uses two different tests based on the scheduled frequency of the service:

> **Scheduled-Departure Service:** A trip is considered to provide scheduled-departure service when it operates with a headway longer than 15 minutes. For scheduled-departure services, passengers generally time their arrivals at bus stops to correspond with the specific published departure times.
>
> **Frequent Service:** A trip is considered to provide frequent service when it operates with a headway of 15 minutes or shorter. For frequent service, passengers can arrive at a stop without looking at a schedule and expect a reasonably short wait. Key bus routes, whose passengers use the services as if they were frequent services despite occasional longer than 15 minute headways, are always evaluated using the frequent service definition even when their headways exceed 15 minutes.

Routes other than key bus routes might operate entirely with frequent service, entirely with scheduled-departure service, or with a combination of both throughout the day. Because any given route may have both types of service, each trip is considered individually to determine whether it represents scheduled-departure service or frequent service, and each timepoint crossed on that trip is measured accordingly. Therefore, there are two separate timepoint tests:

On Time Test for Scheduled-Departure Timepoints

To be considered on time at a timepoint, any trip evaluated using the scheduled-departure standard must meet one of the conditions cited below.

> **Origin timepoint:** The trip must *depart* its origin timepoint between 0 minutes before and 3 minutes after its scheduled departure time.
>
> **Mid-route timepoint:** The trip must *leave* the mid-route timepoint(s) between 1 minute before and 6 minutes after its scheduled departure time.

Destination timepoint: The trip must *arrive* at its destination timepoint no later than 5 minutes after its scheduled arrival time.

This standard allows vehicles to arrive early at their mid-route timepoints and at their destinations. The MBTA's communication standards will assesses the accuracy and timeliness of vehicle arrival predictions in order to make sure passengers have information on early mid-route arrivals.

On-Time Test for Timepoints on Frequent Services

Origin or mid-route timepoint: To be considered on time at a timepoint, a trip evaluated using the frequent service standard must leave its origin timepoint or mid-route timepoint no later than the scheduled headway plus 3 minutes.

For example, if “trip A” is scheduled to depart at 7:00 AM and the route’s next trip, “trip B,” is scheduled to depart at 7:07 AM, trip B has a 7-minute scheduled headway. Therefore, trip B must depart no more than 10 minutes (3 minutes more than the scheduled headway) after trip A actually depart for the origin timepoint to be considered on time. If trip A departs at 7:05 (5 minutes after its scheduled departure time), trip B can depart no later than 7:15 (10 minutes after trip A’s actual departure) to be considered on time.

Destination: The actual run time from the origin timepoint to the destination timepoint must be no more than 120 percent of the scheduled run time for the trip to be considered on time at the destination timepoint.

Treatment of Dropped Trips in the Bus Reliability Standard

The MBTA does not currently track dropped bus trips on a trip-by-trip basis. If the reliability data for a trip is not available, the MBTA excludes the trip from the calculation—the trip is removed from the total number of timepoints that are on time (or not on time) and from the total number of timepoints. In the case of the frequent service test, this means that the MBTA excludes headways preceding and following a trip with missing data from the calculation.

In the future, when the MBTA is able to track dropped trips on a trip-by-trip basis:

In the scheduled-departure test, dropped trips will count as failures for all timepoint crossings.

In the frequent service test, a dropped trip does not count towards the number of timepoint crossings, and the headway of the next operated trip, following the dropped trip(s), is measured from the previous operated trip.

Bus Route Test

Bus reliability is calculated as the:

Percent of each route's timepoints that meet the above definitions.

The numerator is the number of time points that met the above definitions and the denominator is the number of total time points.

Table 9: Summary of the Bus Reliability Timepoint and Route Tests

	Origin	Mid-route	Destination
Scheduled Departures (Headways > 15 min.)			
Standard	Depart 0 min. early to 3 min. late	Depart 1 min. early to 6 min. late	Arrive no more than 5 min. late
Arrival Standard	—	—	A ≤ 5.0
Departure Standard	0.0 ≤ D ≤ 3.0	-1.0 ≤ D ≤ 6.0	—
Frequent Service Departures (Headways ≤ 15 min.)			
Standard	Depart no later than the scheduled headway plus 3 minutes		Actual run time is no more than 120% of the scheduled running time
Standard	$h_a \leq h_s$ + *3 minutes*		$t_a \leq 1.2 \times t_s$

Source: MBTA.

Where:

$A =$ a□□i□a□ □i□□
$D =$ □□pa□□□□□ □i□□
$h_s =$ □□h□□□□□ h□a□□ay
$h_a =$ a□□□a□ h□a□□□□y
□$_s =$ □□h□□□□□□ □□□□i□g □i□□
□$_a =$ a□□□a□ □□□□i□g □i□□

Exceptions:

The first trip of the day on *each* route, which does not have a leading headway, is considered a scheduled-departure trip. All key bus routes are considered frequent services at all times, except for their first trip of the day.

Heavy and Light Rail Reliability

Passenger Wait Time

As with frequent bus services, passengers on light rail and heavy rail do not rely on printed schedules; rather, they expect trains to arrive at consistent headways. Therefore, schedule adherence for light rail and heavy rail is measured based on the proportion of a line's passengers who wait the scheduled headway, or less, for a train to arrive.

The passenger wait time standard is measured based on the:

> *Percent of passengers traveling in each time period that wait the scheduled headway, or less, at each station.*

For people traveling in the trunk section of the Green Line, the headway is defined as 3 minutes.

On-Time Test for Stations on the Mattapan Line

The Mattapan Line is currently separate from the other light rail lines because the systems do not exist to evaluate the line using the passenger wait and travel time standards[4]. The Mattapan Line is evaluated using the On-Time Test for Timepoints on Frequent Services standard, used to measure the on-time performance of frequent bus services, with station departures corresponding to timepoint crossings.

The Mattapan Line reliability is measured by the:

> *Percent of all station departures (or arrivals for terminal stations) on the Mattapan Line over the entire service day that pass their on-time tests.*

Commuter Rail Reliability

Commuter rail passengers expect to arrive at their destination station at the time posted in the schedule. The MBTA will measure the number of trains that arrive at the destination terminal no later than 5 minutes after the time published in the schedule.

Commuter rail reliability is measured as the:

> *Percent of trains that arrive at their destination station on time.*

[4] Once the technology systems necessary to evaluate Mattapan Trolley service is finished being implemented, it will switch over to the same standard as the Light and Heavy Rail.

The MBTA and its commuter rail operator are working to develop passenger weighted measures for commuter rail reliability.

Boat Reliability

Boat passengers expect to arrive at their destination dock at the time posted in the schedule. The MBTA will measure the number of boats that arrive at the destination terminal no later than 5 minutes after the time published in the schedule.

Boat reliability is measured as the:

> *Percent of boats that arrive at their destination dock on time.*

Service Operated Standard

The MBTA intends to operate all of the service it schedules. A multitude of factors, including equipment failure, lack of personnel, and unforeseen delays like medical and police emergencies, can sometimes prevent the MBTA from operating scheduled service.

The MBTA will measure the:

> *Percent of scheduled service that is actually provided for each bus route, light rail line, heavy rail line, commuter rail line, and boat route.*

Planned heavy, light, and commuter rail outages where the MBTA offers substitute service do not count against this standard. For bus this standard will also be examined at the route level to determine if some bus routes have higher dropped trips rates, so steps can be taken to address significant imbalances.

Table 10: Reliability Standards and Performance

Standard	Minimum	Target	2016 performance	2016 data
Bus Reliability (non-Key)	70%	75%	65%	Mar–Dec 2016
Key Bus	75%	80%		
Rapid Transit Passenger Wait Times	—	90%	89%	Mar–Dec 2016
Commuter Rail Reliability	Contract requires 92% adjusted		93.8% (adjusted)	Jan–Dec 2016
Boat Reliability	—	99%	98%	Jul 2015–Jun 2016
Bus Service Operated	—	99.5%	98.5%	Jul 2015–Jun 2016
Light Rail Service Operated	—	99.5%	96.5%**	March-December 2016
Heavy Rail Service Operated	—	99.5%	99.1%**	March-December 2016
Commuter Rail Service Operated	Contract sets fines for canceled service		99.8%	Jan–Dec 2016

** Data subject to change with improvements in data collection methodologies
Source: MBTA.

Comfort Standards

Passenger comfort is influenced by the number of people on the vehicle and whether or not a seat is available to each rider for all or most of the trip. Passenger comfort

standards, which vary by mode and time of day, establish the maximum number of passengers per vehicle to provide a safe and comfortable ride.

Passenger Comfort Standards

As indicated in the frequency of service standard, the level of service provided by the MBTA is primarily a function of demand, as demonstrated by the number of passengers using the service at different times during the day. On weekends and some weekday periods, most MBTA services operate with sufficient frequency to provide every passenger with a seat. However, at the heaviest weekday travel times or locations, some passengers will need to stand.

During periods when some passengers will be standing, the MBTA strives to provide sufficient service so that people are reasonably comfortable. The purpose of the passenger comfort standard is to define the levels of crowding that are acceptable by mode and time period. The periods used by the MBTA for all modes, for both frequency of service and vehicle load standards, are defined earlier in this chapter (see Table 2).

There are a number of different types of vehicles in the MBTA's fleets at any given time, and the fleets change over time. Hence, the actual seating capacity and maximum number of passengers allowed by the comfort standards for each mode changes periodically. These load standards are included in Appendix B: Vehicle Load, which is updated as the fleets change.

Bus

The MBTA will measure the passenger hours of travel experienced by comfortable bus passengers during each time period. The maximum comfortable load is expressed as a ratio of the number of passengers on the vehicle to the number of seats on the vehicle. The maximum comfortable loads are set based on Department of Public Utility (DPU) Regulation 220 CMR 155.02 (26), which states "passengers in excess of 40 percent above the seating capacity of a motor bus shall not habitually be carried… ."

High-volume Time Periods

The maximum comfortable passenger-to-seat ratio for high-volume travel periods is 140%. At loads of 140% or less of seated capacity, all passengers are considered comfortable. No passengers are considered comfortable when the vehicle load exceeds 140% of seated capacity.

Low-volume Time Periods

The maximum comfortable passenger-to-seat ratio for lower-volume travel periods is 125%. At loads up to 125% of seated capacity, all passengers are considered comfortable; above 125% and up to 140% of seated capacity, seated passengers are

considered comfortable; and no passengers are considered comfortable when the vehicle load exceeds 140% of seated capacity.

Appendix B: Vehicle Load contains the number of seats and the loading thresholds for each vehicle type.

The MBTA will measure the:

> *Percent of passenger travel time experienced in comfortable conditions[5].*

Table 11: Passenger Comfort Standard Targets and Performance

Standard	Minimum	Target	2015 performance
Bus Passenger Minutes in Comfortable Conditions	92%	96%	94%

Data from average weekday September 1- December 14, 2015
Source: MBTA.

Heavy and Light Rail

The MBTA currently lacks the data to accurately measure passenger loads on heavy and light rail vehicles. As of 2016, the MBTA is working to procure heavy and light rail vehicles that have Automatic Passenger Counters (APCs) installed. This will allow for a standard similar to bus that measures the passenger time in crowded conditions.

In the meantime, the MBTA is developing a capacity metric for heavy and light rail that compares the number of people entering stations over 30 minute time periods to the capacity of the number of trains operated in that time period. This capacity metric will identify segments in the system that need additional service to address overcrowding.

Commuter Rail

The MBTA currently lacks the data to accurately measure the passenger loads on individual commuter rail coaches. The MBTA and its commuter rail operator are working to collect this type of data to allow for better planning. The contract does set expectations on the number of seats the operator should provide based on expected loads.

[5] For bus routes without enough data to model the passenger time in comfortable conditions, the proxy variable of maximum load will be used for all service planning decisions.

Boat

Federal laws prohibit boats from carrying more than their certified capacity—boats will leave people behind before they exceed their capacity. The MBTA does not have crowding-based comfort standards for its boat services. The MBTA will monitor if passengers are being regularly left-behind to determine if additional capacity is necessary.

Service Planning Tools

In addition to service standards, the MBTA can and should use diagnostic tools as part of its service planning process. For example, the MBTA needs to be able to evaluate the cost-effectiveness of its bus routes, even without establishing a cost standard. This Bus Route Cost-Benefit Ratio Tool will not be used to direct service cuts, but instead will be used to determine the cost-efficiency of the service provided and to identify service changes to improve performance.

Bus Route Cost-Benefit Ratio

Services may be valuable for different reasons; while carrying many passengers is an important characteristic, it is not the only factor that determines whether a service is effective or valuable. The MBTA considers three primary characteristics, or aspects, when evaluating whether a service is valuable to the system:

- **Ridership:** The number of people who use a service.
- **Transit Dependent Passengers:** The percentage of transit dependent people who use the service.
- **Value to Network:** Whether a service provides access to the greater network and the region. Value to the Network is composed of three characteristics:

  Catchment Area: The number of people uniquely covered by each service.

  Destination Coverage: The number of jobs and destinations sited near each service.

  Transferring Passengers: The share of passengers who transfer to other services—these passengers contribute to the service effectiveness of other routes and modes.

Each bus route receives a benefit score for each of these aspects. Each aspect (Ridership, Transit Dependent Passengers, and Value to the Network) may be weighted depending on priorities set by the governing board. Table 12 has the current weights.

Table 12: Weighting of Components of Bus Route Benefit

Weight	Ridership	Transit Dependent	Value to the Network
	70%	15%	15%

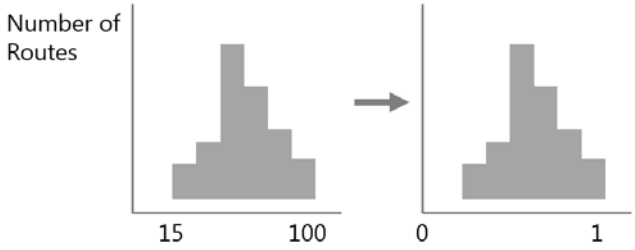
After summing the scores for each aspect, the score is divided by the net operating cost to develop a cost-benefit ratio. A cost-allocation formula uses a route's peak and off-peak service hours and the total miles of service provided to calculate the route's operating cost.

Routes in the 10th percentile or lower will be reviewed to determine what actions could be taken to improve the route's performance or to determine whether the route is a worthy use of resources. In addition, routes that perform above the 90th percentile will be analyzed to determine the characteristics of high performing routes.

The Methodology for Benefit

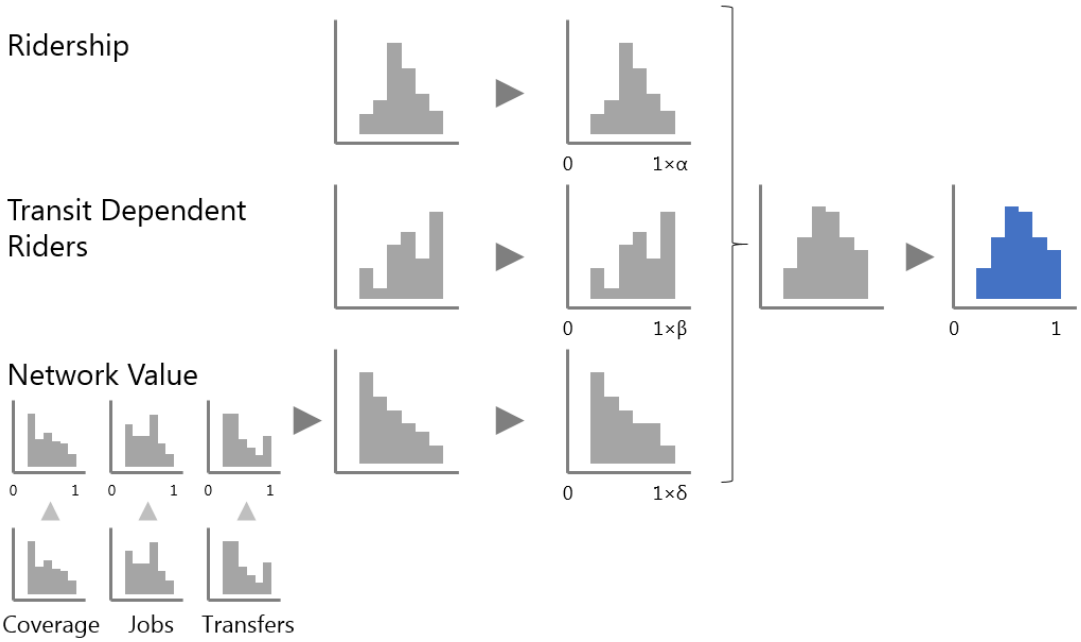
The MBTA combines the scores for each aspect to develop a single value for each service. Since the aspects have significantly different orders of magnitude[6], they need to be standardized before they can be combined.

To scale the values to comparable values, the MBTA scales each aspects distribution to values between 0 and 1:



Within the Value to the Network portion of this equation, the values are added together. The scores for Value to the Network are renormalized to be combined with Ridership and Transit Dependent Passengers metrics. When combining the three top-level aspects, first the weights are applied to each aspect, then the values are added and renormalized.

[6] Ridership per route varies between 50 and 15,000 trips per day. Transit dependent passengers and transferring passengers vary between 0 and 100%. Catchment area and destination coverage can be in the tens of thousands.



For example:

Table 13: Evaluation of an Example Route

Metric	Value	Normalized	×	Weight	Final	
Ridership	13,000	**0.95**	×	**4**	**3.80**	
Transit Dependent Passengers	20%	**0.25**	×	**2**	**0.30**	
Value to the Network	1.10	**0.60**	×	**1**	**0.60**	
Catchment Area	2,000 people	0.10				
Destination Coverage	10,000 jobs	0.60				
Transferring Passengers	10%	0.40				
Total Score	*1.10 (0.10+0.60+0.40)*	*0.60*				
Productivity Score					***4.70***	
Normalized Score					***0.68***	

Frequency of Analysis

The MBTA measures all of the standards at different frequencies depending on the availability of data and the use of the specific metric.

Table 14 shows often each of the standards are measured.

Table 14: Frequency at which Each Standard is Typically Measured

Standard	Daily	Quarterly	Annual/ Service Plan
Availability			
Span of service	☐	■	■
Frequency	☐	■	■
Coverage	☐	■	■
Accessibility			
Platform accessibility	☐	■	■
Vehicle accessibility	☐	■	■
Reliability			
Bus and all rail reliability	■	■	■
Boat reliability	☐	■	■
Service operated	☐	■	■
Comfort			
Crowded passenger minutes	☐	■	■
Service Planning Metric			
Bus cost benefit ratio	☐	☐	■

Source: MBTA.

Chapter 4: Service Planning Process

The MBTA regularly evaluates performance of its services and recommends and implements service changes through the service planning process. The service planning process strives to ensure that the MBTA uses resources in the most effective manner by developing strategies to improve performance and/or to allocate service within the system. Additionally, the process also identifies the gap between actual service levels and the targets set in this policy. The service planning process includes system-wide quarterly changes, ongoing rolling Service Plan changes, and an annual evaluation to inform the MBTA's budget process.

This chapter focuses on planning for bus and subway modes; many of the processes described in this chapter may be used in planning for commuter rail and boat modes.

Service Planning Process

The service planning process takes place on two levels. One is the quarterly evaluation and implementation of incremental service changes. The other is an annual review of system performance along with rolling service plans focused on development of proposals for more substantial service changes in particular regions or on individual routes.

The primary differences between the quarterly service changes and the rolling service plans include:

- Magnitude of service changes considered (as defined below)
- Extent and type of analysis used
- Level of public participation

Quarterly service changes to transit services can be implemented with existing equipment, within the adopted budget, and without significantly affecting route structure or service delivery.

Rolling Service Plan changes have a notable effect on passengers, resource requirements, route structure, or service delivery.

Table 15: Quarterly and Service Plan Changes

Magnitude	Resource Implications	Type
Quarterly	Changes that can be implemented with existing equipment and within the adopted budget	Running time adjustments
		Departure time adjustments
		Headway changes to match ridership and service levels (provided the frequency and comfort minimums are still met)
		Changes to stop locations
		Route alignment changes
		Span of service changes within 1 hour or less
		Route extensions of 1 mile or less
		Route variation modifications
Service Plan	Changes that will have a significant effect on resources, and may potentially have a significant effect on passengers	Major service restructuring
		Implementation of new routes or services
		Elimination of a route or service
		Elimination of part of a route greater than 1 mile
		Span of service changes greater than 1 hour
		Route extensions greater than 1 mile

Source: MBTA.

Initiation of Service Planning Ideas

Service changes may be initiated in a variety of ways, including, but not limited to:

- Service requests and/or comments from the public, including municipalities and organizations through various media (public meetings or workshops, written correspondence, MBTA website, MBTA customer call center, email, Twitter, etc.)
- Proposals made by MBTA staff (Service Planning; Operations staff, such as drivers, inspectors, or garage superintendents)
- Studies completed by regional entities or municipalities

- Gaps identified between provision of MBTA services and performance targets established in this document. If, during the Quarterly or Rolling Service Plan process, a route is found to fall below the minimum on one of the established standards, it should be prioritized.

Quarterly Service Planning Process

The MBTA Service Planning Department screens potential service changes to determine whether they should be evaluated and implemented as part of the Quarterly process or Service Plan process. Potential changes are considered with respect to their impact on Service Delivery Policy standards.

Proposed changes are presented to the Service Committee, which includes representatives of the following departments:

- Service Planning
- Schedules
- Operations
- System-wide Accessibility
- Office of Performance Management and Innovation
- Other departments, as appropriate

Quarterly changes are approved by the Service Committee and implemented within the adopted budget as soon as practical.

Rolling Service Plans Process

Two inputs inform the Service Plan process, which will be performed on a continuous rolling basis in particular areas or on certain routes.

- Current service performance measured against performance targets
- Recommendations for service changes that improve route or network performance

The priorities for the rolling service plan are determined by which service planning standards fall below their minimum level. Depending on the standard, the analysis is done at the network, mode, and/or route level. If the performance level of a mode below the minimum on any standard, that standard must be prioritized. Since there are tradeoffs between standards, allocating resources to address priority standards can impact other standards. After suggested changes, the performance levels on all standards must be re-evaluated to determine if the changes lowered performance on any other standards below the minimum levels (at the route, mode, and/or network

level). Since crowding and reliability can only be measured for operated service, proxy variables can be used to model the impact of the proposed changes.

During the Rolling Service Planning process, the routes are evaluated using the Cost-Benefit Ratio tool corresponding to the most recent data available. Routes that fall below the 10th percentile are flagged for analysis. The tool is used to determine which aspect(s) of the service are driving the low ratio and could be addressed to improve the service, or how the cost could be lowered, up to and including route elimination. Routes that perform at higher than 90th percentile will also be evaluated to consider which aspect(s) may have contributed to extraordinary performance and whether they can be emulated in other services.

The Service Committee recommends service proposals to include in the Preliminary Service Plan. Each Preliminary Service Plan is made available to the public for review and comment. A list of final recommendations are then submitted to the MBTA governing board for approval before the changes are implemented, along with Title VI and environmental justice service equity analyses, if necessary.

As with the Quarterly service planning process, a goal in developing service plans is to ensure that the MBTA uses available resources effectively. However, the rolling planning process also can identify service changes and enhancements that have merit, but which cannot be provided within the existing operating budget. In such cases, additional operating funds may be requested, and the service(s) may be implemented when sufficient resources become available.

With seven bus districts and four heavy rail or light rail districts, the MBTA anticipates that the rolling process will take 2-3 years to complete an entire cycle. The MBTA may consider substantial service changes for a specific route or corridor either individually or grouped with other routes, areas, or bus districts.

Annual Service Evaluation

Once a year, the MBTA will publish a summary report of route and network performance according to the standards included in the Service Delivery Policy. Included in this report will be an analysis of the “gap” between the level of service that the MBTA is currently providing and the levels of service the MBTA would need to provide to reach the performance targets set in the Service Delivery Policy.

The MBTA will quantify gaps and identify potential actions to close the gaps. Options include those internal to the Service Planning process, such as shifting resources to benefit one service or standard over another without dropping below the minimum on any standards. The gap analysis will also consider external measures, such as securing additional operating funds, future capital investments, or more inter-governmental cooperation. Both internal and external measures will give policymakers, MBTA officials, and the public a better sense of the tradeoffs inherent in budget-constrained service

planning and suggest how additional resources could be used to provide service according to Service Delivery Policy performance targets.

Public Participation

Public participation in the general service planning process occurs both on an on-going basis and as part of the Service Plan-specific process. The purpose of public involvement in the service planning process is to promote regular dialogue with existing and potential passengers, elected officials, and communities regarding their service needs.

Public participation is always required for a Service Plan. In addition, specific changes, for example route elimination, require public participation regardless of when the change takes place.

Ongoing Public Outreach

The MBTA provides avenues for ongoing communication through its website, customer phone line, social media outlets, standing committees, and comments sent to individual MBTA officials. Service-related comments and requests are directed to the appropriate department for consideration and response. Upon request, MBTA staff also attend public meetings held by municipalities or with public officials to address specific service issues. From time to time, the MBTA may conduct specific market or route-based meetings to gather direct feedback on potential service changes. This ongoing public outreach informs both the quarterly service planning process and the rolling service plan process.

Rolling Service Plan Public Outreach

Once a Preliminary Service Plan is complete, the MBTA schedules one or more public meetings in appropriate locations. At these open meetings, the MBTA presents the analysis and issues behind the proposed service changes and solicits public comments on them. MBTA staff then assesses and analyzes the suggestions made through the public comments and, as appropriate, incorporates them into the final recommendations that go to the Board of Directors for approval.

All Service Plan public notifications and meetings conform to ADA and Title VI requirements and MBTA policies associated with these laws.

Table 16: Summary of Service Planning Processes

	Quarterly Service Planning Process	Rolling Service Plan Process
Initiation of changes:	Requests/comments from public, including public and non-profit entities Bus Operations feedback Service Planning staff Service studies	Requests/comments from public, including public and non-profit entities Bus Operations feedback Service Planning staff Service studies Public meetings
Evaluation of changes:	Route-level analysis using the evaluation criteria Review by Service Committee	Area or district-level analysis using the evaluation criteria including performance review of all services using service standards Comparative evaluation of proposed service changes and possible new services Review by Service Committee Public review and comment Title VI and Environmental Justice analysis as needed
Implementation of changes:	Quarterly with regular schedule changes	Rolling, upon approval of the Service Plan by the MBTA governing board

Source: MBTA.

Glossary of Terms and Acronyms

ADA: Americans with Disabilities Act of 1990, and as amended in 2008.

Automated Fare Collection (AFC) System: The specific instruments, such as faregates and fareboxes, and back-end infrastructure the MBTA uses to collect fares.

AVL: Automatic Vehicle Locator.

Boston Region MPO: Boston Region Metropolitan Planning Organization. The Boston Region Metropolitan Planning Organization, staffed by CTPS, is responsible for conducting the federally required metropolitan transportation-planning process (often called the 3C—continuing, cooperative, and comprehensive—process) for the Boston metropolitan area. The MPO uses this process to develop a vision for the region, then decides how to allocate federal and state transportation funds to programs and projects—roadway, transit, bicycle, and pedestrian—that support that vision.

Coverage: People living within the geographic area served by the MBTA system.

CTPS: Central Transportation Planning Staff (to the Boston Region MPO).

Dual Mode: Buses that can operate using electrical power from overhead catenary wires or a diesel engine to power the electric traction motors that turn the wheels.

Fixed-Route Service: Services that operate on designated routes with published timetables including all light rail, heavy rail, commuter rail, boat, and bus services. (The RIDE, the MBTA's paratransit service, is not a fixed-route service.)

Frequency of Service: The number of trips per hour provided on a route (for example, a route that operates every 15 minutes has a frequency of four trips per hour).

Headway: The number of minutes between scheduled trips on a route (for example, a route that operates four trips per hour has a 15-minute headway).

Heavy Rail Services: Red Line, Orange Line, and Blue Line.

Key Routes: Key bus routes are similar to local routes, but have policy standards for a longer span and higher frequency of service.

Language Access Plan (LAP): Includes the MBTA's language access needs assessment, based on the US Department of Transportation "four-factor analysis" and it prescribes:

- Methods and measures the MBTA uses to communicate with passengers with limited proficiency in English
- Training programs for educating staff about the Authority's Title VI obligations, including providing accessible services to passengers who are not proficient in English

- Methods the Authority uses to provide notice to the public of the Authority's Title VI obligations, including providing language assistance to passengers who are not proficient in English
- Plans for monitoring and updating the Language Assistance Plan.

Leading Headway: The number of minutes between a trip and the trip before it.

Light Rail Services: Green Line and Mattapan High Speed Line.

Limited English Proficiency (LEP): Individuals who have a limited ability to read, write, speak, or understand English are limited English proficient, or 'LEP. According to the American Community Survey (ACS), those who indicated they spoke English "well," "not well," or "not at all" were considered to have difficulty with English—identified also as people who speak English "less than very well."

MPO: Metropolitan Planning Organization.

Paratransit: A transit mode operating with flexible schedules and without fixed routes. Generally, paratransit operators use cars, vans, or small buses to serve passengers. The MBTA's ADA paratransit service is known as The RIDE.

Peak Direction: The direction in which most commuters are traveling on a route during the peak period (for example, toward Boston in the morning and away from Boston in the afternoon).

Public Participation Plan: The Public Participation Plan, or PPP, serves to guide agency public participation efforts, including populations that have been underserved by the transportation system and/or have lacked access to the process. The PPP guides in its efforts to offer early, continuous, and meaningful opportunities for the public to help identify social, economic, and environmental impacts of proposed transportation policies, projects and initiatives across MassDOT/MBTA.

Schedule Adherence: An indication of on-time performance, or how reliably services adhere to published schedules. Schedule adherence is the service standard that is used to measure progress toward achieving the reliability service objective.

Shared Segment: A portion of the bus network that is used by multiple bus routes.

Span of Service: Refers to the hours during which service is accessible and is defined by the times that a service begins in the morning and ends in the evening. Span of Service is one of the service standards that are used to measure progress toward achieving the availability service objective.

Timepoint: A bus stop for which the MBTA lists the scheduled arrival time on its schedules. Timepoints are frequently found at major intersections along a route. There is neither a set distance between timepoints nor a specific number of timepoints for a route.

Timepoint Crossing: The act of passing a timepoint.

Title VI: Title VI of the Civil Rights Act of 1964 requires that transit agencies that receive federal funding demonstrate that they do not discriminate based on race, color, or national origin in providing services.

Vehicle Load: Defines the level of passenger crowding that is acceptable for a safe and comfortable ride. Vehicle Load is expressed as a ratio of the number of passengers on the vehicle to the number of seats on the vehicle. Vehicle load is used to calculate the service standard for measuring progress toward achieving the comfort service objectives.

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Appendix A: Route Types

Table A1: Local Bus Routes

7	City Point – Otis and Summer Streets
8	Harbor Point /U Mass – Kenmore Station
9	City Point – Copley Square via Broadway Station
10	City Point – Copley Square Via BU Med Center
11	City Point – Downtown
14	Roslindale Square – Heath Street Loop
16	Forest Hills Station – U Mass. Or Andrew Station
17	Fields Corner Station – Andrew Station
18	Ashmont Station – Andrew Station
19	Fields Corner Station – Ruggles or Kenmore Station
21	Ashmont Station – Forest Hills Station
24	Wakefield Ave. – Mattapan Station or Ashmont
26	Ashmont Station – Norfolk and Morton Belt Line
27	Mattapan Station – Ashmont Station
29	Mattapan Station – Jackson Square or Ruggles
30	Mattapan Station – Forest Hills Station
31	Mattapan Station – Forest Hills Station
33	River and Milton Streets – Mattapan Station
34/34E	Walpole Center or Dedham Line – Forest Hills Station
35	Dedham Mall – Forest Hills Station
36	VA Hospital – Forest Hills Station Via Chas. River Loop
37	Baker and Vermont Streets – Forest Hills Station
38	Wren Street – Forest Hills Station
40	Georgetowne – Forest Hills Station
41	Centre and Eliot Streets – JFK U Mass Station
42	Forest Hills Station – Dudley or Ruggles Station
43	Ruggles Station – Park and Tremont Streets
44	Jackson Square Station – Ruggles Station
45	Franklin Park – Ruggles Station
47	Central Square Cambridge. – Broadway Station
50	Cleary Square – Forest Hills Station Via Metropolitan
51	Reservoir – Forest Hills Station
52	Dedham Mall – Watertown Yard
55	Queensberry Street – Park and Tremont Streets
59	Needham Junction – Watertown Square
60	Chestnut Hill Station – Kenmore Station
62	Bedford V.A. Hospital – Alewife Station
64	Oak Square – University Pk. Cambridge
65	Brighton Center – Kenmore Station
67	Turkey Hill – Alewife Station
68	Harvard Square – Kendall MIT Station
69	Harvard Square – Lechmere Station
70/70A	Cedarwood – Central Square Cambridge
72	Aberdeen and Mt. Auburn – Harvard Station
74	Belmont Center – Harvard Station via Concord Ave
75	Belmont Center – Harvard Station via Fresh Pond Pkwy
76	Hanscom Air Force Base – Alewife Station
78	Arlmont Village – Harvard Station
79	Arlington Heights – Alewife Station
80	Arlington Center – Lechmere Station
83	Rindge Ave. – Central Square, Cambridge
85	Spring Hill – Kendall MIT Station
86	Sullivan Station – Reservoir Station

87	Arlington Center or Clarendon Hill – Lechmere Station via Somerville Avenue
88	Clarendon Hill – Lechmere Station via Highland Avenue
89	Clarendon Hill or Davis Square – Sullivan Station via Broadway
90	Davis Square Station – Wellington Station
91	Sullivan Station – Central Square, Cambridge
92	Assembly Square Mall – Downtown Via Main Street
93	Sullivan Station – Downtown Via Bunker Hill
94	Medford Square – Davis Square Station
95	West Medford – Sullivan Station
96	Medford Square – Harvard Station
97	Malden Station – Wellington Station
99	Boston Reg. Med Center Stoneham – Wellington Station
100	Elm Street – Wellington Station
101	Malden Station – Sullivan Station Via Medford Square
104	Malden Station – Sullivan Station Via Ferry Street
105	Malden Station – Sullivan Station Via Main Street
106	Franklin Square or Lebanon Street Loop – Wellington Station
108	Linden Square – Wellington Station
109	Linden Square – Sullivan Station
110	Wonderland Station – Wellington Station
112	Wellington Station – Wood Island Station
119	Northgate Shopping Center – Beachmont Station
120	Orient Heights Station – Maverick Station
132	Redstone Shopping Center – Malden Station
134	North Woburn – Wellington Station
136	Reading Depot – Malden Station Via Lowell St
137	Reading Depot – Malden Station Via North Ave
201/202	Fields Corner Station – Fields Corner Station
210	Quincy Center Station – No. Quincy Station or Fields Corner Station
211	Quincy Center Station – Squantum
214	Quincy Center Station – Germantown
215	Quincy Center Station – Ashmont Station
216	Quincy Center Station – Houghs Neck
220	Quincy Center Station – Hingham
222	Quincy Center Station – East Weymouth
225	Quincy Center Station – Weymouth Landing or Columbian Square
230	Quincy Center Station – Montello Station
236	Quincy Center Station – South Shore Plaza
238	Quincy Center Station – Holbrook/Randolph Comm. Rail St
240	Avon Line – Ashmont Station
245	Quincy Center Station – Mattapan Station
350	North Burlington – Alewife Station
411	Malden Station – Revere/Jack Satter House
426	Central Square Lynn – Haymarket or Wonderland Station Via Cliftondale Square **(Partially Express)**
429	Northgate Shopping Center – Central Square Lynn
430	Malden Center Station – Saugus Center via Square One Mall
435	Liberty Tree Mall – Central Square Lynn
436	Liberty Tree Mall – Central Square Lynn
441	Marblehead – Haymarket or Wonderland Station via Paradise Rd.
442	Marblehead – Haymarket or Wonderland Station via Humphry St.
450	Salem Depot – Haymarket or Wonderland Station via Western Ave **(Partially Express)**
455	Salem Depot – Wonderland Station
456	Salem Depot – Central Square Lynn
465	Danvers Square – Salem Depot
553	Roberts – Downtown Boston **(Partially Express)**
554	Waverley Square – Downtown Boston **(Partially Express)**
CT1 (701)	Central Square Cambridge. – B.U. Medical Campus/Boston Medical Ctr. Via MIT
CT2 (747)	Sullivan Station – Ruggles Station via Union Square Kendall/MIT and Longwood Medical Area
CT3 (708)	Beth Israel Deaconess or B.U. Medical Campus – Andrew Station

Private Carrier Local Bus Routes

710	North Medford – Medford Square Meadow Glen Mall or Wellington Station
712/713	Point Shirley, Winthrop – Orient Heights
714	Pemberton Pt., Hull – Station St., Hingham
716	Cobbs Corner – Mattapan Station via Canton Center

Table A2: Key Bus Routes

1	Harvard Square – Dudley Station via Mass. Ave.
15	Kane Square or Fields Corner – Ruggles Station
22	Ashmont Station – Ruggles Station Via Talbot Ave
23	Ashmont Station – Ruggles Station via Washington Street
28	Mattapan Station – Ruggles Station
32	Wolcott Square or Cleary Square – Forest Hills Station
39	Forest Hills Station – Back Bay Station
57/57A	Watertown Yard – Kenmore Station
66	Harvard Square – Dudley Station via Brookline
71	Watertown Square – Harvard Station
73	Waverley Square – Harvard Station
77	Arlington Heights – Harvard Station
111	Woodlawn or Byway and Park – Haymarket Station
116	Wonderland Station – Maverick Station Via Revere (in combination with 117)
117	Wonderland Station – Maverick Station via Beach (in combination with 116)
SL1 (741)	Logan Airport – South Station
SL2 (742)	Boston Design Center – South Station
SL4 (751)	Dudley Station – South Station
SL5 (749)	Dudley Station – Downtown

Table A3: Commuter Bus Routes

4	North Station – Tide Street
84	Arlmont Loop – Alewife Station
121	Wood Island Station – Maverick Station
131	Melrose Highlands – Malden Station
170	Waltham – Dudley Station (Limited Service) **(Express)**
212	Quincy Center Station – North Quincy Station
217	Quincy Center Station – Ashmont Station
221	Quincy Center Station – Fort Point
325	Elm Street – Haymarket Station **(Express)**
326	West Medford – Haymarket Station **(Express)**
351	EMD Serono/Bedford Woods – Alewife Station **(Express)**
352	Burlington – State Street **(Express)**
354	Woburn Line – State Street **(Express)**
424	Eastern and Essex – Haymarket or Wonderland **(Express)**
428	Oaklandvale – Haymarket Station via Granada Highlands
434	Peabody Square – Haymarket Station via Goodwins Circle **(Express)**
439	Bass Point Nahant – Central Square Lynn
448	Marblehead – Downtown Crossing **(Express)**
449	Marblehead – Downtown Crossing **(Express)**
451	North Beverly – Salem Depot
459	Salem Depot – Downtown Crossing **(Express)**
501	Brighton Center – Downtown Boston **(Express)**
502	Watertown Yard – Copley Square **(Express)**
503	Brighton Center – Copley
504	Watertown Yard – Downtown Boston **(Express)**
505	Waltham Center – Downtown Boston **(Express)**
556	Waltham Highlands – Downtown Boston **(Express)**
558	Auburndale – Downtown Boston **(Express)**

Table A4: Community Bus Routes

5	City Point – McCormack Housing

Table A5: Supplemental Bus Routes

114	Bellingham Square – Maverick Station
171	Dudley Station – Logan Airport via Andrew Station
191	Mattapan – Haymarket via Ashmont, Fields Corner and Dudley Station
192	Cleary Square – Haymarket via Forest Hills and Copley Square
193	Watertown Yard – Haymarket via Kenmore Station
194	Clarendon Hill – Haymarket via Sullivan Square Station
195	Shattuck Hospital – Temple Place
SLW (746)	Silver Line Way – South Station
9701	Cambridge Street at Warren Street – Ruggles Station
9702	Cambridge Street at Warren Street – Andrew Station
9703	Cambridge Street at Warren Street – Jackson Station

Appendix B: Vehicle Load

Table B1: Bus and Trackless Trolley

Vehicle Type	No. of Seats	Off-Peak Standard	Off-Peak Max Load	Peak Load Standard	Peak Max Load
RTS 40' Diesel	40	125%	50	140%	56
New Flyer 40' Emission Contr. Diesel	39	125%	48	140%	55
New Flyer 40' Compressed Natural Gas	39	125%	48	140%	55
New Flyer 40' XDE40	37	125%	46	140%	52
NABI 40' Compressed Natural Gas	39	125%	48	140%	55
Neoplan 40" Emission Controlled Diesel	38	125%	47	140%	53
Neoplan 40' Electric Trolley Bus	31	140%	43	140%	43
New Flyer 60' Diesel-Electric Hybrid	57	125%	71	140%	80
Neoplan 60' Compressed Natural Gas	57	125%	71	140%	80
Neoplan 60' Dual-Mode Articulated	47	140%	66	140%	66
Neoplan 60' Airport Dual-Mode Artic.	38	140%	53	140%	53

Note: Dual-mode vehicles used in Silver Line tunnels and electric trolley buses are always evaluated using the Peak Load Standard because of the operating characteristics of that service and because those vehicles have more standing room per seat.

Source: MBTA.

Table B2: Vehicle Load on Light Rail, Heavy Rail, Silver Line Waterfront

			Total Passengers			
Vehicle Type	No. of Seats	Floor Area (sq. ft.)	Early AM/ AM Peak	Midday Base	Midday School/ PM Peak	Evenings and Weekends
Green Line 7/8	46/44	207	100	66	100	66
Mattapan Line	41	120	73	53	73	53
Red Line 1	63	306	165	94	165	94
Red Line 2	62	297	161	92	161	92
Red Line 3	50	338	163	84	163	84
Orange Line	58	249	141	83	141	83
Blue Line	35	154	86	50	86	50

Source: MBTA.

Table B3: Commuter Rail

Vehicle Type	Fleet ID	Number of Seats	Peak Load Standard	Peak Max Load
Pullman	200–258	114	110%	125
Bombardier	350–389	127	110%	140
Bombardier	600–653	122	110%	134
Bombardier	1600–1652	122	110%	134
Kawasaki	700–749	185	110%	204
Kawasaki	750–781	182	110%	200
Kawasaki	900–932	178	110%	196
Kawasaki	1700–1724	175	110%	193
MBB	500–532	94	110%	103
MBB	1500–1533	96	110%	106
Rotem	800–846	179	110%	197
Rotem	1800–1827	173	110%	190

Source: MBTA.

Table B4: Commuter Boat (MBTA-Owned)

Vessel Name	Vessel Type	Max Load
Flying Cloud	Catamaran	149
Lightning	Catamaran	149

Source: MBTA.

Appendix C: The RIDE Service Standards

The MBTA monitors The RIDE contractors using performance metrics. If a contractor fails to meet standards set in the contracts, as well as FTA ADA requirements, they incur monetary penalties.

These metrics include:

Reliability

Missed trips (service provider at fault)
Vehicle does not show or is more than 30 minutes late.

Late trips (service provider at fault):
Pick up is more than 15 minutes late and/or drop-off is more than 10 minutes after appointment time.

Not Available trips (service provider at fault)

No Show/Late Cancellation trips (customer at fault)

Travel time
Total registered trips that violate travel time standards should not exceed 2% of all registered trips.

Percent of registered trips assigned to non-dedicated vehicles
Total registered trips assigned to non-dedicated vehicles should not exceed 5% of all registered trips, unless the Contractor has received prior approval to do so by the MBTA.

Complaint rates
The number of complaints concerning The RIDE should not exceed 0.2% of the trips requested.

Accident rates (At fault/not at fault)
All incidents and accidents should be reported.

Accessibility

Lift or ramp failures
Ramps should be operable.

Comfort

Air Conditioning/heating failures

Air conditioners and heaters should be operable.

Communication

Telephone communication system failures

The telephone communication system should be operable. The MBTA levies penalties for interruptions in excess of 30 minutes.

Vehicle communication system failures

The vehicle communication system should be operable. The MBTA levies penalties for interruptions in excess of 60 minutes. Any occurrence of <90% functionality of these systems for all vehicles deployed in service shall also constitute a failure/ interruption.

Computer system disruptions

The computer systems used in the delivery of services (reservations, scheduling, dispatching, reporting) should be operable. The MBTA levies penalties for interruptions in excess of 60 minutes.

Telephone hold time

The average hold time is over 1.5 minutes and/or where 5% of the total calls have a hold time that exceeds 5 minutes.

Staff uniform policy violations

Staff should abide by the uniform policy.

Failure to respond to complaints

Complaints should be responded to within 10 days.

Management and Staffing

Key senior staff vacancies

Vacancies in one of the eight “key senior staff” positions should not last longer than 60 calendar days.

Personnel complement compliance

Each month, 100% of the proposed complement of personnel for each position should maintained.

Appendix D: Service Standard Minimums and Target s

Table D1: All Service Standards

Standard	Minimum	Target	2016 performance	2016 data
Span of Service Standards (minimums, targets, and 2016 performance apply to weekdays only)				
Bus	90%	95%	93%	Spring 2016
Heavy Rail	—	100%	100%	Dec 2016
Light Rail	—	100%	100%	Dec 2016
Commuter Rail	—	100%	100%	Dec 2016
Boat	—	100%	100%	Dec 2016
Service Frequency Standards (minimums, targets, and 2016 performance apply to weekdays only)				
Bus	90%	95%	90%	Spring 2016
Rapid Transit	—	100%	100%	Dec 2016
Boat	—	100%	100%	Dec 2016
Coverage Standards				
Base	75%	—	80%	Fall 2016
Frequent service in dense areas	—	85%	80%	Fall 2016
Low-income households	—	85%	83%	Fall 2016

Table D1 continues on next page

Table D1: All Service Standards, continued

Standard	Minimum	Target	2016 performance	2016 data
Accessibility Standards				
Platform Accessibility (Rapid Transit, gated stations)	92%	100%	92%	Apr 2015–Mar 2016
Vehicle Accessibility (Green Line)	98.6%	100%	98.6%	Jul 2015–Jun 2016
Reliability Standards				
Bus Reliability (non-Key)	70%	75%	65%	Mar–Dec 2016
Key Bus Reliability	75%	80%		
Rapid Transit Passenger Wait Times	—	90%	89%	Mar–Dec 2016
Commuter Rail Reliability	Contract requires 92% (adjusted)		93.8% (adjusted)	Jan–Dec 2016
Boat Reliability	—	99%	98%	Jul 2015–Jun 2016
Bus Service Operated	—	99.5%	98.5%	Jul 2015–Jun 2016
Light Rail Service Operated	—	99.5%	96.5%*	Mar–Dec 2016
Heavy Rail Service Operated	—	99.5%	99.1%*	Mar–Dec 2016
Commuter Rail Service Operated	Contract sets fines for canceled service		99.8%	Jan–Dec 2016
Passenger Comfort Standards				
Bus Passenger Minutes in Comfortable Conditions	92%	96%	94%	Weekdays, Sep–Dec 2015

* Data subject to change with improvements in data collection methodologies

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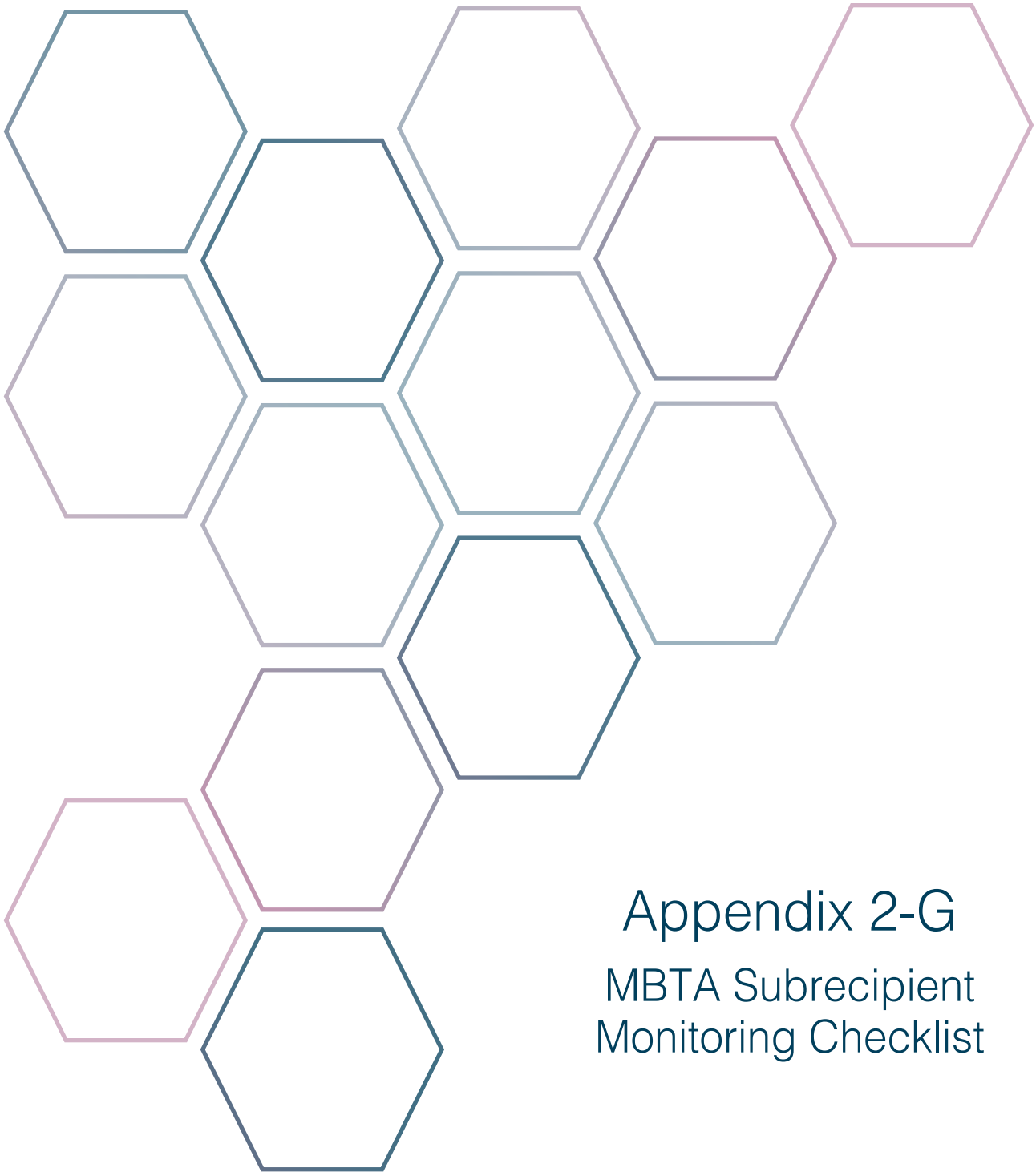

Appendix 2-G

MBTA Subrecipient Monitoring Checklist

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Massachusetts Bay Transportation Authority
Subrecipient Monitoring Checklist

Definition:

From an MBTA perspective, a subrecipient is a governmental or non-profit entity that receives FTA funds, as a pass-through from the Authority, for the purpose of carrying out a Federal program.

Procedures:

Upon execution of an FTA grant that includes a pass-through of funds to a subrecipient, The Capital Budget Office will notify appropriate departments: (Capital Accounting, Legal, Planning, and the monitoring dept.) with the following checklist of pertinent information:

1) Award Information:

a)	Catalog of Federal Domestic Assistance (CFDA) Title and number					
b)	Grant (award) name and title.					
c)	Federal Awarding Agency					
d)	Any applicable compliance requirents	Attached:	Yes		No	
e)	If ARRA Funds, inform that these funds must be reported separately in the Schedule of Expenditures of Federal Awards (SEFA) and the SF-SAC (part of the annual OMB A-133 (Single) Audit).	ARRA Funds:	Yes		No	
f)	All above incorporated into formal agreement between MBTA and subrecipient	Incorporated:	Yes		No	

2) Local Match:

a)	Local match requirement	Percent:	
		Dollar Amount:	
b)	Source of local match		
c)	Expected documentation and eligibility of local match		
d)	Responsible MBTA department for documenting local match		

Massachusetts Bay Transportation Authority
Subrecipient Monitoring Checklist

3) Financial Management:

a) Responsible MBTA department for oversight of this award

b) Confirm that entity has adequate financial systems to carry out program(s) and to receive and disburse Federal funds — Confirmed: Yes ☐ No ☐

c) Obtain copies of annual OMB A-133 audits and Audited Financial Statements — Obtained: Yes ☐ No ☐

d) Insure that any audit findings/deficiencies are resolved timely. — Findings: Yes ☐ No ☐ Resolved: Yes ☐ No ☐

Note: Items b-d will be reviewed annually during life of grant

4) Monitoring Requirements:

a) Responsible MBTA department for oversight of this award

b) Expected oversight tasks (site visits, reviewing financial and/or performance reports, other).

c) Expected documentation/verification of monitoring oversight.

5) **Continuing Control:**

a) If applicable, department responsible for monitoring control over use of any equipment or real estate acquired with awarded funding.

6) **Title VI Requirements**

a) Responsible MBTA department for oversight of this award

I. General Requirement Contents of Title VI program:

i) A copy of the subrecipient's Title VI notice to the public that indicates the subrecipient complies with Title VI and informs members of the public of the protections against discrimination afforded to them by Title VI. Include a list of locations where the notice is posted.

Massachusetts Bay Transportation Authority
Subrecipient Monitoring Checklist

ii) A copy of the subrecipient's instructions to the public regarding how to file a Title VI discrimination complaint, including a copy of the complaint form.

iii) A list of any public transportation-related Title VI investigations, complaints or lawsuits filed with the subrecipient.

iv) A public participation plan that includes an outreach plan to engage minority and limited English proficient populations.

v) A copy of the subrecipient's plan for providing language assistance to persons with limited English proficiency;

vi) Recipients with transit-related, non-elected planning boards, advisory councils, or committees or similar decision-making bodies must provide a table depicting racial breakdown of membership of those bodies;

vii) For subrecipients providing transit service, documentation that level and quality of service is provided on an equitable basis.

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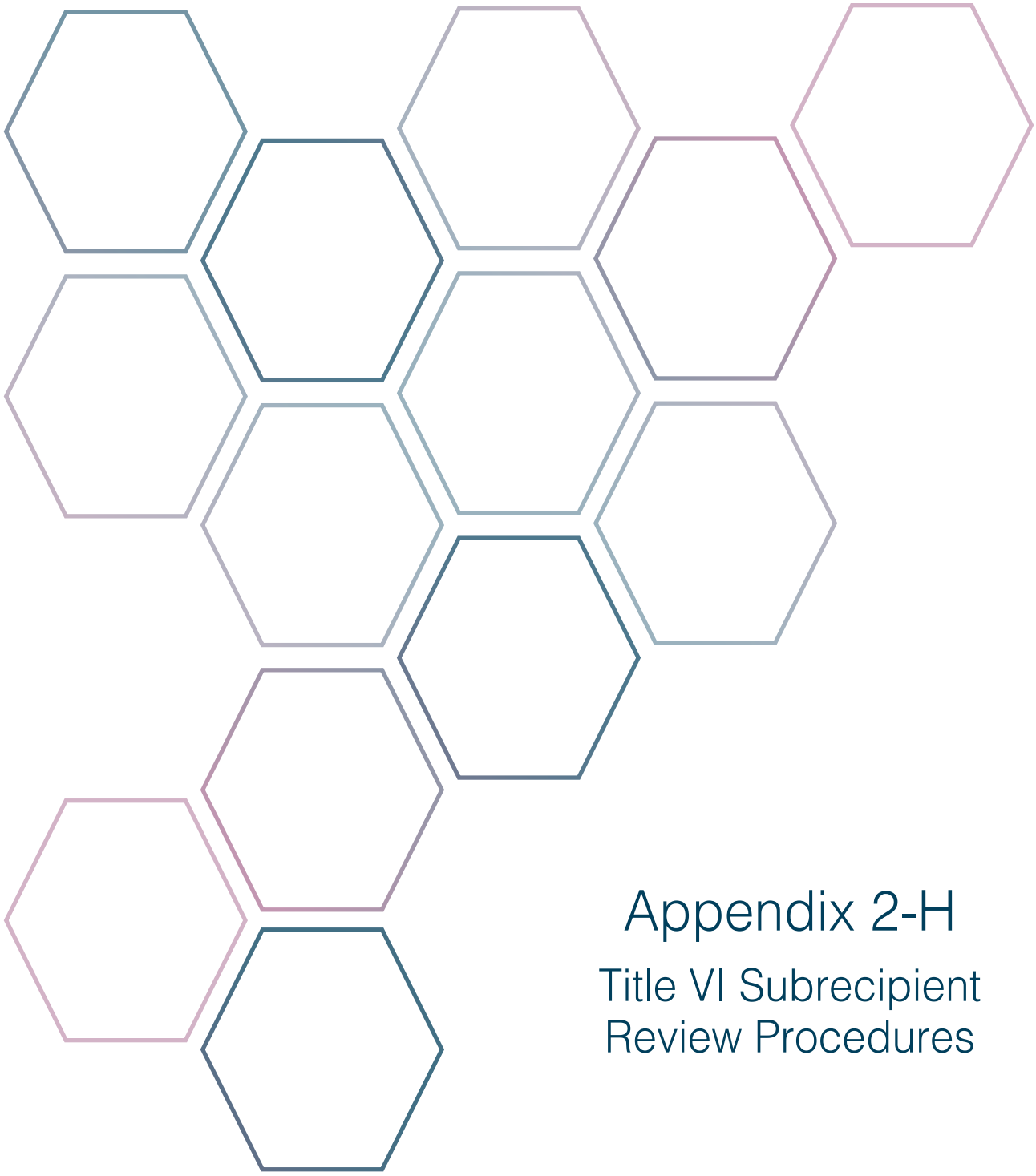

Appendix 2-H

Title VI Subrecipient Review Procedures

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Introduction

In accordance with 23 CFR § 200.9(b)(7), MassDOT's Title VI staff (the Title VI Specialist supervised by the Manager of Federal Programs) is responsible for conducting external Title VI/Nondiscrimination compliance monitoring activities. These monitoring activities reach subrecipients of Federal-aid highway funds, including cities, consultant contractors, universities, colleges, planning agencies, and others.

Risk-Based Prioritization

Just as with MassDOT's internal Title VI/Nondiscrimination compliance monitoring program, the general structure of the external monitoring program is shaped by risk-based prioritization. The subrecipients to which FHWA financial assistance is extended through MassDOT is not a homogenous group. As stated above, it can include planning commissions, municipalities, universities, and construction subcontractors, among others. Title VI/Nondiscrimination risk factors are not necessarily consistent across these organizations and the amount of federal aid at issue will vary dramatically. Monitoring activities will therefore depend on the type of subrecipient at issue, the risk of noncompliance, and the impact that noncompliance could have on beneficiaries. For example, a planning commission that receives significant federal financial assistance and is regularly making transportation project programming decisions about federal aid highway projects poses a greater risk of potential noncompliance under Title VI/Nondiscrimination than a university that participates in only a limited FHWA funded program (such as the National Summer Transportation Institute program) with proportionately less direct impact on beneficiaries. Risk-based prioritization dictates that the limited resources to conduct subrecipient monitoring activities focus more directly on planning commission activities as opposed to university.

Assurance

The FHWA Title VI/Nondiscrimination Agreement and Recipient Assurances (Assurance) is executed by direct recipients (such as MassDOT) as an acknowledgement of Title VI/Nondiscrimination obligations. Subrecipients (such as MPOs and RPAs) are similarly obligated to execute the Assurance. Part of MassDOT's subrecipients monitoring activities includes ensuring that subrecipients are executing this document and implementing its provisions appropriately. MassDOT requires MPOs and RPAs to execute the Assurance every three years and demonstrate the process through triennial reporting obligations. The implementation of Assurance provisions (such as the incorporation of Title VI/Nondiscrimination language in contracts) is reported by subrecipients to MassDOT annually. MassDOT requires municipalities to execute Title VI/Nondiscrimination Assurance every ten (10) years.

While contractors and subcontractors that receive federal highway aid through MassDOT are not required to execute Title VI/Nondiscrimination Assurances, MassDOT is required to include Title VI/Nondiscrimination provisions (found in the Assurance) into contracts with them. The required provisions are included in MassDOT's "Standard Provisions" included into all MassDOT Highway Division and Enterprise Services (including the Office of Transportation Planning) contracts. This includes contracts with colleges and universities that participate as host-sites in the National Summer Transportation Institute (NSTI) program.

Subrecipient Monitoring Methodologies

MassDOT's Title VI staff regularly interacts with subrecipients in a variety of ways. These interactions afford MassDOT the opportunity to monitor these entities for Title VI/Nondiscrimination compliance. Key methods are described below:

- The Transportation Managers Group (TMG)

  This group, which convenes monthly, is comprised of MPO and RPA managers and staff from across the state. MassDOT's Title VI staff attends regularly to discuss Title VI/Nondiscrimination issues, including emphasis on ADA compliance for public meetings, with these subrecipients. The discussions range from MassDOT's Title VI staff reporting findings and recommendations on MPO and RPA Title VI/Nondiscrimination program submissions to providing direct technical assistance or training on Title VI/Nondiscrimination program implementation.

- Workshops/Conferences

  MassDOT's Title VI staff utilizes subrecipient and beneficiary conferences and workshops to advance Title VI/Nondiscrimination program development and implementation and to troubleshoot areas of persistent concern. This includes presentations statewide to municipal officials, group and individual sessions with regional MPO and RPA staff, professional organizations, and industry events. These sessions allow MassDOT to promote best practices and to gauge awareness of and compliance with Title VI/Nondiscrimination obligations across subrecipient and beneficiary categories. It also provides a forum through which to provide direct technical assistance to subrecipients.

- Annual Reporting

  MPOs and RPAs are required to submit annual Title VI/Nondiscrimination reports to MassDOT. MassDOT reviews these reports and, based on this review, makes findings that include the development of Title VI/Nondiscrimination work plans tailored to the needs of the region as well as in-person follow-up conferences to strategize how these organizations will respond to any deficiency findings or corrective actions. These reports provide subrecipients with an opportunity to give MassDOT progress reports on Title VI/Nondiscrimination work plan items, if applicable, as well as to describe and document new innovative Title VI/Nondiscrimination related activities these organizations may be engaging in.

- Triennial Reporting

MPOs and RPAs are required to submit triennial Title VI/Nondiscrimination Program updates to MassDOT. While these subrecipients can choose to adopt MassDOT's Title VI/Nondiscrimination program elements, they are also permitted to develop program components independently. These triennial submissions give MassDOT the opportunity to assess the sufficiency of program development and implementation. MassDOT's response approach to these submissions is the same as for annual reporting – determination of compliance with tailored Title VI/Nondiscrimination work plans and follow-up conferences, as needed.

- Federal MPO Certification Reviews

  FHWA and FTA conduct recurring Certification Reviews of MPOs statewide. The current cycle for these reviews reaches each region about once every three (3) to four (4) years. Since 2013, MassDOT's Title VI Unit has been directly involved in the Civil Rights portion of the Certification Review. This includes reviewing pre-site visit documentation from the MPO, participating in the on-site session (which includes detailed discussions of Title VI/Nondiscrimination obligations, current levels of compliance, and areas for improvement), and contributing to the drafting of an Observations and Recommendations Report. This collaboration benefits all parties involved by facilitating information sharing and promoting consistent messaging, thus better serving the beneficiaries of Title VI/Nondiscrimination protections.

- SharePoint

  MassDOT has found that a number of subrecipients make consistent mistakes in Title VI/Nondiscrimination program development and implementation. The reasons for this are numerous, but stem from the complexity of the law, the multiple unique and sometimes conflicting obligations across federal modal administrations, and the practice of "cutting and pasting" from other Title VI/Nondiscrimination programs that contained inaccuracies. To address this gap, MassDOT has created a SharePoint webpage specifically focused on Title VI/Nondiscrimination. Designated Title VI staff members for each Massachusetts MPO and RPA have been granted access to this resource. This webpage not only allows these subrecipients to submit Title VI/Nondiscrimination reports and programs electronically to MassDOT, but it also allows MassDOT to share documents with them. This resource includes sharing template Title VI/Nondiscrimination documents and program components that are persistently problematic, such as complaint procedures. MassDOT uses the annual subrecipient reporting process to verify that these documents are being implemented by subrecipients.

- Desk Audits and On-Site Visits

  MassDOT's Title VI/Nondiscrimination Program contemplates a detailed review of at least one MPO/RPA each year. In practice, MassDOT regularly considers the Title VI profile of more than one MPO/RPA each year (through reporting activities and through participation in the federal Certification Review process). When MassDOT initiates a more detailed review of such subrecipients, it includes a desk audit and an on-site visit. Similar to the federal Certification Review process, MassDOT requests a pre-site visit materials submission from the subrecipient. This outreach usually includes key Title VI/Nondiscrimination program documents (such as notice, complaint procedures, public participation plans, and language access plans) as well as requests for analytical information (such as project distribution in the region and any indication of disparities). This desk audit review is followed by an on-site session. These sessions allow MassDOT's Title VI staff to discuss the findings of their desk audit, to strategize the subrecipients corrective action plan, and to provide direct technical assistance, where needed. To facilitate compliance reviews, subrecipients are required to keep and submit records for review, as requested, as well as provide access to these records.

Variable Prioritization of Subrecipient Monitoring

While the cycle of external subrecipient monitoring is structured based on risk-based prioritization, it is not rigid. The subrecipients assessed during any given annual cycle can change based on the following factors:

- Federal Certification Review Schedule

  MassDOT strives to coordinate its subrecipient monitoring review schedule with the federal Certification Review schedule. This can mean that MassDOT will pursue focusing its monitoring activities on subrecipient MPOs and RPAs that will be going through a Certification Review in the near future or it will hold off on independent monitoring activities to incorporate them into an upcoming Certification Review. The goal of accommodating the Certification Review process is not only to avoid duplicative efforts with subrecipients but also to ensure the consistency of process and message from both the federal and state levels.

- Complaints

  Changes in the characteristics of frequency or type of complaints received against subrecipient MPOs and RPAs could indicate the need for increased scrutiny for Title VI/Nondiscrimination compliance. If MassDOT determines that a pattern of complaints warrants additional monitoring of subrecipients, the Title VI staff will do so.

- Staffing Changes

  Staffing changes at MPOs and RPAs can impact the Title VI/Nondiscrimination activities in those regions. This can happen because of the reduction of corporate knowledge on these issues or through reduced resources to address these needs. In fact, even staffing changes at MassDOT's Office of Transportation Planning (which includes an MPO Activities section that interacts with and guides MPOs and RPAs on Title VI activities) can impact the degree of Title VI/Nondiscrimination compliance among these subrecipients. MassDOT may shift its subrecipient monitoring activities to those that have undergone staffing changes to ensure that Title VI/Nondiscrimination obligations are understood and continue to be fulfilled.

- Projects

  Transportation projects carry with them varying degrees of Title VI/Nondiscrimination risk, impacts, and interest. When MassDOT becomes aware of transportation projects that could be considered controversial or significant from a Title VI/Nondiscrimination perspective, this can prompt increased monitoring activities at the MPO or RPA that is programming the project at issue.

- Patterns Indicating Noncompliance

  The cycle of subrecipient monitoring activities does not guarantee that all the programs, services, or activities of an MPO or RPA are or will be Title VI/Nondiscrimination compliant. Several methods of MassDOT's subrecipient monitoring process involve the development and issuing of tailored work plans to bring noncompliant subrecipients into compliance. As MassDOT's Title VI staff follows up on the progress of the action items outlined in the work plans, it may become clear that some areas remain persistently unaddressed. Such patterns of noncompliance could prompt additional monitoring activities out of sequence from the cycle.

- Additional Factors

  MassDOT's Title VI staff regularly engages in research and analysis of Title VI compliance strategies across the nation as it strives to identify best-practices and innovate new methods to ensure Title VI/Nondiscrimination adherence. External monitoring prioritization variables and methodologies will be incorporated into MassDOT's monitoring activities will be reported to FHWA in MassDOT's annual Title VI goals and accomplishments report and will be articulated in the triennial updates to MassDOT's Title VI/Nondiscrimination Program.

Contractor Monitoring Methodologies

Compared to subrecipients (such as MPOs), contractors in the Highway project development or planning contexts generally pose lower Title VI/Nondiscrimination risk factors. There is also a significantly high number of contractors when compared to subrecipients, thus MassDOT's limited monitoring resources must be strategically allocated to ensure coverage across all remaining areas of Title VI activity. This means that contractor monitoring relies heavily on the inclusion of Title VI/Nondiscrimination provisions (i.e. Appendix A of the Assurance) into all contracts with these entities. These provisions are discussed during contract negotiations and contractors sign these documents having been fully informed of the obligations and/or having had an opportunity to review them and follow up with questions if needed. For the duration of the contract, MassDOT's Title VI staff stays alert for possible Title VI/Nondiscrimination related concerns or complaints that may arise during the performance of the contract. In such situations, MassDOT relies on increased monitoring or investigative activities to address any such issues.

Subrecipient and Contractor Corrective Actions

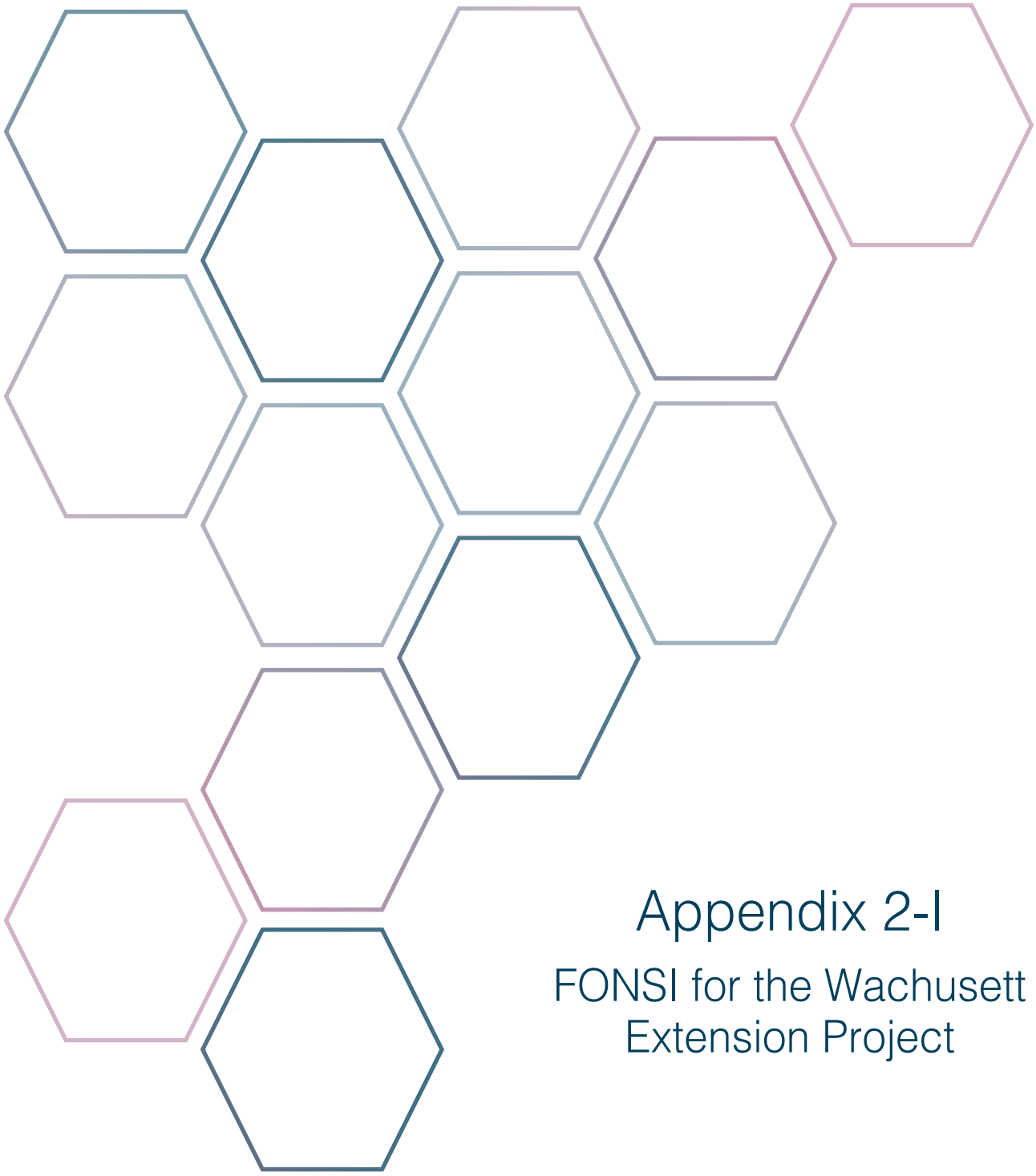
Effective compliance with Title VI requires MassDOT to take prompt action to achieve voluntary compliance in all instances in which noncompliance is found. If a Program or subrecipient is determined to be out of compliance or is believed to be out of compliance with Title VI/Nondiscrimination obligations, MassDOT has three potential remedies:

- Resolution of the noncompliance status or potential noncompliance status by voluntary means by entering into an agreement which becomes a condition of assistance is the first option.
- Where voluntary compliance efforts are unsuccessful, a refusal to grant or continue the assistance is initiated, or
- Where voluntary compliance efforts are unsuccessful, the violation is referred to FHWA, which may undertake further resolution steps, and/or forward the matter to the U.S. Department of Justice for judicial consideration.

Every effort will be made to obtain compliance through voluntary corrective action.

Example Subrecipient Title VI Work Plan

Below is a copy of a Title VI Work Plan recently developed by MassDOT's Title VI staff to shape the ongoing compliance activities of one of the Commonwealth's Metropolitan Planning Organizations (MPO). Such work plans, provided to all high priority subrecipients, informs the compliance activities of the organization as well as the annual reporting requirements to MassDOT. Most recently, MassDOT's Title VI unit has also begun structuring following up trainings and capacity building workshops to reinforce the work plan content and recommendations.



Appendix 2-I

FONSI for the Wachusett Extension Project

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U.S. Department
of Transportation
**Federal Transit
Administration**

REGION I
Connecticut, Maine,
Massachusetts,
New Hampshire,
Rhode Island, Vermont

Volpe Center
55 Broadway, Suite 920
Cambridge, MA 02142-1093
617-494-2055
617-494-2865 (fax)

October 1, 2010

Mr. Mohammed H. Khan
Administrator
Montachusett Regional Transit Authority
R1427 Water Street
Fitchburg, MA 01420

Mr. Richard Davey
General Manager & Rail and Transit Administrator
Massachusetts Bay Transportation Authority
10 Park Plaza
Boston, MA 02116

Re: **Fitchburg Commuter Rail Extension Project**
Wachusett Station and Westminster Layover Facility
Environmental Assessment - Finding of No Significant Impact

Dear Messrs. Khan and Davey:

Based upon our review of the environmental documentation, the Federal Transit Administration (FTA) has issued a Finding of No Significant Impact (FONSI) for the Fitchburg Commuter Rail Extension Project (attached). The purpose of this commuter rail extension is to provide a transit option for motorists traveling to Boston along Route 2. The project will extend commuter rail service 4.5 miles west from the existing terminus in downtown Fitchburg to a new terminus in West Fitchburg, MA (Wachusett). The project includes the following components:

- 4.5 miles of track and signal upgrade
- Up to 285 space station parking facility
- High level boarding platform
- Up to 6 track layover facility

Please be advised that in accordance with 23 CFR 771.121, please transmit a notice of availability of this FONSI to all affected Federal, state and local governmental entities. In addition, under Section 106 of the National Historic Preservation Act, the FTA has determined "No Historic Properties Effected".

The FTA looks forward to continuing to work with the Montachusett Regional Transit Authority and the Massachusetts Bay Transportation Authority on this important transit improvement.

Sincerely,

Mary Beth Mello

Mary Beth Mello
Regional Administrator

Attachment

FEDERAL TRANSIT ADMINISTRATION
REGION I

Finding of No Significant Impact

Project: Fitchburg Commuter Rail Extension Project/Wachusett Station and Westminster Layover Facility

Applicant: Montachusett Regional Transit Authority (MART) and Massachusetts Bay Transportation Authority (MBTA)

Project Location: West Fitchburg, MA/ Westminster, MA

Purpose and Need

The purpose of the Fitchburg Commuter Rail Extension project is to provide a transit option for motorists traveling to Boston via Route 2. By extending commuter rail service 4.5 miles from downtown Fitchburg to a new rail station in West Fitchburg at the intersection of Routes 2 and 31, the ease of access is expected to attract commuters from the North Central Region of Massachusetts.

The need for the project stems from the several inter-related transportation deficiencies; 1) lack of transit options west of Fitchburg; existing demand for transit service and additional parking along the existing Fitchburg Commuter Rail line; 3) the MBTA's current reliance on a poorly located, undersized, and outdated layover facility; and 4) the need for improved access to jobs in both the Boston area and Montachusett region.

The project will extend commuter rail service 4.5 miles west from the existing terminus in downtown Fitchburg to a new terminus in West Fitchburg, MA (Wachusett). The proposed commuter rail station will be located largely within the limits of Pan Am Southern's existing right of way in the City of Fitchburg immediately adjacent to the existing main line and will consist of a full-length high level platform equipped with passenger shelters benched lighting and bicycle storage facilities. The station will be fully accessible per the standards of the Americans with Disabilities Act. Parking for up to 286 cars on adjacent industrially-zoned parcels with access to the parking lot via Authority Drive, which is located less than one-half mile of Route 2. To reduce cut through traffic on Fifth Massachusetts Turnpike, establishment of a cul-de-sac is proposed to be located prior to the parking lot with breakaway bollards for emergency vehicle access. A new layover facility will be located at the Westminster Business Park, approximately 1.5 miles west of Wachusett Station. The layover facility will allow for the overnight night storage of up to six trains.

Alternatives Considered

The environmental assessment (EA) evaluates three alternatives to improve mobility along the corridor; 1) No Build Alternative, 2) Bus Service and 3) Commuter Rail. The commuter rail alternative as described above was selected as the preferred alternative. The EA also evaluated alternative sites for the station and layover facility.

Agency Coordination and Public Opportunity to Comment

The MART involved a number of agencies, local officials and the public in the planning and conceptual design of the Fitchburg Commuter Rail Extension project. The EA was made available for a 30 day comment period. A public meeting was held on July 13, 2010. Meeting minutes and response to comments are included within the EA. During the comment period the Massachusetts Historical Commission (MHC) requested additional information to support FTA's proposed Section 106 determination of "No Historic Properties Effected." Specifically, MHC, in its role as the State Historic Preservation Officer (SHPO), requested additional information on the sensitivity of historical and archaeological resources within the station and layover facility sites. The supplemental information had been prepared and transmitted to MHC. On September 23, 2010, MHC concurred on FTA's determination of effect.

Based on the public comments, including the supplemental Section 206 information, the MBTA and MART determined that no substantative changes were warranted.

Determinations and Findings

National Environmental Policy Act (NEPA) Finding

FTA served as the lead agency under NEPA for the project. The MART and the MBTA prepared an EA in compliance with NEPA, 42 U.S.C. 4321 et seq. and with FTA's regulations, 23 CFR Part 771. The EA analyzes and describes the project's potential significant impacts.

After reviewing the EA, its supporting documents and public comments, the FTA finds under 23 CFR 771.121 that the proposed project will have no significant impacts on the environment. The record provides sufficient evidence and analysis for determining that an Environmental Impact Statement (EIS) is not required.

Section 106 Compliance

In accordance with Section 106 of the Historic preservation Act of 1966 as amended (36 CFR 800); FTA has issued a determination of "No Historic Properties Effected". On September 23, 2010, MHC, in its role as SHPO, concurred on FTA's determination.

Section 4(f) Findings

In accordance with 23 CFR 771.135, the FTA has determined that Section 4(f) requirements do not apply since no land from a significant publicly owned public park, recreation area, or wildlife and waterfowl refuge, or any significant historic site will be used as a result of this project. FTA has made this determination since the current contemplated project has no anticipated 4(f) use.

Approved: Mary Beth Mello Date: 10/1/10
Mary Beth Mello
Regional Administrator
FTA, Region I

Concur: Wendy A. Lee Date: 10/1/10
Wendy A. Lee
Regional Counsel

Deval L. Patrick, Governor
Timothy P. Murray, Lt. Governor
Jeffrey B. Mullan, MassDOT Secretary & CEO
Richard A. Davey, General Manager
and Rail & Transit Administrator

massDOT
Massachusetts Department of Transportation
Rail & Transit Division

September 27, 2010

Mary Beth Mello
Regional Administrator
Federal Transit Administration
55 Broadway, Suite 920
Cambridge, MA 02142

Dear Regional Administrator Mello:

As you are aware, on June 22, 2010, the Montachusett Area Regional Transit Authority (MART), in cooperation with the MBTA, released for public review the Draft Environmental Assessment (EA) for the Wachusett Extension project. The project involves the extension of commuter rail service from the current terminus in Fitchburg to a new terminus in Westminster, MA. A new layover facility adjacent to the end of the line is also part of the project. The MART held a robust public review of the document. Copies of the EA were distributed to the regulatory agencies as well as other municipal agencies and other interested parties. Copies were made available at local libraries in Fitchburg, Westminster and Gardner and a copy of the EA was posted on MART's website.

A public meeting was held on July 13, 2010, at MART's Headquarters in Fitchburg. MART placed an advertisement in the local paper notifying the public of the document's availability and of the public meeting. The meeting included the presentation and an opportunity for questions and answers, as well as comments from the public. A copy of the meeting minutes, including the presentation slides and the sign in sheet have been added to the EA as an Appendix. MART accepted comments on the EA for 30 days; 9 comment letters were received. MART and the MBTA prepared a Response to Comments Memorandum. Copies of the Response to Comments memorandum as well as the comment letters are included in the Appendix to the EA.

During the comment period, the Massachusetts Historical Commission, in its role as State Historic Preservation Officer (SHPO), requested additional information to support the FTA's proposed determination of effect. In summary, the SHPO requested that the Wachusett Station and layover facility sites be subjected to a sensitivity assessment for historical and archeological resources by a qualified cultural resource professional. A copy of MHC's letter is included in the EA. This information was submitted to the FTA on September 16, 2010; on September 17, 2010, the FTA provided this information to SHPO and also reiterated its proposed Section 106 Determination of Effect ("No historic Properties Effected"). On September 23, 2010, SHPO concurred with this Determination of Effect. The supplemental information, the FTA's Draft Finding of Effect and SHPO's concurrence documents have all been included in the EA as attachments in the Appendices.

Based upon the public review, including the supplemental Section 106 information, the MBTA and MART do not believe any substantive changes are needed in the EA. In summary, the EA documents that the project will not result in impacts to the human and natural environment. Given that this project does not have the potential to affect the quality of the human and natural

Massachusetts Bay Transportation Authority
Ten Park Plaza, Boston, MA 02116
www.mbta.com

environment, the MBTA is requesting that the Federal Transit Administration issue a Finding of No Significant Impact (FONSI) for the Wachusett Extension.

We appreciate your assistance on this project. If you have any questions on the document, please feel free to contact me.

Sincerely,

Andrew D. Brennan
Director of Environmental Affairs

Enclosure

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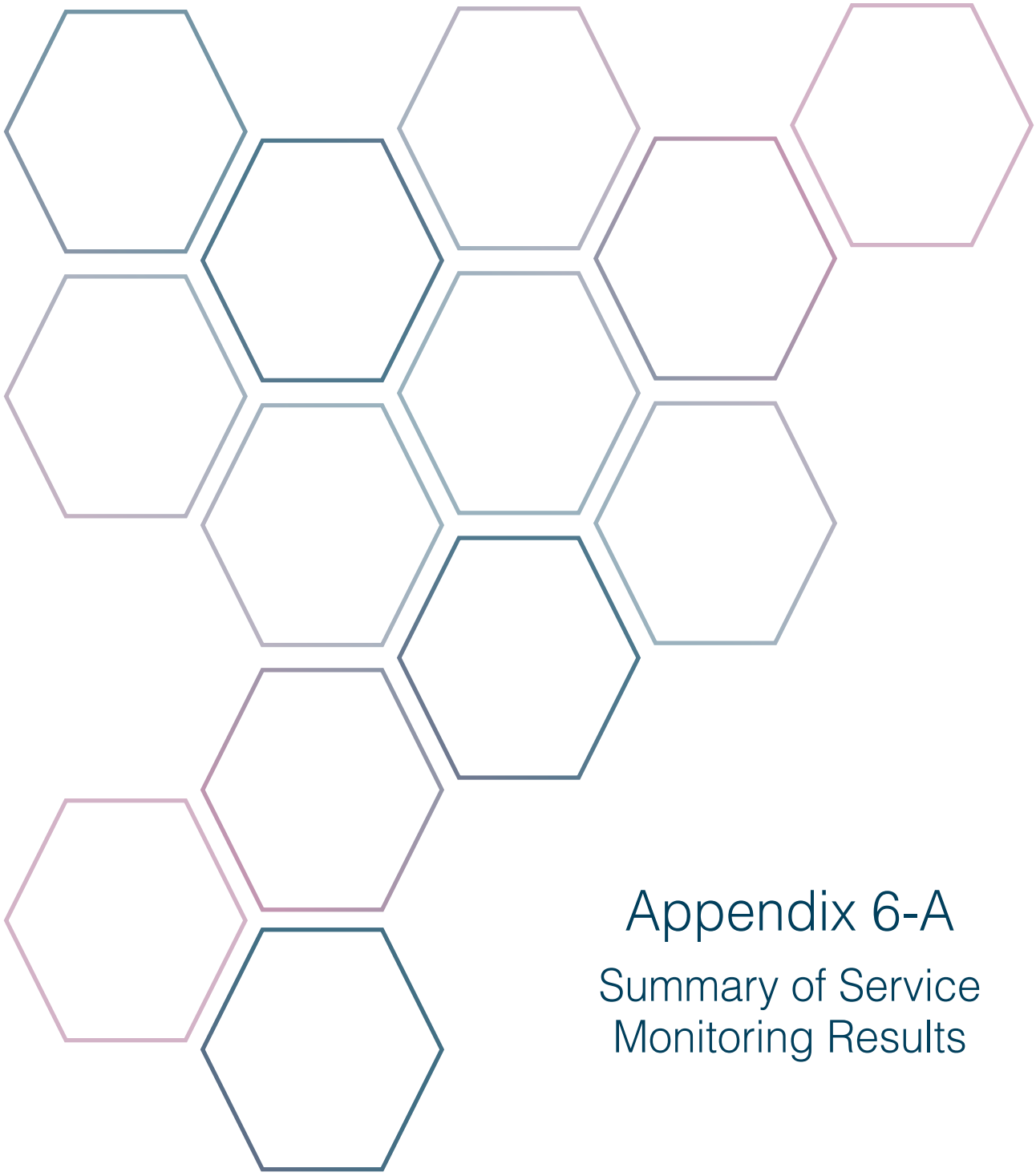

Appendix 6-A

Summary of Service Monitoring Results

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Table 6-A
Summary of Service Monitoring Results

Indicator/Mode	Result of Disparate Impact Analysis	Page
Vehicle Load		
Bus vehicle load – weekday	No disparate impact	6-6
Bus vehicle load – Saturday	No disparate impact	6-6
Bus vehicle load – Sunday	No disparate impact	6-6
Heavy and light rail vehicle load – weekday	N/A*	6-9
Heavy and light rail vehicle load – Saturday	N/A*	6-9
Heavy and light rail vehicle load – Sunday	N/A*	6-9
Commuter rail vehicle load – weekday	No disparate impact	6-9
Commuter rail vehicle load – Saturday	No disparate impact	6-9
Commuter rail vehicle load – Sunday	No disparate impact	6-9
Vehicle Headway		
Bus vehicle headway – weekday	Potential disparate impact	6-12
Bus vehicle headway – Saturday	No disparate impact	6-12
Bus vehicle headway – Sunday	No disparate impact	6-12
Heavy and light rail vehicle headway – weekday	No disparate impact	6-16
Heavy and light rail vehicle headway – Saturday	No disparate impact	6-16
Heavy and light rail vehicle headway – Sunday	No disparate impact	6-16
Commuter rail vehicle headway – weekday	No disparate impact	6-18
Commuter rail vehicle headway – Saturday	No disparate impact	6-18
On-Time Performance		
Bus on-time performance – weekday	No disparate impact	6-20
Bus on-time performance – Saturday	No disparate impact	6-20
Bus on-time performance – Sunday	No disparate impact	6-20
Heavy and light rail on-time performance – weekday	No disparate impact	6-23
Heavy and light rail on-time performance – Saturday	No disparate impact	6-23
Heavy and light rail on-time performance – Sunday	No disparate impact	6-23
Commuter rail on-time performance – weekday	No disparate impact	6-26
Commuter rail on-time performance – Saturday	No disparate impact	6-26
Commuter rail on-time performance – Sunday	No disparate impact	6-26
Service Availability		
Service availability – weekday	No disparate impact	6-29
Service availability – Saturday	No disparate impact	6-29
Service availability – Sunday	No disparate impact	6-29
Span of Service		
Bus span of service – weekday	No disparate impact	6-32
Bus span of service – Saturday	No disparate impact	6-32
Bus span of service – Sunday	No disparate impact	6-32
Heavy and light rail span of service – weekday	No disparate impact	6-35
Heavy and light rail span of service – Saturday	No disparate impact	6-35
Heavy and light rail span of service – Sunday	No disparate impact	6-35
Commuter rail span of service – weekday	No disparate impact	6-38

Indicator/Mode	Result of Disparate Impact Analysis	Page
Commuter rail span of service – Saturday	No disparate impact	6-38
Platform Accessibility		
Platform accessibility – gated rapid transit stations with elevators	No disparate impact	6-40
Platform accessibility – all gated rapid transit stations	No disparate impact	6-40
Platform accessibility – commuter rail stations	No disparate impact	6-42
Vehicle Accessibility		
Heavy and light rail vehicle accessibility	N/A**	6-43
Commuter rail vehicle accessibility	N/A*	6-44
Service Operated		
Bus service operated – weekday	No disparate impact	6-44
Bus service operated – Saturday	No disparate impact	6-44
Bus service operated – Sunday	No disparate impact	6-44
Heavy and light rail service operated – all days	No disparate impact	6-47
Commuter rail service operated – weekday	Potential disparate impact	6-48
Commuter rail service operated – Saturday	Potential disparate impact	6-48
Commuter rail service operated – Sunday	Potential disparate impact	6-48
Bus Shelter and Bench Placement		
Shelter placement – stops with more than 70 ADB	No disparate impact	6-53
Shelter placement – stops with more than 25 ADB	No disparate impact	6-53
Bench placement – stops with more than 50 ADB and no shelter	No disparate impact	6-55
Bench placement – all stops with no shelter	No disparate impact	6-55
Bus Shelter Amenities and Conditions		
Shelter amenities – seating fixtures	No disparate impact	6-58
Shelter conditions – structure	No disparate impact	6-59
Shelter conditions – vandalism	No disparate impact	6-59
Shelter conditions – cleanliness	No disparate impact	6-59
Rapid Transit Station Amenities and Conditions		
Subway lobby amenities – trash receptacles	No disparate impact	6-60
Subway lobby amenities – recycling receptacles	No disparate impact	6-60
Subway lobby amenities – seating fixtures	No disparate impact	6-60
Subway lobby amenities – system map	No disparate impact	6-60
Subway platform amenities – trash receptacles	No disparate impact	6-61
Subway platform amenities – recycling receptacles	No disparate impact	6-61
Subway platform amenities – seating fixtures	No disparate impact	6-61
Subway platform amenities – system map	No disparate impact	6-61
Subway platform amenities – line map	No disparate impact	6-61
Subway exterior conditions – structure	No disparate impact	6-63
Subway exterior conditions – station name signage	No disparate impact	6-63
Subway exterior conditions – vandalism	No disparate impact	6-63
Subway exterior conditions – cleanliness	Potential disparate impact	6-63
Subway lobby conditions – structure	No disparate impact	6-64
Subway lobby conditions – floor surface	No disparate impact	6-64
Subway lobby conditions – stairwell	Potential disparate impact	6-64

Indicator/Mode	Result of Disparate Impact Analysis	Page
Subway lobby conditions – lighting	No disparate impact	6-64
Subway lobby conditions – wayfinding signage	No disparate impact	6-64
Subway lobby conditions – vandalism	No disparate impact	6-64
Subway lobby conditions – cleanliness	Potential disparate impact	6-64
Subway platform conditions – structure	No disparate impact	6-66
Subway platform conditions – platform surface	Potential disparate impact	6-66
Subway platform conditions – tactile strips	No disparate impact	6-66
Subway platform conditions – stairwell	Potential disparate impact	6-66
Subway platform conditions – lighting	No disparate impact	6-66
Subway platform conditions – station name signage	No disparate impact	6-66
Subway platform conditions – wayfinding signage	No disparate impact	6-66
Subway platform conditions – vandalism	No disparate impact	6-66
Subway platform conditions – cleanliness	Potential disparate impact	6-66
Surface platform amenities – trash receptacles	Potential disparate impact	6-68
Surface platform amenities – recycling receptacles	Potential disparate impact	6-68
Surface platform amenities – seating fixtures	No disparate impact	6-68
Surface platform amenities – system maps	No disparate impact	6-68
Surface platform amenities – line map	No disparate impact	6-68
Surface shelter conditions – structure	No disparate impact	6-71
Surface shelter conditions – vandalism	No disparate impact	6-71
Surface shelter conditions – cleanliness	No disparate impact	6-71
Surface platform conditions – walkway	No disparate impact	6-72
Surface platform conditions – pedestrian control	No disparate impact	6-72
Surface platform conditions –platform surface	No disparate impact	6-72
Surface platform conditions – station name signage	No disparate impact	6-72
Surface platform conditions – tactile strips	No disparate impact	6-72
Commuter Rail Station Amenities and Conditions		
Station amenities – trash receptacles	No disparate impact	6-73
Station amenities – seating fixtures	No disparate impact	6-73
Station amenities – system map	No disparate impact	6-73
Station amenities – line schedule	No disparate impact	6-73
Station amenities – Title VI notice	No disparate impact	6-73
Shelter conditions – structure	No disparate impact	6-75
Shelter conditions –station name signage	No disparate impact	6-75
Shelter conditions – vandalism	No disparate impact	6-75
Shelter conditions – cleanliness	No disparate impact	6-75
Platform conditions – platform surface	No disparate impact	6-76
Platform conditions – tactile strips	No disparate impact	6-76
Platform conditions – stairwell	No disparate impact	6-76
Platform conditions – station name signage	No disparate impact	6-76
Platform conditions – wayfinding signage	No disparate impact	6-76
Platform conditions – vandalism	No disparate impact	6-76

Indicator/Mode	Result of Disparate Impact Analysis	Page
Platform conditions – cleanliness	Potential disparate impact	6-76
Automated Fare Collection		
Faregate operability	No disparate impact	6-78
Availability of Full-Service FVMs	No disparate impact	6-79
Availability of Cashless and Full-Service FVMs	No disparate impact	6-79
Populations served by CharlieCard retail sales terminals	No disparate impact	6-81
Provision of Information		
Neighborhood maps at subway rapid transit stations	No disparate impact	6-82
Bus transfer maps at subway rapid transit stations	No disparate impact	6-82
Variable-message sign operability	No disparate impact	6-83
Distribution of variable-message signs with bus arrival information	No disparate impact	6-83
Escalator Operability		
Escalator operability	No disparate impact	6-86
Vehicle Assignment		
Bus vehicle age	No disparate impact	6-87
Bus air conditioning operability	No disparate impact	6-87
Heavy and light rail vehicle age	N/A**	6-88
Commuter rail vehicle age	No disparate impact	6-89

Note: No service monitoring analyses were performed for commuter boat services because all commuter boat services are nonminority-classified.
ADB = Average daily boardings. FVM = Fare vending machines.
N/A* = Not available because the MBTA currently lacks the means to record data for these items.
N/A** = Not applicable because the heavy rail lines and the Mattapan Line use dedicated equipment; all Green Line branches are classified as nonminority.

Appendix 6-B

Minority Classifications of MBTA Services

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Table 6-B1
MBTA Bus Route Minority Classification

Route	Route Name (from MBTA Database)	Classification
1	Harvard Station - Dudley Station via BU Medical Center	Minority
4	North Station - World Trade Center	Nonminority
5✶	City Point - Mary Ellen McCormick Housing	Nonminority
7	City Point - Otis and Summer Streets via Summer Street	Nonminority
8	Harbor Point/UMASS - Kenmore via South Bay and BU Medical Center	Minority
9	City Point - Copley Station	Nonminority
10✶	City Point - St. James Avenue via South Bay Mall	Nonminority
11	City Point - Bedford and Chauncy Streets	Nonminority
14	Roslindale Square - Heath Street via Dudley	Minority
15	Kane Square - Ruggles Station	Minority
16	Forest Hills Station - UMASS Campus via JFK and South Bay	Minority
17	Fields Corner - Andrew Station via Uphams Corner	Minority
18✶✶	Ashmont Station - Andrew Station	Minority
19	Fields Corner Station - Kenmore Station	Minority
21	Ashmont Station - Forest Hills Station	Minority
22	Ashmont Station - Ruggles via Jackson Square Station	Minority
23	Ashmont Station - Ruggles Station via Washington	Minority
24✶	Wakefield Avenue/Truman Parkway - Mattapan Station	Minority
26	Ashmont Station/Norfolk Street Loop via Norfolk	Minority
27	Mattapan Station - Ashmont Station	Minority
28	Mattapan Station - Ruggles via Dudley	Minority
29	Mattapan Square - Jackson Square Station	Minority
30	Mattapan - Forest Hills via Roslindale Square	Minority
31	Mattapan Square - Forest Hills Station	Minority
32	Wolcott Square - Forest Hills Station via Cleary Square	Minority
33✶	River and Milton Streets, Dedham - Mattapan Station	Minority
34	Dedham Line - Forest Hills Station via Washington	Minority
35	Dedham Mall - Forest Hills via Centre and Belgrade	Nonminority
36	VA Hospital West Roxbury - Forest Hills via Charles	Minority
37	Baker and Vermont Streets - Forest Hills Station	Nonminority
38	Wren Street - Forest Hills Station	Minority
39	Forest Hills Station - Back Bay Station	Minority
40✶✶	Georgetown - Forest Hills Station via Alwin Street	Minority
41	Center and Elliott Streets – JFK/UMass via Dudley	Minority
42	Forest Hills - Dudley Square Terminal via Garage	Minority
43	Ruggles Station - Park and Tremont Streets	Minority
44	Jackson Square - Ruggles Station via Seaver Street	Minority
45	Franklin Park - Ruggles Station via Grove Hall	Minority
47	Central Square - Broadway Station	Nonminority
50	Cleary Square - Forest Hills Station	Minority
51	Reservoir Station - Forest Hills Station	Minority

Route	Route Name (from MBTA Database)	Classification
52	Dedham Mall - Watertown via Oak Hill	Minority
55	Jersey and Queensbury - Park and Tremont Streets	Nonminority
57	Watertown Bus Yard - Kenmore Square	Nonminority
59	Needham Junction - Watertown Square	Minority
60	Chestnut Hill Mall - Kenmore Square	Minority
62	Bedford VA Hospital - Alewife Station via Lexington Center	Nonminority
64	Oak Square - Kendall/MIT Station via Union and Central	Nonminority
65	Brighton Center - Kenmore Square	Nonminority
66	Harvard Square - Dudley Square via Union Square, Allston	Minority
67	Turkey Hill - Alewife Station via Arlington Center	Nonminority
68	Harvard Square - Kendall Station	Minority
69	Harvard Square - Lechmere Station	Minority
70	North Waltham (Lakeview) - University Park via Central Square	Minority
71	Watertown Square - Harvard Station via Mount Auburn Street	Nonminority
72	Aberdeen Avenue and Mount Auburn - Bennett Street via Huron	Nonminority
73	Waverly Square - Harvard Station via Belmont	Nonminority
74	Belmont Center - Bennett Street Alley	Nonminority
75	Belmont Center - Bennett Alley via Huron Towers	Nonminority
76	Lincoln Labs - Alewife Station via Hanscom	Minority
77	Arlington Heights - Bennett Street Alley	Nonminority
78	Arlmont Village - Bennett Alley	Nonminority
79	Arlington Heights - Alewife Station	Nonminority
80	Arlington Center - Lechmere Station	Nonminority
83	Rindge Avenue - Central Square, Cambridge	Nonminority
84	Alewife Station - Alewife Station via Arlmont Loop	Nonminority
85	Spring Hill - Kendall Station	Nonminority
86	Sullivan Station - Cleveland Circle	Nonminority
87	Arlington Center - Lechmere Station	Nonminority
88✶	Clarendon Hill - Lechmere Station via Highland Avenue	Nonminority
89	Clarendon Hill - Sullivan Station	Nonminority
90✶	Davis Station - Wellington Station via Sullivan	Nonminority
91	Central Square, Cambridge - Sullivan Station	Nonminority
92	Assembly Square Mall - Franklin Street via Sullivan	Nonminority
93	Sullivan Station - Downtown Boston via Bunker Hill	Nonminority
94	Medford Square - Davis Square via West Medford	Nonminority
95	West Medford - Sullivan Station via Mystic Avenue	Minority
96	Medford Square - Bennett Alley via Davis Square and George	Nonminority
97✶✶	Malden Station - Wellington Station via Commercial Street	Minority
99	Boston Regional Medical Center (Upper Highland) - Wellington Station	Minority
100	Elm Street - Wellington Station via Fellsway	Minority
101	Malden Center Station - Sullivan Station via Winter Hill	Nonminority
104	Malden Center Station - Sullivan Station via Ferry	Minority
105✶✶	Malden Station - Sullivan Station via Newland Street Housing	Minority

Route	Route Name (from MBTA Database)	Classification
106	Lebanon Loop - Wellington Station via Malden Station	Minority
108	Linden Square - Wellington Station via Malden Station	Minority
109	Linden Square - Sullivan Station via Broadway	Minority
110	Wonderland Station - Wellington Station via Woodlawn	Minority
111	Woodlawn - Haymarket via Bellingham Square	Minority
112	Wellington - Wood Island via Mystic Mall	Minority
114✶	Bellingham Square - Maverick Station	Minority
116✶	Wonderland - Maverick via Revere Street	Minority
117✶	Wonderland - Maverick via Beach Street	Minority
119	Northgate Shopping Center - Beachmont Station	Minority
120✶	Orient Heights - Maverick Station via Jeffries Point and Waldemar	Minority
121✶	Wood Island Station - Maverick Station via Lexington Street	Minority
131	Melrose Highland - Oak Grove Station via East Side	Nonminority
132	Redstone Shopping Plaza - Malden Station	Nonminority
134	North Woburn - Wellington Station via Riverside Avenue	Minority
136	Reading Depot - Malden Center Station	Nonminority
137	Reading Depot - Malden Center Station	Nonminority
170✶✶	Oakpark - Dudley Station via Waltham and Back Bay	Minority
201✶	Fields Corner Loop via Neponset Avenue	Minority
202✶	Fields Corner Loop via Adams, Keystone and Puritan	Minority
210✶	Quincy Center Station - Fields Corner Station	Minority
211	Quincy Center Station - Squantum via North Quincy Station	Minority
212✶	Quincy Center Station - North Quincy Station	Minority
214✶	Quincy Center - Germantown	Minority
215	Qunicy Center - Ashmont Station via West Quincy	Minority
216✶	Quincy Center - Hough's Neck	Minority
217✶	Quincy Center - Ashmont Station	Minority
220✶	Quincy Center - Hingham Square via Hingham Center	Nonminority
221✶	Quincy Center - Fort Point via North Weymouth	Nonminority
222	Quincy Center - East Weymouth	Nonminority
225	Quincy Center - Weymouth Landing via DesMoines	Minority
230	Quincy Center - Montello Commuter Rail via Braintree	Minority
236✶✶	West Medford - Haymarket Station	Minority
238	Quincy Center - South Shore Plaza via Braintree Station	Minority
240	Quincy Center - Crawford Square via Holbrook/Randolph Station	Minority
245✶	Avon Square - Ashmont Station	Minority
325	Quincy Center - Mattapan via Quarry Street And Edgehill Road	Nonminority
326	Elm Street, Medford - Haymarket Station via Interstate 93	Nonminority
350	Burlington (Chestnut Avenue) - Alewife Station	Minority
351✶✶	Oak Park/Bedford Woods - Alewife via Mall Road	Minority
352	Burlington (Chestnut Avenue) - State Street, Boston	Nonminority
354	Woburn Line - State Street, Boston via Woburn Square	Nonminority
411✶	Jack Satter House (Revere) - Malden Station	Minority

Route	Route Name (from MBTA Database)	Classification
424✶	Eastern Avenue/Essex Street - Haymarket Station	Minority
426✶	Central Square, Lynn - Haymarket via Cliftondale Square	Nonminority
428✶	Oaklandvale - Haymarket via Granada Highlands	Nonminority
429✶✶	Northgate Shopping Ctr., Central Square, Lynn via Square 1 Mall	Minority
430✶	Saugus Center - Malden Station	Minority
434✶	Neptune Towers - Central Square	Minority
435✶	Main Street, Peabody - Haymarket via Goodwin Circle	Minority
436✶	Liberty Tree Mall - Central Square, Lynn via Euclid	Minority
439✶✶	Nahant - Central Square, Lynn	Nonminority
441	Marblehead - Haymarket via Central Square and Paradise Road	Minority
442	Marblehead - Haymarket via Central Square and Humphrey Street	Minority
448✶	Marblehead - Downtown Crossing Express via Paradise Road	Nonminority
449✶	Marblehead - Downtown Crossing Express via Humphrey	Nonminority
450✶	Salem Center - Haymarket Square via Western Avenue	Minority
451✶	North Beverly - Salem Depot via Cabot Street	Nonminority
455✶	Salem Depot - Wonderland via Central Square, Lynn	Minority
456✶	Salem Depot - Central Square, Lynn via Highland Avenue	Minority
459✶	Salem Depot - Downtown Crossing via Central Square, Lynn	Minority
465✶	Danvers Square - Salem Depot via Liberty Tree Mall	Nonminority
501	Express: Brighton - Federal and Franklin Streets	Nonminority
502	Express: Watertown Square - Copley Square	Nonminority
503	Express: Brighton - Copley Square	Nonminority
504	Express: Watertown Square - Federal and Franklin Streets	Nonminority
505	Express: Waltham Center - Federal and Franklin Streets	Nonminority
553	Roberts - Federal and Franklin Streets	Nonminority
554	Waverly Square - Federal and Franklin Streets	Minority
556	Waltham Highlands - Federal and Franklin Streets	Nonminority
558	Riverside - Federal and Franklin Streets	Minority
701	CT1: Central Square, Cambridge - BU Medical Center	Nonminority
708	CT3: Beth Israel Deaconess - Andrew Station	Minority
747	CT2: Sullivan Station – Ruggles Station	Nonminority

✶ This route was classified using a cluster analysis that combined survey responses for routes in close proximity to achieve a combined confidence level of 90 percent with a confidence interval of 10 percent (90/10 standards).

✶✶ This route did not have enough valid survey responses to provide a confidence level of 90 percent with a confidence interval of 10 percent (90/10 standards), and also could not be reasonably clustered with another route to achieve this standard.

Table 6-B2
Rapid Transit and Commuter Rail Lines Minority Classification

Line	Classification
Rapid Transit—Heavy Rail:	
Red Line – Total	Nonminority
Red Line – Shared Trunk	Nonminority
Red Line – Ashmont Branch	Minority
Red Line – Braintree Branch	Nonminority
Blue Line	Minority
Orange Line	Minority
Rapid Transit—Light Rail:	
Green Line – Total	Nonminority
Green Line – Shared Trunk	Nonminority
Green Line – B Branch	Nonminority
Green Line – C Branch	Nonminority
Green Line – D Branch	Nonminority
Green Line – E Branch	Nonminority
Mattapan (Red)	Minority
Rapid Transit—Silver Line:	
SL1/SL2 Waterfront	Nonminority
SL4/SL5 Washington Street	Minority
Commuter Rail:	
Fairmount	Minority
Fitchburg	Nonminority
Framingham/Worcester	Nonminority
Franklin	Nonminority
Greenbush	Nonminority
Haverhill/Reading	Nonminority
Lowell	Nonminority
Middleborough/Lakeville	Nonminority
Needham	Nonminority
Newburyport/Rockport	Nonminority
Plymouth/Kingston	Nonminority
Providence/Stoughton	Nonminority
Commuter Boat:	
Charlestown Ferry	Nonminority
Hingham/Hull Ferry	Nonminority

Table 6-B3
MBTA Rapid Transit Station Minority Classification

Station	Classification
Transfer Stations	
Ashmont – Red Line and Mattapan Line platforms	Minority
Downtown Crossing – Red Line and Orange Line platforms	Minority
Government Center – Blue Line and Green Line platforms	Minority
Haymarket – Orange Line and Green Line platforms	Minority
North Station – Orange Line and Green Line platforms	Nonminority
Park Street – Red Line and Green Line platforms	Nonminority
South Station – Red Line and Silver Line platforms	Nonminority
State – Orange Line and Blue Line platforms	Minority
Red Line	
Alewife	Nonminority
Davis	Nonminority
Porter	Nonminority
Harvard	Nonminority
Central	Nonminority
Kendall/MIT	Nonminority
Charles/MGH	Nonminority
Park Street – Red Line platform only	Nonminority
Downtown Crossing – Red Line platform only	Nonminority
South Station – Red Line platform only	Nonminority
Broadway	Nonminority
Andrew	Minority
JFK/UMass	Minority
Savin Hill	Nonminority
Fields Corner	Minority
Shawmut	Minority
Ashmont – Red Line platform	Minority
North Quincy	Nonminority
Wollaston	Nonminority
Quincy Center	Minority
Quincy Adams	Nonminority
Braintree	Nonminority
Mattapan High-Speed Line	
Ashmont – Mattapan Line platform only✶	Minority
Cedar Grove✶	Minority
Butler✶	Minority
Milton✶	Minority
Central Avenue✶	Minority
Valley Road✶	Minority
Capen Street✶	Minority
Mattapan✶	Minority

Station	Classification
Orange Line	
Oak Grove	Nonminority
Malden	Minority
Wellington	Minority
Assembly Square	Nonminority
Sullivan Square	Nonminority
Community College	Minority
North Station – Orange Line platform only	Nonminority
Haymarket – Orange Line platform only	Minority
State – Orange Line platform only	Minority
Downtown Crossing – Orange Line platform only	Minority
Chinatown	Nonminority
Tufts Medical Center	Minority
Back Bay	Nonminority
Massachusetts Avenue	Nonminority
Ruggles	Minority
Roxbury Crossing	Minority
Jackson Square	Minority
Stony Brook	Nonminority
Green Street	Nonminority
Forest Hills	Nonminority
Blue Line	
Wonderland	Nonminority
Revere Beach	Minority
Beachmont	Nonminority
Suffolk Downs	Nonminority
Orient Heights	Nonminority
Wood Island	Minority
Airport	Minority
Maverick	Minority
Aquarium	Nonminority
State – Blue Line platform only	Minority
Government Center – Blue Line platform only	Minority
Bowdoin	Nonminority
Green Line Shared Trunk	
Lechmere	Nonminority
Science Park	Minority
North Station – Green Line platform only	Nonminority
Haymarket – Green Line platform only	Nonminority
Government Center – Green Line platform only	Minority
Park Street – Green Line platform only	Nonminority
Boylston	Nonminority
Arlington	Nonminority

Station	Classification
Copley	Nonminority
Hynes Convention Center	Nonminority
Kenmore	Nonminority
Green Line–B	
Blandford Street✶	Nonminority
BU East✶	Nonminority
BU Central✶	Nonminority
BU West✶	Nonminority
St. Paul Street✶	Nonminority
Pleasant Street✶	Nonminority
Babcock Street✶	Minority
Packards Corner✶	Minority
Harvard Avenue✶	Nonminority
Griggs Street✶	Nonminority
Allston Street✶	Nonminority
Warren Street✶	Nonminority
Washington Street	Nonminority
Sutherland Road✶	Nonminority
Chiswick Road✶	Nonminority
Chestnut Hill Avenue✶	Nonminority
South Street✶	Nonminority
Boston College✶	Nonminority
Green Line–C	
St. Marys Street✶	Nonminority
Hawes Street✶	Nonminority
Kent Street✶	Nonminority
St. Paul Street✶	Nonminority
Coolidge Corner	Nonminority
Summit Avenue✶	Nonminority
Brandon Hall✶	Nonminority
Fairbanks Street✶	Nonminority
Washington Square✶	Nonminority
Tappan Street✶	Nonminority
Dean Road✶	Nonminority
Englewood Avenue✶	Nonminority
Cleveland Circle	Nonminority
Green Line–D	
Fenway	Nonminority
Longwood	Nonminority
Brookline Village	Nonminority
Brookline Hills✶	Nonminority
Beaconsfield✶	Nonminority
Reservoir	Nonminority

Station	Classification
Chestnut Hill	Nonminority
Newton Centre	Nonminority
Newton Highlands	Nonminority
Eliot	Nonminority
Waban✶	Nonminority
Woodland✶	Nonminority
Riverside	Nonminority
Green Line–E	
Prudential	Nonminority
Symphony	Nonminority
Northeastern	Minority
Museum of Fine Arts	Nonminority
Longwood Medical	Nonminority
Brigham Circle	Nonminority
Fenwood Road✶	Nonminority
Mission Park✶	Nonminority
Riverway✶	Nonminority
Silver Line Waterfront and Washington Street	
South Station – Silver Line platform only	Nonminority
Court House	Nonminority
World Trade Center	Nonminority
Dudley Station	Minority
Washington Street @ Melnea Cass Blvd✶	Minority
Washington Street @ Lenox Street✶	Minority
Washington Street @ Massachusetts Avenue✶	Minority
Washington Street @ Worcester Street	Nonminority
Washington Street @ E Newton Street✶	Minority
Washington Street @ W Newton Street✶	Minority
Washington Street @ Union Park✶	Minority
Washington Street @ E Berkeley Street✶	Minority
Washington Street @ Herald Street✶	Minority

✶ This station was classified using a cluster analysis that combined survey responses for stations in close proximity to achieve a combined confidence level of 90 percent with a confidence interval of 10 percent (90/10 standards).

Table 6-B4
Commuter Rail Station Minority Classification

Station	Classification
Multiline Stations	
North Station – passengers on all lines	Nonminority
South Station – passengers on all lines	Nonminority
Back Bay – passengers on all lines	Nonminority
Ruggles – passengers on all lines	Nonminority
JFK/UMass – passengers on all lines	Nonminority
Quincy Center – passengers on all lines	Nonminority
Braintree – passengers on all lines	Nonminority
Hyde Park – passengers on all lines	Nonminority
Readville – passengers on all lines	Nonminority
Newburyport/Rockport	
Rockport	Nonminority
Gloucester✶	Nonminority
West Gloucester✶	Nonminority
Manchester	Nonminority
Beverly Farms	Nonminority
Prides Crossing	Nonminority
Montserrat	Nonminority
Newburyport	Nonminority
Rowley	Nonminority
Ipswich	Nonminority
Hamilton/Wenham	Nonminority
North Beverly	Nonminority
Beverly	Nonminority
Salem	Nonminority
Swampscott	Nonminority
Lynn	Nonminority
River Works	Nonminority
Chelsea	Nonminority
North Station - Newburyport/Rockport passengers only	Nonminority
Haverhill	
Haverhill	Nonminority
Bradford	Nonminority
Lawrence	Nonminority
Andover	Nonminority
Ballardvale	Nonminority
North Wilmington✶	Nonminority
Reading	Nonminority
Wakefield	Nonminority
Greenwood	Nonminority
Melrose Highlands	Nonminority

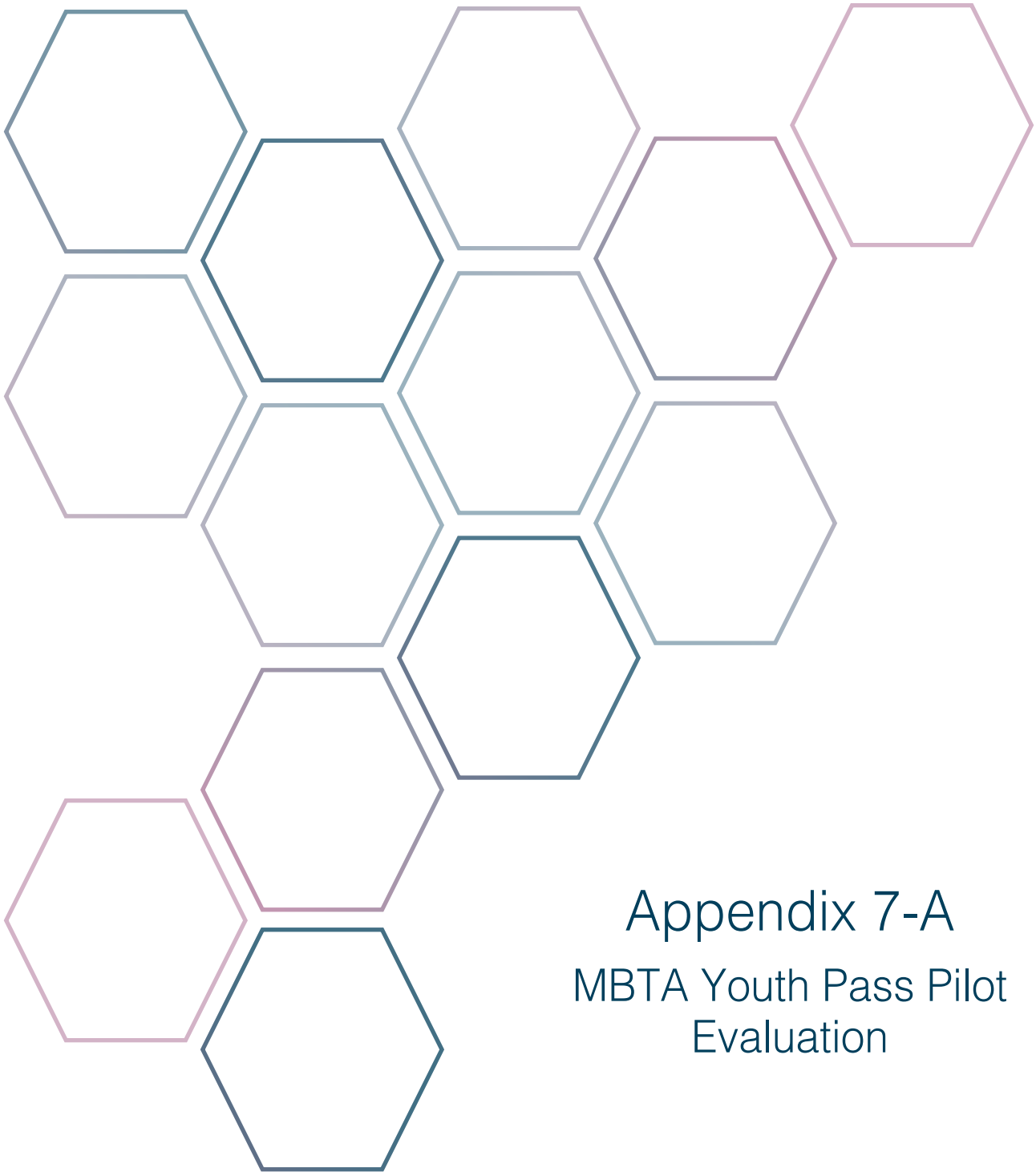
Station	Classification
Melrose/Cedar Park	Nonminority
Wyoming Hill	Nonminority
Malden Center	Nonminority
North Station - Haverhill/Reading passengers only	Nonminority
Lowell	
Lowell	Nonminority
North Billerica	Nonminority
Wilmington✶	Nonminority
Anderson/Woburn	Nonminority
Mishawum	Nonminority
Winchester Center	Nonminority
Wedgemere	Nonminority
West Medford	Nonminority
North Station - Lowell passengers only	Nonminority
Fitchburg	
Wachusett	Nonminority
Fitchburg✶	Nonminority
North Leominster✶	Nonminority
Shirley	Nonminority
Ayer	Nonminority
Littleton/Route 495	Nonminority
South Acton	Nonminority
West Concord	Nonminority
Concord	Nonminority
Lincoln	Nonminority
Silver Hill✶	Nonminority
Hastings✶	Nonminority
Kendal Green✶	Nonminority
Brandeis/Roberts	Nonminority
Waltham	Nonminority
Waverley✶	Nonminority
Belmont✶	Nonminority
Porter Square	Nonminority
North Station - Fitchburg passengers only	Nonminority
Framingham/Worcester	
Worcester	Nonminority
Grafton✶	Nonminority
Westborough✶	Nonminority
Southborough	Nonminority
Ashland	Nonminority
Framingham	Nonminority
West Natick	Nonminority
Natick	Nonminority

Station	Classification
Wellesley Square	Nonminority
Wellesley Hills✶	Nonminority
Wellesley Farms✶	Nonminority
Auburndale	Nonminority
West Newton✶	Nonminority
Newtonville✶	Nonminority
Yawkey	Nonminority
Back Bay - Framingham/Worcester passengers only	Nonminority
South Station - Framingham/Worcester passengers only	Nonminority
Needham	
Needham Heights	Nonminority
Needham Center	Nonminority
Needham Junction	Nonminority
Hersey	Nonminority
West Roxbury	Nonminority
Highland	Nonminority
Bellevue	Nonminority
Roslindale Village	Nonminority
Forest Hills	Nonminority
Ruggles - Needham passengers only	Nonminority
Back Bay - Needham passengers only	Nonminority
South Station - Needham passengers only	Nonminority
Franklin	
Forge Park/495	Nonminority
Franklin	Nonminority
Norfolk	Nonminority
Walpole	Nonminority
Plimptonville	Nonminority
Windsor Gardens	Minority
Norwood Central	Nonminority
Norwood Depot	Nonminority
Islington✶	Nonminority
Dedham Corp. Center	Nonminority
Endicott✶	Nonminority
Readville✶	Nonminority
Hyde Park✶	Nonminority
Ruggles - Franklin passengers only	Nonminority
Back Bay - Franklin passengers only	Nonminority
Providence/Stoughton	
South Attleboro	Nonminority
Attleboro	Nonminority
Mansfield	Nonminority
Sharon	Nonminority

Station	Classification
Stoughton	Nonminority
Canton Center	Nonminority
Canton Junction	Nonminority
Route 128	Nonminority
Hyde Park✶	Nonminority
Ruggles - Providence/Stoughton passengers only	Nonminority
Back Bay - Providence/Stoughton passengers only	Nonminority
South Station - Providence/Stoughton passengers only	Nonminority
Fairmount	
Readville✶	Nonminority
Fairmount✶	Nonminority
Morton Street✶	Minority
Talbot Ave✶	Minority
Four Corners✶	Minority
Uphams Corner✶	Minority
Newmarket✶	Minority
South Station - Fairmount passengers only	Minority
Middleborough	
Middleboro/Lakeville	Nonminority
Bridgewater✶	Nonminority
Campello✶	Nonminority
Brockton✶	Minority
Montello✶	Minority
Holbrook/Randolph	Nonminority
Braintree✶	Nonminority
Quincy Center✶	Nonminority
JFK/UMass✶	Nonminority
South Station - Middleboro/Lakeville passengers only	Nonminority
Kingston/Plymouth	
Plymouth	Nonminority
Kingston	Nonminority
Halifax	Nonminority
Hanson	Nonminority
Whitman	Nonminority
Abington	Nonminority
South Weymouth	Nonminority
Braintree✶	Nonminority
JFK/UMass✶	Nonminority
South Station - Plymouth/Kingston passengers only	Nonminority
Greenbush	
Greenbush	Nonminority
North Scituate	Nonminority
Cohasset	Nonminority

Station	Classification
Nantasket Junction✶	Nonminority
West Hingham✶	Nonminority
East Weymouth✶	Nonminority
Weymouth Landing/East Braintree✶	Nonminority
Quincy Center✶	Nonminority
JFK/UMass✶	Nonminority
South Station - Greenbush passengers only	Nonminority

✶ This station was classified using a cluster analysis that combined survey responses for stations in close proximity or passengers who use the same station to access multiple lines in order to achieve a combined confidence level of 90 percent with a confidence interval of 10 percent (90/10 standards).



Appendix 7-A

MBTA Youth Pass Pilot Evaluation

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MBTA Youth Pass Pilot Evaluation

Final Report

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June 2016

Massachusetts Bay Transportation Authority

ABSTRACT

The Youth Pass Pilot has increased transit access for primarily low-income and minority youth, allowing them access to recreational opportunities, work, school, and medical appointments they would not have had otherwise. Participants are 92 percent minority and 76 percent low-income, and their MBTA usage on average increased approximately 30 percent during school months and 60 percent during summer months. Participants report that without the Youth Pass they would have still taken 60 percent of their trips on the MBTA, but they would have been unable to make13 percent of their trips. Seventy-three percent of the applicants for the Youth Pass are eligible for the existing MBTA reduced-fare Student Monthly LinkPass, but unable to access it due to their school not offering it or the limitations on summer months.

The pilot is having minimum impacts on the MBTA revenues and service because of low participation. Data does suggest it is reducing payments in cash onboard vehicles. The collaborative partnership with municipalities has yielded an auditable reduced fare program with limited administrative impact for the MBTA. However, there is a high burden on the municipal partners due to the cash handling; the recommendation to continue the program past a pilot would be to put payment for the pass on the MBTA fare vending machines.

After the mid-pilot review, the MBTA Fiscal and Management Control Board voted to extend the Student Pass year round and put access to the pass on the fare vending machines. This left two categories of youth in the pilot without access to a reduced-fare pass: 12–18 year olds not in high school or middle school and 19–21 year olds who pass a means-tested screen. Using data collected during the pilot about MBTA usage, the cost to extend the Youth Pass to these two groups was estimated. The range of lost fare revenue estimates is based on assumptions of municipal opt-in and participation rates by eligible youth.

Using an estimate of 15 percent participation, the estimated cost of a full Youth Pass program in annual lost fare revenue would range from $406,000 for the existing partner cities to $593,000 if all 17 MBTA core municipalities join the program. The estimated fare revenue loss at a more conservative estimate of 30 percent participation would range from $812,000 to $1,186,000. The impact of the additional trips on MBTA service is expected to be minimal.

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Chapter 1—Youth Pass Pilot Program Background

The Massachusetts Bay Transportation Authority (MBTA) conducted a pilot program for a Youth Pass, a reduced-fare product that complements the existing Student Monthly LinkPass. The existing Student Monthly LinkPass provides unlimited travel on MBTA rapid transit and buses for middle and high school students for $26 per month (going to $30 on July 1, 2016). However, youth access to the Student Monthly LinkPass was limited by the following factors:

- Boston Public Schools subsidizes the pass only for the students who meet the minimum-distance-from-school requirement.
- Many other schools in the MBTA service area do not distribute Student Monthly LinkPasses (either subsidized or for sale) to their students.
- The Student Monthly LinkPass is available only to currently enrolled full-time students, which excludes many youth who are enrolled in alternative education programs.
- Most students could not obtain reduced-fare passes during the summer months.

In order to explore ways to address some of these barriers, the MBTA, along with community stakeholders and municipal partners, developed a Youth Pass pilot program. This pilot program was designed to test the feasibility of implementing a full Youth Pass program, which would provide all eligible youth in participating municipalities with equal access to a reduced-fare product and close some of the access gaps in the current Student Pass program. This program also pilots providing the same reduced-fare pass to young people 19 to 21 years old who are either enrolled in an alternative education program or satisfy a means test. This pilot program was approved by the MBTA/MassDOT Board of Directors in December 2014 and officially launched in July 2015, with the intention of running for one year. The pilot program is scheduled to end on June 30, 2016.

1.1 MBTA and Partner Collaboration

The Youth Pass Pilot is the result of a multi-year campaign by youth transportation advocates. In the summer of 2014, the leadership of MBTA/MassDOT created a Youth Pass Working Group with members of the advocacy community to develop the details of a pilot program. The pilot was approved by the MBTA/MassDOT Board in December 2014. Four municipalities agreed to participate in the pilot: Boston, Chelsea, Malden, and Somerville (with a non-profit serving as the implementing agency in Chelsea). The details of the program were developed through a collaborative effort between the MBTA and the municipal partners. Each implementing agency signed a Memorandum of Understanding with the MBTA and agreed to follow the rules for the program laid out in

a policy handbook written by the MBTA. After the program launched on July 1, 2015, the MBTA and the municipal partners met monthly to review the program's progress.

1.2 Youth Pass Pilot Program

The Youth Pass Pilot program was limited to 1,500 participants between the ages of 12 and 21 in the cities of Boston, Chelsea, Malden, and Somerville, which serve as municipal partners in administering the program. For the pilot program, all individuals ages 12 through 18 who live in participating municipalities were eligible, and individuals 19 to 21 years old were eligible if they meet needs-based criteria by demonstrating one or more of the following: enrollment in high school, a General Education Development (GED) program, or another education program; a job training program; a state or federal public benefit program (such as the Supplemental Nutrition Assistance Program (SNAP), the Special Supplemental Nutrition program for Women, Infants, and Children (WIC), Transitional Aid for Families with Dependent Children (TAFDC), public housing or other assistance programs); or Mass Health. Youth who were accepted into the pilot program could purchase a Youth Pass product through their local municipal partner organization. The Youth Pass functions like a LinkPass (providing unlimited travel on MBTA local bus and subway), but is branded as a Youth Pass. Monthly Youth passes were sold at the Student Monthly LinkPass price of $26. The 7-day Youth Pass cost $7.

The Youth Pass Pilot was designed to meet the following major goals:

- Create affordable transit access for pilot participants
- Provide the data required to assess the impact of a Youth Pass on the mobility of youth and their engagement in civic and community activities
- Have a limited impact on the MBTA's revenue
- Provide the data required to estimate the impact of a permanent Youth Pass program on MBTA fare revenue and service delivery
- Assess whether municipal partners can distribute reduced fare MBTA passes in an audit-proof manner that minimizes the MBTA's administrative burden

Municipal partners were responsible for the following aspects of the program:

- Recruiting participants
- Receiving enrollment forms and verifying eligibility for the program (including the collection of required documents)
- Taking photos and producing the Youth Pass cards using card printers provided by the MBTA. The Youth Pass Card is a picture ID printed on a blank Charlie Card with its own unique design
- Administering surveys to participants

- Collecting payment from participants for passes each month (or week, if applicable) and using MBTA-provided retail sales terminals (RSTs) to add the appropriate product onto the pass
- Administering the program in a way that could be tracked and audited
- Providing language assistance, including interpretation and translation of materials into languages other than English, based on the needs of their community and consistent with the protocols identified in the MBTA's Limited English Proficiency Plan

The MBTA and the partners worked together to market the Youth Pass pilot. Youth interested in participating in the program were able to apply via an online form on the MBTA website through the end of April 2016. During the initial application period, waiting lists were established because the number of applicants exceeded the number of available pilot slots in some municipalities. All applicants were given a chance to participate after these initial waiting lists were cleared.

Youth from the applicant pool were contacted by the municipal partner agency to arrange a time to come into their office to enroll. When enrolling youth, the municipal partner determined applicant eligibility, and applicants completed an intake survey. Enrollees also filled out a permission form allowing the MBTA to anonymously track their trips for 30 days so that the MBTA would have pre-pilot trip usage data to compare to data gathered during the pilot program. If enrollees did not already have a CharlieCard that the MBTA could track, they received one without value to use to gather 30 days of pre-pilot trip data (participants had to add value to the card during the first 30 days).

After 30 days, the participant could return and have their picture taken for a Youth Pass card. Once they completed this process, participants could purchase a monthly or Youth Pass, depending on availability in each municipality. Chelsea, Malden, and Somerville offered both monthly and weekly passes, while Boston initially only offered the monthly pass, but added the weekly midway through the pilot. Participants were required to fill out a survey each month when they returned to purchase the pass.

1.3 Pilot Evaluation

The proposal for the Youth Pass Pilot, passed by the MBTA/MassDOT Board of Directors, identified research questions the pilot was designed to answer. A mid-point evaluation of the program was completed in December 2015, along with a Title VI fare equity analysis, as required by the Federal Transit Administration (FTA) for the pilot to proceed beyond six months. This report provides a final evaluation of these questions, using data collected through March 2016. It focuses on three main areas: the benefits of the program to the participants, the costs of the program to the MBTA, and the administrative feasibility of the program model.

1. ***Impacts on Youth Riders***

   a. Does the Youth Pass increase use of public transit and access to opportunities for program participants?
   b. Does the Youth Pass change youth riders' attitudes toward the MBTA and public transit?

2. Impacts on the MBTA

   a. What is the impact of the Youth Pass program on MBTA fare revenues?
   b. Does increased ridership from the Youth pass result in violations of MBTA service standards? In particular, does the Youth Pass program result in additional trips taken during peak ridership periods?
   c. Does the Youth Pass improve MBTA service by decreasing cash handling, conflict with MBTA employees, and fare evasion?

3. Administrative Feasibility

   a. What are the administrative costs of the pilot program to the MBTA?
   b. What are the administrative costs to the municipal partners, and is it sustainable?
   c. Does the pilot create a procedure that is audit-proof, limits fraud, and is able to be replicated?

This report also describes two scenarios for a permanent Youth Pass program, should it be continued after June 30, 2016.

Much of the data for the analysis in this report comes from the participants, either from surveys or from the Automated Fare Collection (AFC) system records of their transit usage. A full list of the data sources used for this report is in Appendix A. MBTA staff and the Central Transportation Planning Staff (CTPS) conducted the analysis of this data.

Chapter 2—Pilot Impacts on Youth Riders

This chapter describes the characteristics of Youth Pass applicants and pilot participants, and discusses the impact of the Youth Pass on pilot participants' travel behavior.

2.1 Pilot Program Applicant Characteristics

Tables 2-1, 2-2, and 2-3 describe the applicants from each municipality and within each reported age group, or reported school-enrollment category. This data is taken from applications received as of May 1, 2016, after which applications for the pilot program were no longer accepted. In total, 4,531 youth applied to the program, and CTPS used data from 4,509 of these applicants for further analysis.[1]

Table 2-1 shows that most applicants reported that they live in Boston (approximately 78 percent), and most were in the 13-to-18-year-old age group (approximately 74 percent).

TABLE 2-1
Pilot Program Applicants
by Reported Municipality and Age Group

City	13–18 Years Old	Percent	19–-21 Years Old	Percent	Total
Boston	2,589	57.4%	939	20.8%	3,528
Chelsea	342	7.6%	63	1.4%	405
Malden	301	6.7%	109	2.4%	410
Somerville	103	2.3%	63	1.4%	166
Total	**3,335**	**74.0%**	**1,174**	**26.0%**	**4,509**

Data source: MBTA Youth Pass Pilot program application data

Note: All percentages are of total applicants.

[1] The MBTA was restricted by law from collecting data on youth ages 12 and under as part of the pilot program. According to applicant-provided birth years, 22 applicants were 12 years old or younger. Their data is not included in Tables 2-1 through 2-4.

Table 2-2 shows that approximately three quarters of applicants were enrolled in school.

TABLE 2-2
Pilot Program Applicants
by Reported Municipality and School Enrollment

City	Enrolled in School	Percent	Not Enrolled in School	Percent	Total
Boston	2,505	56.3%	983	22.1%	3,488
Chelsea	323	7.3%	76	1.7%	399
Malden	299	6.7%	102	2.3%	401
Somerville	112	2.5%	51	1.1%	163
Total	**3,239**	**72.8%**	**1,212**	**27.2%**	**4,451**

Data source: MBTA Youth Pass Pilot program application data.
Note: All percentages are of total applicants. Fifty-eight applicants who did not provide school enrollment data, or provided conflicting school enrollment information, were not included in this table.

Table 2-3 categorizes applicants based on both age and school enrollment. The largest group of applicants was made up of youth ages 13-18 who are enrolled in school, while the second largest group was made up of youth aged 19-21 who were not enrolled in school. About 73 percent of Youth Pass pilot program applicants were enrolled in middle or high school, though this share varied by reported age group. Approximately 90 percent of applicants under the age of 18 were enrolled in school, while 79 percent of applicants between 19 and 21 years old were not enrolled in school.

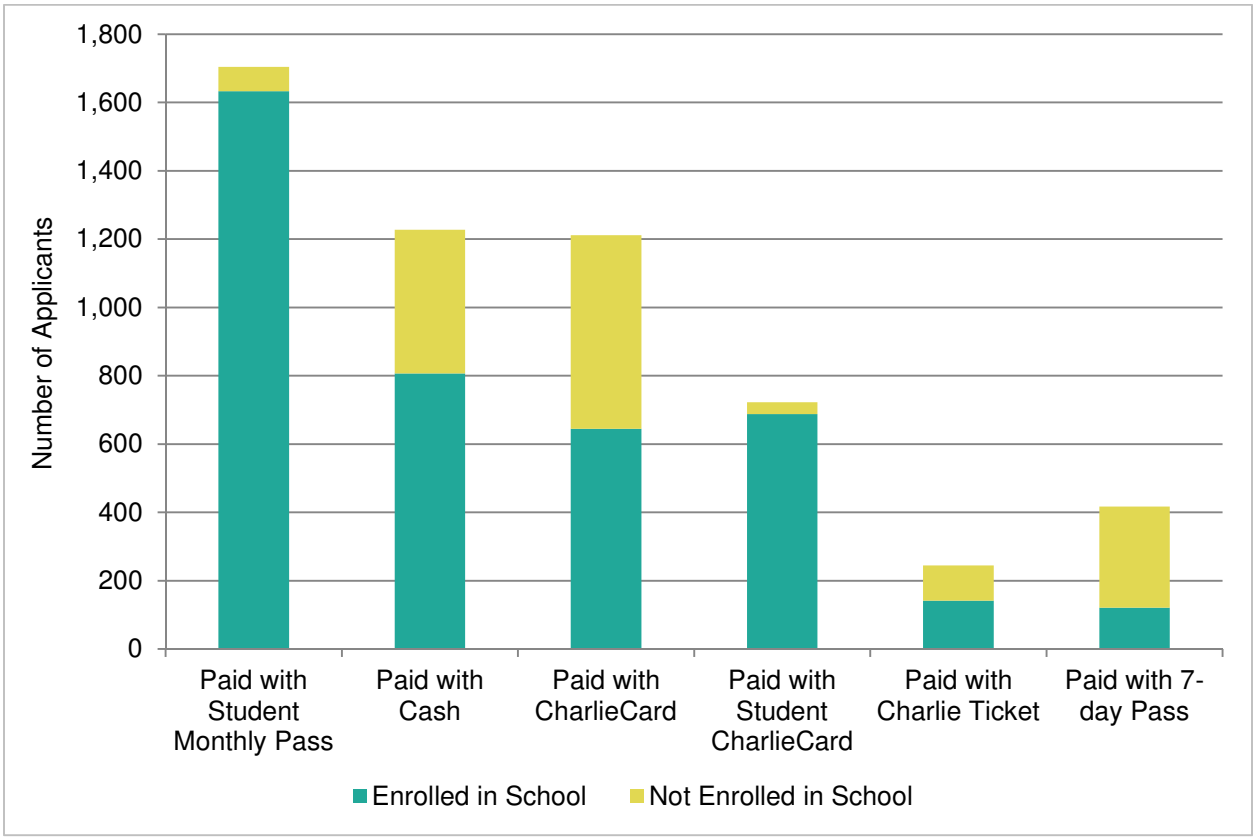
TABLE 2-3
Pilot Program Applicants
by Reported Age and School Enrollment

Age of Applicant	Enrolled in School	Percent	Not Enrolled in School	Percent	Total
13–18 Years Old	3,000	67.4%	319	7.2%	3,319
19–-21 Years Old	239	5.4%	893	20.1%	1,132
Total	**3,239**	**72.8%**	**1,212**	**27.2%**	**4,451**

Data source: MBTA Youth Pass Pilot program application data
Note: All percentages are of total applicants.

Figure 2-1 describes the fare products that applicants reported using to pay MBTA fares. In general, Youth Pass pilot program applicants used different methods of payment depending on their school-enrollment status. Predictably, more school-enrolled applicants used student fare products, such as the Student Monthly LinkPass, while applicants who were not enrolled in school more commonly used a CharlieCard, cash, or a 7-Day LinkPass.

FIGURE 2-1
Fare Payment Methods used by Pilot Program Applicants



Data source: MBTA Youth Pass Pilot program application data

Note: Applicants were allowed to select more than one option.

Table 2-4 focuses more specifically on applicants who have reported paying for MBTA trips with student fare media. Approximately 50 percent of school-enrolled applicants and approximately 6 percent of out-of-school applicants reported using Student Monthly LinkPasses; fewer in each group reported using Student Stored-Value CharlieCards.

TABLE 2-4
Student Fare Media used by Pilot Program Applicants

School Enrollment Category	Have paid with a Student Monthly LinkPass	Percent	Have paid with S-Card	Percent	Have paid with S-Card or Monthly Pass	Percent	Total Applicants in Category
Enrolled in School	1,633	50.4%	688	21.2%	2,321	71.7%	3,239
Not Enrolled in School	71	5.9%	34	2.8%	105	8.7%	1,212
Total	**1,704**	**38.3%**	**722**	**16.2%**	**2,426**	**54.5%**	**4,451**

Data source: MBTA Youth Pass Pilot program application data

Note: All percentages are of the row total.

Approximately 73 percent of all applicants are enrolled in school, and are therefore eligible for student fare products, as shown in Table 2-3; youth who are not enrolled in school may be able to obtain student passes if they are enrolled in GED/High School Equivalency, adult education, or other programs. Table 2-4 shows that approximately 72 percent of the applicants who are enrolled in school reported having used a monthly Student Monthly LinkPass or having paid for trips at the student reduced fare using the stored value purse on their student CharlieCard. This suggests that there are barriers or problems that prevent some students from obtaining student-price fare products.

Table 2-4 also shows that only about half of the school-enrolled youth who applied to the program reported having paid for trips with a Student Monthly LinkPass. The MBTA and CTPS hypothesize that many applicants who have used the Student Monthly LinkPass applied to the program to get access to reduced-price passes during summer months. This hypothesis is supported by the finding that Boston experienced a large turnover of Youth Pass users when the school year started. However, the findings from the Youth Pass pilot application process, discussed above, highlight some other distribution problems that may exist in the current Student Pass program. The applicants who reported using a Student CharlieCard with a stored-value purse meet the eligibility requirements for the Student Monthly LinkPass, but likely have no easy method to obtain one. Some of the barriers they face may be institutional; for example, Malden High School provides students with Student Stored Value cards but no method to purchase the Student Monthly LinkPass. Chapter 5 discusses MBTA initiatives to address these barriers to access, and how these initiatives may affect the target market of a potential permanent Youth Pass program.

2.2 Youth Pass Participant Characteristics

Pilot Participation Rates

The MBTA and CTPS reviewed the available data on Youth Pass usage, from the end of June 2015 through March 2016.[2] Because pilot participants needed to provide 30 days of pre-pilot travel data prior to receiving a Youth Pass, pilot participants who used a Youth Pass throughout March 2016 would likely have had to enroll in the program on or before January 31, 2016. As of January 31, 2016, 919 applicants had taken an enrollment survey.[3]

To learn more about Youth pass sales and the number of people using Youth Passes, the MBTA and CTPS reviewed two sets of data for the period between June 2015 and March 2016:

- Youth Pass purchases, according to data from the Retail Sales Terminals (RSTs) provided to participating municipalities[4]
- Youth Pass usage data from the MBTA's Automated Fare Collection (AFC) system

The AFC usage data showed that 770 individuals had used monthly and/or weekly Youth Passes to make trips from July 2015 through March 31, 2016, and CTPS analyzed data from 762 of these individuals.[5] For the period between June 25, 2015 and March 21, 2016, CTPS identified 897 individual serial numbers associated with Youth Pass purchases, according to data from the Retail Sales Terminals (RSTs) provided to participating municipalities. This time window was selected in order to better compare AFC and RST data. In general, RST sales activity increases significantly after the 21st of each month, which suggests that after this date, many people may be purchasing passes to use during the following month. The difference in the count of individual serial numbers in the RST sales data and the number of individuals appearing in the AFC usage data may occur because some youth may have lost and replaced

[2] Automated Fare Collection system transaction data (AFC data) is created when people interact with fare gates at MBTA stations or with fare boxes on MBTA transit vehicles. It can take several weeks to retrieve all data from MBTA stations and vehicles, so AFC data for a particular month is typically not available until several weeks after the end of that month. March 2016 was the last month with complete data that could be used in the development of this report.

[3] Ten of these individuals would have been excluded from further analysis because they were 12 or younger or because they lacked information on their school enrollment.

[4] This information likely approximates the number of individuals who are participating in the pilot program, although it may overestimate the number of total participants, as some individuals received replacement Youth Passes and thus would have more than one number in the RST records.

[5] This information is based on data provided by the MBTA on May 3, 2016. There were a total of 770 individuals who used a Youth Pass between July 2015 and March 2016; however, eight individuals were removed from the data set because their application forms listed incomplete or conflicting school-enrollment information, or because the participants were 12 years old.

cards, or because insufficient information was available from municipal records to link purchases to specific participants. In any case, both counts are less than the number of participants who took an enrollment survey. This may indicate that a number of participants were unwilling or unable to commit the time and complete the multiple steps necessary to fully enroll in the program and receive a Youth Pass.

Throughout this report, CTPS uses the application and pass usage data available for the 762 participants identified in the AFC data to make inferences about the larger population of Youth Pass users.

Table 2-6 categorizes the Youth Pass users identified in the AFC system by their age and school-enrollment characteristics. Approximately 68 percent of these individuals are between 13 and 18 years old, while the remaining 32 percent are between 19 and 21 years old. Most are between 13 and 18 years old and are enrolled in school (60 percent). Youth who are 19 to 21 years old and are not enrolled in school make up the second largest subcategory of Youth Pass users (26 percent).

TABLE 2-6
School Enrollment and Age Characteristics
of Youth Pass Participants in AFC Data (July 2015 – March 2016)

School Enrollment	13–18 Years Old	Percent	19–21 Years Old	Percent	All Youth Pass Users
Middle School	39	5.1%	0	0.0%	39
High School	413	54.2%	45	5.9%	458
Not Enrolled in School	69	9.1%	196	25.7%	265
Total	**521**	**68.4%**	**241**	**31.6%**	**762**

Data sources: MBTA Youth Pass pilot program application data; MBTA Youth Pass pilot AFC data
Note: This includes those who purchased Youth Passes that were active in late June 2015. All percentages are of total applicants.

The results in Table 2-6 also show that the samples of Youth Pass participants in some of these age- and school-enrollment categories are small. To increase sample sizes for analysis and estimation purposes, CTPS examined Youth Pass user behavior according to whether or not a participant was in school. Table 2-7 shows the shares of Youth Pass participants in the AFC data by whether or not they were enrolled in school.

TABLE 2-7

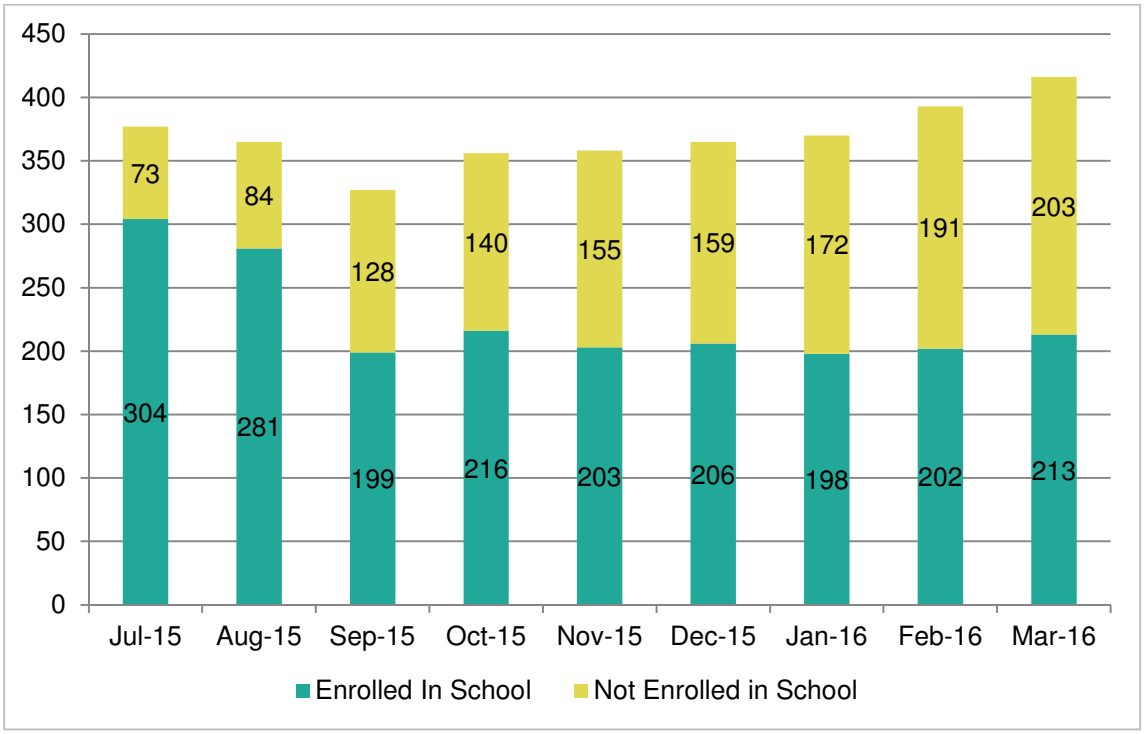
Youth Pass Participants in AFC Data,
by School Enrollment Category (through March 2016)

School Enrollment	Number of Participants	Percent
Enrolled in School	497	65.2%
Not Enrolled in School	265	34.8%
Total	**762**	**100.0%**

Data sources: MBTA Youth Pass pilot program application data; MBTA Youth Pass pilot AFC data
Note: This includes participants who purchased Youth Passes that were active in late June 2015.

Figure 2-2 shows the number of active Youth Pass users by month.

FIGURE 2-2
Active Youth Pass Users
by School Enrollment Category, by Month



Data sources: MBTA Youth Pass pilot program application data; MBTA Youth Pass pilot AFC data.
Note: June 2015 data is not shown. Two people were active on June 30, 2015. One used a 7-day pass solely on that day, while the other continued using their 7-day pass in July 2015.

Overall, the number of people in the Youth Pass program has grown since its launch in July 2015. During the nine months covered by this report, the number of participants who were enrolled in school peaked during summer months and stayed at a stable level during school months. This is likely because the participants who were enrolled in school may have been able to take advantage of Student Monthly LinkPasses (which cost the same as the Youth Pass), or reduced single-ride fares for students, and thus no longer found it advantageous to obtain a Youth Pass. Meanwhile, participation by youth not enrolled in school increased steadily from July 2015 to March 2016 (the end of our analysis dataset). During July 2015, approximately 19 percent of Youth Pass users were not enrolled in school. By comparison, in March 2016, approximately 49 percent of Youth Pass users were not enrolled in school. The number of youth not enrolled in school also increased over time, from 73 active during July 2015 to 203 active during March 2016.

2.3 Youth Pass Participant's Use of Public Transit

Pre-Pilot Data

As discussed in Chapter 1, youth who enrolled in the Youth Pass program were asked to provide 30 days of pre-pilot trip data so that it would be possible for the MBTA and CTPS to compare their travel behavior and expenditures before the pilot program to those during the pilot program. Each participant was given a blank CharlieCard, which they could load with passes and/or stored value. To date, 814 youth have provided pre-pilot data. Of these, only 653 provided data and later made trips with a Youth Pass, which may suggest that a large number of youth completed some steps in the Youth Pass enrollment process, but then never returned to obtain a Youth Pass product. Of these, CTPS selected a subset of 634 pre-pilot participants for further analysis; these individuals 1) were older than 12, 2) provided sufficient school-enrollment information, and 3) made trips using a Youth Pass product before March 31, 2016. Table 2-8 displays these pre-pilot participants by school enrollment status. As shown, approximately two-thirds of these pre-pilot participants are enrolled in school.

TABLE 2-8
Pre-Pilot Participants in Youth Pass Program, by School Enrollment Category

School Enrollment	Number of Participants	Percent
Enrolled in School	408	64.4%
Not Enrolled in School	226	35.6%
Total	**634**	**100.0%**

Data sources: MBTA Youth Pass pilot program application data; MBTA pre-pilot AFC data

CTPS hypothesized that the average number of trips youth might make in a month would vary depending on the time of year, particularly a summer month versus a school month. This was expected to be particularly true for youth enrolled in school. As part of testing this hypothesis, CTPS classified pre-pilot participants according to whether they provided data during school months (late May through June 2015, and September 2015 through March 2016), or during summer months (July and August 2015). Table 2-9 shows the breakdown of pre-pilot participants by these two time categories. Twenty-five pre-pilot data participants were excluded because their data could not be easily classified into one of these categories.[6]

TABLE 2-9
Number of Pre-Pilot Participants,
by School Enrollment and Time-of-Year Categories

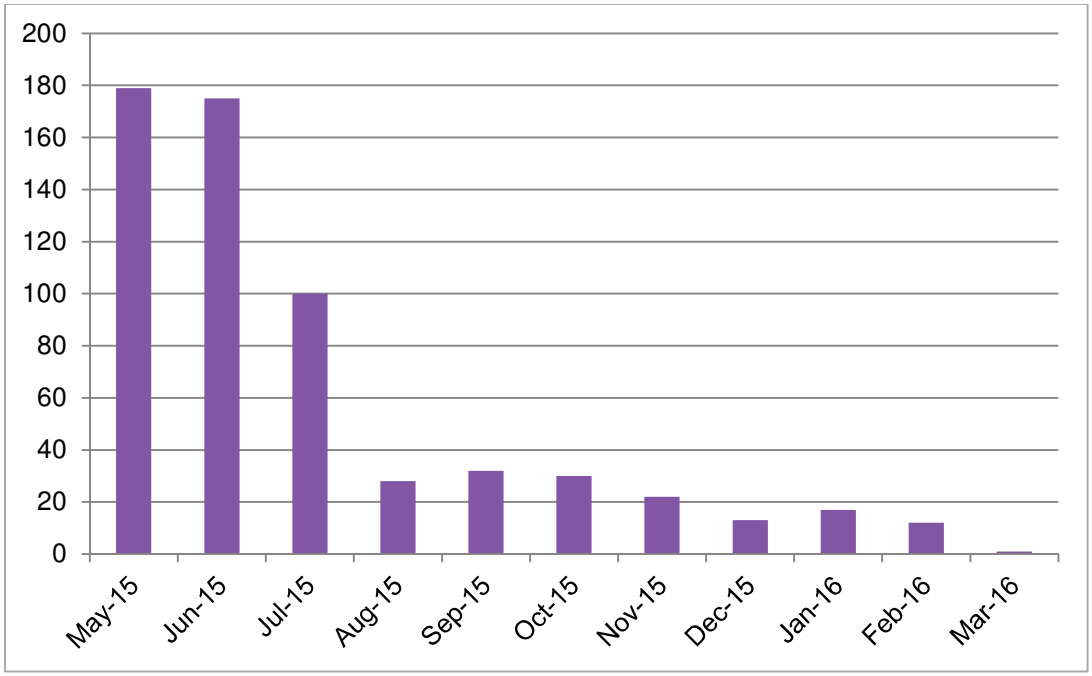
School Enrollment	School Months	Percent	Summer Months	Percent	Total
Enrolled in School	314	51.6%	76	12.5%	390
Not Enrolled in School	161	26.4%	58	9.5%	219
Total	**475**	**78.0%**	**134**	**22.0%**	**609**

Data sources: MBTA Youth Pass pilot program application data; MBTA pre-pilot AFC data.
Note: Percentages are of total pre-pilot participants.

As shown in Table 2-9, most pre-pilot participants provided data during school months. This is likely driven by the fact that there are more school year months than summer months, and by the fact that the majority of pre-pilot participants made their first identified trip in late May or June 2015, as shown in Figure 2-3.

[6] If data from a pre-pilot participant was split between a school and summer month, CTPS looked at whether there was a span of 21 days or greater between her first and last trips in the pre-pilot AFC data set. If so, CTPS examined whether more than two-thirds of those days fell in a school or summer month, and assigned the participant to the school month group or summer month group, accordingly. Twenty-five pre-pilot participants could not be classified using this method, and so were excluded from further analysis.

FIGURE 2-3
Pre-Pilot Participants, by Month of First-Identified Trip in Pre-Pilot AFC Data



Data sources: MBTA Youth Pass pilot program application data; MBTA pre-pilot AFC data

General Changes in Trip Behavior

CTPS analyzed the average number of trips made by youth each month during the school year and during the summer. Comparisons between Youth Pass data and pre-pilot data show that in each school enrollment category and in general, Youth Pass participants increased their ridership once they received the pass.

Table 2-10 describes the average number of unlinked trips that youth made during a school month, using data from the "School" period category of pre-pilot participants, and Youth Pass Pilot program data for school months during the pilot program (September 2015 through March 2016).[7] Estimates of trips made during the Youth Pass program include any trips on local buses, the Silver Line, and the rapid transit system, which are trips that are covered by LinkPasses. These estimates include trips that were made using the stored value purses on the Youth Pass CharlieCards. On average, youth using Youth Passes during a given month made one of these trips or fewer; but in some cases youth may have paid single-ride or transfer fares before they could renew their

[7] An unlinked trip is an individual trip on any single transit vehicle; a single journey, often composed of many unlinked trips on multiple vehicles, is a "linked" trip. These estimates of unlinked trips are based on the number of times people tapped their CharlieCard to interact with an AFC faregate or farebox.

monthly or 7-day Youth Pass. Including these trips makes it possible to provide a more comprehensive picture of trip-making behavior during the Youth Pass pilot.

TABLE 2-10
Average Unlinked Trips per Month for School Months

Participant Category	Pre-Data: School Month	Youth Pass: School Month	Change (Total)	Change (Percentage)
Enrolled in School	48.3	54.1	+5.8	+12.0%
Not Enrolled in School	37.3	62.2	+24.9	+66.8%
Average for All Participants	**44.6**	**57.6**	**+13.0**	**+29.1%**

Data sources: MBTA Youth Pass pilot program application data; MBTA pre-pilot AFC data; MBTA Youth Pass pilot AFC data;

Note: The pre-pilot and Youth Pass average monthly trip estimates do not include any trips that were paid for in cash, because these cannot be tracked on the AFC system.

Participants who are not enrolled in school show the largest increase in average unlinked trips per month when the pre-pilot data and Youth Pass pilot program data are compared. In an average school month, out-of-school participants make an additional 25 unlinked trips, or an increase of 67 percent. Prior to the Youth Pass pilot program, on average, these individuals were making fewer trips per school month than those who were enrolled in school, and they are making more trips per month on average than youth enrolled in school once they are in the pilot program.

The average numbers of trips per month in Table 2-10 include all youth enrolled in school in the School pre-pilot category, regardless of the fare product that they used to pay for their trips. Table 2-11 looks more closely at trip-making by youth that did not use a monthly Student Monthly LinkPass when providing pre-data during school months.

TABLE 2-11
Average Unlinked Trips per Month for School Months
(No Student Monthly LinkPass Use in Pre-Pilot Data)

Participant Category	Pre-Data: School Month	Youth Pass: School Month	Change (Total)	Change (Percentage)
Enrolled in School (Did not use monthly Student Pass)	27.4	54.1	+26.9	+97.4%
Not Enrolled in School	37.3	62.2	+24.9	+66.8%
Average for All Participants	**32.6**	**57.6**	**+25.0**	**+76.7%**

Data sources: MBTA Youth Pass pilot program application data; MBTA pre-pilot AFC data; MBTA Youth Pass pilot AFC data.

Note: The pre-pilot and Youth Pass average monthly trip estimates do not include any trips that were paid for in cash, because these cannot be tracked on the AFC system.

When youth who used Student Monthly LinkPasses are removed from the analysis, the number of trips per month made by youth enrolled in school increases by almost 100 percent once they have access to a Youth Pass. This increase speaks to the ways that multi-trip pass products, like the Student Monthly LinkPass, may help youth increase their mobility.

Table 2-12 describes the average unlinked trips per month that youth made during a summer month, according to data from the pre-pilot participants in the “Summer” time category, and youth pass pilot program data from the Summer months of the pilot program. As for the school months, estimates of trips made during the Youth Pass program include any trips that were made using the stored value purses on the Youth Pass CharlieCards (on average, active Youth Pass participants made less than one stored-value trip per month during July or August). This table shows the net difference and percentage change in the average number of monthly trips across the two data sets.

TABLE 2-12
Average Unlinked Trips per Month for Summer Months

Participant Category	Pre-Data: Summer Month	Youth Pass: Summer Month	Change (Total)	Change (Percentage)
Enrolled in School	32.1	57.6	+25.5	+79.4%
Not Enrolled in School	43.1	63.7	+20.6	+47.8%
Average for All Participants	**36.9**	**58.9**	**+22.0**	**+59.6%**

Data sources: MBTA Youth Pass pilot program application data; MBTA pre-pilot AFC data; MBTA Youth Pass pilot AFC data
Note: The pre-pilot and Youth Pass average monthly trip estimates do not include any trips that .were paid for in cash, because these cannot be tracked on the AFC system.

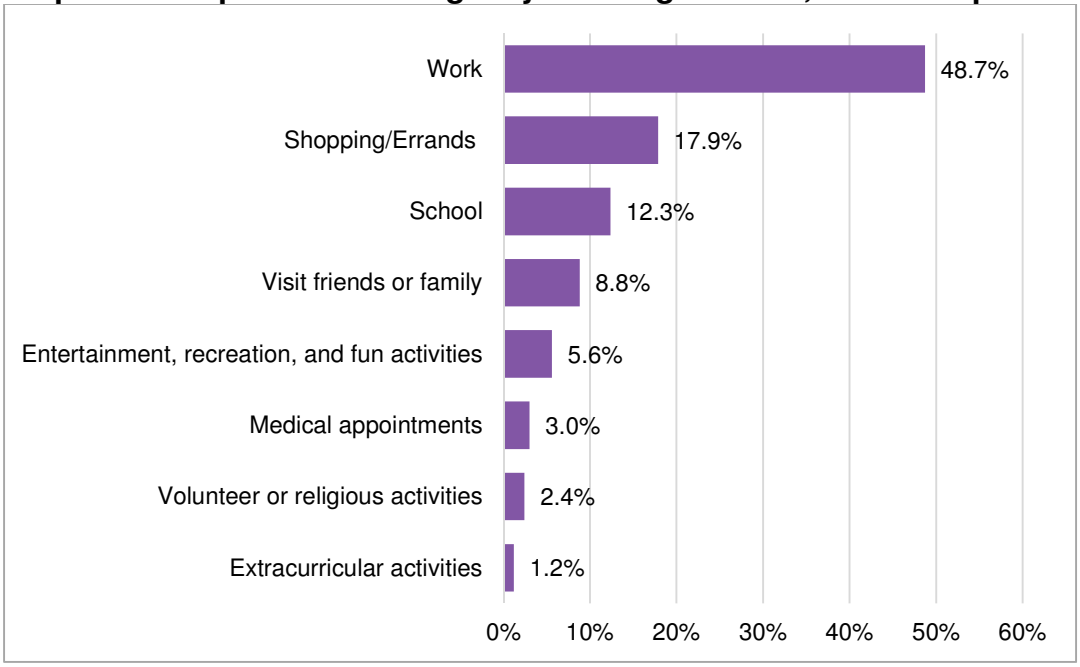
Participants who are enrolled in school made the largest increase in average monthly unlinked trips in a typical summer month, when the pre-pilot data and Youth Pass pilot program data are compared. In an average summer month, in-school participants made an additional 26 unlinked trips, or an increase of 79 percent, once they obtained a Youth Pass. However, participants who are not enrolled in school also made a significant increase in trips, making an additional 21 trips per month, on average.

2.4 Trip Purpose and Potential Foregone Trips

The MBTA conducted monthly surveys of Youth Pass participants to measure the impact of the program on their travel behavior. Each month, participants were asked questions about all of the trips they took on the day prior to the day they received the survey. Participants were asked to describe the purposes of these trips and how they would have made the trips (or whether they would have made them) if they did not have a Youth Pass. As with the other data in this report, the survey results were divided into two groups: those surveyed during the "summer" months of July and August, and those surveyed during the rest of the year (school months). The results of these surveys are displayed in Figures 2-4 through 2-7. It should be noted that since respondents were asked about the previous day, the trips in question nearly all took place from Sunday through Thursday. This is because youth would have taken these surveys at municipal partner offices, which are typically only open Monday through Friday.

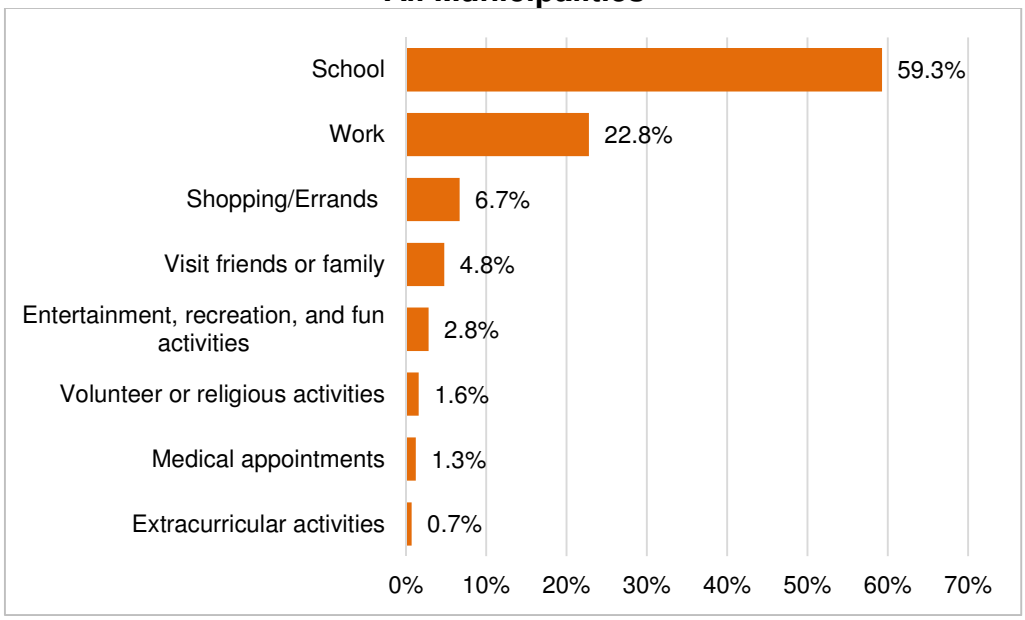
Figures 2-4 and 2-5 describe the purposes of trips taken during the summer and during the school year.

FIGURE 2-4
Purpose of Trips Taken during July and August 2015, All Municipalities



Data source: MBTA Youth Pass Pilot program July and August monthly surveys. n = 1158 trips surveyed.

FIGURE 2-5
Purpose of Trips Taken during All School-Year Months, 2015-16, All Municipalities

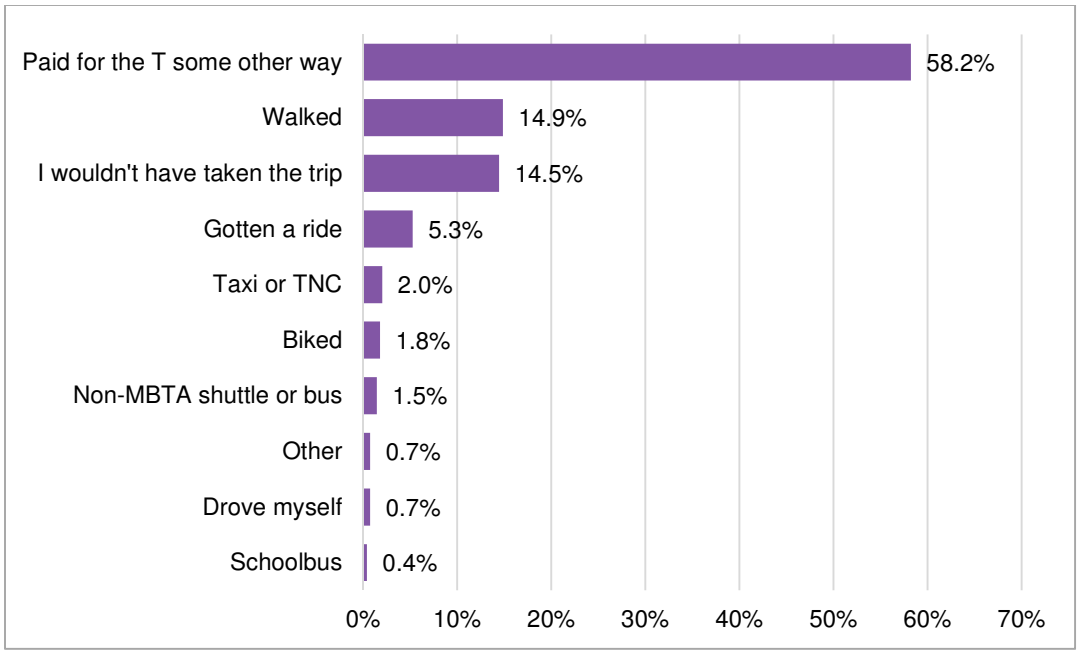


Data source: MBTA Youth Pass Pilot program school year monthly surveys. n = 4,629 trips surveyed.
Note: Data was collected through April 15, 2016, to include trips made during the month of March.

As Figures 2-4 and 2-5 show, the vast majority of trips among participants were either to or from work or school, depending on the season. These two categories combined accounted for 61 percent of the trips in the summer, and 82 percent of the reported trips during the school year. The Shopping/Errands category accounted for the next largest portion of trips.

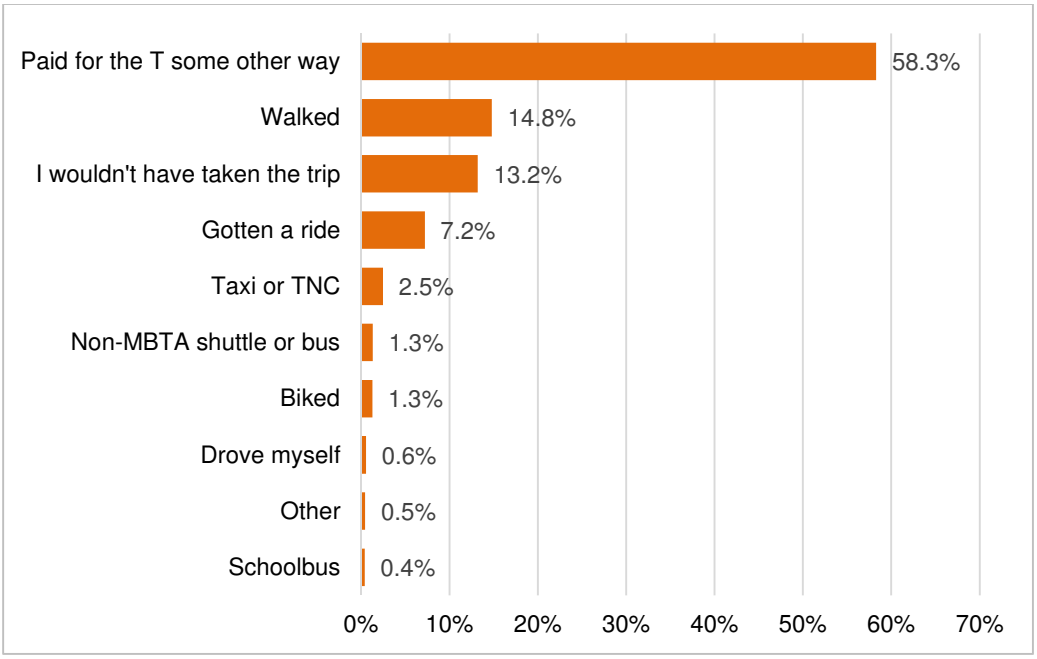
Figures 2-6 and 2-7 describe how Youth Pass participants would have otherwise made their Youth Pass trips during summer and school year months, respectively.

FIGURE 2-6
Participants' Responses to the Question
"Without a Youth Pass, how would you have made the trip?"
(All Municipalities, July and August 2015)



Data source: MBTA Youth Pass Pilot program July and August monthly surveys. n = 1,231 trips surveyed.

FIGURE 2-7
Participant Responses to the Question
"Without a Youth Pass, how would you have made the trip?"
(All Municipalities, School Months)



Data source: MBTA Youth Pass Pilot program school year monthly surveys. n = 4,705 trips surveyed.
Note: Data was collected through April 15, 2016, to include trips made during the month of March

The majority of participants responded that they would have paid to ride the MBTA system another way if they did not have a Youth Pass (approximately 58 percent respondents during both summer and school year groups, as shown in Figures 2-6 and 2-7). Approximately 15 percent of respondents said they would have walked if they did not have the Youth Pass; this was the case for both summer and school-year months. Finally, 14.5 percent of respondents in the summer and just over 13 percent during the school year responded that they wouldn't have made the trip in question at all without a Youth Pass.

In surveys administered between July 2015 and April 2016, participants responded that they would have foregone 13 to 14 percent of their reported trips if they did not have a Youth Pass. Conversely, they would have found another way to make approximately 87 percent of those trips, primarily by paying another way to ride the transit system. Although the surveys did not ask the reason why participants would forego making trips, it is likely because of their cost. Table 2-12 shows the percent of trips that survey respondents *would not* have taken, by type of trip. The highest category is school trips, followed by shopping/errands trips, and work trips.

TABLE 2-12
Trips Survey Respondents Would Not Have Taken without a Youth Pass

Trip Purpose	Percent of Trips Foregone without Youth Pass
Entertainment, recreation, and fun activities	11%
Extracurricular activities (sports, music, tutoring) or trips for your job (but not to it)	1%
Medical appointments	2%
School	24%
Shopping/Errands (for yourself or your family)	21%
Visit friends or family	14%
Volunteer or religious activities	2%
Work	17%
N/A	8%

Data source: MBTA Youth Pass Pilot program monthly surveys July 2015-April 2016.

These results indicate that the Youth Pass is increasing young people's mobility. As expected, transit usage increases with a reduced-fare pass. The first nine months of Youth Pass data show a 30 percent average increase in the number of trips for all participants during school months, and a 60 percent average increase in trips during the summer months. The survey results show that without a Youth Pass nearly 42 percent of trips would not have been taken on the MBTA, and 13 percent of trips would not have been taken at all.

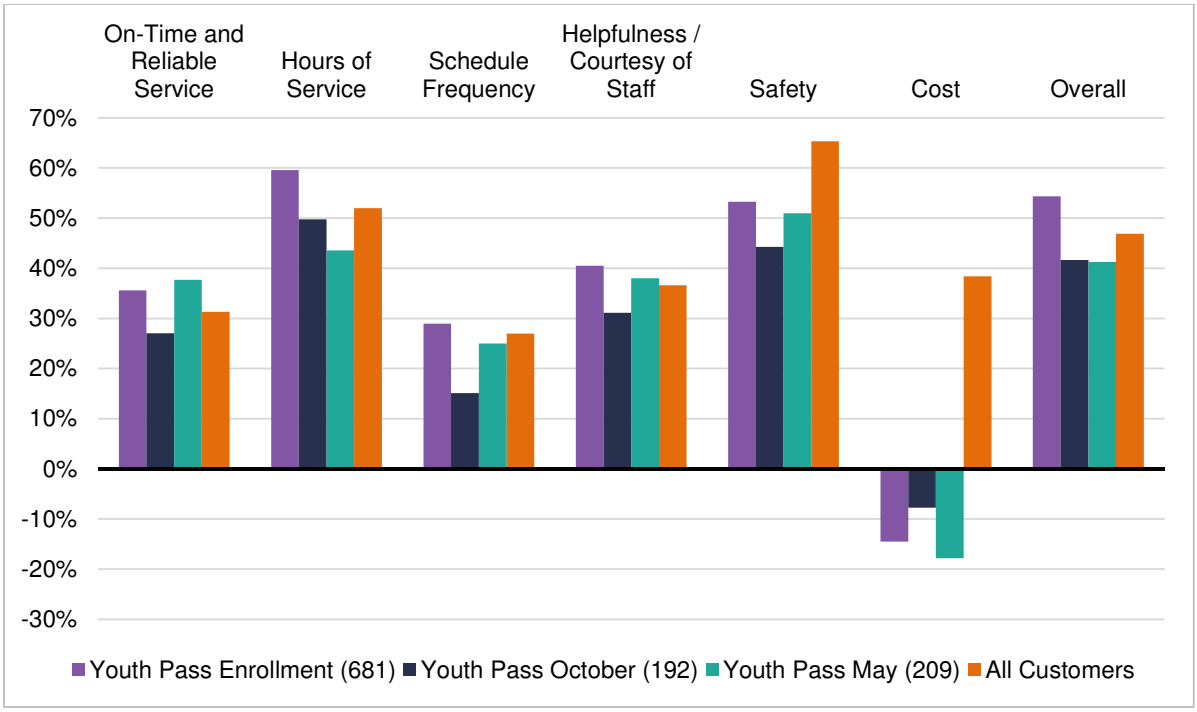
2.5 Youth Riders' Attitudes about the MBTA and Public Transit

One objective of the Youth Pass Pilot research is to determine whether or not the availability of the Youth Pass changes participants' attitudes towards the MBTA and public transit. To gather information on this, the MBTA surveyed Youth Pass participants regarding their level of satisfaction with the MBTA, both overall and in specific categories. Participants were asked to complete these surveys when they enrolled in the pilot program (the month may vary by participant), in October 2015, and then at the end of the program in May 2016. The questions in these surveys matched those that were asked of all MBTA riders during a system-wide customer satisfaction survey from earlier in 2015.

Figure 2-8 shows the net satisfaction for each category across three groups: Youth Pass participants at the time of pilot program enrollment, Youth Pass participants in October 2015 and May 2016, and all MBTA customers from the system-wide customer satisfaction survey. The MBTA determined the net satisfaction rating for each category

by subtracting the percentage of respondents answering below neutral satisfaction (1, 2, or 3) from the percentage answering better than neutral satisfaction (5, 6, or 7).

FIGURE 2-8
Net Satisfaction with Various Aspects of MBTA Service



Data sources: MBTA Youth Pass Pilot enrollment surveys; MBTA Youth Pass pilot October 2015 and May 2016 monthly surveys; MBTA 2015 System-wide Customer Satisfaction Survey

Youth Pass enrollees tended to have an equal or more favorable opinion of the MBTA than respondents to the 2015 system-wide customer satisfaction survey, except in the "cost" and "safety" categories. Youth Pass participants were slightly less satisfied with safety on the MBTA than all passengers, but the vast majority still responded positively. When asked to rate their satisfaction with the MBTA's cost, Youth Pass participants' responses differed somewhat from the survey of all passengers. In fact, the majority of Youth Pass participants rated their satisfaction with the MBTA's cost as negative, which was the only net negative response for both the Youth Pass enrollment and Youth Pass October and May survey groups.

In general, satisfaction with the MBTA decreased slightly among Youth Pass participants between the enrollment survey group and the October and May survey groups, with the exception of the "cost" category. It is important to note that the two surveys do not provide a perfect comparison, as not everyone who took the first survey remained in the program long enough to participate in the second or third survey, or even completed the requirements to obtain a Youth Pass. It is possible that as their use

of the MBTA services increases, Youth Pass participant satisfaction with the MBTA will decrease. This effect appeared in the 2015 system-wide customer satisfaction survey, with regular users expressing less satisfaction than people who use the system less frequently.

Youth Pass respondents' satisfaction with the MBTA's cost improved for the mid-point survey, but then decreased again for the final survey. This could be because of the way the question was asked. Respondents were not told to assume that the Youth Pass Pilot would continue past June 30, 2016 when answering the second and third survey, so some respondents could have answered this question thinking that the program would be ending.

Chapter 3—Pilot Impacts on the MBTA

This chapter describes estimates of the impacts the Youth Pass pilot may have on MBTA revenues and service.

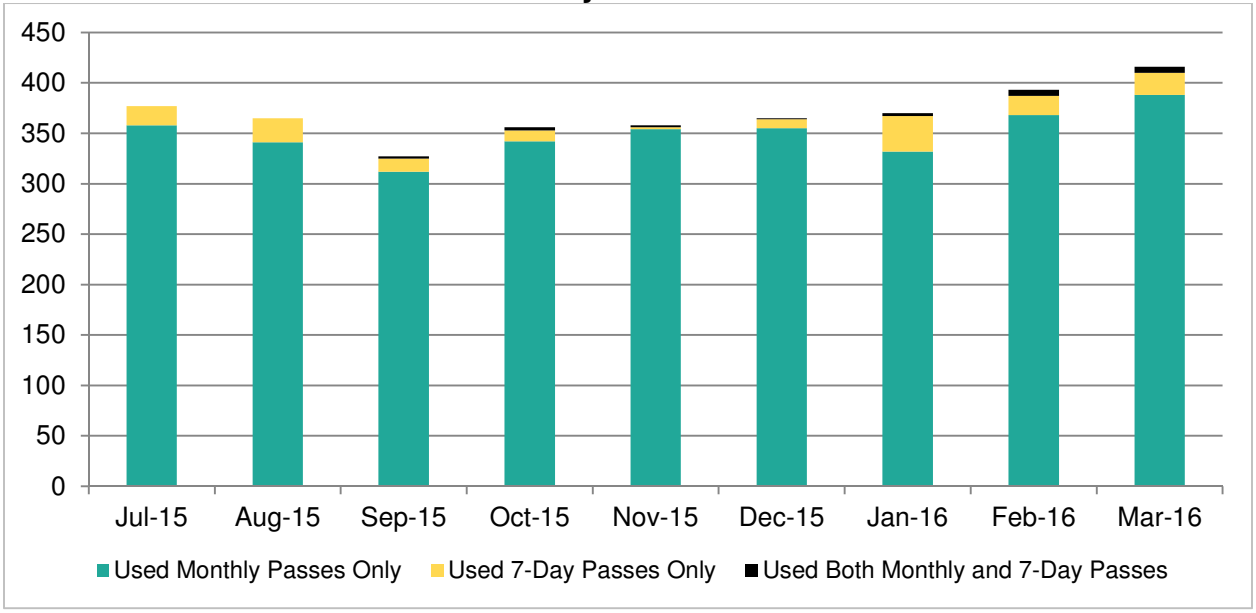
3.1 Impacts on MBTA Fare Revenues

Youth Pass Use Profile

During each month of the pilot, participants could purchase a monthly Youth Pass for $26. Chelsea, Malden, and Somerville also offered 7-day Youth Passes throughout the pilot, while Boston began to sell these passes in January. The 7-day Youth Passes cost $7 each.

As mentioned in Chapter 2, CTPS identified 770 individuals who used youth passes through March 2016, according to the MBTA's AFC data for Youth Pass participants. CTPS analyzed the behavior of 762 of these individuals.[8] Figure 3-1 shows the number of individuals who purchased each type of Youth Pass product during each month.

FIGURE 3-1
Active Participants Who Purchased 7-Day or Monthly Youth Passes, by Month



Data source: MBTA Youth Pass Pilot AFC Data
Note: The number of individuals who purchased 7-Day passes in July includes one person who purchased a 7-Day pass in June only.

[8] Eight of these 770 youth were identified as being age 12, based on their reported date of birth, or their applications had incomplete or conflicting school enrollment data.

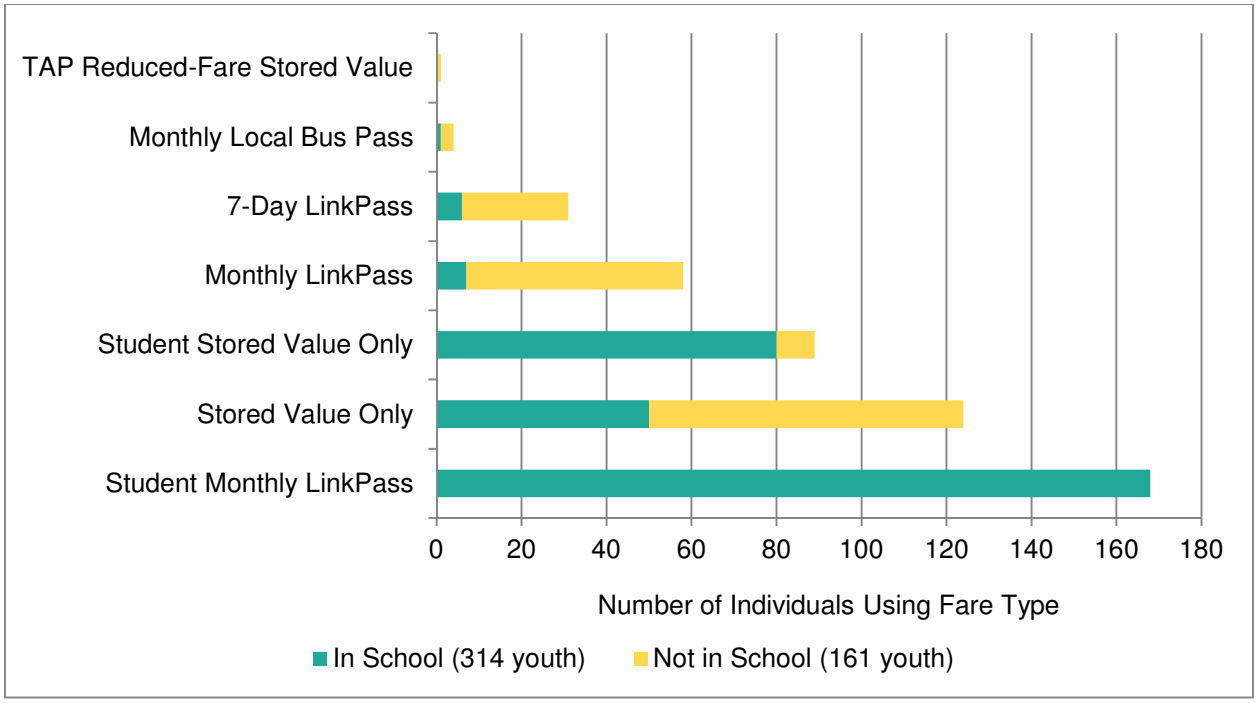
During each month of the pilot, the majority of youth that were "active," or using at least one Youth Pass product to pay for their trips, used a monthly Youth Pass only. During most months of the pilot, fewer than seven percent of active participants used one or more 7-day Youth Passes to pay for their trips. In January 2016, Boston began offering the 7-day pass, but even during that month, only about 10 percent of all active participants used this type of pass. Of the youth who used a 7-day pass during a given month, the majority only purchased one or two passes during the month.

Estimated Youth Pass Revenues

Pre-Pilot Fare Data

Chapter 2 describes the processes that CTPS used to develop samples of pre-pilot data to represent youth travel behavior during the school year or the summer. Figure 3-2 shows the types of fare media that youth in the School pre-pilot data sample used to make trips on the MBTA system.

FIGURE 3-2
Fare Types Used By Pre-Pilot Participants (School Period)



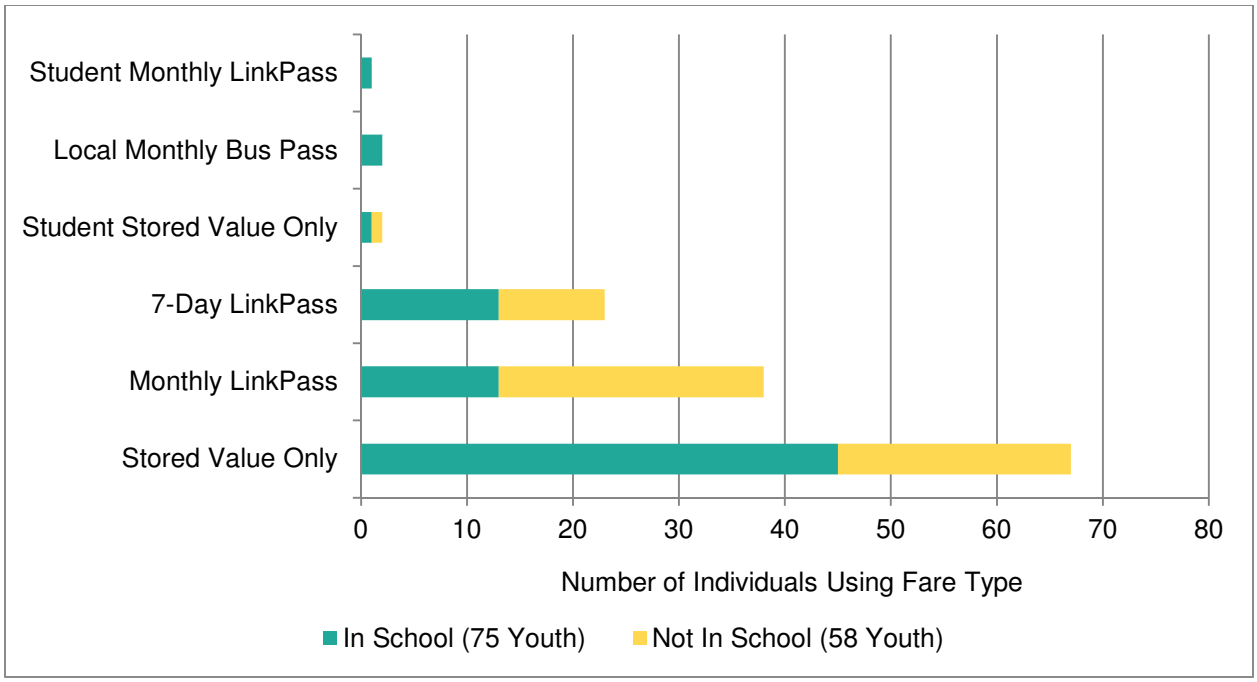
Data source: MBTA pre-pilot AFC data
Notes: Participants may have used more than one fare type during their 30-day pre-pilot data collection period. Stored-value fare types include both trip and transfer fares. Information about fares paid in cash is unknown. Two youth in the "Not in School" group and one in the "In School" group used multiple types of passes; these results are not shown. Three youth in the "In School" group paid for trips with a combination of full-price and student fares, only; these results are not shown.

TAP = Transportation Access Pass.

Based on the data shown in Figure 3-2, of pre-pilot participants who provided data during the School period, slightly more than half of students used Student Monthly LinkPasses, while about 25 percent only paid for trips using their student stored-value purse on their CharlieCard, which enables them to obtain a reduced fare. Only a few used another type of pass (Monthly LinkPass, 7-day LinkPass, or a monthly Local Bus pass). Among youth not-enrolled in school, the largest number of participants paid for their trips using stored-value only, though approximately 32 percent used a monthly LinkPass, and approximately 16 percent used a 7-day LinkPass.

Figure 3-3 shows the types of fare media that youth in the Summer pre-pilot data sample used to ride the MBTA system.

FIGURE 3-3
Fare Types Used By Pre-Pilot Participants (Summer Period)



Data source: MBTA pre-pilot AFC data
Notes: Participants may have used more than one fare type during their 30-day pre-pilot data collection period. Stored Value fare types may include both trip and transfer fares. Information about fares paid in cash is unknown. One person was excluded from the “In School” category because they only paid for Express Bus trips during their pre-data month, which would not be covered by a LinkPass.

Figure 3-3 shows that, of pre-pilot participants who provided data during the Summer period, about 62 percent of students paid for trips using only their stored-value purse (either at standard or reduced-price fares). Approximately 17 percent of students made trips using monthly LinkPasses, while another 17 percent made trips using 7-day LinkPasses. Among youth not enrolled in school, approximately 43 percent paid for trips

using a monthly LinkPass, while another 40 percent paid for trips using their Charlie Card stored-value purse only.

Estimated Youth Pass Revenues

To estimate the net Youth Pass revenues for the first nine months of the pilot program, CTPS followed these steps:

- **Step 1:** CTPS identified each month in the pilot program as either a Summer month (July and August 2015) or a School month (September 2015 through March 2016).

- **Step 2:** CTPS identified the share of youth pass participants in each month who reported being enrolled in school, based on their Youth Pass application data.

- **Step 3:** CTPS estimated the total expenditures each Youth Pass participant made during months when they were "active," or using a Youth Pass to pay for trips. These estimated total expenditures include the cost of Youth Passes (monthly and/or 7-day), and the cost of any stored-value trips. CTPS assumed that youth participants had purchased one monthly Youth Pass if they had made any monthly Youth Pass trips, and estimated the number of 7-day passes purchased based on the time periods during which 7-day Youth Pass trips were made, as shown in the Youth Pass pilot AFC data. As discussed in Chapter 2, on average, youth using Youth Passes during a given month made one stored-value trip or fewer; but in some cases youth may have paid single-ride or transfer fares before they could renew their monthly or 7-day youth pass. Including these trips makes it possible to provide a more comprehensive picture of trip-making behavior for a given month.

  Table 3-1 shows the outputs of steps 1 through 3.

TABLE 3-1
Youth Pass Participant Spending,
by Month and School Enrollment Category

Pilot-Program Month	Month Type	Total Participants	Estimated MBTA Revenues during Youth Pass Pilot Program
July 2015	Summer	377	$9,590
August 2015	Summer	365	$9,390
September 2015	School	327	$8,460
October 2015	School	356	$9,440
November 2015	School	358	$9,520
December 2015	School	365	$9,700
January 2016	School	370	$9,610
February 2016	School	393	$10,410
March 2016	School	416	$11,030
Total			**$87,150**

Data source: MBTA Youth Pass pilot AFC Data
Notes: These amounts exclude one 7-day pass purchased in June 2015, which was only used on June 30, 2015. Amounts are rounded to the nearest $10.

- **Step 4:** CTPS estimated the average cost a participant would have paid per month to ride the MBTA local bus or rapid transit system if they did not have a Youth Pass, depending on the time of year and the participant's school-enrollment category. CTPS used the pre-pilot data sets to develop these estimates. The average monthly cost for each participant is based on the estimated number and types of passes that the individual purchased and the cost of any trips paid for using stored-value. CTPS assumed that youth participants had purchased a certain type of monthly pass if they had had paid for any trips during the month using that pass-type, and estimated the number of 7-day passes purchased based on the time periods during which 7-day Youth Pass trips were made, as shown in the pre-pilot AFC data. Table 3-2 shows the average monthly expenditure values for each school-enrollment and time-period category.

TABLE 3-2
Average Monthly Pre-Pilot Spending,
by Month and School Enrollment Category

Category	Average Monthly Expenditure: Summer Pre-Pilot Data Group	Average Monthly Expenditure: School Pre-Pilot Data Group
Enrolled in School	$42.00	$26.50
Not Enrolled in School	$52.50	$50.00

Data source: MBTA pre-pilot AFC data

Note: Amounts are rounded to the nearest $0.50.

- **Step 5:** For each month, CTPS multiplied the appropriate average monthly pre-pilot expenditure amount by the number of participants in the "enrolled-in-school" and "not-enrolled-in-school" categories, and summed the two categories together to get a total pre-pilot spending amount for each month. This amount will serve as an estimate of the revenue the MBTA would have earned if these youth did not have access to Youth Passes.

- **Step 6:** CTPS subtracted the total monthly foregone revenues from the Youth Pass program revenues for each month, to determine the net revenues per month. For the first nine months of the pilot program. CTPS estimates that participants in the program spent approximately $87,200 between July 2015 and March 2016. The net revenue loss for the program for these nine months, based on the methodology described above, is about $38,200.

TABLE 3-3
Estimated Net MBTA Foregone Revenue during the Youth Pass Pilot Program

Pilot-Program Month	Month Type	Total Participants	Estimated MBTA Revenues during Youth Pass Pilot Program	Estimated Foregone MBTA Revenues	Estimated Net MBTA Revenues
July 2015	Summer	377	$9,580	$16,570	($6,990)
August 2015	Summer	365	$9,400	$13,540	($4,150)
September 2015	School	327	$8,470	$11,630	($3,170)
October 2015	School	356	$9,440	$12,680	($3,250)
November 2015	School	358	$9,520	$13,090	($3,570)
December 2015	School	365	$9,690	$13,370	($3,680)
January 2016	School	370	$9,610	$13,820	($4,200)
February 2016	School	393	$10,410	$14,870	($4,460)
March 2016	School	416	$11,030	$15,760	($4,720)
Total			**$87,150**	**$125,330**	**($38,180)**

Data sources: MBTA pre-pilot AFC data, MBTA Youth Pass pilot AFC data
Note: Amounts have been rounded to the nearest $10. The differences in the net revenues column may not be exact due to rounding.

To estimate the net revenue for a full year of the pilot program at the current participation rate, CTPS applied the number of Youth Pass users that were estimated to be active in March 2016 (416) to the remaining three months of the school year, with the same shares of youth enrolled in school and not enrolled in school. CTPS also assumed the March 2016 Youth Pass revenue amount (approximately $11,030) and the March foregone revenue amount (approximately $15,760) for the three remaining months. Using this approach, CTPS estimated that a full year of the pilot would generate approximately $120,200 in revenue (Youth Pass sales plus other stored value), and a net revenue loss of approximately $52,400 as shown in Table 3-5.

TABLE 3-5
Estimated Net Youth Pass Pilot Program Revenues
(July 2015 – June 2016)

Pilot Program Month	Youth Pass Revenues	Estimated Foregone Revenues	Net Revenues
July 2015 – March 2016	$87,150	$125,330	**($38,180)**
April 2016 – June 2016 (projection)	$33,090	$47,270	**($14,170)**
Total	**$120,240**	**$172,600**	**($52,350)**

Data sources: MBTA pre-pilot AFC data, MBTA Youth Pass pilot AFC data
Note: Amounts are rounded to the nearest $10. The differences in the net revenues column may not be exact due to rounding.

When the cost of program administration by MBTA staff is included (an estimated $200,000), the net loss of the pilot is approximately $252,400.

3.2 Impacts on MBTA Service

Chapter 2 describes the estimated number of unlinked trips that Youth Pass participants made based on several characteristics or circumstances:

- Whether the participants were enrolled in school, or not enrolled in school
- Whether the participants were making trips before or after they had access to a Youth Pass
- Whether the trip was taking place during a school or summer month

This section looks more closely at the magnitude of additional unlinked trips per weekday, and at the magnitude of unlinked trips being made during the AM and PM peak periods, in particular. According to the MBTA's current Service Delivery Policy (2010), the AM peak period takes place between 7:00 AM and 8:59 AM, while the PM peak period takes place between 4:00 PM and 6:30 PM. CTPS also looked at participants' trips on different parts of the MBTA system (bus, rapid transit, light-rail, or Silver Line) during a given weekday.

To estimate the net change in the number of trips on the MBTA local bus and rail system on a weekday, CTPS completed the following steps:

- **Step 1:** CTPS identified each month in the pilot program as either a Summer month (July and August 2015) or a School month (September 2015 through March 2016).

- **Step 2:** CTPS identified the share of youth pass participants in each month who reported being enrolled in school, based on their Youth Pass application data.

- **Step 3:** CTPS estimated the trips per weekday made by youth using Youth Passes, by calculating the total number of trips made by active Youth Pass participants on weekdays during each month of the program. CTPS then divided these trip values by the number of weekdays during each month (excluding holidays) to determine the estimated number of trips per day, during each time period.

- **Step 4:** CTPS estimated the trips per weekday that youth may have made before they had access to a youth pass by using the pre-pilot AFC data. To estimate the total number of trips made by pre-pilot participants during a summer month, CTPS calculated the average numbers of weekday trips per month made by participants (both those enrolled in school, and not enrolled in school) during the Summer time period. These were multiplied by the number of each type of Youth Pass participant (school-enrolled, and not-school-enrolled) during each Summer month. This process was repeated for school months, using data from pre-pilot participants in the School category.

- **Step 5:** CTPS estimated the additional trips per weekday made by youth using Youth Passes by subtracting the results of step 4 from the results of step 3.

A summary of the results of steps 1 through 5 are shown in Table 3-6.

TABLE 3-6
Estimated Weekday Trips by Youth Pass Participants, by Service Period
(July 2015 – March 2016)

Month Type	Range of Trips per Weekday (from Pre-Pilot Data)	Range of Trips per Weekday (Youth Pass Participants)	Range Estimated Net Additional Trips Per Weekday	Average Estimated Net Additional Trips Per Weekday
Summer	490 – 500	800 – 900	+310 – +400	+350
School	600 – 740	770 – 950	+110 – +230	+180

Data sources: MBTA Youth Pass pilot AFC data

Note: Amounts are rounded to the nearest 10 trips.

During summer months, an estimated average 350 trips were added to the MBTA bus and rapid transit system each weekday. During school months, an estimated average 180 trips were added to the MBTA bus and rapid transit system each weekday.

Meanwhile, there were approximately 1.2 million weekday boardings on the MBTA bus and rapid transit systems in fiscal year (FY) 2013. The net growth in trips on the bus and rapid transit system from the Youth Pass pilot program is very small by comparison.[9]

AM and PM Peak Period Trip Share Changes

Table 3-7 shows changes in the share of weekday unlinked trips that youth made during the AM peak period, the PM peak period, and during non-peak periods, once they had a Youth Pass, compared to the share they made during these periods before they had a Youth Pass. These shares have been calculated for both summer (July and August 2015) and school (September 2015 to March 2016) months. To provide a pre-pilot comparison to the Youth Pass pilot shares in each period, CTPS calculated the share of weekday trips made by the Summer group of pre-pilot participants, and the School group of pre-pilot participants made in each period, respectively. This table shows the change in the share of peak period trips between the pre-pilot and Youth Pass AFC data sets in terms of both percentage points and percentage change.

TABLE 3-7
Change in Service-Period Trip Share
between Pre-Pilot and Youth Pass Data

Month Type And Service Period	Pre-Pilot Data	Youth Pass Data	Change in Percentage Points	Percentage Change
School: AM-Peak-Period Share	14.7%	14.7%	(Less than 0.1%)	(Less than 0.1%)
School: PM-Peak-Period Share	17.4%	19.8%	+2.4	+13.6%
School: Non-Peak-Period Share	67.9%	65.5%	(2.4)	(3.5%)
Summer: AM-Peak-Period Share	13.7%	15.7%	+1.9	+13.9%
Summer: PM-Peak-Period Share	21.8%	21.6%	(0.2)	(1.0%)
Summer: Non-Peak-Period Share	64.5%	62.8%	(1.7)	(2.6%)

Data sources: MBTA Youth Pass pilot AFC data, MBTA pre-pilot AFC Data

[9] Source: Massachusetts Bay Transportation Authority. 2014. Ridership and Service Statistics: Fourteenth Edition. http://www.mbta.com/uploadedfiles/documents/2014%20BLUEBOOK%2014th%20Edition.pdf. Accessed May 24, 2015.

As shown in Table 3-7, Youth pass participants make approximately 15 percent of their trips during the AM peak period and about 20 percent during the PM peak period during school months. During summer months, these percentages rise to 16 percent and 21 percent, respectively. When comparing the Youth Pass pilot and pre-pilot data, CTPS estimates that Youth Pass participants make more of their trips during the PM Peak period during School months than before the pilot. Meanwhile, during summer months, Youth Pass participants make more of their trips during the AM peak period than they did prior to the pilot.

Table 3-8 combines the information in Tables 3-6 and 3-7 to show the approximate number of additional weekday trips taking place during the AM and PM peak periods. As shown below, there are fewer than 100 additional trips in either the AM or PM peak on an average weekday, regardless of the time of year.

TABLE 3-8
Estimated Additional Trips by Youth Pass Participants, by Service Period
(July 2015 – March 2016)

Month Type	Range of Additional AM Peak Trips Per Weekday	Average Additional AM Peak Trips Per Weekday	Range of Additional PM Peak Trips Per Weekday	Average Additional PM Peak Trips Per Weekday
Summer	60 – 70	65	70 – 80	75
School	20 – 30	27	40 – 60	52

Data source: MBTA Youth Pass pilot AFC data

Note: Ranges are rounded to the nearest 10 trips.

AM and PM Peak Period Trip Shares by Bus and Rapid Transit Line

Table 3-9 shows the change in AM peak period, PM peak period, and non-peak trip share for the local bus network as a whole, each rapid transit line, and the Silver Line during school months (September 2015 – March 2016). CTPS compared this trip-making activity to that which occurred prior to the Youth Pass pilot, using data from the School group of pre-pilot participants. The highlighted cells show an increase in trip share from the pre-pilot data set to the Youth Pass data set.

TABLE 3-9
Change in Peak-Period Trip Share
for Bus Network and Rapid Transit Lines
(Pre-Pilot and Youth Pass Pilot Data, School Month)

Service Period and Data Set	Bus: All Routes	Rapid Transit: Blue Line	Rapid Transit: Green Line	Rapid Transit: Orange Line	Rapid Transit: Red Line	Rapid Transit: Silver Line
AM-Peak-Period Share: Pre-Pilot	17.1%	17.8%	7.1%	10.9%	16.4%	18.6%
AM-Peak-Period Share: Youth Pass	16.7%	26.4%	6.8%	13.6%	14.6%	15.2%
PM-Peak-Period Share: Pre-Pilot	16.0%	10.1%	23.0%	19.0%	18.4%	13.4%
PM-Peak-Period Share: Youth Pass	20.5%	12.0%	20.1%	19.7%	19.1%	19.9%
Non-Peak-Period Share: Pre-Pilot	66.9%	72.1%	69.9%	70.1%	65.2%	68.0%
Non-Peak-Period Share: Youth Pass	62.8%	61.6%	73.1%	66.7%	66.3%	64.8%

Data sources: MBTA Youth Pass pilot AFC data, MBTA pre-pilot AFC Data

During school months, the share of trips made by Youth Pass participants increased during the AM-Peak period on bus routes and on the Blue and Orange lines. During the PM-Peak period, the share of trips made by Youth Pass participants increased on all bus routes, and the Blue, Orange, Red, and Silver lines. During non-peak periods, the share of trips made by Youth Pass participants increased on the Green and Red lines. The use of different MBTA rapid transit lines and the bus network is determined in part by the municipalities participating in the program, as Youth Pass participants will be making their home-based trips on the bus and rapid transit lines that serve their home communities.

Table 3-10 shows the change in AM Peak period, PM Peak period, and non-peak trip share for the local bus network as a whole, each rapid transit line, and the Silver Line during summer months (July and August 2015). CTPS compared this trip-making activity to that which occurred prior to the Youth Pass pilot, using data from the Summer group of pre-pilot participants. Highlighted cells show an increase from the value calculated from the pre-pilot data set to the value calculated for the Youth Pass pilot data set.

TABLE 3-10
Change in Peak-Period Trip Share
for Bus Network and Rapid Transit Lines
(Pre-Pilot and Youth Pass Pilot Data, Summer Month)

Service Period and Data Set	Bus: All Routes	Rapid Transit: Blue Line	Rapid Transit: Green Line	Rapid Transit: Orange Line	Rapid Transit: Red Line	Rapid Transit: Silver Line
AM-Peak-Period Share: Pre-Pilot	16.8%	24.6%	6.6%	11.3%	14.3%	7.8%
AM-Peak-Period Share: Youth Pass	18.3%	16.2%	6.3%	13.8%	17.6%	15.3%
PM-Peak-Period Share: Pre-Pilot	21.9%	13.7%	24.7%	21.9%	20.7%	24.1%
PM-Peak-Period Share: Youth Pass	21.2%	24.9%	27.0%	19.5%	22.3%	25.2%
Non-Peak-Period Share: Pre-Pilot	61.3%	61.7%	68.7%	66.8%	65.0%	68.1%
Non-Peak-Period Share: Youth Pass	60.6%	58.5%	66.7%	66.7%	60.2%	59.5%

Data sources: MBTA Youth Pass pilot AFC data, MBTA pre-pilot AFC Data

During summer months, the share of trips made by Youth Pass participants increased on bus routes and on the Orange, Red, and Silver lines during the AM Peak period. During the PM Peak period, the share of trips made by Youth Pass participants increased on the Blue, Green, Red and Silver lines. As mentioned previously, though there are changes in the share of trips Youth Pass participants made across modes and across service periods, the overall net impact of their trip-making activity is small.

3.3 Summary of Title VI Fare Equity Analysis

The Federal Transit Administration (FTA) requires that the MBTA conduct a fare equity analysis for any fare change that lasts longer than six months—as is the case for the Youth Pass Pilot program—to evaluate whether the fare changes would have a disparate impact based on race, color, or national origin, and whether low-income riders would bear a disproportionate burden or non-low-income riders would receive disproportionate benefits because of the changes. CTPS conducted a Title VI Fare Equity Analysis of the Youth Pass Pilot program using program data available through October 15, 2015, in order to meet these federal requirements and support continuation

of the pilot program beyond six months. This analysis is detailed in the Youth Pass Pilot Program: Title VI Fare Equity Analysis memorandum (December 15, 2015).

With respect to the analysis findings, the Youth Pass monthly and weekly fare products provide a benefit to eligible users because they provide access to the bus and rapid transit system at a significant discount compared to similar pass products. The monthly Youth Pass, which is priced the same as MBTA Student Monthly ($26), represents a 65 percent discount compared to a full-price monthly LinkPass ($75). When analyzing the effective per-trip costs for minority, low-income, and all Youth Pass participants, CTPS found that the two Youth Pass products (monthly and 7-day) result in no disparate benefit to non-minority youth in the program, and no disproportionate benefit to non-low-income youth in the program, according to the MBTA's Disparate Impact and Disproportionate Burden Policy.

3.4 Impacts on MBTA Service (Cash Handling, Conflicts with Employees, Fare Evasion)

In addition to the other topics discussed in this chapter, the Youth Pass Pilot was intended to examine whether the pass improved the MBTA's operations and riders' experiences on the system. The Youth Pass Working Group theorized that additional passes would:

- Reduce the amount of cash used on-board buses and above-ground trolleys, which slows boarding and increases dwell times
- Reduce the amount of fare evasion by pass-holders
- Improve interactions between MBTA staff and pilot participants

These impacts proved difficult to assess, but the preliminary data does suggest minor impacts, which are explained below.

First, it is likely that the Youth Pass decreased cash payment on-board vehicles for participants. While detailed data is not available on cash transactions as there was no way to track cash payments, youth who applied for the pass reported a high level of cash payment when compared to the population of all riders. Twenty-six percent of applicants reported that they pay for rides with cash at some point recently. While we do not know exactly how many trips were paid for with cash, this is significantly higher than the system-wide average cash payment rate of 2 percent. With a pass, participants would not use cash to board buses and other vehicles.

The MBTA also asked participants their opinions of the Youth Pass's impact on fare evasion and interactions between participants and MBTA employees. When asked if

they thought the Youth Pass reduces fare evasion, 75 percent of respondents said yes, while just 3 percent responded no (the remainder were not sure). When asked if the Youth Pass reduces conflicts between riders and employees, 59 percent believed that it did, while just 11 percent responded no. While this is subjective data, the perception is that the Youth Pass impacts both these issues positively.

Chapter 4—Pilot Administrative Feasibility

4.1 Pilot Administrative Procedures

Municipal Partnerships

The MBTA and the partner organizations worked together for six months to create the pilot program structure. Each partner signed a Memorandum of Understanding with the MBTA that specified each organization's responsibilities. The MBTA wrote a Policy Handbook that detailed the rules of the program for the partners to use in implementation. After the program was launched, the MBTA and representatives of the partner municipalities held monthly meetings to check in on the administration of the program and resolve outstanding issues.

The municipal partners were free to develop their own administration procedures, so long as these procedures could be later audited, and the municipalities collected and verified the necessary paperwork. Some scanned the necessary documents and stored them in an online filing system, while others stored hard copies in folders. The MBTA provided the partners with a spreadsheet to track participants, their enrollment, and their payment status. For the means-tested participants, municipal partners were expected to collect documentation of their enrollment in a means-tested program. They also were expected to conduct a "second-step" verification of 10 percent of their means-tested participants. This was conducted via phone calls to the organizations or programs that participants claimed they were enrolled in; the "second-step" verification revealed no cases of fraud. Staff at the MBTA also reviewed the pass-usage data and found no evidence of suspicious usage (very high numbers of trips on one pass).

The MBTA conducted site visits of each municipal office to observe operations, ensure that partners followed proper procedure, and interview partner staff about their experiences administering the Youth Pass. This section details the results of these audits. Overall, the municipal partners seemed to follow the agreed-upon procedure. While there were some slight irregularities, there were no major problems in administration, nor did MBTA oversight reveal any major errors or cases of fraud. The major concerns expressed by the partners will be largely addressed by making the pass available on fare vending machines.

Municipal Partner Feedback

Partners generally believed the Youth Pass was an important program and wanted it to become permanent, but expressed concerns about the resources required to handle the program in its current design — particularly the handling of cash.

Major positive feedback from the partners included:

- General appreciation of the program by the youth participants. This showed partners that it was a valuable program for these participants and that their work was appreciated. Additionally, the program helped partner offices to fulfill their mission and connect face-to-face with youth constituents who may be difficult to reach via other methods.

- The RSTs provided by the MBTA to refill the cards were reliable and easy to use.

- Invoicing from the MBTA was smooth, and no major errors were reported by either the MBTA or municipal partners.

Negative feedback from the partners included:

- Partners reported that the workload was highly variable. For example, the workload was very high during the initial enrollment period, but there was little to do at mid-month times when few participants were coming in.

- The card printers used to print the Youth Passes were very slow (especially for the first printing of the day) and sometimes created duplicates.

- Participants often wished they could purchase passes online or with a credit or debit card rather than cash.

Finally, partners expressed concerns about having enough staff and other resources to administer the program if continued, especially if the enrollment were expanded. It was clear from partner comments that continuing to vend passes monthly via RSTs in municipal partner offices was not only infeasible for their staff, but also presented barriers to participants, which reduced the reach of the pass and could prevent a full program from meeting its goal of providing access to those who need it.

Most of the negative feedback is addressed by having the passes available on fare vending machines throughout the MBTA system, similar to the Student Pass change approved by the Fiscal and Management Control Board.

Those enrolled in school could purchase passes without ever needing to go to a separate office. Youth who are not enrolled in school would need to visit a partner office to be approved for the program and receive a Youth Pass card, but would not have to return to the office each month because they could re-load their passes at fare vending machines. The workload would still be variable, as most participants would likely enroll in September, but would be far lower overall. The cash handling for the partners would be eliminated as well.

4.2 Administrative Feasibility

The Youth Pass Pilot proposal included three questions about the administration of the program. First, what are the administrative costs of the pilot program to the MBTA?

The administrative cost of the pilot is currently estimated at approximately $200,000, significantly less than the $443,000 of administrative costs presented in the December 2014 proposal. This is mostly due to changes in the structure of the pilot's administration and low participation rates.

The pilot consumes staff resources to:

- Design the program with the partners and write the legal documents
- Train the partners to use the RST and card-printer machines
- Design and order the special cards, work with Scheidt & Bachmann (the MBTA's fare systems contractor) to make tariff changes, and deal with lost cards
- Design the data collection and survey components of the research aspect of the pilot
- Analyze the data from the pilot and oversee CTPS's work
- Meet with the partners monthly to address issues
- Make site visits to audit the partners

Some of those resources would not be necessary for a full program, but the MBTA would still supply the cards and card printers to partners, provide oversight and auditing of partners, and handle lost cards and other administrative issues. This would require a new staff position dedicated to overseeing the program and assisting with the changes to the Student Pass program.

The second question posed in the proposal is, "What are the administrative costs to the municipal partners, and is it sustainable?" The interviews with the partners revealed that the current model of the Youth Pass, with participants paying at the partner's offices, is not sustainable. The City of Boston reported that they cannot continue the program after the pilot is over under this model. However, the partners believe that the program could continue if the passes are sold on the fare vending machines.

The third question posed in the proposal is, "Does the pilot create a procedure that is audit proof, limits fraud, and replicable?" The pilot created a procedure that is auditable and limits fraud. This was in part due to the collaborative nature of the development of the program so that the partners and the MBTA were in agreement with the goals.

There will likely be some challenges with extending the program to other municipal partners who were not involved in the initial program design. The requirements for the means-testing, and procedures for storing documents and verifying eligibility will need to

be standardized. The MBTA will have to develop a new Memorandum of Understanding and policy handbook for the partners.

Chapter 5—Pilot Program Evaluation and Next Steps

5.1 Summary of Program Evaluation Findings

The Youth Pass Pilot was designed to meet the following five major goals.

Goal 1. Create affordable transit access for pilot participants
The pilot has accomplished this goal for the applicants who finished all of the steps to enroll in the pilot.

Goal 2: Provide the data required to assess the impact of a Youth Pass on the mobility of youth and their engagement in civic and community activities
The pilot has collected data, and the preliminary results indicate that the Youth Pass has increased access to a range of activities for participants.

Goal 3: Have a limited impact on the MBTA's revenue
The pilot is estimated to have a very limited impact on MBTA fare revenue.

Goal 4: Provide the data required to estimate the impact of a permanent Youth Pass program on MBTA fare revenue and service delivery
The pilot has generated data to assist in the estimates of a full Youth Pass, but these estimates still require assumptions outside the scope of the pilot data collection.

Goal 5: Assess whether municipal partners can distribute reduced fare MBTA passes in an audit-proof manner that minimizes the MBTA administrative burden
The pilot has demonstrated a proof of concept for a collaborative model of administering reduced fare MBTA products that is auditable and limits the MBTA administrative burden.

5.2 Program Evaluation Challenges and Limitations

The MBTA and CTPS encountered several challenges and limitations while conducting the pilot program evaluation:

- As discussed in Chapter 2, this report uses AFC data from the start of the program in July 2015 through March 2016, which was the last month of complete data available for the development of this report, to analyze Youth Pass usage. As a result, this report does not reflect information about Youth Pass purchases and use during the spring.

- The number of steps required to enroll and participate in the pilot has resulted in limited youth participation.

- As discussed in Section 2.3, most participants began providing their 30 days of pre-pilot trip data during May and June 2015, just before the start of the Youth Pass pilot program. This means that there is limited pre-pilot data that reflects the fall, winter, and spring months of the school year.

- The AFC data and resulting analyses may be missing some of the Youth Pass users. MBTA staff worked to match municipal records of Youth Pass participants to as many pass sales recorded in the RST data as possible, but it was still not possible to match some pass sales to Youth Pass pilot program participants.

5.3 Factors Affecting the Future of the Youth Pass

The Youth Pass pilot program has provided valuable insights into youth transportation needs and behavior. It has also provided an opportunity to evaluate how to most-effectively close gaps that may prevent youth from accessing reduced-price passes, including those available through the existing Student Pass program. To date, findings from the pilot program showed that Youth Pass participants made more trips than they did prior to the pilot program, expanding their ability to be active in their communities.

However, MBTA staff also found that cash-handling created a large burden for municipalities that were administering the program, and that it may be challenging for youth to purchase and renew Youth Passes if they have to continue to return to their municipal office.

The MBTA's most recent package of fare changes addresses some of these issues for both the Youth Pass and student fare products. On March 7, 2016, the MBTA's Fiscal Management and Control Board voted on a package of fare changes, effective July 1, 2016, that includes several relevant provisions:

- The cost of a Student Monthly LinkPass (valid 7 days per week) will increase from $26 to $30. The price of a monthly Youth Pass would equal the cost of a Student Monthly LinkPass, and so the cost of the Youth Pass, if implemented, would increase from $26 to $30.

- Students will be able to purchase Student Monthly LinkPasses 12 months of the year, instead of only 10 months.

- During the 2016–17 school year, the MBTA will pilot-test sales of Student Monthly LinkPasses on MBTA fare vending machines. This would make it possible to sell monthly Youth Passes on fare vending machines as well.

In sum, these elements of the fare change package increase the price of the monthly student passes, but they also expand access to the Student Monthly LinkPass, and potentially to the Youth Pass. Students with a Student CharlieCard will be able to access a reduced-price pass through the Student Pass program year round. This will address 73 percent of the demand in the Youth Pass pilot.

These changes would make it possible to limit the scope of the Youth Pass program so that it specifically targets 12–18-year-old youth who are not enrolled in middle school or high school and 19–21-year-old means-tested youth. Youth that are eligible for Youth Passes would also be able to purchase and renew their passes at any fare vending machine, as opposed to returning to their city or town partner office each month to do so.

5.4 Full Program Recommendations

The preliminary results of the Youth Pass pilot resulted in the following recommendations for changes to the program if the Youth Pass is implemented as a full program:

- Allow sales of the monthly pass on the MBTA fare vending machines to ease the administrative burden on the municipal partners
- Continue to have municipal partners verify eligibility and provide the photo ID cards with an annual expiration date
- Allow additional municipalities to opt-in to the program
- Continue to analyze the means-testing portion of the program for future extensibility

5.5 Youth Pass Program Scenario Evaluation

To assess the possible revenue and service impacts of a full Youth Pass program, this section explores two possible scenarios for continuing or expanding the Youth Pass program beyond the 12-month pilot period. This analysis assumes that a future Youth Pass program, and the Student Pass program, would have the following structural characteristics:

- Only the monthly Youth Pass will be available in a future Youth Pass program. The 7-Day Youth Pass offered during the pilot will be discontinued.

- Monthly Youth Passes and Student Monthly LinkPasses would each cost $30.

- Middle and high dchool students would be able to obtain Student Monthly LinkPasses year round, by receiving the Student S-Card from their school.

- Both monthly Youth Passes and Student Monthly LinkPasses will be available for purchase on MBTA fare vending machines (FVMs), once youth have confirmed

their eligibility for either program. Once they have enrolled, youth in the Youth Pass program would not need to return to their municipal partner office each month to pay for their pass.

As discussed in Section 5.3, the MBTA fare change package effective July 1, 2016, addresses many barriers that limit student access to Student Monthly LinkPasses. This makes it possible to limit the scope of the Youth Pass program so that it specifically targets youth who may not be able to afford a monthly pass at the full price or obtain it through another program. As a result, these two scenarios have the following features in terms of program eligibility:

- Middle and high school students would no longer be eligible to obtain monthly passes through the Youth Pass program because they would be able to obtain Student Monthly LinkPasses year-round. Youth 12–18 years old, not enrolled in middle or high school would be eligible for the Youth Pass.

- Youth in the 19-to-21-year-old age range would need to demonstrate that they meet means testing requirements to be eligible for the Youth Pass program. For the purposes of this scenario analysis, youth would need to be identified as living in a low-income household.[10] This is used as a proxy for meeting the eligibility screens of enrollment in a state or federal benefit program like MassHealth, SNAP and public housing.

The two scenarios described in this report represent a low number and high number of municipalities that might participate in the program. The “Few Towns” scenario only includes the municipalities that have been participating in the pilot program. The “Many Towns” scenario includes the 14 communities that were part of the original Metropolitan Transit Authority’s (MTA) service area when the MBTA was formed, plus three additional municipalities that receive supplemental school bus service from the MBTA (Lynn, Melrose, and Quincy).[11] Table 5-1 lists the municipalities that were included in each scenario. The Many Towns scenario is not based on any discussion with the additional 13 municipalities; it only serves to provide a potential “upper-bound” case for a full Youth Pass program.

[10] The threshold for low income is based on the median household income for the full 175-town MBTA service area estimated from 2010-2014 American Community Survey (ACS) data, which is $73,587. The low income threshold is 60 percent of the median household income value, or $44,152.

[11] The 14 communities that were part of the original Metropolitan Transit Authority’s (MTA) service area when the MBTA was formed include Arlington, Belmont, Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford, Milton, Newton, Revere, Somerville, and Watertown.

TABLE 5-1
Possible Future Youth Pass Scenarios

Scenario	Representative Participating Municipalities
"Few Towns" (Original pilot participants)	Boston, Chelsea, Malden, Somerville
"Many Towns"	Arlington, Belmont, Boston, Brookline, Cambridge, Chelsea, Everett, Lynn, Malden, Medford, Melrose, Milton, Newton, Quincy, Revere, Somerville, Watertown

The sections below describe the three components of the scenarios:

- The market of youth eligible and likely to participate in a Youth Pass program
- The estimated net revenues for the MBTA, based on market size and various levels of program participation
- The estimated impacts to MBTA service, based on market size and various levels of program participation

Youth Eligible for a Future Youth Pass Program

To estimate the number of youth that would be eligible and likely to participate in a Youth Pass program under each scenario, CTPS applied a sequence of steps designed to capture youth that met age, school enrollment, and income (if applicable) criteria; and live near and are likely to use transit. These steps are described below. Several of the data sources mentioned in each step are described in Appendix A: Data Sources. Additional details for a number of these steps are available in Appendix B: Scenario Evaluation Methodology Details.

- **Step 1: Estimate the population of eligible youths, based on age, income, and school enrollment characteristics.** Eligible youth include those that are:

    - Ages 12 to 18 years old and are not enrolled in middle or high school or college
    - Ages 12 to 18 years old, who are enrolled in college
    - Ages 19 to 21 years old, who live in low-income households and are not enrolled in middle or high school or college
    - Ages 19 to 21 years old, who live in low-income households and are enrolled in college

    CTPS developed these estimates using data from the 2014 American Community Survey (ACS), including data from the five-year summary file and

the five-year Public Use Microdata Sample (PUMS). These estimates only include youth in households; they exclude youth living in group quarters, such as college dormitories. Table B-1 in Appendix B shows the estimates for eligible youth in this group.

- **Step 2: Estimate the population of eligible youths who live near transit**
  CTPS conducted a geographic information systems (GIS) analysis to determine the portion of the youth population that is eligible for a Youth Pass that lives within one-quarter mile walking distance of an MBTA bus stop or one-half mile walking distance of an MBTA rapid transit station. Table B-2 in Appendix B shows these results.

- **Step 3: Estimate the population of eligible youths who live near transit that are likely to use transit**
  CTPS used data from the 2010–11 Massachusetts Travel Survey (MTS)—a statewide survey of how people use the Commonwealth's multimodal transportation system—to estimate the percentage of people, by age group, who live in the densely-populated areas of the 17 municipalities included in the two scenarios and are likely to use transit. Appendix A provides additional details about the MTS, while Appendix B describes how information from the MTS was used to determine the share of youth, by age group, who are likely to use transit. Using the MTS data, CTPS estimated that approximately 37 percent of the 12-to-18-year-old population living near transit, and approximately 55 percent of the 19-to-21-year-old population living near transit, reported at least one transit trip as part of their survey response.[12] As a result, CTPS assumes these shares of each population segment reflect those who are likely to use transit.

  Table 5-2 summarizes the results of steps 1 through 3, and shows the estimated number of people in each scenario that would be eligible, and may wish to participate, in a future Youth Pass program.

[12] The estimate of 19-21 year olds who reported at least one transit trip as part of their MTS response reflects youth in this age group, regardless of income. This estimate does not specifically reflect the transit usage of 19-21 year olds in low-income households.

TABLE 5-2
Estimated Youth Population Eligible for a Youth Pass, Who Lives Near Transit and Uses Transit

Category	Few Towns Scenario	Many Towns Scenario
Age 12-18, Not Enrolled in School	800	1,300
Age 12-18, In College	700	1,300
Age 19-21, Low-Income, Not Enrolled in School	2,300	3,500
Age 19-21, Low-Income, In College	4,500	6,100
Total	**8,400**	**12,200**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010-11 Massachusetts Travel Survey.
Note: Values have been rounded to the nearest 100 people. Totals may not sum due to rounding. Population values reflect youth in households only.

The populations of youth in either age group that are enrolled in school vary in comparison to the population groups shown in Table 5-2. In the Few Towns scenario, the estimated 12-to-18-year-old population enrolled in middle or high school is about 17,800. The 19-to-21 year old population that is a) enrolled in middle or high school; and b) living in low income households is about 500 people. Meanwhile, in the Many Towns scenario, the estimated 12-to-18-year-old population enrolled in middle or high school is approximately 32,900.The 19-to-21 year old population that is a) enrolled in middle or high school; and b) living in low income households is about 700 people.

Estimating Future Youth Pass Program Revenues

After estimating the markets of youth who would be eligible and may wish to participate in a Youth Pass program, CTPS applied several assumptions to calculate MBTA revenues under each program scenario. These assumptions are shaped by the MBTA fare-change package described earlier in this chapter and by the findings from the pilot program, as described in Chapters 2 and 3.

- **Youth Pass Cost:** The Youth Pass will cost $30, the same as a Student Monthly LinkPass, based on the new fares that will go into effect on July 1, 2016.

- **Passes on Fare Vending Machines (FVMs).** When reviewing the Youth Pass AFC data, CTPS noticed cases where participants were paying single-ride and

transfer fares for trips for short periods between using their Youth Passes. They may have been paying for trips this way as a stop-gap measure until they could return to their municipal partner office to renew their pass. With the availability of passes on fare vending machines, after enrolling, participating youth will be able to buy their passes on FVMs; this will eliminate their need to pay for "between-pass" trips. As a result, youth participating in the program would only pay the cost of the pass ($30) each month.

- **Estimates of Monthly "Foregone" Revenues per person.** CTPS used pre-pilot AFC data to estimate the amount that pilot participants would spend during either a school year month or summer month if they were not in a Youth Pass program. These monthly expenditure values, when multiplied by the estimated number of participants in the program during a given month, provide a way to estimate the amount of revenue the MBTA would take in if the Youth Pass program did not exist. Details about how CTPS created these estimates are available in Appendix B.

  Table 5-3 shows the estimated monthly foregone revenue amount for each type of month (school or summer). During a given year, summer months include July and August, while school year months include September through June.

TABLE 5-3
Estimated Foregone Revenue Amounts, by Month

Groups Represented	Month Type	Foregone Revenue Amount
12-18, not enrolled in school or enrolled in college	School	$56.50
12-18, not enrolled in school or enrolled in college	Summer	$59.00
19-21 and low income, not enrolled in school or enrolled in college	School	$56.50
19-21 and low income, not enrolled in school or enrolled in college	Summer	$60.50

Data source: CTPS pre-pilot AFC data.

Note: Values have been rounded to the nearest $0.50

- **Ongoing Participation.** CTPS assumed that youth participating in a future Youth Pass program would participate all months of the year. In reality, individual participation in the program would likely fluctuate over time, with youth entering, remaining in, or exiting the program as they learn about it, participate in it, and determine whether it continues to meet their needs.

- **Adding in passes for GED/HiSET program enrollees that would not otherwise be eligible for a Youth Pass.** Currently, some youth who are not enrolled in school may still have access to Student Monthly LinkPasses, particularly if they participate in a General Educational Development (GED) / High School Equivalency (HiSET) testing program that purchases monthly passes on behalf of their students. In the future, youth in these programs will not be able to receive reduced-price passes through the Student Pass program; MBTA staff anticipates that these individuals would be able to obtain passes through a Youth Pass program. Many of these youth are already eligible for the Youth Pass program based on other criteria, but youth aged 19 to 21 who do not live in low-income households would not be eligible based on the other criteria. CTPS estimated the number of passes that may currently be sold to youth in this category through the Student Pass program, and added this number of passes to estimated Youth Pass sales during school or summer months. Appendix B provides additional details on how CTPS estimated the number of passes for GED/HiSET program enrollees for each scenario.

To calculate estimated Youth Pass program revenues and foregone revenues, CTPS completed the following steps for each of the four market categories of participants (12 to 18 years old and not in school; 12 to 18 years old and in college; 19 to 21 years old, low-income, and not enrolled in school; and 19 to 21 years old, low-income, and in college):

- **Step 1:** CTPS developed a range of possible program participation levels, ranging from 10 percent of the eligible market participating in the program, to 100 percent (full participation).

  Example: 1,000 youth in category at a 10 percent participation level
  *1,000 * 0.10 = 100 potential participants*

- **Step 2:** CTPS estimated the pass sales for summer months by multiplying the number of expected participants at each participation level by two (2). Any Student Monthly LinkPasses that were expected to be sold to participants in GED programs during summer months were added to these total pass sales. This adjusted number of passes was multiplied by $30 to determine the estimated program revenues for the summer.

*Example: 100 potential participants * 2 months = 200 passes.*
Add 10 pass sales for GED program enrollees during summer = 210 passes.
*210 passes * $30 = $6,300*

- **Step 3:** CTPS estimated the foregone revenues for summer months by multiplying the number of passes sold by the appropriate average foregone revenue amount for that market category. In this calculation, each pass represents one month of youth travel.

  Example: Summer monthly foregone revenue for category: $59.00
  *210 passes * $59.00 = $12,390*

- **Step 4:** CTPS estimated the pass sales for school months by multiplying the number of expected participants at each participation level by ten (10). Any Student Monthly LinkPasses that were expected to be sold to participants in GED programs during school months were added to total pass sales. This adjusted number of passes was multiplied by $30 to determine the estimated program revenues for the school year.

  *Example: 100 potential participants * 10 months = 1,000 passes*
  Add 50 pass sales for GED program enrollees during the school year = 1,050 passes
  *1,050 passes * $30 = $31,500*

- **Step 5:** CTPS estimated the foregone revenues for school year months by multiplying the number of passes sold by the appropriate average foregone revenue amount for that market category. In this calculation, each pass represents one month of youth travel.

  Example: School monthly foregone revenue for category: $55.00
  *1,050 passes * $55.00 = $57,750*

- **Step 6:** CTPS summed the Youth Pass revenues for the full year, and summed the estimated foregone revenues for the full year. The foregone revenues were subtracted from the Youth Pass revenues to determine the net program revenues at each participation level.

  Example: Total Youth Pass revenues: $6,300 + $31,500 = $37,800
  Total foregone revenues: $12,390 + $57,750 = $70,140
  Total net revenue loss: $70,140 - $37,800 = $32,340

CTPS followed this process for all four market categories of participants in order to develop net revenue estimates for the Few Towns scenario. This process was then repeated to develop estimates for the Many Towns scenario.

Few Towns Scenario: Net Program Revenues

Table 5-4 summarizes the ranges of net Youth Pass Program revenues for the Few Towns scenario, which includes Boston, Chelsea, Malden, and Somerville. CTPS created these ranges by varying the percent of each market category that would be likely to participate in a Youth Pass program. Values were calculated for each market category at 10 percent and at 100 percent. These ranges are shown for each individual market category, and then in total.

Under the Few Towns Scenario, net revenue losses would range from $271,000 (at 10 percent participation) to approximately $2.7 million (at 100 percent participation) per year, assuming all market categories are included in the program.

TABLE 5-4
Few Towns Scenario: Ranges of Estimated Net Program Revenues, by Category

Market Category	Range of Estimated Participants	Range of Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
Age 12–18, Not Enrolled in School	100 – 800	1,000 – 9,500	$29,000 – $285,000	$54,000 – $540,000	($26,000 – $255,000)
Age 12–18, In College	100 – 700	900 – 8,600	$26,000 – $259,000	$49,000 – $491,000	($23,000 – $232,000)
Age 19–21, Low-Income, Not Enrolled in School	200 – 2,330	2,800 – 28,100	$84,000 – $843,000	$160,000 – $1,603,000	($76,000 – $760,000)
Age 19–21, Low-Income, In College	500 - 4500	5,400 – 54,000	$162,000 – $1,621,000	$308,000 – $3,082,000	($146,000 – $1,461,000)
Total	**800 – 8,400**	**10,000 – 100,300**	**$301,000 – $3,009,000**	**$572,000 – $5,716,000**	**($271,000 – $2,708,000)**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.
Note: Participants and pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs that are not accounted for in the estimated range of participants.

Table 5-5 shows the estimated net program revenues for all categories combined at various participation levels. To estimate the number of eligible youth who might choose to participate in a future Youth Pass program, CTPS calculated the pilot program application rate for eligible youth in the participating municipalities. To do so, CTPS first determined the total number of youth who applied to the Youth Pass pilot program that would meet the eligibility criteria of the Youth Pass program under the scenarios (12 to 18-year-old youth not enrolled in middle or high school; and 19 to 21-year-old youth not enrolled in middle or high school, that are also low-income). These values were then compared to the total eligible youth population in the four pilot municipalities that live near transit and are estimated to use transit.

Using this approach, CTPS determined that approximately 14 percent of eligible youth expressed interest in the program under current marketing conditions. As a result, CTPS has highlighted the 15 percent participation rate row in the table to indicate the expected level of participation in a future Youth Pass program. This percentage does not account for increased interest in the program in response to availability of Youth Passes on the fare vending machines or different methods to market the program.

TABLE 5-5
Few Towns Scenario: Estimated Net Program Revenues (All Categories) at Various Participation Levels

Market (All Categories) Participation Level	Age Category	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	12 to 18	1,800	$54,000	$103,000	($49,000)
	19 to 21	8,200	$246,000	$468,000	($222,000)
	All	**10,000**	**$301,000**	**$572,000**	**($271,000)**
15% participation	12 to 18	2,700	$82,000	$155,000	($73,000)
	19 to 21	12,300	$370,000	$703,000	($333,000)
	All	**15,000**	**$451,000**	**$857,000**	**($406,000)**
20% participation	12 to 18	3,600	$109,000	$206,000	($97,000)
	19 to 21	16,400	$493,000	$937,000	($444,000)
	All	20,100	$602,000	$1,143,000	($542,000)
30% participation	12 to 18	5,400	$163,000	$310,000	($146,000)
	19 to 21	24,600	$739,000	$1,405,000	($666,000)
	All	**30,100**	**$903,000**	**$1,715,000**	**($812,000)**
100% participation	12 to 18	18,100	$544,000	$1,032,000	($487,000)
	19 to 21	82,100	$2,464,000	$4,685,000	($2,220,000)
	All	**100,300**	**$3,009,000**	**$5,716,000**	**($2,708,000)**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010-11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21 year old youth in GED/HiSET programs.

At the 15 percent participation level, estimated net revenue losses are approximately $73,000 for the 12-to-18-year-old group (including both youth not enrolled in school and in college), and $333,000 for the 19-to-21-year-old group (including both youth not enrolled in school and in college). At the 15 percent participation level, the estimated net revenue loss for all categories is approximately $406,000.

Appendix B includes four tables that provide the information shown in Table 5-5, but are specific to each of the four market categories.

Many Towns Scenario: Net Program Revenues

Table 5-6 summarizes the ranges of net Youth Pass Program revenues for the Many Towns scenario, which includes the 17 core-area communities listed in Table 5-1. CTPS created these ranges by varying the percent of each market category that would be likely to participate in a Youth Pass program from 10 percent to 100 percent. These ranges are shown for each individual market category, and in total.

TABLE 5-6
Many Towns Scenario: Ranges of Estimated Net Program Revenues, by Category

Market Category	Range of Estimated Participants	Range of Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
Age 12–18, Not Enrolled in School	100 – 1,300	1,500 – 15,400	$46,000 – $464,000	$88,000 – $878,000	($41,000 – $415,000)
Age 12–18, In College	100 – 1,300	1,600 – 16,000	$48,000 – $481,000	$91,000 – $911,000	($43,000 – $431,000)
Age 19–21, Low-Income, Not Enrolled in School	300 – 3,500	4,200 – 41,800	$125,000 – $1,253,000	$238,000 – $2,382,000	($113,000 – $1,129,000)
Age 19–21, Low-Income, In College	600 – 6,100	7,300 – 73,300	$220,000 – $2,198,000	$418,000 – $4,178,000	($198,000 – $1,980,000)
Total	**1,200 – 12,200**	**14,700 – 146,500**	**$440,000 – $4,396,000**	**$835,000 – $8,350,000**	**($395,000 – $3,955,000)**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010-11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.
Note: Note: Participants and pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.

(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21 year old youth in GED/HiSET programs that are not accounted for in the estimated range of participants.

Under the Many Towns Scenario, net revenue losses would range from $395,000 (at 10 percent participation) to approximately $4 million (at 100 percent participation) per year, assuming all market categories are included in the program.

Table 5-7 shows the estimated net program revenues for all categories combined at various participation levels. As discussed in the Few Towns scenario section, CTPS determined that approximately 14 percent of eligible youth expressed interest in the program under current marketing conditions. As a result, CTPS has highlighted a 15 percent participation row in the table to indicate the expected level of participation in a future Youth Pass program.

TABLE 5-7
Many Towns Scenario: Estimated Net Program Revenues (All Categories) at Various Participation Levels

Market (All Categories) Participation Level	Age Category	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	12 to 18	3,100	$94,000	$179,000	($85,000)
	19 to 21	11,500	$345,000	$656,000	($311,000)
	All	**14,700**	**$440,000**	**$835,000**	**($395,000)**
15% participation	12 to 18	4,700	$142,000	$268,000	($127,000)
	19 to 21	17,300	$518,000	$984,000	($466,000)
	All	**22,000**	**$659,000**	**$1,253,000**	**($593,000)**
20% participation	12 to 18	6,300	$189,000	$358,000	($169,000)
	19 to 21	23,000	$690,000	$1,312,000	($622,000)
	All	29,300	$879,000	$1,670,000	($791,000)
30% participation	12 to 18	9,400	$283,000	$537,000	($254,000)
	19 to 21	34,500	$1,035,000	$1,968,000	($933,000)
	All	**44,000**	**$1,319,000**	**$2,505,000**	**($1,186,000)**
100% participation	12 to 18	31,500	$945,000	$1,790,000	($845,000)
	19 to 21	115,000	$3,451,000	$6,560,000	($3,109,000)
	All	**146,500**	**$4,396,000**	**$8,350,000**	**($3,955,000)**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010-11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.

Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding

(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21 year old youth in GED/HiSET programs.

At the 15 percent participation level, estimated net revenue losses are approximately $127,000 for the 12-to-18-year-old group (including both youth not enrolled in school and in college), and $466,000 for the 19-to-21-year-old group (including both youth not enrolled in school and in college). At the 15 percent participation level, the estimated net revenue loss for all categories is approximately $593,000.

Appendix B includes four tables that provide the information shown in Table 5-7, but are specific to each of the four market categories.

Estimating Future Youth Pass Program Service Impacts

CTPS also estimated the additional number of unlinked weekday trips that may take place on the MBTA local bus and rapid transit system under the Few Towns and Many Towns Youth Pass program scenarios.[13] Two sets of estimates were calculated for each scenario: one for additional weekday trips taking place during a summer month, and one for additional weekday trips taking place during a school-year month. To do this, CTPS used the estimated number of Youth Pass program participants to determine the number of passes that would be sold during a school-year or summer month.[14] Each pass represents one month of youth travel. CTPS then applied several assumptions, which are determined by the MBTA fare-change package described earlier in this chapter, and by the findings from the pilot program.

- **Passes on Fare Vending Machines (FVMs).** When reviewing the Youth Pass AFC data, CTPS noticed cases where participants were paying single-ride and transfer fares for trips for short periods between using their Youth Passes. After enrolling in the Youth Pass program, participating youth will be able to buy their passes on FVMs, which will eliminate their need to make "between-pass" trips. Therefore, CTPS assumed that a monthly Youth Pass will cover all of a participant's monthly trips on the local bus and rapid transit system.

- **Ongoing Participation.** CTPS assumed that youth participating in a future Youth Pass program would participate all months of the year.

- **Estimates of Weekday Trips per Month (Pre-Pilot Data).** CTPS used pre-pilot AFC data to estimate the number of unlinked weekday trips that youth made per month before they received a Youth Pass. These values are based on different samples of pre-pilot participants, which varied depending on:

[13] An unlinked trip is an individual trip on any single transit vehicle; a single journey, often composed of many unlinked trips on multiple vehicles, is a "linked" trip. These estimates of unlinked trips are based on the number of times people tapped their CharlieCard to interact with an AFC fare gate or fare box.

[14] These pass estimates were later adjusted to include estimates of passes for 19-to-21-year old youth (not low income) in GED/HiSET programs that would be purchased in a given month.

- Whether the participants were enrolled in school
- Whether the participants lived in a low-income household
- Whether they provided their 30-days of pre-pilot data during school months (late May through June 2015, and September 2015 through March 2016), or during summer months (July and August 2015)

Appendix B includes details about how CTPS created these estimates.

AFC data for taps against MBTA fare gates or fare boxes includes a time stamp, which makes it possible to determine the day of the week and the time of day a trip was made. CTPS used this information to determine whether trips made on weekdays were made during the AM peak period (between 7:00 AM and 8:59 AM), the PM peak period (between 4:00 PM and 6:30 PM), or during non-peak times. In addition to calculating an average number of weekday trips pre-pilot participants made per month, CTPS could also estimate the average number of weekday trips participants made during each service period, as shown in Table B-15 in Appendix B.

- **Estimates of Weekday Trips per Month (Youth Pass Data).** CTPS also used AFC data from Youth Pass participants to estimate the number of unlinked weekday trips that youth made per month with a Youth Pass. These values were calculated using a process similar to the one used to develop the pre-pilot values. CTPS created samples of Youth Pass participants based on whether or not they were enrolled in school, and whether or not they lived in low-income households. Only participants who used monthly Youth Passes were included in these samples, because only the monthly Youth Pass will be offered under these scenarios. CTPS estimated average weekday trips per month (by service period and overall) using per-person averages calculated over school months, and over summer months. These values are shown in Table B-16 in Appendix B.

Using these assumptions, CTPS calculated the net unlinked trips that would be added to the MBTA local bus and rapid transit system each weekday, depending on service period and month type, for the Few Towns and Many Towns scenarios. CTPS completed the following steps for each of the four market categories of participants (12 to 18 years old, not in school; 12 to 18 years old, in college; 19 to 21 years old, low income, and not enrolled in school; 19 to 21 years old, low income, and in college):

- **Step 1:** Using pre-pilot and Youth Pass estimates of net weekday trips per month (by service period), CTPS calculated the net number of additional trips a Youth Pass participant would make per month during each of these periods. Table 5-8 shows these values.

TABLE 5-8
Estimated Average Net Weekday Trips per Month, by Service Period

Groups Represented	Month Type	AM-Peak Period	Non-Peak Period	PM-Peak Period	Total
12–18, not-enrolled-in-school or enrolled–in-college	School	3	13	5	21
12–18, not-enrolled-in-school or enrolled–in-college	Summer	3	14	2	19
19–21 and low-income, not-enrolled-in-school or enrolled-in-college	School	3	14	5	22
19–21 and low-income, not-enrolled-in-school or enrolled-in-college	Summer	3	14	3	19

Data source: MBTA Youth Pass pilot AFC data, MBTA pre-pilot AFC data

- **Step 2:** As in the net revenue calculations, CTPS developed a range of possible program participation levels, ranging from 10 percent of the eligible market participating in the program, to 100 percent (full participation).

- **Step 3:** CTPS used the estimated number of Youth Pass program participants in each market category to determine the number of passes that would be sold during a summer month, including any passes for 19-to-21-year-old youth (not low-income) in GED/HiSET programs. As mentioned above, each pass represents one month of youth travel. CTPS then multiplied the number of passes in each market category by net weekday trip values for that category, as shown in Table 5-8.

  *Example: 100 potential participants * 1 month = 100 passes.*

Add 2 pass sales for GED program enrollees during a summer = 102 passes.
*102 passes * 3 additional AM Peak weekday trips per month = 306 additional AM Peak weekday trips per month.*

- **Step 4:** CTPS divided the number of additional weekday trips per summer month, for each service period, by 20.75, which is the average number of weekdays per month when accounting for holidays. This makes it possible to determine the net additional trips in that service period on a given weekday during a summer month.

  Example: 306 additional AM Peak weekday trips per month / 20.75 = 15 additional AM Peak trips per weekday.

- **Step 5:** CTPS repeated the process outlined in step 3, using data on participants, passes, and net additional weekday trips, to estimate the additional weekday trips per month (by service period) during a school year month.

- **Step 6:** CTPS repeated the process outlined in Step 4 to determine the net additional trips in that service period on a given weekday during a school year month.

Few Towns Scenario: Net Additional Weekday Trips

Tables 5-9 and 5-10 summarize the ranges of net additional weekday trips, by service period, that may be made on the MBTA local bus and rapid transit system for the Few Towns Youth Pass program scenario. Table 5-9 provides this information for a summer month, while Table 5-10 provides this information for a school year month. CTPS created these ranges by varying the percent of each market category that would be likely to participate in a Youth Pass program. Values were calculated for each market category at 10 percent and at 100 percent. These ranges are shown for each individual market category, and then in total. The columns for the peak periods are highlighted in each table.

TABLE 5-9
Few Towns Scenario: Ranges of Additional Weekday Trips per Service Period (Summer Month)

Market Category	Range of Youth Passes Sold, Per Month[1]	Additional AM Peak Period Trips	Additional Non-Peak Period Trips	Additional PM Peak Period Trips	Additional Trips (All Periods)
Age 12–18, Not-Enrolled-in-School	100 – 800	10 - 100	50 - 520	10 – 90	70 – 710
Age 12–18, In-College	100 – 700	10 – 90	50 – 470	10 – 80	70 – 650
Age 19–21, Low-Income, Not-Enrolled-in-School	240 – 2,300	30 – 290	160 – 1,580	30 – 300	220 – 2,170
Age 19–21, Low-Income, In-College	500 – 4,500	60 – 560	300 – 3,030	60 – 580	420 – 4,170
Total	800 – 8,400	**100 – 1,030**	**560 – 5,600**	**110 – 1,060**	**770 – 7,700**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; MBTA pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Additional trips, by service period, have been rounded to the nearest 10 trips. Totals may not sum due to rounding.
The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs that are not accounted for in the estimated range of participants.

TABLE 5-10
Few Towns Scenario: Ranges of Additional Weekday Trips per Service Period (School Month)

Market Category	Range of Youth Passes Sold, Per Month[1]	Additional AM Peak Period Trips	Additional Non-Peak Period Trips	Additional PM Peak Period Trips	Additional Trips (All Periods)
Age 12–18, Not-Enrolled-in-School	100 – 800	10 – 130	50 – 500	20 – 180	80 - 800
Age 12–18, In-College	100 – 700	10 – 110	50 – 460	20 – 160	70 – 730
Age 19–21, Low-Income, Not-Enrolled-in-School	230 – 2,300	40 – 380	160 – 1,570	50 – 530	250 – 2,500
Age 19–21, Low-Income, In-College	500 – 4,500	70 – 730	300 – 3,010	100 – 1,010	480 – 4,760
Total	800 – 8,400	**130 – 1,340**	**550 – 5,540**	**190 – 1,890**	**880 – 8,760**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; MBTA pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Additional trips, by service period, have been rounded to the nearest 10 trips. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs that are not accounted for in the estimated range of participants.

These tables show that under the Few Towns scenario, the additional trips that may be made during the AM peak period range from around 100 trips (at the 10 percent participation level) to around 1,340 trips (at the 100 percent participation level), depending on the month type. During the PM peak period, estimated additional trips range from around 110 trips (at the 10 percent participation level) to nearly 1,900 trips (at the 100 percent participation level), depending on the month type. These estimates show that participants would likely make more peak-period trips during school months

compared to summer months. Overall, additional weekday trips, regardless of service period, range from 770 (at the 10 percent participation level) to approximately 8,800 (at the 100 percent participation level). As mentioned in Chapter 3, there were approximately 1.2 million weekday boardings on the MBTA bus and rapid transit systems in fiscal year (FY) 2013. This projected net growth in trips on the bus and rapid transit system is very small by comparison, and would likely be dispersed throughout the bus and rapid transit networks.

Tables 5-11 and 5-12 show the estimated additional weekday trips for all categories combined at various participation levels. CTPS has highlighted a 15 percent participation-rate row in the table to indicate the expected level of participation in a future Youth Pass program, based on pilot conditions.

TABLE 5-11
Few Towns Scenario: Estimated Additional Weekday Trips at Various Participation Levels (Summer Month)

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Month[1]	Additional AM Peak Period Trips	Additional Non-Peak Period Trips	Additional PM Peak Period Trips	Additional Trips (All Periods)
10% participation	800	100	560	110	770
15% participation	1,300	160	840	160	1,150
20% participation	1,700	210	1,120	210	1,540
30% participation	2,500	310	1,680	320	2,310
100% participation	8,400	1,030	5,600	1,060	7,700

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–-11 Massachusetts Travel Survey; MBTA pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Additional trips, by service period, have been rounded to the nearest 10 trips. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs that are not accounted for in the estimated range of participants

TABLE 5-12
Few Towns Scenario: Estimated Additional Weekday Trips at Various Participation Levels (School Month)

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Month[1]	Additional AM Peak Period Trips	Additional Non-Peak Period Trips	Additional PM Peak Period Trips	Additional Trips (All Periods)
10% participation	800	130	550	190	880
15% participation	1,300	200	830	280	1,310
20% participation	1,700	270	1,110	380	1,750
30% participation	2,500	400	1,660	570	2,630
100% participation	8,400	1,340	5,540	1,880	8,760

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; MBTA pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Additional trips, by service period, have been rounded to the nearest 10 trips. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs that are not accounted for in the estimated range of participants

Tables 5-11 and 5-12 show that, at the 15 percent participation level, CTPS estimates that Youth Pass program participants would add 160 trips to the MBTA local bus and rapid transit system during the AM and PM peak periods during summer months. During school months, they would add approximately 200 trips during the AM peak on a given weekday, and approximately 300 trips during the PM peak.

Many Towns Scenario: Net Additional Weekday Trips

Tables 5-13 and 5-14 summarize the ranges of net additional weekday trips, by service period that may be made on the MBTA local bus and rapid transit system for the Many Towns Youth Pass program scenario. Table 5-13 provides this information for a summer month, while Table 5-14 provides this information for a school-year month. CTPS created these ranges by varying the percent of each market category that would be likely to participate in a Youth Pass program. Values were calculated for each market category at 10 percent and at 100 percent. These ranges are shown for each individual market category, and then in total. The columns for the peak periods are highlighted in each table.

TABLE 5-13
Many Towns Scenario: Ranges of Additional Weekday Trips per Service Period (Summer Month)

Market Category	Range of Youth Passes Sold, Per Month[1]	Additional AM Peak Period Trips	Additional Non-Peak Period Trips	Additional PM Peak Period Trips	Additional Trips (All Periods)
Age 12–18, Not-Enrolled-in-School	100 – 1,300	20 – 160	90 – 850	20 – 150	120 – 1,160
Age 12–18, In-College	100 – 1,300	20 – 170	90 – 170	20 – 160	120 – 1200
Age 19–21, Low-Income, Not-Enrolled-in-School	300 – 3,500	40 – 430	230 – 2,340	50 – 450	320 – 3,220
Age 19–21, Low-Income, In-College	600 – 6,100	80 – 760	410 – 4,110	80 – 790	570 – 5,650
Total	**1,200 – 12,200**	**150 – 1,510**	**820 – 8,180**	**150 – 1,540**	**1,120 – 11,230**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; MBTA pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Additional trips, by service period, have been rounded to the nearest 10 trips. Totals may not sum due to rounding.
The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs that are not accounted for in the estimated range of participants.

TABLE 5-14
Many Towns Scenario: Ranges of Additional Weekday Trips per Service Period (School Month)

Market Category	Range of Youth Passes Sold, Per Month[1]	Additional AM Peak Period Trips	Additional Non-Peak Period Trips	Additional PM Peak Period Trips	Additional Trips (All Periods)
Age 12–18, Not-Enrolled-in-School	100 – 1,300	20 – 200	80 – 820	30 – 290	130 – 1,310
Age 12–18, In-College	100 – 1,300	20 – 210	90 – 850	30 – 300	140 – 1,360
Age 19–21, Low-Income, Not-Enrolled-in-School	300 – 3,500	60 - 560	230 – 2,330	80 – 790	370 – 3,680
Age 19–21, Low-Income, In-College	600 – 6,100	100 – 990	410 – 4,090	140 – 1,380	650 – 6,450
Total	**1,200 – 12,200**	**200 – 1,960**	**810 – 8,070**	**280 – 2,760**	**1,280 – 12,790**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–-11 Massachusetts Travel Survey; MBTA pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Additional trips, by service period, have been rounded to the nearest 10 trips. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs that are not accounted for in the estimated range of participants.

These tables show than under the Many Towns scenario, the additional trips that may be made during the AM peak period range from around 150 trips (at the 10 percent participation level) to around 2,000 trips (at the 100 percent participation level), depending on the month type. During the PM peak period, estimated additional trips range from around 150 trips (at the 10 percent participation level) to nearly 2,800 trips (at the 100 percent participation level), depending on the month type. As with the Few Towns scenario, these estimates show that participants would likely make more peak-

period trips during school months compared to summer months. Overall, additional weekday trips, regardless of service period, range from 1,120 (at the 10 percent participation level) to approximately 12,800 (at the 100 percent participation level). The Many Towns scenario reflects about a 45 percent increase in average weekday trips compared to the Few Towns scenario. However, this growth would likely be dispersed throughout the bus and rapid transit networks and is still small compared to total weekday boardings for the local bus and rapid transit system as a whole.

Tables 5-15 and 5-16 show the estimated additional weekday trips for all categories combined at various participation levels. CTPS has highlighted a 15 percent participation row in the table to indicate the expected level of participation in a future Youth Pass program, based on pilot conditions.

TABLE 5-15
Many Towns Scenario: Estimated Additional Weekday Trips at Various Participation Levels (Summer Month)

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Month[1]	Additional AM Peak Period Trips	Additional Non-Peak Period Trips	Additional PM Peak Period Trips	Additional Trips (All Periods)
10% participation	1,200	150	820	150	1,120
15% participation	1,800	230	1,230	230	1,680
20% participation	2,400	300	1,630	310	2,250
30% participation	3,700	450	2,450	460	3,370
100% participation	12,200	1,510	8,180	1,540	11,230

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; MBTA pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Additional trips, by service period, have been rounded to the nearest 10 trips. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs that are not accounted for in the estimated range of participants

TABLE 5-16
Many Towns Scenario: Estimated Additional Weekday Trips at Various Participation Levels (School Month)

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Year[1]	Additional AM Peak Period Trips	Additional Non-Peak Period Trips	Additional PM Peak Period Trips	Additional Trips (All Periods)
10% participation	1,200	200	810	280	1,280
15% participation	1,800	290	1,210	410	1,920
20% participation	2,400	390	1,610	550	2,560
30% participation	3,700	590	2,420	830	3,840
100% participation	12,200	1,960	8,070	2,750	12,780

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; MBTA pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Additional trips, by service period, have been rounded to the nearest 10 trips. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs that are not accounted for in the estimated range of participants

Tables 5-15 and 5-16 show that at the 15 percent participation level, CTPS estimates that Youth Pass program participants would add 230 trips to the MBTA local bus and rapid transit system during the AM and PM peak periods during summer months. During school months, they would make approximately 290 trips during the AM peak on a given weekday, and approximately 410 trips during the PM peak.

5.6 Conclusions

The Youth Pass Pilot has increased transit access for primarily low-income and minority youth, allowing them access to recreational opportunities, work, school, and medical appointments they would not have had otherwise. The collaborative partnership with municipalities has yielded an auditable reduced-fare program with limited administrative impact for the MBTA. A key finding of the pilot is that 73 percent of the applicants were eligible for an existing MBTA reduced-fare pass, but they are unable to access it due to their school not offering it or the limitations on summer months. These problems were addressed when the MBTA Fiscal and Management Control Board voted to sell the Student Pass on the fare vending machines and make it available year round.

This decision leaves youth 12–18 years old and not in middle or high school and 19–21 year olds who meet the means-tested eligibility criteria without access to the reduced fare when the Youth Pass pilot ends. CTPS and the MBTA used data from the pilot to calculate the cost in lost fare revenue from extending the pilot to these groups and the impact on service from the additional trips they would make. The estimates for the full program range widely based on assumptions of municipal opt in and participation rates by eligible youth.

Using an estimate of 15 percent market participation, the cost of the program in annual lost fare revenue ranges from $406,000 if the four existing partner cities continue to participate to $593,000 if all 17 MBTA core municipalities join the program. The estimated cost at a more conservative estimate of 30 percent participation would range from $812,000 to $1,186,000. The impact on service of the additional trips is expected to be minimal.

Appendices

A. DATA SOURCES

Youth Pass Application, Enrollment Survey, and Monthly Survey Data

Youth who were interested in participating in the pilot program filled out an online application, as mentioned in Chapter 1. They were asked to identify their date of birth, home zip code, age group (13 to 18 years old or 19 to 21 years old), race and ethnicity, household income, and whether they were enrolled in middle or high-school.[15] Applicants who were 19 to 21 years old were asked to identify whether they were enrolled in a jobs program, a benefit program (such as the Special Supplemental Nutrition program for Women, Infants, and Children (WIC) or MassHealth), or a General Education Development (GED) or other adult education program; municipal partners used this information to help municipalities determine whether these applicants met means-testing requirements. The application survey also included questions about the number of trips applicants take on the MBTA bus or rapid transit system during the school year and summer, as well as questions about how applicants currently pay MBTA fares.

All applicants, regardless of whether they were ultimately enrolled in the program, were issued a participant number. The MBTA and CTPS used these participant numbers to identify automated fare collection (AFC) system transactions made by specific individuals (without needing their CharlieCard serial numbers or their personal information), and to link this data with the participants age, household income, school- and program-enrollment, and other information included in the application survey. This information enabled the MBTA and CTPS to make comparisons between sub-groups within the overall Youth Pass population, such as between students and youth not enrolled in school.

Youth who were accepted into the Youth Pass pilot program were asked to complete additional surveys, both during the enrollment process and on a monthly basis throughout the pilot. The enrollment survey requested that participants provide information about the purposes of the trips they make on the transit system and the other modes of transportation they regularly use. It also asked participants to indicate their level of satisfaction with various aspects of MBTA service, such as safety, cost, reliability, and interactions with MBTA staff. The monthly surveys included questions about the number and purposes of the trips participants took on the transit system the day before they received the survey, as well as questions about whether and how they might have made those trips if they did not have access to a Youth Pass.

[15] While youth younger than 13 were permitted to sign up for the program, data they submitted online was not included in the analyses in this report. CTPS identified whether applicants were younger than 13 by calculating their age using the date of birth they reported on the online application form.

Interviews and Audit of Partner Agencies

The MBTA conducted an audit of each partner agency to ensure they were following the procedures for the program as detailed in the MOU and Policy Handbook. The MBTA also asked staff at the partner agencies a series of qualitative questions about the administration of the program.

MBTA Data

Automated-Fare-Collection-System Data (AFC Data)

The MBTA's automated fare collection (AFC) system records information about the date, time, and location at which a rider made a transaction at a fare gate or fare box, along with information about the price of the trip and the fare product that was used to pay for the trip. The MBTA and CTPS used two sets of AFC data from the Youth Pass Pilot program:

- Transaction data generated by the fare cards enrollees used prior to the beginning of the pilot ("pre-pilot data")
- Transaction data generated by Youth Passes

Pre-Pilot AFC Data

When Youth Pass applicants enrolled in the pilot program, municipal partners provided them with a blank CharlieCard and requested that they sign a release allowing MBTA staff to access AFC data associated with the card. This allowed MBTA staff to track a participant's interactions with the AFC system for 30 days prior to that participant receiving and using a Youth Pass. This information enabled the MBTA and CTPS to analyze whether participants' travel behavior changed after they obtained a Youth Pass. To preserve anonymity, the MBTA used the Youth Pass participant numbers generated during the application process to identify individual participants, while the participant's personal information (name, email address, etc.) was kept confidential.

Youth Pass AFC Data

After they provided 30 days of pre-pilot data, Youth Pass participants could return to municipal partner offices to purchase monthly or 7-day youth passes. These passes would be loaded onto their CharlieCard, which the MBTA could track through the AFC system. The Youth Pass AFC data set included the same general content as the pre-pilot AFC data set, and included participant numbers that could be linked to Youth Pass applications and surveys.

Retail Sales Terminal (RST) Data

The MBTA and CTPS also used transaction data from the retail sales terminals (RSTs) distributed to the four participating municipalities. This Retail Sales Terminal (RST) data identifies the date and time of pass purchases, the type and price of the pass that was purchased, and the serial number associated with the card or ticket on which the pass

was loaded. Using this serial number, CTPS could determine how many and what type of Youth Passes (monthly or 7-day) individuals purchased over time. Each RST also had a unique identifier, which made it possible to determine the number of passes sold in individual cities. Unlike the AFC data, however, it was not possible to link RST transaction data to information about the person who purchased the pass. This information was used to check findings from the AFC data, and to estimate whether there are Youth Pass pilot participants that may not be reflected in the AFC data.

Scenario Data Sets

2014 American Community Survey 5-Year Summary File

The American Community Survey (ACS) is an ongoing survey that provides data every year, and covers a broad range of topics about social, economic, demographic, and housing characteristics of the U.S. population.[16] CTPS used the 2014 ACS 5-year summary file to obtain total population and age information for the municipalities included in each of the scenarios. The 5-year estimates from the ACS are referred to as "period" estimates, which represent data collected over a period of time. The advantage of these multi-year estimates is the increased statistical reliability of the data for less-populated areas and small population subgroups.

2014 ACS 5-Year Public Use Microdata Sample (PUMS) Data

Public Use Microdata Sample (PUMS) data contain a sample of actual responses to the ACS, as opposed to data that has already been tabulated for specific geographic areas.[17] The geography associated with Public Use Microdata (PUM) is the Public Use Microdata Area (PUMA). A PUMA is a relatively large geographic area; each PUMA contains at least 100,000 residents. While the geography is large and imprecise, the Census Bureau provides extremely detailed American Community Survey (ACS) data that is not available for smaller geographies. A PUMA may contain more than one municipality, and a municipality can contain more than one PUMA. For example, PUMA 2700 encompasses Arlington, Belmont, Lexington, Watertown, and Waltham; Boston includes PUMAs 3301–3305.

CTPS used 2014 5-Year PUMS data to estimate Youth Pass eligible-populations in relevant municipalities based on school-enrollment and age characteristics, and based on the number of youth in low-income households.

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[16] Powell, Logan T. "American Community Survey 5-Year Data (2005-2009 to 2010-2014)." 2016. http://www.census.gov/data/developers/data-sets/acs-survey-5-year-data.html. Accessed May 31, 2016.

[17] Source 1: U.S. Census Bureau, American Community Survey Office. American Community Survey 2010-2014 ACS 5-Year PUMS files Readme. 2016. http://www2.census.gov/programs-surveys/acs/tech_docs/pums/ACS2010_2014_PUMS_README.pdf. Accessed May 31, 2016.
Source 2: American Community Survey. "Public Use Microdata Sample (PUMS) Documentation." 2015. https://www.census.gov/programs-surveys/acs/technical-documentation/pums.html. Accessed May 31, 2016.

2010–2011 Massachusetts Travel Survey

CTPS determined the percentage of youths who live within walking distance of transit in the scenario study areas who might purchase a Youth Pass using the Massachusetts Travel Survey (MTS). The MTS was a large-scale, statewide survey that collected data on people's travel patterns. The survey was distributed to over 15,000 households between June 2010 and November 2011. From this survey, CTPS determined the percentage of the survey's respondents by age that lived within the study area who used transit on any of their trips, as they should be more likely to purchase a Youth Pass than those who did not use transit. The level of geography associated with the MTS for this analysis is the "ring"—two roughly concentric circles emanating from downtown Boston extending out to Route 128. CTPS used these rings because of their relationship to the study areas associated with the scenarios. Ring 0 and the dense portions of Ring 2 are included because they roughly overlap with people who live near transit in the 17 municipalities that are included in the two scenarios.

Data on Student Monthly LinkPass (M-7) sales to GED/Non-Middle or High School Programs

CTPS obtained MBTA data on sales of Student Monthly (M-7) LinkPasses to General Educational Development (GED) / High School Equivalency (HiSET), alternative education, and other programs outside of middle and high schools. This data was used in the scenarios discussed in Chapter 5 to develop estimates of the number of Youth Passes that may be sold to youth aged 19 to 21 and enrolled in GED/HiSET programs, who previously received passes through the Student Pass program.

B. SCENARIO EVALUATION METHODOLOGY DETAILS

This section provides some additional detail on the three steps used in the scenario evaluation process:

- The market of youth eligible and likely to participate in a Youth Pass program
- The estimated net revenues for the MBTA, based on market size and various levels of program participation
- The estimated impacts to MBTA service, based on market size and various levels of program participation

Youth Eligible for a Future Youth Pass Program

To estimate the number of youth that would be eligible and likely to participate in a Youth Pass program under each scenario, CTPS applied a sequence of steps designed to capture youth that met age, school-enrollment, and income (if applicable) criteria; and that live near and are likely to use transit. These steps are described below. Several of the data sources mentioned in each step are described in Appendix A: Data Sources.

- **Step 1: Estimate the population of eligible youths, based on age, income, and school-enrollment characteristics**
  Eligible youth include those that are:

  - Ages 12 to 18, who are not in middle or high school and are not enrolled in college
  - Ages 12 to 18, who are enrolled in college
  - Ages 19 to 21, who live in low-income households and are not enrolled in middle or high school or in college
  - Ages 19 to 21, who live in low-income households and are enrolled in college

  CTPS developed these estimates using data from the 2014 American Community Survey (ACS), including data from the five-year summary file and the five-year Public Use Microdata Sample (PUMS). The ACS Summary file provides information about the overall population in the relevant municipalities, while the PUMS data provides detailed information about large geographic areas, called Public Use Microdata Areas (PUMAs). Age, school-enrollment, and income factors were calculated using the PUMS data and then applied to the populations of each set of municipalities, depending on the overlap between these municipalities and particular PUMAs.

  Table B-1 shows the population in each school-enrollment category for the Few Towns and Many Towns scenarios. These estimates only include youth in households; they exclude youth living in group quarters, such as college dormitories.

TABLE B-1
Estimated Youth Population Eligible for a Youth Pass, based on Age, School Enrollment and Income Characteristics

Category	Few Towns Scenario	Many Towns Scenario
Age 12–18, Not Enrolled in School	2,200	3,700
Age 12–18, In College	2,000	3,900
Age 19–21, Low Income, Not Enrolled in School	4,300	6,600
Age 19–21, Low Income, In College	8,300	11,800
Total	**16,800**	**26,000**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS).
Note: Values have been rounded to the nearest 100 people. Totals may not sum due to rounding. Population values reflect youth in households only.

The populations of youth in either age group that are enrolled in school vary in comparison to the population groups shown in Table B-2. In the Few Towns scenario, the estimated 12-to-18-year-old population enrolled in middle or high school is about 49,000. The 19-to-21 year old population that is a) enrolled in middle or high school; and b) living in low income households is about 900 people. Meanwhile, in the Many Towns scenario, the estimated 12-to-18-year-old population enrolled in middle or high school is approximately 97,900.The 19-to-21 year old population that is a) enrolled in middle or high school; and b) living in low income households is about 1,300 people.

- **Step 2: Estimate the population of eligible youths who live near transit**
  CTPS conducted a geographic information systems (GIS) analysis to determine the portion of the youth population that is eligible for a Youth Pass and lives within one-quarter mile walking distance of an MBTA bus stop or one-half mile walking distance of an MBTA rapid transit station. Table B-2 shows these results.

TABLE B-2
Estimated Youth Population Eligible for a Youth Pass, Who Lives Near Transit

Category	Few Towns Scenario	Many Towns Scenario
Age 12–18, Not Enrolled in School	2,100	3,500
Age 12–18, In College	2,000	3,600
Age 19–21, Low-Income, Not Enrolled in School	4,300	6,300
Age 19–21, Low-Income, In College	8,200	11,200
Total	**16,600**	**24,600**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis.

Note: Values have been rounded to the nearest 100 people. Population values reflect youth in households only.

The populations of youth in either age group that are enrolled in school vary in comparison to the population groups shown in Table B-3. In the Few Towns scenario, the estimated 12-to-18-year-old population enrolled in middle or high school is about 49,000. The 19-to-21 year old population that is a) enrolled in middle or high school; and b) living in low income households is about 900 people. Meanwhile, in the Many Towns scenario, the estimated 12-to-18-year-old population enrolled in middle or high school is approximately 89,100.The 19-to-21 year old population that is a) enrolled in middle or high school; and b) living in low income households is about 1,300 people.

- **Step 3: Estimate the population of eligible youths who live near transit that are likely to use transit**
  CTPS used data from the 2010–11 Massachusetts Travel Survey (MTS)—a statewide survey of how people use the Commonwealth's multimodal transportation system—to estimate the percentage of people, by age group, who live in the densely-populated areas of the 17 municipalities included in the two scenarios and are likely to use transit. Appendix A provides additional details about the MTS. Using the MTS data, CTPS estimated that approximately 37 percent of the 12-to-18-year-old population living near transit, and 55 percent of the 19-to-21-year-oldpopulation living near transit, reported at least one transit

trip as part of their survey response.[18] As a result, CTPS assumes these shares of each population segment reflect those who are likely to use transit.

Table B-3 summarizes the results of steps 1 through 3, and shows the estimated number of people in each scenario that would be eligible, and may wish to participate, in a future Youth Pass program.

TABLE B-3
Estimated Youth Population Eligible for a Youth Pass, Who Lives Near Transit and Uses Transit

Category	Few Towns Scenario	Many Towns Scenario
Age 12–18, Not Enrolled in School	800	1,300
Age 12–18, In College	700	1,300
Age 19–21, Low-Income, Not Enrolled in School	2,300	3,500
Age 19–21, Low-Income, In College	4,500	6,100
Total	**8,400**	**12,200**

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010-11 Massachusetts Travel Survey.
Note: Values have been rounded to the nearest 100 people. Totals may not sum due to rounding. Population values reflect youth in households only.

The populations of youth in either age group that are enrolled in school vary in comparison to the population groups shown in Table B-4. In the Few Towns scenario, the estimated 12-to-18-year-old population enrolled in middle or high school is about 17,800. The 19-to-21 year old population that is a) enrolled in middle or high school; and b) living in low income households is about 500 people. Meanwhile, in the Many Towns scenario, the estimated 12-to-18-year-old population enrolled in middle or high school is approximately 32,900.The 19-to-21 year old population that is a) enrolled in middle or high school; and b) living in low income households is about 700 people.

[18] The estimate of 19-21 year olds who reported at least one transit trip as part of their MTS response reflects youth in this age group, regardless of income. This estimate does not specifically reflect the transit usage of 19-21 year olds in low-income households.

Revenue Estimation Methodology

After estimating the markets of youth who would be eligible and may choose to participate in a Youth Pass program, CTPS applied several assumptions to calculate MBTA revenues under each program scenario. These assumptions are shaped by the MBTA fare-change package described earlier in this chapter, and by the findings from the pilot program, as described in Chapters 2 and 3.

- **Youth Pass Cost:** The Youth Pass will cost $30, the same as a Student Monthly LinkPass, based on the new fares that will go into effect on July 1, 2016.

- **Passes on Fare Vending Machines (FVMs).** When reviewing the Youth Pass AFC data, CTPS noticed cases where participants were paying single-ride and transfer fares for trips for short periods between using their Youth Passes. They may have been paying for trips this way as a stop-gap measure until they could return to their municipal partner office to renew their pass. With the availability of passes on fare vending machines, after enrolling, participating youth will be able to buy their passes on FVMs; this will eliminate their need to pay for "between-pass" trips. As a result, youth participating in the program would only pay the cost of the pass ($30) each month.

- **Estimates of Monthly "Foregone" Revenues per person.** CTPS used pre-pilot AFC data to estimate the amount that pilot participants would spend during either a school year month or summer month if they were not in a Youth Pass program. These monthly expenditure values, when multiplied by the estimated number of participants in the program during a given month, provide a way to estimate the amount of revenue the MBTA would take in if the Youth Pass program did not exist.

  To create these estimates, CTPS examined the trips that pre-pilot participants made and whether they paid for these trips using particular types of passes or at particular stored-value rates, and applied fare and pass prices that will be in effect after July 1, 2016. CTPS then determined monthly expenditure values using samples of participants who were not enrolled in school and did not use Student Monthly LinkPasses or Student CharlieCards to pay for their trips. To reflect the spending of low-income participants who are not enrolled in middle or high school, CTPS created a separate set of monthly expenditure values using samples of low-income pre-pilot participants.[19]

[19] Youth pass applicants reported their household income level on the Youth Pass application form. Youth who identified their household income as less than $42,000 were flagged as being from low-income households, because at the start of the pilot program, the threshold used to identify low

Table B-4 shows the estimated monthly foregone revenue amount for each type of month (school or summer). During a given year, summer months include July and August, while school year months include September through June.

TABLE B-4
Estimated Foregone Revenue Amounts, by Month

Groups Represented	Month Type	Foregone Revenue Amount
12–18, not enrolled in school or enrolled in college	School	$56.50
12–18, not enrolled in school or enrolled in college	Summer	$59.00
19–21 and low-income, not enrolled in school or enrolled in college	School	$56.50
19-21 and low-income, not enrolled in school or enrolled in college	Summer	$60.50

Data source: CTPS pre-pilot AFC data.

Note: Values have been rounded to the nearest $0.50

- **Ongoing Participation.** CTPS assumed that youth participating in a future Youth Pass program would participate all months of the year. In reality, individual participation in the program would likely fluctuate over time, with youth entering, remaining in, or exiting the program as they learn about it, participate in it, and determine whether it continues to meet their needs.

- **Adding in passes for GED/HiSET program enrollees that would not otherwise be eligible for a Youth Pass.** Currently, some youth who are not enrolled in school may still have access to Student Monthly Link Passes, particularly if they participate in a General Educational Development (GED) / High School Equivalency (HiSET) testing programs that purchases monthly

income households was 60 percent of the median 2011 household income in the MBTA 175 town service area, or $41,636. Since the start of the pilot program, a new low income threshold of $44,162 has been established using 2014 American Community Survey (ACS) data. As a result, the income threshold used to flag Youth Pass participants as low income, and the threshold to identify the low-income population that may participate in a future Youth Pass program are close, but do not match exactly.

passes on behalf of their students. In the future, youth in these programs will not be able to receive reduced-price passes through the Student Pass program; MBTA staff anticipates that these individuals would be able to obtain these passes through a Youth Pass program. Many of these youth are already eligible for the Youth Pass program based on other criteria, though youth aged 19 to 21 who do not live in low-income households would not be eligible based on the other criteria. CTPS estimated the number of passes that may currently be sold to youth in this category through the Student Pass program, and added this number of passes to estimated Youth Pass sales during school or summer months.

CTPS obtained MBTA data on sales of Student Monthly LinkPasses to GED/HiSET, alternative education, and other programs outside of middle and high schools, and attempted to identify GED/HiSET programs from this list based on internet research into the programs. CTPS used information on passes sold to these programs during summer 2015 and the 2015–16 academic year, through May 26. This may underestimate the number of passes that are sold to these programs, as they are currently able to purchase passes for a given academic year through June 15.

Of the estimated pass sales to GED/HiSET programs, CTPS assumed that approximately 50 percent are being sold to youth. This is based on a 1997 study, using data from the 1995 National Household Education Survey, which estimated that from a national survey, 16-to-24 year olds made up approximately 47 percent of those enrolled in GED or other high school completion programs.[20] This study did not contain information about the income levels of youth participating in GED/HiSET programs in the United States. In the absence of available information, CTPS assumed that 60 percent of these passes for GED/HiSET programs are being sold to youth who are not low-income. This assumption is based on the share of the youth population in Boston, Chelsea, Malden, and Somerville (where many of these programs are based), near transit, that is not enrolled in school and not low-income. Approximately 80 percent of these passes were expected to go to 19-to-21 year olds, as these make up about 80 percent of the share of youth who are not low-income and not enrolled in school. Tables B-5 and B-6 show estimates of passes sales during summer and school months, respectively.

TABLE B-5

[20] Kim, K., M.Collins, P. Stowe. Participation in Basic Skills Education: 1994-95. 1997. U.S. Department of Education National Center for Education Statistics. http://nces.ed.gov/pubs97/97325.pdf. Accessed June 1, 2016.

Estimated Student Monthly LinkPass Sales to 19 to 21 Year Olds in GED/HiSET Programs (Summer Months)

	Total Summer M-7 passes sold	Total Passes expected to be sold to youth (50% of previous column)	Total Passes expected to be sold to youth who are not low-income (60% of previous column)	Total Passes expected to be sold to youth who are 19-21 years old and not low-income (80% of previous column)
Few Towns	90	45	27	22
Many Towns	90	45	27	22

Data Source: MBTA data on Student Monthly LinkPass sales to GED/Non-Middle and High School Programs, as of May 26, 2016.

TABLE B-6
Estimated Student Monthly LinkPass Sales to 19 to 21 Year Olds in GED/HiSET Programs (School Months)

	Total Summer M-7 passes sold	Total Passes expected to be sold to youth (50% of previous column)	Total Passes expected to be sold to youth who are not low income (60% of previous column)	Total Passes expected to be sold to youth who are 19-21 and not low income (80% of previous column)
Few Towns	288	144	86	69
Many Towns	438	219	131	105

Data Source: MBTA data on Student Monthly LinkPass sales to GED/Non-Middle and High School Programs, as of May 26, 2016.

In the net revenue calculations, the estimated number of GED pass programs is then adjusted to reflect a particular market participation level. For example, if 30 passes would be sold at full market participation, three (3) passes would be sold at 10 percent participation. Ultimately, this adjusted number of passes is added to the total count of passes that would be sold through the Youth Pass program

during either the summer or school year. CTPS has made the assumptions in the absence of more detailed data about the number and characteristics of people participating in GED/HiSET programs in the MBTA service area, and recommends that more detailed data on these programs be collected if the MBTA chooses to implement a permanent Youth Pass program.

Chapter 5 also provides information on estimated net revenues under the Few Towns and Many Towns Youth Pass program scenarios. Tables B-7 through B-10 provide detail on net revenues specific to each of the four market categories in the Few Towns scenario presented in Chapter 5.

TABLE B-7
Few Towns Scenario: Estimated Net Program Revenues (12 to 18 Years Old, Not-in-School Category) at Various Participation Levels

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	1,000	$29,000	$54,000	($26,000)
15% participation	1,400	$43,000	$81,000	($38,000)
20% participation	1,900	$57,000	$108,000	($51,000)
30% participation	2,900	$86,000	$162,000	($77,000)
100% participation	9,500	$285,000	$540,000	($255,000)

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs.

TABLE B-8
Few Towns Scenario: Estimated Net Program Revenues (19 to 21 Years Old, Low-Income, Not-in-School Category) at Various Participation Levels

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	2,800	$84,000	$160,000	($76,000)
15% participation	4,200	$126,000	$240,000	($114,000)
20% participation	5,600	$169,000	$321,000	($152,000)
30% participation	8,400	$253,000	$481,000	($228,000)
100% participation	28,100	$843,000	$1,603,000	($760,000)

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs.

TABLE B-9
Few Towns Scenario: Estimated Net Program Revenues (12 to 18 Years Old, In-College Category) at Various Participation Levels

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	860	$26,000	$48,000	($23,000)
15% participation	1,300	$39,000	$72,000	($35,000)
20% participation	1,700	$52,000	$96,000	($46,000)
30% participation	2,600	$78,000	$145,000	($70,000)
100% participation	8,600	$259,000	$482,000	($232,000)

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs.

TABLE B-10
Few Towns Scenario: Estimated Net Program Revenues (19 to 21 Years Old, Low-Income, In-College Category) at Various Participation Levels

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	5,400	$162,000	$308,000	($146,000)
15% participation	8,100	$243,000	$462,000	($219,000)
20% participation	10,800	$324,000	$616,000	($292,000)
30% participation	16,200	$486,000	$925,000	($438,000)
100% participation	54,000	$1,621,000	$3,082,000	($1,461,000)

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs.

Tables B-11 through B-14 provide detail on net revenues specific to each of the four market categories in the Many Towns scenario presented in Chapter 5.

TABLE B-11
Many Towns Scenario: Estimated Net Program Revenues (12 to 18 Years Old, Not-in-School Category) at Various Participation Levels

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	1,500	$46,000	$88,000	($41,000)
15% participation	2,300	$70,000	$132,000	($62,000)
20% participation	3,100	$93,000	$176,000	($83,000)
30% participation	4,600	$139,000	$264,000	($124,000)
100% participation	15,500	$464,000	$878,000	($415,000)

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.

(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs.

TABLE B-12

Many Towns Scenario: Estimated Net Program Revenues (19 to 21 Years Old, Low-Income, Not-in-School Category) at Various Participation Levels

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	4,200	$125,000	$238,000	($113,000)
15% participation	6,300	$188,000	$357,000	($169,000)
20% participation	8,400	$251,000	$476,000	($226,000)
30% participation	12,500	$376,000	$715,000	($339,000)
100% participation	41,800	$1,253,000	$2,382,000	($1,129,000)

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.

Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.

(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs.

TABLE B-13

Many Towns Scenario: Estimated Net Program Revenues (12 to 18 Years Old, In-College Category) at Various Participation Levels

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	1,600	$48,000	$91,000	($43,000)
15% participation	2,400	$72,000	$137,000	($65,000)
20% participation	3,200	$96,000	$182,000	($86,000)
30% participation	4,800	$144,000	$273,000	($129,000)
100% participation	16,000	$481,000	$911,000	($431,000)

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.

Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs.

TABLE B-14
Many Towns Scenario: Estimated Net Program Revenues (19 to 21 Years Old, Low-Income, In-College Category) at Various Participation Levels

Market (All Categories) Participation Level	Estimated Youth Passes Sold, Per Year[1]	Total Annual Youth Pass Program Revenues	Total Annual Foregone Revenues	Total Net Program Revenues
10% participation	7,300	$220,000	$418,000	($198,000)
15% participation	11,000	$330,000	$627,000	($297,000)
20% participation	14,700	$440,000	$836,000	($396,000)
30% participation	22,000	$659,000	$1,253,000	($594,000)
100% participation	73,300	$2,198,000	$4,178,000	($1,980,000)

Data sources: 2014 American Community Survey (ACS) 5-Year Summary File; 2014 ACS 5-Year Public Use Microdata Sample (PUMS); CTPS GIS Analysis; 2010–11 Massachusetts Travel Survey; CTPS pre-pilot AFC data.
Note: Pass sales have been rounded to the nearest 100. Dollar values have been rounded to the nearest thousand. Totals may not sum due to rounding.
(1) The total annual pass sales have been adjusted to account for Youth Pass sales to 19-to-21-year-old youth in GED/HiSET programs.

Service Impacts Estimation Methodology

Chapter 5 describes the process CTPS followed to estimate the additional weekday trips that might be made under the Few Towns and Many Towns Youth Pass program scenarios, along with the results of that process. This appendix provides some additional detail on several assumptions that CTPS applied to make these calculations, particularly those related to estimates of weekday trips per month that were drawn from the pre-pilot and Youth Pass AFC data.

- **Estimates of Weekday Trips per Month (Pre-Pilot Data).** CTPS used pre-pilot AFC data to estimate the number of unlinked weekday trips that youth made per month before they received a Youth Pass. These values are based on samples of pre-pilot participants, which varied depending on:
    - Whether the participants were enrolled in school
    - Whether the participants lived in a low-income household

- Whether they provided their 30-days of pre-pilot data during school months (late May through June 2015, and September 2015 through March 2016), or during summer months (July and August 2015)

CTPS then determined an average number of unlinked trips per month for each sample, excluding any participants who used Student Monthly LinkPasses or Student CharlieCards to pay for their trips. To reflect the spending of low-income participants who are not enrolled in middle or high school, CTPS created a separate set of average monthly trip values using samples of low-income pre-pilot participants.[21]

AFC data for taps against MBTA fare gates or fare boxes includes a time stamp, which makes it possible to determine the day of the week and the time of day a trip was made. CTPS used this information to determine whether trips made on weekdays were made during the AM peak period (between 7:00 AM and 8:59 AM), the PM peak period (between 4:00 PM and 6:30 PM), or during non-peak times. In addition to calculating an average number of weekday trips pre-pilot participants made per month, CTPS could also estimate the average number of weekday trips participants made during each service period, as shown in Table B-15.

TABLE B-15
Pre-Pilot Data: Estimated Average Weekday Trips per Month, by Service Period

Groups Represented	Month Type	AM Peak Period	Non-Peak Period	PM Peak Period	Total
12–18, not-enrolled-in-school or enrolled-in-college	School	4	21	6	31
12–18, not-enrolled-in-school or enrolled-in-college	Summer	5	22	9	36
19–21 and low-income, not-enrolled-in-school or enrolled-in-college	School	5	21	6	32

[21] For more information about how these participants were identified, see the section in Appendix B titled “Revenue Estimation Methodology.”

19–21 and low-income, not-enrolled-in-school or enrolled-in-college	Summer	5	22	9	36

Data source: MBTA pre-pilot AFC data.

- **Estimates of Weekday Trips per Month (Youth Pass Data).** CTPS also used AFC data from Youth Pass participants to estimate the number of unlinked weekday trips that youth made per month with a Youth Pass. These values were calculated using a process similar to the one used to develop the pre-pilot values. CTPS created samples of Youth Pass participants based on whether or not they were enrolled in school, and whether or not they lived in low-income households. Only participants who used monthly Youth Passes were included in these samples, because only the monthly Youth Pass will be offered under these scenarios. CTPS estimated average weekday trips per month (by service period and overall) using per-person averages calculated over school months, and over summer months. These values are shown in Table B-16.

TABLE B-16
Youth Pass Data: Average Estimated Weekday Trips per Month, by Service Period

Groups Represented	Month Type	AM Peak Period	Non-Peak Period	PM Peak Period	Total
12–18, not-enrolled-in-school or enrolled-in-college	School	8	34	10	53
12–18, not-enrolled-in-school or enrolled-in-college	Summer	7	36	11	55
19–21 and low-income, not-enrolled-in-school or enrolled-in-college	School	8	35	10	53
19–21 and low-income, not-enrolled-in-school or enrolled-in-college	Summer	8	36	11	55

Data source: MBTA Youth Pass pilot AFC data

Please see Chapter 5 for details on how CTPS applied these values to estimate the number of additional weekday trips, by service period, under the two Youth Pass program scenarios.

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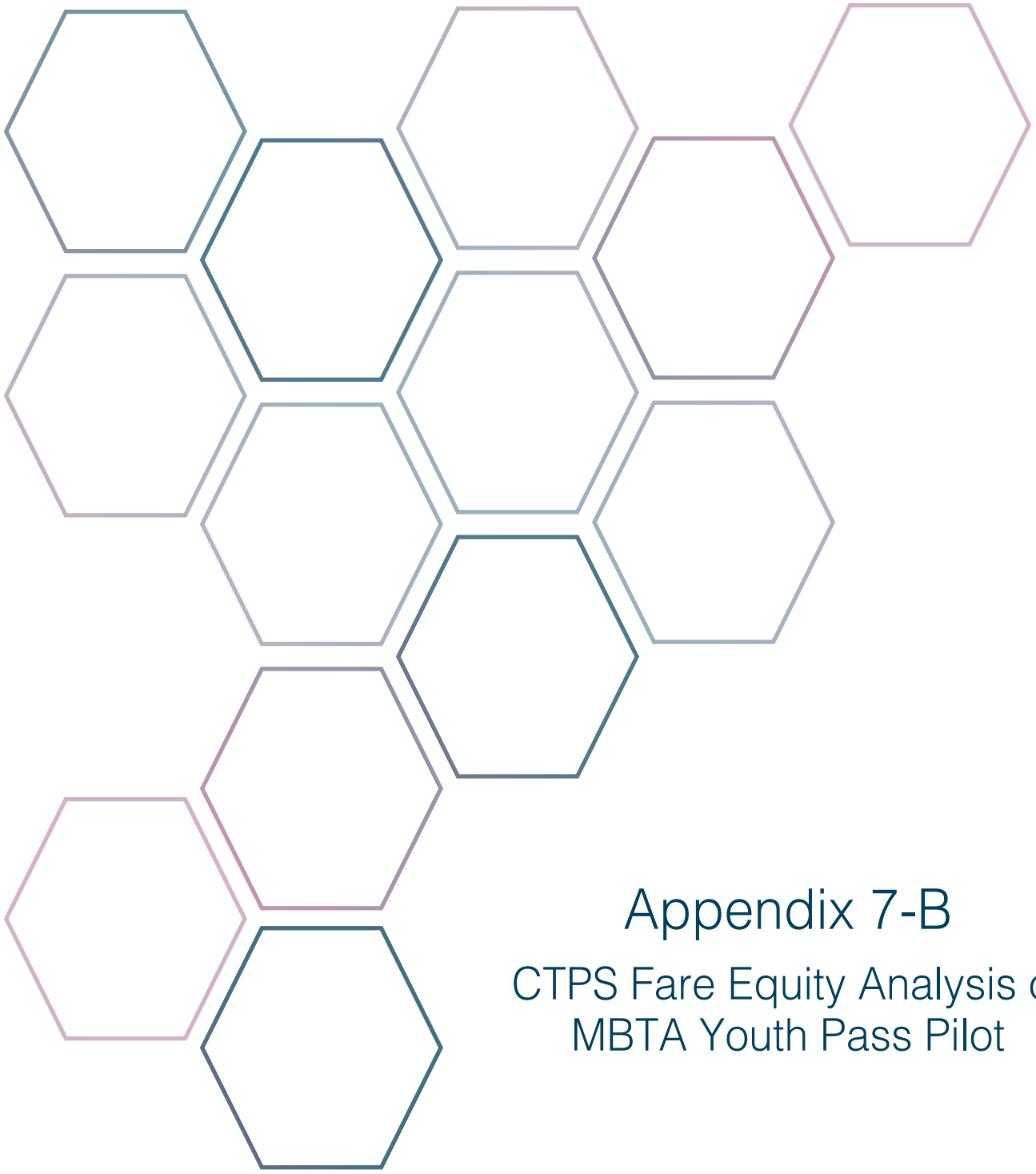

Appendix 7-B

CTPS Fare Equity Analysis of MBTA Youth Pass Pilot

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TECHNICAL MEMORANDUM

DATE: **December 15, 2015**

TO: **Laurel Paget-Seekins, Ph.D., Director of Strategic Initiatives, MBTA Office of Performance Management and Innovations**

FROM: **Andrew Reker, Transit Analyst, CTPS**

RE: **Youth Pass Pilot Program: Title VI Fare Equity Analysis**

This memorandum presents the results of the Title VI fare equity analysis, required by the Federal Transit Administration (FTA), which was conducted by the Central Transportation Planning Staff (CTPS) for the MBTA's Youth Pass Pilot program. The results of the analysis, which applied the MBTA's Disparate Impact and Disproportionate Burden Policy, show that the fare product categories introduced by the Youth Pass Pilot program did not result in disparate impacts on minority populations or disproportionate burdens on low-income populations.

This memorandum includes two appendices. Appendix A presents additional equity analyses which are not required by the FTA, and Appendix B defines the Title VI terminology used in this memorandum.

1 INTRODUCTION

1.1 Description of the Youth Pass Pilot Program

The Massachusetts Bay Transportation Authority (MBTA) is currently conducting a pilot program for a Youth Pass, a new reduced-fare product that complements Student Pass products. As stated in the December 2014 report *Pilot Project Outline and Financial Impacts Youth Pass (YPass) Program,* which the MBTA presented to the MBTA/MassDOT (Massachusetts Department of Transportation) Board of Directors, "the reduced-fare Youth Pass is expected to improve youth access to opportunities to learn, work, thrive, and contribute."[1] The Youth Pass Pilot program was developed by a working group composed of MBTA staff and community stakeholders.

[1] The same report: states "The Youth Way Campaign conducted a survey that showed that a lack of money for MBTA fares meant that 27 percent of youth missed or were late for school, and 29 percent missed or were late for work. Other youth missed health care appointments, GED classes, and a host of other necessities and opportunities for enrichment."

While some youth in Greater Boston currently have access to reduced-fare Student Pass products, access to these passes is limited by the following factors:

- Boston Public Schools subsidizes the pass only for students who meet the minimum-distance-from-school requirement.
- Many other municipal school systems and private schools in the MBTA service area do not distribute Student Passes.
- The Student Pass fare products are available only to currently enrolled full-time students, and this excludes youth who are enrolled in alternative education programs.
- Most students cannot obtain reduced-fare passes during the summer months.

The Youth Pass provides students equal access to the same reduced fare as the existing Student Pass product and closes some of the access gaps in the Student Pass program. The Youth Pass pilot program also provides young people who are 19-to-21 years old with access to the same reduced-fare as the Student Pass if they are in an alternative education program or meet means-testing criteria.

The MBTA is offering the Youth Pass in conjunction with municipal partners, who are responsible for administering the program. A monthly Youth Pass costs $26.00 (the same as the cost of a reduced-fare monthly Student Pass), and a 7-Day Youth Pass costs $7.00. Both passes are valid on the MBTA's local bus and rapid-transit system, as is the LinkPass. For the pilot program, all individuals ages 12 through 18 who live in participating municipalities are eligible, and individuals 19 to 21 years old are eligible if they meet needs-based criteria by demonstrating enrollment in high school, a GED program, or another education program; a job training program; a state or federal public benefit program (such as SNAP, WIC, TAFDC, public housing or other assistance programs); or Mass Health.

The Youth Pass Pilot program is limited to 1,500 participants between the ages of 12 and 21 in the cities of Boston, Chelsea, Malden, and Somerville. The pilot program began in July 2015 and is scheduled to run through June 2016. Data collection is ongoing; however, for the purposes of this analysis, CTPS used data that had been collected from pilot program participants through October 15, 2015.

1.2 Federal Requirements for a Fare Equity Analysis

The Federal Transit Administration (FTA) Circular 4702.1B provides guidelines and requirements for implementing US Department of Transportation regulations

pertaining to Title VI of the Civil Rights Act of 1964 (49 CFR 21). The circular requires the MBTA to conduct a fare equity analysis for any fare reduction that lasts longer than six months—as is the case for the Youth Pass Pilot program—to evaluate whether the fare changes would have a discriminatory impact based on race, color, or national origin, and whether low-income populations would bear a disproportionate burden or non-low-income populations would receive disproportionate benefits because of the changes (see Appendix B for definitions of these terms). The circular also requires: 1) briefing the MBTA Board of Directors on the fare change and the equity impacts of the change, and 2) documenting that the board considered and approved the fare equity analysis.

This document presents the FTA-required fare equity analysis of the Youth Pass Pilot program. Appendix A describes the methodology and results of additional analyses of potential disparate impacts on minority populations and disproportionate burdens on low-income populations. These analyses provide important information for the MBTA to consider when deciding whether to extend the pilot program or to launch a full-scale program. Pursuant to FTA guidance, if the MBTA chooses to continue the program, it will have to update the fare equity analysis any time that there is a significant change to the Youth Pass program, including the addition of new municipal partners.

1.3 Summary of MBTA Disparate Impact and Disproportionate Burden Policy for Fare Changes

The MBTA's Disparate Impact and Disproportionate Burden Policy establishes thresholds for evaluating the equity impacts and the distribution of benefits and burdens caused by any fare change or major service change. For fare changes, the policy requires that the MBTA compare the percentage of difference between the average fare of minority and all riders, and the percentage difference between the average fare of low-income and all riders. For fare type changes, the policy requires the MBTA to assess whether minority and low-income customers are disproportionately more likely to use the affected fare type or media than nonminority and non-low-income customers, respectively. For fare changes, the policy sets different thresholds for major or minor fare changes.

As defined in the MBTA's policy "Public Process for Changing MBTA Fares, and/or Fare Structure or Major Service Reductions," minor fare increases are defined as:

- Minor changes to the MBTA fare structure; or
- A systemwide fare increase in which the percent increase in fare revenue realized by the MBTA would be less than 10 percent; or

- A systemwide fare increase of less than 10 percent that results in a cumulative increase in fare revenue of less than 10 percent within a three year period.

Because the Youth Pass represents a minor change to the MBTA fare structure, the MBTA Disparate Impact and Disproportionate Burden Policy thresholds (directly quoted from the MBTA's policy) for a minor fare change are used in the equity analysis:

- A disparate benefit would be found if the minority riders (population) are projected to receive less than 80 percent of the benefit that all customers (population) receive.
- A disproportionate benefit would be found if the low-income customers (population) are projected to receive less than 80 percent of the benefits that all customers (population) receive.

This policy could be represented by the following:

A disparate impact would be found if:

- Projected benefit to minority < 0.8 x projected benefit to all, for minor fare changes

A disproportionate burden would be found if:

- Projected benefit to low-income < 0.8 x projected benefit to all, for minor fare changes

Appendix B provides definitions for the Title VI terminology used above.

2 FARE EQUITY ANALYSIS

2.1 Proposed Fare Change

Table 1 compares the price of the monthly Youth Pass with the price of other fare products that available to or targeted to this age group. These fare products include the monthly LinkPass, the discounted monthly Student Pass, and an additional fare product for college and university students, the Semester Pass. Table 2 compares the price of the 7-Day Youth Pass with the price of other fare products available to or targeted at this age group.

TABLE 1
Prices of Monthly Passes Available to Youth Pass Pilot Program Participants

Monthly Pass Product	Cost	Discount
LinkPass	$75.00	0%
[College] Semester Pass	$66.75	11.0%
LinkPass Student Pass	$26.00	65.3%
Proposed Youth Pass	$26.00	65.3%

Data source: MBTA.

TABLE 2
Prices of Weekly Passes Available to Youth Pass Pilot Program Participants

Weekly Pass Product	Cost	Discount
LinkPass	$19.00	0%
Proposed Youth Pass	$7.00	63.2%

Data source: MBTA.

In the circular, the FTA provides examples of the tables that are required for presenting the results of a fare equity analysis. These tables depict, for existing and proposed fare media, the existing cost, the proposed cost, the change in fare (absolute and percentage), and the number and percentage of minority, low-income, and all riders using each fare type. Tables 3 and 4 in this memorandum follow the FTA examples. Table 3 presents the fare change and includes annual usage by numbers of minority, low-income, and all riders. Table 4 presents the fare change and includes the percentage of annual usage by minority, low-income, and all riders. The FTA also requires a graphic display of the fare payment distributions by group—low-income, minority, and all riders. —which is shown in Figure 1.

TABLE 3
Proposed Fare Change: Comparison of the Changes in Cost and Usage

Fare Type	Existing Cost	Proposed Cost	Absolute Change	Percent Change	Low-Income Usage	Minority Usage	All-Rider Usage
Local Bus Adult	$1.60	$1.60	$0	0%	3,082,000	2,402,000	5,216,000
Rapid Transit Adult	$2.10	$2.10	$0	0%	9,162,000	7,880,000	17,432,000
Local Bus + Rapid Transit Adult	$2.10	$2.10	$0	0%	3,355,000	3,008,000	8,129,000
Bus Student	$0.80	$0.80	$0	0%	1,315,000	1,276,000	1,711,000
Rapid Transit Student	$1.05	$1.05	$0	0%	741,000	604,000	1,150,000
Bus + Rapid Transit Student	$2.10	$2.10	$0	0%	299,000	278,000	408,000
CharlieTicket/Cash Bus	$2.10	$2.10	$0	0%	1,345,000	1,351,000	2,264,000
CharlieTicket/Cash Rapid Transit	$2.65	$2.65	$0	0%	4,711,000	4,832,000	12,789,000
CharlieTicket/Cash Inner Express Bus	$4.75	$4.75	$0	0%	236,000	210,000	564,000
CharlieTicket/Cash Outer Express Bus	$6.80	$6.80	$0	0%	4,400	NR	8,000
Monthly Local Bus Pass	$50.00	$50.00	$0	0%	3,082,000	2,402,000	5,216,000
Monthly LinkPass	$75.00	$75.00	$0	0%	30,775,000	21,246,000	93,563,000
Monthly LinkPass Student Pass	$26.00	$26.00	$0	0%	10,116,000	126,700	15,295,000
7-Day LinkPass	$19.00	$19.00	$0	0%	20,153,000	21,282,000	36,411,000
1-Day LinkPass	$12.00	$12.00	$0	0%	623,000	463,000	748,000
Inner Express Pass	$115.00	$115.00	$0	0%	663,000	367,000	2,268,000
Outer Express Pass	$168.00	$168.00	$0	0%	124,000	36,900	512,000
Monthly Youth Pass*	$75.00	$26.00	-$49.00	-65.3%	225,000	275,000	289,000
7-Day Youth Pass*	$19.00	$7.00	-$12.00	-63.2%	25,000	46,000	91,000

Data source: FERRET 2015, tool used by CTPS to analyze MBTA fare changes.

* The adult monthly LinkPass and the 7-Day Link Pass were used to represent the existing costs of the monthly Youth Pass and 7-Day Youth Pass, respectively, because they provide the same access to MBTA services as the Youth Pass products. The estimated usage of the Youth Pass products is based on the average number of monthly trips made by pilot program participants.

NR = not reliable. MBTA did not collect enough data during its 2008–09 Systemwide Passenger Survey to calculate a minority usage value for this fare product.

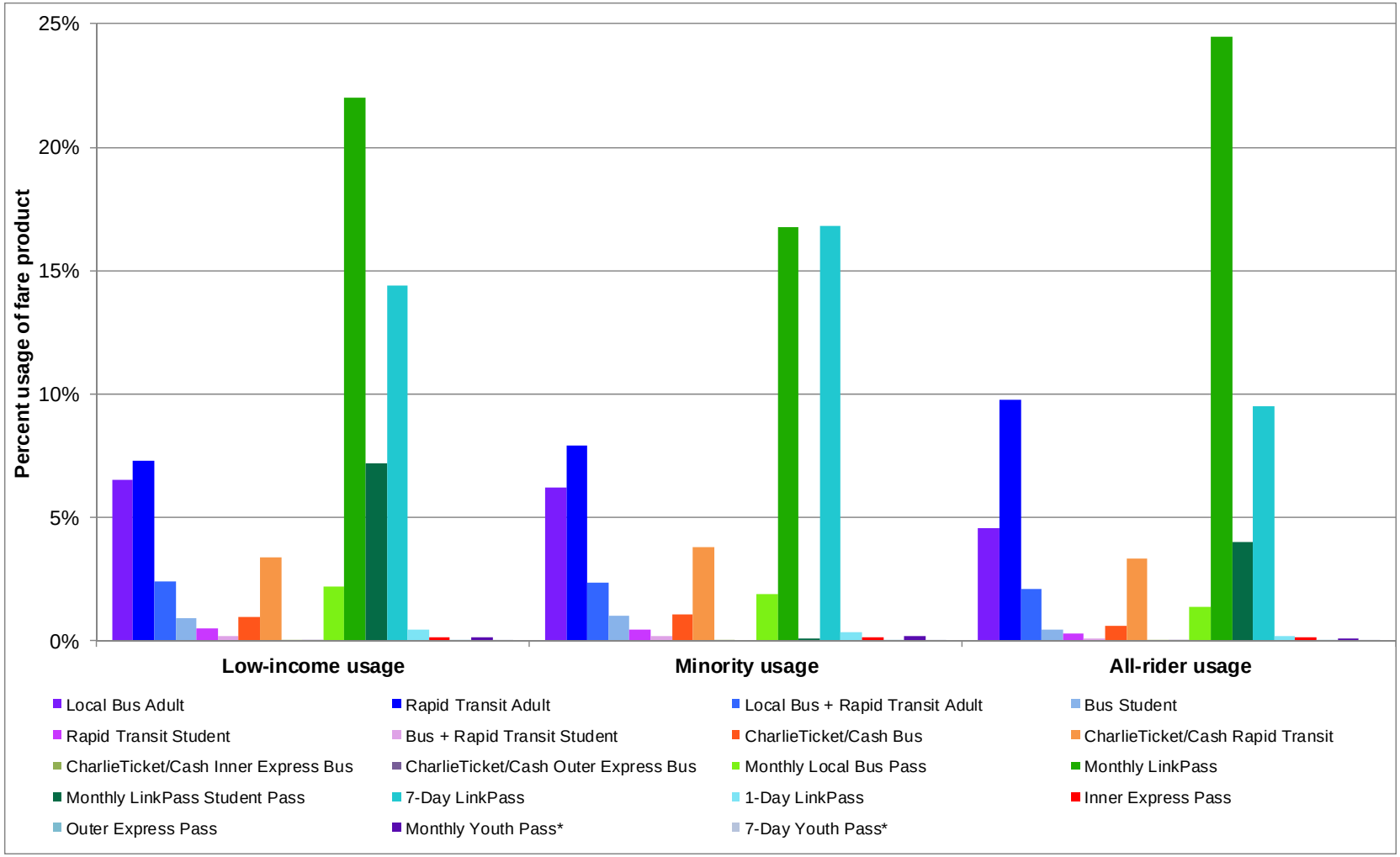
TABLE 4
Proposed Fare Change: Comparison of the Percentages of Change in Cost and Usage

Fare Type	Existing Cost	Proposed Cost	Absolute Change	Percent Change	Low-Income Usage	Minority Usage	All-Rider Usage
Local Bus Adult	$1.60	$1.60	$0.00	0%	3.7%	3.6%	2.6%
Rapid Transit Adult	$2.10	$2.10	$0.00	0%	4.1%	4.6%	5.5%
Local Bus + Rapid Transit Adult	$2.10	$2.10	$0.00	0%	1.4%	1.4%	1.2%
Bus Student	$0.80	$0.80	$0.00	0%	0.5%	0.6%	0.3%
Rapid Transit Student	$1.05	$1.05	$0.00	0%	0.3%	0.3%	0.2%
Bus + Rapid Transit Student	$2.10	$2.10	$0.00	0%	0.1%	0.1%	0.1%
CharlieTicket/Cash Bus	$2.10	$2.10	$0.00	0%	0.5%	0.6%	0.3%
CharlieTicket/Cash Rapid Transit	$2.65	$2.65	$0.00	0%	1.9%	2.2%	1.9%
CharlieTicket/Cash Inner Express Bus	$4.75	$4.75	$0.00	0%	0.0%	0.0%	0.0%
CharlieTicket/Cash Outer Express Bus	$6.80	$6.80	$0.00	0%	0.0%	0.0%	0.0%
Monthly Local Bus Pass	$50.00	$50.00	$0.00	0%	1.2%	1.1%	0.8%
Monthly LinkPass	$75.00	$75.00	$0.00	0%	12.4%	9.8%	13.9%
Monthly LinkPass Student Pass	$26.00	$26.00	$0.00	0%	4.1%	0.1%	2.3%
7-Day LinkPass	$19.00	$19.00	$0.00	0%	8.1%	9.8%	5.4%
1-Day LinkPass	$12.00	$12.00	$0.00	0%	0.3%	0.2%	0.1%
Inner Express Pass	$115.00	$115.00	$0.00	0%	0.3%	0.2%	0.3%
Outer Express Pass	$168.00	$168.00	$0.00	0%	0.1%	0.0%	0.1%
Monthly Youth Pass*	$75.00	$26.00	-$49.00	-65.33%	0.0%	0.0%	0.0%
7-Day Youth Pass*	$19.00	$7.00	-$12.00	-63.16%	0.0%	0.0%	0.0%

Data source: FERRET 2015, tool used by CTPS to analyze MBTA fare changes.

* The adult monthly LinkPass and the 7-Day Link Pass were used to represent the existing costs of the monthly Youth Pass and 7-Day Youth Pass, respectively, because they provide the same access to MBTA services as the Youth Pass products. The estimated usage for the Youth Pass products is based on average monthly trips made by pilot participants.

FIGURE 1
Fare Product Use by Rider Group



2.2 Assessment of Disparate Impacts and Disproportionate Burdens

As stated in the MBTA's Disparate Impact and Disproportionate Burden Policy, an assessment of disparate impacts requires a comparison of the impacts on minority riders or minority population of the MBTA service area to the impacts on all riders or population of the service area, respectively. The MBTA's policy also states that an assessment of disproportionate burdens requires a comparison of the burdens on low-income riders or the low-income population in the service area to the burdens on all riders or the population in the service area, respectively. For this analysis, only an assessment of disparate benefits for nonminority riders or the nonminority population, and disproportionate benefits for non-low-income riders or the non-low-income population, was required because the Youth Pass Pilot program is considered a benefit. To assess the potential disparate benefits for nonminority populations and/or disproportionate benefits for non-low-income populations of the Youth Pass Pilot program, CTPS conducted a two-part analysis, using the methodology described in FTA Circular 4702.1B. For the first part of the analysis, CTPS compared the percentage of minority and low-income youth in the municipalities participating in the pilot program to the percentage of minority and low-income youth enrolled in the pilot program who made transit trips using a Youth Pass product (Youth Pass participants). For the second part of the analysis , CTPS compared the average cost per trip for minority and low-income Youth Pass participants to the average cost per trip for Youth Pass participants overall.

Disparate and Disproportionate Benefit Analysis: Pilot Program Participation

The Youth Pass monthly and weekly fare products provide a benefit to eligible users because they provide access to the bus and rapid transit system at a cost significantly lower than that of similar pass products. To calculate the number and proportion of minority and low-income youth among Youth Pass participants, CTPS used demographic information—including minority and low-income household status—that participants provided in the Youth Pass Pilot program application form. CTPS then used US Census Public Use Micro Area (PUMA) and decennial US Census data to estimate the number and proportion of minority and low-income youth between the ages of 12 and 21 in the pilot program's four partner municipalities: Boston, Chelsea, Malden and Somerville.

Table 5 shows the percentage of minority and low-income youth among the Youth Pass participants and among the population of eligible youth in the four partner municipalities.

TABLE 5
Minority and Low-Income Characteristics of Youth Pass Pilot Program Participants and Eligible Youth in Participating Municipalities

	Minority	Percentage Minority	Low-Income	Percentage Low-Income	Total
Youth Pass participants	402	93.3%	314	72.9%	431
Population of eligible youth	74,716	56.3%	60,834	50.2%	131,671

Data sources: MBTA and US Census.

A significantly larger percentage (93.3 percent) of the Youth Pass Pilot program participants are minority than the percentage of minority youth among the eligible population in the four partner municipalities (56.3 percent). This indicates that the Youth Pass Pilot program is not likely to generate a disparate benefit to the nonminority population, and that the benefit of discounted passes is more likely to accrue to minority youth than to nonminority youth. Similarly, approximately 72.9 percent of Youth Pass Pilot program participants live in low-income households, but only 50.2 percent of youth ages 12–21 live in the four partner municipalities. This indicates that there is not likely to be a disproportionate benefit to the non-low-income population and that the benefit of discounted passes is more likely to accrue to low-income youth.

Disparate and Disproportionate Benefit Analysis: Cost per Trip

The MBTA uses the average cost per trip when conducting the disparate impact and disproportionate burden analysis because there is extensive use of multi-trip pass products in the MBTA's system.

CTPS used the following data to conduct this analysis:

- **Pre-pilot-program trip data:** The MBTA collected data on the trips made by the Youth Pass Pilot program participants before the participants were issued Youth Passes. Applicants provided the number of their current CharlieCard, if available, and signed a release allowing MBTA staff to access automated-fare-collection (AFC) data associated with their individual card. To preserve anonymity, each applicant was assigned an identification number to link their existing CharlieCard data to their demographic information, while the CharlieCard numbers and personal information were kept confidential.
- **Youth Pass trip data:** The MBTA analyzed the AFC data associated with Youth Pass cards to determine how Youth Pass participants made trips during the pilot program. The MBTA also assigned identification numbers to the Youth Pass cards, and kept the actual card numbers and personal information confidential in order to preserve anonymity.

CTPS used the identification numbers to link the AFC data to the demographic information that the participants had supplied through the Youth Pass Pilot program application form in order to compare the cost of trips of minority and low-income youth in the program to those of all of the participants in the program.

Table 6 presents the pre-program and program average cost per trip for minority youth and for all of the youth enrolled in the Youth Pass Pilot program.

TABLE 6
Disparate Benefit Analysis: Cost per Trip

	Cost per Trip before Youth Pass	Cost per Trip with Youth Pass	Percentage Increase or Decrease
Minority participants	$1.15	$0.88	-23.5%
All participants	$1.14	$0.88	-22.8%
Ratio			1.03
Threshold			0.80
Result of analysis			**No disparate benefit**

Data source: MBTA.

Ratio = The ratio of the percentage change in average cost per trip for minority participants to the percentage change in the average cost per trip for all participants.

Threshold = The analysis threshold for minor fare changes.

The average cost per trip for minority Youth Pass Pilot program participants decreased by $0.27 (23.5 percent), while for all Youth Pass participants the average cost per trip decreased by $0.26 (22.8 percent). There is a slightly larger decrease in the per-trip cost for minority Youth Pass participants than for all Youth Pass participants, resulting in a ratio of 1.03 (the change in the average cost per trip for minority participants divided by the change in the average cost per trip for all participants). This ratio of the benefit for minority participants to all participants demonstrates that minority Youth Pass participants are meeting the policy threshold for minor fare changes (receiving more than 80 percent of the benefits). Therefore, there is no disparate benefit for nonminority participants.

Table 7 presents the pre-program and program average cost per trip for low-income Youth Pass participants and for all Youth Pass Pilot program participants overall.

TABLE 7

Disproportionate Benefit Analysis: Cost per Trip

	Cost per Trip before Youth Pass	Cost per Trip with Youth Pass	Percentage Increase or Decrease
Low-income participants	$1.16	$0.84	-27.6%
All participants	$1.14	$0.88	-22.8%
Ratio			1.21
Threshold			0.80
Result of analysis			**No disproportionate benefit**

Data source: MBTA.

Ratio = The ratio of the percentage change in the average cost per trip for low-income participants to the percentage change in the average cost per trip for all participants.

Threshold = The appropriate analysis threshold for minor fare changes.

For low-income Youth Pass Pilot program participants, the average cost per trip decreased by $0.32 (27.6 percent), while for all Youth Pass Pilot program participants, the decrease in average trip cost was $0.26 (22.8 percent). There is a larger decrease in the average cost per trip for low-income Youth Pass participants than for all Youth Pass participants, resulting in a ratio of 1.21 (the change for low-income participants divided by the change for all participants). This ratio of the benefit for low-income participants to the benefit for all participants demonstrates that low-income Youth Pass participants are meeting the threshold for minor fare changes of receiving more than 80 percent of the benefits. Therefore, there is no disproportionate benefit for non-low-income participants.

2.3 Conclusions

The Youth Pass monthly and weekly fare products would provide a benefit to eligible users because they provide access to the bus and rapid transit system at a significant discount when compared to similar pass products. Based on data collected prior to and during the pilot program (through October 15, 2015), CTPS found that the percentages of minority youth and low-income youth participating in the Youth Pass Pilot program are higher than the percentages of minority youth and low-income youth living in the four municipalities that are participating in the pilot program (Boston, Chelsea, Malden, and Somerville). This suggests that there is no disparate benefit to nonminority youth in the program, and no disproportionate benefit to non-low-income youth in the program. When analyzing the average trip cost for minority, low-income, and all Youth Pass Pilot program participants, CTPS found that the two Youth Pass products result in no disparate benefit to nonminority youth in the program, and no disproportionate benefit to non-low-income youth in the program.

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APPENDIX A:
ADDITIONAL FARE EQUITY ANALYSES

In addition to the FTA-required fare equity analyses presented above, CTPS conducted analyses to examine:

- The percentage of participants in the Youth Pass Pilot program in each municipality who are minority and the percentage who are low-income, and the percentage of the whole youth population of each municipality who are minority and who are low-income
- The percentage of minority and low-income Youth Pass participants at each stage of pilot program enrollment
- Changes in the average number of monthly trips made by minority and low-income participants before and during the Youth Pass Pilot program
- Change in the share of monthly bus trips from the period before the Youth Pass Pilot program to the share during the program for minority and low-income participants, respectively, and the same analysis for monthly rapid transit trips

Percentage of Minority and Low-Income Pass Participants by Municipality

The four municipalities participating in the Youth Pass Pilot program—Boston, Chelsea, Malden, and Somerville—have different demographic characteristics. This section examines the minority and low-income status of program participants by municipality and compares the demographics of the program participants to those of all youth in each municipality.

Using the participant identification number, CTPS linked each participant's automated-fare-collection (AFC) system data to their demographic information. Table A-1 provides information on the percentage of Youth Pass Pilot program participants who are minority and low-income youth for each municipality and among people aged 12–21 in each municipality. Very few participants from Chelsea and Somerville appeared in the MBTA AFC datasets, so these municipalities are not represented in Table A-1 or in other tables.

TABLE A-1
Youth Pass Pilot Program Participants by Minority and Low-Income Status by Municipality

	Percentage of Minority Youth Pass Participants	Percentage of Minority Youth in Municipality	Percentage of Low-Income Youth Pass Participants	Percentage of Low-Income Youth in Municipality
Boston	93.0%	57.9%	75.2%	52.9%
Chelsea	NR	88.3%	NR	37.5%
Malden	94.7%	59.1%	65.3%	30.1%
Somerville	NR	44.60%	NR	38.6%
Average	93.3%	58.4%	72.9%	50.2%

Data source: MBTA and US Census.

NR = not reliable. There was not a large enough sample to provide a meaningful or statistically-significant statistic. The average Youth Pass minority percentage and the average Youth Pass low-income percentages reflect data from Boston and Malden only.

Table A-1 shows that the percentage of minority and low-income youth among Youth Pass participants from Boston and Malden is higher than the percentage of minority and low-income youth living in those two municipalities. This supports the conclusion that the pilot program does not create disparate benefits to nonminority youth or disproportionate benefits to non-low-income youth.

Percentage of Minority and Low-Income Youth Pass Participants in Various Pilot Program Enrollment Stages

Youth in the Youth Pass Pilot program need to complete the following steps in order to participate in the program:

- All applicants fill out the program application, which collects data on applicant demographic and school-enrollment characteristics, and on the use of past MBTA fare products
- Applicants who are admitted to the pilot program (up to 1,500) fill out an enrollment survey, which collects data on trip-making behavior and on satisfaction with the MBTA system and services, and then sign (or have a parent or guardian sign) a release form to allow data collection, including trip-making data
- All participants receive a CharlieCard with no pre-loaded stored value or pass products. Each participant adds value or a non-Youth Pass product

to his or her card and uses the card in order for pre-pilot-program data to be collected for 30 days

- All participants return to the municipal office after 30 days to receive a Youth Pass CharlieCard, and purchase a monthly or 7-Day Youth Pass that they can use to make trips, which are logged through the MBTA's automated-fare-collection (AFC) system
- All participants return to the municipal office to renew the Youth Pass and fill out a monthly survey

For each step, a participant needs to either spend time completing a form and/or travel to a municipal office. These requirements may create barriers to participation in the Youth Pass Pilot program.

CTPS examined the demographic characteristics of the youth who completed each step to determine if the enrollment process resulted in a disparate benefit for nonminority populations or a disproportionate benefit for non-low-income populations. For this memorandum, CTPS did not examine the effect of the fourth step—return to the municipal office to renew the Youth Pass— because a majority of Youth Pass Pilot program users are enrolled in middle and high school (77.5 percent), and a calculation of the length of time in the Youth Pass Pilot program would be heavily skewed by students who return to using either a self-purchased or school-provided Student Pass products. Table A-2 shows the percentages of Youth Pass participants by minority and low-income status at each step of the pilot program.

TABLE A-2
Youth Pass Pilot Program Participants by Minority and Low-Income Status at Each Enrollment Step

	Minority	Percentage Minority	Low-Income	Percentage Low-Income	Total
Completed application	3,575	90.3%	3,035	76.6%	3,961
Completed enrollment survey	788	92.9%	631	74.4%	848
Purchased and used Youth Pass	402	93.3%	314	72.9%	431
Total youth population	74,716	56.3%	60,834	50.2%	131,671

Data source: MBTA.

As shown in Table A-2, there is an increase in the proportion of minority participants at each successive step; there is a larger percentage of minority

youth among those using the Youth Pass (93.3 percent) than among those who completed the enrollment survey (92.9 percent), which is itself larger than the percentage of minority youth in the applicant pool (90.3 percent). The increase in the proportion of minority participants at each successive step indicates that there is no disparate barrier for minority populations to entering this program and therefore no disparate benefit for nonminority populations.

Table A-2 also shows that there is a decrease in the proportion of low-income participants at each subsequent step; there is a smaller percentage of low-income youth in the population of people using a Youth Pass (72.9 percent) than the percent of low-income youth in the population of participants who took the enrollment survey (74.4 percent), which is itself smaller than the percentage of low-income youth in the applicant pool (76.6 percent). This trend is the opposite of the one identified for minority youth.

However, the percentage of low-income youth at all stages of the Youth Pass Pilot program—application, enrollment survey, and pass use—is higher than the percentage of low-income youth in the participating municipalities (50.2 percent). CTPS found a disproportionate benefit to non-low-income youth with respect to the enrollment process, and the trend suggests that there is a need to monitor these statistics to determine if the enrollment process is a potential barrier to entry to the pilot program for low-income youth. Most of these enrollment steps will be eliminated in the full Youth Pass program implementation, removing this potential barrier to low-income youth participation.

Changes in Overall Monthly Trip-Making by Minority and Low-Income Youth

The MBTA's unlimited-ride passes provide a benefit to pass holders because the average cost per trip is generally lower than if the user paid for individual trips. These passes, however, require a significant up-front cost, especially the adult Monthly LinkPass ($75.00) and the 7-Day LinkPass ($19.00). This up-front cost may prevent some riders, particularly low-income riders, from taking advantage of the lower per-trip costs available with a pass. The Youth Pass Pilot program provides youth riders with the benefits of 7-day and monthly pass products at a significantly lower cost ($7.00 for a 7-Day pass and $26.00 for a monthly pass). CTPS analyzed Youth Pass usage to see if participants made more trips per month, on average, using the Youth Pass than before they obtained a Youth Pass. Tables A-3 and A-4 summarize this analysis for minority and low-income youth, respectively.

TABLE A-3
Average Monthly Trips by Minority Youth Pass Pilot Program Participants before and during the Pilot Program

	Average Monthly Trips before Youth Pass	Average Monthly Trips with Youth Pass	Percentage Increase or Decrease
Minority youth	43	58	+ 34.9%
All youth	44	57	+ 29.5%
Ratio			1.18
Result of analysis			**No disparate benefit**

Data source: MBTA.

Ratio = The ratio of the percentage change in the average number of monthly trips for minority participants to the percentage change in the average number of monthly trips for all participants.

TABLE A-4
Average Monthly Trips by Low-Income Youth Pass Pilot Program Participants before and during the Pilot Program

	Average Monthly Trips before Youth Pass	Average Monthly Trips with Youth Pass	Percentage Increase or Decrease
Low-income youth	46	61	+ 32.6%
All youth	44	57	+ 29.5%
Ratio			1.10
Result of analysis			**No disproportionate benefit**

Data source: MBTA.

Ratio = The ratio of the percentage change in the average number of monthly trips of low-income participants to the percentage change in the average number of monthly trips of all participants.

Tables A-3 and A-4 show that the average number of trips per month for all Youth Pass participants increased by 30 percent once they had access to a Youth Pass. The average number of trips per month for minority participants increased by 35 percent when they participated in the Youth Pass Pilot program, while the average number of trips per month for low-income participants increased by 33 percent. These findings indicate that both minority and low-income Youth Pass participants accrue more benefit from the Youth Pass, in terms of the number of trips they make, than nonminority and non-low-income Youth Pass participants, respectively. The findings also indicate that there is no disparate benefit for nonminority Youth Pass participants and no disproportionate benefit for non-low-income participants.

Changes in Monthly Trip Making by Minority and Low-Income Participants by Mode

Fares for the MBTA rapid transit system are higher than those for local buses. The Youth Pass allows participants to make unlimited trips on both buses and rapid transit, effectively reducing the cost of rapid transit trips. This effective reduction in fare may improve participants' access to the rapid transit system and their mobility. It may decrease their travel times because, in some cases, rapid transit service runs more frequently than bus service, and, because rapid transit operates on its own right-of-way, it often provides faster service. CTPS examined whether Youth Pass participants made a larger share of their trips on rapid transit once they had access to a Youth Pass.

Tables A-5 and A-6 present the average share of monthly trips that minority, low-income, and all Youth Pass participants made by bus before and during the Youth Pass Pilot program.

TABLE A-5
Average Share of Monthly Trips by Bus before and during the Youth Pass Pilot Program by Minority Youth

	Average Share of Monthly Trips Made by Bus: before Youth Pass	Average Share of Monthly Trips Made by Bus: with Youth Pass	Percentage Increase or Decrease
Minority youth	37.3%	34.7%	-6.8%
All youth	37.4%	35.4%	-5.3%
Ratio			1.29
Result of analysis			**No disparate benefit**

Data source: MBTA.

Ratio = The ratio of the percentage change in the share of monthly trips made by bus by minority participants to the percentage change in the share of monthly trips made by bus by all participants.

TABLE A-6
Average Share of Monthly Trips by Bus before and during the Youth Pass Pilot Program by Low-Income Youth

	Average Share of Monthly Trips Made by Bus: before Youth Pass	Average Share of Monthly Trips Made by Bus: with Youth Pass	Percentage Increase or Decrease
Low-income youth	37.0%	33.5%	-9.3%
All youth	37.4%	35.4%	-5.3%
Ratio			1.76
Result of analysis			**No disproportionate benefit**

Data source: MBTA.

Ratio = The ratio of the percentage change in the share of monthly trips made by bus for low-income participants to the percentage change in the share of monthly trips made by bus by all participants.

As shown in Tables A-5 and A-6, there is a decrease in the share of trips made on the bus network by minority Youth Pass participants (- 6.8 percent), low-income Youth Pass participants (-9.3 percent), and all Youth Pass participants (-5.3 percent). All Youth Pass participants are likely to be benefiting from the better frequency and improved travel time of rapid transit services when they decrease the share of trips they make by bus each month and increase the share made by rapid transit. This analysis indicates that both minority and low-income Youth Pass participants are benefiting more than Youth Pass participants overall; therefore the pilot program is not creating a disparate benefit to nonminority participants or a disproportionate benefit to non-low-income participants.

Tables A-7 and A-8 present the average share of monthly trips that minority, low-income, and all Youth Pass participants made by rapid transit before and during the Youth Pass Pilot program.

TABLE A-7
Average Share of Monthly Trips by Rapid Transit before and during the Youth Pass Pilot Program by Minority Youth

	Average Share of Monthly Trips Made by Rapid Transit: before Youth Pass	Average Share of Monthly Trips Made by Rapid Transit: with Youth Pass	Percentage Increase or Decrease
Minority youth	62.7%	65.3%	+ 4.0%
All youth	62.7%	64.6%	+ 3.1%
Ratio			1.29
Result of analysis			**No disparate benefit**

Data source: MBTA.

Ratio = The ratio of the percentage change in the share of monthly trips made by rapid transit for minority participants to the percentage change in the share of monthly trips made by rapid transit for all participants.

TABLE A-8
Average Share of Monthly Trips by Rapid Transit before and during the Youth Pass Pilot Program by Low-income Youth

	Average Share of Monthly Trips Made by Rapid Transit: before Youth Pass	Average Share of Monthly Trips Made by Rapid Transit: with Youth Pass	Percentage Increase or Decrease
Low-income youth	63.1%	66.5%	+ 5.4%
All youth	62.7%	64.6%	+ 3.1%
Ratio			1.73
Result of analysis			**No disproportionate benefit**

Data source: MBTA.

Ratio = The percentage change in the share of monthly trips made by rapid transit for low-income participants to the percentage change in the share of monthly trips made by rapid transit for all participants.

There is an increase in the share of trips made on the rapid transit network for minority (4.0 percent), low-income (5.4 percent), and Youth Pass participants overall (3.1 percent). Youth Pass participants are most likely benefiting from increasing the share of trips they make by rapid transit each month. This analysis indicates that both minority and low-income Youth Pass participants are benefiting more than Youth Pass participants overall; therefore the pilot program is not creating a disparate benefit to nonminority participants or a disproportionate benefit to non-low-income participants.

APPENDIX B: DEFINITIONS

The sections below define some of the terminology used in this memorandum. The definitions and explanations are directly quoted from the FTA Title VI Circular 4702.1B and the MBTA Disparate Impact and Disproportionate Burden Policy, except where otherwise noted.

Terminology from FTA Circular 4702.1B

Disparate impact refers to a facially neutral [neutral on its face] policy or practice that disproportionately affects members of a group identified by race, color, or national origin, where the [FTA funding] recipient's [MBTA's, in this case] policy or practice lacks a substantial legitimate justification and where there exists one or more alternatives that would serve the same legitimate objectives but with less disproportionate effect on the basis of race, color, or national origin.

Disproportionate burden refers to a neutral policy or practice that disproportionately affects low-income populations more than it affects non-low-income populations. A finding of disproportionate burden requires the recipient to evaluate alternatives and mitigate burdens where practicable.

Low-income population refers to any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed FTA program, policy, or activity.

Minority persons [abbreviated definition] include the following groups: 1) American Indian and Alaska Native, 2) Asian, 3) Black or African American, 4) Hispanic or Latino, and 5) Native Hawaiian or Other Pacific Islander.

Minority population means any readily identifiable group of minority persons who live in geographic proximity and, if circumstances warrant, geographically dispersed/transient populations (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy, or activity.

Terminology from the MBTA Disparate Impact and Disproportionate Burden Policy

Adverse Effects. The MBTA will define and analyze adverse effects related to proposed fare changes or major service changes. The MBTA will measure the

loss (the adverse impact), or the gain (benefit), among minority and nonminority populations and among low-income and non-low-income populations, when conducting the equity analysis of proposed major service changes, and among minority and overall users and among low-income and overall users for any fare changes.

Fare Equity Analysis. Per FTA Circular C4702.1, the fare equity analysis is the required study conducted by large, urban transit agencies prior to the enactment of a fare increase or decrease. The analysis examines the impact that the fare change will have on minority and low-income users, based on each individual fare type (e.g., cash, CharlieCard, CharlieTicket, 1-day pass, weekly pass), when compared to the impact the fare change will have on all users.

Low-Income. The FTA Title VI guidelines define “low-income” as “a person whose median household income is at or below the US Department of Health and Human Services poverty guidelines.” As of 2013, the base level for a one-person household is $11,490 annually, with a $4,020 increase per household member. Because median incomes in the MBTA service area are high in comparison to national levels, the MBTA uses a more inclusive definition for low-income. The median household income for the years 2007 through 2011 for the 175-municipality MBTA service area was $69,393. A low-income census tract is defined as one in which the median household income in 2011 was less than 60% of that level, or $41,636.[2]

Major Fare Increase. As defined in the "Public Process for Changing MBTA Fares, and/or Fare Structure or Major Service Reductions" policy, major fare increases are defined as:

- Major changes to the fare structure; or
- A systemwide fare increase in which the percent increase in fare revenue realized by the MBTA would be 10 percent or more; or
- A systemwide fare increase of less than 10 percent that results in a cumulative increase in fare revenue of 10 percent or more within a three-year period.

[2] In its analyses, CTPS used the 2013 household income threshold (using data from the US Census American Community Survey) to define low-income households because this was the threshold in place when the pilot program launched in July 2015. In September 2015, the MBTA updated the household income threshold with new American Community Survey data; this new threshold will be used in future Title VI fare equity analyses.

Minor Fare Increase. As defined in the "Public Process for Changing MBTA Fares, and/or Fare Structure or Major Service Reductions" policy, minor fare increases are defined as:

- Minor changes to the MBTA fare structure; or
- A systemwide fare increase in which the percent increase in fare revenue realized by the MBTA would be less than 10 percent; or
- A systemwide fare increase of less than 10 percent that results in a cumulative increase in fare revenue of less than 10 percent within a three year period.

Policy Thresholds. [Summary from the MBTA's Disparate Impact and Disproportionate Burden Policy.] Policy thresholds are levels of impact that require the MBTA to conduct additional analysis, mitigation, or other actions to resolve potential disparate impacts or disproportionate burdens. These policy thresholds are described below for minor and major fare changes. There are also policy thresholds for service changes.

For minor fare changes:

- A disparate benefit would be found if the minority riders (population) are projected to receive less than 80 percent of the benefit that all customers (population) receive.
- A disproportionate benefit would be found if the low-income customers (population) are projected to receive less than 80 percent of the benefits that all customers (population) receive.
- A disparate burden would be found if the minority customers (population) are projected to sustain more than 20 percent additional burden than the total burden that all customers (population) sustain.
- A disproportionate burden would be found if the low-income customers (population) are projected to sustain more than 20 percent additional burden than the total burden that all customers (population) sustain.

For major fare changes:

- A disparate benefit would be found if the minority customers (population) are projected to receive less than 90 percent of the benefit that all customers (population) receive.
- A disproportionate benefit would be found if the low-income customers (population) are projected to receive less than 90 percent of the benefits that all customers (population) receive.

- A disparate burden would be found if the minority customers (population) are projected to sustain more than 10 percent additional burden than the total burden that all customers (population) sustain.
- A disproportionate burden would be found if the low-income customers (population) are projected to sustain more than 10 percent additional burden than the total burden that all customers (population) sustain.

For fare changes, the MBTA will compare the percentage change in the average fare for minority and nonminority riders and for low-income and non-low-income riders. For fare type changes, the MBTA will assess whether minority and low-income customers are disproportionately more likely to use the affected fare type or media than nonminority and non-low-income customers, respectively.

This policy could be represented by the following:

A disparate impact would be found if:

- Projected benefit to minority < 0.8 x projected benefit to all, for minor fare changes
- Projected benefit to minority < 0.9 x projected benefit to all, for major fare changes
- Projected burden to minority > 1.2 x projected burden to all, for fare minor changes
- Projected burden to minority > 1.1 x projected burden to all, for fare major changes

A disproportionate burden would be found if:

- Projected benefit to low-income < 0.8 x projected benefit to all, for minor fare changes
- Projected benefit to low-income < 0.9 x projected benefit to all, for major fare changes
- Projected burden to low-income > 1.2 x projected burden to all, for minor fare changes
- Projected burden to low-income > 1.1 x projected burden to all, for major fare changes

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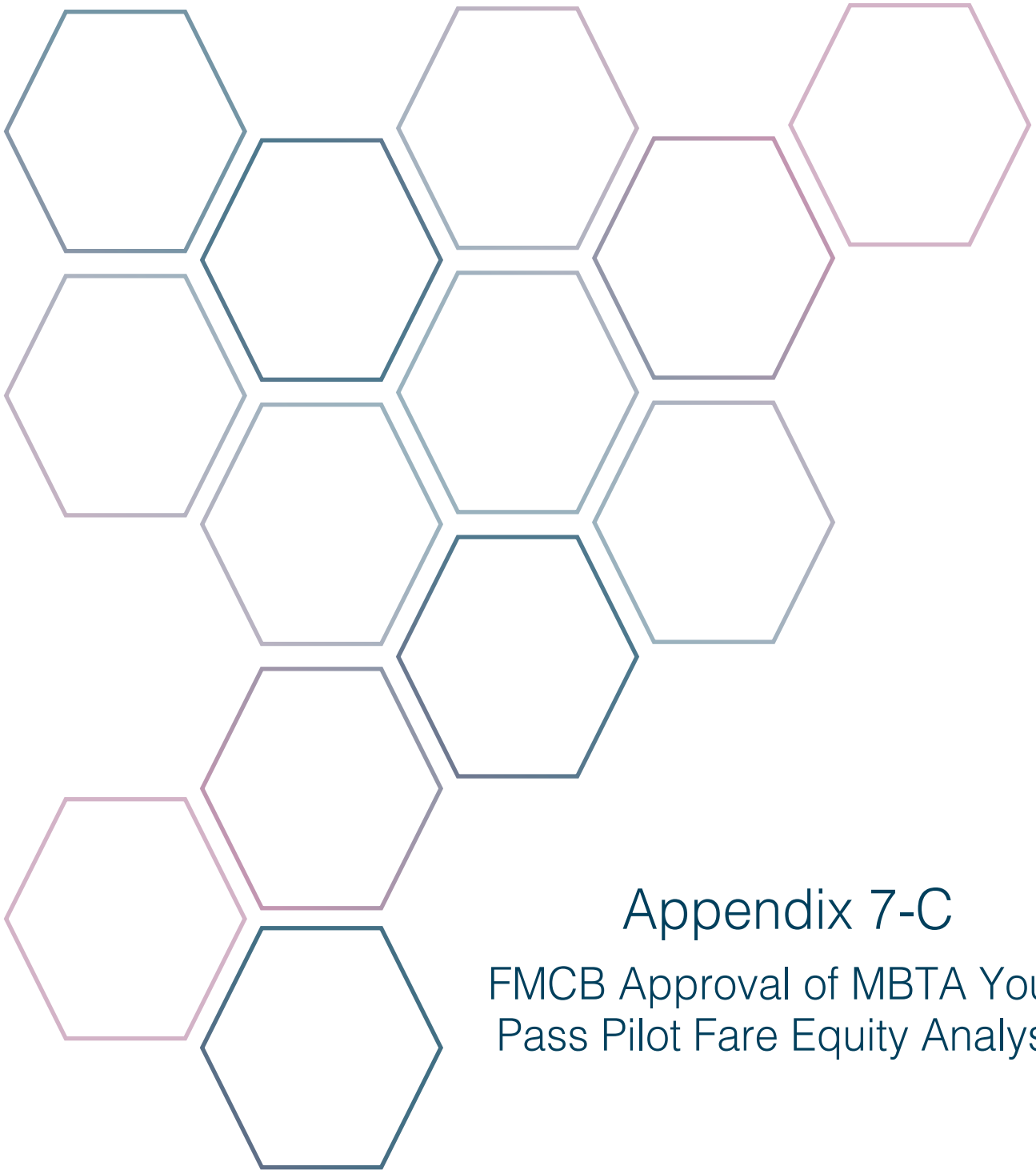

Appendix 7-C

FMCB Approval of MBTA Youth Pass Pilot Fare Equity Analysis

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Fiscal and Management Control Board

December 21, 2015
MassDOT Boardroom
10 Park Plaza, Suite 3830
Boston, MA

MEETING MINUTES

Members: Chairman Joseph Aiello, Director Lisa Calise, Director Brian Lang, Director Steven Poftak, and Director Monica Tibbits-Nutt

Present: Chairman Joseph Aiello, Director Lisa Calise, Director Steven Poftak, and Director Monica Tibbits-Nutt

Quorum Present: Yes

Other Participants: Secretary Stephanie Pollack, General Manager Frank DePaola, Chief Administrator Brian Shortsleeve, General Counsel John Englander, First Assistant General Counsel Marie Breen

PROCEEDINGS:

Call to Order by Chairman Aiello

The Chair called the meeting to order of business at 1:05pm.

The Chair opened up the meeting for public comment.

The first speaker was James White, chairman of ACCT who commented on options for the RIDE and elimination of service. Mr. White submitted a joint letter of opposition to the elimination or reconfiguration of the RIDE's premium service from AACT, BCIL, Mass. Senior Action Council, Disability Policy Consortium and the Bay State Council of the Blind

Next was Rick Morin from the Bay State Council for the Blind and ACCT Vice Chairman who also commented on the RIDE.

Next was Helen Azanow from Mass Senior Action who commented on the fare increase and elimination of the RIDE premium service. She also asked the Board to commit to meet with Mass Senior Action to create a task force to look at those issues.

Next was Josh Ostroff from Transportation for Mass. who commented on the fare policy. He also submitted to the Board 2,500 petitions to keep fares affordable and protect current MBTA service.

Next was Jeremy Mendelson from Transit Matters who commented on the fare policy. Mr. Mendelson also submitted a letter to the Board.

The next speaker was Louise Baxter from the TRU who stated she was against any fare increase and supported the youth pass.

Next was Maria Belen Power from the Chelsea Collaborative who spoke in support of the youth pass.

The next speaker was Cate Maas from the Chelsea Collaborative and the Chelsea Board of Health who commented on and was in support of the Arts on the T Program.

Next was Marilyn McNab who commented on the RIDE.

The last speaker was David Jenkins, Coordinator of the Youth Affordability Coalition who spoke in support of the youth pass.

PROCEDURAL ITEMS

Next was the approval of the minutes from the meeting of November 18, 2015.

On motion duly made and seconded, it was:

Voted to approve the minutes of the November 18, 2015 meeting.

PRESENTATIONS/DISCUSSION

Next Chairman Aiello asked Chief Administrator Brian Shortsleeve to give his report. Mr. Shortsleeve began his report by discussing overtime paid to MBTA employees through the operating and capital budget as of 12/15/15, as set forth in the attached presentation made to the board labeled "Chief Administrator's Report: MBTA FY 2015 Payroll Data."

Next General Manager Frank DePaola gave his report. He updated the board on the previous week's operations of heavy rail and commuter rail and said he would continue to look at on-time-performance. Mr. DePaola said he was working on the GLX 90-day look ahead schedule that would be presented at the January 4, 2016 FMCB meeting. He said he also received proposals to hire a new project manager for the GLX project and asked the board to authorize him to engage interim project management services for the project.

On motion duly made and seconded, it was:

VOTED: That the General Manager, or his designee, is hereby authorized to execute in the name of and on the behalf the Massachusetts Bay Transportation Authority (the "MBTA"), and in a form approved by the General Counsel, agreements and ancillary documents to effectuate the

following pertaining to the management, design and construction of the Green Line Extension ("GLX") Project:

1. **The engagement of interim project management services for the GLX Project; and**
2. **Such other extra work orders and other agreements, including the engagement of an executive search firm for project management leadership, associated with the GLX Project, that require action between this date and the next meeting of the Fiscal Management and Control Board on January 4, 2016, in a total amount not to exceed $250,000.**

And further voted, that the General Manager shall report to the FMCB on January 4, 2016 on expenditures made pursuant to this authorization.

Next, Chairman Aiello re- opened the public comment session to accommodate a speaker, Fred Lew from AACT who spoke against any fare increase to the RIDE.

The fourth item on the agenda was the discussion and action on the FMCB Annual Report as required by Section 207 of Chapter 46 of the Acts of 2015.

On motion duly made and seconded, it was:

VOTED: That the Fiscal and Management Control Board (the "FMCB") approve the report entitled "MBTA Fiscal and Management Control Board First Annual Report (the "Report"), including any amendments and revisions as directed by the FMCB; and

VOTED FURTHER: That the Report as amended, shall be submitted on December 22, 2015 in the name of and on behalf of the FMCB, to the Legislature, pursuant to Section 207(b) of Chapter 46 of the Session laws of 2015.

Chairman Aiello asked Laurel Paget-Seekins, Director of Strategic Initiatives to present the next agenda item, the discussion and action on the Fare Policy. Ms. Paget-Seekins said the policy will set forth guidelines for establishing and restructuring fares by the MBTA and will provide guidance with respect to charging fares as authorized by Chapter 161A of the Massachusetts General Laws. The policy addresses fare levels, including discounts, fare equity, and a fare structure, including but not limited to fare media and passes, and includes a system for free or substantially price-reduced transfer privileges, as set forth in the attached presentation made to the board labeled "Fare Policy Revisions, December 21, 2015."

On motion duly made and seconded, it was:

VOTED: **That the Fiscal and Management Control Board (the "FMCB") hereby adopts the Authority's revised 2016 MBTA Fare Policy, as presented to this Board on December 21, 2015, including any amendments and revisions as directed by the FMCB.**

Next, Chairman Aiello recognized a speaker who did not make it to the earlier public comment session. Bill Henning, Executive Director from BCIL, commented on the RIDE premium service and stated he looked forward to working with the MBTA on funding solutions for that service.

Next, the Chair asked Laurel Paget-Seekins, Director of Strategic Initiative to present the next item, the discussion of the Youth Pass Pilot Mid-Year Report. Ms. Paget-Seekins said the Youth Pass Pilot has increased transit

access for primarily low-income and minority youth allowing them access to recreational opportunities, work, school and medical appointments they would not have had otherwise. The collaborative partnership with municipalities has yielded an auditable reduced fare program with limited administrative impact of the MBTA. A key result of the pilot was that three-quarters of the participants were eligible for an existing MBTA reduced fare pass, but unable to access it due to their school not offering it or the limitations on summer months.

Ms. Paget-Seekins said the pilot has provided data to measure the impacts of the pilot, but the estimates for the full program range widely based on assumptions of municipal opt in and participation rates by eligible youth. These estimates also included the cost of effectively increasing the access to the existing Student Pass, as set forth in the attached presentation made to the board labeled "Youth Pass Pilot Mid-Year Report, December 21, 2015." **Chairman Aiello stated that it was noted that the FMCB has received and accepted the Youth Pass Title VI Report and there was no need for a formal vote.**

Next, Chairman Aiello asked CA Brian Shortsleeve to present the next item, an update of the Automated Fare Collection Systems. Mr. Shortsleeve said the key goals were to improve customer experience, increase revenue, reduce cost of fare collection and provide regional mobility and access, as set forth in the attached presentation made to the board labeled "Fare Collection Technology."

Next, the Chair asked Jerry Polcari, Chief Procurement Officer to update the board on the Red and Orange Line car construction. Bill Wolfgang, Director of Vehicle Engineering also participated in the discussion, as set forth in the attached presentation made to the board labeled “Red/Orange Line Procurement Update, December 21, 2015.”

After motion duly made and seconded, it was:

VOTED: To adjourn at 3:38pm.

DOCUMENTS RELIED ON IN THE MEETING

Minutes of November 18, 2015 meeting
DRAFT MBTA Fare Policy
Fare Policy Revisions PPP
MBTA Youth Pass Pilot Evaluation Preliminary Report
CTPS Youth Pass Pilot Program: Title VI Fare Equity Analysis
Youth Pass Pilot Mid-Year Report PPP
Fare Collection Technology PPP
Red/Orange Line Procurement Update PPP

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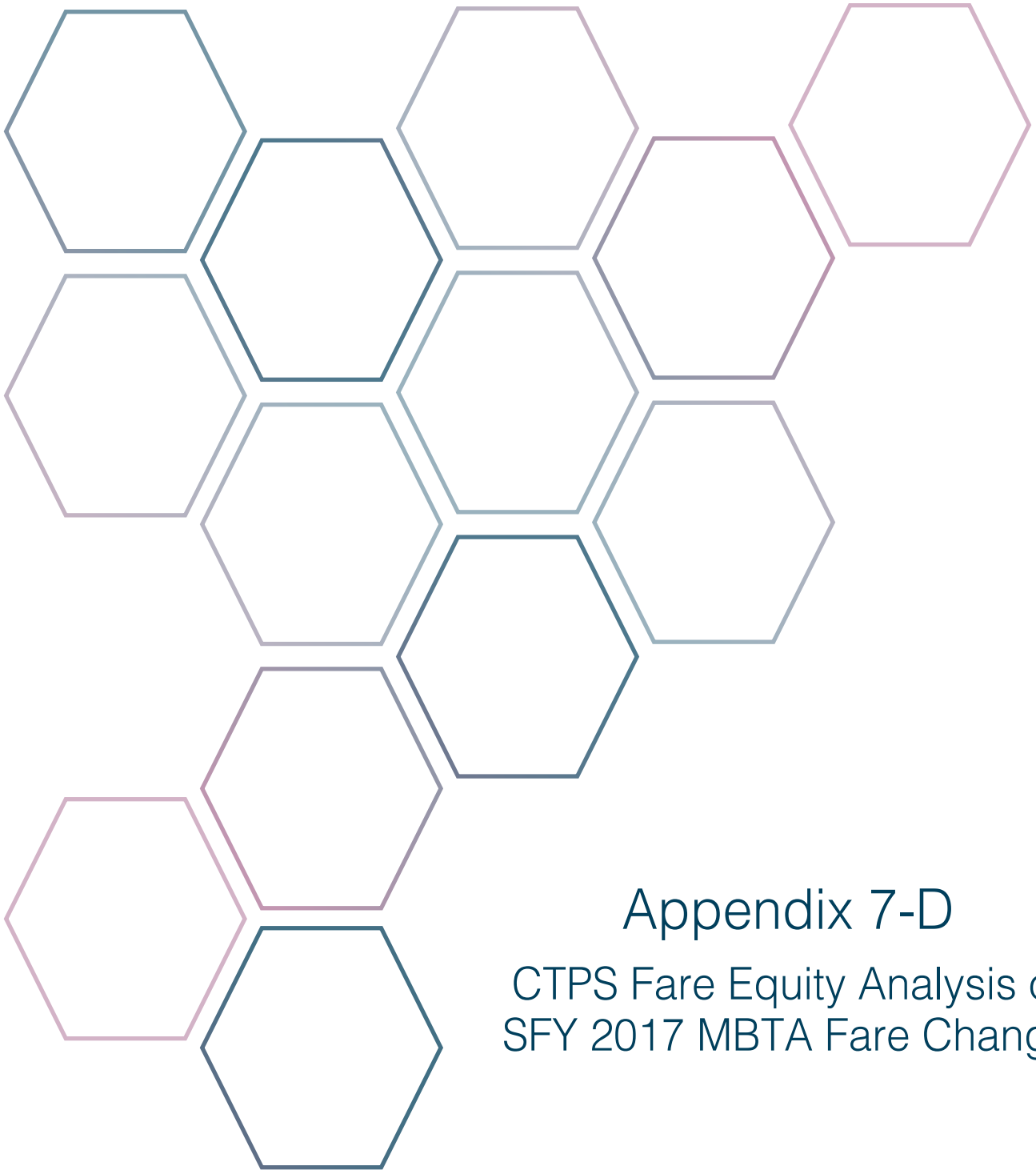

Appendix 7-D

CTPS Fare Equity Analysis of SFY 2017 MBTA Fare Change

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Potential MBTA Fare Changes in SFY 2017

Final Option: Impact Analysis

A report produced for the Massachusetts Bay Transportation Authority
by the Central Transportation Planning Staff

Potential MBTA Fare Changes in SFY 2017

Final Option: Impact Analysis

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March 2016

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ABSTRACT

This study analyzes the various effects of a potential MBTA fare-pricing scenario aimed at raising revenue to help meet revenue targets in state fiscal year (SFY) 2017. The proposed scenario would raise new revenue stemming from a nearly 9.3% average fare increase.

TABLE OF CONTENTS PAGE

Executive Summary

Before considering any changes in fares, the MBTA undertakes a comprehensive process to model the impacts of the changes. This modeling is done with the assistance of the Central Transportation Planning Staff (CTPS), which is the staff of the Boston Region Metropolitan Planning Organization (MPO). CTPS examines the impacts on ridership, revenue, and fare equity.

CTPS used an elasticity-based spreadsheet model known as the Fare Elasticity, Ridership, and Revenue Estimation Tool (FERRET) to estimate projected ridership loss associated with the proposed fare increase, and the net revenue change that would result from lower ridership and higher fares. CTPS produced a range of estimates of potential impacts on ridership and revenue and conducted a Title VI of the Civil Rights Act of 1964 (Title VI) fare-equity analysis to determine if the fare changes would result in disparate impacts for minority populations or disproportionate burdens for low-income populations.

Table 1 presents a summary of total ridership and revenue projections for SFY 2017. As the table indicates, revenue should increase by approximately 7.1% with a ridership loss of 1.5%.

TABLE 1
Revenue and Ridership Projections
for the Proposed Fare Increase: SFY 2017

Analysis Category	Existing Values	SFY 2015 Projections	Projected Change	Projected Pct. Change
Ridership	389.5 M	383.5 M	(5.9) M	(1.5)%
Revenue	$647.3 M	$693.1 M	$45.8 M	7.1%

Source: Central Transportation Planning Staff.
M= Million. SFY = State fiscal year.

Saved operating costs from trips no longer made on the MBTA's paratransit service, THE RIDE, are projected to be $929,000. Treating this saved cost as revenue yields an 7.7% increase.

In CTPS's fare-equity analysis, staff compared the absolute and relative fare increases between riders who are minorities and all riders, and between low-income riders and all riders. We applied the MBTA's disparate-impact and disproportionate-burden policies and found neither the presence of a disparate impact nor a disproportionate burden.

Chapter 1. Introduction

In recent years, the MBTA has managed to balance its budget through cost reductions, special appropriations by the Legislature, and fare and fee increases. In 2007, simultaneous with the introduction of the Automated Fare Collection (AFC) technology, the MBTA restructured its fare system and raised fares an average of 21%. The Authority did not raise fares again until July 2012 (SFY 2013), when it implemented a 23% average increase. Almost a year later, the state Legislature—in Chapter 46, An Act Relative to Transportation Finance—required that the MBTA attain revenue benchmarks, which it could satisfy by changing fares, fees, or any other funds directly collected by the Authority. In response, the MBTA established a pattern of modest, regularly scheduled fare changes, as needed, beginning with a minor fare increase in SFY 2015. As planned, the MBTA is continuing this pattern by increasing its fares in SFY 2017. The MBTA expects that modest, predictable fare increases would be less disruptive for the Authority and its customers compared to past major fare increases.

In January and February 2016, the MBTA hosted public meetings and a public hearing with customers and service-area residents regarding two proposed fare-change packages: Option 1, a smaller fare increase and Option 2, a larger fare increase. Those meetings resulted in some refinements to the previous fare-change packages. MBTA staff presented a refined version of Option 2 to the Fiscal Management Control Board, who recommended a final set of changes. In the pages that follow, the results of the final fare change package are presented.

1.1 Document Structure

The remainder of this document is organized as follows:

- Review of the methodology used for the analysis (Chapter 2)
- Description of the proposed fare changes (Chapter 3)
- Results of ridership and revenue analyses (Chapter 4)
- Results of a fare-equity analysis (Chapter 5)
- Conclusions (Chapter 6)

A detailed description of the FERRET methodology is provided in Appendix A.

Chapter 2. Methods Used to Estimate Ridership and Revenue

In consultation with the MBTA, CTPS used the spreadsheet application, FERRET, specifically to perform fare-change calculations to estimate the impact of the proposed fare increase on MBTA's ridership and revenue.

2.1 CTPS FERRET Approach

FERRET estimates the revenue and ridership impacts of the proposed fare-increase scenario. This model reflects the many fare-payment categories of the MBTA pricing system and applies price elasticities to analyze various changes across these categories. CTPS determined that this methodology met expectations through two post-fare increase analyses: 1) following the SFY 2007 fare restructuring, and 2) following the SFY 2013 fare increase.

Modeling of Existing Ridership and Revenue

Inputs to FERRET include existing ridership in the form of unlinked trips by mode, fare-payment method, and fare-media type. An unlinked trip is an individual trip on any single transit vehicle; a single journey, often composed of many unlinked trips on multiple vehicles, is a "linked trip."

The MBTA provided CTPS with existing ridership statistics (to which FERRET applies price elasticity values) for local bus, express bus, and rapid transit networks in the form of AFC data.[1] These data are for station, fare payment type (for example, cash, monthly pass, and weekly pass), fare media (for example, CharlieCard, CharlieTicket, cash), day of the week, and routes for buses and the light rail system.

Because the MBTA has not deployed AFC equipment on the commuter rail or commuter boat systems, CTPS estimated the number of trips made on these modes using sales figures. Single-ride trips on commuter rail and ferry were set equal to the number of single-ride fares sold. Staff estimated the number of trips made using passes on these modes by multiplying the number of pass sales by the estimated average number of trips made using the respective pass type (calculated using survey responses from a corporate pass-users survey conducted in spring 2008).

[1] "Existing ridership" is for SFY 2015 (July 1, 2014–June 30, 2015).

The MBTA also provided data for the number of trips made on THE RIDE by fare payment type, and the number of cars parked at MBTA parking lots. FERRET calculates revenue for single-ride trips by multiplying the number of trips in each fare/mode category by that category's price.[2] FERRET calculates revenue for pass trips by pass type by multiplying the number of pass sales by the pass price.[3] The model distributes pass revenue between mode categories based on each category's ridership and most-equivalent single-ride fare (generally, the lowest-priced adult fare).

Estimation of Ridership Changes Resulting from a Fare Increase

Fares are one of many factors that influence the level of ridership on transit services. Price elasticity is a measure of the rate of change in ridership relative to a change in fares if all other factors remain constant. On a traditional demand curve that describes the relationship between price, on the y-axis, and demand, on the x-axis, elasticities are equivalent to the slope along that curve. Price elasticities are usually negative, meaning that a price increase will lead to a decrease in demand (with a price decrease having the opposite effect). The larger the negative value of the price elasticity (the greater its distance from zero), the greater the projected affect demand. Larger (more negative) price elasticities are said to be relatively "elastic," while smaller negative values (closer to zero), are said to be relatively "inelastic."[4] Thus, if the price elasticity of the demand for transit were relatively elastic, a given fare increase would cause a greater loss of ridership than if demand were relatively inelastic. Appendix A.5 presents an example of how the concept of price elasticity is applied.

FERRET permits the use of various ranges of elasticities to estimate different possible ridership impacts of price increases. Performing calculations in FERRET with the same prices but with a range of higher and lower elasticities provides a range of estimates. In the present analysis, the model uses the middle range of elasticities, called the base elasticities, as these represent the best estimate of where the elasticities should be set based on past experience and a post-SFY

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[2] For example, if there were 30 million adult CharlieCard fares paid at stations, the revenue generated is equal to 30 million multiplied by $2.10—the adult CharlieCard fare—or $63 million.

[3] The MBTA offered discounted prices during May 2015. This analysis used the full price rather than the discounted price to estimate the total revenue generated by a pass type.

[4] More specifically, an elasticity of less than -1 is considered "elastic"—a 1% increase in price will cause a greater-than 1% decrease in demand; an elasticity of -1 is called "unit elasticity"—a 1% increase in price will cause a 1% reduction in demand; and an elasticity greater than -1 is called "inelastic"—a 1% increase in price will result in a lower-than 1% decrease in demand; an elasticity of 0 is called "perfectly elastic demand"—an increase in price does not affect demand.
The elasticity of transit ridership with respect to small fares changes is generally considered inelastic.

2013-fare increase analysis. For a description of how we determined the base elasticities, see Appendix A.4. However, we also use both more inelastic and more elastic elasticity values to determine a range of possible effects; the lower and higher ranges are plus or minus 0.10 the base value. If subtracting 0.10 from the base elasticity would result in an elasticity of 0.00, we subtracted 0.05 instead. This serves as a sensitivity analysis of the model's projections of the ridership losses and revenue gains. Table 2 presents the three elasticity ranges used in FERRET for this study's analysis.

FERRET also uses ridership diversion factors. These factors reflect estimates of the likelihood of a switch in demand from one MBTA product type or mode to another resulting from a change in the relative prices of product types or modes. The diversion factors essentially work to redistribute demand between two product types or modes after the model applies the respective price elasticities. Appendix A.5 presents examples of applying diversion factors and the methodology for using combined price elasticities and diversion factors. While diversion factors estimate the migration of riders between MBTA product types and modes based on their price, FERRET can only estimate the total loss of riders from the MBTA transit system, not the diversion of riders to specific non-MBTA modes such as driving, biking, or walking.

TABLE 2
Single-Ride and Pass Elasticities by Fare Type and Mode

Mode Category	Low	Base	High
Cash Elasticities			
Bus and Trackless Trolley			
Bus-Adult	(0.15)	(0.25)	(0.35)
Bus-Senior	(0.10)	(0.20)	(0.30)
Bus-Student	(0.05)	(0.15)	(0.25)
Subway			
Subway-Adult	(0.15)	(0.25)	(0.35)
Subway-Senior	(0.05)	(0.15)	(0.25)
Subway-Student	(0.05)	(0.10)	(0.20)
Surface Light Rail			
Surface Light Rail-Adult	(0.20)	(0.30)	(0.40)
Surface Light Rail-Senior	(0.10)	(0.20)	(0.30)
Surface Light Rail-Student	(0.05)	(0.15)	(0.25)
Commuter Rail			
Commuter Rail-Adult	(0.10)	(0.20)	(0.30)
Commuter Rail-Senior	(0.05)	(0.15)	(0.25)
Commuter Boat			
Commuter Boat-Adult	(0.20)	(0.30)	(0.40)
Commuter Boat-Senior	(0.15)	(0.25)	(0.35)
THE RIDE	(0.25)	(0.35)	(0.45)
Parking	(0.10)	(0.20)	(0.30)
Pass Elasticities			
Bus	(0.05)	(0.15)	(0.25)
Inner Express	(0.15)	(0.25)	(0.35)
Outer Express	(0.15)	(0.25)	(0.35)
LinkPass	(0.05)	(0.15)	(0.25)
1-Day LinkPass	(0.05)	(0.15)	(0.25)
7-Day LinkPass	(0.05)	(0.15)	(0.25)
Commuter Rail	(0.05)	(0.10)	(0.20)
Commuter Boat	(0.10)	(0.20)	(0.30)
Senior	(0.05)	(0.10)	(0.20)
Student	(0.05)	(0.10)	(0.20)

Source: FERRET.

Chapter 3. Description of Proposed Fare Increase Scenario

This chapter describes proposed changes in the MBTA's fare structure and the proposed SFY 2017 fares.

3.1 Fare Structure Changes

The MBTA proposed several fare structure changes for SFY 2017, including:

- Setting the cash and CharlieTicket fares to convenient-to-pay prices; that is, values that are multiples of $0.25
- Setting all discounted monthly LinkPasses (senior, Transportation Access Pass (TAP), and student) to the same price
- Eliminating the 10-ride tickets for boats and the commuter rail system
- Transferring all 5-day validity monthly student passes to 7-day validity monthly student passes, then discontinuing the redundant, less-beneficial 5-day validity student pass

3.2 Fare Changes: Single-Ride Fares and Pass Prices

Table 3 cites key existing and proposed single-ride fares for each fare category, along with the percentage change from existing to proposed price. Table 4 cites the same information for the pass prices. Table 5 presents the value of monthly passes in terms of their single-ride equivalents, a concept discussed at the end of this section. The MBTA is not implementing parking fee increases as part of this fare and fee structure change.

The overall price increase across all modes and fare/pass categories is 9.3%. This systemwide average is based on the percentage change between the existing average fare (total revenue divided by existing ridership) and the proposed average fare (total projected revenue divided by total projected ridership). Table 5 presents these average percentage increases by mode category. Percentage changes in price can differ between modes that are similarly priced, such as local bus and the Silver Line–Washington Street, or subway and surface light rail, because of differences in how riders on these modes pay for their trips (more riders use a monthly pass on the subway than on the surface light rail system, for example).

The percentage changes in prices are relatively consistent across fare payment types. The most notable departures from the baseline are:

- Neither commuter rail interzone 1–3 fares nor one-day LinkPass prices increase—a result of these products having relatively high fare increases in SFY 2015.
- The cross-harbor ferry fare decreases to match the commuter ferry fares.
- Neither the outer express single-ride CharlieCard fares nor the outer express pass price increases
- The local bus CharlieTicket and cash fares decrease by $0.10 to $2.00 to simplify payment

Another factor the MBTA considers when raising fares is the pass-ride value, or multiple, which is the number of trips required at the lowest-cost single-ride fare to match the cost of the pass.[5] Lower multiples indicate that a passenger needs to make fewer trips to make the pass financially worthwhile.

[5] For example, the monthly LinkPass currently costs $75.00. The lowest price single-ride rapid transit fare is $2.10, which a passenger may obtain by using a CharlieCard. Thus, a $75.00 monthly LinkPass is equal to 35.71 single-ride CharlieCard rapid transit trips.

TABLE 3
Key Single-Ride Fares: Existing and Proposed

Fare Category	Existing Fare	Proposed Fare	Percent Change	Absolute Change
CharlieCard				
Adult				
Local Bus	$1.60	$1.70	6.3%	$0.10
Rapid Transit	2.10	2.25	7.1%	0.15
Bus and Rapid Transit	2.10	2.25	7.1%	0.15
Inner Express	3.65	4.00	9.6%	0.35
Outer Express	5.25	5.25	0.0%	0.00
Senior				
Local Bus	$0.80	$0.85	6.3%	$0.05
Rapid Transit	1.05	1.10	4.8%	0.05
Bus and Rapid Transit	1.05	1.10	4.8%	0.05
Student				
Local Bus	$0.80	$0.85	6.3%	$0.05
Rapid Transit	1.05	1.10	4.8%	0.05
Bus and Rapid Transit	1.05	1.10	4.8%	0.05
CharlieTicket or Cash				
Adult				
Local Bus	$2.10	$2.00	(4.8)%	$(0.10)
Rapid Transit	2.65	2.75	3.8%	0.10
Bus and Rapid Transit	4.75	4.75	0.0%	0.00
Inner Express	4.75	5.00	5.3%	0.25
Outer Express	6.80	7.00	2.9%	0.20
Commuter Rail				
Zone 1A	$2.10	$2.25	7.1%	$0.15
Zone 1	5.75	6.25	8.7%	0.50
Zone 2	6.25	6.75	8.0%	0.50
Zone 3	7.00	7.50	7.1%	0.50
Zone 4	7.50	8.25	10.0%	0.75
Zone 5	8.50	9.25	8.8%	0.75
Zone 6	9.25	10.00	8.1%	0.75
Zone 7	9.75	10.50	7.7%	0.75
Zone 8	10.50	11.50	9.5%	1.00
Zone 9	11.00	12.00	9.1%	1.00
Zone 10	11.50	12.50	8.7%	1.00
Interzone 1	$2.75	$2.75	0.0%	$0.00
Interzone 2	3.25	3.25	0.0%	0.00
Interzone 3	3.50	3.50	0.0%	0.00
Interzone 4	3.75	4.00	6.7%	0.25
Interzone 5	4.25	4.50	5.9%	0.25
Interzone 6	4.75	5.00	5.3%	0.25
Interzone 7	5.25	5.50	4.8%	0.25
Interzone 8	5.75	6.00	4.3%	0.25
Interzone 9	6.25	6.50	4.0%	0.25
Interzone 10	6.75	7.00	3.7%	0.25
Ferry				
F1: Hingham	$8.50	$9.25	8.8%	$0.75
F2: Boston	8.50	9.25	8.8%	0.75
F2: Cross Harbor	13.75	9.25	(32.7)%	(4.50)
F2: Logan	17.00	18.50	8.8%	1.50
F4: Inner Harbor	3.25	3.50	7.7%	0.25
THE RIDE				
ADA Service Area	$3.00	$3.15	5.0%	$0.15
Premium Service Area	5.00	5.25	5.0%	0.25

Source: Central Transportation Planning Staff.

TABLE 4
Pass Prices: Existing and Proposed

Pass Category	Existing Fare	Proposed Fare	Percent Change	Absolute Change	Existing Multiple	Proposed Multiple
Local Bus	$50.00	$55.00	10.0%	$5.00	31.25	31.43
LinkPass	75.00	84.50	12.7%	9.50	35.71	37.56
Senior/TAP	29.00	30.00	3.4%	1.00	27.62	27.27
Student 5-Day Validity	26.00	30.00	15.4%	4.00	24.76	27.27
Student 7-Day Validity	26.00	30.00	15.4%	4.00	24.76	27.27
1-Day	12.00	12.00	0.0%	0.00	5.71	5.33
7-Day	19.00	21.25	11.8%	2.25	9.05	9.44
Inner Express	115.00	128.00	11.3%	13.00	31.51	32.00
Outer Express	168.00	168.00	0.0%	0.00	32.00	32.00
Commuter Rail						
Zone 1A	$75.00	$84.50	12.7%	$9.50	35.71	37.56
Zone 1	182.00	200.25	10.0%	18.25	31.65	32.04
Zone 2	198.00	217.75	10.0%	19.75	31.68	32.26
Zone 3	222.00	244.25	10.0%	22.25	31.71	32.57
Zone 4	239.00	263.00	10.0%	24.00	31.87	31.88
Zone 5	265.00	291.50	10.0%	26.50	31.18	31.51
Zone 6	289.00	318.00	10.0%	29.00	31.24	31.80
Zone 7	306.00	336.50	10.0%	30.50	31.38	32.05
Zone 8	330.00	363.00	10.0%	33.00	31.43	31.57
Zone 9	345.00	379.50	10.0%	34.50	31.36	31.63
Zone 10	362.00	398.25	10.0%	36.25	31.48	31.86
Interzone 1	$86.00	$90.25	4.9%	$4.25	31.27	32.82
Interzone 2	105.00	110.25	5.0%	5.25	32.31	33.92
Interzone 3	114.00	119.75	5.0%	5.75	32.57	34.21
Interzone 4	124.00	130.25	5.0%	6.25	33.07	32.56
Interzone 5	141.00	148.00	5.0%	7.00	33.18	32.89
Interzone 6	159.00	167.00	5.0%	8.00	33.47	33.40
Interzone 7	175.00	183.75	5.0%	8.75	33.33	33.41
Interzone 8	193.00	202.75	5.1%	9.75	33.57	33.79
Interzone 9	211.00	221.50	5.0%	10.50	33.76	34.08
Interzone 10	229.00	240.50	5.0%	11.50	33.93	34.36
Commuter Boat	$275.00	$308.00	12.0%	$33.00	23.08	24.14

Source: Central Transportation Planning Staff.

TABLE 5
Weighted Average Percentage Change in Average Fares, by Mode Category, for Unlinked Passenger Trips

Mode Category	Percent Change
Bus	**8.6%**
Rapid Transit	**9.5%**
Subway	9.6%
Silver Line–Washington St.	8.2%
Silver Line–Waterfront	9.8%
Surface Light Rail	9.4%
Commuter Rail	**9.2%**
Zone 1A	11.8%
Zone 1	9.8%
Zone 2	9.5%
Zone 3	9.2%
Zone 4	10.2%
Zone 5	9.7%
Zone 6	9.5%
Zone 7	9.3%
Zone 8	9.8%
Zone 9	9.8%
Zone 10	9.7%
Interzone	4.1%
Onboard	6.0%
Ferry	**9.5%**
F1: Hingham-Boston	9.7%
F2: Boston	9.5%
F2: Cross Harbor	(32.3)%
F2: Logan	9.7%
F4: Inner Harbor	8.6%
THE RIDE	**4.8%**
ADA Service Area	4.8%
Premium Service Area	4.8%
Total System	**9.3%**

Source: FERRET.

Chapter 4. Ridership and Revenue Impacts

4.1 Overview of Results

We estimate that these proposed fare changes would increase the MBTA's revenue by $45.8 million and decrease unlinked passenger trips by 5.9 million—excluding decreased utilization of MBTA parking lots.

4.2 FERRET Estimates

Projections

Table 6 presents CTPS's estimates of the fare revenue and ridership impacts of the fare increase produced using FERRET and its base elasticities.[6] The existing fare revenue and ridership numbers in the table represent adjusted existing conditions prior to the fare increase. The MBTA offered discounted passes in May 2015; the existing total revenue accounted for these discounted passes as full-price passes.

The total estimated fare revenue increase in this scenario is $45.8 million, a 7.1% increase. We estimate that the total estimated ridership loss would be 6.0 million unlinked passenger trips (including parking reductions), a 1.5% decrease. The estimated revenue increases are, on a relative basis, similar for all modes. The MBTA will derive the plurality of its new fare revenue from the heavy rail system ($16.2 million).

We expect THE RIDE's fare increase to result in decreased use of the service, and estimate a decline of approximately 31,000 trips on THE RIDE. The current average variable cost of operating a trip on THE RIDE is approximately $30.[7] Not providing these trips would save the MBTA approximately $929,000 in operating costs.

[6] See Chapter 2 for a discussion of the range of elasticities used in this analysis.

[7] A variable cost is a cost that changes as the quantity of service provided changes. This includes fuel costs and driver wages. Fixed costs do not change with change in quantity of service. Fixed costs could include those associated with storage facilities and certain administrative costs.

TABLE 6
FERRET Estimates of Annual Ridership Impacts
(in Unlinked Passenger Trips)

Mode	Existing Fare Revenue	Revenue Change	Revenue Change	Existing Ridership	Ridership Change	Ridership Change
Bus	$117,473,918	$8,396,557	7.1%	119,200,567	(1,603,251)	(1.3)%
Heavy Rail	205,419,713	16,216,994	7.9%	188,772,433	(3,113,054)	(1.6)%
Light Rail	71,521,262	5,213,467	7.3%	46,915,412	(804,603)	(1.7)%
Commuter Rail	196,410,110	15,610,697	7.9%	31,360,269	(370,937)	(1.2)%
Ferry	8,322,312	588,251	7.1%	1,181,046	(25,933)	(2.2)%
THE RIDE	5,805,368	183,595	3.2%	2,029,533	(30,866)	(1.5)%
Parking	42,379,890	(413,213)	(1.0)%	7,896,388	(74,391)	(0.9)%
Total System	**647,332,573**	**45,796,346**	**7.1%**	**397,355,649**	**(6,023,035)**	**(1.5)%**

Source: FERRET.

Notes: The average variable cost of each RIDE trip to the MBTA is $30.10. The combined changes in THE RIDE's fares would decrease ridership, causing the MBTA to save approximately $929,000 in operating expenses. Adding these saved operating costs to the new revenue, the net fiscal impact would be $46,725,000.
Parking ridership and revenue losses are not a result of parking price increases; rather they are a result of riders who once parked no longer parking because another part of their trip became more expensive. In this table, "Fare Revenue" represents the gross revenue generated from parking at lots where the MBTA retains the revenue. "Ridership" includes the number of vehicles that parked at these lots.

Sensitivity Analysis

Table 6 cites the results of FERRET using the base elasticities. Table 7 presents a sensitivity analysis of the model's results, showing the range of estimated fare revenue and ridership impacts using the range of elasticities shown in Table 2. In the ranges of ridership-change estimates in the table, the greater losses are those resulting from a higher range of elasticities; while in the ranges of fare-revenue-increase estimates, the greater increases are those resulting from a lower range of elasticities.

The use of higher-range elasticities results in much greater estimates of ridership losses: 9.75 million unlinked trips, compared to 2.65 million using the lower-range elasticities; using the base-range elasticities results in a loss of 6.02 million unlinked passenger trips (including parking reductions). As a result, the projected revenue gain from the fare increase estimated using the higher-range elasticities is approximately $39.3 million, compared to $51.5 million using the lower-range elasticities; using the base-range elasticities results in an increase of $45.8 million, as shown in Table 6.

TABLE 7
FERRET Estimate Ranges of Annual Ridership and Fare Revenue Impacts using Low and High Elasticities

Mode	Range of Increases in Revenue ($ in Millions)	Range of Revenue Percent Increases	Difference between Maximum and Minimum	Range of Ridership Changes (Trips in Millions)	Range of Ridership Percent Changes	Difference between Maximum and Minimum
Bus	$7.2 to 9.5	6.4 to 8.3%	$2.3	(2.66) to (0.65)	(2.2) to (0.7)%	2.01
Heavy Rail	$14.0 to 18.4	5.3 to 7.0%	$4.3	(4.97) to (1.37)	(2.0) to (0.5)%	3.60
Light Rail	$4.5 to 5.9	5.0 to 6.7%	$1.4	(1.25) to (0.38)	(2.1) to (0.6)%	0.87
Commuter Rail	$13.6 to 16.9	6.8 to 8.5%	$3.3	(0.67) to (0.18)	(2.1) to (0.6)%	0.49
Ferry	$0.5 to 0.7	5.7 to 7.6%	$0.2	(0.04) to (0.02)	(3.0) to (1.3)%	0.02
THE RIDE	$0.2 to 0.2	4.4 to 6.3%	$0.1	(0.04) to (0.02)	(3.4) to (1.9)%	0.02
Parking	$(0.7) to (0.2)	(1.4) to (0.3)%	$0.6	(0.13) to (0.03)	(1.4) to (0.3)%	0.10
Total System	**$39.3 to 51.5**	**5.5 to 7.2%***	**$12.2**	**(9.75) to (2.65)**	**(2.1) to (0.6)%***	**7.10**

Source: FERRET.
*These values refer to the percentage increase for the total changes in revenue or ridership systemwide compared to existing systemwide values. That is, the 7.2% revenue increase means that the total revenue increase for the low-elasticity iteration of FERRET represents a 7.2% increase systemwide in revenue over the existing systemwide revenue. The 7.2% relative increase corresponds to a $51.5-million increase.
In this table, "Fare Revenue" includes revenue generated from parking at lots where the MBTA retains the revenue. "Ridership" includes the number of vehicles that parked at these lots.

Where applicable, the MBTA also accounts for the cost of changing the system's levels of service. While the MBTA recognizes the inherent value to its customers of each trip made on its system, it is necessary to consider the cost associated with changes in THE RIDE usage—a significant item in the MBTA's budget. Table 8 explores the change in the cost of operating THE RIDE based on riders' reaction to fare changes.

Although we account for decreased operating costs caused by the loss of ridership on THE RIDE, we do not account for decreased operating costs resulting from lessened ridership on other modes. Decreased demand on the other modes would only translate to savings in operating costs if the MBTA were to reduce service levels, which would require a separate analysis that is not factored into this analysis.[8]

[8] It is relatively easy to save on operating costs with THE RIDE: If a trip is not taken, the MBTA does not pay the incremental cost to provide the service. On the MBTA's other modes, in the short term, if a passenger does not take a trip, the bus, train, or boat still must operate to serve the remaining passengers.

TABLE 8
FERRET Estimates of Annual Ridership and Fare Revenue Impacts Using Low, Base, and High Elasticities (THE RIDE)

Analysis Category	Low Elasticity	Base Elasticity	High Elasticity
Change of Ridership	(22,047)	(30,866)	(39,685)
Change of Revenue	$214,073	$183,595	$153,117
Saved Operating Costs	663,613	929,058	1,194,504
Net Impact (Revenue + Saved Operating Costs)	**$877,686**	**$1,112,653**	**$1,347,620**

Source: FERRET.

Chapter 5. Fare Equity Analysis

5.1 Requirements

Title VI of the Civil Rights Act of 1964 prohibits discrimination, either intentionally or unintentionally, by recipients of federal financial assistance based on race, color, or national origin. To comply with 49 CFR Section 21.5(b) (2), 49 CFR Section 21.5(b) (7), and Appendix C to 49 CFR Part 21, the MBTA must evaluate any fare changes to *fixed-route* modes prior to implementing them to determine if the proposed changes would have a discriminatory effect. This requirement applies to any fare change. The FTA provides guidance for conducting fare equity analyses in FTA Circular 4702.1B ("Circular"), Section IV.7.b. Prior to a fare change, the MBTA must analyze any available information generated from ridership surveys that indicates whether minority and/or low-income riders disproportionately more likely would use the mode of service, payment type, or payment media that would be subject to fare change. In addition, the MBTA must describe the datasets and collection methods used in its analysis.

The Circular states that the transit provider shall:

- Determine the number and percentage of users of each fare media subject to change
- Review fares before and after the change
- Compare the relative cost burden impacts of the proposed fare change between minority and overall users for each fare media
- Compare the relative cost burden impacts of the proposed fare change between low-income and overall users for each fare media

Under Title VI and other directives, the FTA requires that transit agencies develop a policy to assess whether a proposed fare change would have a "disparate impact" on minority populations or "disproportionate burden" on low-income populations. The FTA Title VI guidelines define "disparate impact" as "a facially neutral policy or practice that disproportionately affects members of a group identified by race, color, or national origin, where the recipient's policy or practice lacks a substantial legitimate justification and where there exists one or more alternatives that would serve the same legitimate objectives, but with less disproportionate effects on the basis, of race, color, or national origin," and "disproportionate burden" as "a neutral policy or practice that disproportionately affects low-income populations more than non-low income populations." A finding of disproportionate burden requires the recipient to evaluate alternatives and mitigate burdens where practicable.

5.2 MBTA Title VI Disparate-Impact and Disproportionate-Burden Policy

Policy Thresholds

The MBTA established the following policy thresholds for determining a disparate impact or disproportionate burden from a **major fare change**:

- A disparate benefit would be found if minority riders receive less than 90 percent of the benefit that all riders receive.
- A disproportionate benefit would be found if low-income riders receive less than 90 percent of the benefit that all riders receive.
- A disparate burden would be found if minority riders sustain more than 10 percent additional burden than the total burden that all riders sustain.
- A disproportionate burden would be found if low-income riders sustain more than 10 percent additional burden than the total burden that all riders sustain.

The policy thresholds are encapsulated in the following equations:

A disparate impact would be found if:

$$\text{Minority Benefit} < 90\% \times \text{All-Rider Benefit}$$
$$\text{Minority Burden} > 110\% \times \text{All-Rider Burden}$$

A disproportionate burden would be found if:

$$\text{Low-income Benefit} < 90\% \times \text{All-Rider Benefit}$$
$$\text{Low-income Burden} > 110\% \times \text{All-Rider Burden}$$

Upon finding a disparate impact or disproportionate burden based on a Title VI evaluation using the above threshold policy definition, the MBTA shall consider modifying the proposed changes in order to avoid, minimize, or mitigate the disparate impacts or disproportionate burdens of the proposed changes.

Demographics and Definitions

Demographics

The systemwide demographic profile in Table 9 below shows how the MBTA's ridership characteristics in terms of minority and income status vary by mode. Minority and low-income profile data of the MBTA's ridership is from the MBTA 2008–09 Systemwide Passenger Survey report published in July 2010.

TABLE 9
Demographic Profiles of MBTA Riders by Mode

Mode	Minority	Non-minority	No Response	Low-Income	Non-Low-Income	No Response
Rapid Transit	27.4%	68.7%	3.9%	21.6%	68.2%	10.2%
Bus and Trackless Trolley	45.0%	49.8%	5.1%	35.3%	49.9%	14.7%
Commuter Rail	13.7%	81.4%	4.9%	6.3%	81.0%	12.7%
Commuter Ferry and Boat	5.6%	89.1%	5.3%	3.8%	80.4%	15.8%
Total	**32.4%**	**63.1%**	**4.5%**	**25.1%**	**62.8%**	**12.2%**

Source: 2008–2009 MBTA Systemwide Passenger Survey.

Minority- and Low-Income Populations

The MBTA uses both United States Census data and passenger-survey data to define minority- and low-income populations. The census data are used when considering impacts on area residents. The survey data are used to assess impacts on riders.

Using US Census data, the MBTA defines minority- and low-income populations based on the average percentage of minority residents and average income levels for the service area. For the MBTA service area, these were identified for each census tract. Minority census tracts were defined as those in which the percentage of the non-white population (including the Hispanic population) was greater than the average for the MBTA service area. The average percentage of minority residents is 26.2% in the service area. A census tract is classified as low-income if its income level is at or below 60% of the median household income in the service area. For the 175-community MBTA service area, 60% of household median income is $43,415.[9]

When using the MBTA Systemwide Passenger Survey as a basis for analysis, the definition of a minority rider mirrors the definition provided above: a minority rider is a person who is non-white or Hispanic. A low-income individual is a person whose household income is less than $40,000—the income category from the survey that most closely matched the US Census-defined low-income threshold.

[9] Median household income was determined based on the 2009–13 American Community Survey. Minority percentages were determined based on the 2010 US Census.

5.3 Datasets, Data Collection Efforts, and Descriptions

CTPS used several datasets in the fare equity analysis:

- 2010 US Census and 2009–13 American Community Survey demographic data
- CTPS FERRET
- MBTA 2008–09 Systemwide Passenger Survey, published in July 2010
- The 2012 Rhode Island Commuter Rail Service Passenger Surveys Summary Report

The US Census provides a count of total population and population by ethnicity every 10 years; the most recent US Census occurred in 2010. Data on population by income level no longer is collected as part of the decennial US Census. Instead, we used more recent estimates from the American Community Survey (ACS)—that has replaced the long form of the decennial US Census, and provides estimates of total population as well as population by ethnicity and income level. We used ACS five-year estimates for the 2009–13 period—the most recently available data at the time we began our Title VI analysis. We used data from these sources to determine whether the units of analysis (census tracts) were minority, nonminority, low-income, or non-low-income.

FERRET is an elasticity-based spreadsheet model. CTPS has used this model in the past to provide inputs to the fare-increase analysis process. FERRET takes existing ridership in the form of unlinked trips by mode, fare-payment type, and fare media as inputs. The MBTA provides CTPS with ridership data from the automated fare collection system. For modes that are not yet part of the AFC system, the MBTA provides data (most notably, sales data for transit passes) to estimate ridership. Using these input data, FERRET employs elasticities and diversion factors to model a range of possible impacts resulting from changes in the MBTA's fares. (See Chapter 2 and Appendix A for further detail.)

The MBTA 2008–09 Systemwide Passenger Survey report, published in July 2010, included all of the transit modes operated by the MBTA—the Red, Blue, Orange, and Green Lines; commuter rail system; bus system; and ferry system. The survey questions asked for each mode varied based on the specific characteristics of the given mode; but common among all of the surveys were questions regarding origins, destinations, frequency of travel, and most important to this equity analysis, fare payment method, usage frequency, race, and income. In general, CTPS staff distributed the surveys from early morning until midafternoon. Each survey result was expanded to represent typical boardings during the survey hours. The systemwide survey was used in conjunction with

FERRET to estimate the number of riders using each fare type, and the fare changes for low-income, minority, and all riders.

The Rhode Island Department of Transportation (RIDOT) published the Rhode Island Commuter Rail Service Passenger Surveys Summary Report in August 2012.[10] RIDOT conducted the survey in June 2012. It distributed 245 surveys containing questions about race, ethnicity, and income at two MBTA stations (Wickford Junction and T.F. Green); 195 surveys were returned. Assuming the agency attempted to hand a survey to each rider, this represents an 80% return rate.

5.4 Equity Analysis and Results

CTPS used the MBTA Systemwide Survey in conjunction with FERRET to determine the number of riders using each fare type and the price change by fare type for minority, low-income, and all riders. Because the model's ridership values are in trips and the survey's values are in riders, CTPS used the survey responses for the frequency of travel, fare type, and minority/income status to translate surveyed riders into trips per surveyed rider by fare type by minority status and income status.

We used the equation below to determine the number of days per week a fare is used by a demographic classification. We weighted each survey response by the number of days per week the pass is used—data we also obtained from the systemwide survey. If 1,000 minority riders use monthly passes five days per week and 200 minority riders use monthly passes seven days per week, the average weighted usage per week for the minority riders using passes is equal to 5.33 days per week:

$$\text{Minority Pass Usage} = \frac{1{,}000 \times 5 + 200 \times 7}{1{,}000 + 200} = 5.33$$

If minority riders used passes 5.33 days per week, and nonminority riders used passes 4.25 days per week, and minority riders made up 25% of the total pass fares, the percentage of minority riders using that fare type is:

$$\text{Minority Pass Percentage} = \frac{5.33 \times 25\%}{(5.33 \times 25\%) + (4.25 \times 75\%)} = 29.5\%$$

We used this procedure for each type of pass to estimate the share of riders by demographic classification who use each fare type. We multiplied the resulting

[10] Rhode Island Commuter Rail Service Passenger Surveys: Summary Report. August, 2012, www.dot.ri.gov/documents/intermodal/2012_Commuter_Rail_Survey.pdf.

percentage by the total number of trips made using a fare type to estimate the number of riders by classification by fare. If the MBTA recorded 50 million total trips made using passes, the minority usage would be:

Total Minority Usage = 29.5% × 50 million trips = 14.8 million trips

Table 10 provides a snapshot of fare type usage by demographic group.[11] Low-income riders are somewhat more likely to use single-ride fares. When using a single-ride fare, minority riders and low-income riders are more likely to be on a bus and paying a student or senior fare. In an effort to minimize the impact of the fare increase on minority and low-income riders, the MBTA increased senior and student bus fares as little as possible—$0.05. The single-ride CharlieCard bus fare was increased $0.10, which is slightly less than the increase in the rapid transit single-ride fare on a relative basis. Further, the MBTA proposal includes fare decreases for the local bus cash and CharlieTicket fares—fare types used disproportionately more by minority and low-income riders. Riders who currently use a CharlieTicket or pay cash can obtain a CharlieCard to gain access to lower single-ride fares.

Minority and low-income riders are more likely to use a 7-Day LinkPass than a monthly LinkPass compared to all riders.[12] The MBTA added the 7-Day LinkPass during the 2007 fare structure changes to allow passengers who cannot afford to—or for some other reason do not—purchase a monthly pass at the beginning of the month to spread their purchases out over a longer period. Four 7-Day LinkPasses essentially cost the same as a monthly LinkPass. The 7-Day LinkPass is also somewhat more flexible—if someone knows they are not going to make enough trips in a given week for the pass to be worthwhile (say, during the winter holidays or school vacation), they can choose not to purchase it for that week.

[11] Minority and low-income riders share some of the same payment characteristics; however, the difference between how low-income riders and all riders pay is significantly more notable than the difference between payment trends of minority riders and all riders.

[12] The 7-Day LinkPass and the monthly LinkPass provide unlimited access to all local bus and rapid transit services.

TABLE 10
Minority, Low-Income, and All Riders Using Each Principal Fare-Payment Type

	Price		Change		Annual Usage in Unlinked Trips			Annual Usage Share of Group Total		
Fare-Payment Type	Existing	Proposed SFY 2017	Absolute	Percent	Minority	Low-Income	All Riders	Minority	Low-Income	All Riders
Local Bus										
Local Bus Pass	$ 50.00	$ 55.00	$ 5.00	10.0%	3,082,000	2,402,000	5,216,000	2.2%	1.8%	1.4%
Local Bus (Adult)	1.60	1.70	0.10	6.3%	9,162,000	7,880,000	17,432,000	6.5%	5.8%	4.6%
Local Bus (Senior)	0.80	0.85	0.05	6.3%	1,548,000	3,107,000	4,128,000	1.1%	2.3%	1.1%
Local Bus (Student)	0.80	0.85	0.05	6.3%	1,315,000	1,276,000	1,711,000	0.9%	0.9%	0.4%
Local Bus (CharlieTicket)	2.10	2.00	(0.10)	(4.8)%	632,000	627,000	1,024,000	0.5%	0.5%	0.3%
Local Bus (Cash)	2.10	2.00	(0.10)	(4.8)%	714,000	724,000	1,241,000	0.5%	0.5%	0.3%
Express Bus										
Inner Express Pass	115.00	128.00	13.00	11.3%	663,000	367,000	2,268,000	0.5%	0.3%	0.6%
Inner Express (Adult)	3.65	4.00	0.35	9.6%	236,000	210,000	564,000	0.2%	0.2%	0.1%
Inner Express (Senior)	2.35	2.50	0.15	6.4%	4,200	37,100	73,200	0.0%	0.0%	0.0%
Inner Express (Student)	2.35	2.50	0.15	6.4%	20,900	32,300	34,400	0.0%	0.0%	0.0%
Inner Express (CharlieTicket)	4.75	5.00	0.25	5.3%	6,900	3,500	26,000	0.0%	0.0%	0.0%
Inner Express (Cash)	4.75	5.00	0.25	5.3%	27,200	34,700	52,200	0.0%	0.0%	0.0%
Outer Express Pass	168.00	168.00	0.00	0.0%	124,000	36,900	512,000	0.1%	0.0%	0.1%
Outer Express (Adult)	5.25	5.25	0.00	0.0%	26,500	13,300	109,000	0.0%	0.0%	0.0%
Outer Express (Senior)	3.40	3.50	0.10	2.9%	NR	NR	14,400	0.0%	0.0%	0.0%
Outer Express (Student)	3.40	3.50	0.10	2.9%	NR	NR	700	0.0%	0.0%	0.0%
Outer Express (CharlieTicket)	6.80	7.00	0.20	2.9%	0	NR	3,500	0.0%	0.0%	0.0%
Outer Express (Cash)	6.80	7.00	0.20	2.9%	4,400	0	4,500	0.0%	0.0%	0.0%
Bus and Rapid Transit										
Bus and Rapid Transit (Adult)	2.10	2.25	0.15	7.1%	3,355,000	3,008,000	8,129,000	2.4%	2.2%	2.1%
Bus and Rapid Transit (Senior)	1.05	1.10	0.05	4.8%	478,000	988,000	1,462,000	0.3%	0.7%	0.4%
Bus and Rapid Transit (Student)	1.05	1.10	0.05	4.8%	299,000	278,000	408,000	0.2%	0.2%	0.1%
Bus and Rapid Transit (CharlieTicket)	4.75	4.75	0.00	0.0%	6,700	6,700	12,000	0.0%	0.0%	0.0%
Rapid Transit										
LinkPass	75.00	84.50	9.50	12.7%	30,775,000	21,246,000	93,563,000	22.0%	15.7%	24.5%
Senior/TAP Pass	29.00	30.00	1.00	3.4%	4,448,000	8,561,000	12,988,000	3.2%	6.3%	3.4%
Student 5-Day	26.00	30.00	4.00	15.4%	140,000	126,000	209,000	0.1%	0.1%	0.1%
Student 7-Day	26.00	30.00	4.00	15.4%	9,976,000	9,037,000	15,086,000	7.1%	6.7%	3.9%
1-Day Pass	12.00	12.00	0.00	0.0%	623,000	463,000	748,000	0.4%	0.3%	0.2%
7-Day Pass	19.00	21.25	2.25	11.8%	20,153,000	21,282,000	36,411,000	14.4%	15.7%	9.5%
Rapid Transit (Adult)	2.10	2.25	0.15	7.1%	10,210,000	10,041,000	37,311,000	7.3%	7.4%	9.8%
Rapid Transit (Senior)	1.05	1.10	0.05	4.8%	954,000	2,110,000	3,863,000	0.7%	1.6%	1.0%
Rapid Transit (Student)	1.05	1.10	0.05	4.8%	741,000	604,000	1,150,000	0.5%	0.4%	0.3%
Rapid Transit (CharlieTicket)	2.65	2.75	0.10	3.8%	4,711,000	4,694,000	12,558,000	3.4%	3.5%	3.3%
Rapid Transit (Cash)	2.65	2.75	0.10	3.8%	47,700	138,000	231,000	0.0%	0.1%	0.1%
Commuter Rail										
Zone 1A–10 Pass	$75.00–$362.00	$84.50–$398.25	$9.50–$36.25	10.0%–12.7%	4,793,000	1,661,000	28,943,000	3.4%	1.2%	7.6%
Zone 1A	$75.00	$ 84.50	$ 9.50	12.7%	910,000	483,000	3,004,000	0.7%	0.4%	0.8%
Zone 1	182.00	200.25	18.25	10.0%	265,000	82,600	1,759,000	0.2%	0.1%	0.5%
Zone 2	198.00	217.75	19.75	10.0%	553,000	180,000	4,483,000	0.4%	0.1%	1.2%
Zone 3	222.00	244.25	22.25	10.0%	630,000	171,000	4,429,000	0.5%	0.1%	1.2%
Zone 4	239.00	263.00	24.00	10.0%	770,000	240,000	4,267,000	0.6%	0.2%	1.1%
Zone 5	265.00	291.50	26.50	10.0%	350,000	110,000	2,492,000	0.2%	0.1%	0.7%
Zone 6	289.00	318.00	29.00	10.0%	650,000	164,000	4,276,000	0.5%	0.1%	1.1%
Zone 7	306.00	336.50	30.50	10.0%	367,000	114,000	2,069,000	0.3%	0.1%	0.5%
Zone 8	330.00	363.00	33.00	10.0%	289,000	109,000	2,080,000	0.2%	0.1%	0.5%
Zone 9	345.00	379.50	34.50	10.0%	7,600	6,400	60,000	0.0%	0.0%	0.0%
Zone 10	362.00	398.25	36.25	10.0%	1,600	1,800	23,500	0.0%	0.0%	0.0%

Fare-Payment Type	Price		Change		Annual Usage in Unlinked Trips			Annual Usage Share of Group Total		
	Existing	Proposed SFY 2017	Absolute	Percent	Minority	Low-Income	All Riders	Minority	Low-Income	All Riders
Zone 1A–10 Single Ride	$2.10–$11.50	$2.25–$12.50	$0.15–$1.00	7.1%–10.0%	1,086,000	769,000	8,273,000	0.8%	0.6%	2.2%
Interzone 1–10 Pass	$86.00–$229.00	$90.25–$240.50	$4.25–$11.50	4.9%–5.1%	21,600	6,400	140,800	0.0%	0.0%	0.0%
Interzone 1–10 Single Ride	$2.75–$6.75	$2.75–$7.00	$0.00–$0.25	0.0%–6.7%	29,300	20,700	223,000	0.0%	0.0%	0.1%
Ferry										
Commuter Boat Pass	$275.00	$ 308.00	$ 33.00	12.0%	8,000	6,600	298,000	0.0%	0.0%	0.1%
F1: Hingham	8.50	9.25	0.75	8.8%	14,200	5,500	403,000	0.0%	0.0%	0.1%
F2: Boston	8.50	9.25	0.75	8.8%	1,400	32,900	215,000	0.0%	0.0%	0.1%
F2: Cross Harbor	13.75	9.25	(4.50)	(32.7)%	0	100	400	0.0%	0.0%	0.0%
F2: Logan	17.00	18.50	1.50	8.8%	1,900	5,000	17,600	0.0%	0.0%	0.0%
F4: Inner Harbor	3.25	3.50	0.25	7.7%	22,700	15,900	238,000	0.0%	0.0%	0.1%
Free Transfers and Other Fares										
In-station Transfers	Free	Free	-	-	17,651,000	17,041,000	52,567,000	12.6%	12.6%	13.8%
AFC Noninteraction[1]	Free	Free	-	-	9,039,000	13,769,000	25,462,000	6.5%	10.1%	6.7%
Free trips[2]	Free	Free	-	-	1,039,000	1,142,000	3,563,000	0.7%	0.8%	0.9%
Short fares[3]	Variable	Variable	-	-	1,705,000	1,943,000	3,315,000	1.2%	1.4%	0.9%

Source: Central Transportation Planning Staff.

[1] AFC noninteraction is an estimate of the number of riders who do not interact with the AFC. The noninteraction categories include children aged 11 or younger, who are not required to pay a fare when riding with an adult; MBTA employees who are waved onto vehicles or otherwise bypass the AFC equipment; passengers who are allowed by MBTA employees to enter the paid area of a station without interacting with the AFC equipment; passengers who show an operator a valid pass rather than interacting with the farebox; passengers who board certain vehicles via the rear door; and passengers who simply do not pay a fare (not all of these categories apply to every mode). [2] Free trips include people who are not required to pay a fare. Some of these people pay with the Blind Access Card; others are PCAs. [3] Short fares are fares paid less than the full fare.

AFC = Automated fare collection. NR = No riders. PCAs = Personal care assistants. TAP = Transportation Access Pass.

Notes: Values greater than 100,000 are rounded to the nearest 1,000. Values less than 100,000 are rounded to the nearest 100. Percentages are calculated using unrounded values. NR indicates that no riders from a given classification responded to the survey.

Minority Riders Compared to All Riders and Low-income Riders Compared to All Riders

Table 11 presents existing and proposed average fares, and absolute and relative price changes for minority riders, low-income riders, and all riders. As the Circular indicates, fare equity analyses are applicable only to fixed-route modes; neither THE RIDE nor parking is included in the following analysis. Minority and low-income riders pay lower average fares compared to the overall average fare for all riders. This is largely because nonminority and non-low-income riders use the commuter rail system and other more expensive modes more than minority and low-income riders. At the proposed fare levels, minority and low-income riders would continue to pay lower average fares.

Results from Applying the Disparate-Impact and Disproportionate-Burden Policy Thresholds

The results of the analysis, shown in Table 11, show that there is no disparate impact on minority riders and no disproportionate burden on low-income riders when considering both the absolute and relative fare changes.

Application of the disparate-impact policy threshold shows:
The **absolute increase** in the average fare for minority riders is **82%** of the **absolute increase** in the average fare for all riders.

The **relative increase** (or the change taken as a percentage of the initial fare) in the average fare for minority riders is **101%** of the **relative increase** in the average fare for all riders.

Application of the disproportionate-burden policy threshold shows:
The **absolute increase** in the average fare for low-income riders is **62%** of the **absolute increase** in the average fare for all riders.

The **relative increase** in the average fare for low-income riders is **90%** of the **relative increase** in the average fare for all riders.

Because all differences in impacts are less than the 10% threshold in the disparate-impact and disproportionate-burden policy, we do not find a disparate impact on minority populations or disproportionate burden for low-income populations.

TABLE 11
Existing and Proposed Average Fares and Price Changes
(Weighted by Fare Usage Frequency)

Rider Classification	Existing Average Fare	Proposed Average Fare	Absolute Price Change	Percentage Price Change
Minority	$1.24	$1.36	$0.12	9.49%
Low-income	$1.06	$1.15	$0.09	8.46%
All Riders	$1.55	$1.69	$0.14	9.35%

Source: FERRET.
Note: The values in this table are rounded to the nearest cent or the nearest hundredth of a percent. All calculations were performed using unrounded values.

Chapter 6. Conclusions

CTPS conducted an analysis of the impacts of fare changes on ridership and revenue using a methodology based on established data inputs. These analyses show that the MBTA fare proposal would generate approximately $45.8 million of additional revenue, with an anticipated ridership decrease of 5.9 million trips annually. The resulting reduction of trips made on THE RIDE system should decrease operating costs by approximately $929,000 annually. The SFY 2017 fare changes likely would generate the additional revenue required to help meet the SFY 2017 revenue targets. The MBTA has made smaller, more regular fare increases a fare policy goal.

Staff applied the MBTA's disparate-impact and disproportionate-burden policy thresholds to assess the estimated Title VI and regional equity impacts of the proposed fare changes. We do not expect the fare increase to cause disparate impacts or disproportionate burdens.

Appendix A: FERRET Methodology

A.1 Apportionment of Existing Ridership

One of the first steps in starting a new iteration of FERRET is collecting new AFC and pass sales data—this data represent the largest share of the MBTA's ridership and revenue—and revenue and ridership reports for the ferries, THE RIDE, and the MBTA's parking lots.

The MBTA provides CTPS with AFC data summarized by hour, by day, for the various combinations of fare type, fare mode, and fare media (Table 12). After processing, AFC data can be attributed to each mode, fare type, and station (or Green Line branch). The fares for approximately 85% of all trips made on the system are paid using the AFC system.

The remaining trips are made using transit modes on which fares are not paid using the AFC system: commuter rail, commuter boat, THE RIDE, and parking. For these modes, we rely on fare-mix reports (that indicate how riders pay), various CTPS passenger surveys, and other ridership and revenue reports provided by the MBTA.

TABLE 12
AFC Fare Categories

Fare Type	Fare Mode	Fare Media
Adult/Senior/TAP/Student/Free	Single-Ride	CharlieCard CharlieTicket Onboard Cash
Adult/Senior/TAP/Student	Transfer	CharlieCard CharlieTicket
Short (fares below the full value)	Single-Ride	Onboard Cash
Bus/Inner Express/Outer Express	Pass	CharlieCard CharlieTicket
LinkPass: Monthly/1-Day/7-Day	Pass	CharlieCard CharlieTicket
Commuter Rail Zone and Interzone/Commuter Boat	Pass	CharlieCard CharlieTicket
Senior/TAP/Student	Pass	CharlieCard CharlieTicket

Source: Central Transportation Planning Staff.

A.2 Price Elasticity

Price elasticity measures the rate of change in ridership relative to a change in fares if all other factors remain constant. On a traditional demand curve that describes the relationship between price, on the y-axis, and demand, on the x-axis, elasticities are equivalent to the slope along that curve. Therefore, price elasticities generally are expected to be negative, meaning that a positive price increase would lead to a decrease in demand (with a price decrease having the opposite effect). The more negative (farther from zero) the value of a price elasticity, the larger the projected decrease in demand. More negative price elasticities are said to be relatively "elastic," while smaller negative values, closer to zero, are said to be relatively "inelastic." Thus, if the price elasticity of the demand for transit is assumed to be elastic, a given fare increase would cause a greater loss of ridership than if demand were assumed to be inelastic.

At its most elemental, FERRET is based on this simple price elasticity relationship, and requires four inputs: 1) original demand, 2) original fare, 3) new fare, and 4) price elasticity. The formula for calculating new demand is:

$$\text{New Demand} = \text{Original Demand} \times [1 + \text{Price Elasticity} \times (\text{New Fare} \div \text{Old Fare} - 1)]$$

As an example, assume that original demand equals 100 and that the impact we are modeling is a 10 percent fare increase from $1.00 to $1.10. Also assume that the price elasticity is -0.25.

$$\text{New Demand} = 100 \times [1 + -0.25 \times (\$1.10 \div \$1.00 - 1)] = 97.50$$

Thus, using an elasticity of -0.25, a simple price elasticity model projects that a 10 percent increase in price will lead to a 2.50 percent decrease in demand. With the fare increased from $1.00 to $1.10, this simplified example projects a 7.25 percent increase in revenue ($100.00 to $107.25).

A.3 Diversion Factors

FERRET's calculations are more comprehensive than a simple elasticity calculation. The model's greater detail lays in its use of ridership diversion factors. Diversion factors reflect estimates of the likelihood of a switch in demand for one type of good or service to another resulting from a change in the relative prices of those goods or services. In FERRET, we use such factors to estimate the number of riders who would choose to divert from one fare/mode to another.

Using cash tickets and passes as an example, assume that original ridership equals 100 cash riders and 1,000 pass riders. Also assume that original prices for cash tickets and passes equal $2.00 and $100.00, respectively, and that the

new prices are set at $1.50 for cash tickets and $50.00 for passes, representing price decreases of 25 percent and 50 percent, respectively. Assume that the cash price elasticity equals -0.35 and the pass price elasticity equals -0.25. Finally, assume a cash-to-pass diversion factor of 0.05 and a pass-to-cash diversion factor of 0.00.

In these calculations, one of the diversion factors must always equal zero, indicating that the diversion is expected to occur in one direction only. The direction of the diversion, and thus the diversion factor value, depends on the respective price changes of the two types of goods. The category with the greater relative price decrease (or the smaller relative price increase)—in this case, passes, for which the price decrease is 50 percent, compared to cash tickets, for which the price decrease is 25 percent—would gain riders from the diversion, while the other category, with the smaller relative price decrease (or the greater relative price increase), would lose riders from the diversion. Therefore, one would therefore expect that cash customers would switch to passes, but not that pass customers would switch to cash tickets, resulting in the 0.05 cash-to-pass and 0.00 pass-to-cash diversion factors.

The diversion factors essentially work to redistribute demand between the two categories after the respective price elasticities have been applied. For instance, after the cash fare is decreased from $2.00 to $1.50, the projected effect of price elasticity is that cash demand grows to 108.75 riders. Similarly, the pass price decrease from $100 to $50 leads to a projected increase in pass demand, because of price elasticity, to 1,125, for a total ridership of 1,233.75. However, the percentage decrease in the pass price is larger than that in cash fares (50 percent versus 25 percent); thus, one would expect some customers to switch from cash to pass.

This diversion is estimated by taking the ratio of new-to-original cash prices ($1.50 ÷ $2.00, or 75 percent), dividing that ratio by the ratio of new-to-original pass prices ($50 ÷ $100, or 50 percent), subtracting 1, and multiplying this result by the 0.05 diversion factor and the price-elasticity-estimated cash ridership (108.75). The number of riders “diverted” from cash to pass equals 2.72, giving final ridership estimates of 106.03 for cash and 1,127.72 for pass (still summing to a total ridership of 1,233.75).

New Cash Demand (Price Effect):

$$Cp = 100 \times [1 + -0.35 \times (\$1.50 \div \$2.00 - 1)] = 108.75$$

New Pass Demand (Price Effect):

$$Pp = 1{,}000 \times [1 + -0.25 \times (\$50 \div \$100 - 1)] = 1{,}125.00$$

Total Demand = 108.75 + 1,125.00 = 1,233.75

$$\text{Diverted Riders from Cash to Pass} = \left(\frac{\$NewCash/\$OldCash}{\$NewPass/\$OldPass} - 1\right) \times \text{Diversion} \times C_P$$

$$\text{Diverted Riders from Cash to Pass} = \left(\frac{\$1.50/\$2.00}{\$50/\$100} - 1\right) \times 0.05 \times 108.75 = 2.72$$

New Cash Demand = C_p − Diverted Riders from Cash to Pass = 106.03
New Pass Demand = P_p + Diverted Riders from Cash to Pass = 1,127.72
Total Demand = 106.03 + 1,127.72 = 1,233.75

We used diversion factors to estimate diversions between

- Cash and pass categories (for example, bus cash versus bus pass, subway cash versus subway pass)
- Bus and rapid transit (in other words, bus cash versus subway cash, bus pass versus subway pass)
- CharlieTicket/onboard cash and CharlieCard (for example, bus onboard cash versus bus CharlieCard, subway CharlieTicket versus subway CharlieCard)

Initially, we developed a range of diversion factors based on results of the 2007 Post-Fare Increase Impacts Analysis. We used these factors in the SFY 2013 fare increase analysis, and continued to use them in the SFY 2015 analysis. After reviewing the impacts of the SFY 2013 fare increase, we found sufficient evidence that the willingness of people to divert between passes and cash on the subway and light rail system would increase slightly.

Given that the fare increases are relatively level across all modes and fare media, these factors have a negligible effect on the results.

A.4 Price Elasticity Estimation

CTPS estimated the price elasticity of demand for the both the SFY 2015 and the SFY 2017 versions of the fare increase model based on a review of the changes in ridership, revenue, and price following implementation of the SFY 2013 fare increase. We used the demonstrated elasticities, which we calculated following our analysis of the impact of the SFY 2013 fare increase to guide our decisions about modifying the previously used set of elasticities. However, because factors in addition to fare changes also likely influenced the changes in ridership, we did not use the demonstrated elasticities for the SFY 2015 or SFY 2017 iterations of FERRET directly.

The following sections explain the process CTPS used to modify elasticities for the SFY 2015 and SFY 2017 iterations of FERRET, using the SFY 2013 demonstrated elasticities.

A.5 Calculating the Demonstrated Elasticity of Each Fare Type

Before we performed projections using the latest iteration of FERRET, we reviewed how ridership changed after past price changes to calculate demonstrated elasticities.

To calculate the demonstrated elasticity for a given fare, we used two pieces of information: the percentage change in fares and the percentage change in ridership. For each fare payment type on each mode, we calculated the percentage change between full SFY 2012 (before the fare increase) and full SFY 2013 (after the fare increase) ridership and fares using the formula:

$$\text{Percentage Change} = \frac{X_2 - X_1}{\left(\frac{X_2 + X_1}{2}\right)}$$

Where:
X_1 = SFY 2012 value (the year before the fare changes)
X_2 = SFY 2013 value (the year after the fare changes)

This formula provides the percentage change between X_1 and X_2 relative to the midpoint of X_1 and X_2. If $X_1 = 10$ and $X_2 = 20$, the formula would indicate that the percentage change relative to the midpoint (15) is equal to 66%.

For example, in SFY 2012, single-ride bus ridership was 22,441,080. SFY 2013 ridership was 21,237,096. The percentage change in ridership between these two years is:

$$\text{Percentage Change} = \frac{21{,}237{,}096 - 22{,}441{,}080}{\left(\frac{21{,}237{,}096 + 22{,}441{,}080}{2}\right)} = -5.5\%$$

For each relevant fare payment type, we calculated the demonstrated elasticity with respect to fares using the following formula:

$$\text{Elasticity} = \frac{\Delta\text{Ridership (in \%)}}{\Delta\text{Fare (in \%)}}$$

For example, the percentage change in single-ride ridership on MBTA buses from SFY 2012 to SFY 2013 was -5.5%. The percentage change in the fare was 19.5%. The demonstrated elasticity is calculated as follows:

$$\text{Elasticity} = \frac{\Delta\text{Ridership (in \%)}}{\Delta\text{Fare (in \%)}} = \frac{-5.5\%}{19.5\%} = -0.28$$

As another example, the total change in LinkPass ridership was -0.3%. The change in the average LinkPass trip price was 17.4%. The demonstrated elasticity is calculated as follows:

$$\text{Elasticity} = \frac{\Delta\text{Ridership (in \%)}}{\Delta\text{Fare (in \%)}} = \frac{-0.3\%}{17.4\%} = -0.02$$

Modifying the Elasticities of Each Fare Type for the Current Projection

Because the demonstrated elasticity values only incorporate the changes in fares and do not account for other factors that affect transit ridership—such as gas prices, employment levels, and development—we do not advise using the elasticities calculated based on results of the SFY 2013 fare increase in the SFY 2017 model. Some of the demonstrated elasticities could indicate that other factors are affecting ridership, especially for those results with positive values that appeared to indicate that ridership increased in response to the fare increase. Therefore, we only used the demonstrated elasticities, along with the following heuristics, to inform the modification of the SFY 2012 elasticities:

- If the value of a demonstrated elasticity was close to zero or positive, we modified the value to make it more inelastic (closer to zero)
- No elasticity was set to be greater than -0.10 (closer to zero)
- If an elasticity was used in SFY 2012 and the demonstrated elasticity was roughly similar, we did not modify the elasticity
- If the demonstrated elasticity was significantly more negative than the one we used in SFY 2012, we decreased the elasticity (made it more negative or more elastic)

Table 13 presents the elasticities we used to predict what might have happened following the SFY 2013 fare increase, the elasticities we calculated based on the actual changes between SFY 2012 and SFY 2013, the elasticities we used to project the effects of the SFY 2015 fare changes, and the estimated 2017 base elasticity.

TABLE 13
SFY 2012, Demonstrated, and SFY 2015 and SFY 2017 Elasticities

Mode Category	Estimated SFY 2013 Elasticity	Demonstrated SFY 2013 Elasticity	Estimated SFY 2015 and SFY 2017 Base Elasticity
Cash Elasticities			
Bus and Trackless Trolley			
Bus-Adult *(from example)*	(0.20)	(0.28)	(0.25)
Bus-Senior	(0.15)	(0.26)	(0.20)
Bus-Student	(0.15)	0.30	(0.15)
Subway			
Subway-Adult	(0.25)	(0.26)	(0.25)
Subway-Senior	(0.15)	(0.18)	(0.15)
Subway-Student	(0.15)	1.80	(0.10)
Surface Light Rail			
Surface Light Rail-Adult	(0.25)	(0.29)	(0.30)
Surface Light Rail-Senior	(0.20)	(0.19)	(0.20)
Surface Light Rail-Student	(0.20)	1.96	(0.15)
Commuter Rail			
Commuter Rail-Adult	(0.35)	0.01	(0.20)
Commuter Rail-Senior	(0.25)	0.37	(0.15)
Commuter Boat			
Commuter Boat-Adult	(0.30)	(0.34)	(0.30)
Commuter Boat-Senior	(0.20)	(0.75)	(0.25)
THE RIDE	(0.12)	(0.39)	(0.35)
Parking	(0.20)	(0.18)	(0.20)
Pass Elasticities			
Bus	(0.30)	(0.09)	(0.15)
Inner Express	(0.20)	(0.33)	(0.25)
Outer Express	(0.20)	(0.33)	(0.25)
LinkPass *(from example)*	(0.30)	(0.02)	(0.15)
1-Day LinkPass	(0.35)	0.41	(0.15)
7-Day LinkPass	(0.35)	0.09	(0.15)
Commuter Rail	(0.10)	(0.17)	(0.10)
Commuter Boat	(0.25)	(0.17)	(0.20)
Senior	(0.15)	0.23	(0.10)
Student	(0.15)	(0.04)	(0.10)

Source: Central Transportation Planning Staff.

Notes: The estimated SFY 2013 elasticity is the one we used to estimate the effects of the SFY 2013 fare increase.

The demonstrated SFY 2013 elasticity is the one we calculated based on ridership changes following the SFY 2013 fare increase.

The estimated SFY 2015 and SFY 2017 base elasticity is the elasticity we used to estimate the effects of the SFY 2015 and SFY 2017 fare increases.

A.6 Examples of Ridership and Revenue Calculations

Simple Example: Price Elasticity Only
Given:
Original Demand: 100,000
Original Fare: $1.50
New Fare: $2.50
Price Elasticity: -0.05
New Demand =
Original Demand × [1 + Price Elasticity × (New Fare ÷ Old Fare − 1)]
New Demand = 100,000 × [1 + −0.05 × ($2.50 ÷ $1.50 − 1)] = 96,666.67

More Complex Example: Price Elasticity plus Ridership Diversion — Cash to Pass
Given:
Original Cash Demand: 10,000
Original Cash Fare: $2.25
New Cash Fare: $2.00
Cash Price Elasticity: -0.30
New Demand =
Original Demand × [1 + Price Elasticity × (New Fare ÷ Old Fare − 1)]
New Cash Demand (Price Effect),
C_p = 10,000 × [1 + −0.30 × ($2.00 ÷ $2.25 − 1)] = 10,333.33

Given:
Original Pass Demand: 5,000
Original Pass Price: $71.00
New Pass Price: $50.00
Pass Price Elasticity: -0.25
New Pass Demand (Price Effect),
P_p = 5,000 × [1 + −0.25 × ($50 ÷ $71 − 1)] = 5,369.72
Total Demand = 10,333.33 + 5,369.72 = 15,703.05
Percentage Change in Cash Price: $2.25 to $2.00: -11%
Percentage Change in Pass Price: $71 to $50: -30%

Given:
Cash-to-Pass Diversion Factor: 0.05
Pass-to-Cash Diversion Factor: 0.00
Diverted Riders from Cash to Pass = $\left(\frac{\$NewCash/\$OldCash}{\$NewPass/\$OldPass}-1\right)\times Diversion\times C_P$
Diverted Riders from Cash to Pass = $\left(\frac{\$2.00/\$2.25}{\$50/\$71}-1\right)\times 0.05\times C_p=135.48$
New Cash Demand = C_p – Diverted Riders from Cash to Pass = 10,197.85

New Pass Demand = P_p + Diverted Riders from Cash to Pass = 5,505.20
Total Demand = 10,197.85 + 5,505.20 = 15,703.05

Another Complex Example: Price Elasticity plus Two Ridership Diversions — Single-Ride CharlieCard (SR-CC) to Pass, and Single-Ride CharlieTicket (SR-CT) to Single-Ride CharlieCard (SR-CC)
Given:
Original Single-Ride CharlieCard Demand: 10,000
Original Single-Ride CharlieCard Fare: $2.20
New Single-Ride CharlieCard Fare: $3.50
Single-Ride CharlieCard Price Elasticity: -0.30
New SR-CC Demand (Price Effect),
CC_p = 10,000 × [1 + −0.30 × ($3.50 ÷ $2.20 − 1)] = 8,227.27

Given:
Original Pass Demand: 50,000
Original Pass Price: $71.00
New Pass Price: $90.00
Pass Price Elasticity: −0.25
New Pass Demand (Price Effect),
P_p = 50,000 × [1 + −0.25 × ($90 ÷ $71 − 1)] = 46,654.93

Given:
Original Single-Ride CharlieTicket Demand: 5,000
Original Single-Ride CharlieTicket Fare: $2.50
New Single-Ride CharlieTicket Fare: $4.50
Single-Ride CharlieTicket Price Elasticity: −0.30
New SR-CT Demand (Price Effect),
CT_p = 5,000 × [1 + −0.30 × ($4.50 ÷ $2.50 − 1)] = 3,800.00
Total Demand = 8227.27 + 46,654.93 + 3,800.00 = 58,682.20

Given:
Single-Ride CharlieCard-to-Pass Diversion Factor: 0.05
Pass-to-Single-Ride CharlieCard Diversion Factor: 0.00
Single-Ride CharlieCard to Single-Ride CharlieTicket Diversion Factor: 0.00
Single-Ride CharlieTicket to Single-Ride CharlieCard Diversion Factor: 0.25

Note:
Percentage Change in Single-Ride CharlieCard Fare: $2.20 to $3.50: 59.09%
Percentage Change in Pass Price: $71 to $90: 26.76%
Percentage Change in Single-Ride CharlieTicket Fare: $2.50 to $4.50: 80.00%
Diverted Riders from SR-CC to Pass = $\left(\frac{\$3.50/\$2.20}{\$90/\$71}\text{-}1\right) \times 0.05 \times CC_p$=104.92

$$\text{Diverted Riders from SR-CT to SR-CC} = \left(\frac{\$4.50/\$2.50}{\$3.50/\$2.20} - 1\right) \times 0.25 \times CT_p = 124.86$$

New Single-Ride CharlieCard Demand =
CC_p – Diverted Riders from SR-CC to Pass + Diverted Riders from SR-CT to SR-CC = 8,247.21
New Pass Demand = P_p + Diverted Riders from SR-CC to Pass = 46,759.85
New Single-Ride CharlieTicket Demand =
CT_p – Diverted Riders from SR-CT to SR-CC = 3,675.14
Total Demand = 8,202.15 + 46,759.85 + 3,720.20 = 58,682.20

As we introduce additional ridership diversion factors, and more cells in the spreadsheet become linked, the complexity of FERRET increases significantly. However, the basics of the methodology explained above regarding price elasticities and ridership diversion factors remain the same.

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Appendix 7-E

FMCB Approval of Fare Equity Analysis of SFY 2017 MBTA Fare Change

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Joint Meeting of MassDOT Board of Directors and the Fiscal and Management Control Board
March 16, 2016

Transportation Building
Conference Rooms 1,2 and 3
10 Park Plaza
Boston, MA

MEETING MINUTES

Members:	Chairman Joseph Aiello, Director Lisa Calise, Director Brian Lang, Director Steven Poftak, and Director Monica Tibbits-Nutt
Present:	Chairman Joseph Aiello, Director Lisa Calise, Director Steven Poftak and Director Monica Tibbits-Nutt

Quorum Present: Yes

Others Present: General Manager Frank DePaola, Chief Administrator Brian Shortsleeve, General Counsel John Englander, Registrar Erin Deveney, Highway Administrator Tom Tinlin, Rail & Transit Administrator Astrid Glynn, Assistant General Manager of Rail Operations Jody Ray and Senior Counsel to the Board Owen Kane, Laurel Paget-Seekins, Charles Planck

At the call of the Chair, a meeting of the Fiscal and Management Control Board was called to order at 11:00 a.m. at 10 Park Plaza, Conference Rooms 1,2 & 3, Boston, Massachusetts.

After motion duly made and seconded, it was voted to immediately enter into executive session to discuss strategy related to pending litigation.

By roll call:

Chair Aiello	yes
Directory Poftak	yes
Director Calise	yes
Director Tibbits-Nutt	yes

VOTED: To enter into executive session at 11:03 a.m.

The Fiscal and Management Control Board returned from Executive Session and reconvened the Open Session at 11:45 a.m.

Next Chair Aiello, began item F, a Special Presentation from the Mayors of Cambridge, Medford and Somerville regarding the Green Line Extension. Mayor Curtatone of Somerville, introduced Senator Jehlen, a leader in the state delegation for the City, who spoke in support of extending the Green Line Extension to Route 16 in Winchester.

Next, Mayor Curtatone introduced Medford Mayor Stephanie Burke and Councillor Cheung, representing the Mayor of Cambridge. Mayor Curtatone also recognized all the elected officials who had advocated in support of the project. Mayor Curtatone praised the Governor and the Secretary, and the interim team for their diligence and determination in developing a fiscally responsible plan for the Green Line Extension that will move the project forward.

Next, Mayor Burke restated Medford's support of the project. Mayor Burke indicated that the public engagement and planning process must include the local communities to review the design, the financing alternatives and implementation schedule.

Next, Leland Cheung from the Cambridge City Council spoke on delivered remarks on behalf of Mayor Simmons of Cambridge. Ms. Cheung commented

that they need to be asking for a more information and more data, to figure out how to get this project back on track before asking residents to make sacrifices.

PROCEDURAL:

Next, was the approval of the Fiscal and Management Control Board minutes of February 1, 2016.

On motion duly made and seconded, it was

VOTED: To approve the minutes of February 1, 2016

Next, was the approval of the Fiscal and Management Control Board minutes of February 10, 2016.

On motion duly made and seconded, it was

VOTED: To approve the minutes of February 10, 2016

Next, Chair Aiello asked General Manager Frank DePaola to give the Report of the General Manager, Agenda Item D. Mr. DePaola commenting on the Washington Metro's one-day suspension of service to conduct a series of inspections of their electrical distribution system. Mr. DePaola stated that the MBTA already has a regular inspection protocol in place. Additionally the T is experimenting with thermal imaging cameras, a pilot program, which can detect defects before they are visible to the naked eye.

Next, Chief Administrator Shortsleeve, presented Agenda Item E. Mr. Shortsleeve gave a brief update on hedging strategy as well as a monthly update on overtime, as set forth in the attached presentation entitled "CA Report".

PRESENTATIONS:

Next, Brian Kane presented Agenda Item G, a review of upcoming FMCB agenda items as forth in the attached presentation entitled “Fiscal and Management Control Board: Public Meeting Agenda Items”.

ACTION ITEMS:

Next, Laurel Paget-Seekins began Agenda Item H, a discussion and possible vote regarding equity analysis related to the fare increase. Ms. Paget-Seekins informed the Board they had received the final equity analysis that included all of the changes discussed at the March 7, 2016 Board Meeting, attached hereto and entitled “Potential MBTA Fare Changes in SFY 2017 Final Option: Impact Analysis”.

On motion duly made and seconded, it was

VOTED:

WHEREAS, on March 7, 2016, the Fiscal and Management Control Board (the “Board”) approved Massachusetts Bay Transportation Authority (“MBTA”) fare changes to be effective July 1, 2016, which approval included modifications to Option 2 as presented (“FY 17 Fare Changes”); and

WHEREAS, The Board directed MBTA staff to complete a Title VI fare equity analysis (“Equity Analysis”) to evaluate the effects of the modifications to Option 2, amend the Equity Analysis and provide the results to the Board for review and acceptance;

NOW, THEREFORE, it is hereby

VOTED:

That the Board hereby accepts the Equity Analysis for the FY 17 Fare Changes as presented.

Next, Chair Aiello called upon General Counsel John Englander and Charles Planck, to present Agenda Item I, Late Night Service Equity Analysis, as forth in the attached presentation entitled “MBTA Late-Night Service – Equity Analysis”.

On motion duly made and seconded, it was

VOTED:

WHEREAS, the Fiscal and Management Control Board (the “Board”) voted on February 29, 2016 to terminate the Massachusetts Bay Transportation Authority’s (the “MBTA”) Late Night Service Pilot Program; and

WHEREAS, the MBTA has completed service equity analyses on the termination of the Late Night Service Pilot Program using available alternative data, comparators and methodologies under Federal Transit Authority guidance producing mixed results; and

WHEREAS, the Board has determined that the MBTA should consider service mitigation that meets the legitimate business needs of the Authority to limit cost and provide efficient service, provide greater access for infrastructure and equipment maintenance and allows the MBTA to measure the impact of change;

NOW, THEREFORE, IT IS HEREBY

VOTED:

The Board hereby accepts the Late Night Service Pilot Program equity analyses as presented.

FURTHER VOTED:

The Board hereby directs MBTA staff to design service mitigation that addresses the service needs of the targeted population, based upon the following criteria:

1. Mitigation must serve the MBTA's legitimate business needs by limiting any additional cost and preserving the maximum feasible access for maintenance activities.

2. Consider mitigating the loss of work trips for minority or low-income workers, by providing targeted, efficient improvements to quality or quantity of service for minority and/or low income riders;

3. Consider any additional no cost or low-cost changes that will improve service to minority or low-income riders, including partnering with private sector ride share and other transportation service providers.

FURTHER VOTED:

The Board hereby directs MBTA staff to take all steps necessary within the thirty days to provide a meaningful opportunity for public comment on the proposed mitigation measures with clear adherence to the principles identified in the previous vote.

Next, Michael Abramo presented Agenda Item K, Fiscal 2017 Operating Budget as forth in the attached presentation entitled "FY17 Preliminary Itemized Budget". Mr. Abramo prefaced his presentation acknowledging the proposed budget is extremely aggressive, but he was confident it could be achieved by following the steps as outlined in the presentation.

On motion duly made and seconded, it was

VOTED:

That the Fiscal and Management Control Board hereby approves the Authority's preliminary itemized budget of current operating expenses and debt service costs for a one year period—July 1, 2016 through June 30, 2017—in the amount of $2,021,884,129 in the form submitted at this meeting; and

FURTHER VOTED:

That the General Manager and Chief Administrator are hereby authorized and directed to submit the preliminary itemized budget, in the name and on behalf of the Authority, to the MBTA Advisory Board for review.

At 1:00 p.m., the Fiscal and Management Control Board was joined by the MassDOT Board of Directors in a Joint Meeting.

At the call of the Chair Pollack, a joint meeting of the Board of Directors of the Massachusetts Department of Transportation and the Fiscal and Management Control Board was called to order at 1:10 p.m. at the State Transportation Building in Conference Rooms 1,2 & 3, 10 Park Plaza, Boston, Massachusetts.

Those present were Secretary Pollack, Chair, Directors Ruth Bonsignore, Betsy Taylor, Russell Gittlen, Dean Mazzarella, Joseph Sullivan, Dominic Blue, Monica Tibbits-Nutt and Steven Poftak, being a quorum of the Board of Directors of the Massachusetts Department of Transportation.

Also present were the members of the Fiscal and Management Control Board, Chairman Joseph Aiello as well as Directors Steven Poftak and Monica Tibbits-Nutt who also serve as members of the Massachusetts Department of Transportation Board.

Next Chair Pollack opened up the public comment period.

The following commented in support of the Green Line Extension going forward: Ms. Emily Reichert of Greentown Labs; Jim McGinnis, STEP; Representative Christine Barber; Representative Denise Provost; Representative Tim Toomey; Alderman Katyana Ballantyne; Rafael Mares, CLF; Joseph Barr on behalf of City Manager Richard Rossi; John McDougall 350 Mass Transportation Working Group; Elizabeth Boyle, Medford; Mike Connolly, Cambridge Resident Alliance; John Elliott, Medford; David Bauer Somerville; Ian Hardy, Somerville; Meredith Levy, Somerville; Ellin Reisner, STEP; Saul Tannenbaum, Cambridge; Louise Baxter,TRU; Esther Hanig, Union Square Main Streets; Greg Karczewski, US2; Charlie Ticotsky, TYMA; Bill Shelton, Somerville Times; Stephen Mackey, Somerville and Mr. Derby.

Mike Stanley, TransitX, opposes the Green Line Extension.

David Senatillaka, Malden commented that ABC counters would help with fare evasion and the non-collection of fares.

Tom Ryan, ABC, commented on the MassDOT Capital plan.

Steven Kaiser, Citizen Engineer, commented on the lockbox, and in support of the Green Line Extension Public Process.

Alex Feldman, Alan Moore and Lynn Weissman, of Friends of the Community Path support the Green Line Extension and Community Path

Mary Vogel, supports pre-apprenticeship programs in the MassDOT five-year capital plan

Wig Zamore, STEP, spoke in support of Late night bus service, and the Green Extension.

Claudia Murrow commented on eminent domain process.

Next, was the approval of the December 9, 2015 and December 14, 2015 minutes.

On motion duly made and seconded, it was

VOTED: to approve the MassDOT's minutes of December 9, 2015 and December 14, 2015.

Next, Chairman Aiello gave the update of the Fiscal and Management Control Board to the MassDOT Board of Directors. Chair Aiello began his report by going through the presentation the FMCB that was delivered to Legislature's Joint Committee on Transportation as set forth in the attached presentation labeled "MBTA Fiscal and Management Control Board, Joint Committee on Transportation Oversight Hearing".

Next, the Chair moved to agenda item #2, an update of the Green Line Extension project (GLX). Jack Wright, the interim project manager of the GLX began the discussion, as set forth in the attached presentation labeled "Green Line Extension, Joint Board Meeting GLX March 16, 2016".

Next, General Manager DePaola contributed to the GLX discussion concerning the design/build manual submitted to the Inspector General.

Next, on motion duly made and seconded, it was

VOTED: to adjourn the Fiscal & Management Control Board at 2:51 p.m.

DOCUMENTS RELIED ON IN THE MEETING

FMCB Public Meeting Agenda Items
CA Report

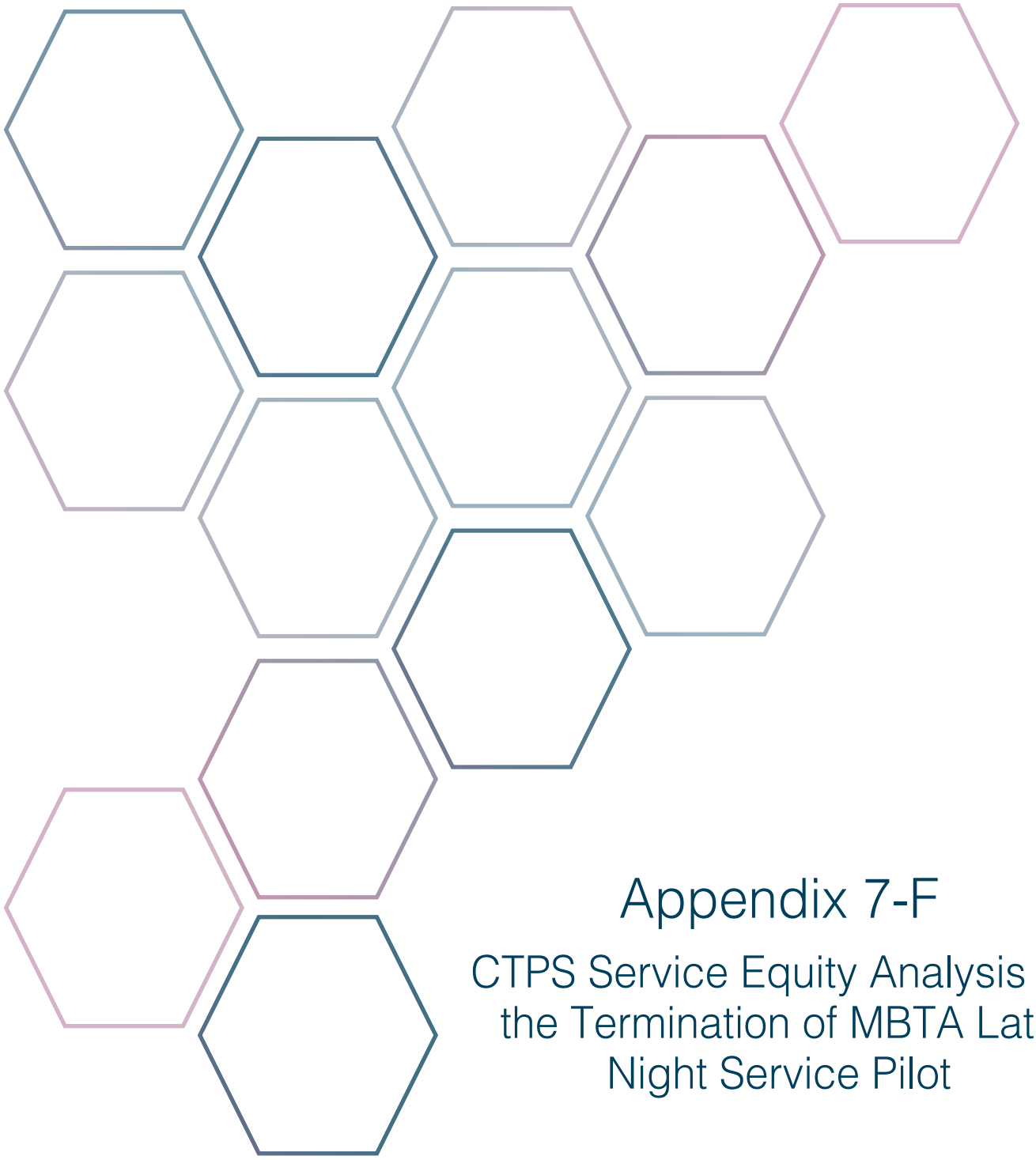
Commuter Rail Schedules Initiative Public Comment Summary

FY17 Preliminary Itemized Budget

Late-Night Discontinuance SEA to Board

Late-Night Service Equity Analysis

Potential MBTA Fare Changes in SFY 2017 Final Option: Impact Analysis



Appendix 7-F

CTPS Service Equity Analysis for the Termination of MBTA Late Night Service Pilot

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TECHNICAL MEMORANDUM

DATE: **March 15, 2016**

TO: **Frank DePaola, General Manager**
MBTA

FROM: **Annette Demchur, Manager**
CTPS Transit Service Planning Group

RE: **Service Equity Analysis of the Proposed Discontinuation of MBTA Late-Night Service**

1 INTRODUCTION

The Massachusetts Bay Transportation Authority (MBTA) began a pilot program of extended weekend late-night hours of service on Friday, March 28, 2014. This program was initially intended to operate for one year, through March 27, 2015. However, because the MBTA wanted the pilot program to last long enough to provide sufficient data to evaluate the program, and vehicle operator schedules are set well in advance of each new schedule-rating period, the program was continued without changes through June 26, 2015. On April 15, 2015, the Massachusetts Department of Transportation (MassDOT) board of directors, which then governed the MBTA, voted to implement the fiscal year 2016 budget which assumed certain changes in the late-night program that would become effective in June of 2015. These changes consisted of discontinuing all late-night trips that had been added to five bus routes in March of 2014 and reducing the span of hours of late-night service on the bus and rapid transit routes in the pilot program that were being retained.

In July of 2015, governance of the MBTA was transferred to a new fiscal and management control board. On December 14, 2015, that board directed the MBTA staff to pursue discontinuation of the remaining late-night service as part of a series of cost-reduction measures. The attachment to this memorandum shows the late-night service that is proposed for elimination and the demographics of the MBTA service area population.

The Federal Transit Administration (FTA) Circular 4702.1B provides guidelines and requirements for implementing US Department of Transportation regulations pertaining to Title VI of the Civil Rights Act of 1964 (49 CFR 21). The Circular requires the MBTA to conduct a service equity analysis to evaluate, prior to implementation of any major service change, whether the major service changes

would have a discriminatory impact based on race, color, or national origin and whether low-income populations would bear a disproportionate burden or non-low-income populations would receive disproportionate benefits because of the changes. These requirements do not apply to temporary service changes—those that last less than one year. However, because the late-night pilot program extended beyond the FTA's 12-month limit for a temporary addition of service, FTA considers it a permanent service and requires an equity analysis of its elimination.

This memorandum presents the results of a service equity analysis of the proposed elimination of late-night service.

1.1 Late-Night Service History and Service Proposal

Historically, MBTA services have run daily from approximately 5:30 AM until approximately 1:00 AM, which allows time for maintaining and inspecting the system during the night. In 2001, the MBTA implemented "Night Owl" service, which provided bus service every weekend at 30-minute intervals from 1:00 AM to 2:30 AM along nine routes that paralleled MBTA subway lines, and along seven heavily used daytime bus routes—Routes 1, 9, 28, 57, 66, 77, and 111. This service was reduced over the following few years until it was suspended in 2005 to help close a projected budget deficit in state fiscal year (SFY) 2006. At the time of its suspension, Night Owl service cost the MBTA $7.53 per passenger trip (net), whereas daytime bus service cost $1.37 per passenger trip (net).

Effective March 28, 2014, the MBTA implemented the late-night service pilot program discussed above, which extended the hours of service on the rapid transit system and on the most heavily used bus routes on Friday and Saturday nights. The goal was to provide a transit alternative for patrons and employees of late-night businesses, including the restaurant, entertainment, hospitality, and health-care sectors. The MBTA's hours of service were extended by 90 minutes for the rapid transit system (the Red, Orange, Green, Blue, Mattapan, and Silver lines except SL2) and for the Key Bus Routes (Routes 1, 15, 22, 23, 28, 32, 39, 57, 66, 71, 73, 77, 111, and 116/117). In the pilot program, late-night service operated approximately every 15 to 20 minutes, and, in most cases, it served the same stations and stops and charged the same fares as regular daytime service.

The service changes implemented in June of 2015 included ending late-night service on the rapid transit system 30 minutes earlier, and discontinuing late-night service on 5 of the 15 bus routes that were included in the program (Routes 15, 22, 71, 73, and 77). The elimination of all remaining late-night service would return the departure times of the last inbound and outbound trips on all MBTA rapid transit and bus routes to their corresponding departure times that were scheduled immediately prior to the implementation of late-night service in March 2014.

1.2 Major Service Changes

The MBTA's Service Delivery Policy defines major service changes at the individual route level as changes that would have a significant effect on riders, resource requirements, route structure, or service delivery. This includes:

- Major service restructuring
- Implementation of new routes or services
- Elimination of a route or service
- Elimination of part of a route
- Span of service changes greater than one hour
- Route extension of greater than one mile

The discontinuance of late-night service changes the span-of-service on two nights a week by more than one hour, and so can be considered a major service change that requires a service equity analysis.

1.3 Identification of Adverse Effects

The MBTA's Disparate Impact and Disproportionate Burden Policy states that the MBTA will define and analyze adverse effects related to proposed fare changes or major service changes. Because the late-night service operating since the start of the pilot program, in March of 2014, did not involve any fare changes, only service equity analyses (no fare equity analyses) are necessary. These service equity analyses evaluate the possible disparate impacts on minority populations and disproportionate burdens on low-income populations.

The MBTA uses the following thresholds for assessing disparate burdens and disproportionate burdens:

- A disparate burden would be found if the minority customers (population) sustain more than 20 percent additional burden than the total burden that the nonminority customers (population) sustain.
- A disproportionate burden would be found if the low-income customers (population) sustain more than 20 percent additional burden than the total burden that the non-low-income customers (population) sustain.

2 ASSESSMENT OF DISPARATE BURDENS AND DISPROPORTIONATE BURDENS

2.1 Analysis Framework

As presented in the MBTA's Disparate Impact and Disproportionate Burden Policy, assessment of disparate burdens requires a comparison of:

- The burdens imposed on minority customers using the service to the burdens imposed on nonminority customers using the service

  OR

- The burdens imposed on the minority population living in the market area of the service to the burdens imposed on the nonminority population living in the market area of the service

And the assessment of disproportionate burdens requires a comparison of:

- The burdens imposed on low-income customers using the service to non-low-income customers using the service

  OR

- The burdens imposed on the low-income population living in the market area of the service to the burdens imposed on the non-low-income population living in the market area of the service

During the final month of the original one-year pilot period for the late-night service program, the MBTA surveyed riders using this service on March 6, 7, 13, and 14, 2015, to determine the trip-making characteristics and the minority and income status of the ridership, consistent with the definitions below.

Minority

FTA Title VI guidelines define a minority person as one who identifies as any of the following:

- American Indian and Alaska Native, which refers to people having origins in any of the original peoples of North and South America (including Central America), and who maintain tribal affiliation or community attachment.
- Asian, which refers to people having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent, including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
- Black or African American, which refers to people having origins in any of the Black racial groups of Africa.
- Hispanic or Latino, which includes persons of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race.
- Native Hawaiian or Other Pacific Islander, which refers to people having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

Low-Income

FTA Title VI guidelines define a "low-income" person as "a person whose median household income is at or below the US Department of Health and Human Services poverty guidelines." As of 2013, the national low-income level for a one-person household was $11,490 annually, with an additional $4,020 per household member. Because median incomes in the MBTA service area are higher than national levels, the MBTA uses a more inclusive definition of low-income. The MBTA Title VI program defines a low-income rider as one whose household income is less than 60 percent of the median household income of the MBTA service area. The median household income for the years 2008 through 2012 for the 175-municipality MBTA service area was $69,393. Therefore, for the MBTA Title VI program, a low-income rider is defined as one whose household income is less than 60 percent of that level, or $43,159.

Under FTA guidance and the MBTA Disparate Impact and Disproportionate Burden Policy, a service equity analysis can be performed using either actual ridership (survey) data, or population (census) data concerning persons who would potentially ride the system. In this case, the MBTA used the late-night survey data along with data from the MBTA 2008–09 Systemwide Passenger Survey to conduct the equity analysis. However, because the composition of the service area population has changed over the six to seven years since the systemwide survey, the MBTA also conducted an equity analysis using census data. Because late-night service has a broad base of potential riders, many of whom use the service infrequently, using population data may be more appropriate for the late-night service equity analysis. The results of each of these analyses, using ridership and population data, are presented below.

The MBTA use the Central Transportation Planning Staff (CTPS) to conduct the equity analyses using the data sources discussed above.

2.2 Assessment of Disparate Burdens and Disproportionate Burdens: Ridership Data

To assess the potential disparate burdens and/or disproportionate burdens that might be imposed by the proposed MBTA late-night service reductions, CTPS staff analyzed ridership using a methodology described in FTA Circular 4702.1B. This methodology compares the proportion of minority and low-income late-night-service riders with the proportion of minority and low-income riders using the MBTA system as a whole, for each mode of transit service.

The MBTA's March 2015 survey of late-night passengers was designed to obtain results at a 90 percent confidence level and a 5 percent confidence interval for overall late-night rapid transit riders and for overall late-night bus riders. It was not

feasible to obtain statistically reliable results at the individual route or station level. The data for the proportions of minority and low-income riders using the MBTA system as a whole were based on the results of the MBTA 2008–09 Systemwide Passenger Survey, which provided composite one-day samples of weekday ridership for the hours of 6:00 AM to 3:30 PM.

Although the 2008-09 survey included demographic questions comparable to those in the 2015 survey on late-night service, the demographics are not necessarily the same in 2015 as they were in 2008–09 for passengers traveling between 6:00 AM and 3:30 PM or for those using late-night service on the same routes. To identify such differences, CTPS compared the minority and low-income percentages for all of the bus routes combined that were included in the late-night survey, with the minority and low-income percentages obtained from the 2008–09 survey. For this group of routes, the percentage of minority passengers in the 2015 late-night survey (59.9 percent) was similar to the percentage in the 2008–09 survey (61.3 percent). However, the percentage of low-income riders was much higher in the 2015 late-night survey (70.9 percent) than in the 2008–09 survey (48.2 percent)—a difference of 22.7 percentage points and a ratio of the 2015 percentage to the 2008–09 percentage of 1.47.

To estimate the percentage of minority riders on the 10 bus routes on which late-night service was retained after June of 2015, the average combined Friday late-night and Saturday late-night ridership on each route for all weekends in July, August, September, and October 2015 was multiplied by the percentage of minority riders on the same route in the 2008–09 survey. As shown in Table 1, for the 10 routes combined, average weekend late-night ridership from July through October 2015 was 2,056, with an estimated 1,119 minority riders (54.4 percent minority ridership).

TABLE 1
Estimation of Late-Night Bus Minority Ridership

Route	Late-Night Ridership	Percentage Minority	Number Minority
Route 1	305	42.3	129
Route 23	156	90.6	141
Route 28	258	96.5	249
Route 32	118	62.5	74
Route 39	153	39.9	61
Route 57	293	32.2	95
Route 66	292	39.1	114
Route 111	277	56.3	156
Route 116	75	58.3	44
Route 117	128	44.0	56
Total	**2,056**	**54.4**	**1,119**

Note: Late-night ridership is the average ridership on Friday and Saturday late-night trips on all of the weekends in July through October 2015. The percentage of minority ridership of each route was estimated by using the same percentage that was found in the results of the MBTA 2008–09 systemwide passenger survey.

The late-night rapid transit survey was conducted at 15 stations that accounted for approximately 70 percent of all late-night rapid transit station entries. Of the survey respondents reporting ethnicity, 43.4 percent were classified as minorities applying the federal standards described above. In the MBTA 2008–09 Systemwide Passenger Survey, only 24.1 percent of the respondents from the same 15 stations were minorities. These figures imply that the minority share of late-night ridership at these stations was 1.8 times the share during the span of hours when the 2008–09 survey was conducted.

Discontinuing late-night rapid transit service would impact the number of entries at all stations, not just the 15 stations included in the 2015 late-night survey. Applying the same factor of 1.8 to the minority percentage at each rapid transit station in the 2008–09 survey, and applying those minority percentages to the average late-night entries per weekend for the corresponding stations from July through October 2015, an estimated 47.1 percent of late-night rapid transit passengers were minorities.

Similar methods were used to estimate the percentages of low-income riders on late-night bus and rapid transit services. For each of the 10 bus routes with late-night service, the 2008–09 percentage of low-income riders was multiplied by a factor of 1.47 (the ratio of the percentage of low-income riders on the routes that were included in the 2015 late-night survey to the percentage on the same routes in the 2008–09 survey) to adjust for the difference between daytime and late-night rates of low-income ridership, with a limit of 100 percent on the result for any

individual route. As shown in Table 2, for the 10 bus routes combined, the average weekend late-night ridership from July through October 2015 was 2,056, with an estimated 1,324 (64.4 percent) low-income riders.

TABLE 2
Estimation of Late-Night Bus Low-Income Ridership

Route	Late-Night Ridership	Percentage Low-Income	Number Low-Income
Route 1	305	55.6	169
Route 23	156	85.3	133
Route 28	258	100.0	258
Route 32	118	66.6	79
Route 39	153	48.8	75
Route 57	293	37.7	110
Route 66	292	67.2	196
Route 111	277	55.4	153
Route 116	75	78.0	59
Route 117	128	71.7	92
Total	**2,056**	**64.4**	**1,324**

Note: Late-night ridership is the average ridership on Friday and Saturday late-night trips on all of the weekends in July through October 2015. The percentage of low-income ridership of each route was estimated by using the same percentage that was found in the results of the MBTA 2008–09 Systemwide Passenger Survey by a factor of 1.50.

Of the late-night rapid transit survey respondents who reported household income, 54.0 percent were classified as low-income under the federal standards described above. In the MBTA 2008–09 Systemwide Passenger Survey, only 22.0 percent of the respondents from the same 15 stations that were surveyed in 2015 were low-income. These figures imply that the low-income share of late-night ridership at these stations was 2.45 times as great as the share during the span of hours when the 2008–09 survey was conducted.

Applying the same factor of 2.45 to the low-income percent at each station in the 2008–09 survey, and applying these percentages to the average late-night entries per weekend at each system station from July through October 2015, an estimated 59.2 percent of late-night rapid transit passengers were low-income.

TABLE 3
Assessment of Disparate Burdens on Minority Riders If Late-Night Service on 10 MBTA Bus Routes Is Discontinued using Ridership Data

Metric	Valuation
MBTA bus system – 2008–09 weighted percentage minority	47.5%
Late-night service, 10 bus routes – percentage minority	54.4%
Ratio of late-night to systemwide minority ridership	1.15
Disparate burden threshold	>1.20
Result of disparate burden analysis	**No disparate burden**

Sources: The 2015 MBTA late-night service survey and the MBTA 2008–09 Systemwide Passenger Survey.

TABLE 4
Assessment of Disproportionate Burdens on Low-Income Riders If Late-Night Service on 10 MBTA Bus Routes Is Discontinued using Ridership Data

Metric	Valuation
MBTA bus system – 2008–09 weighted percentage low-income	41.5%
Late-night service – 10 bus routes, percentage low-income	64.4%
Ratio of late-night to systemwide low-income ridership	1.55
Disproportionate burden threshold	>1.20
Result of disproportionate burden analysis	**Disproportionate burden**

Sources: The 2015 MBTA late-night service survey and the MBTA 2008–09 Systemwide Passenger Survey.

TABLE 5
Assessment of Disparate Burdens on Minority Riders If Late-Night Service on MBTA Rapid Transit Lines Is Discontinued using Ridership Data

Metric	Valuation
Rapid transit system – 2008–09 weighted percentage minority	28.5%
Late-night rapid transit service – percentage minority	47.1%
Ratio of late-night to systemwide minority ridership	1.65
Disparate burden threshold	>1.20
Result of disparate burden analysis	**Disparate burden**

Sources: The 2015 MBTA late-night service survey and the MBTA 2008–09 Systemwide Passenger Survey.

TABLE 6
Assessment of Disproportionate Burdens on Low-Income Riders If Late-Night Service on MBTA Rapid Transit Lines Is Discontinued Using Ridership Data

Metric	Valuation
Rapid transit system – 2008–09 weighted percentage low-income	24.1%
Late-night rapid transit service – percentage low-income	59.2%
Ratio of late-night to systemwide low-income ridership	2.46
Disproportionate burden threshold	>1.20
Result of disproportionate burden analysis	**Disproportionate burden**

Sources: The 2015 MBTA Late-Night Service Survey and the MBTA 2008–09 Systemwide Passenger Survey.

Table 3 shows that the proportion of minority riders using the 10 late-night bus routes that the MBTA proposes to discontinue (54.4 percent) is higher than the proportion of minority riders using MBTA bus service systemwide (47.5 percent). The resulting ratio of the proportion of minority riders using the 10 late-night bus routes that the MBTA proposes to discontinue to the proportion of minority riders using MBTA bus service systemwide, 1.15, is less than the threshold of 1.20 for a disparate burden.

Table 4 shows that the proportion of low-income riders using the 10 late-night bus routes (64.4 percent) is higher than the proportion of low-income riders using MBTA bus service systemwide (41.5 percent). The resulting ratio of the proportion of low-income riders using the 10 late-night bus routes to the proportion of low-income riders using MBTA bus service systemwide, 1.55, is greater than the threshold of 1.20 for a disproportionate burden.

Table 5 shows that the proportion of minority riders using the late-night rapid transit service that the MBTA proposes to discontinue (47.1 percent) is higher than the proportion of minority riders using MBTA rapid transit service systemwide (28.5 percent). The resulting ratio of the proportion of minority riders using the late-night rapid transit service that the MBTA proposes to discontinue to the proportion of minority riders using MBTA rapid transit service systemwide, 1.65, is greater than the threshold of 1.20 for a disparate burden.

Table 6 shows that the proportion of low-income riders using late-night rapid transit service (59.2 percent) is higher than the proportion of low-income riders using MBTA rapid transit service systemwide (24.1 percent). The resulting ratio of the proportion of low-income riders using the late-night rapid transit service to the proportion of low-income riders using MBTA rapid transit service systemwide, 2.46, is greater than the threshold of 1.20 for a disproportionate burden.

2.3 Assessment of Disparate Burdens and Disproportionate Burdens: Population Data

To assess the potential disparate burdens and/or disproportionate burdens that might be imposed by the proposed MBTA late-night service reductions, CTPS staff conducted a second form of analysis using population data. The Circular requires that the transit provider consider the degree of adverse effects when conducting the equity analysis. CTPS staff is working with the MBTA to develop a procedure that considers the degree of adverse effect by incorporating a measure of access to the system. This methodology compares the proportion of minority and low-income population with access to late-night-service with the proportion of minority and low-income population with access to the MBTA system as a whole.

To determine the proportion of minority and low-income population with access to late-night service and to the MBTA system as a whole, the population of each municipality was weighted by its share of systemwide service hours (including bus, rapid transit, and commuter rail service hours) divided by its share of systemwide population. These weights were applied to determine the proportion of minority and low-income populations with access to late-night service and to the MBTA system as a whole, shown in Table 7 and Table 8.

TABLE 7
Assessment of Disparate Burdens on Minority Population
If Late-Night Service Is Discontinued using Weighted Population Data

Metric	Valuation
Late-night minority percentage	46.6%
MBTA systemwide minority percentage	42.0%
Ratio of late-night to systemwide minority population	1.11
Disparate burden threshold	>1.20
Result of disparate burden analysis	**No disparate burden**

TABLE 8
Assessment of Disproportionate Burdens on Low-Income Population
If Late-Night Service Is Discontinued using Weighted Population Data

Metric	Valuation
Late-nigh low-income percentage	39.1%
MBTA systemwide low-income percentage	37.1%
Ratio of late-night to systemwide low-income population	1.05
Disproportionate burden threshold	>1.20
Result of disproportionate burden analysis	**No disproportionate burden**

Table 7 shows that the proportion of minority population with access to late-night service (46.6 percent) is higher than the proportion of minority population with access to the MBTA system as a whole (42.0 percent). The resulting ratio of the proportion of minority population with access to the late-night service that the MBTA proposes to discontinue to the proportion of minority population with access to the MBTA system as a whole, 1.11, is less than the disparate burden threshold of 1.20.

Table 8 shows that the proportion of low-income population with access to late-night service (39.1 percent) is higher than the proportion of low-income population with access to the MBTA system as a whole (37.1 percent). The resulting ratio of the proportion of low-income population with access to the late-night service that the MBTA proposes to discontinue to the proportion of low-income population with access to the MBTA system as a whole, 1.05, is less than the disproportionate burden threshold of 1.20.

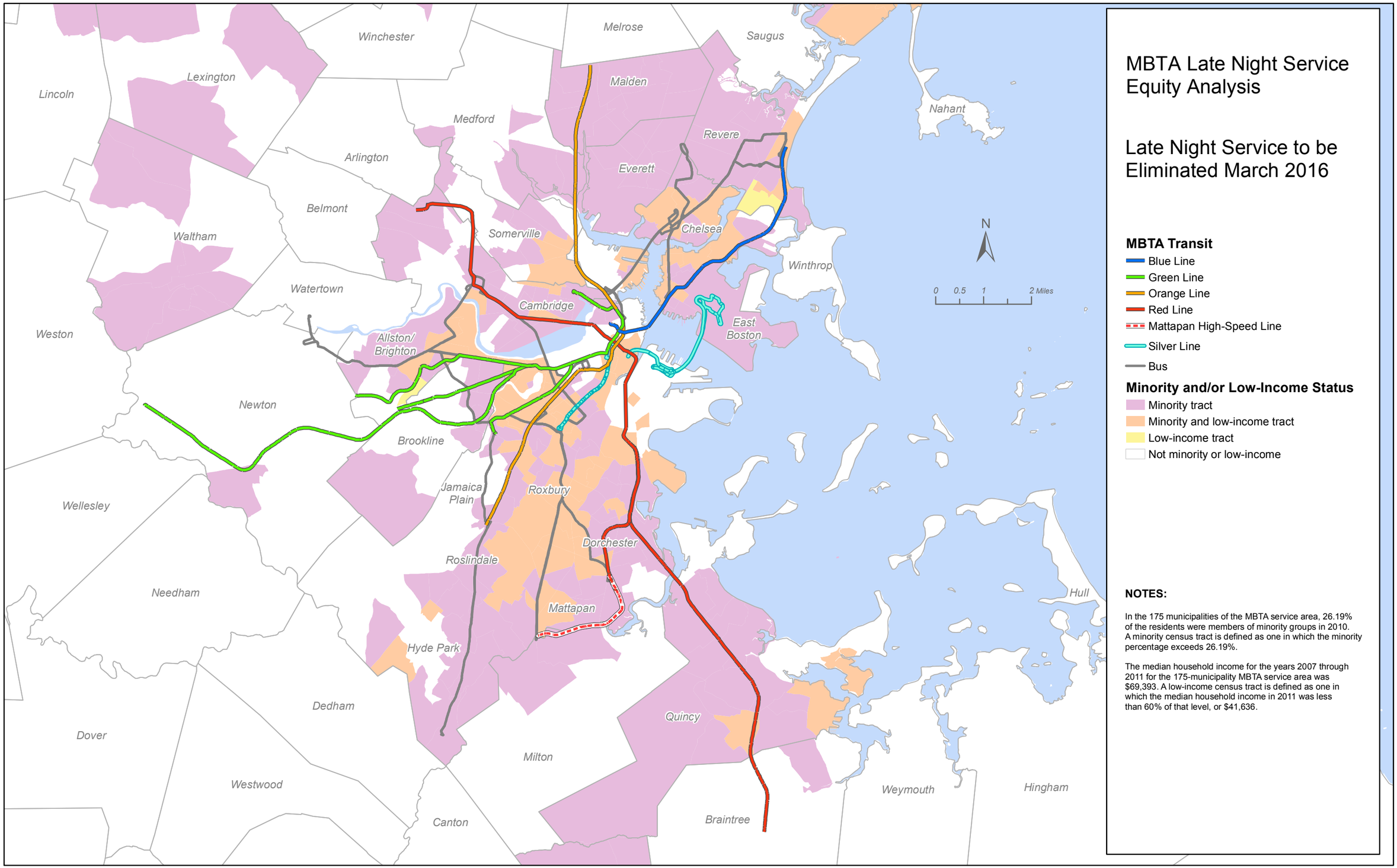
3 CONCLUSION

The results of the service equity analysis using ridership data indicate that discontinuing the late-night service that has been operated on 10 MBTA bus routes would not result in a disparate burden on minority riders, but would result in a disproportionate burden on low-income riders. Discontinuing the late-night service that has been operated on all MBTA rapid transit lines since July 1, 2015, would result in a disparate burden on minority riders and a disproportionate burden on low-income riders.

The results of the service equity analysis using population data indicate that the overall discontinuance of late-night service would not result in a disparate burden on minority populations and would not result in a disproportionate burden on low-income populations.

AD/TJH/tjh

cc: Charles Planck, MBTA
Melissa Dullea, MBTA
John Lozada, MassDOT
Greg Sobczynski, MassDOT
Miles Walters, MBTA



MBTA Late Night Service Equity Analysis

Late Night Service to be Eliminated March 2016

MBTA Transit

- Blue Line
- Green Line
- Orange Line
- Red Line
- Mattapan High-Speed Line
- Silver Line
- Bus

Minority and/or Low-Income Status

- Minority tract
- Minority and low-income tract
- Low-income tract
- Not minority or low-income

NOTES:

In the 175 municipalities of the MBTA service area, 26.19% of the residents were members of minority groups in 2010. A minority census tract is defined as one in which the minority percentage exceeds 26.19%.

The median household income for the years 2007 through 2011 for the 175-municipality MBTA service area was $69,393. A low-income census tract is defined as one in which the median household income in 2011 was less than 60% of that level, or $41,636.

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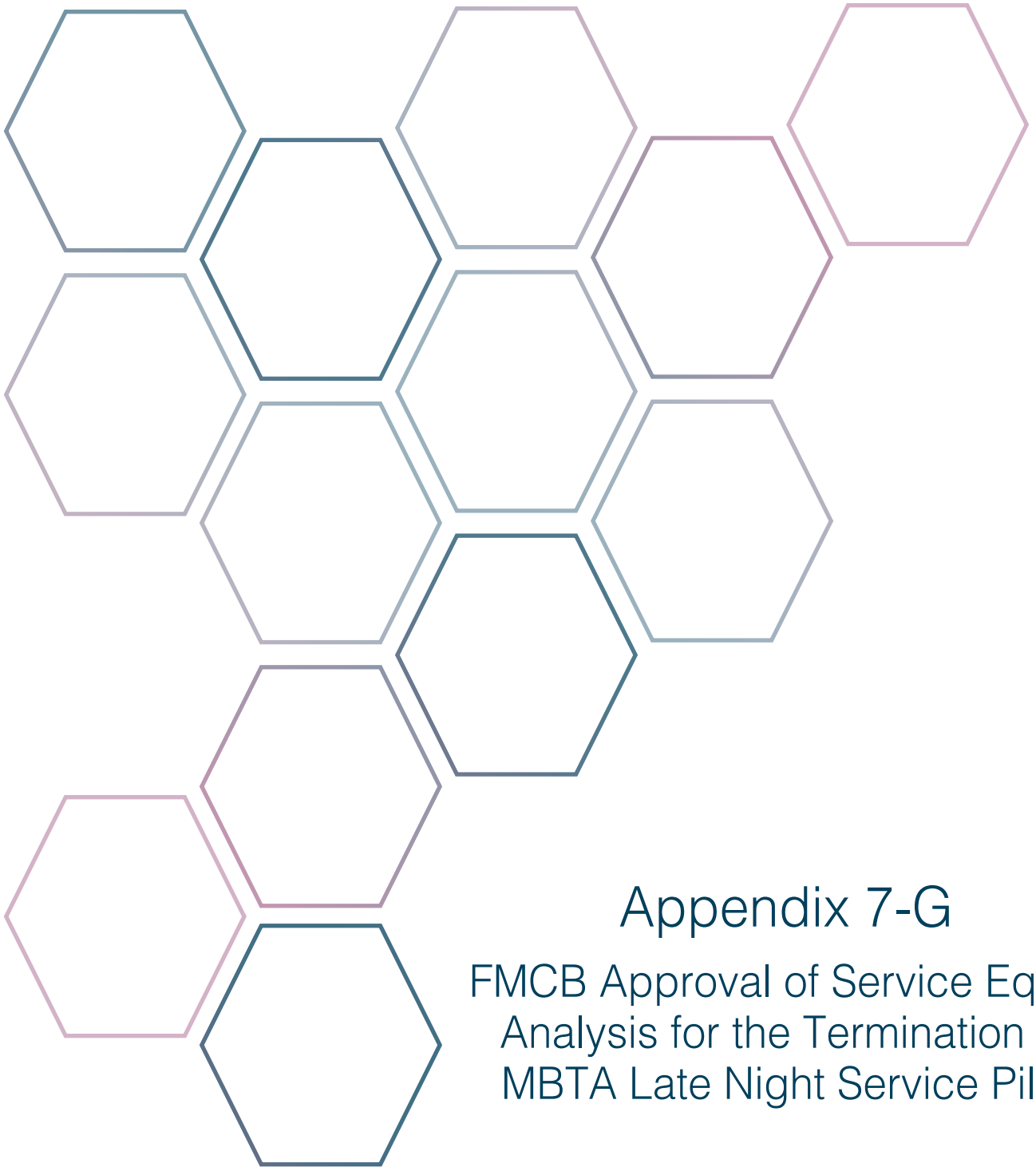

Appendix 7-G

FMCB Approval of Service Equity Analysis for the Termination of MBTA Late Night Service Pilot

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Joint Meeting of MassDOT Board of Directors and the Fiscal and Management Control Board
March 16, 2016

Transportation Building
Conference Rooms 1,2 and 3
10 Park Plaza
Boston, MA

MEETING MINUTES

Members:	Chairman Joseph Aiello, Director Lisa Calise, Director Brian Lang, Director Steven Poftak, and Director Monica Tibbits-Nutt
Present:	Chairman Joseph Aiello, Director Lisa Calise, Director Steven Poftak and Director Monica Tibbits-Nutt

Quorum Present: Yes

Others Present: General Manager Frank DePaola, Chief Administrator Brian Shortsleeve, General Counsel John Englander, Registrar Erin Deveney, Highway Administrator Tom Tinlin, Rail & Transit Administrator Astrid Glynn, Assistant General Manager of Rail Operations Jody Ray and Senior Counsel to the Board Owen Kane, Laurel Paget-Seekins, Charles Planck

At the call of the Chair, a meeting of the Fiscal and Management Control Board was called to order at 11:00 a.m. at 10 Park Plaza, Conference Rooms 1,2 & 3, Boston, Massachusetts.

After motion duly made and seconded, it was voted to immediately enter into executive session to discuss strategy related to pending litigation.

By roll call:

Chair Aiello	yes
Directory Poftak	yes
Director Calise	yes
Director Tibbits-Nutt	yes

VOTED: To enter into executive session at 11:03 a.m.

The Fiscal and Management Control Board returned from Executive Session and reconvened the Open Session at 11:45 a.m.

Next Chair Aiello, began item F, a Special Presentation from the Mayors of Cambridge, Medford and Somerville regarding the Green Line Extension. Mayor Curtatone of Somerville, introduced Senator Jehlen, a leader in the state delegation for the City, who spoke in support of extending the Green Line Extension to Route 16 in Winchester.

Next, Mayor Curtatone introduced Medford Mayor Stephanie Burke and Councillor Cheung, representing the Mayor of Cambridge. Mayor Curtatone also recognized all the elected officials who had advocated in support of the project. Mayor Curtatone praised the Governor and the Secretary, and the interim team for their diligence and determination in developing a fiscally responsible plan for the Green Line Extension that will move the project forward.

Next, Mayor Burke restated Medford's support of the project. Mayor Burke indicated that the public engagement and planning process must include the local communities to review the design, the financing alternatives and implementation schedule.

Next, Leland Cheung from the Cambridge City Council spoke on delivered remarks on behalf of Mayor Simmons of Cambridge. Ms. Cheung commented

that they need to be asking for a more information and more data, to figure out how to get this project back on track before asking residents to make sacrifices.

PROCEDURAL:

Next, was the approval of the Fiscal and Management Control Board minutes of February 1, 2016.

On motion duly made and seconded, it was

VOTED: To approve the minutes of February 1, 2016

Next, was the approval of the Fiscal and Management Control Board minutes of February 10, 2016.

On motion duly made and seconded, it was

VOTED: To approve the minutes of February 10, 2016

Next, Chair Aiello asked General Manager Frank DePaola to give the Report of the General Manager, Agenda Item D. Mr. DePaola commenting on the Washington Metro's one-day suspension of service to conduct a series of inspections of their electrical distribution system. Mr. DePaola stated that the MBTA already has a regular inspection protocol in place. Additionally the T is experimenting with thermal imaging cameras, a pilot program, which can detect defects before they are visible to the naked eye.

Next, Chief Administrator Shortsleeve, presented Agenda Item E. Mr. Shortsleeve gave a brief update on hedging strategy as well as a monthly update on overtime, as set forth in the attached presentation entitled "CA Report".

PRESENTATIONS:

Next, Brian Kane presented Agenda Item G, a review of upcoming FMCB agenda items as forth in the attached presentation entitled “Fiscal and Management Control Board: Public Meeting Agenda Items”.

ACTION ITEMS:

Next, Laurel Paget-Seekins began Agenda Item H, a discussion and possible vote regarding equity analysis related to the fare increase. Ms. Paget-Seekins informed the Board they had received the final equity analysis that included all of the changes discussed at the March 7, 2016 Board Meeting, attached hereto and entitled “Potential MBTA Fare Changes in SFY 2017 Final Option: Impact Analysis”.

On motion duly made and seconded, it was

VOTED:

WHEREAS, on March 7, 2016, the Fiscal and Management Control Board (the “Board”) approved Massachusetts Bay Transportation Authority (“MBTA”) fare changes to be effective July 1, 2016, which approval included modifications to Option 2 as presented (“FY 17 Fare Changes”); and

WHEREAS, The Board directed MBTA staff to complete a Title VI fare equity analysis (“Equity Analysis”) to evaluate the effects of the modifications to Option 2, amend the Equity Analysis and provide the results to the Board for review and acceptance;

NOW, THEREFORE, it is hereby

VOTED:

That the Board hereby accepts the Equity Analysis for the FY 17 Fare Changes as presented.

Next, Chair Aiello called upon General Counsel John Englander and Charles Planck, to present Agenda Item I, Late Night Service Equity Analysis, as forth in the attached presentation entitled “MBTA Late-Night Service – Equity Analysis”.

On motion duly made and seconded, it was

VOTED:

WHEREAS, the Fiscal and Management Control Board (the “Board”) voted on February 29, 2016 to terminate the Massachusetts Bay Transportation Authority’s (the “MBTA”) Late Night Service Pilot Program; and

WHEREAS, the MBTA has completed service equity analyses on the termination of the Late Night Service Pilot Program using available alternative data, comparators and methodologies under Federal Transit Authority guidance producing mixed results; and

WHEREAS, the Board has determined that the MBTA should consider service mitigation that meets the legitimate business needs of the Authority to limit cost and provide efficient service, provide greater access for infrastructure and equipment maintenance and allows the MBTA to measure the impact of change;

NOW, THEREFORE, IT IS HEREBY

VOTED:

The Board hereby accepts the Late Night Service Pilot Program equity analyses as presented.

FURTHER VOTED:

The Board hereby directs MBTA staff to design service mitigation that addresses the service needs of the targeted population, based upon the following criteria:

1. Mitigation must serve the MBTA's legitimate business needs by limiting any additional cost and preserving the maximum feasible access for maintenance activities.

2. Consider mitigating the loss of work trips for minority or low-income workers, by providing targeted, efficient improvements to quality or quantity of service for minority and/or low income riders;

3. Consider any additional no cost or low-cost changes that will improve service to minority or low-income riders, including partnering with private sector ride share and other transportation service providers.

FURTHER VOTED:

The Board hereby directs MBTA staff to take all steps necessary within the thirty days to provide a meaningful opportunity for public comment on the proposed mitigation measures with clear adherence to the principles identified in the previous vote.

Next, Michael Abramo presented Agenda Item K, Fiscal 2017 Operating Budget as forth in the attached presentation entitled "FY17 Preliminary Itemized Budget". Mr. Abramo prefaced his presentation acknowledging the proposed budget is extremely aggressive, but he was confident it could be achieved by following the steps as outlined in the presentation.

On motion duly made and seconded, it was

VOTED:

That the Fiscal and Management Control Board hereby approves the Authority's preliminary itemized budget of current operating expenses and debt service costs for a one year period—July 1, 2016 through June 30, 2017—in the amount of $2,021,884,129 in the form submitted at this meeting; and

FURTHER VOTED:

That the General Manager and Chief Administrator are hereby authorized and directed to submit the preliminary itemized budget, in the name and on behalf of the Authority, to the MBTA Advisory Board for review.

At 1:00 p.m., the Fiscal and Management Control Board was joined by the MassDOT Board of Directors in a Joint Meeting.

At the call of the Chair Pollack, a joint meeting of the Board of Directors of the Massachusetts Department of Transportation and the Fiscal and Management Control Board was called to order at 1:10 p.m. at the State Transportation Building in Conference Rooms 1,2 & 3, 10 Park Plaza, Boston, Massachusetts.

Those present were Secretary Pollack, Chair, Directors Ruth Bonsignore, Betsy Taylor, Russell Gittlen, Dean Mazzarella, Joseph Sullivan, Dominic Blue, Monica Tibbits-Nutt and Steven Poftak, being a quorum of the Board of Directors of the Massachusetts Department of Transportation.

Also present were the members of the Fiscal and Management Control Board, Chairman Joseph Aiello as well as Directors Steven Poftak and Monica Tibbits-Nutt who also serve as members of the Massachusetts Department of Transportation Board.

Next Chair Pollack opened up the public comment period.

The following commented in support of the Green Line Extension going forward: Ms. Emily Reichert of Greentown Labs; Jim McGinnis, STEP; Representative Christine Barber; Representative Denise Provost; Representative Tim Toomey; Alderman Katyana Ballantyne; Rafael Mares, CLF; Joseph Barr on behalf of City Manager Richard Rossi; John McDougall 350 Mass Transportation Working Group; Elizabeth Boyle, Medford; Mike Connolly, Cambridge Resident Alliance; John Elliott, Medford; David Bauer Somerville; Ian Hardy, Somerville; Meredith Levy, Somerville; Ellin Reisner, STEP; Saul Tannenbaum, Cambridge; Louise Baxter,TRU; Esther Hanig, Union Square Main Streets; Greg Karczewski, US2; Charlie Ticotsky, TYMA; Bill Shelton, Somerville Times; Stephen Mackey, Somerville and Mr. Derby.

Mike Stanley, TransitX, opposes the Green Line Extension.

David Senatillaka, Malden commented that ABC counters would help with fare evasion and the non-collection of fares.

Tom Ryan, ABC, commented on the MassDOT Capital plan.

Steven Kaiser, Citizen Engineer, commented on the lockbox, and in support of the Green Line Extension Public Process.

Alex Feldman, Alan Moore and Lynn Weissman, of Friends of the Community Path support the Green Line Extension and Community Path

Mary Vogel, supports pre-apprenticeship programs in the MassDOT five-year capital plan

Wig Zamore, STEP, spoke in support of Late night bus service, and the Green Extension.

Claudia Murrow commented on eminent domain process.

Next, was the approval of the December 9, 2015 and December 14, 2015 minutes.

On motion duly made and seconded, it was

VOTED: to approve the MassDOT's minutes of December 9, 2015 and December 14, 2015.

Next, Chairman Aiello gave the update of the Fiscal and Management Control Board to the MassDOT Board of Directors. Chair Aiello began his report by going through the presentation the FMCB that was delivered to Legislature's Joint Committee on Transportation as set forth in the attached presentation labeled "MBTA Fiscal and Management Control Board, Joint Committee on Transportation Oversight Hearing".

Next, the Chair moved to agenda item #2, an update of the Green Line Extension project (GLX). Jack Wright, the interim project manager of the GLX began the discussion, as set forth in the attached presentation labeled "Green Line Extension, Joint Board Meeting GLX March 16, 2016".

Next, General Manager DePaola contributed to the GLX discussion concerning the design/build manual submitted to the Inspector General.

Next, on motion duly made and seconded, it was

VOTED: to adjourn the Fiscal & Management Control Board at 2:51 p.m.

DOCUMENTS RELIED ON IN THE MEETING

FMCB Public Meeting Agenda Items
CA Report

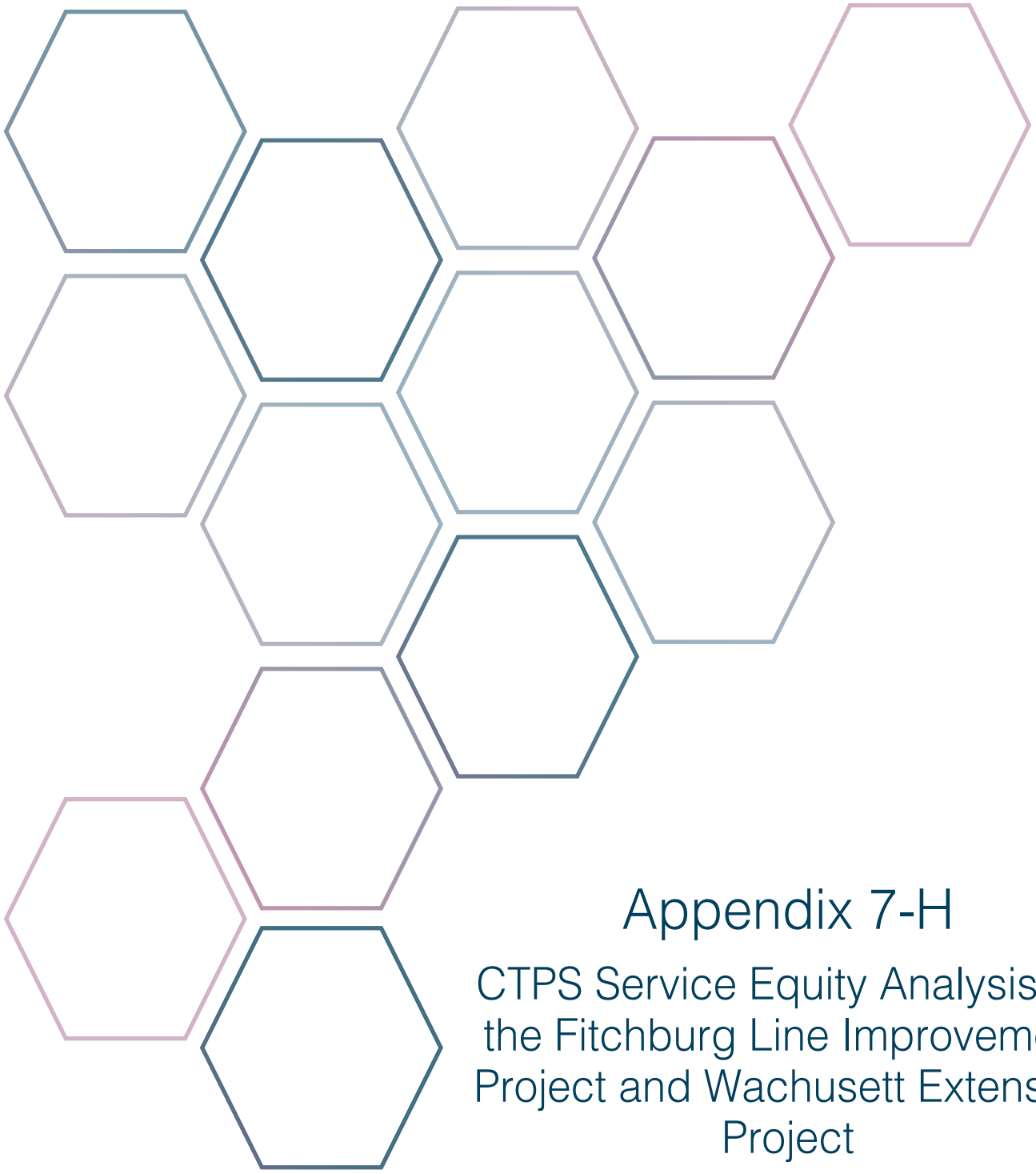
Commuter Rail Schedules Initiative Public Comment Summary

FY17 Preliminary Itemized Budget

Late-Night Discontinuance SEA to Board

Late-Night Service Equity Analysis

Potential MBTA Fare Changes in SFY 2017 Final Option: Impact Analysis



Appendix 7-H

CTPS Service Equity Analysis for the Fitchburg Line Improvement Project and Wachusett Extension Project

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TECHNICAL MEMORANDUM

DATE: **September 23, 2016**

TO: **Brian Shortsleeve, Chief Administrator & Acting General Manager, Massachusetts Bay Transportation Authority**
John Lozada, Manager of Federal Programs, MassDOT Office of Diversity and Civil Rights

FROM: **Annette Demchur, Manager**
CTPS Transit Analysis and Planning Group
Nicholas Hart, Principal Transportation Planner
CTPS Transit Analysis and Planning Group

RE: **Service Equity Analysis of MBTA Fitchburg Line Improvements and Service Extension to Wachusett Station**

1 INTRODUCTION

The Massachusetts Bay Transportation Authority (MBTA) has completed upgrades to its Fitchburg Commuter Rail Line and completed construction of a new Wachusett Station that extends the Fitchburg Line by four miles. The Federal Transit Administration (FTA) regulations pertaining to Title VI of the Civil Rights Act of 1964, found in FTA Circular 4702.1B, require the MBTA to conduct a service equity analysis to evaluate whether a capital project funded by a federal Small Start's grant or a major service change will have a discriminatory impact based on race, color, or national origin, and whether low-income populations will bear a disproportionate burden or non-low-income populations will receive disproportionate benefits because of the project or service change. Because the Fitchburg Line improvements were completed with a Small Starts grant from the FTA, and extending commuter rail service to Wachusett Station qualifies as a major service change as defined in the MBTA's Service Delivery Policy, a service equity analysis is required for each. Consistent with FTA Circular 4702.1B, the MBTA's Disparate Impact and Disproportionate Burden Policy defines procedures for conducting service equity analyses. This memorandum presents the results of equity analyses for both the Fitchburg Line improvements and service extension to Wachusett Station.

1.1 Fitchburg Line Improvement Project

The primary goal of the Fitchburg Line Improvement Project was to increase benefits to users of the transportation system by offering reduced travel times

and improved service reliability throughout the corridor. In order to accomplish this goal, substantial upgrades were necessary to overcome the significant geographical and infrastructure issues that have long plagued service on the Fitchburg Line. Specifically, the project was deemed necessary to remedy the following issues:

- The Fitchburg Line has the oldest infrastructure in the MBTA commuter rail system.
- The Fitchburg Line is the longest commuter rail line in terms of both distance and travel time.
- The Fitchburg Line has one of the worst on-time performance records in the MBTA.
- The Fitchburg Line serves the Montachusett region, which has limited commuter options.
- The Montachusett region has had significant population growth in the past decade.

The Fitchburg Line Improvement Project was funded by three sources: Small Starts, American Recovery and Reinvestment Act (ARRA), and ARRA Transportation Investment Generating Economic Recovery funds. The portion of the project funded by Small Starts contains the following elements:

- Replacement and realignment of the track structure
- Replacement or repair of eight bridge structures
- Upgrades to signal and communication systems
- Resolution of freight rail and passenger rail conflicts
- Upgrades to South Acton Station

Upon completion of the project, it was estimated that service reliability along the corridor would increase on-time performance from 83 percent to over 95 percent, and maximum train speeds would increase from 60 miles per hour (mph) to 80 mph. Construction was substantially completed at the end of 2015, and new train schedules reflecting the faster and more reliable service were implemented on May 23, 2016. Although the improvements do not qualify as a major service change under the MBTA's Service Delivery Policy, FTA regulations pertaining to Title VI of the Civil Rights Act of 1964, found in FTA Circular 4702.1B, require the MBTA to conduct a service equity analysis for Small Start capital projects, whether or not the changes to existing service rise to the level of a major service change.

1.2 Wachusett Extension Project

The Wachusett Extension Project consists of a new Wachusett Station at the end of the Fitchburg Line, upgrades to the existing rail line to accommodate the extension of commuter rail service four miles west from Fitchburg Station to Wachusett Station, and a new layover facility located in Westminster. Wachusett Station has a fully-accessible high-level platform, which allows direct platform-to-coach boarding, and a new 360-space parking lot, which will be operated by the Montachusett Regional Transit Authority (MART). The goals of the Wachusett Extension Project were as follows:

- Improve mass transit options to the communities west of Fitchburg
- Improve the region's economy by reducing the commute time from the Montachusett Region to the Boston area job market
- Increase the supply of commuter rail parking for riders in the western part of the region
- Improve the operation and capacity of the Fitchburg Line train layover facility

The MBTA's Service Delivery Policy defines major service changes at the individual route level as ones that will have a significant effect on riders, resource requirements, route structure, or service delivery, and specifically lists route extensions of greater than one mile as a major service change. Since the new Wachusett Station extends commuter rail service on the Fitchburg Line four miles west of its pre-existing terminus it is considered a major service change under the MBTA's Service Delivery Policy.

The new Fitchburg Line layover facility in Westminster replaces the existing layover facility in Lunenburg. The facility is located approximately 1.5 miles west of Wachusett Station in the Westminster Business Park. It contains six train storage tracks, an employee parking area, a maintenance building, and an electrical substation. The siting of the Westminster layover facility was determined through an alternatives analysis conducted through the National Environmental Policy Act (NEPA) process, which resulted in a Finding of No Significant Impact (FONSI). Therefore, the MBTA is not required to conduct an additional Title VI equity analysis, as per the guidelines in FTA Circular 4702.1B. A copy of the FONSI for the Wachusett Extension Project is provided in Appendix A.

2 ASSESSMENT OF DISPARATE BENEFITS AND DISPROPORTIONATE BENEFITS – FITCHBURG LINE IMPROVEMENTS

2.1 Analysis Framework

To compare the impacts of the Fitchburg Line improvements on minority and nonminority riders, and low-income and non-low-income riders, Central Transportation Planning Staff (CTPS) conducted an analysis of travel-time savings before and after project implementation. This analysis is consistent with the required methodology described in FTA Circular 4702.1B, which states that the service equity analysis shall include a comparative analysis of service levels pre- and post- the Small Starts capital project, depicted in a tabular format.

Average weekday station-to-station travel-time savings for the inbound direction of the Fitchburg Line were estimated by comparing scheduled service that went into effect on December 14, 2015 (pre-implementation) to that of May 23, 2016 (post-implementation). An estimation of these travel-time savings is provided in Appendix B. Some of the origin and destination pairs in the analysis did not benefit from the project in terms of average travel-time savings; CTPS performed an analysis to determine if each population (minority, nonminority, low-income, and non-low-income) along the line received a travel-time benefit as a whole.

For the analysis, CTPS used FTA's Title VI guidelines for defining a minority person as one who identifies as any of the following:

- American Indian and Alaska Native, which refers to people having origins in any of the original peoples of North and South America (including Central America), and who maintain tribal affiliation or community attachment.
- Asian, which refers to people having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent, including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
- Black or African American, which refers to people having origins in any of the Black racial groups of Africa.
- Hispanic or Latino, which includes persons of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race.
- Native Hawaiian or Other Pacific Islander, which refers to people having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

FTA's Title VI guidelines define a "low-income" person as "a person whose median household income is at or below the US Department of Health and Human Services' poverty guidelines." As of 2013, the national low-income level for a one-person household was $11,490 annually, with an additional $4,020 per household member. Because median incomes in the 175-municipality MBTA service area are higher than national levels, the MBTA uses a more inclusive definition of low-income. The MBTA's Title VI Program defines a low-income rider as one whose household income is less than 60 percent of the median household income of the MBTA service area. The median household income for the years 2010 through 2014 for the 175-municipality MBTA service area was $73,587. Therefore, a low-income rider is defined as one whose household income is less than 60 percent of that level, i.e., less than $44,152.

The percentage of minority and low-income passengers boarding at each station[1] was multiplied by the number of passengers traveling between station origin and destination pairs[2] to produce an estimated minority/nonminority and low-income/non-low-income flow rate from station to station. The estimated percentage of minority and low-income boardings at each station along the Fitchburg Line is provided in tabular format in Appendix C. The estimated flow rates from station to station for all passengers, minority passengers, nonminority passengers, low-income passengers, and non-low-income passengers is provided in tabular format in Appendix D.

The minority/nonminority and low-income/non-low-income flow rates from station to station were multiplied by the estimated time savings from station to station to determine the total amount of time savings for each population. The total estimated time savings from station to station for each population is provided in tabular format in Appendix E. The total amount of time savings for each population was divided by the size of the population to determine the travel-time savings per person for each population. The results are summarized in Table 1.

[1] Estimated from the 2008-09 MBTA systemwide passenger survey results
[2] Estimated from 2012 CTPS commuter rail passenger counts

TABLE 1
Summary of Travel-Time Savings – Fitchburg Line Improvement Project

Population	Total Change in Travel Time (minutes)	Total Passengers	Change in Travel Time per Passenger (minutes)
Minority	-1,397	515	-2.71
Nonminority	-9,384	3,440	-2.73
Low-Income	-642	228	-2.82
Non-Low-Income	-10,139	3,727	-2.72

Source: CTPS.

Travel times for minority riders of the Fitchburg Line are estimated to be reduced by an average of 2.71 minutes, and for nonminority riders by an average of 2.73 minutes. Travel times for low-income riders of the Fitchburg Line are estimated to be reduced by an average of 2.82 minutes, and for non-low-income riders by an average of 2.72 minutes. Since the Fitchburg Line improvements are not provided at the expense of reductions in service on other MBTA routes or services, and each population receives the benefit of travel-time savings, the Title VI equity analysis of the project is restricted to an assessment of disparate benefits for nonminority populations and disproportionate benefits for non-low-income populations, as described below.

2.2 Assessment of Disparate Benefits and Disproportionate Benefits

The suggested methodology in FTA Circular 4702.1B and the MBTA's subsequently implemented Disparate Impact and Disproportionate Burden Policy requires an assessment of disparate benefits and disproportionate benefits to reflect a comparison of the demographic makeup of riders, who will receive the benefit of the new service to the demographic makeup of riders who use the system as a whole.

The MBTA uses the following thresholds defined in its Disparate Impact and Disproportionate Burden Policy for assessing disparate benefits and disproportionate benefits:

- Disparate benefit – The existing minority customers or minority service area populations receive less than 80 percent of the benefits that the existing nonminority customers or nonminority service area populations receive.
- Disproportionate benefit – The existing low-income customers or low-income service area populations receive less than 80 percent of the benefits that the existing non-low-income customers or non-low-income service area populations receive.

CTPS used the 2008-09 MBTA systemwide passenger survey to obtain data on minority and low-income inbound boardings on the Fitchburg Line (see Appendix C). Those data were used to estimate that 13.0 percent of Fitchburg Line passengers are minorities and 5.8 percent are people with low-incomes.

The ratio of the percentage of minority passengers on the Fitchburg Line (13.0 percent) to the percentage of minority commuter rail riders systemwide (14.4 percent) is 0.90. Based on this comparison, minority commuter rail riders are receiving more than 80 percent of the benefits that nonminority commuter rail riders are receiving, thus no disparate benefit is found.

The ratio of the percentage of low-income passengers on the Fitchburg Line (5.8) to the percentage of low-income commuter rail riders systemwide (7.2 percent) is 0.81. Based on this comparison, low-income commuter rail riders are receiving more than 80 percent of the benefits that non-low-income commuter rail riders are receiving, thus no disproportionate benefit is found.

3 ASSESSMENT OF DISPARATE BENEFITS AND DISPROPORTIONATE BENEFITS – SERVICE EXTENSION TO WACHUSETT STATION

3.1 Analysis Framework

Since extending service to Wachusett Station will not be provided at the expense of reductions in service on other MBTA routes or services, and all populations surrounding the station receive the benefit of increased transit access, the Title VI equity analysis of the project is restricted to an assessment of disparate benefits for nonminority populations and disproportionate benefits for non-low-income populations.

To conduct the analysis, CTPS used 2010 US Census Bureau and 2014 American Community Survey data to determine the locations of minority and low-income populations at the census tract level, respectively. These are the most recent data sets with statistically significant minority and household income data for the MBTA service area and the census tract level is the smallest statistically significant unit of measurement for both minority and low-income populations.

The FTA's Title VI guidelines define a minority population as "any readily identifiable group of minority persons who live in geographic proximity and, if circumstances warrant, geographically dispersed/transient populations who will be similarly affected by a proposed DOT program, policy, or activity." In the 175 municipalities of the MBTA service area, 26.19 percent of the residents were members of minority groups in 2010. The MBTA defines a minority tract as one in

which the percentage of minorities exceeds the 26.19 percent average for its service area.

The FTA's Title VI guidelines define "low-income" as "a person whose median household income is at or below the US Department of Health and Human Services' poverty guidelines." As of 2013, the base level for a one-person household was $11,490 annually, with a $4,020 increase per household member. Because median incomes in the MBTA service area are high compared to national levels, the MBTA uses a more inclusive definition for "low-income." The MBTA's Title VI Program defines a low-income area as a unit of census geography in which the median household income is less than 60 percent of the median household income of the MBTA service area. The median household income for the years 2010 through 2014 for the MBTA service area was $73,587. Consistent with the MBTA's Title VI Program, a low-income tract is defined as one in which the median household income in 2014 was less than 60 percent of that level, i.e., less than $44,152. Since the US Census household income data are reported by ranges that do not provide a break at $44,152, CTPS performed an additional procedure to apportion a certain percentage of households that fall within the $40,000–$49,999 household income bracket as low-income. Since $44,152 falls approximately 42 percent of the way between $40,000 and $49,999, approximately 42 percent of households that fell within this income bracket in each census tract were apportioned as low-income households.

CTPS created a demographic profile of the market access area surrounding Wachusett Station (including minority status, low-income status, and population density of each census tract) by selecting roadways within five miles of the station using geographic information system (GIS) software. Roadways within five miles of the station represent the market access area of a terminal station outside of the core 65 MBTA municipalities. The market access area is defined for each type of commuter rail station in Table 2 and Table 3. Since the five-mile market access area for Wachusett Station overlaps with the five-mile market access area for Fitchburg Station, the overlapping area was divided halfway, and each station was assigned the nearest half. The area of each tract within the Wachusett Station market access area was calculated, and then multiplied by the population density to obtain the population in the market access area. Finally, minority and low-income populations in the market access area were summed to obtain a total for each category. The market access area for Wachusett Station is displayed in Figure 1.

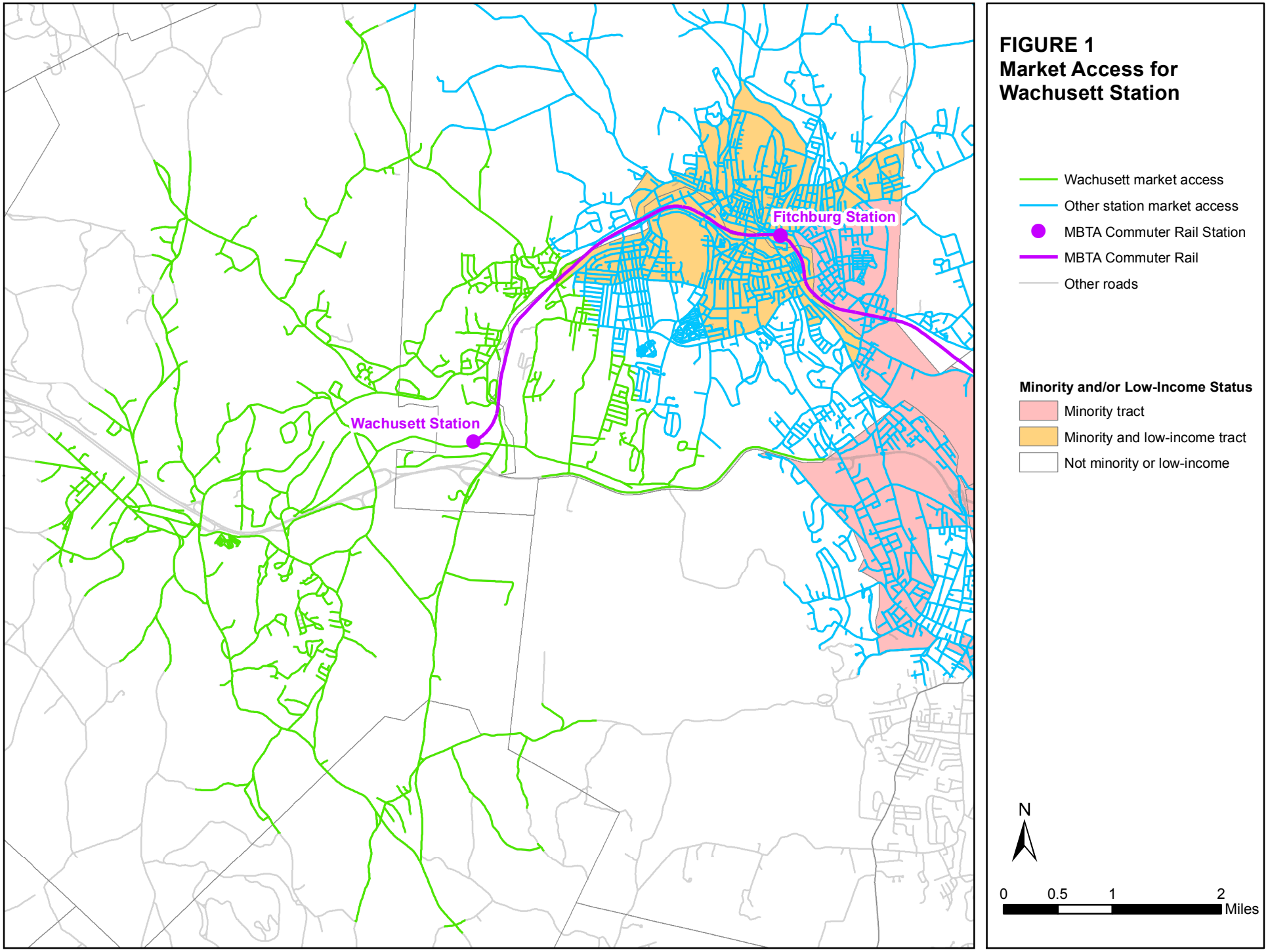
Fitchburg Station
Wachusett Station
FIGURE 1
Market Access for
Wachusett Station
Wachusett market access
Other station market access
MBTA Commuter Rail Station
MBTA Commuter Rail
Other roads
Minority and/or Low-Income Status
Minority tract
Minority and low-income tract
Not minority or low-income
N
0
0.5
1
2
Miles

TABLE 2
Market Access Definitions of MBTA Commuter Rail Stations Outside of the Core 65 MBTA Municipalities

Station Type	Market Access
Terminal stations with low service frequency and minimal parking	3 miles
All other terminal stations	5 miles
Stations with significant ridership from municipalities beyond three miles*	5 miles
All other stations	3 miles

*Straight-line distance from the boarding station to the nearest point on the town border
Source: CTPS.

TABLE 3
Market Access Definitions of MBTA Commuter Rail Stations Inside of the Core 65 MBTA Municipalities

Station Type	Market Access
Stations that significantly serve other municipalities	3 miles
Fairmount Line–South Station and Readville Station	1 mile
Fairmount Line– all other stations	0.5 miles
All other stations	1 mile

Source: CTPS.

3.2 Assessment of Disparate Benefits and Disproportionate Benefits

As with the Fitchburg Line improvements, CTPS conducted an assessment of disparate benefits and disproportionate benefits for the extended service to Wachusett Station using the suggested methodology in FTA Circular 4702.1B and the MBTA's Disparate Impact and Disproportionate Burden Policy. The MBTA's policy requires an assessment of disparate benefits and disproportionate benefits to reflect a comparison of the demographic makeup of the population receiving the benefit of the new service to the demographic makeup of the population using the system as a whole.

As noted previously, the MBTA uses the following thresholds defined in its Disparate Impact and Disproportionate Burden Policy for assessing disparate benefits and disproportionate benefits:

- Disparate benefit – The existing minority customers or minority service area populations receive less than 80 percent of the benefits that the existing nonminority customers or nonminority service area populations receive.
- Disproportionate benefit – The existing low-income customers or low-income service area populations receive less than 80 percent of the

benefits that the existing non-low-income customers or non-low-income service area populations receive.

The demographic profile of the market access area surrounding Wachusett Station is 15.28 percent minority. The ratio of the percentage of minorities in the market access area surrounding Wachusett Station (15.28 percent) to the percentage of minorities in the MBTA systemwide service area (26.19 percent) is 0.58. Based on this comparison, minority populations are receiving less than 80 percent of the benefits that nonminority populations are receiving, thus a disparate benefit is found.

The demographic profile of the market access area surrounding Wachusett Station is 30.19 percent low-income. The ratio of the percentage of low-income households in the market access area surrounding Wachusett Station (30.19 percent) to the percentage of low-income households in the MBTA systemwide service area (31.85 percent) is 0.95. Based on this comparison, low-income populations are receiving more than 80 percent of the benefits that non-low-income populations are receiving, thus no disproportionate benefit is found.

cc: John Ray, MBTA
Paul Hadley, MBTA
Miles Walters, MBTA
John Englander, MassDOT/MBTA

Appendix A:
Finding of No Significant Impact for the Siting of the Westminster Layover Facility

U.S. Department
of Transportation
**Federal Transit
Administration**

REGION I
Connecticut, Maine,
Massachusetts,
New Hampshire,
Rhode Island, Vermont

Volpe Center
55 Broadway, Suite 920
Cambridge, MA 02142-1093
617-494-2055
617-494-2865 (fax)

October 1, 2010

Mr. Mohammed H. Khan
Administrator
Montachusett Regional Transit Authority
R1427 Water Street
Fitchburg, MA 01420

Mr. Richard Davey
General Manager & Rail and Transit Administrator
Massachusetts Bay Transportation Authority
10 Park Plaza
Boston, MA 02116

Re: **Fitchburg Commuter Rail Extension Project**
Wachusett Station and Westminster Layover Facility
Environmental Assessment - Finding of No Significant Impact

Dear Messrs. Khan and Davey:

Based upon our review of the environmental documentation, the Federal Transit Administration (FTA) has issued a Finding of No Significant Impact (FONSI) for the Fitchburg Commuter Rail Extension Project (attached). The purpose of this commuter rail extension is to provide a transit option for motorists traveling to Boston along Route 2. The project will extend commuter rail service 4.5 miles west from the existing terminus in downtown Fitchburg to a new terminus in West Fitchburg, MA (Wachusett). The project includes the following components:

- 4.5 miles of track and signal upgrade
- Up to 285 space station parking facility
- High level boarding platform
- Up to 6 track layover facility

Please be advised that in accordance with 23 CFR 771.121, please transmit a notice of availability of this FONSI to all affected Federal, state and local governmental entities. In addition, under Section 106 of the National Historic Preservation Act, the FTA has determined "No Historic Properties Effected".

The FTA looks forward to continuing to work with the Montachusett Regional Transit Authority and the Massachusetts Bay Transportation Authority on this important transit improvement.

Sincerely,

Mary Beth Mello

Mary Beth Mello
Regional Administrator

Attachment

FEDERAL TRANSIT ADMINISTRATION
REGION I

Finding of No Significant Impact

Project: Fitchburg Commuter Rail Extension Project/Wachusett Station and Westminster Layover Facility

Applicant: Montachusett Regional Transit Authority (MART) and Massachusetts Bay Transportation Authority (MBTA)

Project Location: West Fitchburg, MA/ Westminster, MA

Purpose and Need

The purpose of the Fitchburg Commuter Rail Extension project is to provide a transit option for motorists traveling to Boston via Route 2. By extending commuter rail service 4.5 miles from downtown Fitchburg to a new rail station in West Fitchburg at the intersection of Routes 2 and 31, the ease of access is expected to attract commuters from the North Central Region of Massachusetts.

The need for the project stems from the several inter-related transportation deficiencies; 1) lack of transit options west of Fitchburg; existing demand for transit service and additional parking along the existing Fitchburg Commuter Rail line; 3) the MBTA's current reliance on a poorly located, undersized, and outdated layover facility; and 4) the need for improved access to jobs in both the Boston area and Montachusett region.

The project will extend commuter rail service 4.5 miles west from the existing terminus in downtown Fitchburg to a new terminus in West Fitchburg, MA (Wachusett). The proposed commuter rail station will be located largely within the limits of Pan Am Southern's existing right of way in the City of Fitchburg immediately adjacent to the existing main line and will consist of a full-length high level platform equipped with passenger shelters benched lighting and bicycle storage facilities. The station will be fully accessible per the standards of the Americans with Disabilities Act. Parking for up to 286 cars on adjacent industrially-zoned parcels with access to the parking lot via Authority Drive, which is located less than one-half mile of Route 2. To reduce cut through traffic on Fifth Massachusetts Turnpike, establishment of a cul-de-sac is proposed to be located prior to the parking lot with breakaway bollards for emergency vehicle access. A new layover facility will be located at the Westminster Business Park, approximately 1.5 miles west of Wachusett Station. The layover facility will allow for the overnight night storage of up to six trains.

Alternatives Considered

The environmental assessment (EA) evaluates three alternatives to improve mobility along the corridor; 1) No Build Alternative, 2) Bus Service and 3) Commuter Rail. The commuter rail alternative as described above was selected as the preferred alternative. The EA also evaluated alternative sites for the station and layover facility.

Agency Coordination and Public Opportunity to Comment

The MART involved a number of agencies, local officials and the public in the planning and conceptual design of the Fitchburg Commuter Rail Extension project. The EA was made available for a 30 day comment period. A public meeting was held on July 13, 2010. Meeting minutes and response to comments are included within the EA. During the comment period the Massachusetts Historical Commission (MHC) requested additional information to support FTA's proposed Section 106 determination of "No Historic Properties Effected." Specifically, MHC, in its role as the State Historic Preservation Officer (SHPO), requested additional information on the sensitivity of historical and archaeological resources within the station and layover facility sites. The supplemental information had been prepared and transmitted to MHC. On September 23, 2010, MHC concurred on FTA's determination of effect.

Based on the public comments, including the supplemental Section 206 information, the MBTA and MART determined that no substantative changes were warranted.

Determinations and Findings

National Environmental Policy Act (NEPA) Finding

FTA served as the lead agency under NEPA for the project. The MART and the MBTA prepared an EA in compliance with NEPA, 42 U.S.C. 4321 et seq. and with FTA's regulations, 23 CFR Part 771. The EA analyzes and describes the project's potential significant impacts.

After reviewing the EA, its supporting documents and public comments, the FTA finds under 23 CFR 771.121 that the proposed project will have no significant impacts on the environment. The record provides sufficient evidence and analysis for determining that an Environmental Impact Statement (EIS) is not required.

Section 106 Compliance

In accordance with Section 106 of the Historic preservation Act of 1966 as amended (36 CFR 800); FTA has issued a determination of "No Historic Properties Effected". On September 23, 2010, MHC, in its role as SHPO, concurred on FTA's determination.

Section 4(f) Findings

In accordance with 23 CFR 771.135, the FTA has determined that Section 4(f) requirements do not apply since no land from a significant publicly owned public park, recreation area, or wildlife and waterfowl refuge, or any significant historic site will be used as a result of this project. FTA has made this determination since the current contemplated project has no anticipated 4(f) use.

Approved: Mary Beth Mello Date: 10/1/10
Mary Beth Mello
Regional Administrator
FTA, Region I

Concur: Wendy A. Lee Date: 10/1/10
Wendy A. Lee
Regional Counsel

Deval L. Patrick, Governor
Timothy P. Murray, Lt. Governor
Jeffrey B. Mullan, MassDOT Secretary & CEO
Richard A. Davey, General Manager
and Rail & Transit Administrator

massDOT
Massachusetts Department of Transportation
Rail & Transit Division

September 27, 2010

Mary Beth Mello
Regional Administrator
Federal Transit Administration
55 Broadway, Suite 920
Cambridge, MA 02142

Dear Regional Administrator Mello:

As you are aware, on June 22, 2010, the Montachusett Area Regional Transit Authority (MART), in cooperation with the MBTA, released for public review the Draft Environmental Assessment (EA) for the Wachusett Extension project. The project involves the extension of commuter rail service from the current terminus in Fitchburg to a new terminus in Westminster, MA. A new layover facility adjacent to the end of the line is also part of the project. The MART held a robust public review of the document. Copies of the EA were distributed to the regulatory agencies as well as other municipal agencies and other interested parties. Copies were made available at local libraries in Fitchburg, Westminster and Gardner and a copy of the EA was posted on MART's website.

A public meeting was held on July 13, 2010, at MART's Headquarters in Fitchburg. MART placed an advertisement in the local paper notifying the public of the document's availability and of the public meeting. The meeting included the presentation and an opportunity for questions and answers, as well as comments from the public. A copy of the meeting minutes, including the presentation slides and the sign in sheet have been added to the EA as an Appendix. MART accepted comments on the EA for 30 days; 9 comment letters were received. MART and the MBTA prepared a Response to Comments Memorandum. Copies of the Response to Comments memorandum as well as the comment letters are included in the Appendix to the EA.

During the comment period, the Massachusetts Historical Commission, in its role as State Historic Preservation Officer (SHPO), requested additional information to support the FTA's proposed determination of effect. In summary, the SHPO requested that the Wachusett Station and layover facility sites be subjected to a sensitivity assessment for historical and archeological resources by a qualified cultural resource professional. A copy of MHC's letter is included in the EA. This information was submitted to the FTA on September 16, 2010; on September 17, 2010, the FTA provided this information to SHPO and also reiterated its proposed Section 106 Determination of Effect ("No historic Properties Effected"). On September 23, 2010, SHPO concurred with this Determination of Effect. The supplemental information, the FTA's Draft Finding of Effect and SHPO's concurrence documents have all been included in the EA as attachments in the Appendices.

Based upon the public review, including the supplemental Section 106 information, the MBTA and MART do not believe any substantive changes are needed in the EA. In summary, the EA documents that the project will not result in impacts to the human and natural environment. Given that this project does not have the potential to affect the quality of the human and natural

environment, the MBTA is requesting that the Federal Transit Administration issue a Finding of No Significant Impact (FONSI) for the Wachusett Extension.

We appreciate your assistance on this project. If you have any questions on the document, please feel free to contact me.

Sincerely,

Andrew D. Brennan
Director of Environmental Affairs

Enclosure

Appendix B:
Estimated Travel-Time Savings from the Fitchburg Line Improvement Project

TABLE B-1
Estimated Travel-Time Savings on Fitchburg Line From Station to Station – Inbound Direction

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		-1.5	-0.8	-1.1	-2.0	-2.7	-4.6	-6.5	-5.0	-4.0	-3.0	-4.7	-6.9	-6.3	-6.8	-6.5	-8.3	-6.4
North Leominster			0.7	0.5	-0.5	-1.2	-3.1	-4.9	-3.5	-3.0	-2.0	-3.8	-5.2	-4.7	-5.8	-5.5	-6.7	-4.8
Shirley				-0.2	-1.2	-1.8	-3.7	-5.6	-4.1	-3.0	-2.0	-4.2	-5.8	-5.3	-6.2	-5.9	-7.4	-5.5
Ayer					-0.9	-1.6	-3.7	-5.5	-4.0	-2.0	-1.0	-3.8	-5.8	-5.3	-6.0	-5.7	-7.2	-5.3
Littleton/Route 495						-0.7	-2.7	-4.5	-3.1	-1.0	0.0	-3.0	-4.8	-4.4	-5.0	-4.7	-6.1	-4.4
South Acton							-1.9	-3.6	-2.2	0.0	1.0	-0.2	-3.0	-2.7	-1.7	-1.3	-4.9	-4.1
West Concord								-1.7	-0.3	1.0	2.0	1.2	-1.0	-0.8	-0.2	0.2	-1.2	-0.8
Concord									1.4	2.0	3.0	2.6	0.7	0.9	1.2	1.6	0.5	0.9
Lincoln										0.0	1.0	1.0	-0.8	-0.5	-0.3	0.1	-0.8	-0.5
Silver Hill											1.0	2.0	1.0	1.0	1.0	2.0	1.0	0.0
Hastings												1.0	0.0	0.0	0.0	1.0	0.0	-1.0
Kendal Green													-0.8	-1.0	-1.0	-0.6	-1.2	-2.2
Brandeis/Roberts														0.0	-0.1	0.3	-1.4	-0.9
Waltham															0.0	0.4	-0.9	-0.7
Waverley																0.4	0.1	-0.9
Belmont																	-0.3	-1.3
Porter Square																		-1.0
North Station																		

Source: CTPS.

Appendix C:
Summary of Minority and Low-Income Boardings by Station

TABLE C-1
Summary of Minority and Low-Income Riders by Station for Inbound Boardings before 3:30 PM

Station	Percentage Minority Boardings	Confidence Interval at 95 Percent Level - Percentage Minority Boardings	Percentage Low-Income Boardings	Confidence Interval at 95 Percent Level - Percentage Low-Income Boardings
Fitchburg	15.2	8.7	14.5	8.7
North Leominster	10.8	9.1	10.5	9.1
Shirley	3.0	4.8	9.3	8.1
Ayer	8.4	4.9	1.5	2.5
Littleton/Route 495	7.6	6.0	2.2	3.1
South Acton	18.1	4.1	1.8	1.5
West Concord	15.4	5.5	2.8	2.6
Concord	9.4	4.9	9.0	4.9
Lincoln	7.1	6.0	3.3	4.0
Silver Hill	0.0	19.5	0.0	19.5
Hastings	0.0	5.3	0.0	5.3
Kendal Green	19.4	18.0	0.0	4.6
Brandeis/Roberts	21.4	14.3	14.7	12.4
Waltham	13.4	8.8	0.0	2.6
Waverley	0.0	7.0	14.3	24.5
Belmont	0.0	7.6	20.8	31.0
Porter Square	11.8	14.7	0.0	4.5

Source: 2008-09 MBTA Systemwide Passenger Survey.

Appendix D:
Estimated Weekday
Total Station-to-Station Trips
by Population

TABLE D-1
Estimated Weekday Total Station-to-Station Trips – All Passengers

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		0	7	14	1	2	2	4	1	0	0	0	4	4	2	3	110	133
North Leominster			5	10	0	1	1	3	1	0	0	0	3	3	1	2	82	99
Shirley				8	0	1	1	2	1	0	0	0	2	2	1	1	61	74
Ayer					0	2	2	3	1	0	0	0	4	4	2	2	104	125
Littleton/Route 495						2	1	3	1	0	0	0	3	3	2	2	85	103
South Acton							4	9	3	1	0	2	12	13	5	7	283	342
West Concord								4	1	0	0	1	5	7	2	3	136	164
Concord									0	0	0	1	6	6	3	4	156	189
Lincoln										0	0	1	3	3	1	2	73	88
Silver Hill											0	0	0	0	0	0	3	4
Hastings												0	0	0	0	0	12	15
Kendal Green													1	2	1	1	38	45
Brandeis/Roberts														7	3	4	182	218
Waltham															4	4	163	198
Waverley																1	30	36
Belmont																	25	31
Porter Square																		281
North Station																		

Source: Winter/Spring 2012 CTPS Commuter Rail Passenger Counts.

TABLE D-2
Estimated Weekday Total Station-to-Station Trips – Minority Passengers

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		0	1	2	0	0	0	1	0	0	0	0	1	1	0	0	17	20
North Leominster			1	1	0	0	0	0	0	0	0	0	0	0	0	0	9	11
Shirley				0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Ayer					0	0	0	0	0	0	0	0	0	0	0	0	9	10
Littleton/Route 495						0	0	0	0	0	0	0	0	0	0	0	6	8
South Acton							1	2	1	0	0	0	2	2	1	1	51	62
West Concord								1	0	0	0	0	1	1	0	0	21	25
Concord									0	0	0	0	1	1	0	0	15	18
Lincoln										0	0	0	0	0	0	0	5	6
Silver Hill											0	0	0	0	0	0	0	0
Hastings												0	0	0	0	0	0	0
Kendal Green													0	0	0	0	7	9
Brandeis/Roberts														1	1	1	39	47
Waltham															1	1	22	27
Waverley																0	0	0
Belmont																	0	0
Porter Square																		33
North Station																		

Source: Winter/Spring 2012 CTPS Commuter Rail Passenger Counts.

TABLE D-3
Estimated Weekday Total Station-to-Station Trips – Nonminority Passengers

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		0	6	12	1	2	2	3	1	0	0	0	3	3	2	3	93	113
North Leominster			4	9	0	1	1	3	1	0	0	0	3	3	1	2	73	88
Shirley				8	0	1	1	2	1	0	0	0	2	2	1	1	59	72
Ayer					0	2	2	3	1	0	0	0	4	4	2	2	95	115
Littleton/Route 495						2	1	3	1	0	0	0	3	3	2	2	79	95
South Acton							3	7	2	1	0	2	10	11	4	6	232	280
West Concord								3	1	0	0	1	4	6	2	3	115	139
Concord									0	0	0	1	5	5	3	4	141	171
Lincoln										0	0	1	3	3	1	2	68	82
Silver Hill											0	0	0	0	0	0	3	4
Hastings												0	0	0	0	0	12	15
Kendal Green													1	2	1	1	31	36
Brandeis/Roberts														6	2	3	143	171
Waltham															3	3	141	171
Waverley																1	30	36
Belmont																	25	31
Porter Square																		248
North Station																		

Source: Winter/Spring 2012 CTPS Commuter Rail Passenger Counts.

TABLE D-4
Estimated Weekday Total Station-to-Station Trips – Low-Income Passengers

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		0	1	2	0	0	0	1	0	0	0	0	1	1	0	0	16	19
North Leominster			1	1	0	0	0	0	0	0	0	0	0	0	0	0	9	10
Shirley				1	0	0	0	0	0	0	0	0	0	0	0	0	6	7
Ayer					0	0	0	0	0	0	0	0	0	0	0	0	2	2
Littleton/Route 495						0	0	0	0	0	0	0	0	0	0	0	2	2
South Acton							0	0	0	0	0	0	0	0	0	0	5	6
West Concord								0	0	0	0	0	0	0	0	0	4	5
Concord									0	0	0	0	1	1	0	0	14	17
Lincoln										0	0	0	0	0	0	0	2	3
Silver Hill											0	0	0	0	0	0	0	0
Hastings												0	0	0	0	0	0	0
Kendal Green													0	0	0	0	0	0
Brandeis/Roberts														1	0	1	27	32
Waltham															0	0	0	0
Waverley																0	4	5
Belmont																	5	6
Porter Square																		0
North Station																		

Source: Winter/Spring 2012 CTPS Commuter Rail Passenger Counts.

TABLE D-5
Estimated Weekday Total Station-to-Station Trips – Non-Low-Income Passengers

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		0	6	12	1	2	2	3	1	0	0	0	3	3	2	3	94	114
North Leominster			4	9	0	1	1	3	1	0	0	0	3	3	1	2	73	89
Shirley				7	0	1	1	2	1	0	0	0	2	2	1	1	55	67
Ayer					0	2	2	3	1	0	0	0	4	4	2	2	102	123
Littleton/Route 495						2	1	3	1	0	0	0	3	3	2	2	83	101
South Acton							4	9	3	1	0	2	12	13	5	7	278	336
West Concord								4	1	0	0	1	5	7	2	3	132	159
Concord									0	0	0	1	5	5	3	4	142	172
Lincoln										0	0	1	3	3	1	2	71	85
Silver Hill											0	0	0	0	0	0	3	4
Hastings												0	0	0	0	0	12	15
Kendal Green													1	2	1	1	38	45
Brandeis/Roberts														6	3	3	155	186
Waltham															4	4	163	198
Waverley																1	26	31
Belmont																	20	25
Porter Square																		281
North Station																		

Source: Winter/Spring 2012 CTPS Commuter Rail Passenger Counts.

Appendix E:
Estimated Weekday Total Time Savings from Station-to-Station by Population

TABLE E-1
Estimated Total Change in Travel Time – Minority Passengers

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		0	-1	-2	0	-1	-1	-4	-1	0	0	0	-4	-4	-2	-3	-139	-129
North Leominster			0	0	0	0	0	-2	0	0	0	0	-2	-2	-1	-1	-59	-52
Shirley				0	0	0	0	0	0	0	0	0	0	0	0	0	-14	-12
Ayer					0	0	-1	-1	0	0	0	0	-2	-2	-1	-1	-63	-56
Littleton/Route 495						0	0	-1	0	0	0	0	-1	-1	-1	-1	-40	-34
South Acton							-1	-6	-1	0	0	0	-6	-6	-2	-2	-249	-257
West Concord								-1	0	0	0	0	-1	-1	0	0	-25	-19
Concord									0	0	0	0	0	0	0	1	8	17
Lincoln										0	0	0	0	0	0	0	-4	-3
Silver Hill											0	0	0	0	0	0	0	0
Hastings												0	0	0	0	0	0	0
Kendal Green													0	0	0	0	-9	-19
Brandeis/Roberts														0	0	0	-56	-43
Waltham															0	0	-21	-17
Waverley																0	0	0
Belmont																	0	0
Porter Square																		-33
North Station																		

Source: CTPS.

TABLE E-2
Estimated Total Change in Travel Time – Nonminority Passengers

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		0	-5	-13	-2	-5	-8	-22	-4	0	0	0	-23	-21	-12	-17	-776	-719
North Leominster			3	4	0	-1	-3	-13	-3	0	0	0	-14	-13	-5	-10	-491	-427
Shirley				-2	0	-2	-4	-11	-4	0	0	0	-11	-10	-6	-6	-438	-397
Ayer					0	-3	-7	-15	-4	0	0	0	-21	-20	-11	-10	-687	-607
Littleton/Route 495						-1	-3	-13	-3	0	0	0	-13	-12	-9	-9	-480	-416
South Acton							-6	-27	-5	0	0	0	-29	-29	-7	-7	-1125	-1162
West Concord								-6	0	0	0	1	-4	-5	0	1	-134	-106
Concord									0	0	0	2	4	5	3	6	76	161
Lincoln										0	0	1	-2	-2	0	0	-51	-38
Silver Hill											0	0	0	0	0	0	3	0
Hastings												0	0	0	0	0	0	-15
Kendal Green													-1	-2	-1	0	-37	-80
Brandeis/Roberts														0	0	1	-205	-158
Waltham															0	1	-133	-112
Waverley																0	3	-32
Belmont																	-7	-40
Porter Square																		-248
North Station																		

Source: CTPS.

TABLE E-3
Estimated Total Change in Travel Time – Low-Income Passengers

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		0	-1	-2	0	-1	-1	-4	-1	0	0	0	-4	-4	-2	-3	-132	-123
North Leominster			0	0	0	0	0	-2	0	0	0	0	-2	-1	-1	-1	-58	-50
Shirley				0	0	0	0	-1	0	0	0	0	-1	-1	-1	-1	-42	-38
Ayer					0	0	0	0	0	0	0	0	0	0	0	0	-11	-10
Littleton/Route 495						0	0	0	0	0	0	0	0	0	0	0	-11	-10
South Acton							0	-1	0	0	0	0	-1	-1	0	0	-25	-25
West Concord								0	0	0	0	0	0	0	0	0	-4	-4
Concord									0	0	0	0	0	0	0	1	8	16
Lincoln										0	0	0	0	0	0	0	-2	-1
Silver Hill											0	0	0	0	0	0	0	0
Hastings												0	0	0	0	0	0	0
Kendal Green													0	0	0	0	0	0
Brandeis/Roberts														0	0	0	-38	-30
Waltham															0	0	0	0
Waverley																0	0	-5
Belmont																	-2	-8
Porter Square																		0
North Station																		

Source: CTPS.

TABLE E-4
Estimated Total Change in Travel Time – Non-Low-Income Passengers

Station	Fitchburg	North Leominster	Shirley	Ayer	Littleton/Route 495	South Acton	West Concord	Concord	Lincoln	Silver Hill	Hastings	Kendal Green	Brandeis/Roberts	Waltham	Waverley	Belmont	Porter Square	North Station
Fitchburg		0	-5	-13	-2	-5	-8	-22	-4	0	0	0	-23	-22	-12	-17	-782	-725
North Leominster			3	4	0	-1	-3	-13	-3	0	0	0	-14	-13	-5	-10	-493	-428
Shirley				-2	0	-2	-3	-10	-4	0	0	0	-10	-10	-6	-5	-410	-371
Ayer					0	-3	-7	-16	-4	0	0	0	-23	-21	-12	-11	-739	-653
Littleton/Route 495						-1	-3	-13	-3	0	0	0	-14	-13	-10	-9	-508	-441
South Acton							-8	-32	-7	0	0	0	-35	-35	-8	-9	-1349	-1394
West Concord								-7	0	0	0	1	-5	-5	0	1	-154	-122
Concord									0	0	0	2	4	5	3	6	76	162
Lincoln										0	0	1	-2	-2	0	0	-53	-40
Silver Hill											0	0	0	0	0	0	3	0
Hastings												0	0	0	0	0	0	-15
Kendal Green													-1	-2	-1	-1	-46	-99
Brandeis/Roberts														0	0	1	-223	-171
Waltham															0	2	-154	-129
Waverley																0	3	-28
Belmont																	-6	-32
Porter Square																		-281
North Station																		

Source: CTPS.

Appendix 7-I

FMCB Approval of Service Equity Analysis for the Fitchburg Line Improvement Project and Wachusett Extension Project

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WHEREAS, the Fiscal and Management Control Board (the "FMCB") voted on July 11, 2016 to execute an Amendment to a certain Interdepartmental Service Agreement (ISA) with the Massachusetts Department of Transportation (MassDOT) for the Wachusett Extension Project; and that the MBTA has conducted a Fitchburg Commuter Line Improvement project under an FTA Tiger grant;

WHEREAS, the Federal Transit Administration requires that equity analyses be conducted on major service changes as defined by the MBTA and on Small Starts and other New Fixed Guideway Systems grants;

WHEREAS, the MBTA staff has conducted an equity analysis as to the Fitchburg project and determined that said project poses neither a disparate impact or disproportionate burden to minorities or low-income individuals;

WHEREAS, the MBTA staff has conducted an equity analysis as to the Wachusett project and determined that said project may pose a disparate impact but does not pose a disproportionate burden to minorities or low-income individuals;

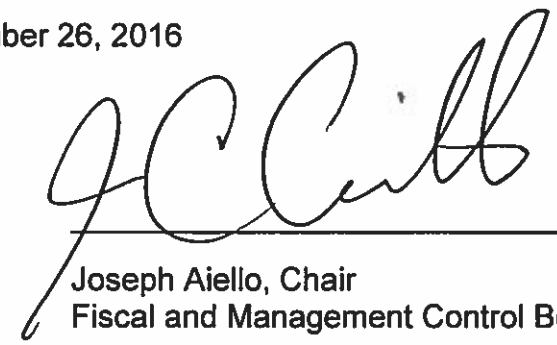
WHEREAS, the MBTA's equity analysis provided a showing of a substantial legitimate justification the Wachusett service change and there are no alternatives that would have a less disparate impact on minority riders;

NOW, THEREFORE, BE IT VOTED by the members of the FMCB, as follows:

The FMCB hereby accepts the Title VI Equity Analysis determinations and directs the Authority, through the General Manager to take all steps necessary to provide notice of such acceptance to all interested parties, including the Federal Transit Authority.

A true copy,

Attest: September 26, 2016



Joseph Aiello, Chair
Fiscal and Management Control Board