Chapter 2: Existing and Future Conditions

To develop and analyze future alternatives for Wellington Circle, it is essential to understand how the Circle and its surrounding area currently function. To this end, an existing conditions analysis was undertaken, looking at land use and economic development, socioeconomic conditions, public health, environmental, and traffic concerns. These analyses reveal a diverse study area that has opportunities to provide denser, transit-oriented development and improve multimodal infrastructure and connectivity. Developing a future alternative that leverages these opportunities would help accommodate a growing population, minimize the impact on vehicular circulation and congestion, improve safety, and positively impact public health metrics such as air quality.

2.1 Key Findings

- **Land Use and Economic Development**

  The study area is diverse in land use mix, with commercial, open space, mixed use, residential, and industrial zones all abutting the Circle. Generally, single- and multi-family residential homes with areas of low-density commercial/light industrial development characterize the study area. The combination of low-density areas within a mixed-use environment demonstrate opportunity to densify the local study area around Wellington Circle through mixed-used development. This has already started to happen, with the largest planned developments located in special zoning districts, such as Assembly Square in Somerville, creating a shift in employment and population centers around the Circle.

- **Socioeconomic Conditions**

  Similar to changes in land use, population and employment growth in the local study area are being driven by large developments like Assembly Square in Somerville and the Encore Casino in Everett. Increasing the mode share for sustainable trips in the region will be important for accommodating this growth, as most commuters in all study area municipalities currently drive alone to work. Improving sustainable transportation options will support the diverse community, as two of the five study area municipalities are predominantly non-white and 14% of study area households are car-free.

- **Public Health**

  The biggest public health challenge in the study area is providing transportation options to food and healthcare resources. Seventy-five percent of the study area has a very low food access score -- the lowest level on the scale of very low to very high -- indicating lack of access to a grocery store of any scale within ¼ mile. Transportation to food and healthcare is

especially crucial for elderly and low-income populations. Expanding these links via pedestrian and bicycle infrastructure would provide additional benefits by encouraging physical activity through transportation. Potential strategies to address these challenges include Complete Streets and transit-oriented development.

- **Environmental Conditions**

A review of the environmental conditions in the study area identifies resources and constraints. Environmental resources include the Mystic and Malden Rivers, and the Mystic River Reservation and Macdonald Park Playground. All of the roadways comprising Wellington Circle (i.e., the Fellsway, the Mystic Valley Parkway, and the Revere Beach Parkway) are designated as historic parkways, which presents both design constraints and an opportunity to redesign the roadways as more functional parkways for all modes. Additional constraints include wetlands to the northwest of the Circle, two areas under Chapter 91 Jurisdiction and five closed Hazmat sites in the vicinity of the Circle. Understanding the legislation protecting these assets and their associated permitting requirements will help guide the alternatives development process.

- **Traffic and Multimodal Transportation**

As it currently operates, Wellington Circle serves as a barrier for multimodal transportation and a congestion point for vehicles. The necessity of completing five to six individual crossings to walk from one corner of the Circle to the other hinders pedestrian connectivity and creates a long route in terms of both distance and time, demanding patience and prolonged attention from users. There is also a lack of dedicated bicycle facilities through the Circle, creating a gap in regional networks in all directions. Vehicular congestion and delay are most problematic east of the Circle, and in peak hours the queues from signals at the center of the Circle extend beyond the adjacent intersection in multiple directions. Improving multimodal connectivity between neighborhoods on every side of Wellington Circle would increase access to destinations such as shops, transit, and parks by sustainable transportation modes, which in turn has the potential to reduce vehicular congestion.

- **Origin-Destination Analysis**

The majority of vehicular trips through the Circle have local origins and destinations, with 60% of AM (6:00 AM – 10:00 AM) trips originated in and 64% of PM (3:00 PM – 7:00 PM) trips destined for either Medford, Malden, Everett, Somerville, or Melrose. Trips destined for Wellington Station are mainly from Medford and Everett, with some from Chelsea and Revere. Trips related to the Encore Casino are clustered in nearby communities, including Everett, Revere, Chelsea, and East Boston. This demonstrates an opportunity to shift these trips to more sustainable modes.

- **Transit**

  Transit in the study area is provided by the Massachusetts Bay Transportation Authority (MBTA) Orange Line at Wellington Station and eight MBTA bus routes, all of which service the station. Almost 70% of bus riders in the study area board at Wellington Station, which represents 20% of the ridership for all eight routes. Buses experience the most travel-time delay and variability directly east and west of Wellington Station along Revere Beach Parkway. Bus passengers on these routes experience up to 40% excess passenger time (i.e., the time in addition to the expected travel time of a trip). Both multimodal connectivity enhancements to Wellington Station and improvements to vehicular circulation and congestion would improve the experience for bus riders in the local study area.

The following sections of this chapter describe these existing conditions in more detail. Future year demographics forecasted for the year 2040 are also presented. The chapter concludes with a definition and evaluation of issues and opportunities related to current and future multimodal transportation concerns, safety, land use and economic development, transit, and public health, and environmental conditions.

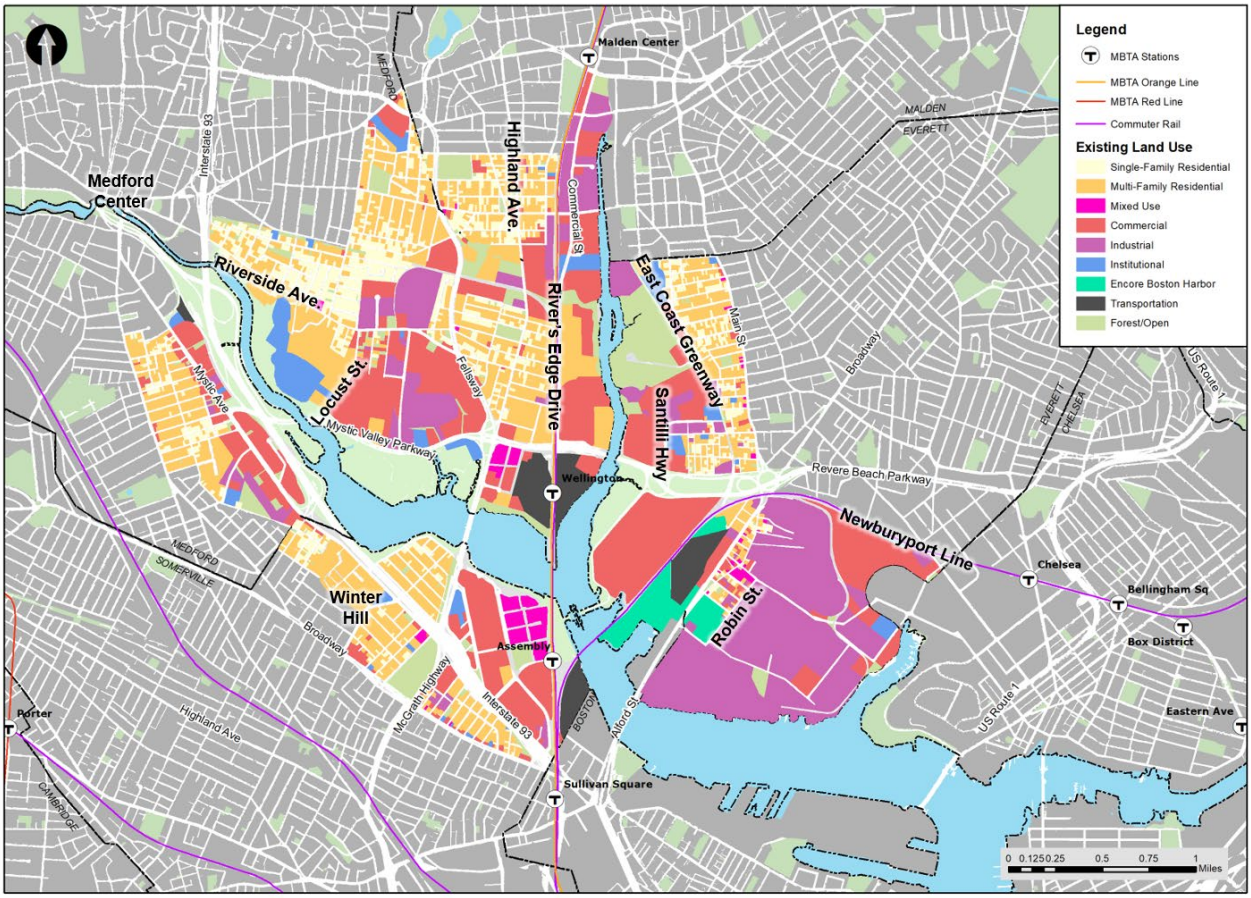
2.1 Land Use and Economic Development

By dictating the different types of origins and destinations within a given area, land use and zoning have crucial impacts on transportation. Understanding land use helps illuminate the why and where of travel demand. In the Wellington Circle study area, there are several municipalities, each with different zoning regimes and land use paradigms. Thus, Wellington Circle is surrounded by varied land uses, with different pockets of growth and development. These pockets of projected growth and development often occur in special zoning districts like Assembly Square in Somerville, the largest local engine for residential and commercial development. Understanding these large developments and their future impacts on travel tendencies can help guide the development of alternatives for Wellington Circle.

2.1.1 Land Use

Existing land use in the study area, depicted in Figure 2.1-1, is characterized by single and multi-family residential neighborhoods interspersed with areas of low-density commercial and light industrial development. The shores of the Mystic and Malden Rivers are primarily open space (including some residential and commercial private landscaped areas and the Department of Conservation and Recreation (DCR) Mystic River Reservation).

Figure 2.1-1: Study Area Land Use



A map and description of the study area are presented in Chapter 1. By community, the land use in the local study area includes:

- **Medford |** The study area in Medford is roughly split into three different sections. Around Wellington Station, land use is characterized by medium-density commercial, residential, and mixed-use development. North of Mystic Valley Parkway and along Mystic Avenue to the west, auto-oriented commercial and industrial areas predominate. Around Wellington and west along Riverside Avenue toward Medford Center, residential is the most common land use, including single-family residential.

  The study area includes two major developments in the immediate Wellington Station area: Station Landing and Rivers Edge Drive. Station Landing is a master-planned mixed-use development including office, retail, and multi-family residential uses. Rivers Edge Drive features office buildings surrounded by surface parking lots, as well as large multi-family apartment buildings. This corridor is projected to see the study area's largest population decline by 2040, potentially indicating planned land use changes.

The area roughly bordered by Mystic Valley Parkway, the Fellsway, Riverside Avenue, and the Mystic River contains low-density auto-oriented commercial shopping strips, low-density industrial fabrication, warehousing, and small-scale distribution land uses, which extend across Riverside Avenue to Sycamore Avenue and a Budweiser distribution plant. The western end of this area features larger apartment buildings, including one under construction on Locust Street. Similar uses can be found along Mystic Avenue on the west side of the Mystic River.

The presence of large-scale single-family zoning in Medford results in fewer two- and three-unit residential buildings and more single-family lots in the residential neighborhoods of Wellington and the eastern end of Medford Center, as compared to other residential parts of the study area.

- **Everett |** The portions of Everett in the study area include four distinct areas: the industrial port on the Chelsea city line, the Lower Broadway district surrounding the Encore Boston Harbor casino/hotel, the Malden River shoreline, and the residential neighborhood to the east of the Northern Strand Community Trail, which is part of the East Coast Greenway.

  The industrial port is bounded by the MBTA Newburyport Commuter Rail Line, Robin Street, the Mystic River, and the City of Chelsea. It is characterized by large storage tanks and distribution facilities, including a U.S. Postal Service Facility and the New England Produce Center. On the northwestern edge of this area is the Lower Broadway district. This neighborhood is currently made up of single and multi-family homes and has been identified by the City of Everett for future growth – it is projected to see a modest increase in population by 2040. Beyond its residential uses, it also includes the property of Encore Boston Harbor and the MBTA's Everett Shops.

  North of the Newburyport Line and west of Santilli Highway and the Northern Strand Community Trail, the study area in Everett is currently characterized by auto-oriented retail, commercial, and industrial development, including the Gateway Center. While no large-scale residential development has occurred in this area to-date, such redevelopment is in the planning stages. To the east, the study area includes the neighborhood between the Northern Strand Community Trail and Main Street, characterized by residential development of three units or fewer and low-density commercial along Main Street. A large apartment building has already been built directly abutting the Community Trail.

- **Malden |** The study area includes two areas of Malden: The Commercial Street corridor and a residential neighborhood along Highland Avenue. The Commercial Street corridor is currently a mix of auto-oriented commercial, light industrial, fabrication, and distribution uses, including the Malden City (public works) Yard. The City of Malden has conducted a study of the possible redevelopment of this area to mixed-use, higher-density land uses. The residential area along Highland Avenue includes single-family and neighborhood commercial uses, continuing the development pattern of adjacent neighborhoods in Medford.

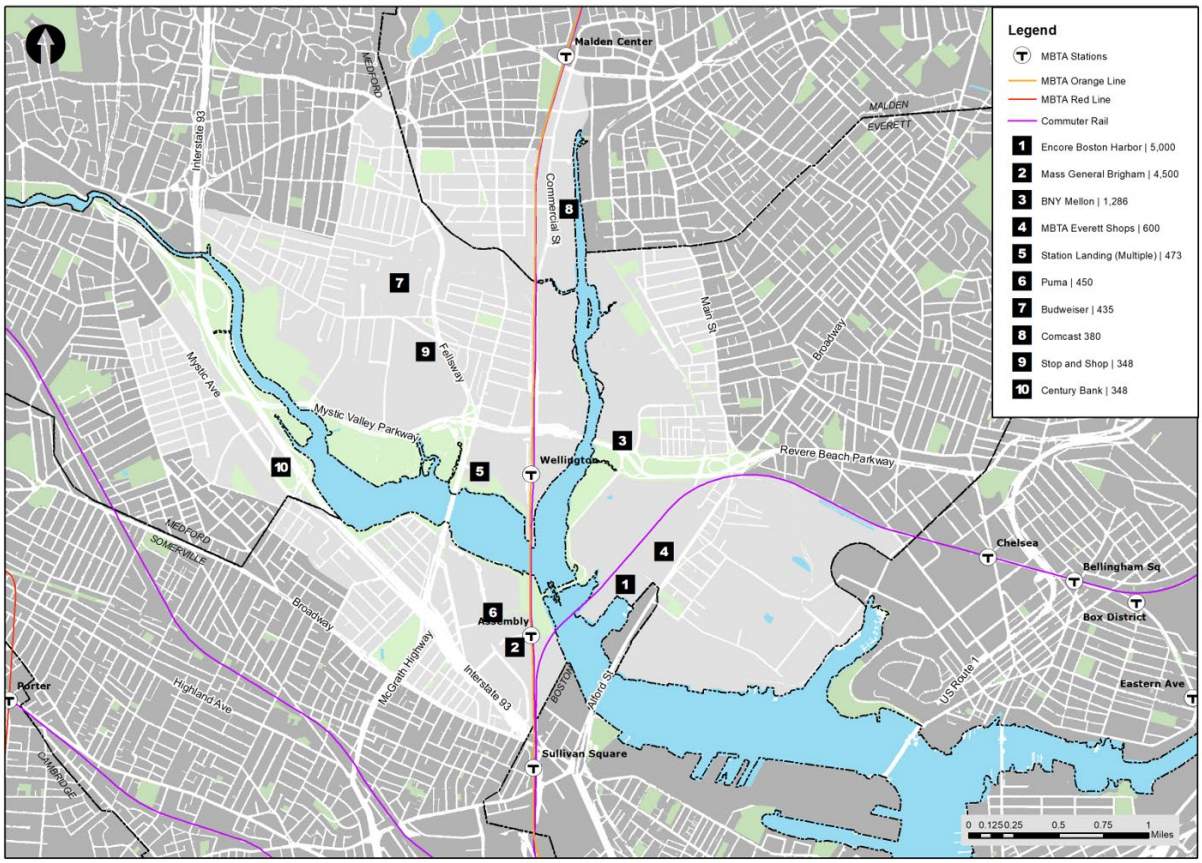
- **Somerville |** The Somerville portion of the study area includes the whole of the Assembly Square mixed-use district, which is bounded by Interstate 93, the Fellsway, and the Mystic

River. This district is characterized by both high-density, medium-to-high-rise mixed-use buildings and "big box" auto-oriented retail. To the southeast across the MBTA Newburyport Commuter Rail Line is the MBTA's Charlestown Garage (bus maintenance).

The remainder of the study area in Somerville comprises the residential neighborhoods of Ten Hills, Winter Hill, and the northern end of East Somerville. These areas are primarily two or three-unit homes with low-density neighborhood retail at major intersections. Some larger residential buildings have been built along Mystic Avenue.

2.1.2 Employment

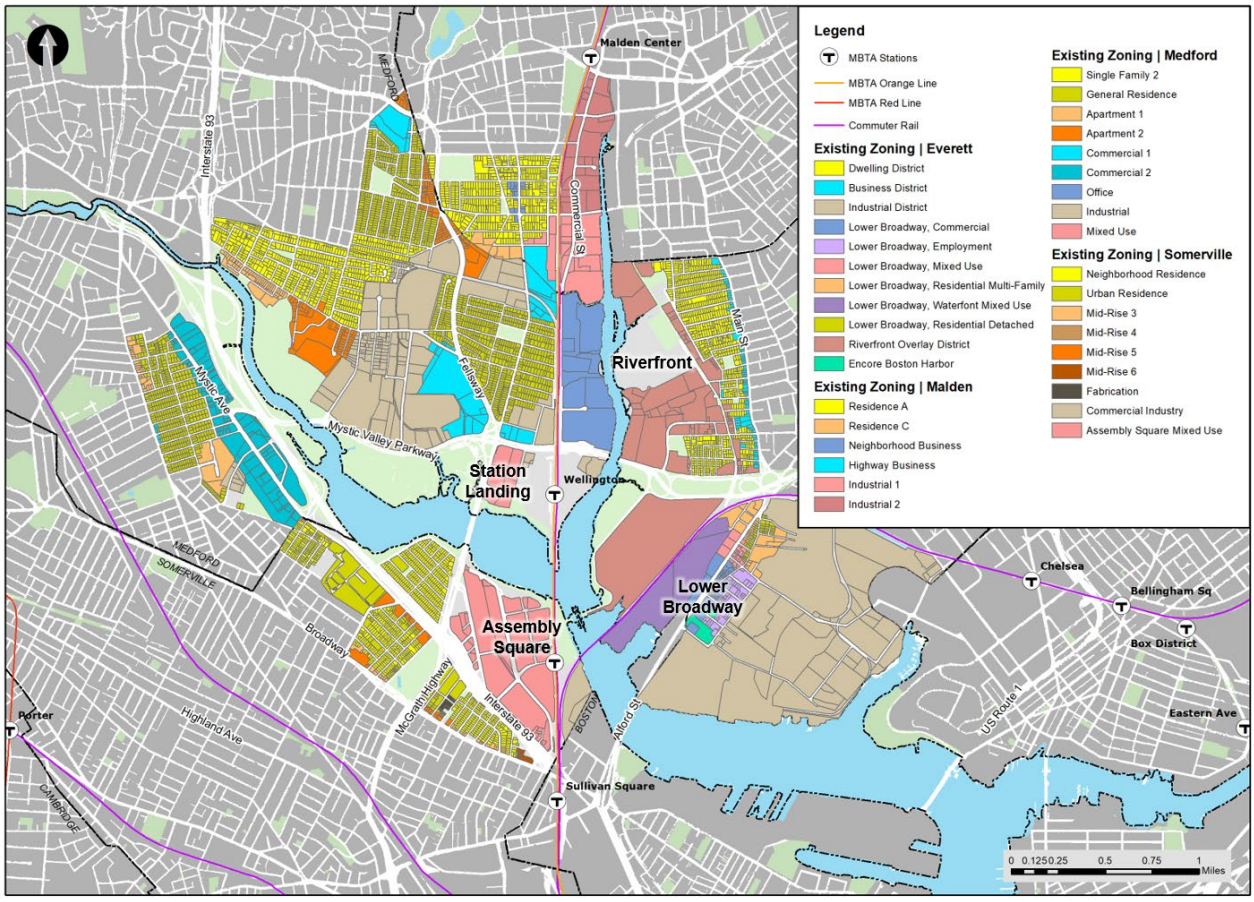
Encore Boston Harbor and Mass General Brigham lead the list of the 10 largest employers in the study area, shown in Figure 2.1-2. The data for this list comes from the most recent Comprehensive Annual Financial Report (CAFR) for each of the four municipalities. The North American Headquarters of athletic wear company Puma (number 6 in Figure 2.1-2) opened in November 2021. The Assembly Square area also includes significant potential for new lab/office development as part of the proposed "XMBLY" and "EDGE at Assembly" developments.



2.1.3 Zoning

Zoning in the study area, depicted in Figure 2.1-3, varies considerably by municipality, as the four communities that comprise the study area have different zoning histories. Medford's zoning ordinance, for instance, has remained fairly constant since 1965, whereas Somerville undertook comprehensive zoning reform in 2019. As a result of these differences, and because the study area contains several areas targeted for zoning overlays and special districts to facilitate redevelopment efforts, zoning in the study area contains a significant amount of locally relevant terminology.

Figure 2.1-3: Study Area Zoning



More details on zoning in each community's portion of the study area are provided below.

- **Medford |** Medford's zoning code, little-changed since 1965, is mostly built around single-use principles. The City has applied a special "Mixed Use Zone" to Station Landing alone, which governs according to floor area ratio, while the rest of the city is governed by setbacks and height limits.

- **Everett |** Everett's zoning is primarily single use, but much of the study area in Everett falls in special zones, including:
    - The "Lower Broadway Economic Development District" near the Mystic River and Encore Boston Harbor casino/hotel. This district is a patchwork of single-use zones, often at the individual parcel level, that seeks to guide and define the mixed-use development vision of the 2012 Lower Broadway Master Plan; and
    - The "Riverfront Overlay District" along the Malden River, which is specifically limited to multifamily housing, lodging, research and development, offices, and sit-down restaurants with more permissive height limits and density than the rest of the city.

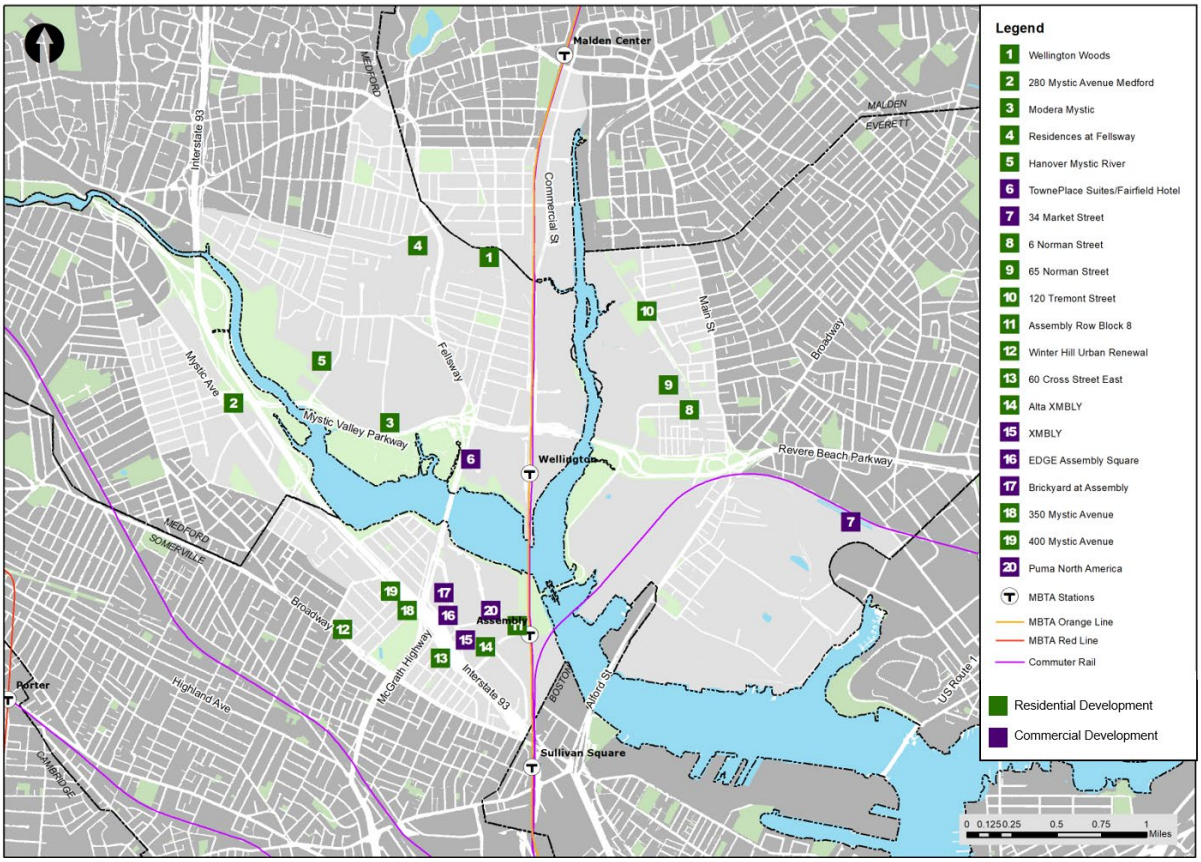
- **Malden |** Malden maintains a generally single-use zoning code. The Commercial Street corridor along the Malden River is undergoing study, whichmay result in changes to its zoning. It is currently zoned for a combination of industrial and "Highway Business" (i.e., larger-scale office and retail) uses.

- **Somerville |** Somerville's zoning code – comprehensively restructured in 2019 – includes no single-use zones. The Assembly Square mixed-use special district and small amounts of light industrial "Fabrication" and "Commercial Industry" zones make up the remainder of the study area.

2.1.4 Planned Developments (Proposed and Under Construction)

Looking at the current land use in the local study area gives a snapshot of a dynamic landscape. While widespread changes may take years, numerous development projects have been proposed or are actively under construction in the study area, making the near-term future slightly different than existing conditions. These developments, identified from the document libraries of the planning boards or zoning boards of appeals for Medford Everett, and Somerville are depicted in Figure 2.1-4, as of October 31, 2020. No large developments were identified for the study area in Malden.

Figure 2.1-4: Developments (Proposed and Under Construction)



These developments include both residential and commercial projects. While retail was included on the first floor of some developments to achieve a mixed-use label, no development included significant residential and commercial uses at once:

- **Residential Developments |** The smallest of the developments plans to add 27 units to the study area, with smaller single or two-family projects excluded. The area also includes much larger-scale residential projects (65 Norman Street in Everett has nearly 400 units), as well as Section 40B affordable housing proposals. The larger residential projects in all three communities are typically located in areas where the prevailing land use is not residential, and sometimes in areas not zoned for residences.
- **Commercial Developments |** Commercial developments are centered around Assembly Square in Somerville, including three major office/lab/research projects along Middlesex Avenue.

2.2 Socioeconomic Conditions

The area surrounding the Circle is fast-growing and diverse, with a high percentage of minority populations among the five cities in the broader area. Ensuring that the needs of these communities are met will be essential for any Wellington Circle alternative. For demographic purposes, the local study area was used where possible, in addition to a regional study area incorporating the municipalities of Everett, Somerville, Malden, Medford, and Revere.

2.2.1 Population

The study area has an estimated 2020 population of 36,534, as shown in Table 2.2-1. Many of the most densely populated portions of the area are found in long-established neighborhoods such as Winter Hill in Somerville and the residential portions of Medford north and west of Wellington Circle. The less dense portions of the study area tend to be those along the Mystic and Malden Rivers, though an exception to this is the densely populated area that includes the Rivers Edge development on the western shore of the Malden River in Medford. (See Figure 2.2-1.)

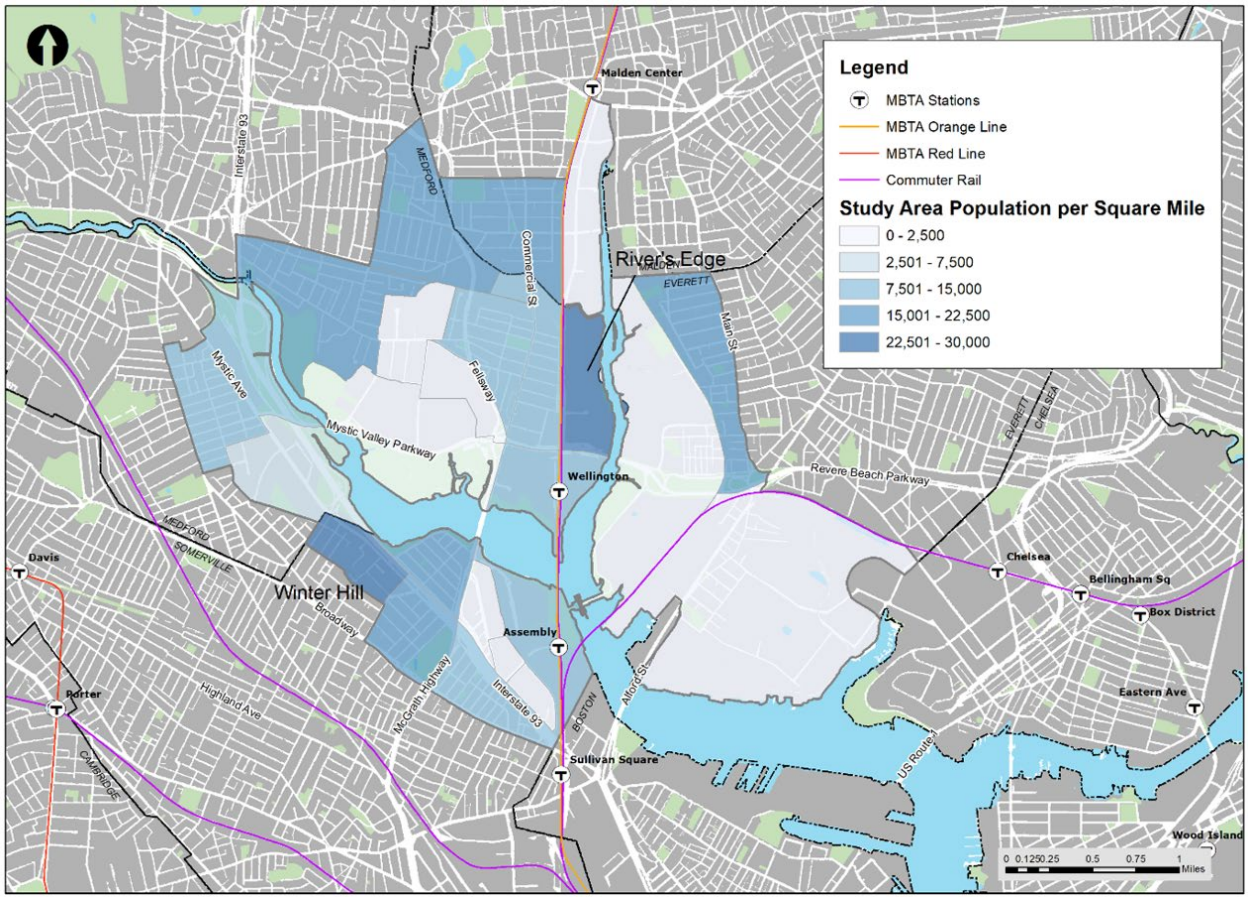
Table 2.2-1: Local and Regional Study Area Population

	Local Study Area	Everett	Malden	Medford	Revere	Somerville
2010 Population[1]	N/A*	41,667	59,450	56,173	51,755	75,754
2020 Population Estimate[2]	36,534	41,039	68,550	64,230	50,967	83,657
2040 Population Projection[3]	43,197	44,906	73,815	70,389	55,413	97,606
Change in Pop. 2020-2040	6,663	3,867	5,265	6,159	4,446	13,949
Pct. Change in Pop., 2020-2040	18%	9%	8%	10%	9%	17%

**2010 data not available for local study area defined by TAZs*

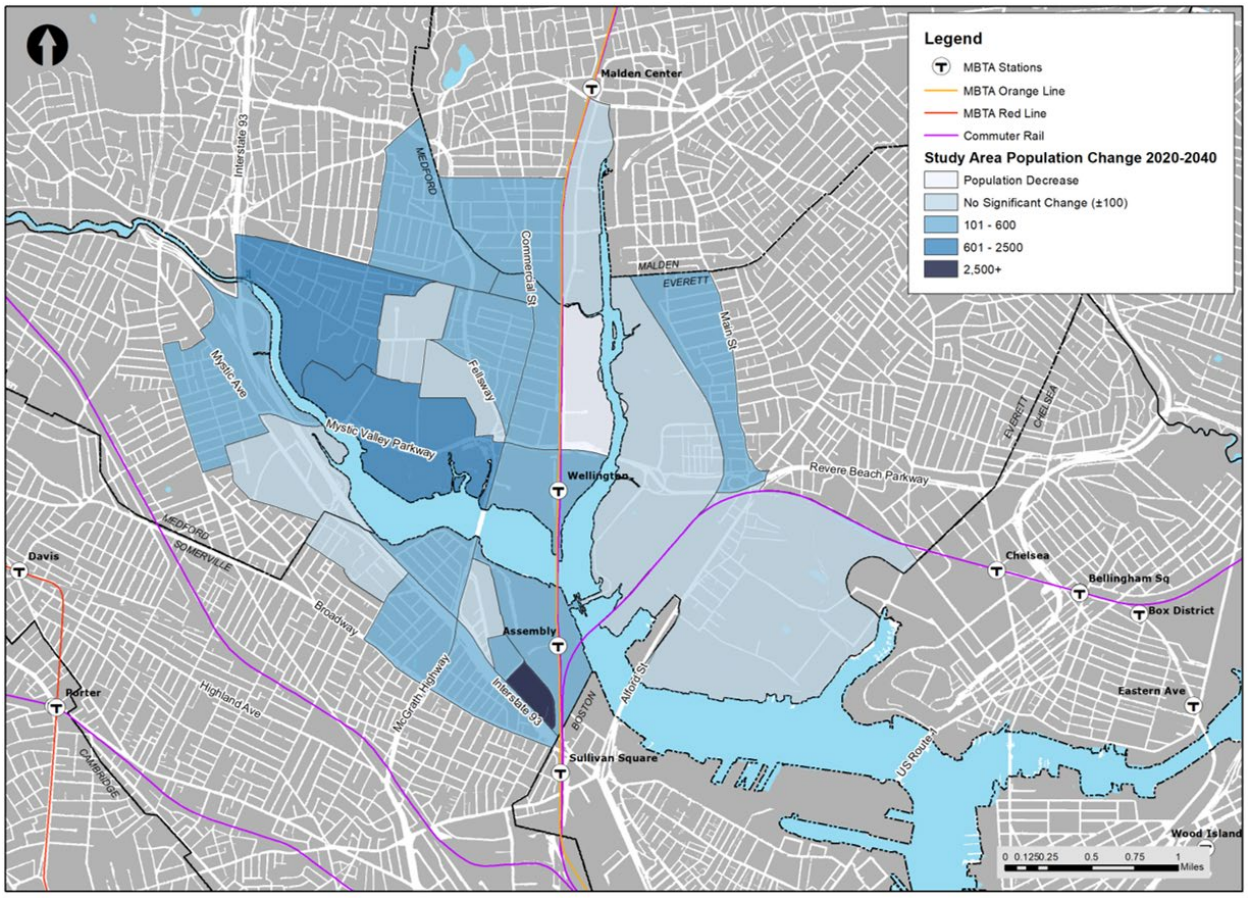
[1] US Census Bureau, Decennial Census, 2010
[2] Metropolitan Area Planning Council (MAPC)
[3] MAPC

Figure 2.2-1: 2020 Population Density in Study Area



The study area represents a rapidly rising population, expected to increase by roughly 18% to 43,197 residents in 2040 – a higher rate than any of the cities within the regional study area. Much of this population growth, shown in Figure 2.2-2, is associated with areas along the Mystic River, including the area around Assembly Square in Somerville and the area immediately north of the Mystic River Reservation in Medford, portions of which are expected to more than double in population. As detailed in Section 2.1, these areas have been programmed for growth, with numerous developments in the pipeline in the Assembly Square area. The Rivers Edge area in Medford, however, is projected to see a population decline of nearly one-fourth – likely related to changes in land use – while the predominantly industrial area east of the Encore Casino in Everett is also expected to see a decrease in population.

Figure 2.2-2: Study Area Population Change 2020-2040



Age and Race

The largest age bracket of the population in each of the cities in the regional study area is age 25-34. Somerville has the youngest population among the regional study area cities, with a median age of 32 years. The median age in Medford, Malden, Everett, and Revere varies between 37 and 40.[4] The distribution of age is shown in Figure 2.2-3.

In terms of racial composition, Medford and Somerville are very similar, with 74% of the population identifying as non-Hispanic white. Revere is 55% non-Hispanic white. Malden and Everett, by contrast, are both majority-minority cities, with 48% and 45% of the population identifying as non-Hispanic white, respectively.[5] Population by race is shown in Figure 2.2-4.

[4] US Census Bureau, American Community Survey, 2018 5-year estimates
[5] US Census Bureau, American Community Survey, 2018 5-year estimates

Figure 2.2-3: Age Distribution in Regional Study Area Cities

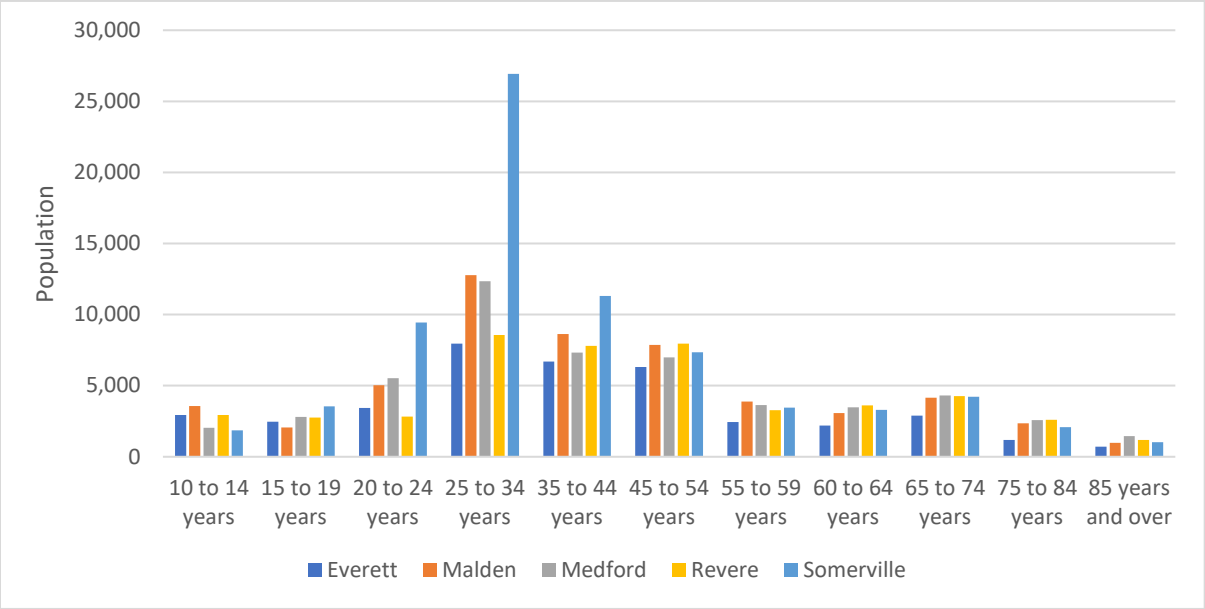
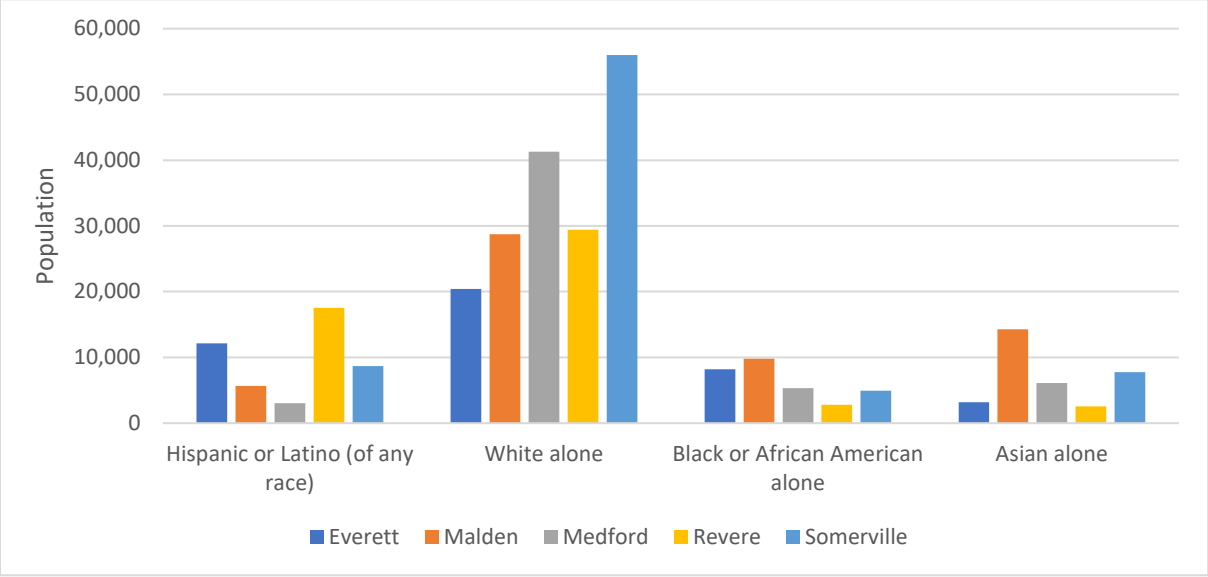


Figure 2.2-4: Racial Composition by City



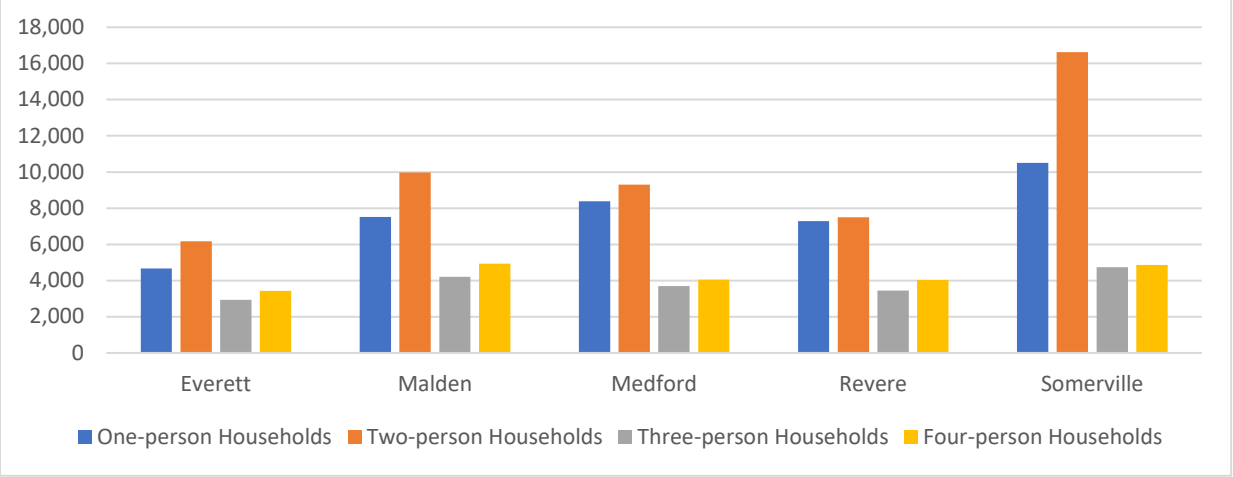
2.2.2 Households

Of the more than 15,000 households in the local study area, 33% are one-person households, a higher rate than the city-wide rate in any of the regional study area cities (Somerville is highest at 31%). Similar to the regional study area, four-person households in the local study area are comparatively low, at 16%.[6] Household size by city is shown in Figure 2.2-5. The changes in number of households in the regional study area between 2020 and 2040 are shown in Table 2.2-2 and in the local study area in ***Figure 2.2-6***.

Table 2.2-2: Household Changes 2020-2040

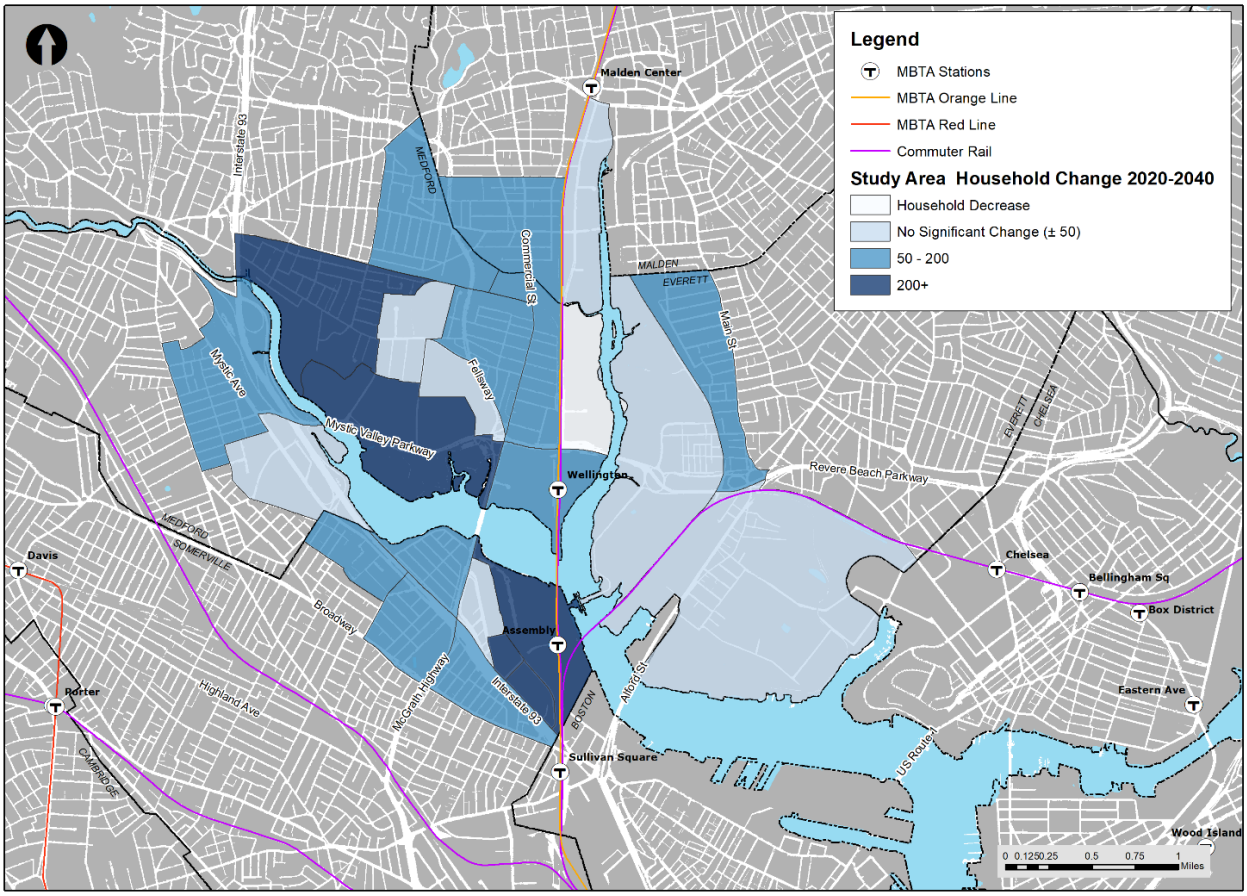
	Local Study Area	Everett	Malden	Medford	Revere	Somerville
2020 Households	15,068	17,214	26,635	25,427	22,284	36,732
2040 Households	18,545	19,558	30,056	29,093	25,163	45,258
Change in HHs	3,477	2,344	3,421	3,666	2,879	8,526
Percent Change	23%	14%	13%	14%	13%	23%

Figure 2.2-5: Household Sizes by City



[6] Boston Region MPO, Household by TAZ data provided by Central Transportation Planning Staff, 2020 projection

Figure 2.2-6: Study Area Household Change 2020-2040



In Everett, Malden, and Somerville, over 50% of housing units are renter occupied. Medford is the only city with more owner-occupied than renter-occupied housing. Vacancy rates within the regional study area range from 4-6%.[7]

Household incomes in the local study area are generally higher than those city-wide in Everett and Revere, but lower than those in Medford and Somerville. As shown in Table 2.2-3, 28% of households in the study area are considered low-income (less than $35,000), while 41% are medium-high- or high-income households.[8][9]

[7] US Census Bureau, American Community Survey, 2018 5-year estimates
[8] Boston Region MPO, Household by TAZ data provided by Central Transportation Planning Staff, 2020 projection
[9] Household income data shown in Table 2-2.2 represents income groups in 2011 Dollars based on MassDOT's 2011 Statewide Household Survey and the 2010 U.S. Census data. Note that the definition of low-income differs from that used by the Boston Region MPO in the Environmental Justice analysis.

Table 2.2-3: Household Income Brackets

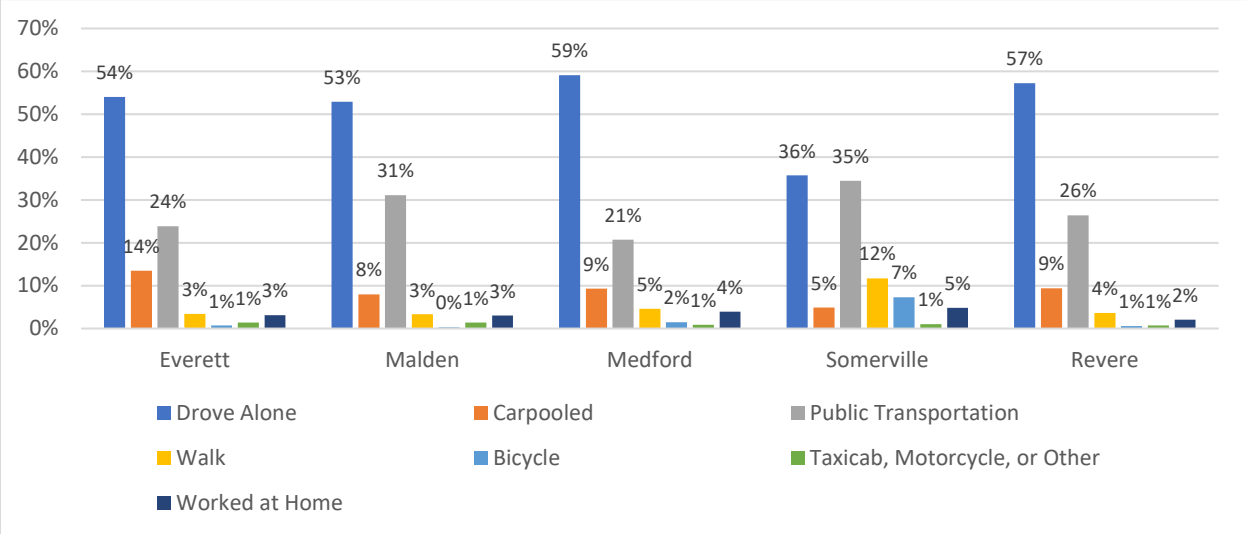
	Local Study Area	Everett	Malden	Medford	Revere	Somerville
Low-income (Less than $35,00)	28%	28%	28%	27%	33%	19%
Med Low-income ($35,000 - $74,999)	31%	36%	30%	27%	32%	35%
Med High- or High-income ($75,000+)	41%	36%	42%	46%	35%	46%

Mode Share

Within the regional study area, city-wide rates of households without a vehicle range from 11% (Medford) to 24% (Somerville). The local study area falls in the middle of this range, with 18% of households having no vehicles available.[10]

In the regional study area, aside from Somerville, the majority of commuters drive alone to work, as shown in Figure 2.2-7. Somerville, meanwhile, has much higher rates of walking and biking, with nearly a fifth of the population choosing these modes.[11]

Figure 2.2-7: Commuter Mode Shares in Regional Study Area Cities



2.2.3 Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations" of February 11, 1994 lays the groundwork for the Boston Region Metropolitan Planning Organization's (MPO) transportation equity program. The program

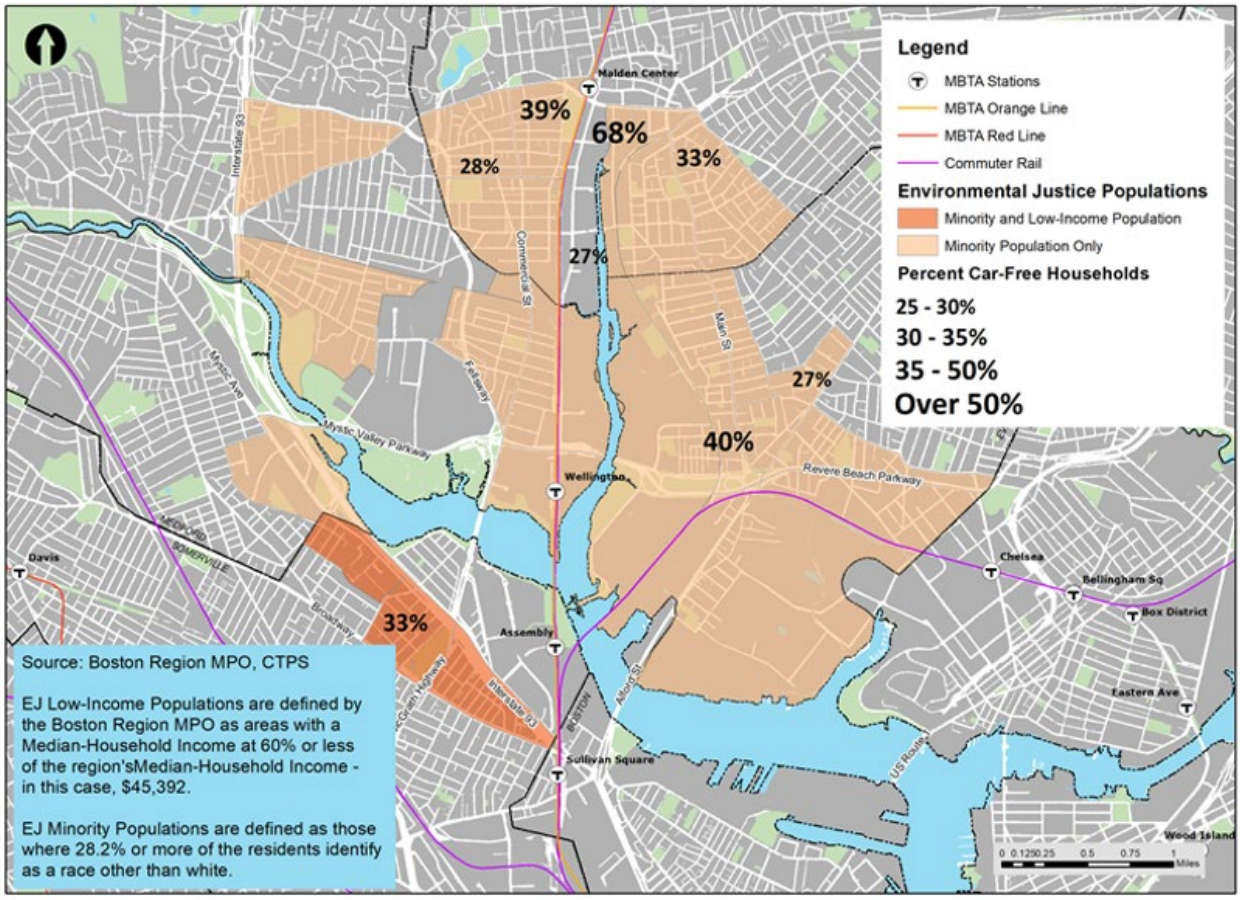
[10] US Census Bureau, American Community Survey, 2018 5-year estimates
[11] US Census Bureau, American Community Survey, 2018 5-year estimates

ensures that EJ populations are provided with equal opportunity to participate in the transportation planning and decision–making process. It also ensures that EJ populations share equitably in the benefits and burdens of transportation projects and services. Engaging EJ populations in transportation decisions is important, as historically low-income and minority populations have experienced many negative effects and few benefits of transportation projects. Involving EJ communities helps to avoid, minimize, or mitigate disproportionate adverse health and environmental effects on these populations.

The Boston Region MPO defines Environmental Justice communities for analysis and outreach purposes. It measures environmental justice populations at the transportation analysis zone (TAZ) level and defines criteria for both the minority and low-income thresholds. These areas are defined where a cluster of TAZs contain a non-white or Hispanic population that is greater than 28.2% and/or when a population's income is less than 60% of the MPO Region's median household income ($45,392). Since all the regional study area cities are within the Boston Region MPO, the same definition of EJ populations was used for consistency in the transportation planning process.

The majority of the study area contains EJ populations, the majority of which meet only the minority criteria, as seen in Figure 2.2-8. The Wellington Circle intersection specifically is located with an EJ population that meets the minority criteria. There is an EJ population that meets both the income and minority criteria in the southern section of the study area in Somerville along I-93. There are no EJ populations within the local study area that meet the definition on income alone.

Figure 2.2-8: Environmental Justice Populations

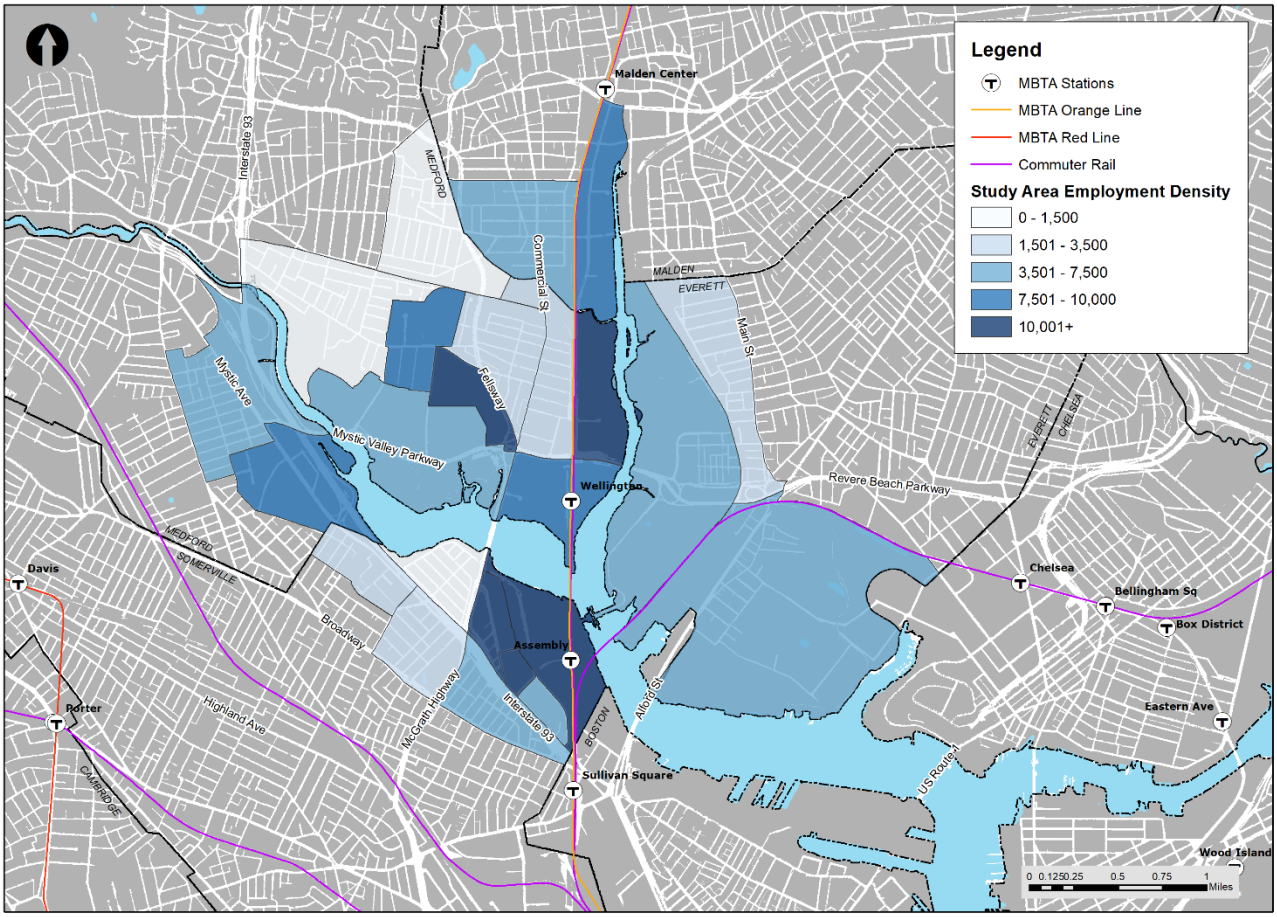


2.2.4 Employment

An area is not solely impacted by its residents; the workers active in the area can influence the alternatives considered for Wellington Circle. The study area has a considerably high number of people working within its bounds at 23,300 – more than the cities of Malden, Everett, and Revere, individually. In total, the study area's employment represents 26% of the total employment of the five cities. In contrast, the study area's population represents just 12% of the total population of the five cities.[12] Employment density in the study area is shown in Figure 2.2-9.

[12] Boston Region MPO, Data provided by Central Transportation Planning Staff, 2020 projection

Figure 2.2-9: Employment Density in Study Area



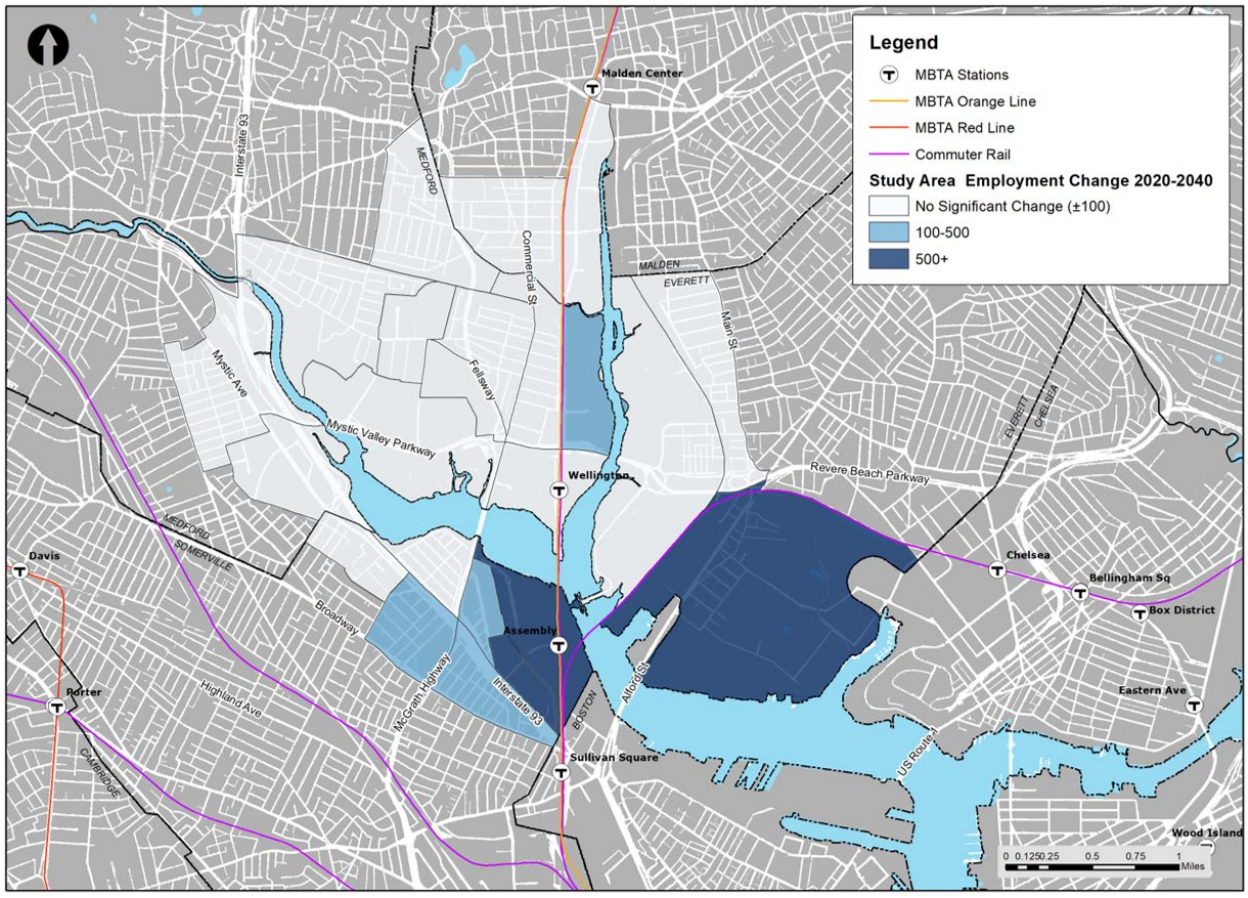
By 2040, the study area is expected to add 6,954 employees, a 30% increase, with the majority of the job growth occurring in the vicinity of the Encore Casino in Everett, as well as Assembly Square across the river in Somerville (Figure 2.2-10). This rate surpasses that of all regional study area cities except Somerville, which is projected to see a 59% increase in total employment by 2040. Much of this growth may be overlapping in the Assembly Square area, which is expected to have nearly 5000 more employees in 2040 than 2020.[13] Notable as well is the growth in the Rivers Edge Drive area of Malden which, while projected to decline in population, is expected to see significant growth in employment. Employment growth in the regional study area is shown in Table 2.2-4.

[13] Boston Region MPO, Employment TAZ data provided by Central Transportation Planning Staff, 2020 and 2040 projections

Table 2.2-4: Employment Change in Local and Regional Study Area, 2020-2040

	Local Study Area	Everett	Malden	Medford	Revere	Somerville
2020 Employment	23,300	15,985	15,522	21,032	9,130	27,838
2040 Employment	6,954	17,264	15,666	22,918	9,272	44,281
Change in Emp.	32,254	1,279	144	1,886	142	16,443
Percent Change	30%	8%	1%	9%	2%	59%

Figure 2.2-10: Study Area Employment Change 2020-2040



2.3 Public Health Conditions

Understanding public health is an essential component of developing alternatives for Wellington Circle. Changes to transportation can impact public health by affecting how people travel and what they can access in their area, such as healthy food and healthcare.

Depending on the availability of data, both the local and regional study areas were used to evaluate public health conditions. Community-level public health data from the study area's municipalities – Everett, Malden, Medford, and Somerville – were used to compile profiles of health conditions.

The Massachusetts Department of Public Health - Bureau of Environmental Health provides public health data via the Massachusetts Environmental Public Health Tracking (EPHT) website. While the data for some public health indicators in the EPHT are available by community, others are only available at larger scales such as State, County, Emergency Preparedness Region, and MA Executive Office of Health & Human Services (EOHHS) Region. The Wellington Circle study area includes portions of EOHHS Region Three – Northeast (Medford, Malden, Everett) and EOHHS Region Four – Metro West (Somerville). EPHT was used to compile data on hospitalization, pediatric type I and type II diabetes, and pediatric asthma.

Other federal and local data were referenced as necessary. The data sources are identified throughout the section. For this analysis, data was compiled by community, where possible, and by EOHHS Region or County if community level data was not available. The entire study area is within Middlesex County. The data for each indicator was pulled from the most recent year(s) of data available.

2.3.1 Community Health Needs Assessments (CHNA)

Community health needs assessment (CHNA) reports, published by healthcare providers and often covering multiple cities and towns, provide insight into health priorities for the communities within the study area. Relevant findings from recent CHNAs for communities in the study area are summarized in Table 2.3-1.

Table 2.3-1: CHNA Findings Summary

CHNA Publisher	Year	Study Area Communities	Findings
Mount Auburn Hospital[14]	2018	Somerville	- Socioeconomic status, housing, transportation leading social determinants of health - Lack of transportation a major concern due to cost, schedule inflexibility, unreliability - Healthy food a concern for low-income families
Melrose/Wakefield Healthcare[15]	2019	Everett, Medford, Malden	- Mental health, substance use, chronic disease, and access to care among top health concerns - Top community needs identified as housing stability, employment, education, and transportation - Transportation options to access healthcare particularly of concern to older adults
Everett/Malden Collaborative for Community Health Improvement[16]	2019-2020	Everett, Malden	- Housing availability and stability, access to healthy food, economic stability, and access to care among top health concerns - Transportation a concern regarding access to healthy food

The following summarizes the major concerns directly relevant to the Wellington Circle Study from the CHNAs across the study area and the relevant concerns consistent to all areas.

- Across all communities in the study area, access to health care and services was identified as a primary concern.
- Most communities also noted access to healthy and affordable food was a public health concern.
- In Somerville, despite the strong public transit system, it was noted that barriers exist related to health care access, including cost of transportation, inflexibility of schedules, and unreliability of service.

[14] Mount Auburn Hospital (MAH). 2018 Community Health Needs Assessment. Accessed at https://www.mountauburnhospital.org/app/files/public/1518/2018-community-health-needs-assessment.pdf
[15] MelroseWakefield Healthcare (MWHC). Community Health Needs Assessment 2019. Accessed at: https://www.melrosewakefield.org/wp-content/uploads/2017/07/2019-MWHC-CHNA-report-FINAL-updated.pdf
[16] Everett/Malden Collaborative for Community Health Improvement, 2019/2020 Community Health Needs Assessment. Accessed at: https://hhsf.sharefile.com/share/view/s8a32eac8de247189

2.3.2 Baseline Public Health Information

Beyond the summary views given by the CHNAs, existing public health data was compiled as available to better understand factors in the study area communities. Generally presented as five-year averages and compared with statewide numbers, this data identifies specific needs for improvement in the community. In the tables below, statistical significance indicates how likely the variance of each public health indicator from the statewide prevalence is due to chance.

2.3.2.1 Hospitalization

Hospitalization data, shown in Table 2.3-2 through Table 2.3-4, represents the five-year annual average for the period from 2012-2016 (most recent five-year period available in EPHT). Generally, the rate of hospitalization for asthma, COPD, and myocardial infarction in communities within the study area is not statistically significantly different from the statewide rate, though Everett has a statistically significantly higher rate of hospitalization for COPD. Hospitalization rates for congestive heart failure, stroke, and hypertension were not available from EPHT data.

Table 2.3-2: Annual Average Age Adjusted Rates of Hospital Admission for Asthma per 10,000 People (2012-2016)

	Case Count	Census Population	Crude Rate	Age Adjusted Rate	Confidence Intervals	Statistical Significance
Statewide	7,484	6,781,208	11.0	11.1	11.0 - 11.2	N/A
Everett	61	45526	13.5	13.8	10.4 - 17.3	Not statistically significantly different
Malden	68	63979	10.6	11.1	8.5 - 13.8	Not statistically significantly different
Medford	55	58839	9.4	9.8	7.2 - 12.4	Not statistically significantly different
Somerville	53	76706	6.9	8.9	6.5 - 11.4	Not statistically significantly different

Data source: Massachusetts Department of Public Health Bureau of Environmental Health, EPHT website https://matracking.ehs.state.ma.us/Health-Data/Asthma/hospitalization.html

Table 2.3-3: Annual Average Age Adjusted Rates of Hospital Admission for COPD per 10,000 People (2012-2016)

	Case Count	Census Population	Crude Rate	Age Adjusted Rate	Confidence Intervals	Statisti
Statewide	14,429	4,668,344	30.9	27.1	26.9 - 27.3	N/A
Everett	97	30,453	31.7	34.9	27.9 - 41.8	Statistically significantly higher
Malden	123	45,316	27.1	28.9	23.8 - 34.0	Not statistically significantly different
Medford	127	42,273	30.0	27.0	22.3 - 31.7	Not statistically significantly different
Somerville	100	56,487	17.8	26.9	21.6 - 32.2	Not statistically significantly different

Data source: Massachusetts Department of Public Health Bureau of Environmental Health, EPHT website https://matracking.ehs.state.ma.us/Health-Data/copd.html

Table 2.3-4: Annual Average Age Adjusted Rates of Hospital Admission for Myocardial Infarction per 10,000 People Age 35+(2012-2016)

	Case Count	Census Population	Crude Rate	Age Adjusted Rate	Confidence Intervals	Statistical Significance
Statewide	11,229	3,739,354	30.0	26.7	26.5 - 26.9	N/A
Everett	76	22,631	33.6	34.5	26.7 - 42.2	Not statistically significantly different
Malden	94	33,032	28.6	28.2	22.5 - 33.9	Not statistically significantly different
Medford	105	31,750	33.0	27.8	22.5 - 33.1	Not statistically significantly different
Somerville	81	33,129	24.3	25.5	19.9 - 31.1	Not statistically significantly different

Data source: Massachusetts Department of Public Health Bureau of Environmental Health, EPHT website https://matracking.ehs.state.ma.us/Health-Data/Heart_Attack_Hospitalization.html

2.3.2.2 Pediatric and adult obesity

Compared to nationwide obesity rates, Massachusetts has lower rates of obesity in youth, high school students, and adults, as seen in Table 2.3-5. Obesity data at the individual community level is limited. The percentage of overweight or obese children (grades 1, 4, 7, 10) in all study area communities was higher than the statewide total percentage in the period from 2010-2011 (See Table 2.3-6). Adult obesity data was available at the state and county level. Middlesex County had a far lower age adjusted percentage of adult obesity than the state overall according to 2016 data (See Table 2.3-7).

Table 2.3-5: Youth, High School, and Adult Nationwide and State Obesity Rates

	Massachusetts Obesity Rate	Nationwide Obesity Rate
Youth (Children 10-17)	11.8%	15.5%
High School Students	14.2%	15.5%
Adults	25.2%	42.4%

Source: State of Childhood Obesity Website, https://stateofchildhoodobesity.org/states/ma/. Youth data derived from 2018-19 National Survey of Children's Health (NSCH). High School data derived from 2019 Youth Risk Behavior Surveillance System (YRBSS). Adult data derived from 2019 Behavioral Risk Factor Surveillance System (BRFSS).

Table 2.3-6: Overweight or Obese Children in Grades 1, 4, 7, 10 in Massachusetts School Districts (2010-2011)

School District	Total number of students screened (N)	Overweight (%)	Obese (%)	Overweight or Obese (%)
Statewide Total	205,975	16.7	15.7	32.3
Everett	1,627	19.5	26.7	46.2
Malden	1,782	17.2	20.1	37.3
Medford	1,439	17.2	19.5	36.7
Somerville	1,377	17.7	25.9	43.6

Source: The Status of Childhood Weight in Massachusetts 2011 Report, Bureau of Community Health and Prevention Massachusetts Department of Public Health

Table 2.3-7: Massachusetts Adults with Obesity (2016)

	Crude Obesity	Obesity Age Adjusted Percentage	Lower Limit	Upper Limit
Statewide	1,319,986	49.5	40.1	59.0
Middlesex County	271,044	21.6	20.4	22.9

Source: United States Diabetes Surveillance System, Division of Diabetes Translation, CDC https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html. According to CDC, upper limit is the maximum or highest value in the confidence interval and the lower limit is the lowest value.

2.3.2.3 Pediatric and adult diabetes (including Type II)

Pediatric diabetes prevalence represents data for children enrolled in grades Kindergarten through 8th grade for school year 2016-2017 by county. Middlesex County cases were not statistically significantly different from statewide cases per 1,000 students for Type I pediatric diabetes, see Table 2.3-8. Similarly, Middlesex County cases were not statistically significantly different from statewide cases per 100,000 for Type II pediatric diabetes, see Table 2.3-9 below. Adult diabetes rates were also available at the county level and represent 2016 data. Compared with the statewide age adjusted rate, Middlesex County has a lower rate of adult diabetes (See Table 2.3-10).

Table 2.3-8: Pediatric Diabetes Type I Cases per 1,000 Students (School Year 2016-2017, Public charter and private schools combined)

	Student Case Count	Student Enrollment Count	Cases per 1,000	95% Confidence Interval	Statistical Significance
Statewide	1,586	679,336	2.3	2.2 - 2.4	N/A
Middlesex County	363	155,691	2.3	2.1 - 2.6	Not statistically significantly different

Data source: Massachusetts Department of Public Health Bureau of Environmental Health, EPHT website https://matracking.ehs.state.ma.us/Health-Data/diabetes-pediatric.html

Table 2.3-9: Pediatric Diabetes Type II Cases per 100,000 Students (School Year 2016-2017, Public, charter and private schools combined)

	Student Case Count	Student Enrollment Count	Cases per 100,000	95% Confidence Interval	Statistical Significance
Statewide	71	679,336	10.5	8.1 - 12.9	N/A
Middlesex County	17	155,691	10.9	5.7 - 16.1	Not statistically significantly different

Data source: Massachusetts Department of Public Health Bureau of Environmental Health, EPHT website https://matracking.ehs.state.ma.us/Health-Data/diabetes-pediatric.html

Table 2.3-10: Adult Diabetes (2016)

	Crude Total Adults with Diabetes	Age Adjusted Rate (2016)	Confidence Interval
Statewide	506,608	8.3	7.6 – 9.3
Middlesex County	91,249	6.8	6.2 – 7.4

Source: United States Diabetes Surveillance System, Division of Diabetes Translation, CDC https://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html

2.3.2.4 Pediatric and adult asthma

Pediatric asthma prevalence represents data from children enrolled in grades Kindergarten through 8th grade for school year 2016-2017. In Massachusetts, one out of every eight students has asthma.[17] Based on the most recent year of data available, each community within the study area has statistically significantly lower prevalence of pediatric asthma as compared to statewide prevalence, see Table 2.3-11.

Data concerning adult asthma prevalence was only available at the state level. Massachusetts state asthma prevalence for both adults and children were higher than nationwide prevalence, based on 2017 data, see Table 2.3-12.

Table 2.3-11: Pediatric Asthma Prevalence per 100 Students (School Year 2016-2017, Public, charter and private schools combined)

	Student Case Count	Student Enrollment Count	Prevalence (%)	95% Confidence Interval	Statistical Significance
Statewide	82,279	679,336	12.1	12.0 - 12.2	N/A
Everett	515	5,231	9.8	9.0 - 10.7	Statistically significantly lower
Malden	587	5,392	10.9	10.0 - 11.8	Statistically significantly lower
Medford	350	3,689	9.5	8.5 - 10.5	Statistically significantly lower
Somerville	431	4,073	10.6	9.6 - 11.6	Statistically significantly lower

Data source: Massachusetts Department of Public Health Bureau of Environmental Health, EPHT website https://matracking.ehs.state.ma.us/Health-Data/Asthma/pediatric.html

Table 2.3-12: Child and Adult Nationwide and State Asthma Prevalence (2017)

	Prevalence (%)	Standard Error
Nationwide – Adult	7.7	0.20
Massachusetts – Adult	11.5	0.68
Nationwide – Children	8.4	0.38
Massachusetts – Children	15.8	3.05

Source: 2017 National Health Interview Survey (NHIS) Data, https://www.cdc.gov/asthma/data-visualizations/prevalence.htm.

[17] https://www.mass.gov/guides/phit-data-pediatric-asthma

2.3.3 Injuries and fatalities related to crashes

Crash data represents average community level data for the five-year period from 2015-2019. Medford had the highest average number of crashes out of all the communities in the study area, and the highest average number of crashes that were fatal or resulted in serious injury, see Table 2.3-13 below. Malden had the second highest average number of crashes with the highest average number of pedestrian and motorcycle related crashes at 49 and 14, respectively. Somerville had the third highest number of crashes and the highest average number of bicycle related accidents, see Table 2.3-14 below.

Table 2.3-13: 5-year Average Crashes by Severity and Municipality (2015-2019)

	Total Crashes	Fatal	Serious Injury
Statewide	142,080	336	2,356
Everett	443	1	8
Malden	930	1	17
Medford	1,203	2	22
Somerville	855	1	13

Source: MassDOT Impact - Crash Data, https://apps.impact.dot.state.ma.us/cdp/home

Table 2.3-14: 5-year Average Crashes by Type and Municipality (2015-2019)

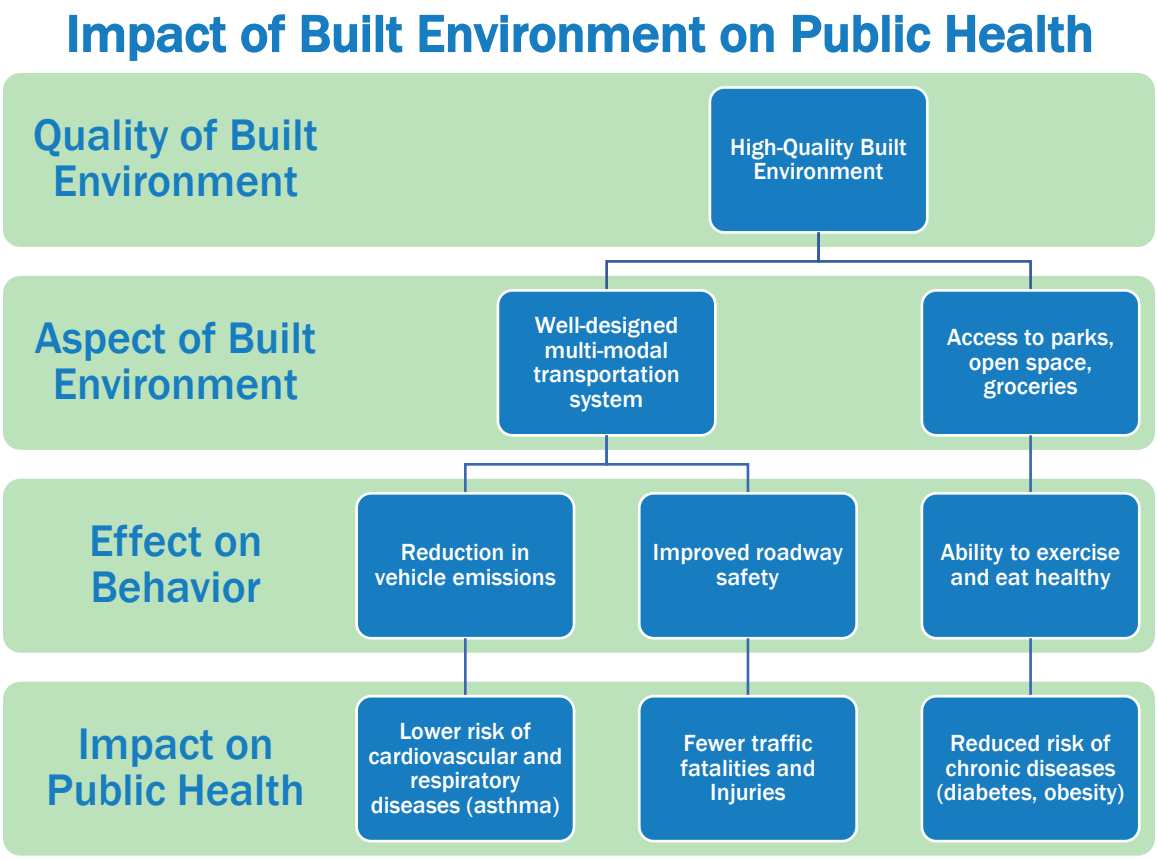
	Total Crashes	Pedestrian Related Crash	Bicycle Related Crash	Motorcycle Related Crash
Statewide	142,080	2,237	1,369	1,845
Everett	443	20	7	8
Malden	930	49	14	14
Medford	1,203	33	17	13
Somerville	855	44	55	10

Source: MassDOT Impact – Crash Data, https://apps.impact.dot.state.ma.us/cdp/home

2.3.4 Built Environment and Public Health

The built environment is comprised of the man-made physical characteristics of a community's spaces for living, learning, working, and recreation. This includes housing, schools, businesses, streets, sidewalks, open spaces, utilities, transportation, and more. As seen below, the quality of the built environment is directly related to overall community public health.[18]

[18] https://www.cdc.gov/nccdphp/dnpao/state-local-programs/built-environment-assessment/index.htm



2.3.4.1 Complete Streets

There are numerous strategies and aspects of the built environment that can help to improve public health. One of these is to adopt an approach to transportation policy and infrastructure design that considers the needs of all users. A complete street provides safe and accessible options for all travel modes (walking, biking, transit and vehicle) for people of all ages and abilities. MassDOT incentivizes complete streets through the Complete Street Funding Program that facilitates improved pedestrian, bicycle, and transit travel for all users, while achieving equity across municipalities.[19] In 2014, Somerville was the first municipality in the state to enact a Complete Streets Ordinance.[20] The City of Malden Complete Streets Policy was signed in 2016,[21] while Everett also has a Complete Streets initiative led by the Transportation Planning Division.[22] In 2019, The City of Medford received a Complete Streets grant from MassDOT for improvements at multiple intersections. Example project elements include installing curb extensions, curb ramps, striping, pavement markings, rectangular rapid flashing beacons (RRFB), and signage to enhance safety and accessibility.[23]

[19] https://masscompletestreets.com/Content/Docs/CompleteStreetsAnnualReportFY18%20(2).pdf
[20] https://www.somervillebydesign.com/transportation/complete-streets/
[21] City of Malden, Complete Streets Policy, October 2016. https://www.cityofmalden.org/DocumentCenter/View/841/Complete-Streets-Policy-PDF
[22] http://www.cityofeverett.com/508/Transportation-Planning-Division
[23] http://www.medfordma.org/complete-streets/

2.3.4.2 Active Transportation

Another way to improve public health through the built environment is to promote active transportation, such as walking and bicycling, into transportation planning. Active transportation provides opportunities for recreational exercise and builds physical activity into daily routines.[24] One example of this type of strategy is found in the MassDOT Healthy Transportation Policy Directive, which requires "incorporation of waking, biking, and transit infrastructure in all projects" funded under the Commonwealth's transportation investment strategy, the Capital Investment Plan (CIP).

2.3.4.3 Transit-Oriented Development

Transit-oriented neighborhoods offer a way to prioritize transit, walking, and bicycling over driving. This type of development can improve physical activity, decrease traffic and pedestrian injuries and fatalities, decrease air pollutants and greenhouse gas emissions, and improve mobility for those without cars.[25] Transit stations are key to creating connected networks; accessibility to transit via pedestrian and bike connections ensures convenient and safe access to multiple modes of transportation and those without cars.

2.3.4.4 Access to Open Space

Increased access to open space, parks, and trails promotes physical activity. The Everett-Malden CHNA lists open space and recreation as a strength of the Everett and Malden communities as 98.8% of Everett and 92.6% of Malden residents have access to a park within a 10-minute walk. It also lists accessibility to parks, open spaces, and bike paths/bike lanes as a strength in both communities. The graphic below summarizes local open space, parks, and trails in the study area, including recent development updates.

[24] https://www.transportation.gov/mission/health/active-transportation
[25] American Public Health Association, The Hidden Costs of Transportation, March 2010 https://www.apha.org/-/media/files/pdf/topics/transport/hidden_health_costs_of_transportation_backgrounder.ashx?la=en&hash=F711B4B5C507F30BA4D9C4844A089BFD024DC1CC

Malden River Route	• Developed in 2013 by the City of Malden, with partners • Spans 1.9 miles, connecting local points of interest
Northern Strand Community Trail	• Spans 7.5 miles, connecting Everett, Malden, Revere and Saugus • Improvements begun in 2020 will extend the trail to Somerville
Mystic Greenways Trail System	• Still under development • Will eventually include 25 miles of paths • Will incorporate the forthcoming Wellington Greenway and Malden River Greenway
Other Resources	• Park at Rivers Edge • Riverbend Park • Mystic River Reservation

Sources[26] [27] [28] [29]

[26] https://www.cityofmalden.org/DocumentCenter/View/1975/Malden-River-Walking-Route-Map-PDF
[27] https://biketothesea.org/wp-content/uploads/2020/04/B2C_Brochure_2020_Compressed.pdf
[28] Mystic River Watershed Association. Greenways. https://mysticriver.org/greenways
[29] Mystic River Watershed Association. Malden River Works for Waterfront Equity and Resilience. https://mysticriver.org/maldenriver

2.3.4.5 Access to Healthy Food

Another way to improve public health through the built environment is ensuring access to healthy food. Statewide programs include the "Mass in Motion" Municipal Wellness and Leadership Grant program and the Massachusetts Food Trust Program (MFTP), which seeks to improve food security in underserved areas by providing loans, grants, and business assistance to local businesses that produce, promote, or sell healthy food.[30] Current initiatives supported by Mass in Motion in study area communities include: Energize Everett, Malden is Moving!, and Mass in Motion Medford.[31] Additionally, multiple study area municipalities have recently released related assessments and plans describing the state of food access in their communities:

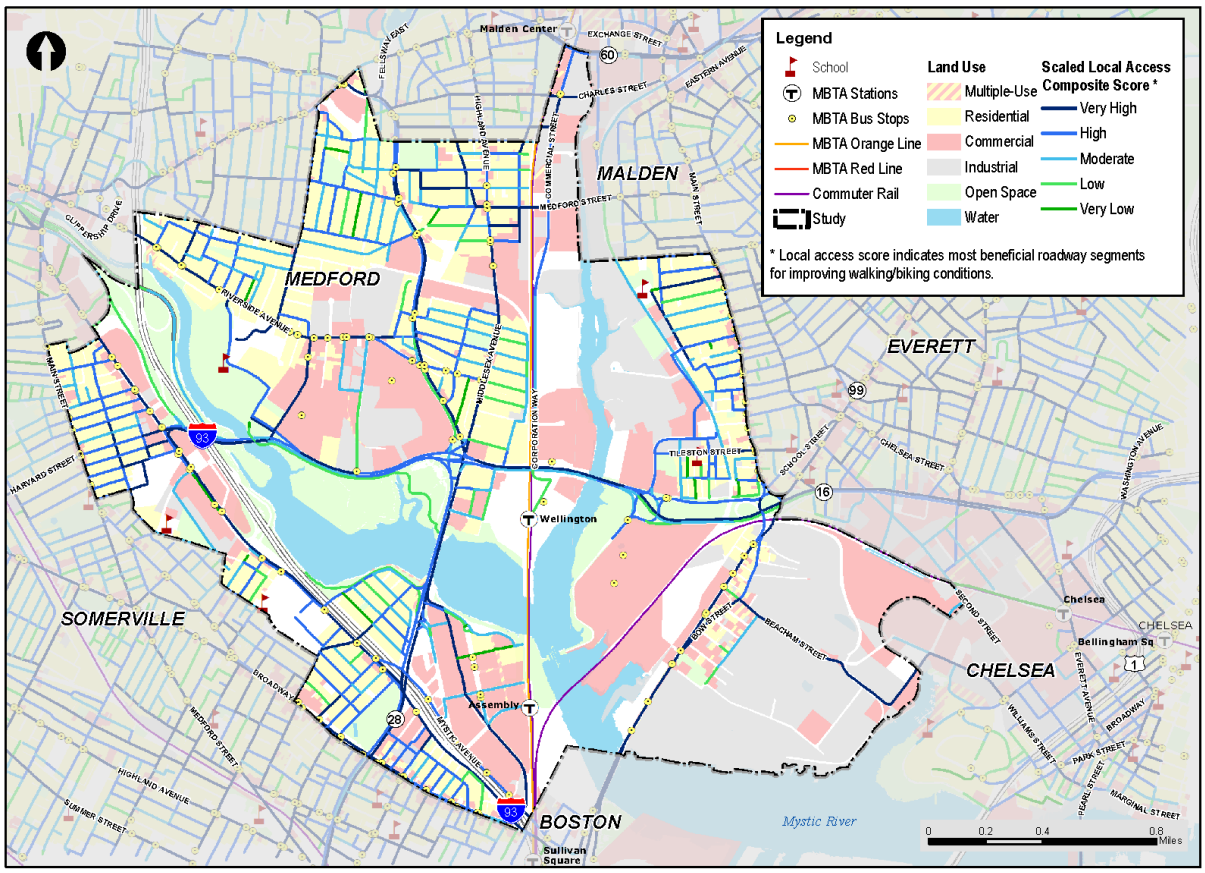
- City of Somerville Community Food System Assessment and Plan, July 2018[32]
- Everett Community Food Assessment & Plan, September 2018[33]
- Medford Food Security Plan, September 2019[34]

2.3.4.6 Built Environment Profiles

Metropolitan Area Planning Council (MAPC) created a scoring system under the Local Access Project to evaluate how the built environment affects public health. Using Complete Streets principles, the scoring system ranks roadway segments by their potential for providing connectivity between origins and destinations – such as schools, shops, restaurants, parks, and transit stations – using active transportation.[35] Infrastructure improvements to facilitate walking and biking would be most beneficial in areas with high local access scores. The roadway segments with higher composite local access scores are shown in darker blue shades in Figure 2.3-1.[36] For example, in the Wellington Circle area Middlesex Avenue and Route 28 North represent higher local access scores, meaning that improvements would be most beneficial for access. Route 16 also scores highly, especially westbound toward the Circle.

[30] https://massfoodtrustprogram.org/
[31] https://www.mass.gov/info-details/directory-of-mass-in-motion-programs
[32] City of Somerville Community Food System Assessment. July 2018. http://www.mapc.org/wp-content/uploads/2019/12/2018_Somerville-Community-Food-System-Assessment.pdf
[33] Everett Community Food Assessment & Plan. September 2018. http://www.mapc.org/wp-content/uploads/2018/11/Everett-Community-Food-Assessment-and-Plan-and-Appendices_Final_3.pdf
[34] Medford Food Security Plan. September 2019. http://www.mapc.org/wp-content/uploads/2019/12/Food-Plan-9-27-2019.pdf
[35] Metropolitan Area Planning Council (MAPC). Local Access Scores: Active Transportation Network Utility Scores Technical Report, September 2016. http://localaccess.mapc.org/assets/pdfs/LocalAccess_Technical_Report.pdf
[36] The local access scores were rescaled (0-100) based on the log of localized raw utility scores.

Figure 2.3-1 Local Health Access

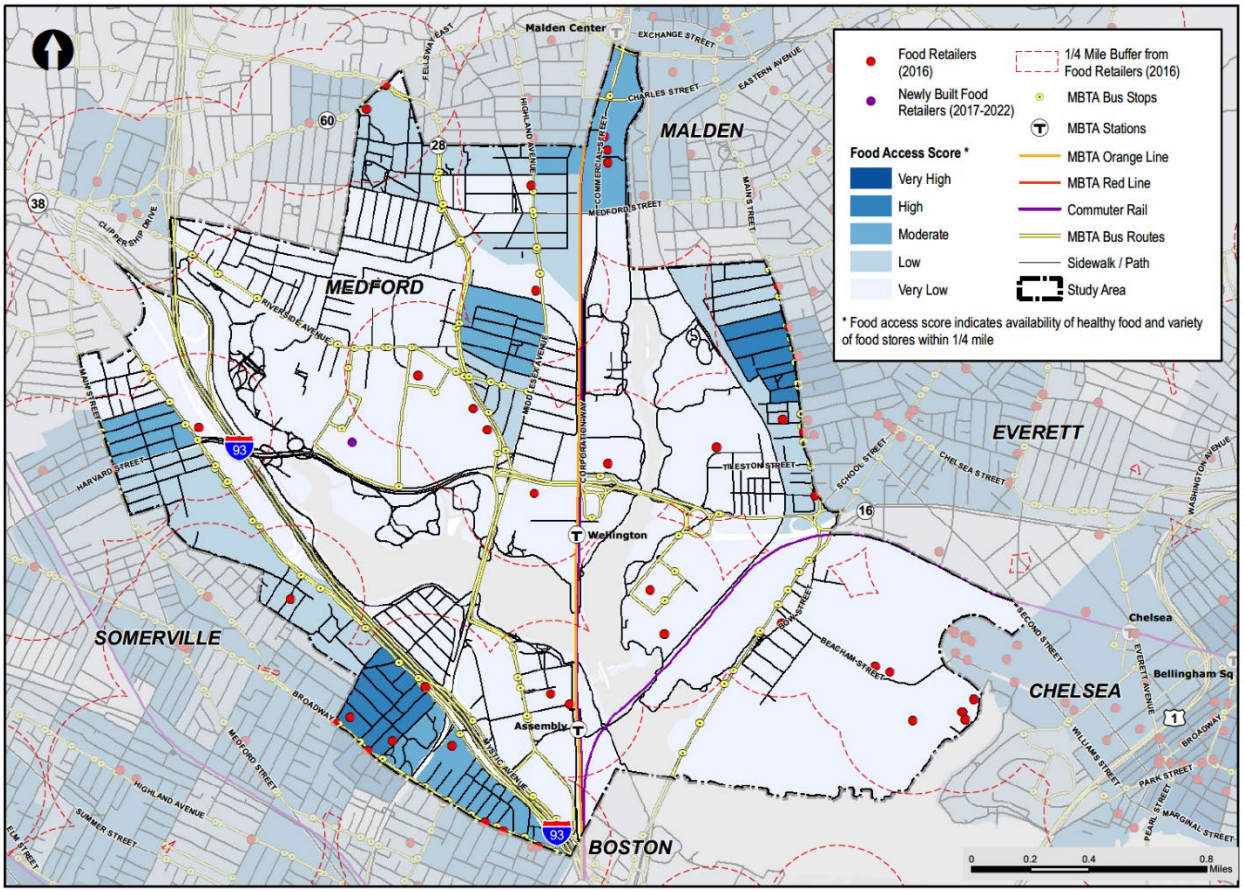


MAPC also scores food access by census block group, as shown in Figure 2.3-2. Each score represents the availability of healthy food and food store varieties within a quarter of a mile walkshed within each census block group.[37] The figure also shows food retailers including Farmers Markets, Fish & Seafood Markets, Fruit & Vegetable Markets, Meat Markets, and Supermarkets.

The MAPC dataset represents 2016 data and the stores that were open at that point in time, although development has occurred since then. For reference, grocery stores that exist within the study area on Google maps, as of July 2022, were included in Figure 2.3-2, although they are not reflected in the MAPC data or food access scoring methodology. While convenience stores are part of the MAPC data, they are excluded from the figure as they are not representative of healthy food options for communities.

As shown in Figure 2.3-2, seventy-five percent of the study area was categorized with a very low food access score, which indicates minimal access to a grocery store for much of the area making up the block group. A quarter mile buffer from each food store shows that, although there are food stores in the immediate Wellington Circle area, there is limited food access in some of the surrounding areas. Residents of the study area would benefit from improved healthy food access by maintaining or increasing transportation connectivity across all modes between the study area and areas with higher food access scores.

Figure 2.3-1: Local Food Access



2.4 Environmental Conditions

Existing environmental conditions cover a wide range of factors, many of which are critical in understanding potential constraints early in the planning process to guide decisions regarding the development of alternatives and inform the environmental review process during a future design phase. These constraints can vary from historic resource protections to watershed and open space preservation. Understanding this information can help guide decisions regarding the development of alternatives and inform the environmental review process during a future project design phase. Additional information is found in the Existing Environmental Conditions Report (See Appendix D).

A summary of the key environmental resources and compliance considerations is provided in Table 2.4-1 below. Major considerations are Wellington Circle and associated parkways, as well as Mystic River Reservation, which are listed on the Nation Register of Historic Places and subject to the jurisdiction of Section 106 of the National Historic Preservation Act and Section 4(f) of the U.S. Department of Transportation Act. The Mystic River is a significant environmental feature within the study area with protected resources including, wetlands, Waters of the US (WOTUS), Endangered and Threatened Species Habitat (Atlantic Sturgeon), and floodplains (1% Annual Chance Flood Hazard).

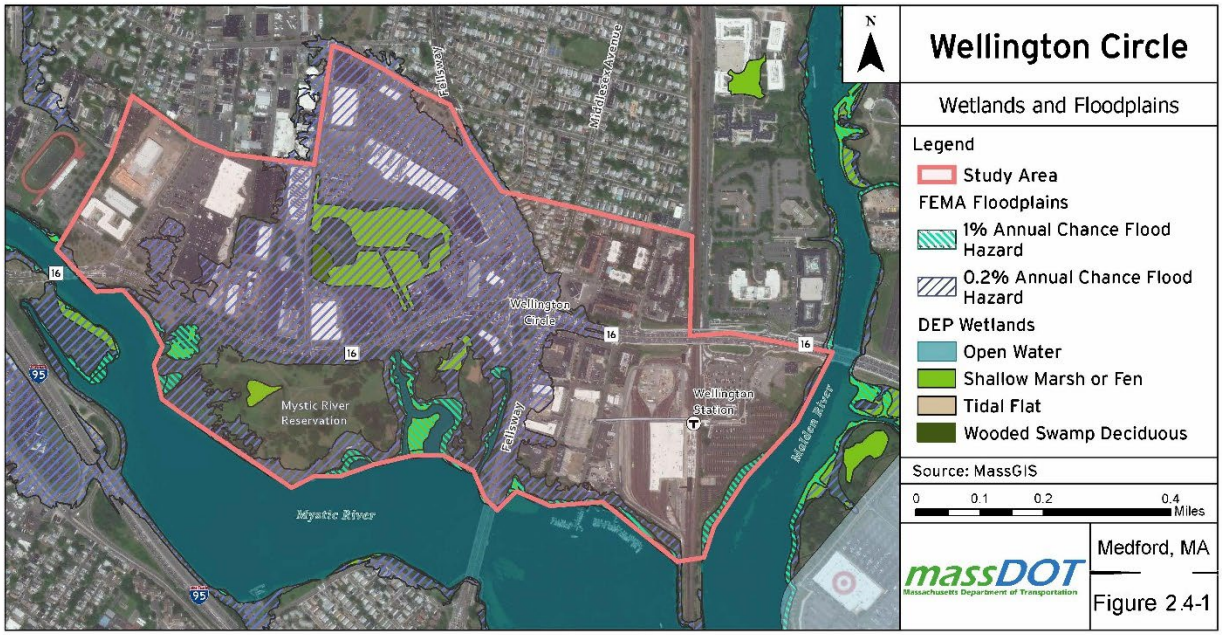
Table 2.4-1: Key Environmental Resources and Compliance Considerations

Protected Resources	Federal Compliance	State Compliance
Mystic River and associated vegetated wetlands	Clean Water Act; Section 404 and National Pollutant Discharge Elimination System Program; Endangered Species Act (Atlantic Sturgeon habitat); FEMA floodway	Massachusetts Wetland Protection Act; Chapter 91 of the Massachusetts Public Waterfront Act; Clean Water Act Section 401: State Certification of Water Quality
Malden River and associated vegetated wetlands	Clean Water Act; Section 404 and National Pollutant Discharge Elimination System Program; Endangered Species Act (Atlantic Sturgeon habitat); FEMA floodway	Massachusetts Wetland Protection Act; Chapter 91 of the Massachusetts Public Waterfront Act; Clean Water Act Section 401: State Certification of Water Quality
Mystic River Reservation	Section 106 of the National Historic Preservation Act; Section 4(f) of the U.S. Department of Transportation Act of 1966; Section 6(f) of the Land and Water Conservation Fund Act; 1% Annual Chance Flood Hazard; Article 97 of the Massachusetts State Constitution	Massachusetts Historic Commission Review; Massachusetts Wetland Protection Act; Chapter 91 of the Massachusetts Public Waterfront Act; Clean Water Act Section 401: State Certification of Water Quality
The Fells Connector Parkway (including Wellington Circle)	Section 106 of the National Historic Preservation Act; Section 4(f) of the U.S. Department of Transportation Act of 1966; Contaminated materials and substances (AUL sites)	Massachusetts Historic Commission Review
Mystic Valley Parkway	Section 106 of the National Historic Preservation Act; Contaminated materials and substances (RCRA site)	Massachusetts Historic Commission Review
Revere Beach Parkway	Section 106 of the National Historic Preservation Act; Section 4(f) of the U.S. Department of Transportation Act of 1966	Massachusetts Historic Commission Review

2.4.1 Wetlands and Waterbodies

Within the vicinity of Wellington Circle, the Mystic River runs northwest-southeast to the south and Malden River runs north-south then east within the Mystic River Watershed (see Figure 2.4-1). Flowing from Lower Mystic Lake through Arlington, Somerville, Medford, Everett, Chelsea, Charlestown, and East Boston, the Mystic River empties into Boston Harbor after a nearly 7-mile course. Its watershed supports diverse fish and wildlife populations, including one of the largest river herring (alewife and blueback herring) migrations in the Commonwealth. The 2.3-mile Malden River flows through Malden, Medford, and Everett. The two rivers converge to the southeast of Wellington Circle before the Amelia Earhart Dam. The Dam, built in 1966, divides the river into an upstream freshwater impoundment and a downstream tidal estuary. Subsequent construction, including the introduction of Interstate 93, filled in many of the surrounding wetlands and allowed for further development on the coast. The rivers have a long history of former industrial use, with extensive ongoing cleanups, including remediation as part of the construction of the Encore Casino in Everett. Currently, the Mystic Greenways program is working to connect 25 miles of parks and paths in the riverfront areas.[37]

Figure 2.4-1: Wellington Circle Wetlands and Floodplains



The Mystic and Malden Rivers are considered navigable waters by the US Army Corps of Engineers (USACE) and are protected as Waters of the United States (WOTUS) under the Clean Water Act. Wetland resources in the immediate project study area are associated with tributaries of the Mystic River located to the southwest of Wellington Circle within the Mystic River State Reservation. Areas of shallow marsh are also present on the north side of Mystic Parkway and northwest of Wellington Circle buffered from Route 16 (Mystic Valley Parkway) by a radio transmitter facility.

The Wetlands Protection Act (WPA), administered by the Massachusetts Department of Environmental Protection (MassDEP), protects wetland resources and the public interests they serve.

[37] The Mystic River Watershed Association, 2020

The WPA established a 100-foot buffer around vegetated wetlands and banks and a riverfront area determined by a 200-foot buffer from each side of the river from the mean annual high-water line.

Section 404 of the Clean Water Act (CWA) established a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. The basic premise of the program is that no discharge of dredged or fill material may be permitted if: (1) a practicable alternative exists that is less damaging to the aquatic environment or (2) the nation's waters would be significantly degraded.

2.4.2 Floodplains

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) GIS layer displays the floodplains within the project area as recorded on the FEMA Flood Hazard Map 25017C0437E effective June 4, 2010 and shown in Figure 2.4-21 (MassGIS, 2020). The regulatory floodway follows the banks of the Mystic River. Areas with a 1% Annual Chance Flood Hazard are associated with the tributaries of the Mystic River located within the Mystic River Reservation. Wellington Circle itself is not within a 1% Annual Chance Flood Hazard area.

Executive Order 149 provides for Massachusetts participation in the National Flood Insurance Program and requires state agencies to avoid projects in floodplains to the extent possible (44 CFR § 60.3 (d)(3)). Areas within the 1% Annual Chance Flood Hazards are regulated by the WPA as Bordering Land Subject to Flooding (310 CMR 10.57, 2014).

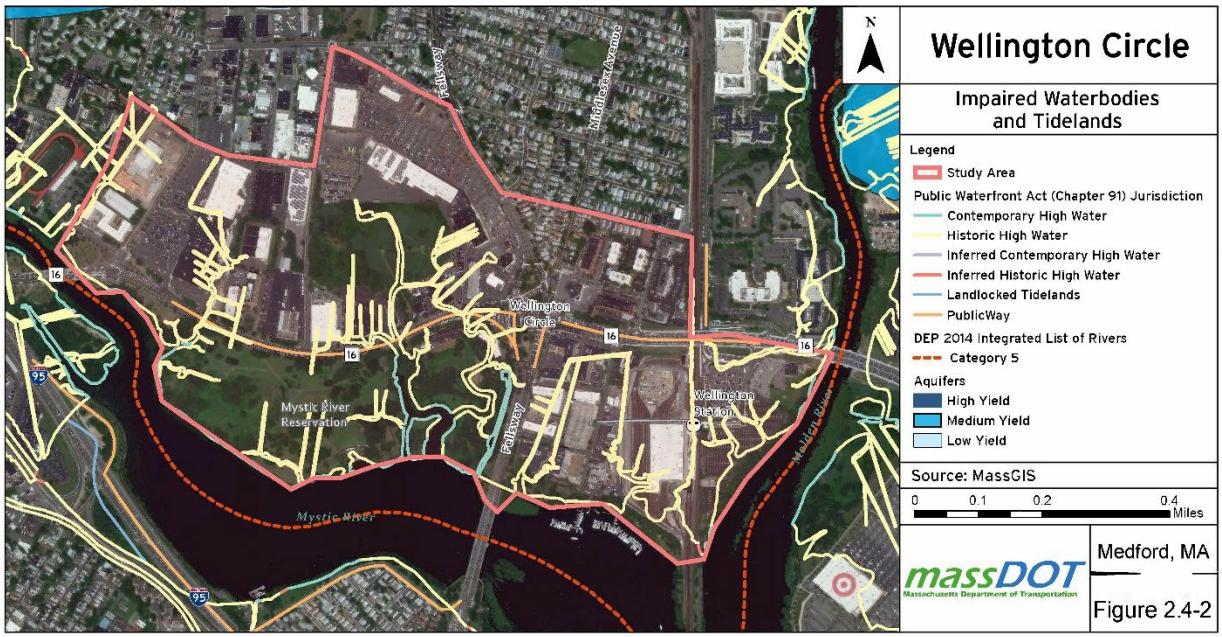
2.4.3 Impaired Waterbodies

Impaired Waterbodies with the potential to be affected by highway runoff generated were reviewed per the requirements of Section 303(d) of the Federal Clean Water Act. They are shown in Figure 2.4-2. The portion of the Mystic River upstream of the Amelia Earhart Dam (Segment ID: MA71-02) and the Malden River (Segment ID: MA71-05) are both classified as Impaired, Category 5 "Waters Requiring a Total Maximum Daily Load (TMDL)" for Bacteria/Pathogens on the 303(d) list for the Massachusetts Year 2014 Integrated List of Waters. TDML serves as a planning tool and potential starting point for restoration or protection activities by establishing the maximum amount of a pollutant that can occur in a waterbody with the goal of attaining or maintaining state water quality standards.

MassDOT works to incorporate stormwater best management practices (BMPs) into all roadway and bridge design projects to meet state and federal regulations: USEPA National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit for discharges of highway runoff to impaired waters; and the Massachusetts Stormwater Management Standards as found in the Massachusetts Wetlands Protection Act Regulations and Section 401 Water Quality Certification Regulations. Although MassDEP is currently not authorized by United States Environmental Protection Agency (EPA) to administer the NPDES, Massachusetts has issued a 401 Water Quality Certification.

The NPDES permit program, established in 1972 at section 303(d) of the Clean Water Act, helps address pollution from point and non-point source discharges. Under the program, the EPA requires states to establish priority rankings for waters and develop TMDLs for impaired waters. States are required to submit lists of impaired waters to the EPA for approval. "Impaired" status means that the waterway is too polluted or otherwise degraded to meet state water quality standards. Once approved under the 303(d) Program, the state continues to study and test the waterway and develops a TMDL for specific pollutants.

Figure 2.4-2: Wellington Circle Impaired Waterbodies and Tidelands



2.4.4 Tidelands

Tidelands under the Massachusetts Public Waterfront Act (Chapter 91) jurisdiction are present at Wellington Circle (MassGIS, 2020). The limit of filled tidelands is A.) Outside Designated Port Areas, the first public way or 250 feet from mean high water, whichever is farther landward and B.) Inside Designated Port Areas, the historic mean high water (MHW) shoreline (i.e., all filled areas). The former defines the applicable limit of filled tidelands within the immediate study area. Chapter 91 regulates activities on both coastal and inland waterways, including construction, dredging, and filling in tidelands, great ponds, and certain rivers and streams.

2.4.5 Protected Wildlife Habitat

Endangered Species Act (ESA) Section 7 mapper shows portions of the Mystic and Malden Rivers within the project area include mapped habitat of a Federally Threatened and Endangered Species, the Atlantic sturgeon, as shown in Figure 2.4-3 (EPA, 2020b). Section 7 of the ESA prohibits any action that causes a "taking" of any listed species of endangered fish or wildlife.

The northern long-eared bat is known to occur or may be affected by activities at this location as identified using the United States Fish and Wildlife Service (USFWS) Information for Planning and

Construction (IPaC) tool (USFWS, 2020). However, IPaC shows critical habitat is not present within the project area.

Mapping maintained by MassGIS indicates priority habitat, estimated habitat, certified vernal pools, and potential vernal pools are not present within the immediate project study area.

The Core Habitat and Critical Natural Landscape data layer from MassGIS developed by the Natural Heritage & Endangered Species Program (NHESP) of the Massachusetts Division of Fisheries & Wildlife and the Nature Conservancy's Massachusetts Program was reviewed. South of Wellington Circle, the area surrounding the Mystic River Fellsway Bridge carrying the Fellsway (MA Route 28) across the Mystic River between Somerville and Medford is considered Core Habitat for Species of Conservation Concern and Critical Natural Landscape for Tern Foraging.

Figure 2.4-3: Wellington Circle Protected Wildlife Habitat

2.4.5.1 Areas of Critical Environmental Concern (ACECs)

According to the Secretary of Energy and Environmental Affairs (EEA), ACECs are not present in the immediate project study area. ACECs are areas in Massachusetts that receive special recognition because of the quality, uniqueness, and significance of their natural and cultural resources.

2.4.6 Historic and Archeological Resources

According to the Massachusetts Cultural Resource Information System (MACRIS) maintained by MassGIS, there are several historic sites and areas within the vicinity of Wellington Circle (see *Table 2.4-2* and Figure 2.4-4). The Fells Connector Parkway properties, Revere Parkway properties, Mystic River Reservation, and Mystic Valley Parkway within the immediate study area are listed on the National Register of Historic Places. Additionally, the Metropolitan Park System of Greater Boston lists the Mystic River Reservation and Mystic Valley Parkway within the National Register of Historic

Places. Previously unidentified archaeological resources may also be present in this area. The location of archaeological resources is privileged information and is not included in this report.

Table 2.4-2: Historical Resources within the Immediate Study Area

MACRIS #	Historic Name	Designations	Significance
MDF.AB (multi-property submission)	Revere Beach Parkway	Nat'l Register District (12/06/2007). Nat'l Register MPS (12/06/2007)	Community Planning; Engineering; Landscape Architecture; Transportation
MDF.942 (One property within MDF.AB)	Revere Beach Parkway	Nat'l Register District (12/06/2007). Nat'l Register MPS (12/06/2007)	Community Planning; Engineering; Transportation
MDF.943 (one property within MDF.AB)	Revere Beach Parkway Bridge over MBTA Orange Line (MBTA Bridge #1)	Nat'l Register District (12/06/2007). Nat'l Register MPS (12/06/2007)	Engineering; Transportation
MDF.Y (multi-property submission)	Fells Connector Parkways	Nat'l Register District (05/09/2003). Nat'l Register MPS (05/09/2003)	Community Planning; Conservation; Engineering; Landscape Architecture; Transportation
MDF.936 (One property within MDF.Y)	Fells Connector Parkway - Wellington Circle Rotary	Nat'l Register District (05/09/2003). Nat'l Register MPS (05/09/2003)	Community Planning; Engineering; Landscape Architecture; Transportation
MDF.933 (One property within MDF.Y)	Fells Connector Parkway - The Fellsway	Nat'l Register District (05/09/2003). Nat'l Register MPS (05/09/2003)	Community Planning; Engineering; Landscape Architecture; Recreation; Transportation
MDF.U (multi-property submission)	Metropolitan Park System of Greater Boston (includes Mystic River Reservation and Mystic Valley Parkway)	Nat'l Register MPS (02/04/2003)	Community Planning; Conservation; Engineering; Landscape Architecture; Politics Government; Recreation; Transportation
MDF.82	Rolfe, John Abbott - Gleason, Joseph Merriam House	-	Queen Anne, Stick Style Architecture
MDF.68	Wellington - Walker, Frank A. House	-	Italianate Architecture

Figure 2.4-4: Wellington Circle Natural, Historic and Cultural Resources

Any projects that require funding, licenses, or permits from federal agencies must be reviewed in compliance with Section 106 of the National Historic Preservation Act of 1966. Section 106 requires federal agencies to consider the effects of their actions on historic properties. "Section 106 review," follows a specific process, which is guided by federal regulations (36 CFR 800). In Massachusetts, these steps are taken in consultation with the Massachusetts State Historic Preservation Officer (SHPO). The Massachusetts Historical Commission (MHC) is the office of the SHPO. Other interested parties such as local historical commissions or Indian Tribes are also consulted.

Any projects that require funding, licenses, or permits from any state agency must be reviewed by MHC in compliance with Massachusetts General Laws Chapter 9, sections 26-27C. This law created the MHC, the office of the State Archaeologist, and the State Register of Historic Places among other historic preservation programs.[38] The information provided below is taken from the National Register of Historic Places forms for each historic property within the study area. [39]

2.4.6.1 The Fells Connector Parkways (ID: MDF.Y Multiple Property Submission)

The Fells Connector Parkways in Medford and Malden, consisting of the Y-shaped system of roadways known as The Fellsway, Fellsway East, and Fellsway West, are significant as some of the earliest connecting parkways designed for the Metropolitan Park Commission (MPC) by Olmsted, Olmsted, and Eliot and its successor firm, Olmsted Brothers. They are emblematic of the firm's principles of parkways creation. Curvilinear divided parkways that run north through early 20th-century residential and commercial neighborhoods, the Fells Connector Parkways connect the

[38] MHC, 2020
[39] https://www.nps.gov/subjects/nationalregister/database-research.htm

Middlesex Fells Reservation directly with Boston, the Mystic River Reservation (and Parkway), and the Revere Beach Parkway (all of which are discussed in separate nominations).

The Fells Connector Parkways have been determined to possess integrity of location, design, setting, materials, workmanship, feeling, and association. These parkways meet National Register Criteria A and C in the significance areas of Community Planning and Development, Conservation, Engineering, Landscape Architecture and Transportation at the state level and fulfill the Parkways Registration Requirements for the associated Connecting Parkway property subtype, under Section F of this Multiple Property Documentation Format nomination. The period of significance for the Fells Connector Parkways is from 1895 (when takings for the parkways began) to 1956 when reconstruction work was completed.

The Fellsway (ID: MDF.933)

The Fellsway is a continuation of the travel lanes of Fellsway West, from its intersection with Fellsway East in Malden, and progresses south in a gently curvilinear course to the northern end of Wellington Bridge in Medford. The eastern terminus of the parkway corresponds to a line of convenience drawn south from the northwestern corner of Fellsway East where it intersects with Fellsway West and The Fellsway. Fellsway West continues east of this line. The southern terminus of The Fellsway corresponds to a line of convenience drawn across the parkway at the northern end of Wellington Bridge, which is not a part of this nomination.

Wellington Circle Rotary (ID: MDF.936)

Wellington Circle Rotary is a large traffic rotary. It began in the late 1890s as a small intersection at the point where Middlesex Avenue and The Fellsway diverged. In 1931, the MDC built a rotary to improve the connection of The Fellsway with Revere Beach Parkway, an intersection further strained by the connection of Mystic Valley Parkway (discussed in a separate nomination for Mystic Valley Parkway) in 1936. Wellington Circle was substantially enlarged and reconstructed in 1941, at which point the Metropolitan District Commission (MDC), a predecessor agency to DCR, also completed a planting plan for 25 different species of bushes on the landscaped central rotary and associated landscaped traffic islands. Wellington Circle was reconstructed again in 1956. Today it is an enormous, complicated rotary with numerous large and small traffic islands used to direct traffic and create (or prevent) turning lanes. Because it was built and reconstructed within the period of significance, it is considered a contributing element of the parkways.

2.4.6.2 Revere Beach Parkway (ID: MDF.AB Multiple Property Submission)

Revere Beach Parkway, a curvilinear divided highway that runs generally east-west through early 20th-century residential and commercial neighborhoods, is significant as one of the earliest connecting parkways designed for the Metropolitan Park Commission (MPC) by Olmsted, Olmsted and Eliot and its successor firm, Olmsted Brothers.[40] The Parkway, intended as a link between the Mystic River and Middlesex Fells Reservations to the west and the Revere Beach Reservation to the east, was one of the first parkways suggested by Charles Eliot in his 1893 report to the Temporary Commission. Revere Beach Parkway is emblematic of the firm's principles of parkways creation.

[40] Note: In 1920, the MPC became the Metropolitan District Commission [MDC]. In July 2003, the MDC was reorganized as the Division of Urban Parks and Recreation within the newly created DCR

Revere Beach Parkway possesses integrity of location, design, setting, materials, workmanship, feeling, and association. It meets National Register Criteria A and C in the significance areas of Community Planning and Development, Engineering, Landscape Architecture and Transportation at the State level and fulfills the Parkways Registration Requirements for the associated Connecting Parkway property type, under Section F of this nomination. The period of significance for Revere Beach Parkway is 1897, when construction first began, through 1957.

Revere Beach Parkway (ID: 942)

Revere Beach Parkway is a curvilinear roadway that travels through a variable topography. From its commencement in the north edge of the marshes of the Mystic River, the Parkway follows the course of several inland waterways, including the Malden River, Mill Creek, and Sales Creek. Because of the heavy industrial development these waterways historically attracted, particularly at the turn of the 19th and 20th centuries, views toward the waterways are often blocked by large brick industrial buildings and complexes. Intermittently, the nearby topography rises above the grade of the roadway offering medium-distance views of various residential developments, industrial pockets, and the Boston skyline. Much of the topography of this part of the Boston Basin is dominated by glacial drumlins and the roadway's course, after leaving the wetlands surrounding the Mystic River, skirts the edges of four major hills in Everett, Chelsea, and Revere — Mount Washington, Powder Horn Hill, Fennos Hill, and Young's Hill — before terminating at Eliot Circle. The roadway itself is moderately hilly and travels at a variable elevation that ranges from 10 to 40 feet above sea level.

2.4.6.3 Metropolitan Park System of Greater Boston (ID: MDF.U Multiple Property Submission)

The Metropolitan Park System, established by the Metropolitan Park Commission in 1893, is significant for its internationally recognized contribution to the American park movement of the nineteenth and early twentieth century. It is considered the first regional park and parkway system in the country and a work of visionary regional planning.

Over a century after its creation, the Metropolitan Park System consists of nearly 20,000 acres of reservations, parks and parkways. There are seven woodland reservations, three river reservations, ten ocean reservations, 162 miles of parkway and a variety of recreational facilities, historic sites, and playgrounds in 37 cities and towns in Greater Boston. All are located within 15 miles of the Massachusetts State House and are an integral part of the regional open space and transportation system used daily by residents of the region. Mystic River Reservation and Mystic Valley Parkway are part of the historic Metropolitan Park System.

Mystic River Reservation and Mystic Valley Parkway

The Mystic River begins in Winchester and flows southeast through Arlington, Medford, Somerville, and Everett before joining with Chelsea Creek near Boston’s Inner Harbor. Early efforts by the MPC focused primarily on acquisition of the more pristine upper reaches of the river, particularly the area from Medford Center to Winchester. Land acquisition began in 1895 based on principles similar to those employed at the Charles River Reservation, which primarily involved purchase of areas with scenic or natural value and undeveloped lands. The twofold goal was to protect the river from future pollution and to provide readily accessible open space. There was strong public interest in this project and the MPC effort was supplemented by municipal contributions and private donations.

Mystic River Reservation was much smaller than the other two river reservations, with fewer than 300 acres acquired by 1899, but was valued because of its recreational potential. The Mystic Lakes, at the upper reaches of the river, were the focal point of the Reservation, although only land along the eastern edge of the lakes was acquired by the MPC. Another integral component of the Mystic River Reservation was Mystic Valley Parkway, which served as a pleasure road and also provided a connection to other units of the MPC system.

2.4.7 Open Space and Recreational Areas

The banks of the Mystic River are primarily part of Mystic River Reservation under the jurisdiction of the Massachusetts Department of Conservation and Recreation. The Mystic River Reservation includes various parks and outdoor facilities throughout (see Figure 2.4-5). South of Wellington Circle, the Torbert Macdonald State Park is a nature preserve within the Mystic River Reservation system. The park abuts the north side of the Mystic River and encompasses much of the Wellington Circle immediate project study area, as well as the portion of Route 16 (Mystic Valley Parkway) west of Wellington Circle, and the portion of Route 28 (Fellsway) south of the interchange. The park offers trails for walking, running, and biking. The Mystic River Master Plan details recommendations for the Mystic River Reservation, including limiting access to paved trails, managing invasive species, and encouraging the growth of native vegetation.[41] A new playground is planned for the northeast corner of the Macdonald Park in the Reservation, south of the State Police Barracks.

Publicly owned open space may be protected through Section 4(f) of the Department of Transportation Act. Publicly owned open space that has received Land and Water Conservation Act funding is also protected under Section 6(f). Additionally, publicly owned open spaces may be protected through Article 97 of the Massachusetts Constitution, which mandates all citizens have a right to the quality of life that clean water and undeveloped open space can provide.

2.4.8 Hazardous Materials and Sites

According to the EPA, the Project Area contains a RCRA Corrective Action site west of Wellington Circle at the Mystic Valley Parkway and Commercial Street intersection.

Additionally, the Massachusetts Department of Environmental Protection (MassDEP) Bureau of Waste Site Cleanup (BWSC) online database identified the release sites that have occurred in the immediate project study area and have been reported to MassDEP – listed in Table 2.4-3 below and shown in Figure 2.4-5. The Massachusetts Contingency Plan (310 CMR 40.0000) allows three main types of preliminary response actions at disposal sites. These are Limited Removal Actions, Immediate Response Actions, and Release Abatement Measures. The release action outcomes (RAO) codes are as follows:

- A-2: A permanent solution has been achieved. Contamination has not been reduced to background.
- A-3: A permanent solution has been achieved. Contamination has not been reduced to background and an Activity and use Limitation (AUL) has been implemented.
- PA: Permanent Solution with Conditions and a land use restriction (Activity and Use Limitation)

[41] Massachusetts Department of Conservation and Recreation (DCR), 2009

- PC: Permanent Solution with Conditions and no land use restriction. Note that site "conditions" may require special considerations or management as described in the closure documents.

Table 2.4-3: Release Sites with AUL Limitations

Map #	RTN	Name	Address	Class of RAO	AUL Date
1	3-0021584	Commercial St Blake St	30 Commercial St	A3	5/13/2005
2	3-0022235	500 East of Fellsway Intersection	35 Revere Beach Pkwy	A3	11/4/2003
3	3-0028997	Dealership Repair Shop Area	3780 Mystic Valley Pkwy	PA	5/11/2016
4	3-0025926	Lincoln Mercury Dealership	3780 Mystic Valley Pkwy	A2	5/21/2007
5	3-0002955	Mystic Center Development	451 461 495 Fellsway	A3	11/25/2009
6	3-0010429	No Location Aid	461 Riverside Ave	A3	4/17/1996
7	3-0002366	Nissen Bakery	48 Commercial St	A3	6/24/1996
8	3-0032838	Fellsway Plaza	491 Riverside Avenue	PA	10/31/2019
9	3-0000889	Webster Trucking FMR	49-87 Locust St	PC	11/10/1993
10	3-0022798	Station Landing – East and West Bldgs	50 And 55 Station Landing	A3	4/26/2006
11	3-0011747	Fellsway And Mystic Valley Parkway	590 & 616 Fellsway & 4110 MVP	A3	10/31/1995
12	3-0026958	No Location Aid	760 Fellsway	A3	7/29/2010
13	3-0026620	MBTA Wellington Sta Facility Pkg Lot	Revere Beach Parkway (Rte 16)	A3	10/20/2011
14	3-0026436	Station Landing Health Club and Garage	Rte 28 And Earhart Lndg	A3	11/25/2009

RTN – Release tracking number
Source: OLIVER: MassGIS's Online Mapping Tool (http://maps.massgis.state.ma.us/)

Figure 2.4-5: Wellington Circle Hazardous Materials and Sites

2.4.9 Air Quality

The Clean Air Act (CAA) assigns primary responsibility to individual states to assure compliance with the National Ambient Air Quality Standards (NAAQS). Air quality regions that meet the NAAQS for a criteria pollutant are designated as being in attainment. Areas that do not meet the NAAQS for one or more criteria pollutants are designated by the US Environmental Protection Agency (EPA) as nonattainment areas. The EPA Green Book,[42] which lists non-attainment, maintenance, and attainment areas, shows that Malden, Medford, and Everett are in areas of the county which are designated as being in attainment for all of the National Ambient Air Quality Standards (NAAQS).

2.4.9.1 Climate and Meteorology

The climate of the area in which the project is located consists of four distinct seasons: winter, spring, summer, and fall. Winters are cold with snowfall, spring tends to be a transitional period from winter to summer, summers are hot and humid, and the fall tends to have the most precipitation of the four seasons. According to the National Weather Service data,[43] the average annual temperature for nearby Boston Logan Airport is 51.5 degrees Fahrenheit. The area typically receives slightly over 44 inches of rainfall annually and up to 44 inches of snow.

2.4.9.2 Ambient Air Quality Data and Trends

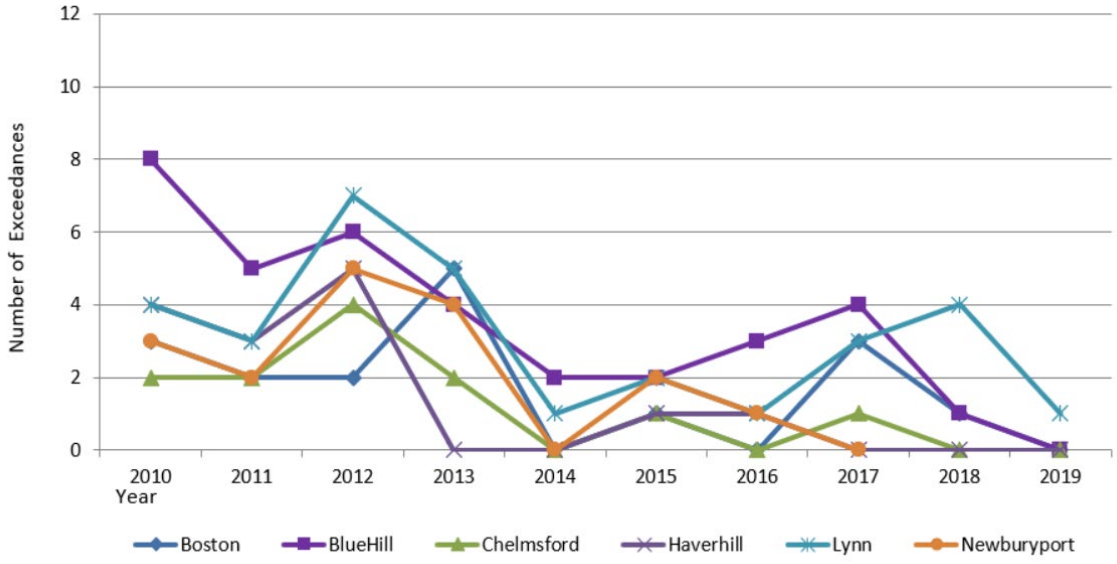
The MassDEP most recent annual air quality monitoring report[44] shows that measured pollutant concentrations from all stations representative of the study area are below the NAAQS except ozone,

[42] EPA Green Book: https://www3.epa.gov/airquality/greenbook/faq.html
[43] NWS Climate https://w2.weather.gov/climate/getclimate.php?wfo=box
[44]See: Mass DEP 2019 https://www.mass.gov/doc/2019-annual-air-quality-report/download

where there were five days in 2019 when the 8-hour ozone standard was exceeded. Ambient concentrations of carbon monoxide, nitrogen dioxide for the hourly and annual standard, sulfur dioxide, and PM_{10} were within the USEPA's national ambient air quality standards (NAAQS) in 2019. While ozone concentrations have trended downward over the past several decades due to air pollution control programs, ozone concentrations vary each year due to varying weather patterns. In general, the chemical reactions that produce elevated ozone concentrations occur when high energy sunlight (present on hot summer days) facilitates the react of ozone "precursor" pollutants –volatile organic compounds (VOCs) and nitrogen oxides (NOx)–which results in ozone formation. An ozone exceedance occurs when a monitor records ambient levels of ozone above the standard. Monitoring an ozone exceedance does not mean that a violation of the ozone standard has occurred, because a violation of an ozone standard (as opposed to an exceedance) is based on three-year averages of data at each monitor. Typically, Massachusetts ozone exceedances occur when there is a south or southwesterly airflow that transports elevated levels of ozone, VOCs and NOx up the coastal urban corridor. While there have been exceedances of the ozone standard, there have not been any violations of the standard in Middlesex County.

As presented in Figure 2.4-6 through Figure 2.4-10, MassDEPs ten-year monitoring indicates that most criteria pollutants concentrations have been decreasing since 2010. The reduction in carbon monoxide (CO), sulfur dioxide (SO2), NOx and ozone emissions are due to a variety of control measures that have been implemented over the last two decades, including motor vehicle engine controls and reductions in evaporative emissions from gasoline stations and consumer products, as well as reductions from power plants, businesses, and residential combustion sources.

Figure 2.4-6: Ozone Exceedance Trends (2010-2019) Based on the 0.070 PPM Standard[45]



[45] https://www.mass.gov/doc/2019-annual-air-quality-report/download

Figure 2.4-7: Sulfur Dioxide Trends (2010-2019)[46]

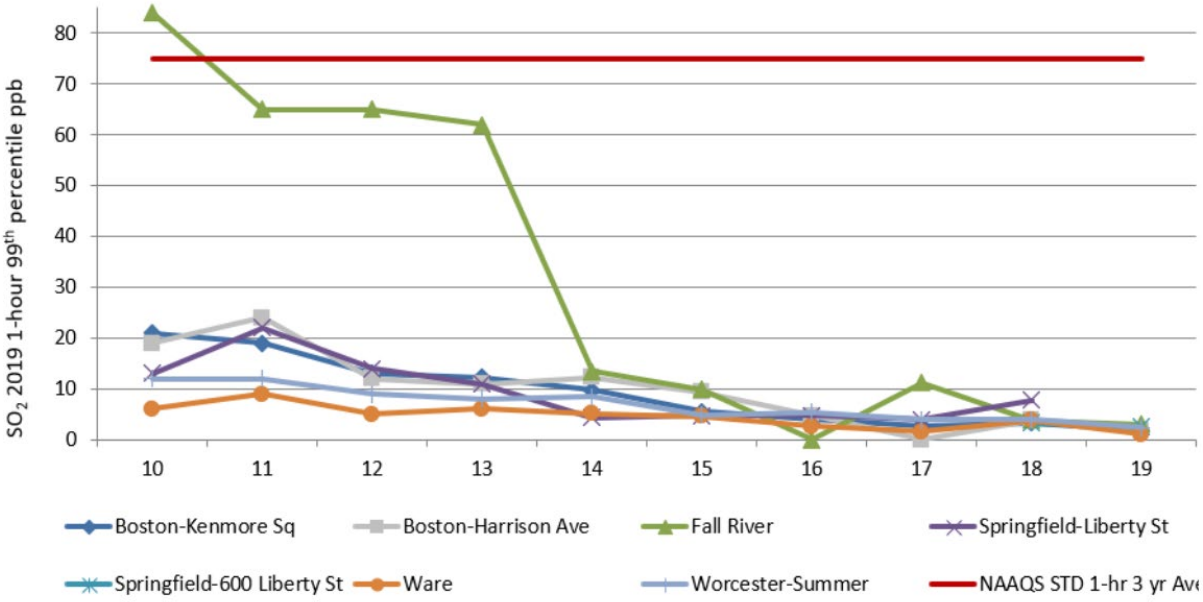
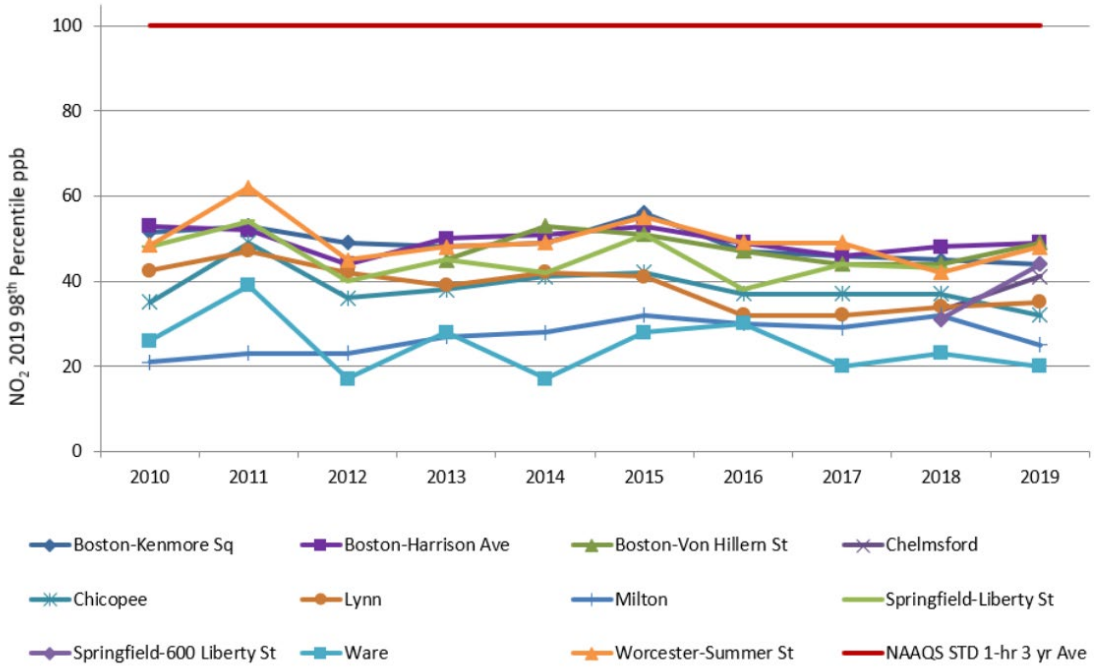


Figure 2.4-8: Nitrogen Dioxide Trends (2010-2019)[47]



[46] Source: https://www.mass.gov/doc/2019-annual-air-quality-report/download
[47] Source: https://www.mass.gov/doc/2019-annual-air-quality-report/download

Figure 2.4-9: Carbon Monoxide Trends (2010-2019)[48]

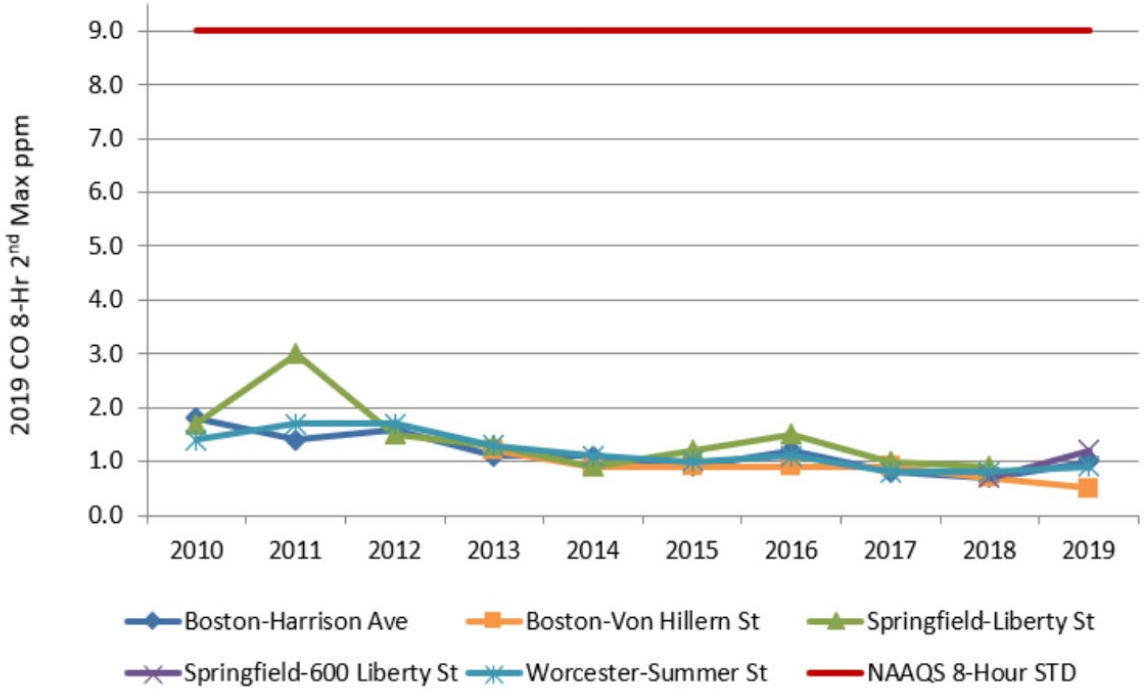
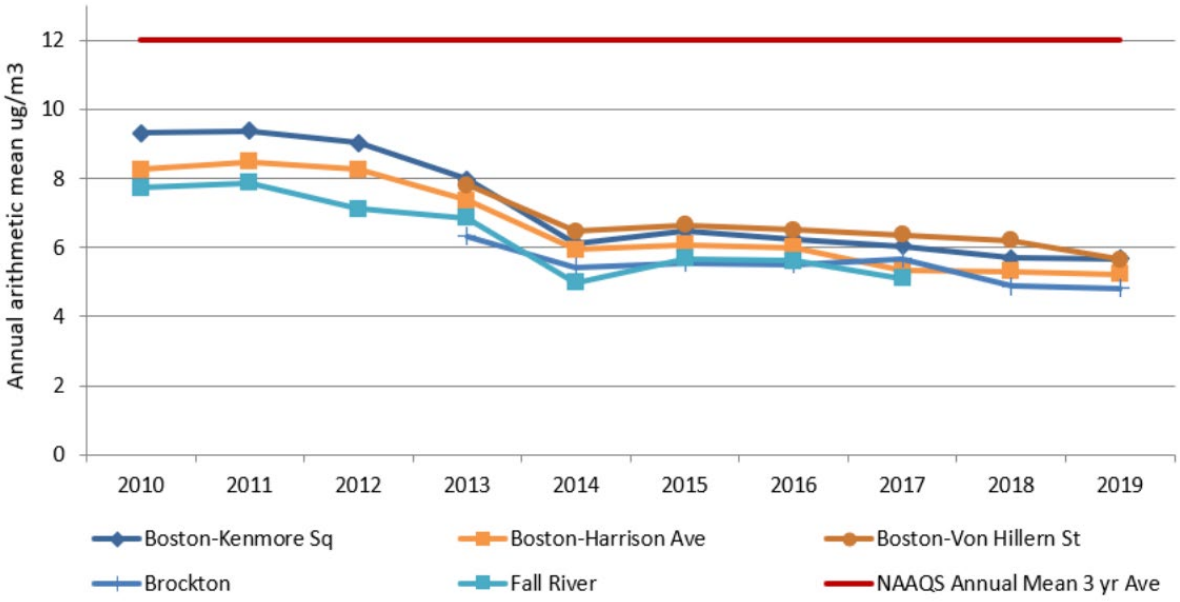


Figure 2.4-10: $PM_{2.5}$ Trends (2010-2019)[49]



[48] Source: https://www.mass.gov/doc/2019-annual-air-quality-report/download
[49] Source: https://www.mass.gov/doc/2019-annual-air-quality-report/download

2.4.10 Noise

With the number of major roadways in the study area, noise is of concern. Noise sensitive land uses in the study area include:

- The residential neighborhood north of Revere Beach Parkway between Rivers Edge Drive and Route 28 (Fellsway)
- The Mystic River Reservation south of Route 16, which includes the Torbert Macdonald Park and the River Path
- Station Landing Park located east of Route 28 (Fellsway) and south of Presidents Landing

2.4.10.1 Noise Standards and Conditions

To assess the degree of impact of highway traffic and noise on human activity, the Federal Highway Administration (FHWA) established Noise Abatement Criteria (NAC) for different categories of land use activity. The NAC are given in terms of the hourly, A-weighted, equivalent sound level in decibels (dBA). The A-weighted sound level is commonly used when measuring environmental noise to provide a single number descriptor that correlates with human subjective response to noise because the sensitivity of human hearing varies with frequency. For traffic noise assessment, Leg is typically evaluated over a one-hour period and may be denoted as Leg(h).

In this study, the noise sensitive land uses are residential (Activity Category B) and recreational (Category C). The NAC for each category is included in Table 2.4-4. For Categories B and C, noise impact is assumed to occur when predicted exterior future noise levels approach or exceed 67 dBA in terms of Leg(h) during the loudest hour of the day. The Massachusetts Department of Transportation (MassDOT) defines approach as within 1 dBA of the NAC. Therefore, an impact for Categories B or C would be 66 dBA or above.

Table 2.4-4: Noise Abatement Criteria by Activity Category

Activity Category	Leq(h)[1]	Description of Activity Category
B[2]	67 (Exterior)	Residential
C	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings

1.) Hourly Equivalent A-weighted Sound Level (dBA)
2.) Includes undeveloped lands permitted for this activity category

Source: 23 CFR Part 772.

2.4.10.2 Existing Noise Environment

Existing noise conditions within the study area zone were evaluated to assist in determining the noise impacts of the proposed project. A noise measurement program was conducted, consistent

with FHWA and MassDOT recommended procedures, to document existing ambient noise levels and to facilitate validation of the noise prediction model.

Noise measurements were conducted at four short-term sites on October 10, 2020. The short-term measurements characterized existing noise levels in the study zone but were not necessarily conducted during the loudest hour of the day, and included little contribution from sources other than traffic on the study roadways.

Table 2.4-5 shows that the measured "Total" Leq ranged from a low of 65.9 dBA at the corner of Middlesex Ave and Rt. 28 (Site M4) to a high of 70.1 dBA in the front yard of the Mystic River Park Condos (Site M1). Also shown in Table 2.4-5 is the measured "Traffic Only" Leq, which excludes non-typical traffic noise such as excessive honking, sirens, or other non-traffic related noise sources.

Table 2.4-5: Results of the Short-Term Noise Monitoring on October 10, 2020

Site No.	Address / Name	Land Use	Start Time	Total L_{eq}	Traffic Only L_{eq}
M1	Mystic River Park Condos	Residential	9:58 AM	70.1	69.3
M2	Mystic River Reservation	Recreational	10:50 AM	65.7	65.7
M3	Mystic River Path by Rt. 28	Recreational	12:05 AM	70.0	69.0
M4	Corner of Middlesex Ave and Rt. 28	Residential	12:49 AM	65.9	64.5

2.4.10.3 Predicted Existing Noise Levels

2.4.10.3.1 Noise Prediction Model

The noise measurements provided valuable information on current noise conditions and the effects of terrain and shielding on sound propagation from the roadways to the nearby noise-sensitive land uses. However, because existing noise levels are not always measured during the loudest traffic hour of the day, estimates of the loudest-hour existing noise levels using the appropriate traffic data as input were developed. Traffic data pertinent to the noise analysis were included for Route 16, Route 28, and relevant major side roads.

All traffic noise computations for this study were conducted using SoundPLAN®, a widely accepted computer noise model for computing outdoor sound levels associated with ground-based noise sources. SoundPLAN® includes several different methods of accounting for the above effects on sound propagation. For this evaluation, traffic noise levels were computed using the SoundPLAN® implementation of the FHWA Traffic Noise Model (TNM version 2.5).

2.4.10.3.2 Noise Model Validation

According to FHWA and MassDOT policies, the accuracy of the noise prediction model must be verified on a project-by-project basis. The noise model validation process compares existing noise levels monitored in the field with predicted noise levels from SoundPLAN® using the traffic conditions during the monitoring period as input to the model. FHWA and MassDOT consider the noise model to be validated when measured noise levels are within +/- 3 dBA of predicted noise levels for existing conditions.

The difference between the measured and predicted noise levels, shown in Table 2.4-6, falls within three decibels, which is the accepted level of accuracy in the noise model.

Table 2.4-6: Results of Noise Model Validation

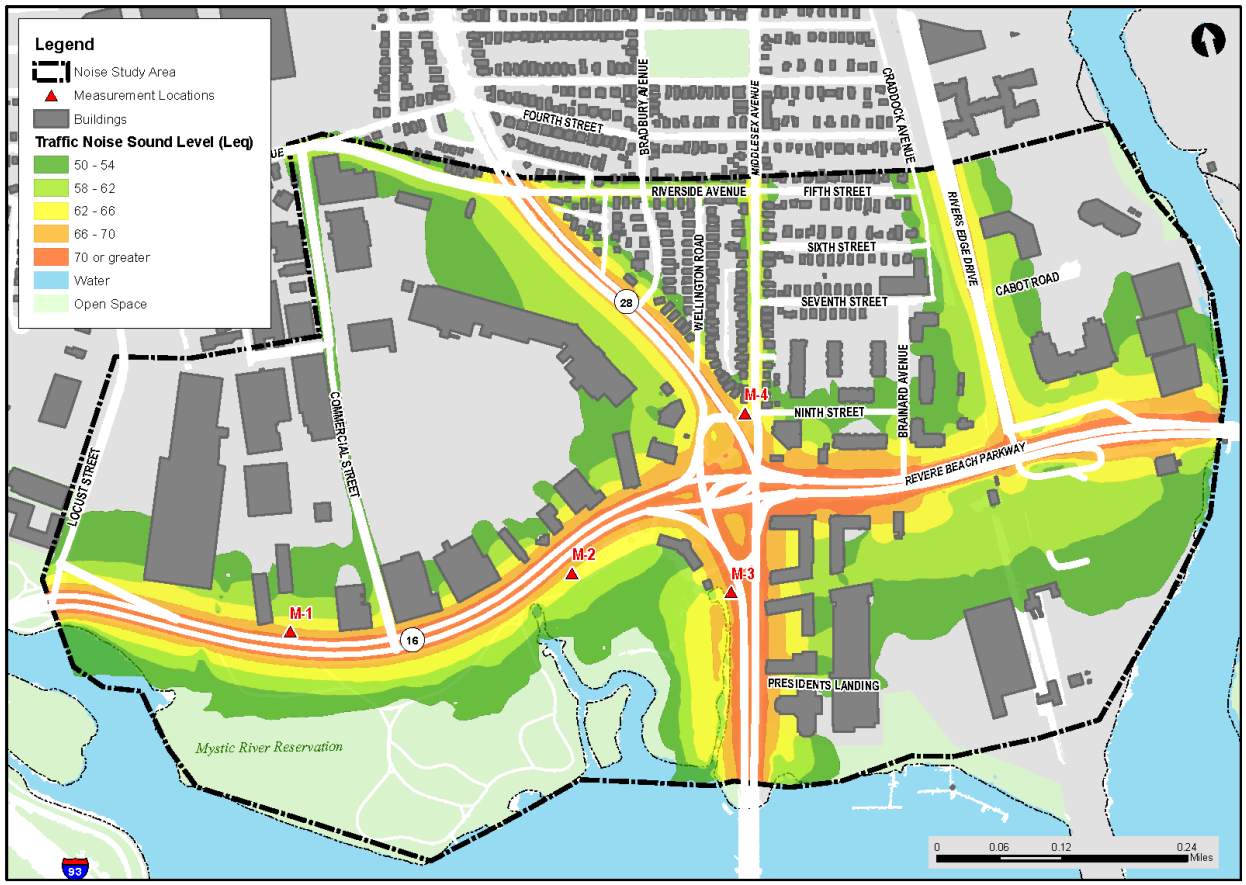
Site No.	Address / Name	Land Use	Measured Traffic Only L_{eq} (dBA)	Modeled L_{eq}	Modeled *minus* Measured L_{eq} (dBA)
M1	Mystic River Park Condos	Residential	69	68	-1
M2	Mystic River Reservation	Recreational	66	66	0
M3	Mystic River Path by Rt. 28	Recreational	69	67	-2
M4	Corner of Middlesex Ave and Rt. 28	Residential	65	63	-2
Average Difference (Modeled minus Measured Leq) =					**-1**
Standard Deviation of the Differences =					**1**

2.4.10.4 Noise Evaluation Results

The noise-sensitive land uses in the study area include several apartments buildings, single-family residences, and the recreation areas within the Mystic River State Reservation. Figure 2.4-11 shows the location of measurement sites and the hourly L_{eq} (dBA) contours developed from the SoundPLAN® noise modeling.

The noise sensitive land uses with the highest sound levels are those building facades immediately adjacent to Route 28 and Route 16, shown in the orange contour areas in Figure 2.4-11. This includes the multi-use sidewalk in the Mystic River State Reservation that follows the eastbound direction of Route 16 and the first row of homes along Route 28 north of Wellington Circle. The existing sound levels are typical for a 4-lane urban arterial roadway with levels approaching the NAC of 67 dBA at approximately 50-100 feet away from the roadway depending on terrain, shielding from buildings, and traffic levels. The levels drop to well below the NAC of 67 dBA at the sensitive land uses located further from the roadway edges or behind the first row of buildings since the buildings and terrain shield noise from the high-volume roadways.

Figure 2.4-11: Wellington Noise Layout



2.5 Multimodal Transportation Network

As a junction of regional roadways, including Mystic Valley Parkway/Revere Beach Parkway (Route 16) and Fellsway (Route 28), Wellington Circle primarily serves car traffic. Correspondingly, the population in the area surrounding the Circle prefers to travel by single-occupancy vehicle – 52% of study area residents commute by this mode. This leaves a significant proportion of the population, 48%, that choose a sustainable mode of travel to commute, including walking, biking, taking transit, and carpooling. These populations are served by the sidewalk network through and surrounding the Circle, bicycle facilities that surround but do not serve the Circle, and transit facilities centered at Wellington Station, southeast of the Circle. In considering the future of the Circle it is important to account for the current conditions of all modes, not just the automobile traffic that is often seen as a primary determinant of major intersection configurations.

One of the major determinants of how people travel is the facilities that are available for them to use. In understanding the way people might use Wellington Circle in the future, it is essential to first understand the existing roadways, sidewalks, bicycle lanes, and other multimodal facilities that comprise and surround the Circle now.

2.5.1 Roadways

The major roadways within the study area are:

- Fellsway (Route 28)
- Mystic Valley Parkway and Revere Beach Parkway (Route 16); and
- Middlesex Avenue

Rivers Edge Drive and Riverside Avenue, as minor arterials, are also major roadways, though secondary to the previously mentioned roadways for the purposes of this study.

Minor roadways include:

- Commercial Street.
- Station Landing.
- Constitution Way.
- Brainard Avenue.
- Rivers Edge Drive.
- 9th Street.
- Riverside Avenue.
- Earhart Landing; and
- Presidents Landing.

The major roadways are detailed below:

2.5.1.1 Fellsway (Route 28):

An urban principal arterial, Route 28 is a major vehicle route for access to downtown Boston, Somerville, and Medford. Near Wellington Circle, Route 28 is called Fellsway. It connects to I--93 and Route 38 approximately three quarters of a mile south of Wellington Circle, on the other side of the Mystic River. The section of Fellsway south of Wellington Circle is under MassDOT jurisdiction and serves primarily open space and commercial land uses. To the north of Wellington Circle, Fellsway splits into Fellsway East and Fellsway West, with Fellsway East ending shortly to the north in Malden and Fellsway West continuing westward toward I-93. Land uses in this segment, which is under DCR jurisdiction, are predominantly residential and commercial. The speed limit throughout Fellsway is 35 miles per hour (mph). The typical roadway configuration of Fellsway- is shown in Table 2.5-1.

Table 2.5-1: Fellsway

Roadway Configuration		
	South of Circle	North of Circle
Number of Travel lanes	3 northbound and 3 southbound	2 northbound, 3 southbound
Sidewalks	Both sides	Both sides
Bike facilities	Buffered lanes on both sides (partly sharrow on northbound side) from Station Landing south across Wellington Bridge	Buffered lanes on both sides, north of Riverside Avenue
Shoulder	Yes	Yes, southbound
Parking	No	Yes, northbound
Median	8-foot grass	Concrete

2.5.1.2 Mystic Valley Parkway (Route 16)

An urban principal arterial, Route 16 west of the Circle is known as Mystic Valley Parkway. Under MassDOT jurisdiction, it connects Wellington Circle to I-93- and Mystic Avenue (Route 38) just under one mile to the west. Mystic Valley Parkway is the northern boundary of the Mystic River State Reservation and land uses to its north are primarily commercial. A 35-mph speed limit is posted in both directions. The typical configuration of Mystic Valley Parkway is shown in Table 2.5-2.

Table 2.5-2: Mystic Valley Parkway

Roadway Configuration	
Number of Travel lanes	2 eastbound and 2 westbound
Sidewalks	Both sides
Bike facilities	No
Shoulder	Yes, 14’ signed as breakdown lane
Parking	No
Median	20-foot tree-lined

2.5.1.3 Revere Beach Parkway (Route 16)

West of the Circle, Route 16 continues as an urban principal arterial under MassDOT jurisdiction and is known as Revere Beach Parkway. It travels from the Circle to the east, connecting to Route 99, Route 1, and Route 1A. Land uses along Route 16 in the vicinity of Wellington Circle are predominantly commercial, and there is a 35-mph speed limit posted in both directions. The typical roadway configuration is illustrated in Table 2.5-3.

Table 2.5-3: Revere Beach Parkway

Roadway Configuration	
Number of Travel lanes	3 eastbound and 3 westbound (plus right turn lanes)
Sidewalks	Both sides
Bike facilities	5’ lane on each side
Shoulder	No
Parking	No
Median	Concrete barrier

2.5.1.4 Middlesex Avenue

An urban minor arterial under MassDOT jurisdiction, Middlesex Avenue connects at its southern end to Wellington Circle and travels to the north through the City of Malden. Middlesex Avenue serves residential and commercial land uses, and has a posted speed limit of 25 mph in both directions. Its typical configuration is shown in Table 2.5-4.

Table 2.5-4: Middlesex Avenue

Roadway Configuration	
Number of Travel lanes	1 northbound and 1 southbound (lanes unmarked, roadway is 38’ wide)
Sidewalks	Both sides
Bike facilities	No
Shoulder	No
Parking	Both sides
Median	No

2.5.2 Signalized Intersections

Intersections are a crucial part of the existing transportation facilities, as they can significantly impact traffic and present crucial interaction points between modes. The major intersections in the study area are:

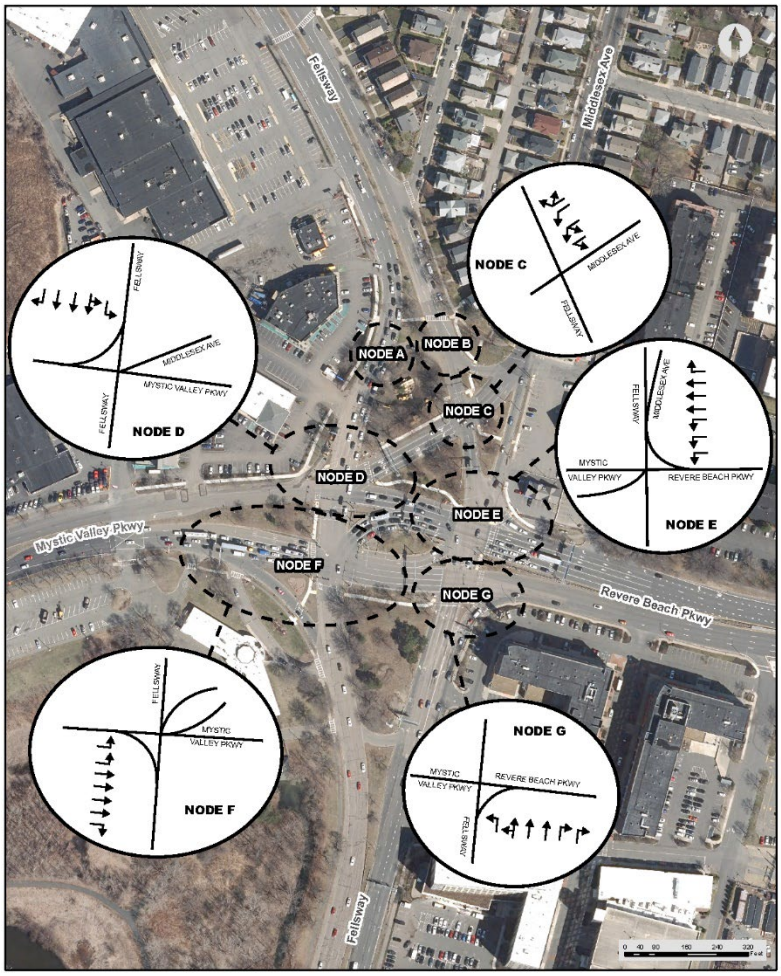
- Wellington Circle,
- Commercial Street at Route 16,
- Rivers Edge Drive at Route 16,
- Presidents Landing at Route 16, and
- Riverside Avenue at Fellsway

These intersections are detailed below.

2.5.2.1 Wellington Circle

While this study covers a wider area surrounding Wellington Circle, the Circle itself is the critical core intersection. Comprised of nine sub-intersections, or nodes, the Circle essentially acts as a 5-legged junction of Fellsway (Route 28), Revere Beach Parkway/Mystic Valley Parkway (Route 16), and Middlesex Avenue and is under MassDOT jurisdiction. This configuration is shown in Figure 2.5-1.

Figure 2.5-1: Intersection Geometry - Wellington Circle



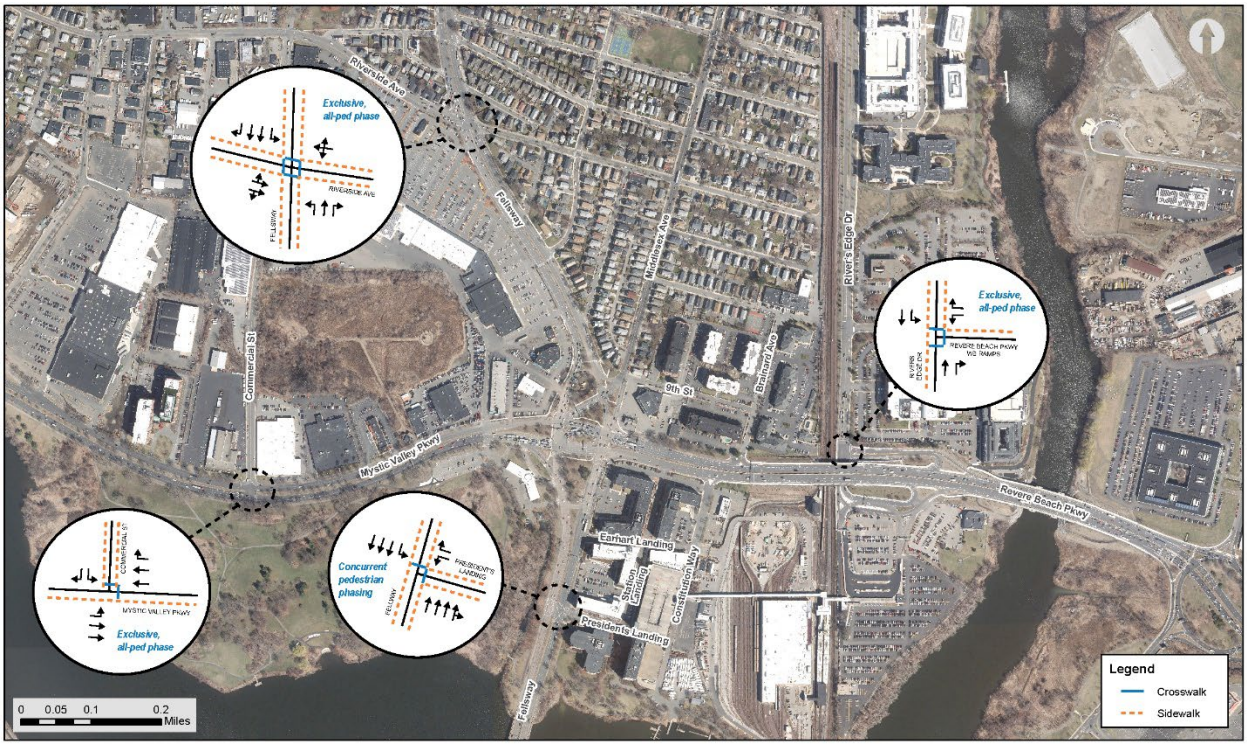
In addition to the major roadways, within the greater intersection, there are ten driveway access points to commercial and institutional properties.

The signalized nodes of the Circle operate on a 100-second cycle length during peak traffic periods, and on a 90-second cycle length during off-peak periods. Vehicle detection is generally in place for all approaches; however, the intersection operates on fixed timings regardless of actuation. Phasing details are included in Appendix E.

Within the Circle, there are approximately 6-foot-wide sidewalks through all entries and exits to the intersection, providing pedestrian access through the Circle to and from each roadway. Despite this comprehensive access, many crossings are indirect and convoluted. Most of the crosswalks within the Circle are signalized and phased concurrently with non-conflicting vehicle movements. Pedestrian push buttons are provided at all the signalized crosswalks, but Walk signals are displayed regardless of actuation. There are no dedicated bicycle facilities within the Circle. Pedestrian and bicycle facilities are discussed further in Sections 2.5.1.3 and 2.5.1.4.

Other major intersections in the study area include Fellsway at Riverside Avenue, Commercial Street at Mystic Valley Parkway, Fellsway at President's Landing, and Rivers Edge Drive at the Revere Beach Parkway westbound ramps. These intersections and their pedestrian accommodations are detailed in Figure 2.5-2.

Figure 2.5-2: Intersection Geometry - Expanded Area



2.5.3 Pedestrian Facilities and Conditions

All major roadways within the study area, including Fellsway, Mystic Valley Parkway, Revere Beach parkway, and Middlesex Avenue, have sidewalks on both sides. While all these sidewalks are approximately 5-feet to 6-feet wide, providing the minimum required four feet of width for ADA accessibility, many need additional improvement to make them accessible for people of all ages and abilities. Some of the challenges to accessibility, and example locations with photographs, include:

Figure 2.5-3: Sidewalk obstructions such as utility poles that obstruct the minimum four-foot-wide path of travel requirement for ADA accessibility - South side of Revere Beach Parkway.

Figure 2.5-4: High frequency of driveways breaking up the sidewalk and creating conflicts between pedestrians and turning cars - West side of Fellsway north of Wellington Circle

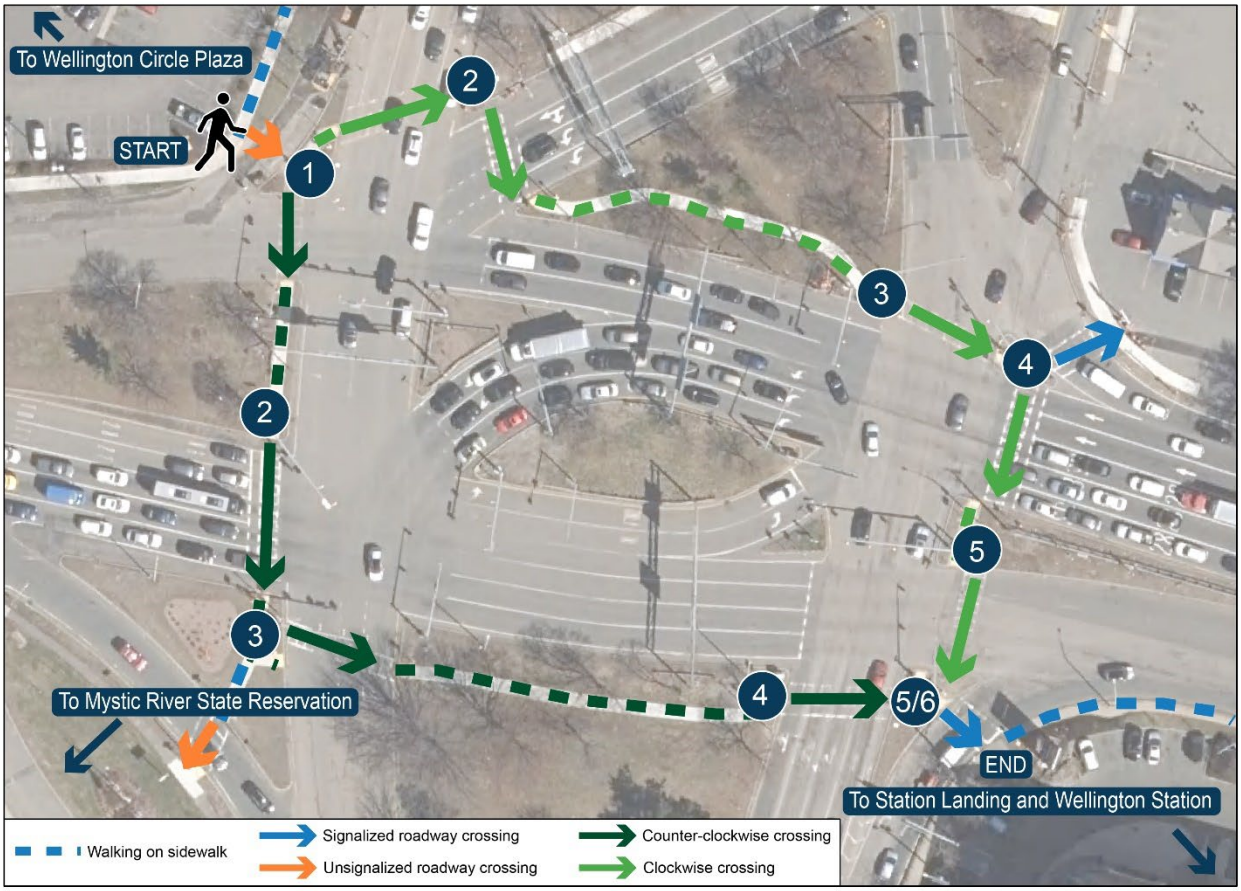
Figure 2.5-5: Poor pavement conditions making it difficult for people in wheelchairs or with strollers to navigate the sidewalk - North side of Mystic Valley Parkway

Figure 2.5-6: Crossing of several lanes of traffic and high vehicle speeds making an uncomfortable pedestrian environment even with marked crosswalks and paths – Wellington Circle

The MassDOT Pedestrian Plan calls for all people in Massachusetts to have a safe, comfortable, and convenient option to walk for short trips. While the pedestrian facilities at Wellington Circle are comprehensive, including sidewalks on both sides of all approaches and exclusive pedestrian phases at all signalized crossings, they do not necessarily meet the Plan standards, especially when it comes to their convenience.

To cross from one corner of the Circle to another may necessitate four to six individual crossings, requiring a pedestrian's time, patience and prolonged attention while facing multiple streams of crossing traffic. Figure 2.5-7 demonstrates a crossing from the northwest corner to the southeast corner of the circle which, if taken directly, would cover about 440 feet and take roughly one minute and 45 seconds. The path required to follow marked crossings with the Circle's current configuration, though, requires a walking distance of over 600 feet and nearly six minutes, about half of which is spent waiting at pedestrian signals.

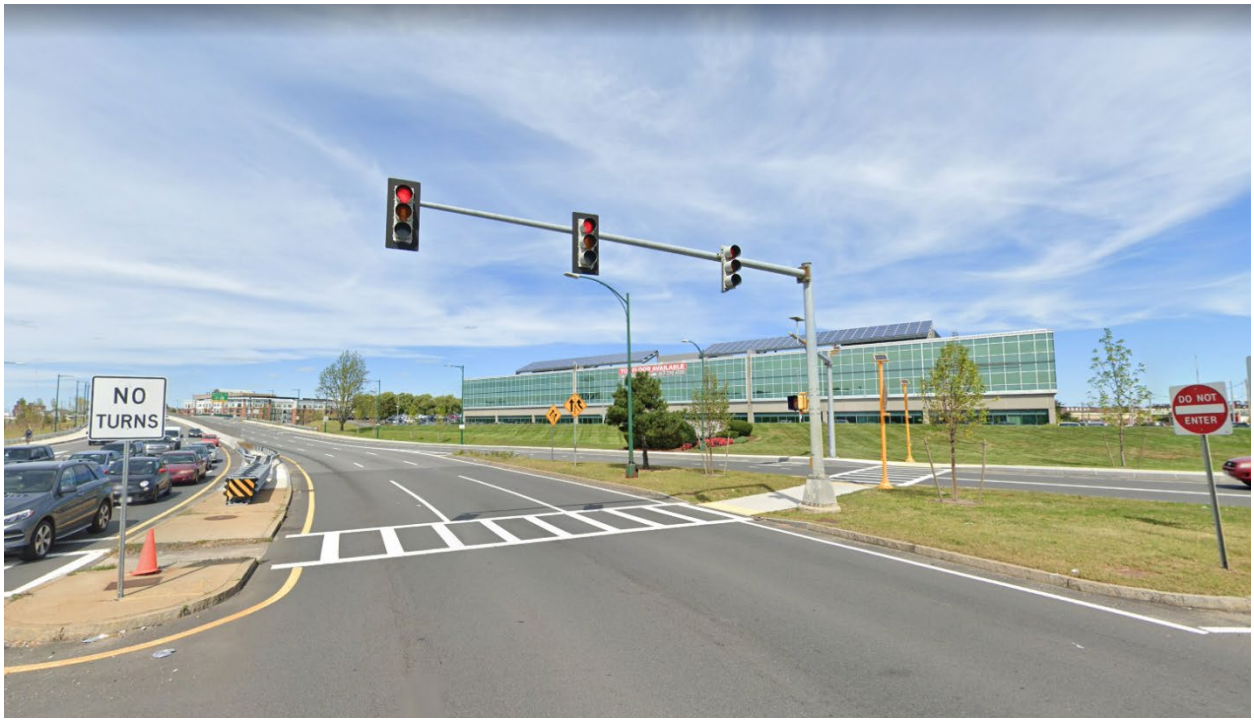
Figure 2.5-7: Wellington Pedestrian Crossing



Some general challenges presented by the walking conditions in the study area outside the Circle include the proximity between pedestrians and high-speed traffic, even where sidewalks are in good condition, walkers are often directly alongside busy roadways like Revere Beach Parkway or Fellsway. Access to Wellington Station is also a challenge, as the rivers, major roadways, and rail lines channelize foot traffic into just a handful of access points, including the Wellington Greenway, the walkway from Station landing, and from the north via River's Edge Drive or Revere Beach Parkway.

Some recent improvements have been made to pedestrian facilities in the study area, including at Wellington Circle and Santilli Circle (Figure 2.5-8), as well as along Rivers Edge Drive and its ramps to Revere Beach Parkway.

Figure 2.5-8: Santilli Circle Pedestrian Improvements



2.5.4 Bicycle Facilities and Conditions

With no dedicated bicycle facilities crossing through the intersection, Wellington Circle is a major gap in the region's high-comfort bicycle network, as identified by the MassDOT Bicycle Plan. Moreover, the Plan identifies Wellington Circle and its surroundings, especially to the east, as having a high potential for everyday biking trips.[50] This study aims to address this crucial gap.

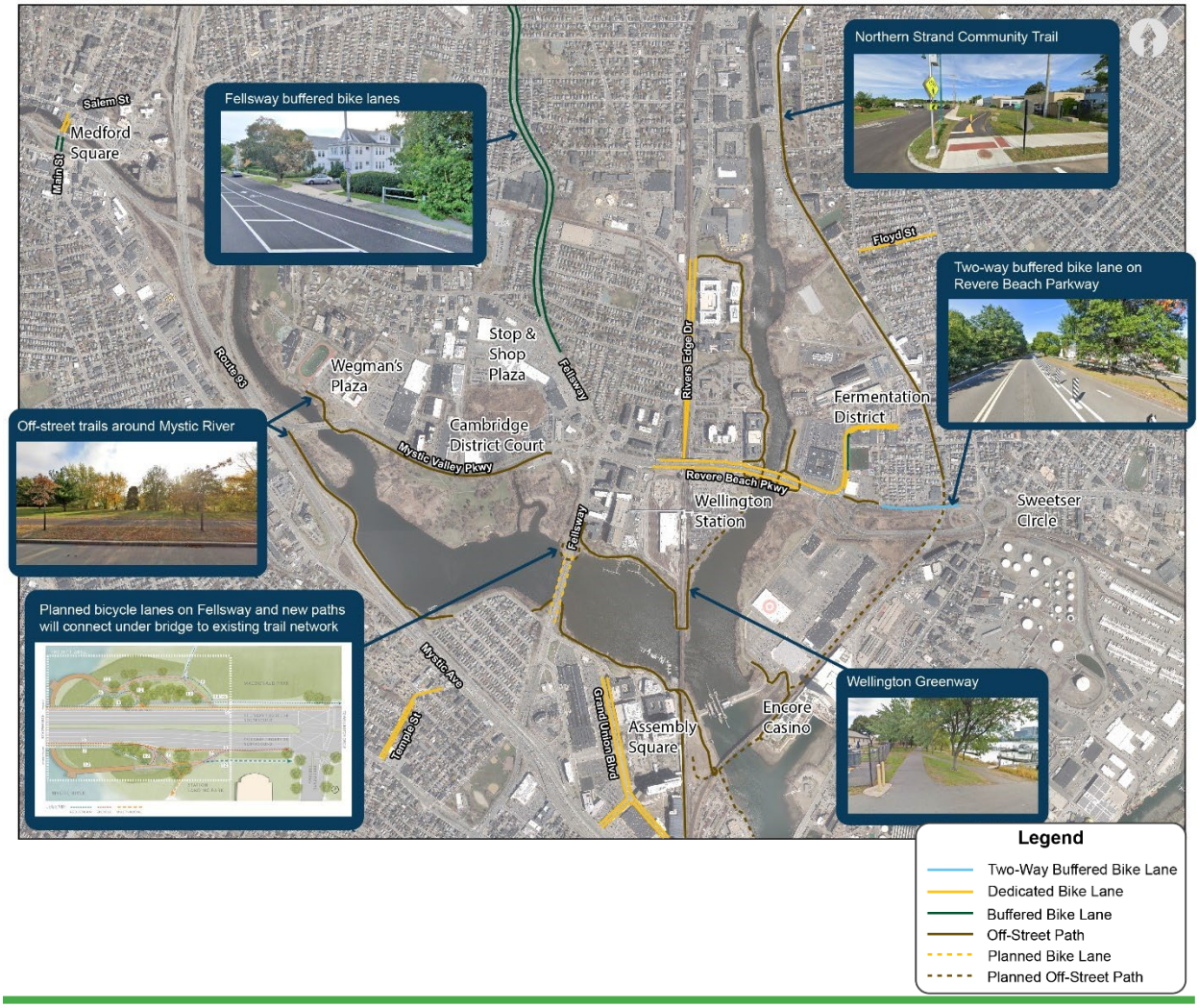
Surrounding the circle, several bicycle facilities either exist or are proposed. These facilities are described in Table 2.5-5 and shown in Figure 2.5-9.

50

Table 2.5-5: Bike Facilities Existing and Proposed in Study Area

Facility	Description
Revere Beach Parkway Bike Lanes	5' street-level lanes on both sides of Revere Beach parkway from Brainard Avenue to Santilli Circle. Two-way buffered lanes along Revere Beach Parkway Access Road between Santilli and Sweetser Circles.
Fellsway Bike Lanes	Buffered lanes north of Riverside Avenue
Northern Strand Community Trail	Off-street path running north from West Avenue in Everett to Revere and beyond
Wellington Greenway	Off-street path running from Fellsway/Presidents Landing along Mystic/Malden Rivers to Wellington Station
Fellsway Bridge (PROPOSED)	Proposed protected lanes along the Fellsway Bridge across the Mystic River, including a connection under the bridge into the existing trail network

Figure 2.5-9: Bike Facilities in Wellington Circle Study Area



The Wellington Circle bicycle network gap is even more glaring with the potential demand in the immediate area around the Circle holds for bicycling. As mentioned above, the MassDOT Bicycle Plan's Everyday Biking Score placed the area as high as the 98th percentile within the MAPC region. This score "predicts where people are reasonably expected to bike for everyday travel if safe, comfortable and convenient bikeways are available."[51] Factors such as land use, trip distance, income, and car ownership factor into the calculations.

2.5.5 Multimodal Volumes

Crucial to the understanding of any interchange is a knowledge of how many people use it. Due to the COVID-19 pandemic, a regular traffic data collection program for Wellington Circle was not feasible. Thus, a methodology to understand traffic patterns was developed, described in full in Appendix E, and in part below.

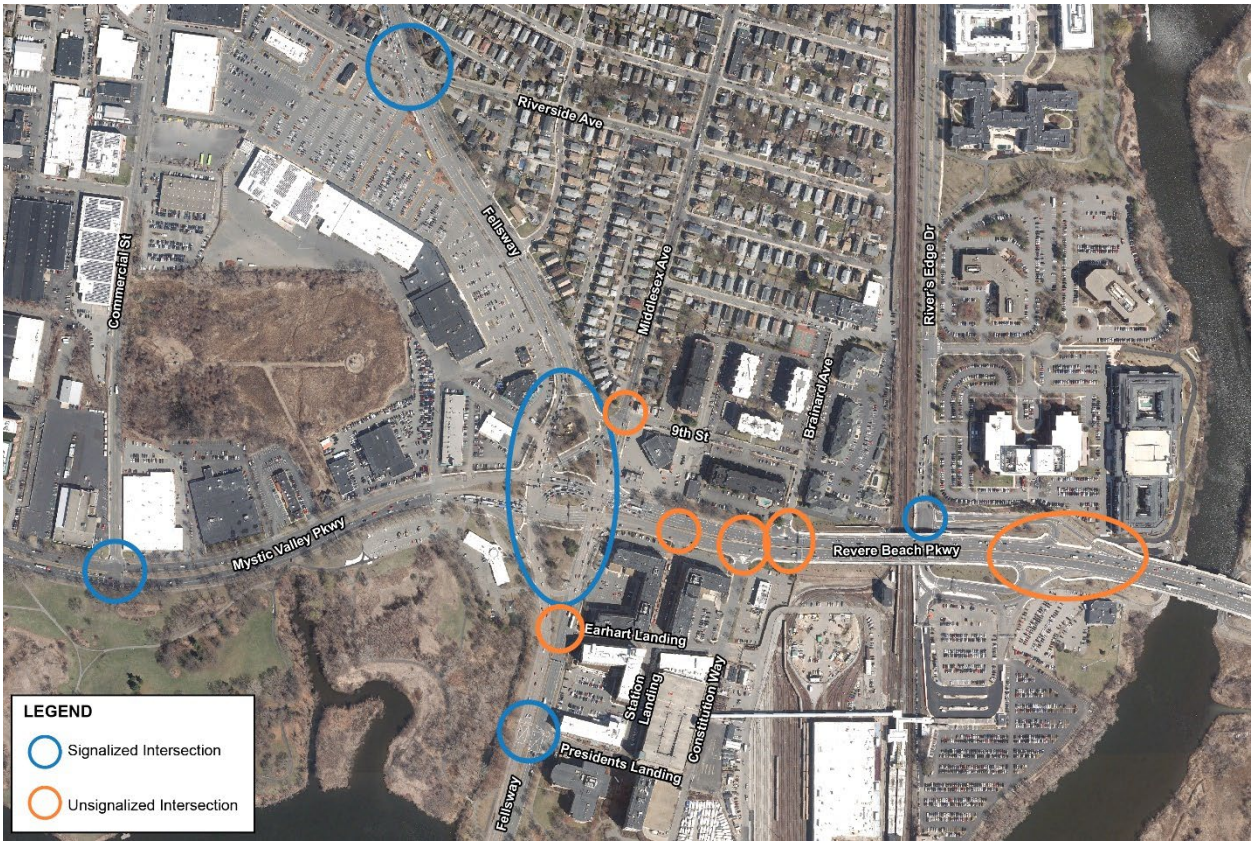
To determine baseline traffic volumes, historical counts from prior studies and programs were used, as shown in Table 2.5-6. To create (pre-COVID) 2020 baseline volumes, appropriate growth rates were applied to the applicable counts, which were obtained at 13 area intersections –five signalized and eight unsignalized, as shown in Figure 2.5-10. Seasonal adjustment factors were also calculated using MassDOT continuous count station data from the area and applied to all counts. For bicycle volumes, seasonal factors were created using continuous count data from the Eco-Totem bike counter on Broadway in Cambridge.

Table 2.5-6: Traffic Count Sources

Count Source	Date(s)	Location(s)
4000 Mystic Valley Parkway Traffic Impact Study	June 2019	Commercial Street at Mystic Valley Parkway
Woods Bridge Study	January 2011	Rivers Edge Drive at Revere Beach Parkway
BJ's Fueling Facility Traffic Impact Study	May 2019	Fellsway at Riverside Avenue, Middlesex Avenue at 9th Street
Route 1 Chelsea Study	February 2019	Wellington Circle
Encore Monitoring Program (Weekday PM only)	February 2020	Wellington Circle

[51] https://www.arcgis.com/home/item.html?id=371274be470c4f9db0543943398eb3d3

Figure 2.5-10: Traffic Count Intersections



For locations with no historic data, counts were conducted in December 2020 at the following intersections:

- Fellsway at Earhart Landing,
- Middlesex Avenue at 9th Street; and
- Revere Beach Parkway's intersections with Station Landing, Constitution Way, and Brainard Avenue.

As these counts were still impacted by COVID-19 conditions, additional adjustments were made by comparing the counts taken at Middlesex at 9th Street to historic counts at the same location. The volume difference informed the adjustments that were then applied to all the December 2020 counts.

Once these adjustments were made, the volumes were balanced. With counts coming from varied sources, there were larger differences in volumes between nearby intersections than typically expected. The following steps were taken to ensure that balancing was done to best reflect typical (pre-COVID) conditions:

- Volume differences internal to the individual nodes within the Wellington Circle intersection were fully balanced, as no volume sinks or sources exist between them and the data at each was obtained from a single count source.
- Volume differences between nearby intersections with no volume sources or sinks were balanced to within 5% of the roadway volume.
- Volume differences between intersections with minimal volume sources or sinks were balanced to within 10% of the roadway volume.
- Volume differences between intersections with many or particularly substantial volume sources or sinks were balanced to within 20% of the roadway volume.

The final balanced volumes are shown in Appendix E.

2.5.5.1 2020 Existing Traffic Volumes

At the Circle, the vehicle volumes shown in Figure 2.5-11 and Figure 2.5-12, indicate high volumes of travel in the AM between north and south and between east and south, with Fellsway south of the Circle having the highest overall volumes. In the PM, the highest volumes of vehicle travel are between east and west and between east and south, with Revere Beach Parkway east of the Circle having the highest overall volumes. Between the two peak hours, the dominant pattern is between the south (Fellsway) and the east (Revere Beach Parkway).

Figure 2.5-11: Wellington Circle Existing Vehicle Flow Diagram - AM

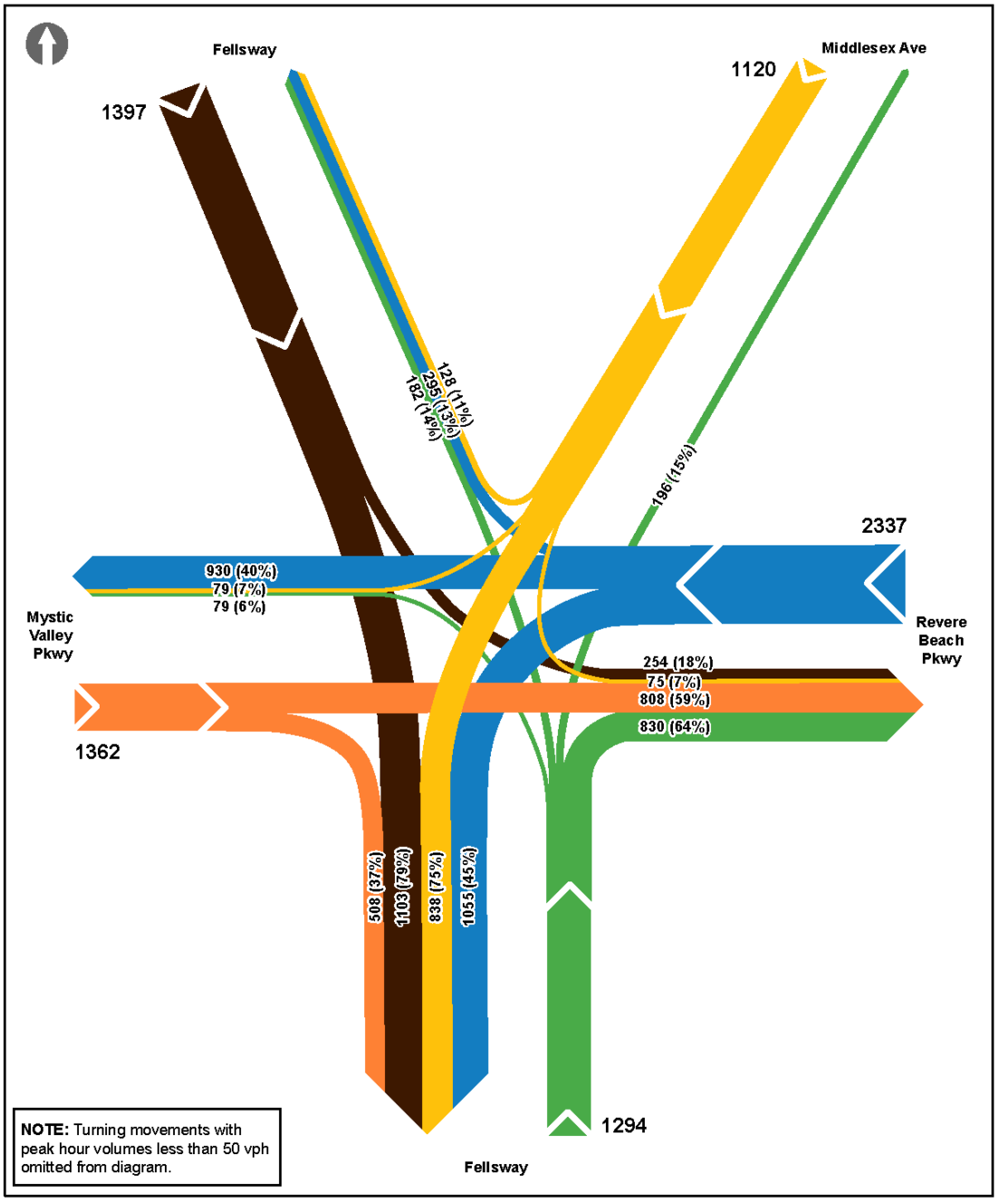
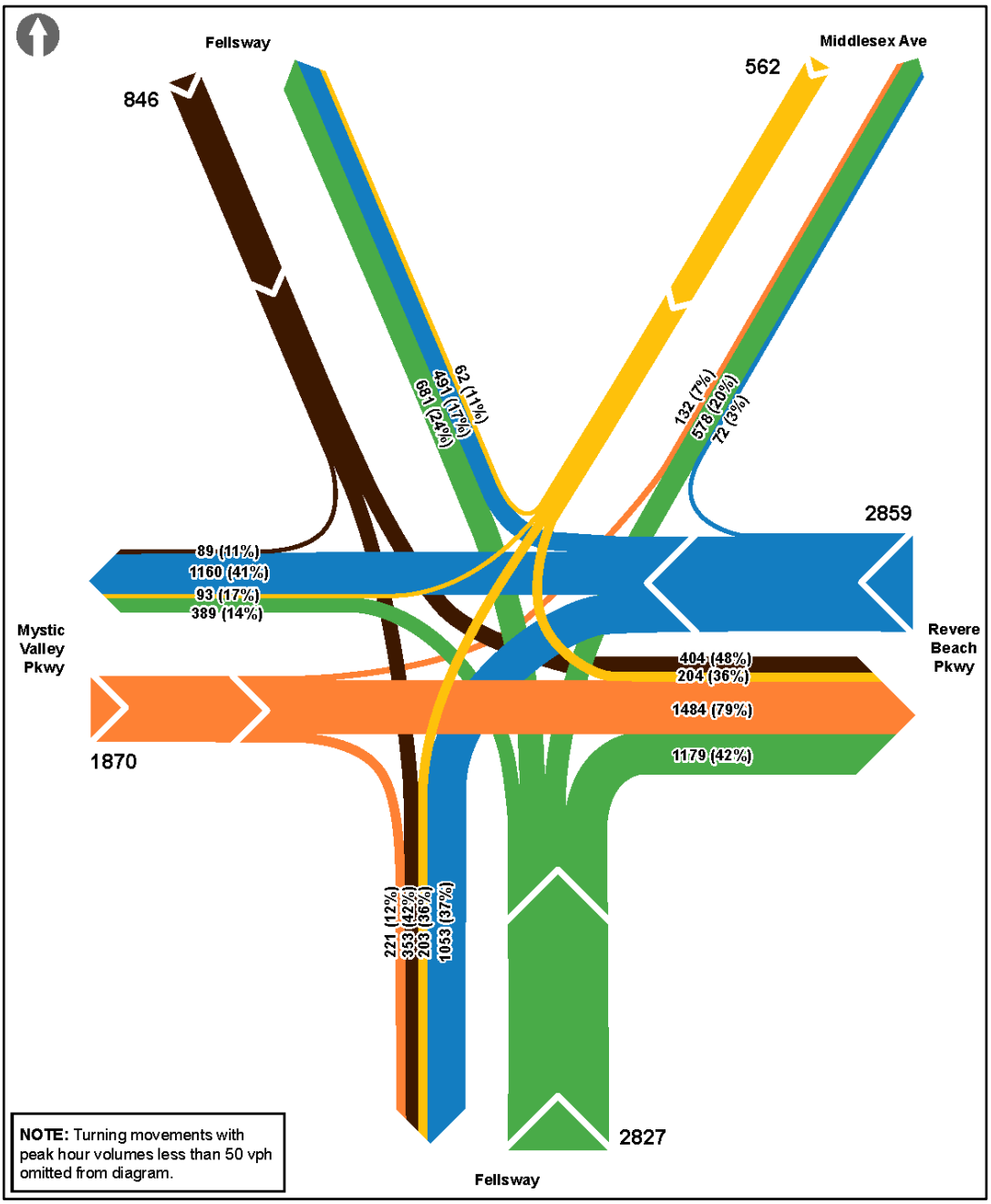


Figure 2.5-12: Wellington Circle Existing Vehicle Flow Diagram - PM



2.5.5.2 Future Traffic Volumes

To determine future vehicle demands on Wellington Circle and the adjacent study area roadways and intersections, traffic volumes were projected to the future-year 2040 by the Central Transportation Planning Staff (CTPS) using the Statewide Travel Demand Model. The Statewide Travel Demand Model projects future-year volumes based on anticipated development both locally and regionally, socioeconomic and land-use changes, and changes to mode-share. The future-year 2040 volume projections from CTPS were then developed into the full 2040 No-Build volume set, which are used

as the basis of the comparison for the alternatives analysis in Chapter 4. Based on the CTPS projections, the resulting 2040 No-Build volumes at the Circle are shown to increase by approximately eight percent during the weekday morning peak hour and by approximately seven percent during the weekday afternoon peak hour. Individual approaches to the Circle are shown to increase by anywhere between approximately zero and 19 percent during the peak hours analyzed, as shown in Table 2.5-7.

The 2040 No-Build volumes are shown in Appendix E.

Table 2.5-7: Summary of Entering Vehicle Volumes by Approach

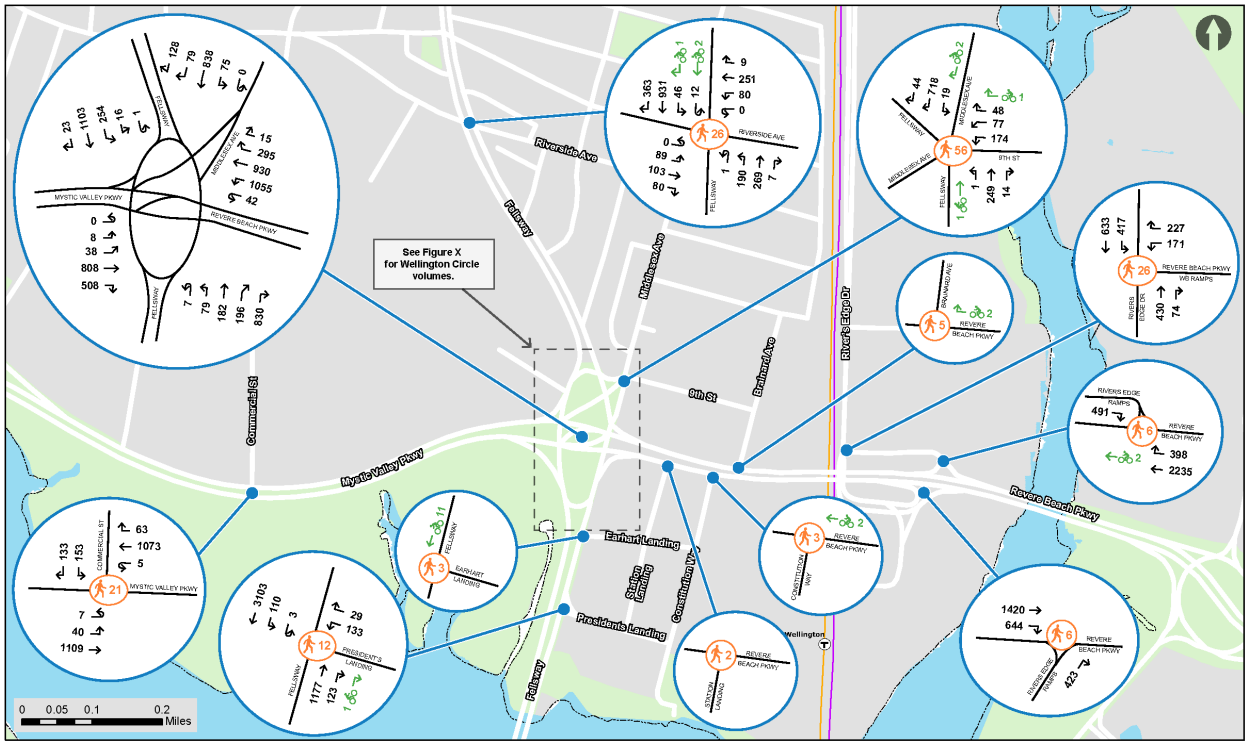
	Entering Volume					
	AM			PM		
Approach	2020 Existing	2040 No-Build	% Change	2020 Existing	2040 No-Build	% Change
Mystic Valley Parkway (Rt 16) Eastbound	1,362	1,441	+5.8%	1,870	1,969	+5.3%
Revere Beach Parkway (Rt 16) Westbound	2,337	2,415	+3.3%	2,859	2,980	+4.2%
Fellsway Northbound	1,294	1,538	+18.9%	2,827	3,219	+13.9%
Fellsway Southbound	1,397	1,475	+5.6%	846	847	+0.1%
Middlesex Avenue/9th Street Southwestbound	1,120	1,238	+10.5%	562	589	+4.8%
TOTAL:	**7,510**	**8,107**	**+7.9%**	**8,964**	**9,604**	**+7.1%**

2.5.5.3 Pedestrian and Bicycle Volumes

While all the count sources listed above included vehicle counts, not all of them included pedestrian and bicycle counts. The pedestrian and bicycle volumes used in the study are listed in Appendix E. Aside from the nodes comprising the Circle, the busiest crossings for pedestrians in the immediate vicinity of Wellington Circle, shown in Figure 2.5-13, occur at the intersection of Middlesex Avenue at 9th Street and Fellsway at Riverside Avenue, possibly indicating higher pedestrian activity originating from the residential neighborhood to the north connecting to Wellington Station.

Bicycle volumes through the Circle are noticeably lower in the morning (8 bicyclists in the peak hour) than the afternoon (58 bicyclists in the peak hour). Most of these bicyclists in the afternoon are travelling from south to north. Given the urban nature of the surrounding area, its position in the regional bicycle network, and its proximity to Wellington Station, these bicycle counts may not represent the full demand for bicycling in the area, especially considering the lack of facilities through the Circle.

Figure 2.5-13: Pedestrian Volumes



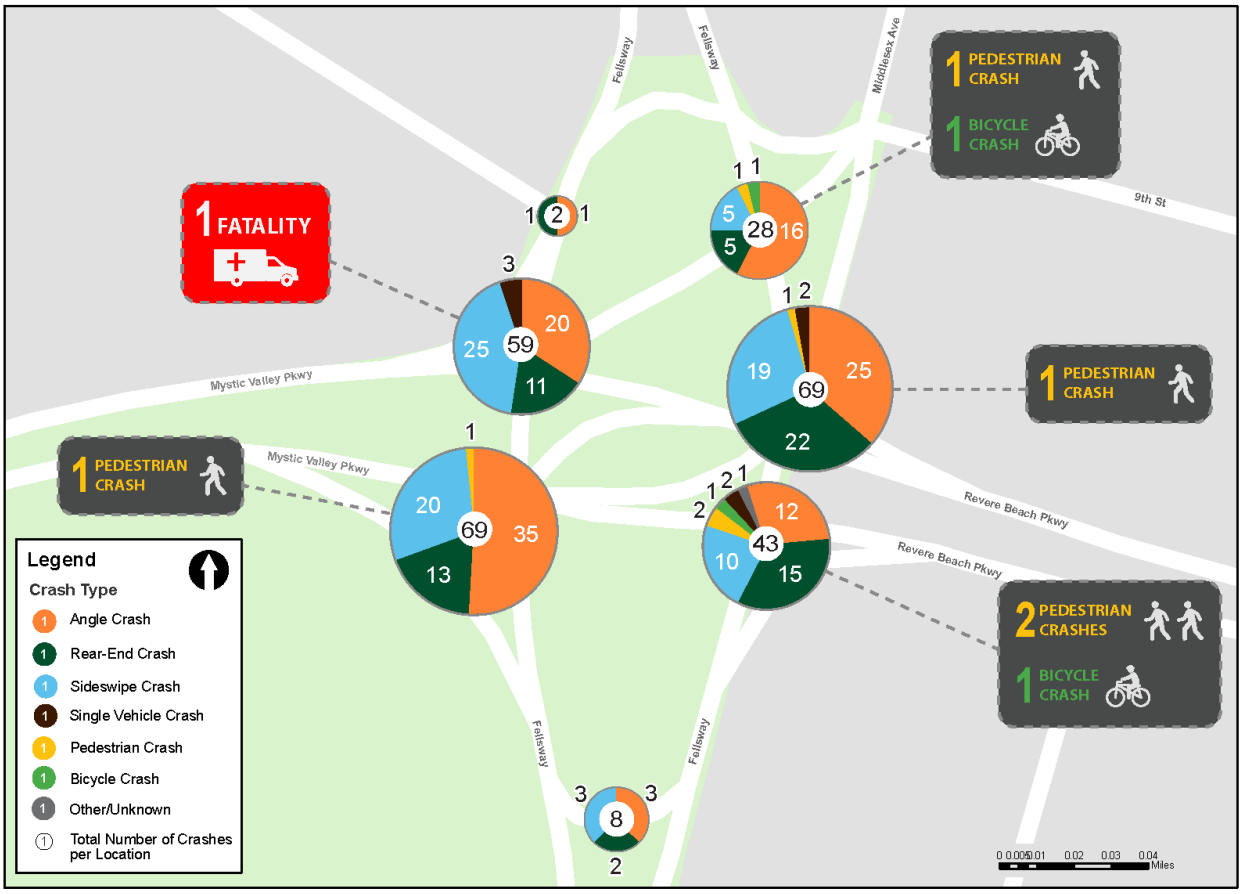
The pedestrian and bicycle volumes were not projected to future-year 2040 due to limited available methodologies for pedestrian and bicycle volume projections. The Future No-Build uses the existing pedestrian and bicycle volumes depicted in this section.

2.5.6 Safety Analysis

2.5.6.1 Crashes

To analyze the safety of Wellington Circle and the surrounding study area, crash data from recent years obtained from the MassDOT crash portal were reviewed. While the most recent years available for analysis in the portal were 2015 through 2017, some improvements have been made at the Circle since. Thus, the number of crashes shown in Figure 2.514 may not comprehensively reflect current-day existing conditions. A summary of the reported crashes at all study area intersections is compiled in Appendix E.

Figure 2.5-14: Wellington Circle Crashes



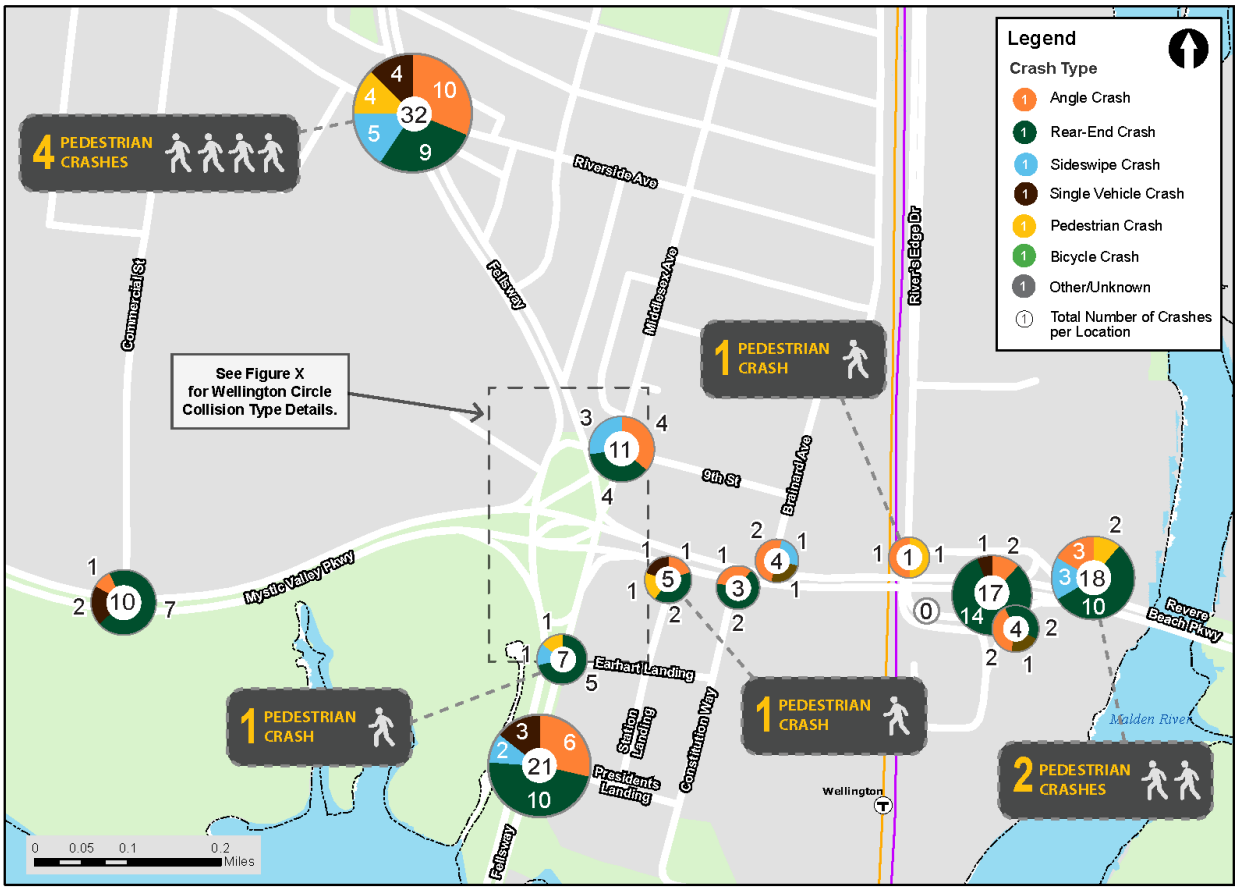
Over the three-year period analyzed, a total of 278 total crashes were reported at the nodes comprising Wellington Circle. A significant portion of the crashes at the Circle were angle collisions, which is typical of signalized intersections. However, relative to crash types at typical signalized intersections, the crash data for the Circle shows a disproportionately high number of sideswipe collisions and a disproportionately low number of rear-end collisions. This greater rate of sideswipe collisions may be related to wayfinding and driver confusion with how to navigate through the Circle and the multiple turn lanes for higher volume moves.

Five total pedestrian crashes were reported across four nodes within Wellington Circle, two of which also included one bicycle crash.

Except for Fellsway at Riverside Avenue, all other intersections in the extended study area have intersection crash rates below the Statewide and MassDOT District 4 averages for their respective intersection types. Fellsway at Riverside Avenue had 32 reported crashes over the three-year period analyzed. This makes the crash rate higher than the MassDOT District 4 average, but lower than the statewide average for signalized intersections. Four of the crashes at Fellsway and Riverside Avenue involved pedestrians, which is the highest occurrence in the study area. Crashes in the broader study area are shown in Figure 2.5-15.

Additionally, collision diagrams are included in Appendix E.

Figure 2.5-15: Study Area Crashes



2.5.6.2 Road Safety Audits

Several road safety audits (RSAs) have been completed within the study area in the previous decade. These RSAs focus on the safety conditions of a particular intersection or corridor and include recommendations for improvements over the short-, mid-, and long-term. These RSAs include:[52]

Woods Bridge RSA (1) September 2011

- Some short- and mid-term needs on Revere Beach Parkway and Rivers Edge Drive were addressed by a 2019 reconstruction project.
- Longer-term recommendations include reconstructing the MBTA Wellington Station access roads to improve parking, live parking, and bus stops.

Wellington Circle (2) March 2016

- A 2018 reconstruction project addressed some short- and mid-term recommendations.
- Longer-term recommendations included examining separated bicycle lanes along Route 16, possibly moving the Middlesex Avenue signal further north, and reducing pavement width on slip lanes to reduce pedestrian crossing distances and vehicle speeds.

Fellsway at Riverside Avenue (3) November 2019

- Longer term recommendations include performing an access management review of Fellsway Plaza, looking into alternative traffic control options at Fellsway and 4th Street, and evaluating the potential for a grade-separated pedestrian crossing of Fellsway.

[52] (1) Fay, Spofford & Thorndike. (September 19, 2011). Road Safety Audit: Segment of MA Route 16 (Revere Beach Parkway) in Everett & Medford, Massachusetts and Intersection of River's Edge Drive at Route 16 Westbound Ramps in Medford, Massachusetts. https://gis.massdot.state.ma.us/arcgis/rest/services/Roads/RoadSafetyAudits/MapServer/0/159/attachments/148
(2) AECOM. (March 10, 2016). Road Safety Audit: Wellington Circle, Municipality of Medford. https://gis.massdot.state.ma.us/arcgis/rest/services/Roads/RoadSafetyAudits/MapServer/0/269/attachments/250
McMahon Associates. (November 2019).
(3) McMahon Associates. (November 2019). Road Safety Audit: Fellsway (Route 28) & Riverside Avenue, City of Medford. https://gis.massdot.state.ma.us/arcgis/rest/services/Roads/RoadSafetyAudits/MapServer/0/189600/attachments/20113

2.5.6.3 Other Safety Measures

In addition to assessing crashes and RSAs, the safety analysis evaluated designations made by the Highway Safety Improvement Program (HSIP), which identified Wellington Circle as a Top 200 Intersection Cluster for 2015-2017 and a HSIP Pedestrian Cluster for 2008-2017.

2.5.7 Operational Analysis

The operational analysis of the roadway network was conducted using the Synchro 11 software, based on the latest Highway Capacity Manual methodologies. Inputs to Synchro included:

- Roadway geometry
- Lane Widths
- Signal timings and phasings (field verified)
- Vehicle volumes
- Conflicting ped and bike volumes
- Pedestrian signal calls
- Peak hour factors (PHF), calculated for every approach at every intersection based on count data
- Heavy vehicle percentage, calculated for every movement at every intersection based on count data

Vehicle operations at the study area intersections were modeled using these inputs. To more accurately reflect real-world conditions, the model was further calibrated based on historical travel times within the study area and field observations of traffic conditions.

Synchro outputs a metric called Level of Service (LOS), which gives a shorthand look at the amount of delay a vehicle incurs at an intersection. A rating of A implies free flow and high speeds, while a rating of F describes longer delays and a condition where volume may exceed capacity. According to the Synchro analysis under existing conditions, the five signalized intersections comprising Wellington Circle ranged from LOS C to LOS F in the AM peak (Figure 2.5-16) and from LOS C to LOS E in the PM peak (Figure 2.5-17). Outside of the Circle, the lowest LOS ratings were seen in the PM at Rivers Edge Drive at the Revere Beach Parkway westbound ramp and at Fellsway at Riverside. Table 2.5-8 shows Synchro existing conditions results from the Wellington Circle intersections. The full results are included in Appendix E.

While LOS is often used to represent intersection operations, for a complex network such as Wellington Circle, it can be more important to evaluate queuing and volume to capacity ratios. Volume to capacity ratio (v/c ratio) indicates the amount of traffic on a given approach in relation to the theoretical capacity. V/C ratios greater than 1.0 for existing conditions usually indicate more aggressive driving behaviors often because of excessive delays. Synchro also reports estimated queue lengths, which can give an idea of the delays in approaching a specific intersection. Queue lengths are an important metric for closely spaced intersections where queue storage length is limited. In each peak hour, under existing conditions, two approaches have estimated queue lengths that stretch beyond the previous intersection – compounding the issue and creating additional delays. In the AM, these are southbound Middlesex Avenue towards Mystic Valley Parkway, and westbound Revere Beach Parkway toward southbound Fellsway (Figure 2.5-16). In the PM, these are

westbound Revere Beach parkway towards southbound Fellsway, and eastbound Mystic Valley Parkway toward Middlesex Avenue and Fellsway North (Figure 2.5-17).

Table 2.5-8: Wellington Circle Intersection Existing Conditions Synchro Analysis

			Weekday AM					Weekday PM				
Intersection	**Movement**		**LOS[1]**	**Delay[2]**	**V/C[3]**	**50th Q[4]**	**95th Q[5]**	**LOS**	**Delay**	**V/C**	**50th Q**	**95th Q**
Fellsway SB at	WB	T	A	6.2	0.51	30	35	A	7.7	0.50	97	110
Middlesex Avenue SWB/	SB	T	F	96.3	1.10	292	367	F	105.2	1.06	159	225
Revere Beach Parkway WB		R	A	0.0	0.01	0	0	A	0.1	0.06	0	0
(Node D)	SWB	BL/BR	D	40.5	0.96	185	254	E	77.3	1.00	112	169
	Overall		*D*	*52.3*	*0.71*			*D*	*48.1*	*0.63*		
Fellsway SB at	EB	L	D	38.1	0.13	17	36	C	31.6	0.27	60	93
Mystic Valley Parkway EB		T	E	67.4	0.97	156	225	E	60.3	0.98	275	359
(Node F)		R	A	0.4	0.30	0	0	A	0.2	0.13	0	0
	SB	L/HL	A	9.5	0.48	1	m1	C	20.3	0.65	5	3
		T	D	41.2	0.88	60	46	B	11.1	0.65	6	3
	SWB	L	F	197.5	1.38	354	443	F	121.3	1.22	395	489
	Overall		*E*	*75.6*	*0.88*			*E*	*61.4*	*0.81*		
Fellsway NB at	WB	L	F	80.8	0.69	223	273	E	77.0	0.71	261	314
Revere Beach Parkway WB		T	C	28.2	0.54	169	211	C	24.6	0.53	179	221
(Node E)		BR/HR	B	19.4	0.50	98	182	D	45.5	0.82	276	468
	NB	L	A	5.0	0.22	5	10	A	0.2	0.22	0	0
		T/BR	A	0.6	0.10	0	4	A	2.4	0.32	49	40
	NEB	HL	E	62.6	0.02	4	16	F	85.9	0.24	31	70
		BL	E	63.3	0.19	48	78	F	161.9	1.08	161	311
	Overall		*D*	*43.8*	*0.49*			*D*	*39.9*	*0.85*		
Fellsway NB at	EB	T	C	21.7	0.52	110	120	B	11.1	0.75	127	129
Mystic Valley Parkway EB	NB	T	C	21.0	0.28	70	72	D	48.9	0.84	336	378
(Node G)		R	B	11.6	0.65	65	85	E	59.7	1.00	457	609
	Overall		*B*	*18.2*	*0.57*			*D*	*35.9*	*0.81*		
Fellsway NB at	WB	T	C	23.7	0.40	131	160	D	36.0	0.44	96	123
Middlesex Avenue SWB	NB	T	B	15.2	0.28	90	116	A	9.4	0.55	160	161
(Node C)	*Overall*		*C*	*20.8*	*0.35*			*B*	*17.5*	*0.51*		

1 Level-of-Service
2 Average vehicle delay (s)
3 Volume-to-capacity ratio, intersection capacity utilization reported for overall values
4 50th percentile queue length (ft)
5 95th percentile queue length (ft)

Figure 2.5-16: Wellington Circle Existing Vehicle Queues and LOS - AM

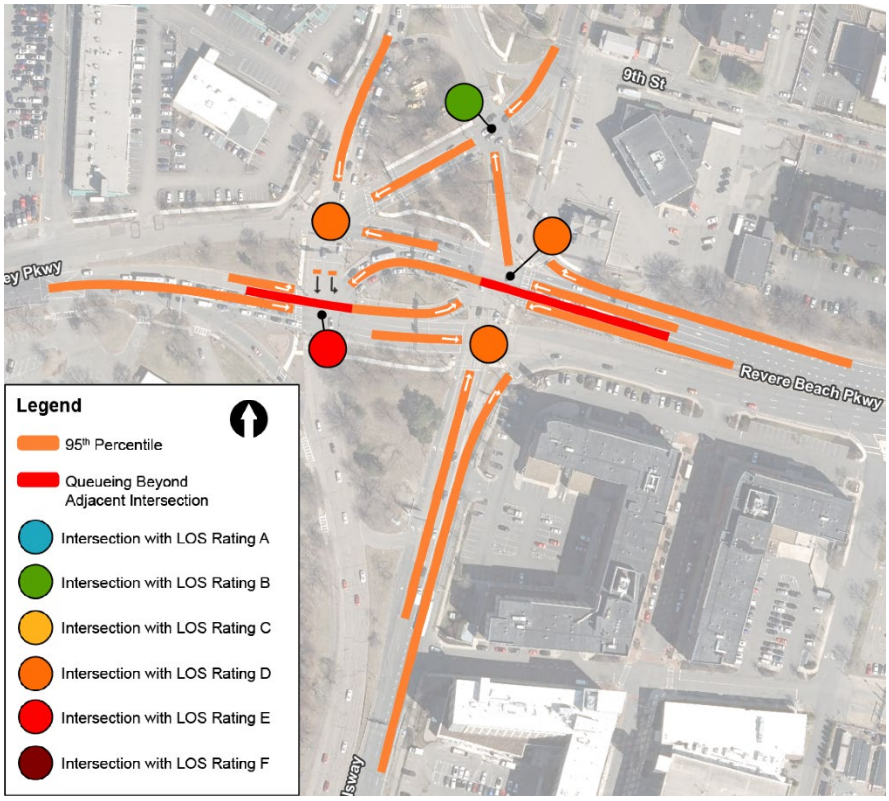
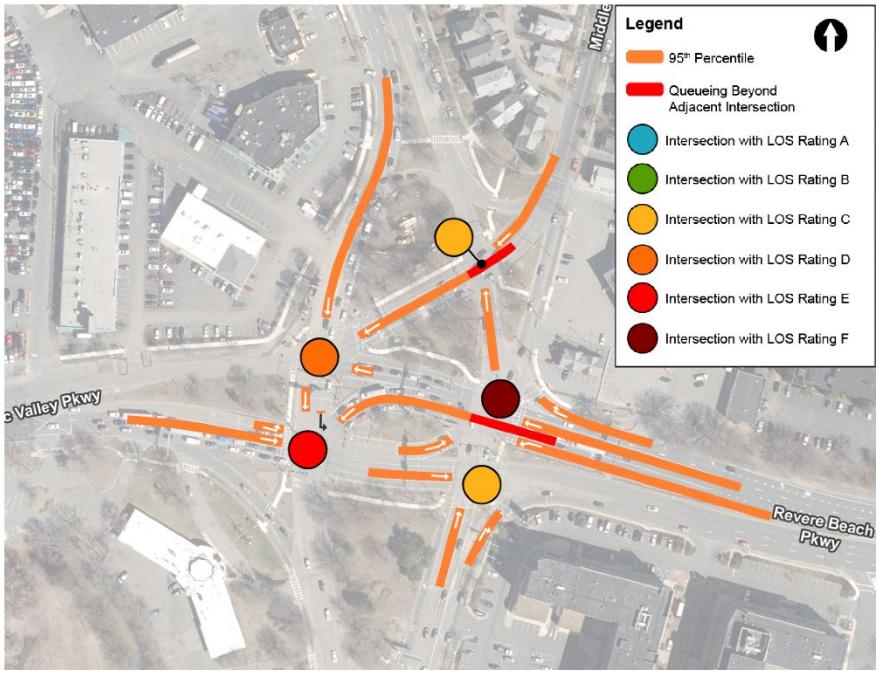


Figure 2.5-17: Wellington Circle Existing Vehicle Queues and LOS - PM



The Future No-Build (2040) scenario was also modeled in Synchro. To account for changes in traffic volumes and patterns, minor adjustments to signal timing splits were included in the Future No-Build scenario.

According to the Synchro analysis under Future No-Build conditions, the five signalized intersections comprising Wellington Circle show minor degradations in LOS ratings compared to existing conditions, as shown in Figure 2.5-18. The full results for the Future No-Build are included in Appendix E.

Figure 2.5-18: Wellington Circle Operational Comparison – Existing and Future No-Build (2040)

Existing (2020)

No Build (2040)

2.6 Transit

Public transit conditions are a key component of the existing conditions surrounding Wellington Circle given the number of bus routes through the area, as well as the immediate proximity to Wellington Station on the MBTA Orange Line. This section details the findings of the public transit conditions analysis, with additional information included in Appendix G.

Through an analysis of publicly available MBTA transit data, the following key takeaways were identified with regards to the study area's existing conditions:

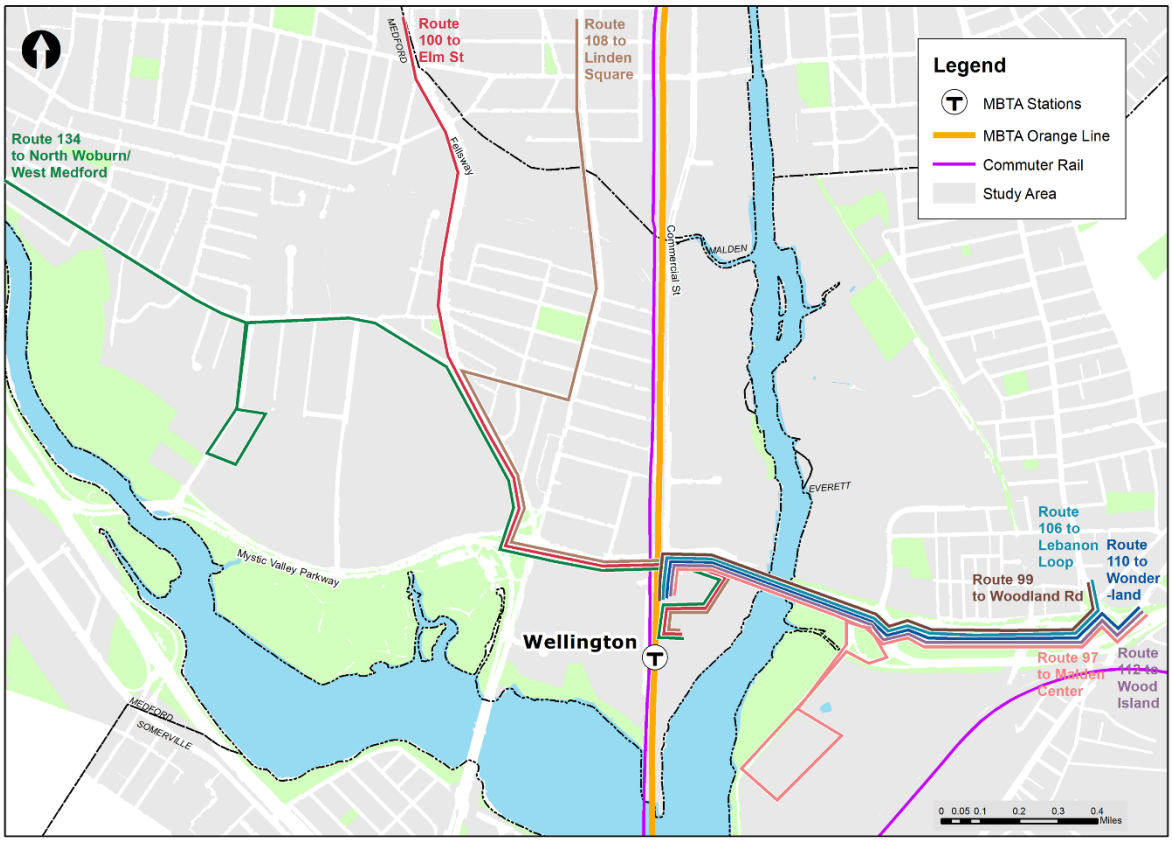
- Bus boardings at Wellington Station account for one-fifth of all bus boardings on the eight routes that serve the study area.
- Fewer MBTA customers arrived at Wellington Station by car in 2017 than in 2009, and many arrive by bus.
- MBTA bus ridership decreased or remained steady on all routes within the study area, except on routes 100 & 106.
- Overall, MBTA rapid transit ridership has decreased since 2014.[53]
- The travel time quality of service for passengers onboard MBTA buses in the study area is poor both during the weekday morning and evening peak times.
- Travel times are highly variable onboard buses between Wellington and Sweetser Circles in both directions at both weekday morning and evening peak times.
- At the route level, conditions during the morning peak are worse than in the evening for both inbound and outbound buses.
- Overall, MBTA bus travel times and travel time variability are worse in the mornings than in the evenings on weekdays.
- The most passengers experience the most travel time delay in MBTA buses between Wellington and Sweetser Circles.
- Approximately 40% of total bus passenger travel time is 'excess' in the AM peak, while about 30% in the PM peak.

[53] Rapid transit ridership has decreased in the aggregate for rapid transit services, and also decreased for the Orange Line itself.

2.6.1 Bus Routes

The eight local MBTA bus routes that serve the study area are shown in Figure 2.6-1.

Figure 2.6-1: MBTA Bus Routes Serving the Study Area



2.6.2 Ridership

Table 2.6-1: Fall 2019 Average Daily Weekday Boardings

Route	All Stops	Stops in Study Area[54]	Wellington Station
97	893	276	165
99	1,060	315	264
100	819	569	357
106	2,647	536	439
108	2,972	567	250
110	3,421	1,066	879
112	1,111	271	215
134	1,588	879	420
Total	**14,511**	**4,479**	**2,989**

Source: MBTA Blue Book Open Data Portal

Per the MBTA Open Data Portal, the bus routes that serve the study area carried an average of 14,500 passengers per weekday in the Fall of 2019, historically the busiest season for the MBTA. Boardings in the study area made up one third of those, while boardings at Wellington Station alone accounted for one fifth of the total number on a typical weekday. For a breakdown of the boarding data, see Table 2.6-1.

2.6.3 Wellington Station Access

Although Table 2.6-1 demonstrates the importance of Wellington Station as a bus connection, MBTA fixed-route buses are not the only major means of access to Wellington Station. Figure 2.6-2 shows boardings at Wellington Station decreased from 2009 to 2017 (from 5.3% of total Orange Line boardings to 4.6%) and how each access mode to the station changed in that time.

Driving alone or via carpool to Wellington Station and parking accounted for 47% of the total mode share for access to the MBTA station in 2009, as opposed to just 18% in 2017. Access to the station via MBTA bus, however, increased from 28% in 2009 to 58% in 2017. The other modes of access remained relatively unchanged. The changes in access mode share are likely due to the increase in user fees at MBTA's Wellington Station parking facilities that took effect in 2008. The poor economy at the time may have had an impact as well.

The share of drop-offs remained roughly the same but grew as a share of total auto-based access, as shown in Figure 2.6-2. Non-motorized access dropped slightly over the same period. The decrease in weekday boardings at Wellington Station shown in the figure above is a trend seen across most of the MBTA system since at least 2014. Table 2.6-2, below, lays out the average weekday station entries for the MBTA system between 2014 and 2019 at all gated stations, at all Orange Line stations, and at Wellington Station separately. As shown in the table, the MBTA has experienced an overall decrease in rapid transit ridership since 2014. Further ridership information is provided in Appendix G, Table A-1.

[54] 'Stops in the Study Area' column is inclusive of boardings at Wellington Station.

Figure 2.6-2: Change in Modes of Access to Wellington Station

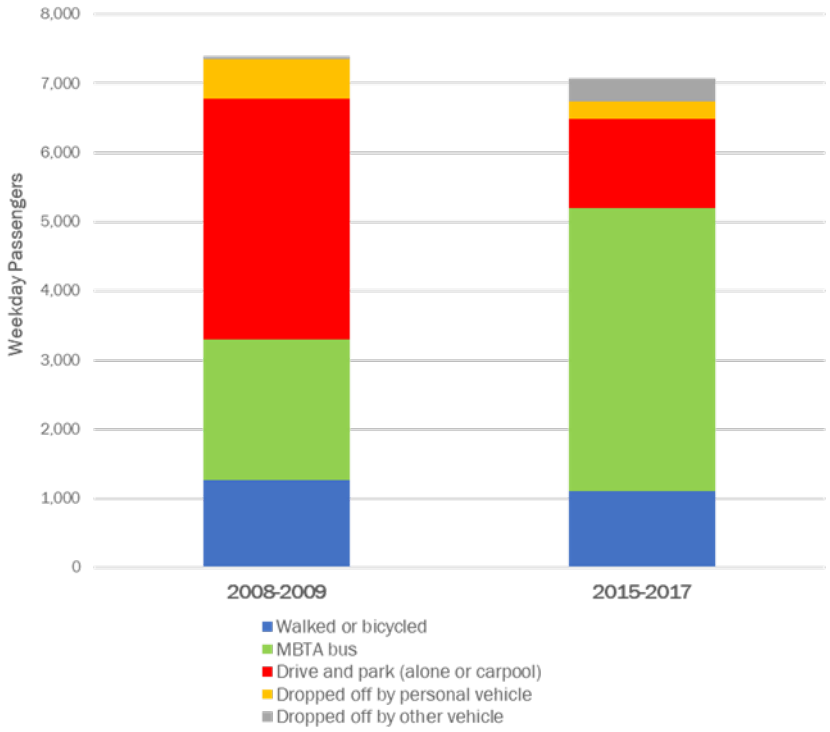


Table 2.6-2: Gated Station Entries

Year	All MBTA Gated Rapid Transit Stations	Orange Line - All Stations	Orange Line - Wellington Station
2014	501,901	158,351	7,539
2015	490,767	155,658	7,201
2016	493,127	154,638	7,047
2017	495,025	155,231	7,074
2018	471,385	147,931	6,971
2019	431,031	134,113	6,624
Average Annual Growth Rate	**-2.9%**	**-3.2%**	**-2.5%**
% Change From 2014 to 2019	**-14.1%**	**-15.3%**	**-12.1%**

Source: Gated station entries downloaded from the MBTA Performance Dashboard. https://mbtabackontrack.com/performance.

2.6.4 Travel Time and Travel Time Variability

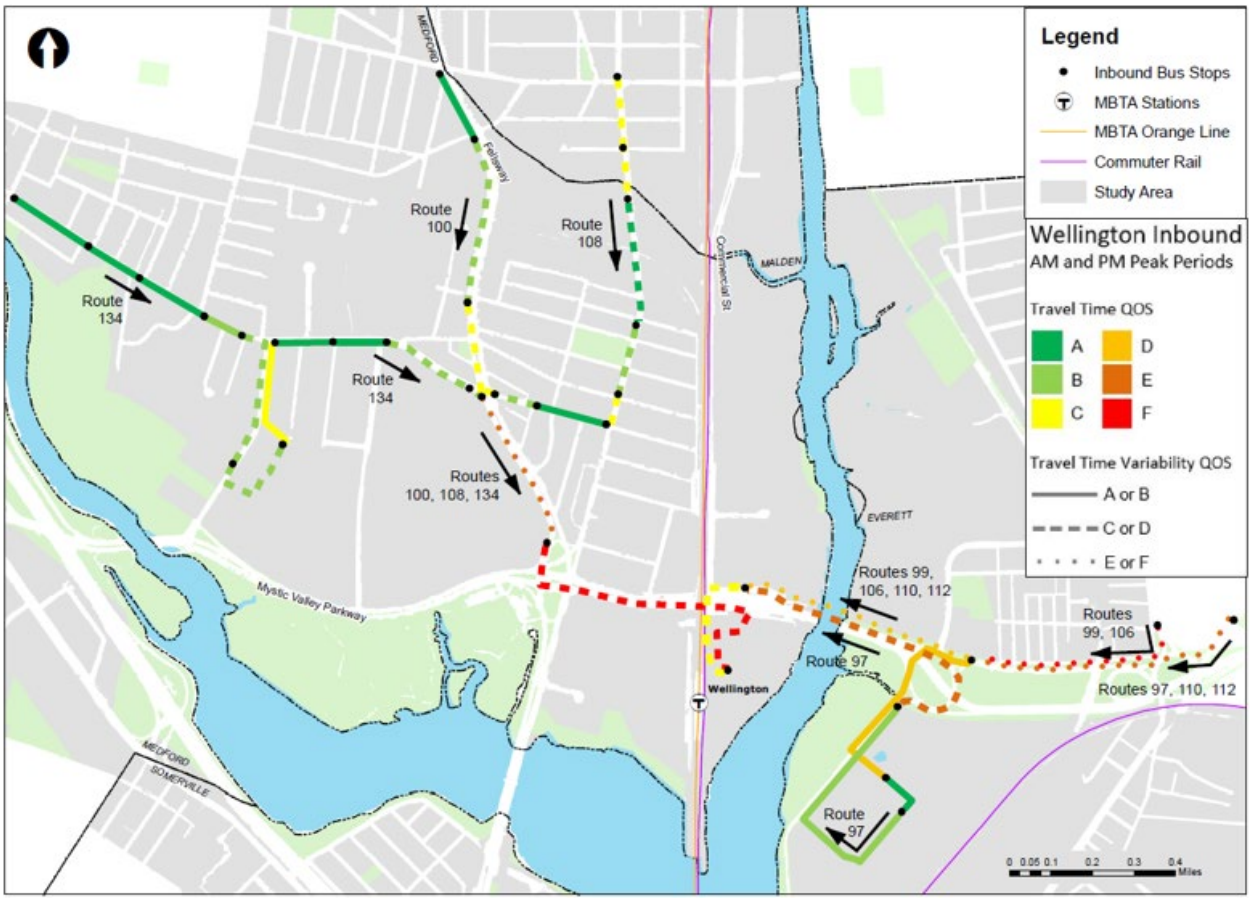
Bus routes and segments within the study area typically exhibit travel time level of service grades of D, E, and F during both peak periods in both directions. These grades are typically associated with transit services that experience significant impacts from traffic congestion or are operating at or over capacity. From the customer perspective, these services are likely viewed as unsatisfactory, and perceived as so slow as to not be a good travel choice. A detailed description of the travel time and travel time variability thresholds and grades are provided in Appendix G, Table A-2.

Segments within the study area typically exhibit travel time variability level of service grades C and D during the AM peak period in both directions. These grades suggest that some customers plan to leave early for their trips to arrive at their destination on time.

The two following figures,

Figure 2.6-3 and Figure 2.6-4, each depict a composite result of the morning and evening peak conditions by segment on weekdays. Dwell time is entirely excluded from these metrics and the results are calculated from APC data sampled from Fall 2019, Spring 2019, and Spring 2018.

Figure 2.6-3: Inbound Travel Time and Travel Time Variability

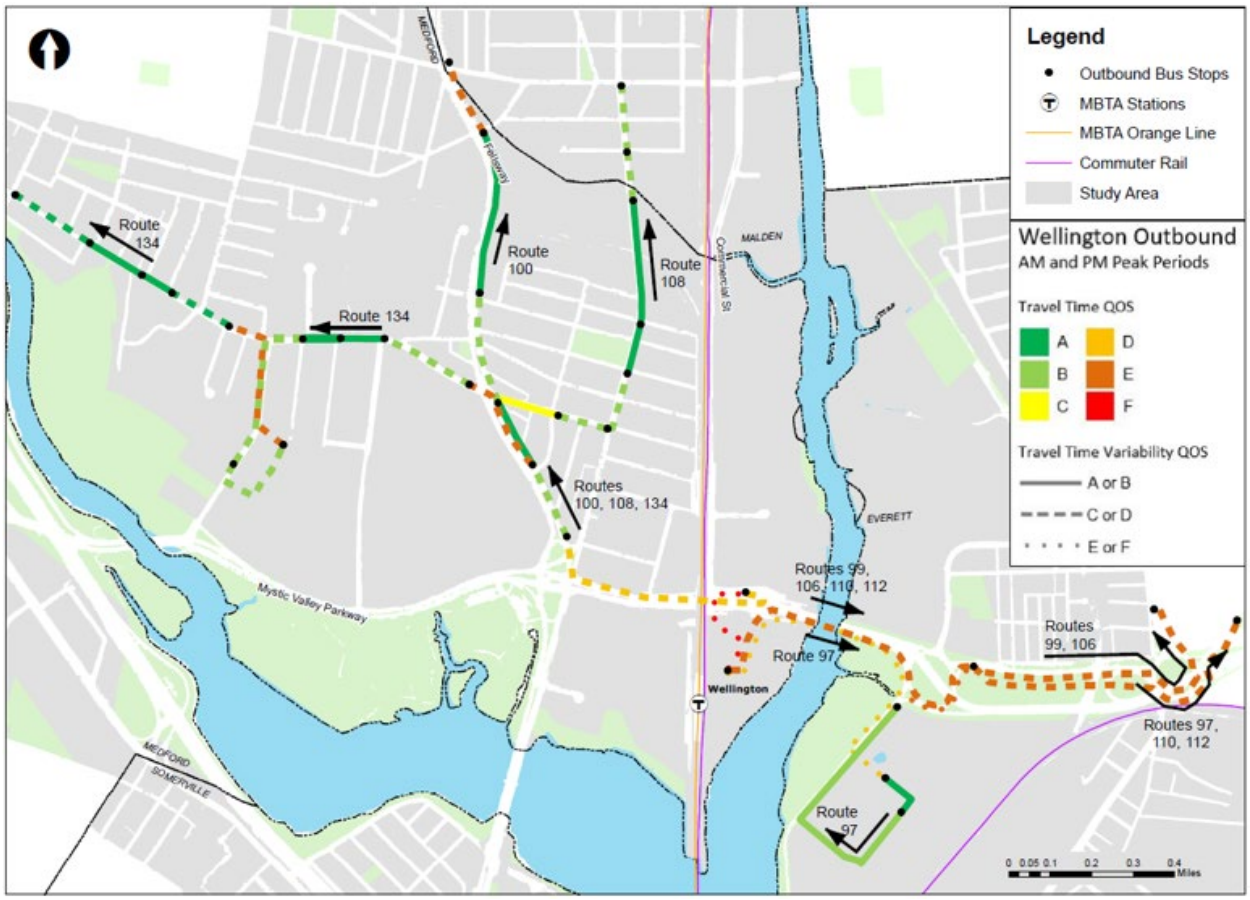


During weekday morning peak service hours, most inbound MBTA bus routes have a poor travel time quality of service throughout the study area. Travel times are so poor in some cases that buses approach walking speeds, especially from Wellington Circle and from Sweetser Circle heading toward Wellington Station.

Bus travel times are highly variable from both Riverside Avenue and Sweetser Circle inbound toward Wellington Station, which has shown to undercut passenger trust in transit options. At the route level, conditions for inbound MBTA buses during the morning peak service hours are worse than during the evening peak.

During the weekday morning peak service hours, most outbound MBTA bus routes have a poor travel time quality of service throughout the study area, as shown in Figure 2.6-4. Travel times are poor between Wellington Station and Wellington Circle as well as Sweetser Circle. Bus travel times are undesirably variable throughout the study area and, at the route level, conditions for outbound MBTA buses during morning peak hours are poorer and more variable than in the evenings. For the MBTA bus routes that do so, travel times might improve if the MBTA eliminates deviations from routes into shopping centers, such as Gateway Center. Detailed route-level summaries of travel time and travel time variability are provided in Appendix G, Tables A-3 and A-4.

Figure 2.6-4: Outbound Travel Time and Travel Time Variability



2.6.5 Excess Passenger Minutes

Excess passenger minutes are defined as the amount of excess travel time over the segment in question multiplied by the number of passengers on board the bus traveling through that segment. Excess travel time is calculated as being the amount of observed travel time in excess of the travel time quality of service threshold at the C/D boundary. Travel times below the C/D boundary are typical for local bus service operating without significant impacts from traffic congestion.

As shown in Figure 2.6-5, the most passengers experience the most travel time delay in MBTA buses between Wellington and Sweetser Circles. A chart of the cumulative fraction of study area segments and their amount of excess passenger time is provided in Appendix G, Figure A-1.

Figure 2.6-5: Excess Passenger Time (XPT)

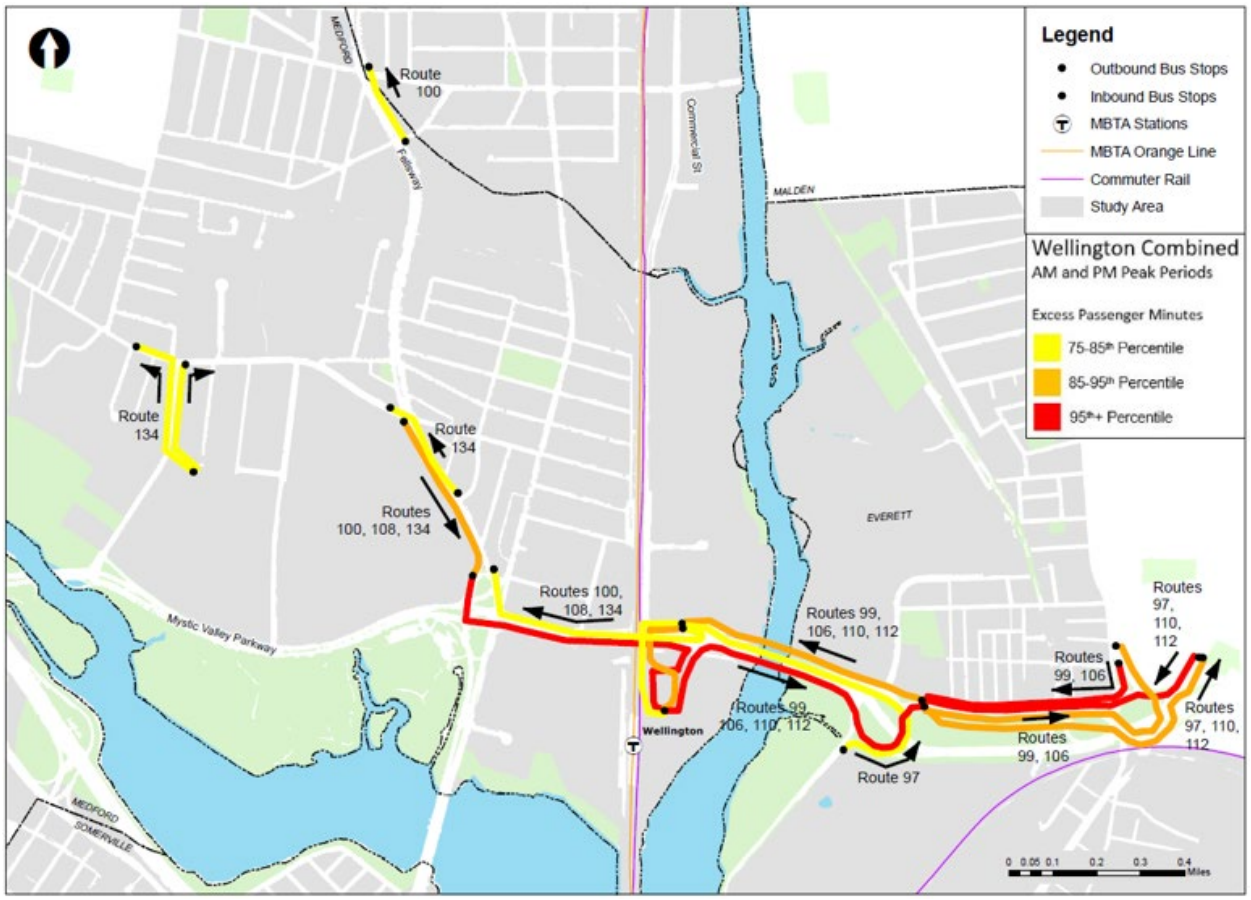
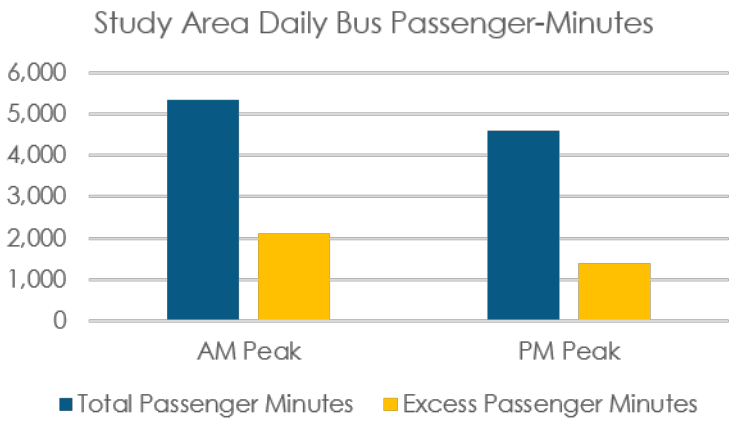


Figure 2.6-6 compares the total passenger minutes to excess passenger minutes experienced by bus riders on weekdays within the study area at both the morning and evening peak periods. Approximately 40% of total bus passenger travel time is excess during morning peak service hours, while about 30% in the evening.

Figure 2.6-6: Daily Bus Passenger-Minutes



2.7 Origin-Destination Data Analysis

To determine the travel patterns of Wellington Circle and its surrounding areas, origin-destination data was analyzed. This data comes from Location-Based Services (LBS), which provide anonymized device locations and can show point-to-point trip data or can be generalized into “analysis zones.” This section briefly summarizes the results of the Wellington Circle Origin-Destination Data Analysis. Additional information, including the full analysis, can be found in Appendix F.

The AM peak origin-destination locations for Wellington Circle are depicted in Figure 2.7-1 and summarized in Figure 2.7-2. These show that:

- The majority of trips through Wellington Circle (60%) during the AM Peak period originate in the local communities of Medford, Everett, Malden, Somerville, and Melrose.
- Twenty-two percent of the AM Peak trips through Wellington Circle begin and end in these five local communities.
- Approximately 40% of the AM peak trips through Wellington Circle are destined for Cambridge or Boston. Of these 40% of the AM peak trips, more than two-third of the trips are from the local communities of Medford, Everett, Malden, Somerville, and Melrose, with only 12% of the trips originating in other communities.

Figure 2.7-1: AM Peak Origin-Destination Locations

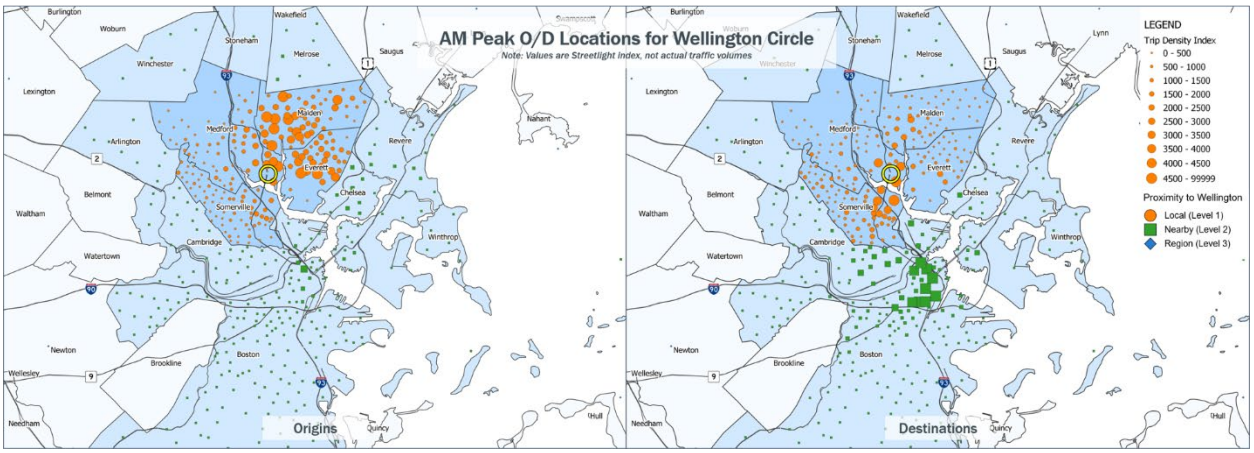


Figure 2.7-2: AM Peak Origin-Destination Trip Proportions Through Wellington Circle

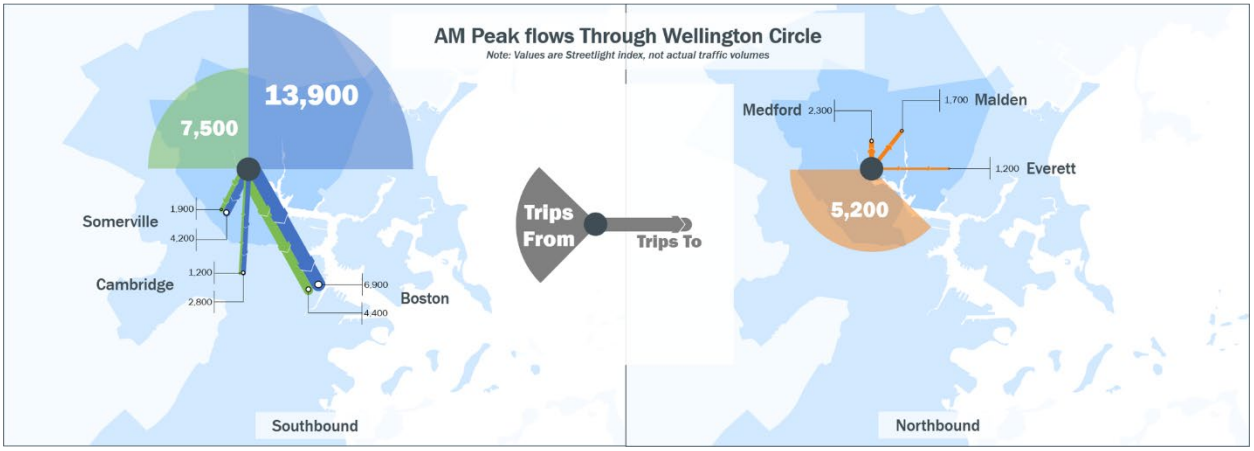
AM PEAK	Everett	Malden	Medford	Melrose	Somerville	Cambridge	Boston	Other	Total
Everett	21.8%					27.0%		11.3%	60.0%
Malden									
Medford									
Melrose									
Somerville									
Cambridge	5.7%					0.8%		1.5%	8.0%
Boston									
Other	13.3%					11.9%		6.8%	32.0%
Total	40.8%					39.7%		19.6%	100%

2.7.1 Predominant Movements

The predominant movement through Wellington Circle is a north/northeast to south travel pattern, with major movements consisting of Medford-Malden-Everett to/from Somerville-Cambridge-Boston, as shown in Figure 2.7-3. Of the seven major approaches to Wellington Circle:

- Fellsway Bridge over Mystic River – Similar patterns to overall circle patterns, captures north-south movements.
- Mystic Valley Parkway (Route 16) – Minor east-west movements serve mostly Medford to/from Everett.
- Riverside Avenue – Predominantly local movements, minor impact on circle.
- Fellsway North of Riverside – Serves Medford-Malden to/from Boston and local trips.
- Middlesex Avenue & Rivers Edge (north of Route 16) – Both serve trips on each side of the Orange line to/from Boston.
- Revere Beach Parkway – east-west movements and east-west to north-south over Mystic River.

Figure 2.7-3: AM Peak Flows Through Wellington Circle



The evaluation of existing and future conditions in Wellington Circle was used to inform the development of potential improvement concepts and, eventually, alternatives to address the issues and opportunities presented in this chapter. The process for identifying potential improvement options and refining them into alternatives is discussed in the following Chapter 3.