

APPENDIX E. RIDERSHIP FORECASTS AND MARKET ASSESSMENT



Ridership Forecasts and Market Assessment

Overview

As part of the Plaistow Commuter Rail Extension Study, the New Hampshire Department of Transportation (NH DOT) developed a set of alternatives for a potential extension of Massachusetts Bay Transportation Authority (MBTA) commuter rail service from Haverhill, Massachusetts to the Plaistow, New Hampshire area. The initial set of alternatives was screened to three alternatives.

The three station alternative sites are all located within one-quarter mile of each other between Route 125 (Plaistow Road) and Route 121A (Main Street). Since the three alternative station sites are located in such close proximity, the difference in ridership would be negligible and therefore the ridership estimates apply to any of the three alternatives selected.

The ridership estimate consists on two components: forecasting riders that are **diverted** (or transferred) to the Plaistow Commuter Rail Station from existing trips/routes that are currently being made; and new commuter rail riders to the Plaistow Commuter Rail Station that are **induced** to begin a travel pattern that they currently do not make.

For this study, the **diverted** ridership component of the forecast considers existing commuter rail and highway users that currently travel from the Plaistow area to the Boston area that would be diverted to the proposed commuter service at Plaistow. This was computed using data from two different surveys. One survey source was daily travel origin/destination volumes that are based on the agglomeration of cell phone data purchased through a data collection firm. The other survey source was an on-board survey of riders that was conducted by the Boston Region Metropolitan Planning Organization (MPO) Central Transportation Planning Staff (CTPS) for the MBTA in 2008-2009 combined with existing (2013) ridership data.

The **induced** component of the ridership estimate utilized an analysis of existing employment data from the U.S. Census Bureau and the survey data from the MBTA to evaluate the opportunity to induce additional riders to the proposed commuter rail service that currently do not travel from the Plaistow area to Boston. The methodology and ridership projections for each component of the ridership forecasts are discussed in detail below.

Existing Haverhill Line Ridership/Parking Utilization

According to the MBTA's *2014 Ridership and Service Statistics* report (2014 Blue Book), the Haverhill commuter line carries approximately 5,008 trips on an average weekday.¹ The Haverhill line travels from Haverhill, Massachusetts through the northern suburban Boston area before terminating at North Station in Boston. In 2013, the total daily boardings at the Haverhill and Bradford stations were 854.

¹ MBTA, *Ridership and Service Statistics*, Fourteenth Edition 2014, <http://www.mbta.com/uploadedfiles/documents/2014%20BLUEBOOK%2014th%20Edition.pdf>



Compared to other terminal stations within the MBTA commuter rail system, Haverhill Station is within the mid-range of the number of boardings by station. As shown in Table 1, the number of average daily boardings at Haverhill Station, and other commuter rail stations, is subject to change on an annual basis. In many instances between 2007 and 2013, the number of daily boardings increased and decreased at comparable stations by as much as 100 to 200 boardings. This annual variation is likely due to a number of factors such as level of regional highway congestion, changes in the economy or employment, changes in commuter rail or parking fares, or impacts to service from capital improvement projects. This variation also occurs at non-terminal stations located within other communities that are comparable to Plaistow in terms of population and distance to downtown Boston.

Table 1. Comparison of Average Daily Boardings at Existing MBTA Stations, 2007-2013

Station		Average Daily Boardings By Station						
		2007	2008	2009	2010	2011	2012	2013
Terminal	Newburyport	610	497	568	534	661	703	812
	Rockport	421	291	390	278	245	337	323
	Haverhill	479	583	536	478	677	467	576
Comparable Community	Bradford	365	480	391	276	380	299	278
	Ayer	327	427	490	304	419	405	435
	Rowley	156	167	164	125	175	111	140
	Shirley	191	218	144	189	240	297	315

Source: MBTA 2014 Blue Book

According to the CTPS *MBTA Systemwide Passenger Survey: North Side 2008-09 Station-by-Station Tables - Commuter Rail* (MBTA Survey),² 92 to 99 percent of the commuter rail trips originating at Haverhill and Bradford stations are work-, business-, or school-related. The majority of these trips are inbound to Boston in the morning and outbound from Boston in the afternoon/evening. Among the primary reasons for using the MBTA Commuter Rail services were to avoid driving/traffic and to avoid parking at their destination. A license plate survey conducted by the Merrimack Valley Planning Commission (MVPC) in March 2013 indicated that 25 percent of the cars parked at Haverhill station came from New Hampshire. This is consistent with the findings of the MBTA Survey.

Currently, two parking lots serve Haverhill Station. An MBTA parking lot is located directly alongside the station, provides a capacity of 159 spaces, and charges \$4 per day. Its current utilization is about 28 percent.³ The MBTA lot at Bradford Station is larger, with 303 parking spaces. The average weekday availability is 78 percent.

² Central Transportation Planning Staff (CTPS), *MBTA Systemwide Passenger Survey: North Side 2008-09, Station-by-Station Tables - Commuter Rail*, http://www.ctps.org/Drupal/2008_09_mbta_survey

³ MBTA, Haverhill Station Information, http://www.mbta.com/schedules_and_maps/rail/lines/stations/?stopId=83



Visual observation indicates that a large number of riders at Haverhill Station park on streets in order to avoid the \$4.00 parking fee. The Merrimack Valley Regional Transit Authority (MVRTA) owns another parking garage, which is located about 150 feet from the rail station and has a direct skyway access to the rail platform. It has a capacity of 315 spaces and charges an hourly rate. According to the MVRTA's website, the current rates for this lot are \$1 for 0-1 hours, \$2 for 1-2 hours, \$3 for 2-4 hours, \$4 for 4-18 hours, and \$8 for 18+ hours. A discount is provided for frequent parkers through a monthly pass.⁴ The combination of a monthly pass and skyway access makes the MVRTA garage more attractive than the MBTA parking lot for many passengers and therefore appears to have higher utilization.

Diverted Riders

To help develop near-term ridership, two methods were used to identify existing daily trips between the Plaistow area and Boston area that would likely be **diverted** to commuter rail service at Plaistow. The first method involved analysis of cell phone data and the second involved analysis of existing boardings and employment data.

Cell Phone Data Analysis of Existing Ridership & Diversion Potential

METHODOLOGY

The methodology for analysis of cell phone data involved developing an initial analysis of existing travel behavior of people currently residing in the existing Haverhill Station market area, including the proportion of these people that use the commuter rail option to travel to downtown Boston. To estimate the potential rail trips to downtown Boston via a new station in Plaistow, a market area for a new station in Plaistow was developed and a similar ratio of commuter rail riders was applied to the residents within this new station market area.

DATA COLLECTION/ANALYSIS

To understand the existing travel behavior in the study area, it was necessary to obtain accurate data of the number of people traveling from the Haverhill / Plaistow study area to downtown Boston by time of day. The required data was developed based on cell phone based movement tracking. Use of cell phone data is fast becoming the preferred method of determining accurate travel patterns based on its ability to capture a substantial amount of data. This reduces the errors that often occur with survey-based data because of the relatively low relative responses compared to the actual trips made. The data was obtained from the cell data service provider StreetLight Data.⁵

For this study, StreetLight Data provided the following data:

- Total number of trips originating from the Haverhill Station market area and traveling to downtown Boston and Back Bay area on an average weekday;
- Total number of trips originating from the Haverhill Station market area traveling to Haverhill commuter rail station on an average weekday; and

⁴ Merrimack Valley Regional Transit Authority, Haverhill Parking Facility information, <http://www.mvrta.com/HomepageContent/Haverhill-Garage.aspx>

⁵ StreetLightData, <http://www.streetlightdata.com/>

- Total number of trips originating from a Plaistow Station market area and traveling to downtown Boston and Back Bay area on an average weekday.

STATION MARKET AREAS

For this portion of the ridership analysis, station market areas were defined based on the parameters used in the Boston MPO’s travel demand forecasting model, one for Haverhill station and one for Plaistow station. In general, for terminal stations on a commuter rail line, with good freeway access, the park-and-ride trips can be drawn from as far as 10 miles from the rail station. Figure 1 shows the initial Plaistow Station market area (in green) used in the analysis. This market area does not overlap the market area of another rail line. In the same figure, the market area for the Haverhill station is also shown (in yellow). It is noted that the initial market area for Plaistow station is more extensive than the Haverhill station market area in the future since Plaistow would become the terminal station. The Plaistow Station market area identified for this initial analysis covers the towns located within ten miles of the station.

The target travel destination area that was considered in trip estimation to Boston is shown in Figure 2. The target areas are considered conservative, as they do not include the fast growing area of South Boston and the high tech areas of Cambridge.

Figure 1: Park and Ride Capture Area for the Existing Haverhill Station and the Proposed Plaistow Station

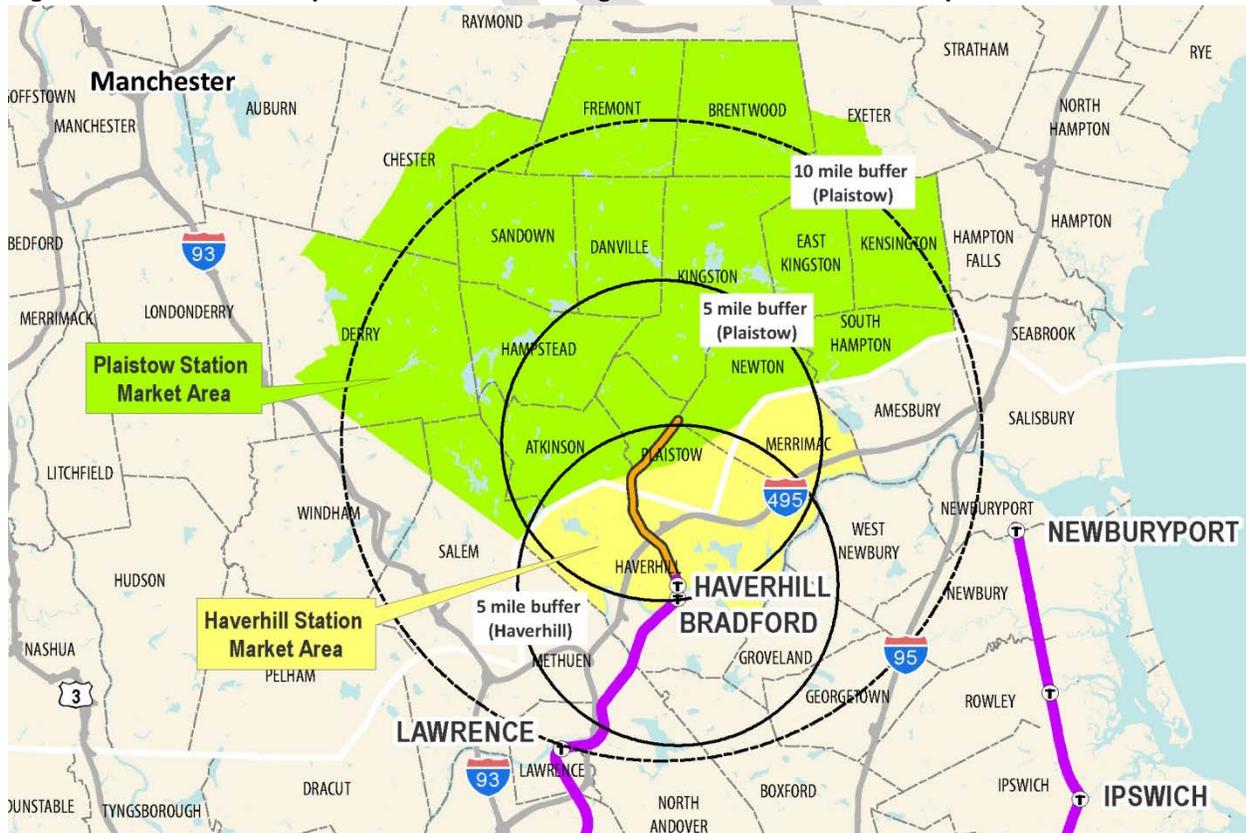
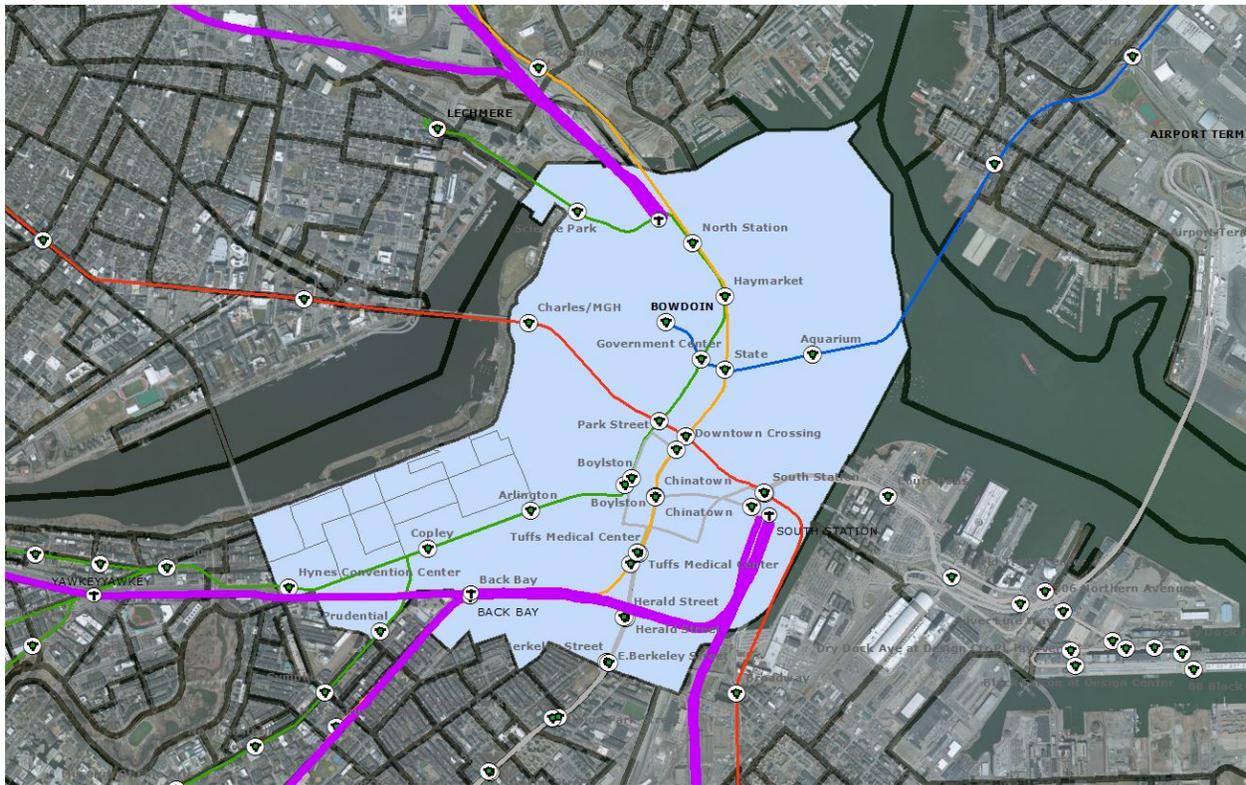


Figure 2: Destination Area (Downtown Boston and Back Bay) for Commuter Rail Users



CELL PHONE/GPS DATA SOURCE

The travel metrics provided by StreetLight Data are derived from anonymous, trace data from GPS navigation devices. The navigation device sources include smart phone navigation applications, in-dashboard car navigation systems, after market navigation hardware and commercial vehicle management systems.

These metrics have significant strengths over the metrics primarily derived from cellular-based data traces including:

- Extreme spatial precision down to five meters or better;
- High frequency sampling rate (on average greater than once per minute); and
- Ability to separate commercial and personal trips.

The use of GPS navigation trace data is a very effective tool for establishing trip origin and destinations and travel times between areas. Millions of data records were analyzed to determine whether vehicles traveled between the market areas and existing travel between Haverhill Station and downtown Boston. Additional filters were applied over the study period to determine trips occurring on weekdays versus weekends and the time of day the trips occurred (i.e., morning, mid-day, afternoon, or evening). This allowed for comparison of commuter behavior to general travel behavior in the region.

CELL PHONE/GPS ANALYSIS RESULTS

The cell phone/GPS data indicates there are currently 490 people traveling from the Haverhill Station Market Area (shown in Figure 1) to the Downtown Boston Destination Area (shown in



Figure 2). The number of people originating from the Haverhill Station Market Area and going to Haverhill Station is about 460, according to the cell phone/GPS data. This indicates that almost 94 percent of the downtown bound travelers residing in the Haverhill Station Market Area use the commuter rail. Although this percentage might appear unusually high, other data sources such as U.S. Census 2000 Journey-to-Work and U.S. Census Bureau's 2006-2010 American Community Survey (ACS) Five-Year Estimates support this finding.

According to the cell phone/GPS data analysis, the total number of people traveling from the initial Plaistow Station Market Area shown in Figure 1 to the Downtown Boston Destination Area is 100. Applying the same 90 percent commuter rail mode share as seen in the Haverhill Station Market Area would result in 90 daily rail boardings based on the Plaistow Station Market Area shown in Figure 1 destined to downtown Boston. The findings from this data analysis were then compared to the MBTA Survey data as identified below.

Existing MBTA Ridership Data Comparison

METHODOLOGY

To confirm the validity/reasonableness of the data provided through the cell phone data, the estimated ridership at Plaistow Station was compared to the existing ridership experienced at the Haverhill and Bradford stations. MBTA station boarding statistics from the 2014 Blue Book⁶ and the 2008-09 MBTA Survey⁷ results were the data sources utilized for this assessment. The MBTA Survey provided origin/destination information for existing riders.

INITIAL RIDERSHIP ESTIMATES

The survey results were used to estimate how many of the total boardings at the Haverhill and Bradford stations originated from the Plaistow Area. The survey includes a series of tables that show the origin and destination for all boardings at the Haverhill and Bradford stations. Using survey results and the total number of boardings at the Haverhill and Bradford stations in 2013, an estimated 139 people from the five-town area of Plaistow, Atkinson, Newton, Hampstead, and Kingston currently utilize the MBTA Haverhill Commuter Rail service. There were not noted boarding from the other twelve towns included in the initial Plaistow Station Market Area.

This finding is consistent with the survey results on the Haverhill Line and other MBTA lines show that, on average, 92 to 95 percent of commuter rail riders travel no more than 20 minutes to access the commuter rail station. Based on this information, the estimated Plaistow Station Market Area was reduced from the 10-mile area shown in Figure 1 to the smaller five-town area identified above.

Furthermore based on the data from the MBTA Survey, it was identified that ridership increased by 34 percent when considering destinations within Boston and Cambridge, but outside of the Downtown/Back Bay core that was used for the cell phone data analysis (Figure 2). This downtown core has historically been understood as the destination of commuter rail riders.

⁶ MBTA, *Ridership and Service Statistics*, Fourteenth Edition 2014,

<http://www.mbta.com/uploadedfiles/documents/2014%20BLUEBOOK%2014th%20Edition.pdf>

⁷ Central Transportation Planning Staff (CTPS), *MBTA Systemwide Passenger Survey: North Side 2008-09 Station-by-Station Tables - Commuter Rail*, http://www.ctps.org/Drupal/2008_09_mbt_a_survey



Resulting from an assessment of the MBTA Survey results, the understanding of origins and destination of riders who would use commuter rail service from Plaistow was modified. The origin of riders would be generally limited to the five town area of Plaistow, Atkinson, Newton, Hampstead, and Kingston, with some additional riders (5 to 8 percent) coming from other New Hampshire towns. The destination of riders was expanded to include all of Boston and Cambridge.

Regardless of the change in understanding of origin and destination patterns, the MBTA Survey confirms the reasonableness of the cell phone data in identifying that 92 riders from the five-town Plaistow Area are currently using commuter rail to access the Downtown/Back Bay area. An estimated 139 daily riders from the five-town area use the existing commuter rail service to access the entire Boston/Cambridge area.

Although it is documented that 139 daily riders come from the five-town Plaistow Area, it is estimated that approximately 15 percent of those riders would still board at Haverhill or Bradford stations. Therefore, the estimated number of riders at a new Plaistow Station on opening day is 118. A summary of this estimate is provided in Table 2 at the end of this memorandum. Additional supporting tables are provided in an appendix.

Induced Riders

To understand how the improved commuter rail service may impact peoples travel choices, a second method to estimate how Plaistow and the surrounding areas would be served by a new station in Plaistow utilized employment data from the 2006-2010 American Community Survey conducted by the U.S. Census.⁸ This method estimates the number of new riders that would utilize the commuter rail service about one year after the start of service. A summary of this estimate is provided in Table 2 at the end of this memorandum. Additional supporting tables are provided in an appendix.

Improved Train Service-Induced Growth in Ridership

The second component of the near-term ridership forecast is to estimate the potential to **induce** additional riders to the proposed commuter rail service that currently do not travel from the Plaistow area to Boston or Cambridge. The process includes an alternative means of estimating diversion of existing riders and the estimation for inducement of users to begin to travel to Boston within one year of the start of service to Plaistow.

According to the U.S. Census Bureau's 2006-2010 ACS Five-Year Estimates, the total number of workers within the Plaistow Area communities was 17,485 in 2010. The number of workers was 52 percent of the area's total population of 33,511. Approximately 4.2 percent of these workers, or 743 workers, were employed within Cambridge or Boston. For this estimation methodology, it is assumed that the majority of the commuter rail riders' destination is Cambridge or Boston.

⁸ U.S. Census Bureau, *2006-2010 American Community Survey Five-Year Estimates*, Table 3, Residence MCD/County to Workplace MCD/County Flows for the United States and Puerto Rico Sorted by Residence Geography: 2006-2010, <http://www.census.gov/population/metro/data/other.html>.



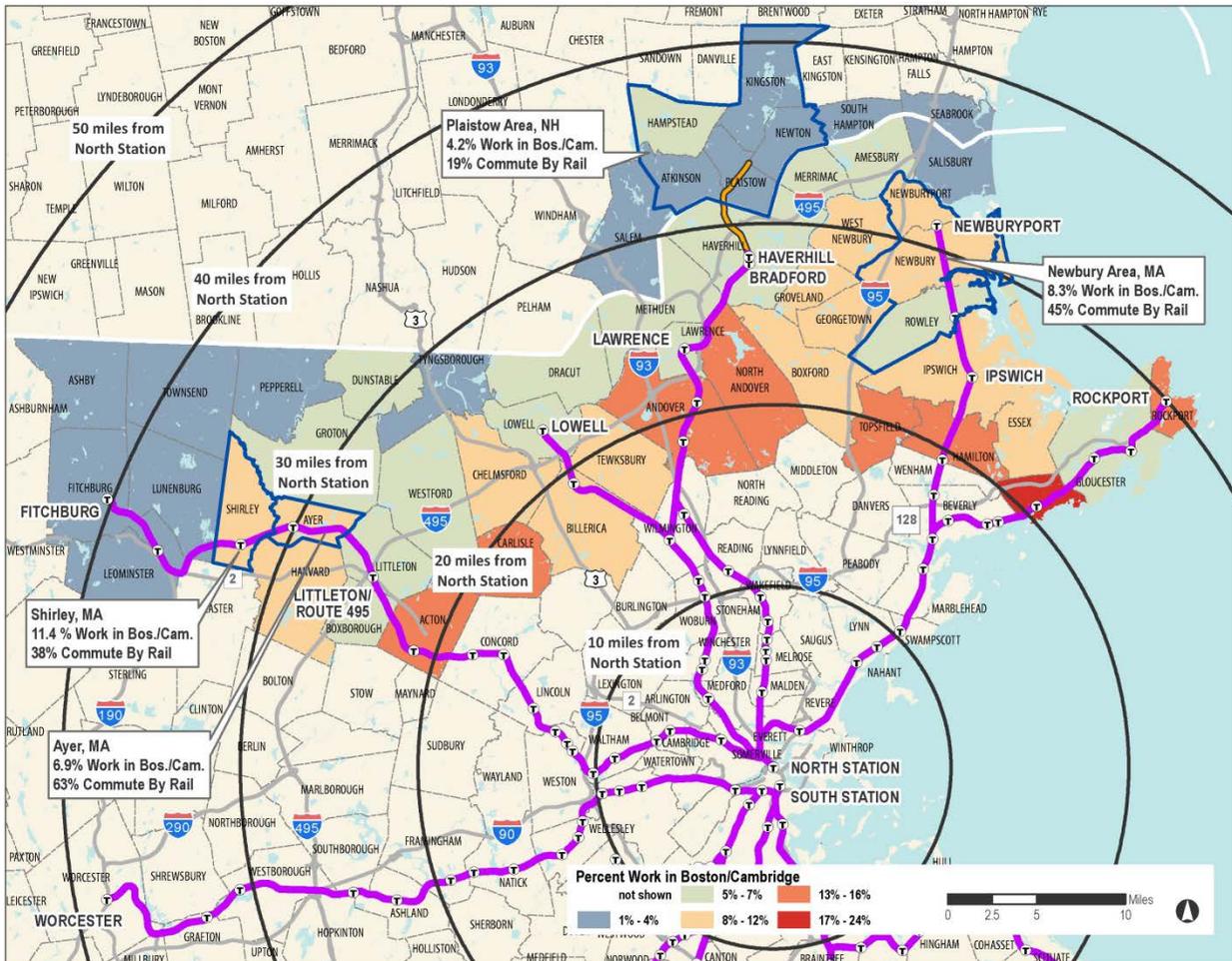
According to 2015 population estimates from the New Hampshire Office of Energy and Planning (NHOEP), the total Plaistow Area population in 2015 was estimated at 33,491. Based on the percent of area workers employed in 2010, the total number of Plaistow Area workers is estimated at 17,469 in 2015. Assuming that the number of workers employed within Cambridge or Boston remains the same as 2010 (4.2 percent of total workers), an estimated 742 Plaistow Area workers work in one of these two destinations.

Results from the MBTA Survey, 2006-2010 ACS estimates, and the total number of boardings at Haverhill and Bradford stations in 2013 were used to estimate how many of the total boardings at the Haverhill and Bradford stations were riders from the Plaistow Area. An estimated 139 daily riders, or 19 percent of the 742 Plaistow Area workers, commute to work in Boston or Cambridge using commuter rail.

Based on an evaluation of comparable communities, the Plaistow Area has lower rates of employment in Boston or Cambridge, as well as the number of existing workers who commute by commuter rail. As shown in Figure 3, other communities with similar demographics and distance from Boston have both higher percentages of workers employed in Boston or Cambridge and commuter ridership double or triple that of the Plaistow Area.⁹ (See also Table A1 in the appendix.)

⁹ U.S. Census Bureau, *2006-2010 American Community Survey Five-Year Estimates*, Table 3, Residence MCD/County to Workplace MCD/County Flows for the United States and Puerto Rico Sorted by Residence Geography: 2006-2010, <http://www.census.gov/population/metro/data/other.html>.

Figure 3. Comparator Communities Boston and Cambridge Employment



Source: U.S. Census Bureau, 2006-2010 ACS Five-Year Estimates.

In Ayer, Massachusetts, a town northwest of Boston on the Fitchburg commuter rail line, approximately 6.9 percent of workers are employed in Boston and Cambridge, and 63 percent of those workers commute to work by rail. The adjacent community of Shirley, Massachusetts is also located on the Fitchburg line. An estimated 11.4 percent of workers in that town work in Boston or Cambridge, and an estimated 38 percent commute by rail. In the three communities at the northern end of the Newburyport commuter rail line, an estimated 8.3 percent work in Boston or Cambridge and an estimated 55 percent of those workers commute to work by rail.

As previously described, 19 percent of the 742 Plaistow Area workers employed in Cambridge or Boston commute to work by rail. If the number of Plaistow Area Cambridge/Boston workers who commute by rail increased from 19 to 30 percent to be more in line with ridership in comparable communities, the total estimated number of workers who would commute by rail is 223.

To account for riders who do not commute every day during the five-day workweek, it is estimated that only 85 percent of the total Plaistow Area commuter riders commute on a daily basis. This results in an average daily ridership of 189. Additionally, the projected number of



boardings at a new Plaistow Station is further reduced by 15 percent to account for riders who would board at another station. The number of boardings at Plaistow Station is increased by 5 percent to include additional riders from outside the Plaistow Area. Based only on the combination of commuter rail riders and increased ridership based on improved access and service, it is projected that near-term ridership at a new station in Plaistow could be approximately 170 boardings per day.

This ridership estimate is summarized in Table 2 at the end of this memorandum. The estimate includes riders that would transfer from boarding at another station and new commuter rail riders that would utilize the service. Subtracting out the number of estimated riders that would transfer from another station (118 boardings), the total induced ridership is estimated to be 52 riders. The inducement of the 52 riders is expected to occur over the first twelve months of service.

2030 Ridership Projections

Using existing estimates for employment and ridership, two different growth scenarios were used to project ridership at a Plaistow station in 2030. The first scenario involved an increase in the percentage of existing Plaistow Area workers who are employed in Boston or Cambridge. The second scenario considers an overall growth in population and employment in the Plaistow Area based on an annual growth rate of 0.32 percent. Both scenarios are described in the following text and summarized in Table 2 at the end of this memorandum.

Growth of Plaistow Area Workers

Currently, an estimated 4.2 percent of the total 17,469 Plaistow Area workers are employed in Boston or Cambridge. As outlined previously, in comparable communities, the percent of total workers employed in these two cities is much higher, ranging from 6.9 percent in Ayer, 8.3 percent in the Newburyport area, and 11.4 percent in Shirley. Based on this comparison with communities with commuter rail service, it is reasonable to assume that a one percent growth in the total percentage of Plaistow Area workers who are employed in Boston or Cambridge would occur by 2030. Based on this modest increase to 5.2 percent, by 2030 an estimated 917 Plaistow Area workers would be employed in Boston or Cambridge.

Additionally, an estimated 19 percent of Plaistow Area workers who are employed in Boston or Cambridge commute by rail. In the other comparable communities, the percent of workers who commute by rail is between 38 to 63 percent. Assuming that the number of Plaistow Area workers employed in Boston or Cambridge increases to 35 percent, it is projected that 321 workers would commute by rail.

To account for riders who do not commute every day during the five-day workweek, it is estimated, based on data from the MBTA Systemwide Passenger Survey that only 85 percent of the total Plaistow Area commuter riders commute on a daily basis. Additionally, the projected number of boardings at a new Plaistow Station is further reduced by 15 percent to account for riders who would board at another station. The number of boardings at Plaistow Station is increased by 5 percent to include additional riders from outside the Plaistow Area. Based on the combination of commuter rail riders and increased ridership based on an increase in the



percentage of existing workers who work in Boston or Cambridge and who choose to commute by rail, it is projected that 2030 ridership could be approximately 246 boardings per day.

Summarized in Table 2 at the end of this memorandum, this ridership estimate includes existing riders that would transfer from boarding at another station and new commuter rail riders that would utilize the service. After subtracting the number of riders that would transfer from another station (118 boardings), the total induced ridership by 2030 is estimated to be 128 riders.

Overall Population/Employment Growth

The previous growth scenario assumed that population and the number of workers in the Plaistow Area would remain static between 2015 and 2030. This future ridership projection assumes a growth in employment using an annual growth rate of 0.32 percent. According to the NHOEP, the projected number of total Plaistow Area workers in 2030 is projected to be 18,351.¹⁰ Assuming that the percent of those workers who are employed in Boston or Cambridge also increases modestly to 5.2 percent, as estimated under the other future growth scenario, it is projected that 963 Plaistow Area workers would work in one of these two cities by 2030.

This scenario also assumes that the percent of those workers who commute by rail would also increase from 19 percent to 35 percent, based on rates of commuter rail usage in other comparable communities with commuter rail service. Out of the total 963 Boston or Cambridge workers, it is estimated that 337 would commute by rail. As was done in the previous estimate methodologies, ridership estimates were modified to reflect daily riders, riders from outside the core market area and rider that board at another station. The resulting total projected ridership is 258 riders taking into account this additional growth in the region.

This ridership projection is estimated in Table 2 at the end of this memorandum. The total number of induced riders in this scenario is 140. This is calculated by reducing the number of estimated daily riders (258 boardings) by the number of existing riders that would transfer from another station (118 boardings).

Ridership Summary

Based on the two estimates of existing commuter rail ridership utilizing other commuter rail stations, the ridership forecasts for the transfer or diversion of riders is between 90 and 104 at the initiation of service. The cell phone data estimate is based on a larger market area, but a smaller destination area that includes downtown Boston and the Back Bay. The second set of estimates based on an employment and ridership data comparison, show higher estimates of existing ridership because the destination area includes all of Boston and Cambridge. The anticipated initial ridership in this estimate is 104 daily boardings. The number of daily boardings is expected to increase to 170 daily boardings at the end of year one of service.

¹⁰ The projected number of total workers for the Plaistow Area in 2030 is based on NHOEP Population Forecasts. Between 2015 and 2030, the annual population growth rate is 0.32%. For this analysis, the total number of workers was estimated to grow at the same rate of growth. NHOEP, *Population Projection by Municipality: Fall 2013*, <http://www.nh.gov/oep/data-center/population-projections.htm>.



Projections for service in year 2030 are conservatively estimated to be approximately 258 daily boardings. In the case that Plaistow Station area residents commute to Boston and utilize commuter rail at rates comparable to other communities in the region, ridership at Plaistow Station would be 25 to 30 percent higher.

Table 2. Near-Term and Long-Term Ridership Forecasts

	Existing Conditions (2015)		Future Conditions (2030)	
	Diversion/ Transfer of Existing Riders (Day 1)	Improved Train Service-Related Growth (Year 1)	Growth of Boston/ Cambridge Workers	Projected Growth of Population
Plaistow Area ¹				
Existing Total Workers (2015) ²	17,469	17,469	17,469	17,469
Projected Total Workers ³				18,351
Existing Percent Work in Boston/Cambridge (2015) ⁴	4.2%	4.2%		
Existing Boston/Cambridge Workers (2015)	742	742		
Projected Percent Work in Boston/Cambridge (1% Growth) ⁵			5.2%	5.2%
Projected Boston/Cambridge Workers			917	963
Estimated Percent Commute By Rail ⁶	19%	30%	35%	35%
Estimated Workers Commute by Rail	139	223	321	337
Existing Ridership (Haverhill/Bradford Stations)	139			
Projected Total Ridership (All Stations)		223	321	337
Average Daily Rider (85% of Total Ridership) ⁷	139	189	273	287
Projected Boardings at New Plaistow Station (85% of Average Daily Riders) ⁸	118	170	246	258
Induced Boardings (Increased riders after initial transfer of existing riders) in above total ridership		52	128	140

(Source notes on following page)

Table 1 source notes:

1. Plaistow Area includes Plaistow, Atkinson, Newton, Hampstead, and Kingston, NH.
2. The total number of existing workers is based on the U.S. Census Bureau's 2006-2010 American Community Survey (ACS) Five-Year Estimates (Table 3, Residence MCD/County to Workplace MCD/County Flows for the United States and Puerto Rico Sorted by Residence Geography: 2006-2010, <http://www.census.gov/population/metro/data/other.html>) and New Hampshire Office of Energy and Planning (NHOEP), Population Forecasts by Municipality: 2013 (<http://www.nh.gov/oep/data-center/population-projections.htm>).
3. The projected number of total workers for the Plaistow Area in 2030 is based on NHOEP Population Forecasts. Between 2015 and 2030, the annual population growth rate is 0.32%. For this analysis, the total number of workers was estimated to grow at the same rate of growth.



4. *The percent of Plaistow Area workers that work in Boston or Cambridge in 2015 is based on 2010 employment data from the U.S. Census Bureau's 2006-2010 ACS Five-Year Estimates.*
5. *The existing percent of workers that commute by rail is 19% and is based on employment data from the U.S. Census Bureau's 2006-2010 ACS Five Year Estimates and MBTA Survey results showing origin and destination by station (CTPS, MBTA Systemwide Passenger Survey: North Side 2008-09 Station-by-Station Tables - Commuter Rail, http://www.ctps.org/Drupal/2008_09_mbt_a_survey). The projected increase in the percent of workers employed in Boston or Cambridge is based on comparable communities with commuter rail service (percent of workers employed in Boston/Cambridge range from 6.9 to 11.4%).*
6. *The estimated percent of workers who commute by rail is calculated by dividing the number of Boston and Cambridge workers from the 2006-2010 ACS Five-Year Estimates by the number of estimated boardings by origin and destination for each Plaistow Area community (CTPS, MBTA Systemwide Passenger Survey: Commuter Rail 2008-09). Projected increases are based on comparable communities with commuter rail service (percent of Boston/Cambridge workers who commute by rail ranges from 38 to 63%).*
7. *For employment-based ridership estimates, the number of average daily riders is based on a reduction of the total ridership to account for riders who do not commute every day during the five- day workweek.*
8. *The projected number of boardings at a new Plaistow station is based on a 15% reduction of the daily number of riders from the Plaistow Area to account for riders who would board at another station (Haverhill or Bradford), plus the addition of approximately 5% of riders who would come from outside the Plaistow area.*

DRAFT



Appendix

Table A1. Plaistow Area and Comparator Communities Boardings by Origin and Destination, Employment, and Estimated Ridership

Origin Town	2008 Station Boardings**			2008 Boardings by Destination**				% of Total Station Boardings	Estimated Boardings (2013)****	2010 Employment by Origin Town*****			Estimated % Commute by Rail (2013)*****
	Haverhill	Bradford	Total	Downtown Boston	Other Boston	Cambridge	Other			Total Workers	Boston/Cambridge Workers	% of Total Workers	
Total (All Origins)	353	250	603	Haverhill/Bradford Station - 2013 Daily Boardings***				854					
Atkinson	27	6	33	18	12	3	0	5%	47	3,235	122	3.8%	38%
Hampstead	21	8	29	23	0	6	0	5%	41	4,514	278	6.2%	15%
Plaistow	18	9	27	18	6	0	3	4%	38	4,032	180	4.5%	21%
Newton	6	0	6	3	3	0	0	1%	8	2,618	101	3.9%	8%
Kingston	3	0	3	3	0	0	0	0%	4	3,086	62	2.0%	7%
Total (Plaistow Area)*	75	23	98	65	21	9	3		139	17,485	743	4.2%	19%
Percent of Total (Plaistow Area)	21%	9%	16%	66%	21%	9%	3%						

Origin Town	2008 Station Boardings Ayer**	2008 Boardings by Destination**				% of Total Station Boardings	Estimated Boardings (2013)****	2010 Employment by Origin Town*****			Estimated % Commute by Rail (2013)*****
		Downtown Boston	Other Boston	Cambridge	Other			Total Workers	Boston/Cambridge Workers	% of Total Workers	
Total (All Origins)	284	Ayer Station - 2013 Daily Boardings***				435					
Total (Ayer)	115	57	15	18	27	40%	176	4,032	280	6.9%	63%
Percent of Total (Ayer)	40%	50%	13%	16%	23%						

Origin Town	2008 Station Boardings Shirley**	2008 Boardings by Destination**				% of Total Station Boardings	Estimated Boardings (2013)****	2010 Employment by Origin Town*****			Estimated % Commute by Rail (2013)*****
		Downtown Boston	Other Boston	Cambridge	Other			Total Workers	Boston/Cambridge Workers	% of Total Workers	
Total (All Origins)	128	Shirley Station - 2013 Daily Boardings***				315					
Total (Shirley)	52	9	10	11	27	41%	128	2,923	333	11.4%	38%
Percent of Total (Shirley)	41%	17%	19%	21%	52%						

Origin Town	2008 Station Boardings**			2008 Boardings by Destination**				% of Total Station Boardings	Estimated Boardings (2013)****	2010 Employment by Origin Town*****			Estimated % Commute by Rail (2013)*****
	Newburyport	Rowley	Total	Downtown Boston	Other Boston	Cambridge	Other			Total Workers	Boston/Cambridge Workers	% of Total Workers	
Total Boardings (ALL Origins)	450	142	592	Newbury/Rowley Stations - 2013 Daily Boardings***				952					
Newbury	27	8	35	12	2	0	21	6%	56	3,439	270	7.9%	21%
Newburyport	230	5	235	112	15	31	70	40%	378	9,132	811	8.9%	47%
Rowley	0	93	93	69	4	12	8	16%	150	2,955	215	7.3%	70%
Total Boardings (Newbury Area)*	257	106	363	193	21	43	99		584	15,526	1,296	8.3%	45%
Percent of Boardings (Newbury Area)	57%	75%	61%	53%	6%	12%	27%						

* Plaistow Area includes: Plaistow, Atkinson, Newton, Hampstead, and Kingston, NH; Newbury Area includes: Newburyport, Newbury, and Rowley, MA

** For each origin town/area included in this table, the number of station boardings and boardings by destination are from CTSPS, MBTA Systemwide Passenger Survey: North Side 2008-09 Station-by-Station Tables - Commuter Rail, http://www.ctps.org/Drupal/2008_09_mba_survey.

*** Total daily boardings for all origins at indicated stations is from MBTA Ridership and Service Statistics, Fourteenth Edition 2014, <http://www.mba.com/uploadedfiles/documents/2014%20BLUEBOOK%2014th%20Edition.pdf>

**** The estimated number of 2013 boardings by origin town or area was calculated by applying the percent of total station boardings for each origin town at the applicable station or stations to the total daily boardings at each station in 2013.

***** For each origin town, the total number of workers and workers in Boston/Cambridge is from the U.S. Census Bureau's 2006-2010 American Community Survey Five Year Estimates (Table 3, Residence MCD/County to Workplace MCD/County Flows for the United States and Puerto Rico Sorted by Residence Geography: 2006-2010, <http://www.census.gov/population/metro/data/other.html>)

***** The estimated percent of workers who commute by rail is calculated by dividing the number of Boston and Cambridge workers from the 2006-2010 ACS Five-Year Estimates by the number of estimated boardings by origin town.



Table A2. Plaistow Area Population Estimates and Projections

	2010			2015 Estimates		2030 Projections	
	Population*	Employment*	% Employed	Population**	Employment***	Population**	Employment***
Atkinson	6,751	3,235	48%	6,932	3,322	7,485	3,586.72
Hampstead	8,523	4,514	53%	8,484	4,493	8,878	4,702
Plaistow	7,609	4,032	53%	7,391	3,916	7,535	3,993
Newton	4,603	2,618	57%	4,685	2,665	5,016	2,853
Kingston	6,025	3,086	51%	5,999	3,073	6,280	3,217
Total (Plaistow Area)*	33,511	17,485	52%	33,491	17,469	35,194	18,351

* U.S. Census Bureau's 2006-2010 American Community Survey (ACS) Five-Year Estimates (Table 3, Residence MCD/County to Workplace MCD/County Flows for the United States and Puerto Rico Sorted by Residence Geography: 2006-2010, <http://www.census.gov/population/metro/data/other.html>)
** New Hampshire Office of Energy and Planning (NHOEP), Population Forecasts by Municipality: 2013 (<http://www.nh.gov/oep/data-center/population-projections.htm>).
*** Employment estimates for 2015 and 2030 are based on the percent of the population that was employed in 2010.