Transportation in Boston

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Introduction

This report identifies sources for transportation data by mode, and documents major trends in active transportation, public transportation, automobile travel, and freight. It covers ridership and utilization, costs and investments, and future developments. Exploring the transportation data sources available for local and regional analysis, this report combines data from the U.S. Census Bureau, Federal Highway Administration, Massachusetts Bay Transportation Authority (MBTA), Bluebikes, and several others, offering an in-depth look at the factors influencing transportation patterns at the individual, municipal, and regional levels.

The Boston transportation system offers a variety of travel choices for passenger and freight transit. Every day, millions of passengers choose to use MBTA-operated services, such as the subway, bus, commuter rail, and ferry, to get in and around Boston. Aside from public transit, driving is a highly utilized form of transportation in the city. Ride-sharing, ride-hailing, and autonomous vehicles are altering the automobile industry. Cheaper, more environmentally friendly alternatives to driving are biking and walking. In addition to passenger transit, the Boston transportation system supports freight transit. The Massachusetts Port Authority (MassPort) operates the Port of Boston and Logan International Airport, the state's major air and sea transportation centers. For the movement of both people and freight, Boston's transportation system is growing and adapting to be more efficient, safe, sustainable, and secure.

Photo Credit: Elizabeth Trauger, Red Line Car at Charles / MGH Station, BPDA Research Division, 2019.

Commute Patterns

Boston is the economic center of Massachusetts, home to 10 percent of the state's population and 18 percent of the state's jobs.[1] Thousands of individuals travel into, within, and out of Boston each workday. In 2015, 28 percent of the people who worked in Boston also lived in Boston, while the remaining 72 percent commuted into the city from the surrounding communities.[2] Among Bostonians, 55 percent worked in the city, while 45 percent "reverse-commuted" out to the surrounding metropolitan region. Altogether, Boston experienced a net inflow of 280,400 workers each weekday.

Commuters into Boston come primarily from the metropolitan region within I-95, where I-90 and I-93 provide easy access to Boston, as seen on Map 1. Many of these commuters live in towns located along MBTA rapid transit lines, including Revere and Chelsea along the Blue Line; Malden and Somerville along the Orange Line; Quincy, Braintree, Cambridge, and Somerville along the Red Line; and Newton and Brookline along the Green Line. Other common home locations for employees who work in Boston are towns located along MBTA commuter rail lines.

Residents commuting out of Boston work at jobs concentrated within the surrounding suburbs and along I-95, as seen on Map 2. Cambridge, Newton, Waltham, Brookline, and Quincy are the top five places of work for Boston residents commuting out of the city.

TABLE 1

Top Home and Work Locations for Payroll Workers, 2015

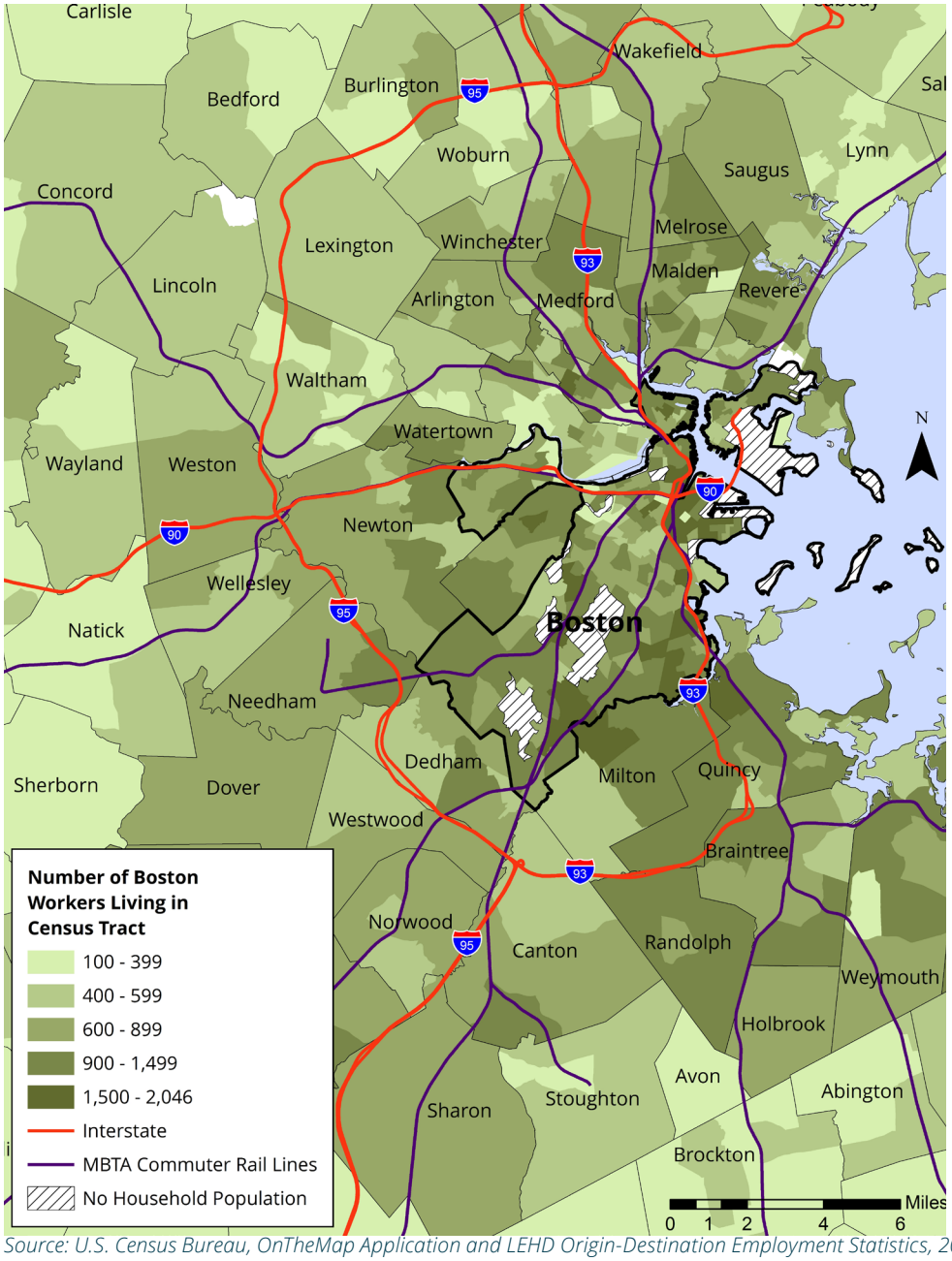
Top Home Locations for Employees Who Work in Boston			Top Work Locations for Employees Who Live in Boston		
	Count	Share		Count	Share
Boston	160,525	28.0%	Boston	160,525	54.8%
Quincy	18,449	3.2%	Cambridge	18,679	6.4%
Cambridge	17,818	3.1%	Newton	9,056	3.1%
Somerville	14,450	2.5%	Waltham	6,556	2.2%
Brookline	13,778	2.4%	Quincy	5,253	1.8%
Newton	12,895	2.2%	Brookline	5,148	1.8%
Malden	9,510	1.7%	Somerville	3,681	1.3%
Medford	8,785	1.5%	Braintree Town	3,037	1.0%
Revere	8,456	1.5%	Burlington	2,970	1.0%
Lynn	7,561	1.3%	Framingham	2,757	0.9%
All Other Locations	301,198	52.5%	All Other Locations	75,333	25.7%
Total	**573,435**	**100.0%**	**Total**	**292,995**	**100.0%**

Note: Primary Payroll Jobs Only, 2015,
Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics, 2015, BPDA Research Division Analysis.

Data in Map 1 show the place of residence for those who work in Boston. People who work in Boston are more likely to live in the surrounding suburbs, and commute in using the regional transportation network.

MAP 1

Place of Residence for Boston Workers, 2015

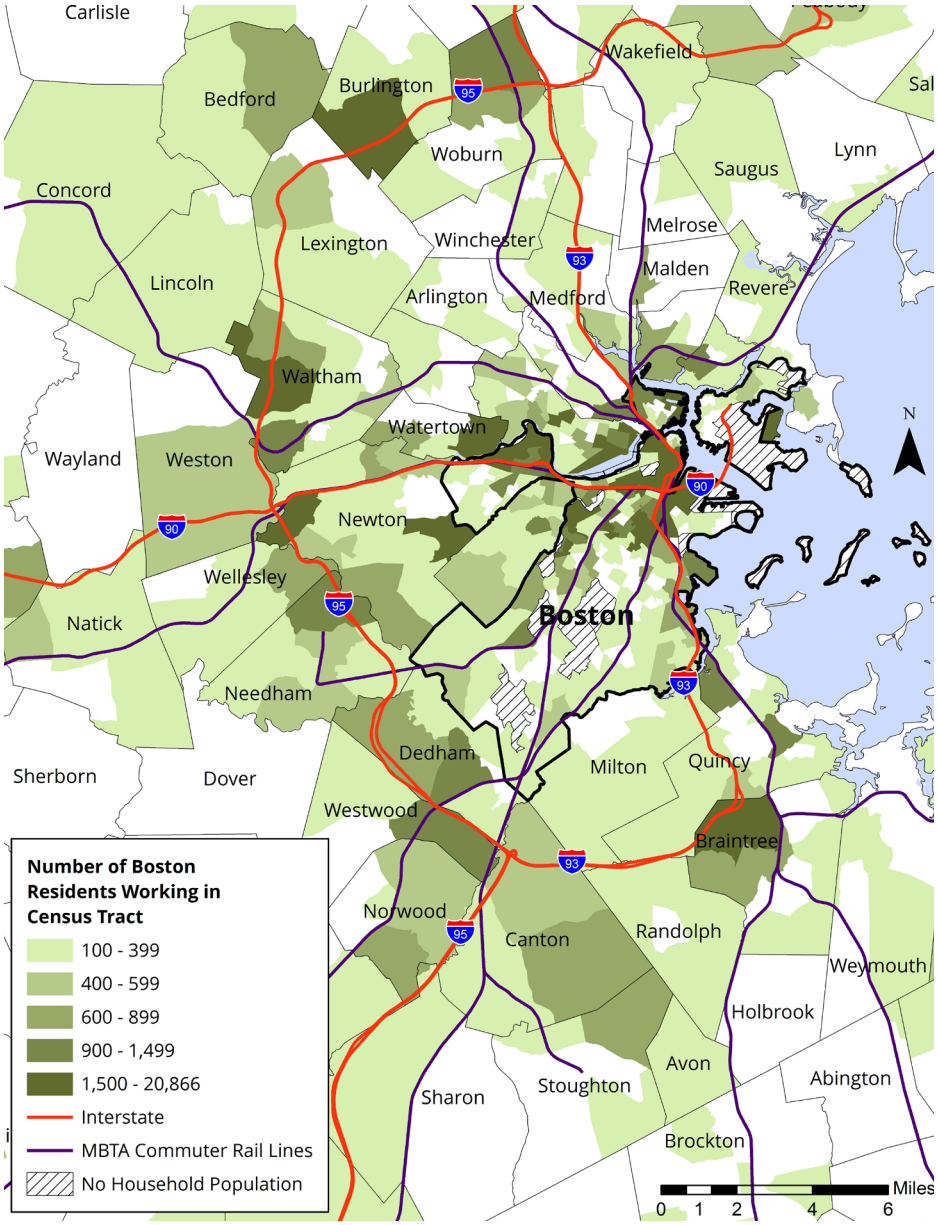


Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics, 2015. BPDA Research Division Analysis.

Data in Map 2 show the place of work for Boston residents. Little more than half of people who live in Boston work in the city. The other half commute to select suburbs that are accessbile from the regional transportation network and have large number of jobs.

MAP 2

Place of Work for Boston Residents, 2015



Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics, 2015. BPDA Research Division Analysis.

Characteristics of Commuters by Mode of Travel

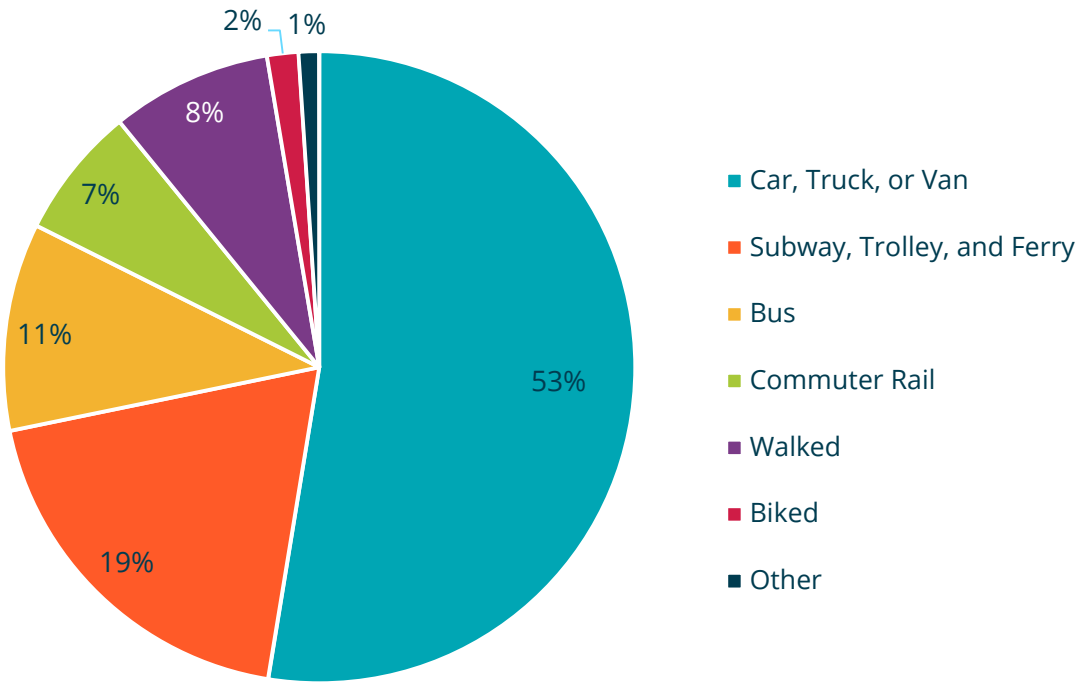
The following sections provide demographic characteristics for Boston residents and workers employed in Boston, who commute into the city.[3] Since trips to non-work destinations are not accounted for, the data describe only a fraction of trips made within Boston.

Of the 724,500 people who live in Boston or work in Suffolk County, approximately 53 percent travel to work by automobile, while 37 percent travel by public transportation, including 19 percent by subway, 11 percent by bus, and 7 percent by commuter rail, as seen in Figure 1.[4] (Note that while some workers use multiple modes of transportation for their commute, these data only account for their dominant mode.) 10 percent are "active commuters," with 8 percent walking and 2 percent biking.

Since 2009, the share of people who commute by car has decreased by 1.8 percentage points, while the share of people who commute by bus has increased by 0.8 percentage points. The share of people traveling by other modes has remained fairly constant over the past eight years.

FIGURE 1

Commute Mode for Boston Residents and Workers in Boston

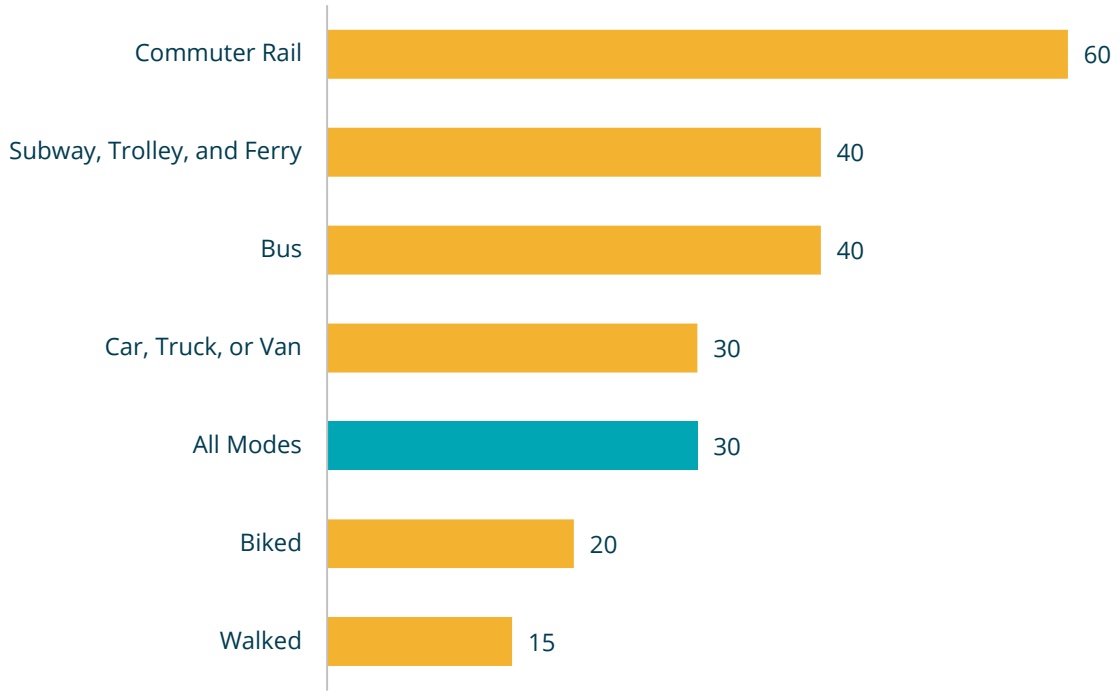


Source: U.S. Census Bureau, ACS Five-Year Estimates, PUMS, 2013-2017, BPDA Research Division Analysis.

As noted in Figure 2, the median commute time for workers who live and/or work in Boston is approximately thirty minutes, which is seven minutes longer than the national median.[5] Workers who take the commuter rail have the longest median commute time at sixty minutes, while those who walk have the shortest at fifteen minutes. With the exception of the commuter rail, the MBTA's other services, including the bus, subway, trolley and ferry, take workers 40 minutes to travel to work. Since 2009, the share of workers whose commutes take over 45 minutes has increased from 34 percent to 39 percent; but the median commute time has remained fairly constant over the past eight years.

FIGURE 2

Median Commute Time in Minutes by Mode for Workers Who Live and/or Work in Boston



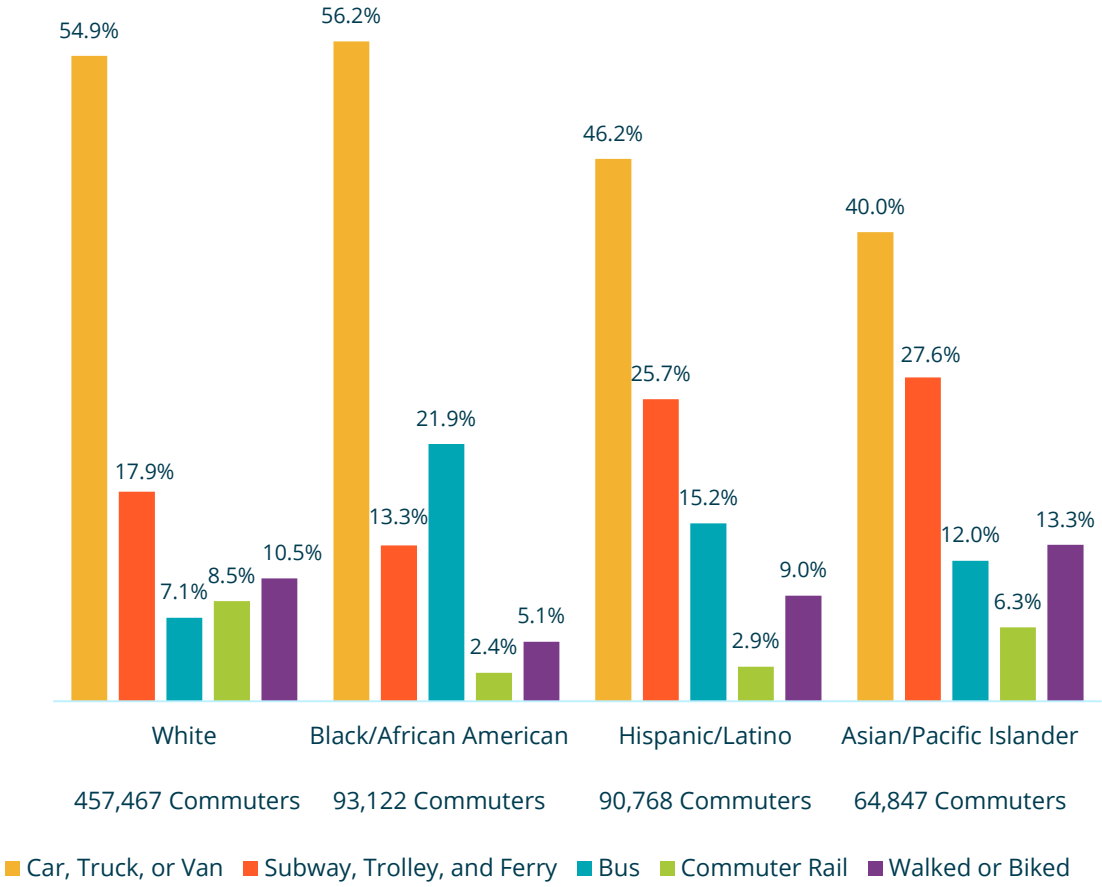
Source: U.S. Census Bureau, ACS Five-Year Estimates, PUMS, 2013-2017, BPDA Research Division Analysis.

Demographics of Commuters by Mode of Travel

Transportation and employment options often vary across neighborhoods which affects populations differently; as a result, transportation modes are utilized at different rates by different racial and ethnic communities. For instance, Black or African American workers make up 13 percent of the total workers living and/or working in Boston but comprise 27 percent of workers commuting by bus. Meanwhile, 63 percent of the workers living and/or working in Boston are White, but 80 percent of those traveling by commuter rail are White. As Figure 3 shows, across all races, traveling by car is the most common, while traveling by commuter rail is the least common.

FIGURE 3

Share of Workers of Each Race/Ethnicity Commuting by Mode for Workers Who Live and/or Work in Boston

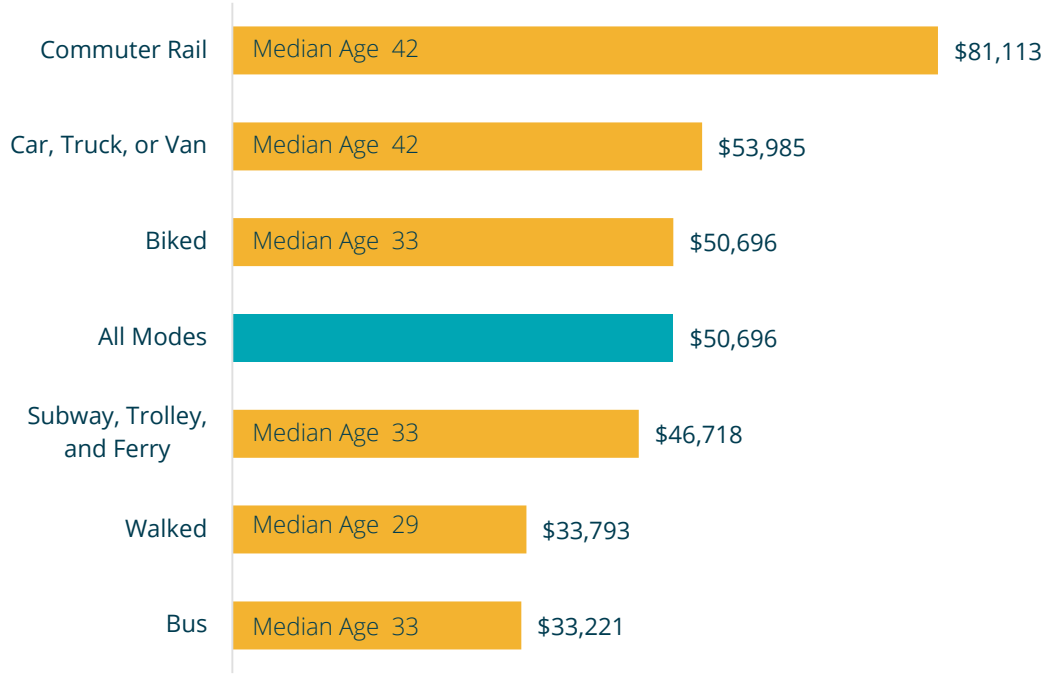


Source: U.S. Census Bureau, ACS Five-Year Estimates, PUMS, 2013-2017, BPDA Research Division Analysis.

Income and age are also associated with different transportation modes. Workers who live and/or work in Boston and take the commuter rail have the highest median age at 42 years and highest median income at $81,113. Workers who walk have the lowest median age at 29 years. Buses serve workers with the lowest median income at $33,221. Workers who drive have a median income of $53,985.

FIGURE 4

Median Earnings by Commute Mode for Workers who Live and/or Work in Boston, 2017



Source: U.S. Census Bureau, ACS Five-Year Estimates, PUMS, 2013-2017, BPDA Research Division Analysis.

The following sections take an in-depth look at active transportation (walking and biking), public transportation, automobiles, and freight. Each section will describe the trends associated with demographics, utilization and ridership, and future projections.

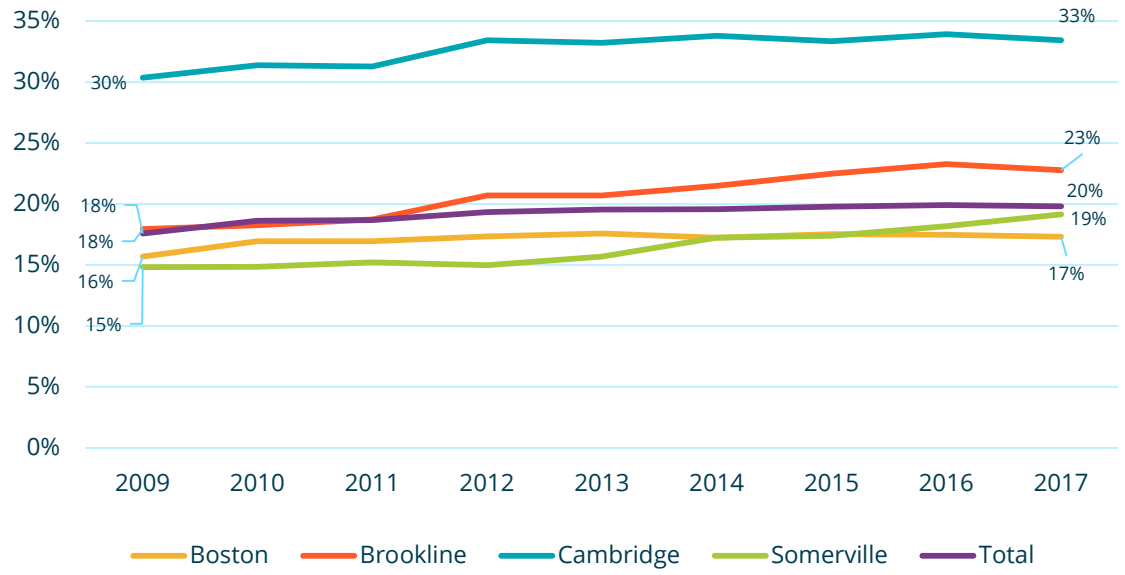
ACTIVE TRANSPORTATION

Active transportation, particularly biking and walking, is becoming an appealing alternative to congested roadways and public transit. Active transportation has a significantly smaller environmental impact and frequently costs less than other transportation options. Boston has always been a highly walkable city due to its density. Within this decade, the city has made significant improvements to the bicycle infrastructure, including installing an extensive bike share system called Bluebikes. The Bluebikes partnership, starting in 2011, has expanded to include Brookline, Cambridge, and Somerville. These cities, in addition to Boston, make up the Bluebikes Service Area and are the geographic focus of this section.

In the Bluebikes Service Area, about 20 percent of employed residents over the age of sixteen bike or walk to work. Walking is more common than biking, accounting for 16.5 percent of commuters, while biking accounts for only 3.4 percent of commuters. Residents in Cambridge bike and walk far more frequently than residents in Boston, Brookline, or Somerville, though the share of active commuters rose in all four communities since 2009. As seen in Table 2, walking is significantly more common than biking in every municipality.

FIGURE 5

Percent of Commuters Biking or Walking to Work, 2009-2017



Source: U.S. Census Bureau, ACS Five-Year Estimates, 2009 to 2017.

As part of Vision Zero Boston, an initiative focused on eliminating traffic fatalities by 2030, Boston has committed to implementing comfortable and safe bike lanes across the city. The different types of bike lanes in Boston include buffered bike lanes, which provide space between bicyclists and parked vehicles; separate bike lanes, which offer vertical separation between bicyclists and cars; and contraflow bike lanes, which allow people to bike in both directions on one-way streets.[6] Other bike lane design elements include buffers, offset intersections, bike signals, intersection conflict markings, bike boxes, and two-stage turn boxes.[7]

The Bluebikes Service Area is one of the most pedestrian-commuter friendly regions in the nation. Cambridge ranks first in the nation among cities with populations over 30,000 for share of pedestrian commuters, while Brookline and Boston also rank among the top ten. Boston's pedestrian commuter share is the highest among the largest cities in the country, with Washington, D.C. ranked second, though Boston falls behind Washington, D.C. for biking and walking, combined. Table 2 gives the number and share of active commuters in the Bluebikes service area.

TABLE 2

Bike and Pedestrian Commuters in Bluebikes Service Area, 2017

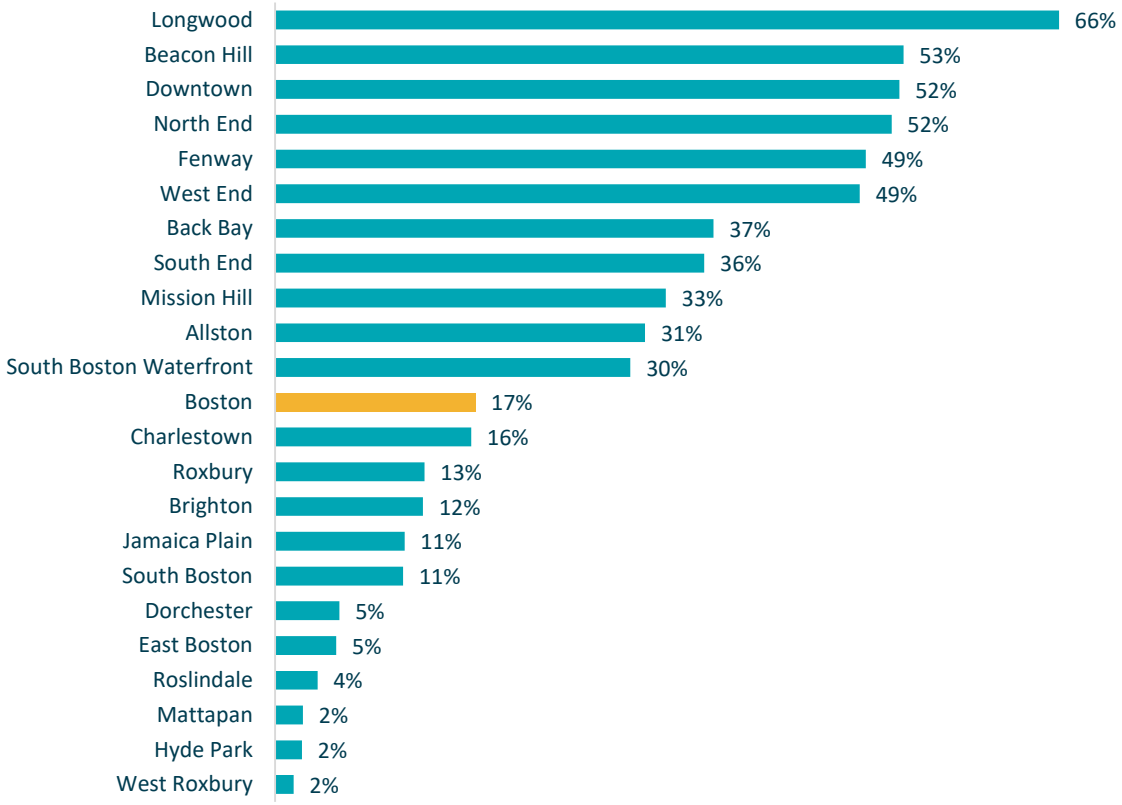
	Boston		Brookline		Cambridge		Somerville		Total	
Walk	52,237	15%	5,284	17%	15,341	26%	6,040	12%	78,902	16%
Bike	7,539	2%	1,601	5%	4,424	7%	3,631	7%	17,195	4%
Total Active Transportation	59,776	17%	6,885	23%	19,765	33%	9,671	19%	96,097	20%

Source: U.S. Census Bureau, 2013-2017 American Community Survey, BPDA Research Division Analysis.

On a neighborhood scale, Longwood has the highest percentage of commuters who walk or bike to work at 66 percent, while West Roxbury has the lowest percentage at two percent, as seen in Figure 6. Eight of Boston's neighborhoods have higher proportions of active commuters than Cambridge, while eleven of the neighborhoods have higher proportions than Brookline and Somerville.

FIGURE 6

Percent of Commuters Biking or Walking to Work by Neighborhood, 2017

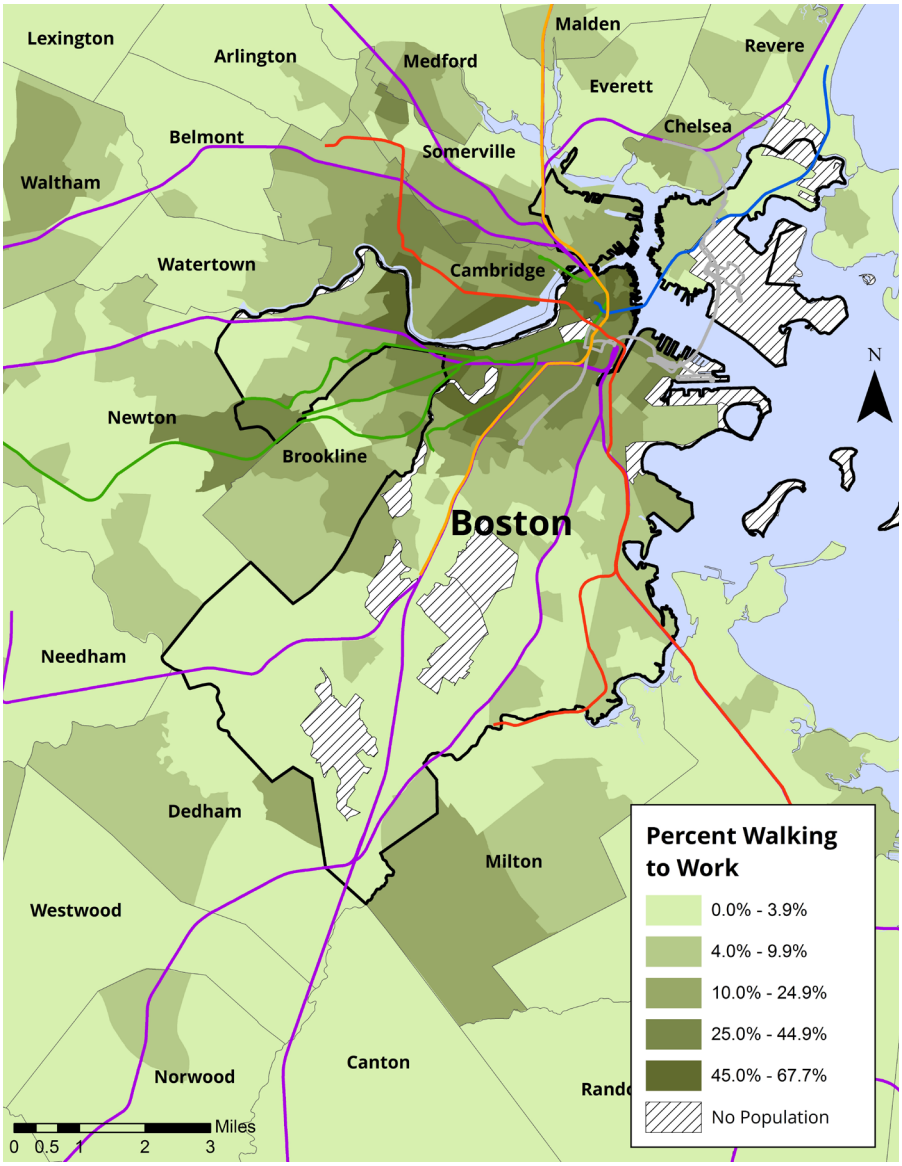


Source: U.S. Census Bureau, ACS Five-Year Estimates, 2013-2017, BPDA Research Division Analysis.

Map 3 shows pedestrian commuters are concentrated in the North End, Downtown, Beacon Hill, Back Bay, Fenway, and Longwood Medical Area, and around Harvard University and the Massachusetts Institute of Technology in Cambridge. There is also a large share of pedestrian commuters around Boston College in Brighton.

MAP 3

Share of Commuters Walking to Work by Census Tract, 2013-2017

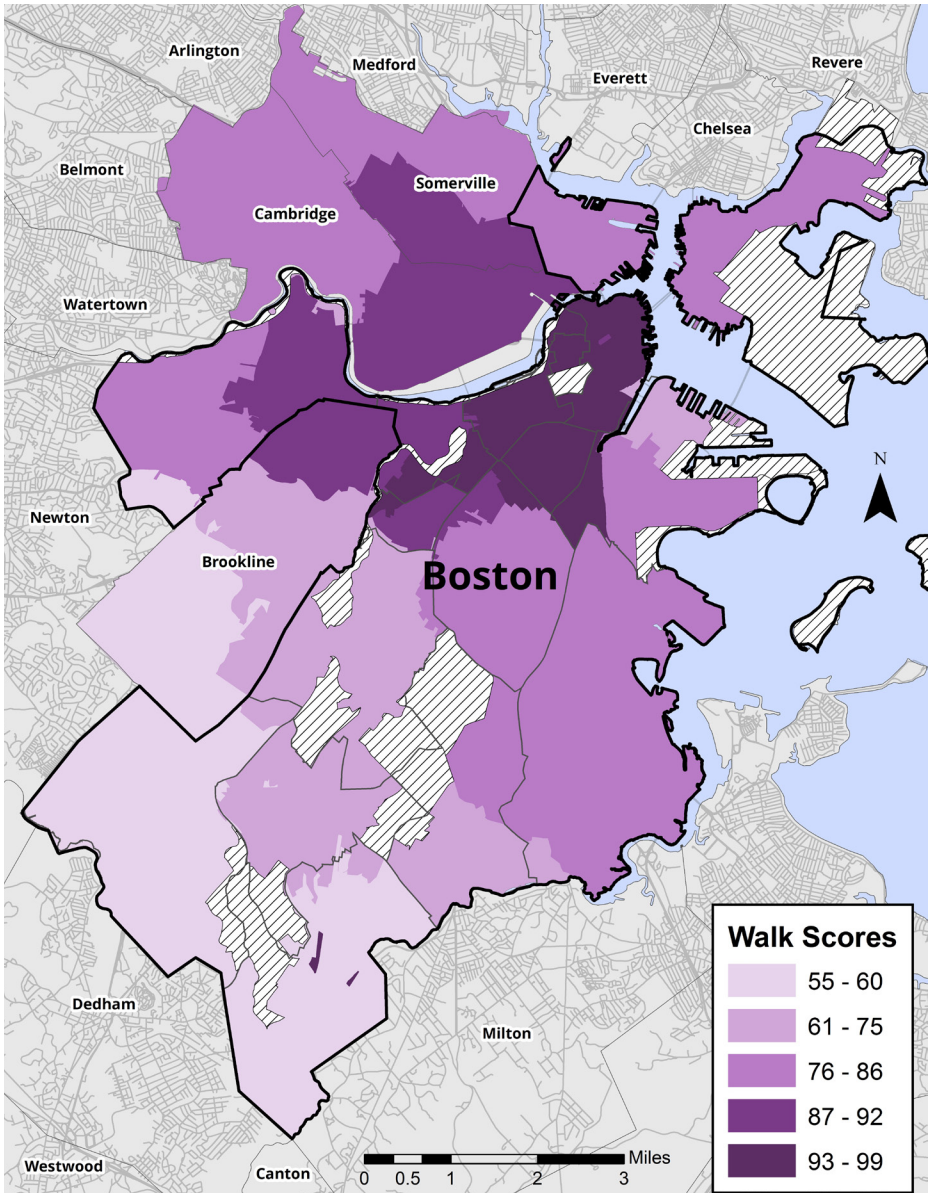


Source: U.S. Census Bureau, 2013-2017 American Community Survey, BPDA Research Division Analysis.

Walk Score is an index assigned to a neighborhood, zip code, or city, used to describe how easy it is to walk to important amenities like public transportation and grocery stores. Map 4 shows that the most walkable zip codes in greater Boston are located Downtown, due to the high density of offices, restaurants, and shopping centers. Neighborhoods located farther from downtown are less walkable, due to their lower density.

MAP 4

Walk Scores in Boston, Brookline, Cambridge, and Somerville, 2017

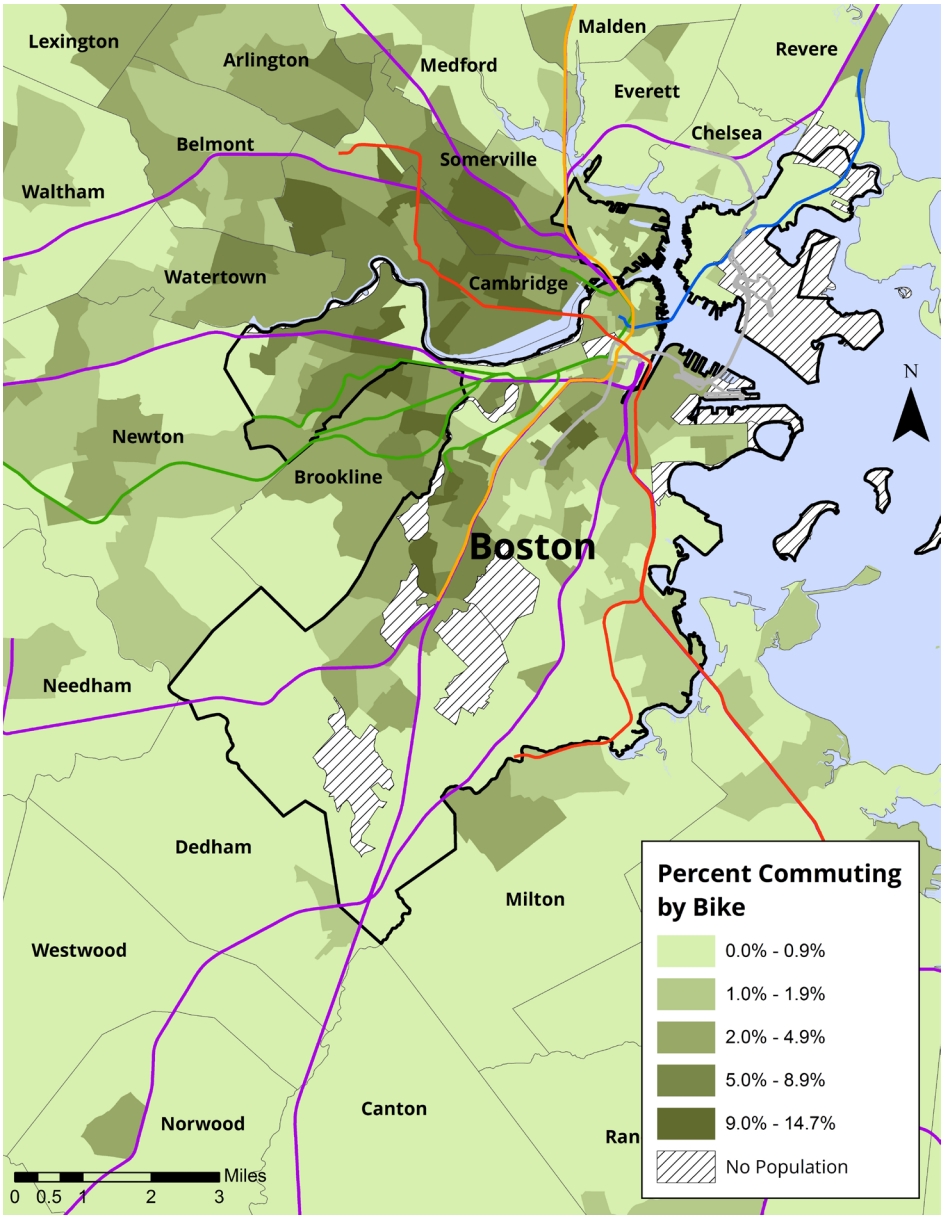


Source: WalkScore at walkscore.com. Data provided by Redfin Real Estate in Boston, Redfin.com.

Map 5 shows bike commuters generally reside in Cambridge, Somerville, and North Brookline, rather than Boston. Census tracts along the Southwest Corridor Park, a high-quality bike facility which stretches from the South End to Jamaica Plain above the Orange Line, have the highest shares of bike commuters in Boston.

MAP 5

Share of Commuters Biking to Work by Census Tract, 2013-2017



Source: U.S. Census Bureau, 2013-2017 American Community Survey, BPDA Research Division Analysis.

Micro-mobility

In recent years, micro-mobility options have begun to change the way that people move from place to place. Micro-mobility is defined as shared vehicles weighing less than 500 kg, that are either electric or human-powered, and with limited speed ranges. These vehicles are designed to occupy bicycle lanes or space alongside bicycles. Generally, the most popular micro-mobility vehicles are shared bicycles and e-scooters.[8] Micro-mobility services are designed to better connect people with public transit and make current transportation networks and infrastructure more efficient. They have the potential to improve congestion issues by replacing automobile usage for short trips, lower carbon emissions and improve air quality, and solve uneven access to transit. Some current issues with the micro-mobility industry include vandalism or theft of vehicles, difficulty in enforcing company or government policies related to safety and parking at an individual level, and the lack of access to vehicles by people with certain disabilities.[9]

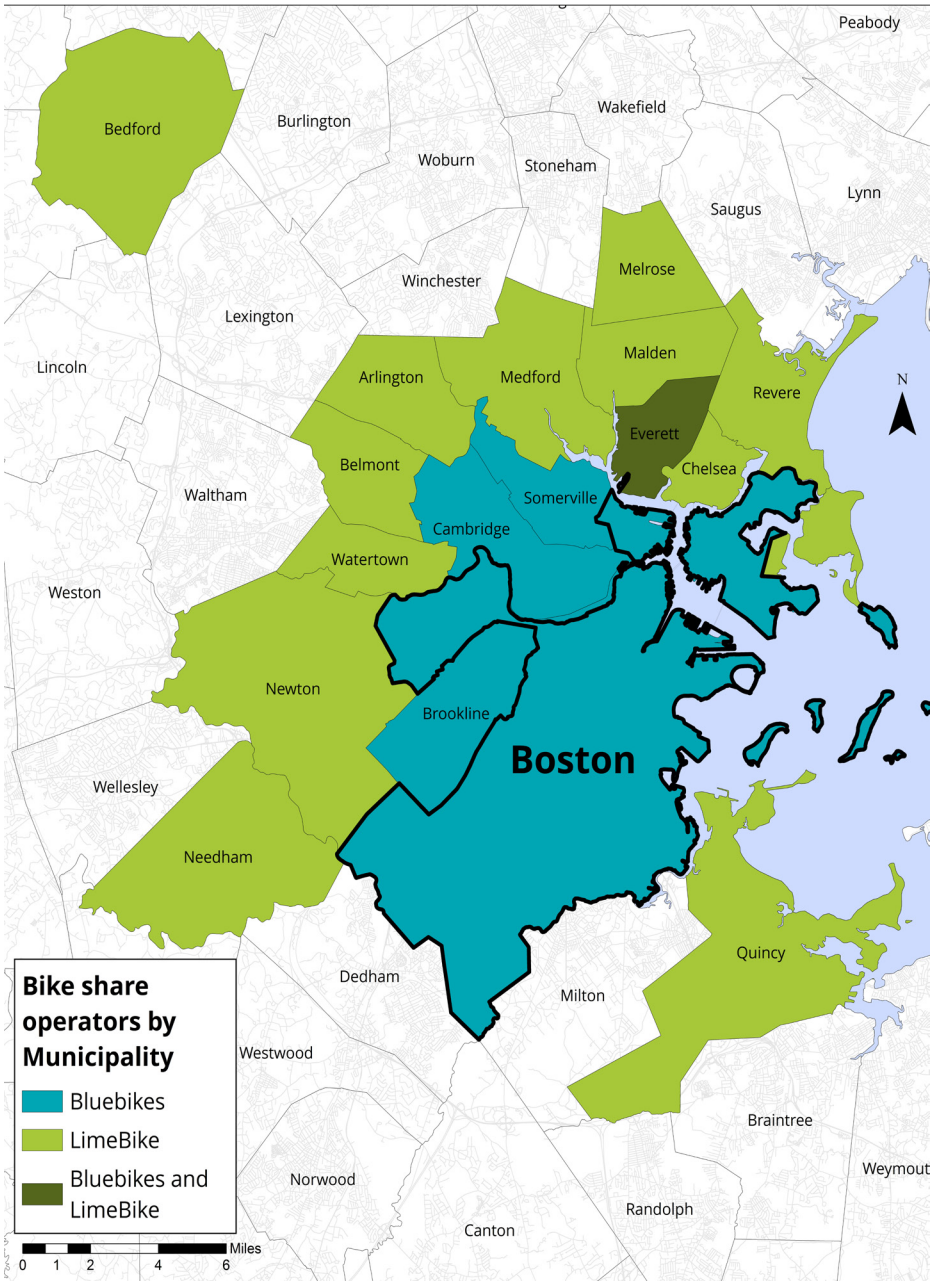
Bike Sharing

In 2011, the City of Boston started a partnership with its municipal partners to bring Hubway, now known as Bluebikes, to the region. After launching with 60 stations in Boston, the public bike share system expanded to Brookline, Cambridge and Somerville. Today, Bluebikes is an integral part of the Metro region's public transportation system. Riders have taken more than 10 million trips on Bluebikes, and the system has grown to 325 stations and more than 3,000 bikes.

In 2018, the Metropolitan Area Planning Council selected LimeBike to provide dockless bike share service in 15 municipalities not served by Bluebikes. LimeBike currently operates in 14 municipalities. Map 6 below shows the counties in which the bike shares operate.

MAP 6

Bike Share Operators by Municipality, 2019



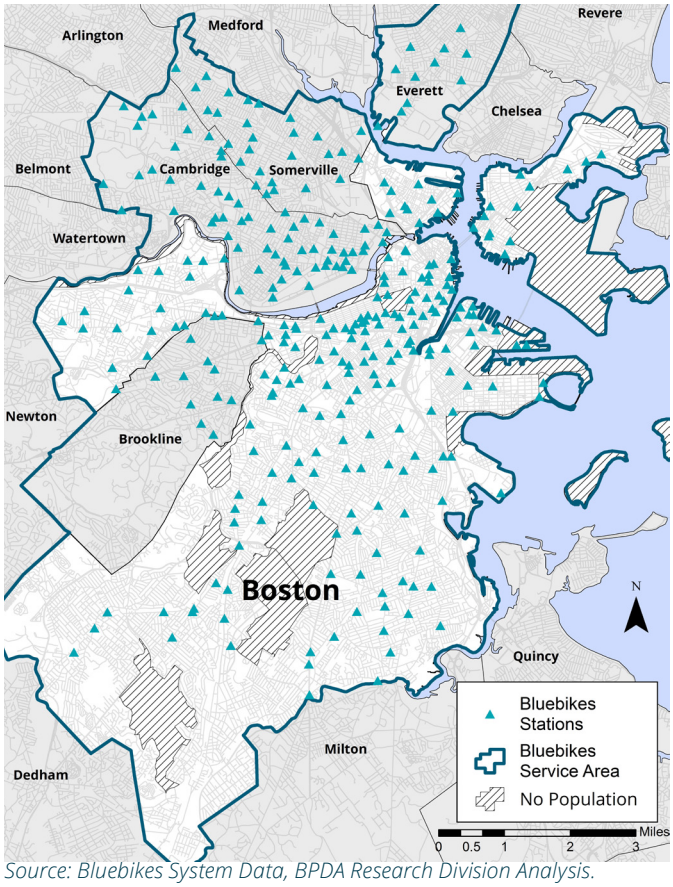
Source: MAPC, Mass GIS, Mass DOT, BPDA Research Division, 2019.

Bluebikes

Bluebikes is public transportation by bicycle. Owned and jointly governed by the municipalities of Boston, Brookline, Everett, Cambridge, and Somerville, Bluebikes offers a convenient and affordable transportation option. Bluebikes is sponsored by Blue Cross Blue Shield of Massachusetts and operated by Motivate Massachusetts. Bluebikes utilizes a station-based docking system as shown in Map 7. Docked bikes provide predictability to users, ensure equitable distribution of bikes and docks, and helps municipalities maintain an orderly public right of way. Stations are located throughout the five municipalities providing access to residential, commercial and recreational destinations.

MAP 7

Bluebikes Stations and Service Area, 2017



Source: Bluebikes System Data, BPDA Research Division Analysis.

Bluebikes provides a range of options to commuters: single, thirty-minute rides for $2.50, daily adventure passes for $10.00, and annual memberships for $99.00.[10] Bluebikes also provides monthly memberships, group membership programs, and reduced-fare membership for income-eligible riders.

In 2017, the Bluebikes fleet included 1,800 bikes dispersed among 190 stations.[11] In 2018, launched the largest expansion to date. Today Bluebikes has 325 stations and more than 3,500 bikes with approximatley 18 docks per station.[12] There are 213 Bluebikes docking stations in Boston, and one station per 4.4 square miles in Boston.

In 2017, 1.3 million rides were tracked across the four municipalities, accounting for over 2.4 million miles. More specifically, residents in Boston took approximately twenty Bluebikes trips per 1,000 residents, with four daily trips per bike.

Cambridge, and neighborhoods of Boston including Downtown, Chinatown, Back Bay and the South Boston Waterfront saw frequent ridership throughout the day in 2017. Outlying neighborhoods experience lower ridership during the day, but often see heavy use during AM and PM peak commutes.

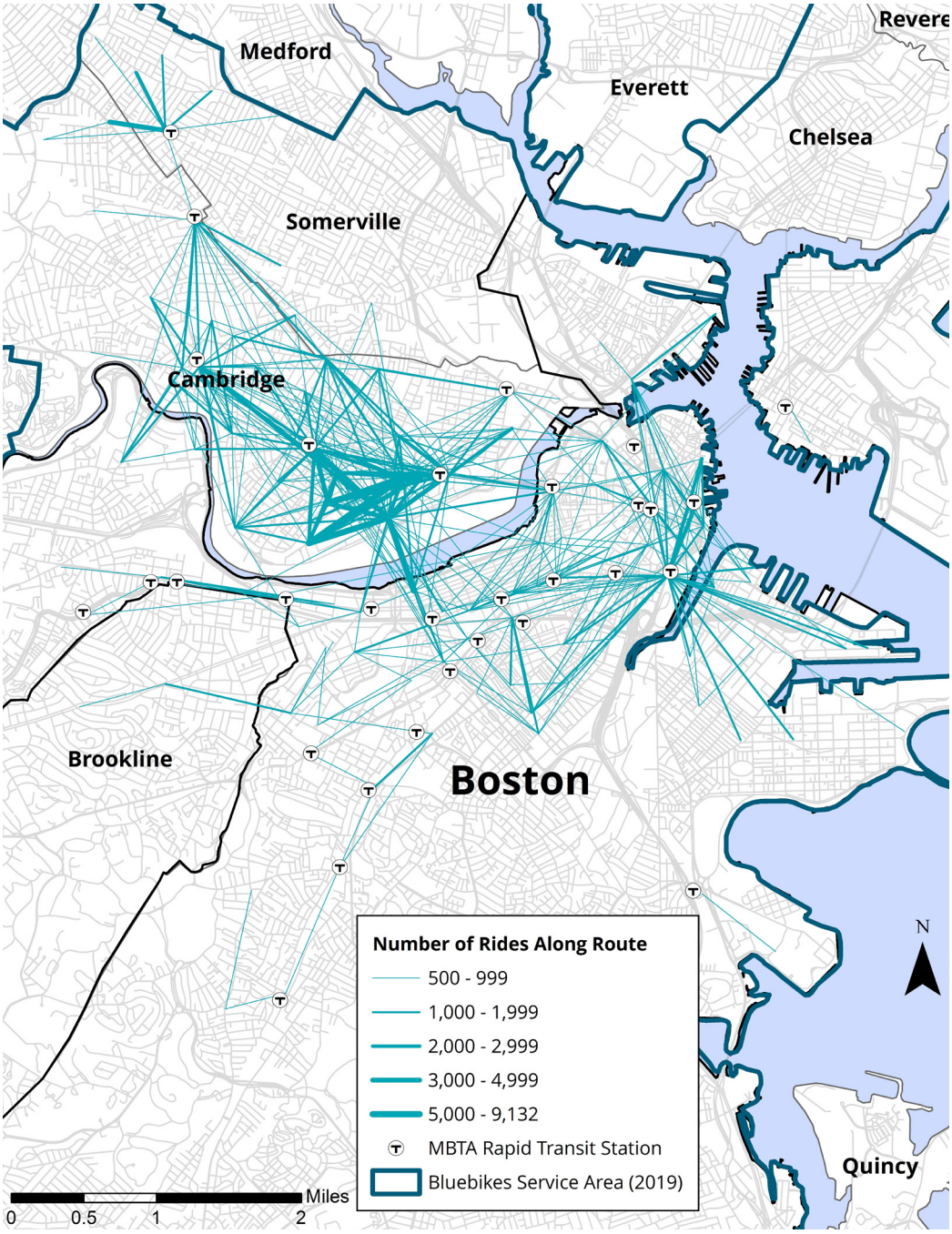
About a third of the docking stations are located within 500 feet of a T station, allowing riders to combine rapid transit with biking during their commutes. In 2017, 58 percent of rides began or ended at a rapid-transit station, 28 percent of which were during rush hour.

Regardless of the time of day, rides in Boston and Somerville begin or end at MBTA Stations more frequently than rides in Cambridge. A potentail explanation is that Cambridge has extensive bicycling infrastructure and it is easy for a rider to complete a trip using only a Bluebike. Whereas, in Boston and Somerville, the Bluebikes network serves as a complement to the MBTA.

Photo credit: Bluebikes dock, Charlestown, BPDA Research Division, 2018.

MAP 8

Bluebikes Ride Origins and Destinations, MBTA Stations, 2017

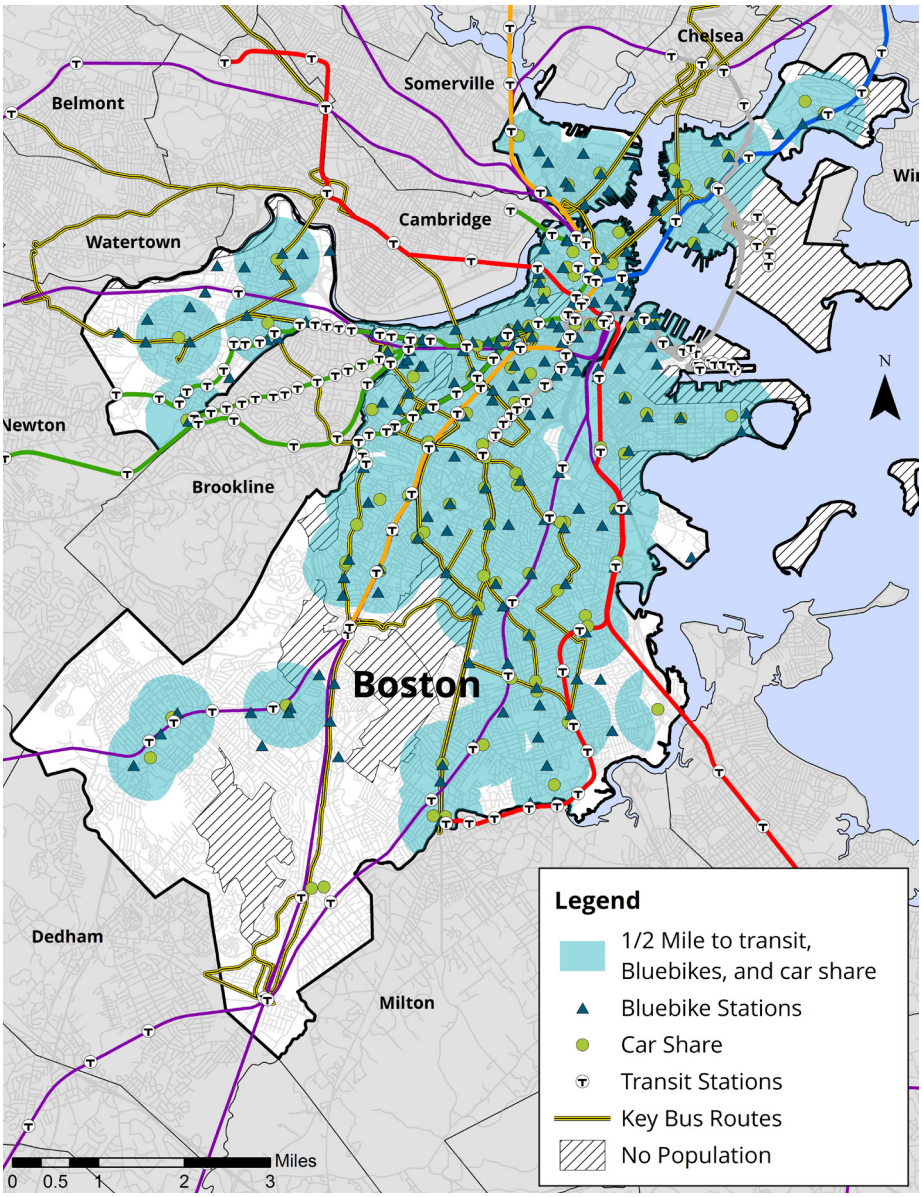


Source: Bluebikes System Data, BPDA Research Division Analysis.

Throughout the city, public transit stations are located in close proximity to car-sharing services and Bluebikes stations. As seen in Map 9, the majority of Boston's population is within 0.5 miles to rail, subway, or key bus routes, and car-share and bikeshare vehicles. This offers commuters options for getting where they want to go, and allows people to quickly connect between different modes of transportation.

MAP 9

Multimodal Transit Accessibility 0.5 mile Walkshed, September 2019.



Source: BTD, MBTA, Bluebikes, ZipCar, MA DOT BPDA Research Division, 2019.

E-Scooters

While micro-mobility companies that provide shared bikes such as Bluebikes and Lime Bike are currently operating in the Boston region, efforts to introduce e-scooters in Boston and other Massachusetts cities have been more difficult. This is largely because e-scooters are technically illegal in Massachusetts under a law that was originally aimed at mopeds, requiring powered scooters to have brake lights and turn signals - something that most rental e-scooters do not have.[13]

Some Massachusetts cities, such as Brookline and Salem, have been working to set regulations for the industry and introduce legal e-scooters through pilot programs. Brookline's e-scooter pilot program is taking place from April to November 2019 and has introduced over 200 e-scooters provided by companies Lime and Bird to the city's streets.[14] The city of Salem plans to pilot e-scooters through its Ride Salem's scooter program beginning in the spring of 2020.[15]

In Boston, the city council passed an ordinance in March 2019 to establish regulations for the growing industry. This ordinance creates a licensing system for e-scooter companies wishing to enter the Boston market, sets standards and fees for such companies, and establishes an advisory committee, all while giving the Boston Transportation Department jurisdiction. Effectively, this ordinance opens up the possibility for issuing licenses for pilot programs to companies that are able to meet the ordinance's standards for safety.[16]

Photo credit: Elizabeth Trauger, Coolidge Corner, BPDA Research Division, 2019.

Active Transportation Projects and Funding

In 2017, 15 percent of Boston's residents walked and two percent biked during their commutes.[17] [18] According to Go Boston 2030, Boston aspires to increase the citywide average share of those walking to twenty-one percent and those biking to eight percent, while also ensuring that every household is within a five minute walk of a protected bike facility or shared path.[19] The goals of each neighborhood differ based on existing percentages. The FY 2019-2023 Boston Capital Plan allocates funding to a number of projects and policies described in Go Boston 2030. In collaboration with state and federal resources, Boston will invest $967 million over the next five years in furthering initiatives featured in Go Boston 2030.[20] Many of these projects have already been implemented under Vision Zero. About $18.9 million is expected to be invested in Vision Zero through FY 2023, with $3.9 million projected from the Capital Plan. Go Boston 2030 also suggests that $3.1 million will need to be allocated annually for the design and construction of Vision Zero Corridors and Neighborhood Slow Streets, an initiative that focuses on design and construction for slower traffic in selected districts. The Capital Plan's investment in Neighborhood Slow Streets for FY 2019 supports the transformation of North Square ($950,000), New England Avenue ($400,000), and Boylston Street ($500,000).

In FY 2019, $1.25 million was invested in the Strategic Bicycle Network, an initiative to construct 15 miles of new protected bike lanes over the next four years. $1.75 million was invested in Walkable Streets, an initiative that focuses on sidewalk improvements. The Capital Plan will also allocate for investments in Green Links, an initiative that connects parks and paths for walkers and bikers.[21]

In addition to the Boston Capital Plan, the Massachusetts Department of Transportation's 2019 to 2023 Capital Investment Plan proposes $180.6 million for the design and construction of statewide active transportation initiatives over the next five years. Additionally, $60 million will be dedicated to planning efforts focused on the safety, accessibility, and maintenance of facilities for pedestrians and bicyclists.[22]

Boston also expects further investments with Bluebikes. In 2011, the bike-sharing program was funded by $4.5 million in grants from the Federal Transit Administration ($3 million), the Boston Public Health Commission ($450,000), and the Metropolitan Planning Organization's Congestion Mitigation and Air Quality (CMAQ) Grant Program ($250,000).[23] Eleven corporate sponsorships were secured for $1.5 million over the following three years, with $600,000 from New Balance. In March 2018, Hubway announced a six-year sponsorship with Blue Cross Blue Shield of Massachusetts (BCBS). The BCBS sponsorship will pay $18 million to rebrand Hubway as Bluebikes and expand the program to underserved communities, like Mattapan, Dorchester, and Roxbury.[24]

PUBLIC TRANSIT (MBTA)

The Massachusetts Bay Transportation Authority (MBTA) is one of the oldest and busiest public transportation systems in the country, serving over a million passengers every weekday: 58 percent by subway, 30 percent by bus, and 10 percent by commuter rail in 2017.[25] The MBTA has seen a number of 'firsts' for transit in the United States: the opening of Tremont Street Subway in 1897 marked North America's first subway tunnel, while in 1964, the MBTA became the first combined regional transit system in the country, serving 78 municipalities. Today, the MBTA extends from Boston's neighborhoods into nearly two hundred cities and towns in the metropolitan region, connecting the city's centers of employment to the regional labor pool.

The MBTA maintains 173 bus routes, 14 commuter rail lines, three heavy rail lines (Red, Orange, and Blue Lines), 2 light rail systems (the branched Green Line and the Ashmont-Mattapan High-Speed Line), 1 bus rapid transit system (Silver Line), and 2 ferry lines.[26] Since a series of winter storms in 2015 and the Climate Change Strategy Executive Order in 2016, the MBTA has focused on maintaining and modernizing the transportation system to meet the metropolitan region's needs for more reliable and accessible public transportation. A reliable and resilient MBTA has an important role to play in improving commuters' quality of life and supporting economic growth throughout the region.

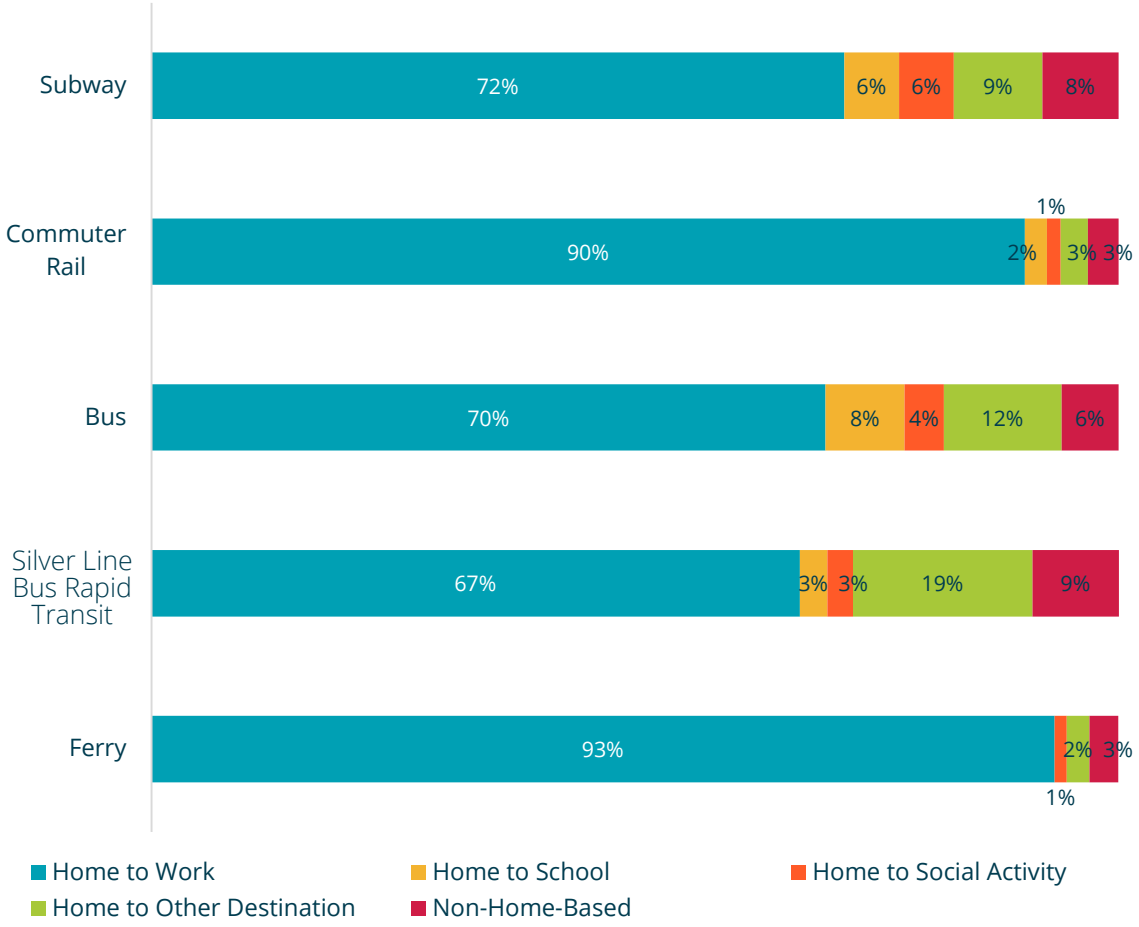
Photo Credit: Elizabeth Trauger, State Street Orange Line, Downtown, BPDA Research Division, 2019.

Characteristics of MBTA Commuters

According to 2015-2017 MBTA System Passenger Survey, 80 percent of reported trips were work-related, defined as trips between home and work. The ferry was the most likely to be used for commuting to work at 93 percent of trips, while around 70 percent of trips by bus and subway were for work-related purposes.

FIGURE 7

Purpose of MBTA Trip by Mode



Source: MassDOT, MBTA Performance Dashboard, 2017, BPDA Research Division Analysis.

The MBTA services seven counties: Bristol, Essex, Middlesex, Norfolk, Plymouth, Suffolk, and Worcester. While five percent of employed residents in the United States were public transportation commuters in 2017, about 12 percent of employed residents in the seven counties commuted by public transportation.[27] From 2005 to 2017, the share of workers commuting regularly by public transportation increased from 9 percent to 12 percent in the seven-county metropolitan region.

In 2017, 14 percent of resident workers in Norfolk County, 12 percent of resident workers in Middlesex County and 6 percent of resident workers in Essex County, and 6 percent in Plymouth County used public transportation for work-related commutes. Within the seven-county metropolitan region, the counties with the smallest share of resident workers taking public transportation to work were Bristol and Worcester, at 3 percent and 2 percent, respectively. From 2005 to 2017, Plymouth County had the greatest increase in public transportation commuters in the seven-county metropolitan region (39 percent), followed by Middlesex County (26 percent) and Norfolk County (17 percent).[28]

MAP 10

Share of Resident Workers Taking Public Transportation to Work by County

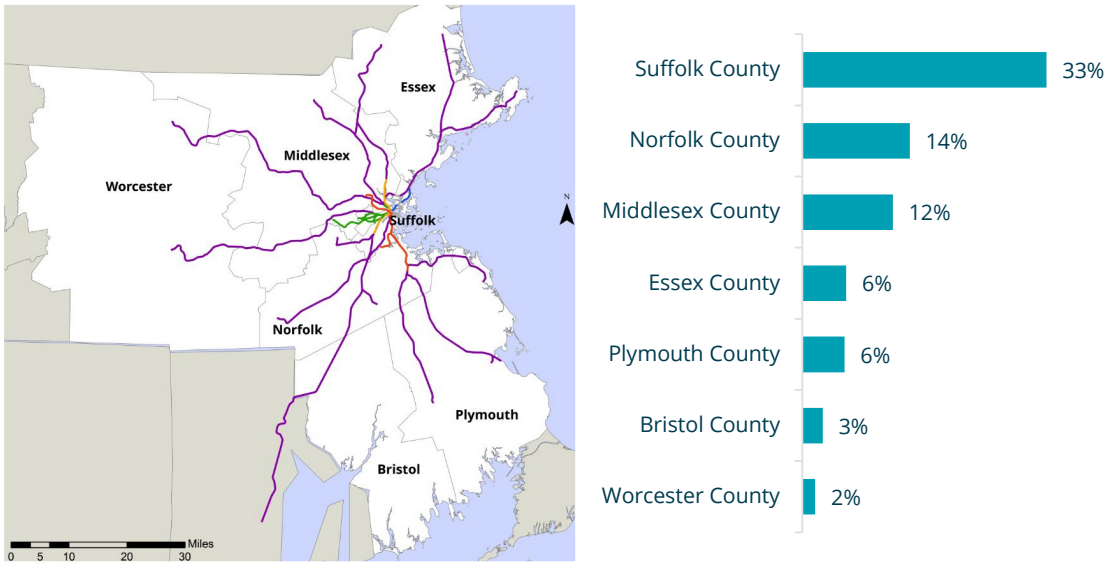
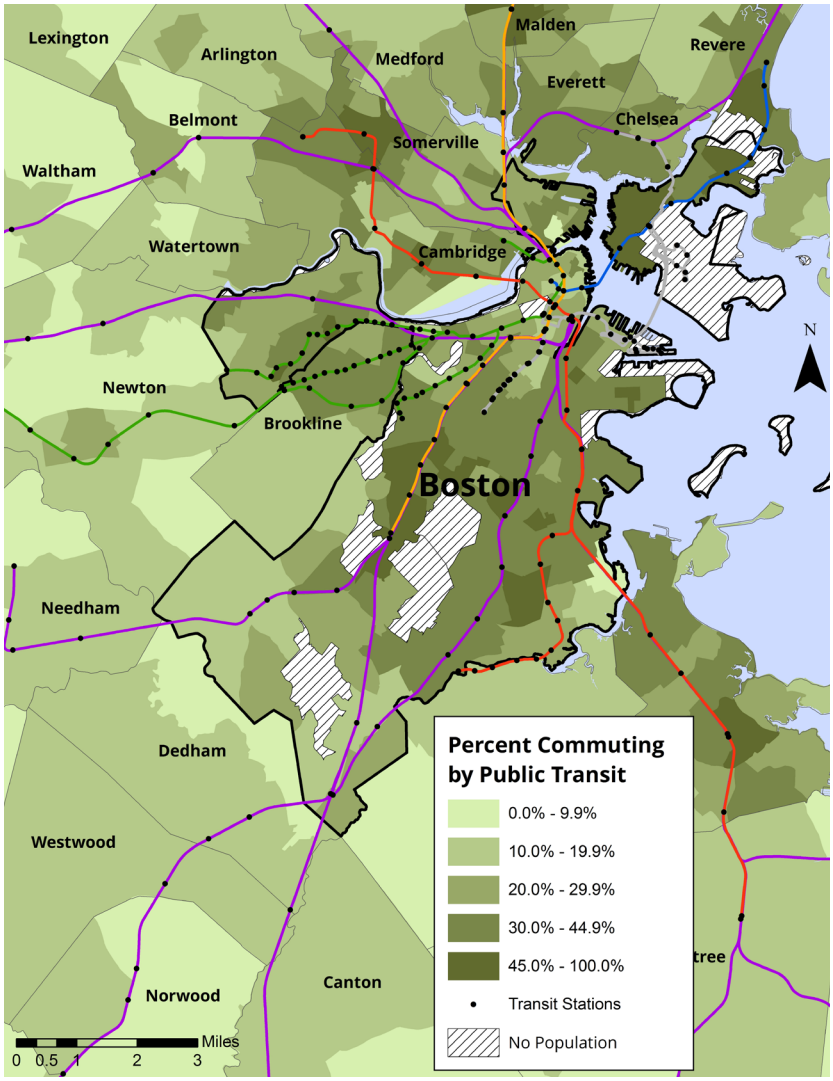


Figure Source: U.S. Census Bureau, ACS Five-Year Estimates, PUMS, 2013-2017, BPDA Research Division Analysis.
Map Source: MassGIS, BPDA Research Division.

34 percent of Boston's resident workers commute by public transportation, with those commuting by subway accounting for 60 percent, those commuting by bus accounting for 26 percent, and those commuting by commuter rail accounting for 13 percent of work-related commutes.[29] Today, 45 percent of Boston's land area is within a quarter-mile, and 70 percent is within a half-mile of a subway station or a key bus route stop. (The 2004 MBTA Service Policy defines key bus routes as routes that have a heavy demand for service and higher frequency standards than other bus lanes.)[30] Use of public transportation for commuting is strongly correlated with proximity to transit routes, as shown in Map 11.

MAP 11

Share of Commuters Using Public Transportation by Census Tract, 2013-2017

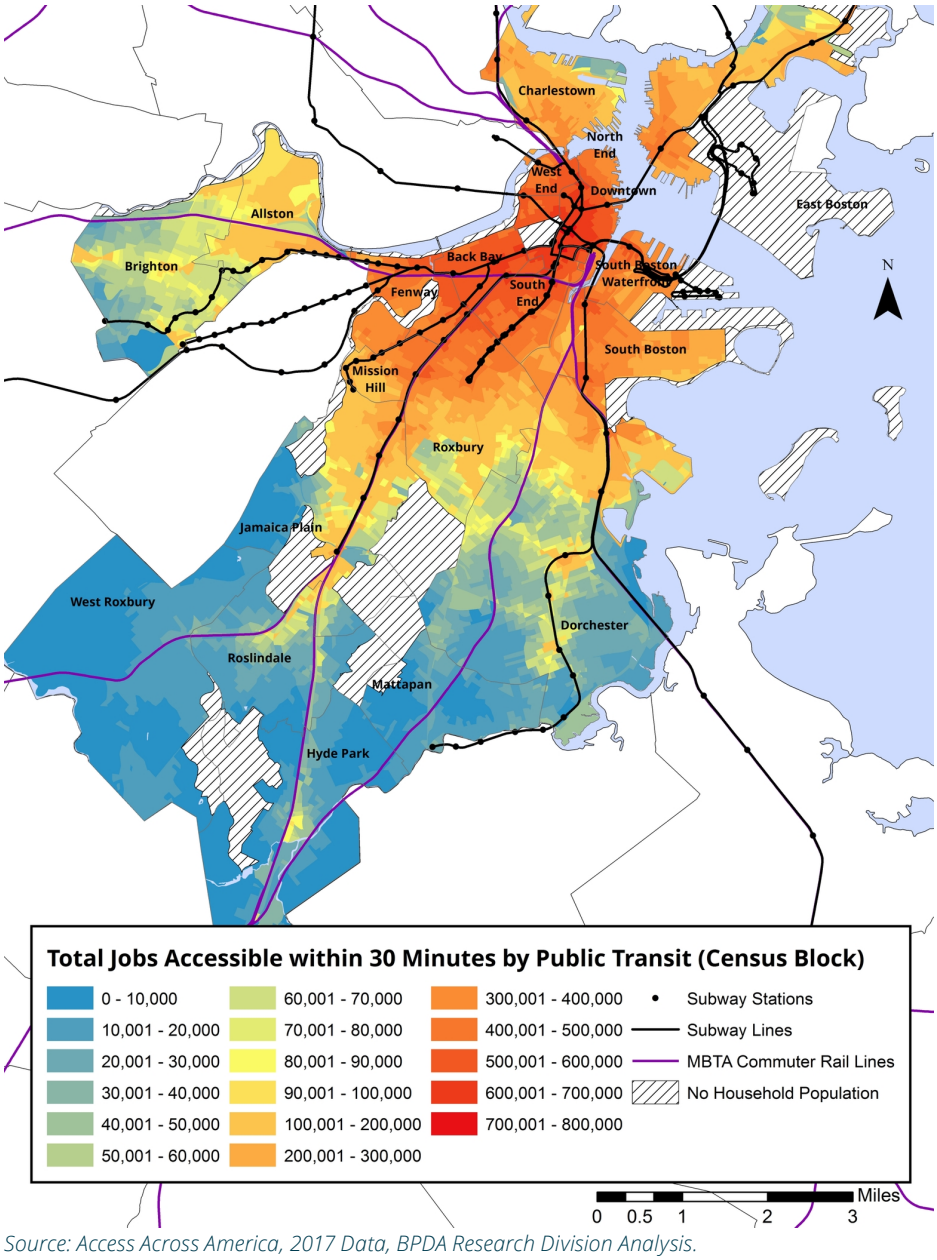


Source: U.S. Census Bureau. 2013-2017 American Community Survey, BPDA Research Division Analysis.

The MBTA is an important connector for Boston residents to jobs in the area. Data in Map 12 show the number of jobs that are accessible within 30 minutes by public transit. As seen in the Map 12, MBTA lines extend access to jobs. Many residents who live close to public transit stations have nearly 800,000 jobs accessible within a 30-minute commute.

MAP 12

Number of Jobs Accessible within 30 minutes by Public Transit



Source: Access Across America, 2017 Data, BPDA Research Division Analysis.

Public Transit Ridership

According to the Federal Transit Administration (FTA), national public transportation ridership has fallen by six percent from a high of 10.7 billion in 2014 to 10.1 billion in 2017.[31] Ridership is defined as the number of boardings of public transportation vehicles (trip segments). From 2008 to 2017, 10 of the 41 areas with a population of more than one million have experienced a sharp decline in public transportation use, including a decline of 22 percent in Miami, 19 percent in Los Angeles, 16 percent in Atlanta, and 14 percent in Washington, D.C.[32] In contrast, overall ridership increased by three percent in the Boston market, despite the decline from the peak ridership year in 2014.

National ridership on heavy rail, light rail, and commuter rail lines increased by seven, eighteen, and four percent, respectively, adding a total of 345 million riders since 2008. However, this was outweighed by a loss of 862 million riders on trolley and bus lines during the same period. Although bus ridership fell 15 percent from 2008 to 2017, buses remain the most popular mode of public transportation nationally, supporting nearly half of all trips or 4.8 billion trips.[33] Among the ten transit markets with the highest ridership, the Boston Metropolitan Area is the only region that saw an increase in bus ridership over the last decade, with bus ridership rising 11 percent.

TABLE 3

National Public Transportation Ridership by Mode (Billions), 2008 and 2017

	Total Ridership	Heavy Rail	Light Rail	Commuter Rail	Trolley Bus	Bus
2008	10.6	3.6	0.46	0.48	0.11	5.6
2017	10.1	3.8	0.54	0.50	0.08	4.8
Change '08-'17	-0.5	0.2	0.08	0.02	-0.02	-0.8
% Change '08-'17	-5%	7%	18%	4%	-22%	-15%

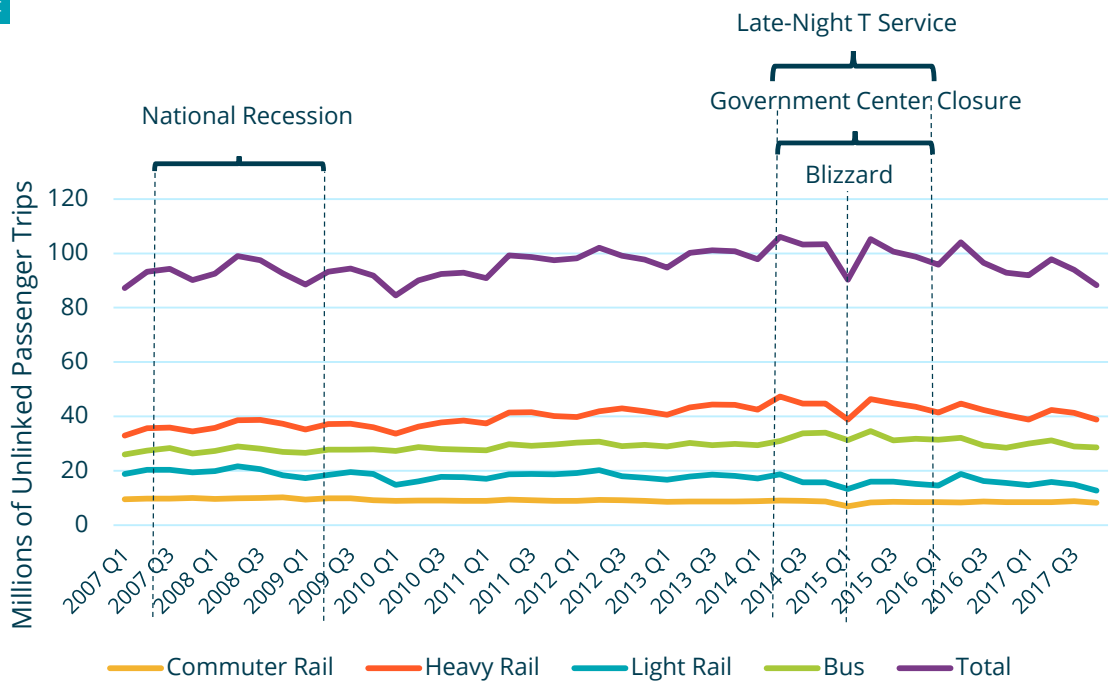
Source: American Public Transportation Association, Ridership Report, 2017.

Total ridership on the MBTA grew from 374 million trip segments in 2007 to a height of 423 million in 2014, before falling to 383 million in 2017.[34] Both trips by bus, which constitute over 30 percent of trips, and trips by heavy rail, which make up nearly 45 percent of trips, experienced strong positive growth from 2007 to 2014. However, since 2014, annual ridership has trended downward, decreasing by nine percent overall, five percent on commuter rail, ten percent on heavy rail lines, fourteen percent on light rail lines, and seven percent on bus routes.

The quarterly unlinked passenger trip totals shown in Figure 8 depict the impact of the strong winter storms of 2015, when the MBTA shut down service for several days.[35] The closure of Government Center for rennovation from 2014 to 2016 also appears to have contriuted to a decline in light rail ridership, though the MBTA reported an increase in ridership at nearby heavy rail stops during this time period.[36] Though the late-night service pilot (which extended subway and bus service by two hours on the weekends between March 2014 and March 2016) added an additional 27,000 rides per weekend during its first year, overall ridership declined during this period, contributing to budget constraints that eventually led to the discontinuation of the program.

FIGURE 8

Quarterly MBTA Ridership by Mode, 2007-2017



Note: Heavy rail is Red, Blue and Orange lines. Light rail is Green line and Ashmont-Mattapan High Speed line.

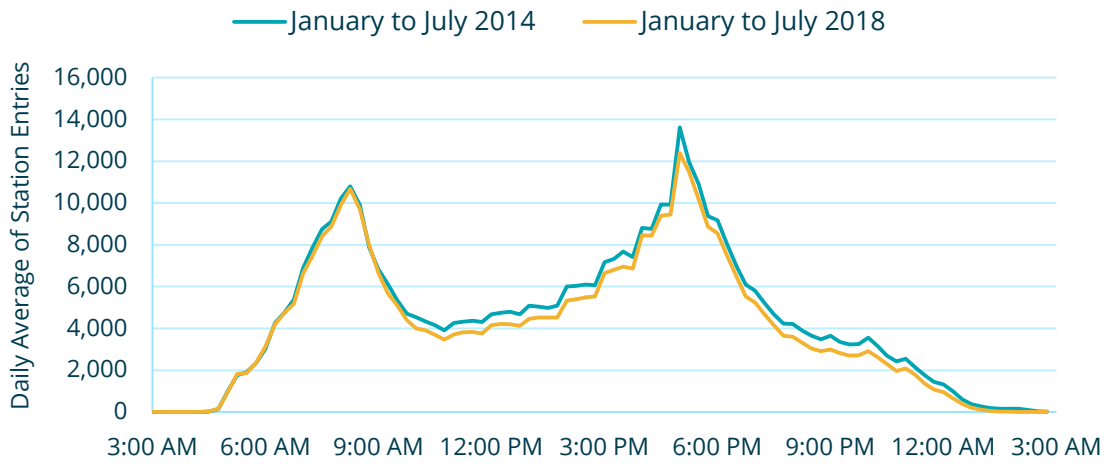
Source: FTA, Monthly Module Adjusted Data, BPDA Research Division Analysis.

Figure 9 shows the daily average entries for gated heavy rail stations (including the Silver Line) and light rail stations from January to June, 2014 and from January to June, 2018.

Comparing 2018 to 2014, the daily average station entries remained stable at peak travel times and decreased 11 percent from 10:00 AM to 3:00 PM and 19 percent from 8:00 PM to 3:00 AM the next day. Therefore it appears off peak transit ridership is pulling down overall ridership numbers, while peak travel remains strong. In recent years, the rise of Transportation Network Companies (TNCs), which are also known as ride-hailing apps, has affected public transportation ridership.

FIGURE 9

The Daily Average of Entries for Gated Stations by 15-Minute Period Minute Period



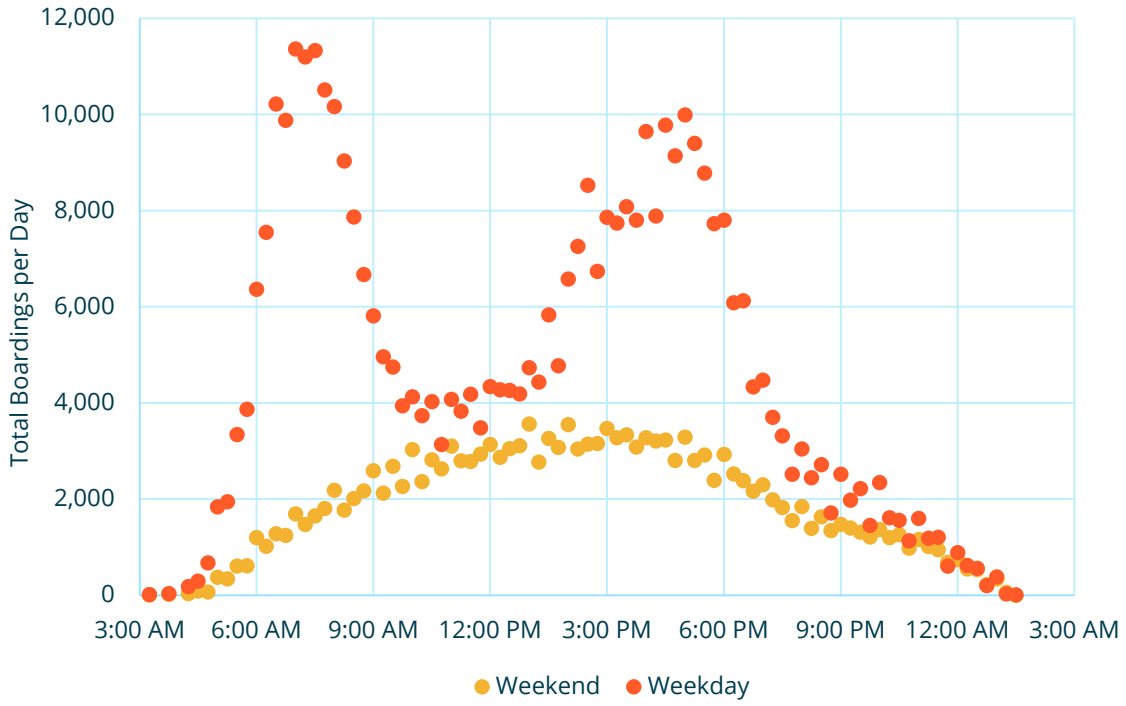
Source: Massachusetts Department of Transportation (MassDOT), MBTA Performance Dashboard, BPDA Research Division Analysis.

Photo Credit: Elizabeth Trauger, North Station, West End, BPDA Research Division, 2019.

Figure 10 shows an average of 414,000 weekday bus boardings, with 20 percent occurring during the morning peak period (7:00 AM to 9:00 AM) and 24 percent occurring during the evening peak period (4:00 PM to 7:00 PM). A daily average of about 170,000 boarding passengers was observed throughout Saturday and Sunday, with 45 percent occurring between 10:00 AM and 6:00 PM.[37]

FIGURE 10

The Daily Average of Boardings for MBTA Bus Trips by 15-Minute Period - FY2017

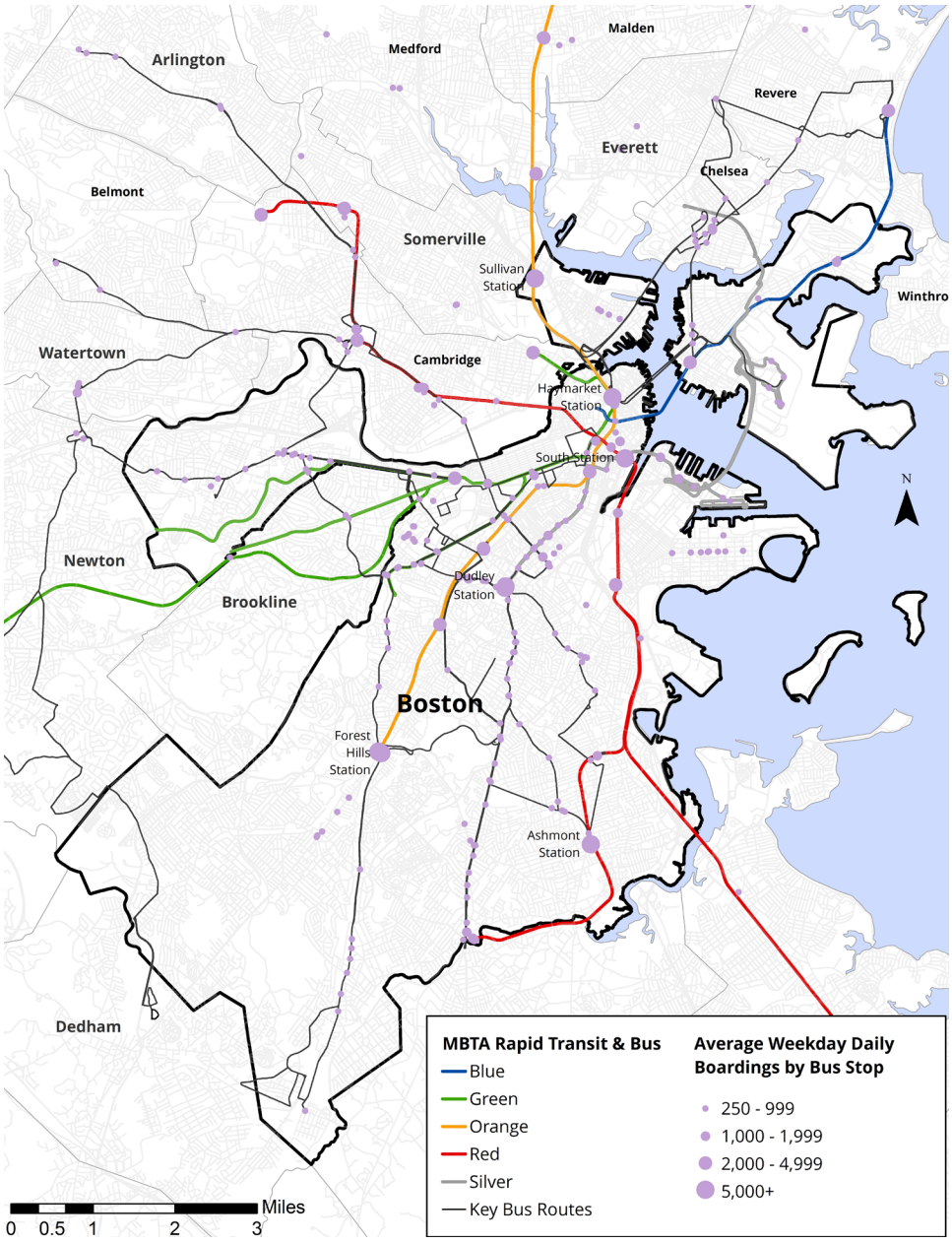


Source: MassDOT, MBTA Performance Dashboard, Fiscal Year 2017, BPDA Research Division Analysis.

Bus stops with the highest boardings on weekdays are primarily located at the terminus of a subway line, such as Ashmont or Forest Hills Station. The busiest bus stop is Dudley Station, which is a transfer point between seventeen bus routes. Map 13 shows the most frequented bus stops as well as their intersections with rapid transit lines.

MAP 13

The Average Weekday Daily Boardings by Stop in 2017



Source: Massachusetts Bay Transportation Authority, BPDA Research Division Analysis.

Ferry System

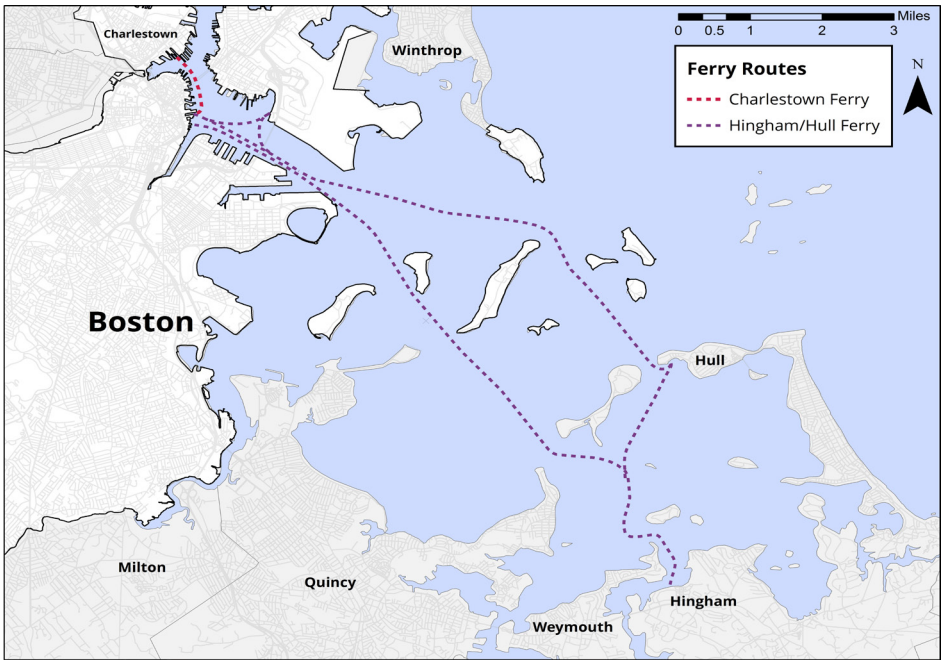
The MBTA operates three ferry lines that run year round, and these ferries service the North Shore, South Shore and neighborhoods in Boston. There are three ferry terminals in Boston, located at Long Wharf South, Long Wharf North, and Rowes Wharf.

The F1 ferry has service from Rowes Wharf to Hewitt Cove in Hingham. The F2H ferry service runs from Long Wharf to Boston Logan Airport, Pemberton Point in Hull, and ends at Hewitt Cove in Hingham. The F4 ferry runs an inner harbor loop, departing from Long Wharf to the Charlestown Navy Yard. Additionally, there are seasonal ferries that travel to Salem and Winthrop but these are operated independently by the respective municipalities. The Ferry service is an alternative transit method for commuters into Boston, there are monthly pass zones that are comparable to the commuter rail monthly passes for zones 6 to 10.

Additionally, the ferry is the most reliable MBTA transit modes, with an on-time performance of 98 percent, which is higher than the Subway (89%), the Ride (87%), the Commuter Rail (68%) and the Bus (66%).[38] In August 2019, the ferry had 7,699 passengers, which is roughly 1 percent of all MBTA commuters.

MAP 14

MBTA Ferry Routes



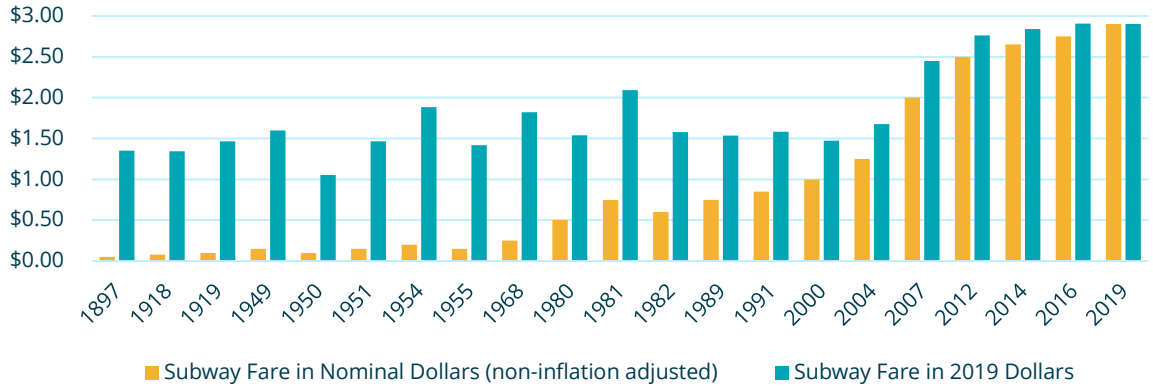
Source: MBTA, BPDA Research Division.

Public Transportation Fares

At the opening of the Tremont Street Subway in 1897, the fare for a single ride cost five cents per person, or $1.35 in 2019 dollars. Over the next hundred years, fares kept approximate pace with inflation, averaging around $1.55 in constant terms. 2007 saw the largest fare hike in with rates increasing from $1.25 to $2.00, or $2.45 in constant 2019 dollars. This fare hike followed the rollout of the CharlieCard system in 2006, which replaced the former token-based system with a refillable smart card, which gives cardholders a discount off of the price of a single-ride ticket. The CharlieCard system is effective for separating visitors from commuters. Visitors can use the paper ticket system, the Charlie Ticket, while frequent commuters can use the CharlieCard system and receive a fare discount. Historical (non-CharlieCard) subway fares are shown in Figure 11.

FIGURE 11

MBTA Subway Fare



Note: 2019 rates took effect in July 2019.
Source: Northeastern University, Kitty and Michael Dukakis Center for Urban and Regional Policy; MBTA Fare and Passes Change Notices.

The MBTA's reach of service has risen steadily over time. When the Tremont Street subway opened in 1897, the subway system included roughly five miles of track connecting four stations on two different lines. By 1912, the first stations of each current major line - Green, Orange, Blue, and Red - were built. Boston's subway track mileage and number of stations has gradually expanded over the past century, with major extensions opening in the 1950s, 70s, 80s, and 2000s. Currently the MBTA Subway consists of about 64 miles of track, 127 stations, and about 650 rail cars.

Boston is one of eleven major cities in the United States with a subway system. Cities with comparable systems in terms of total subway route mileage, number of rail lines, and number of stations include Philadelphia (SEPTA), San Francisco (BART), Los Angeles (Metro Rail), and Washington, D.C. (Metro). In this group of five cities, Boston has the third highest price for a one-way trip ($2.90), after San Francisco ($3) and Washington, D.C. (ticket price ranges from $2 to $6 depending on place of origin and destination). For a monthly pass, however, Boston ranks as the least expensive at $90, after Washington, D.C. ($81-135), Los Angeles ($100), San Francisco ($81-98), and Philadelphia ($96). Among all U.S. cities with subway systems, Boston's monthly pass is the second least expensive behind only Baltimore, where the monthly pass costs $74 but the subway system has 50 fewer miles of rail tracks and over 100 fewer stations than Boston's subway system.

TABLE 4

Comparison of Subway Characteristics and Fares in U.S Cities, 2019.

	Subway Characteristics				Subway Fares		
City	Total Subway Route Miles	Number of Rail Lines/ Routes	Number of Stations	Number of Rail Cars	Monthly Pass[39]	One-way trip	
						From Ticket Machine	With Reusable Card
Atlanta	48	4	38	338	$95	$2.50	
Baltimore	15.5	3	14	100	$74	$1.90	
Boston[40]	64	5	127	647	$90	$2.90	$2.40
Chicago	224.1	8	145	1,492	$105	$2.50	
Cleveland[41]	37	4	52	74	$95	$2.50	
Los Angeles[42]	98	6	93	n/a	$100	$1.75	
Miami	24.4	2	23	136	$112.50	$2.25	
NYC	665	22	472	6,418	$127	$2.75	
Philadelphia	57	4	88	n/a	$96[43]	$2.50	$2.00
San Francisco	122	7	48	723	$81-$98[44]	$3.00	$2.50
Washington, D.C.	118	6	91	1,144	$81-$135[45]	$2-$6[46]	

Sources: Metropolitan Atlanta Rapid Transit Authority, Maryland Transit Administration, MBTA, Chicago Transit Authority, Greater Cleveland Regional Transit Authority, Los Angeles County Metropolitan Transportation Authority, Miami-Dade Transit, New York City Transit Authority, Southeastern Pennsylvania Transportation Authority, Bay Area Rapid Transit District, Washington Metropolitan Area Transit Authority.

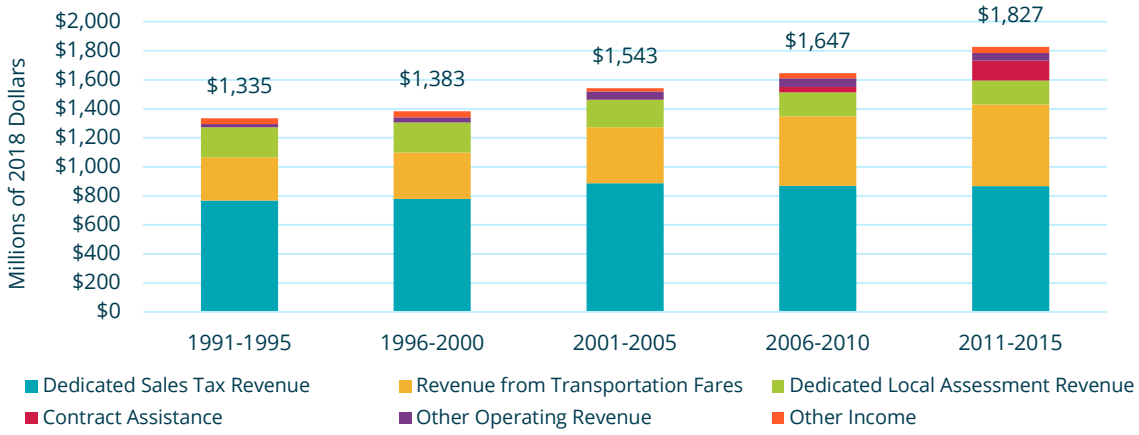
MBTA Finances

From 2000 to 2017, operational expenditure growth has slightly outpaced revenue growth at 34 percent compared to 32 percent. Total revenue decreased by $63 million between 2013 and 2014, contributing to a budget deficit of about $105 million. However, revenue growth surpassed expenditure growth in FY2016 and FY2017, decreasing the budget deficit significantly from $123 million in FY2015 to about $30 million in FY2017.

Operating revenue, primarily from transportation fares, has consistently grown as a share of total revenue from 25 percent in 2000 to 37 percent in 2017. Operating revenue totaled $719 million in FY2017. Despite this growth, dedicated sales tax revenue from Forward Funding, which was authorized under the Enabling Act of 2000, continues to be the largest source of revenue ($1.01 billion, or 53 percent of the FY2016 budget). Contract assistance began in FY2010 and continued through FY2014, providing an average of $172 million a year in sales tax revenue.[47]

FIGURE 12

Revenue: 5-Year Averages of Annual Revenue and Revenue Sources (Millions of 2018 Dollars)

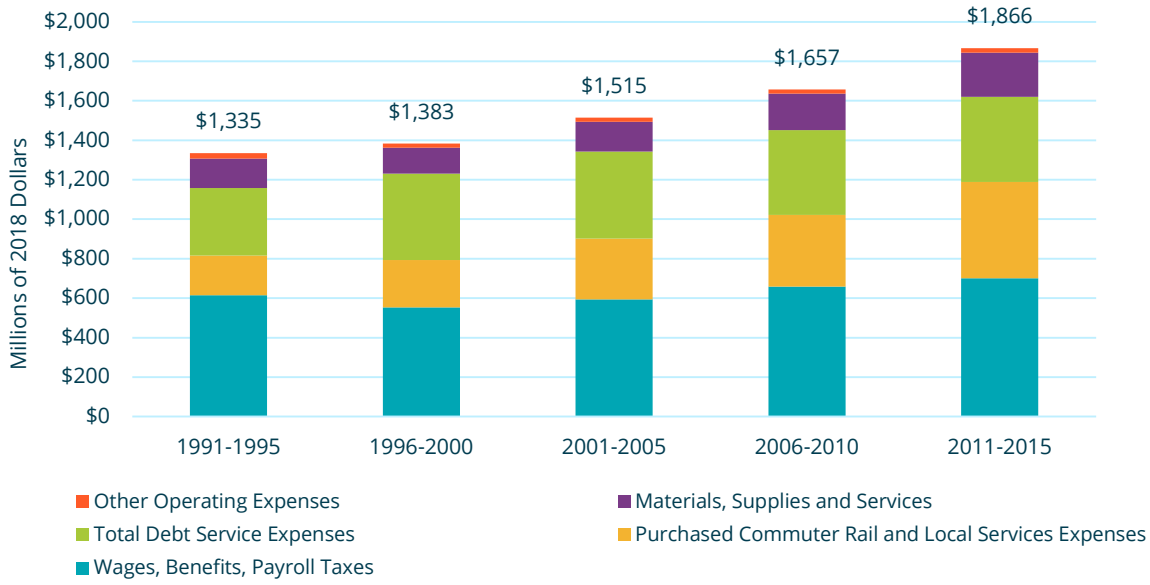


Note: Forward Funding was authorized under the Enabling Act of 2000.
Source: MBTA, MBTA Budget and Financials, https://www.mbta.com/financials/mbta-budge

Operating expenses were $1.5 billion in 2017, making up 78 percent of total expenses. Wages are the largest expense in the MBTA budget, totaling $524.7 million or 25 percent of total expenditures in the 2016 operating budget. Purchases for the commuter rail made up an additional 19 percent of the 2016 budgeted expenditures, while purchases for local service (subway, ferry, and bus) made up six percent.

FIGURE 13

Expenses: Operating 5-Year Averages of Annual Expenses and Source of Expenses (Millions of Constant 2018 Dollars)



Source: MBTA, MBTA Budget and Financials, https://www.mbta.com/financials/mbta-budget

As for other public transit agencies, debt service is another significant expense category for the MBTA. Interest, lease payments, and principal payments on debt constituted about $459 million, or 22 percent of total expenses in FY2017.[48] As of September 2017, the MBTA has approximately $5 billion in outstanding debt.[49] The state budget for FY2019 includes $1.62 billion for transportation funds, including the Commonwealth Transportation Fund (CTF) and the Massachusetts Transportation Trust Fund (MTTF), which will be used for the operating budget and debt service. The budget also accounts $88 million for the fifteen regional transportation authorities.

One expense that is not accounted for in the MBTA budget is fare evasion. In 2016, the MBTA and Keolis estimated that they were losing $42 million annually from fare evasion on commuter trains, Green Line trolleys, and buses.[50] [51] Fare evaders on the commuter rail were responsible for $35 million of the loss.[52]

The 2019-2023 Capital Investment Plan for the Mass Department of Transportation (MassDOT) outlines planned funding for capital projects for the next five years. For example, the Capital Plan allocates $544.7 million for repairs and reconstructions of bridges and tunnels that line the transportation system over the next five years. The Capital Plan also proposes an investment of $1.3 billion in the replacement and rehabilitation of transportation fleet, an investment of $400.8 million in upgrades to stations, and an investment of $235 million in system upgrades.[53]

Upcoming MBTA System Upgrades

The MBTA continues to renovate, modernize, and expand its system to better serve commuters. The following projects are ongoing or recently completed:

New Vehicles

While the newest Red Line vehicles went into service in 1993, some of the oldest Red Line vehicles date back to 1969.[54] By 2025, the MBTA will entirely replace the Red and Orange Line fleets with more spacious and secure vehicles and will incorporate 24 new Green Line vehicles into service.

Beginning in 2014, China Railway Rolling Stock Corporation (CRRC) was awarded a $842 million contract to design and build 152 Orange Line vehicles and 252 Red Line vehicles.[55] The cars, manufactured in China, will be shipped to and assembled in Springfield, Massachusetts, entering service by 2025. The new rail cars will increase capacity by up to 50 percent during peak commute times and lead to more reliable service.

Automated Fare Payment System

In October 2018, the MBTA installed new GPS devices in the entire bus fleet, improving bus arrival predictions by 10 percent and facilitating the development of bus tracking apps that allow customers to view bus location almost in real time.[56]

The MBTA is also working on implementing the Automated Fare Collection 2.0 (AFC 2.0). The AFC 2.0 will allow passengers to use CharlieCard, contactless credit cards, or smart devices to pay for fares, which will help the system effectively capture ridership information and reduce delays caused by slow boardings.

MBTA Stations

In order to reduce travel time along the Green Line, the MBTA is consolidating four stations - St Paul and BU West as well as Babcock and Pleasant Street - while updating the fare collection machines.

Ruggles Station and Busway in Roxbury, currently the fourth busiest destination for commuter rail service, is undergoing construction to add a new commuter rail platform. The new platform will curb the congestion that occurs between Back Bay Station and Ruggles Station and ultimately provide easier access to the Providence, Stoughton, and Franklin Commuter Rail Lines. These upgrades are estimated to be complete in 2020.

Bus Lane Piloting

In 2018 and 2019, area communities, including Boston, collaborated with the MBTA to implement a number of successful bus lane pilots that made buses faster and more reliable.[57] The success of the pilot programs led to two permanent lanes on Washington Street in Roslindale and on Brighton Avenue.[58] Boston Transportation Department is due to install six more bus priority lanes by the end of the 2019 Fiscal Year.[59]

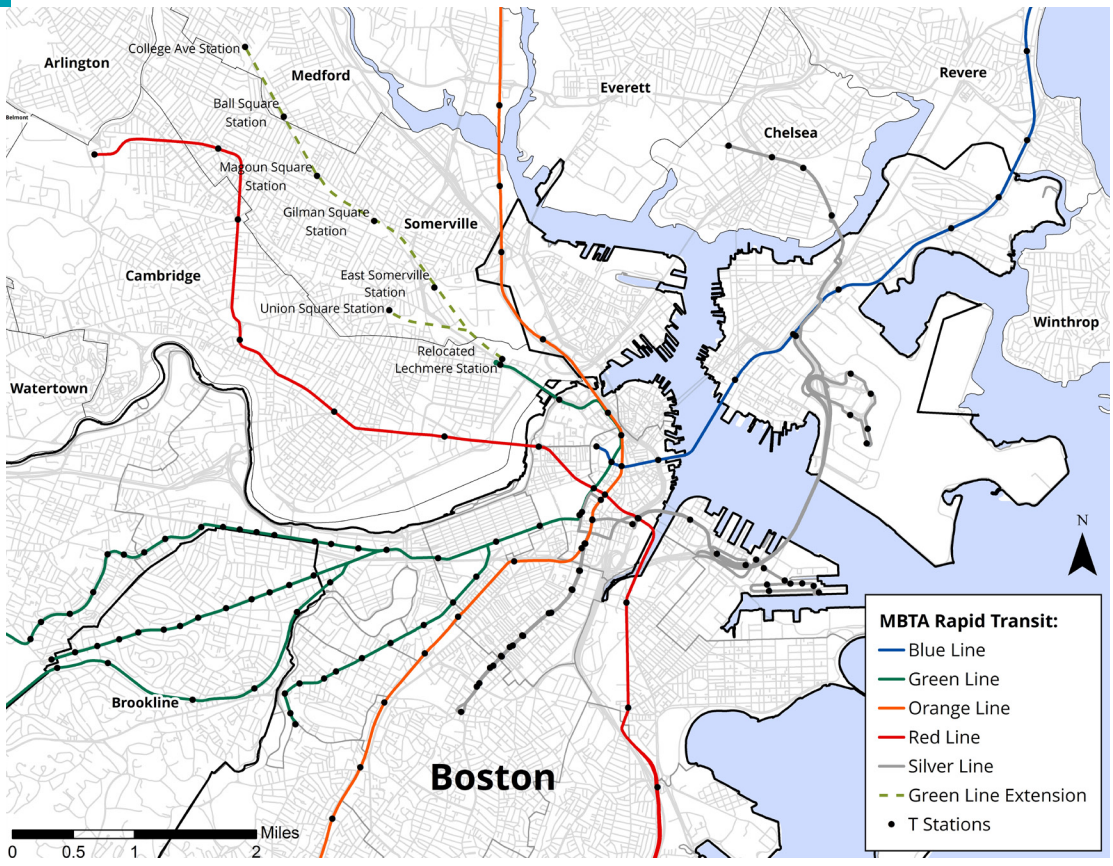
Extensions

The FTA signed a Full Funding Grant Agreement (FFGA) with the MBTA in 2015 for the Green Line Extension (GLX), providing nearly $1 billion in federal funds toward the $2.3 billion cost of the GLX.[60] In December 2017, U.S. Department of Transportation (DOT) issued the first in-stallation of grant money, totaling $100 million.

The GLX will link Lechmere Station with Union Square in Somerville and College Avenue in Medford, improving regional access for residents in Somerville and Medford to Downtown. Map 15 illustrates the proposed stations based on documentation published by MassDOT and the MBTA, and current stations and lines based on documentation published by the Massachusetts Bureau of Geographic Information (MassGIS). Construction broke ground in June 2018 and is expected to be completed in 2022.[61]

MAP 15

Green Line Extension



Source: MBTA Performance Dashboard. BPDA Research Division Analysis.

MOBILITY MICROHUBS

As the City of Boston looks forward to the future of transit, the City has identified the need for greater public assistance in wayfinding, and improved predictability of travel times and safety while on trips. To fill this need, the City has established a plan to develop Mobility MicroHUBs. Mobility MicroHUBs consist of interactive kiosks and nodes that display real-time information about transit-schedules and the availability of shared vehicles located at points where various modes of transit intersect, near clusters of bus stops, train stations, carshare and bikeshare vehicles, ride-hailing pick-up spots, and electric vehicle charging stations. MicroHUBs will be able to quickly connect people between different modes of transportation and help to make people more confident in making trips that require multiple modes of transportation.[62]

In addition to being a reliable way for people to start, continue, or complete a journey using multiple modes, Mobility MicroHUBs will offer free Wi-Fi and will utilize place making strategies. Such strategies include parklets or plazas, shelters, information signs, and works of art, which will make the hubs into comfortable waiting areas.

The estimated cost for design and construction of the Mobility MicroHUBs is around $500,000, with sources for funding including the City capital plan and MBTA funding. Boston Transportation Department and MBTA are leading this project over what is expected to be a 10 year period. The City will pilot Mobility MicroHUBs near recent bikeshare station expansion locations in East Boston and Roxbury, with installations starting in 2020. Currently, the City has identified over one hundred potential Neighborhood Mobility MicroHUB locations throughout Boston.

Source: Kayla Myros, Downtown, BPDA Research Division, 2019.

DRIVING AND AUTOMOBILES

Driving is the most utilized form of transportation in Boston, with 45 percent of residents in Boston and 58 percent of workers in Suffolk County commuting to work by car.[63] During the period of nationwide highway expansion following World War II, infrastructure development in Boston centered on the automobile. Major infrastructure projects like the elevated Central Artery promoted vehicular access to Downtown during the 1950s, though public opposition halted the development of the Southwest Expressway, a space now occupied by the MBTA Orange Line.

While some commuters find driving convenient and enjoy the sense of privacy it may offer, car travel can suffer from traffic congestion and parking scarcity, in addition to higher greenhouse gas emissions, and health risks such as collisions and air pollution. These limitations are addressed in Go Boston 2030 which aims to halve the share of commuters driving alone by 2030, while increasing public transportation usage by a third and walking by half.[64] This section highlights trends in vehicle ownership in Boston, and the potential implications for congestion, environmental health, and ownership costs. This section also identifies ways in which vehicle ownership is changing shape through ride-sharing, ride-hailing, and autonomous vehicles.

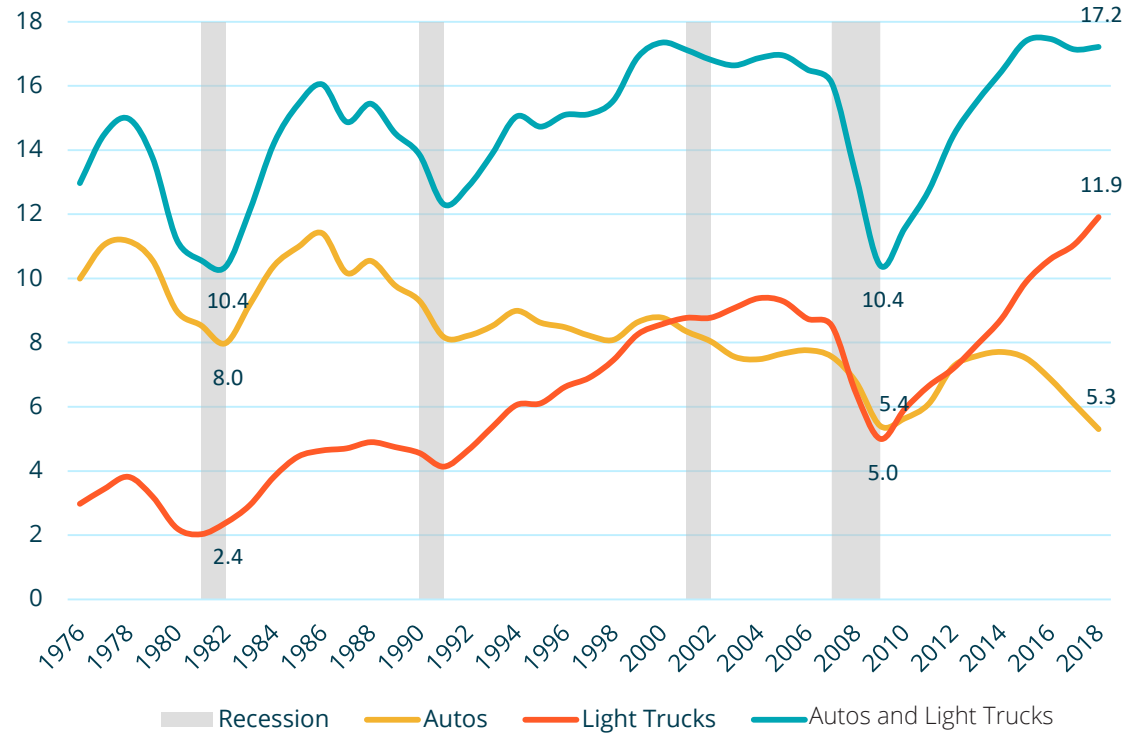
Photo Credit: Zakim Bridge, Downtown, Alex MacLean/ Landslides Aerial Photography, 2014.

National Automobile Trends

Nationally, sales of automobiles and light trucks (including SUVs and minivans) decreased during the Great Recession, falling to 10.4 million sales in 2009, the lowest since 1982.[65] Since 2009, sales have rebounded and gradually increased, reaching 17.2 million in 2018. This rebound has been driven by a strong increase in sales of light trucks, making up for a decrease in sales of automobiles. Paralleling this trend, automobile registrations have fallen from 138 million in 2001 to 113 million in 2016.[66] Over the same time period, truck registrations, which include SUVs, pick-ups and heavier trucks, have risen from 92 million to 146 million.[67]

FIGURE 14

Light Vehicle Sales (Millions)



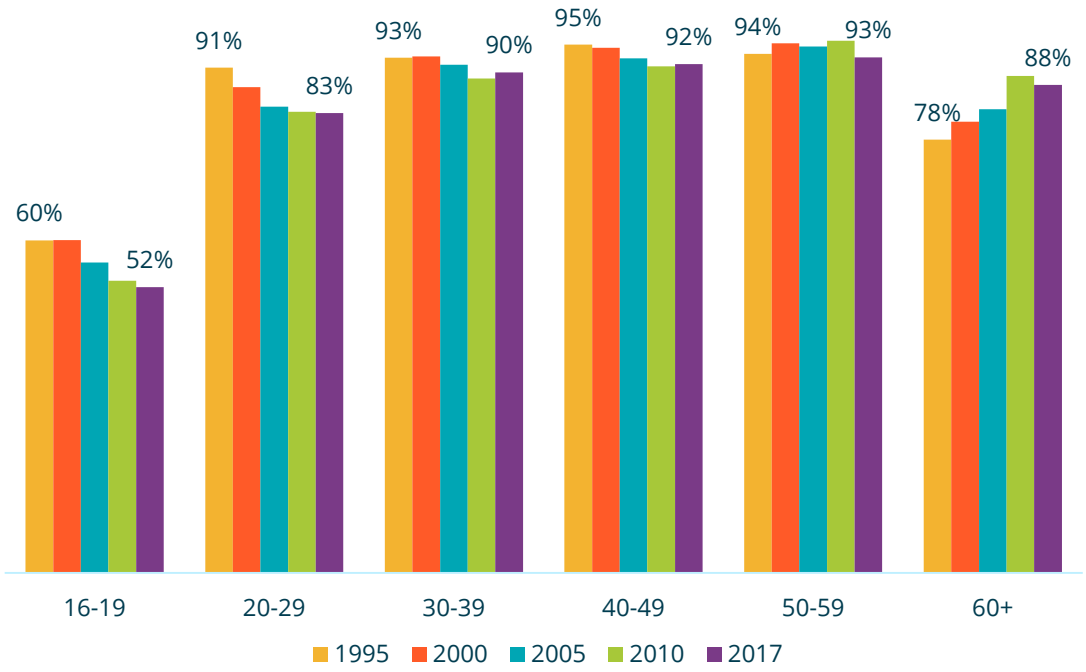
Source: Bureau of Economic Analysis, Auto and Light Truck Sales, June 2019.
https://www.bea.gov/docs/gdp/auto-and-truck-seasonal-adjustment

The absolute number of licensed drivers in the U.S. has been growing consistently since the 1950s, and this trend follows the national population growth during this time period. However, the share of U.S. residents aged 16 and over who are licensed drivers is shrinking.

The percentage of all Americans aged 16+ who are with a driver's license has fallen from 91 percent in 1995 to 86 percent in 2017. As shown in Figure 15, the share of young people with licenses has fallen more quickly: from 60 percent in 1995 to 52 percent in 2017 for those under 19, and from 91 percent to 83 percent among 20-29 year olds.[68]

FIGURE 15

National Percent of Age Group with a Driver's License, 1995-2017

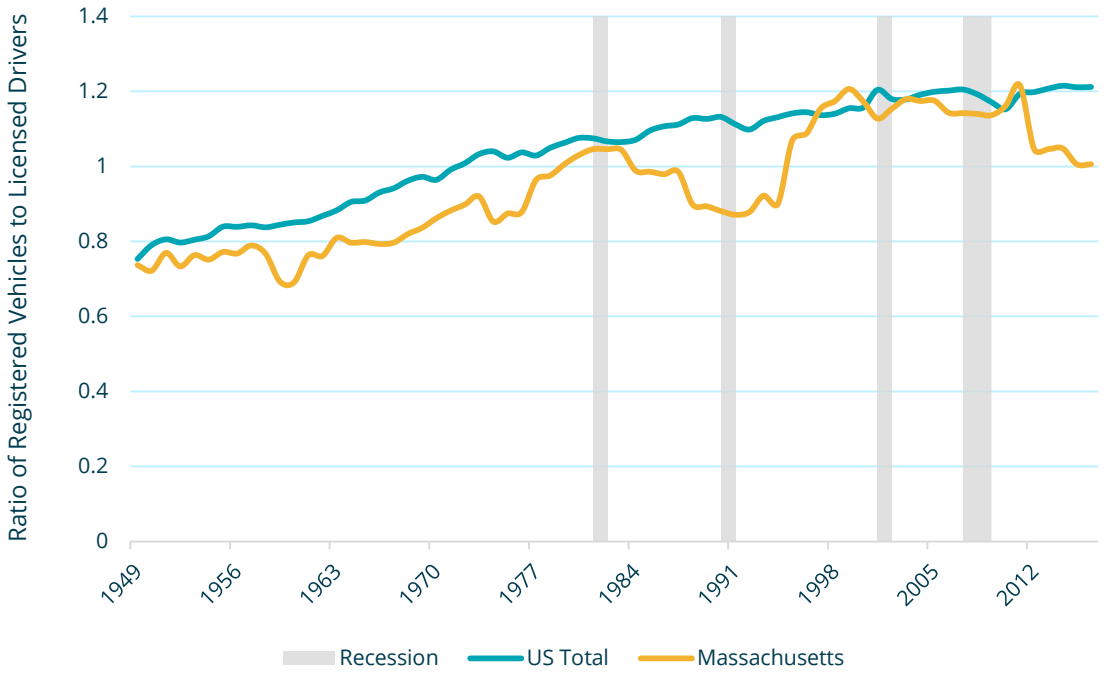


Source: U.S. Department of Transportation, Federal Highway Administration, Office of Highway Policy Information. Table DL-20: Distribution of Licensed Drivers by Sex and Percentage in Each Age Group and Relation to Population, 1995, 2017.

Nationally, the ratio of registered vehicles to licensed drivers rose from 0.8 in 1949 to 1.2 in 1999, where it remained through 2016. As of 2016, the statewide average is 1.02 vehicles per licensed driver, after falling from 1.2 in 2011. The ratio of registered vehicles to licensed drivers is at a low comparable to the mid 1990s.[69] The trend in Massachusetts contrasts with the steady increase of registered vehicles to licensed driver in the U.S as a whole, which has been flat since 1999.

FIGURE 16

Vehicles Registered per Licensed Driver



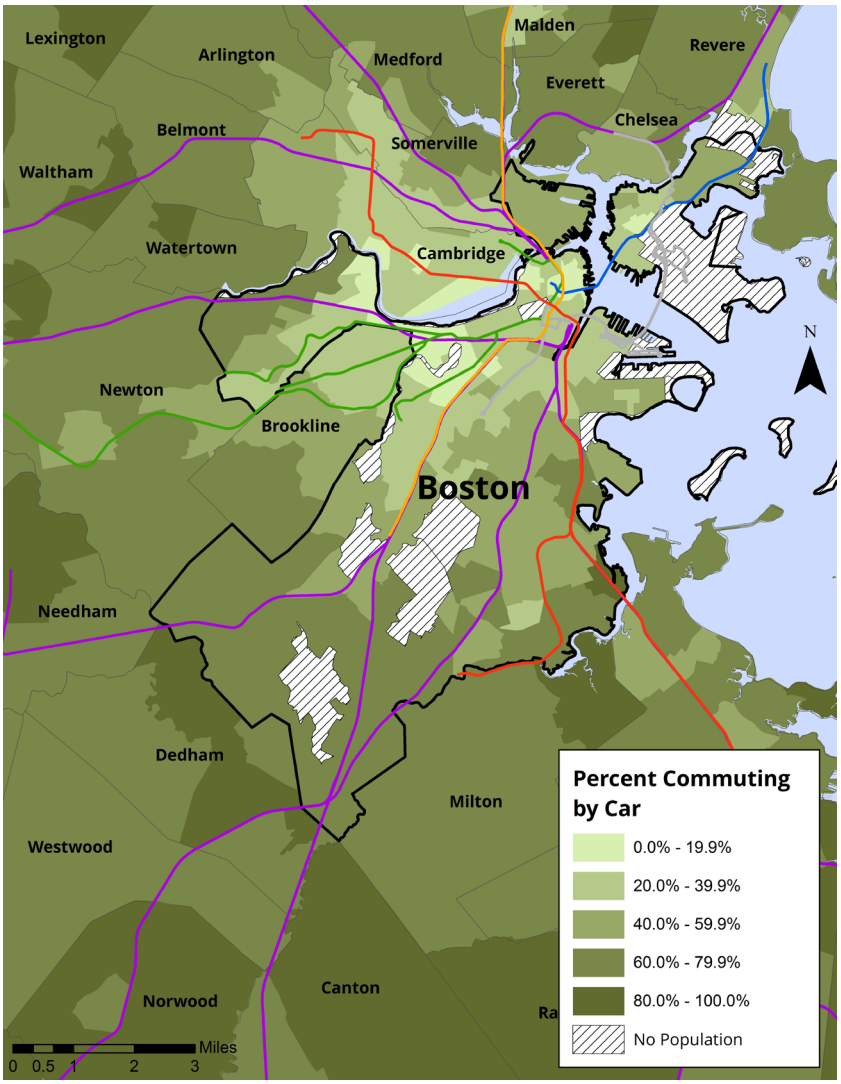
*Source: U.S. DOT, FHA, Office of Highway Policy Information, Public and Private Vehicles, via Google Public Data Explorer, https://www.google.com/publicdata/explore?ds=gb66jodhlsaab_*

Boston Automobile Trends

As shown in Map 16, workers who live near job centers and public transportation hubs in Boston and Cambridge are less likely to drive to work, while almost all workers living in some outer suburbs drive to work. As of 2017, 45 percent of Boston residents commuted to work by car, which is down from 51 percent of residents commuting by car in 2000.[70]

MAP 16

Share of Commuters that Drive to Work by Census Tract, 2013-2017



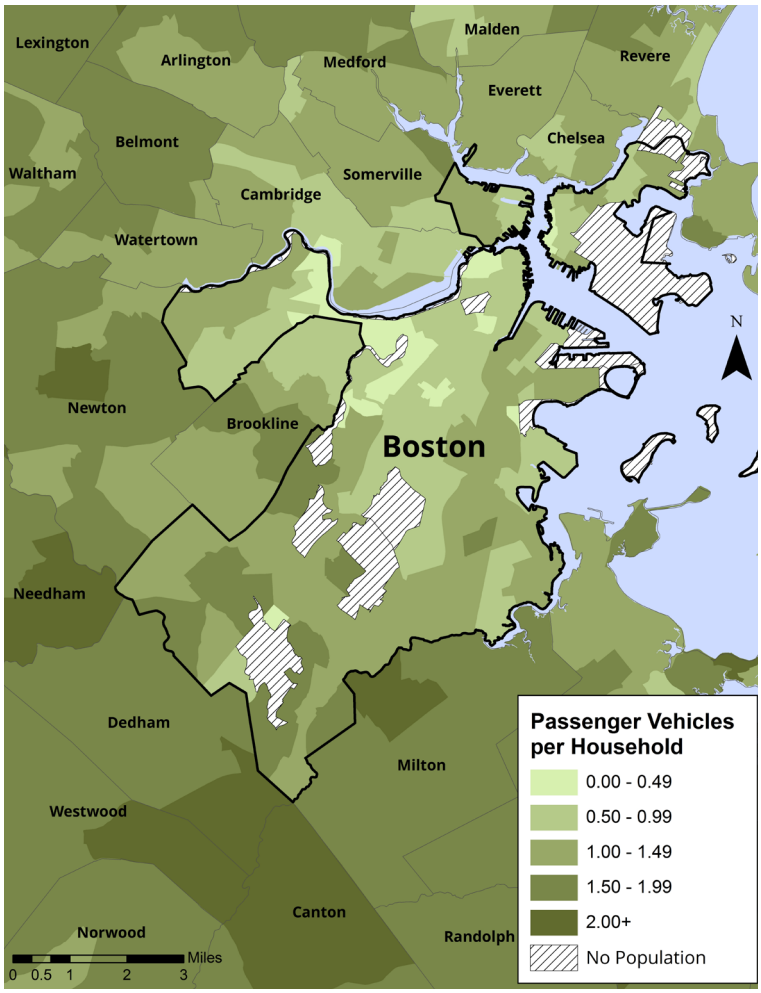
Source: U.S. Census Bureau. 2013-2017 American Community Survey, BPDA Research Division Analysis.

As Map 17 shows, towns and cities close to Boston tend to have fewer vehicles per household: in fact, Cambridge, Boston, Brookline, Somerville, and Chelsea are the five municipalities with the lowest ratios of cars to households in the state. Boston saw the largest absolute increase in number of registered vehicles from 2011 to 2014 in the state. However, due to Boston's large population size, Boston has the lowest ratio of vehicles per household in Massachusetts.

In 2017, the ratio for Boston was 0.92 vehicles per household. Second to Boston, Lawrence added 1,747 vehicles from 2011 to 2014. Chelsea, Methuen, and Lowell also added the most new vehicles. Quincy saw the largest decline in vehicle registrations in Massachusetts at 1,100, while Newton, Cambridge, Medford, Brookline, and Somerville all saw declines of over 500 vehicles.

MAP 17

Passenger Vehicles Registered per Household by Census Tract, 2014



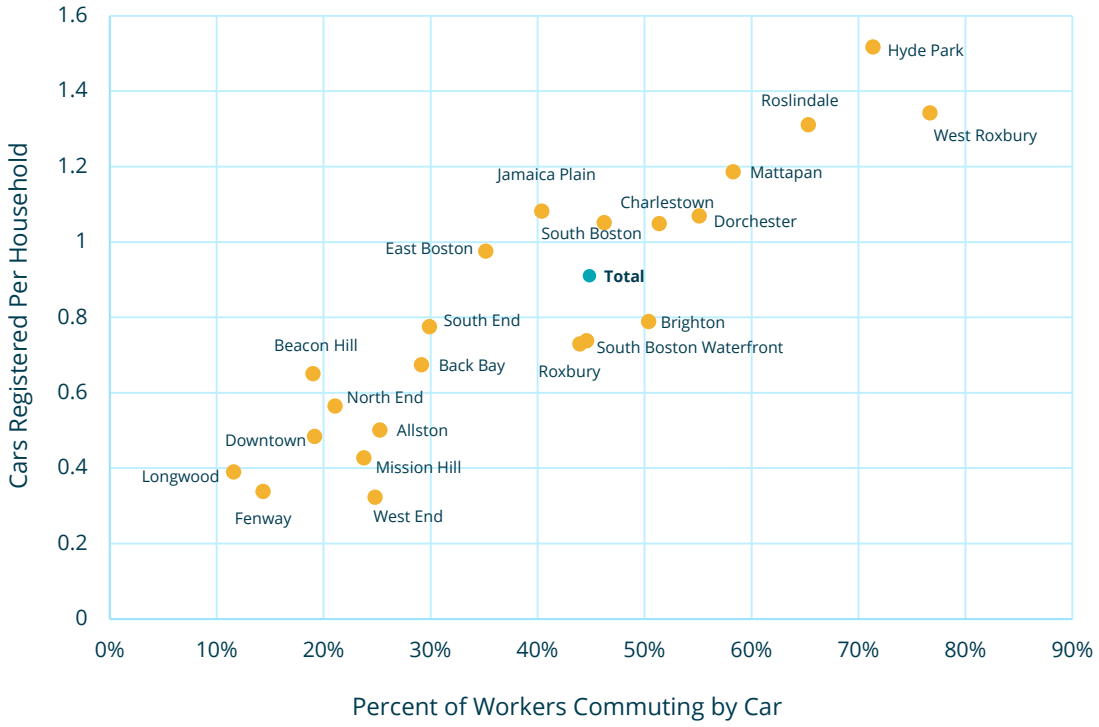
Source: Massachusetts Area Planning Council, 2014 Vehicle Census and U.S. Census Bureau, 2010-2014 American Community Survey, BPDA Research Division Analysis.

As of 2016, 65 percent of Boston households have access to at least one vehicle. According to the Massachusetts Vehicle Census by the Metropolitan Area Planning Council (MAPC), there were 234,020 passenger vehicles registered in Boston in 2014, an increase of around 3,320 vehicles over 2011. Across the city, there were about 0.92 vehicles registered per household and this ratio remained consistent from 2011 to 2014.

Neighborhoods far from Downtown employment centers with less access to public transportation options have more vehicles registered per household, as seen in Figure 17. On average, neighborhoods where more than half of workers commute by car have more than one car registered per household, while neighborhoods where less than half of the population commute by car have less than one car registered per household.

FIGURE 17

Cars Per Household and Share Driving to Work



Source: U.S. Census Bureau, ACS 5-Year Estimate, 2012- 2016. MAPC Massachusetts Vehicle Census, 2014.

As shown in Figure 18, between 2011 and 2014, 10 of Boston's neighborhoods saw a decrease in total vehicles registered, with the North End losing 234 cars and Jamaica Plain losing 201 (despite both neighborhoods adding new households). Dorchester added the most cars, at 1,327. Hyde Park added the second most vehicles at 760.

FIGURE 18

Change in Total Vehicles Registered from 2011 to 2014 by Neighborhood

Source: U.S. Census Bureau, ACS 5-Year Estimate, 2012- 2016. MAPC Massachusetts Vehicle Census, 2014.

The following sections will evaluate consequences of vehicle ownership: cost, parking, traffic congestion and carbon emissions. Additionally, there is a profile on the changing automobile industry, featuring electric and hybrid vehicles and autonomous vehicles.

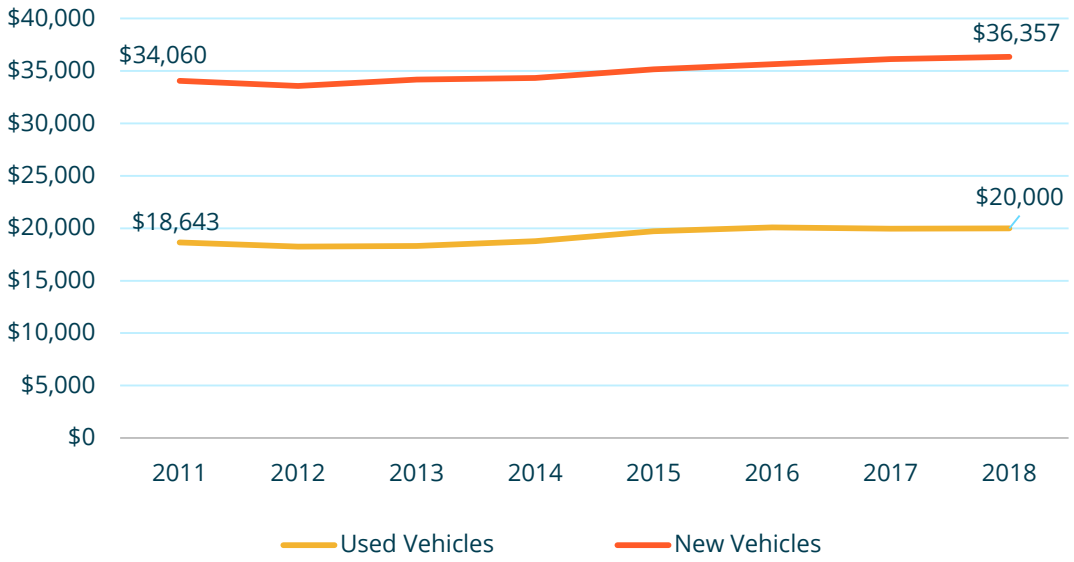
The Cost of Vehicle Ownership

Owning a car can quickly become expensive when adding up the cost of use, insurance, maintenance, and fuel. The American Automobile Association (AAA) estimates that the national average cost per year to own a new car in 2019 was $6,201 (including insurance, registration and fees, depreciation, and finance charges), while the cost to operate was 21 cents per mile (including fuel, maintenance, repair, and tires).[71] For a car traveling 15,000 miles per year, the cost of depreciation makes up 36 percent of total costs, the largest expense associated with ownership. AAA found that in the initial five years of ownership, new vehicles lose an average of $16,670 in value.[72]

In 2018, the average price of a used car was $20,000 while the average price of a new car was $36,357. As Figure 19 shows, the average vehicle transaction prices for used cars and new cars have increased modestly. Analysts from Edmunds suggest that the decline in new car sales during the Recession created a shortage of used cars, making it difficult to find affordable used vehicles.

FIGURE 19

National Average Car Transaction Prices (Adjusted to 2018 Dollars)



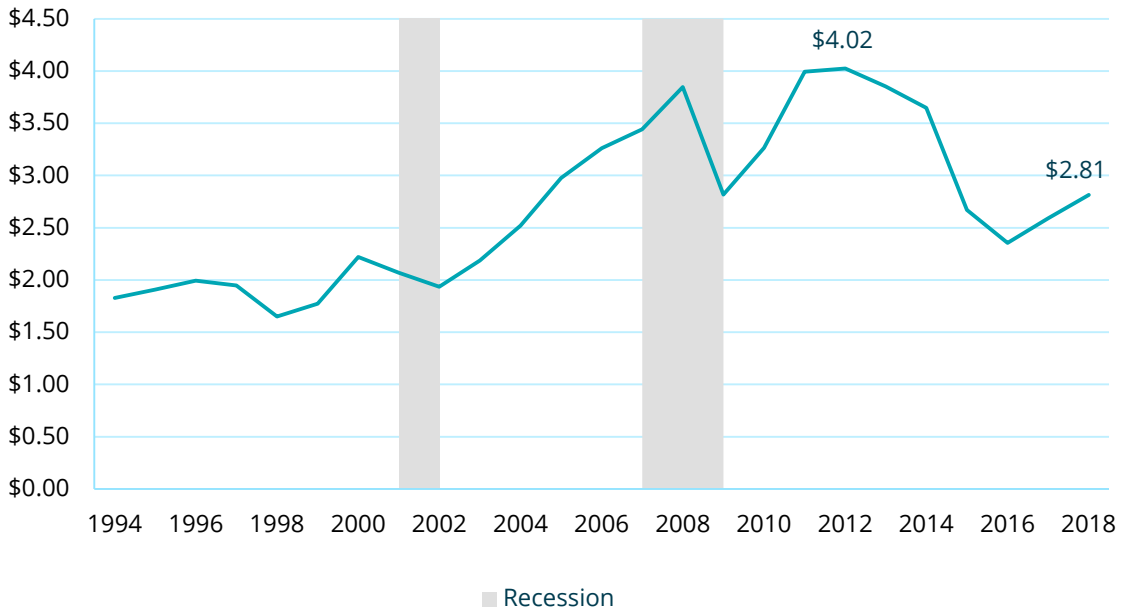
Source: Bureau of Transportation Statistics, New and Used Passenger Car and Light Truck Sales and Leases https://www.bts.gov/content/new-and-used-passenger-car-sales-and-leases

Note: Prices were adjusted using CPI values for all items in U.S. city average.

Fuel also impacts the costs associated with vehicle ownership, and fuel prices fluctuated greatly in the past two decades. In 2018, the average cost of gasoline was $2.81 per gallon in the United States, according to the Energy Information Administration (EIA).[73] Figure 20 shows gas prices dropped during the recession but quickly rebounded, peaking at $4.02 per gallon in 2012. Since then, gas prices have steadily decreased until 2016. Unsurprisingly, these patterns correlate with price fluctuations in crude oil, which is determined by global supply and demand.[74] Other influences on gas prices include the strength of the dollar, which can ultimately influence the price in the international market, and the increased production of crude oil in the United States.[75]

FIGURE 20

Annual Average Gasoline Prices, United States, Adjusted to Constant 2018 Dollars



Source: U.S Energy Information Administration, "United States All Grades All Formulations Retail Gasoline Prices," 2019.

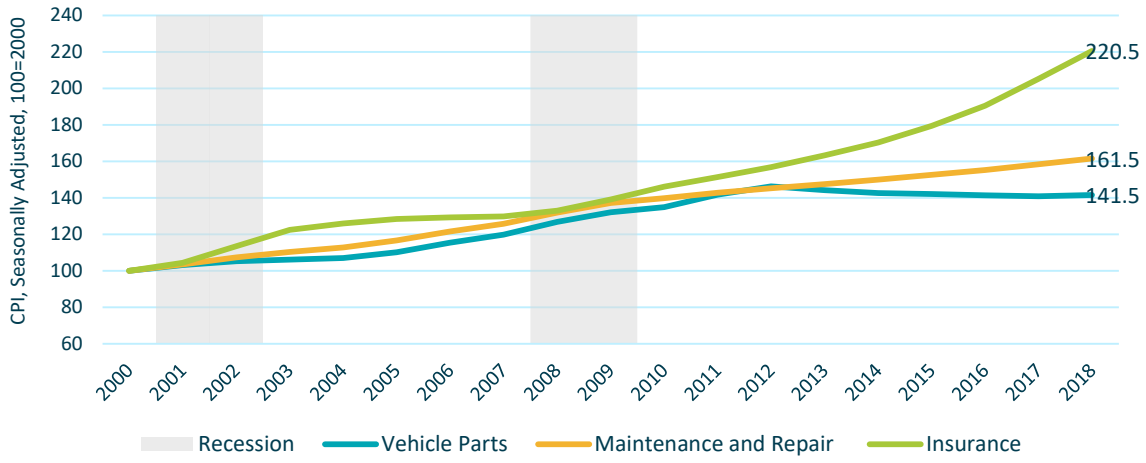
In addition to the costs of fuel, the increasing costs of insurance and maintenance have made vehicle ownership more expensive than previous years. The Zebra[76] is an insurance search engine that analyzes insurance rates in the U.S. From their analysis, the national average insurance premium was $1,470 in 2018, which is an increase of 23 percent since 2011.[77] [78] Massachusetts' average annual rate is estimated at $1,277, only a 2 percent increase since 2011.

Nationally, auto-insurance premiums have been rising, potentially due to external forces such as worsening weather events, an increase of drivers on the road, and the prevalence of distracting smart devices.[79] Insurance analysts suggest that insurance companies are struggling to maintain profitability due to a rise in expensive crashes, poor investment returns, and large payouts due to natural disasters, causing them to pass on costs to consumers. [80]

Data in Figure 21 show the rising cost of vehicle ownership using the Consumer Price Index for Vehicle Related Expenses. The costs of auto insurance, vehicles parts, and maintenance and repair have all risen considerably since 2000.

FIGURE 21

National Consumer Price Index for Vehicle Related Expenses



Source: Bureau of Labor Statistics, Consumer Price Index 2019, and BPDA Research Division Analysis.

Auto loans for purchasing a vehicle are an another cost to vehicle ownership. In 2018, 85 percent of new car purchases and 53 percent of used car purchases relied on auto loans.[81] These purchases increased the auto debt per capita for the U.S. to $4,520. A prominent driver of this growth has been the increase in subprime loans, which made up 26 percent of auto loans in 2016.[82] Subprime loans allow consumers who are low income or have low credit scores to purchase vehicles that are more expensive than they would typically be able to afford. The trade off is that, subprime loans often have higher interest rates and longer terms, making the overall cost of the vehicle much higher for the consumer.

Parking in Boston

Currently, neighborhoods in Boston offer residents on-street parking in their neighborhood with a city-registered parking permit. The neighborhood parking permit is free. To be eligible, the motorist must be a Boston resident, have no outstanding parking tickets, and the vehicle must be registered in Massachusetts. As many residential roads in Boston are limited to "resident-parking only," this program ensures that neighborhood residents get priority for on-street parking near their homes.

Boston has metered on-street parking on main roads throughout the city. Meters are available for two hour periods and are in operation Monday through Saturday, 8:00 am to 8:00 pm; outside of these times parking in these spaces is free.[83] Parking meters in most parts of the city, including Beacon Hill, the Financial District and the South End, cost $2.00 per hour. In Back Bay and the South Boston Waterfront there was a year-long Performance Parking Pilot program in 2017. The pilot prices metered parking spaces dynamically based on demand to free up spaces to help mitigate traffic congestion caused by motorists searching for parking spaces.[84] Following the pilot, meter prices went into effect on July 1, 2019. Meter rates are $3.75 per hour in Back Bay and South Boston Waterfront, $2.50 per hour in Fenway, $2.50 per hour in Bulfinch Triangle, and $0.50 per hour for motorcycle parking.[85]

For residents who live in multifamily residential developments in the city, such as apartments or condos, parking and housing are typically a package deal. In a 2019 study conducted in Boston and surrounding areas,[86] the MAPC surveyed nearly 200 multifamily residential developments. The study found that the developments provide an average of one parking space per unit, and only 32 percent of the surveyed sites required residents to pay separately for parking.[87] The study also reported that the one-space per unit is underutilized, and that 30 percent of the available parking was unoccupied. These empty spaces cost an estimated $94.5 million in construction. In addition to wasting money, oversupply of parking wastes urban land, encourages more driving, and drives up the cost of housing.[88]

Photo Credit: Commonwealth Avenue, BPDA Research Division, 2017.

TABLE 5

Parking Rates for Off -Street Parking in Commercial Business Districts, 2018

	Hourly Parking Rate		Daily Parking Rate		Monthly Parking Rate	
Rank	City	Median Rate	City	Median Rate	City	Median Rate
1	New York City	$27.00	New York City	$42.25	New York City	$616.00
2	Chicago	$17.00	Boston	$34.00	Boston	$424.00
3	Boston	$16.00	Chicago	$30.00	San Francisco	$322.50
4	Philadelphia	$12.00	San Francisco	$28.00	Seattle	$289.00
5	Washington, D.C.	$11.00	Miami	$25.00	Philadelphia	$284.50

Source: Parking Property Advisors and Parkopedia, "Top 40 US Cities Parking Index," 2018.

Off-street parking, in a garage or parking lot, typically charges an hourly rate in Boston. Neighborhoods in the central business districts of Boston offer more garage parking options to accommodate those driving in for work or business, in comparison to the outer, residential neighborhoods. Data in Table 5 show the median off-street parking rates in the Business Districts for Boston compared to other U.S. cities. Boston consistently ranks in the top three costliest U.S. cities for off-street parking rates by hourly, daily and monthly rates.

Another option for a resident or commuter who does not have access to a parking spot is to purchase a parking space. The cost to own a parking space in Boston varies greatly by neighborhood, costing more in Back Bay, Beacon Hill, Downtown, and South Boston Waterfront. For example, according to NeighborhoodX, a parking garage in Beacon Hill sold a parking space for $350,000, while a space off of Commonwealth Avenue in Brighton sold for $49,999 in 2018.[89]

Commuter parking benefits offered by employers offset the cost of parking for some employees in Boston, though at a cost to the federal government. Nationwide, $7.3 billion is paid out as a tax refund for employer-provided parking, compared to $1.3 billion for the commuter transit benefit program.[90] In Downtown Boston, the annual cost of the commuter parking benefit is $34.7 million.

Traffic Congestion in Boston

The number of drivers in conjunction with aging infrastructure in Boston contributes to congestion that exacts a toll on the local economy. In 2017 and 2018, INRIX rated Boston as the most congested city in North America, estimating that drivers spent 164 hours per year in traffic. [91] Of particular concern is the corridor I-93 between the Massachusetts Avenue Connector and Braintree, which is ranked as the seventh worst corridor in the United States, averaging a delay of thirteen minutes each day.[92]

According to a 2019 MassDOT report, the most severe congestion in the Commonwealth occurs on road segments inside the I-95/128 during peak commute hours, with 55 percent of roads being congested or highly congested at 8 am and 66 percent of roads being congested or highly congested at 5 pm.[93] Unfortunately, congestion still occurs outside of peak hours. People's attempts to avoid rush hour traffic has resulted in congestion starting at 6 am and 3 pm.[94]

Using historical speed data collected from their GPS systems, TomTom estimates that drivers in Boston spend about 28 percent more time in their cars than they would if roads were uncongested, amounting to about 29 minutes per day and 112 hours per year.[95] According to this methodology, Boston ranks 13th out of major cities in the United States in congestion level.

Boston's age relative to other cities contributes to this congestion problem, as much of the road infrastructure was built long before the daytime population grew to its current size. The Central Artery Project was the most recent attempt to reduce congestion on streets in Downtown. Completed in 2007, the Central Artery Project or the "Big Dig" rerouted the elevated I-93 highway underneath Downtown, constructed a fourteen-lane bridge across the Charles River, and extended the Massachusetts Turnpike through the Ted Williams Tunnel to Logan Airport.[96] Despite being over budget and plagued by delays, upon completion, the Central Artery Project reduced travel time by 62 percent, saving an estimated $200 million in time and fuel costs annually.

Photo Credit: Longwood Medical, BPDA Research Division, 2018.

Roadway and Highway Finances

State funds contribute to regional highways and local roads. Revenue is generated from toll agencies, highway charges, fees, fines, the motor vehicle sales tax, and motor fuels tax (currently $0.24 per gallon). In FY2018, 60 percent of MassDOT's $2.99 billion in revenue came from capital grants and contributions, 18 percent came from fees, fines, and charges for services, and 16 percent was operational assistance from the Commonwealth.[97] Total revenues declined four percent over 2017. Net revenue declined 55 percent, or $352 million because of an increase in expenses and a decrease in revenue. Expenses totaled $2.7 billion and were comprised primarily of highway spending (63 percent), followed by rail and transit, and planning and enterprise services.

In FY2019, Massachusetts set aside $358.5 million to support the Massachusetts Transportation Trust Fund (MTTF), which funds highways, transit, intercity rail, small airports, the Massachusetts Turnpike, and the Motor Vehicle Registry.[98] In addition, the FY2019 budget for transportation accounts for debt payments for long-term capital investment projects such as reconstructing bridges or ordering new train vehicles. For FY2019, $1.36 billion will be dedicated to make transportation-related debt payments, including debt stemming from the Accelerated Bridge Program, which will rehabilitate or replace over 270 bridges, and the Rail Enhancement Program, which will modernize and expand public transportation, and the "Big Dig."

Photo Credit: I-93, South Boston, BPDA Graphic Design Department, 2013.

Hybrid and Electric Vehicles

In 2016, transportation accounted for 29 percent of Boston's CO_2 emissions.[99] While driving alone has higher costs in terms of carbon emissions than any other mode of transportation, there are measures that can mitigate the environmental burden. Boston has been working to expand infrastructure that supports electric and hybrid vehicles by requiring that five percent of parking spaces be equipped with electric vehicle charging stations and ten percent of new construction projects have infrastructure to support charging stations in the future.[100] From 2014 to September 2019, Massachusetts offered rebates for electric vehicle purchases through the MORE-EV Program, which was funded by the Massachusetts Department of Energy Resources.[101] During the program, vehicle owners in Suffolk County were issued 915 rebates, totaling $1,813,750.

Despite higher initial costs, the long-term costs to operate an electric vehicle are now cheaper than a gasoline-powered vehicle. According to the Department of Energy, a gallon of gasoline in Massachusetts cost $2.86 in August 2018, while charging a comparable electric vehicle, long enough to drive the same distance, only cost $1.97.[102] Across the United States, electric vehicles cost, on average, half as much to operate in comparison to gasoline-powered vehicles.

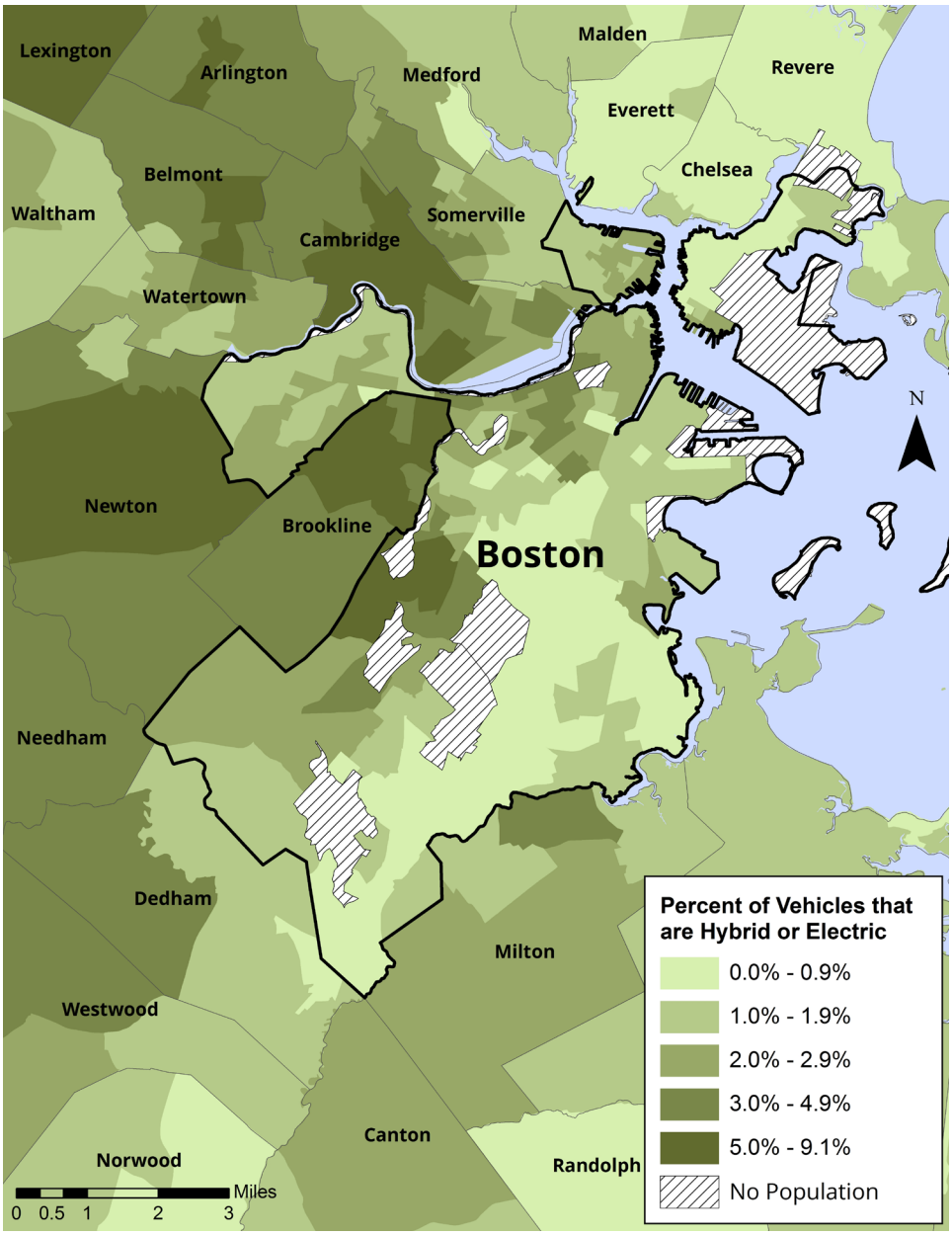
On average, passenger cars registered in the city traveled 24 miles per day in 2014, with cars registered in the South Boston Waterfront traveling the farthest (27 miles per day) and those registered in the West End traveling the least (22 miles per day).[103] MAPC estimates that passenger vehicles registered in Boston traveled 36.6 million more miles in 2014 than in 2011, reaching 2.1 billion miles traveled. However, perhaps due to rising fuel economy and increase in hybrid and electric vehicles, the total number of gallons of fuel consumed per year dropped by three percent to 98.2 million during the same period. As a result, the estimated quantity of CO_2 released by Boston vehicles also fell three percent to 889,100 metric tons.

From 2011 to 2014, Boston drivers registered an additional 1,500 hybrid or electric vehicles, bringing the total to 3,960.[104] Hybrid or electric vehicles still make up only 1.7 percent of total cars registered in 2014. Jamaica Plain had the highest share of hybrid or electric vehicles, followed by Back Bay and Beacon Hill, as shown in Map 18. Between 2011 and 2014, Jamaica Plain added the most hybrid or electric vehicles, while also decreasing the total number of registered vehicles. Brighton and the South End also added more than a hundred hybrid and electric vehicles while decreasing the total number of registered vehicles. However, compared to surrounding municipalities, such as Brookline and Cambridge, Boston has a much lower percentage of hybrid or electric vehicles.

Finally, while electric and hybrid vehicles can reduce carbon emissions, they do not address the problems of congestion and high per passenger mile energy usage when compared to transit and other more sustainable modes.

MAP 18

Share of Hybrid and Electric Vehicles

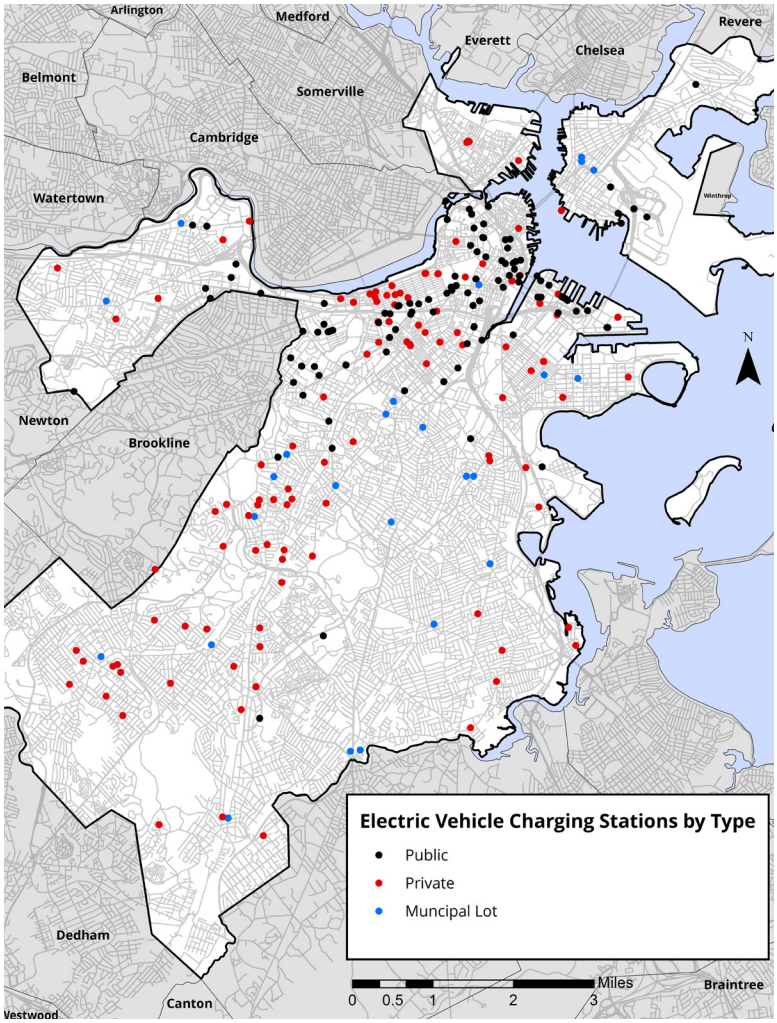


Source: Metropolitan Area Planning Council (MAPC), Massachusetts Vehicle Census, 2009-2014, BPDA Research Division. Analysis.

In January 2019, Mayor Martin Walsh released a Carbon Free Boston report, in which the administration outlined its goals for the City to be completely carbon neutral by 2050. A plan to reach that goal includes requiring new private garages in Downtown, West End, Beacon Hill, North End, Back Bay, South Boston and the South End to have 25 percent of parking spaces equipped with EV charging equipment, and the remainder to be easily converted to EV charging stations. The City also proposes to install EV charging stations in municipal lots. These proposed changes will improve Boston residents' access to EV infrastructure, potentially driving more people to make that switch. Boston has room to improve, compared to neighboring municipalities on hybrid and electric vehicle ownership, and making charging infrastructure more accessible will improve the ratios.

MAP 19

Electric Vehicle Charging Stations by Type, 2019



Source: Boston Transportation Department, 2019 and BPDA Research Division Analysis.

Ride-hailing

Ride-hailing services, or Transportation Network Companies (TNC), such as Lyft and Uber, are integrated into the region's mobility network. These TNCs differ from traditional taxi services by allowing users to call a ride from a mobile-app and car pool with other riders who are headed to a similar destination. The growth of TNCs has had an effect on how people move within the city of Boston. In the past decade we have seen this effect in the changes in personal driving and public transit usage. In Massachusetts, there were 81.3 million trips completed by a TNC in 2018 and of those trips, 42.2 million trips were in Boston alone.[105] In 2016, 3.6 percent of vehicle trips originating in Boston, and 3.9 percent of vehicle trips ending in Boston were ride-hailing.[106]

These services initially faced few regulations, but have recently received some restrictions. In 2016, Massachusetts became the first state to tax these services, imposing a rate of $0.20 per ride. The funds are distributed to cities and towns and are used for the following purposes: supporting city infrastructure ($0.10), alleviating the economic impact on taxi services ($0.05), and funding state transportation ($0.05).[107] According to Massachusetts DOT, the TNC fees amounted to more than $12 million in 2017 and in 2018, more than $16 million.

In 2016, Massachusetts passed a law requiring rideshare companies to share data with the Commonwealth. TNCs are required to report the city or town where each ride began and ended, aggregated route miles and time data. The resulting submittals still fall short of the information needed to truly understand ride hailing in the region. Due to the shortfalls of the data provided by TNC companies, studying them often relies upon surveying TNC users.

In 2017, TNCs accounted for over 291 million vehicles miles traveled in Massachusetts.[108] The ride-hailing VMT estimate is likely understated because this figure does not account for the non-revenue travel (travel without passengers).[109] Within Suffolk County, TNCs accounted for 7.7 percent of vehicle miles traveled in 2018.[110] TNCs should not shoulder all of the blame for the increase in traffic congestion in Boston, since personal vehicle and commercial vehicle use is also increasing.

However, it is important that the City address traffic congestion caused by TNCs appropriately. In recent years pilot programs created designated pickup zones at Logan Airport and pick up and drop off zones in congested neighborhoods, such as Fenway. These pilot programs are designed to help mitigate the congestion created by increased TNC use.

According to The New Automobility Report, 60 percent of ride-hailing users would have opted to take public transportation, walked, biked, or not made the trip if ride-hailing was unavailable. The other 40 percent would have opted to take a personal vehicle or taxi.[111] The trends in Massachusetts show that the ratio of vehi-

cles to licensed driver has been decling in the past decade. It is possible that the introduction of this new transit mode has shifted the preferences of consumers away from traveling in their own car or perhaps owning a car in Massachusetts. However, the number of vehicle miles traveled has been on the rise, suggesting that people are still opting to travel by vehicle, likely in a ride-hail vehicle, and are selecting that option over public transportation or active transportation.

Evidence on the effect of ride-hailing services on public transportation usage is mixed. On one hand, ride-hailing services may directly compete with public transportation because they are more direct and faster route than traditional public transportation. On the other hand, proponents, including ride-hailing companies, have pitched their services as complementary to public transportation by filling in service gaps or operating during late night hours.

A study of Metropolitan Statistical Areas (MSA) in the United States found that the arrival of Uber increased public transportation usage by 5.8 percent in cities that had below the median ridership before the company's arrival. This suggests that TNCs may act as complements to public transportation in smaller cities where public transportation options are not as flexible.[112] However, cities that had above the median ridership before the company's arrival saw a decrease in ridership by two percent, indicating that residents of larger cities may be more willing to substitute ride-hailing for public transportation.

A survey completed by the MAPC revealed that 42 percent of users were substituting a ride-sharing trip for public transportation, which the MAPC estimates that the MBTA loses 35 cents of revenue per TNC trip.[113] In Massachusetts, the majority of ride-hail trips occurred during MBTA operating hours; in fact minimal trips were completed between 12:00 AM and 6:00 AM, suggesting that ride-hailing is less of a complement but a replacement good to public transit in Boston.[114] During weekdays, at least 40 percent of ride-hail users took a trip during peak commuting hours, which is when MBTA ridership is at the highest and is generating the most revenue.[115] For 2017, the MAPC estimates that the MBTA lost approximately $19.3 million in revenue as a direct result of ride-hailing.[116]

The MBTA is piloting a program with Uber, Lyft, and Curb to offer on-demand, ADA compliant, paratransit as a supplement to the MBTA's paratransit option, The Ride.[117] The Ride is MBTA's current ADA complementary paratransit, which runs fixed-route service to provide public transportation to people with disabilities that would be unable to take a bus or subway. The pilot program offers The Ride patrons an on-demand service, something that The Ride is unable to offer. However the paratransit option is likely to be more expensive than The Ride. According to the MBTA, fares on The Ride are $3.50 or $6.50 per trip, while the TNC paratransit trip is the same price as a standard TNC trip. Therefore the TNC trip cost is variable and dependent on where the person is traveling rather than a flat rate. This pilot program benefits patrons by offering an on-demand service; however the pilot pricing structure may not be accessible to all The Ride users.

Ride-hailing users are paying a substantial premium for the service, especially when considering the less expensive and free transit options available. The majority of TNC trips cost more than $10, and 20 percent of trips cost more than $20.[118] Therefore private ride-hailing services are not a financially accessible option for the majority of people's daily commutes, nor is it viable for this service to replace public transit.

It is necessary for cities and metropolitan regions to consider the impact and effect that TNCs have on traffic congestion, personal transit choices and public transportation. The growing body of research surrounding TNCs and more publicly available TNC data allow cities and metro regions like Boston to assess the impacts and create better guided policies.

Car-sharing in Boston

Car-sharing provides flexibility to individuals who do not own personal vehicles, but want access for shorter trips. Car-sharing companies, like Zipcar, allow users to rent a vehicle from a company-owned fleet. Car-sharing is an additional transportation mode that complements public transit, micro-mobility, active transportation and TNC use for individuals without a car. Car-sharing is a new form of car rental that stores its fleet on city streets rather than in retail lots - this provides drivers the flexibility to pick up a car anywhere at any time. Zipcar has a membership that allows drivers to access a car at an hourly base price and rent a vehicle up to multiple days. The pricing overall is comparable to traditional car rental. This service can be a less expensive alternative to owning a car, and may reduce the number of cars on the road. One study found that many users of car-sharing services got rid of their own vehicles or postponed purchases.[119] Most car-sharing companies have designated locations for drop-off and pick-up; however, new peer-to-peer services, like Turo, Getaround, and Maven, allow users to rent local, individually-owned cars. This provides greater geographic flexibility than company-owned car-sharing services, which tend to be concentrated in dense, downtown neighborhoods.

The number of Zipcar members in Boston fluctuates throughout the year. In 2016, the number of Zipcar members peaked in September at 39,000.[120] This peak could be influenced by returning students and the residential rental cycle. Allston, Fenway, and Longwood had the highest annual average of Zipcar members in 2016. Accordingly, these neighborhoods also had the lowest median ages of residents, highest percentages of students enrolled in under-

graduate, graduate or professional school, and the highest percentages of group quarter populations.[121]

There is not a lot of independent research on the impact of car-sharing on cities. Zipcar has only a national fleet of 12,000 vehicles, so the utilization of this service seems less frequent than TNCs.[122] Therefore, car-sharing has more of a minimal impact on roadways and public transit useage. Car-sharing is useful for a multimodal lifestyle, but may not be as widely used as other modes.

The Future of the Automobile Industry

Industry analysts expect that personal vehicle ownership will decline or change form in the next several decades. Increasing consumer interest in shared mobility, such as ridehailing, carpooling and car-sharing, and new technology that offers the option of on-demand and autonomous vehicles have the potential to decrease demand for individual ownership.[123] [124] These trends are expected to occur much more rapidly in dense urban areas, where ride sharing apps are already established and widely used by the population.

Widespread adoption of shared mobility and autonomous vehicles will likely alter how we use passenger cars in the future. McKinsey predicts that by 2030 up to 10 percent of vehicles sold could be shared vehicles and up to 15 percent of new vehicles sold could be fully autonomous, assuming that technological and regulatory barriers are overcome.[125] Individual ownership may be supplanted or decreased by the shift toward on-demand mobility services, particularly in dense urban areas where local policies discourage private vehicle use and alternative transportation options are more available.

Boston is also considering the potential impact of autonomous vehicles on roads. Boston's partnership with nuTonomy has featured limited testing within the Raymond L. Flynn Industrial Park, followed by extended range testing in the Seaport District. nuTonomy also led a pilot program, in partnership with Lyft, that offered passengers autonomous rides. In June of 2018, nuTonomy received approval from Boston to continue testing autonomous vehicles. Boston, along with thirteen other municipalities, signed a Memorandum of Understanding streamlining the process for companies seeking to test autonomous vehicles on roads and standardizing the safety guidelines in Massachusetts, promising further testing to come.[126]

FREIGHT

Freight transportation is the physical movement of goods from one place to another by land, sea, air, or any combination of the three. The freight system reaches every region in Massachusetts and impacts shippers, carriers, consumers, members of the workforce, and communities. With the rise in e-commerce, the expansion of the population, and increasing economic activity, the Massachusetts freight system is continuously growing and adapting. The Massachusetts Department of Transportation projects that Massachusetts' freight system will transport a total of $1 trillion worth of goods by 2045, nearly doubling in value from 2015.[127]

In the freight network, railways and roadways connect air, land, and sea gateways. Private carriers like CSX Corporation and Pan Am Southern own the state's major rail yards, which are located in cities in Central Massachusetts.[128] In 2013, operations at Boston's only rail yard, Beacon Park Yard in Allston, relocated to Worcester. Because of this, Boston depends on roadways and trucks to transport freight between the major ports in the city and the railways in Central Massachusetts. The main highways that directly reach Boston's ports are I-90, which transports freight west, and I-93, which transports freight north or south.[129]

Source: Port of Boston, Alex MacLean Aerial Photography, 2014.

Massport

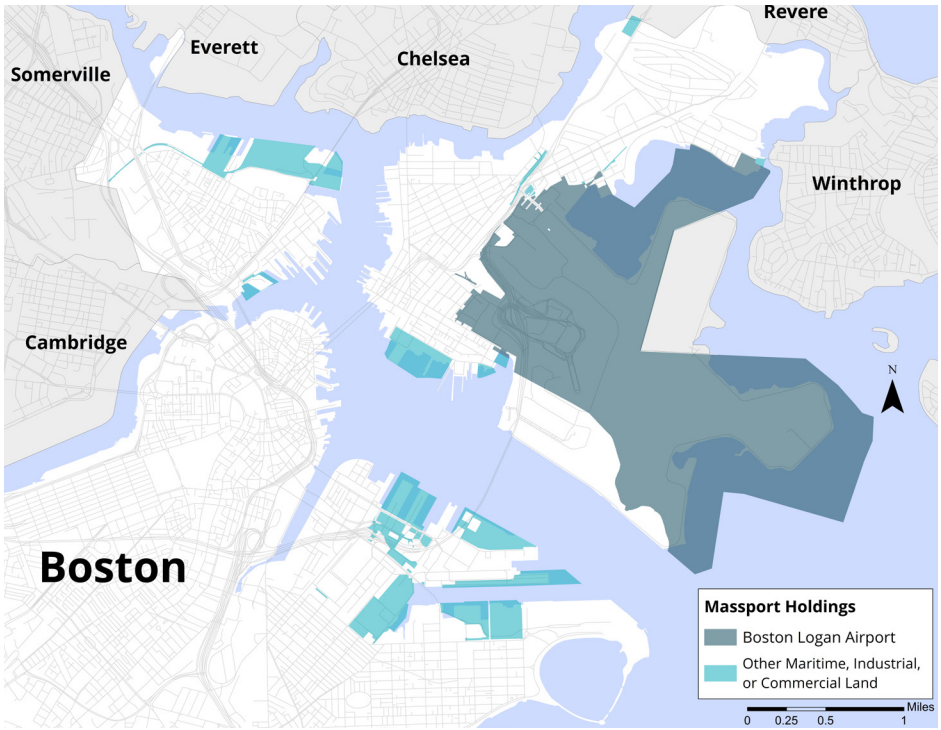
The state legislature created the Massachusetts Port Authority ("Massport") in 1956 to develop and manage the state's major air and sea transportation centers. Massport oversees Boston-Logan Airport, regional airports Worcester Regional Airport and Hanscom Field, and Paul W. Conley Marine Terminal and Flynn Cruiseport. The combined economic impact of Massport's air and sea ports in Boston is estimated to be around $24.5 billion.[130]

Massport owns, operates, and leases out over 2,000 acres of land within the City of Boston. The greatest share of these holdings is the 1,700 acres on which Boston-Logan Airport operates, followed by the 644 acres of maritime, industrial, and commercial waterfront property located in or near the Port of Boston.[131]

Massport directly employs about 1,300 people spread across all of its facilities. It also supports nearly 21,000 jobs at its Boston air and sea ports.

MAP 20

Massport Holdings in Boston, 2018



Source: BPDA Research Division Analysis.

The Massport capital improvement program will allocate $3.8 billion from FY2019 to FY2023 for capital projects. The projects will mitigate congestion and improve facilities, and will meet both LEED (Leadership in Energy and Environmental Design) standards and Massport's Flood-proofing Design Guidelines.

Boston-Logan Airport

Boston-Logan Airport, the 15th busiest airport in the United States, transported nearly 41 million passengers and more than 700 million pounds of cargo in 2018. With four passenger terminals and 94 gates, Logan hosts more than 40 airlines which provide non-stop service to 75 domestic and 58 international locations. The most frequently traveled flight route is to and from Washington D.C.[132] Boston-Logan employs approximately 17,000.[133]

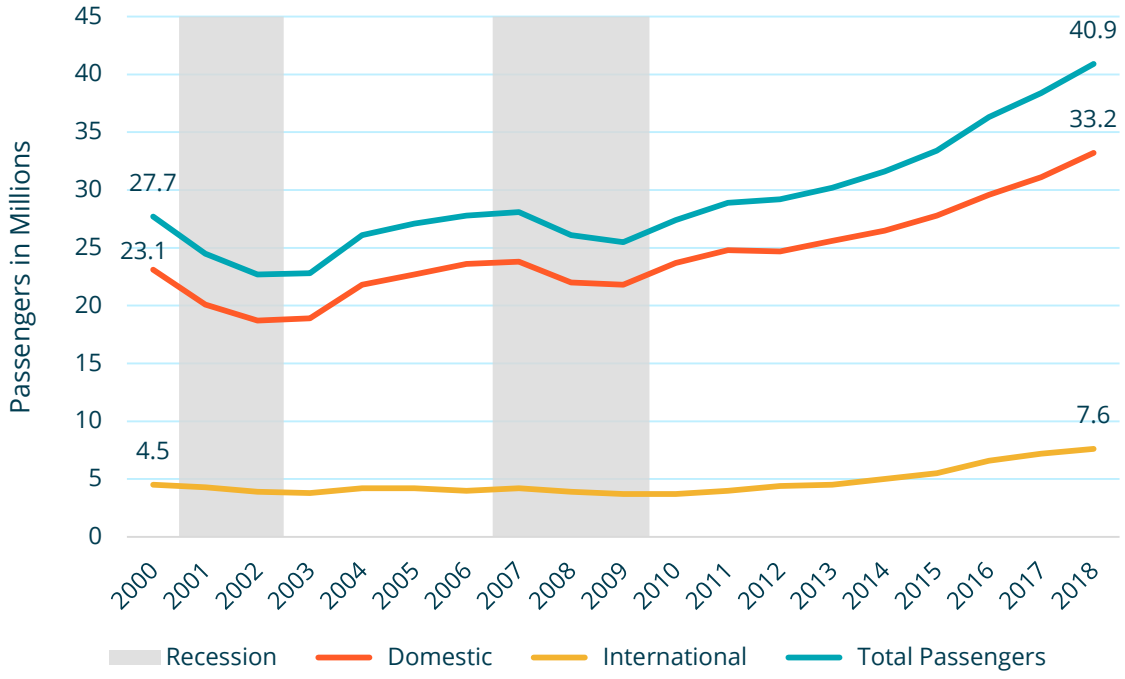
Massport expects to spend $1.9 billion on ongoing and proposed projects at Boston-Logan between FY2019-2023 as a part of its capital improvement program. These projects are largely designed to solve congestion issues and update facilities to better handle increasing passenger volumes and cargo processing. The most significant capital investment projects will improve passenger terminals and facilities in Terminals B and E, connect Terminals B and C, widen traffic lanes and curbsides, and add 5,000 more parking spaces.[134]

Source: Plane taking off from Boston-Logan, Alex MacLean Aerial Photography, 2014.

In 2018, nearly 41 million passengers traveled through Boston-Logan Airport - an increase of 35 percent in the past five years.[135] The total number of passengers is expected to continue increasing at an annual rate of around 5 percent and surpass 47 million passengers by 2024. If passenger volume continues to grow at its current rate, Boston-Logan could become one of the top 10 busiest airports in the U.S. by 2022.

FIGURE 22

Passengers in Millions at Boston-Logan Airport



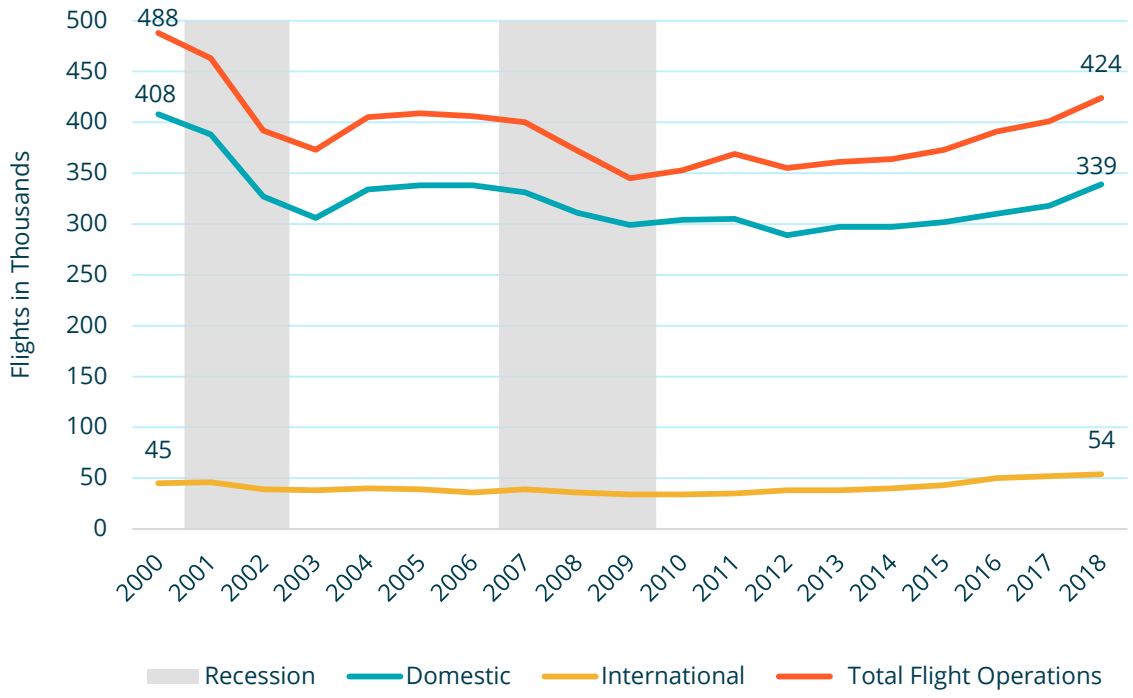
Source: Massport, "Airport Statistics", 2000-2018.

Note: Values may not add to total due to rounding. Total includes general aviation passengers.

Of the 425,000 flight operations at Boston-Logan Airport in 2018, 339,000 were domestic flights and about 54,000 were international.[136] Since 2000, there have been fewer total flight operations, but a larger number of passengers. These trends reflect a long-term industry-wide shift toward larger air-craft with higher seating capacities, which are more fuel-efficient. From 2000 to 2017, the average number of passengers per flight at Boston-Logan increased by 68 percent, from 57 to 96, now consistent with the national average in 2017.[137]

FIGURE 23

Flight Operations in Thousands at Boston-Logan Airport



Source: Massport, "Airport Statistics", 2000-2018

Note: Values may not add to total due to rounding. Total includes general aviation passengers.

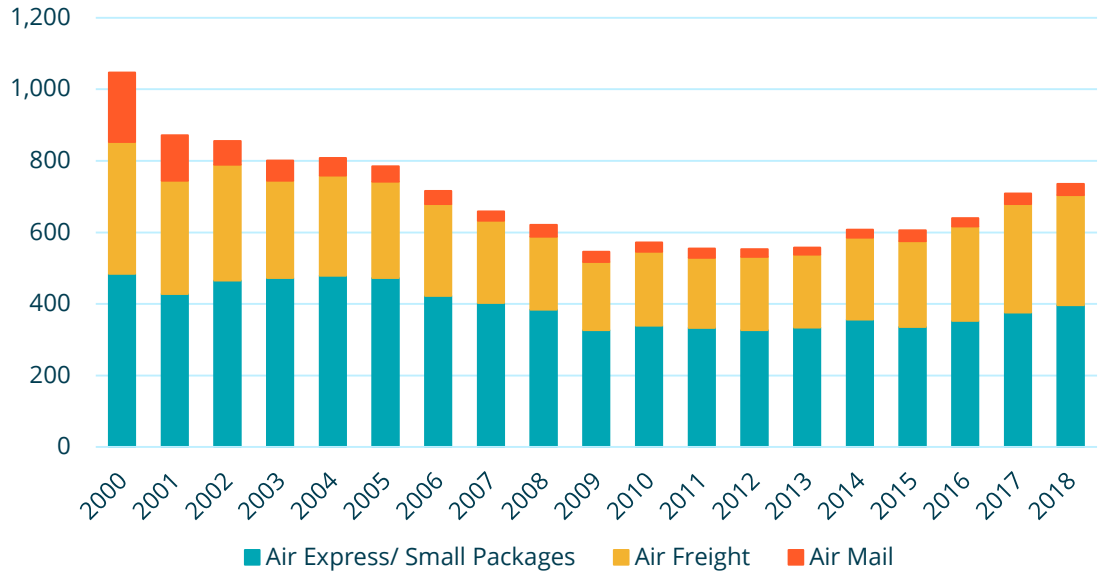
In 2018, cargo operations at Boston-Logan transported more than 700 million pounds of packages, freight, and mail to domestic and international locations. Goods that are transported via air have highly accurate arrival times and can travel to a wide range of destinations. Short and reliable shipment times make air shipment ideal for low weight, high-value and perishable goods. A downside of air shipment is that heavier goods or larger quantities of goods are more expensive to ship largely due to size and weight limits, as the average-sized airplane can carry roughly 23 tons in passenger and cargo weight.[138]

Less expensive alternatives to air shipment are the use of email or the use of trucks by cargo carriers for shorter haul markets. These alternative modes are partially responsible for the reduction in cargo, freight, and mail volume, which have decreased by 45 percent since 2000, with mail service decreasing by 84 percent since 2000.[139] However, as Figure 24 shows, freight shares are returning to positive growth.

While cargo volume is declining, cargo operations in long-haul markets have been growing since 2010. International cargo, which is generally stored as "belly freight" in international commercial flights, greatly increases the flight's profitability. It accounts for 39 percent of all cargo shipments at Boston-Logan and is projected to continue growing at 1.7 percent annually.[140] This trend has led Massport to convert some airport facilities previously used only for cargo-processing into facilities capable of processing both passengers and belly freight through projects like its Terminal E Modernization project.

FIGURE 24

Cargo and Mail at Boston Logan Airport in Millions of Pounds,



Source: Massport, "Airport Statistics," 2000-2018.

Trade goods traveling in and out of Boston-Logan Airport in 2018 were valued at $16.6 billion and weighed 138 thousand tons. Of this, imports were valued at $9.2 billion and weighed 81 thousand tons, and exports at $7.4 billion and nearly 57 thousand tons. These figures rank Boston-Logan Airport at 13th in terms of total value of trade goods out of all of the country's airports.[141] The airport's top international trade partners in 2018 were Germany, Ireland, Switzerland, the United Kingdom, and France, which accounted for 56 percent of total trade. The top import by value in 2018 was medical instruments for surgeons, dentists, and veterinarians, whereas the top import by weight was chilled or frozen fish fillets.

TABLE 6

Imports at Boston-Logan in 2018

Imports by Value (in millions of $)				Imports by Weight (in thousands of tons)			
		Value	Share			Weight	Share
1	Medical Instruments for Surgeons, Dentists, Vets	1,270	14.0%	1	Fish Fillets, Chilled or Frozen	11.0	14.0%
2	Orthopedic Appliances, Artificial Body Parts	1,270	14.0%	2	Fish, Fresh or Chilled	7.9	9.7%
3	Medicines in Individual Dosages	979	11.0%	3	Medical Instruments for Surgeons, Dentists, Vets	3.1	3.9%
4	Plasma, Vaccines, Blood	481	5.2%	4	Peppers, Asparagus, Squash, etc.	1.6	1.9%
5	Value Added to a Returned Import	416	4.5%	5	Centrifuges, Filters, Machines, and Parts	1.4	1.7%
6	Aircraft Engines, Engine Parts	382	4.1%	6	Sweaters, Pullovers, Vests, Knit or Crocheted	1.2	1.5%
7	Sulfonamides	315	3.4%	7	Medical Equipment for Physicals	1.2	1.4%
8	Medical Equipment for Physicals	210	2.3%	8	Compressors and Pumps	1.1	1.3%
9	Centrifuges, Filters, Machines and Parts	208	2.2%	9	Leather Shoes	1.0	1.2%
10	Fish Fillets, Chilled or Frozen	129	1.4%	10	Parts for Heavy Machinery	0.9	1.2%
	Other	3,580	37.9%		Other	50.7	62.2%
	Total Value	**9,240**	**100.0%**		**Total Weight**	**81.0**	**100.0%**

Source: US Trade Numbers, "Boston-Logan Airport," 2018.

Note: Values may not add to total due to rounding.

In 2018, the top export by value was medical instruments for surgeons, dentists, and veterinarians, and the top export by weight was shrimp and other crustaceans. The top exports passing through Boston-Logan Airport reflect the significance of some of Boston's top industries, such as healthcare, medical research and development, technical services, and the region's commercial fishing.

TABLE 7

Exports at Boston-Logan in 2018

Exports by Value (in millions of $)				Exports by Weight (in thousands of tons)			
		Value	Share			Weight	Share
1	Medical Instruments for Surgeons, Dentists, Vets	1,150	16.0%	1	Shrimp, Other Crustaceans	7.6	13.0%
2	Civilian Aircraft, Parts	716	9.7%	2	Medical Instruments for Surgeons, Dentists, Vets	4.2	7.5%
3	Plasma, Vaccines, Blood	518	7.0%	3	Civilian Aircraft, Parts	2.3	4.6%
4	Centrifuges, Filters, Machines and Parts	486	6.6%	4	Centrifuges, Filters, Machines and Parts	2.5	4.5%
5	Medical Equipment for Physicals	299	4.0%	5	Transmission Shafts, Bearings, Gears	2.5	4.4%
6	Medicines not in Individual Dosages	220	3.0%	6	Binders for Found Molds; Chemical Products	2.4	4.3%
7	Orthopedic Appliances, Artificial Body Parts	206	2.8%	7	Fish, Fresh or Chilled	1.6	2.7%
8	Misc. Medical Chemical Re-Agents	195	2.6%	8	Misc. Medical Chemical Re-Agents	1.3	2.4%
9	Computers	190	2.6%	9	Medical Equipment for Physicals	1.0	1.8%
10	Laser-Based Medical Equipment, Parts	185	2.5%	10	Enzymes	1.0	1.7%
	Other	3,235	43.2%		Other	30.2	53.1%
	Total Value	**7,400**	**100.0%**		**Total Weight**	**56.6**	**100.0%**

Source: US Trade Numbers, "Boston-Logan Airport," 2018.

Note: Values may not add to total due to rounding.

Port of Boston

One of the oldest ports in the nation, the Port of Boston dates back to the establishment of Boston as a settlement in 1630. The port has remained an important center for domestic and international trade, and is a notable source of economic activity for the region. The port contains both public and private terminals; all public terminals are owned and operated by Massport; these include Conley Terminal, Flynn Cruiseport, and smaller facilities like Boston Fish Pier, Boston Autoport, and Massport Marine Terminal. These terminals specialize in the shipment of containerized cargo, automobiles, and cement. A variety of private terminals also exist in the Port of Boston, including the Exelon LNG Terminal, Twin Rivers, Eastern Minerals Salt Terminal, and others specializing in the processing and distribution of gasoline, petroleum, seafood, and salt.[142]

Source: Overhead of Conley Terminal, Alex MacLean Aerial Photography, 2014.

Current capital improvement projects for the Port of Boston are underway, including a dredging project that will deepen the South North Channel and Main Shipping Channel from about 45 to 51 feet deep and from about 36 to 47 feet deep, respectively. This will allow the port to accommodate larger ships already calling in other Atlantic coast ports that are capable of carrying up to 12,000 TEUs (twenty-foot equivalent units). The largest ships currently calling in the Port of Boston can carry around 8,500 TEUs.[143] The estimated project cost is $350 million and is expected to be completed by 2021.[144]

The Port of Boston creates 9,000 direct jobs and supports an estimated total of 66,000 direct, indirect, induced, and related jobs. In 2018, the Port of Boston generated an estimated $8.2 billion in economic output, $1.8 billion of which was direct business revenue.[145]

The Economic Development and Industrial Corporation owns the Raymond L. Flynn Marine Park, formally known as the Boston Marine Industrial Park. The Park extends nearly 200 acres along the South Boston Waterfront, and the area is mainly used for maritime industries and industrial purposes. The primary goal of the businesses in the park is to create and protect different jobs for people at a variety of skill levels.

The advantages of transporting freight by container ship are that producers can ship their products in large quantities at a low price. The containers are highly protective barriers against outside forces, making them suitable for the shipment of raw materials and chemicals. Disadvantages of this mode are slow and sometimes unreliable transport times, as container ships travel at an average speed of 20 to 25 knots or 23 to 29 mph, and the sealed environment within the container may be incompatible with certain goods.[146]

Goods traveling through the Port of Boston in 2018 were valued at a total of $10.5 billion, weighing 10 million tons, with imports accounting for $9.3 billion and 8.4 million tons and exports accounting for $1.3 billion and 1.6 million tons. The Port of Boston is ranked 14th among Atlantic seaports in terms of container volume. The top five countries trading with the Port of Boston are China, Canada, Japan, the United Kingdom, and Germany, which account for nearly 70 percent of total trade.[147]

The top import entering the Port of Boston is gasoline and other fuels, which alone accounted for 35 percent of total value and 64 percent. Conley Terminal, the only full-service container terminal in New England, is an international commerce hub for the region. Nine of the top container shipping lines ship internationally through Conley, directly connecting the Port of Boston to over 100 other seaports globally. Conley Terminal has six ship to shore cranes, all of which have a lifting capacity between 40 and 50 tons. 307,000 TEUs went through Conley Terminal in FY2019, an 8 percent increase from FY2018.[148] To accommodate growth and improve the Terminal, Massport is investing $310 million between FY2019-2023 in ongoing and proposed projects to improve waterside and landside infrastructure.[149] In 2017, Massport completed a Dedicated Freight Corridor, a direct connection between Summer Street and Conley Terminal to ease the congestion Conley Terminal causes on East First Street.[150] Ongoing projects at Conley Terminal include the creation of two 50-foot berths, obtaining larger ship-to-shore cranes, expanding reefer storage, and modernizing the existing facility.[151] of total tonnage of all inbound shipments in 2018.

As seen in Table 9, the top export in 2018 was scrap iron and steel, accounting for 19 percent of total export value and 46 percent of the total weight of all outbound shipments. The top exports traveling through the Port of Boston again reflect the significance of some of Boston's top industries such as medical research and development, technical services, and commercial fishing.

Flynn Cruiseport, named in honor of former Boston Mayor Ray Flynn, sees heavy traffic during the cruise season, which is from March to November for Boston.[152] In 2018, Flynn Cruiseaport saw 151 different ships and nearly 390,000 passengers, a record for the cruise-port; although 2019 is expected to surpass this with passenger projections exceeding 400,000. According to its capital improvement plan, Massport is investing roughly $36 million in ongoing and proposed projects at Flynn Cruiseport between FY2019-2023.

TABLE 8

Imports at Port of Boston in 2018

Imports by Value (in millions of $)				Imports by Weight (in thousands of tons)			
		Value	Share			Weight	Share
1	Gasoline, Other Fuels	3,200	35.0%	1	Gasoline, Other Fuels	5,390	64.0%
2	Motor Vehicles for Transporting People	730	7.9%	2	Petroleum Gases, Other Gaseous hydrocarbons	985.0	12.0%
3	Petroleum Gases, Other Gaseous hydrocarbons	293	3.2%	3	Various Forms of Salt	645.0	7.7%
4	Wine	260	2.8%	4	Petroleum Products	98.9	1.2%
5	Fish Fillets, Chilled or frozen	243	2.6%	5	Wine	77.1	0.9%
6	Rum, Gin, Vodka, other liquors	182	2.0%	6	Coconut, Palm Kernel or Babassu Oil Etc	70.0	0.8%
7	Furniture Parts	176	1.9%	7	Furniture Parts	60.4	0.7%
8	Seats, Excluding Barber/ Dental	112	1.2%	8	Granite, Marble, Other Stones	58.5	0.7%
9	Mussels, Scallops, other mollusks	107	1.2%	9	Motor Vehicles for Transporting People	56.2	0.7%
10	Toys, Children's Bicycles, Games	98	1.1%	10	Fish Fillets, Chilled or frozen	47.9	0.6%
	Other	3,859	41.1%		Other	921.0	10.7%
	Total Value	**9,240**	**100.0%**		**Total Weight**	**8,410.0**	**100.0%**

Source: US Trade Numbers, "Port of Boston," 2018

Note: Values may not add to total due to rounding.

TABLE 9

Exports at Port of Boston in 2018

Exports by Value (in millions of $)				Exports by Weight (in thousands of tons)			
		Value	Share			Weight	Share
1	Scrap Iron, Steel	245	19.0%	1	Scrap Iron, Steel	716.0	46.0%
2	Paper, Paperboard Scrap	69	5.5%	2	Paper, Paperboard Scrap	466.0	30.0%
3	Aluminum Waste and Scrap	65	5.1%	3	Wood in the Rough, Stripped or Not of Sapwood, Etc	79.4	5.1%
4	Medical Equipment for Physicals	57	4.4%	4	Wood, Sawed or Chipped, Greater than 6 Meters Thick	51.9	3.4%
5	Copper Waste and Scrap	48	3.8%	5	Aluminum Waste and Scrap	48.9	3.2%
6	Wood, Sawed or Chipped, Greater than 6 Meters Thick	40	3.2%	6	Copper Waste and Scrap	14.8	1.0%
7	Motor Vehicles for Transporting People	39	3.1%	7	Raw Hides, Skins of Cows, Horses	14.7	1.0%
8	Mussels, Scallops, other mollusks	38	3.0%	8	Worn Clothing, Other Worn Textile Articles	14.4	0.9%
9	Misc. Plastic Plates, Sheets and Film	36	2.9%	9	Mussels, Scallops, other mollusks	13.3	0.9%
10	Misc. Coated Paper, Paperboard	34	2.7%	10	Chemical Wood Pulp, Not Dissolving Grade	11.6	0.8%
	Other	600	47.3%		Other	119.0	7.9%
	Total Value	**1,270**	**100.0%**		**Total Weight**	**1,550.0**	**100.0%**

Source: US Trade Numbers, "Port of Boston," 2018

Note: Values may not add to total due to rounding.

Issues and Opportunities

The continual growth of freight transport in Boston has opened up a unique set of issues requiring the expansion and improvement of infrastructure to continue supporting growth. The table below describes some of those issues and opportunities by mode.

TABLE 10 **Issues and Opportunities of the Freight System by Mode**

Mode	Issues	Opportunities
Trucks / Highways	Massachusetts lacks an adequate amount of truck parking and service facilities along highways, particularly on I-495 and I-90, which see the highest volume of trucks in the state.	-Build/expand truck parking and facilities on central truck routes. -Create smartphone application for drivers that will show available parking and give directions.
	9 percent of highway bridges, 2 percent of lane-miles Interstate pavement, and 13 percent of non-Interstate pavements are in "poor" condition.	-Continue investment in infrastructure such as the creation of a feedback mechanism to report infrastructure issues.
	There is an increasing nationwide shortage of truck drivers.	-Develop training programs for freight professions.
Railroads	Many rail lines in Massachusetts cannot be fully loaded since they have a 263K lb weight restriction. This reduces efficiency and puts Massachusetts companies at a competitive disadvantage	-Upgrade all lines in Massachusetts to the 286K lb standard norm.

Airport	On roadway congestion affects the efficacy and safety of landside operations, and creates environmental issues.	-Improve high-occupancy (HOV) facilities. -Implement on-Airport roadway and MBTA Blue Line/ intra-terminal connectivity projects.
Seaport	Congestion near Seaport District prevents the Port from reaching its full economic potential.	-Build Cypher-E Freight Corridor to enhance connection between South Boston and Interstate Highway System.
	Port of Boston is not equipped to handle larger container ships, which are now calling more frequently in other Atlantic seaports	Projects are underway to: -Deepen existing berths. -Construct new gate facilities. -Enhance terminal technology. -Expand the storage area for refrigerated containers. -Obtain larger cranes.
All Modes	CO_2 emissions from transportation pollute air and affect public health.	-Support policies such as the Massachusetts Global Warming Solutions Act in 2008, which has set goals for greenhouse gas reduction across all industries. -Electrify truck stops and railyards to prevent idling at stops.
	Customs clearance delays affect the efficiency of the delivery of goods. Delays also cause perishable goods to spoil if they are sitting at the airport, seaport, or rail yard for too long.	-Use a cloud based ledger called "blockchain" that tracks every transfer of custody in a supply chain to make the flow of goods more efficient.

Sources:

"Massachusetts Freight Plan." MassDOT. https://www.mass.gov/files/documents/2018/09/04/Freight%20Plan508.pdf.

"2017 Environmental Status and Planning Report." Massachusetts Port Authrority. http://www.massport.com/media/3336/2017_espr_amended_081219_part1.pdf

Conclusion

This report is a practitioner's guide to some of the data available for transportation analysis and some trends highlighted in Boston.

Transportation choices that people make are influenced by many factors, including convenience, availability, price, technological change, environmental awareness, and time-savings. The future of transportation in Boston will likely be influenced by technological change, federal funding, energy costs, and city/state federal policy. The Go Boston 2030 process completed in 2017 incorporates the input of thousands of residents through roundtable discussions, visioning labs, workshops, and surveys. The resulting recommendations are based on three goals: Accessibility, Reliability and Safety, anthree guiding principles: equity, economic opportunity, and climate responsiveness.[153]

The Go Boston 2030 plan resulted in several near-term action steps for which planning is currently underway. The project that received the most public votes during the outreach process was making Main Street Districts more accessible to pedestrians and bikers, a project that the city is undertaking through improvements to lights and crosswalks, sidewalks, and bike lanes. Another high priority is to improve traffic signaling via "smart lights" that communicate with each other about traffic flow and adjust to relieve congestion on busy roadways. There is also a proposal to build a greenway connecting Franklin Park to Moakley Park along Columbia Road, completing the original proposed design of the Emerald Necklace.

Boston will also work toward extending transit routes to underserved communities and residents. For instance, some recommendations in Go Boston 2030 are to extend the Orange Line to Roslindale Square, which would connect residents to Forest Hills Station, and extend the Green Line from Heath Street to Hyde Square, further, which would connect residents to the Longwood Medical Area.[154] In addition to these extensions, Go Boston 2030 suggests for bus services to connect Mattapan and Dorchester to Longwood, expanding economic opportunities to residents throughout the city.[155]

Appendix

The following Appendix describes publicly available datasets that researchers can use to answer their own research questions related to transportation. Some of the data are specific to Boston and Massachusetts, while others apply to the entire United States. Each source contains a description of the variables, geography, and timeframe available.

American Community Survey (ACS)

Description: The U.S. Census and American Community Survey (ACS) collect data on commute patterns for the national workforce, including time to work, means of transportation to work, time leaving for work, time arriving at work, place of work, and vehicles used in commute.

Geography: All geographies available through the ACS and U.S. Census, available either by household geography or workplace geography.

Time Frame: ACS 5-Year for 2005-2009 through 2013-2017. Decennial Census for 2000 and 2010. ACS 1-Year for 2005 through 2017.

URL: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

MBTA General Transit Feed Specification (GTFS)

Description: The MBTA General Transit Feed Specification (GTFS) includes seventeen files documenting various attributes of MBTA facilities, routes, and trip schedules. The GTFS is a static feed documenting existing or scheduled actions on public transportation lines. The MBTA also makes a live feed available through an API for real-time service alerts and vehicle locations.

Geography: Data files include all service regions for the MBTA.

Time Frame: The feed is updated at least quarterly, though the data can change at any time. Archived data are also available for download.

URL:
Access the most recent file here: http://gtfs.org/.
Documentation available here: http://gtfs.org/reference/#term-definitions.
Helpful examples: http://gtfs.org/examples/.
Live feed: https://www.mbta.com/developers/v3-api.
MBTA Performance Data

MBTA Performance Data

Description: MBTA Performance Data provides data on reliability, ridership, financial information, and customer satisfaction. Reliability is calculated as on-time percentages for various modes and routes, ridership is calculated from station and vehicle entrances, financial information is calculated from amount spent, received and budgeted, and customer satisfaction is derived from a monthly panel survey of riders on general satisfaction, conditions, communication, and perceptions of the MBTA.

Geography: Data is provided for all MBTA service areas.

Time Frame: For Reliability, daily. For Ridership, monthly, since January 2015. For Financials, monthly since July 2015, yearly from FY2011-FY2015. For Customer Satisfaction, monthly since July 2015.

URL: http://www.mbtabackontrack.com/performance/index.html#/download.

Metropolitan Area Planning Council Vehicle Census

Description: A catalog of data about vehicles registered in Massachusetts from 2009 to 2014, including data on mileage, ownership patterns, fuel consumption and emissions. The data is collected from a combination of vehicle registrations, inspection records, mileage ratings, and other sources. Data available both in anonymized record level microdata and in summarized data files.

Geography: Available by municipality, 150M grid, 2010 Census 2010 Tracts, and 2010 Census Block Groups.

Time Frame: Quarterly, 2009 - 2014.

URL: https://www.mapc.org/learn/data/#vehiclecensus.

Boston's Bicycle Share Program (Bluebikes)

Description: Provides records of individual Bluebikes trips, and historical data for Hubway trips, including starting and ending stations, trip durations, and user details.

Geography: Bluebikes Service Area (Boston, Cambridge, Somerville, and Brookline).

Timeframe: Updated quarterly. Historical data from 2011.

URL: https://www.bluebikes.com/system-data.

OntheMap

Description: States share Unemployment Insurance earnings data and the Quarterly Census of

Employment and Wages (QCEW) data with the Census Bureau. LEHD Origin-Destination Employment Statistics (LODES) combines these administrative data, additional administrative data and data from censuses and surveys to create statistics on employment, earnings, and job flows.

Geography: All geographies provided by U.S. Census, analyzed either by place of residence or place of employment.

Timeframe: For Massachusetts, yearly data from 2011 to 2017.

URL: https://onthemap.ces.census.gov/.

MAPC Trail Map Database

Description: Comprehensive spatial data of pedestrian and bicycle facilities throughout the MAPC Planning Area, collected from city and town trail data, land trusts, Department of Conservation & Recreation (DCR), MassDOT, OpenStreetMap and other sources.

Geography: MAPC Planning Area, 22 cities and 79 towns divided into eight subregions.

Time Frame:

URL: https://trailmap.mapc.org/.

U.S Department of Transportation, Federal Highway Administration

Description: Provides reports containing analyzed statistical information on motor fuel, motor vehicle registrations, driver licenses, highway user taxation, highway mileage, travel, and highway finance. Data is presented in tables and selected charts.

Geography: Data available by U.S. state

Time frame: Yearly since 1945.

URL: https://www.fhwa.dot.gov/policyinformation/index.cfm

Tomtom Traffic Index

Description: Offers statistics and information on congestion levels in urban areas, including congestion levels by time of day, workdays peak congestion, extra travel time during peak hours, and the best and worst days of travel congestion.

Geography: Data available in over 400 cities across 56 countries.

Time frame: Updated yearly.

URL: https://www.tomtom.com/en_gb/traffic-index/ AAA Exchange - Your Driving Costs

AAA Exchange - Your Driving Costs

Description: Analyzes the costs of owning and operating a new vehicle in the United States. The analysis covers costs of depreciation, finance, fuel, insurance, license, registration, taxes, maintenance, repair and tires.

Geography: United States, national average.

Time frame: Yearly since 1950.

URL: https://exchange.aaa.com/automotive/driving-costs/#.XVv24uNKi70

INRIX Global Traffic Scorecard

Description: Evaluates urban travel and traffic health by tracking congestion and mobility trends, such as hours lost in congestion, cost of congestion, and inner city travel time.

Geography: Data collected from over 200 cities, across 38 countries.

Time frame: Updated report published annually.

URL: http://inrix.com/scorecard/

National Transit Database

Description: Produced by the Federal Transit Administration, the National Transit Database (NTD) provides records on the financial, operating and asset condition of transit systems, including data on transit profiles, national transit summaries and trends, time series data on transit systems, and time series of safety data. Data categories include Expenses, Fares/Funding, Monthly Ridership, Resources, Safety and Security and Service Data.

Time frame: Updated monthly. Data available since 1997.

Geography: Data reported and organized by American transit systems.

URL: https://www.transit.dot.gov/ntd/ntd-data

U.S. Energy Information Administration

Description: The U.S Energy Information Administration (EIA) provides retail gasoline and diesel prices.

Geography: Data available by U.S region level, selected U.S cities,and selected U.S states.

Time frame: Weekly. Data available from 1993.

URL: https://www.eia.gov/

Massport

Description: Compiles statistics on Logan Airport, Conley Terminal and Flynn Cruiseport. For Logan, Massport reports data on domestic flights, international flights, domestic passengers, international passengers, mail volume, and freight volume. For Conley Terminal, data categories include containerized cargo volumes, gate visits/ truck turnaround times, adjusted gross productivity, cement tonnage, and autoport. Flynn Cruiseport data reports cruise passenger volume.

Geography: Data provided for Massport operated facilities.

Time frame: For Logan, monthly since 1999. For Flynn Cruiseport, monthly since FY15. For Conley Terminal, monthly, except Containerized Cargo category is yearly.

URL: http://www.massport.com/massport

Freight Analysis Framework (FAF)

Description: Produced by the Bureau of Transportation Statistics (BTS) and Federal Highway Administration (FHWA). FAF version 4 includes freight tonnage and value with breakdowns by region of origin/destination, commodity type, and transportation mode.

Geography: Data available by region or state for the U.S.
Time frame: Freight data available both regionally and by state 2012-2017, forecast estimates available 2020-2045 in 5-year intervals. State data also available for 1997-2007

URL: https://faf.ornl.gov/fafweb/

Bureau of Transportation Statistics (BTS)

Description: Cargo and commodity data for seaports and airports, broken down into domestic/ foreign and import./export categories. Seaport data also includes vessel calls based on type of cargo and container/tanker dwell times.

Geography: Data available for specific ports as well as the U.S. as a whole.

Time frame: For the Port of Boston, cargo, commodity, and vessel call data is available by year for 2014-2017. Container and Tanker dwell time is available by month for 2016 and 2017.

URL: https://www.bts.gov/

US Army Corps of Engineers Waterborne Commerce Statistics

Description: Provides container volumes for U.S. ports, including foreign/domestic import and export volumes and data on commodities volumes.

Geography: Data available for top 50 U.S. ports by volume. Data can also be accessed by region, the regions they divide the US port into are: Atlantic Coast, Miss. River and Gulf Coast, Great Lakes, and Pacific, Alaska, Hawaii.

Time frame: Tonnage data is available 2000-2017 and container traffic is available 2003-2017.

URL: https://www.iwr.usace.army.mil/About/Technical-Centers/WCSC-Waterborne-Commerce-Statistics-Center/

UN Comtrade, OECD / European Commission

Description: Data available for international import/export trade between specified countries. Data includes commodities by weight and value, mode of transport, and can be broken down into import/export and re-import/re-export.

Geography: Data available at the country level and can be used to view trade flow between specific countries or flow between a specified country and the rest of the world.

Time frame: Data available by year, with earliest, though incomplete, data from 1962. Some more general trade data also available on a weekly or monthly basis.

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