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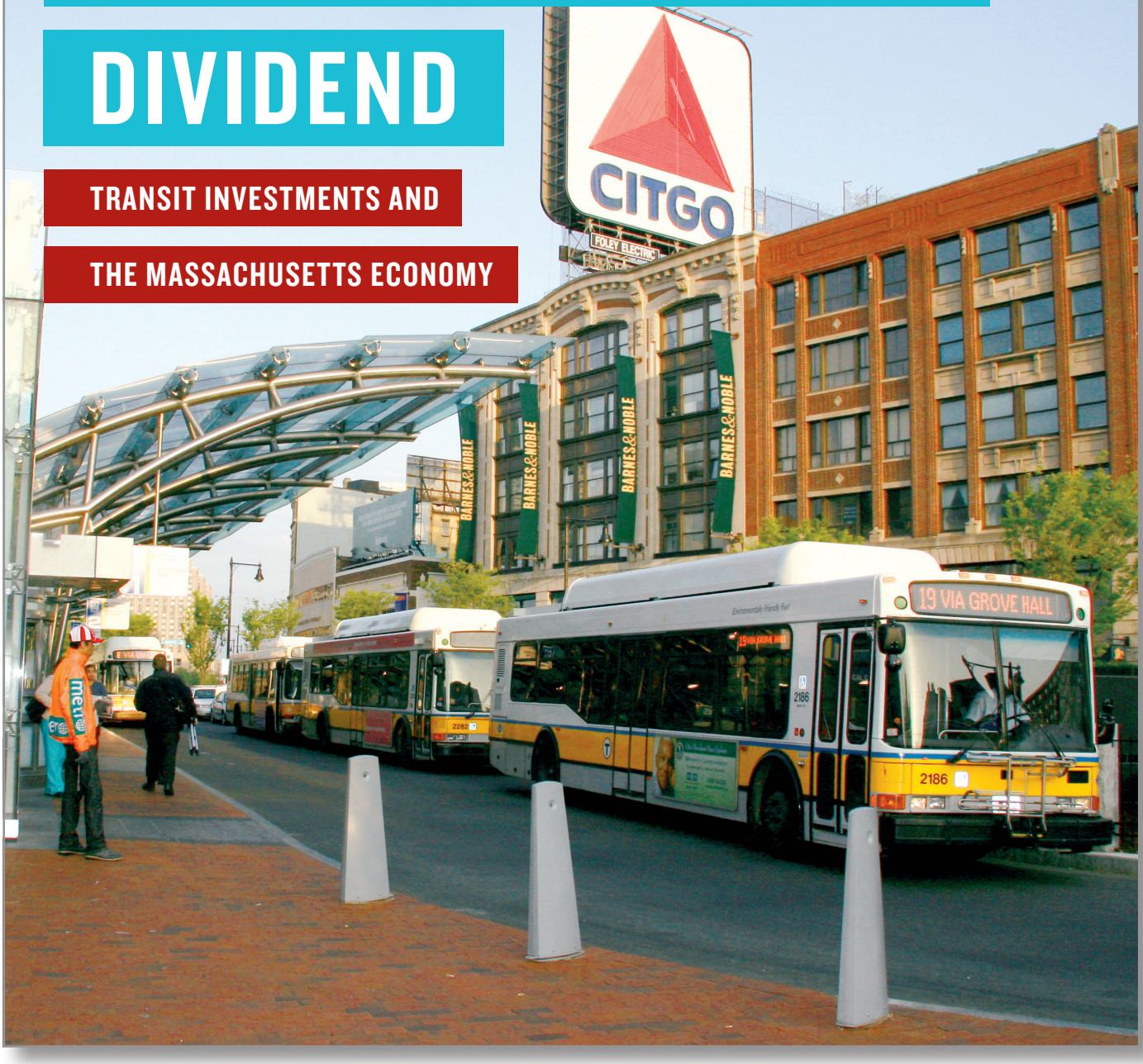
TECHNICAL APPENDICES

REPORT FEBRUARY 2018

THE TRANSPORTATION DIVIDEND

TRANSIT INVESTMENTS AND THE MASSACHUSETTS ECONOMY



TECHNICAL APPENDIX A

ECONOMIC BENEFITS METHODOLOGY AND RESULTS

THE TRANSPORTATION DIVIDEND

TRANSIT INVESTMENTS AND THE MASSACHUSETTS ECONOMY

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INTRODUCTION

OVERVIEW

The analysis in this Technical Appendix considers two questions.

- How does the Boston metropolitan economy benefit from the availability of MBTA operations?
- Is there an economic penalty associated with allowing the system to fall out of a state of good repair? Or, put another way, would there be an economic gain to returning the system to a state of good repair?

The report is not a cost-benefit analysis on the existence of MBTA, nor should its results be construed as such. Instead, it is designed to give multiple audiences a sense of transit's role in the region by simply describing the variety of ways MBTA's transit services impact the region.

STUDY SCENARIOS

To measure MBTA's contribution to the economy of Metropolitan Boston, Three distinct scenarios were developed for the years 2015 and 2030, in addition to a Base Case or "Baseline".

The first scenario hypothetically removes all existing MBTA transit service. This "no MBTA" scenario is not the research objective, but a mechanism for isolating the benefits of existing MBTA operations. The second scenario builds on the first scenario by removing all MBTA transit service and adjusting the zonal population to reflect how Boston residents might respond to the lack of transit service over time by making different housing or work location decisions. The outcomes of Scenarios 1 and 2 are not additive. The third scenario, in three iterations, describes the impacts of an improved MBTA system in a "State of Good Repair" with more frequent rail service. Important aspects of the Baseline and the three Alternative scenarios are listed below:

- Baseline:
  - Serves as the basis for comparing the different scenarios
  - Represents the current travel patterns and levels of service on transit and highways
  - Used to model the 2015 Existing and 2030 Anticipated Baseline Condition

- Scenario 1: "No Transit"
  - Hypothetically removes all existing MBTA rail and bus transit service
  - Maintains the input trip table and demographics used in the Baseline
  - Increases input automobile travel times to account for increased highway congestion

- Scenario 2: "No Transit" with Land Use Changes
  - Removes all existing MBTA transit service
  - Maintains the input trip table
  - Increases input automobile travel times to account for increased highway congestion
  - Adjusts zonal population using a gravity model-like approach to account for population shifts responding to increased auto travel times

- Scenario 3: State of Good Repair + Improved Service
  - Maintains the input trip table

- Adjusts input transit boardings "targets" to reflect potential increases in ridership due to improvements in reliability
- Increases MBTA rail service frequency to reflect desired service levels:
  - 3A: Brings the rail system up to a state of good repair, achieving on-time performance goals on all lines, but makes no additional improvements or changes in service frequency.
  - 3B: Expands Red line service by 50% during the peak, and expands Orange Line service by 30-35% during the peak in addition to bringing the system up to a state of good repair, as in Scenario 3A.
  - 3C: Expands Green Line capacity by running 3-car trains instead of 2-car trains in addition to making all the changes listed under Scenario 3B.

The Baseline and the three comparison scenarios were modeled for years 2015 and 2030 using the Federal Transit Administration's Simplified Trips on Project Software (STOPS) forecasting tool (version 1.50). The 2015 results utilize current CPTS population and employment estimates and patterns and report values in 2015 dollars. The 2030 results are also reported in 2015 dollars for comparison purposes. What distinguishes the 2030 results from those in 2015, is that 2030 demographics (population and employment) underpin the estimates, capturing the benefits/costs incurred by the larger 2030 Boston economy.

The STOPS model used in this project was previously developed and calibrated as part of Federal Railroad Administration's NEC FUTURE work in 2014. Central Transportation Planning Staff (CTPS) of the Boston Region Metropolitan Planning Organization provided demographic projections and automobile travel times, both of which were used as inputs into the STOPS model.

SUMMARY OF FINDINGS

Transit service generates $11.4 billion in travel time and cost savings, avoided crashes and a cleaner environment. This represents about 3 percent of Metropolitan Boston's Gross Domestic Product, or an average benefit of about $6,700 per household. Moreover, the higher capacity of transit preserves valuable land for other higher valued purposes. Without MBTA the region would require another 2,200 lane-miles of roads and nearly 3,000 acres of parking. Finally, bringing the system into a state of good repair would generate $170 million annually, growing year-by-year with the economy to over $430 million by 2030.

TRAVEL DEMAND: TECHNICAL APPROACH

BASELINE

The Baseline represents 2015 travel patterns and conditions in the Boston area and is used to model the 2030 Anticipated Baseline Condition. The 2015 Baseline and the 2030 condition serve as bases for comparing Alternative Scenarios 1 through 3, respectively. The STOPS model relies on various inputs, which are common to each scenario:

- Demographic data and projections for 2015 and 2030 that were supplied by CTPS
- Zone-to-zone automobile travel times that were used in STOPS to represent the local highway network (obtained from CTPS)
- General Transit Feed Specification (GTFS) files that were used to represent the MBTA transit system. GTFS files define transit service in terms of the transit routes offered by a transit agency, the location of transit stops along each route, and the trip patterns and scheduling of each trip along a route.
- Census Transportation Planning Package (CTPP) data that served as the basis for area travel patterns (e.g., the input person trip table)
- Rail station locations and attributes, including station boardings (obtained from the 2014 MBTA Blue Book)

Each of the Alternative scenarios was based on the Baseline, yet differed from the Baseline because of some modification to one or more of the above inputs. The unique aspects of each Alternative scenario are described below.

SCENARIO 1: "NO TRANSIT"

Scenario 1 maintained the demographic data and input trip tables from the CTPP data from the Baseline but removed all transit service so that no transit service was represented in the GTFS files. Removing all transit service would cause auto traffic to increase, and therefore the input auto travel times were increased 15%, 30%, or 45% to account for higher levels of highway congestion. Scenario 1 was modeled in both 2015 and 2030.

The auto travel time factors were developed by examining the number of auto trips between downtown Boston and south of downtown along I-93 (Dorchester, Quincy, and Braintree) in the Baseline and in a preliminary model run for Scenario 1 (before factors were applied to the auto travel times). The difference in the numbers of auto trips between these two areas from the Baseline to Scenario 1 was used to estimate the increase in lane density (vehicles/hour/lane) and the subsequent decrease in travel speed of at least 42%. A decrease in travel speed on the order of 42% yields an increase in travel time of roughly 70%. Because not all areas in Boston have the same travel patterns as highway travel between downtown Boston and south of downtown, which follows directly the rail line and therefore would likely experience a greater amount of shifted traffic, the study team chose to increase auto travel times using relatively modest factors of 15%, 30%, and 45%, which fall well below the estimated 70% increase in travel time.

Transit travel patterns in the Baseline were examined, and areas with relatively more transit travel were assumed to be prone to higher levels of highway congestion if transit was not available, as there would be more transit riders shifting to auto. To reflect this dynamic, the input auto travel times were increased by using high, moderate, and low factors based on the amount of transit travel between an origin and destination. The auto travel times between areas with the most transit travel were increased 45%, and the auto travel times between areas with the least transit travel were increased 15%. Auto travel times between areas with moderate amounts of transit travel were increased 30%.

SCENARIO 2: "NO TRANSIT" WITH LAND USE CHANGES

Scenario 2 builds on Scenario 1 by assuming that if all transit service was removed, travel patterns would shift towards shorter distance trips to reflect the lack of transit and increased auto travel times. For this scenario, all transit service was removed, and the input auto travel times were increased in the same way as described for Scenario 1. Scenario 2 differs from Scenario 1 in that the input zonal population was adjusted based on a gravity model-like approach in order to demonstrate how residents might adjust their location decisions if transit service were not available. Scenario 2 was modeled in 2030 but not in 2015, which represents current conditions.

In order to shift the travel patterns in this manner, the population distribution was adjusted to shorten access to employment. This was done by calculating an employment access factor (EAF) that is similar to gravity model equations used in trip distribution models, which is how a standard four-step travel demand model determines travel patterns. Because the STOPS model does not include a trip distribution step, it was necessary to develop this off-model process. The access factor calculates a weighted average of the travel time from each origin (home end) zone to every other zone by using the employment in every other destination zone (work end). The brief example below shows travel time between three zones (a, b, and c) and how the EAF for each zone was calculated.

TABLE 1: Example Travel Time (TT) Matrix

		Destination Zone		
		a	b	c
Origin Zone	a	TT_{aa}	TT_{ab}	TT_{ac}
	b	TT_{ba}	TT_{bb}	TT_{bc}
	c	TT_{ca}	TT_{cb}	TT_{cc}

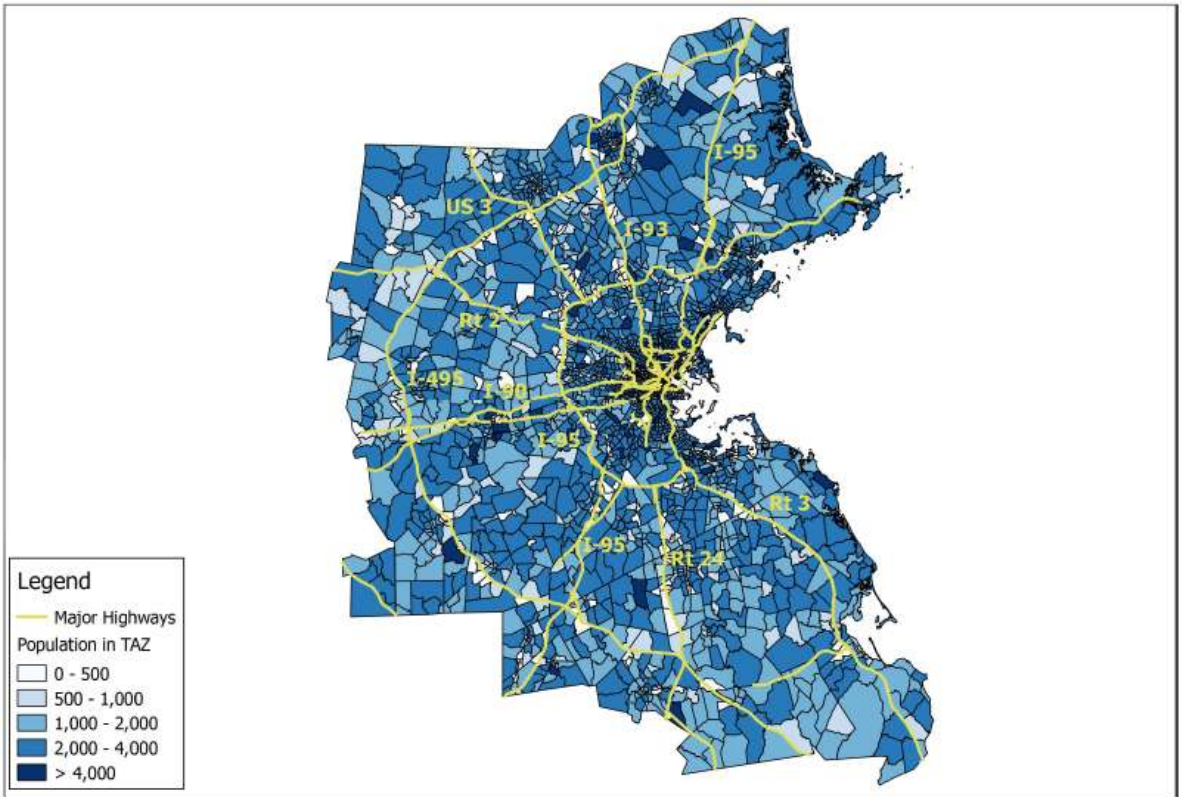
$$EAF_a = \frac{EMP_a * TT_{aa} + EMP_b * TT_{ab} + EMP_c * TT_{ac}}{EMP_a + EMP_b + EMP_c}$$

A high employment access factor means that zones with high employment are difficult to access, and therefore zones with higher employment access factors have a proportionally higher reduction in population (i.e., more people would shift out of these zones).

Once the EAF was calculated for each zone, a percentage of the population (ranging from 20% to 60%) was shifted out of zones in the top 50th percentile (based on the EAF) and into the bottom 50th percentile, based on the EAF. As a result, zones with lower EAFs had a higher percentage shift. Overall, approximately 20% of the total population in the region was shifted to a more employment-accessible zone. The basis for picking the zones to shift the population to was a distance-based algorithm, which searched for the closest zone with an acceptable EAF percentile. Once the population was shifted, the zones were examined to make sure there were not any which had unreasonably large increases; manual adjustments were made, as necessary, by distributing the excess population to neighboring zones. The final adjusted zonal populations were used as the model input for this scenario.

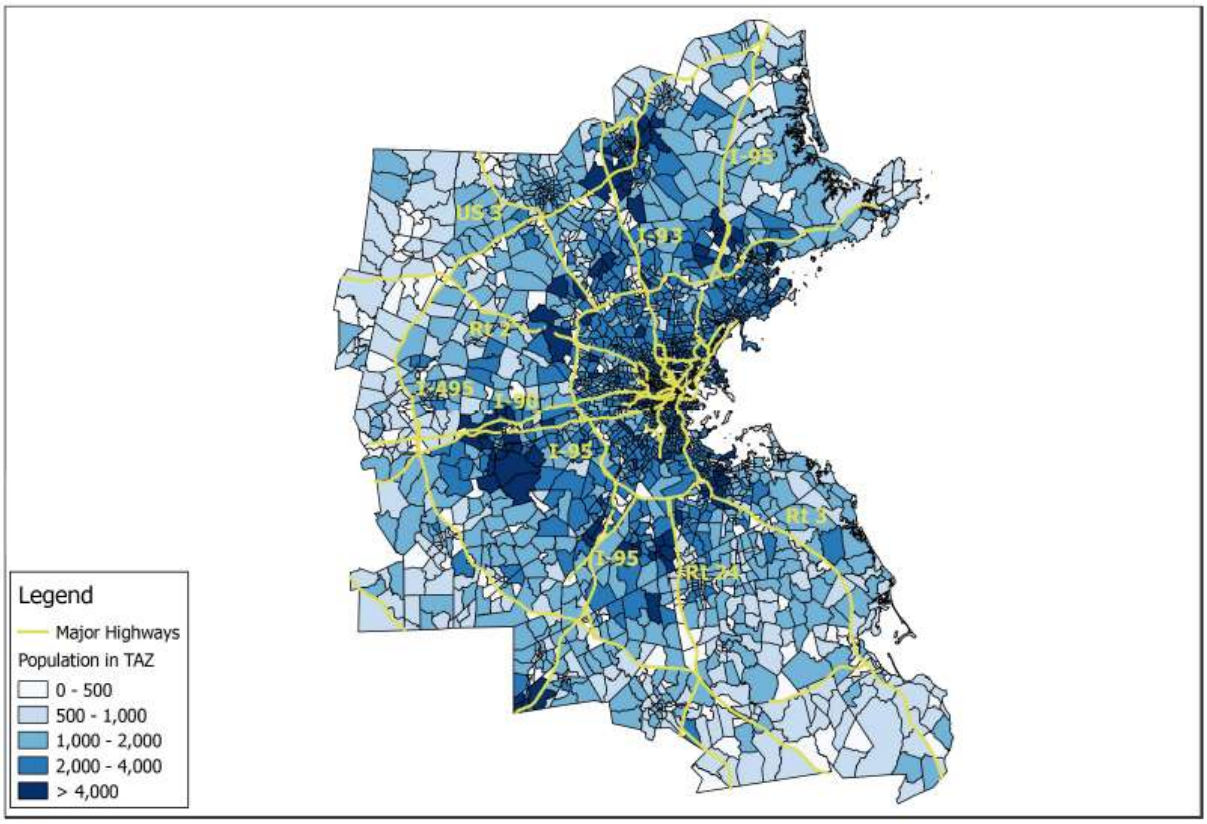
Error! Reference source not found. shows the relative population used in the 2030 Anticipated Baseline Condition, Scenarios 1, and Scenario 3 for 2030. FIGURE 2 shows the relative population used in Scenario 2. Darker blues indicate higher zonal populations, and lighter colors indicate lower populations. Error! Reference source not found. shows a fairly even distribution of a moderate blue hue in the greater Boston metropolitan area, indicating that the population outside and around the Boston core is fairly well distributed. In contrast, FIGURE 2 shows large areas of lighter colors and also clusters of relatively darker blues, which indicates that population shifted from many zones in the metropolitan area to particular clusters.

Figure 1: Relative 2030 Population by TAZ for Anticipated Baseline, Scenario 1, and Scenario 3



Source: AECOM Analysis

FIGURE 2: Relative 2030 Population by TAZ for Scenario 2



Source: AECOM Analysis

SCENARIO 3: STATE OF GOOD REPAIR

Scenario 3 represents a "State of Good Repair" (SGR) condition and considers the impact on ridership due to improvements in transit service reliability. As with Scenario 1, this scenario was modeled in both 2015 and 2030. Three alternatives for Scenario 3 were considered: A, B, and C. All three alternatives maintained the same demographics and input auto travel times as were used in the Baseline. The differences between the three Scenario 3 iterations and the Baseline relate to the input transit boardings "targets" and the input GTFS files that represent transit service. Each is described below.

SCENARIO 3A: SGR

STOPS includes station-level boardings targets and an overall total unlinked trip target that are used to calibrate the model to existing transit travel patterns in an area. In Scenario 3A, the target transit boardings from the Baseline were adjusted to reflect potential ridership gains due to improved reliability. A 2012 CTPS study of the impact of reliability on transit ridership suggested that transit service improvements and subsequent improved reliability may result in a system-wide ridership increase of up to 6%[1]. Because STOPS already incorporates a fixed transit service schedule (and therefore does not encounter variation in service), the input boardings targets were adjusted to reflect the potential gains due to improved reliability. Both the total daily system-wide unlinked transit trips and the daily rail station boardings (for subway, light rail, and commuter rail) were increased by 6%.

SCENARIO 3B: SGR AND EXPAND RED AND ORANGE LINE SERVICE

Scenario 3B has the same increases in total unlinked trips and station boarding targets as Scenario 3A, but also modified the Orange and Red Line 'T' subway service. The GTFS files for Scenario 3B were edited to replace the existing peak period service for the Orange and Red Lines with more frequent service. Red Line service was increased approximately 50% to 20 trains per hour in the peak period, and Orange Line service was increased

approximately 30% to 13 trains per hour in the peak period. The Red and Orange Line frequency increases are based on MassDOT's 2040 Investment Plan for the MBTA[1].

SCENARIO 3C: SGR AND EXPAND RED, ORANGE, AND GREEN LINE SERVICE

Scenario 3C uses the same transit service plan as Scenario 3B, with the exception that Green Line service frequency is also increased (in addition to the Red and Orange lines). The 2040 Investment Plan for the MBTA[2] proposes a 50% increase in capacity along the Green Line by shifting from 2-car trains to 3-car trains. STOPS does not directly capture train capacities, so in order to model the proposed increase in capacity, Green Line service frequency was increased by 30% instead of the 50% proposed capacity increase. The frequency increase implemented was not as great as the proposed capacity increase because frequency has a larger impact on ridership than capacity, and increasing frequency the whole 50% would overstate the change in Green Line service attractiveness. Increasing frequency 30% would add the required capacity without representing unrealistic service along the Green Line.

TRAVEL DEMAND: RESULTS

TABLE 2 and TABLE 3 summarize the STOPS model results for a typical weekday in years 2015 and 2030, respectively, for the Baseline and each scenario described in Section 2. The 2030 results of each scenario – relative to the 2030 Baseline – are discussed below.

SCENARIO 1: "NO TRANSIT"

There are no transit trips in Scenario 1 because all transit service in the Boston metropolitan area was removed. The number of auto trips in 2030 increases by about 830,000, which is a 6.7% increase over the Baseline. Auto VMT increases by about 6%, while auto travel time increases by 43%. The percentage increase in auto travel time is much greater than the percentage increases in auto VMT and auto trips, which suggests that if most transit riders shift to auto, long auto travel times will result from heavy congestion. To accommodate the additional vehicles on highways while maintaining the current highway level-of-service, an additional 2,191 new lane-miles would be needed in 2030.

SCENARIO 2: "NO TRANSIT" WITH LAND USE CHANGES

Transit service was removed in Scenario 2, and the input population was adjusted to demonstrate how Boston metropolitan residents may respond to the lack of transit service. Relative to Scenario 1, Scenario 2 has a higher number of auto trips yet lower amounts of overall auto travel time and VMT, which suggests more auto trips are made over shorter distances. Shorter-distance trips result because the population clustered together more in Scenario 2 compared to other scenarios. In 2030 relative to the Baseline, the number of auto trips increases by about 866,000, which is a 7% increase over the Baseline. Auto VMT increases by 6%, and auto travel time increases by about 43%. As with Scenario 1, the increase in auto travel time is much greater than the corresponding increase in auto VMT and auto trips, which suggests that if most transit riders shift to auto, long auto travel times will result due to heavy highway congestion. To accommodate the additional vehicles on highways while maintaining the current highway level-of-service, an additional 2,284 new lane-miles would be needed in 2030.

SCENARIO 3: STATE OF GOOD REPAIR

In 2030 for Scenario 3A, the total linked transit trips and the total transit travel time increase by about 13%. Auto trips, auto travel time, and auto VMT decrease by about 1%. In 2030 for Scenarios 3B and 3C, the total linked transit trips and total transit travel time increase by more than 15% and the number of auto trips and the total auto travel time decrease by about 1%. Because of the improvement in rail service frequency in Scenarios 3B and 3C, transit ridership and transit travel time are greater in 3B and in 3C relative to 3A. The number of auto trips, auto VMT, and auto travel time are lower in Scenarios 3B and 3C relative to 3A. More frequent rail service causes some auto drivers to shift to using transit.

TABLE 2: STOPS Model 2015 Average Weekday Travel Results

2015 Daily Results: Scenario Totals

	2015 BASELINE	SCENARIO 1	SCENARIO 3A	SCENARIO 3B	SCENARIO 3C
Total Linked Transit Trips	996,297	0	1,054,959	1,079,613	1,080,043
Total Auto Trips	11,853,886	12,652,703	11,806,516	11,786,816	11,786,474
Total Transit Travel Time (hours)	661,282	0	701,490	720,473	719,153
Total Auto Travel Time (hours)	4,055,617	5,582,549	4,038,490	4,031,709	4,031,575
Total Auto VMT	92,788,506	98,418,711	92,440,978	92,295,117	92,291,940

2015 Daily Results: Difference between Scenarios and Baseline

	2015 BASELINE	SCENARIO 1	SCENARIO 3A	SCENARIO 3B	SCENARIO 3C
Total Linked Transit Trips	-	-996,297	58,662	83,316	83,746
Total Auto Trips	-	798,816	-47,370	-67,070	-67,412
Total Transit Travel Time (hours)	-	-661,282	40,209	59,191	57,871
Total Auto Travel Time (hours)	-	1,739,259	-17,127	-23,908	-24,042
Total Auto VMT	-	5,630,205	-347,528	-493,389	-496,566

2015 Daily Results: Percent difference between Scenarios and Baseline

	2015 BASELINE	SCENARIO 1	SCENARIO 3A	SCENARIO 3B	SCENARIO 3C
Total Linked Transit Trips	-	-100.0%	5.9%	8.4%	8.4%
Total Auto Trips	-	6.7%	-0.4%	-0.6%	-0.6%
Total Transit Travel Time (hours)	-	-100.0%	6.1%	9.0%	8.8%
Total Auto Travel Time (hours)	-	42.9%	-0.4%	-0.6%	-0.6%
Total Auto VMT	-	6.1%	-0.4%	-0.5%	-0.5%

Source: AECOM Analysis

TABLE 3: STOPS Model 2030 Average Weekday Travel Results

2030 Daily Results: Scenario Totals

	2030 BASELINE	SCENARIO 1	SCENARIO 2	SCENARIO 3A	SCENARIO 3B	SCENARIO 3C
Total Linked Transit Trips	1,035,896	0	0	1,173,750	1,199,222	1,199,710
Total Auto Trips	12,377,917	13,209,160	13,244,399	12,266,626	12,246,300	12,245,901
Total Transit Travel Time (hours)	692,518	0	0	780,773	800,423	798,877
Total Auto Travel Time (hours)	4,782,146	6,834,574	6,816,503	4,734,289	4,726,281	4,726,099
Total Auto VMT	96,044,494	101,904,749	101,851,084	95,205,338	95,056,927	95,053,227

2030 Daily Results: Difference between Scenarios and Baseline

	2030 BASELINE	SCENARIO 1	SCENARIO 2	SCENARIO 3A	SCENARIO 3B	SCENARIO 3C
Total Linked Transit Trips	-	-1,035,896	-1,035,896	137,854	163,326	163,814
Total Auto Trips	-	831,244	866,483	-111,290	-131,617	-132,015
Total Transit Travel Time (hours)	-	-692,518	-692,518	88,255	107,905	106,359
Total Auto Travel Time (hours)	-	2,052,428	2,034,358	-47,857	-55,865	-56,046
Total Auto VMT	-	5,860,254	5,806,590	-839,156	-987,567	-991,268

2030 Daily Results: Percent difference between Scenarios and Baseline

	2030 BASELINE	SCENARIO 1	SCENARIO 2	SCENARIO 3A	SCENARIO 3B	SCENARIO 3C
Total Linked Transit Trips	-	-100.0%	-100.0%	13.3%	15.8%	15.8%
Total Auto Trips	-	6.7%	7.0%	-0.9%	-1.1%	-1.1%
Total Transit Travel Time (hours)	-	-100.0%	-100.0%	12.7%	15.6%	15.4%
Total Auto Travel Time (hours)	-	42.9%	42.5%	-1.0%	-1.2%	-1.2%
Total Auto VMT	-	6.1%	6.0%	-0.9%	-1.0%	-1.0%

Source: AECOM Analysis

BENCHMARKING RESULTS

To test the reasonableness of the results, two similar analyses were reviewed, focusing on the Scenario 2 results. The two analyses included the CTPS memo evaluating the impacts of transit reliability on transit ridership and the WMATA Making the Case for Transit report. The three analyses have the same basic idea of removing transit service and examining the impact on transportation in the region, primarily focused on the impact on auto travel. Specific differences in the model assumptions and inputs are as follows:

- CTPS:
  - The base year for the data was 2010 as opposed to 2015 for the MBTA analysis.
  - The MBTA analysis removed all transit in the region, while CTPS retained non-MBTA transit options.
  - The MPO regional travel model was used, while MBTA used STOPS, which is a more standardized, simplified model.
- WMATA:
  - Used 2007 as the base year.
  - Removed all transit service, but used the model directly to adjust travel patterns, where MBTA required a separate process to adjust the patterns.
  - Used MPO regional travel model.

TABLE 4 highlights key outputs from each of the analyses and compares the results. All three analyses have very similar percentage increases in auto trips, ranging from 6% to 8%. The MBTA analysis has the highest percentage increase in auto vehicle travel time, but is relatively close to the WMATA percentage (43% versus 31%). As the MBTA average auto travel time is approximately double that of WMATA both in the Baseline and the Scenario Alternative, it is reasonable to expect a higher amount of auto travel time in the MBTA analysis. The CTPS analysis has a much lower percentage increase in auto travel time compared to the other two, with only a 9% increase. This comes directly from the average travel time and - by extension - the speed. As described in the MBTA methodology, the input auto travel time matrix was adjusted based on a capacity analysis. This led to using a range of travel time increases from 15% to 45%, based on the amount of transit trips that converted to auto trips. By contrast, the CTPS analysis had an average decrease in speed of 6%, with the Boston core experiencing a decrease in speed of 18%.

Based on the benchmarking analysis, the percentage increases in travel time were adjusted to reflect more conservative estimates ranging from 15% to 35%, which is reflected in the results of TABLE 4.

TABLE 4: Benchmarking Comparison

	MODEL OUTPUT	SCENARIO ALTERNATIVE	BASELINE	DIFFERENCE	% INCREASE OVER BASE
WMATA Scenario 2	Auto Person Trips	17,480,869	16,211,003	1,269,866	8%
	Auto Vehicle Travel Time (hours)	3,784,401	2,886,156	898,245	31%
	Ave Travel Time (min)	13.0	10.7		22%
MBTA Scenario 2, 2030	Auto Person Trips	15,893,279	14,853,500	1,039,779	7%
	Auto Vehicle Travel Time (hours)	6,834,574	4,782,146	2,052,428	43%
	Ave Travel Time (min)	22.7	19.3		17%
CTPS Analysis	Auto Person Trips	12,037,500	11,324,600	712,900	6%
	Auto Vehicle Travel Time (hours)	3,487,000	3,193,000	294,000	9%
	Ave Travel Time (min)	17.4	16.9		3%

Source: AECOM Analysis

While not materially contributing to the differences in the results, the WMATA and MBTA analyses also used different proportions of trip purposes and value of time assumptions, as shown in TABLE 5. These differences averaged out to approximately the same value overall. (Commuting trips are non-business trips.)

TABLE 5: Trip Purposes and Values of Time, 2030

	TRIP PURPOSE SPLIT		VALUE OF TIME	
	Business	Non-Business	Business	Non-Business
WMATA	31%	69%	$32.86	$16.43
MBTA	10%	90%	$40.00	$22.00

Source: AECOM Analysis

MONETIZATION OF OPERATIONAL BENEFITS

Transit in the Boston metropolitan area provides transportation benefits to users in terms of travel cost, accident reduction, and emissions reduction savings that result from increases in mobility and reduced congestion and VMT in the region. The following section describes these operational benefits estimated in the three scenarios for 2015 and 2030. These benefits are estimated compared to the Baseline scenario and are discussed for the 2030 results. For Scenarios 1 and 2, they are presented as costs, because transit is removed compared to the Baseline scenario. Conversely, they can be interpreted as the benefits of having transit compared to removing transit. For Scenarios 3A, 3B, and 3C, they are presented as benefits, because transit services are improved compared to the Baseline scenario. An annualization factor of 305, based on NTD data,[3] was used to convert daily numbers to annual totals. The benefits are monetized using outputs from the STOPS travel demand model, values of time, operating costs associated with auto and transit travel, and economic values of accidents and emissions consistent with USDOT guidance.[4]

TRAVEL TIME SAVINGS

When transit is removed, riders are forced to use an alternative mode to make trips. The STOPS model forces the trips then to be made either by auto, bike, or walking; riders cannot elect to not make the trip. Approximately 20% of trips are made by bike or walking; the remainder are taken by auto. Because the number of cars on the road will swell when people cannot take transit trips, there will be a significant increase in congestion, and thus travel time for all travelers because there is no additional highway infrastructure available to meet this increase in demand. The STOPS model estimates the changes in auto and transit person-trips, and transit travel time (*transit person hours*) separately for the Baseline and Scenarios. Results for 2030 are discussed here.

In the Baseline, district to district auto travel times are defined by an unweighted average highway time in minutes for zone to zone records with CTPP trips. Multiplying the approximately 14 million auto trips in the Baseline by the Baseline zone to zone travel times results in the total auto travel time in the Baseline of 344.3 million minutes per day.

In the Baseline, transit travel time for zone to zone is built into the STOPS model. The total transit travel time in the Baseline is 41.6 million minutes. In Scenarios 1 and 2, auto zone to zone travel times are adjusted as described in Section 3 and compared to the Baseline depending on the number of transit trips in the Baseline.

Under Scenario 1 there would be 15.9 million auto trips – an increase of nearly 1 million trips compared to the Baseline. In Scenario 2, there would be an even larger increase of approximately 1.04 million auto trips per day compared to the Baseline. Auto travel time in Scenario 1 compared to the Baseline totals 147.8 million additional minutes per day. Auto travel time in Scenario 2 compared to the Baseline totals 146.5 million additional minutes per day. Because Scenarios 1 and 2 remove transit, the transit travel time is zero; compared to the Baseline, that results in a travel time savings of 41.6 million minutes in 2030. Autos would incur more travel time in Scenarios 1 and 2, while transit riders would theoretically "save" travel time compared to the Baseline. These values are added together to result in a net time savings in the Baseline compared to Scenarios 1 and 2 due to the overwhelmingly large time spent in auto trips in Scenarios 1 and 2. The total hours of travel time saved or lost for Scenarios 1 and 2 compared to the Baseline are shown in TABLE 6 for 2030. Savings are shown as negative numbers, while costs are positive.

TABLE 6: Scenarios 1 and 2 Travel Time, 2030

	SCENARIO 1: NO TRANSIT	SCENARIO 2: NO TRANSIT, LAND USE CHANGES
Total Annual Auto Person Hours	751,821,957	745,202,640
Total Annual Transit Hours	(211,395,971)	(211,395,971)
Total Annual People Hours	**540,425,985**	**533,806,668**

Source: AECOM Analysis

For Scenarios 3A, 3B, and 3C, there would be a reduction in auto trips and an increase in transit trips compared to the Baseline. Under Scenario 3A there would be over 14.7 million daily auto person trips, a reduction of over 133,000 compared to the Baseline. Auto travel time would decrease by over 3.4 million minutes per day. Transit trips, on the other hand, would increase by over 137,000 compared to the Baseline, amounting to 1.17 million daily transit trips in 2030. Transit travel time would increase by nearly 5.3 million minutes per day. On net, total travel time would increase by 9.4 million hours in 2030.

Under Scenario 3B there would be an even greater reduction in auto trips, amounting to nearly 158,000 fewer than in the Baseline and resulting in 14.7 million daily auto trips. Auto travel time would decrease by over 4 million minutes per day. Conversely, transit trips would increase by more than 163,000, amounting to nearly 1.2 million daily transit trips in 2030. Transit time would increase by nearly 6.5 million minutes per day. This would result in a net gain of 12.5 million hours of travel time in 2030.

Under Scenario 3C there would be 14.7 million auto trips, a reduction of over 158,000 compared to the Baseline. Auto travel time would decrease by over 4 million minutes per day. Transit trips under Scenario 3C would grow by over 163,000 to nearly 1.2 million per day. Transit time would increase by nearly 6.4 million minutes per day. This would result in a net gain of 11.9 million hours of travel time in 2030.

The total travel time savings for Scenarios 3A, 3B, and 3C compared to the Baseline are shown in TABLE 7 for 2030. Savings are shown as negative numbers, while costs are positive.

TABLE 7: Scenarios 3A, 3B, and 3C Travel Time, 2030

	SCENARIO 3A	SCENARIO 3B	SCENARIO 3C
Total Annual Auto Person Hours	(17,530,424)	(20,463,805)	(20,530,289)
Total Annual Transit Hours	26,940,571	32,938,758	32,466,910
Total Annual People Hours	**9,410,148**	**12,474,953**	**11,936,621**

Source: AECOM Analysis

To value the time, trip purposes were estimated at 10% business and 90% personal based on a weighted average of trip purposes on the T from the 2008-2009 MBTA Survey[5]. STOPS provides auto trips as person trips, so no auto occupancy factor was applied in the travel time analysis. The value of time was estimated using the gross median hourly wage for all occupations[6] and the hourly household income[7] for business and personal travel for the Greater Boston Area, respectively. For value of time in 2030, the 2015 value was escalated by 1.2% per year to 2030, per USDOT guidance[8]. Half of the value of the hourly household income is used as the value of personal travel time; the full value of the gross median hourly wage is used for the value of business travel time. The values of time in 2015 and 2030 were $18.15 and $21.71 for personal travel and $33.72 and $40.32 for business travel, respectively.

To supplement Scenarios 1 and 2 and provide a range of expected benefits, low-end estimates of the travel time costs incurred under Scenarios 1 and 2 were calculated. A draft 2012 CTPS memo that used 2010 travel and transit conditions for its analysis estimated that travel time would go up by 9% over the baseline if all MBTA transit were to be removed[9]. This finding was used as the basis for the low-end estimate of Scenario 1 –Low and Scenario 2 –Low in

2030. For Scenario 1 -Low, Baseline total travel time (the sum of auto and transit) was scaled up by 9% to obtain auto travel time. Because Scenario 2 factors land use changes into the analysis, unlike the analysis described in the CTPS report, the travel time for Scenario 2 –Low was calculated by scaling up the Scenario 1 -Low estimate by the ratio of auto travel times for Scenario 2 to Scenario 1.

The range of travel times for 2015 was found by using the STOPS model for Scenario 1- Low in 2015, and increasing average auto travel times by six minutes for Scenario 1[10]. To estimate the 2015 value of travel time for Scenario 2 and Scenario 2 – Low, the ratio of travel times between Scenario 1 and Scenario 1 – Low from 2015 to 2030 were applied to Scenario 2 results for 2030.
While the CTPS study provided a means to estimate a lower bound, there was no equivalent study on which to base an upper bound to bracket the main set of scenarios. A percentage change could have been assumed, but it would not have been grounded in a simulation as are the other two estimates. In addition, the CTPS study was developed off of 2010 estimates and travel conditions which would tend to somewhat understate impacts relative to 2015. Thus, while the results are provided here for comparison purposes, Scenarios 1 and 2 are effectively the mid-point estimates and they are carried forward in the summary tables.

TABLE 8 shows the total value of travel time by Scenario, trip purpose, and mode for 2030. For example Scenario 1 totals $12.7 billion and Scenario 2 totals $12.5 billion in additional costs of travel time for users compared to the Baseline in 2030. As shown in Table 21, in 2015 the total additional travel cost is $7.1 billion for Scenario 1 and $7.0 billion for Scenario 2.

TABLE 8: Value of Travel Time in 2030 by Scenario

	AUTO			TRANSIT			ANNUAL VALUE OF TOTAL TRAVEL TIME ($ MILLIONS)
	Additional Travel Time (millions of hours)	VOT 2030	Annual Value of Time ($ millions)	Additional Travel Time (millions of hours)	VOT 2030	Annual Value of Time ($ millions)	
Scenario 1: No Transit							
Business	75	$40	$3,026	-21	$40	-$851	$2,175
Personal	677	$22	$14,690	-190	$22	-$4,131	$10,560
Total			**$17,716**			**-$4,981**	**$12,735**
Scenario 2 :No Transit, Land Use Changes							
Business	74	$40	$2,999	-21	$40	-$851	$2,148
Personal	671	$22	$14,561	-190	$22	-$4,131	$10,430
Total			**$17,560**			**-$4,981**	**$12,579**
Scenario 1 :No Transit-Low							
Business	39	$40	$1,562	-21	$40	-$851	$711
Personal	349	$22	$7,583	-190	$22	-$4,131	$3,452
Total			**$9,145**			**-$4,981**	**$4,163**
Scenario 2: No Transit, Land Use Changes -Low							
Business	38	$40	$1,539	-21	$40	-$851	$688
Personal	344	$22	$7,472	-190	$22	-$4,131	$3,342
Total			**$9,011**			**-$4,981**	**$4,030**
Scenario 3A: SGR							
Business	-2	$40	-$71	3	$40	$108	$38
Personal	-16	$22	-$343	24	$22	$526	$184
Total			**-$413**			**$635**	**$222**
Scenario 3B: SGR and Expand Red and Orange Line Service							
Business	-2	$40	-$82	3	$40	$133	$50
Personal	-18	$22	-$400	30	$22	$644	$244
Total			**-$482**			**$776**	**$294**
Scenario 3C: SGR and Expand Red, Orange, and Green Line Service							
Business	-2	$40	-$83	3	$40	$131	$48
Personal	-18	$22	-$401	29	$22	$634	$233
Total			**-$484**			**$765**	**$281**

Source: AECOM Analysis

Under Scenarios 3A, 3B, and 3C, existing transit riders would incur an additional benefit of avoided incident delay time savings. On-time performance from January 2015 to November 2016, the latest available data at the time of the analysis, was obtained from MBTA[11] and average on-time performance percentages were calculated. On-time performance is measured as the share of passengers that waited on a platform for no longer than the scheduled headway. On-time performance during the studied period was 93% for the Blue Line, 73% for the Green Line, 93%

for the Orange Line, and 90% for the Red Line. While MBTA currently sets an on-time performance goal of 90%, for the purpose of the analysis the goal was set to 95%, equivalent to the agency's goal in 2014 and the years prior[12]. It was assumed that by bringing the system up to a state of good repair, all lines would be able to reach the agency's on-time performance target, meaning that at most 5% of passengers would wait for a train longer than the scheduled headway. This would be equivalent to eliminating delays for 2% of total passengers on the Blue Line, 22% of total passengers on the Green Line, 2% of total passengers on the Orange Line, and 5% of total passengers on the Red Line.

Daily weekday ridership by line was obtained for the Baseline Scenario from the STOPS model, and Saturday and Sunday ridership were estimated using the percentage of Saturday and Sunday riders as a share of daily weekday ridership obtained from the National Transit Database[13]. Weekly ridership was then obtained and annualized for each line, and then state of good repair improvement percentages were applied to each line to determine the number of people that would benefit from reduced incident delays. It was assumed that the average delay duration was 5 minutes, a conservative estimate. The average delay time was then applied to the number of people impacted to calculate the total time saved annually. It was assumed that 90% of the trips would be personal trips and 10% of the trips would be for business, consistent with the auto and transit travel time analysis. The values of time in 2015 and 2030 as previously discussed, were applied to the time saved to calculate the value of travel time saved. It was estimated that travel time savings from reduced incident delays would amount to $33.17 million per year for current users of the system under Scenarios 3A, 3B, and 3C in 2030.

TRAVEL COST SAVINGS

As discussed in the previous sections, without the MBTA transit system in Scenarios 1 and 2, users must shift to autos. This decrease in transit ridership would result in additional auto VMT, tolls, and parking fees incurred. These drivers will incur the vehicle maintenance costs for trips completed by using autos but will avoid transit fares. This increases the vehicle costs as travelers use autos instead of transit. The travel costs section will describe the cost savings of using transit in the Baseline compared to autos in Scenarios 1 and 2; Scenario 3 results in travel cost savings compared to the Baseline.

The change in VMT was estimated using the STOPS model. The change in VMT between the Scenarios and Baseline show that in Scenario 1 with the removal of transit, riders must instead drive to make their trips and incur more VMT. In Scenario 2, however, with the removal of transit and the shift in land use, transit riders from the Baseline make shorter trips and the change in VMT is lower than in Scenario 1. People switch from driving to transit in Scenarios 3A, 3B, and 3C, resulting in VMT reductions compared to the Baseline.

Similar to the travel time savings analysis, the STOPS model estimates the changes in *auto VMT* and *transit trips* separately, and therefore, the auto and transit travel cost savings are monetized separately. For example, the changes in auto costs for Scenario 1 do not account for any previous money spent on transit trips under the Baseline. However, for an estimate of total travel costs saved for the scenarios, the analysis should only consider the additional money spent traveling by auto (i.e. the cost over and above the previous transit trips). Therefore, the previous transit costs must be netted out from the auto travel cost analysis.

The change in daily VMT associated with each Scenario is annualized using a factor of 305.[14] The increase in personal vehicle trips in the region adds 1.79 billion VMT annually for Scenario 1, and 1.77 billion annually for Scenario 2 in 2030. VMT is reduced in Scenarios 3A, 3B, and 3C. For the new drivers in Scenarios 1 and 2, this translates into a reduced transit trip cost (fare)[15], but an increase in parking costs, tolls, and personal variable vehicle operating costs in terms of fuel, maintenance, tires, and half of the depreciation.[16] These vehicle operating costs vary by the size of the vehicle; however, the average auto operating cost per mile for these components is 27.3 cents (for all sedans), according to AAA's 2016 Edition of "Your Driving Costs."[17] The 2016 value was converted to 2015 dollars using the GDP deflator, resulting in $0.268 per mile. This vehicle operating cost assumption is conservative because at least some portion of these miles will be made in cars that would have to be purchased due to the removal of transit from the transportation network. However, the travel demand model does not provide an

estimate of the number of additional cars required in the region to accommodate the Scenarios 1 and 2 travel needs.

In addition to vehicle operating costs, new drivers will also have an increase in auto parking and toll expenses. The median parking fare per trip of $33.50[18] was escalated to 2015 dollars from 2012 dollars using the GDP deflator. The number of trips to the core for each Scenario was used to estimate the parking fees because trips to noncore destinations are assumed not to incur a parking fee. Additionally, it is also important to note that the average parking cost assumptions do not change in the model for Scenario 2. This assumption likely understates the additional parking costs associated with Scenario 2 in comparison to the Baseline because the increase in demand for trips to the downtown and limited change in supply would likely drive up the average daily peak parking costs in the downtown area. For tolls, it is estimated that 3.59%[19] of auto linked trips incur a toll of $1.62.[20]

The changes in daily auto parking and toll expenses associated with each Scenario are annualized using a factor of 305.[21]

The travel cost savings is monetized by multiplying the annual change in VMT by the average auto operating cost per mile, and adding the change in toll and parking expenses, and the change in transit fares.[22] TABLE 9 summarizes the annual travel costs associated with transit services for all Scenarios in 2030 in comparison to the Baseline. Savings compared to the Baseline are shown as negative numbers. Scenarios 1 and 2 result in higher travel costs than the Baseline, while Scenario 3 results in travel cost savings compared to the Baseline.

TABLE 9: Travel Cost (Savings) Associated with Transit Service in 2030 ($M 2015)

	AUTO					RAIL	ANNUAL VALUE OF TOTAL TRAVEL COST ($M 2015)
	Annual VMT 2030 (millions)	Auto Operating Cost per Mile	Annual Value of Auto Travel Cost (millions)	Annual Value of Auto Parking Cost (millions)	Annual Value of Toll Cost (millions)	Annual Value of Transit Travel Cost Savings (millions)	
Scenario 1 No Transit	1,789	$0.27	$479.87	$4,244.81	$14.72	-$986.67	**$3,752.73**
Scenario 2 No Transit, Land Use Changes	1,773	$0.27	$475.48	$4,314.50	$15.35	-$986.67	**$3,818.65**
Scenario 3A: SGR	-256	$0.27	-$68.72	-$574.30	-$1.97	$135.51	**-$509.48**
Scenario 3B: SGR and Expand Red and Orange Line Service	-301	$0.27	-$80.87	-$692.00	-$2.33	$161.49	**-$613.71**
Scenario 3C: SGR and Expand Red, Orange, and Green Line Service	-303	$0.27	-$81.17	-$694.07	-$2.34	$162.02	**-$615.55**

Source: AECOM Analysis

AUTO CRASH AVOIDED SAVINGS

Compared to the Baseline, Scenarios 1 and 2 would increase the VMT traveled in the Boston metropolitan area by diverting annual transit trips to the highway network. Scenarios 3A, 3B, and 3C result in increased transit ridership, removing VMT from highways. These changes in personal vehicle trips in the region add 1.789 billion VMT annually for Scenario 1, and removed 303 million VMT under Scenario 3C in 2030. The increases in VMT under Scenarios 1 and 2 escalate the likelihood of vehicle crash occurrences involving fatalities, injuries, and property damage as the

crash rate for autos is higher than the crash rate for transit vehicles. Because data for transit accidents is not available for all types of accidents, and recognizing that the propensity for transit accidents is very low—nearly zero in the case of fatalities- the value of accidents avoided through the use of transit is estimated on the change in VMT and auto accident rates only.

To estimate the increase in these accidents by severity, the change in VMT for each Scenario is multiplied by fatal, injury, and property damage only crash rates developed by the US DOT Bureau of Transportation Statistics (BTS). The accident crash rates are shown in TABLE 10.

TABLE 10: Accident Rates per 100,000,000 VMT, 2014

Fatalities	1.0799311	per 100,000,000 VMT
Injured persons	77.2628151	per 100,000,000 VMT
Crashes	200.426519	per 100,000,000 VMT

Source: 2014 Bureau of Transportation Statistics Motor Vehicle Safety Data Table 2-17 [23]

These crash reduction factors were then converted to the Maximum Abbreviated Injury Score (MAIS) accident types in order to apply US DOT Guidance on the value of avoiding an accident. The conversion is based on the NHTSA KABCO-AIS Conversion Table (July 2011) provided on page 12 of the Tiger Benefit-Cost Analysis Resource Guide (updated November 17, 2016)[24], for Injury (severity unknown) and No Injury accidents. Applying crash reduction factors to the auto VMT and converting to MAIS accident type results in estimates of annual fatalities and injuries. The auto accidents avoided savings or cost is estimated by applying the value of a statistical life as published by the US DOT. The value of a statistical life grows by 1.18% per year, per guidance.[25] The estimates applied in this analysis are summarized in TABLE 11.

TABLE 11: Value of Accidents Avoided, $M 2015

CRASH TYPE	2015	2030	SOURCE AT USDOT
Value of Statistical Life	$9.600	$11.447	Guidance on Treatment of the Economic Value of a Statistical Life in the US, Department of Transportation Analyses 2016
MAIS 5 Critical (0.593) Fraction of VSL	$5.693	$6.788	
MAIS 4 Severe (0.266) Fraction of VSL	$2.554	$3.045	
MAIS 3 Serious (0.105) Fraction of VSL	$1.008	$1.202	
MAIS 2 Moderate (0.047) Fraction of VSL	$0.451	$0.538	
MAIS 1 Minor (0.003) Fraction of VSL	$0.029	$0.034	
Property Damage Only (PDO) Crashes, 2010	$0.004	$0.004	The Economic and Societal Impact of Motor Vehicle Crashes, 2010 in 2015$

Source: USDOT

In 2015, 18 fatal, about 1,300 injury, and nearly 3,500 property damage-only crashes are avoided. By 2030, 19 fatal, just over 1,350 injury, and over 3,600 property damage-only crashes are avoided. TABLE 12 summarizes the annual accidents avoided savings or costs associated with the each Scenario in 2030.

TABLE 12: Auto Crash Avoided Costs (Savings) Associated with Transit Service in 2030 ($M 2015)

	ANNUAL VMT (MILLIONS)	REDUCED FATALITIES	REDUCED INJURIES	REDUCED CRASHES	ANNUAL VALUE OF SAFETY ($M 2015)
Scenario 1 No Transit	1,788.88	19.32	1,382.14	3,585.40	**$536.96**
Scenario 2 No Transit, Land Use Changes	1,772.50	19.14	1,369.49	3,552.57	**$532.04**
Scenario 3A: SGR	-256.16	-2.77	-197.92	-513.41	**-$76.89**
Scenario 3B: SGR and Expand Red and Orange Line Service	-301.46	-3.26	-232.92	-604.21	**-$90.49**
Scenario 3C: SGR and Expand Red, Orange, and Green Line Service	-302.59	-3.27	-233.79	-606.47	**-$90.83**

Source: AECOM Analysis

EMISSIONS SAVINGS

The change in auto and transit VMT translates to changes in emissions to the region compared to the Baseline. Emissions rates for autos, bus, commuter rail, heavy rail, and streetcar from MOVES 2010a for carbon monoxide (CO), nitrogen oxide (NOx), volatile organic compounds (VOCs), particulate matter (PM), and carbon dioxide (CO2/GHG), are applied to the changes in VMT to estimate the pollutant emissions. TABLE 13 displays the emission rates applied in 2015 and 2030. The emissions factors change over time to reflect changing fuel and emission standards for vehicles over time. As a result, the impact of auto travel on air quality lessens over time and the diversion of auto travel to transit generates a smaller air quality benefit in the future compared to the present.

TABLE 13: MOVEs 2010a Emission Rates for 2015 and 2030 Analysis

MODE	GRAMS PER VMT				
	CO	NOx	VOC	PM2.5	GHG
Rates Applied in 2015					
Automobile	16.77	0.91	0.6	0.010	532
Bus - Diesel	5.83	8.67	0.73	0.48	3319
Heavy Rail	7.06	6.38	0.13	0.413	3211
Light Rail and Streetcar	10.51	9.5	0.19	0.615	4779
CR - Diesel locomotive (used) and DMU	16.8	93	4.36	4.600	7970
Rates Applied in 2030					
Automobile	11.46	0.28	0.27	0.010	434
Bus - Diesel	3.26	2.08	0.24	0.09	2854
Heavy Rail	6.85	5.58	0.13	0.398	3106
Light Rail and Streetcar	10.2	8.31	0.19	0.593	4623
CR - Diesel locomotive (used) and DMU	16.8	43	1.26	1.330	7970

Source: MOVEs 2010a

The estimated transit VMT in 2015 and 2030 for the analysis of Scenarios 1 and 2 were calculated as follows:

- Bus VMT was estimated using the MBTA 2014 Blue Book[26] and totaled 86,897 weekday, 49,325 Saturday, and 31,796 Sunday miles. Annualizing for 52 weeks in a year results in 26.8 million miles per year. Schedules were assumed to be unchanged in 2030.

- The heavy rail miles were estimated weekly as the sum of the Red, Orange, and Blue lines to total 77,664 miles from MBTA subway operations schedules in 2013.[27] Schedules were assumed to be unchanged in 2030. Multiplying the weekly VMT by 52 to get an annual total results in 4 million miles.
- Commuter rail mileage totaled 3.9 million in 2013[28]. Schedules were assumed to be unchanged in 2030.
- The light rail/trolley VMT is the sum of the Green Line and Mattapan Trolley, totaling 63,409 miles weekly[29]. Multiplying the weekly VMT by 52 to get an annual total, light rail/trolley totals 3.3 million VMT. Schedules were assumed to be unchanged in 2030.

Travel by MBTA instead of automobile helps to preserve air quality. In 2015, just under 1,100 short tons of volatile organic compounds, just over 1,000 short tons of nitrogen oxides, and about 843,000 short tons of carbon dioxide are avoided through transit's use. In 2030, assuming the region's growth in population and employment as well as rising fuel standards, just under 520 short tons of volatile organic compounds, just under 250 short tons of nitrogen oxides, and about 706,000 metric tons of carbon dioxide are avoided.

No change in transit VMT is applicable in Scenario 3A because there are no changes to transit operations from the Baseline.

The estimated transit VMT in 2015 and 2030 used in the analysis of Scenario 3B is calculated as follows:

- Bus has no change from the Baseline.
- Heavy rail runs new additional headways for the Orange and Red Lines during the peak hours, resulting in 561,600 route miles added annually.
- Commuter rail has no change from the Baseline.
- Light rail/trolley has no change from the Baseline.

The estimated transit VMT in 2015 and 2030 used in the analysis of Scenario 3C is calculated as follows:

- Bus has no change from the Baseline.
- Heavy rail runs new additional headways for the Orange and Red Lines during the peak hours, resulting in 561,600 route miles added annually.
- Commuter rail has no change from the Baseline.
- Light rail/trolley operates additional headways on the Green Line during the peak hours, totaling 795,581 miles per year.

Auto VMT changes for Scenarios 1 and 2 are the result of transit ceasing operations and therefore riders must instead drive to make their trips. In 2030, annual VMT in Scenario 1 increases by 1.79 billion miles per year compared to the Baseline, and Scenario 2 increases by 1.77 billion miles per year compared to the Baseline. Scenarios 3A, 3B, and 3C all increased transit ridership by at least 6%, reducing auto VMT by at least 250 million miles per year each. Table 14 shows the changes in VMT by mode and Scenario in 2030.

TABLE 14: Changes in VMT by Mode and Scenario in 2030

	ANNUAL AUTO VMT (MILLIONS)	ANNUAL HEAVY RAIL VMT (MILLIONS)	ANNUAL LIGHT RAIL/TROLLEY VMT (MILLIONS)	ANNUAL LIGHT BUS VMT (MILLIONS)	ANNUAL CR VMT (MILLIONS)
Scenario 1 No Transit	1,788.88	-4.04	-3.30	-26.81	-3.93
Scenario 2 No Transit, Land Use Changes	1,772.50	-4.04	-3.30	-26.81	-3.93
Scenario 3A: SGR	-256.16	0.00	0.00	0.00	0.00
Scenario 3B: SGR and Expand Red and Orange Line Service	-301.46	0.56	0.00	0.00	0.00
Scenario 3C: SGR and Expand Red, Orange, and Green Line Service	-302.59	0.56	0.80	0.00	0.00

Source: AECOM Analysis

The emission rates in grams per mile from TABLE 13 were multiplied by the appropriate conversion factor to calculate short tons per mile for each pollutant type, except for GHG which was in metric tons. The tons of emissions avoided per VMT were multiplied by the annual change in VMT for the appropriate mode. The short tons of emissions for transit and auto are of opposite signs and are added together and multiplied by the economic value of the emissions damage cost from National Highway Safety Administration guidance[30] as shown in TABLE 15. Because the economic value of GHG changes over time, the values in 2015 and 2030 were applied in the respective analyses.

Travel by MBTA instead of automobile saves about 86 million gallons of fuel in 2015, rising to 89 million gallons by 2030.

TABLE 15: Value of Emissions per Short Ton, 2015$

	2015$
Carbon Monoxide	$0
VOC	$1,844
Nitrogen Oxides	$7,266
Particulate Matter	$332,405
Sulfur Dioxide	$42,947
GHG (per metric ton) 2015 2030	 $41 $56

Source: 2016 TIGER BCA Resource Guide, https://www.transportation.gov/sites/dot.gov/files/docs/BCA%20Resource%20Guide%202016.pdf

Emissions impacts are positive for Scenarios 1 and 2 because the increase in auto VMT is greater than the reduction in VMT of transit compared to the Baseline. The opposite is true for Scenarios 3A, 3B, and 3C, where more transit ridership results in reducing auto VMT compared to the Baseline. In Scenarios 3A, 3B, and 3C there is an overall emissions savings to the region. TABLE 16 shows the value of emissions by Scenario compared to the Baseline for 2030.

TABLE 16: Emissions Associated with Regional Transit Service in 2030 ($M 2015)

	VALUE OF EMISSIONS SAVINGS				ANNUAL VALUE OF TOTAL EMISSIONS ($M 2015)
	Annual VOC (millions)	Annual NOx (millions)	Annual PM (millions)	Annual CO2 (millions)	
Scenario 1 No Transit	$0.96	$1.81	$2.45	$35.88	**$41.09**
Scenario 2 No Transit, Land Use Changes	$0.95	$1.77	$2.39	$35.48	**$40.59**
Scenario 3A: SGR	-$0.14	-$0.57	-$0.94	-$6.23	**-$7.88**
Scenario 3B: SGR and Expand Red and Orange Line Service	-$0.17	-$0.65	-$1.02	-$7.23	**-$9.07**
Scenario 3C: SGR and Expand Red, Orange, and Green Line Service	-$0.17	-$0.60	-$0.85	-$7.05	**-$8.67**

Source: AECOM Analysis

CONGESTION SAVINGS

The change in congestion cost of auto traffic on Boston's roads was estimated to quantify the marginal change in disbenefits to other users. The change in VMT from the Baseline to Scenarios 1 and 2 show that over 1.7 billion additional VMT are incurred when transit is removed from the region in 2030. On the other hand, Scenarios 3A, 3B, and 3C result in a reduction of VMT in the region of at least 250 million annually in 2030. The FHWA Cost Allocation Study, 2000 Addendum, Table 13[31] estimates the marginal congestion costs per VMT to be 7.70 cents ($2000) for autos on urban Interstates and the marginal crash costs per VMT to be 1.19 cents ($2000) for autos on urban Interstates. In total, the marginal congestion and crash cost per mile is $0.12 (2015$). It is assumed that all travel is on urban interstates as most travelers could use an interstate for at least some part of the trip. Applying these marginal congestion and crash costs to the annual change in auto VMT yields the marginal congestion and crash costs for Scenarios 1 and 2. Conversely, because Scenarios 3A, 3B, and 3C result in a decrease in auto VMT in the region as drivers switch from auto to transit, the value of congestion and crashes avoided is a benefit. TABLE 17 summarizes the congestion costs and savings in the Boston region associated with each Scenario in 2030.

TABLE 17: Annual Value of Congestion and Crashes in the Boston Region in 2030 ($M 2015)

	AUTO		ANNUAL VALUE OF CONGESTION ($M 2015)
	Annual VMT (millions)	Marginal Congestion Cost per Mile	
Scenario 1 No Transit	1,788.88	$0.12	**$214.53**
Scenario 2 No Transit, Land Use Changes	1,772.50	$0.12	**$212.56**
Scenario 3A: SGR	-256.16	$0.12	**-$30.72**
Scenario 3B: SGR and Expand Red and Orange Line Service	-301.46	$0.12	**-$36.15**
Scenario 3C: SGR and Expand Red, Orange, and Green Line Service	-302.59	$0.12	**-$36.29**

Source: AECOM Analysis

MONETIZATION OF CAPITAL BENEFITS

If transit service were not available in the Boston region, (as assumed in Scenarios 1 and 2), additional infrastructure costs would be required in order to support the additional cars on the roadways and the resulting increase in demand for parking in downtown Boston. For Scenario 1 and Scenario 2, these additional costs would include the additional road infrastructure required to maintain the 2015 roadway network's level of service as well as additional parking garages/spaces. Scenario 3 results in diverting auto drivers to transit, so no change in highway or parking capital expenses would be needed.

HIGHWAY LANE MILES

METHODOLOGY

Using FHWA capital improvement costs per lane mile in 2002 dollars, the costs for adding a lane at normal costs for urban interstates, principal arterials, and arterials and collectors were estimated (excluding right-of-way expenses)[32]. These average costs represent industry starting points for capital projects based on location (small urban, small urbanized, or large urbanized) and would go up or down depending on the nature of the project, including factors such as number of interchanges, presence of wetlands, drainage, mitigation costs, and other similar factors. The estimates for highway/road per lane mile costs were developed as described below:

Highway/Road costs (excluding ROW):

- Urban interstates, other freeways and expressways: average of small and large urbanized lanes at normal cost: $4.552M per lane mile (2002 dollars)
- Urban other principal arterials: average of small and large urbanized lanes at normal cost: $3.535M per lane mile (2002 dollars)
- Urban minor arterials and collectors: average of small and large urbanized lanes at normal cost: $2.460M per lane mile (2002 dollars)

These per lane mile costs were converted to 2015 dollars using the GDP deflator. The cost per lane mile of urban minor arterials and collectors was applied to both collectors and local roads. On average, they result in $4.6M per lane mile.

To estimate the number of additional lane miles needed by functional class, a shapefile of the Boston highway network of over 322,000 links was obtained for 2015, the latest available year. The individual links on the network included the functional class, number of lanes, and lane miles per segment. Multiplying the lane miles per segment by the daily lane capacity results in a proxy of system-wide capacity with the units vehicle-miles per day. A weighted average of daily lane capacity was calculated using the number of lane miles in the shapefile and the general lane capacity associated with each highway functional class. The daily auto volumes for the Baseline and Scenarios 1 and 2 were obtained from the travel demand model. The volume-to-capacity ratio, which is a measure of highway level-of-service, was assumed to be the same in the Baseline and in Scenarios 1 and 2. Since the volumes were known from the model and the proxy system-wide capacity for the Baseline was already calculated, the proxy system-wide capacity in Scenarios 1 and 2 could be computed. The net difference in system-wide capacity was then divided by the weighted average of daily lane capacity to yield the number of additional lane miles needed to maintain the same highway level-of-service in Scenario 1 and 2 as in the Baseline. The resulting capacity in Scenarios 1 and 2 will be greater than the Baseline. The difference in capacity in Scenarios 1 and 2 is then converted into the lane miles by functional class. In 2030, Scenario 1 would require 2,191 additional lane miles to maintain the same level of service as the Baseline. Scenario 2 would require slightly more: 2,284 more lane miles than the Baseline in 2030.

Because only the 2015 highway network was available for the analysis and was used to calculate the lane miles needed for both 2015 and 2030, which have different vehicle volumes, Scenario 1 2015 lane miles were adjusted to maintain the same volume to capacity ratio as in Scenario 1 2030. The lane miles calculated in 2015 were shared down by the ratio of Scenario 1 2015 daily traffic volumes to the Scenario 1 2030 daily traffic volumes. To estimate the lane miles needed for Scenario 2 in 2015, the ratio of lane miles needed in Scenario 1 2015 to Scenario 1 2030 were applied to the lane miles found in Scenario 2 2030.

The estimated capital costs assume the same shares of functional class as the Baseline. In the Baseline, the 47,000 lane miles in the shapefile constituted of 5.1% interstates, and 84.3% local and collectors, and 10.6% arterials. Applying these shares of functional class to the lane miles needed in 2030 in Scenario 1 results in 112 lane miles of interstates, 514 lane miles of collectors, 1,334 lane miles of local, and 231 lane miles of arterials. The breakdown of lane miles for Scenario 2 in 2030 is similar, with 117 interstate lane miles, 1,390 local lane miles, 536 collector lane miles, and 241 arterial lane miles.

RESULTS

The total capital costs (excluding ROW or land) required to construct the additional roadway lane miles necessary to accommodate roadway demand created under Scenarios1 and 2 in 2030 were estimated by multiplying the standard cost per lane mile by functional class by the number of lane miles estimated by the travel demand model. These results are shown in TABLE 18 and TABLE 19 by road type.

TABLE 18: Total Highway Capital Costs Avoided (excluding ROW), Scenario 1 in 2030 ($M 2015)

ROAD TYPE AND LOCATION		ADDITIONAL LANE MILES	AVERAGE COST PER LANE MILE (MILLIONS)	TOTAL CAPITAL COST ($M 2015)
Urban				
	Interstate	112	$ 5.9	$ 662.8
	Arterial	231	$ 4.6	$ 1,059.6
	Collector	514	$ 3.2	$ 1,639.1
	Local	1,334	$ 3.2	$ 4,253.3
Total		**2,191**		**$ 7,614.7**

Source: AECOM Analysis

TABLE 19: Total Highway Capital Costs Avoided (excluding ROW), Scenario 2 in 2030 ($M 2015)

ROAD TYPE AND LOCATION		ADDITIONAL LANE MILES	AVERAGE COST PER LANE MILE (MILLIONS)	TOTAL CAPITAL COST ($M 2015)
Urban				
	Interstate	117	$ 5.9	$ 690.9
	Arterial	241	$ 4.6	$ 1,104.5
	Collector	536	$ 3.2	$ 1,708.6
	Local	1,390	$ 3.2	$ 4,433.6
Total		**2,284**		**$ 7,937.6**

Source: AECOM Analysis

The total capital costs shown in TABLE 18 and TABLE 19 are one-time capital costs for the construction of additional road capacity required for Scenarios 1 and 2 to maintain the same highway level of service in 2030 as the 2030 Baseline. The costs shown in the tables exclude the cost of ROW or land purchases that could be required. These costs are not annual costs; however, they likely would be spent over a multi-year construction period.

PARKING CAPACITY

In the absence of a transit network, the number of home-based work trips. In order to accommodate these vehicles at their work destinations, additional parking infrastructure would be required for these scenarios, particularly in downtown Boston where available parking is more constrained than the rest of the region. The capital costs associated with this new parking investment represents a benefit of transit in the Boston area because these investments would be required only if the transit system did not exist and the land cannot therefore be used for a higher valued function. This section summarizes the methodology used to estimate the capital costs associated with the additional parking infrastructure required due to the removal of transit from the region.

METHODOLOGY

The estimate of parking infrastructure needs to accommodate additional vehicle trips generated in Scenarios 1 and 2 begins with the number of new vehicles that will require parking spaces. The travel demand model estimated the additional automobile linked trips for both Scenarios 1 and 2 for trips to the core in 2015 and 2030. It is assumed that trips need parking at one end of two linked trips and not both. These estimates are vehicle counts and represent an increase in demand for parking spaces, but not a one-to-one increase in new parking spaces required[33]. For example, in 2030:

- Scenario 1 would increase parking demand by 395,870 cars/spaces
- Scenario 2 would increase parking demand by 402,369 cars/spaces

Once the parking demand was established, the demand was turned into an estimated square feet (SF) of parking garage space need. The analysis assumes that parking infrastructure is composed of an equal mixture of above ground parking garages and underground parking; it is understood that the above ground space is infeasible without razing existing building stock to accommodate parking due to the density of existing development in the region. The average square footage required per parking space is assumed to be 9 feet wide by 18 feet long, or 162 square feet. Including ramps, lanes, and other space for manoeuvring, it is assumed that 325 square feet are required per vehicle. The costs per SF for above and below ground garages were taken from RS Means *Square Foot Costs* (2007). The above ground garage assumes a 5 story building with 10' story height and 145,000 square feet of floor area. The below ground garage is based on a two story building with 10' story height and 100,000 square feet of floor area. The cost of the average garage is the average of the above and below ground costs per square foot. The costs were escalated to 2015 dollars using the GDP direct capital deflator as reported by the US Office of Management and Budget.

RESULTS

The total capital costs to construct the additional parking necessary to accommodate Scenarios 1 and 2 were estimated by multiplying the RS Means costs per square foot for an above- or below-ground garage by the total square footage of parking need to accommodate the total vehicles as estimated by the travel demand model. These results are shown in TABLE 20 for 2030. Please note that the costs shown in TABLE 20 exclude the cost of ROW or land purchases that could be required. It is also important to note that the capital costs shown in TABLE 20 reflect the costs associated with the entire increase in demand for parking (not just the spaces in excess of current parking capacity).

TABLE 20: Total Parking Capital Costs Avoided in the Boston Core, Scenarios 1 and 2, 2030 ($M 2015)

	ADDITIONAL PARKING SF	AVERAGE COST PER SF	TOTAL CAPITAL COST ($M 2015)
Scenario 1	128,657,912		
Above ground garage		$ 43.66	$ 5,617.0
Below ground garage		$ 68.96	$ 8,872.8
Average garage		$ 56.31	$ 7,244.9
Scenario 2	130,770,066		
Above ground garage		$ 43.66	$ 5,709.2
Below ground garage		$ 68.96	$ 9,018.5
Average garage		$ 56.31	$ 7,363.8

Sources: (1) STOPS; (2) RS Means Square Foot Costs, 2007 (parking SF costs), escalated to 2015 dollars

To illustrate the volume of parking more visually, the square footage required for parking under both scenarios is equal to over 100 Prudential Towers.

SUMMARY OF MODELING RESULTS

The total results of the analysis are shown in Tables 21 through Table 24. The results in Tables 21 and 23 are for Scenarios 1 and 2 in 2015 and 2030, respectively, which show the costs to the region if transit is removed. In both years, the costs indicate that the Baseline is better than Scenario 1 or 2, resulting in savings to the region. The opposite is true for Scenario 3. As shown in Tables 22 and 24, all three iterations of Scenario 3 in 2015 and 2030 offer savings relative to the Baseline. In total, these results indicate that transit saves the region time and costs in terms of out-of-pocket travel costs, safety, congestion, emissions, and the costs of additional highways and parking.

TABLE 21: 2015 Scenarios 1 and 2 Total Results

COSTS [POPULATION INCURRING COST]	SCENARIO 1: NO TRANSIT $M 2015	SCENARIO 2 : NO TRANSIT AND LAND USE SHIFT $M 2015
Travel Time Cost [R]	$7,127.4	$7,040.2
Travel Costs [R]	$3,603.1	$3,666.4
Accident Cost [R]	$435.0	$431.0
Congestion Cost [N]	$206.1	$204.2
Emissions Cost [G]	$34.3	$33.8
Total Annual Transportation Costs	**$11,405.9**	**$11,375.7**
Highway Capital Cost [G]	$7,317.7	$7,627.9
Parking Capital Cost [G]	$6,967.4	$7,081.7
Share of Boston Metro GDP 2015*	**2.88%**	**2.87%**

Source: AECOM Analysis
Note: R=riders, people who switch from riding transit to auto; N=nonriders, other auto drivers; G=general public including riders and nonriders
* Excludes highway and parking capital costs

TABLE 22: 2015 Scenario 3 Total Results

SAVINGS [BENEFICIARIES]	SCENARIO 3A: 6% INCREASE IN BOARDINGS $M 2015	SCENARIO 3B : 6% INCREASE IN BOARDINGS AND IMPROVED RED AND ORANGE LINE HEADWAYS $M 2015	SCENARIO 3C: 6% INCREASE IN BOARDINGS, IMPROVED RED AND ORANGE LINE HEADWAYS, GREEN LINE CAPACITY EXPANSION $M 2015
Travel Time Benefit (existing users and users who switch modes) [R]	-$118.22	-$183.46	-$174.55
Travel Cost Savings [R]	$218.74	$319.09	$320.63
Accident Benefit [R]	$26.85	$38.12	$38.37
Congestion Benefit [N]	$12.72	$18.06	$18.18
Emissions Benefit [G]	$3.61	$4.93	$4.57
Existing Transit Users			
Incident Delay Benefit [R]	$27.73	$27.73	$27.73
Total Annual Transportation Benefits	**$171.42**	**$224.47**	**$234.93**

Source: AECOM Analysis
Note: R=riders, people who switch from auto to transit; N=nonriders, other auto drivers; G=general public including riders and nonriders

TABLE 23: 2030 Scenarios 1 and 2 Total Results

COSTS [POPULATION INCURRING COST]	SCENARIO 1: NO TRANSIT $M 2015	SCENARIO 2: NO TRANSIT AND LAND USE SHIFT $M 2015
Travel Time Cost [R]	$12,734.7	$12,578.8
Travel Costs [R]	$3,752.7	$3,818.7
Accident Cost [R]	$537.0	$532.0
Congestion Cost [N]	$214.5	$212.6
Emissions Cost [G]	$41.1	$40.6
Total Annual Transportation Costs	**$17,280.1**	**$17,182.6**
Highway Capital Cost [G]	$7,614.7	$7,937.6
Parking Capital Cost [G]	$7,244.9	$7,363.8
Share of Boston Metro GDP 2015*	4.36%	4.33%

Source: AECOM Analysis
Note: R=riders, people who switch from riding transit to auto; N=nonriders, other auto drivers; G=general public including riders and nonriders
* Excludes highway and parking capital costs

TABLE 24: 2030 Scenario 3 Total Results

SAVINGS [BENEFICIARIES]	SCENARIO 3A: 6% INCREASE IN BOARDINGS $M 2015	SCENARIO 3B: 6% INCREASE IN BOARDINGS AND IMPROVED RED AND ORANGE LINE HEADWAYS $M 2015	SCENARIO 3C: 6% INCREASE IN BOARDINGS, IMPROVED RED AND ORANGE LINE HEADWAYS, GREEN LINE CAPACITY EXPANSION $M 2015
Travel Time Benefit (existing users and users who switch modes) [R]	-$221.74	-$293.96	-$281.28
Travel Cost Savings [R]	$509.48	$613.71	$615.55
Accident Benefit [R]	$76.89	$90.49	$90.83
Congestion Benefit [N]	$30.72	$36.15	$36.29
Emissions Benefit [G]	$7.88	$9.07	$8.67
Existing Transit Users			
Incident Delay Benefit [R]	$33.17	$33.17	$33.17
Total Annual Transportation Benefits	**$436.39**	**$488.62**	**$503.23**

Source: AECOM Analysis
Note: R=riders, people who switch from auto to transit; N=nonriders, other auto drivers; G=general public including riders and nonriders

PROPERTY VALUATION PREMIUM

The operation of MBTA rapid transit services provides the property parcels surrounding station access points with improved access to the Boston metropolitan economy relative to areas without transit access. Regional access is impacted most for those areas within walking distance of a station, generally approximated as being within ½ mile of a station. As a result, residents and commercial enterprises are willing to pay a premium for the locations that are in close proximity to transit. Empirical research on the economic impact of transit access and the value of walkable community centers indicates that there are often positive impacts on property values associated with such investments.

Using a shapefile with over 1.2 million parcel records for the Boston metropolitan area obtained from the Metropolitan Area Planning Council (MAPC), data for parcels within ½ mile of MBTA rapid transit and commuter rail stations were collected. MAPC's database shows tax assessor records including property classifications and values that were collected from each jurisdiction. As each jurisdiction performs property assessments on a different cycle, the assessment years vary depending on when the latest available data were provided and processed, ranging from FY 2011 to FY 2017. Assessed values were converted to 2015 dollars using the GDP deflator. Assessments were assumed to be done at the start of the fiscal year; therefore, FY 2011 was assumed to be equivalent to calendar year 2010 and FY 2017 equivalent to 2016.

Once the data were reconciled to a common value, the value of properties within a ½ mile of stations was totalled and compared to the amount of property within a ½ mile buffer of the stations[34]. Areas within ½ mile of MBTA rapid transit and commuter rail stations account for 38% of all property value in the jurisdictions that are served by MBTA rapid transit and commuter rail, while making up only 12% of the total land area of those jurisdictions.

In addition, using recent research on the Boston economy, the value of station access was estimated. The paper titled "Selectivity, Spatial Autocorrelation, and the Valuation of Transit Accessibility"[35] concluded that holding all other property characteristics constant, the value of access for a residential property was 6.7%.[36] The resultant value was nearly $4.9 billion for residential properties and $2.4 billion for commercial and industrial properties[37]. This is a wealth effect that is taxable. The value of tax revenues collected on that additional increment of value is nearly $111 million annually within ½ mile of rapid transit stations. For commuter rail, using the Boston property tax rate as a regional average for the surrounding region, the annual increment of tax revenues within ½ mile of stations is estimated to be over $47 million[38]. Collectively, it is estimated that the annual tax revenues on property premium within ½ mile of MBTA stations is nearly $160 million.

ACKNOWLEDGMENT

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[14] Annualization factor is from NTD.

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[16] This analysis assumes that half of the depreciation impacts are due to mileage or wear and tear on the vehicle.

[17] The AAA per mile operating cost is the composite average for small, medium, and large sedans. This average is conservative because it excludes higher cost vehicles (e.g. SUVs and minivans); however, it also does not include other lower cost vehicles (e.g. motorcycles). AAA, Your Driving Costs 2016 Edition, http://exchange.aaa.com/wp-content/uploads/2016/04/2016-YDC-Brochure.pdf

[18] In 2012, parking in downtown Boston was $33.50 on average. See Colliers International 2012 CBD Parking Rate Survey, http://www.lexpark.org/sites/default/files/pdf/ColliersParkingRateSurvey2012.pdf

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[33] Unless all parking is fully occupied, at least some of these vehicles will park in existing spaces. As a result, some of the increase in parking demand is likely to be met with existing parking inventory.

[34] The analysis adjusted for overlapping station-area buffers by eliminating overlaps

[35] Diao, M. "Selectivity, Spatial Autocorrelation, and the Valuation of Transit Accessibility". January 2014. Urban Studies Vol. 52(1) 159-177

[36] *Ibid*.

[37] Empirical analysis assessing transit's impact on commercial and industrial properties in Boston could not be located. In the absence of a specific study of the market, the consultant team applied 7 percent for commercial properties and 5 percent for industrial properties based on the experience in other markets that these property types often bracket the residential estimate. This estimate of non-residential valuation is likely conservative as commercial property premiums are often estimated at rates higher than 7 percent. Though conservative, the analysis illustrates the wealth created by transit.

[38] The volume of jurisdictions served by rail transit outside the City of Boston precluded a jurisdiction-by-jurisdiction individual rate assessment. Thus, the City's rate was applied as an average proxy.

TECHNICAL APPENDIX B

THE METROPOLITAN REGION AND THE INNER CORE

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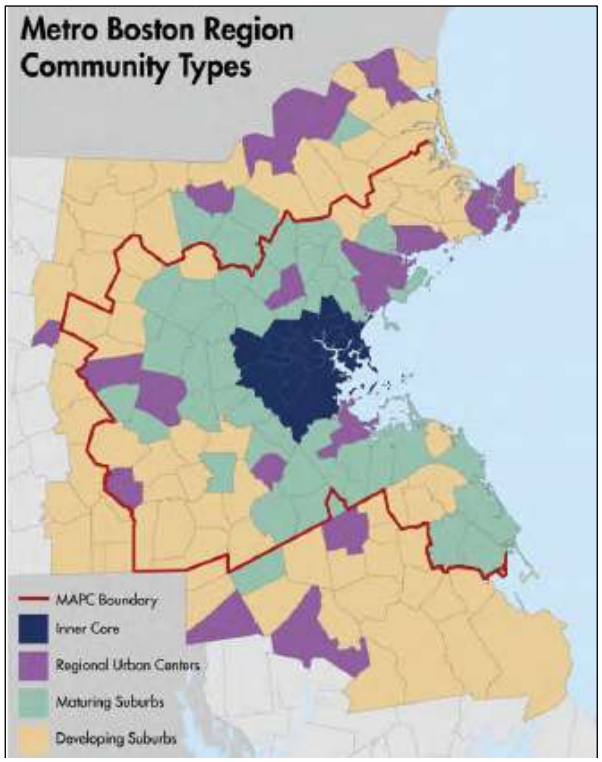
THE METROPOLITAN REGION AND THE INNER CORE

DEFINING THE REGION AND THE INNER CORE

THE METROPOLITAN REGION

This study begins with a definition of its geographic framework: Metropolitan Boston and its Inner Core. Different jurisdictions define Metropolitan Boston in different ways. In this report, unless otherwise stated, Metropolitan Boston means the region used by the Metropolitan Area Planning Council (MAPC) as the basis for its Metro Future long-term vision plan, published in 2008, and its Metropolitan Boston Population and Housing Demand Projections, published in 2014.[1] This "Metro Future" region consists of 164 cities and towns and is referred to interchangeably in this document as Metropolitan or Metro Boston, the metro region, and the region.

FIGURE 1: Metro Region, MAPC District, and MAPC Community Types



Source: MAPC, *MetroFuture* (www.mapc.org)

With a 2010 population of 4.46 million, ours is the tenth-largest metropolitan area in the United States. As defined, it is considerably larger than MAPC's own jurisdictional planning district of 101 cities and towns, which had a 2010 population of 3.17 million.[2] The additional territory and population consists principally of the Merrimack Valley; the Brockton, Taunton, and Attleboro areas; and the lower South Shore extending to Plymouth. The 164-municipality region is coextensive with the transportation network covered by the Boston Metropolitan Planning Organization's travel demand model and is the largest definition of Metro Boston lying entirely within Massachusetts.[3] FIGURE 1 shows the 164-community region (which includes all color-coded municipalities) and the smaller MAPC district.

THE INNER CORE

The MAPC uses the term "inner core" to denote two overlapping areas in the center of the metro region:

- an Inner Core geographic subregion consisting of 20 cities and towns;4
- an Inner Core community type, a subset consisting of 16 of those same cities and towns. This slightly smaller core is represented by the darkly shaded area in FIGURE 1, includes 13 of the 14 cities and towns originally served by the Metropolitan Transit Authority (MTA), predecessor of the MBTA, from its creation in 1947. These Inner Core communities are divided by MAPC into two subtypes: Metro Core Communities (Boston and six adjacent communities) and Streetcar Suburbs. MAPC defines the two subtypes as follows:

TABLE 1: Inner Core Community Subtypes [5]

METRO CORE COMMUNITIES	STREETCAR SUBURBS
• High density inner cities • Urban environment with mix of apartment buildings, multifamily houses, single family houses • Completely "built-out" • New growth: redevelopment, infill, and conversion from industrial uses to residential • Large minority and immigrant populations; recovering from urban disinvestment/suburban flight in the 1960s and 1970s	• Historic, high-density suburbs near the urban core • Village-oriented residential neighborhoods dominated by multifamily homes and smaller apartment buildings • All are essentially built-out • Very little new growth: limited redevelopment, infill, and expansion of existing structures • Moderately diverse population; stable or losing population due to decreasing household size.

Source: MAPC (http://www.mapc.org/wp-content/uploads/2017/09/Massachusetts-Community-Types-Summary-July_2008.pdf)

The remaining four communities in the Inner Core Subregion consist of:

- the cities of Lynn and Quincy, classified by MAPC as Subregional Urban Centers. These are cities with urban-scale downtown cores, served by rail transit and surrounded by more suburban residential neighborhoods;
- the towns of Milton and Saugus, classified by MAPC as Maturing Suburbs.[6]

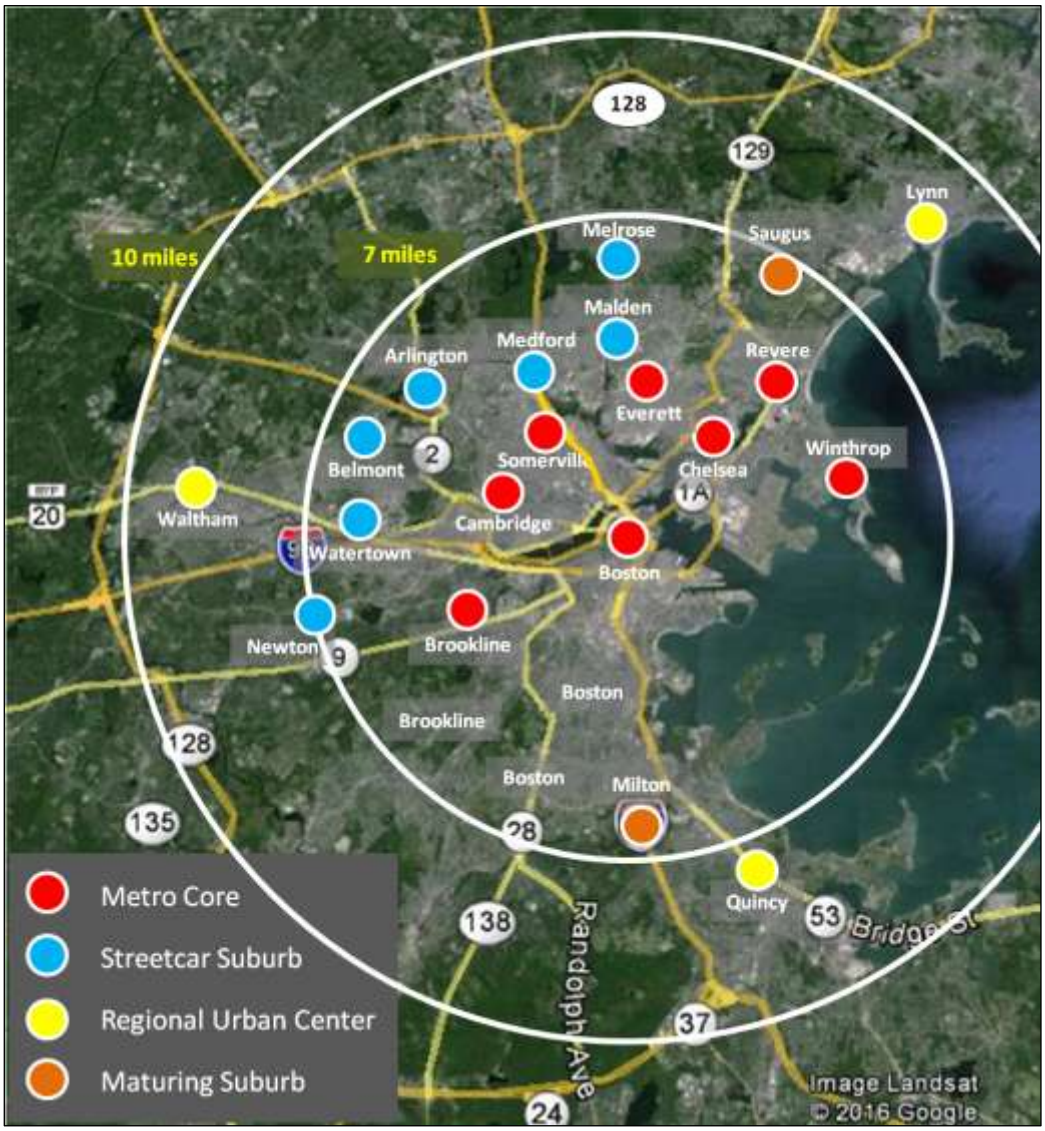
For purposes of defining the region's Inner Core, this study uses the 20-community Inner Core Subregion, thereby including Lynn and Quincy—important targets for transit-oriented development, and Milton, the remaining community of the MTA "original 14". Individual cities and towns are classified as they are in MAPC's typology, with two exceptions:

- This analysis groups the Town of Brookline with the Metro Core Communities rather than the Streetcar Suburbs. Brookline is surrounded by Boston on three sides, and its northerly half, containing the great majority of its population and employment, is strongly influenced by the B, C, and D branches of the MBTA Green Line.

- The City of Waltham is treated as a Subregional Urban Center rather than a Streetcar Suburb. Like Lynn and Quincy, Waltham is more distant from downtown Boston—lying roughly 10 miles out, while the remaining Streetcar Suburbs are contained within a seven-mile radius. Lynn, Quincy, and Waltham have industrial histories distinct from Boston, and while they have long had rail and bus connections to Boston, they are historically on the periphery of the core-based regional transit network.[7]
- Each of these three cities has seen its economic development potential elevated by major regional transportation investments of the mid- to late twentieth century: for Lynn, the Ted Williams Tunnel and its connection of the Route 1A corridor to the interstate highway system; for Quincy, the Red Line extension and the restoration of Old Colony commuter rail service; for Waltham, a generation earlier, the development of Route 128.

Error! Not a valid bookmark self-reference. shows the 20 communities of the Inner Core Subregion in relation to the highway system and their distance from downtown Boston. TABLE 2 summarizes the various community groupings.

FIGURE 2: The 20 Communities of the Inner Core Subregion



Source: AECOM

TABLE 2: The Inner Core

CITY OR TOWN	MAPC INNER CORE SUBREGION	MAPC COMMUNITY TYPE				MBTA
		Inner Core: Metro Core	Inner Core: Streetcar Suburb	Subregional Urban Center	Maturing Suburb	MTA "Original 14"
Arlington	●		●			●
Belmont	●		●			●
Boston	●	●				●
Brookline	●	● (a)	●			●
Cambridge	●	●				●
Chelsea	●	●				●
Everett	●	●				●
Lynn	●			●		
Malden	●	●				●
Medford	●		●			●
Melrose	●		●			
Milton	●				●	●
Newton	●		●			●
Quincy	●			●		
Revere	●	●				●
Saugus	●				●	
Somerville	●	●				●
Waltham	●		●	● (b)		
Watertown	●		●			●
Winthrop	●		●			

(a) Brookline is classified as a Streetcar Suburb by MAPC, as an Inner Core community in this study.
(b) Waltham is classified as a Streetcar Suburb by MAPC, as a Subregional Urban Center in this study.

Source: MAPC Subregions and Community Types (www.mapc.org/subregions) https://mbta.com/history

TRANSIT IN THE INNER CORE

As noted, the Inner Core Subregion contains all of the "MTA Original 14"—the cities and towns served by the Metropolitan Transit Authority (MTA), predecessor of the MBTA, from its creation in 1947 (and before that by the private subway, elevated, streetcar, and bus operations that the MTA acquired). This is the core of Metropolitan Boston's transit legacy, where urban form began organizing itself around mass transit more than a century ago.

The Inner Core is also the focus of today's MBTA system. It contains the Orange, Blue, Green, and Silver lines in their entirety, the entire Red Line (except Braintree Station), and the Ashmont-Mattapan high-speed trolley line. Thus almost all of the MBTA's 780,000 weekday rapid transit trips, *from end to end,* occur within the Inner Core.[8] Two current MBTA enhancement projects—the Green Line Extension and the Silver Line Gateway—are located entirely in the Inner Core as well.

Most MBTA bus routes—which carry 447,000 people each weekday—run within the Inner Core and feed its rapid transit corridors. The MBTA's 15 designated Key Bus Routes are located entirely in the Inner Core.[9] Virtually all of

the MBTA's 122,000 weekday commuter rail trips take people into and out of the Inner Core.[10] In much of the Inner Core, it is rare to find places that are *not* within walking distance of a rapid transit station, commuter rail station, or bus stop. *The MBTA's regional economic impact is largely, by definition, its impact on the Inner Core and on the Inner Core's ability to support the larger metropolis and the Commonwealth.*

A MONOCENTRIC REGION

Metropolitan regions are often described as either monocentric—that is, organized around a single dominant core—or polycentric. The core of a monocentric region contains a concentration of employment and commerce, and, depending on how far from the central business district the core is considered to extend, of population as well. The transportation network of a monocentric region is primarily radial in structure. While decades of sprawl since World War II have diluted the dominance of the core in many regions, dispersion is not the same as polycentrism. A polycentric region is one with two or more distinctly identifiable cores. These may be historically distinct multiple centers, as in Minneapolis-St. Paul, Dallas-Fort Worth, or the Bay Area, or a traditional core with one or more major "edge cities".

Metropolitan Boston is historically monocentric. Since World War II, it has expanded to Route 128 and beyond to I-495, creating an edge city of employment, retail, and population in Metro West (Framingham, Natick, and their surrounding towns) and an arc of commercial and industrial development along Route 128 from Burlington and Woburn in the northwest to Westwood and Dedham in the southwest. The once-separate metro areas of the Merrimack Valley are now part of the Boston MSA.

At a larger scale, the US Census has created a construct of Combined Statistical Areas (CSA's)—adjoining MSAs that meet certain thresholds of economic and transportation interdependency. One of these is the Boston-Providence-Worcester CSA, the nation's sixth-largest. It includes the Boston, Providence, Worcester, Manchester, and Cape Cod MSAs, extends into four states, and had a 2010 population of nearly eight million.[11] In this larger framework, Providence and Worcester are recognized as legitimate metropolitan centers—but of southeastern New England, not Metro Boston.

The analysis in the following sections demonstrates the continuing primacy of Metro Boston's Inner Core in a dispersed but still predominantly monocentric metropolis, and the pivotal role that the Core can be expected to play if the region is to grow sustainably and competitively in the coming decades.

FROM WORLD WAR II TO NOW

POPULATION

TABLE 3 summarizes regional population trends since 1950, the first post-war decennial census. The area to the left of the dark red divider line represents actual decennial census data from 1950 to 2010 and US Census estimates for 2015.[12] As a point of reference, data for 1900 are also included—a time representative of the Industrial Revolution, when Metropolitan Boston's population was approaching two million and more than half of it was contained in the 20-municipality Inner Core. It shows the following:[13]

- The region grew steadily from 1900 to 2015 (except for an aberrant dip of less than 1% from 1970 to 1980).
- The population of the Inner Core Subregion peaked in 1950. From 1950 to 1980, the population of the Inner Core Subregion and especially its dense Metro Core declined in absolute terms. With the region continuing to grow, the Inner Core's share of the metropolitan population fell significantly: from 38% to 23% for the Metro Core Communities; from 49% to 32% for the Metro Core and Streetcar Suburbs together; and from 58% to 39% for the entire 20-municipality Inner Core Subregion. Since 1980, however, the Inner Core Subregion and all of its subcomponents have grown in absolute terms and have roughly held their share of the regional population.
- In summary, after losing 17% of its population between 1950 and 1980, the Inner Core has bounced almost all the way back, regaining 13%. Its share of the metropolitan population has held steady and in 2015 was 37%. Within the Inner Core Subregion:
- Boston and the Metro Core Communities underwent a steady, substantial decline from their 1950 peak population to 1980. Boston lost 30% of its 1950 population, from its all-time high of 801,444 in 1950 to its postwar low of 562,994 in 1980—even as the metropolitan region was growing significantly. But as of 2015, Boston's estimated population was 667,137—a 18% gain since 1980 and a rate of resurgence that stands out among peer cities of the northeast and Midwest.
- The eight-community Metro Core as a whole (including Boston) lost 25% of its population from 1950 to 1980, but has grown by 18% from 1980 to 2015.
- The Streetcar Suburbs underwent a more mixed pattern, and one that unfolded somewhat later. Their population peaked in 1970, generally declined through 2000, and made a comeback from 2000 to 2015.
- Lynn's population, nearly 100,000 in 1950, followed the same pattern as Boston's—falling steadily until 1980 and rebounding since, but not to its 1950 level. Quincy grew somewhat from 1950 through 1970, dipped from 1970 to 1990, and has grown since then to achieve its all-time high. Waltham, opened up by Route 128, grew from 1950 to 1970, leveled off from 1970 to 2010, and has grown since 2010.

The decline in the Inner Core's share of regional population since 1950 raises the question of whether the region is trending toward polycentrism. For planning purposes, MAPC divides its 101 cities and towns into eight geographic subregions, including the 20-community Inner Core. These subregions are shown in FIGURE 3.

TABLE 4 compares the 1970 and 2015 populations of each subregion and their respective shares of the regional population. Whether one uses as the point of comparison the 20-community Inner Core Subregion, the 15 Inner Core-type communities (Metro Core and Streetcar Suburbs, or the eight Metro Core communities, there is clearly only one regional center in Metropolitan Boston. Notwithstanding the Inner Core's slippage from 1950 to 1980 and the steady growth in the rest of the region, the Inner Core still dwarfs every other subregion in population.[14] If one looks outside the MAPC district to the Merrimack Valley (which is part of the 164-municipality metro region), the Greater Lowell and Lawrence-Haverhill areas, with populations of roughly 300,000 and 262,000, respectively, are secondary centers—similar to Framingham-Natick and Salem-Beverly-Peabody—not competing ones.[15]

TABLE 3: Population Trend Data for Metro Region and Inner Core

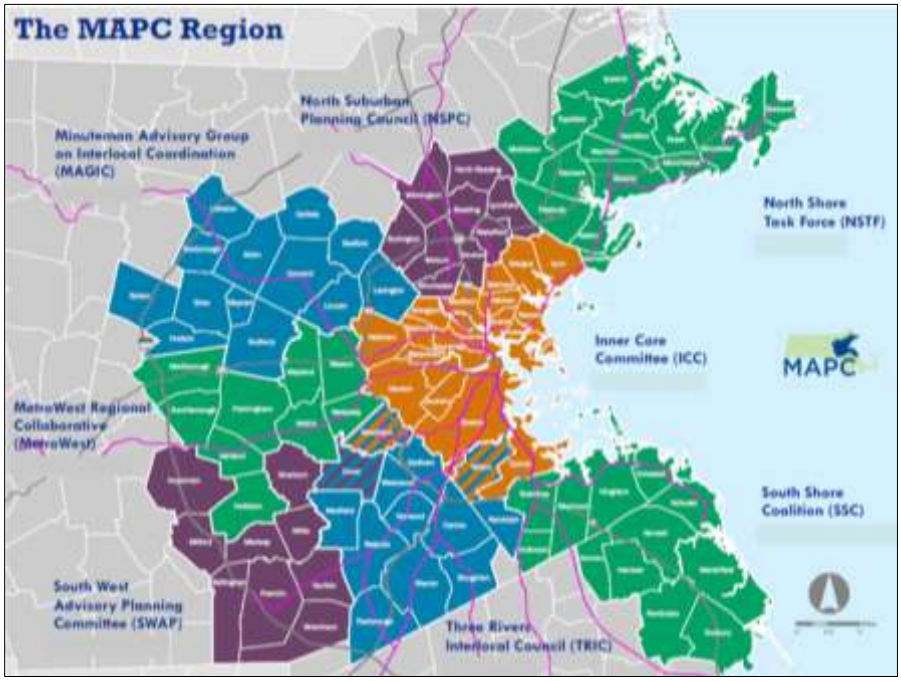
	ACTUAL DATA									MAPC STATUS QUO		MAPC STRONGER REGION	
	1900	1950	1960	1970	1980	1990	2000	2010	2015	2020 SQ	2030 SQ	2020 SR	2030 SR
Metro Core (8 municipalities)													
Boston *	574,136	801,444	697,197	641,071	562,994	574,283	589,141	617,594	667,137	640,798	664,867	664,218	709,400
Brookline	19,935	57,589	54,044	58,689	55,062	54,718	57,107	58,732	59,195	62,595	65,951	64,206	69,110
Cambridge	91,886	120,740	107,716	100,361	95,322	95,802	101,355	105,162	110,402	107,864	110,623	112,359	118,625
Chelsea	34,072	38,912	33,749	30,625	25,431	28,710	35,080	35,177	39,398	36,389	37,691	37,641	40,224
Everett	24,336	45,982	43,544	42,485	37,195	35,701	38,037	41,667	46,050	45,976	51,351	47,391	54,475
Revere	10,395	36,763	40,080	43,159	42,423	42,786	47,283	51,755	53,422	56,870	63,028	58,567	66,737
Somerville	61,643	102,351	94,697	88,779	77,372	76,210	77,478	75,754	80,318	81,817	87,982	85,240	94,433
Winthrop	10,132	19,496	20,303	20,335	19,294	18,127	18,303	17,497	18,164	17,181	16,775	17,522	17,444
Subtotal, Metro Core	826,535	1,223,277	1,091,330	1,025,504	915,093	926,337	963,784	1,003,338	1,074,086	1,049,490	1,098,268	1,087,144	1,170,448
Streetcar Suburbs (7)													
Arlington	8,603	44,353	49,953	53,524	48,219	44,630	42,389	42,844	44,815	42,911	43,192	43,975	44,996
Belmont	3,929	27,381	28,715	28,285	26,100	24,720	24,194	24,720	25,584	25,300	26,111	25,790	27,148
Malden	33,664	59,904	57,676	56,127	53,386	53,884	56,340	59,450	61,068	63,246	67,611	65,284	71,843
Medford	18,244	66,113	64,971	64,397	58,076	57,407	55,765	56,173	57,403	57,548	59,465	58,842	62,236
Melrose	12,962	26,988	29,619	33,180	30,055	28,150	27,134	26,983	27,997	26,718	26,618	27,256	27,713
Newton	33,587	81,994	92,384	91,263	83,622	82,585	83,829	85,146	88,817	85,579	86,191	87,264	89,585
Watertown	9,766	37,329	39,092	39,307	34,384	33,284	32,986	31,915	34,319	32,976	34,352	33,788	35,927
Subtotal, Streetcar Suburbs	120,755	344,062	362,410	366,083	333,842	324,660	322,637	327,231	340,003	334,278	343,540	342,199	359,448
Total Metro Core +Streetcar (15)	947,290	1,567,339	1,453,740	1,391,587	1,248,935	1,250,997	1,286,421	1,330,569	1,414,089	1,383,768	1,441,808	1,429,343	1,529,896
Subregional Urban Centers (3)													
Lynn	68,513	99,738	94,478	90,924	78,471	81,245	89,050	90,329	92,457	92,300	94,433	94,582	99,187
Quincy	23,899	83,835	87,409	87,966	84,743	84,985	88,025	92,271	93,618	97,074	101,986	99,534	106,865
Waltham	23,481	47,187	55,413	61,582	58,200	57,838	59,226	60,632	63,378	62,203	64,371	63,834	67,520
Maturing Suburbs (2)													
Milton	6,578	22,395	26,375	27,190	25,860	25,725	26,062	27,003	27,374	27,183	27,792	27,640	28,705
Saugus	5,084	17,162	20,666	25,110	24,746	25,549	26,078	26,628	27,994	26,895	27,393	27,459	28,545
Total, Inner Core Subregion (20)	1,074,845	1,837,656	1,738,081	1,684,359	1,520,955	1,526,339	1,574,862	1,627,432	1,718,910	1,689,423	1,757,783	1,742,392	1,860,718
Metro Region, Total **	1,890,122	3,186,970	3,516,435	3,937,288	3,903,844	4,056,947	4,306,692	4,457,728	4,676,577	4,558,017	4,683,113	4,662,641	4,887,880
Metro Core Communities % of Region	44%	38%	31%	26%	23%	23%	22%	23%	23%	23%	23%	23%	24%
Metro Core + Streetcar % of Region	50%	49%	41%	35%	32%	31%	30%	30%	30%	30%	31%	31%	31%
Inner Core Subregion % of Region	57%	58%	49%	43%	39%	38%	37%	37%	37%	37%	38%	37%	38%

* Boston's 1900 population includes the Town of Hyde Park (13,244), which was not annexed to Boston until 1912.

** The Metro Region population through 1960 is for the MSA as then defined by the US Census. From 1970 onward, the Metro totals are for the 164-municipality Metro Future region defined by MAPC and CTPS

Source: AECOM, compiled from US Census data for decennial years 1900, 1950-2010; US Census Estimate for 2015 (from MAPC Data Catalogue); MAPC: *Metropolitan Boston Population and Housing Demand Projections* (http://www.mapc.org/wp-content/uploads/2017/08/MetroBoston-Projections-Final-Report_1_16_2014_0.pdf)

FIGURE 3: The MAPC Subregions



Source: MAPC (www.mapc.org/subregions)

TABLE 4: Population of Regional Core and MAPC Subregions

SUBREGION	POPULATION, 1970	POPULATION, 2015
Inner Core (ICC) Subregion (20 municipalities)	1,684,359	1,718,910
15-municipality Inner Core Community Type	1,391,587	1,414,089
8-municipality Metro Core Community Subtype	1,025,504	1,074,086
Minuteman (MAGIC) Subregion	139,775	180,517
MetroWest Subregion	202,172	244,166
North Suburban (NSPC) Subregion	189,513	214,376
North Shore (NSTF) Subregion	263,766	292,314
South Shore (SSC) Subregion	221,797	267,691
South West (SWAP) Subregion	86,034	144,504
Three Rivers (TRIC) Subregion	226,929	258,468
Population of Massachusetts	5,689,367	6,794,222
Percent of State pop. in Inner Core Subregion	30%	25%
Population of 164-municipality Metro Area	3,987,288	4,676,577
Percent of Metro Area pop. in Inner Core Subregion	43%	37%
Population of MAPC 101-municipality District	3,013,912	3,327,946
Percent of MAPC pop. in Inner Core Subregion	56%	52%

Source: AECOM, from US Census, 1970 and 2015 Estimate (compiled for subregions in MAPC Data Catalogue, http://databrowser.mapc.org/)

Jobs

The concentration of jobs in the Inner Core is greater than that of population. Table 5 examines the number of jobs physically located in Core communities and the metro region in 2001, 2010, and 2014.[16] Overall, the trend bracketing the Great Recession is clear and uniform: the metro region and every one of the 20 Inner Core Subregion communities lost jobs from 2000 to 2010 (the decade that included the recession and the early stages of recovery) and then bounced back between 2010 and 2015. In some municipalities, there were more jobs in 2015 than there had been back in 2001; in others, the 2001 job levels had not yet been regained.

Table 5: Jobs Location Data for Metro Region and Inner Core

	ALL INDUSTRIES BY YEAR			KEY INDUSTRIES IN 2015			
	2001	2010	2015	Education	Health	Finance	Accom.
Metro Core (8 munic.)							
Boston	578,460	552,369	611,362	53,769	136,202	67,260	57,592
Brookline	15,442	15,368	18,306	2,683	5,283	296	2,647
Cambridge	113,365	105,861	116,089	27,979	10,976	2,151	9,971
Chelsea	13,610	13,544	16,091	1,267	2,272	109	896
Everett	12,835	11,952	12,777		1,347	1,368	1,117
Revere	8,604	9,163	10,117		1,451	134	1,364
Somerville	22,948	21,258	26,188		5,595	291	3,575
Winthrop	2,309	1,771	1,995		259	92	296
Subtotal, Metro Core	767,573	731,286	812,925	85,698	163,385	71,701	77,458
Streetcar Suburbs (7)							
Arlington	8,735	8,009	9,009	1,067	1,851	393	833
Belmont	6,359	6,480	7,413	944	2,691	231	536
Malden	17,482	13,798	13,413	1,225	2,571	317	1,063
Medford	18,931	17,190	18,712	3,779	3,189	1,082	1,266
Melrose	6,549	5,815	6,121	636	2,324	158	478
Newton	48,050	53,789	55,148	10,045	10,611	1,421	3,661
Watertown	20,381	18,895	20,800	1,678	1,772	2,155	995
Subtotal, Streetcar Suburbs	126,487	123,976	130,616	19,374	25,009	5,757	8,832
Total, Metro+Streetcar (15)	894,060	855,262	943,541	105,072	188,394	77,458	86,290
Regional Urban Centers							
Lynn	25,258	22,522	24,574	2,975	7,400	1,031	1,427
Quincy	47,299	45,773	48,492	2,711	8,763	10,333	3,387
Waltham	60,780	53,520	63,967	5,303	4,650	3,740	3,091
Maturing Suburbs							
Milton	6,067	5,400	6,049	2,180	1,262	92	484
Saugus	11,040	10,343	11,011		811	159	2,243
Total, Inner Core Subregion	1,044,504	992,820	1,097,634	118,173	211,160	92,832	96,966
Metro Future Region, Total	2,406,853	2,305,205	2,521,851	194,717	430,933	136,626	209,731
Metro Core Communities % of	32%	32%	32%	44%	38%	52%	37%
Metro Core + Streetcar % of	37%	37%	37%	54%	44%	57%	41%
Inner Core Subregion % of	43%	43%	44%	61%	49%	68%	46%

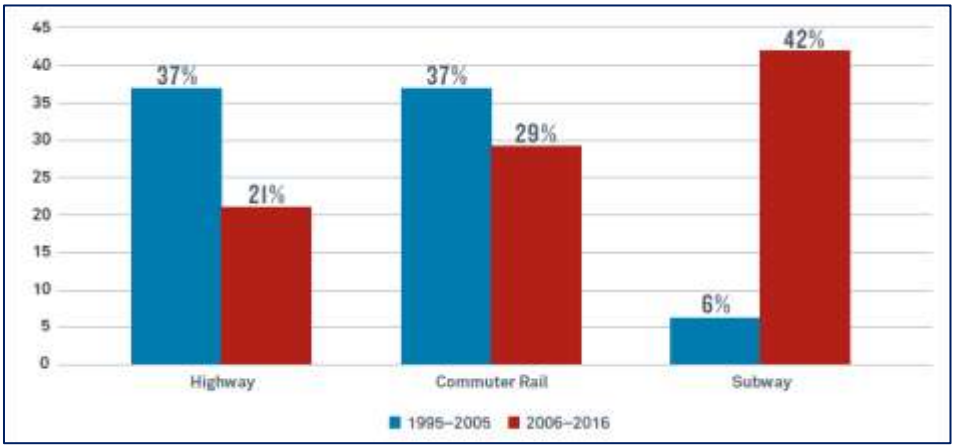
Source: AECOM, compiled from MAPC, ES-202 Data from Massachusetts Department of Labor and Workforce Development (I http://databrowser.mapc.org/Economy/Employment%20ES-202%20NAICS)

The degree of concentration is readily apparent:

- In 2015, Boston and the seven neighboring Metro Core Communities, with 23% of the 2010 metro population, had 32% of the jobs.
- The 15 Metro Core Communities and Streetcar Suburbs combined, with 30% of the 2015 metro population, had 37% of the jobs.
- The 20-municipality Inner Core Subregion, with 37% of the 2015 metro population, had 44% of the jobs.
- Moreover, the Inner Core Subregion had 61% of the metro region's education jobs, 49% of its healthcare jobs, 68% of its financial services jobs, and 46% of its hotel and food jobs (a proxy for tourism- and convention-related activity). The Inner Core remains Metropolitan Boston's singularly dominant employment destination.

An analysis of state employment data cited by MassINC suggests a significant shift in the geographic focus of job growth toward the Inner Core. In the decade of 1995-2005, most job growth occurred in areas served primarily by highways and commuter rail lines; in the decade of 2006-2016, job growth in highway settings receded, while job growth in subway settings—all of them in the Inner core—surged. This shift is illustrated in Figure 4.

FIGURE 4: Share of State's Net Job Growth by Transportation Infrastructure



Source: MassINC, analysis of ES-202 data from Massachusetts Department of Labor and Workforce Development

LOOKING AHEAD

Massachusetts is one of the few states in the Northeast/Mid-Atlantic/Midwest quadrant of the US that are expected to grow significantly in population between 2010 and 2040.[17] With the metro region containing 68% of the state's 2010 population, Massachusetts' growth potential is primarily that of Metro Boston. This section examines future regional growth based on MAPC's official projections.

METRO FUTURE

MAPC's long-term planning and visioning program is the foundation of the regional conversation on land use, transportation, and growth. MAPC's landmark 2008 regional vision document, *Metro Future,* was a scenario-based exploration of how Metropolitan Boston could grow in the decades from 2000 to 2030. It was based on modeled growth projections of 546,000 net new residents (a 13% increase in population), requiring 349,000 net new residential units to house them. The over-55 population was projected to increase by 55%, as the Baby Boomer generation ages; and the region's non-white population was projected to grow from 18% of the total to 31%.[18]

On the employment side, *Metro Future* estimated growth of 293,000 net new jobs (12% of the 2000 total). Beneath this overall gain was a projected loss of 46,000 manufacturing jobs, offset by large increases in professional, educational, medical, transportation, and leisure/hospitality jobs.

Metro Future's alternative growth scenarios all used these aggregate housing and employment growth assumptions—that is, the scenarios differed not in the amount of projected growth, but in its distribution across the region. MAPC developed four scenarios: "Current Trends" (in which the projected growth would unfold with no significant change in patterns or policies) and three alternatives, in ascending order of smart growth and transit-orientation: "Little By Little", "Winds of Change", and "Imagine". The scenario eventually adopted by MAPC, "Metro Future", was a modification of "Winds of Change".[19]

Compared to Current Trends, the Metro Future scenario relied heavily on the Inner Core; in Current Trends, by contrast, the Inner Core's share of regional population and employment would decline:[20]

- In 2000, Inner Core Communities had 31% of the existing metro population. Under Current Trends, the Inner Core would accommodate only 17% of the projected population growth, compared to 35% under Metro Future.
- In 2000, the Inner Core had 40% of existing metro region jobs. Under Current Trends, the Inner Core would provide 24% of projected job growth; under Metro Future, 41% of all job growth.

A linchpin of the Metro Future scenario was its reliance on transit-oriented development. In the Inner Core, 100% of projected growth would occur within a half-mile of an MBTA stop. In Regional Urban Centers and Maturing Suburbs, 60% of growth would occur within a half-mile of transit. Even in Developing Suburbs, where most sprawl occurs, 22-26% of growth would be near transit. Put differently, the Metro Future scenario relied on most regional growth occurring either within the Core or near transit stations along the spokes of the MBTA's radial system.

GROWING STATION AREAS

In 2012, MAPC published its region-wide strategy for transit-oriented development, *Growing Station Areas*. In 2010, the MBTA's 268 existing and planned station areas (the half-mile radius around each station entrance) contained, in the aggregate, only 5% of the metro region's land mass but 25% of its housing units and 37% of its jobs. MAPC found that over 30,000 housing units were underway or planned within the station areas.

Based on that pipeline and an analysis of each station's land availability and place type, MAPC estimated that by 2035, MBTA station areas could accommodate 76,000 new units—one-third of the total projected regional growth

for the 25-year period. Similarly, there were over 45 million square feet of commercial space (office, retail, R&D, and institutional) underway in station areas; by 2035, station areas could accommodate enough space to house 133,000 new jobs—over half the projected regional growth. This development could generate 60,000 daily MBTA work trips, as well as many non-work trips—bringing ridership and revenue to the MBTA but challenging its strained capacity.[21]

STATUS QUO VERSUS STRONGER REGION

In 2014, MAPC published its *Population and Housing Demand Projections*, which updated *Metro Future* to a 2010 start date and a 2040 planning horizon. Unlike *Metro Future*, the 2014 analysis did not assume constant regional growth regardless of scenario. It presented two scenarios—"Status Quo" and "Stronger Region"—that resemble the earlier Current Trends and Metro Future, but with one key change. The Stronger Region scenario accommodates nearly twice as much net population and labor force growth than the Status Quo. The scenarios are summarized in TABLE 6:

TABLE 6: Summary of MAPC Status Quo and Stronger Region Scenarios

	EXISTING	STATUS QUO		STRONGER REGION	
	2010	2030	2040	2030	2040
Population	4.46 million	+225,000 (4.9%) 4.68 million	+293,000 (6.6%) 4.75 million	+430,000 (9.6%) 4.89 million	+561,000 (12.6%) 5.02 million
Labor Force	2.52 million	-96,000 (-0.4%) 2.51 million	+96,000 (3.8%) 2.53 million	+120,000 (4.8%) 2.64 million	+175,000 (6.9%) 2.69 million
Housing Units	1.83 million	+239,000 (13%) 2.07 million	+305,000 (17%) 2.14 million	+323,000 (18%) 2.15 million	+435,000 (24%) 2.27 million
% Multi-Family	51%		48% of new units		62% of new units
Households	1.72 million		+290,000 (17%) 2.01 million		+400,000 (23%) 2.12 million

Source: MAPC, *Metropolitan Boston Population and Housing Demand Projections,* from material on pp. 2 and 9.

The composition of Metro Boston households and their resultant housing preferences is projected to undergo significant change. In either scenario, average household size shrinks from 3.2 in 1970 to 2.53 in 2010 and 2.3 in 2030 and 2040. Young households and aging households are already shifting to multi-family settings, and this trend is expected to intensify. The net demand for single family homes can be satisfied largely by managing the anticipated "senior sell-off"; the principle challenge lies in meeting the demand for apartments and condominiums. In the Stronger Region scenario, from 2010-2030, the Inner Core has a projected demand for 86,000 multi-family units (46% of whole regional demand for multi-family), but only 22,000 single-family homes. TABLE 7 summarizes single- and multi-family demand in the Inner Core and in the Regional Urban Centers, where transit station areas (particularly commuter rail) are expected to absorb considerable demand in the Stronger Region scenario.

TABLE 7: Projected Single- and Multi-Family Demand, 2010-2030[22]

	STATUS QUO NEW DEMAND, 2010-30		STRONGER REGION NEW DEMAND, 2010-30	
	Single-Family	Multi-Family	Single-Family	Multi-Family
Inner Core Communities (16 municipalities)	19,000	53,000	22,000	86,000
Regional Urban Centers	27,000	27,000	31,000	44,000

Source: MAPC, *Metropolitan Boston Population and Housing Demand Projections,* from material on p. 35

Metro Boston's population change, positive or negative, is largely a net product of migration. From 2006 to 2010, the region experienced an average net out-migration of about 10,600 people a year—roughly 6,200 leaving for other states and 4,400 for other regions in Massachusetts. The only age cohort providing net in-migration was the student cohort—ages 18-24. The prime working cohorts (ages 25-49) produced most of the net out-migration. (There was no documented out-migration of senior citizens.) In the Status Quo scenario, this modest annual net out-migration continues; in Stronger Region, it closes and reverses, resulting in a average 10,000 net *in*-migration by 2020.

MAPC also foresees a potential shift in intra-regional migration patterns. Today, households in their family formation years, especially those with school-age children, still tend to move out of the core cities, off-setting the in-migration of college students and childless young adults. In the Status Quo, this traditional pattern continues, while in the Stronger Region, the needle moves a bit in the other direction, as 10% of school-aged households who would have traditionally moved to the suburbs decide not to. This contributes to a multi-faceted resurgence in urban communities.[23]

As shown earlier, after three decades of decline in its own population and its share of the regional population, the 20-community Inner Core Subregion has, since 1980, grown slowly along with the region as a whole. As of 2010, 37% of Metro Boston's people live in the Inner Core Subregion. In either future scenario, the Inner Core provides over half the region's population growth through 2030, and its share of the total regional population grows slightly. The difference is in the actual growth of the Inner Core itself: as summarized in TABLE 8, the Inner Core Subregion is projected to grow by 8% in the Status Quo, but by 14% in the Stronger Region. The densely developed, transit-intense Metro Core grows by 9% in the Status Quo, but 17% in the Stronger Region. A glance at the right-hand side of TABLE 3 (page B-7) shows that this pattern is repeated for virtually all 20 municipalities in the Inner Core Subregion.

TABLE 8: Inner Core Growth by Scenario, 2010-2030

	2010	2030 STATUS QUO			2030 STRONGER REGION		
	% Metro Pop.	% Growth 2010-30	% Metro Pop.	% Metro Growth	% Growth 2010-30	% Metro Pop.	% Metro Growth
Metro Core (8)	23%	9%	23%	42%	17%	24%	39%
Metro Core + Streetcar (15)	30%	8%	31%	49%	15%	31%	46%
Inner Core Subregion (20)	37%	8%	38%	58%	14%	38%	54%

Source: AECOM, compiled from US Census for 2010 and MAPC, *Metropolitan Boston Population and Housing Demand Projections*

The bottom line is that both the Status Quo and the Stronger Region scenarios rely on a disproportionate share of growth occurring in the Inner Core. Particularly with respect to the Stronger Region, the higher population growth, net in-migration, labor force growth, and accommodation of evolving housing preferences do not merely work better, more competitively, and more sustainably by focusing on the Inner Core. It is not clear that these outcomes could be achieved any other way.

ENDNOTES

[1] Metropolitan Area Planning Council (MAPC), *Metro Future: A Regional Plan* (2008; hereinafter Metro Future), and *Metropolitan Boston Population and Housing Demand Projections* (2014; hereinafter MAPC Projections).

[2] MAPC Data Commons: Population by Decade (1970-2010) for MetroFuture, Community Types, and Municipalities (http://metroboston.datacommon.org/datasets/13928ca3-59ef-41ef-bc1e-2159eb14d6c6). The tenth-largest designation reflects the US Census Boston Metropolitan Statistical Area (MSA), described below.

[3] *MAPC Projections*, p. 2. The US Census Boston MSA includes all of Suffolk, Middlesex, Essex, Norfolk, and Plymouth Counties, as well as Rockingham and Strafford Counties in New Hampshire (it excludes Attleboro, Taunton, and adjoining towns in Bristol County). It had a 2010 population of 4.55 million. (US Census, 2010)

[4] A 21st community, Needham, is a member of two subregion *organizations* (the Inner Core Committee and the Three Rivers Inter-local Committee), but MAPC does not include Needham in the Inner Core Subregion for statistical purposes.

[5] MAPC, Massachusetts Community Types (2008). It should be noted that while the "streetcar suburb" concept was originally expounded in the classic book by Sam Bass Warner (*Streetcar Suburbs: the Process of Growth in Boston, 1870-1900*; Harvard University Press, 1962 and 1978), the book itself describes the development not of any current suburbs but of Dorchester, Roxbury, and West Roxbury, as they grew along their street railway corridors and became annexed to Boston.

[6] MAPC, Massachusetts Community Types (2008).

[7] While Newton, like Waltham, extends out to Route 128, it better fits the Streetcar Suburb category for purposes of this transit-based analysis. It adjoins Boston, straddles the seven-mile circle, and is served by both the D branch of the Green Line and by the Worcester-Framingham commuter rail line, which has three Newton stations. Waltham has two commuter rail stations.

[8] The system-wide ridership numbers by mode cited in this and the following paragraph are 2015 data reported in Massachusetts Bay Transportation Authority (MBTA), Focus 40.

[9] The MBTA designates 15 of its busiest bus routes as "Key Bus Routes". Each Key Bus Route operates at a high frequency, 7 days a week, to meet passenger demand along high-density corridors. Service operates every 10 minutes or better during weekday peak periods, every 15 minutes or better during weekday midday, and every 20 minutes or better during off-peak periods. (http://old.mbta.com/about_the_mbta/t_projects/default.asp?id=19047)

[10] Daily ridership figures are 2015 data reported in MBTA, Focus40.

[11] US Census, 2010. There is a large body of literature on monocentrism and polycentrism, in both the economics and planning fields. The monocentric model was pioneered by economist William Alonso (*Location and Land Use,* Harvard University Press, 1964). See also Joel Garreau, *Edge City: Life on the New Frontier* (Anchor Books, 1992).

[12] The area to the right of the divider represents growth projections under MAPC's Status Quo and Stronger Region growth scenarios; these are defined and discussed beginning on page 12.

[13] MAPC Data Commons: Population by Decade (1970-2010) for MetroFuture, Community Types, and Municipalities (http://metroboston.datacommon.org/datasets/13928ca3-59ef-41ef-bc1e-2159eb14d6c6); US Census for 1900, 1950, 1960.

[14] MAPC Data Commons; Population by Decade for Subregion, Community Subtype, Metro Future Region, Regional Planning Agency, and Massachusetts (http://metroboston.datacommon.org/datasets/13928ca3-59ef-41ef-bc1e-2159eb14d6c6).

[15] US Decennial Census, 2010 and MAPC Data Catalogue, US Census Estimated Population Data for 2015.

[16] MAPC, ES-202 Data (from Massachusetts Department of Employment Services). As of 2017, data are available for all years between 2001 and 2015.

[17] A 2016 analysis by the University of Virginia's Weldon Cooper Center for Public Service projects that Massachusetts' population will grow 20% between 2010 and 2040—the highest among Northeast/Mid-Atlantic/Midwest states except for Washington, DC, Delaware, and Maryland. Several states are projected to lose population, including Maine, Vermont, and Rhode Island; Connecticut and New Hampshire are projected to gain only marginally (http://www.coopercenter.org/demographics/national-population-projections).

[18] *Metro Future,* p. 10. MAPC's modeling methodology, based on the *Community Viz* software platform, is summarized on p. 7.

[19] *Ibid*., p. 7.

[20] *Ibid*., p. 17. The Inner Core referenced by MAPC in these projections is its subset of 16 Inner Core-type communities (including Waltham), rather than the 20-community Inner Core Subregion..

[21] MAPC, *Growing Station Areas,* 2012; Executive Summary.

[22] The Inner Core referenced here is the 16-community subset of Inner Core-type communities, including Waltham. The metro region's 21 MAPC-designated Regional Urban Centers include Lynn and Quincy.

[23] *Ibid*., pp. 5-6 (migration discussion).

TECHNICAL APPENDIX C

THE INNER CORE: STRATEGIC CORRIDORS AND TRANSIT GROWTH CLUSTERS

THE TRANSPORTATION DIVIDEND

TRANSIT INVESTMENTS AND THE MASSACHUSETTS ECONOMY

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INTRODUCTION

This Technical Appendix addresses in detail the question of how—and more specifically, where—the growth in population and jobs projected in the Inner Core of Metropolitan Boston will likely occur. As discussed in Technical Appendix B, in both of MAPC's growth scenarios—the Status Quo and the Stronger Region—more than 50% of the predicted population growth in the metropolitan region as a whole would occur in the 20-community Inner Core Subregion. In either case, regional growth depends disproportionately on Inner Core growth. The difference is that in the Stronger Region scenario, the Core would grow much more between now and 2030 than in the Status Quo—about 14% versus 8%.

That growth will not happen in the abstract, no matter how supportive the demographic trends, local policies, and market forces that underlie MAPC's community-by-community projections. Development happens in actual places, where there is available land, good access by transit and by road, public policy support, and specific market interest. In the pages that follow, 24 such places within the Inner Core Subregion are defined and analyzed to understand how their development potential and their transportation assets align, and where there are mobility gaps that will need to be filled, sooner or later, through public, private, or joint initiative, if the development potential is to be achieved. The focus is on gaps in the transit system, because the capacity of the regional highway network, especially within the Inner Core, is widely understood to be approaching its practical limit.

Put differently, current and future growth in the Inner Core consists largely of transit-oriented development (TOD); this analysis seeks to identify prime TOD opportunities and their future needs on the transit side of the equation. Most of these involve the "state of good repair" of the MBTA's existing system. Some represent core capacity enhancements associated with but surpassing "pure" state of good repair investments, such as fleet replacement or signal system upgrades. Some involve strategic service enhancements.

STRATEGIC CORRIDORS AND TRANSIT GROWTH CLUSTERS

The 24 units of analysis in this Appendix are geographic subsets of the Inner Core Subregion. They are characterized by development of regional significance that is underway, planned, or anticipated at specific locations. The 24 places thus identified are called "Transit Growth Clusters" or "Growth Clusters".[1] Ten are located entirely in Boston, three partially in Boston, and eleven in other communities. The 24 Growth Clusters identified and examined here represent ***an illustrative subset*** of a larger universe of transit-rich development areas in the Inner Core Subregion.

The Growth Clusters are best understood not as stand-alone districts or neighborhoods, but as parts of larger groupings of regionally strategic scale, connected by highways, arterial streets, rail and bus lines, waterways, and economic synergies. These larger groupings or "Strategic Corridors" consist of one central agglomeration called "The Hub" and five radial corridors; they are listed in Table 1.

Three different TOD scenarios can be found among the Growth Clusters. As shown in TABLE 1, they are not mutually exclusive; several Growth Clusters exemplify two of these scenarios:

- *Established*: on-going, large-scale development districts where significant build-out capacity remains; examples are the South Boston Waterfront and the Southwest Corridor.
- *Transformative*: emerging development opportunities of transformative scale—for example, Allston Landing or the envisioned redevelopment of the Lynn Waterfront.
- *Infill*: significant infill and adaptive reuse opportunities that strengthen the linkage between transit and sustainable, equitable development, such as the revitalization of Quincy Center or Arsenal Street.

TABLE 1: The Strategic Corridors and Growth Clusters

CORRIDOR AND GROWTH CLUSTER	LOCATION	TYPE
The Hub		
Downtown Boston	Boston	Established
Back Bay	Boston	Established
LMA/Fenway	Boston, Brookline	Established; Infill
Kendall	Cambridge	Established; Transformative
Seaport District	Boston	Established; Transformative
South Bay Corridor	Boston	Infill; Transformative
Near North Shore		
East Boston Waterfront	Boston	Infill
Chelsea	Chelsea, Everett	Transformative
Suffolk Downs/Wonderland	Boston, Revere	Transformative
Lynn Waterfront	Lynn	Transformative
North Corridor		
East Cambridge/East Somerville	Cambridge, Somerville	Established; Transformative
Green Line Extension Villages	Somerville, Medford	Infill
Mystic/Malden River Corridor	Boston, Somerville, Everett, Medford, Malden	Transformative
Charles River		
Allston/Brighton Rail Corridor	Boston	Transformative
Arsenal Street	Watertown	Infill
Newton Rail TOD Corridor	Newton	Transformative; Infill
Needham Street	Newton	Infill; Transformative
Downtown Waltham	Waltham	Infill
South Neighborhoodss		
Upper Southwest Corridor/Dudley	Boston	Established; Infill
Lower Southwest Corridor/Egleston	Boston	Infill, Transformative
Lower Blue Hill Avenue	Boston	Infill
Hyde Park Villages	Boston	Infill, Transformative
Red Line Outer Markets		
Alewife	Cambridge	Established
Quincy Red Line Corridor	Quincy	Infill

The bulk of this Appendix consists of six sections, each addressing in detail one of the Strategic Corridors and the Growth Clusters included in it. Each section begins with an overview of the grouping in question, consisting of:

- an aerial map of the entire Strategic Corridor identifying its Transit Growth Clusters and major transportation features;

- a table summarizing, for each Growth Cluster and for the aggregate of Growth Clusters within the grouping, a high-level estimate of the number of residential units and the number of jobs associated with current development and *potentially* associated with future development. These estimates, which are critical to understanding the significance of the Strategic Corridors and Growth Clusters, are documented in detail in Technical Appendix C1; the methodology is summarized below.

Following this overview of a particular Strategic Corridor, each of its Growth Clusters is addressed in a subsection consisting of:

- a more localized overview, using an aerial map to show the Growth Cluster, its primary development features, its existing transit and commuter rail stations, their half-mile station area radii, major arterial streets, and other features that are salient to this analysis;
- a discussion of distinguishable development districts within the Growth Cluster, summarizing the current state of planning and development and listing specific plans and projects that contribute to the estimate of development capacity documented in Technical Appendix C1;
- a transit assessment, featuring a battery of metrics describing existing conditions at each station in the Growth Cluster. These include ridership, job and labor market connectivity, and various equity and sustainability outcomes associated with transit use at this location. The transit assessment concludes with a qualitative discussion of transit and related mobility needs identified in the course of the discussion.

METRICS AND METHODOLOGY

This Technical Appendix includes, for each Transit Growth Cluster, two types of detailed quantitative evaluation; the methodologies involved are described below:

- the high-level spreadsheet estimates of ***development capacity***, documented in Technical Appendix C1;
- an assessment of existing transit market conditions using a battery of metrics derived from publicly available data bases to measure ridership, existing residential and employment density, accessibility of jobs and labor, affordability, and automobile usage. These metrics all relate, directly or indirectly, to the theme of ***labor market connectivity***.

ESTIMATES OF DEVELOPMENT CAPACITY

The estimates are developed for each Growth Cluster, in three timeframes:

- "Recent or Current" refers to projects that are currently in construction or which have come on-line since 2013 (meaning, in most cases, that they began construction after the 2010 census).
- "Pipeline" refers to projects which are at some stage of the formal public review and approval process, and have thus made at least one official submittal describing the project.
- "Long-Term Potential" refers to development which may occur on sites that have been identified as significant development opportunities but for which a program-specific planning or approval process has not begun or is in its earliest stages.
- For "Recent or Current" and "Pipeline" projects, the estimate of development was taken from the most recent available official documentation. In Boston, the Boston Planning and Development Agency's database of development projects was used in nearly all cases. In other municipalities, Massachusetts Environmental Policy Act (MEPA) documentation is used wherever applicable and available, again using the most recent available stage of documentation. Where available, municipal filings or decisions were used as a cross-reference to MEPA documentation, or as a substitute for it in non-MEPA situations. MAPC's region-wide development projects data base, MassBuilds, was used broadly as a cross-reference and, where no original documentation was available, as a primary source.[2]

The number of housing units associated with a development project is typically stated in those terms, and in almost all cases the number of residential units listed for a "recent/current" or "pipeline" project is simply the number stated in the referenced documentation. The number of jobs, on the other hand, is usually not stated; rather, a number of built or proposed square feet in a particular use category is provided. To translate these non-residential square footages into jobs, a series of "job factors" was used. Listed at the top of each Strategic Corridor page in Technical Appendix C1, these factors include one job per 225 square feet of office space, one per 500 square feet of retail; one per 400 square feet of R&D, etc. These factors were taken from the conservative end of the ranges typically discussed in real estate literature; for example, new office space is often generating one job per 175 or 200 square feet of space, rather than 225.

For "Long-Term Potential" development, where there are no site-specific documents on which to base the development estimates, two methods were used:

- Where the municipality in question has developed district-level planning numbers, those were used. Examples are Boston's plan to facilitate up to 8,000 housing units in the Broadway-Andrew segment of Dorchester Avenue, or Somerville's high-level estimate of housing units and jobs in transformational areas like Inner Belt and Union Square. Where applicable, the housing and job numbers associated with specific "recent/current" or "pipeline" projects were subtracted to avoid double-counting. In the case of Suffolk Downs, where the owner has begun the public process by filing a broad planning concept with a programmatic range of uses and densities, the low end of those ranges are used here.
- Where there are simply no recognized numbers for future opportunity sites, high-level estimates were prepared by taking the nominal acreage and reducing it to a developable subset (by assuming a percentage to be left unbuilt, such as for large open space reservations); assigning a gross FAR in the 1.25 to 2.0 range to the acreage assumed to be buildable ("gross meaning that the site area includes streets, sidewalks, plazas, etc.; hence the relatively low FAR assumptions); dividing the resultant buildout into residential and employment components (based on the consultant's judgment about the area in question); and applying rough square footage factors for housing units and jobs. Each instance is documented on the "Estimates" page of Technical Appendix C1.

In the aggregate, the 24 illustrative Transit Growth Clusters provide the following estimated development capacity:

- About 49,000 housing units in Recent, Current, or Pipeline projects.
- The long-term potential to accommodate approximately 49,000 additional housing units.
- Commercial and industrial space in Recent, Current, or Pipeline projects that can accommodate approximately 146,000 jobs.
- Long-term potential for space that could accommodate approximately 116,000 additional jobs.

The totals for each Strategic Corridor and its Growth Clusters are provided in the subsequent sections of this Appendix. (See: The Hub, Table 3, page C-7; Near North Shore, Table 16, page C-41; North Corridor, Table 25, page C-61; Charles River Corridor, Table 32, page C-74; South Neighborhoods Corridor, Table 43, page C-91; Red Line Outer Markets, Table 52, page C-108.)

These totals must be understood as conceptual and high-level. Moreover, with respect to "pipeline" and "long-term" projects, these are estimates of *potential* rather than certainty; for normal market reasons, not all of the potential development in these locations will ultimately be built. Equally important, the development that *is* ultimately built cannot be assumed to represent 100% net new growth; some of the Inner Core's future TOD will accommodate the replacement of older building stock, but often in a more transit-oriented, less automobile-dependent location.

TRANSIT MARKET CONDITIONS

The transit assessment for each Growth Cluster features a table in which a battery of metrics available from recognized data bases are applied to *each rapid transit or commuter rail station* in that particular Growth Cluster. These metrics were chosen by the consultant team as particularly representative of the nexus of transit, economic development, labor market connectivity, and equity. The metrics, their source attributions, and their significance are described in Table 2.

TABLE 2: Summary of Metrics Used in Growth Cluster Transit Assessments

METRIC	SOURCE	DESCRIPTION AND SIGNIFICANCE
Station Area Typology	MAPC, *Growing Station Areas* (2012; https://www.mapc.org/resource-library/growing-station-areas-the-variety-and-potential-of-tod/), and MAPC's station-area data base, http://tstation.info/#search/.	MAPC has created a station area typology that sorts all 268 rapid transit and commuter rail stations into 10 "place types". These reflect each station's development context, location in the regional transect, function in the transit system, scale of development, and long-term aspirational character. (See the description in *Growing Station Areas.*)
Percentage of Daily Transit Use	MAPC, http://tstation.info/#search/.	The percentage of daily commuters living in the station area who commute by transit. This is a key indicator of existing connectivity and behavior, with two limitations. First, it does not include *in-bound* commuting to job or school destinations located in the given station area. Second, MAPC's database uses the American Community Survey (ACS) 2008-2012 five-year series to compute this metric; thus, it does not reflect the mode share behavior of commuters living in recently opened TOD housing. (The cars/household and VMT/household metrics described below are based on 2014 Registry of Motor Vehicles data.)
Daily Ridership	MBTA "Blue Book", 2014 Edition (https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Panel/MBTARidershipandServiceStatistics2014.pdf)	For rapid transit lines, the average weekday boardings in either direction. For commuter rail, the average daily Boston-bound boardings (or for North Station, South Station, and Back Bay, in-bound alightings). This measure counts each round trip passenger once, rather than boardings plus alightings.
Rush Hour Seating	Boston Transportation Department and Nelson Nygaard, Inc., Subway line seated capacity analysis for GoBoston 2030.	For the Red, Orange, and Blue Lines, this analysis determined the station at which all seats become filled during an in-bound AM rush hour trip, or at which seats first become available on an out-bound PM rush hour trip. This analysis thus shows whether a station has available seating capacity in the rush hour commute direction or only in the "reverse commute". (This metric does not appear in the transit assessment tables, but is applied in the narrative as applicable.)
Households in ½ Mile	MAPC's station area database, which uses GIS to match a range of variables to each MBTA station's ½-mile radius. Data are from the ACS. http://tstation.info/#search/	The estimated number of households living within ½ mile of the station. The median value of this variable across all 289 station areas (2,815 households) is provided as part of each Growth Cluster transit assessment table, enabling an immediate comparison of a given station to the median.
Jobs in ½ Mile	MAPC, http://tstation.info/#search/	The estimated number of jobs physically located within ½ mile of the station. Here again, the median value for all stations (2,964 jobs) is provided for comparison.
Job Shed	Center for Neighborhood Technology (CNT)'s All-Transit Database, which allows a range of variables to be searched at the Census Block Group, Census Tract, municipality, MPO, or MSA level.	The estimated number of jobs accessible by a 30-minute transit commute, located within ¼ mile of the destination stations. For CNT's methodology, see http://alltransit.cnt.org/methods/AllTransit-Methods.pdf. In this study, the job shed number is that of the Census Block Group in which the origin station is located; if a station lies on

METRIC	SOURCE	DESCRIPTION AND SIGNIFICANCE
	http://alltransit.cnt.org/	the boundary of two or three Block Groups, the job shed number is their unweighted average. The average for any location in the MAPC region is 302,000, to which the value for a particular station can be compared. This is a measure of job access via transit for any station in the MBTA system, and allows at least a qualitative judgment of the extent to which developing transit-oriented housing at a given station will enable workers to access jobs in the region without needing an automobile.
Labor Shed	Center for Neighborhood Technology, http://alltransit.cnt.org/	The estimated number of workers who can access a job at given station by a 30-minute transit commute, from within ¼ mile of any other station in the system. The methodology is analogous to that of Job Share, and the average for any location in the MAPC region is 151,000. This is the "flip side" measure of job access via transit and allows at least a qualitative judgment of the extent to which developing *employment* at a given station will enable workers living throughout the region to access it without acar.
H+T Index (AMI)	Center for Neighborhood Technology's Housing+ Transportation Affordability Index database, which allows a range of variables to be searched at the Census Block Group, Census Tract, municipality, MPO, or MSA level. (http://htaindex.cnt.org)	The percentage of income consumed by *housing plus transportation* costs for a household earning the Greater Boston Area Median Income (AMI), currently $73,180. The definition of affordability in this metric is 45% of household income spent on housing plus transportation. This definition is becoming accepted in urban policy analysis as a more descriptive alternative than the traditional 30% spent on housing alone, since it takes into account the role of transit (with low costs compared to car ownership) in offsetting housing costs. The average "H+T" value across the entire MAPC region is 48%. In this study, the H+T percentage for a given station is that of the Census Block Group in which it is located; if it lies on the boundary of two or three Block Groups, the H+T percentage is their average. Comparing the value for a given station to the regional average (48%) and the affordability benchmark (45%) provides an indication of relative affordability for people of median income living near that station.
H+T Index (80% AMI)	Center for Neighborhood Technology, (http://htaindex.cnt.org)	The same at the prior measure, except the median income used is 80% of AMI, the standard definition of moderate income. The 80% AMI for the MAPC region is $58,544. The benchmark definition of affordability is 45%, but the average value across the region jumps to 59%, reflecting the lower income denominator.
Cars/Household	http://tstation.info/#search/ (MAPC)	The average number of cars registered per household in the ½ mile station area (using Registry of Motor Vehicles records). For comparison, each table includes the average cars per household for the whole MAPC region (1.55 cars) and the median among all MBTA stations (1.03 cars).
VMT/Household	http://tstation.info/#search/ (MAPC)	VMT/Household (average of daily VMT per household based on odometer readings of cars registered within the ½-mile station area and Cars/Household. For comparison, each table includes average daily VMT per household for the MAPC region (50.27) and the median among all MBTA stations (25.84 cars).

THE HUB

As shown in Figure 1, The Hub is an amalgam of six closely interconnected Growth Clusters in the heart of the Inner Core. Their estimated development potential is presented in Table 3.

FIGURE 1: The Hub and Its Six Growth Clusters

Source: AECOM

TABLE 3: The Hub; Housing and Job Capacity by Growth Cluster

	RECENT/ CURRENT		IN THE PIPELINE		RECENT/CURRENT PLUS PIPELINE		LONG-TERM POTENTIAL		TOTAL	
	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs
Downtown Boston	3,300	9,200	1,800	8,900	5,100	18,100	900	4,200	6,000	22,300
Back Bay	700	1,900	2,000	4,100	2,700	6,000	800	700	3,500	6,700
LMA/Fenway	2,800	5,200	800	2,800	3,600	8,000	100	11,700	3,700	19,700
Kendall	900	7,200	900	7,100	1,800	14,300	1,000	4,400	2,800	18,700
Seaport	2,700	18,000	3,000	11,500	5,700	29,500	3,700	6,500	9,400	36,000
So. Bay Corridor	1,600	400	200	7,000	1,800	7,400	11,700	7,500	13,500	14,900
Hub Total	**12,000**	**41,900**	**8,700**	**41,400**	**21,000**	**83,000**	**18,000**	**35,000**	**39,000**	**118,000**

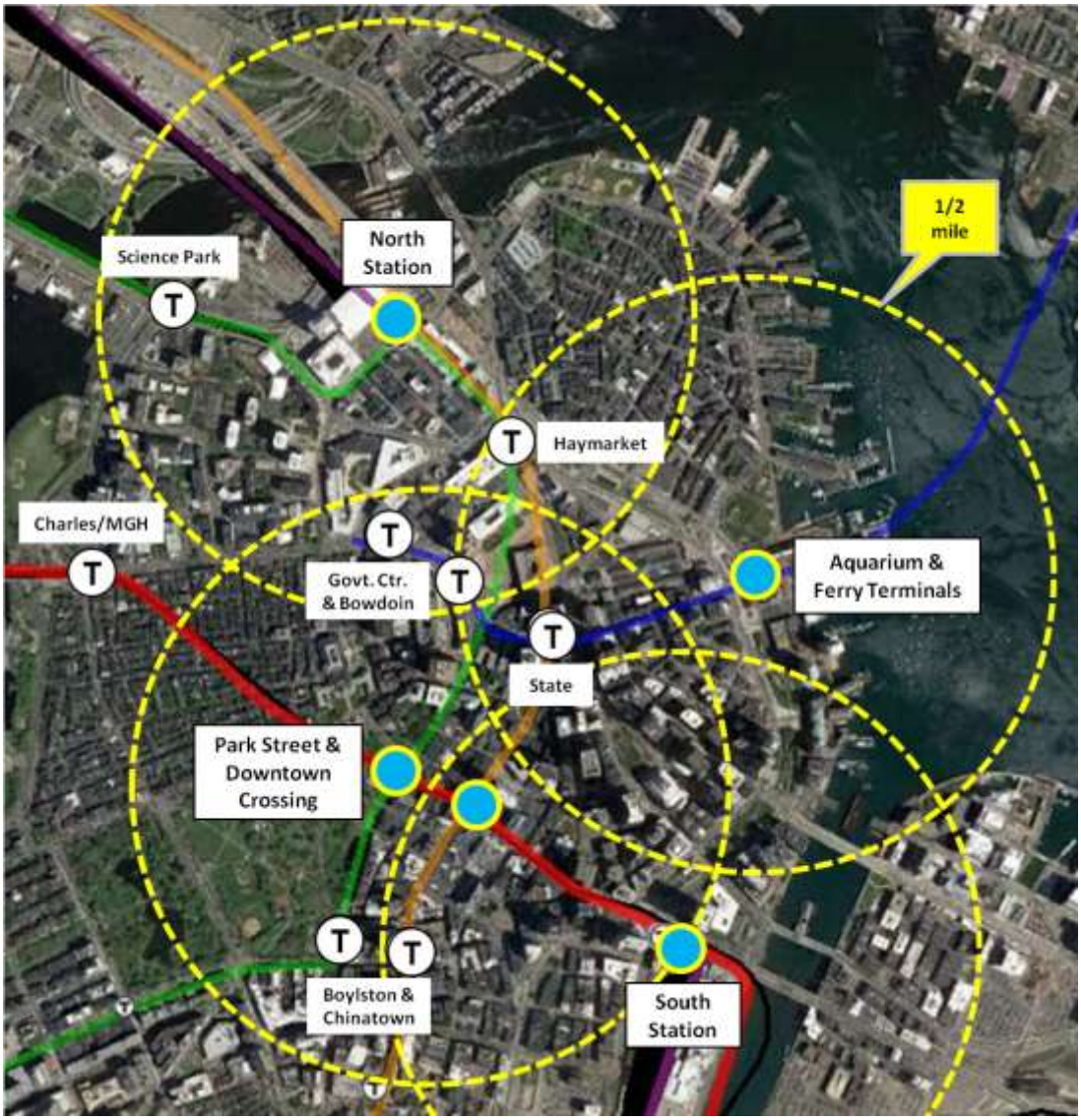
Source: AECOM; compiled from Boston Planning & Development Agency (BPDA) database; MEPA database; MAPC MassBuilds (see Appendix C-1). Shaded Hub Totals are rounded to the nearest thousand; other cells are rounded to nearest hundred.

DOWNTOWN BOSTON

OVERVIEW

From both a density and a transit perspective, Downtown Boston is the "core of the core". For purposes of this study, Downtown is the area framed by North and South Stations, the waterfront, and Beacon Hill. It includes 13 MBTA rail transit stations, of which seven serve multiple subway or commuter rail lines; two ferry terminals; and the Downtown termini of the Silver Line.

FIGURE 2: Downtown Boston



Source: AECOM

Because the stations' half-mile circles overlap substantially, most are not shown in Figure 2. The four circles that are shown, and that correspond to the development districts described below, are centered on North Station; South Station; the tandem of Downtown Crossing and Park Street; and the grouping of Aquarium Station and the nearby ferry terminals.

Downtown Boston has long been the epicenter of the region's hub-and-spokes transit network, and its viability as a transit-oriented employment and institutional destination is essential to the other 23 Growth Clusters. But Downtown also retains a capacity for significant growth in its own right, ***through infill, joint development, and diversification.*** Residential development, educational and medical expansion, and tourism are rising alongside the traditional core of office, commercial, and governmental activities. While Downtown is no longer the regional's dominant retail center, retail remains important and helps animate a streetscape fed by transit and public amenities. According to the capacity estimate prepared for this analysis (see Table 3), Downtown Boston could accommodate roughly 6,000 new housing units and 22,300 new jobs, and is well on its way to doing so.

DEVELOPMENT DISTRICTS

Downtown Boston is very compact, and its subdistricts are generally a short walk or a one-seat transit ride apart. That said, virtually all of the Downtown can be grouped into four overlapping but distinct districts.

North Station/Haymarket

In the last two decades, the North Station-Haymarket area has undergone significant redevelopment, propelled by two seminal investments: the North Station-New Boston Garden complex, which opened in 1995; and the nexus of the Artery-Tunnel, Rose Kennedy Greenway, and Green Line relocation. Development, of a strong place-making character, has occurred in the eastern half of the Bullfinch Triangle, whose 19th-century street grid was restored by the Big Dig, and in the industrial wharf buildings east of the station.

Development is now underway on the parcels left vacant by the demolition of the old Boston Garden two decades ago. A quarter-mile down Canal Street, at the southern tip of the Bullfinch Triangle, is the Government Center Garage redevelopment at Haymarket Station. Together, these two large-scale, mixed-use projects, each attached to an MBTA station and each including a pedestrian make-over at street level, will complete the redevelopment of this district.[3]

Downtown Crossing

For purposes of this analysis, the Downtown Crossing district is the half-mile spine of Washington and Tremont Streets centered on Downtown Crossing and Park Street stations—which, from a transit and pedestrian standpoint, constitute a single hub. The similar tandems of State and Government Center stations to the north, and Chinatown and Boylston stations to the south, are barely a quarter-mile away.

The last two decades have seen the growth of Suffolk and Emerson Universities as fully invested downtown institutions; the Hayward Place mixed-use development; and the survival of retail through recession, department store consolidation, and the loss of Filene's. The district's further growth is concentrated in two transformative mixed-use projects, which rely heavily on transit and pedestrian access: the recently completed redevelopment of the former Filene's block and the future redevelopment of the City's Winthrop Square Garage site.[4]

South Station

Rescued from demolition four decades ago, South Station was restored to its role as the region's most important transit hub through the revival and expansion of the south commuter rail system; the creation of Amtrak's Acela service and its capture of much of the former Northeast Corridor air shuttle market; the development of South Station's regional bus terminal; and the creation of the Silver Line, making South Station the gateway to the South Boston Waterfront. Completed developments in the financial district and along the Downtown side of Fort Point Channel reflect the proximity of South Station.

Two large-scale development projects are contemplated at the station itself:

- the mixed-use air rights joint development project above the existing terminal facilities, to be integrated with the station and with the Atlantic Avenue sidewalk;[5]

- a mixed-use waterfront TOD project along Dorchester Avenue, which would occur in the future once MassDOT's planned South Station Expansion Project has been completed, creating a development zone along a reopened Dorchester Avenue.[6]

Downtown Waterfront

The Downtown Waterfront, extending roughly from Christopher Columbus Park to the Old Northern Avenue and Moakley Bridges, has emerged as a district in its own right, highlighted by the Rose Kennedy Greenway, the drawing power of the New England Aquarium, and the redevelopment of building spaces and remnant lots that had been "orphaned" while the Central Artery viaduct stood. The Blue Line's Aquarium Station is in the center of the waterfront district, with short connections to the Green and Orange Lines. Portions of the waterfront are also within walking distance of State, Government Center, Haymarket, and South Station. Boston's two downtown ferry terminals, serving scheduled transit routes as well as Harbor Island and excursion travelers, are located at Long Wharf (adjacent to Aquarium Station) and Rowe's Wharf (a quarter-mile away).

On the seaward side of the Greenway, two major mixed-use development projects are contemplated in the Downtown Waterfront Municipal Harbor Plan prepared by the Boston Planning & Development Agency and under state review at this time: the redevelopment of the Hook Lobster site, at the intersection of Atlantic Avenue, the Old Northern Avenue Bridge, and the Moakley Bridge; and the redevelopment of the Harbor Garage, adjoining the Aquarium, Aquarium Station, and Long Wharf ferry terminal.[7]

Table 4 summarizes the important development sites in the Downtown Boston Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 4: Key Development Sites, Downtown Boston

North Station/Haymarket		Status *
Multiple building projects in the Bullfinch Triangle	Market-rate residential; street-level retail and MBTA entrances; two hotels; supermarket.	R/C
Causeway & Beverly	239-unit building, 100% affordable, no dedicated parking,	R/C
Lovejoy Wharf	Converse Shoe headquarters; residential,	R/C
Nashua Street Residences	Market-rate high-rise adjoining TD Garden,	R/C
The Hub on Causeway	Major mixed-use development on Causeway Street parcels fronting TD Garden; includes new passageways linking North Station commuter rail concourse to Orange and Green Lines.	R/C
Bullfinch Crossing	Redevelopment of Government Center Garage; multi-phase mixed-use development directly above to Haymarket Station; pedestrian make-over.	R/C
Downtown Crossing		
Filene's Redevelopment	Burnham Building adaptive reuse for office and retail; Millennium Tower market-rate residential.	R/C
One Bromfield	Large residential high-rise.	P
Congress Square	Adaptive reuse and expansion of six historic buildings near Post office Square; mixed-use, primarily office.	R/C
Winthrop Square Garage	Mixed-use, high-rise redevelopment of City garage site; pedestrian make-over.	P
Infill residential buildings	Several.	R/C, P
South Station		
45 Stuart Street	Major residential development.	P
South Station Air Rights	Major mixed-use development above bus terminal and rail concourse, with entrances on Atlantic Avenue; includes signature office tower behind headhouse.	P
South Station/Dorchester Avenue	Future TOD, following South Station Expansion Project, clearance of USPS facility, and opening of Dorchester Avenue.	LT
Downtown Waterfront		
Harbor Garage Site	Proposed major mixed-use redevelopment, subject to Municipal Harbor Plan currently in process.	LT
Hook Lobster Site	Proposed major mixed-use redevelopment, subject to Municipal Harbor Plan currently in process.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds, press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 5 presents, for all MBTA stations located in Downtown Boston, the suite of metrics described earlier in “Metrics and Methodology” (Table 2, page C-5). Where and as applicable, the average value for the region, or for all MBTA stations including commuter rail, is provided for comparison. (In this and the similar table for each Transit Growth Cluster, the average regional values are for the 111-municipality MAPC district rather than the 164-municipality Metro Region.) Stations that serve multiple lines are represented by multiple entries, so that ridership for each service can be distinguished.

TABLE 5: Station Characteristics, Downtown Boston

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Red Line											
Charles/MGH	Metro Core	18%	12,065	8,516	17,226	833,000	446,000	42%	52%	.42	10.10
Park Street	Metro Core	22%	10,779	9,612	150,261	969,000	653,000	—*	—*	.41	9.59
Downtown Crossing	Metro Core	22%	10,588	8,566	156,259	999,000	691,000	—*	—*	.38	9.03
South Station	Metro Core	21%	23,703	3,737	128,066	1,005,000	708,000	52%	64%	.37	8.76
Orange Line											
North Station	Metro Core	21%	10,831	10,645	47,727	924,000	587,000	42%	51%	.39	9.86
Haymarket	Metro Core	21%	7,041	10,614	106,537	950,000	621,000	40%	48%	.41	10.51
State	Metro Core	21%	8,265	7,684	149,638	993,000	675,000	41%	50%	.41	10.25
Downtown Crossing	Metro Core	22%	12,486	8,566	156,259	999,000	691,000	—*	—*	.38	9.03
Chinatown	Metro Core	22%	6,498	6,711	119,569	949,000	632,000	25%	31%	.44	10.05
Blue Line											
Bowdoin	Metro Core	21%	1,526	10,982	111,212	935,00	596,000	43%	53%	.36	8.73
GovT. Center	Metro Core	21%	2,835	11,178	143,565	1,009,000	692,000	42%	51%	.40	9.91
State	Metro Core	21%	4,993	7,684	149,638	993,000	675,000	41%	50%	.41	10.25
Aquarium	Metro Core	21%	4,776	5,029	105,855	929,000	599,000	47%	58%	.50	13.03
Green Line											
Science Park	Metro Core	21%	1,042	6,016	20,468	910,000	567,000	42%	51%	.35	8.30
North Station	Metro Core	21%	6,248	10,645	47,727	924,000	587,000	42%	51%	.39	9.86
Haymarket	Metro Core	21%	4,428	10,614	106,537	950,000	621,000	40%	48%	.41	10.51
GoVT. Center	Metro Core	21%	7,993	11,178	143,565	1,009,000	692,000	42%	51%	.40	9.91
Park Street	Metro Core	22%	8,119	9,612	150,261	969,000	653,000	—*	—*	.41	9.59
Boylston	Metro Core	22%	6,826	11,116	117,913	929,000	607,000	15% *	18% *	.44	10.31
Silver Line											
South Station	Metro Core	21%	7,705	3,737	128,066	1,005,000	708,000	52%	64%	.37	8.76
Downtown Crossing (curb)	Metro Core	22%	2,630	8,566	156,259	999,000	691,000	—*	—*	.38	9.03
Commuter Rail											
North Station	Metro Core	21%	16,321**	10,645	47,727	924,000	587,000	42%	51%	.39	9.86
South Station	Metro Core	21%	19,942**	3,737	128,066	1,005,000	708,000	52%	64%	.37	8.76

* Missing data or small number of units in the station's Census Block Group.

** Daily in-bound *alightings*, exclusive of Amtrak (Boston MPO, MBTA Commuter Rail Passenger Count Results (2012), p. Appendix-26.)

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2).

All of the Downtown stations are included in MAPC's Metro Core typology category, indicating the highest levels of ridership and density. The data fall in an obvious and consistent pattern:

- These are high-ridership stations. The nearly 24,000 daily Red Line entries at South Station are the highest on any line at any station in the system. North Station, Park Street, and Downtown Crossing are among the five highest-use stations in the system—even though ridership at any one station is diluted by the close proximity of others.
- In addition to the subway lines, South Station in 2012 averaged nearly 20,000 daily commuter rail alightings, and North Station over 17,000. Some 2,000 daily Amtrak passengers also alight at South Station, as well as 8,000 Silver Line passengers and 8,000 intercity bus passengers.[8]
- The seating capacity analysis performed for GoBoston 2030 confirms that on the Orange and Red Lines, rush hour trains are generally at or above seating capacity in both directions at all of their Downtown stations.[9] On the Blue Line, by contrast, rush hour trains in the off-peak direction (outbound in the morning, inbound in the evening) are well below their seated capacity at Bowdoin, Government Center, State, and Aquarium. This suggests that downtown residents would have ready access to future development in East Boston (see the Suffolk Downs and Wonderland section later in this report).
- Downtown automobile ownership is very low—less than half the average *at all MBTA stations* and one-third the average in the region generally. Average Vehicle Miles Traveled (VMT) per household is even lower compared to the system-wide and regional averages. On the other hand, the percentage of transit use by Downtown residents is just average for the system; this reflects the larger-than-average share of Downtown-based commuters who walk to work.[10]
- The measure of jobs within one-half mile confirms that the Downtown stations serve the region's highest concentration of employment. Downtown Crossing has the highest job concentration of any station in the system, and all but three of the 13 Downtown stations have over 100,000 jobs within a half-mile.[11]
- While there are many more jobs than residents, every Downtown station has thousands of households within its half-mile radius, way above the system-wide average. Moreover, these numbers, which date to 2013, do not take into account the residential and mixed-use developments that have been built or added to the pipeline since 2013.
- In terms of affordability, the Downtown picture is mixed. Housing costs vary from luxury to low-income, but households at all levels benefit from the ability to walk or take the T rather than drive to work. On the combined Index of Housing+Transportation, most stations are a little below the threshold of 45% of Area Median Income (AMI).
- The attractiveness of Downtown Boston to further development is demonstrated by the "job shed" and "labor shed" measures. Across the MAPC region as a whole, the average *job* shed—the estimated number of jobs that a worker living near a particular station can reach by a 30-minute transit commute and a quarter-mile walk—is 302,000. For the Downtown stations, the job sheds are in the ***900,000-1,000,000*** range. Across the region, the average *labor* shed—the estimated number of workers who can reach a job at given station by a similar commute—is 151,000. For the Downtown stations, the labor sheds are in the ***600,000-700,000 range***. Density, infill, mixed uses, walkability, and avoidance of parking costs are all supported by this extraordinary level of labor market connectivity at The Hub—provided that the transit system can absorb it reliably.

Transit Mobility Needs

More than anywhere else in the MBTA system, the state of good repair of the subway system is essential to the sustainability of Downtown Boston, the success of development projects currently underway, and the ability to realize future development potential. The employment density of the Downtown commercial and institutional office base represents not only built square footage, but the growing ratio of workers per 1,000 square feet of space.

The 2012 *Hub and Spoke* report by the Urban Land Institute and Northeastern University noted that while the modernized Blue Line has available capacity, peak-hour trains at most of the Downtown Orange, Red, and Green Line stations were either "Highly Congested" (exceeding service policy loads) or "Over Capacity" (exceeding crush loads). The ability to run three-car trains on the Green Line is constrained by rolling stock, signal, and power deficiencies.[12] The subway fleet replacements, Green Line central subway improvements, and other state of good repair investments contemplated in the MassDOT Capital Improvement Plan are essential to Downtown Boston and, as noted in subsequent sections of this report, other primary employment destinations in The Hub—Back Bay, the Longwood Medical Area, the Seaport District, Kendall, and the South Bay Corridor.[13]

Both of Downtown's multi-modal hub stations require improvement. At South Station, the expansion of yard, platform, and track capacity is needed to accommodate the anticipated growth of both commuter rail and Amtrak services in the coming decades. Expanded Amtrak service is essential for the on-going role of Downtown Boston and the larger Inner Core as an economic anchor of the Northeast Corridor.[14] At North Station, the creation of a direct underground connection between the commuter rail concourse, the TD Garden, and the Orange and Green Lines is being undertaken by the developers of the old Garden site.[15]

Water transportation is an emerging force in Downtown Boston. In Fiscal Year 2013, the MBTA ferry routes to Hingham, Hull, and Charlestown served 4,439 daily inbound riders, or 1.26 million for the year.[16] When MBTA routes are combined with Harbor Island and excursion services, the estimated annual ridership—most of it from Rowes and Long Wharves—is three million.[17] Efforts by the Commonwealth, Boston Harbor Now, and other entities to expand the scale of water transportation and more fully integrate it with landside MBTA services are of great relevance to the growth of the Downtown Waterfront and its role in the Inner Core.

Three long-term core capacity expansion options, not currently programmed for implementation, would support future Downtown growth and avoid transfers at stations that are already congestion hotspots. The least expensive, the Red Line-Blue Line Connector would link the Downtown Waterfront to Mass General and Cambridge. Silver Line III would connect the Downtown Crossing district to the Seaport District and Logan Airport with a one-seat ride, avoiding transfers at Park, Downtown Crossing, Government Center, and State.[18] The most expensive, the North-South Rail Link, would better distribute commuter rail trips to their destinations, eliminating some transfers and reducing congestion on the Orange, Red, and Green Lines.

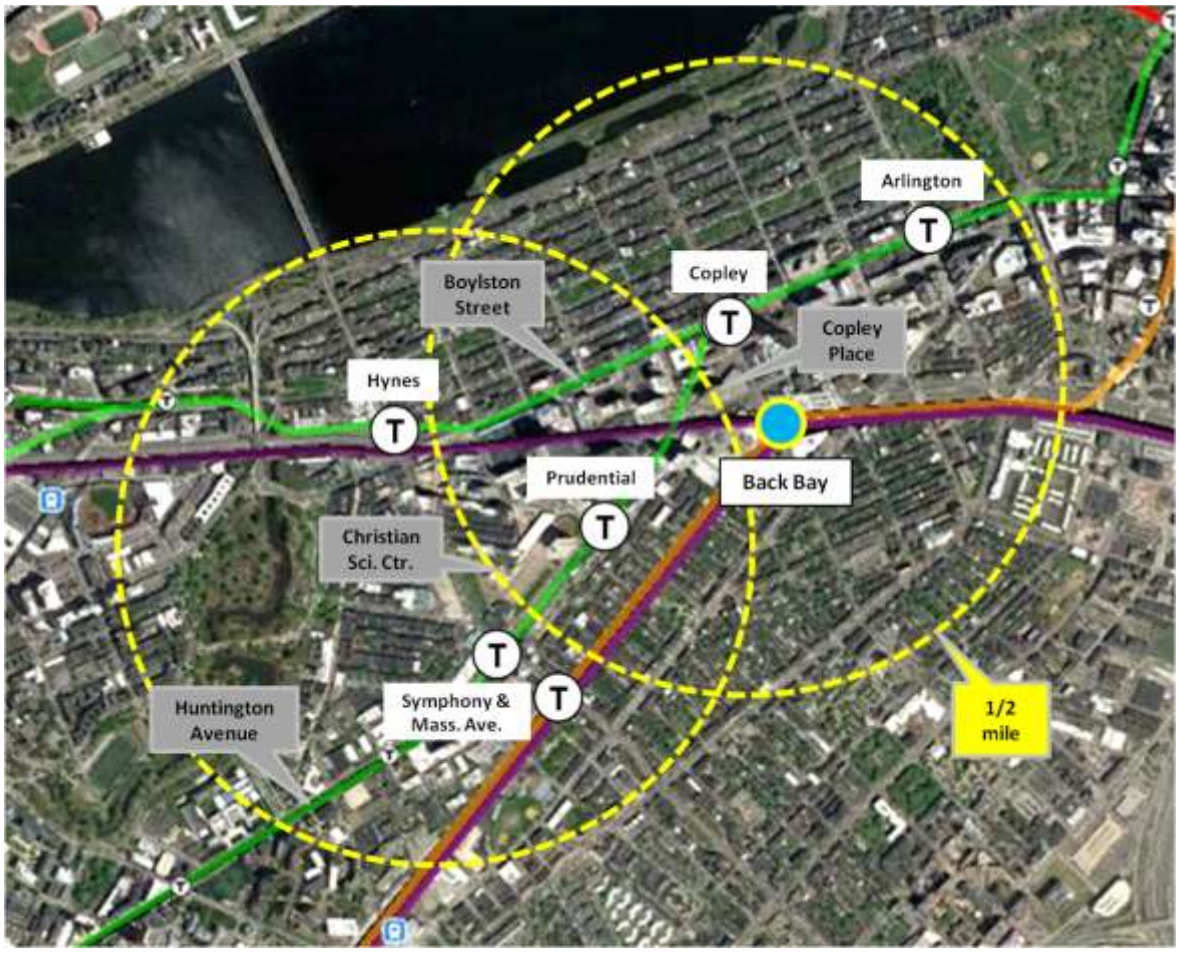
SUMMARY OF TRANSIT NEEDS, DOWNTOWN BOSTON
General
Rapid Transit System State of Good Repair: Reliability and Capacity
Water Transportation Expansion and Integration
Station-Specific
South Station Capacity Expansion
North Station Connecting Concourse
Long-Term Options (Not to Preclude)
Red Line-Blue Line Connector
Silver Line III
North-South Rail Link

BACK BAY

OVERVIEW

Back Bay adjoins Downtown Boston, extending from the Public Garden to Charlesgate, with high-density spines on Boylston Street and Huntington Avenue. Back Bay is served by the Green and Orange Lines, and by the south commuter rail system through Back Bay Station. There are overlapping but distinct development districts in the eastern and western portions of Back Bay. A series of high-rise and air rights projects tied closely to transit represents an opportunity of regional significance.

FIGURE 3: Back Bay



Source: AECOM

DEVELOPMENT DISTRICTS

Back Bay Core

The Back Bay Core is centered on Copley and Back Bay Stations, located 1,000 feet apart within sight of each other. Their walkshed covers the entire eastern half of the historic Back Bay street grid, as well as Copley Place and the upper South End as far as Tremont Street. The Massachusetts Turnpike air rights corridor cuts across the district. Planned projects include the Copley Place expansion and the Back Bay Station Gateway, which includes a developer-funded and maintained upgrade of the station concourse. There is potential market interest in re-initiating the Columbus Center air rights project, abandoned several years ago, which would span the Turnpike air rights east of the station.

Hynes/Prudential/Christian Science

The western portion of the Back Bay is centered on Hynes and Prudential Stations. It is dominated by the Hynes Convention Center, the Prudential Center and its on-going expansion, and the Christian Science Center, where large-scale high-rise development is occurring on Dalton Street. Two potential Turnpike air rights projects would bracket Hynes Station.

Table 6 summarizes the important development sites in the Back Bay Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 6: Key Development Sites, Back Bay

Back Bay Core		Status *
Back Bay Station/Gateway Project	Major mixed-use development attached to station, and including a developer obligation to improve and operate/maintain station facilities.	P
Copley Place Expansion	Residential and retail expansion across Dartmouth Street from Back Bay Station.	P
500 Boylston	Commercial infill project.	P
Trinity Place	Mixed-use development next to Boston Public Library.	P
Columbus Center	Major mixed-use air rights project on multiple Turnpike air rights parcels; former development cancelled; potential interest in re-initiating.	LT
Hynes/Prudential/Christian Science		
Prudential Center Expansion, remaining phases	Major, on-going mixed-use buildout.	R/C
30 Dalton	Large residential high-rise.	R/C
One Dalton	Mixed-use multi-building high-rise at Christian Science Plaza.	R/C
MassDOT Parcel 13	Mixed-use development on Turnpike air rights parcel attached to Hynes station.	P
MassDOT Parcels 12 and 15	Major mixed-use project combining two Turnpike air rights parcels.	P
2 Charlesgate West	Proposed residential high-rise at Charlesgate end of Back Bay near Fenway park	P
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 7 presents, for all MBTA stations located in Back Bay, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the region, or for all MBTA stations including commuter rail, is provided for comparison. Back Bay Station is represented by separate entries for the Orange Line and commuter rail, so that ridership for each service can be distinguished. All of the stations fall in MAPC's Metro Core typology category, indicating the highest levels of ridership and density.

TABLE 7: Station Characteristics, Back Bay

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Orange Line											
Back Bay	Metro Core	29%	18,100	14,726	71,949	913,000	560,000	39%	48%	.55	12.97
Mass. Ave.	Metro Core	32%	6,417	16,438	23,892	842,000	490,000	36%	44%	.40	9.57
Green Line B, C, D, E											
Arlington	Metro Core	25%	8,519	10,913	71,484	925,000	584,000	51%	63%	.51	11.72
Copley	Metro Core	27%	14,021	12,322	69,825	910,000	556,000	48%	59%	.51	12.00
Green Line E											
Hynes	Metro Core	29%	8,946	14,987	29,441	827,000	459,000	42%	51%	.33	7.88
Prudential	Metro Core	30%	3,643	17,815	44,151	897,000	550,000	40%	49%	.42	10.12
Symphony	Metro Core	32%	1,711	15,402	26,623	844,000	497,000	38%	47%	.37	8.83
Commuter Rail											
Back Bay	Metro Core	29%	9,156 *	14,726	71,949	913,000	560,000	39%	48%	.55	12.97

* Daily in-bound *alightings*, exclusive of Amtrak. Boston MPO, MBTA Commuter Rail Passenger Count Results (2012), p. Appendix-27.

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Back Bay and Copley are very high-ridership stations. In addition to the Orange Line, Back Bay Station in 2012 averaged over 9,000 daily commuter rail alightings, in addition to Amtrak activity.[19] Arlington and Hynes on the Green Line, and Massachusetts Avenue on the Orange Line, are high-ridership as well.
- Back Bay automobile ownership is very low, similar to Downtown. Average Vehicle Miles Traveled (VMT) per household is even lower compared to the system-wide and regional averages. The percentage of transit use by residents is higher than in Downtown, although Back Bay also has many residents who walk or bike to work.[20]
- Back Bay and Copley Stations have high concentrations of jobs within a half mile—levels exceeded in the entire system only in nearby Downtown. The other stations all have concentrations of jobs in excess of 23,000, nearly an order of magnitude higher than the average of all MBTA transit and commuter rail stations.
- Every station serving the Back Bay has from 11,000 to 17,000 households within a half-mile—a level of residential density unsurpassed in the entire system.
- Despite its high housing costs, Back Bay is more affordable than one might expect, thanks to the ability of residents commute by transit, walking, or cycling. On the combined Index of Housing+Transportation, all stations except Arlington fall below the threshold of 45% of Area Median Income (AMI) and below region-wide average of 48%.
- The stations serving Back Bay have job sheds—the estimated number of jobs that a worker can reach by a 30-minute transit commute and a quarter-mile walk—around three times the region-wide average. The same is true of the labor sheds—the estimated number of workers who can reach a job at given station by a similar commute. As in the case of Downtown, density, infill, mixed uses, walkability, and avoidance of parking costs are all supported by this extraordinary level of labor market connectivity—provided that the transit system in general, and in the case of Back Bay, the Orange and Green Lines in particular, can absorb it reliably.

Transit Mobility Needs

The dominant transit need in the Back Bay Growth District is the reliability and capacity of the two rapid transit lines on which it directly depends. The Green Line connects Back Bay to Downtown, the LMA, the Fenway, the labor sheds of Brookline and Newton, and, when the Green Line Extension opens, the new mixed-use development districts of Cambridge, Somerville, and Medford. The Orange Line connects Back Bay to Downtown and to its entire commuter shed, from Oak Grove to Forest Hills. Both lines connect Back Bay to North Station and to the commuter sheds of the entire north commuter rail system. Back Bay also relies on its connections the Red Line. The programmed replacement of the Orange and Red Line fleets are essential to Back Bay as a Growth Cluster, and no Growth Cluster would benefit more from the investments required to enable three-car peak-hour trains on the Green Line.[21]

SUMMARY OF TRANSIT NEEDS, BACK BAY
General
Rapid Transit System State of Good Repair: Reliability and Capacity, especially Orange and Green Lines
Station-Specific
Back Bay Station joint development enhancements
Long-Term Options (Not to Preclude)
Potential Back Bay-Seaport rail shuttle

The Back Bay Gateway joint development project to be undertaken by the MBTA and a private partner includes a significant enhancement of the station's pedestrian areas, to be funded, built, and, where applicable, maintained by the developer. This addresses a significant need for modernized, less congested lobbies, concourses, and intermodal connections.[22]

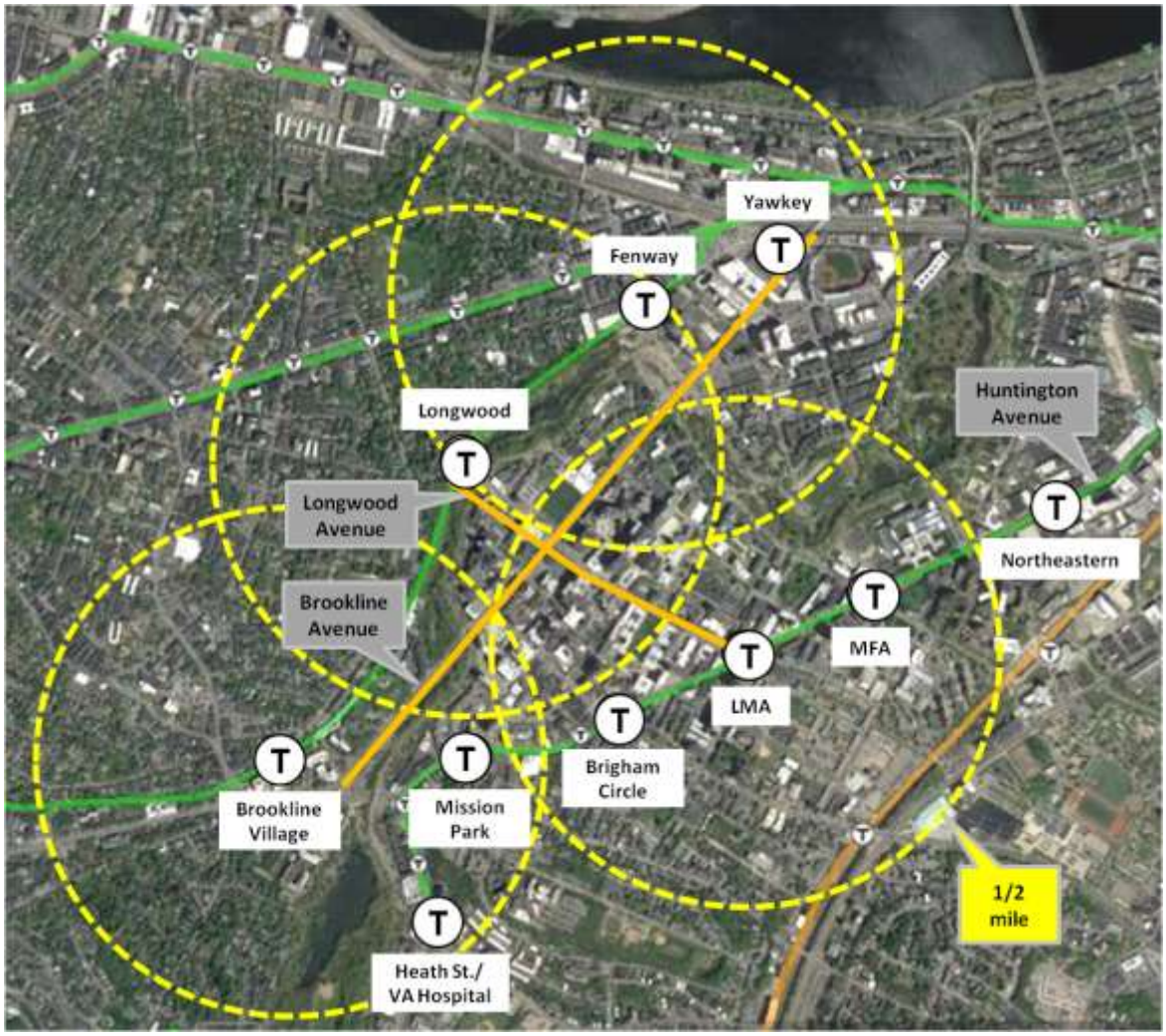
There is a need to better connect the Back Bay hotels, restaurants, and cultural institutions with the Boston Convention and Exhibition Center in the Seaport. While the feasibility of a proposed direct rail connection has yet to be established, the track connections should be preserved.

LONGWOOD MEDICAL AREA/FENWAY

OVERVIEW

The Longwood Medical Area, or "LMA", is Boston second densest employment destination after Downtown. It has 49,000 employees—up from 25,000 two decades ago—and posts about 6,600 job openings annually. Its hospitals admit nearly 100,000 patients annually and receive 2.5 million outpatient visits annually. There are nearly 22,000 students. All told, over 110,000 people come to the LMA every day.[23]

FIGURE 4: LMA/Fenway



Source: AECOM

Transit is essential to the sustainable growth of the LMA, whose "main streets"—Longwood Avenue and Brookline Avenue—are heavily congested. Over half the workforce commutes by transit, and fewer than 30% drive alone. The LMA is framed by the Fenway and Longwood stations on the Green Line's D Branch and a series of stops on the E Branch along Huntington Avenue. The LMA's non-profit umbrella organization, MASCO, operates a shuttle that connects to Ruggles, JFK/UMass, Yawkey, and other stations and carries over 12,000 trips per day in its own right.

DEVELOPMENT DISTRICTS

The LMA is adjoined by three other development districts, with which it shares not only proximity but a synergistic economic and transit relationship. They are the Fenway Triangle, Brookline Village, and South Huntington Avenue as far as the Veterans' Administration Medical Center.

Table 8 summarizes the important development sites in the LMA/Fenway/Brookline Village Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 8: Key Development Sites, LMA

Longwood Medical Area		Status *
Children's Hospital Clinical Bldg.	In the hospital core on Longwood Avenue.	R/C
Children's Hospital Longwood Research Institute	In approved Institutional Master Plan.	LT
Brigham & Women's/Emmanuel	In approved Institutional Master Plan.	LT
Mass Mental Hospital Redevelopment	Mixed-use development at Riverway and Brookline Ave.	R/C
Balance of MASCO Projection	Balance of MASCO's projected growth in jobs from 2013 to 2030, net of listed projects (over 9,000 jobs)	P, LT
Emmanuel College Julie Hall	Large dormitory project relieving off-campus market.	P
Fenway Triangle		
Children's Office Building at Audubon Circle	In approved Institutional Master Plan.	LT
Boylston Street residential projects	Fenway Trilogy, 1282 Boylston, 1350 Boylston, The Pierce; nearly 1500 units with street-level retail.	R/C
Fenway Triangle	Mixed-use residential, office, retail.	R/C
Landmark Center Expansion	New office/lab building	R/C
Fenway Center	Mixed-use, multi-phased in the Beacon St./Brookline Ave. "wedge", including expanded Yawkey Station.	R/C, P
Infill residential buildings	Several at Audubon Circle.	R/C, P
Brookline Village		
2 Brookline Place	Children's Hospital out-patient offices and retail, adjoining Brookline Village station.	R/C
Emerald Island redevelopment	Mixed-use redevelopment of industrial lands at nexus of Village and Emerald Necklace; hotel and mixed-use.	R/C, LT
South Huntington		
South Huntington residential projects	35 South Huntington, 105A South Huntington; 160 South Huntington; 201 South Huntington. On Green Line near VA Hospital, Brookline Village.	R/C, P
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

Fenway Triangle

The segment of Boylston Street and Brookline Avenue from the Muddy River to Fenway Park has emerged as a dense, mixed-use, pedestrian-friendly district featuring high-rise residential buildings and continuous street-level retail and restaurants. [24] As a residential neighborhood, this district is attractive to doctors, nurses, and other employees of the LMA. It is also home to a major medical facility, the Harvard Vanguard Kenmore Health Center. The area is directly served by Fenway Station on the Green Line D Branch, as well as Yawkey Station on the Worcester-Framingham commuter rail line. The mixed-use Fenway Center, attached to Yawkey Station, will fill the physical gap created by the Turnpike air rights and an expanse of surface parking lots across Brookline Avenue from Fenway Park.

Brookline Village

Brookline Village is connected to the LMA by the Green Line D Branch, by bus service on Brookline Avenue, and by the Green Line E Branch, which stops at Huntington and South Huntington Avenues just steps away. The Village is attracting development ancillary to the LMA, including a Children's Hospital out-patient office center next to Brookline Village Station and a new hotel connected by three adjacent transit lines to the core of the LMA.

South Huntington

The VA Medical Center, as well as a series of new residential developments, are located along South Huntington Avenue near the terminus of the Green Line E Branch. This district has a medical focus and enjoys a one-seat Green Line connection to the LMA proper.

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 9 presents, for all MBTA stations located in the LMA/Fenway/Brookline Village Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

The stations serving the LMA proper, and Yawkey Station which serves the fast-growing Fenway development district, are categorized by MAPC as "Metro Core" stations, signifying the highest levels of density and ridership. Brookline Village Station and Heath Street Station in Jamaica Plan are categorized as "Neighborhood Subway".

- The primary Green Line stations serving the area—Fenway, Longwood, and Brookline Village on the D Branch; Northeastern, LMA, and Brigham Circle on the E Branch—have daily boardings in the 2,500-3,500 range. Along with Coolidge Corner and Reservoir, these are the highest daily numbers anywhere on the Green Line outside of the central subway.[25] Growth since 2013 is not reflected.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are among the lowest anywhere in the system. Average transit use is in the 30-35% range—well above the system average.
- Longwood, Fenway, LMA, Brigham Circle, and Mission Park stations have at least 20,000 jobs within a half-mile, reflecting the 46,000 jobs in the LMA and thousands more in the Fenway.

TABLE 9: Station Characteristics, LMA/Fenway

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Green Line D											
Fenway	Metro Core	29%	3.488	6,128	19,260	807,000	385,000	38%	47%	.33	7.11
Longwood	Metro Core	31%	2,719	7,341	20,168	777,000	365,000	48%	58%	.48	10.10
Brookline Village	Neighbhd. Subway	36%	3,230	6,910	6,704	745,000	354,000	37%	46%	.57	12.48
Green Line E											
Northeastern	Metro Core	33%	2,650	12,040	16,761	868,000	523,000	24%	29%	.28	6.72
Museum of FA	Metro Core	33%	1,683	7,175	14,454	842,000	474,000	18%	21%	.28	6.53
Longwood Medical Area	Metro Core	33%	3,813	6,070	21,738	811,000	427,000	26%	31%	.31	7.22
Brigham Circle	Metro Core	35%	2,768	6,126	20,935	757,000	367,000	29%	37%	.37	8.21
Mission Park	Metro Core	35%	1,043	7,199	21,376	746,000	358,000	29%	35%	.43	9.32
Heath Street	Neighbhd. Subway	37%	855	7,454	4,709	732,000	344,000	36%	44%	.53	12.19
Commuter Rail, Worcester-Framingham Line											
Yawkey	Metro Core	25%	21 **	5,676	17,761	808,000	383,000	38%	47%	.29	6.42

* Brigham Circle ridership also includes Fenwood; Mission Park includes Riverway; Heath Street includes Back-of-the-Hill.
** Yawkey in-bound boardings exclude most Fenway Park riders, the principal current clientele. Yawkey ridership numbers also fail to capture residential growth since 2013.

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Northeastern Station on the E Branch has 12,000 households within a half-mile. All of the others have 6,000-7,500—two or two and one-half times the system-wide average.
- On the combined Index of Housing+Transportation costs, the LMA/Fenway/Brookline Village area is significantly more affordable than the region or the MBTA system as a whole. Except for Longwood, these stations fall below the threshold of 45% of Area Median Income (AMI) and well below region-wide average of 48%.
- The stations serving the LMA/Fenway/Brookline Village Growth Cluster have job sheds (the estimated number of jobs that a worker can reach by a 30-minute transit commute and a quarter-mile walk) two and one-half to three times the region-wide average. The labor sheds (the estimated number of workers who can reach a job at given station by a similar commute) are at least double the region-wide average. The LMA, which posts an average of 6,600 jobs per year, is well situated to attract workers who commute by transit. However, the challenge of maintaining efficient transit on the crowded Green Line, and on buses that run on Brookline and Longwood Avenues, is paramount.

Transit Mobility Needs

The dominant transit issue in the LMA/Fenway Growth District is the reliability and capacity of the Green Line, on which it most directly depends. The Green Line connects the LMA, Fenway, and Brookline Village to each other and to Downtown, the labor sheds of Brookline and Newton, and, when the Green Line Extension opens, the new mixed-use development districts of Cambridge, Somerville, and Medford. The investments required to enable three-car peak-hour trains on the Green Line D Branch would greatly benefit this entire Growth Cluster.

The Orange and Red Lines are also critical, not only because of their connections to the Green Line, but because the MASCO shuttle system, which carries 12,000 trips per day and is an indispensable part of the LMA transit system, has principal collection points at Ruggles and JFK/UMass.[26] The programmed replacement of the Orange and Red Line fleets are important to the LMA.

So are two specific commuter rail improvements in other Growth Clusters: the TIGER-funded platform improvements underway at Ruggles Station, which will enable any commuter train to stop there; and the restored and improved direct pedestrian connection between the commuter rail platforms and the Green Line at North Station, being constructed by the Hub on Causeway development team.[27]

SUMMARY OF TRANSIT NEEDS, LMA/FENWAY
General
Rapid Transit System State of Good Repair: Reliability and Capacity, especially Green Line
Enhanced bus/BRT to Kendall via Grand Junction
Dedicated or partially dedicated right of way for buses in the LMA core
Station-Specific
Ruggles commuter rail platforms
Yawkey Station Phase II developer enhancements
North Station commuter rail/Green Line connection

In the mid to longer term, the LMA would benefit from a bus rapid transit connection to Kendall via the Grand Junction river crossing. The LMA and Kendall have an important functional synergy, but travel between them on the MBTA requires a Red Line/Green Line transfer at Park Street. A direct BRT connection would benefit both Growth Clusters and shift some trips from the two rail transit lines.[28]

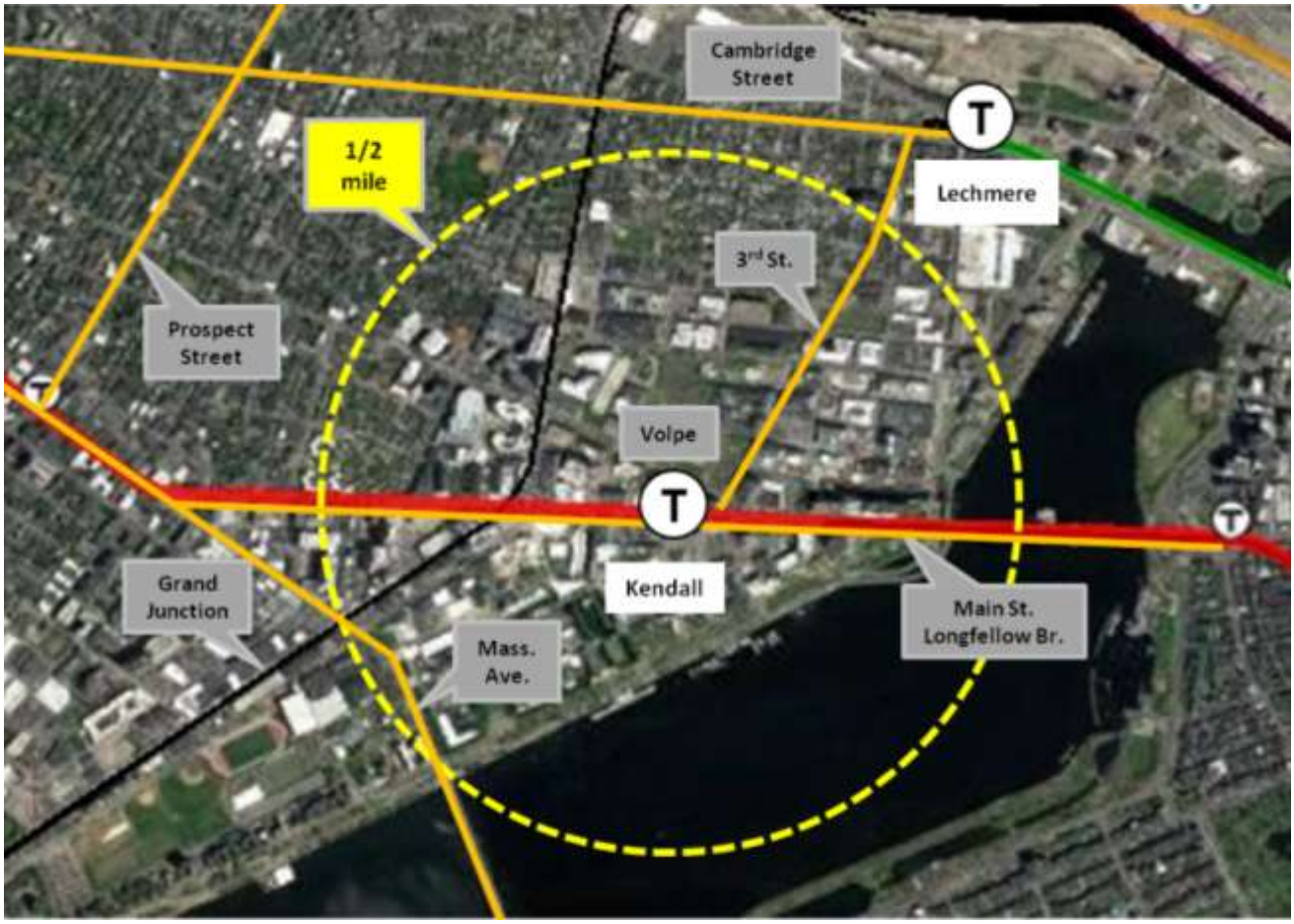
Many LMA riders arrive by MASCO shuttle bus or by multiple MBTA bus routes, which are constrained by the severe congestion on Longwood and Brookline Avenues. In the long run, the City, MassDOT, and MASCO will need to collaborate on a dedicated right-of-way solution.

KENDALL

OVERVIEW

Kendall is the only one of The Hub's six Growth Clusters not located in Boston; however, it is one stop from Downtown on the Red Line, and its robust EZ Ride shuttle system connects it to North Station. Kendall Station is the sole rapid transit stop serving MIT, its east campus expansion, and its intense, growing ecosystem of technology companies. The City of Cambridge is encouraging Kendall's emergence as a mature, mixed-use TOD district by adding housing, retail, and contemporary urban streetscapes to the continuing employment and institutional growth.

FIGURE 5: Kendall



Source: AECOM

DEVELOPMENT DISTRICTS

Kendall consists of a single development district. Its major planned growth opportunities are multi-phased, mixed-use undertakings, including MIT's East Campus program; the expansion of the Cambridge Center commercial complex; the on-going construction of the Alexandria Center along Binney and Third Streets; and the proposed transformative redevelopment by MIT of the federally-owned Volpe Center, an urban renewal anachronism that dominates the core of the district near the station. The City of Cambridge contemplates that built square footage will have doubled, from 10 million to 20 million, between 2010 and 2030.

Table 10 summarizes the important development sites in the Kendall Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 10: Key Development Sites, Kendall

Kendall		Status *
Novartis Headquarters	Buildings on opposite sides of Mass. Ave.	R/C
MIT 610 Main Street	Large academic and office building.	R/C
MIT Residences on Broadway	Residential high-rise with street-level retail.	R/C
Balance of MIT program	Major rezoning by City of Cambridge in conjunction with MIT for multi-building phased program.	P, LT
Alexandria Center	Multi-building development along Binney and 3rd Streets; primarily office and R&D, some residential.	R/C
Cambridge Center	Expansion and improvement of multi-building center along Main Street near station.	P
Volpe Center Redevelopment	Transformative redevelopment of federally-owned site across Broadway from station block; City's preliminary plan assumed residential, office, R&D, hotel, retail.	LT
88 Ames Street	Large residential project.	R/C
250 Kendall Street	Large residential project.	R/C
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from City of Cambridge; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 11 presents, for Kendall Station, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison. Kendall is an MAPC "Metro Core" station, the same high-density, high-ridership category as the stations in Downtown Boston.

TABLE 11: Station Characteristics, Kendall

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Red Line											
Kendall	Metro Core	25%	15,433	2,491	46,699	789,000	405,000	37%	45%	.52	11.38

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- With over 15,000 daily boardings, Kendall is one of the busiest stations on the Red Line.
- The household averages for automobile ownership, Vehicle Miles Traveled (VMT), and transit use per household are similar to those in Downtown Boston. It should be noted, however, that Kendall currently

has fewer households within walking distance than the stations in Downtown, Back Bay, or the Longwood Medical Area, and fewer than the system-wide average. Cambridge's emphasis on mixed-use development, with an ample residential component, is meant to change the district's traditional "9-5" character.

- By contrast, with 46,000 jobs in a half-mile radius, Kendall has an employment density surpassed only in Downtown Boston.
- On the combined Index of Housing+Transportation costs, Kendall is more affordable than the region or the MBTA system as a whole. It falls below the threshold of 45% of Area Median Income (AMI) and well below region-wide average of 48%.
- Kendall has a job shed (the estimated number of jobs that a worker can reach by a 30-minute transit commute and a quarter-mile walk) two and one-half times the region-wide average. The labor shed (the estimated number of workers who can reach a job at given station by a similar commute) is triple the region-wide average. Kendall is well positioned to attract workers who commute by transit, but this potential relies heavily on the congested Red Line and on conventional bus routes. New residential development will be well-connected to the job market, both within the Kendall walk- and bike-shed and within the 30-minute transit commuting shed.

Transit Mobility Needs

Kendall is a high-density, high-growth regional center served by a single rapid transit station and multiple surface bus routes. The great majority of transit trips to Kendall (84%) originate on the Red Line or on local bus routes; most others transfer from commuter rail to the Red Line at South Station or Porter, or to the non-profit EZ Ride shuttle at North Station.

Today, 46% of Kendall commuters arrive by transit, foot, or bicycle. With density on a trajectory to double, the City's goal is to raise that combined mode share to 65% by 2030.[29] A joint Kendall Square Mobility Task Force, led by the City and MassDOT and comprising Kendall's other key stakeholders, is expected to make recommendations in 2017. Primary transit needs fall into several categories.

The predominant need is to improve the reliability and capacity of the Red Line, which connects Kendall to much of its current workforce and to Mass General, the Seaport, UMass/Boston, and the commuter rail hub at South Station. The MBTA's decision to replace the full Red Line fleet, potentially increasing peak capacity by 50%, is essential to Kendall's sustainability.[30]

MassDOT is examining a number of potential bus route changes, designed to bring more direct and frequent service to Kendall. Some of these changes will be enabled by the Green Line Extension; others could be implemented independently. The bus component is significant; 22% of Kendall transit trips arrive by bus, and 80% of these are direct origin and destination trips. One physical change to be evaluated by MassDOT is a priority bus corridor, with dedicated lanes, between Kendall and Lechmere via First and Binney Streets. This corridor could support multiple routes and services, including those described below, but as the Cambridge Crossing development (formerly North Point) matures, the Kendall/Lechmere connection in and of itself will be important to both districts.[31]

SUMMARY OF TRANSIT NEEDS, KENDALL
Rapid Transit System State of Good Repair: Reliability and Capacity, especially Red Line
Bus route changes, GLX-related and independent
Lechmere-Kendall bus priority corridor
Grand Junction connection to LMA, Green Line, and West Station
Enhanced connections to Sullivan, GLX

A long-term strategic priority is to connect Kendall to surrounding origins and destinations without relying on the Red Line. One set of strategic connections lies across the Charles River: the Longwood Medical Area (with its economic and academic links to Kendall's biotech cluster); the Green Line west of Kenmore; and the future West Station in Allston, which will serve the Framingham-Worcester commuter rail line. One way or another, these connections would use the Grand Junction river crossing.

On its own side of the river, Kendall will need efficient connections not only to Cambridge Crossing (formerly North Point), but to the transformative mixed use development planned for East Somerville, Union Square, and Sullivan Square. These connections could be made in part via the Grand Junction, the proposed Kendall/Lechmere bus priority corridor, or a combination of these and other alignments.[32]

SEAPORT DISTRICT

OVERVIEW

The Seaport District, also known as the South Boston Waterfront and the Innovation District, has been planned as Boston's in-town growth frontier since the 1980s. Five major public investments created the development template and primed the pump: the Ted Williams Tunnel and its South Boston Interchange; the Silver Line; the Moakley Courthouse; the Moakley Bridge; and the Boston Convention and Exhibition Center. The Silver Line connects the Seaport to South Station and Logan Airport, and has allowed the Seaport to be developed on a transit-oriented basis, a planning philosophy reinforced by the South Boston Parking Freeze in effect in both City of Boston and Massport territory since 1992.

FIGURE 6: Seaport District

Source: AECOM

It took two decades—and the passing of the Great Recession—for development to achieve critical mass, but in the last several years the Seaport has exceeded the pace of development that was built into the Big Dig and Silver Line planning projections. From 2000 to 2013, ten million square feet of development was built, adding more than 4,100 new residents and 7,700 jobs. From 2013 to 2035, another 17 million square feet of development is underway or planned—including 5,300 new residences, 6 million square feet of new office and research space, nearly one million square feet of port and maritime-related uses, and more than a doubling of convention and hospitality space.[33] The growth in corporate investment and employment includes not only downtown-type office buildings and working port improvements, but the headquarters of companies as diverse as General Electric, Vertex, and Reebok.

DEVELOPMENT DISTRICTS

The Seaport consists of about 1,000 acres of historically filled tidelands, and is a mile long from Fort Point Channel to the Reserve Channel. It includes four distinct, if overlapping, development districts.

TABLE 12: Key Development Sites, Seaport District

Fort Point		Status *
General Electric Headquarters	Adaptive reuse and new construction	R/C, LT
Channel Center	Major office complex, adaptive reuse, new construction	R/C, P
319 A Street	Major residential construction.	R/C
22 Boston Wharf Road	Office building.	R/C
Residences at 399 Congress	Large mixed-income residential.	P
Fan Pier/Seaport Square		
Fan Pier Vertex and Parcels D, E, H, I	Current and recently-completed phases of large mixed-use nine-block project.	R/C
Pier 4	Large-scale mixed-use, adjacent to Fan Pier.	R/C
Seaport Square	Largest mixed-use project, along Northern Avenue and Seaport Boulevard. Multi-phase residential, office, retail, institutional.	R/C, P
150 Seaport Boulevard	Residential high-rise and street-level retail.	P
Commonwealth Flats		
Waterside Place	Mixed-use at World Trade Station: residential, hotel, retail.	R/C, P
Parcel K	Mixed-use development on Massport site.	P
D Street Apartments	Residential facing BCEC.	R/C
D Street Hotels	Two hotels facing BCEC (Aloft, Element)	R/C
Massport BCEC Hotel	On Summer Street parcel facing BCEC; to be undertaken despite decision not to expand BCEC.	P
Balance of South Boston Sustainable Transportation Plan Buildout Forecast for District	Forecast for 2013-2035: 9410 new residential units, 35,220 new jobs; balance calculated net of projects listed above and below..	P, LT
Industrial Port		
BMIP Parcel Q1	New construction; office, R&D, light assembly.	P
25 FID Kennedy Road	Reuse of vacant industrial building.	P
Innovation Square	New construction; office, R&D.	P
Massport Marine Terminal	Stavis Seafood complex; awaiting developer selection and future plan for remainder of large site.	P, LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

Fort Point

The lands along the South Boston side of Fort Point Channel include the historic Boston Wharf Company blocks as well as the "Hundred Acres" planning area between Boston Wharf and the Gillette complex. This is the district where the new GE headquarters will be constructed. As shown in Figure 6, this district lies entirely within walking distance of South Station and/or Courthouse Station.

Fan Pier/Seaport Square

The most intense of the development districts is the one located the foot of the Moakley Bridge, surrounding Courthouse Station. It includes the courthouse itself and three massive, multi-phased, mixed-use development programs: the Fan Pier, Pier Four, and the largest, Seaport Square. This entire development district lies within a quarter-mile walk of Courthouse Station.

Commonwealth Flats

Commonwealth Flats, owned principally by Massport, is the development district in the center of the Seaport, straddling D Street and served by both World Trade and Silver Line Way stations. Massport's long-term development program, which includes the World Trade Center on Commonwealth Pier, the Seaport hotel and office complex, Waterside Place, Liberty Wharf, a planned new convention hotel, and the cluster of buildings between Liberty Wharf and the Haul Road, has been underway for two decades.

Industrial Port

The Seaport District includes the working port and related facilities on the west side of the Reserved Channel: the Fish Pier and fish processing facilities; the Black Falcon Cruiseport; maritime support businesses; and diverse employment generators with manufacturing, R&D, and innovation themes. The Raymond Flynn Marine Park (formerly the Boston marine Industrial Park) is owned by the Boston Planning and Development Agency, and a large subset of the park is under long-term lease to Massport. The Silver Line serves the port district.

Table 12 summarizes the important development sites in the Seaport District Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 13 presents, for South Station and for the Silver Line stations located in the Seaport, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

South Station is included because it is within walking distance of the Fort Point and Fan Pier/Seaport Square development districts. As described earlier in the Downtown Boston section, South Station is the busiest station in the entire MBTA system; its 24,000 daily Red Line boardings are the most at any rapid transit station, and nearly 20,000 daily commuter rail passengers come to South Station. Those bound for the Seaport either walk to their destination or transfer to the Silver Line.

The four Silver Line stations in within the Seaport have their own category in the MPAC station typology. "Seaport/Airport" stations have "large amounts of surface parking and underutilized land, very few current residents, and capacity for transformative redevelopment."[34] The data for these four stations do not yet reflect the Seaport's emerging density or its transit-oriented character.

TABLE 13: Station Characteristics, Seaport District

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Silver Line											
South Station	Metro Core	21%	7,705	3,737	128,066	1,005,000	708,000	52%	64%	.37	8.76
Courthouse	Seaport *	33%	1,283	536	20,230	868,920	493,174	44%	54%	.54	13.83
World Trade	Seaport *	33%	1,574	537	23,688	868,920	493,174	44%	54%	.64	16.20
Silver Line Way	Seaport *	33%	870	162	13,194	868,920	493,174	44%	54%	.83	20.82
Design Center	Seaport *	28%	1,039 **	160	11,936	667,928	234,458	—***	—***	.81	19.88
Red Line											
South Station	Metro Core	21%	23,703	3,737	128,066	1,005,000	708,000	52%	64%	.37	8.76
Commuter Rail											
South Station	Metro Core	21%	19,942	3,737	128,066	1,005,000	708,000	52%	64%	.37	8.76

* MAPC's Seaport/Airport typology category; applies only to these stations and the Silver and Blue Line stations at Logan Airport.
** Total boardings for all stops between Silver Line Way and Design Center/Black Falcon.
*** Missing data or small number of units in the station's Census Block Group.

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- While Courthouse and World Trade Stations have over 20,000 jobs within a half-mile, in general the job, household, and Silver Line ridership numbers (all from 2013 and before) do not reflect the businesses and apartments that have come on-line since then or the many more under construction today.
- The household automobile ownership, VMT, and transit use metrics are somewhat consistent with the near-Downtown location, but they are based on the small number of households that existed in 2013.
- The job and labor sheds show at a glance why the Seaport is outgrowing its development projections, even with a district-wide parking freeze. The job shed (the estimated number of jobs a resident can reach by a 30-minute transit trip and a quarter-mile walk) is nearly triple the region-wide average. The labor shed is more than triple the region-wide average. These advantages depend on the Silver Line and the Red Line.

SUMMARY OF TRANSIT NEEDS, SEAPORT
General
Silver Line Reliability and Capacity, including fleet replacement, T under D
Silver Line Gateway
Rapid Transit System State of Good Repair: Reliability and Capacity, especially Red Line
Shuttle Consolidation, possible North Station/Seaport BRT
Water Transportation terminal and service
Station-Specific
South Station Expansion
Long-Term Option (Not to Preclude)
Potential Back Bay/Seaport Urban Rail or Red Line
Silver Line III

Transit Mobility Needs

The *South Boston Waterfront Sustainable Transportation Plan,* published in 2015 by A Better City, Inc., and the Seaport's public stakeholders, recommended a series of mobility improvements. Because the district's roadway network, except for some key truck route segments, is built out, and because a district-wide parking freeze is in effect, the Seaport's future is sustainable only through transit, pedestrian-bicycle connectivity, and changes in roadway operations. The key transit recommendations are as follows.[35]

The Seaport's mobility backbone is the Silver Line, which is approaching peak capacity with millions of square feet of additional development to come. In addition to service and operational improvements (such as traffic signal priority at D Street and next-generation fare collection), the Silver Line fleet will need to be replaced and expanded, and the bottleneck at D Street will need to be eliminated, most probably by constructing the "T under D" grade separation. Completion of the Silver Line Gateway extension to Chelsea is critical to the Seaport, because it will use the Silver Line's ***counter-peak*** direction to access not only the Chelsea Growth Cluster but the commuter shed of the Newburyport/ Rockport commuter rail line.[36]

The Seaport depends on the reliability and capacity of the rapid transit system as a whole, but particularly of the Red Line. As with all of the Red Line-dependent Growth Clusters, the decision to replace the full Red Line fleet and increase peak-hour capacity by up to 50% is essential to the Seaport's future growth.

Water transportation is an obvious but unexploited means of enhancing the Seaport's transit network, including the potentially high-volume connection to North Station. The Seaport would be a focus of the harbor-wide ferry system that Boston Harbor Now, the Convention Center Authority, and other stakeholders are seeking to advance. The proposed Seaport terminal at World Trade Center has already been designed by Massport.

The *Sustainable Transportation Plan* strongly recommends consolidating the several private shuttles that now connect Seaport passengers to North Station and other Downtown destinations. In time, this consolidation could demonstrate the value of a North Station/Seaport bus rapid transit link.

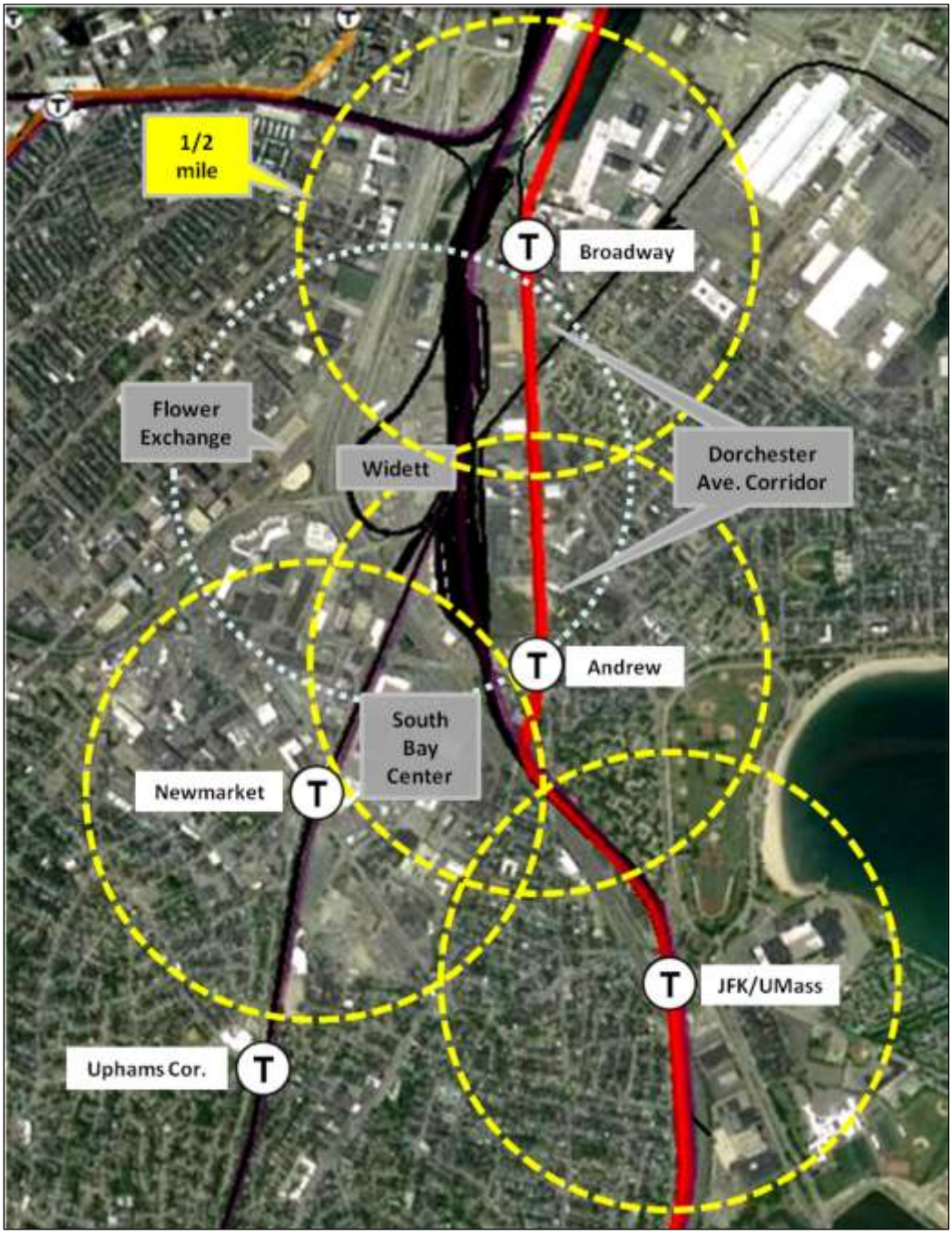
The South Station Expansion Project is critical to the Seaport in the long term, because it is the portal by which the entire south commuter rail system accesses the district. The *Sustainable Transportation Plan* also recommends that a direct rail connection between Back Bay Station and the Seaport be explored, and that the ability to implement such a connection on Track 61 be preserved. The MBTA has also begun exploring a Red Line spur alternative using Track 61. Finally, the *Plan* recommends that Silver Line III, which would enable Orange and Green Line passengers to reach the Seaport by a simple, one-transfer trip, be preserved as a future option.

SOUTH BAY CORRIDOR

OVERVIEW

The South Bay Corridor, illustrated in FIGURE 7, is the industrial and transportation corridor that runs north-south along the seam of Dorchester, South Boston, Roxbury, and the South End.[37]

FIGURE 7: South Bay Corridor



Source: AECOM

The corridor was originally created by filling the South Bay flats in the 19th and 20th centuries. Today the Southeast Expressway and the MBTA and Amtrak railroad infrastructure separate development districts and neighborhoods that lie barely a half-mile apart. The South Bay Corridor, as defined here, is similar to the Widett-Newmarket area designated in Imagine Boston 2030 as one of six major "neighborhood expansion" sites across the city.[38]

DEVELOPMENT DISTRICTS

The development potential of the South Bay Corridor consists of five distinct areas. While semi-isolated from one another today, they could become more integrated as development unfolds, particularly if Widett Circle were developed in a way that created multi-modal connections to the surrounding districts.

Dorchester Avenue

The segment of Dorchester Avenue between Broadway and Andrew stations is one mile long. Several market-rate multi-family residential developments, involving both new construction and adaptive reuse, have occurred near Broadway Station. This successful development demonstrated the feasibility of locating multi-family housing in close proximity to the rail and bus operation and maintenance activities immediately west of Dorchester Avenue.

In 2015, as part of the citywide effort to create 53,000 units of housing by 2030, the City of Boston designated this segment of Dorchester Avenue as a TOD demonstration corridor. The City is in the process of rezoning the corridor, which currently includes about 1,200 housing units, to accommodate 6,000 to 8,000, 23% of them income-restricted. Washington Village, an eight-building, mixed-income project near the intersection of Old Colony Avenue and Dorchester Street, is about to begin construction. This project includes 565 residential units and nearly 100,000 square feet of retail with only 565 parking spaces, an example of the market "betting" on the Red Line.[39]

South Bay Center

The existing South Bay Center retail mall is located immediately southwest of the Expressway, between Southampton Street and Massachusetts Avenue. While a predominantly automobile-dependent use, it is located next to the Newmarket commuter rail station and a short distance from Andrew Station, with connecting bus service. The owners of the center are undertaking a major mixed-use intensification, in which 10 acres of mostly vacant land and surface parking will be redeveloped as retail, a cinema complex, a hotel, and housing. Parking will be in "wrapped" garages, and residential units will have less than one dedicated space per unit, reflecting the transit location.[40]

Newmarket

The Newmarket Industrial and Commercial District, located just across the railroad tracks from South Bay Center, is home to over 150 businesses employing over 15,000 people.[41] These are predominantly in food processing and distribution, light industry, and other blue-collar occupations, making Newmarket one of the most important such concentrations in the City. In the 2015 Fairmount/Indigo Planning Initiative, the Newmarket station area is singled out as one of the two principal opportunities for job growth.[42]

Widett Circle

Widett Circle, narrowly defined, is the roughly 17-acre area circumscribed by the public Amtrak service track loop. Two multi-tenant food processing and distribution facilities were purpose-built four decades ago when the redevelopment of Quincy Market required that these businesses find a new home. More broadly, Widett Circle is used to describe an area of nearly 85 acres of land and air rights owned by the Widett food businesses, the Commonwealth, the MBTA, the City of Boston, and Amtrak.

The City envisions a permanent new neighborhood, to be created on air rights over the transportation infrastructure at the transformative scale of the Hudson Yards development in western Manhattan. The Boston 2024 Olympic

concept estimated site assembly, decking, and infrastructure costs well in excess of a billion dollars, supporting a multi-phase mixed-use development program of over seven million square feet.

The scale, footprint, phasing, and composition of any future Widett development will depend on two threshold issues—the future of the Widett food businesses (at their present site or in a new 21st-century location) and MassDOT's determination as to whether a portion of the site will be needed for mid-day train layovers associated with South Station Expansion.[43] Development at Widett could extend the street grid across the tracks eastward to Dorchester Avenue and Broadway Station and over the Expressway westward to the proposed redevelopment of the Boston Flower Exchange as a major R&D and employment campus. As part of any Widett Circle development, a future Fairmount Line commuter rail station could be created at track level.

JFK/UMass

The JFK/UMass Red Line station, which is also served by the three Old Colony commuter rail branches, is only three-quarters of a mile from Andrew Station, with overlapping walksheds. The principal development uses associated with the station today are out on Columbia Point, east of the station: UMass Boston, the JFK Library/State Archives complex, and the 1285-unit Harbor Point mixed-income residential community.

In the coming decades, a series of developments are contemplated in the immediate vicinity of the station on both sides of Morrissey Boulevard: UMass' redevelopment of the 20-acre former Bayside Exposition Center property; on-going multi-family residential development; the redevelopment of the Boston Globe site, which, like the Flower Exchange, is a proposed employment center; and the MBTA's potential solicitation of development its air rights at JFK/UMass Station. [44] In 2011, the BRA issued a Columbia Point Master Plan, which identified a long-term redevelopment potential of over 4,000 residential units, 800,000 square feet of office space, and nearly 500,000 square feet of retail.[45]

Table 14 summarizes the important development sites in the Seaport District Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 14: Key Development Sites, South Bay Corridor

Dorchester Avenue		Status *
Washington Village	Large-scale, multi-building housing and neighborhood retail complex at Old Colony Ave. and Dorchester St.	R/C
Smaller residential infill projects	Several.	P, R/C
Balance of City's housing buildout	6,o000-8,000 TOD units, net of those listed above.	LT
South Bay Center		
South Bay Center	Mixed-use intensification; housing and commercial.	R/C
Newmarket/Widett		
Boston Flower Exchange	Large-scale R&D/employment campus redevelopment.	P
Newmarket District capacity	Identified as an employment Growth Cluster in the Fairmount Corridor Plan.	LT
Widett/Midtown Concept	Transformative air rights deckover and multi-million square foot mixed-use neighborhood, with built-in commuter rail station.	LT
JFK/UMass		
25 Morrissey Boulevard	Major residential building.	R/C
University Place	Residential building.	P
Bayside redevelopment by UMass	Program and plan not yet known; 20-acre site with mixed-use, academic potential. Potential soccer stadium.	LT
Globe site redevelopment	Proposed office/R&D employment center.	P
Balance of Columbia Point Master Plan buildout	4,100 residential units, mixed hotel/office/retail program, net of listed projects.	P, LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

MAPC categorizes Broadway, JFK/UMass, and Newmarket as Transformational Subway stations, and Andrew as a Neighborhood Subway station. Given the City of Boston's plans for large-scale redevelopment around Andrew Station, as part of the Dorchester Avenue TOD corridor, it could reasonably be considered transformational as well. Table 15 presents the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

- The transit mode share for commuters living in these four station areas ranges from 30% to 37%, all well above the system-wide and regional averages.
- Broadway and Andrew stations are among the lower-ridership Red Line stations, while JFK/UMass is in the middle of the pack, reflecting the degree of student and workforce commuting associated with UMass/Boston. The Newmarket commuter rail station opened in 2013 and had no ridership data in the most recent MBTA Blue Book. Based on the analysis performed for GoBoston 2030, Red Line trains at

Broadway, Andrew, and JFK/UMass are generally "standing room only" in the peak commute direction, but have available rush hour seating capacity in the reverse commute direction.

- While all four station areas contain a mix of housing and employment, the larger employment destinations are Broadway (near Gillette and the MBTA repair yards) and Newmarket (the Newmarket industrial district and South Bay Center).

TABLE 15: Station Characteristics, South Bay Corridor

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Red Line											
Broadway	Transform. Subway	30%	5,264	3,252	10,020	884,000	520,000	49%	61%	.50	12.69
Andrew	Neighbhd. Subway	34%	6,425	4,385	4,814	803,000	420,000	36%	44%	.59	15.35
JFK/UMass	Transform. Subway	37%	8,920	4,567	4,567	766,000	382,000	35%	43%	.61	15.24
Commuter Rail, Fairmount Line											
Newmarket	Transform. Subway	36%	no data	2,271	8,686	818,000	440,000	33%	40%	.60	14.87
Commuter Rail, Greenbush, Kingston-Plymouth, Middleboro-Lakeville Lines											
JFK/UMass	Transform. Subway	37%	1 *	4,567	4,567	766,000	382,000	35%	43%	.61	15.24

* Boston-bound boardings only.

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- The Andrew, JFK/UMass, and Newmarket station areas are all more affordable places to live than the region as a whole. Their combined housing+transportation costs represent, on average, less than the 45% benchmark of household income, for those earning the Area Median Income (AMI) as well as those earning 80% of AMI. The Broadway station area is more expensive; transportation costs are low but housing costs reflect the recent development of high-end market-rate apartments and condominiums.
- Because of their central locations, all four stations enjoy strong job access and labor market connectivity through the MBTA network. The four job sheds—the estimated number of jobs that a worker living near the station can reach by a 30-minute transit commute and a quarter-mile walk—range from 766,000 to 884,000, more than double the average for all locations in the region. Their labor sheds—the estimated number of workers who can reach a job at the target station by a 30-minute transit commute—range from 382,000 to 520,000, compared to a regional average of only 151,000.
- Average automobile ownership in these station areas is low—from .5 to .6 cars per household, compared to 1.55 in the region at large and 1.03 across the average of all MBTA stations. The combination of transit use and low car ownership is reflected in daily VMT rates per household that are far below the regional average and the average for all stations. Area residents benefit from reduced car ownership and operating costs (which for some would be unaffordable) and from the reduction of greenhouse gas and other automotive emissions.

Transit Mobility Needs

The development potential of the South Bay Corridor is limited by the rush-hour capacity of the Southeast Expressway and the key arterial roadways that connect to it: Columbia Road, Massachusetts Avenue, Dorchester

Avenue, Old Colony Avenue, Morrissey Boulevard, and others. It will take a robust transit system to accommodate development underway today in the South Bay Corridor and to support its longer-term potential. Based on the discussion of the development districts, several transit improvements will be needed.

The ability of all four existing stations, including Newmarket, to support sustainable development depends on the reliability and capacity of the rapid transit system—especially the Red Line, but also the Orange and Green Lines, with which it connects.

The viability of transit-oriented development at Newmarket depends on the introduction of "urban rail" or similar service on the Fairmount Branch—more frequent service and shorter trains, using multiple unit technology rather than standard locomotives. The MBTA has contemplated such service, especially on the Fairmount Line, for several years. The South Station Expansion Project is critical to the long-term viability of the Fairmount Line, particularly with urban rail-type service.[46]

SUMMARY OF TRANSIT NEEDS, SOUTH BAY CORRIDOR
General
Rapid Transit System State of Good Repair: Reliability and Capacity, especially Red Line
Urban Rail service on the Fairmount Line
District shuttle connecting Andrew, Newmarket, Widett, and South Bay
Station-Specific
South Station capacity expansion
JFK/UMass connectivity improvements
District shuttle(s)
Future Widett Fairmount station

If MassDOT and the City agree to pursue large-scale development on at least a portion of Widett Circle, a new Fairmount Line commuter rail station, as noted earlier, would presumably become an integral part of the development program.

Newmarket and Andrew Stations need to be better connected to the existing Widett industrial center, the proposed Flower Exchange development, and, in the case of Andrew, the Newmarket district and South Bay Center. A "district shuttle" could be implemented by the City, developers, or district organizations.

The emergence of JFK/UMass, Morrissey Boulevard, and Columbia Point as a cohesive TOD district depends on pedestrian improvements linking the station to its immediate walkshed, as well as a more legible, seamless, and reliable bus connection serving the main UMass campus, the JFK Library, and Harbor Point. The bus connection could take the form of a branded district shuttle or a bus rapid transit line operating on Mt. Vernon Street. These improvements could be undertaken independently or as part of any air rights joint development at the station.

NEAR NORTH SHORE

As shown in Figure 8, the Near North Shore Corridor extends from East Boston to Lynn along Route 1A, the Newburyport-Rockport commuter line (the historic Eastern Railroad), the Blue Line, and the new Silver Line Gateway. Chelsea and Wonderland are also served by the MBTA's #111, #116, and #117 Key Bus Routes, connecting them to the commuter rail, and Downtown Boston. The Near North Shore includes four Transit Growth Clusters, whose estimated development potential is presented in Table 16.

FIGURE 8: The Near North Shore and Its Four Growth Clusters

Source: AECOM

TABLE 16: Near North Shore; Housing and Job Capacity by Growth Clusters

	RECENT/ CURRENT		IN THE PIPELINE		RECENT/CURRENT PLUS PIPELINE		LONG-TERM POTENTIAL		TOTAL	
	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs
East Boston Waterfront	1,300	100	700	100	2,000	200			2,000	200
Chelsea	1,300	800			1,300	800	1,900	2,400	3,200	3,200
Suffolk Downs/ Wonderland	900	200		2,300	900	2,500	8,500	23,900	9,400	26,400
Lynn Waterfront	400		1,500		1,900		3,200	4,500	5,100	4,500
Corridor Total	**3,900**	**1,100**	**2,200**	**2,400**	**6,000**	**4,000**	**14,000**	**31,000**	**20,000**	**35,000**

Source: AECOM; compiled from BPDA database; Cities of Chelsea and Lynn; MEPA database; MAPC MassBuilds; press accounts (see Appendix C-1). Shaded Corridor Totals are rounded to the nearest thousand; other cells are rounded to nearest hundred.

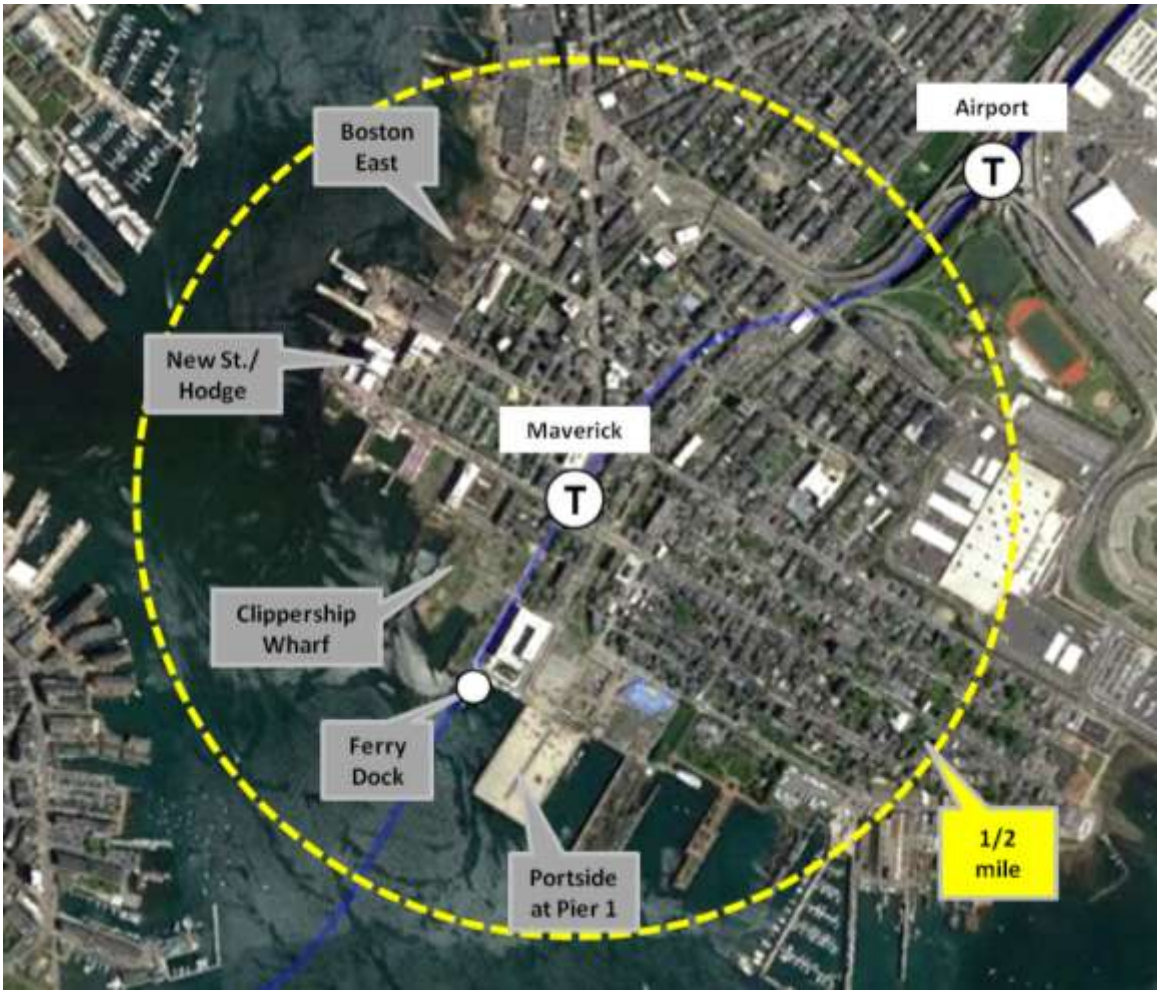
EAST BOSTON WATERFRONT

OVERVIEW

The East Boston Waterfront has emerged as a significant market for residential development. Several multi-family projects, amounting to nearly 2,000 units, are recently completed, underway, or in the pipeline. Maverick and Central Squares, the two local business districts, are benefitting from the increased residential activity.

As shown in Figure 9, the waterfront is served by the Blue Line's Maverick Station. All of the new and proposed developments are within walking distance, and for purposes of this analysis, the East Boston Waterfront consists of a single development district. The major employment destinations of Logan Airport and Downtown Boston are a one- and two-stop ride from Maverick.

FIGURE 9: East Boston Waterfront



Source: AECOM

Table 17summarizes the important development sites in the East Boston Waterfront Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 17: Key Development Sites, East Boston Waterfront

East Boston Waterfront		Status *
Residential infill projects	Several.	R/C, P
Portside	Multi-building residential project with retail on Massport Pier 1 parcel.	R/C, P
Clippership Wharf	Major residential project adjoining ferry dock.	R/C
New Street, Hodge Boiler Works	Adjacent high-profile residential projects.	R/C, P
Boston East	High-profile residential project.	R/C
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 18 presents, for Maverick Station, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison. Maverick is characterized by MAPC as a "Transformational Subway" station, indicating that it has the "potential for transformative change through district-scale land development projects".[47] That description applies principally to the waterfront.

TABLE 18: Station Characteristics, East Boston Waterfront

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Blue Line											
Maverick	Transform. Subway	51%	10,106	4,801	3,452	566,000	219,000	36%	44%	.52	13.46

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- With over 10,000 daily boardings, Maverick is the third-busiest station on the Blue Line and the busiest outside of State and Government Center.[48]
- The household averages for automobile ownership and Vehicle Miles Traveled (VMT) are low, and transit use per household—at 51%--is among the highest in the system. With 4,800 households inside a half-mile, these data reflect a dense residential neighborhood with many transit-reliant riders and a growing influx of "choice riders".
- The modest number of jobs within a half-mile reflects the fact that virtually of Logan Airport lies outside Maverick's half-mile circle. The Airport's 16,000 jobs, however, are one stop away at Airport Station.
- On the combined Index of Housing+Transportation costs, the Maverick station area is more affordable than the region or the MBTA system as a whole. It falls below the threshold of 45% of Area Median Income (AMI) and well below region-wide average of 48%.[49]
- Maverick's 30-minute job and labor sheds substantially exceed the region-wide average. However, despite direct rapid transit service, they are not as robust as those found in The Hub. This reflects the fact that the

Blue Line is the shortest of the four rapid transit lines; has direct connections to only two of the three others; and has several station areas with extensive undeveloped land and/or water bodies.

Transit Mobility Needs

The East Boston Waterfront is well served by transit. In the near term, while the Blue Line is generally reliable and operates within capacity, many trips depend on the quality of Orange or Green Line service, to which it connects at State and Government Center. As a long-term option, the Red-Blue Connector would link East Boston, by a one-transfer trip, to Downtown, Kendall, and other Red Line job markets.

In addition to Maverick Station and multiple bus routes, the East Boston Waterfront is served by three current or potential transit assets.

- Airport Station, and the airport's 16,000 jobs, are one stop away on the Blue Line.
- The Silver Line Gateway service will connect Airport Station to the Seaport District and South Station by direct, off-street bus rapid transit. In the other direction, the Silver Line Gateway will provide a short, direct ride to the future TOD district around the new Chelsea Station. Completion of Silver Line Gateway is important for East Boston.
- The City owns a ferry dock near Maverick Square, adjacent to the Portside and Clippership developments, with the potential for direct service to Downtown and the Seaport. Introduction of Seaport service would be especially beneficial for sustainable residential development on the East Boston waterfront.

SUMMARY OF TRANSIT NEEDS, EAST BOSTON WATERFRONT
General
Rapid Transit System State of Good Repair: Reliability and Capacity, especially of Blue (OK), Orange and Green Lines
Completion of Silver Line Gateway
Station-Specific
Ferry service from Maverick/Lewis to Downtown and Seaport
Long-Term / Not to Preclude
Red Line-Blue Line Connector

CHELSEA

OVERVIEW

Chelsea is defined by MAPC as a Metro Core community—the densest, innermost subset of the Inner Core. It is located just north of Boston, separated from Charlestown by the Mystic River and from East Boston by Chelsea Creek, the region's vital waterway for petroleum imports. Chelsea's population of roughly 35,000 is among the poorest and most transit-reliant in the region. After entering into bankruptcy and receivership in the early 1990s, Chelsea has stabilized, recovered, and begun to attract a regionally significant concentration of development, especially in its core alongside Route 1.

FIGURE 10: Chelsea

Source: AECOM

Chelsea is served by several MBTA bus routes and by the Newburyport-Rockport commuter rail line, whose Chelsea station is currently the only stop between Lynn and North Station. The existing station is substandard, non-ADA compliant, and poorly used.

Chelsea's revitalization has relied thus far on its central location in the regional highway network and its proximity to Logan Airport. However, the Silver Line Gateway project, currently under construction, will bring Chelsea a one-seat connection to the Airport, the Seaport District, South Station, and the financial district. It will also create a multi-modal hub station serving the commuter rail, Silver Line, and Key Bus Routes at a site surrounded by recent development and by land primed for TOD.

DEVELOPMENT DISTRICTS

Chelsea's physically small central core could easily be considered a single development district. That said, the core is bisected by the Route 1 viaduct and Everett Avenue, which, as shown in Figure 10, run roughly parallel to each other for about a mile. Recent development thus far lies east of Everett Avenue, while the large area primed for future TOD lies west of Everett Avenue.

East of Everett Avenue

Chelsea has begun to attract significant new development over the last 10 to 15 years. The strip of land between Everett Avenue and the Route 1 viaduct has absorbed the new Chelsea High School, the Massachusetts Department of Revenue Data Center, a Massachusetts General Hospital satellite facility, three hotels, and the FBI New England Headquarters. Together, this cluster provides over 1,000 jobs.

There have been two new multi-phased residential developments as well: the mixed-income infill development known as the Box District and the multi-phase, market-rate project known as One North of Boston.[50] One North is marketed as close to the rail station and minutes from Boston, while the Box District will have its own Silver Line station. In and around Bellingham Square, Chelsea's small downtown, the City is encouraging infill residential development near the BRT station.[51]

West of Everett Avenue

Chelsea's principal future development opportunities lie west of Everett Avenue. A vacant eight-acre industrial site, located just inside the city line and across Everett Avenue from the high school, is under construction as a 692-unit residential project with street-level retail. This development was attracted in part by the anticipated BRT/rail station.

Adjoining this approved project is an area of roughly 53 acres that surrounds the multi-modal commuter rail station on three sides. The largest portion is the 33-acre Mystic Mall property, which is presently in low-density, automobile-intensive retail use.[52] Its owners are contemplating a mixed-use, transit-oriented redevelopment. The remaining 20 acres contain a number of industrial properties, some of which will likely seek to modernize and expand while others may be redeveloped as mixed-use TOD.

As this is written, a joint TOD planning process by the City of Chelsea and MAPC is in its early stages, as are specific project plans by property owners. An estimate prepared for MassDOT found that this 53-acre area could accommodate, over time, 1,300 to 1,800 housing units *over and above* the 692 approved on the adjoining site, and 2,500 to 4,300 permanent new jobs. The same analysis estimated 1,300 to 1,900 daily transit trips from work commuting alone, whether by commuter rail or Silver Line.[53] The intermodal station's half-mile radius also encompasses two significant industrial areas: about 55 acres along Williams Street in Chelsea, and 110 acres in the "Everett Commercial Triangle".

Table 19 summarizes the important development sites in the Chelsea Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 19: Key Development Sites, Chelsea

East of Everett Avenue		Status *
Box District	Multi-phase, mixed-income infill residential development; most recent phase on-line since 2013.	R/C
New England FBI Headquarters	In-service late 2016; high-profile investment in city.	R/C
One North of Boston	Large multi-phase market-rate apartment project. Highly visible from Route 1; marketed as next to commuter rail and (2017) BRT to airport and Seaport.	R/C
Homewood Suites	Most recent of three hotels along Route 1.	R/C
Residential upgrade, infill.	Several identified in Bellingham Square area.	R/C, P
West of Everett Avenue		
Clock Tower	Major residential development to replace abandoned industrial site and junkyard; gateway to Chelsea.	R/C
Future station-area TOD	Approximately 53 acres surrounding new commuter rail/BRT/bus hub station. Anticipated mixed-use TOD on large, parking-dominated mall site; TOD and industrial modernization in existing industrial blocks.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from City of Chelsea; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

MAPC categorizes the Chelsea commuter rail station as an Urban Gateway station. Existing transit market conditions are summarized in Table 20. Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison. The key findings are as follows:

TABLE 20: Station Characteristics, Chelsea

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Newburyport-Rockport Line											
Chelsea *	Urban Gateway	24%	179 *	6,210	10,271	564,000	265,000	37%	45%	.66	15.92
Silver Line (under construction)											
Bellingham Square *	*Urban Gateway or Neighbhd.Subway*	24%	—	6,210	10,271	564,000	265,000	37%	45%	.66	15.92
Box District**	*Neighbhd.Subway*					544,000	222,000	35%	43%		

* Data are for the existing Chelsea commuter rail station, which is also the location of the future Bellingham Square Silver Line Station. The 179 commuter rail riders are daily Boston-bound boardings; this includes any riders who "reverse commute" from Boston to Chelsea (boarding in-bound in the evening), but excludes any who may commute outbound from Chelsea to Lynn or points north.

** Bellingham Square and Box District BRT service has not commenced as of this writing. Box District values for Job Shed, Labor Shed, and H+T Affordability are based on the station location.

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Chelsea station area residents have a transit commuter mode share of 24%. This is higher than the regional and all-station averages, but lower than might be expected in light of the very low figures for vehicle ownership (only .66 cars per household) and VMT per household. Taken together, these numbers suggest that transit use is constrained by Chelsea's reliance on conventional bus service and an isolated, substandard commuter rail station.
- Compared to all stations in the system, Chelsea Station is surrounded by high numbers of both households and jobs. Introduction of Silver Line service and the relocation of the train station (see below) are projected to attract 8,730 riders by 2030, of whom 2,500 will be new transit riders.54
- Chelsea Station's 30-minute job shed and labor shed are above the region-wide averages, at levels similar to those in East Boston. Like the East Boston stations, Chelsea enjoys direct connections to the Orange and Green Lines in Downtown Boston.
- The Chelsea station area is a significantly less expensive place to live than Greater Boston as a whole. Housing+Transportation costs are below the 45% of income benchmark and well below the regional average. These numbers reflect the importance of bringing transit and jobs to this low-income community as well as the challenge of preserving and adding affordable housing.

Transit Mobility Needs

The future of Chelsea as a Growth Cluster rests on the Silver Line Gateway bus rapid transit (BRT) project, which is illustrated in FIGURE 11. The project will extend the Silver Line from Airport Station to the new multi-modal Chelsea Station at Mystic Mall, with intermediate stations at Bellingham Square, the Box District, and the industrial area on Eastern Avenue. Except for the Chelsea Street Bridge, the entire Silver Line extension will run in a dedicated busway, using Massport's Coughlin Bypass road in East Boston and excess rail right-of-way in Chelsea. From Bellingham Square, the one-seat BRT trip will take eight minutes to the Airport, 15-19 minutes to the Seaport, and 23 minutes to South Station—far less, in all cases, than the multi-transfer connections available today. [55]

SUMMARY OF TRANSIT NEEDS, CHELSEA
General
Rapid Transit System State of Good Repair: Reliability and Capacity, especially Orange and Green Lines
Urban Rail service on the commuter rail line from North Station to Lynn
Station-Specific
Completion of Silver Line Gateway
District infrastructure and possible district shuttle west of Everett Avenue

The project will also relocate the Chelsea commuter rail station from its substandard location near Bellingham Square to a new multi-modal location at Mystic Mall. This shift will place the train station in the epicenter of development on either side of Everett Avenue, make way for the Bellingham Square Silver Line stop, and create a direct transfer between the Silver Line and the commuter rail. In addition to enhancing Chelsea's rail connections to Boston and to future development on the Lynn Waterfront, these changes will connect Lynn to the Airport and Seaport.[56] As of 2017, Phase 1 of the project—the busway and three of the stops—is nearing completion. Phase 2 will consist of the multi-modal hub, Bellingham Square BRT stop, improved pedestrian access, and traffic signal priority. Completing this project is essential.

The Chelsea Growth Cluster would be strengthened by the introduction of "urban rail" service on the segment of the Newburyport/Rockport commuter rail between North Station and Lynn. Urban rail—with more frequent service and shorter, multiple-unit trains—would provide the new Chelsea Station with a more rapid transit-like connection to North Station. With or without urban rail, the value of Chelsea's one-stop train ride to North Station depends on the reliability and capacity of the Green and Orange Lines.

Large-scale TOD around the new multi-modal Chelsea Station will require district infrastructure: a supportive grid of streets, sidewalks, lighting, utilities, and open space. This investment would be built, in phases, through public and developer actions. It is also likely that a district shuttle will be needed to connect the station to the more distant development sites west of Everett Avenue and to the nearby Everett Commercial Triangle.

FIGURE 11: The Silver Line Gateway

Source: MassDOT

SUFFOLK DOWNS AND WONDERLAND

OVERVIEW

The four outermost stations on the Blue Line serve an emerging development corridor defined by three features: the Suffolk Downs Race Course; the former Wonderland Dog Track; and an oceanfront development strip. These sites and their relationship to the Blue Line are illustrated in Figure 12.

FIGURE 12: Suffolk Downs and Wonderland

Source: AECOM

These development sites are surrounded by the Orient Heights neighborhood of East Boston and the Beachmont, Young's Hill, and Shirley Avenue neighborhoods of Revere; by the port-related facilities along Route 1A between Suffolk Downs and Chelsea Creek; and by the wetlands and waterways of the Belle Isle Marsh and Rumney Marsh reservations. Notwithstanding these constraints, the combination of large, available tracts of land and exceptional regional transportation access makes this segment of the Route 1A Corridor an emerging Growth Cluster of potentially transformative scale.

This Corridor was repositioned by the Ted Williams Tunnel, which made Route 1A, in effect, a local extension of I-90. But congestion on Route 1A makes clear that the redevelopment potential of Suffolk Downs and Wonderland depends on transit. Existing transit access includes direct service to Logan Airport and the Boston financial district via the Blue Line. When the Silver Line Gateway opens in 2018, the Seaport District will become conveniently accessible via a direct interface with the Blue Line at Airport Station.

DEVELOPMENT DISTRICTS

Although Suffolk Downs and Wonderland are distinct development districts, they have the potential to be developed synergistically. Their adjacency on the Blue Line means that if both are developed in a mixed-use, transit-oriented fashion, with housing and jobs at each location, the Blue Line can serve, in effect, as a commuter shuttle between the two.

Suffolk Downs

The Suffolk Downs Race Course site is approximately 153 acres, straddling the Boston-Revere city line. Existing conditions include the track and grandstand, the stables complex, a wide access corridor connecting to Route 1A, and parking. The owners and the two cities have recognized the potential for a large-scale, mixed-use, transit-oriented redevelopment of the property, which is bracketed by the Suffolk Downs and Beachmont stations. In Imagine Boston 2030, the City of Boston identifies Suffolk Downs as one of a half-dozen primary "neighborhood expansion" opportunities, and Suffolk Downs was the primary site offered by Boston (in partnership with Revere and the owner) in the City's 2017 bid for Amazon's HQ2 mega-project.[57] Suffolk Downs has entered the public planning and approval pipeline; the developer's initial estimates of housing and commercial development over the next 15-20 years confirm that even if those numbers are reduced substantially, this would be the region's largest single development site.[58]

The MBTA owns a 3.5-acre parking lot next to Beachmont Station, across the street from the northeast corner of the Suffolk Downs property. This land, and several low-density uses adjoining it along Washburn Street, could be developed as a TOD gateway to the Suffolk Downs redevelopment.

Wonderland

A major public-private TOD project is underway on land owned by the MBTA and the City of Revere at Wonderland Station. Known as Waterfront Square, it consists of the redevelopment of approximately nine acres of land on the east side of the station, facing the beach and connected to it by a pedestrian plaza. The site, formerly used for Blue Line park-and-ride, was freed up by the MBTA's construction of a 1500-car garage west of the station.[59] Waterfront Square follows a series of earlier beachfront residential projects. In 2008, Waterfront Square was designated a state Growth District (now one of 23 statewide), giving it priority in state infrastructure, development, and regulatory programs.[60]

The prime development opportunity at Wonderland consists of the 28-acre site of the former dog track, which closed in 2010. This site is directly across Route 1A from Wonderland Station. A formal public planning process has yet to begin. There is also a multi-parcel tract of approximately 15 acres in the triangle formed by Route 1A, North Shore Road, and Kimball Avenue. Located between Wonderland and Revere Beach Stations, the principal use in this

triangle today is the Wonderland Marketplace shopping plaza. In the long term, as market conditions evolve, this triangle could be developed in a more intensified, transit-supportive fashion.

The Newburyport-Rockport commuter rail line passes along the western edge of the Wonderland Dog Track property. The MBTA has long contemplated a "Revere Station", either as a stand-alone improvement or as part of a larger strategy involving a Blue Line/commuter rail interface.[61] This is discussed further in the Transit Assessment below. In 2017, the NECCO candy factory, located immediately west of the potential commuter rail station site, was sold to a developer; in the near term, the building will remain in industrial use.

Table 21 summarizes the important development sites in the Suffolk Downs/Wonderland Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 21: Key Development Sites, Suffolk Downs/Wonderland

Suffolk Downs		Status
Future redevelopment of Suffolk Downs Race Track property	153 acres, in Boston and Revere. Phase 1 office development proposed; full planning and entitlement process in earliest stage. Developer's initial estimate is 16.5 million square feet of mixed-use buildout.	P, LT
MBTA parking lot at Beachmont	3.5 acres, adjacent to station	LT
Wonderland		
Waterfront Square	Major mixed-use development underway at Wonderland Station. Housing, hotel, office, retail. Connected to MBTA garage, station, parkland, and beach.	C/R
Future redevelopment of Wonderland Dog Track site	28 acre site, closed in 2010; across Route 1A from Wonderland Station; commuter rail passes along west boundary and could support infill station. Planning process anticipated.	LT
Wonderland Marketplace	Shopping plaza and adjacent undeveloped land; total approximately 15 acres. Could be intensified in the future at owners' discretion.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

MAPC categorizes Suffolk Downs and Wonderland as Transformational Subway stations, and Beachmont and Revere Beach as Neighborhood Subway stations. While Beachmont is reasonably categorized as Neighborhood Subway, it has a potentially transformative role as well, given its coverage of the northern half of the Suffolk Downs property. Existing transit market conditions are summarized in Table 22. Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison. The salient findings are as follows:

TABLE 22: Station Characteristics, Suffolk Downs and Wonderland

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Blue Line											
Suffolk Downs	Transform. Subway	51%	1.125	1,523	1,193	509,000	171,000	48%	59%	.83	18.96
Beachmont	Neighbhd. Subway	46%	3,045	2,834	573	513,000	204,000	39%	48%	.78	18.80
Revere Beach	Neighbhd. Subway	34%	3,197	3,163	1,313	528,000	261,000	36%	45%	.70	17.74
Wonderland	Transform. Subway	31%	6,105	2,006	745	584,000	286,000	41%	50%	.73	.17.36

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- All four stations have high transit commuter mode shares, compared to the region- and system-wide average.[62] This reflects the close proximity of their walk-up residential clientele, as well as the below-average car ownership and transit-dependency in some neighborhoods.
- Wonderland is one of the highest-ridership stations on the Blue Line; daily boardings are driven mostly by park-and-ride (1,862 spaces) and by 13 connecting bus routes.[63] Suffolk Downs, by contrast, is the lowest-ridership station on the Blue Line, surrounded primarily by Belle Isle Marsh and the race track. Beachmont and Revere Beach, which serve walk-up patrons from the adjoining neighborhoods, fall in between but are still among the lowest-ridership stations in the heavy rail subway system, reflecting the fact that barely half of their 360-degree radii are trip-generating terra firma.
- The modest ridership numbers (other than intermodal arrivals at Wonderland) are consistent with the low numbers of households and jobs within the half-mile radii of all four stations. Beachmont and Revere Beach are just above the system-wide average for households within a half-mile, while Suffolk Downs and Wonderland are well below average. All four stations are well below the system-wide average of jobs within one-half mile.
- All four stations enjoy job access and labor market connectivity via transit at levels well above the regional and MBTA system-wide averages. The four job sheds—the estimated number of jobs that a worker living near the station can reach by a 30-minute transit commute and a quarter-mile walk—range from 509,000 to 584,000, compared to a regional average of 302,000. Their labor sheds—the estimated number of workers who can reach a job at the target station by a similar commute—range from 171,000 to 286,000, compared to a regional average of 151,000.
- The Beachmont, Revere Beach, and Wonderland station areas are more affordable places to live than the region as a whole. For those earning the Area Median Income (AMI) of $73,180, the combined housing+transportation costs in these neighborhoods are, on average, comfortably below the 45% benchmark of household income. The Suffolk Downs station area is at the regional average; transportation costs are low but housing costs are somewhat higher.
- Average automobile ownership in these station areas is in the range of .70 to .83 per household—below the system-wide average, but higher than the station areas of inner-city Boston and some other Metro Core neighborhoods.[64] The same is true of daily VMT per household.

Transit Mobility Needs

The development potential of the Route 1A Corridor is limited by the rush-hour capacity of Route 1A itself. The Blue Line, with available two-way rush-hour seating capacity at all four stations, is a platform for large-scale TOD.[65] The Blue Line modernization program, in progress for the last two decades, has resulted in six-car trains and in physical modernization and accessibility at all stations.

Phase I of the Silver Line Gateway project, set to open in 2018, will connect Airport Station directly to the South Boston Seaport district, making that employment center accessible to the Blue Line corridor via transit for the first time. The thousands of jobs in the Seaport will then become part of the job shed for residents of East Boston and Revere.

SUMMARY OF TRANSIT NEEDS, SUFFOLK DOWNS/WONDERLAND
General
Rapid Transit System State of Good Repair: Reliability and Capacity of Blue (OK), Orange and Green Lines
Completion of Silver Line Gateway
Urban Rail service on the commuter rail line from North Station to Lynn, including Revere Station
Station-Specific
New Revere commuter rail station at Wonderland
Long-Term (Not to Preclude)
Red Line-Blue Line Connector

Nonetheless, based on an assessment of the development districts, several additional transit improvements will likely be needed. The effective capacity of the Blue Line depends on the general state of good repair of the Orange and Green Lines, with which it connects. Thus, the Orange Line fleet replacement and the Green Line fleet, signal, and traction power investments described previously will affect Suffolk Downs and Wonderland.

In addition, two capacity and connectivity enhancements, long contemplated by the MBTA, would optimize the ability of Suffolk Downs and Wonderland to accommodate transformative TOD without unsustainable dependence on Route 1A:

- As noted previously, "Revere Station" would be a new stop on the North Shore commuter rail line, directly adjoining the Wonderland Dog Track. It could be built as part of the Dog Track redevelopment, similar to the public-private joint development arrangements undertaken at Boston Landing the Worcester line. The half-mile radius around a new Revere Station is shown in light grey n Figure 12.

  The Revere Station concept is part of the larger menu of North Shore Transit Improvements evaluated by the MBTA a decade ago.[66] From the Wonderland TOD perspective, the Revere commuter rail station would provide a crucial benefit: one-seat connections to North Station and to the entire transit shed of the Newburyport-Rockport line, including not only Lynn but Salem and Beverly, two of the busiest stations in the entire commuter rail system. A commuter rail station would also divert some long-term ridership from the Blue Line, which—despite its ample capacity today—is expected to face capacity constraints by 2040.[67]

  Revere Station would be located about 1,100 feet west of the central plaza entrance of Wonderland Station. A grade-separated connection could be achieved by constructing an airport-style moving sidewalk as part of the Revere Station program, with the added benefit of enhancing the flow of traffic on Route 1A (North Shore Road). Alternatively, as one possible outcome of the Blue Line discussion, the line could be extended over North Shore Road to an intermodal terminus at Revere Station.

- The Red Line-Blue Line Connector, which would extend the Blue Line subway one stop from Bowdoin to Charles, was removed from the list of required mitigation projects in the Conservation Law Foundation Artery-Tunnel Consent Agreement.[68] However, it should be preserved as a long-term option. The Silver Line Gateway will provide a more efficient transfer from the Blue Line to the Seaport and arguably to South Station, but connections between East Boston/Revere and Park Street, Mass General, Kendall, and the remaining Cambridge and Somerville stations will remain fragmented unless the Red-Blue Connector is built. This link would enhance the value of Suffolk Downs and Wonderland as regional TOD opportunities.

LYNN WATERFRONT

OVERVIEW

The Lynn Waterfront lies three miles north of Wonderland Station. While it is far enough away from Suffolk Downs and Wonderland to be considered its own Growth Cluster, it shares with them the regional transportation benefits of the I-90 extension, the rush hour congestion of Route 1A, and the nexus of regional transit issues involving commuter rail, airport access, and the Blue Line.

FIGURE 13: The Lynn Waterfront

Source: AECOM

Lynn is characterized by MAPC as a Regional Urban Center. In the last three decades, Lynn lost approximately 12,000 jobs, most of them through a prolonged decline in employment at the General Electric River Works complex. Lynn's waterfront revitalization opportunity, which is of regional scale, consists of three distinct areas—Downtown, the River Works, and the central waterfront—served by two stations on the Newburyport-Rockport commuter rail line. Much of the central waterfront lies outside the half-mile radius of both stations and is separated from them by Route 1A (the Lynnway).

In 2015, Governor Baker, Congressman Moulton, and the City of Lynn established a task force known as "LEAD"—Lynn Economic Advancement and Development—focused exclusively on Lynn redevelopment, particularly with respect to the waterfront and adjoining districts.[69]

DEVELOPMENT DISTRICTS

Downtown Lynn

The revitalization of Downtown Lynn has made halting progress, despite the opening of the Lynn Heritage State Park and the North Shore Community College Campus in the 1980s and the adaptive reuse of several mill buildings as multi-family housing. Downtown is served by the Central Square commuter rail station, which includes a 965-car garage built by the MBTA in anticipation of the potential Blue Line extension. The garage is highly underutilized and could provide a shared parking resource for off-site development. The station is also served by a dozen MBTA bus routes, connecting to the North Shore as well as to Wonderland, Logan Airport, and Boston.

River Works

In 2014, General Electric sold a 65-acre parcel adjoining the River Works station to a private developer, who has obtained approval from the City of Lynn for a large-scale residential project.[70] This development requires the transformation of the River Works station from a "flag stop" reserved for GE employees to a full-fledged station open to the general public. Such an improvement is expected to be undertaken by the developer. The River Works stop is nearly 1.5 miles from Central Square, sufficient spacing for two stations, particularly in an "urban rail" format.

Central Waterfront

The City's top development priority has long been the 305-acre industrial waterfront along the Lynnway. While continuing to provide some jobs and economic activity (especially at the Clock Tower Business Center, a former factory at the end closer to downtown), the waterfront has languished for reasons of market weakness, regional transportation access, and the cost of creating a contemporary, mixed-use district infrastructure template where none exists today.

The current Waterfront Master Plan was completed in 2007 and called for roughly 4.2 million square feet of residential development; 1.1 million square feet of commercial and retail; and 230,000 square feet of laboratory or R&D space; and a hotel. In addition, 45 acres along the shoreline constitute a Designated Port Area under the state waterway regulations, reserved for maritime uses.[71] In 2016, a residential developer purchased the former Beacon Chevrolet site near the Clock Tower facility.

In 2009, the Lynn Waterfront was designated a Growth District (now one of 23 statewide), giving it priority in state infrastructure, development, and regulatory programs.[72] The City estimates that the buildout of the waterfront plan would generate $18 million in annual property tax revenues. Over time, a series of major infrastructure investments will be required to realize the waterfront plan:

- One threshold project has been completed with state funds—the relocation of a 214 KV power line that had effectively blocked development along much of the site.
- District infrastructure represents a multi-phased investment by the public and private sectors. The Master Plan provided a rough order-of-magnitude estimate, in 2007 dollars, of some $186 million in site work and remediation; streets and sidewalks; utilities; marine infrastructure; and parks.[73]
- For the waterfront to work, the Lynnway must be redesigned to make it more pedestrian, bicycle, and TOD-friendly without unduly reducing its capacity. Pedestrian crossings will be especially important at the northern ends near the two train stations. Lynnway concepts are still in the exploratory stage, with no meaningful cost estimate.

Table 23 summarizes the important development sites in the Lynn Waterfront Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 23: Key Development Sites, Lynn Waterfront

Downtown Lynn		Status *
Gateway Residences	Multi-family infill.	R/C
Balance of downtown infill projection	MAPC/City study.	LT
Central Waterfront		
Building 19 redevelopment	Large multi-family, within walking distance of Central Square rail station.	P
Beacon Chevrolet site redevelopment	Large multi-family, within walking distance of Central Square rail station.	R/C
Central Waterfront, balance of projected buildout	Assumes that 100 acres of the nominal 305-acre waterfront is available for development. Large-scale mixed-use program.	LT
River Works		
River Works residential development	65 acres assembled and zoned for 1250 units; plan includes upgrade of River Works commuter rail stop to a full infill station.	P
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from City of Lynn; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

MAPC categorizes Lynn's Central Square as an Urban Gateway station and River Works as a Commerce Park station (the latter denoting industrial or office settings). Existing transit market conditions are summarized in Table 24. The key findings are as follows:

- By regional and network standards, these station areas have low transit mode shares. While the River Works sample size is too low to be representative, Central Square, at a commuter mode share of 10%, is low for a station with one-seat rail service to Boston and multiple bus connections. By contrast, average automobile ownership and daily VMT around Central Square station are low.
- In absolute terms, Central Square is one of the higher-ridership stations on the Newburyport-Rockport line (although far below Salem and Beverly, which board more than 2,000 daily commuters each).[74] River Works station generates minimal use; its importance lies in its potential repositioning in support of new development. In addition to the reported count of Boston-bound daily boardings, the potential value of this commuter rail line in connecting Lynn to origins and destinations *north* of the city should not be overlooked.

TABLE 24: Station Characteristics, Lynn Waterfront

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Commuter Rail, Newburyport-Rockport Line											
River Works	Commerce Park	10%*	56	361	5,677	344,000	192,000	37%*	44%*	1.13*	31.10*
Central Square	Urban Gateway	9%	662	4,710	8,598	162,000	185,000	25%	30%	0.48	11.67
* Small number of households.											

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Compared to all stations in the system, Central Square is surrounded by high numbers of both households and jobs—making its modest ridership even more anomalous. Transit is not a major force in the city's downtown core. The River Works station has over 5,000 jobs within its half-mile radius (including virtually all the remaining Lynn GE jobs).
- The two stations' job sheds (the estimated number of jobs that a worker living near the station can reach by a 30-minute transit commute) differ significantly, with River Works somewhat above the regional average of 302,000 and Central Square well below. The two labor sheds (the estimated number of workers who can reach a job at the target station by a 30-minute transit commute) are essentially identical, slightly above the region-wide average.
- The Central Square station area is a significantly less expensive place to live than Greater Boston as a whole. Housing+Transportation costs are well below the 45% of income benchmark and well below the regional average.

Transit Mobility Needs

To realize the long-term development potential of the Lynn Waterfront, transit and TOD-related investments that will be needed over time at two levels: local and regional. At the local level, the need to repurpose the River Works flag stop as a full-fledged station has already been mentioned, as has the need to plan and implement a long-term district infrastructure program for the Central Waterfront and the Lynnway. Two additional investments are envisioned:

- Ferry service to Boston. Water transportation is viewed by the City and potential developers as a valuable complement to commuter rail, much as the MBTA's Hingham ferry has supported the redevelopment of Hingham Shipyard. Over several years, the City has secured state and federal funds to build a terminal at the foot of Blossom Street in the Central Waterfront and obtain a vessel. Service operated in 2015. However, state operating funds to sustain the service on a permanent basis have not been committed.
- A district shuttle. As with many large, spread-out development districts, the Central Waterfront

SUMMARY OF TRANSIT NEEDS, LYNN WATERFRONT
General
Rapid Transit System State of Good Repair: Reliability and Capacity of Orange and Green Lines
Urban Rail service on the commuter rail line from North Station to Lynn
Completion of Silver Line Gateway, both phases
Station-Specific
Permanent Lynn-Boston Ferry Service
Central Waterfront district infrastructure and shuttle to rail stations and ferry
A full-service commuter rail station as part of River Works development
A Blue Line cross-connection at Wonderland

cannot be easily reached on foot from nearby transit stations; most of the district, in fact, is more than a half-mile from either the Central Square of River Works stations and is separated from them by the Lynnway. A district shuttle connecting waterfront locations to each other and to the train stations and ferry terminal will be needed as the district unfolds.

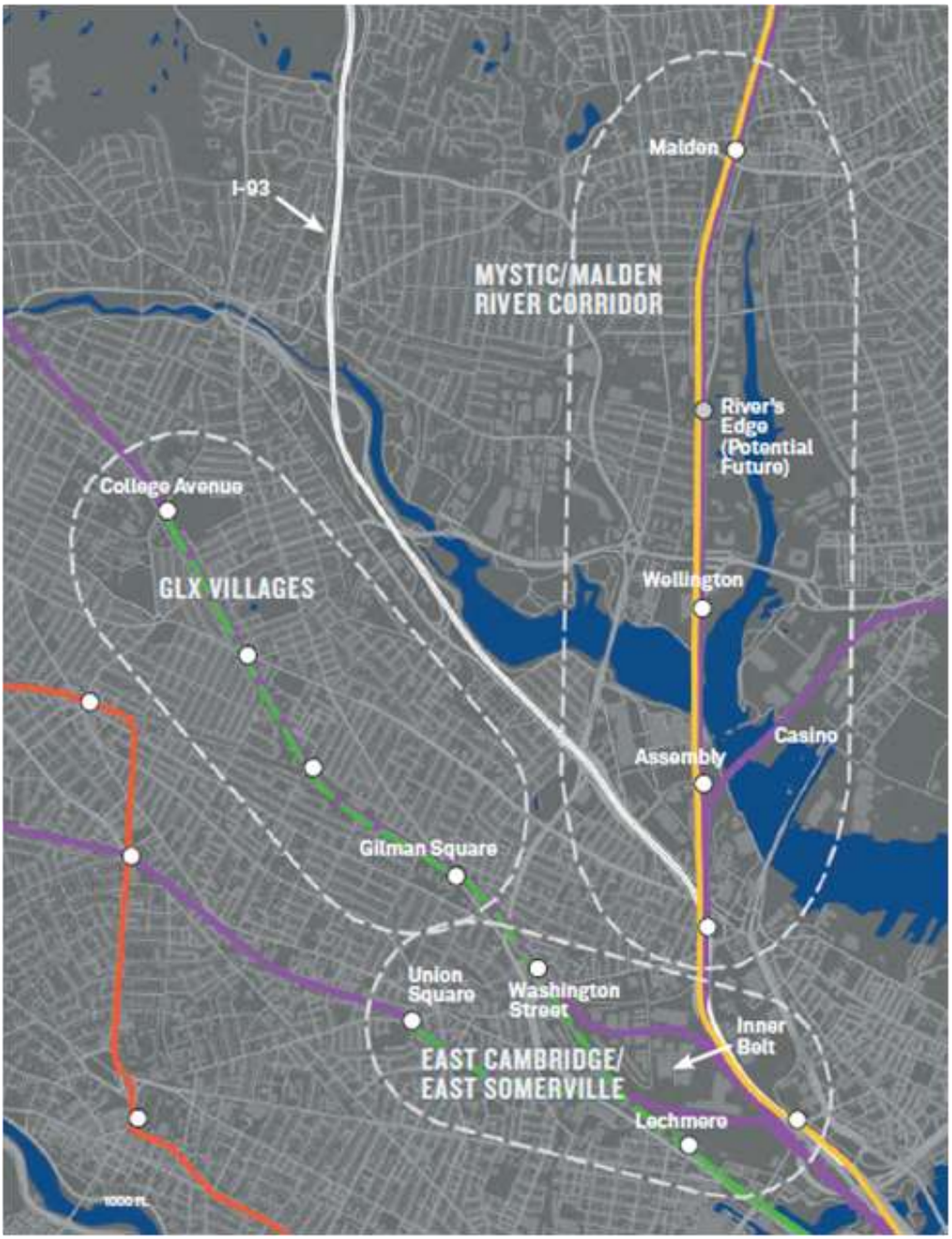
At the regional level, Lynn is a focal point of the potential North Shore Transit Improvements, under study since the early 2000s. If the Blue Line were extended to Central Square and River Works, the entire Lynn Waterfront would gain one-seat rail rapid transit access to the Wonderland and Suffolk Downs development districts, Logan Airport, the Downtown Boston waterfront, and the financial district. The alternative, described in the Suffolk Downs/Wonderland section of this report, is a cross-connection to the Blue Line at a new Wonderland/Revere commuter rail station and the introduction of "urban rail" service, with more frequent trips and shorter, multiple-unit trains, on the Newburyport/Rockport line from North Station to Lynn. The development of the Lynn Waterfront would be well served by a decision as to which set of improvements will be pursued.

Regardless of the Blue Line outcome, Lynn will benefit from the completion of the Silver Line Gateway project and its interface with the Newburyport/Rockport line at the new Chelsea station. This project, described in detail in the Chelsea section of this report, will provide a direct transfer from the commuter line to the Silver Line. For passengers traveling from Lynn to the Airport or Seaport, the travel time savings will be at least 20 minutes.[75]

NORTH CORRIDOR

As shown in Figure 14, the North Corridor extends from Charlestown and East Cambridge through Somerville, Everett, Medford, and Malden along the rail and highway corridors of eastern Middlesex County. It consists of three contiguous Growth Clusters; their estimated development potential is presented in Table 25.

FIGURE 14: The North Corridor and Its Three Growth Clusters



Source: AECOM

TABLE 25: North Corridor; Housing and Job Capacity by Growth Clusters

	RECENT/ CURRENT		IN THE PIPELINE		RECENT/CURRENT PLUS PIPELINE		LONG-TERM POTENTIAL		TOTAL	
	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs
East Cambridge/ East Somerville	1,300	1,000	1,500	8,400	2,800	9,400	5,600	24,100	8,400	33,500
GLX Villages	200			300	200	300	500	2,500	700	2,800
Mystic/Malden River Corridor	3,000	15,000	1,100	10,500	4,100	25,500			4,100	25,500
Corridor Total	**4,500**	**16,000**	**2,600**	**19,200**	**7,000**	**35,000**	**6,000**	**27,000**	**13,000**	**62,000**

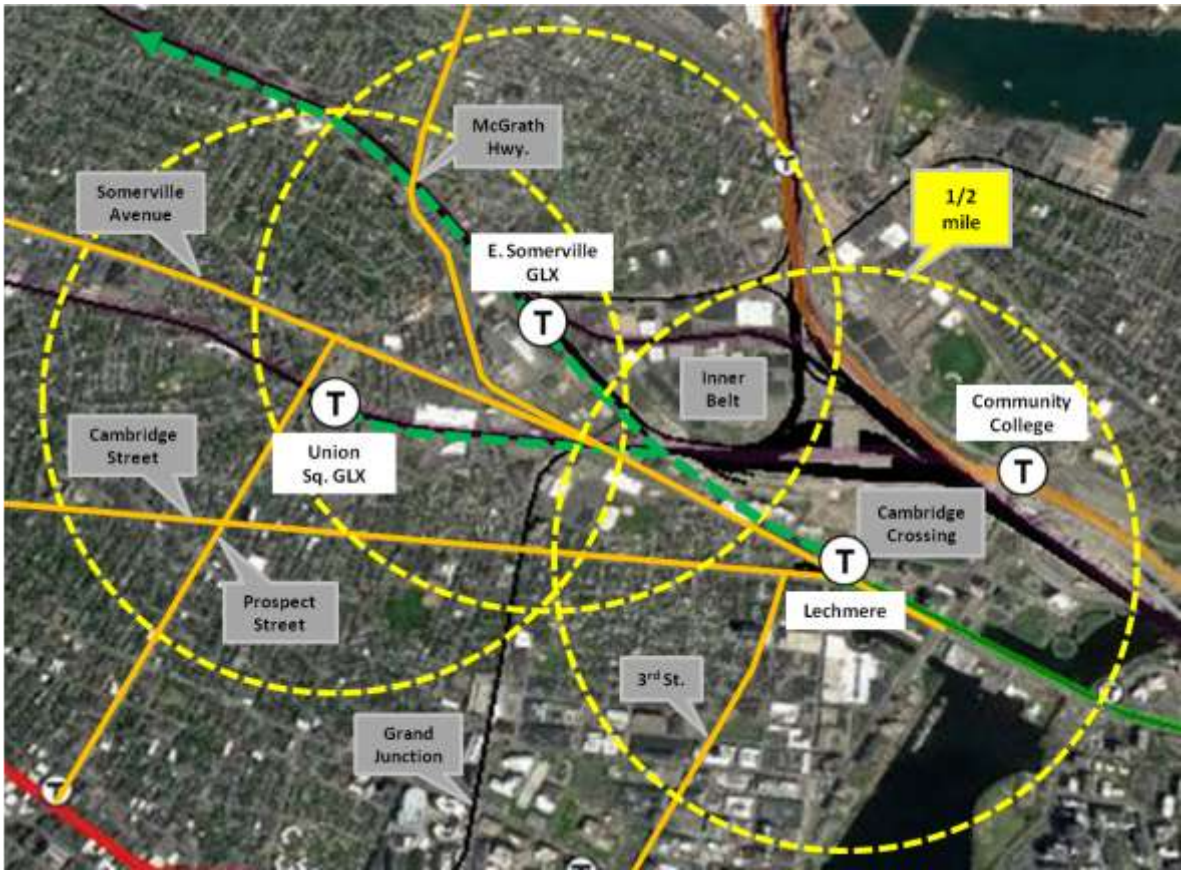
Source: AECOM; compiled from Cities of Cambridge and Somerville; MEPA database; MAPC MassBuilds (see Appendix C-1).
Shaded Corridor Totals are rounded to the nearest thousand; other cells are rounded to nearest hundred.

EAST CAMBRIDGE/EAST SOMERVILLE

OVERVIEW

The East Cambridge/East Somerville Growth Cluster includes three station areas: Lechmere and the transformative Cambridge Crosing development (formerly North Point) on the Green and Orange Lines; Union Square, whose station on the Green Line Extension (GLX) will serve Somerville's largest square as well as the planned mixed-use redevelopment of the Boynton Yards industrial area; and the East Somerville GLX station, which will serve the Brickbottom and Inner Belt redevelopment areas.[76] As shown in FIGURE 15, the three station areas overlap one another as well as the Cambridge-Somereville city line, with the potential to influence land use and travel patterns in both cities.

FIGURE 15: East Cambridge/East Somerville



Source: AECOM

DEVELOPMENT DISTRICTS

While the three station areas are close together, they can be understood as two distinct development districts.

Lechmere/Cambridge Crossing

Cambridge Crossing (formerly North Point), one of the region's largest mixed-use transit-oriented developments, has resumed its long-term, multi-phased buildout. Located mostly in Cambridge, it also includes building sites in Somerville and Boston. The project is facilitating the relocation and redesign of Lechmere Station (necessary for GLX). Cambridge Crossing is also served by Community College Station on the Orange Line and thus enjoys parallel one-seat transit connections to North Station, Downtown Boston, and Back Bay.

Union Square/East Somerville

The Union Square and East Somerville (formerly Washington Street) GLX stations are within walking distance of one another, and the McGrath Highway overpass, which separates them today, is to be "de-elevated", facilitating a more synergistic relationship as development unfolds. The City of Somerville's comprehensive plan, *Somervision*, identifies the four development areas served by these two stations—Union Square, Boynton Yards, Brickbottom, and Inner Belt—as "Areas to be Transformed" through high-density, mixed-use TOD. Along with Assembly Square, these areas represent 15% of Somerville's land area but are targeted for 85% of its growth from 2010-2030.77

Table 26 summarizes the important development sites in the East Cambridge/East Somerville Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 26: Key Development Sites, East Cambridge/East Somerville

Lechmere/Cambridge Crossing		Status *
Cambridge Crossing (formerly North Point)	Multi-phase, region-scale, mixed-use program on two rapid transit lines. Residential, office, R&D, institutional.	R/C, P, F
159 First Street/150 Second Street	Mixed-use residential and office.	R/C
249 Third Street	Future multi-family.	LT
ZINC (22 Water Street)	Large multi-family adjacent to Cambridge Crossing.	R/C
Union Square/East Somerville		
Union Square	*Somervision* plan for "Area to Transform"; roughly 1,300 residential units, 7,900 jobs. Includes the "D Parcels" assembled by the City and designated to a master developer.	R/C
Boynton Yards	*Somervision* plan for "Area to Transform"; roughly 1,000 residential units, 7,500 jobs.	LT
Brickbottom/Inner Belt	*Somervision* plan for "Area to Transform"; roughly 2,200 residential units, 12,200 jobs.	LT
111 South Street	Large multi-family project.	P
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from Cities of Cambridge and Somerville; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 27 presents, for the three Green Line stations located in the East Cambridge/East Somerville Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). While there are no ridership data for East Somerville and Union Square Stations (which do not yet exist), the other metrics are available for their future locations. Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison. MAPC categorizes these three stations as "Transformational Subway", which reflects how they are seen by the two cities.

TABLE 27: Station Characteristics, East Cambridge-East Somerville

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Green Line											
Lechmere *	*Transform. Subway*	27%	6,421	4,116	17,841	776,000	386,000	51%	62%	.61	13.98
E. Somerville GLX **	*Transform. Subway*	—	—	7,396	8,645	723,000	350,000	37%	45%	.72	16.12
Union Square GLX **	*Transform. Subway*	—	—	4,899	7,658	674,000	286,000	39%	48%	.80	18.81

* The Lechmere values are for the existing station, which will be relocated across the street as part of the Green Line Extension (GLX) project and will gain access to jobs and workers located near new GLX stations to the west.

** The East Somerville and Union Square GLX stations are future conditions. Values are based on the station locations, but reflect today's transit network only (bus and pedestrian connections to existing Green, Orange, and Red Line stations).

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Lechmere today is one of the Green Line's highest-ridership stations, before it is relocated, modernized, and surrounded by the future buildout of the Cambridge Crossing development program.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are already well below the region- and system-wide averages. When the Green Line Extension and all three stations are operating, these metrics will undoubtedly drop further.
- The three stations are well above the system-wide averages for households and jobs within a half-mile radius—despite the fact that most of Cambridge Crossing (formerly North Point), and all of the planned development at Union Square, Boynton Yards, Brickbottom, and Inner Belt, has yet to occur.
- On the combined Index of Housing+Transportation costs, the East Somerville and Union Square station areas are more affordable that the region as a whole; they fall below the threshold of 45% of Area Median Income (AMI) and well below region-wide average of 48%. Lechmere, on the other hand, is somewhat higher than the 45% benchmark and the regional average.
- Because of their one-seat rides to the Green Line central subway and their direct connections to the three other rapid transit lines, these three stations have large job and labor sheds. These will grow over time, as transformative development at Cambridge Crossing, Union Square, Boynton Yards, Brickbottom, and Inner Belt place each of these stations within a one-stop ride of thousands of new residents and jobs.

Transit Mobility Needs

The planned development in all three East Cambridge/East Somerville station areas relies on the implementation of the Green Line Extension. In the case of Union Square and East Somerville, the reliance is fundamental; Somerville's concept of these districts as "Areas to be Transformed" is based on GLX service. In the case of Cambridge Crossing, where Green and Orange Line service already exists, the GLX project will create a new Lechmere Station within and connected to the development footprint.

The existing rapid transit system is no less important. The Green Line Extension will ultimately work only as well as the Green Line in general; the fleet replacements and central subway improvements contemplated in the MassDOT Capital Improvement Plan will be critical to long-term TOD success on the Extension, especially if they enable three-car trains in the future. The MBTA's programmed replacement of the Orange Line fleet, and the capacity expansion

that comes with it, is critical not only for direct Orange Line access to Cambridge Crossing, but for Green Line transfers at North Station and for potential connections at Sullivan (see below).

Radial connections into the center of the transit system do not represent the entire mobility challenge for these three station areas; cross-connections on their own side of the Charles River have economic development implications as well. As noted previously in the discussion of Kendall Square, a direct, rapid bus connection between Lechmere and Kendall is important to both districts, and MassDOT is studying a priority bus corridor that would achieve this.[78] From a Lechmere/Cambridge Crossing perspective, this link would not only provide convenient access to jobs at Kendall, but it would create a simpler way to connect to the Red Line, avoiding the need to take the Green Line and transfer at Park Street. There is also interest in a menu of potential connections linking Sullivan Station, East Somerville, Union Square, Lechmere, and Kendall; these could be made in part via the Grand Junction, the proposed Kendall/Lechmere bus priority corridor, or a combination of these and other alignments.[79]

Finally, the transformative redevelopment of the Boynton Yards, Brickbottom, and Inner Belt areas will require an investment in district infrastructure—a TOD-friendly grid of streets, sidewalks, and infrastructure that supports development in each area, connects it to the station, and ties into the emerging East Cambridge/East Somerville pedestrian and bicycle network.

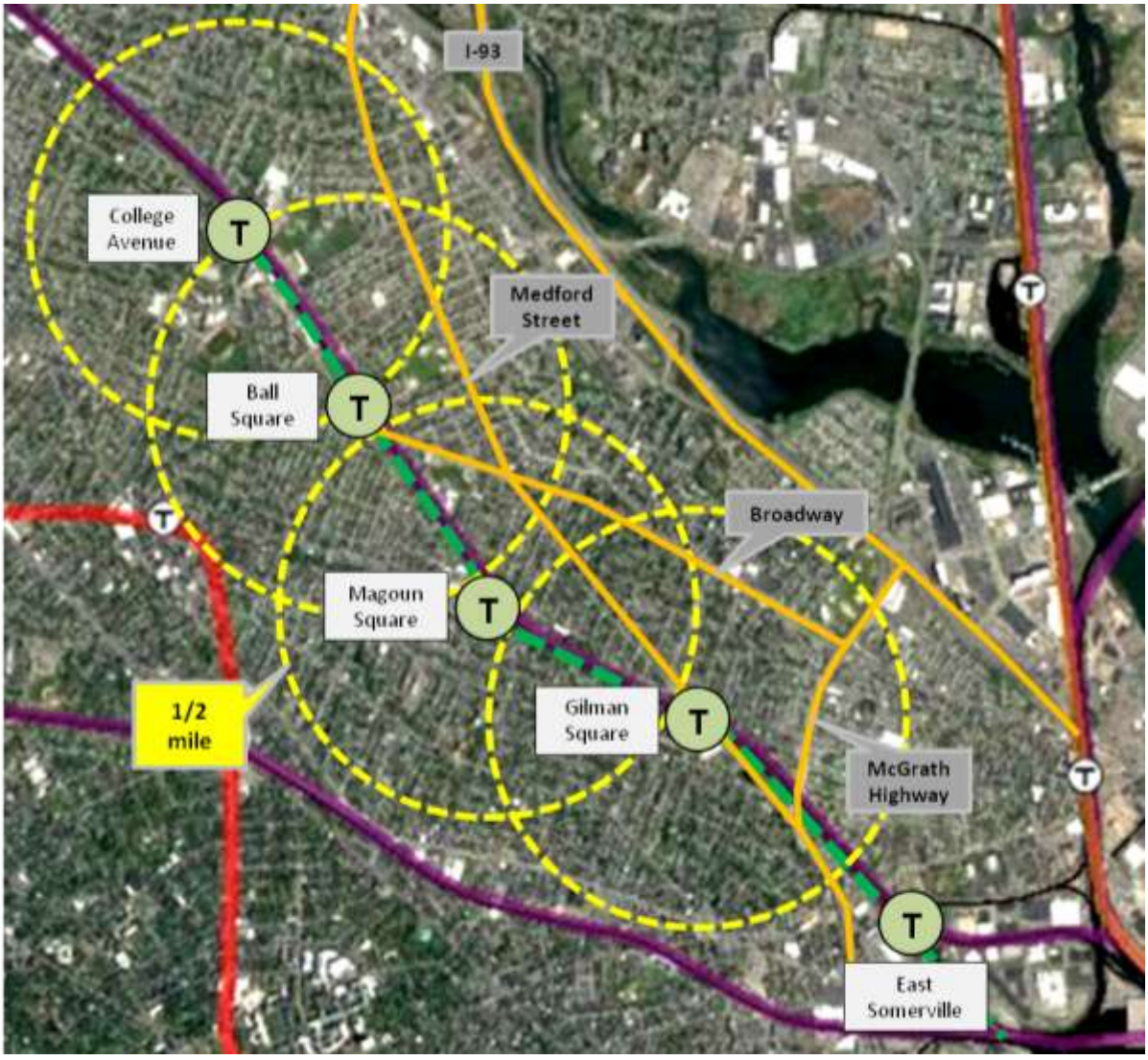
SUMMARY OF TRANSIT NEEDS, EAST CAMBRIDGE/EAST SOMERVILLE
General
Implementation of GLX
Rapid Transit System State of Good Repair: Reliability and Capacity of Green, Orange, Red Lines
Enhanced connections among Sullivan, East Somerville, Union Square, Lechmere
District infrastructure at Boynton Yards, Brickbottom, Inner Belt
Station-Specific
Lechmere-Kendall priority bus corridor

GREEN LINE EXTENSION VILLAGES

OVERVIEW

While Somerville's Comprehensive Plan treats the Union Square and East Somerville districts as "Areas to Transform", it treats the three remaining Somerville GLX stations as "Areas to Enhance". Gilman, Magoun, and Ball Squares are places where the Green Line Extension is expected to stimulate infill and reinvestment. College Avenue Station in Medford presents an opportunity to enhance the Tufts University campus is a transit, pedestrian, and bicycle-friendly way.

FIGURE 16: GLX Villages



Source: AECOM

DEVELOPMENT DISTRICTS

Each of the four station areas in the GLX Villages Growth Cluster defines a distinct development district. In all cases, individual catalyst projects create an opportunity for additional infill and reinvestment in the surrounding blocks.

Gilman Square

This station serves Somerville's central cluster of civic institutions, including City Hall, Somerville High School, and the Public Library. There are infill development opportunities on the Medford Street side of the square.

Magoun Square

This station serves a traditional local business district and the connecting segment of Lowell Street. A major residential project--the redevelopment of an industrial site adjoining the station--has been completed.

Ball Square

This local business district straddles the Somerville-Medford city line. Residential TOD is underway on Boston Street a short walk from the station, and the station, when complete, will include a joint development opportunity as well.

College Avenue

This station is located in Medford at an important crossroads for the Tufts University campus. Tufts is planning an academic and office center tied to the station.

Table 28 summarizes the important development sites in the GLX Villages Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 28: Key Development Sites, Glx Villages

Gilman, Magoun, and Ball Square		Status *
Somervision projection	City's combined buildout projection (primarily infill) for these three station areas, net of listed projects.	LT
Magoun Square		
Maxwell's Green	Large multi-building apartment project adjoining station off Lowell Street.	R/C
Ball Square		
Sphere Apartments	Infill-scale; close to station in Medford.	R/C
Future joint development	Station construction will leave the MBTA with a developable site on Boston Street.	LT
College Avenue		
Tufts building at College Avenue	Academic and university office building with direct connection to station.	P
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from City of Somerville; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 29 presents, for the four future Green Line stations in the GLX Villages Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). The ridership columns are, of course, blank. Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is

provided for comparison. MAPC categorizes these stations as "Neighborhood Subway", similar to the Green Line neighborhood stations in Brookline.

TABLE 29: Station Characteristics, GLX Villages

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Green Line											
Gilman Sq.	*Neighbhd. Subway*	—	—	7,906	6,796	665,000	305,000	39%	48%	.84	20.26
Lowell Street	*Neighbhd. Subway*	—	—	7,359	2,747	561,000	221,000	45%	54%	.91	22.21
Ball Square	*Neighbhd. Subway*	—	—	6,050	2,537	585,000	289,000	43%	53%	.95	23.26
College Ave.	*Neighbhd. Subway*	—	—	3,638	1,083	585,000	292,000	47%	57%	.95	23.22

The GLX stations are future conditions. Values are based on the station locations, but reflect today's transit network only (bus connections to existing Green, Orange, and Red Line stations).

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household approach the system-wide averages, although they are well below the region-wide averages. As in the case of East Somerville and Union Square, these values reflect today's conditions; car ownership and use are expected to drop once Green Line service is in place.
- The Gilman, Magoun, and Ball Square stations areas have residential density (households within a half-mile) well above the system-wide average. However, only Gilman Square—with City Hall and the High School next door—has employment density above the region-wide average.
- On the combined Index of Housing+Transportation costs, the GLX station areas are slightly more affordable than the region or the MBTA system as a whole. Anticipation of light rail service is already raising housing costs along the GLX corridor, a trend that may be countered by a more affordable commute.[80]
- In today's transit network, these future station sites, relying on bus connections to the rapid transit system, have 30-minute job and labor sheds well in excess of the region-wide average. With GLX service, these commuting sheds will grow, making the GLX Villages attractive places to live or run a business.

Transit Mobility Needs

The obvious and fundamental transit need for these four station areas is implementation of the GLX project, which is the basis for TOD planning and project development to date in both Somerville and Medford. As in the case of the GLX stations in East Somerville, TOD in these smaller village settings also relies, in the long run, on the capacity and reliability of the Green Line as a whole.

SUMMARY OF TRANSIT NEEDS, GLX VILLAGES
General
Implementation of GLX
Rapid Transit System State of Good Repair: Reliability and Capacity of Green, Orange, Red Lines

MYSTIC/MALDEN RIVER CORRIDOR

OVERVIEW

The Mystic/Malden River Corridor extends north along the Orange Line from Sullivan Square to Malden Center. Today this corridor is anchored by two landmark mixed-use TOD projects: the earlier Station Landing at Wellington and the newer, larger Assembly Row, organized around the MBTA's new Assembly infill station. The TOD corridor is poised to extend in both directions—southward to Sullivan Square, and northward to Malden Center and the historically industrialized Malden River. This Growth Cluster also includes the Wynn Boston Casino, on the Everett waterfront facing Assembly and Sullivan.

FIGURE 17: Mystic-Malden River Corridor

Source: AECOM

DEVELOPMENT DISTRICTS

Sullivan/Assembly

Although located in different cities (Boston and Somerville, respectively) Sullivan and Assembly Stations are just three-fifths of a mile apart. Assembly Station serves a planned TOD district of 130 acres. The Assembly Row project—a five million-square foot mixed use riverfront community—designed the infill station and funded $15 million of its cost, including all pre-construction activities. The paradigm of an infill station, propelled by large-scale TOD and delivered with developer participation, has subsequently been replicated elsewhere in the system.

Sullivan Square, an important rapid transit/bus route transfer station, is constrained by the I-93 and Orange Line viaducts and a disjointed street pattern. However, the City of Boston, in its Imagine Boston 2030 Master Plan, identifies Sullivan as one of six "neighborhood expansion" sites, where available land and strategic infrastructure changes could create a significant opportunity.[81]

Everett Waterfront

The Wynn Boston Casino, one of the region's largest single development projects, is being built on the Everett waterfront directly across the Mystic River from Assembly and Sullivan Squares; it is connected to the latter by the Alford Street Bridge (Route 99). Concerns about the potential impact of casino traffic on Assembly, Sullivan, and Everett's own revitalization plans for Lower Broadway have led to a discussion of potential land and water transit improvements, discussed in the Transit Assessment which follows.

Malden Center

In recent years, a series of TOD projects has begun to change Malden Center into a denser, more diverse central business district. One project, directly adjoining the station, is replacing Malden's 1960s urban renewal-vintage City Hall with a mixed-use, transit-oriented development that includes new City offices.

River's Edge

Between Wellington and Malden Center is a 1.4-mile corridor of historically industrial land along the Malden River. Straddling the cities of Medford, Malden, and Everett, this corridor was the site, in the 1990s, of a tri-city development initiative known as Telecom City. In 2009, the effort was rebranded as River's Edge, with a mixed-use development program and a state Growth District designation.[82] Development has begun, and MassDOT has suggested, as part of its larger review of mobility issues in the tri-city area, that a developer-supported infill station be considered. With or without a new station, River's Edge presents an opportunity to create a continuous TOD corridor from Sullivan Square to Malden Center.

Table 30 summarizes the important development sites in the Mystic/Malden River Corridor Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 30: Key Development Sites, Mystic/Malden River Corridor

Sullivan/Assembly		Status *
Assembly Row	Remaining buildout of region-scale mixed-use TOD project; Phase 1 and infill Orange Line station completed 2013.	R/C
Office and Research Center at Assembly	Separate major mixed-use development, next to Assembly Row and Orange Line station.	P
Hood Business Park	Multi-phase redevelopment of high-profile industrial site. Some residential, mostly office.	P
32 Cambridge Street	Large multi-family development.	P
Everett Waterfront		
Wynn Boston Casino	High-profile regional destination on Mystic River waterfront; BRT and ferry proposals as part of mitigation.	R/C
The Batchyard	On Broadway near Wynn Casino; large multi-family development.	R/C
River's Edge		
River's Edge	Tri-city mixed-use, multi-phase development program. One residential phase completed; program could intensify in response to MBTA interest in an infill Orange Line Station.	R/C, P
Wellington Parkside	Recent multi-family development on Everett side of Malden River.	R/C
Medford Mews	Recent multi-family development on Medford side of Malden River, across Rt. 16 from Wellington Station.	R/C
Malden Center		
Malden Government Center/Jefferson Apartments	Redevelopment of City Hall and environs as a mixed-use TOD center.	R/C
Residences at Malden Square	Recent multi-family close to station.	R/C
Residences at Malden Station	Recent multi-family close to station.	C
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from Cities of Somerville, Medford, and Malden; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 31 presents, for the four Orange Line stations in the Mystic/Malden River Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

Sullivan, Assembly, and Wellington are categorized by MAPC as "Transformational Subway"—having the "potential for transformative change through district-scale land development projects".[83] Malden Center is categorized as an "Urban Gateway".

TABLE 31: Station Characteristics, Mystic-Malden River Corridor

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Orange Line											
Sullivan	Transform. Subway	29%	10,125	3,131	5,186	845,000	484,000	44%	54%	.77	18.58
Assembly *	Transform. Subway	27%	1,864 *	482	1,417	825,000	450,000	—	—	.85	20.80
Wellington	Transform. Subway	23%	7,609	1,376	2,036	699,000	341,000	50%	61%	.84	19.39
Malden	Urban Gateway	31%	12,686	5,204	5,707	625,000	318,000	35%	43%	.72	17.33

* Assembly Station values reflect the first partial year of operation, with portions of Assembly Row Phase I development in place but not the Partners HealthCare headquarters, which is open as of this writing.

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Sullivan, Wellington, and Malden have robust ridership, in the higher tier of Orange Line stations outside of Downtown and Back Bay. The low figure for Assembly is from 2013, the first partial year of operation, and is unrepresentative of current, normalized operations.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are somewhat below the system-wide average and well below the region-wide average. The percentage of transit use by station area residents is correspondingly above average.
- Housing and employment density is substantially above the system-wide average at Malden Center. As the Assembly station area is built out, it will achieve high residential density and even higher employment density; Partners HealthCare alone, with 4,500 jobs literally attached to the station, is not reflected in the 2013 data.
- On the combined Index of Housing+Transportation costs, Malden Center is significantly more affordable than the region or the MBTA system as a whole; Sullivan is somewhat so.
- All four stations, but especially Sullivan and Assembly, have large 30-minute job and labor sheds, reflecting their one-seat connections to Downtown and Back Bay and their direct transfer connections to the Orange, Red, and Green Lines. Sullivan and Assembly, with their slightly shorter rides, have job and labor sheds three times the regional average. This advantage likely explains Partners' attraction to Assembly Square and the attraction of Assembly and Wellington as residential locations for commuting households.

Transit Mobility Needs

The Mystic/Malden River Corridor is, first and foremost, the Orange Line corridor from Malden Center to Sullivan Square, and its top TOD priority is the reliability and capacity of Orange Line service. The MBTA's programmed investment to replace and expand the Orange Line fleet, and to modernize the Wellington Car House to support it, will enable the MBTA to improve peak-hour headways from the current six minutes to as little as 4.5 minutes, a change that should create excess peak-hour capacity at every station.[84]

As part of its larger review of mobility issues in the Everett/Medford/Malden area, MassDOT has suggested that a developer-supported infill station, similar in concept to Assembly Station, be considered.[85] If such a station were built, a district infrastructure program focused on it (including a pedestrian bridge connecting the station to the Everett side of the Malden River) would need to be developed as well. Absent an infill station, district infrastructure

connecting the development corridor to Malden and Wellington Stations, including perhaps a River's Edge district shuttle, would be needed. The other station where a transformative district infrastructure program will be required is Sullivan Square.

The siting of the Wynn casino created a widely recognized need to develop mobility alternatives for the workforce and, ideally, for some patrons as well. Moreover, Everett was already planning for economic development on Lower Broadway and in its large "Commercial Triangle" area bordering Chelsea. This entire section of Everett is congested today, and additional traffic will impact the Wellington, Assembly, and Sullivan station areas. Wynn is responsible for ferry service connecting the casino site to Downtown Boston and the Seaport.

On the land side, working with the MBTA, the City of Everett, and other stakeholders, MassDOT has suggested a menu of enhanced bus improvements, of which the most important are:

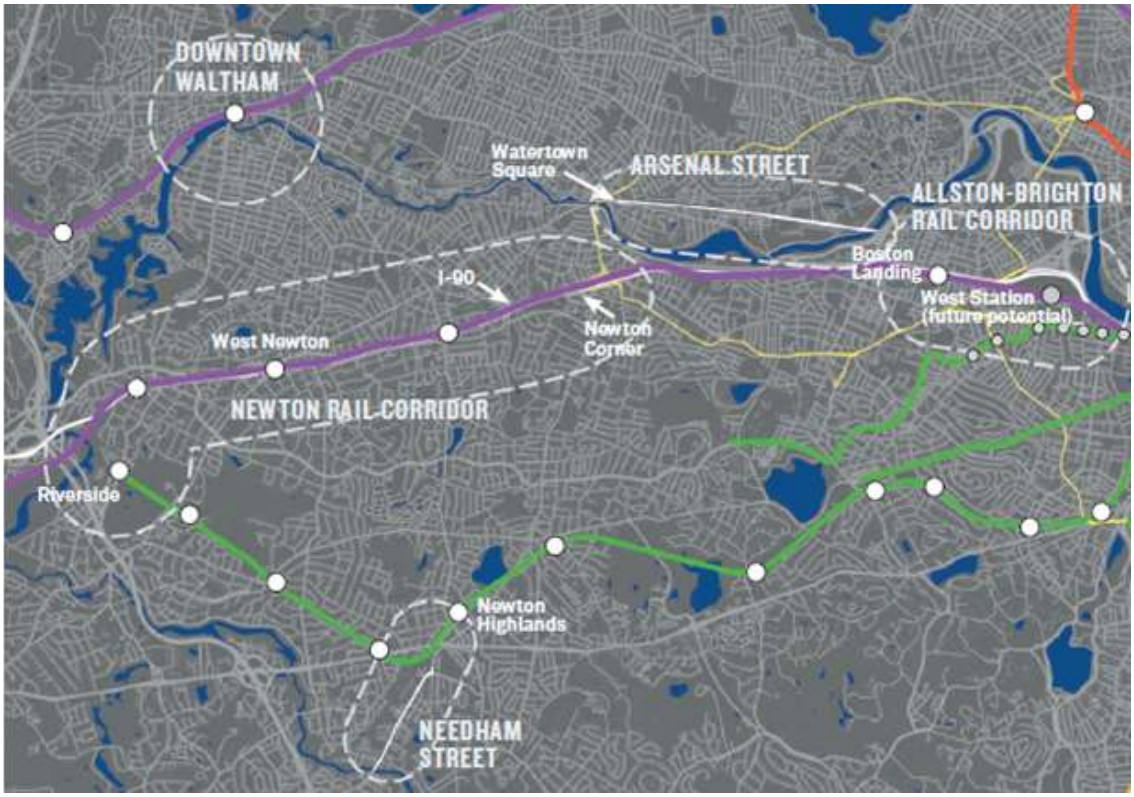
SUMMARY OF TRANSIT NEEDS, MYSTIC/MALDEN RIVER CORRIDOR
General
Rapid Transit System State of Good Repair: Reliability and Capacity of Orange Line, connections to Green and Red Lines
Bus priority corridor/dedicated bus lanes on Broadway, Everett
Potential Silver Line Gateway Extension to Everett and Malden
Station-Specific
Ferry service from Wynn casino to Downtown Boston and Seaport
Potential future River's Edge infill TOD station
District infrastructure at Sullivan Square

- the installation of bus-only lanes on Upper and Lower Broadway (Route 99 to Sullivan Square), for which a pilot study is underway at this writing;
- a future western extension of the Silver Line Gateway from Chelsea Station to Broadway in Everett, and potentially all the way to Malden Center Station via Ferry Street.[86]

CHARLES RIVER CORRIDOR

Extending west from Allston, five Growth Clusters share an orientation to the regional rail network, the Masachusetts Turnpike, and the Charles River's historic influence on land use and transportation. The Growth Clusters are shown in Figure 18, and their estimated development potential in Table 32.

FIGURE 18: The Charles River Corridor and Its Five Growth Clusters



Source: AECOM

TABLE 32: Charles River Corridor; Housing and Job Capacity by Growth Clusters

	RECENT/ CURRENT		IN THE PIPELINE		RECENT/CURRENT PLUS PIPELINE		LONG-TERM POTENTIAL		TOTAL	
	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs
Allston-Brighton Rail Corridor	1,500	5,200	900	4,200	2,400	9,400	2,800	10,400	5,200	19,800
Arsenal Street	1,100	1,100		2,500	1,100	3,600	400	200	1,500	3,800
Newton Rail TOD Corridor	100		300	1,100	400	1,100	600		1,000	1,100
Needham Street			1,000	600	1,000	600	500	1,000	1,500	1,600
Downtown Waltham	300	100	300		600	100	800	2,000	1,400	2,100
Corridor Total	**3,000**	**6,400**	**2,500**	**8,400**	**6,000**	**15,000**	**5,000**	**14,000**	**11,000**	**29,000**

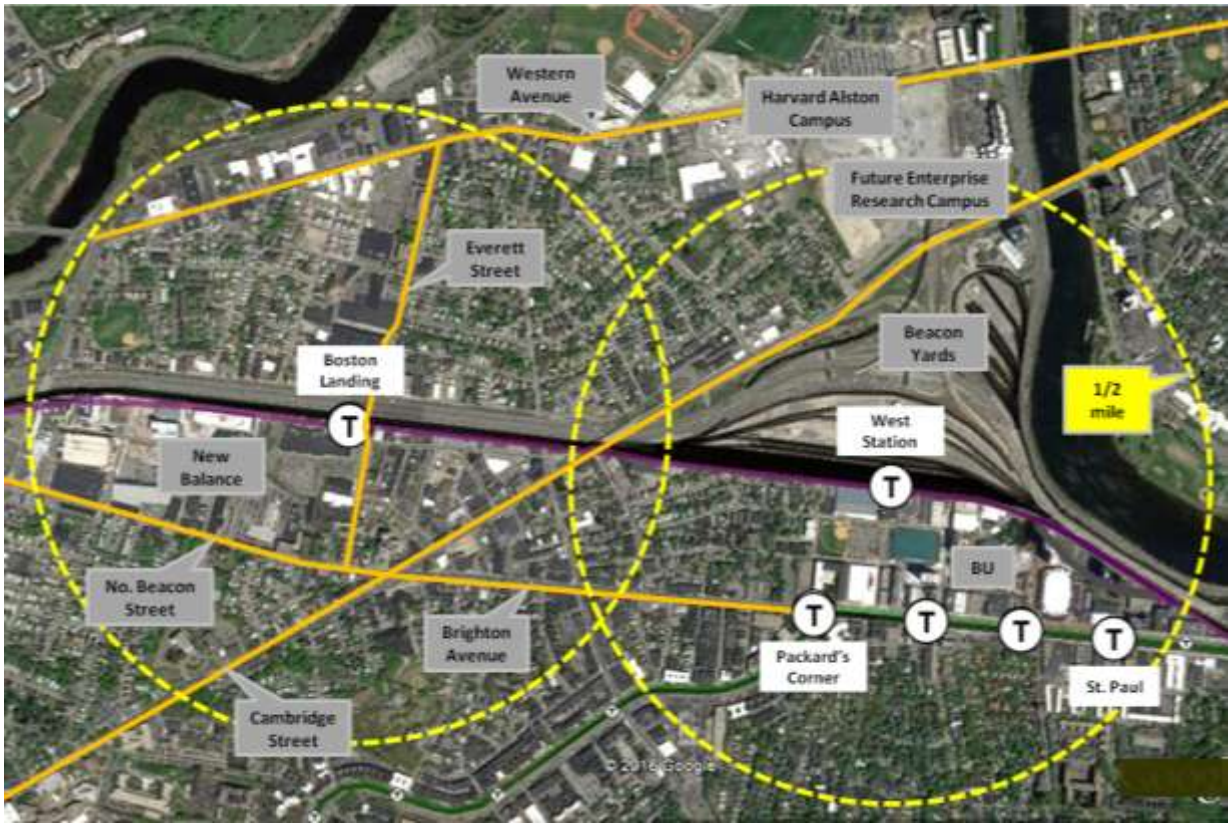
Source: AECOM; compiled from BPDA; Cities of Newton and Waltham; MEPA database; MAPC MassBuilds (see Appendix C-1). Shaded Corridor Totals are rounded to the nearest thousand; other cells are rounded to nearest hundred.

ALLSTON/BRIGHTON RAIL CORRIDOR

OVERVIEW

The Allston/Brighton Rail Corridor is defined by two infill stations on the Framingham/Worcester commuter rail line: Boston Landing, now being constructed in the Brighton neighborhood, and the future West Station at Allston Landing.

FIGURE 19: Allston/Brighton Rail Corridor



Source: AECOM

DEVELOPMENT DISTRICTS

Allston Landing

West Station will be built as part of MassDOT's massive project to realign the Allston Interchange of the Massachusetts Turnpike. The station will serve Harvard University's developing Allston campus, Boston University's West Campus. and a new grid of streets and blocks immediately north of the station designed to support 50 acres of mixed-use TOD, as well as potential air rights development, on land owned by Harvard.[87] The Green Line's B branch is a half-mile away on Commonwealth Avenue.

Harvard's current and planned development activity is concentrated on Western Avenue. The Univeristy has thus far completed several laboratory buildings and the Barry's Corner mixed-use development, and is preparing to build its Science and Engineering complex, the centerpiece of ita 10-year, city-approved Instititonal Master Plan. Future plans call for a 36-acre Research Enterprise Campus in a portion of Harvard's former railroad land between Wester Avenue and Cambridge Street, and ultimately the new TOD community at West Station.[88] Imagine Boston 2030 identifies Allston Landing/Beacon Yards as one of six major "neighborhood expansion" opportunity sites.[89]

Boston Landing

Boston Landing Station, funded and built by New Balance, is part of that company's headquarters and mixed-use TOD initiative. The development includes retail, office, hotel, and sports components, with a major residential development next door. The housing—the Residences at 125 Guest—consists of 295 units with just 155 residential parking spaces, barely .5 spaces per unit in a setting new to rail transit.[90] The station is also within walking distance of several new multi-family residential developments on Western Avenue.

Table 33 summarizes the important development sites in the Allston/Brighton Rail Corridor Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 33: Key Development Sites, Allston/Brighton Rail Corridor

Allston Landing		Status *
Barry's Corner	Harvard mixed-use development at Western Avenue triangle	R/C
Harvard Chao, Klarman, and Life Laboratories	Initial Allston science campus investments.	R/C
Harvard Science & Engineering Complex and balance of 10-year Institutional Master Plan	Major facilities on Western Avenue.	R/C, P
Harvard Research Enterprise Campus	Future phase of Allston campus, occupying a 36-acre portion of the former rail properties.	P
Allston Interchange land and air rights development	50-acre new community at West Station, following MassDOT's interchange, station, and street grid investments.	LT
Residential infill projects	Several.	R/C, P
1047 Commonwealth Avenue	Large multi-family project.	R/C
Packard Crossing.	Large multi-family project.	R/C
Boston Landing		
Boston Landing	New Balance headquarters and mixed commercial, including office, hotel, Bruins and Celtics practice venues; developer-funded infill commuter rail station.	R/C
Residences at 125 Guest	Multi-family companion project to Boston Landing.	R/C
530 Western Avenue, Charlesview, Telford 180	Cluster of multi-family projects on Western Avenue, within walking distance of Boston landing station.	R/C
Stop & Shop	Mixed-use, multi-phase redevelopment of store location on Guest Street	P, LT
Residential infill projects.	Several.	R/C, P
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 34 presents, for the existing and future stations in the Allston/Brighton Rail Corridor Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

MAPC has not yet assigned a station typology designation to Boston Landing or the future West Station. The Green Line B Branch stops along Commonwealth Avenue, a short distance from West Station, are categorized as "Neighborhood Subway" stations.

TABLE 34: Station Characteristics, Allston/Brighton Rail Corridor

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Framingham/Worcester Line											
West Station (Future) *	TBD		—			771,000	352,000	38%	47%		
Boston Landing	TBD	38%	—	3,546	10,230	738,000	328,000	42%	52%	.71	17.62
Green Line B											
St. Paul St.	Neighbhd. Subway	33%	1,296	4,454	5,259	757,000	325,000	45%	56%	.49	10.85
Pleasant St.	Neighbhd. Subway	33%	1,167	5,602	4,940	735,000	301,000	43%	53%	.46	10.35
Babcock St.	Neighbhd. Subway	38%	1,387	5,875	5,104	764,000	345,000	45%	56%	.45	10.45
Packard's Cnr.	Neighbhd. Subway	40%	2,654	6,958	6,564	752,000	339,000	41%	50%	.47	11.30

* West Station is planned for construction before 2020; its Job Shed, Labor Shed, and H+T values are based on the proposed station location.

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- The four Green Line stops are in the higher tier of ridership on the surface B Branch.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are among the lowest in the system, and the percentage of transit use by station area residents is among the highest.
- Housing and employment density are substantially above the system-wide average; jobs within a half-mile of Boston Landing are especially high..
- On the combined Index of Housing+Transportation costs, this corridor is somewhat more affordable than the region or the MBTA system as a whole.
- The future commuter rail stations and the existing Green Line stops have large 30-minute job and labor sheds, reflecting their one-seat connections to Back Bay and Downtown. The values are uniformly more than double the region-wide averages.

Transit Mobility Needs

The defining infrastructure investments in the Allston/Brighton Rail Corridor Growth Cluster are the new rail stations: the privately funded Boston Landing, which is under construction; and West Station, to be jointly funded by public and private sources, which is still in the planning process as part of MassDOT's Allston Interchange project. The emergence of Allston Landing and the former Beacon Yards as a major TOD community depends on the implementation of West Station and its 50 acres of district infrastructure.

Boston Landing and West Station are on the busy Worcester-Framingham commuter rail line. Their development potential would be enhanced by the introduction of "urban rail" service on the Newton-to-Boston segment—more frequent service and shorter trains, using multiple unit technology rather than standard locomotives. The value of

such service is discussed further in the Newton Rail TOD Corridor section which follows.

This Growth Cluster will benefit from the MBTA's planned investments in the reliability and capacity of the Orange and Red Lines, which intersect the Worcester-Framingham Line at Back Bay and South Station, respectively. The Green Line's B Branch, which will benefit from reinvestment in the Green Line's rolling stock, signals, and traction power system, is an integral part of the Allston Landing/West Station area.

The opportunity presented by West Station is even larger than the creation of a new 50-acre TOD district with commuter rail at its core. West Station can emerge as a multi-modal hub, where commuter rail interchanges with local bus routes, Harvard and BU shuttles, and two new cross-connecting transit services: to Kendall, East Cambridge, and East Somerville via the Grand Junction river crossing; and to the Longwood Medical Area.

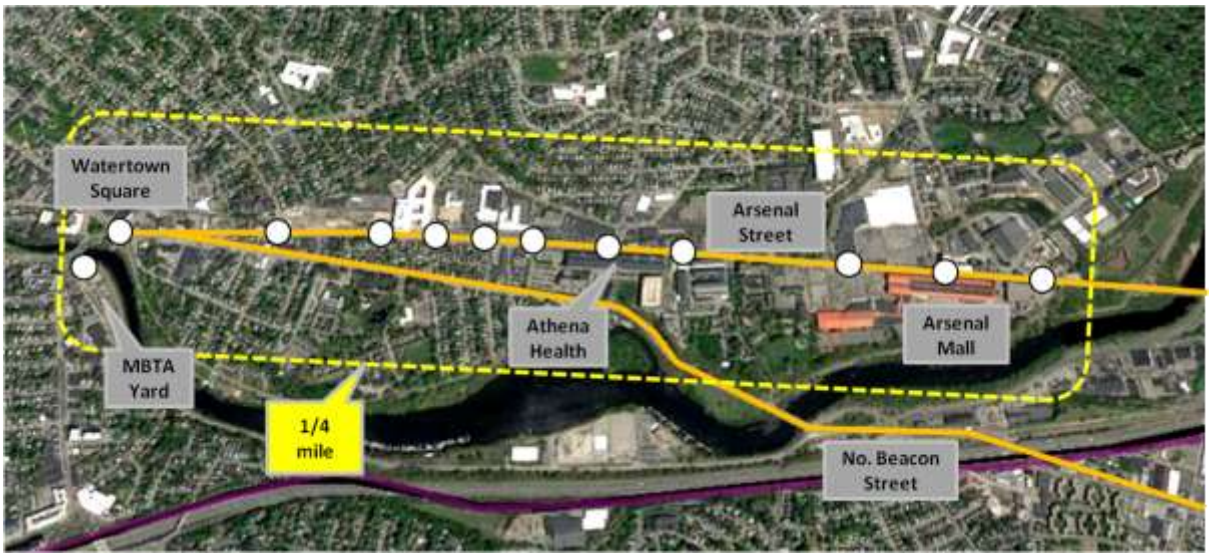
SUMMARY OF TRANSIT NEEDS, ALLSTON/BRIGHTON RAIL CORRIDOR
General
Urban Rail service on the Newton-Boston portion of the Worcester-Framingham Line
Rapid Transit System State of Good Repair: Reliability and Capacity of Green, Orange, Red Lines
Potential cross-town service from West Station to Kendall, East Cambridge/East Somerville via Grand Junction
Potential cross-town service from West Station to to LMA
Station-Specific
Introduction of service at Boston Landing
Implementation of West Station
West Station district infrastructure

ARSENAL STREET

OVERVIEW

Arsenal Street in Watertown is the only Growth Cluster not served by rail; it is a traditional MBTA bus corridor whose route currently connects to Central Square on the Red Line. Bus stops are indicated by white dots in Figuire 20. At the western end of the corridor, Watertown Square is also served by two Key Bus Routes, the #57 to Kenmore and the #71 to Harvard. A legacy industrial corridor, Arsenal Street evolved over time into a mostly commercial strip. That has changed, as a series of higher-density residential, hotel, office, and mixed-use projects are underway or in the pipeline.[91] At the west end of Arsenal Street, Watertown Square has room for infill and intensification.

FIGURE 20: Arsenal Street



DEVELOPMENT DISTRICTS

Arsenal Street parallels the Charles River for nearly two miles, from its connection to Western Avenue on the east to Watertown Square on the west. There are three recognizable development districts.

Arsenal

The historic arsenal, now in retail and office use, occupies the eastern half of the corridor. Current and planned developments include major upgrades of the two arsenal properties, as well as new hotel and office projects north of Arsenal Street.

Middle Segment

Two major residential developments, totaling nearly 600 units, are underway in the middle segment of the corridor, between the Arsenal properties and the Square

Watertown Square

Watertown's central business district lies on both sides of the Charles River. It includes several surface parking lots which could accommodate infill development, as well as an MBTA bus yard. Table 35 summarizes the important development sites in the Arsenal Street Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 35: Key Development Sites, Arsenal Street

Arsenal		Status *
Arsenal on the Charles	AthenaHealth's upgrade and intensification project.	P
Arsenal Yards	Major mixed-use repositioning of the Arsenal mall, including housing.	R/C, P
The LYNX @ 480 Arsenal	New office building.	R/C
Marriott Hotel	New hotel across the street from Arsenal complex.	R/C
80 Elm Hotel	New hotel near Arsenal complex.	R/C
Middle		
Elan	Major multi-family development.	R/C
The Gables	Major multi-family development.	R/C
Watertown Square		
MBTA Watertown Yard	Strategic riverfront site in town center; could support substantial mixed-use program.	LT
Town parking lots	Comprehensive Plan envisions restructuring these lands and freeing up development potential.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from Town of Watertown; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 36 presents the available station area metrics for Arsenal Street. The data are limited because there are no rail stations, but the Center for Neighborhood Technology datasets, which can be tuned to any location, allow us to look at job access and affordability.

TABLE 36: Station Characteristics, Arsenal Street

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Key Bus Locations on Arsenal Street:											
Arsenal Mall						673,000	277,000	39%	48%		
Central Area						605,000	239,000	37%	45%		
Watertown Sq.						754,000	285,000	42%	51%		
Bus stop ridership, transit use, households, jobs, cars, and VMT data are not available. Job Shed, Labor Shed, and H+T Affordability are based on the Census Blocks containing the bus stop locations. Arsenal Mall data for Addington Street stop; Central Area data for School Street stop.											

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Despite being served directly only by conventional bus routes, Arsenal Street has 30-minute transit job sheds that are more than double the region-wide average, and labor sheds well in excess of the region-wide average.

- Arsenal Street remains a more affordable place to live than the region as a whole. Its combined Housing+Transportation Affordability Index falls below the 45% of income benchmark and the 47% region-wide average.
- The MBTA's #70 and #70A bus routes had an overall daily ridership of 5,255 in FY2012—in the top 25 out of 169 routes.[92] Data for individual stops or segments is not available.

Transit Mobility Needs

The primary transit factor in the sustainable development of Arsenal Street is the quality and reliability of the bus routes on Arsenal Street—the #70 and #70A, which originate in Waltham and terminate at Central Square Station on the Red Line. These routes have capacity issues today, which could be exacerbated by 2030.[93] MassDOT has discussed extending these routes to Kendall, so that Kendall-bound commuters will not need to the Red Line.[94] In the longer term, Arsenal Street service could be diversified, with a route terminating at West Station for easy access to Back Bay, South Station, and the LMA.

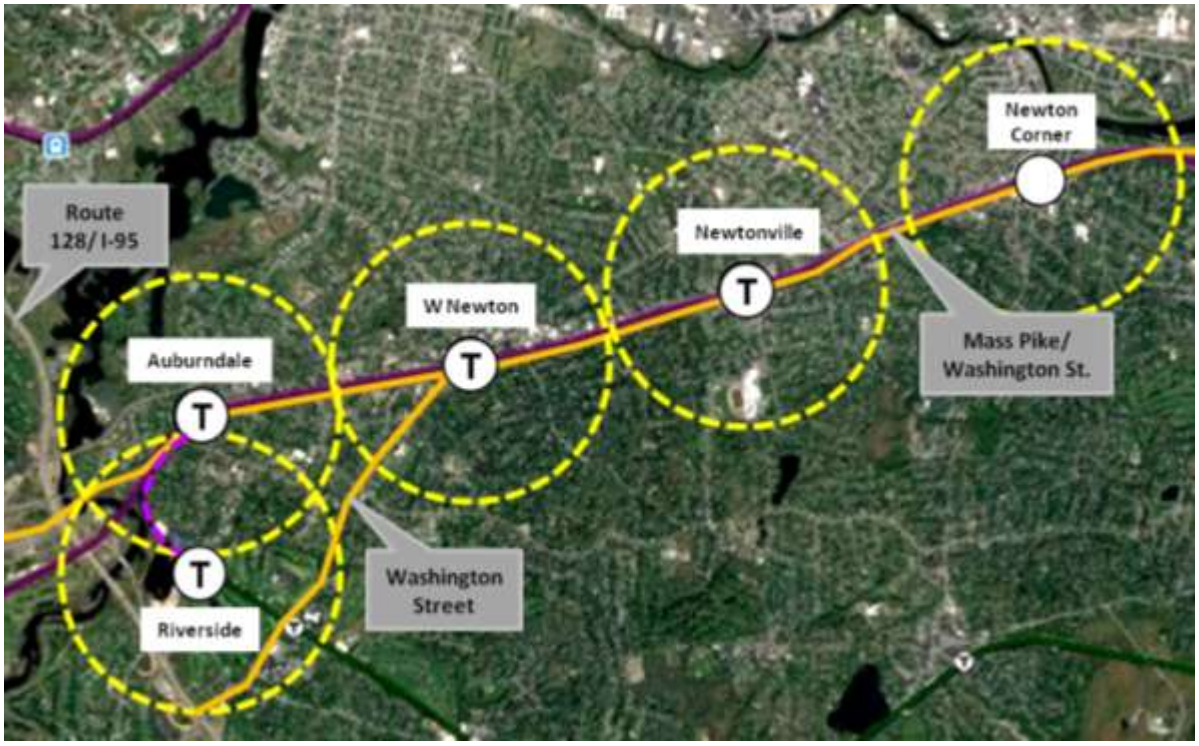
SUMMARY OF TRANSIT NEEDS, ARSENAL STREET
General
Reliability and capacity of bus service on Arsenal Street (currently #70, #70A)
Future rerouting to Kendall, West Station
Rapid Transit System State of Good Repair: Reliability and Capacity of Red Line

NEWTON RAIL TOD CORRIDOR

OVERVIEW

The Newton Rail TOD Corridor includes a "string of pearls" along the Massachusetts Turnpike: Riverside Station, where the Green Line's D Branch begins; the Auburndale, West Newton, and Newtonville stations on the Framingham/Worcester commuter rail line; and Newton Corner, which does not have a rail stop but provides multiple express bus routes to Downtown Boston via the Turnpike.

FIGURE 21: Newton Rail TOD Corridor



Source: AECOM

DEVELOPMENT DISTRICTS

The four rail stations and Newton Corner, a major express bus portal to Boston, are far enough apart to be considered individual development districts.

Riverside

The largest TOD initiative thus far is at Riverside, where the City and the MBTA support a long-planned mixed-use joint development initiative. Before introduction of the Green Line, Riverside was historically a commuter rail station. Under the Urban Rail concept discussed in this report, such service could be reintroduced, making Riverside an even more strategic location in the rail and highway network.

Others

Two residential projects are underway at Newtonville. The City's Housing Strategy, released in 2016, includes a survey of parcels potentially suitable for infill residential development. Such sites are available near all three commuter rail stations and in Newton Corner.[95]

Table 37 summarizes the important development sites in the Newton Rail TOD Corridor Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 37: Key Development Sites, Newton Rail TOD Corridor

Newton Rail TOD Corridor		Status *
Riverside Station development	Approved joint development project; substantial mixed-use residential and commercial program.	P
Newtonville residential infill projects	Austin Street and Court Street projects, near Newtonville Station.	R/C
Housing Strategy Site Review	City's Housing Strategy includes a list of potential sites, mostly infill; parcels in Newton Corner, Newtonville, West Newton, Auburndale included in this estimate.	P, LT
Auburndale:70 Rowe Street	Larger multi-family development near West Newton Station; 40B withdrawn	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from City of Newton; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 38 presents, for the stations in the Newton Rail TOD Corridor Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

TABLE 38: Station Characteristics, Newton Rail TOD Corridor

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Green Line, D											
Riverside	Trolley Suburb	14%	2,241	727	4,702	632,000	199,000	59%	72%	1.04	25.55
Commuter Rail, Framingham-Worcester Line											
Newtonville	Town & Village	13%	293	2,570	3,612	682,000	223,000	51%	62%	1.17	28.94
West Newton	Town & Village	14%	284	1,586	2,715	650,000	200,000	59%	73%	1.27	32.42
Auburndale	Town & Village	17%	325	1,401	1,500	595,000	170,000	57%	71%	1.34	35.39
Express Bus Location											
Newton Cnr. *	—	—	—	—	—	738,000	265,000	48%	58%	—	—
* Newton Corner is currently served by the MBTA's #502, #504, #553, #554, and #556 Mass Pike express buses.											

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

Riverside is categorized by MAPC as a "Trolley Suburb" station, as are all the D Branch stations in Newton. The three commuter rail stops are classified as "Town & Village" stations, indicating their location in an existing or potential walkable village environment.

Although Newton is part of the Inner Core, the semi-suburban nature of these station areas is apparent in the metrics:

- While Riverside is one of the high-ridership stations on the D Branch, this is mostly attributable to its role as a park-and-ride collector on Route 128. The three commuter rail stops have lower riderships, typical of secondary commuter rail stations.
- Housing and employment density are modest.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are below the region-wide average but above the average of all MBTA stations in the system and well above the urban rapid transit figures seen in other Growth Clusters. The percentage of daily transit use is at the region-wide level and below the average of all stations in the MBTA system.
- On the combined Index of Housing+Transportation costs, these Newton station areas are somewhat less affordable than the region as a whole. This highlights the importance of transit in off-setting Newton's higher housing costs, and helps explain the City's interest in promoting residential TOD at Riverside, Newtonville, Newton Corner, and other transit locations.[96]
- The labor sheds at these stations (the estimated number of workers who can reach a local business by a 30-minute transit commute and a quarter-mile walk) are only slightly above the region-wide average. However, the job sheds (the estimated number of station-area residents who can reach a job by a similar commute) are robust—double the region-wide average. This reinforces the point that housing at these stations would be conducive to inexpensive transit commuting and thus contribute to overall affordability.

Transit Mobility Needs

The Newtonville, West Newton, and Auburndale commuter rail stations today handle a modest 900 daily in-bound boardings. Their value as infill TOD locations would be enhanced with different and better service. The "urban rail" concept, with shorter, multiple-unit trains rather than diesel locomotives, could be overlaid on the Worcester-Framingham Line from Newton to Boston, providing more frequent service to Brighton Landing, the future West Station (with connecting service to Kendall and the LMA), Yawkey, Back Bay, and South Station. Moreover, Riverside Station, which has a track connection to Auburndale, could be added as the outer terminus of the urban rail segment, giving it two rail modes—the Green Line and urban rail—at a high-volume park-and-ride location.

As the Green Line's D Branch terminus and as a TOD site, Riverside depends on the reliability and capacity of the entire D Branch and the central subway.

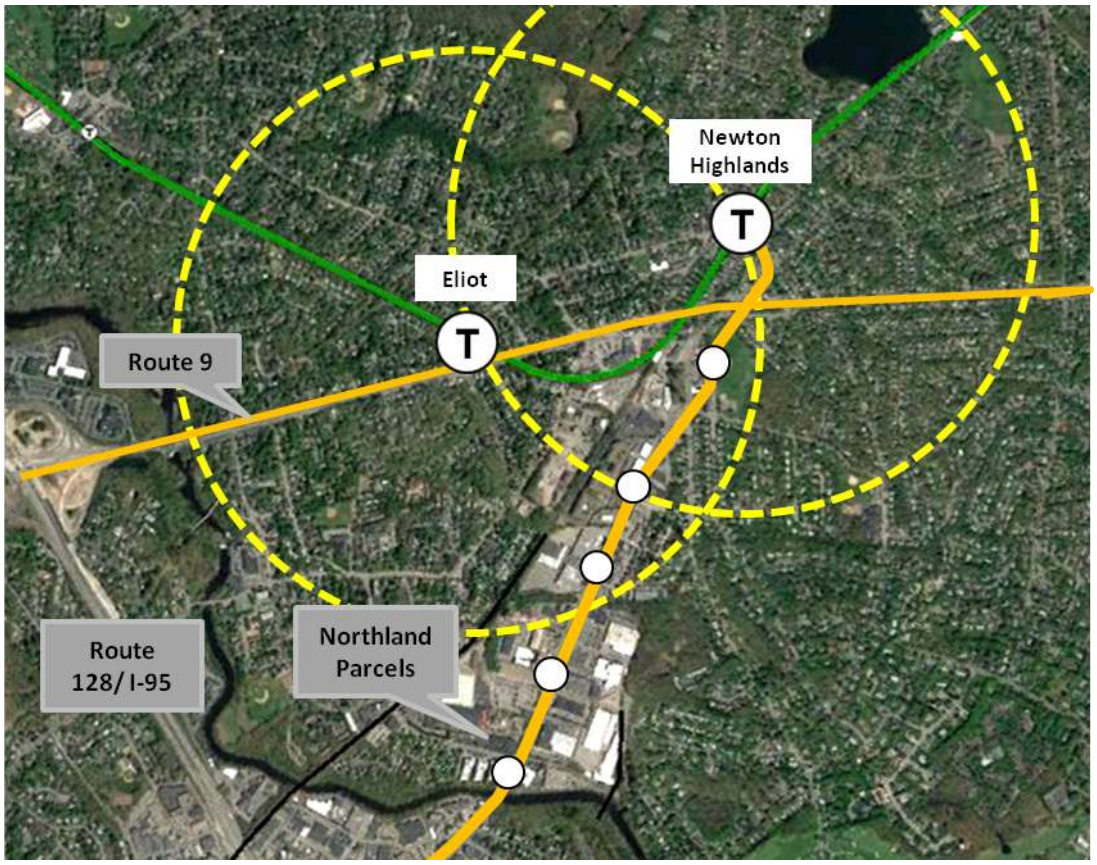
SUMMARY OF TRANSIT NEEDS, NEWTON RAIL TOD CORRIDOR
General
Urban Rail service on the Newton-Boston segment of the Worcester-Framingham Line
Rapid Transit System State of Good Repair: Reliability and Capacity of the Green Line
Station-Specific
Connection of Riverside Station to the Newton-Boston Urban Rail

NEEDHAM STREET

OVERVIEW

Needham Street runs one mile from Route 9 to the Charles River and is connected by MBTA bus service to the Green Line's Newton Highlands Station. A legacy railroad and industrial corridor of roughly 150 acres, Needham Street evolved into an unplanned industrial and retail strip, with multi-family housing introduced in the last decade. With planning, public improvements, and better transit, Needham Street is seen by the City of Newton as a leading residential, office, retail, and mixed-use opportunity. South of the river, Needham Street becxomes Highland Avenue in the Town of Needham, with additional land available for development.

FIGURE 22: Needham Street



Source: AECOM

DEVELOPMENT DISTRICTS

Needham Street is a single planning district for the City of Newton. While infill and intensification opportunities exist along the entire corridor, two development areas stand out. The Northland Parcels, a 27-acre holding that dominates the southwestern quadrant of Needham Street, is entering a planning and approval process for a redevelopment of some 900 residential units and a substantial retail and restaurant destination. The City's Housing Strategy identifies parcels suitable for residential development along Eliot Street, which forms the corridor's western edge.

Table 39 summarizes the important development sites in the Needham Street Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 39: Key Development Sites, Needham Street

Needham Street		Status *
Northland Parcel	Large-scale residential and commercial mixed-use redevelopment proposed for lands comprising southwestern quadrant of Needham Street	P
Housing Strategy Site Review	City's Housing Strategy includes a list of potential sites, mostly infill; parcels on Eliot and Charlemont Streets included in this estimate.	LT
Comprehensive Plan buildout	Estimated residential buildout in Newton Comp Plan for Needham Street, exclusive of Northland Parcel.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from City of Newton; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 40 presents, for the two Green Line stations and the bus route serving the Needham Street Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

The Newton Highlands and Eliot Street stops on the Green Line D Branch are classified by MAPC as "Trolley Suburb" stations, as are the other Green Line stations in Newton. Only partial data is available for the bus route on Needham Street itself.

TABLE 40: Station Characteristics, Needham Street Corridor

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Green Line, D											
Newton Highlands	Trolley Suburb	18%	1,627	1,516	1,457	496,000	184,000	68%	84%	1.37	33.96
Eliot	Trolley Suburb	14%	814	1,697	1,898	487,000	177,000	61%	74%	1.26	32.94
Key Bus Location											
Needham St.	—	—	—	—	—	499,000	189,000	53%	64%	—	—

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

As in the case of the other Newton Growth Cluster described in the prior section, the semi-suburban character of Newton Highlands and Eliot Stations is apparent in the metrics:

- Housing and employment density are below the average of all stations in the MBTA system.

- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are below the region-wide average but well above the average of all MBTA stations in the system. The percentage of daily transit use is a little above the region-wide level but below the average of all stations in the MBTA system.
- On the combined Index of Housing+Transportation costs, these station areas are less affordable than the region as a whole. This highlights the importance of transit in off-setting Newton's higher housing costs, and helps explain the City's interest in promoting residential TOD as part of future development along Needham and Eliot Streets.[97]
- The labor sheds at these stations (the estimated number of workers who can reach a local business by a 30-minute transit trip and a quarter-mile walk) are slightly above the region-wide average. The job sheds (the estimated number of station-area residents who can reach a job by a similar commute) are more robust—nearly double the region-wide average, representing 500,000 jobs reachable by transit for someone who lives in this neighborhood.

Transit Mobility Needs

Needham Street is served by the MBTA's #59 bus route, which connects to the Newton Highlands Green Line station (as well as the Needham Heights commuter rail station on the other side of Route 128 and the Charles River). This route runs at 30-50 minute headways in the course of the day, and its service is split between two parallel routes—one on Needham Street, the other on Eliot Street which, although nearby does not have good pedestrian connections to Needham Street. In short, unlike Arsenal Street, Needham Street does not currently have a level of bus service consistent with substantial TOD.

MassDOT is preparing to reconstruct Needham Street, based on a design that will create continuous sidewalks, add bicycle lanes, and accommodate bus stops.[98] Whether as an MBTA service or as a branded shuttle supported by a Needham Street transportation management district, Needham Street needs a visible, reliable, multi-stop bus connection to the Green Line to realize its potential as Newton's major TOD opportunity.[99]

SUMMARY OF TRANSIT NEEDS, NEEDHAM STREET
General
Enhanced bus service on rebuilt Needham Street
Rapid Transit System State of Good Repair: Reliability and Capacity of the Green Line

DOWNTOWN WALTHAM

OVERVIEW

Downtown Waltham is a traditional Massachusetts city center, with historic mills and a mixed-use central business district along the Charles River. It is served by the Fitchburg commuter rail line and by multiple MBTA bus routes, including express service to Boston via the Turnpike. Downtown revitalization has been underway since the 1980s. Currently, two major redevelopment projects—the MERC at Main & Moody and the Cooper Street Apartments—bracket the train station, and the downtown has a buildout capacity, through new construction and adaptive reuse, of several hundred more residential units.

FIGURE 23: Downtown Waltham

Source: AECOM

Table 41 summarizes the important development sites in the Downtown Waltham Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 41: Key Development Sites, Downtown Waltham

Downtown Waltham		Status *
The MERC (Moody and Main)	Major multi-family and retail mixed-use development in center of downtown.	R/C
Cooper Street Apartments	Major multi-family development in center of downtown. Destroyed by fire while under construction; reported plans to rebuild..	P
Potential Downtown buildout	Comprehensive Plan buildout analysis, net of MERC and Cooper Street.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from City of Waltham; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 42 presents, for the Downtown Waltham Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2,, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

TABLE 42: Station Characteristics, Downtown Waltham

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Commuter Rail, Fitchburg Line											
Waltham	Urban Gateway	7%	610	4,480	6,750	496,000	201,000	33%	40%	.88	23.00
Note: Downtown Waltham is also served by four MBTA express routes. The #505, #553, #554, and #556 connect Downtown Waltham to Downtown Boston, via Moody Street and the Mass Pike.											

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

MAPC classifies Downtown Waltham as an Urban Gateway station, the category used for downtown stations in Regional Urban Centers and Gateway Cities. This character is evident in the metrics:

- Housing and employment density are well above the average of all stations in the MBTA system.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are a little below the average of all MBTA stations and well below the region-wide average. but well above the average of all MBTA stations in the system.
- The percentage of daily household transit use is low (only 7%), considering the availability of commuter rail and multiple bus routes. However, the absolute daily ridership—610 in-bound boardings—is in the middle range for system generally and second-highest on the Fitchburg Line. Given that Waltham Station has only 50 park-and-ride spaces, the great majority of the 610 daily riders are therefore local.[100]
- Downtown Waltham is a relatively affordable place to live. On the combined Index of Housing+Transportation costs, it falls well below the 45% of income benchmark and the 48% region-wide average.
- Similar to Needham Street, the transit labor shed is somewhat above the region-wide average. The job shed is more robust—nearly double the region-wide average, representing 500,000 jobs accessible by transit for those living within walking distance of Waltham Station.

Transit Mobility Needs

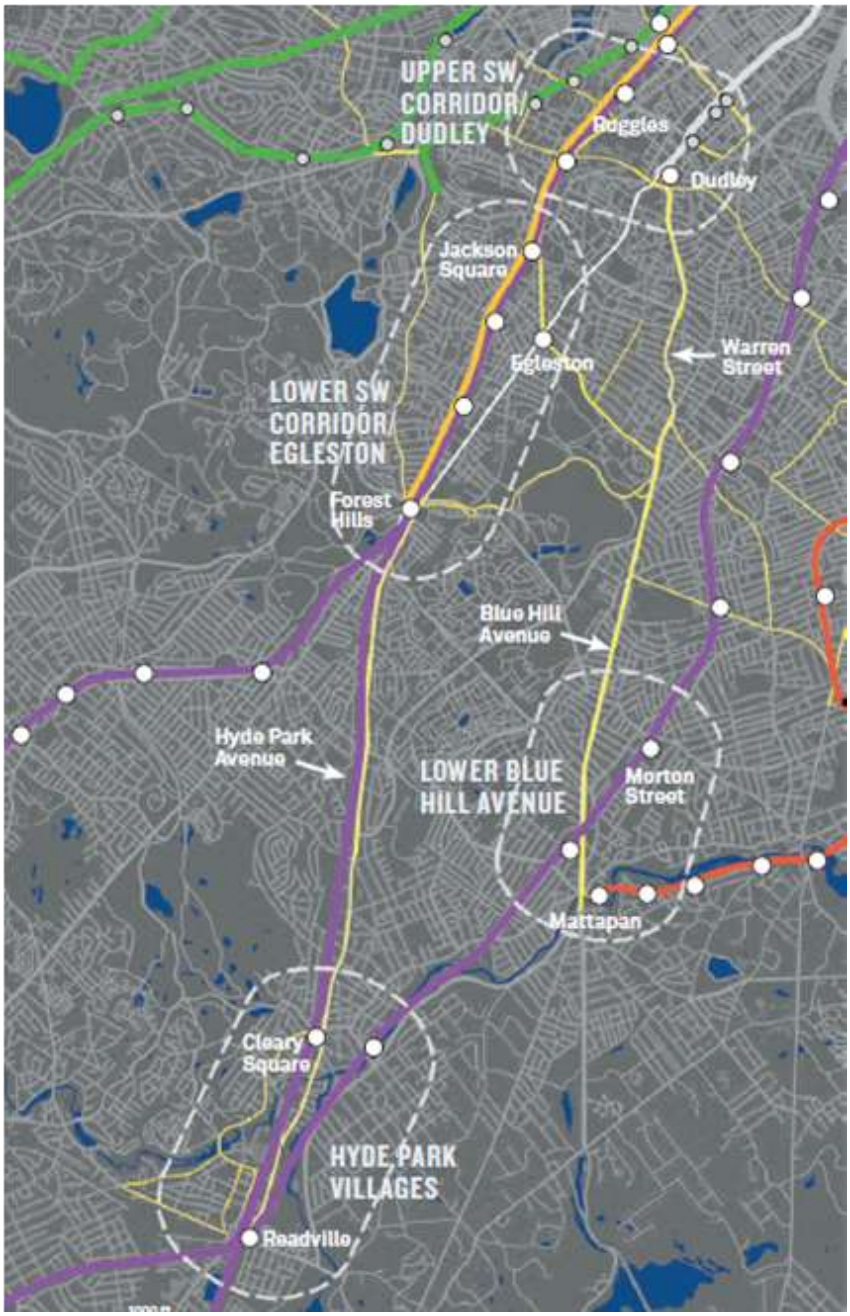
Downtown Waltham as a Transit Growth Cluster depends on the state of good repair of the Fitchburg commuter rail line and on the capacity and reliability of the connecting rapid transit lines, including the Red Line, to which it connects at Porter Square. The #70 and #70A bus routes described earlier connect Waltham to the Arsenal Street Growth Cluster.

SUMMARY OF TRANSIT NEEDS, DOWNTOWN WALTHAM
General
State of Good Repair of the Fitchburg Line
Rapid Transit System State of Good Repair: Reliability and Capacity of the Red Line

SOUTH NEIGHBORHOODS CORRIDOR

Boston's South Neighborhoods Corridor consists of the Southwest Corridor, the southerly portion of the Fairmount Corridor, their converging rail lines, and the iconic arterial streets that tie them together and support MBTA Key Bus Routes. As shown in Figure 24, there are four Growth Clusters: the Upper and Lower Southwest Corridors, Lower Blue Hill Avenue, and the commercial/industrial villages of Hyde Park. Their estimated development potential is summarized in Table 43.

FIGURE 24: The South Neighborhoods Corridor and Its Four Growth Clusters



Souce: AECOM

TABLE 43: South Neighborhoods Corridor; Housing and Job Capacity by Growth Cluster

	RECENT/ CURRENT		IN THE PIPELINE		RECENT/CURRENT PLUS PIPELINE		LONG-TERM POTENTIAL		TOTAL	
	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs
Upper SW Corridor/ Dudley	200	1,500	2,200	2,300	2,400	3,800			2,400	3,800
Lower SW Corridor/ Egleston	800	200	1,000	200	1,800	400	2,500	500	4,300	900
Lower Blue Hill Ave			400	200	400	200	300	300	700	500
Hyde Park Villages			800	700	800	700	900	1,800	1,700	2,500
Corridor Total	**1,000**	**1,700**	**4,400**	**3,400**	**5,000**	**5,000**	**4,000**	**3,000**	**9,000**	**8,000**

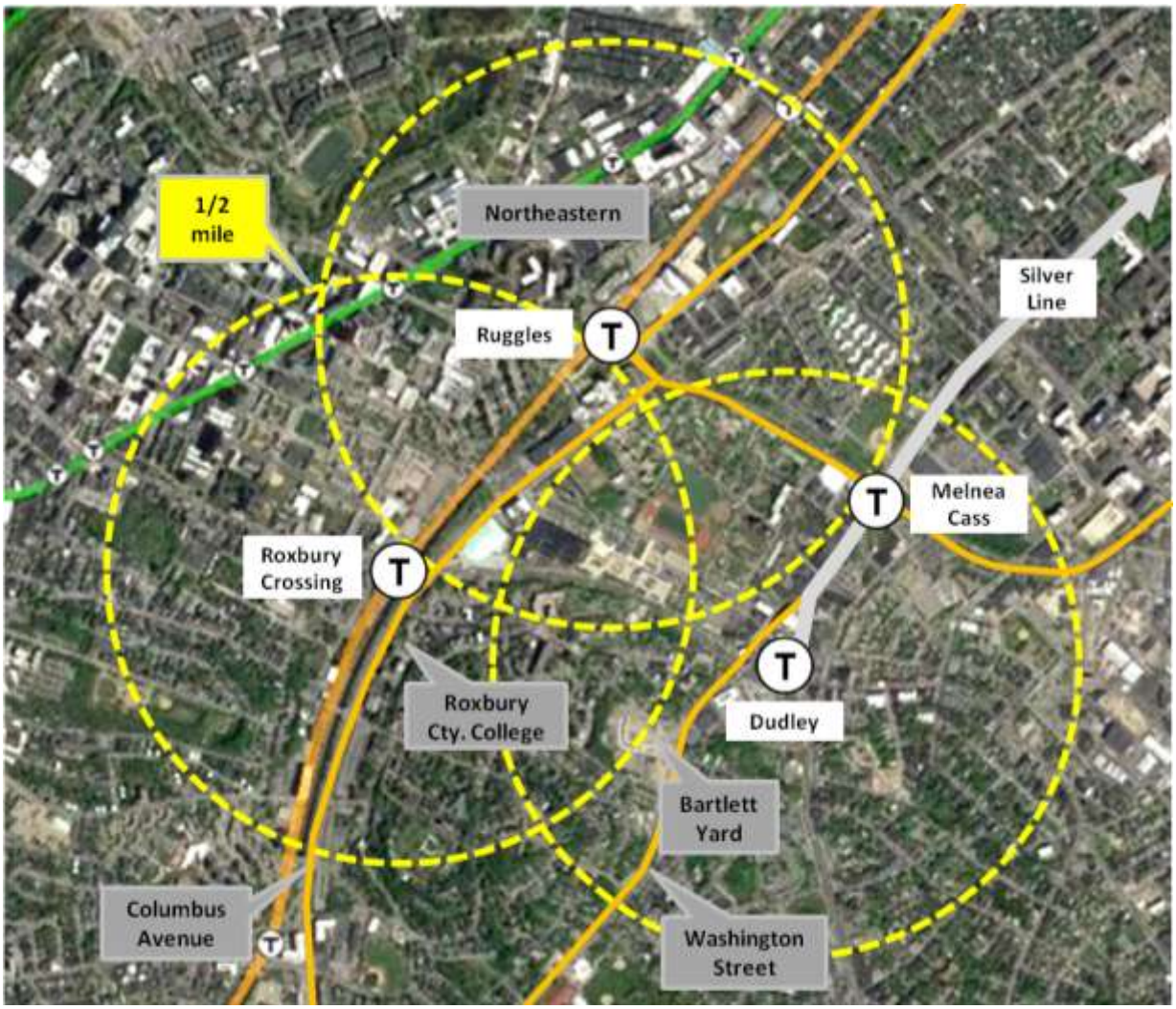
Source: AECOM; compiled from BPDA database; MEPA database; MAPC MassBuilds (see Appendix C-1). Shaded Corridor Totals are rounded to the nearest thousand; other cells are rounded to nearest hundred.

UPPER SOUTHWEST CORRIDOR/DUDLEY

OVERVIEW

Upper Southwest Corridor/Dudley includes the Ruggles and Roxbury Crossing Orange Line stations and, a half-mile to the east, the Dudley and Melnea Cass stations on the Silver Line. The box framed by these four stations constitutes a TOD hub of city- and region-wide significance. Private and institutional development in this Growth Cluster reflects public decisions of prior decades to invest in the Southwest Corridor and the Silver Line.

FIGURE 25: Upper Southwest Corridor/Dudley



Source: AECOM

DEVELOPMENT DISTRICTS

Ruggles/Roxbury Crossing

Ruggles is a multimodal, mixed-use hub at the convergence of Lower Roxbury and Northeastern University. It is served by the Orange Line, commuter rail, and 14 MBTA bus routes. The Ruggles Station area would have been the location of the I-95 (Southwest Expressway) / I-695 (Inner Belt) interchange, had those destructive superhighways not been stopped in the 1970s. In the two decades that followed, land cleared for that interchange became

Northeastern's Parcel 18 development and Boston Police Headquarters. A half-mile south at Roxbury Crossing, cleared land became Roxbury Community College and the Reggie Lewis Athletic Center. Major mixed-use developments—Tremont Crossing and One Roxbury Crossing—are planned at each station, as are large mixed-income residential projects.

TABLE 44: Key Development Sites, Upper Southwest Corridor/Dudley

Ruggles/Roxbury Crossing		Status *
Northeastern Off-Campus Housing	Relieves off-campus rental market.	P
Northeastern Science & Engineering Center	Major component of Institutional Master Plan.	R/C
Tremont Crossing	Major mixed-use development on BPDA land across street from Police Headquarters and Ruggles Station.	P
Whittier Choice Housing	Mixed-income redevelopment of Whittier public housing; next to Tremont Crossing.	P
Basilica Court	Mixed-income multi-family development at Mission Church, near Roxbury Crossing Station.	P
One Roxbury Crossing	Mixed-use office, retail, and residential project on Tremont Street near Roxbury Crossing Station.	R/C, P
Residential infill buildings	Several.	R/C, P
Dudley/Melnea Cass		
Bolling Municipal Building	Boston Public School headquarters and street-level retail in historic Ferdinand Block adjoining station.	R/C
Taber Street	Office and retail infill building across from Bolling and station.	P
Bartlett Place	Major mixed-use redevelopment of MBTA Bartlett Yard on Washington Street south of station; housing, commercial, school.	P
Tropical Foods (Parcel 10)	Expansion and mixed-use development at intersection of Washington and Melnea Cass, on Silver Line.	R/C
Melnea Cass hotel and residential (Parcel 9)	Expansion and mixed-use development at intersection of Washington and Melnea Cass, on Silver Line.	R/C
Residential infill buildings	Several.	R/C, P
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

Dudley/Melnea Cass

A half-mile east of the Orange Line is Dudley Station, the Silver Line terminus also served by 13 conventional bus routes, including the #1, a Key Bus Route connecting to MIT. Dudley is Roxbury's historic downtown. Its revitalization includes the recent catalytic redevelopment of the Ferdinand Furniture block as the Bolling Municipal Center, headquarters of the Boston Public Schools. South of the station on Washington Street, the old MBTA Bartlett Yard is being redeveloped as a mixed-use, mixed-income community.

Just north of Dudley Station, at the intersection of Melnea Cass Boulevard and Washington Street, are Parcels 9 and 10, cleared as part of the Inner Belt right of way and fallow for four decades. With the revitalization of Dudley, these crossroads sites are being developed as commercial, hotel, and residential space, with Silver Line service to Downtown Boston at the doorstep.

Table 44 summarizes the important development sites in the Upper Southwest Corridor/Dudley Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 45 presents, for the Orange and Silver Line stations in the Upper Southwest Corridor/Dudley Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

TABLE 45: Station Characteristics, Upper Southwest Corridor/Dudley

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Orange Line											
Ruggles	Metro Core	35%	10,433	7,751	13,313	886,000	540,000	20%	24%	.32	7.31
Roxbury Crossing	Neighbhd. Subway	35%	4,727	5,492	10,071	827,000	456,000	27%	32%	.40	9.24
Silver Line											
Dudley	Transform. Subway	35%	3,826	3,570	4,764	850,000	482,000	22%	26%	.48	10.75
Melnea Cass	Transform. Subway	36%	466	7,527	22,801	854,000	496,000	21%	26%	.44	10.25
Commuter Rail, Northeast Corridor											
Ruggles	Metro Core	35%	186 *	7,751	13,313	886,000	540,000	20%	24%	.32	7.31
* Ruggles commuter rail boardings are inbound only; any Ruggles-bound trips from the south are not counted.											

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

These four stations represent three different MAPC Station Typology categories, suggesting how strategic this location is in the economic and transportation geography of the region. Ruggles, a major, multi-modal station serving Northeastern University and closest to Downtown and Back Bay, is a "Metro Core" station. Roxbury Crossing, one stop away at the crossroads of Roxbury and Jamaica Plain, is classified as "Neighborhood Subway". The two Silver Line stations, although their transit mode is street-running bus rapid transit, are classified as "Transformational Subway" because of their potential to support district-scale redevelopment. These station areas overlap, and they share an urban, transit-oriented character:

- Ruggles, with over 10,000 daily boardings, is among the Orange Line's busier stations. Roxbury Crossing, with a more walkup-based ridership, has fewer than 5,000.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are among the lowest anywhere in the system. Average transit use is in the 35% range, among the highest.

- Household and job density within a half-mile exceed the system-wide average, and by large margins at all stations but Dudley. The Dudley numbers do not include the recently opened Boston School Headquarters.
- These neighborhoods are affordable. On the combined Index of Housing+Transportation costs, all four station areas fall far below the threshold of 45% of Area Median Income (AMI) and the region-wide average of 48%. This is true whether using the full AMI or 80% of AMI as the base.
- The stations serving the Upper Southwest Corridor/Dudley Growth Cluster have job sheds (the estimated number of jobs that a worker can reach by a 30-minute transit trip and a quarter-mile walk) nearly three times the region-wide average. The labor sheds (the estimated number of workers who can reach a job at given station by a similar commute) are at least triple the region-wide average. From a labor market connectivity perspective, this is a strong area to develop housing or to open a business.

Transit Mobility Needs

Economic and community development in the Upper Southwest Corridor depends first and foremost on the state of good repair of the Orange Line, which connects Corridor residents to the employment centers of Back Bay, Downtown Boston, Cambridge Crossing (formerly North Point), and Assembly Square, and brings residents of the entire Orange Line commuter shed to jobs at Northeastern, Roxbury Crossing, and Dudley. The replacement and expansion of the Orange Line fleet, and the modernization of the Wellington Car House, are crucial to realizing the decades-old vision of large-scale, sustainable, mixed-use development in the Corridor.

The Silver Line, which connects Dudley and the emerging development crossroads at Melnea Cass and Washington Street to Downtown and South Station, is essential for the same reasons.

Both the Orange and Silver Lines depend on the reliability and capacity of the Red and Green Lines. Ruggles and Dudley are also highly dependent on the state of good repair of the MBTA bus system, with so many routes converging at either or both of these hub stations.

The commuter rail stop at Ruggles has been until now a little-used feature of the station, due in part to a platform configuration that limits the number of trains that can stop there. Ruggles could become a commuter rail destination as well as a key transfer point to Dudley (via connecting bus routes). This gap is now being remedied by the MBTA.[101]

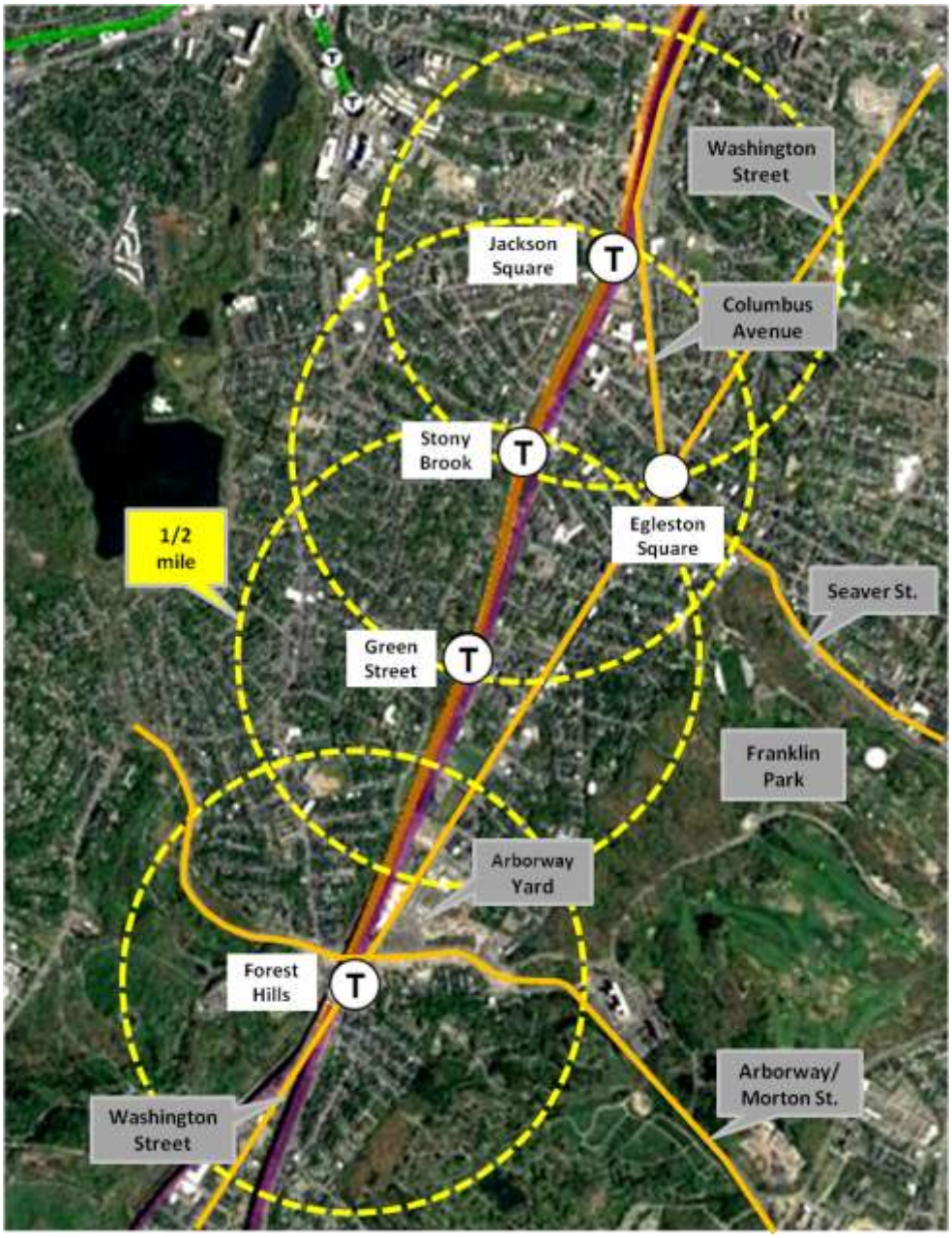
SUMMARY OF TRANSIT NEEDS, UPPER SOUTHWEST CORRIDOR/DUDLEY
General
Rapid Transit System State of Good Repair: Reliability and Capacity, especially the Orange Line
State of Good Repair: Washington St. Silver Line
State of Good Repair: MBTA bus fleet
Station-Specific
Ruggles Station commuter rail platform upgrade

LOWER SOUTHWEST CORRIDOR/EGLESTON

OVERVIEW

The Lower Southwest Corridor includes the Jackson Square, Stony Brook, Green Street, and Forest Hills stations. Egleston Square, at Washington Street and Columbus Avenue near Stony Brook Station, is a traditional neighborhood center. The City has made this "JP/Rox" corridor a residential TOD pilot district, similar in concept to Dorchester Avenue from Broadway to Andrew (see the South Bay Corridor discussion).[102]

FIGURE 26: Lower Southwest Corridor/Egleston Square



Source: AECOM

DEVELOPMENT DISTRICTS

Jackson Square

Jackson Square, where Centre Street crosses Columbus Avenue and the Southwest Corridor, is a neighborhood crossroads for Roxbury and Jamaica Plain. The multi-building, mixed-use, mixed-income Jackson Square TOD project, undertaken jointly by for-profit and non-profit developers, is in its second phase, creating a highly visible center at the station. Additional residential development is occurring nearby on Amory, Lamartine, and Centre Streets.

Egleston/Stony Brook/Green Street

Egleston Square, now served by four MBTA bus routes, was for most of the twentieth century a transit hub where the Mattapan-Roxbury streetcar met the Washington Street Orange Line. While the streetcar is long gone and the relocated Orange Line runs a quarter-mile away in the Southwest Corridor, Egleston remains an important neighborhood crossroads. The City's TOD corridor plan envisions both residential and commercial infill.

TABLE 46: Key Development Sites, Lower Southwest Corridor/Egleston

Jackson Square		Status *
Jackson Square	Multi-phase mixed-use development; housing, retail, office, community services.	R/C, P
Residential infill buildings	Several.	R/C, P
Egleston/Stony Brook/Green Street		
Washington Street infill residential buildings	Several.	R/C, P
Forest Hills		
MBTA Parcel U Development	Mixed-use, housing and commercial on Washington Street	R/C
Commons at Forest Hills	Major multi-family development on Washington Street north of station.	R/C
Residences at Forest Hills	Major multi-family development in commercial block across Washington Street from station.	R/C
3521 Washington Street	Large multi-family with street-level retail on Washington Street north of station.	P
Arborway Yard	MBTA property fronting Washington Street north of station; 8 acres envisioned as mixed-use development.	LT
Balance of Plan JP/Rox	City's plan for this corridor as a TOD housing pilot corridor, net of identified projects.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

Forest Hills

Forest Hills is a regional mobility hub, where the Orange Line's southern terminus intersects the Needham and Providence commuter rail lines and 20 MBTA bus routes fanning out through Boston's southern neighborhoods and adjoining towns. With the demolition of the adjacent Casey Overpass and its repalcement by surface streets and sidewalks, Forest Hills is emerging as an important center for TOD housing and local retail. This development is occurring both on surplus MBTA land and on private land along Washington Street. A signature opportunity remains

at the MBTA Arborway Yard, where the MBTA and the City have envisioned a modernized bus maintenance facility and a multi-acre joint development site.

Table 46 summarizes the important development sites in the Lower Southwest Corridor/Egleston Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 47 presents, for the Orange Line stations defining the Lower Southwest Corridor/Egleston Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2,, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

Jackson Square, Stony Brook, and Green Street Stations are classified by MAPC as "Neighborhood Subway", indicating mostly residential station areas with a primarily walkup ridership base. Forest Hills is classified as "Transformational Subway" because of the large expanses of industrial land available for redevelopment and the major infrastructure changes associated with the elimination of the Casey Overpass.

TABLE 47: Station Characteristics, Lower Southwest Corridor/Egleston

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Orange Line											
Jackson Sq.	Neighbhd. Subway	38%	5,828	5,489	3,179	727,000	362,000	26%	32%	.63	14.72
Stony Brook	Neighbhd. Subway	40%	3,652	8,195	3,572	705,000	334,000	41%	54%	.66	15.69
Green Street	Neighbhd. Subway	41%	5,618	5,651	4,083	683,000	315,000	45%	55%	.78	18.57
Forest Hills	Transform. Subway	46%	15,150	2,746	2,544	719,000	360,000	36%	43%	.78	19.28
Key Bus Location											
Egleston						677,000	334,000	26%	31%		
Commuter Rail, Northeast Corridor											
Forest Hills	Transform. Subway	46%	112	2,746	2,544	719,000	360,000	36%	43%	.78	19.28

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Forest Hills, with over 15,000 daily boardings, is the third-busiest Orange Line station, trailing only Downtown Crossing and North Station. The three more localized stations range from 3,600 to 5,800—substantial for stations without any park-and-ride. Stony Brook and Green Street also lack feeder bus service.[103]
- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are far below the system-wide and region-wide averages, although not as low as the more centrally-located Upper Southwest Corridor. Average transit use, however, is in the 40% range, among the highest in the system.
- Household and job density within a half-mile exceed the system-wide average at the three neighborhood stations, but not at Forest Hills, where much of the half-mile circle is occupied by infrastructure, parkland,

the MBTA Arborway Yard, and the Arnold Arboretum. On the housing side, more than a thousand units under construction, in the pipeline, or envisioned by the City will bring Forest Hills well above the system average.

- These neighborhoods are relatively affordable. On the combined Index of Housing+Transportation costs, all four station areas fall at or below the threshold of 45% of Area Median Income (AMI), and all are below the region-wide average of 48%.
- Notwithstanding their peripheral locations, the stations serving the Lower Southwest Corridor/Egleston Growth Cluster have transit job and labor sheds at least double the region-wide average.

Transit Mobility Needs

Transit-oriented development in the Lower Southwest Corridor—including the projects already undertaken at Jackson Square and Forest Hills—depends on the reliability and capacity of the Orange Line. Like the Upper Southwest Corridor, this Growth Cluster, targeted by the City of Boston as a TOD priority district, will benefit from the replacement, enlargement, and enhanced maintenance of the Orange Line fleet. There is ample morning peak-hour capacity at these stations, which contributes to the market's embrace of Forest Hills.[104] However, evening peak-hour trains leaving the downtown stations and Back Bay are highly congested.

This Growth Cluster also depends on the state of good repair of the MBTA bus system. Forest Hills derives added market strength from its accessibility by 20 bus routes, while Egleston Square and Washington Street are served only by bus routes.

MassDOT's on-going project to remove the Casey Overpass and create a new grid of streets, sidewalks, plazas, and bike lanes at Forest Hills is a prime example of "district infrastructure", the term used throughout this report to describe the transformative infrastructure improvements often needed to support district-scale TOD.[105]

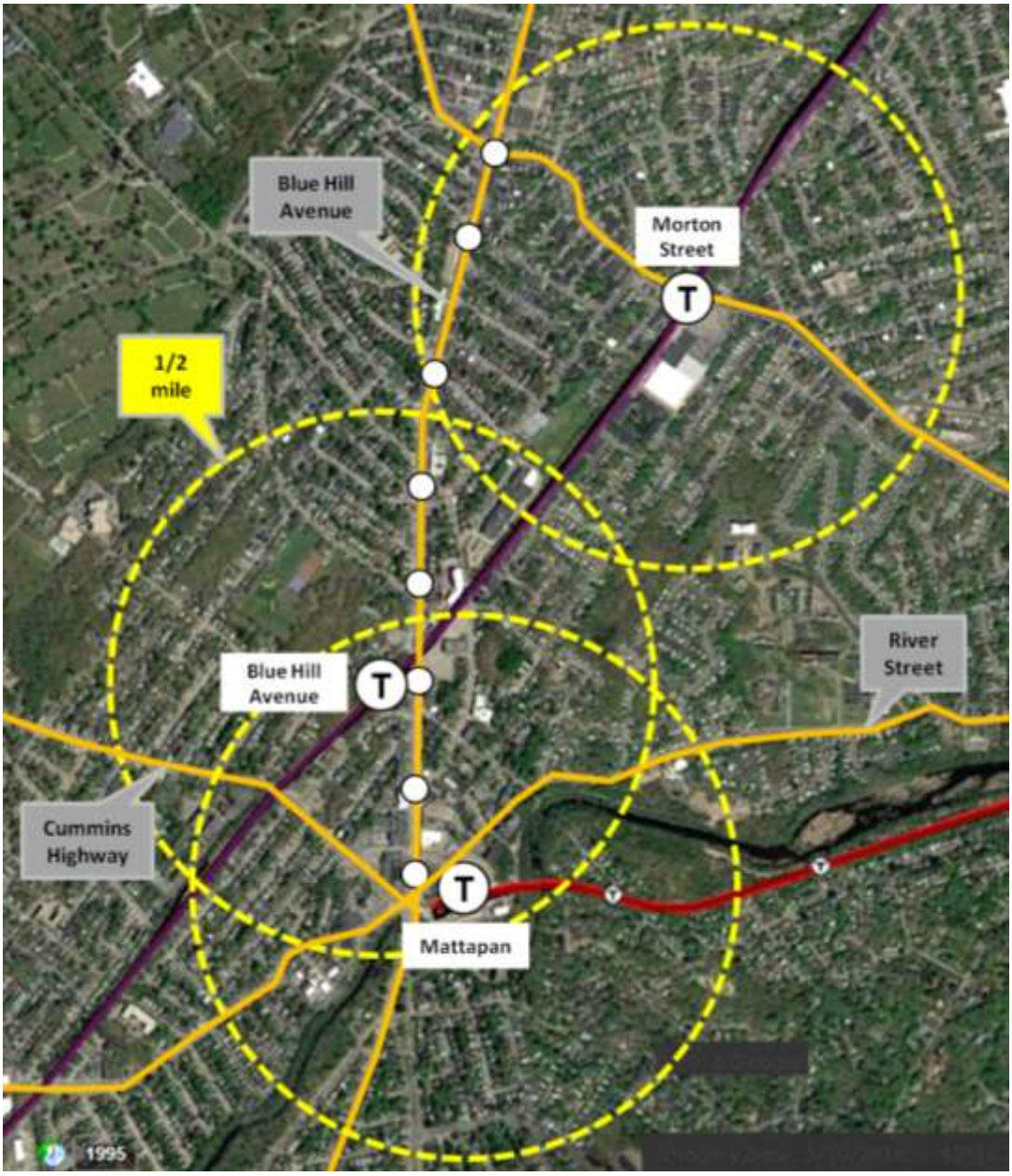
SUMMARY OF TRANSIT NEEDS, LOWER SOUTHWEST CORRIDOR/EGLESTON
General
Rapid Transit System State of Good Repair: Reliability and Capacity, especially the Orange Line
State of Good Repair: MBTA bus fleet
Station-Specific
Casey Overpass removal and district infrastructure

LOWER BLUE HILL AVENUE

OVERVIEW

Lower Blue Hill Avenue, from Morton Street to the Milton line, is Mattapan's "main street". In the twentieth century, this corridor grew along the Blue Hill Avenue streetcar line and others that converged at Mattapan Square; the neighborhood also enjoyed passenger service on the Dorchester Branch railroad—today's Fairmount Line, which includes stations at Morton Street and and a new station, now under construction, Blue Hill Avenue. With enhanced rail and bus service, Lower Blue Hill Avenue can re-emerge as the robust transit village it historically was.

FIGURE 27: Lower Blue Hill Avenue



Source: AECOM

DEVELOPMENT DISTRICTS

Morton Street

The recently modernized Morton Street Station, with vacant and underutilized land nearby, represents a significant neighborhood TOD opportunity. The City is marketing two sites across the street from the station, and a local business owns a large, underutilized parking lot adjoining the station itself. The City's Indigo Corridor plan identified additional infill demand in the station area walkshed.[106]

Mattapan Square

The new Blue Hill Avenue Station on the Fairmount Line will be located at the northern edge of the Mattapan Square business district. Mattapan Station, where the MBTA plans a multi-family joint development project, is the terminus of the Mattapan-Ashmont trolley, an extension of the Red Line. There are numerous opportunities for infill development, including Cote Village, a mixed-income affordable project at the abandoned Cote Ford site. Here again, the City's Indigo plan identifies demand for both residential and commercial infill.[107]

Table 48 summarizes the important development sites in the Lower Blue Hill Avenue Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 48: Key Development Sites, Lower Blue Hill Avenue

Morton Street		Status *
City-owned parcels	Morton and Hopkins Street parcels, across Morton Street from station; advertised for mixed-use development.	P
Economy Plumbing & Heating frontage	Large, mostly unused lot between business and Morton Street, immediately next to station.	LT
1199 Blue Hill Avenue	Neighborhood residential and retail project at key corner	P
Morton Street Station Area	Indigo Corridor Plan projections for station area.	LT
Mattapan Square		
Mattapan Station joint development	Residential development on MBTA station parking lot.	P
Cote Ford redevelopment (Cote Village)	Residential and street-level retail at abandoned car dealership site on Cummins Highway.	P
Supermarket demand	Mattapan Economic Development Initiative identified demand for full-service supermarket.	LT
Blue Hill Avenue Station Area	Indigo Corridor Plan projections for station area.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 49 presents, for the stations serving the Lower Blue Hill Avenue Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

MAPC classifies Mattapan Station and the nearby future Blue Hill Avenue commuter rail station as "Neighborhood Subway" stops. The Morton Street commuter rail station, with more significant development opportunities, is classified as "Transformational Subway".

TABLE 49: Station Characteristics, Lower Blue Hill Avenue

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Red Line Trolley											
Mattapan	Neighbhd. Subway	26%	1,504	3,131	2,205	428,000	261,000	38%	46%	.89	23.62
Commuter Rail, Fairmount Line											
Morton Street	Transform. Subway	37%	130	4,722	1,346	472.000	259,000	36%	44%	.74	18.24
Blue Hill Ave. (Future)	Neighbhd. Subway	30%	—*	3,262	1,922	465,000	248,000	37%	45%	.78	18.99
Key Bus Locations on Blue Hill Avenue											
Morton Street						477,000	254,000	36%	44%		
Fessenden S.						473,000	250,000	39%	48%		

* The 30% existing transit mode share for station area residents reflects bus ridership.

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Mattapan Station, where the Mattapan-Ashmont Trolley and several bus lines terminate, has 1,500 daily boardings. It is the busiest station on the Trolley line (other than Ashmont), and if it were a Green Line station, it would rank as one of the busier surface stops. The small ridership at Morton Street reflects the limited service available on the Fairmount Line and the absence of any development to date.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) per household are below the system-wide average and well below the region-wide average, although not as low as in more centrally located neighborhoods. The percentage of daily transit use, from 26-37%, is relatively high.
- Household density within a half-mile exceeds the system-wide average, but job density is below the system-wide average.
- These station areas are affordable. On the combined Index of Housing+Transportation costs, they fall well below the threshold of 45% of Area Median Income (AMI) and the region-wide average of 48%.
- Notwithstanding their peripheral locations, the stations serving the Lower Southwest Corridor/Egleston Growth Cluster have transit job and labor sheds at least double the region-wide average.

Transit Mobility Needs

With two stations on the Fairmount Line, Lower Blue Hill Avenue could be well-served by rail transit to South Station. The transit profile of the neighborhood, and its visibility to TOD developers, would improve dramatically if "urban rail" service were introduced—more frequent service and shorter trains made of up of diesel or electric multiple units.

It is also important to retain in good working order the Mattapan-Ashmont Trolley, a unique neighborhood asset with direct, cross-platform connections to the Red Line at Ashmont. Developer interest in the MBTA parcel reflects

this route to Downtown. If the trolley fleet were unable to be preserved, any replacement service would have to maintain the dedicated alignment, village stations in Boston and Milton, and direct Red Line link at Ashmont.

Lower Blue Hill Avenue depends on daily bus service. The #28 from Mattapan to Ruggles via Dudley, a Key Bus Route, and the #29 from Mattapan to Ruggles via Egleston and Jackson Square together handle over 16,000 daily boardings, the highest volume on any bus corridor. Just over 14,000 of the boardings are on the #28, the second-highest individual route .[108] Mattapan Station is a hub served by 11 routes. The bus system's state of good repair is critical.

However, state of good repair alone will not support the Avenue's economic and community development potential. There are areas of significant weekday congestion delay between Franklin Field and Dudley. With respect to capacity—a related but separate issue—the #28 was overcrowded until the MBTA switched to 60-foot articulated buses on this route; capacity constraints are expected to recur by 2040 if not sooner.[109] Blue Hill Avenue would be a good candidate for priority bus lanes or full-fledged bus rapid transit, on routes to Dudley, Ruggles, Roxbury Crossing, and the LMA.

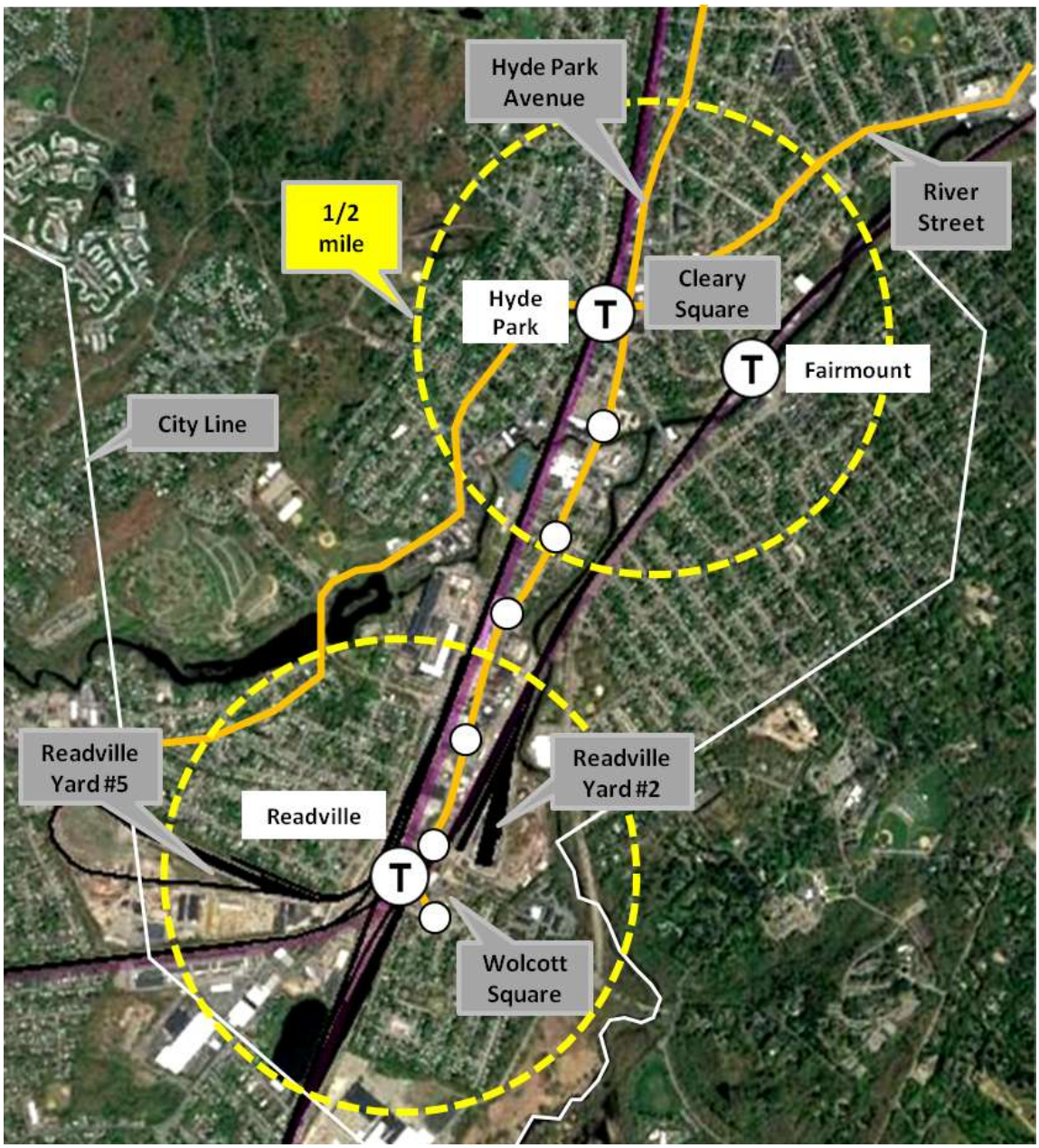
SUMMARY OF TRANSIT NEEDS, LOWER BLUE HILL AVENUE
General
Urban Rail on the Fairmount Line
Bus system State of Good Repair
Future Blue Hill Avenue BRT to Dudley, Southwest Corridor, and LMA
Station-Specific
Implement Blue Hill Avenue Station

HYDE PARK VILLAGES

OVERVIEW

In Hyde Park, the Fairmount Line converges with the Boston-Providence main line to form an unusual TOD opportunity. Fairmount Station and the main line's Hyde Park Station, barely a quarter-mile apart, give Cleary and Logan Squares one-seat service to Forest Hills, Ruggles, Back Bay, South Station, and Route 128. The same is true at Readville, where the lines have side-by-side platforms. The City has targeted Readville as a twenty-first cntury industrial employment center, and residential developers are attracted to the dual rail service to Downtown. Readville is one of the six major "neighborhood expansion" opportunities identified in Imagine Boaston 2030.[110]

FIGURE 28: Hyde Park Villages



Source: AECOM

DEVELOPMENT DISTRICTS

Cleary and Logan Squares

TOD opportunities in this established neighborhood center primarily involve infill development and improvement of existing properties. Hyde Park Avenue extending south from Cleary Square supports a mix of residential, commercial, and institutional uses.

Readville

Historically a railroad industrial center, Readville retains an industrial core along Hyde Park Avenue, Sprague Street, and Industrial Drive, surrounded by residential neighborhoods. The industrial and former railroad lands are largely inefficient and underutilized, and the City envisions an opportunity to develop a modern industrial center. One defined project is a planned multi-building private industrial complex on former MBTA land at Readville Yard #5.[111] Additional land, in close proximity to the station, is occupied by school bus storage and surface parking.

The southerly end of Hyde Park Avenue, which runs in the narrow "V" between the rail lines, is lined with low-density industrial, construction, and commercial uses. These could evolve over time into a coridor of modern light industry and mixed-use redevelopment; there is emerging market interest in multi-family residential development nearest to the station.

Table 50 summarizes the important development sites in the Hyde Park Villages Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 50: Key Development Sites, Hyde Park Villages

Hyde Park Villages		Status *
Fairmount and Readville station areas	Indigo Corridor Plan projections for demand in station areas.	LT
Readville Yard 5	Industrial development initiative on City-owned land.	P
1725 Hyde Park Avenue	Large multi-family development.	P
36-70 Sprague Street	Large multi-family development.	P
MBTA Readville park-and-ride lots	Could be made available for future TOD.	LT
Private school bus storage lot	In Readville Yards area; could be made available for future TOD.	LT
Mixed-use upgrade of Hyde Park Avenue "V	Narrow corridor at Readville end of avenue between converging railroads; multiple owners, could be repositioned as modern industrial and mixed-use area.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from BPDA projects database; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 51 presents, for the commuter rail stations serving the Hyde Park Villages Growth Cluster, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for

the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison. MAPC classifies all three stations as "Town & Village".

TABLE 51: Station Characteristics, Hyde Park Villages

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Commuter Rail, Fairmount Line											
Fairmount	Town & Village	19%	188	2,780	2,473	672,000	334,000	33%	40%	1.03	27.97
Readville	Town & Village	17%	256	1,325	1,603	578,000	279,000	40%	49%	1.07	28.79
Commuter Rail, Northeast Corridor											
Hyde Park	Town & Village	21%	149	2,190	2,527	672,000	334,000	38%	46%	1.00	26.70
Readville	Town & Village	17%	365	1,325	1,603	578,000	279,000	40%	49%	1.07	28.79

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Existing ridership at Readville—when the two lines are combined—is over 600, which would place Readville in the middle of the pack across the south commuter system. Ridership at Hyde Park (Cleary Square) and Fairmount, even if combined to reflect their close proximity, is modest.
- Automobile ownership, Average Vehicle Miles Traveled (VMT), and the percentage of daily transit use are all at the MBTA system-wide averages. All of these measures are considerably better (lower car ownership and VMT, higher transit use) than the region as a whole. These data are predictable, given the Hyde Park Villages' location—nine miles from Downtown Boston, with no rapid transit service.
- Household and job density within a half-mile radius are somewhat below the system-wide averages at Hyde Park and Fairmount. They are lower at Readville, reflecting the large amount of station area land in railroad, open space, and low-density industrial use.
- These station areas are affordable. On the combined Index of Housing+Transportation costs, they fall well below the threshold of 45% of Area Median Income and the region-wide average of 48%.
- Notwithstanding their peripheral locations, the Hyde Park stations have transit job and labor sheds approximately double the region-wide average.

Transit Mobility Needs

The most important transit ingredient for the revitalization of Cleary Square, Logan Square, and Readville is the introduction of frequent "urban rail" service on the Fairmount Line. Development drawn to the commuter rail will also depend on the reliability and capacity of the Red Line (to which both Hyde Park rail lines connect at South Station) and the Orange Line (to which the Northeast Corridor connects at Forest Hills, Ruggles, and Back Bay).

The state of good repair of the bus system is essential to the Hyde Park Villages, as it is to all of the Inner Core's outlying neighborhoods. The segment of Hyde Park Avenue between

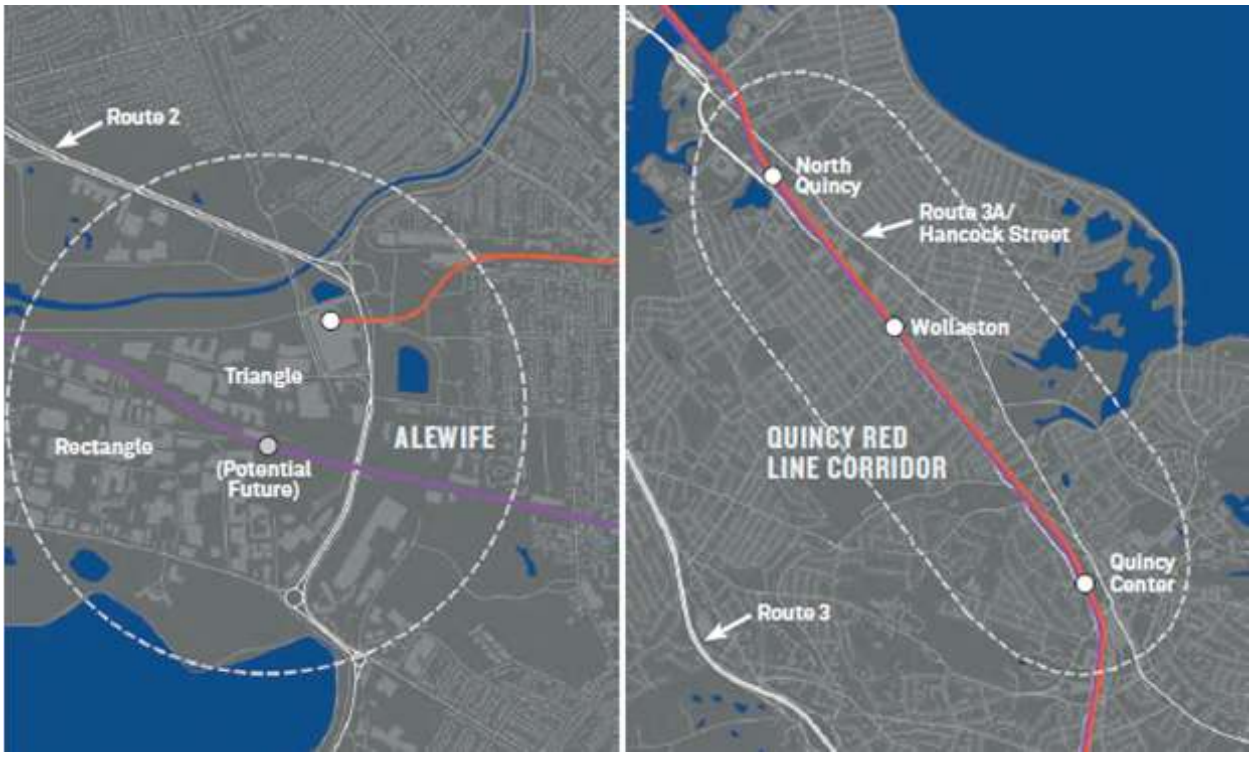
SUMMARY OF TRANSIT NEEDS, HYDE PARK VILLAGES
General
Urban Rail service on the Fairmount Line
Rapid Transit System State of Good Repair: Reliability and Capacity, especially the Red and Orange Lines
State of Good Repair: MBTA bus fleet
Segment-Specific
Future redesign of Hyde park Avenue in the "V"

Cleary Square and Readville is the southern end of the #32 bus, a Key Bus Route which carries 11,000 people a day between Hyde Park and Forest Hills at Frequent headways and is the fifth-busiest bus line in the system.[112] While framed by the converging rail lines, the repositioning of this long V-shaped corridor as a mix of modern light industry and multi-family housing will require the redesign of this segment of Hyde Park Avenue as a more pedestrian, bicycle, and transit-friendly environment.

RED LINE OUTER MARKETS

The final strategic corridor is comprised of Growth Clusters that are not contiguous but rather located at opposite ends of the Red Line—at Alewife Station in Cambridge and at three consecutive stations in Quincy. Developers are turning to these areas, with somewhat lower costs and less Red Line congestion, as alternatives to more central locations.[113] The Alewife and Quincy Growth Clusters are shown in Figures 30 and 31, and their development potential is summarized in Table 52.

FIGURE 29: The Red Line Outer Markets and Their Two Transit Growth Clusters



Source: AECOM

TABLE 52: Red Line Outer Markets; Housing and Job Capacity by Growth Clusters

	RECENT/ CURRENT		IN THE PIPELINE		RECENT/CURRENT PLUS PIPELINE		LONG-TERM POTENTIAL		TOTAL	
	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs	Units	Jobs
Alewife	1,100	100	1,100	1,300	2,200	1,400	800	3,200	3,000	4,600
Quincy Red Line	900	100	1,100	2,100	2,000	2,200	1,500	2,600	3,500	4,800
Corridor Total	**2,000**	**200**	**2,200**	**3,400**	**4,000**	**4,000**	**2,000**	**6,000**	**6,000**	**10,000**

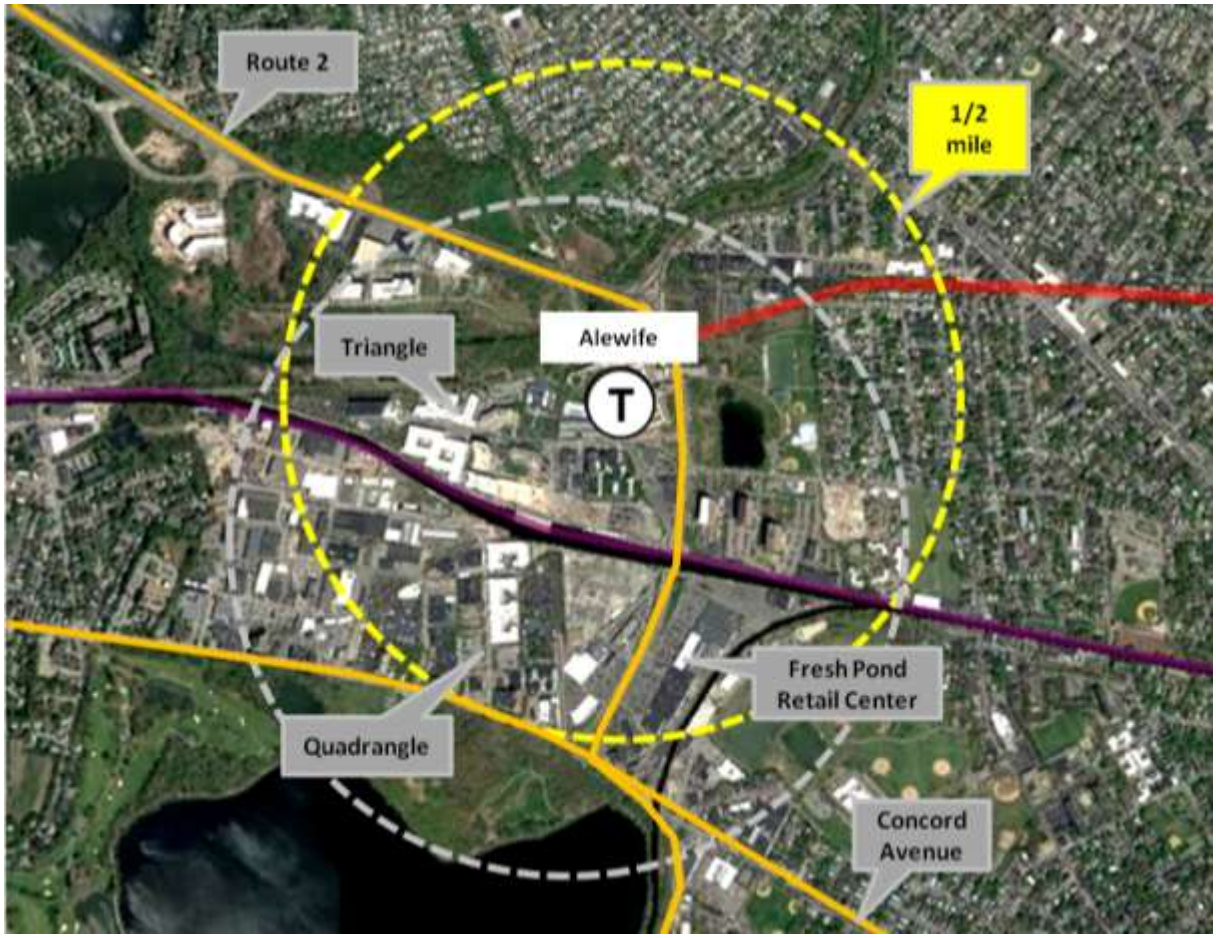
Source: AECOM; compiled from Cities of Cambridge and Quincy; MBTA; MEPA database; MAPC MassBuilds (see Appendix C-1). Shaded Corridor Totals are rounded to the nearest thousand; other cells are rounded to nearest hundred.

ALEWIFE

OVERVIEW

Alewife¸ the Red Line's northern terminus, was a low-density light industrial area whose station served, for its first two decades, as little more than a park-and-ride collector. In the last decade, with a City master plan and market recognition, Alewife has attracted redevelopment in four sectors: R&D, multi-family residential, office, and retail. Additional planned phases of redevelopment amout to a regionally significant opportunity.

FIGURE 30: Alewife



Source: AECOM

DEVELOPMENT DISTRICTS

Alewife is best understood as a single development district with three physically distinct development areas: the more heavily developed Triangle (north of the railroad); the emerging Quadrangle (south of the railroad); and the Fresh Pond Retail Center, across Fresh Pond Parkway, which the City of Cambridge envisions as evolving over time to a more dense, mixed-use urban location.

TABLE 53 54 summarizes the important development sites in each area. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 53: Key Development Sites, Alewife

Triangle		Status *
Cambridge Discovery Park	Multi-phase redevelopment of old Arthur D. Little site, on Route 2 side of Triangle; office and R&D.	R/C, P
VOX on 2	Large multi-family development adjoining Discovery Park.	R/C
185-211 Concord Turnpike	Large multi-family development.	P
Cambridgepark Drive	Major mixed-use project area in core of Triangle.	R/C, P
City Buildout Plan for Triangle	Long-term projection for mixed-use completion of district.	LT
Quadrangle		
70-95 Fawcett Street	Major multi-phase residential development in eastern portion of Quadrangle.	R/C, P
City Buildout Plan for Quadrangle	Long-term projection for mixed-use completion of district.	R
Fresh Pond Retail		
563-579 Concord Avenue	Multi-family and street-level retail.	R/C, P
75 New Street	Multi-family development behind Fresh Pond mall.	P
City buildout plan for Fresh Pond Retail Area	Long-term projection, envisioning intensification and introduction of housing.	LT
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from City of Cambridge; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 54 presents, for Alewife Station, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison. MAPC classifies Alewife as a "Transformational Subway" station, reflecting the expansive opportunity to reshape infrastructure and land use.

TABLE 54: Station Characteristics, Alewife

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Red Line											
Alewife	Transform. Subway	29%	11,221	3,069	6,090	677,000	248,000	42%	52%	.82	19.97

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- Alewife's existing daily ridership of 11,221 is second-lowest of the Cambridge Red Line stations, despite Alewife's large park-and-ride capacity and nine feeder bus routes. Today, rush hour trains leave Alewife with empty seats, an inducement for the residential development that is occurring.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) are below the MBTA system-wide average and well below the region as a whole. The percentage of daily transit use is correspondingly high.
- Household density within a half-mile radius is somewhat above the system-wide average. Employment density is well above, reflecting the historic pattern of land use around the station. The large volume of residential units coming on-line since 2013 will bring these numbers into greater balance, although hundreds of new jobs are coming on-line as well.
- The Alewife station area is slightly more affordable, on average, than the region as a whole.
- Notwithstanding its peripheral location, Alewife residents have a transit job shed more than double the region-wide average, reflecting the large concentrations of jobs along the Red Line at Harvard, Central, Kendall, Mass General, the Financial District, the Seaport, and UMass/Boston. The labor shed available to Alewife employers, on the other hand, is less than double the region-wide average.

Transit Mobility Needs

Alewife's continued development depends on the relaibility and capacity of the Red Line, which still has available rush hour seats in both directions.[114] The MBTA's decision to replace the entire Red Line fleet and generate up to 50% addition peak hour train capacity helps assure Alewife's continued market appeal.

Alewife's two major development areas—the Triangle and the Quadrangle—are split by the Fitchburg commuter rail line, which traverses the station area without stopping there and impedes pedestrian and bicycle access between the Quadrangle and the Red Line station. At minimum, a robust pedestrian-bicycle connection spanning the tracks is needed.

A potentially more effective step would be to add an infill station on the Fitchburg Line, integrated with the ped-bike bridge and funded through the continued development of the Triangle and Quadrangle. In addition to providing Alewife residents with an alternative transit route to Downtown Boston, a commuter rail stop would open up Alewife's office, R&D, and commercial development to employees living west of Alewife along the Fitchburg Line. This would give Alewife a more robust transit labor shed and would attract workers who live in the Route 2 corridor but face a highly congested highway commute to Alewife.

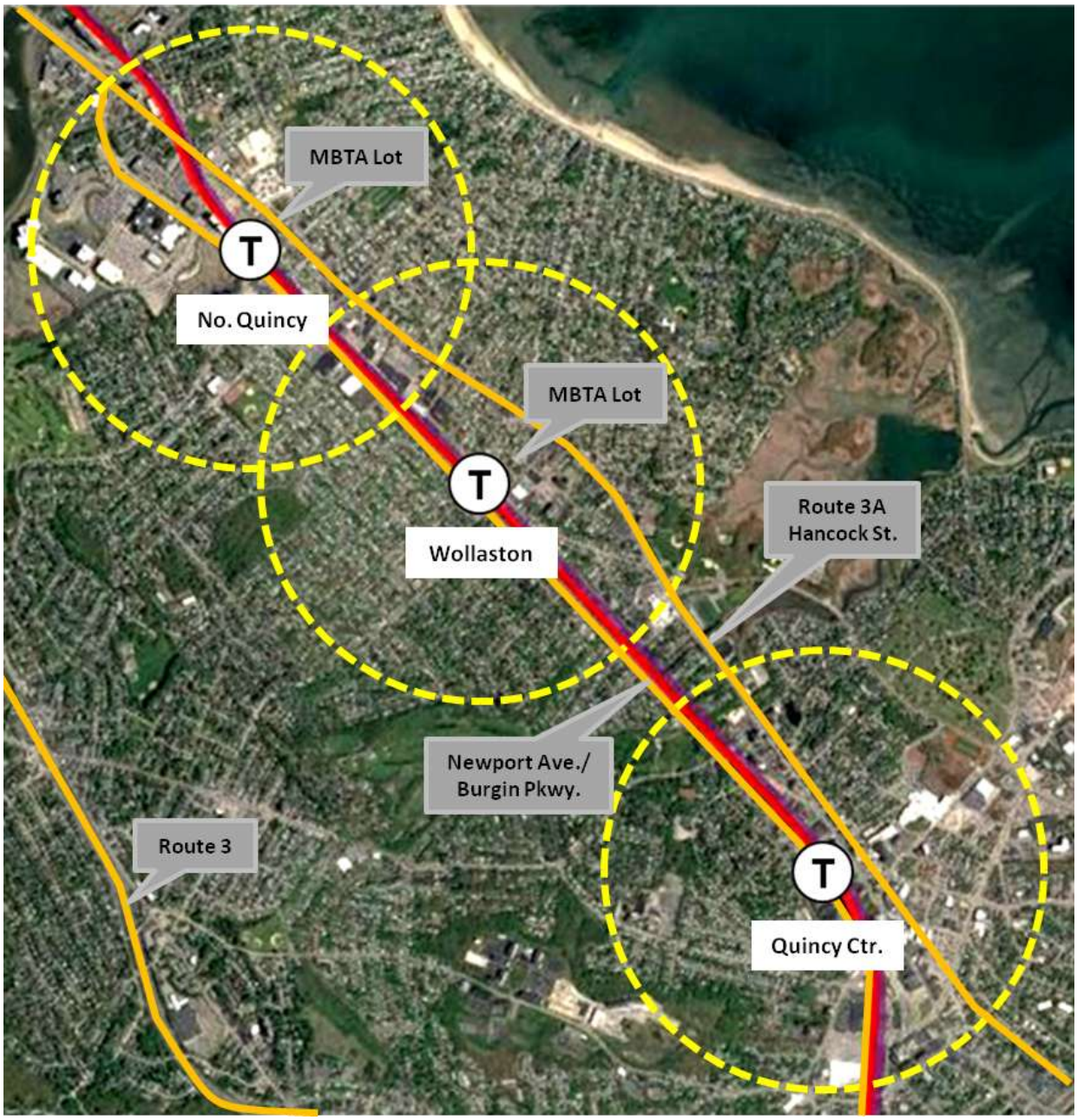
SUMMARY OF TRANSIT NEEDS, ALEWIFE
General
Rapid Transit System State of Good Repair: Reliability and Capacity, especially of the Red Line
Station-Specific
Ped-bike connection from Quadrangle to Red Line station
New commuter rail infill station on Fitchburg Line

QUINCY RED LINE CORRIDOR

OVERVIEW

The Quincy Red Line TOD Corridor consists of the North Quincy, Wollaston, and Quincy Center station areas. At all three, the MBTA and the City envision catalytic joint development projects on MBTA property. In Quincy Center, the proposed station project is part of a larger, comprehensive downtown revitalization program.

FIGURE 31: Quincy Red Line Corridor



Source: AECOM

DEVELOPMENT DISTRICTS

North Quincy and Wollaston

North Quincy is attracting development on its sea of surface parking lots, one of which is the MBTA's park-and-ride facility, for which a large residential/retail joint development project was designated in 2016 and is currently under construction. A similar opportunity exists at Wollaston.

Quincy Center

At Quincy Center, the historic downtown, the City and its private development partners have embarked on a multi-phase revitalization plan, with renewed infrastructure and greater density. Some development projects, including a large multi-family residential complex and a series of street-level retail and restaurant investments, are underway, and others are in the planning stages. The centerpiece is a proposed MBTA/City partnership to redesign the aging Quincy Center Station, demolish its closed park-and-ride garage, and create a mixed-use development program, including air rights.[115] The MBTA designated a developer in 2017.

Table 55 summarizes the important development sites in the Quincy Red Line Corridor Growth Cluster. The detailed estimate of housing units and/or jobs associated with each site, and a hyperlink to its official documentation, are provided in Technical Appendix C1.

TABLE 55: Key Development Sites, Quincy Red Line Corridor

North Quincy		Status *
MBTA North Quincy Park-and-Ride Lot	Large-scale joint development project; primarily residential, with street-level retail.	R/C
Private surface parking lots at State Street South	Emerging market interest in building residential and commercial development on freed-up surface lots.	LT
Residential infill projects on Hancock Street	Several.	R/C, P
Wollaston		
MBTA Wollaston Park-and-Ride Lot	Likely to be made available for joint development, primarily residential.	LT
Quincy Center		
West of Chestnut	Large multi-family at central intersection of Hancock, Chestnut, and Granite Streets.	R/C
Hancock Parking Lot and Ross Garage site	Major city-owned parcels, key to downtown urban renewal plan.	P
MBTA Quincy Center Station joint development	Legislatively-approved joint undertaking by City and MBTA; includes redesigned and modernized station and garage.	P
Downtown Quincy Revitalization Plan	Balance of approved Urban Renewal District buildout, net of listed projects.	P
* R/C = recent (on-line since 2013) or current; P = in the approval pipeline; LT = long-term potential.		

Source: AECOM; compiled from City of Quincy; MBTA; MEPA database; MAPC MassBuilds; press accounts

TRANSIT ASSESSMENT

Existing Transit Market Conditions

Table 56 presents, for the three Quincy TOD stations, the suite of metrics described earlier in "Metrics and Methodology" (Table 2, page C-5). Where and as applicable, the average value for the MAPC region, or for all MBTA stations including commuter rail, is provided for comparison.

The three station settings are quite different, and this is reflected in their MAPC Station Typology classifications. North Quincy is classified as "Transformational Subway", reflecting the large areas of surface parking where redevelopment could occur over time. Wollaston is a "Neighborhood Subway" station. Quincy Center is an "Urban Gateway" station, signifying its place in the downtown of a Regional Urban Center and Gateway City.

TABLE 56: Station Characteristics, Quincy Red Line Corridor

	MAPC TYPOLOGY	TRANSIT USE %	DAILY RIDERS	HHOLDS IN ½ MILE	JOBS IN ½ MILE	JOB SHED	LABOR SHED	H+T AMI	H+T 80%	CARS/ HHOLD	VMT/ HHOLD
All Stations	n/a	21%	n/a	2,815	2,964	—	—	—	—	1.03	25.84
MAPC Region	—	13%	—	—	—	302,000	151,000	48%	59%	1.55	50.27
Red Line											
North Quincy	Transform. Subway	30%	6,925	2,956	3,454	539,000	222,000	41%	49%	.82	25.00
Wollaston	Neighbhd. Subway	29%	4,624	4,187	2,118	513,000	224,000	42%	51%	.90	22.00
Quincy Center	Urban Gateway	27%	8,655	3,986	10,515	457,000	221,000	42%	51%	.68	16.97
Commuter Rail, Greenbush, Kingston-Plymouth, Middleborough-Lakeville Lines											
Quincy Center		27%	87	3,986	10,515	457,000	221,000	42%	51%	.68	16.97

Source: AECOM, compiled from MBTA Blue Book; MAPC stations database; Center for Neighborhood Technology databases (see Table 2)

- North Quincy's ridership—second-highest among the five Quincy and Braintree stations—reflects its combination of office development, park-and-ride capacity, and feeder bus network. Quincy Center has the highest ridership of the Quincy and Braintree stations; however, its current ridership does not include its park-and-ride garage, which was closed in 2012.
- Automobile ownership and Average Vehicle Miles Traveled (VMT) are below the MBTA system-wide average and well below the region as a whole. The percentage of daily transit use is correspondingly high.
- Household density within a half-mile radius exceeds the system-wide average in all three station areas. Employment density is above average at North Quincy, with the State Street South office complex, and high at Quincy Center, with a concentration of jobs typical of regional downtowns.
- All three station areas are somewhat more affordable places to live than the region as a whole. On the combined Housing+Transportation cost index, they fall below the 45% of income benchmark and the region-wide average of 48%.
- The transit job and labor sheds at all three of these stations are smaller than those at Alewife. They are nonetheless at least 50% greater than the region-wide average, with direct access to the other Red Line Growth Clusters and a one-transfer commute to all points in the Seaport.

Transit Mobility Needs

The defining TOD need at the three Quincy stations is the reliability and capacity of the Red Line. The MBTA's decision to replace the entire Red Line fleet, enabling a peak capacity increase of potentially 50%, is essential.

In Quincy Center, the planned improvement of the station and the adjoining public infrastructure, as part of a City/MBTA joint development initiative, is integral to creating the environment and the physical template for TOD in and immediately around the station. The prospect of a new, more welcoming station is a key factor in attracting private investment in the larger downtown revitalization district.

SUMMARY OF TRANSIT NEEDS, QUINCY TOD CORRIDOR
General
Rapid Transit System State of Good Repair: Reliability and Capacity, especially of the Red Line
Station-Specific
Redesign and reconstruction of Quincy Center Station through joint development initiative

ENDNOTES

[1] "Growth Clusters" are not to be confused with "Growth Districts", the statewide district designation program conducted by the Executive Office of Housing and Economic Development. Some of the Growth Clusters identified in this report coincide with state-designated Growth Districts, but there is no further connection.

[2] MAPC, http://www.massbuilds.com/.

[3] http://www.bostonredevelopmentauthority.org/projects/development-projects/the-boston-garden and http://www.bostonredevelopmentauthority.org/projects/development-projects/government-center-garage-redevelopment; http://www.tdgarden.com/delaware-north-and-boston-properties-celebrate-groundbreaking-of-the-hub-on-causeway/.

[4] http://www.bostonplans.org/getattachment/59bd6382-8ebe-4142-8663-86e2fcaf6963.

[5] http://www.bostonredevelopmentauthority.org/getattachment/be76f85f-9ff2-4f36-903b-9ef568d0e1d8; http://www.globest.com/sites/johnjordan/2016/08/01/hines-gemdale-jv-moving-forward-with-south-station-air-rights-project/?slreturn=20160721003113.

[6] MassDOT, South Station Expansion Project. http://www.massdot.state.ma.us/Portals/25/Docs/FEIR/FEIR_CH1_Intro.pdf and http://www.massdot.state.ma.us/Portals/25/docs/DEIR/report/03-chapter3.pdf.

[7] Boston Planning & Development Agency, Draft Municipal Harbor Plan (2016); http://www.bostonredevelopmentauthority.org/getattachment/3ad86e0e-42c4-4510-8d07-008b47482fcc.

[8] MassDOT, South Station Expansion Project Draft Environmental Impact Statement, p. 2-2. If boardings and alightings are both counted for all modes, South Station has over 90,000 weekday passengers coming or going, North Station nearly 70,000.

[9] Boston Transportation Department and Nelson Nygaard, Inc., Subway line seated capacity analysis for GoBoston 2030.

[10] City of Boston, *GoBoston2030, Vision Framework* (2016).

[11] The exceptions—North Station, Charles/MGH, and Science Park, on the fringe of the Downtown with large areas of water or undevelopable land—are still way above the system-wide average.

[12] Urban Land Institute and Northeastern University, Dukakis Center for Urban and Regional Policy, *Hub and Spoke: Core Transit Congestion and the Future of Transit and Development in Greater Boston* (2012; http://boston.uli.org/wp-content/uploads/sites/12/2012/06/Hub_and_Spoke_WEB.pdf).

[13] MassDOT, FY2017-21 Capital Investment Plan (2016); http://www.massdot.state.ma.us/Portals/0/docs/infoCenter/docs_materials/CapitalInvestmentPlan2017-2021.pdf (henceforth MassDOT CIP, loc. cit.).

[14] The South Station Expansion Project is most recently described in the Final Environmental Impact Report: http://www.massdot.state.ma.us/southstationexpansion/Documents/FEIR.aspx.

[15] http://www.bostonredevelopmentauthority.org/projects/development-projects/the-boston-garden-phase-I .

[16] MBTA Blue Book, 2014 edition (https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Panel/MBTARidershipandServiceStatistics2014.pdf)

[17] The Boston Harbor Association (Boston Harbor Now), *Completing Boston's Ferry System: A Blueprint for Excellence* (2015).

[18] The existing Silver Line IV service provides a portion of this connectivity but runs on the street and currently terminates at South Station.

[19] MassDOT, South Station Expansion Project Draft Environmental Impact Statement, p. 2-2. If boardings and alightings are both counted for all modes, South Station has over 90,000 weekday passengers coming or going, North Station nearly 70,000.

[20] City of Boston, *GoBoston2030, Vision Framework* (2016).

[21] MassDOT CIP, loc. cit.

[22] http://www.bostonredevelopmentauthority.org/getattachment/fbd05d54-069d-4d91-9d4c-c63ece15ccf8.

[23] Medical Area Service Corporation (MASCO), 2013 Data Presentation, and 2017 interview with MASCO.

[24] The name "Fenway Triangle" is used in this report to denote the triangular-shape of the district formed by the intersection of Boylston Street and Brookline Avenue. One of the major development projects in the district is also named the Fenway Triangle.

[25] MBTA Blue Book, 2014 Edition (https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Panel/MBTARidershipandServiceStatistics2014.pdf)

[26] http://www.masco.org/lma-shuttles/routes.

[27] See the Upper Southwest Corridor/Dudley and Downtown sections, respectively. Within the LMA/Fenway/Brookline Village Growth Cluster, the recently opened Yawkey commuter rail station will be improved by the developer as part of the planned Fenway Center mixed-use project.

[28] See the Kendall section.

[29] Kendall Square Mobility Task Force; presentation of June 23, 2015 (https://www.massdot.state.ma.us/planning/Main/CurrentStudies/KendallSquareMobility/DocumentsandMeetingMaterials.aspx.)

[30] Kendall Square Mobility Task Force, ibid.; presentation of September 20, 2016 (Red Line Capacity Update).

[31], Kendall Square Mobility Task Force, ibid.; presentation of September 20, 2016 (Bus Priority Corridors).

[32] Kendall Square Mobility Task Force, ibid.; presentation of October 25, 2016 (Grand Junction Feasibility Workshop).

[33] A Better City, MassDOT, MBTA, Massport, Boston Redevelopment Authority, et al., *South Boston Waterfront Sustainable Transportation Plan (2015).*

[34] MAPC, *Growing Station Areas* (2012; https://www.mapc.org/resource-library/growing-station-areas-the-variety-and-potential-of-tod/).

[35] A Better City, MassDOT, MBTA, Massport, Boston Planning & Development Agency, et al., *South Boston Waterfront Sustainable Transportation Plan (*2015). Transit recommendations are listed on pp. 13 ff, divided into Intermediate & Short-Term (10-year horizon) and Mid- & Long Term (20-year horizon). The summary presented here focuses on the mid- to long-term outcomes. (http://www.abettercity.org/docs/2015.01.15%20SBoston%20Waterfront_ExecSumm_ONLY_PB.pdf).

[36] See the Chelsea and Lynn Waterfront sections.

[37] The term "South Bay Corridor" is original to this study, as a collective reference to the Dorchester Avenue, South Bay, Newmarket, JFK/UMass, and Widett planning areas and their inter-relationships.

[38] City of Boston, *Imagine Boston 2030* (https://imagine.boston.gov/imagine-boston-plan/), pp. 190 ff.

[39] http://www.bostonplans.org/getattachment/4e9fe8b6-4136-4904-bacd-5699a2d8730c.

[40] http://www.bostonredevelopmentauthority.org/projects/development-projects/south-bay-mixed-use-town-center-project.

[41] http://www.newmarketboston.org/about/newmarket-today/. This number exceeds the roughly 9,000 jobs listed in MAPC's half-mile station area database and included in Table 2. In addition to the tendency of the MAPC database to under-count, not all of the jobs associated with Newmarket businesses are located on-site.

[42] BRA, *Fairmount/Indigo Planning Initiative,* 2015. http://www.bostonredevelopmentauthority.org/getattachment/9251b1ae-7526-4b43-b7f5-77732890169f.

[43] In its 2016 Final Environmental Impact Report on the South Station Expansion Project, MassDOT identified Widett Circle as a potential layover location, with further design studies to follow. The FEIR and its certificate specify that creation of a layover facility at Widett would be coordinated with the City and the Widett industrial owners, and that the design would accommodate a future air rights deck. (http://www.massdot.state.ma.us/Portals/25/Docs/FEIR/FEIR_CH1_Intro.pdf).

[44] https://www.umb.edu/the_university/masterplan/bayside.

[45] BRA, Columbia Point Master Plan (2011); http://www.cssboston.com/wp-content/uploads/2015/03/Columbia%20Point%20Maser%20Plan%20Final%20June%202011.pdf.

[46] The South Station Expansion Project is most recently described in the Final Environmental Impact Report: http://www.massdot.state.ma.us/southstationexpansion/Documents/FEIR.aspx.

[47] MAPC, *Growing Station Areas* (2012; https://www.mapc.org/resource-library/growing-station-areas-the-variety-and-potential-of-tod/).

[48] MBTA Blue Book, 2014 edition (https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Panel/MBTARidershipandServiceStatistics2014.pdf)

[49] The rent levels at the new waterfront multi-family developments will likely push this value up to some degree, as is the case in many Inner Core locations. However, the metric reflects the housing stock in the entire station walkshed.

[50] http://uli.org/wp-content/uploads/ULI-Documents/Box-draft-profile2.pdf.

[51] Chelsea Department of Planning and Development, March 2016.

[52] The station site abuts the high-volume Market Basket supermarket, which is expected to remain.

[53] MassDOT, Silver Line Gateway TIGER Application (April 2016).

[54] MassDOT, Silver Line Gateway TIGER Application (April 2016).

[55] MassDOT, Silver Line Gateway TIGER Application (April 2016).

[56] See the Lynn Waterfront section.

[57] City of Boston, *Imagine Boston 2030* (https://imagine.boston.gov/imagine-boston-plan/), pp. 190 ff.

[58] http://www.bostonplans.org/projects/development-projects/suffolk-downs-phase-1 and http://www.bostonplans.org/projects/development-projects/suffolk-downs. The Expanded PNF/ENF sets forth a conceptual plan for the site and two alternative program mixes for a total multi-phase, 20-year buildout of 16.5 million square feet. In Technical Appendix C1, the low end of the range in each use category is assumed.

[59] http://www.waterfrontsquarema.com/master-plan/ and https://www.mbtarealty.com/wp-content/uploads/projects/1269/Waterfront-Square-3.pdf. An additional private parcel of 1.2 acres bisects the Waterfront Square site and is expected to be developed separately.

[60] http://www.mass.gov/hed/economic/eohed/pro/gdi/gdi-guidelines.html.

[61] See the MBTA North Shore Transit Improvements Study, especially http://www.mbta.com/uploadedFiles/Documents/North_Shore_Transit_Improvements/Figure_3_6_Revere-station.pdf.

[62] It should be noted, however, that the highest ridership station (Wonderland) had the lowest resident commuter mode share. This presumably reflects the large number of Wonderland riders who arrive by car or bus. Suffolk Downs, with the lowest ridership, has the highest mode share because of the close proximity of its walk-up neighbors.

[63] http://www.mbta.com/schedules_and_maps/system_map/.

[64] "Metro Core" is the inner-most subset of Inner Core communities: Boston, Cambridge, Somerville, Brookline, Chelsea, Everett, Revere, Winthrop.

[65] Boston Transportation Department and Nelson Nygaard, Inc., Subway line seated capacity analysis for GoBoston 2030.

[66] http://mbta.com/about_the_mbta/t_projects/default.asp?id=1012#project. This menu includes the potential extension of the Blue Line to Downtown Lynn, an issue addressed in the Lynn Waterfront Growth Cluster discussion, which follows.

[67] See MassDOT prediction in https://commonwealthmagazine.org/transportation/t-notes-blue-line-major-peak-concern/.

[68] The Red-Blue obligation was downgraded to completing the design in 2006 and dropped entirely in 2013.

[69] http://www.mass.gov/hed/press-releases/ma-leaders-discuss-economic-development-in-lynn.html.

[70] Under zoning, the site could accommodate a 1,250-unit, 20-story development (https://www.bostonglobe.com/business/2016/03/10/getrain/KYt0KvY1zo3dqbAfllO7oK/story.html).

[71] *Ibid*.; p. 2. http://ediclynn.org/files/LynnFinalReport_LowRes_9-07.pdf.

[72] http://www.mass.gov/hed/economic/eohed/pro/gdi/gdi-guidelines.html.

[73] City of Lynn (Sasaki Associates), *Lynn Waterfront Master Plan*, 2007; p. 53. The comparable district infrastructure for the 66-acre Assembly Row site in Somerville (not counting the new Orange Line station) was at least $125 million.

[74] MBTA Blue Book, 2014 edition (https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Panel/MBTARidershipandServiceStatistics2014.pdf)

[75] MassDOT, Silver Line Gateway TIGER Application (2016).

[76] East Somerville Station, renamed by the MBTA in 2016, was formerly known as Washington Street Station.

[77] http://www.somervillema.gov/sites/default/files/SomerVisionComprehensivePlanWithAppendicesAdoptedApril-19-2012.pdf),

[78], Kendall Square Mobility Task Force, ibid.; presentation of September 20, 2016 (Bus Priority Corridors).

[79] Kendall Square Mobility Task Force, presentation of October 25, 2016 (Grand Junction Feasibility Workshop).

[80] See, *inter alia*, MAPC with City of Somerville, *Dimensions of Displacement* (2014).

[81] City of Boston, *Imagine Boston 2030* (https://imagine.boston.gov/imagine-boston-plan/), pp. 190 ff.

[82] River's Edge is the name of the specific development project that succeeded Telecom City and occupies most of the developable land in the Malden River corridor. In this discussion, the term is used to denote the entire corridor.

[83] MAPC, *Growing Station Areas* (2012; https://www.mapc.org/resource-library/growing-station-areas-the-variety-and-potential-of-tod/).

[84] MassDOT, *Focus40: Bus and Rapid Transit Capacity Gap Analysis (Draft)*; September 21, 2016 Presentation.

[85] MassDOT, *Everett Transit Action Plan* (September 21, 2016 Presentation).

[86] *Ibid*. See the Chelsea section of this report for a description of the Silver Line Gateway.

[87] http://www.massdot.state.ma.us/highway/HighlightedProjects/AllstonI90InterchangeImprovementProject.aspx.

[88] https://www.massdot.state.ma.us/Portals/8/docs/HighlightedProjects/AllstonInterchange/PresentationHarvard_081915.pdf.

[89] City of Boston, *Imagine Boston 2030* (https://imagine.boston.gov/imagine-boston-plan/), pp. 190 ff

[90] http://www.bostonplans.org/projects/development-projects/boston-landing; http://www.bostonplans.org/projects/development-projects/the-residences-at-125-guest-street-boston-landing.

[91] See, for a summary: https://www.bostonglobe.com/business/2015/05/19/proposed-watertown-office-building-latest-arsenal-street-development-spree/cir6Sx3UrFtxFjgVSu8HBP/story.html.

[92] MBTA Blue Book, 2014 edition (https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Panel/MBTARidershipandServiceStatistics2014.pdf)

[93] Draft MBTA Focus40 Capacity Gap Analysis: https://www.cambridgema.gov/CDD/News/2016/8/~/~/media/DA08688CB00544F2A6D28E3D6F5819D6.ashx

[94] Kendall Mobility Task Force, Bus Priority Presentation (September 20, 2016)

[95] City of Newton, *Housing Needs Analysis and Strategic Recommendations* (2016).

[96] See City of Newton, *Newton Leads 2040: A Blueprint to Promote Affordable, Diverse Housing & Economic Growth* (2016).

[97] See City of Newton, *Newton Leads 2040: A Blueprint to Promote Affordable, Diverse Housing & Economic Growth* (2016).

[98] https://www.dropbox.com/s/m8577p982tqo0g7/606635_Public_Hearing_2014aspresented-Needham%20%281%29.pptx?dl=0

[99] In 2013, MAPC worked with Newton and Needham to prepare and evaluate a conceptual plan for a dedicated bus shuttle on the MBTA's abandoned rail spur that runs parallel to Needham Street on its west side, between Needham and Eliot Streets. (http://www.mapc.org/needhamnewton-rail-right-way-transit-concept.) The study recognized several impediments to this approach; the most obvious is the separation of the rail alignment from Needham Street itself as the character of the street and its long-term built form evolve. That said, the rail alignment option, which would separate the bus route from automobile congestion, could be revisited as an alternative to enhanced or branded service on Needham Street.

[100] http://www.mbta.com/schedules_and_maps/rail/lines/stations/?stopId=213.

[101] The MBTA received a $20 million federal TIGER grant in support of this project, which is currently in design. http://www.mbta.com/about_the_mbta/t_projects/default.asp?id=25059.

[102] http://www.bostonplans.org/planning/planning-initiatives/plan-jp-rox.

[103] http://www.mbta.com/schedules_and_maps/subway/lines/stations/?stopId=11952&lat=42.310359&lng=-71.107125.

[104] The two large multi-family developments proposed to date (The Commons at Forest Hills, which is nearing completion, and the Residences at Forest Hills, in the planning and approval stage) have a total of 532 units and only 309 parking spaces, a reliance on transit use and reduced car ownership replicated at dozens of TOD sites in this report (http://www.bostonplans.org/getattachment/b9231be2-203d-4f7e-8404-82bfd3980f5a and http://www.bostonplans.org/projects/development-projects/the-residences-at-forest-hills).

[105] https://www.massdot.state.ma.us/caseyarborway/AbouttheProject.aspx.

[106] http://www.bostonplans.org/getattachment/653f6e4d-a482-4163-ad39-11876d8f656a.

[107] *Ibid.*

[108] MBTA Blue Book, 2014 edition (https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Panel/MBTARidershipandServiceStatistics2014.pdf).

[109] See the Roxbury-Mattapan-Dorchester Transit Needs Study (http://www.massdot.state.ma.us/Portals/17/docs/RDM/RDMReport_0912.pdf) and Focus40 Priority Bus Lane Study: https://www.massdot.state.ma.us/Portals/49/Docs/BusLane20160513%20.pdf.

[110] City of Boston, *Imagine Boston 2030* (https://imagine.boston.gov/imagine-boston-plan/), pp. 190 ff

[111] http://www.bostonplans.org/getattachment/d0010560-6cae-4b78-a61d-11afe13cd4ad.

[112] MBTA Blue Book, 2014 Edition (https://d3044s2alrsxog.cloudfront.net/uploadedfiles/About_the_T/Panel/MBTARidershipandServiceStatistics2014.pdf).

[113] See, for example, National Association of Industrial and Office Parks (NAOIP), *The Brain Train: The Red Line's Effect on Real Estate* (March 1, 2016).

[114] Boston Transportation Department and Nelson Nygaard, Inc., Subway line seated capacity analysis for GoBoston 2030.

[115] http://www.quincyma.gov/CityOfQuincy_Content/documents/URDP%204%20V.2%20Proposed.pdf.

TECHNICAL APPENDIX C1

CALCULATION OF DEVELOPMENT CAPACITY ESTIMATES

THE INNER CORE: STRATEGIC CORRIDORS AND TRANSIT GROWTH CLUSTERS

THE TRANSPORTATION DIVIDEND

TRANSIT INVESTMENTS AND THE MASSACHUSETTS ECONOMY

SUMMARY TABLE: HOUSING AND EMPLOYMENT CAPACITY

	Rounded to nearest hundred				*Cluster totals rounded to nearest thousand*					
	Recent / Current		Pipeline		R/C + Pipeline		Long-Term Potential		Total	
	Res. Units	Jobs	Res. Units	Jobs	Res. Units	Jobs	Res. Units	Jobs	Res. Units	Jobs
The Hub										
Downtown Boston	3,300	9,200	1,800	8,900	5,100	18,100	900	4,200	6,000	22,300
Back Bay	700	1,900	2,000	4,100	2,700	6,000	800	700	3,500	6,700
LMA/Fenway/Brookline Vill.	2,800	5,200	800	2,800	3,600	8,000	100	11,700	3,700	19,700
Kendall	900	7,200	900	7,100	1,800	14,300	1,000	4,400	2,800	18,700
Seaport	2,700	18,000	3,000	11,500	5,700	29,500	3,700	6,500	9,400	36,000
South Bay Corridor	1,600	400	200	7,000	1,800	7,400	11,700	7,500	13,500	14,900
Total	**12,000**	**41,900**	**8,700**	**41,400**	**21,000**	**83,000**	**18,000**	**35,000**	**39,000**	**118,000**
Near North Shore										
East Boston Waterfront	1,300	100	700	100	2,000	200			2,000	200
Chelsea	1,300	800			1,300	800	1,900	2,400	3,200	3,200
Suffolk Downs/Wonderland	900	200		2,300	900	2,500	8,500	23,900	9,400	26,400
Lynn Waterfront	400		1,500		1,900		3,200	4,500	5,100	4,500
Total	**3,900**	**1,100**	**2,200**	**2,400**	**6,000**	**4,000**	**14,000**	**31,000**	**20,000**	**35,000**
North Corridor										
E. Cambridge/E. Somerville	1,300	1,000	1,500	8,400	2,800	9,400	5,600	24,100	8,400	33,500
GLX Villages	200			300	200	300	500	2,500	700	2,800
Mystic/Malden Rivers	3,000	15,000	1,100	10,500	4,100	25,500			4,100	25,500
Total	**4,500**	**16,000**	**2,600**	**19,200**	**7,000**	**35,000**	**6,000**	**27,000**	**13,000**	**62,000**
Charles River Corridor										
Allston-Brighton Rail Corridor	1,500	5,200	900	4,200	2,400	9,400	2,800	10,400	5,200	19,800
Arsenal Street	1,100	1,100		2,500	1,100	3,600	400	200	1,500	3,800
Newton Rail TOD Corridor	100		300	1,100	400	1,100	600		1,000	1,100
Needham Street			1,000	600	1,000	600	500	1,000	1,500	1,600
Downtown Waltham	300	100	300		600	100	800	2,000	1,400	2,100
Total	**3,000**	**6,400**	**2,500**	**8,400**	**6,000**	**15,000**	**5,000**	**14,000**	**11,000**	**29,000**
Southern Neighborhoods										
Upper SW Corridor/Dudley	200	1,500	2,200	2,300	2,400	3,800			2,400	3,800
Lower SW Corridor/Egleston	800	200	1,000	200	1,800	400	2,500	500	4,300	900
Lower Blue Hill Avenue			400	200	400	200	300	300	700	500
Hyde Park Villages			800	700	800	700	900	1,800	1,700	2,500
Total	**1,000**	**1,700**	**4,400**	**3,400**	**5,000**	**5,000**	**4,000**	**3,000**	**9,000**	**8,000**
Red Line Outer Markets										
Alewife	1,100	100	1,100	1,300	2,200	1,400	800	3,200	3,000	4,600
Quincy Red Line Corridor	900	100	1,100	2,100	2,000	2,200	1,500	2,600	3,500	4,800
Subtotal	**2,000**	**200**	**2,200**	**3,400**	**4,000**	**4,000**	**2,000**	**6,000**	**6,000**	**10,000**
Grand Total	**26,400**	**67,300**	**22,600**	**78,200**	**49,000**	**146,000**	**49,000**	**116,000**	**98,000**	**262,000**

THE HUB

Factors: sf/employee		
	Office	225
	Retail	500
	Grocery	1000
	Hotel	1000 (per 1000 sf)
	Hotel	0.625 (per key)
	R&D	400
	Hospital	500 incl. medical R&D; med/dental offices same as "office"

	Recent/Current			Pipeline			Long-Term Potential		
	Res. Units	Jobs		Res. Units	Jobs		Res. Units	Jobs	
Downtown Boston									
One Canal	320	134	http://www.bostonredevelopmentauthority.org/getattachment/...e6de8ac2-6a56-406d-9919-ed5cac8f3d39						MAPC DD
104 Canal Hotel					56	http://www.bostonredevelopmentauthority.org/getattachment/...88ec7f53-d092-4b20-8dcf-d3d032af3562			
The Victor	286	34							
Forecaster Building	52		http://www.bostonredevelopmentauthority.org/projects/development-projects/121-127-portland-street-(the-forecaster-bldg).						
Causeway & Beverly	239	602	http://www.bostonredevelopmentauthority.org/getattachment/...38837a14-da35-4436-a894-8e5376f3f92e						
Lovejoy Wharf	175	400	http://www.bostonredevelopmentauthority.org/getattachment/f...f9bf18a-5438-4a7f-a3e2-0e7f90104b65						No. of jobs per Converse.
Nashua St. Residences	503		http://www.bostonredevelopmentauthority.org/getattachment/...6f71d748-3df9-4501-981d-6464e46359ad						
Hub on Causeway (Old Boston Garden Site)	440	1,805	http://www.bostonredevelopmentauthority.org/projects/development-projects/the-boston-garden-phase-i.						
Bullfinch Crossing (Govt. Ctr. Garage)	771	3,714	http://www.bostonredevelopmentauthority.org/projects/development-projects/government-center-garage-redevelopment						
Filene's/Millennium	442	1,089	http://www.bostonredevelopmentauthority.org/getattachment/f...0319f951-1e12-4def-8688-96c346d038d2-1, http://millenniumtwr.com/.						
One Bromfield				400	60	http://www.bostonredevelopmentauthority.org/getattachment/...91302ef-029f-4338-ac15-e78f1f04c3d5			
533 Washington Street				94		http://www.bostonredevelopmentauthority.org/projects/development-projects/533-washington-street.			
Congress Square	35	1,424	http://www.bostonredevelopmentauthority.org/getattachment/...7fbbe20a-999a-4dd2-980a-13407186d5bd						
Winthrop Square				500	2,670	http://www.bostonplans.org/getattachment/59bd6382-8ebe-4142-8663-86e2fca69643			No. of jobs per Draft EIR/PIR
110 Broad Street	52	7	http://www.bostonredevelopmentauthority.org/getattachment/f...051925b-bde6-48e6-85a0-150c1f177313						
55 India Street				44		http://www.bostonredevelopmentauthority.org/projects/development-projects/55-india-street			
45 Stuart Street				398		http://www.bostonredevelopmentauthority.org/projects/development-projects/45-stuart-street			
South Station Air Rights				412	6,072	http://www.bostonredevelopmentauthority.org/getattachment/...be76f85f-9ff2-4f36-903b-9ef568d0e1d8.			
Future South Station/Dot Ave.							500	1,978	DEIR range 600K-2MSF; assume 1M, mixed use program.
Hook Lobster Site							265	20	MHP ~275,000 sf; assume residential over retail.
Harbor Garage							150	2,234	MHP ~ 900,000 sf; mixed-use.
TOTAL DOWNTOWN	3,300	9,200		1,800	8,900		900	4,200	
Back Bay									
Back Bay Station/ Gateway Project				600	2,636	http://www.bostonredevelopmentauthority.org/getattachment/f...bd05df54-069d-4d91-9d4c-c63ece15ccf8.			
Copley Place Expansion				542	228	http://www.bostonredevelopmentauthority.org/getattachment/...6ef49a51-a1e4-44cc-85a9-b46971d407f4			
500 Boylston					331	http://www.bostonredevelopmentauthority.org/projects/development-projects/500-boylston			
40 Trinity Place				146	119	http://www.bostonredevelopmentauthority.org/getattachment/...bef4ad07-1df4-4c4a-be95-f1d42110ca37			
Columbus Center							500	724	Assume that the plan is revived at prior density.
Parcels 12 and 15 MassDOT Air Rights				500	733	http://www.behtrefleisen.com/single-post/2016/10/28/Project-Over-Turnpike-Moves-Closer-to-Reality			Article 80 to start; Parcel 12 assumed to be 50-50 office and residential.
30 Dalton	222	26	http://www.bostonredevelopmentauthority.org/projects/development-projects/30-dalton-street.						
Christian Science Plaza/One Dalton	472	191	http://www.bostonredevelopmentauthority.org/getattachment/...39cfb739-930a-4742-9ae0-6d921fc60d4d						
Prudential Expan- sion Phases 4a, 6	188	1,689	http://www.bostonredevelopmentauthority.org/getattachment/...b5f278ed-26b6-4c7f-bd47-7f1a00a24581.						
Hynes/MassDOT Parcel 13				170	90	https://blog.mass.gov/transportation/mbta/massdot-mbta-approve-parcel-13-hynes-station-deal/.			
2 Charlesgate West (TransNational site)						http://www.bostonredevelopmentauthority.org/getattachment/...4a9f9784-f962-43ff-9e2f-012c63f31535.	295		LOI filed Sept. 2016
TOTAL BACK BAY	700	1,900		2,000	4,100		800	700	
LMA/Fenway									
Children's Clinical Bldg.					890	http://www.bostonredevelopmentauthority.org/getattachment/...4e408c92-d8cf-4edc-bd81-20ea3cf77ab1			
Children's Office Bldg at Audubon Circle						http://www.bostonredevelopmentauthority.org/getattachment/...dc1c76e5-a86b-4d6b-9c68-710c20692dcf		490	
Children's Longwood Research Institute						http://www.bostonredevelopmentauthority.org/projects/development-projects/longwood-north-research-center.		880	In Master Plan; BRA approved 2007.
Brigham & Women's at Emmanuel						http://www.bostonredevelopmentauthority.org/getattachment/f...4c79f848-322d-4060-8b21-2ed75aff8aa1		720	
Mass. Mental Redevelopment	136	716	http://www.bostonredevelopmentauthority.org/projects/development-projects/mass-mental-health-center-residential-building;, http://www.bostonredevelopmentauthority.org/getattachment/...dc1c76e5-a86b-4d6b-9c68-710c20692dcf						
Remaining MASCO Job Growth Forecast								9,504	MASCO *LMA Facts 2013* forecast of +13,200 jobs *in LMA* by 2030; this number is the balance net of the above LMA projects.
Fenway Trilogy	576	86	http://samuelsre.com/property/fenway-triangle-trilogy.						
Fenway Triangle	300	1,340	http://www.bostonredevelopmentauthority.org/getattachment/...4771ad52-e6e1-48b1-9e3c-0e1356c83515.						
1282 Boylston (The Viridian)	322	30	http://www.bostonredevelopmentauthority.org/projects/development-projects/1282-boylston-street-(mcdonald-s).						
1350 Boylston Street	200	50	http://www.bostonredevelopmentauthority.org/projects/development-projects/1350-boylston-street.						
The Pierce (The Point)	350	40	http://www.bostonredevelopmentauthority.org/getattachment/...7f6c08f4-eab0-440a-9f5f-ee1b66625cbc.						
Landmark Center		2,249	http://www.bostonplans.org/projects/development-projects/landmark-center.						
Miner Street	49		http://www.bostonredevelopmentauthority.org/getattachment/...bedd470b-6044-4cd8-8c14-528c04a72127.						
839 Beacon Street				45		http://www.bostonredevelopmentauthority.org/getattachment/...3837a215-1139-433d-a5cf-dedc5d4a2b2f			
900 Beacon Street	38	8	http://www.bostonredevelopmentauthority.org/getattachment/...465d49b96-4896-4524-8f3b-7379634fbd1c						
Emmanuel Julie Hall				471		http://www.bostonredevelopmentauthority.org/getattachment/...0d438533-edb0-4f79-a1e0-332b3032d569.			471 net new beds; counted as units for this analysis.
Fenway Center	312		http://www.bostonplans.org/projects/development-projects/fenway-center-phase-1.		1904	http://www.bostonredevelopmentauthority.org/getattachment/...03fd3e77-bed8-4349-84d9-8fc2c9880253.			
2 Brookline Place		656	http://www.brooklinema.gov/DocumentCenter/Home/View/7152.						MAPC DD
70 Parker Hill Ave				40		http://www.bostonplans.org/projects/development-projects/70-parker-hill-avenue.			
35 South Huntington				38	14	http://www.bostonplans.org/projects/development-projects/35-south-huntington.			
105A South Huntington	195		http://www.bostonplans.org/projects/development-projects/105a-south-huntington-avenue.						
161 South Huntington	196		http://www.bostonplans.org/projects/development-projects/161-south-huntington.						
201 South Huntington				169		http://www.bostonplans.org/projects/development-projects/goddard-house.			
Brookline River Road/ Emerald Island	78		hotel component underway				93	115	http://www.brooklinema.gov/DocumentCenter/Home/View/10077.

TOTAL LMA-PLUS	2,800	5,200		800	2,800		100	11,700	
Seaport District									
Channel Center		2,333	http://www.bostonredevelopmentauthority.org/projects/development-projects/one-channel-center		924	http://www.bostonredevelopmentauthority.org/getattachment/17f7273d-bb1b-4735-84f6-e59aeed268a9			One Channel Center done; 5-7-9 in pipeline.
319A Street	202		http://www.bostonredevelopmentauthority.org/projects/development-projects/319-a-street-rear						
22 Boston Wharf Road		249	http://www.bostonredevelopmentauthority.org/projects/development-projects/22-boston-wharf-road						
GE Headquarters		800	http://www.bostonredevelopmentauthority.org/projects/development-projects/general-electric-(ge)-headquarters-project						No. of jobs per GE.
381 Congress Street				44		http://www.bostonredevelopmentauthority.org/projects/development-projects/381-congress-street			
399 Congress Street				414		http://www.bostonredevelopmentauthority.org/getattachment/a5b464c1-bf36-4530-8c46-694ce485675a			
150 Seaport Blvd.				124	22	http://www.bostonredevelopmentauthority.org/projects/development-projects/150-seaport-boulevard			
Fan Pier Vertex and Parcel I Office		4,039	http://www.bostonredevelopmentauthority.org/getattachment/2944a35f-edff-406f-a803-824494a5a806			http://www.bostonredevelopmentauthority.org/projects/development-projects/fan-pier-parcel-I			Vertex job number from I-Cubed; Parcel I includes Goodwin Proctor.
Fan Pier Parcels D, E, H	557	3,692	http://www.bostonredevelopmentauthority.org/projects/development-projects/fan-pier-parcel-d						MAPC DD
Pier 4 Phases 1, 2 and 3	356	1,630	http://www.bostonredevelopmentauthority.org/projects/development-projects/pier-4			http://www.bostonredevelopmentauthority.org/projects/development-projects/pier-4-phase-2			
Waterside Place	236	148	http://www.bostonplans.org/getattachment/a4d19c04-6a90-441a-ab74-f0d8910fbda7		659	http://www.bostonplans.org/projects/development-projects/summer-street-hotel			Phase 1 residential and grocery; Phase 2 1054-room hotel
Seaport Square	1,200	4,705	http://www.bostonplans.org/getattachment/2e0f672e-a739-4785-a23b-b1f54dbf9bde	2,100	6,550	http://www.bostonplans.org/getattachment/2e0f672e-a739-4785-a23b-b1f54dbf9bde			BPDA Board Memo with full history and tally; November 2017. Pipeline phase: approx split of res., commercial. R/P Phase: all but Block B.
Parcel K				304	295	http://www.bostonredevelopmentauthority.org/getattachment/c32a0b6f-b47f-4068-a819-cd6950700ca6			
D Street Apartments	197		http://www.bostonredevelopmentauthority.org/projects/development-projects/411-d-street						
D Street Hotels		365	http://www.bostonredevelopmentauthority.org/projects/development-projects/d-street-development						
Massport Hotel at BCEC					625	http://www.massport.com/business-with-massport/planning-and-development/			Hotel on Summer Street parcel; approx. 1000 rooms anticipated
BMIP Parcel Q1					767	http://www.bostonredevelopmentauthority.org/getattachment/2dd5806b-d4f0-41cf-a0e6-cca1e3281cfb			Mix of office, R&D, light assembly
25 FID Kennedy					314	http://www.bostonredevelopmentauthority.org/getattachment/3974263a-6e1d-4dc5-873f-dbdd118ab39a			Renovation of 157,000 sf industrial building; jobs at 1/500 sf.
Massport Marine Terminal					402	http://www.bostonplans.org/getattachment/d335da80-bcdc-4b5a-a443-a09ebd8de289		500	Stavis Seafoods set; remainder awaiting plan, 500=placeholder.
Innovation Square (6 Tide Street)					900	http://www.bostonredevelopmentauthority.org/getattachment/921cc643-f43b-4a3a-bb13-3d584bab11a5			New office/R&D construction.
Balance of Master Plan Buildout						*South Boston Waterfront Sustainable Transportation Plan*	3,720	5,961	Forecast for 2013-2035: 9410 res. units, 35,220 new jobs; subtract above-listed projects.
TOTAL SEAPORT	2,700	18,000		3,000	11,500		3,700	6,500	
South Bay Corridor									
Washington Village (235 Old Colony)	656	197	http://www.bostonplans.org/getattachment/4e9fe8b6-4136-4904-bacd-5699a2d8730c						
232 Old Colony		29	http://www.bostonredevelopmentauthority.org/projects/development-projects/232-old-colony-avenue						
248 Dorchester Avenue				33		http://www.bostonredevelopmentauthority.org/projects/development-projects/248-dorchester-avenue			
488 Dorchester Avenue		33	http://www.bostonredevelopmentauthority.org/projects/development-projects/488-dorchester-ave						
Balance of BRA Dot Ave TOD Plan							5,049		1200 existing; Plan envisions 6-8,000; say 7,000, net = 5,800; minus identified projects.
South Bay Center	475	321	http://www.bostonredevelopmentauthority.org/projects/development-projects/south-bay-mixed-use-town-center-project						
Flower Exchange					5028	http://www.bostonplans.org/getattachment/a3408495-7144-40ea-9c37-5bc9c861b859			"Xchange South End; 1.6 MMSF employment/R&D campus
Suffolk Constrctuon Expansion	169		http://www.bostonplans.org/projects/development-projects/suffolk-construction-expansion						
Newmarket in BPDA Fairmount Plan						http://www.bostonredevelopmentauthority.org/getattachment/653f6e4d-a482-4163-ad39-11876d8f656a	100	1,200	BRA Fairmount Plan estimates for Newmarket.
Widett/Midtown Concept							2,345	3,300	Boston 2024 concept = 7 million sf; assume 50% (3.5 million), 67% res'al.
25 Morrissey Blvd.	278		http://www.bostonredevelopmentauthority.org/projects/development-projects/25-morrissey-boulevard						
University Place				184		http://www.bostonredevelopmentauthority.org/projects/development-projects/university-place-residences			
UMass Bayside						https://www.umb.edu/editor_uploads/images/university/BaysideCharrettingProcessFinalReportFeb2012.pdf	584	821	Specific planning not begun; assume 20-acre site, gross FAR 1, split dorms-acad./office.
Boston Globe Site					1,971	http://www.bostonplans.org/getattachment/f84eab47-702f-4a8b-a3b4-c6ea311967bd			Early stages; proposed 690,000 sf office/employment.tech center
Columbia Point Master Plan						http://www.bostonredevelopmentauthority.org/getattachment/3dbb6601-3336-492e-bc69-cc4ef07f8dd1	3,638	2,151	Total: 4100 res. units, 410 hotel rms., 833,000 office, 492,000 retail; net out preceding 3 projects.
TOTAL SO. BAY CORRIDOR	1,600	400		200	7,000		11,700	7,500	
Kendall									
MIT 610 Main Street		470							MAPC DD.
Novartis		1,430							
MIT Residences on Broadway	290	32	http://209.80.128.250/EEA/emepa/mepadocs/2015/052015em/nps/enf/15371%20ENF%20The%20residences%20on%20Main%20Cambridge.pdf						
Balance of MIT Kendall Program				450	3,976	http://kendallsquare.mit.edu/sites/default/files/documents/MIT_Vol_I_SoMa.pdf			Special permits adopted by City Council 2016. Housing is MIT dormitory.
88 Ames Street	280	32	http://www.cambridgeredevelopment.org/ames-street-development/						
Cambridge Center				450	3,095	https://static1.squarespace.com/static/51f173a6e4b04fc573b07c0c/t/56732c685a566877a05bb89e/1450388584156/1891seir+Kendall+Square+Urban+Renewal+Project+Cambridge.pdf			Pipeline numbers reflect CRA's increase in capacity of KSURP plan.
Alexandria Center	220	5,167	https://www.kendallsq.org/planning-and-development/						Approching completion. MAPC DD.
Volpe Redevelopment						http://www.cambridgema.gov/CDD/Projects/Zoning/~/media/6C9208AE07684141AE45813E14E5F02F.ashx	1,000	4,379	No developer or plan yet; numbers reflect City's 2015 prelim. plan.
250 Kendall Street	144	20							MAPC DD.
TOTAL KENDALL	**900**	**7,200**		**900**	**7,100**		**1,000**	**4,400**	
GRAND TOTAL, THE HUB	**12,000**	**41,900**		**8,700**	**41,400**		**18,000**	**35,000**	

NEAR NORTH SHORE

Factors: sf/employee		
	Office	225
	Retail	500
	Grocery	1000
	Hotel	1000 (per 1000 sf)
	Hotel	0.625 (per key)
	R&D	400
	Hospital	500 incl. medical R&D; med/dental offices same as "office"

	Recent/Current			Pipeline			Long-Term Potential		
	Res. Units	Jobs		Res. Units	Jobs		Res. Units	Jobs	
East Boston Waterfront									
202 Maverick				23		http://www.bostonredevelopmentauthority.org/projects/development-projects/202-maverick-street			
320 Maverick	33		http://www.bostonredevelopmentauthority.org/projects/development-projects/320-maverick-st						
99-111 Sumner				119		http://www.bostonplans.org/projects/development-projects/99-sumner-street			
245 Sumner	34		http://www.bostonredevelopmentauthority.org/projects/development-projects/245-sumner-street						
248 Meridian	66	30	http://www.bostonredevelopmentauthority.org/projects/development-projects/248-meridian-street						
301-303 Border				64		http://www.bostonredevelopmentauthority.org/projects/development-projects/301-303-border-street			
Boston East	196		http://www.bostonredevelopmentauthority.org/projects/development-projects/boston-east						
Clippership Wharf	492	30	http://www.bostonredevelopmentauthority.org/projects/development-projects/clippership-wharf						
Coppersmith Village	56		http://www.bostonredevelopmentauthority.org/getattachment/44a4cd17-59be-4054-a19a-75e87117dccf						
Hodge Boiler Works				95		http://www.bostonredevelopmentauthority.org/projects/development-projects/hodge-boiler-works			
New Street	216		http://www.bostonredevelopmentauthority.org/getattachment/8a60a613-2080-4bc7-8689-6d799f49a131						
Portside/East Pier	176			381	100	http://www.bostonredevelopmentauthority.org/getattachment/b4d22274-6df4-4315-937f-629084018a48			
TOTAL EB WATERFRONT	1,300	100		700	100				
Chelsea									MassDOT; SL Gateway TIGER Application, 2016
Box District	128		http://uli.org/wp-content/uploads/ULI-Documents/Box-draft-profile2.pdf						Completed since 2012; remaining 120 earlier.
FBI Headquarters		750	http://www.chelseama.gov/bulletins/bulletins/economic-development						
One North of Boston	450								
Homewood Suites		78							
Clock Tower	692		http://www.chelseama.gov/bulletins/bulletins/economic-development						http://www.chelseama.gov/bulletins/bulletins/economic-development
Future Station Area TOD							1,934	2,381	53 acres; assume gross FAR 1.25, 2/3 res'al (MassDOT SL Gateway TIGER Application).
TOTAL CHELSEA	1,300	800		0	0		1,900	2,400	
Suffolk Downs-Wonderland									
Suffolk Downs Development					2,311	http://www.bostonplans.org/projects/development-projects/suffolk-downs-phase-1;	7,500	22,430	Use midpoint of housing abd commercial estimates in ENF/PNF. http://www.bostonplans.org/getattachment/0c653ee2-62e7-412b-a792-1e7f166d0bb6.
Waterfront Square	900	174	https://www.mbtarealty.com/wp-content/uploads/projects/1269/Waterfront-Square-3.pdf						
525 Beach Street	30								MAPC DD. Completed; affordable.
Future Wonderland Development							1,021	1,437	Assume 28 ac. Dog Track site + 15 ac. Plaza; 75% developable at gross FAR 1.5.
TOTAL SUFFOLK DNS-WONDERLAND	900	200			2,300		8,500	23,900	
Lynn Waterfront									
Gateway Residences	68	0	http://www.ediclynn.org/documents/Developer%20Tour%20Book%20for%20PRINT.pdf						
Lynn CBD Buildout						http://dtl.mapc.org/What_We_Learned/Downtown_Planning.html	300	362	MAPC Study and DD.
Building 19 Redevelopment				250		http://www.itemlive.com/news/is-the-lynnway-the-ugliest-street-in-america/			
Beacon Chevrolet Redevelopment	348		http://209.80.128.250/EEA/emepa/mepadocs/2016/090716em/nps/enf/15575%20254-272%20and%20282R%20Lynnway.pdf						
River Works Development				1,250	32	http://209.80.128.250/EEA/emepa/mepadocs/2016/010616em/sc/enf/15441enf%20Lynn%20Gear%20Works%20Redevelopment%20LYNN%20DB%20Comment.pdf			65 acres, bought and zoned; 1,250 units in MEPA.
Lynnway Central Waterfront							2,919	4,107	305 ac. total, City/LEAD say 100 available. Assume gross FAR 1.25, 67% residential.
TOTAL LYNN WATERFRONT	400	0		1,500	0		3,200	4,500	
GRAND TOTAL, NEAR NORTH SHORE	**3,900**	**1,100**		**2,200**	**2,400**		**14,000**	**31,000**	

NORTH CORRIDOR

Factors: sf/employee	Office	225	
	Retail	500	
	Grocery	1000	
	Hotel	1000	(per 1000 sf)
	Hotel	0.625	(per key)
	R&D	400	
	Hospital	500	incl. medical R&D; med/dental offices same as "office"

	Recent/Current			Pipeline			Long-Term Potential		
	Res. Units	Jobs		Res. Units	Jobs		Res. Units	Jobs	
East Cambridge/East Somerville									
159 First Street/150 Second	115	524	https://www.cambridgema.gov/~/media/Files/CDD/ZoningDevel/SpecialPermits/sp231mja2/sp231_mja2_decision.pdf?la=en						MAPC DD.
249 Third Street							100		MAPC DD.
262 Msgr. O'Brien	56		http://www.cambridgema.gov/~/media/Files/CDD/ZoningDevel/LargeProjectReview/2013/262monsignorobrien/lpr_262msgrobrien_certificate.pdf?la=en						
ZINC (22 Water Street)	392		http://www.marketwired.com/press-release/topping-out-ceremony-z-i-n-c-new-high-rise-apartment-community-cambridge-set-july-8-1927485.htm						Adjacent to NorthPoint but not part of it.
North Point	724	500	Glassworks Ave done; Avalon II under construction; EF Bldg. 2 done.		500	http://web1.env.state.ma.us/EEA/emepa/mepadocs/2014/121014em/nps/enf/15293.pdf	2,177	6,250	http://www.cambridgema.gov/~/media/Files/CDD/ZoningDevel/SpecialPermits/sp179mja6/sp179amdt6_decision.pdf?la=en
Union Square				1,319	7,890	https://issuu.com/ospcd/docs/union_square_np_-_final_web			City's 2016 Union Square N'hood Plan; incl. Parcels D1-D7 (US2 designated developer).
111 South				207		http://web1.env.state.ma.us/EEA/emepa/meparcproj.aspx?eoea_num=13910			
Boynton Yards						https://issuu.com/ospcd/docs/union_square_np_-_final_web	1,030	7,574	City's 2016 Union Square N'hood Plan.
Brickbottom/InnerBelt						http://www.somervillebydesign.com/wp-content/uploads/2014/12/Innerbelt-Brickbottom-Plan-Draft-2014-152-pages.pdf	2,250	10,250	Draft 2013 Neighborhood Plan; SomerVision numbers are 1,750 housing units, 12,500 jobs.
TOTAL E. CAMBRIDGE-E. SOMERVILLE	1,300	1,000		1,500	8,400		5,600	24,100	
Mystic-Malden River Corridor									*NOTE: Station Landing completed 2009-10.*
32 Cambridge (Sullivan)				171		http://www.bostonplans.org/projects/development-projects?neighborhoodid=4&sortby=name&sortdirection=ASC&type=dev&viewall=1			
Hood Business Park				177	4,676	http://www.bostonplans.org/projects/development-projects/hood-480-rutherford-avenue; http://www.bostonplans.org/projects/development-projects/hood-business-park			
Assembly Row	1,843	11,640	http://web1.env.state.ma.us/EEA/emepa/mepadocs/2014/052114em/nps/npc/13989npc.pdf						Reflects 2014 Project Change replacing IKEA with Partners (4500 jobs).
Office & Research Ctr. & Res. at Assembly				219	3,798	http://209.80.128.250/EEA/emepa/mepadocs/2016/100516em/nps/enf/15595%20The%20Office%20and%20Research%20Center%20and%20The%20Residences%20at%20Assembly.pdf			Adjacent but separate from Assembly Row. Filed 2016.
Wynn Everett Casino		3,287	http://massgaming.com/wp-content/uploads/Wynn-Everett-Boston-Impact-Analysis-7-23-14.pdf						
The Batchyard	328		http://www.thebatchyard.com/						Would abut Broadway bus-only or SL extension.
Wellington Parkside	190		http://www.wellingtonparkside.com/						In Everett; 1/2 mile from proposed River's Edge station.
Malden Govt. Center/ Jefferson Apartments	320	44	http://209.80.128.250/EEA/emepa/mepadocs/2015/112315em/nps/enf/15442%20ENF%20Jefferson%20at%20Malden%20Center%20Malden.pdf						Not counting new City Hall (42,000 sf), which is a straight on-site replacement.
Residences at Malden Square	195		http://www.cityofmalden.org/content/residences-malden-square						MAPC DD.
Residences at Malden Station	84		http://www.residencesatmaldenstation.com/						MAPC DD.
Medford Mews				247		http://web1.env.state.ma.us/EEA/emepa/mepadocs/2014/012214em/nps/enf/15146.pdf			
River's Edge				262	1,984	http://web1.env.state.ma.us/EEA/emepa/mepadocs/2013/091113em/nps/npc/11818npc.pdf			Medford, Malden, and Everett, not including 222 residential phase already built.
TOTAL MYSTIC-MALDEN	3,000	15,000		1,100	10,500		0	0	
GLX Villages									
Maxwell's Green	199	0							
Sphere Apts. Ball Square (Medford)	42								
Tufts Building at College Ave. Station					250	http://now.tufts.edu/articles/new-academic-building-planned-t-station			
Somervision Lowell, Gilman, Ball							450	2,500	SomerVision Appendix 2; these numbers are 50% of the Areas to Enhance targets.
TOTAL GLX VILLAGES	200	0		0	300		500	2,500	
GRAND TOTAL, NORTH CORRIDOR	**4,500**	**16,000**		**2,600**	**19,200**		**6,000**	**27,000**	

CHARLES RIVER CORRIDOR

Factors: sf/employee		
	Office	225
	Retail	500
	Grocery	1000
	Hotel	1000 (per 1000 sf)
	Hotel	0.625 (per key)
	R&D	400
	Hospital	500 incl. medical R&D; med/dental offices same as "office"

	Recent / Current			Pipeline			Long-Term Potential		
	Res. Units	Jobs		Res. Units	Jobs		Res. Units	Jobs	
Allston-Brighton Rail Corridor									
1047 Comm Ave	180		http://www.bostonplans.org/projects/development-projects/1047-commonwealth-avenue						
31 North Beacon			http://www.bostonplans.org/projects/development-projects/31-north-beacon-street-mixed-use-development	20	6				
392 Cambridge			http://www.bostonplans.org/projects/development-projects/392-398-cambridge-street	32	10				
40 Malvern	48		http://www.bostonplans.org/projects/development-projects/40-malvern-street						
450 Cambridge	40	10	http://www.bostonplans.org/projects/development-projects/450-cambridge-street-development						
75 Braintree	80	12	http://www.bostonplans.org/projects/development-projects/61-83-braintree-street						
Barry's Corner	325	90	http://www.bostonplans.org/projects/development-projects/barrys-corner-residential-retail-commons						Just outside 1/2 mile but all Harvard devt linked to West Station.
Harvard Chao, Klarman, Life Lab		488	http://www.bostonplans.org/projects/development-projects/harvard-university-chao-center						
Harvard, Science & Eng. Complex		1,240	http://www.bostonplans.org/projects/development-projects/harvard-university-science-complex						
Harvard Allston IMP 10-year plan balance					1,500	http://www.bostonplans.org/getattachment/a44c3e68-8afe-468f-bdb9-528770bead1c		1,500	1.4 MSF, minus Chao/Klarman/Lab; employment assumed at R&D factor. Split between Pipeline and Long-Term.
Harvard Enterprise Research Campus				235	2,646	https://www.massdot.state.ma.us/Portals/8/docs/HighlightedProjects/AllstonInterchange/PresentationHarvard_081915.pdf		2,646	36 acres; filed PDA in late 2017. Split between Pipeline and Long-Term.
Allston Interchage Land and Air Rights						https://www.massdot.state.ma.us/Portals/8/docs/HighlightedProjects/AllstonInterchange/PresentationHarvard_081915.pdf	2,178	6,223	50 acres of land; not counting 35 of air rights; assume gross FAR of 2.0; 50-50 residential/employment
Boston Landing		3,281	http://www.bostonplans.org/projects/development-projects/boston-landing						
24 Hichborn				20	4	http://www.bostonplans.org/projects/development-projects/26-hichborn-street			
530 Western Ave				132	20	http://www.bostonplans.org/projects/development-projects/530-western-ave			
Charlesview (Western Avenue)	340	54	http://www.bostonplans.org/projects/development-projects/charlesview-redevelopment						
61 North Beacon				16		http://www.bostonplans.org/projects/development-projects/district-9			
125 Guest	295	32	http://www.bostonplans.org/projects/development-projects/the-residences-at-125-guest-street-boston-landing						
Stop & Shop Allston Yards				360		http://www.bostonplans.org/getattachment/ea7925ed-96b0-4381-ac34-0bfe01f49233	650		Redevt of Stop & Shop as mixed-use project near Boston Landing
37 North Beacon				87	10				MAPC DD
Packard Crossing	114	10	http://www.bostonplans.org/getattachment/c99b7da0-ec5b-46b5-8207-685a2cb97465						
Telford 180	85		http://www.bostonplans.org/projects/development-projects/telford-180						
TOTAL ALLSTON-BRIGHTON RAIL	**1,500**	**5,200**		**900**	**4,200**		**2,800**	**10,400**	
Arsenal Street									
LINX (480 Arsenal)		822	http://www.watertown-ma.gov/DocumentCenter/View/16364						
Arsenal on the Charles/AthenaHealth					1,111	http://209.80.128.250/EEA/emepa/mepadocs/2016/081016em/nps/enf/15558%20Arsenal%20on%20the%20Charles.pdf			
The Arsenal	500				1,386	http://209.80.128.250/EEA/emepa/mepadocs/2016/090716em/nps/enf/15581%20The%20Arsenal%20Project.pdf			
ELAN (Arsenal & Irving)	282	22	http://www.watertown-ma.gov/DocumentCenter/View/16923						
Gables (202-204 Arsenal)	296	74	http://www.watertown-ma.gov/index.aspx?NID=748						
33 Mt. Auburn	24	4	http://www.watertown-ma.gov/index.aspx?NID=748						
Marriott Hotel		94	http://www.watertown-ma.gov/index.aspx?NID=748						
80 Elm Hotel		64	http://www.watertown-ma.gov/index.aspx?NID=748						
MBTA Watertown Yard							268	40	3.24 acres, incl. small private corner parking lot; assume FAR 2 and 65% residential.
Watertown Square Town Parking Land							131	185	Shown in Comp Plan as as area for restructuring.
TOTAL ARSENAL ST.	1,100	1,100		0	2,500		400	200	
Newton Rail TOD Corridor									
75-83 Court Street	36								
Austin St., Newtonville	68	10	http://www.newtonma.gov/civicax/filebank/documents/76931						
70 Rowe Street						http://www.newtonma.gov/gov/planning/current/devrev/hip/rowe_street_70.asp	150		40B withdrawn; future unclear; a hgih-profile TOD housing site
Riverside				290	1,052	http://209.80.128.250/EEA/emepa/mepacerts/2015/sc/eir/14590%20FEIR%20The%20Station%20at%20Riverside%20Newton.pdf			
Housing Strategy Site Review						Housing Needs Analysis and Strategic Recommendations, Appendix of Sites	450		All parcels within the Newton TOD Corridor Growth Center; assume 50% use, 25 du/acre
TOTAL NEWTON RAIL TOD CORRIDOR	100	0		300	1,100		600	0	
NEEDHAM STREET									
Northland Parcel				950	571	http://www.bostonglobe.com/business/2016/11/01/new-multi-use-complex-would-newton-biggest-development-			
Housing Strategy Site Review						Housing Needs Analysis and Strategic Recommendations, Appendix of Sites	500		All parcels on Elliot, Charlemont Streets; assume 50% use, 25 du/acre
Comp Plan						http://www.newtonma.gov/civicax/filebank/documents/30752		1,000	Estimate from Comp Plan, exclusive of Northland Parcel.
TOTAL NEEDHAM ST.	0	0		1,000	600		500	1,000	
Downtown Waltham									
Moody & Main (The MERC)	269	56							MAPC DD.
200 Moody	16								MAPC DD.
Cooper Street Apartments				264		http://waltham.wickedlocal.com/article/20150527/NEWS/150526848			
Potential Future Downtown Buildout						http://www.city.waltham.ma.us/sites/walthamma/files/u56/wpd_buildout_analysis_-_web_version_5.18.06.pdf	750	2,000	Comp Plan buildout; blend of Riverview Overlay Special Permit and downtown wards.
TOTAL DOWNTOWN WALTHAM	300	100		300	0		800	2,000	
GRAND TOTAL, CHARLES RIVER	**3,000**	**6,400**		**2,500**	**8,400**		**5,000**	**14,000**	

SOUTH NEIGHBORHOODS CORRIDOR

Factors: sf/employee		
	Office	225
	Retail	500
	Grocery	1000
	Hotel	1000 (per 1000 sf)
	Hotel	0.625 (per key)
	R&D	400
	Hospital	500 incl. medical R&D; med/dental offices same as "office"

	Recent / Current			Pipeline			Long-Term Potential		
	Res. Units	Jobs		Res. Units	Jobs		Res. Units	Jobs	
Upper SW-Dudley									
Bolling Muncipal Bldg.		540	http://www.bostonplans.org/projects/development-projects/dudley-municipal-building						
Taber Street					83	http://www.bostonplans.org/projects/development-projects/2-14-taber-street			
Bartlett Place				313	90	http://www.bostonplans.org/getattachment/c8663e98-eac5-4df8-87cd-3c4cceb0a714			
Bartlett Station Condos	16		http://www.bostonplans.org/getattachment/3bfe84ac-3d7d-4ac1-9526-931b34d6d6af						
209 Dudley				43		http://www.bostonplans.org/projects/development-projects/dudley-greenville-rental-housing			
Tropical Foods/ Parcel 10	30	297	http://www.bostonplans.org/getattachment/bd9c17b7-8423-439c-9c6a-f5ae3f7b17b3						
Melnea Hotel & Res./Parcel 9	50	107	http://www.bostonplans.org/getattachment/e1daecd9-426d-4ae9-9c7c-6bb8083cad50						
1065 Tremont	16	2	http://www.bostonplans.org/projects/development-projects/1065-tremont-street						
Douglas Park				44		http://www.bostonplans.org/projects/development-projects/douglass-park			
Madison Park Infill				76		http://www.bostonplans.org/projects/development-projects/madison-park-infill			
Northeastern Off-Campus Housing				207	35	http://www.bostonplans.org/getattachment/4a5cba6e-9c66-4c3a-9194-c6ecfe98abef			800 beds, stated as the equivalent of 207 apartments.
Northeastern Science & Engineering Center		493							
Tremont Crossing				694	1,265	http://www.bostonplans.org/getattachment/e82d61cc-2a92-491b-a6ca-a1d567cdd9fd			
Whittier Choice Housing				387		http://www.bostonplans.org/projects/development-projects/whittier-choice			Replaces 200 substandard BHA units; counting all 387.
1467 Tremont	18	4	http://www.bostonplans.org/projects/development-projects/1467-tremont-street						
1470 Tremont				33	2	http://www.bostonplans.org/projects/development-projects/1470-tremont-street			
1486 Tremont	66	12	http://www.bostonplans.org/projects/development-projects/1486-tremont-street						
44 Terrace Street				21		http://www.bostonplans.org/projects/development-projects/44-64-terrace-street			
Basilica Court				269		http://www.bostonplans.org/projects/development-projects/basilica-court			
Parker & Terrace Infill				44		http://www.bostonplans.org/projects/development-projects/the-parker-and-terrace-street-development			
One Roxbury Crossing	40		http://www.bostonplans.org/projects/development-projects/parcel-25	48	858				
TOTAL UPPER SW-DUDLEY	200	1,500		2,200	2,300		0	0	
Lower SW-Egleston									
City's Plan JP/Rox				209		http://www.bostonplans.org/getattachment/3aed2f09-a579-439e-a938-b85ab725500e	2,000		Pipeline is net of all but Res at FH. Future= mid-range of potential future unit buildout.
Arborway Yard							523	498	8 acres; deduct from future total
Forest Hills MBTA Parcel U	126	50	http://www.bostonplans.org/getattachment/fab5aa29-b5e7-445b-b8e0-eccefc9290dc						
Walker Park (Egleston)				49		http://www.bostonplans.org/projects/development-projects/walker-park-apartments			
Westminster House				30		http://www.bostonplans.org/projects/development-projects/washington-street-westminster-house-project			
Residences at Forest Hills	252	10	http://www.bostonplans.org/projects/development-projects/the-residences-at-forest-hills						South of Casey Overpass--not included/deducted in JP/Rox pipeline total.
Commons at Forest Hills	283	16	http://www.bostonplans.org/getattachment/b9231be2-203d-4f7e-8404-82bfd3980f5a						
3193 Washington				40	6	http://www.bostonplans.org/projects/development-projects/3193-washington-street			
3200 Washington				76	10	http://www.bostonplans.org/getattachment/75b21517-76b4-4415-96b9-53cc653ef2d6			
3353 Washington				44	4	http://www.bostonplans.org/projects/development-projects/3353-washington-street			
3383 Washington				21	4	http://www.bostonplans.org/projects/development-projects/3383-3389-washington-street			
3521 Washington				130	50	http://www.bostonplans.org/getattachment/cbc2ee10-5d51-450c-9e63-565b194f5fa7			
76 Stonley Road				28		http://www.bostonplans.org/projects/development-projects/76-stonley-road			
Bartlett Sq. II				15	4	http://www.bostonplans.org/projects/development-projects/bartlett-square-ii			
Centre Lamartine (Jackson Sq.)				30	12	http://www.bostonplans.org/projects/development-projects/centre-lamartine			
General Heath				47		http://www.bostonplans.org/projects/development-projects/general-heath-square			
Jackson Square Urban Edge Project	179	121		243	121	http://www.bostonplans.org/getattachment/2e62c0cb-c295-45ae-8a14-21f76cc7ec2a			
TOTAL LOWER SW-EGLESTON	800	200		1,000	200		2,500	500	
Lower Blue Hill Avenue									
Morton Street Parcels (Economy + City)				159	152		0	0	Econ. Hdw. Frontage ~ 2.5 acres; 872 Morton/ 11 Hopkins ~.75 acre. FAR 1.5, 75% res.
Morton Street, Indigo Corridor Plan						http://www.bostonplans.org/getattachment/653f6e4d-a482-4163-ad39-11876d8f656a	90		Plan projects 250 units, 125 jobs; this line reps. Balance after prior line.
1199 Blue Hill Avenue				21	8	http://www.bostonplans.org/projects/development-projects/1199-1203-blue-hill-avenue			
Blue Hill Ave Station Area, Indigo Plan						http://www.bostonplans.org/getattachment/653f6e4d-a482-4163-ad39-11876d8f656a	165	125	Plan projects 300 units; 165 is the balance after the Mattapan Station project below.
Supermarket demand						http://www.bostonplans.org/getattachment/841c41a9-6057-4ac5-89ce-0a22513e45ba		150	Mattapan Economic Devt Initiative: 75K grocery store space
Cote Ford Site				76	8	http://www.bostonplans.org/projects/development-projects/cote-village			
New Covenant Parking Lot							20		2.8-acre parcel; southerly 1 acre empty
Mattapan Station Lot				135	20	http://www.bostonplans.org/projects/development-projects/mattapan-station-development			
TOTAL LOWER BLUE HILL AVENUE	0	0		400	200		300	300	
Hyde Park Villages									
Fairmount Plan for Fairmount, Readville						http://www.bostonplans.org/getattachment/653f6e4d-a482-4163-ad39-11876d8f656a	300	125	Plan numbers exclude Readville Yards redevelopment.
Readville Yard 5					714	http://www.bostonplans.org/getattachment/b3d8c1ae-62c1-4797-b2c9-ed2bfadde00a			250,000 sf mixed industrial/commercial; assume 350 sf/job
Residences at Fairmount Station	24		http://www.bostonplans.org/projects/development-projects/the-residences-at-fairmount-stat						
1580 River				32		http://www.bostonplans.org/projects/development-projects/1580-river-street			
MBTA Readville P&R Lots							65	163	https://www.mbtarealty.com/wp-content/uploads/opportunities/2395/Readville-Marketing-Doc.pdf
School bus storage lot								871	South of Readville #5. Assume all employment @ 1000 sf/job.
Low-density industrial land in the "wedge"							334	668	23 acres; assume 1/3 stays ind., 1/3 higher-density empl., 1/3 residential.
Ad Meliora--1725 Hyde Park Ave				240		http://www.bldup.com/projects/1717-hyde-park-avenue			
36-70 Sprague				521	12	http://www.bostonplans.org/projects/development-projects/36-70-sprague-street	200		In Article 80
TOTAL HYDE PARK VILLAGES	0	0		800	700		900	1,800	
GRAND TOTAL, SOUTH NBRHOODS	**1,000**	**1,700**		**4,400**	**3,400**		**4,000**	**3,000**	

RED LINE OUTER MARKETS

Factors: sf/employee	Office	225	
	Retail	500	
	Grocery	1000	
	Hotel	1000	(per 1000 sf)
	Hotel	0.625	(per key)
	R&D	400	
	Hospital	500	incl. medical R&D; med/dental offices same as "office"

	Recent / Current			Pipeline			Long-Term Potential		
	Res. Units	Jobs		Res. Units	Jobs		Res. Units	Jobs	
Alewife									
Cambridge Discovery Park		94	https://www.cambridgema.gov/CDD/News/2016/10/~/media/193706155AD54B36B0D89E0AB2E78DA4.ashx)		1,143	http://www.bizjournals.com/boston/real_estate/2015/02/bulfinch-approved-for-mixed-use-expansionat.html			Jobs in MAPC DD.
VOX on Two	227								MAPC DD.
185-211 Concord Turnpike				200		https://drive.google.com/drive/folders/0B-ZbJdsEcId8M21OUjBFZE1RTU0			
579 Concord Ave			Ditto throughout--City Development Log	49		https://www.cambridgema.gov/CDD/News/2016/10/~/media/193706155AD54B36B0D89E0AB2E78DA4.ashx)			
563 Concord Ave	61	22				https://www.cambridgema.gov/CDD/News/2016/10/~/media/193706155AD54B36B0D89E0AB2E78DA4.ashx)			
70-95 Fawcett	429			44		https://www.cambridgema.gov/CDD/News/2016/10/~/media/193706155AD54B36B0D89E0AB2E78DA4.ashx)			
Cambridgepark Drive	398			718	185	https://www.cambridgema.gov/CDD/Projects/Planning/~/media/F724DB86EEAB45238802003CA05BEA65.ashx			
75 New Street				93		https://www.cambridgema.gov/CDD/News/2016/10/~/media/193706155AD54B36B0D89E0AB2E78DA4.ashx)			
City Buildout Plan for Triangle							180	410	MAPC DD.
City Buildout Plan for Quadrangle							340	1,314	MAPC DD.
City Buildout Plan for Fresh Pond Retail							272	1,514	MAPC DD.
City's 2005 Alewife Master Plan						https://www.cambridgema.gov/~/media/Files/CDD/Planning/Studies/ConcordAlewifeStudy/concale_plan_2006.pdf			Est. ~1.5 M sf new commercial; assume 350 sf/job (blend office, R&D, retail) net of above.
TOTAL ALEWIFE	1,100	100		1,100	1,300		800	3,200	
Quincy			Next 2 lines: MEPA Cert. and 2016 Revised URDP:						
Downtown Quincy Revitalization Plan			http://web1.env.state.ma.us/EEA/emepa/mepadocs/2012/12191 2em/sc/eir/14780FEIR.pdf http://www.quincyma.gov/CityOfQuincy_Content/documents/URDP%204%20V.2%20Proposed.pdf	819	1,118				Totals net of WoC, Hancock, Ross, T. Based on 1882 MEPA units; est. of jobs by MEPA uses.
West of Chestnut	200								
Hancock Lot							536	289	Numbers from URDP Amendment.
Ross Garage Site							327	1,356	Numbers from URDP Amendment.
MBTA Quincy Center Station Joint Devt				300	1,000				Council approves 300 units, 225,000 sf office
MBTA North Quincy Lot	579	84	https://www.boston.com/news/real-estate/2016/04/05/mbta-developer-see-big-housing-opportunity-on-north-quincy-parking-lot						
MBTA Wollaston Lot							333	106	~4.25 acres; assume FAR 2.0 net; 90% res.
Misc. Hancock Street	106								MAPC DD.
68 Beale Street	22								MAPC DD.
Surface lots at State Street South (best)							305	871	~ 7 acres; assume net FAR 2.0; 50-50 residential/empl. for reverse commute.
TOTAL QUINCY	900	100		1,100	2,100		1,500	2,600	
GRAND TOTAL, RED LINE OUTER MKTS	2,000	200		2,200	3,400		2,000	6,000	

HIGH-LEVEL ESTIMATES FOR MAJOR FUTURE SITES

Brookline Emerald Island		
(Exclusive of hotel)		
Acres	0.8	
Land sf	34,848	
Gross FAR	4	
Gross Built sf	139,392	
Res. %	67%	
Empl. %	33%	
Res. Sf	93,393	
Units	1,000	93
Empl. Sf	45,999	
Jobs @	400	115

Chelsea 53 Acres		
Acres	53	
Land sf	2,308,680	
Gross FAR	1.25	
Gross Built sf	2,885,850	
Res. %	67%	
Empl. %	33%	
Res. Sf	1,933,520	
Units	1,000	1,934
Empl. Sf	952,331	
Jobs @	400	2,381

Suffoilk Downs
Replaced by estimates in PNF/ENF of December 2017

Wonderland		
Acres	28	
Land sf	1,219,680	
Gross FAR	1.25	
Gross Built sf	1,524,600	
Res. %	67%	
Empl. %	33%	
Res. Sf	1,021,482	
Units	1,000	1,021
Empl. Sf	503,118	
Jobs @	350	1,437

Lynnway Waterfront		
Acres	100	
Land sf	4,356,000	
Gross FAR	1	
Gross Built sf	4,356,000	
Res. %	67%	
Empl. %	33%	
Res. Sf	2,918,520	
Units	1,000	2,919
Empl. Sf	1,437,480	
Jobs @	350	4,107

Widett/Midtown		
Acres	TBD	
Land sf	TBD	
Gross FAR	TBD	
Gross Built sf	3,500,000	
Res. %	67%	
Empl. %	33%	
Res. Sf	2,345,000	
Units	1,000	2,345
Empl. Sf	1,155,000	
Jobs @	350	3,300

UMass Bayside		
Acres	20	
Land sf	871,200	
Gross FAR	1	
Gross Built sf	871,200	
Res. %	67%	
Empl. %	33%	
Res. Sf	583,704	
Units	1,000	584
Empl. Sf	287,496	
Jobs @	350	821

Boston Globe Site		
Acres	16.5	
Land sf	718,740	
Gross FAR	1.5	
Gross Built sf	1,078,110	
Res. %	67%	
Empl. %	33%	
Res. Sf	722,334	
Units	1,000	722
Empl. Sf	355,776	
Jobs @	350	1,017

Watertown MBTA Yard		
Acres	3.24	
Land sf	141,134	
Gross FAR	2	
Gross Built sf	282,269	
Res. %	95%	
Empl. %	5%	
Res. Sf	268,155	
Units	1,000	268
Empl. Sf	14,113	
Jobs @	350	40

Watertown Square Parking Lots		
Acres	2.25	
Land sf	98,010	
Gross FAR	2	
Gross Built sf	196,020	
Res. %	67%	
Empl. %	33%	
Res. Sf	131,333	
Units	1,000	131
Empl. Sf	64,687	
Jobs @	350	185

Downtown Waltham		
Riverview Overlay Spec Permit		
Ward 5	531	
Ward 9	1782	
Total	2313	
Assume 50% in station area		
	1157	
Minus Cooper St.		-260
	897	
Alternative:		
	Units	SF
Ward 5	1234	2901000
Ward 6	1143	1672000
Ward 9	2277	-622000
Totals	4654	3951000
Assume 25% in station area:		
	1163.5	2822.1429
Minus MERC, Cooper		
	634.5	
Say:	750	2000

Morton St. Economy Hardware		
Acres	3.25	
Land sf	141,570	
Gross FAR	1.5	
Gross Built sf	212,355	
Res. %	75%	
Empl. %	25%	
Res. Sf	159,266	
Units	1,000	159
Empl. Sf	53,089	
Jobs @	350	152

Needham Street		
Acres	25	
Land sf	1,089,000	
Gross FAR	1	
Gross Built sf	1,089,000	
Res. %	50%	
Empl. %	50%	
Res. Sf	544,500	
Units	1,000	545
Empl. Sf	544,500	
Jobs @	350	1,556
Comp Plan Buildout: 2.9 mm sf		
Say 1 mm sf net new empl		
		2857

Harvard Enterprise Campus		
Acres	36	
Land sf	1,568,160	
Gross FAR	1.5	
Gross Built sf	2,352,240	
Res. %	10%	
Empl. %	90%	
Res. Sf	235,224	
Units	1,000	235
Empl. Sf	2,117,016	
Jobs @	400	5,293

Harvard Allston Landing South		
Acres	50	
Land sf	2,178,000	
Gross FAR	2.00	
Gross Built sf	4,356,000	
Res. %	50%	
Empl. %	50%	
Res. Sf	2,178,000	
Units	1,000	2,178
Empl. Sf	2,178,000	
Jobs @	350	6,223

MBTA Readville P&R Lots		
Acres	2	
Land sf	87,120	
Gross FAR	1.50	
Gross Built sf	130,680	
Res. %	50%	
Empl. %	50%	
Res. Sf	65,340	
Units	1,000	65
Empl. Sf	65,340	
Jobs @	400	163

MBTA School Bus Lot		
Acres	10	
Land sf	435,600	
Gross FAR	1.00	
Gross Built sf	435,600	
Res. %	0%	
Empl. %	100%	
Res. Sf	0	
Units	1,000	0
Empl. Sf	435,600	
Jobs @	500	871
	industrial	

Hyde Park Ave Ind. Land		
Acres	15.3318	
Land sf	667,853	
Gross FAR	1.00	
Gross Built sf	667,853	
Res. %	50%	
Empl. %	50%	
Res. Sf	333,927	
Units	1,000	334
Empl. Sf	333,927	
Jobs @	500	668

Arborway Yard Mitigation Land		
Acres	8	
Land sf	348,480	
Gross FAR	2.00	
Gross Built sf	696,960	
Res. %	75%	
Empl. %	25%	
Res. Sf	522,720	
Units	1,000	523
Empl. Sf	174,240	
Jobs @	350	498

Wollaston Lot		
Acres	4.25	
Land sf	185,130	
Gross FAR	2.00	
Gross Built sf	370,260	
Res. %	90%	
Empl. %	10%	
Res. Sf	333,234	
Units	1,000	333
Empl. Sf	37,026	
Jobs @	350	106

State Street South Lots		
Acres	7	
Land sf	304,920	
Gross FAR	2.00	
Gross Built sf	609,840	
Res. %	50%	
Empl. %	50%	
Res. Sf	304,920	
Units	1,000	305
Empl. Sf	304,920	
Jobs @	350	871

NEWTON HOUSING SITES, FROM "HOUSING NEEDS ANALYSIS, APPENDIX OF SITES"

Parcels in Washington Street Villages, Riverside			
250 Centre	0.4		
275 Centre	1.4		
20 Pearl	0.7		
20 Richardson	0.7		
431 Washington	1.5		
501 Washington	1.9		
281 Newtonville Ave	5.8		
104-108 Crafts	6.7		
115 Central Ave	0.8		
911 Washington	0.3		
1190-1251 Washington	4.5		
25 Chestnut	0.5		
2-8 Highland	0.5		
1299 Washington	0.8		
429 Cherry	0.3		
120 elm	0.7		
1492-1518 Washington	1.4		
12-20 Curve	0.5		
70 Crescent	2.2		
2000 Comm Ave	1.2		
283 Melrose	1.0	Total area	36
132 Grove	0.6	Say 50%	18
114 Stanton Ave water tower	1	du/ac 25	450
91 Wyman	0.6		

Parcels in Needham Street GC			
52 Elliot	4.3		
70-98 Elliot	8		
132-154 Elliot (Fire house)	4.9	Total area	21.1
160 Charlemont	3.5	Say 60%	12.66
10-14 Hartford	0.4	du/ac 40	506.4
		Say	500