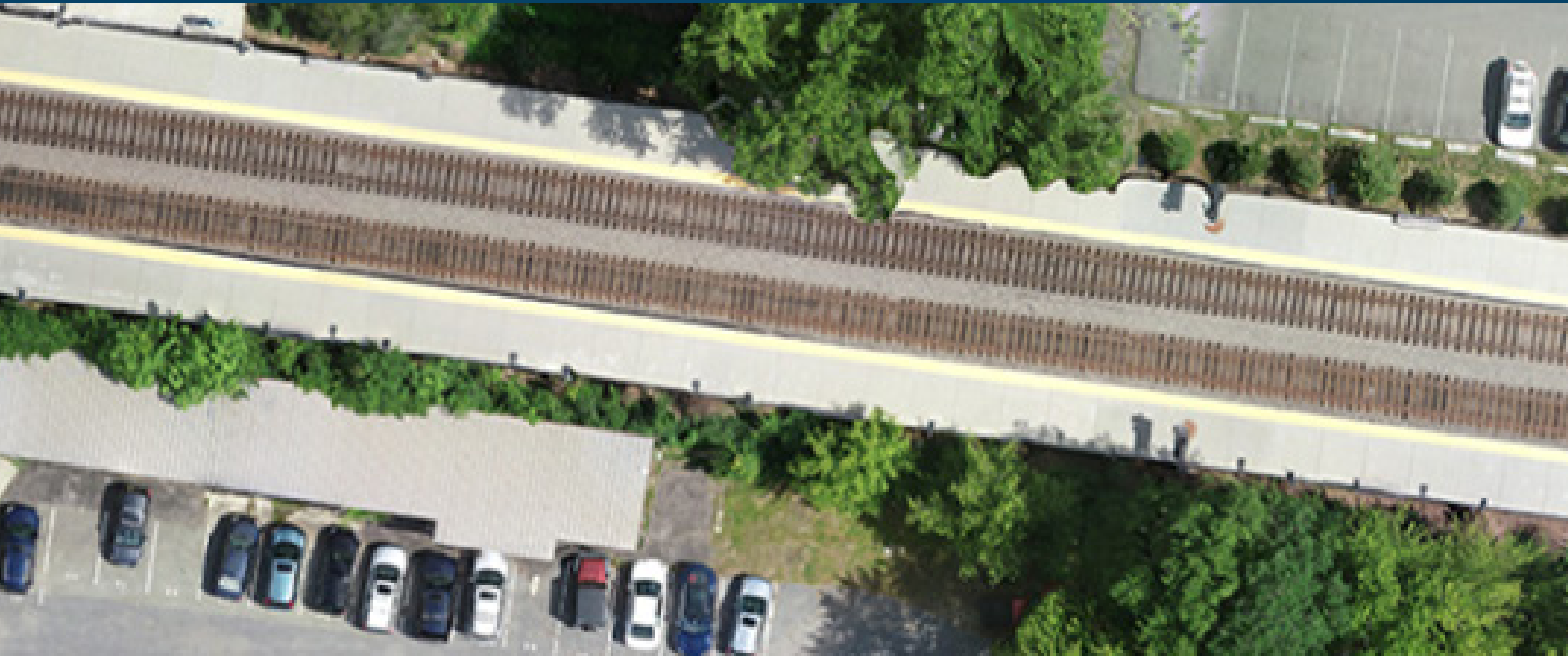
massDOT
Massachusetts Department of Transportation

Massachusetts Bay Transportation Authority

The MBTA Station Access Study

September 2020



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Note: These analyses on ridership and demand were conducted before the COVID-19 pandemic, which has contributed to reduced ridership systemwide and will continue to have longer term ridership implications that we cannot predict. However, the importance of transit service for the residents of the Eastern Massachusetts and many of these findings could hold as ridership demand returns.

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RED LINE
OUTBOUND
TO BRAINTREE


EMERGENCY

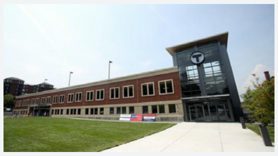
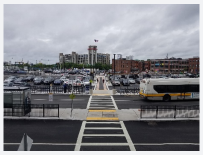
Executive Summary

Riders get to MBTA stations by a variety of means—walking, biking, or by car or bus—and their choices are shaped by their priorities and constraints. Across 154 rapid transit stations and 141 commuter rail stations, available access options vary, and a lack of options may serve as a barrier to accessing the system in some areas. As the MBTA seeks to expand capacity by adding fleet, making service adjustments, and other investments through its capital plan, a lack of access will continue to serve a barrier to ridership growth.

Station access, however, requires investment in itself—the addition of bicycle parking, the expansion of bus routes and frequency, and the construction of car parking all have capital and operating costs and support different levels of access and ridership growth. Municipalities in the MBTA service areas have traditionally first looked to additional car parking to solve access needs, but a majority of riders get to MBTA services by walking or biking—even at many commuter rail stations. Building more car parking provides a limited amount of additional access at a high cost, while requiring significant land area in city and town centers with competing demands on valuable downtown space. Access investments in walking, biking, and transit can often better serve existing and potential demand, increase capacity at a lower cost, and enable alternative uses of station area land. Deciding the best access investments at each station requires a broader understanding of the context and availability of options for riders.

Improving station access is a shared responsibility among the entities that operate and maintain the networks people use to get to transit stations: the MBTA, MassDOT, municipalities, Transportation Management Associations (TMAs), and other roadway and infrastructure owners. This study serves as a guide for all these organizations and agencies.

Figure ES-1 Generalized and Example Access Improvement Costs

Car Parking	Active Transportation	Transit	Transit-Oriented Development
Garage: $25-$50,000+ / space Surface: $5-$15,000+ / space Ongoing Operations and Maintenance (O&M) costs + parking fee revenue	Bike Parking: $700-$2,000/ space Infrastructure costs vary widely Ongoing O&M costs + typically limited revenue	Transit requires supporting infrastructure: bus stops, layover space, and transit priority near station Ongoing service subsidies + potential fare revenue	Likely revenue positive, dependent on revenues from: • Land sale or lease • Replacement parking • Transit fares
 **Beverly Depot Garage** $34 million or $68,000 / space	 **Bruce Freeman Rail Trail Phase 2C** $6.3 million for 2.8 miles	 **Sullivan Square Busway** *(Costs vary widely by project type)*	 **North Quincy TOD** $230 million in revenue for 99-year lease 1:1 replacement MBTA parking

This study evaluates station access needs and identifies context-specific, cost-effective management and investment strategies for the MBTA and its local partners to enhance access at a wide range of station types. It was conducted as a joint effort by the MBTA and MassDOT. The findings reflect an array of data collected on access, ridership, and mobility needs, as well as the input from a Working Group made up of relevant departments across both agencies. This study complements work conducted through other, related efforts, including MassDOT's Bicycle and Pedestrian Plans—which detail the approach and best practices for improving conditions for people walking and biking throughout the state—and several systemwide MBTA efforts (the MBTA Plan for Accessible Transit Infrastructure (PATI); Better Bus Project; the Red Line, Orange Line, and Green Line Transformation Programs; and the Regional/Urban Rail Transformation).

Substantial work from this study was completed before the COVID-19 pandemic and its near-term impacts on ridership and service provision. While the MBTA focuses its current efforts on ensuring rider safety and meeting the needs of essential workers, this study can inform future efforts to expand access. Study recommendations include strategies that both enhance existing access options and introduce new options, and identify which strategies are most applicable to each station type. Recommendations also place emphasis on strategies—such as investments in walking, biking, and transit—that enable a higher volume of people to access stations without the need for significant capital or operating expansion as demand grows. This framework and resulting strategies will enable the MBTA and its partners to adapt access options more easily as transit demand, transit service design, and neighborhood context change.

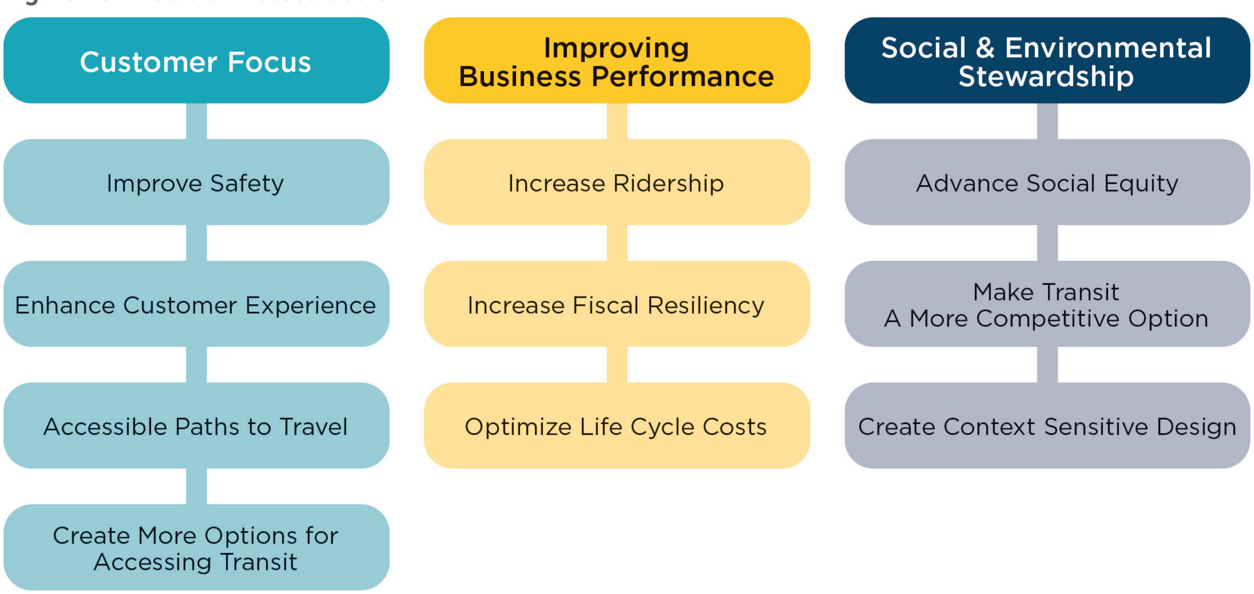
This report consists of the following sections:

- **Station Access Goals** frames the approach to improving station access.
- **Key Findings** describes the access patterns and conditions across the system.
- The **Station Access Playbook** provides recommended strategies for improving station access.

STATION ACCESS GOALS

While most directly related to ridership, improving station access helps achieve multiple goals. The goals illustrated in Figure ES-2 were identified by the study's Working Group.

Figure ES-2 Station Access Goals



KEY FINDINGS: STATION ACCESS PATTERNS AND CONDITIONS

The study pulls from multiple data sets and analyses to identify the current patterns and conditions for access to MBTA stations. The findings from these analyses are broken into two sections:

1. **Access Profiles by Station Type** describes how available service options and surrounding context shapes access trends for different groups of stations.
2. **Systemwide Access Trends** describes three overarching trends when examining access demand and infrastructure conditions across the system.

Access Profiles by Station Type

While MBTA access planning has historically focused heavily on car parking, the vast majority of riders who currently use MBTA rapid transit and rail stations arrive as a pedestrian. Even for commuter rail, where riders are more likely to drive and park or be dropped off, walking is still a major access mode at many stations.

Access profiles are driven by the type and frequency of service at a station—rapid transit or commuter rail—and the location within the network and local context. Figure ES-3 provides an overview of the mix of access modes associated with the three rapid transit and five commuter rail station types identified in this study.

Figure ES-3 Station Types: Distribution and Mode Share Breakdown

Primary Service	Station Type	# of Stations	Magnitude of Bus Transfers	Mode Share (Except Bus Transfers)			
				Walk or Bike	Drive Alone	Carpool	Dropped Off
Rapid Transit	Core	68	None to Moderate	95%	1%	0%	4%
	Neighborhood	68	None to Moderate	87%	6%	1%	6%
	Regional	26	High	83%	7%	1%	9%
Commuter Rail	Town Centers	46	None	38%	43%	4%	15%
	Neighborhood	29	None to Low	70%	21%	2%	7%
	Urban Centers	14	Low	31%	44%	3%	22%
	Regional Park-and-Rides	17	None	8%	68%	4%	20%
	Local Park-and-Rides	26	None	15%	62%	5%	18%

Mode Share Source: 2015-2017 MBTA Systemwide Passenger Survey

Note: Ferry terminals and the Watertown Yard bus terminal have been incorporated into commuter rail or rapid transit station types based on station location and service characteristics. Logan Airport, Long Wharf, Rowes Wharf, and Watertown Yard were classified according to rapid transit station types, while Hingham and Hull were classified according to commuter rail station types. Stations with both rapid transit and commuter rail service—including South Station, North Station, and Back Bay Station—were classified as rapid transit stations.

Systemwide Access Trends

In addition to identifying and analyzing station types to understand the nuances of access across the rapid transit and commuter rail networks, this study also performed analyses at the system level. These findings reinforce and map onto the station types identified above:

- **Dense Areas Near Stations Show the Greatest Potential for Ridership Growth:** Analysis of travel data for all trips—regardless of mode—reveals that existing and potential demand for station access increases significantly in the denser, more urban areas closer to Downtown Boston. Population density, as shaped by land use and housing patterns, helps explain why so much of the potential demand comes from areas in the inner core and areas near stations. Increasing housing near transit could therefore support easier access to transit services for more people.
- **Parking Lots are Often Full, But Many Riders Drive Short Distances to Get to Stations:** MBTA car parking lots serve both local and regional access trips—about half of drive and park access trips are less than four miles (based on an analysis at select stations). At stations in town centers and urban neighborhoods, many riders drive less than two miles to access stations. Investments in pedestrian, bike, and bus/shuttle access could provide more options for riders, including for those that drive today. End-of-line stations and stations with nearby highway access often serve a larger share of longer distance trips, including many trips longer than eight miles. Car parking plays a larger role in access at these stations, but there may be opportunities for longer distance bus connections to provide more options.
- **Pedestrian and Bike Conditions Vary, Improvements Pose Opportunity:** Pedestrian conditions in neighborhoods around stations are generally good, with targeted need for safety and accessibility investments, but there is significant room to improve conditions for people biking. Notably, many of the stations with the best conditions for pedestrians have the worst conditions for biking. As a high proportion of existing and potential MBTA riders live within a 10- to 20-minute walk or bike ride from their local station, investments in pedestrian and bike access would have compounding benefits and create more access options.

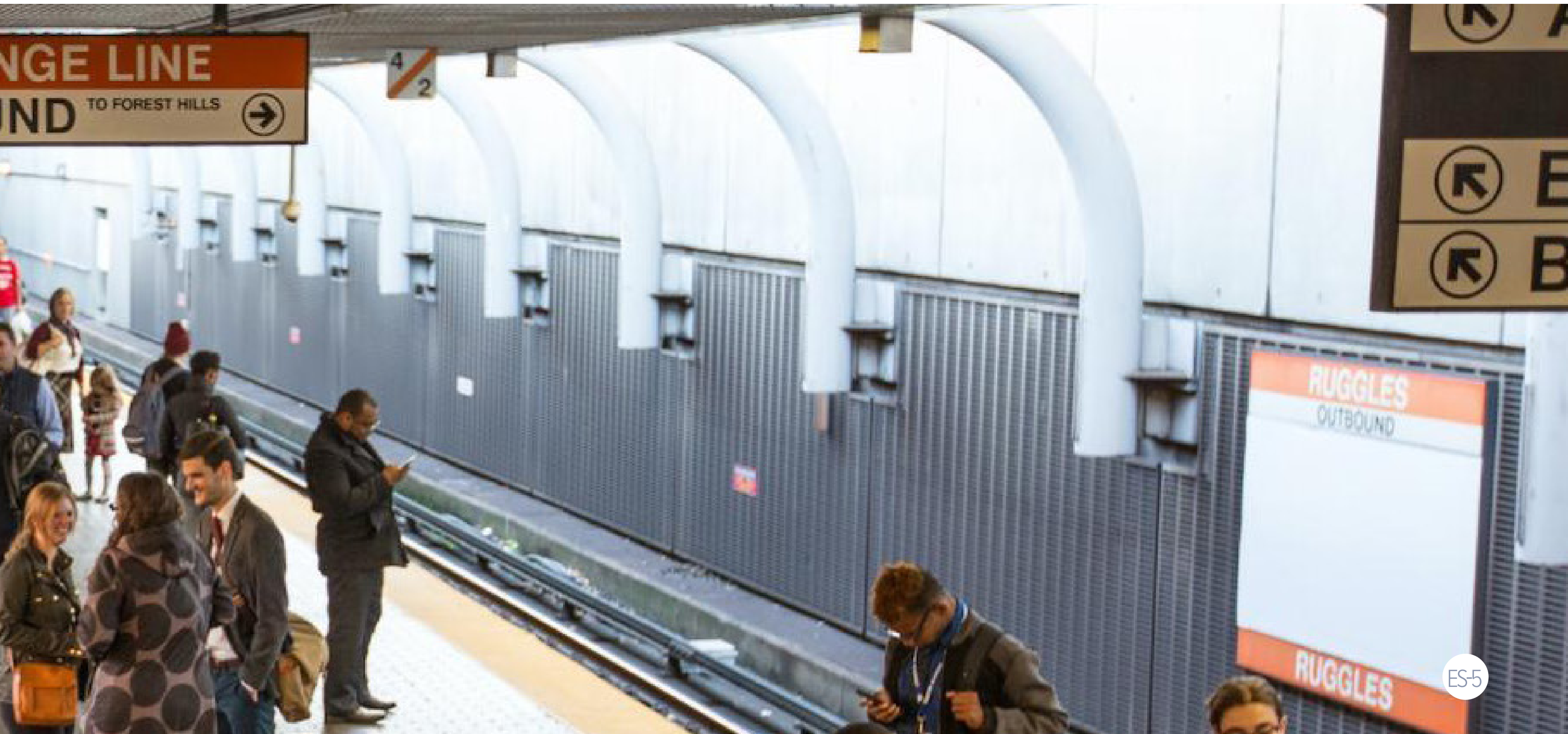
STATION ACCESS PLAYBOOK: STRATEGIES FOR ENHANCING STATION ACCESS

The key findings reveal the potential for station access improvements to unlock ridership and benefit people who seek to use transit. In particular, they demonstrate how station access is more complicated than just considering car parking needs alone.

This study puts forward two recommendations for improving station access and describes the most effective strategies for implementation based on the wide range of station contexts and needs in the MBTA system:

- **Addressing Access Demand:** This study recommends the MBTA and its local partners use a four-step approach to address demand for accessing a station that considers other, potentially more effective and less costly solutions before building new car parking. The process consists of: (1) an analysis of market context, (2) better car parking management solutions, (3) implementation of pedestrian, biking, and transit solutions, and (4) strategic, low-capital solutions for adding car parking.
- **Addressing Station Design:** The MBTA can support and complement local access improvements by elevating the station access profile in station design and infrastructure. Four key areas of consideration include: (1) Apply intuitive design standards to improve accessibility and customer experience, (2) Better manage the curb to optimize across access needs, (3) Expand bike parking at high demand locations, and (4) Improve busway and station area transit operations for smooth bus-to-rail transfers.

The recommendations are organized as a universal Playbook, or toolkit that can serve as a resource for all entities responsible for station access—including local city and town planners, infrastructure owners, MBTA and MassDOT departments, connecting service operators, and private mobility providers who interface with station access. The strategies included range from management policies and low-build improvements that could be led at the local level to larger scale capital improvements. While the prioritization of capital needs at MBTA stations will continue to be driven by safety, operational, and state of good repair needs, the strategies included in this Playbook can shape the planning and design approach taken, based on station context.



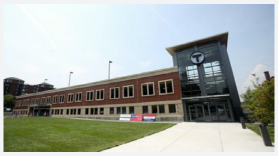
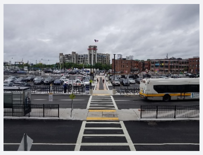

EMERGENCY ENTRY
EMERGENCY ENTRY

1 Introduction

Riders get to MBTA stations by a variety of means—most commonly walking, biking, or by car or bus—and their choices are shaped by their priorities and constraints. Across 154 rapid transit stations and 141 commuter rail stations, the options available vary, and a lack of options may serve as a barrier to accessing the system in some areas. In other words, MBTA ridership cannot meet its fullest potential if people cannot easily get to stations. As the MBTA seeks to expand capacity by adding fleet, making service adjustments, and other investments through its capital plan, a lack of access would continue to serve as a barrier to ridership growth.

Station access, however, requires investment in itself—the addition of bicycle parking, the expansion of bus routes and frequency, and the construction of car parking all have capital and operating costs and support different levels of access and ridership growth. Municipalities in the MBTA service areas have traditionally first looked to additional car parking to solve access needs, but a majority of riders get to MBTA services by walking or biking—even at many commuter rail stations. Building more car parking provides a limited amount of additional access at a high cost, while requiring significant land area in city and town centers with competing demands on valuable downtown space. Access investments in walking, biking, and transit can often better serve existing and potential demand, increase capacity at a lower cost, and enable alternative uses of station area land. Deciding the right access investments at each station requires a broader understanding of the context and availability of options for riders.

Figure 1-1 Generalized and Example Access Improvement Costs by Mode

Car Parking	Active Transportation	Transit	Transit-Oriented Development
Garage: $25-$50,000+ / space Surface: $5-$15,000+ / space Ongoing Operations and Maintenance (O&M) costs + parking fee revenue	Bike Parking: $700-$2,000/ space Infrastructure costs vary widely Ongoing O&M costs + typically limited revenue	Transit requires supporting infrastructure: bus stops, layover space, and transit priority near station Ongoing service subsidies + potential fare revenue	Likely revenue positive, dependent on revenues from: • Land sale or lease • Replacement parking • Transit fares
 **Beverly Depot Garage** $34 million or $68,000 / space	 **Bruce Freeman Rail Trail Phase 2C** $6.3 million for 2.8 miles	 **Sullivan Square Busway** *(Costs vary widely by project type)*	 **North Quincy TOD** $230 million in revenue for 99-year lease 1:1 replacement MBTA parking

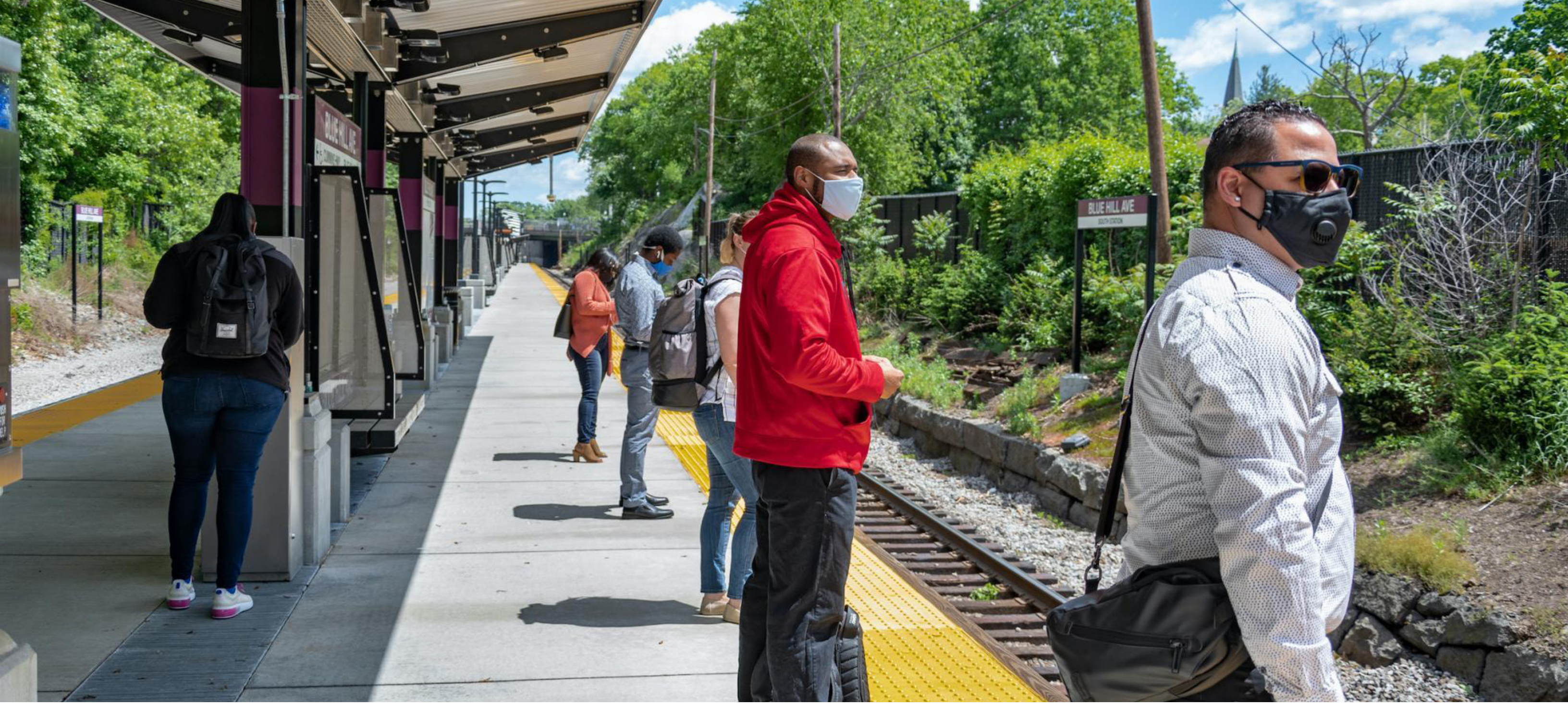
1

Improving station access is a shared responsibility among the entities that operate and maintain the networks people use to get to transit stations: the MBTA, MassDOT, municipalities, Transportation Management Associations (TMAs), and other roadway and infrastructure owners. This study serves as a guide for all these organizations and agencies.

This study evaluates station access needs and identifies context-specific, cost-effective management and investment strategies for the MBTA and its local partners to enhance access at a wide range of station types. It was conducted as a joint effort by the MBTA and MassDOT. The findings reflect an array of data collected on access, ridership, and mobility needs, as well as the input from a Working Group made up of relevant departments across both agencies. This study complements work conducted through other, related efforts, including MassDOT's Bicycle and Pedestrian Plans—which detail the approach and best practices for improving conditions for people walking and biking throughout the state— and several systemwide MBTA efforts (the MBTA Plan for Accessible Transit Infrastructure (PATI); Better Bus Project; the Red Line, Orange Line, and Green Line Transformation Programs; and the Regional/Urban Rail Transformation).

This report consists of the following sections:

- **Station Access Goals:** A description of the aims and objectives that the MBTA seeks to achieve with station access improvements.
- **Key Findings:** A summary of the analyses conducted through this study, which examine the access profiles for different types of stations, as well as land use, travel patterns, and infrastructure conditions to identify gaps in access and areas with opportunity for improvement.
- **Station Access Playbook:** A set of strategies to improve station access categorized into two overarching recommendations: (1) A four-step process for the MBTA and its local partners to use to address demand to access stations, and (2) best practices in station design to support different access modes when the MBTA is making station upgrades.



Station Access, COVID-19, and the Future of Mobility in Massachusetts

This study provides insight into how riders access MBTA services before March 2019, drawing data primarily from 2018 and 2019. Since substantial work for this study was completed, the COVID-19 pandemic has drastically reduced transit ridership—leading to significant changes in how the MBTA provides service and how riders access transit. In the short-term, the MBTA is focused on adapting its services to meet rapidly changing mobility needs of people who rely on transit, as well as on the safety of its riders and staff. This focus inherently requires the agency and its partners to temporarily place less emphasis on many of the goals highlighted in this study and more emphasis on meeting the travel needs of essential workers and other riders, including enhanced facilities that enable social distancing for people accessing stations by people walking or biking.

MassDOT and the MBTA are also actively engaged in major capital projects and planning efforts that may change how people use and access transit. The ongoing **Red Line**, **Orange Line**, and **Green Line** Transformation Programs will increase the capacity and reliability of the MBTA rapid transit system—enabling more people to use transit and increasing demand for station access. **Regional/Urban Rail Transformation**, the **Better Bus Project**, and **Bus Network Redesign** have each explored new ways of planning and delivering commuter rail and bus service, including changes that would impact where, when, and how people access rail transit. The MBTA also regularly evaluates and updates policies (such as fare structure), engages in service changes and pilots, and introduces new information and technology resources that impact station access.

Given the ongoing evolution of transit demand and station access needs, the recommendations from this study were structured to have two primary focuses:

1. Identifying strategies that present near-term opportunities for increasing access to MBTA services as they operated in 2019.
2. Providing a framework for evaluating station access demand profiles, based around station types. This framework enables the MBTA and its partners to identify relevant opportunities for enhancing access as demand for transit and the types of service the MBTA operates change over time.

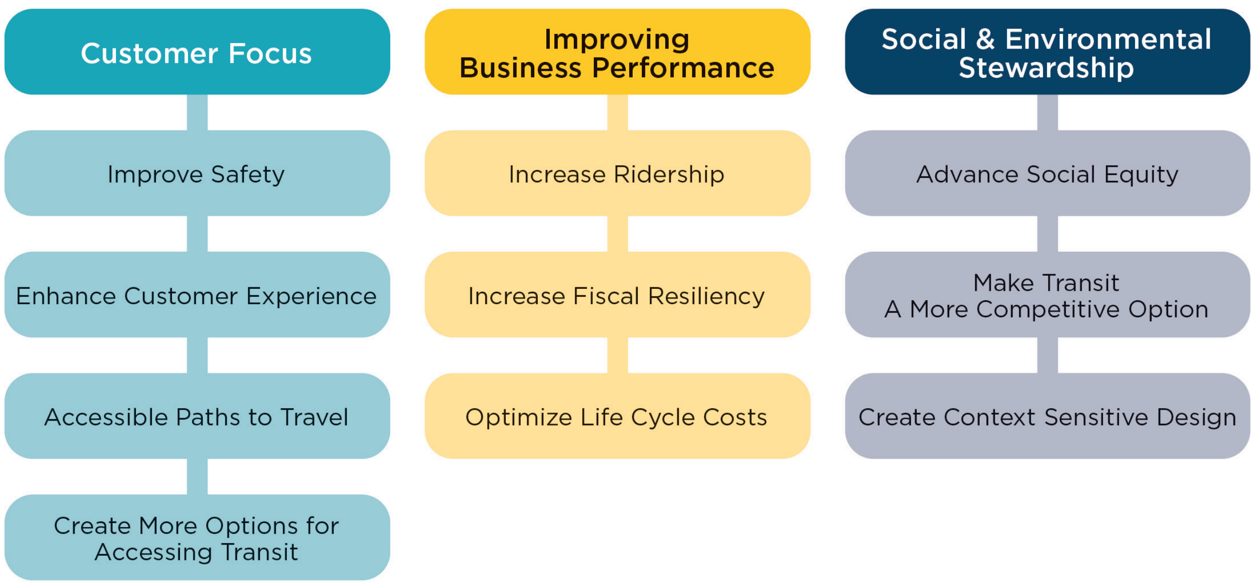
Study recommendations include strategies that both enhance existing access options and introduce new options, and identify which strategies are most applicable to each station type. Recommendations also place emphasis on strategies, such as investments in walking, biking, and transit, that enable a higher volume of people to access stations without the need for significant capital or operating expansion as demand grows. This framework and resulting strategies will enable the MBTA and its partners to adapt access options more easily as transit demand, transit service design, and neighborhood context change.

2 Station Access Goals

While most directly related to ridership, improving station access helps achieve multiple goals.

The goals illustrated in Figure 2-1 were identified with input from the study's Working Group, to ensure they reflect the full spectrum of outcomes, and demonstrate how station access plays a role in meeting larger, regional and statewide goals related to transit. They are organized into three themes: Customer Focus, Improving Business Performance, and Social and Environmental Stewardship.

Figure 2-1 Station Access Goals



CUSTOMER FOCUS

The Customer Focus goals center around making the experience of the rider safe, positive, and reliable. Riders who find it easy, comfortable, and problem-free to ride are more likely to be return customers and positively promote the MBTA to their friends, family, and coworkers.

The four Customer Focus goals are:

Improve Safety: Safety—both physical and perceived—is paramount. If a rider does not feel safe accessing the station, they will not be a regular rider. The portions of the trip spent waiting at stations or traveling to stations are a major focus of safety concerns. Improving safety at stations can include measures such as ensuring there is proper lighting at night, reducing wait times, and enhancing station design. It can also include ensuring there are proper bike and pedestrian facilities so riders can get to a station safely.

Accessible Paths of Travel: Safe, comfortable, and reliable transportation should be accessible to all. Full system accessibility is a goal of the MBTA. Through the Plan for Accessible Transportation Infrastructure (PATI), the MBTA is working with the disability community to analyze and prioritize stations to make the system as effective and usable as possible for people with disabilities, and to proactively remove access barriers. Making paths of travel to stations and stops more accessible is a critical component.

Create More Ways to Access Transit: In line with goals of the Commonwealth, a key to improving access is expanding the options people have for getting to stations—by creating safer, more comfortable bike and pedestrian paths, bus or shuttle options, or alternative solutions for people driving and parking.

Enhance the Customer Experience: The MBTA serves riders both with and without alternate options. To address these unique needs, the MBTA has improved information-sharing about transit service, including disruption and real-time information. Continuing to meet this expectation in the built environment at stations through wayfinding, static and real-time signage with consistent, reliable information not only about the service, but about each station, enhances access for all.

IMPROVING BUSINESS PERFORMANCE

The Improving Business Performance goals center around generating ridership, increasing fiscal resiliency, and managing costs. Ridership and revenue are intricately intertwined goals; ridership influences revenue (e.g., amount of fare revenue collected) and revenue influences ridership (e.g., lower revenue may make service levels less sustainable over time).

The three Improve Business Performance goals are:

- **Increasing Ridership:** Generating ridership is the core performance goal of the system. It also drives metrics supporting other station access goals. Increased ridership leads to reduced vehicle congestion and emissions and it increases the revenues that help to sustain the service.
- **Increasing Fiscal Resiliency:** The MBTA relies on both external funding and own source revenues to sustain its services. Revenues at the station include anything from fares, parking fees, leasing space to small businesses in the station itself, advertisement sales, implementing transit-oriented development (TOD) on MBTA property, or even leasing air rights to development, provided such leases or developments do not inhibit future needs.
- **Optimize Life Cycle Costs:** Improving station access across all modes should include an understanding of the full life cycle costs of investment options. This includes initial capital investment, ongoing operations and maintenance, and mid- and end-of-life replacement costs. The life-cycle costs of an investment should also be balanced with the total potential access it provides, as well as the likelihood that it will benefit existing riders and attract new riders over time.

SOCIAL AND ENVIRONMENTAL STEWARDSHIP

The Social and Environmental Stewardship goals recognize that decisions made by the MBTA have the potential to reshape historical social inequities and combat climate change.

The three Social and Environmental Stewardship goals are:

Advance Social Equity: Disadvantaged individuals and communities, including people of color and minorities, people with low incomes, and people with disabilities, often face additional barriers to daily mobility, affecting access to jobs and services. Access to public transit and commute times are shaped by a multitude of policy decisions and economic factors, including but not limited to: transit service availability and quality, transit fares, job distribution, and housing availability and affordability. Increasing access options presents an opportunity to reduce or remove transportation barriers, which can directly advance social equity.

Make Transit a More Competitive Option: Many existing and potential MBTA riders make an active choice to use or not use transit for a given trip. This decision-making process is guided in part by the availability of transit services, the quality of those services, and the relative travel time compared to other options. Improving station access will make transit a more competitive mobility option, enabling more people to consider using transit for both short and long trips. Increasing public transit usage can help to manage traffic congestion, reduce emissions, and have a positive impact on environmental justice communities and other neighborhoods located adjacent to major roadways.

Create Context Sensitive Design: MBTA stations not only shape transportation choices but also create or impact a sense of place. It is important that the MBTA incorporate the best access options and management practices, but also fit the community character and the surrounding built environment. For example, right-sizing parking to reduce "dead space" in a vibrant downtown or providing improved access to existing bike and pedestrian facilities are context elements to be considered.

T
HIGHLAND AVE
COLLEGE AVE
DOVER ST
HOLLAND ST
DAVIS
H
Somerville Hospital
NISSAN

3 Key Findings

While MBTA and its local partners have historically focused heavily on car parking, the vast majority of riders who currently use MBTA rapid transit and rail stations arrive as a pedestrian (Figure 3-1). Even for commuter rail, where riders are more likely to drive and park or be dropped off, walking is still a major access mode at many stations.

This study drew from existing sources and collected new data to identify trends and gaps related to station access across all modes. These analyses investigated the access patterns of current MBTA riders to understand how people get to stations and from where they are coming. It also examined travel and land use patterns more broadly, as well as bike and pedestrian infrastructure conditions, to identify opportunities to grow ridership through improvements.

The following sections describe findings from these analyses and are organized into two parts:

1. **Access Profiles by Station Type:** This section describes how available service options and surrounding context shapes access trends for different groups of stations. Stations are grouped into three types of rapid transit stations and five types of commuter rail stations.
2. **Systemwide Access Trends:** This section describes three overarching findings when examining access demand and infrastructure conditions across the system.

Figure 3-1 The MBTA Network Today

82%	of customers walk or bike
136	stations with car parking
43,000	MBTA parking spaces
10,000	non-MBTA parking spaces
75%	parking utilization (MBTA lots)
51	MBTA lots at 90%+ utilization

Access Profiles by Station Type

Car parking is often discussed as the primary mechanism for providing access to transit service, but the majority of riders get to MBTA services by walking or biking (Figure 3-2).

While most MBTA riders access rail service by walking, car parking at MBTA stations is well used—about 75% of parking spaces are full on a typical weekday (Figure 3-3). This utilization rate varies between line and stations. At 51 stations, more than 90% of spaces are occupied on an average weekday, which is the rate at which riders likely perceive facilities as full and inaccessible.

Figure 3-2 Mode Share by Service Type for Access to First Transit Mode*

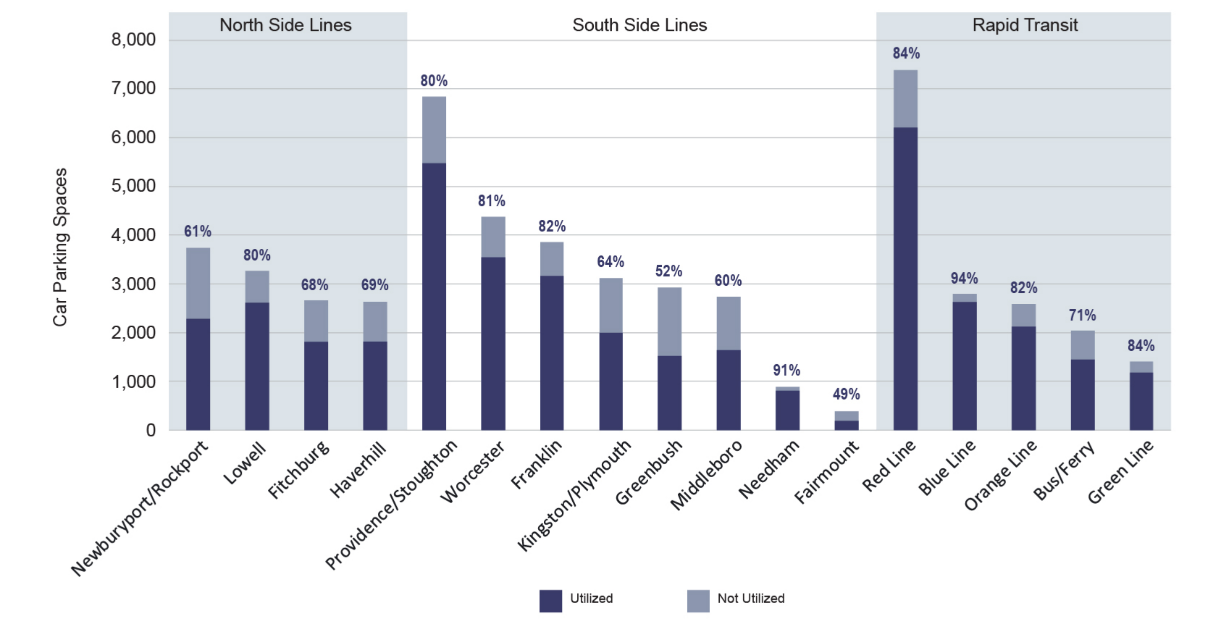
Service	Walk or Bike	Drive Alone	Carpool	Dropped Off
Commuter Rail**	30%	49%	4%	17%
Rapid Transit	87%	5%	1%	7%
All Rail Stations (Commuter Rail + Rapid Transit)	82%	9%	1%	8%
Bus Stops*	96%	1%	0%	3%

Source: 2015-2017 MBTA Systemwide Passenger Survey

* The survey asked riders how they accessed their first MBTA mode. Riders that took an MBTA bus to access rapid transit or commuter rail reported how they accessed bus service, rather than reporting that they took a bus to access a rail station. Bus mode share is therefore not reflected in the access breakdown at rapid transit or commuter rail stations.

** Excludes all stations that are served by both commuter rail and rapid transit, including, but not limited to, South Station, North Station, and Back Bay Station. These stations were classified as rapid transit stations.

Figure 3-3 Car Parking Capacity and Utilization by Line



Source: Study Car Parking Utilization Survey (Fall 2019)

Variation in access mode is driven by each station's neighborhood context and the transit service available at the station.

Today, the MBTA operates two distinct rail systems serving different markets and trip types: the rapid transit system and the commuter rail system. Within each system, the mode share and distances riders travel differ, in part based on the characteristics of the surrounding area and its location within the network. To better understand access needs and improvement opportunities, this study divides the network into distinct station types defined by these features. The station types help organize the access characteristics of similar stations and help frame which strategies and investments would work best to improve access.

To characterize station catchment areas, this study defines "regional" as stations that pull a larger portion of riders from more than four miles and "local" as stations that pull most riders from within four miles. There is significant variation among stations with "local" access profiles, with some stations primarily attracting riders from within two miles—where many riders could walk or bike within 10- to 20-minutes—and others attracting riders from throughout the four mile catchment area (which often includes the station municipality and directly adjacent municipalities). These variations are highlighted throughout the key findings and recommendations.

The following sections detail the access profiles and considerations for three rapid transit station types and five commuter rail station types (Figure 3-4).

Figure 3-4 Station Types: Distribution and Mode Share Breakdown

Primary Service	Station Type	# of Stations	Magnitude of Bus Transfers	Mode Share (Except Bus Transfers)			
				Walk or Bike	Drive Alone	Carpool	Dropped Off
Rapid Transit	**Core**	68	None to Moderate	95%	1%	0%	4%
	Neighborhood	68	None to Moderate	87%	6%	1%	6%
	Regional	26	High	83%	7%	1%	9%
Commuter Rail	**Town Centers**	46	None	38%	43%	4%	15%
	Neighborhood	29	None to Low	70%	21%	2%	7%
	Urban Centers	14	Low	31%	44%	3%	22%
	Regional Park-and-Rides	17	None	8%	68%	4%	20%
	Local Park-and-Rides	26	None	15%	62%	5%	18%

Mode Share Source: 2015-2017 MBTA Systemwide Passenger Survey

Note: Ferry terminals and the Watertown Yard bus terminal have been incorporated into commuter rail or rapid transit station types based on station location and service characteristics. Logan Airport, Long Wharf, Rowes Wharf, and Watertown Yard were classified according to rapid transit station types, while Hingham and Hull were classified according to commuter rail station types. Stations with both rapid transit and commuter rail service—including South Station, North Station, and Back Bay Station—were classified as rapid transit stations.

Figure 3-5 Rapid Transit Station Types

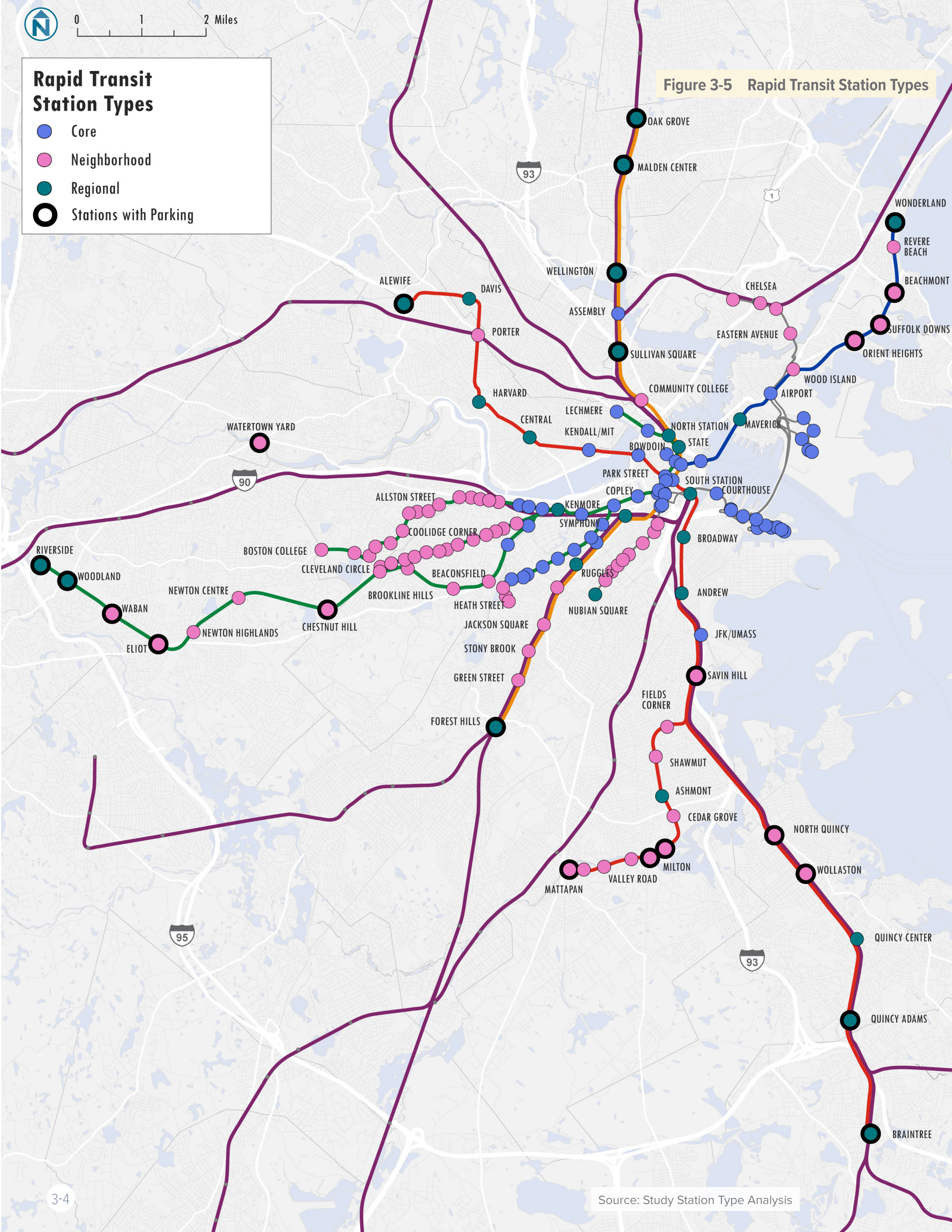
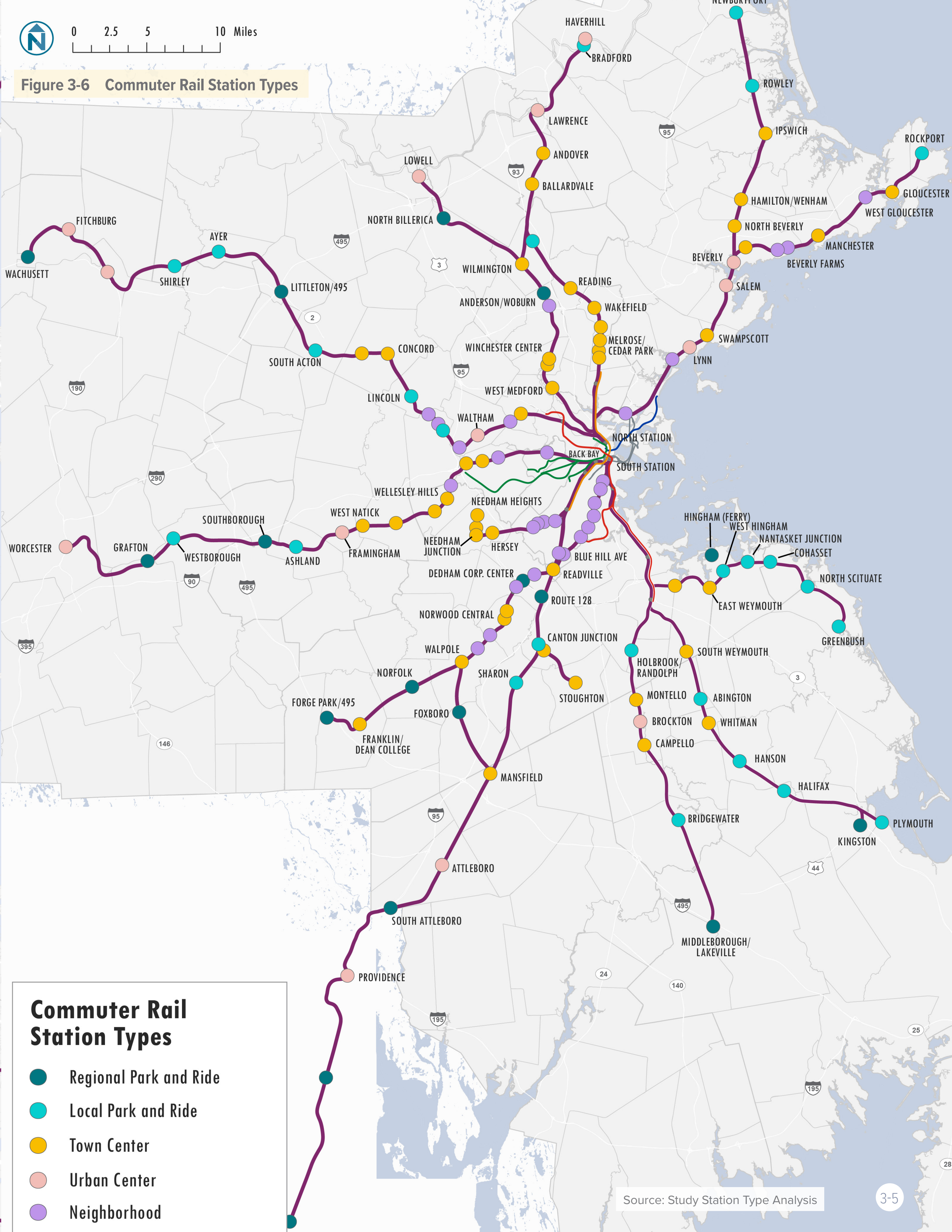


Figure 3-6 Commuter Rail Station Types



Source: Study Station Type Analysis

ACCESS TO RAPID TRANSIT STATIONS

Rapid transit stations provide riders with access to frequent all-day service to regional employment centers and local inner core destinations at a lower cost than commuter rail, attracting more than 700,000 trips on an average weekday. The network covers what this study defines as the inner core of the Greater Boston Region, an area characterized by densely populated, largely walkable neighborhoods, with major employment districts at the center (Boston's Financial District and Back Bay, Cambridge's Kendall Square). The MBTA bus network serves as a feeder to the rapid transit lines, with select stations, in particular at the ends of lines, serving as major bus transfer hubs.

Core Stations

These stations serve employment hubs and other highly frequented destinations in Boston (including Longwood Medical Area, Back Bay, South Boston Waterfront) and Cambridge (Kendall Square). Core stations are primarily destinations for commuting trips, and do not have car parking or regional bus hubs (though some are served by bus routes).

Walking is the primary access mode for these stations—accounting for 95% of riders (not including bus transfers). At select core stations—most notably Hynes Convention Center and Lechmere—there are a high volume of bus transfers (which are not reflected in the mode share survey referenced in Figure 3-4 and cited throughout this Chapter). While bikes are not a major access mode, over two-thirds of core stations have at least some bike parking nearby—often provided and maintained by the municipality. Bike parking spaces at or near many stations may be used by people traveling exclusively by bike, rather than using bikes to access transit.

Boylston and Chinatown Stations
Image Source: NearMap

Rail Vision, Focus40, and MAPC TOD Station Typologies

The MBTA and MassDOT regularly use station typologies to frame systemwide improvement recommendations.

- The **MBTA Rail Vision Study** developed typologies to frame service design alternatives. The typologies were based on each station's location within the network and neighborhood context:
  - **Inner Core Stations** are in dense areas directly surrounding Boston, generally within Route 128.
  - **Key Stations** are in dense areas outside central Boston and/or locations that provide regional access and transit connectivity.
  - **Other Stations** are all other stations not falling into the above typologies.
- The MBTA's **Focus40** identifies priority places that need and can support higher quality transit. This reflects a goal for the MBTA to be proactive about meeting regional needs and redefine conversations around system expansion. The three priority place types identified are: Major Employment Districts, Inner Core Communities Lacking Rapid Transit, and Urban Gateways.
- MAPC's **Growing Station Areas TOD Study** developed typologies to frame the nature and magnitude of potential development in station areas. The typologies were based on neighborhood context and demographics, transit service availability, and development potential. The study included 10 station typologies.

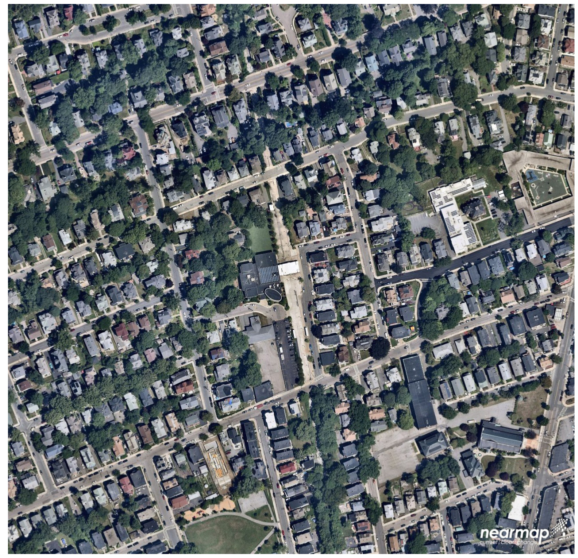
The station types developed for this study are primarily focused on how riders access stations today, and how neighborhood context and service types affect each station's access profile. The station types are most like the MAPC TOD Study typologies, with more focus on access than development. Most of the Key Stations from Rail Vision that are outside the inner core are categorized as urban centers or regional park-and-rides for this study, which directly parallel many of the factors defining them in the Rail Vision alternatives.

Neighborhood Stations

These stations attract most of their riders from the residential neighborhoods surrounding stations, typically serving as the origin for commuting trips or other trips starting from home (rather than as destinations).

Overall, over 85% of riders access these stations by walking. Most neighborhood stations have few or no local bus connections, though several—such as Mattapan, Fields Corner, and Jackson Square—serve as neighborhood bus hubs. About two-thirds of these stations have bike parking—mostly 10 to 25 spaces per station. This bike parking does not fill up on a typical weekday except at a few stations.

Thirteen of these stations have car parking, ranging from 16 to 593 spaces. Half of the riders that park at these lots drive less than about two miles to access the station, and two-thirds drive less than about four miles.[1] This indicates that these stations generally serve a more local drive and park market, especially compared to park-and-rides at regional rapid transit stations.



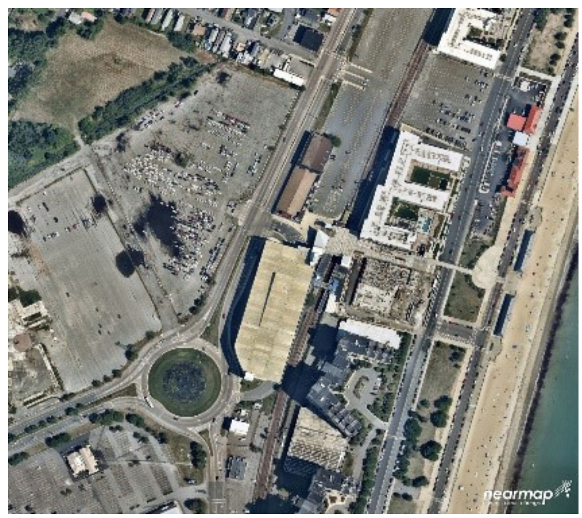
Shawmut Station

Image Source: NearMap

Regional Stations

Located at key points on the bus network and at rapid transit terminals, these stations attract riders from a larger catchment area than neighborhood stations. These stations either have major bus terminals or large park-and-ride facilities, and several have both.

Despite the regional pull of these stations, pedestrian and bike access serves the greatest demand. Excluding bus access. 83% of riders arrive as pedestrians or by bike. Many of these stations offer car parking and serve as



Wonderland Station

Image Source: NearMap

1 Based on a vehicle origin analysis described in depth later in this chapter

Figure 3-7 Bus and Rail Boardings at the Top Five Rapid Transit Park-and-Rides by Parking Capacity

Station	Total Weekday Rail Boardings	Daily Occupied Car Parking Spaces	Daily Weekday Bus Boardings
Alewife	11,514	2,220	2,369
Quincy Adams	4,665	1,760	63
Wonderland	6,866	1,726	3,712
Braintree	4,677	1,394	404
Wellington	7,174	872	2,988

Sources: MBTA Performance Dashboard (Fall 2019), Study Car Parking Utilization Survey (Fall 2019) major bus hubs, but they are also generally located in dense urban neighborhoods where walking or biking is often faster than using the bus and cheaper than driving and parking. More isolated stations with large park-and-rides have lower pedestrian access mode shares—most notably Quincy Adams, Wonderland, and Braintree. But, at Alewife, twice as many people who start their trip at the station arrive as a pedestrian or by bike than by driving and parking.

Bus access is essential: 15 regional stations have greater than 2,000 bus-to-rail transfers each day (Figure 3-8). There are especially high numbers of bus-to-rail transfers at Forest Hills, which averages 11,670 transfers per day, and Sullivan Square, which averages 4,800 transfers per day. By comparison, only one station (Alewife) has more than 2,000 riders who drive and park (Figure 3-7). At Alewife, Wonderland, and Wellington, more riders access the station by bus than by driving and parking.

Many riders who use local and express buses to access regional stations from surrounding suburban areas are coming from beyond the immediate walkable or bikeable area, such as Arlington, Newton, Hyde Park, West Roxbury, and much of the inner North Shore (Lynn, Marblehead, and Salem).

Parking accounts for only 15% of riders at regional stations with car parking.[2] But, due to the high-volume of overall ridership at these stations, they have the MBTA system's largest parking facilities and highest utilization rates. Most parking at rapid transit stations, including at neighborhood stations, has greater than 90% utilization on weekdays. For 11 of the 26 regional rapid transit stations that have parking, seven have a utilization rate over 90%. Two other stations—Quincy Adams and Wollaston—likely reach 90% utilization on some days.

Riders travel significantly farther to access car parking at regional rapid transit stations than at other stations in the MBTA network. About half of drive and park trips to these stations are longer than eight miles, and an additional 22% of trips are between four and eight miles. This demonstrates how these stations provide transit access for a larger catchment area than more locally focused stations (an issue discussed in greater depth in the systemwide trends section).

2 This figure was calculated based on the number of occupied spaces divided by the total daily boardings on weekdays (assuming an average of 1.1 boardings per occupied space). This methodology accounts for riders that access these stations using MBTA buses, which are not accounted for in the Access to First MBTA Service figures from the 2015-2017 Systemwide Passenger Survey used for Mode Share figures elsewhere in this document.

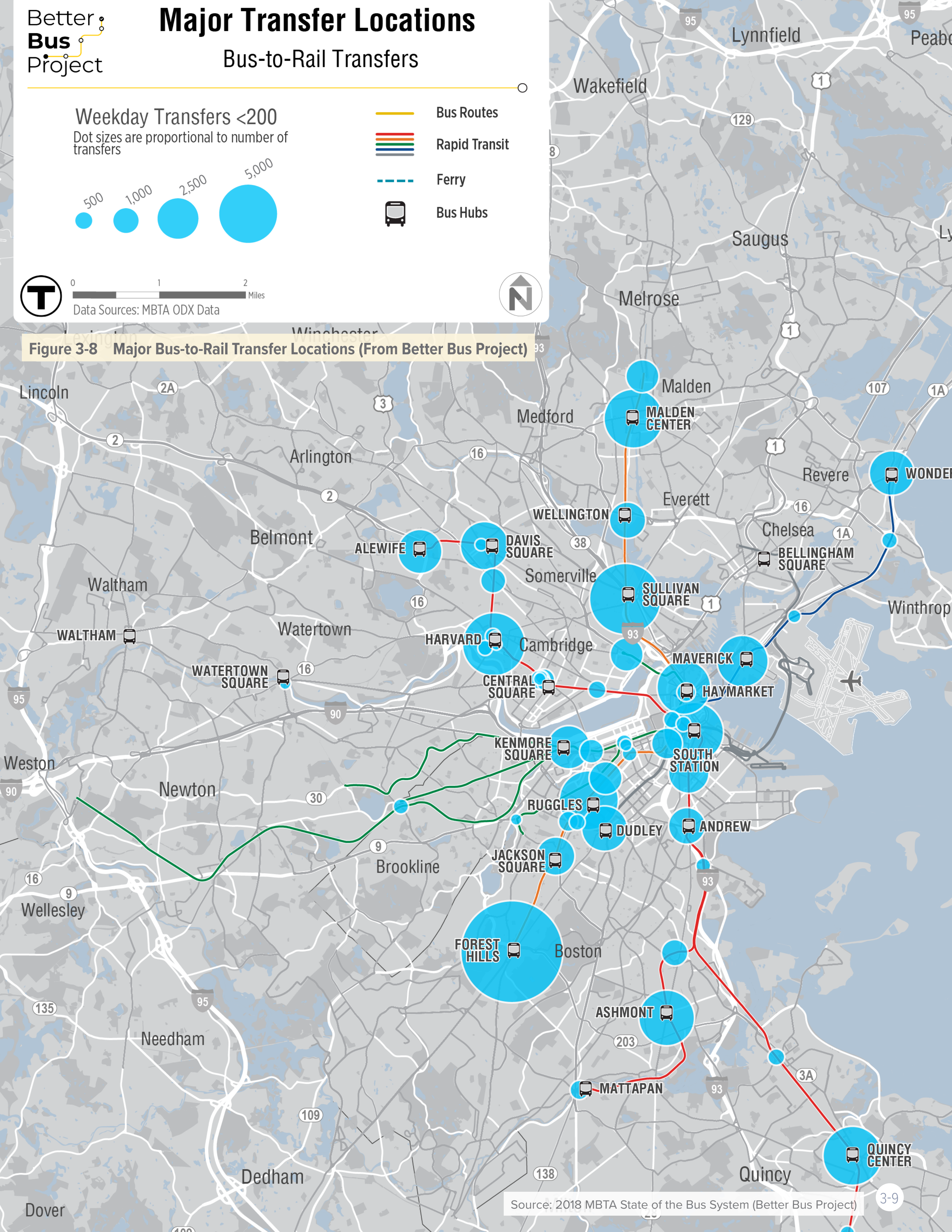


Figure 3-8 Major Bus-to-Rail Transfer Locations (From Better Bus Project)

ACCESS TO COMMUTER RAIL STATIONS

Riders interact with the commuter rail differently than rapid transit—service is focused on peak period commuting toward Boston, with higher peak period frequency inbound in the mornings and outbound in the evenings. While the service attracts fewer riders than rapid transit, with an average 120,000 weekday trips, riders typically use the expansive network to travel longer distances, as it reaches cities and towns as far as 40-60 miles outside Boston.

How riders access stations reflect these characteristics. Just 30% of riders reach stations by walking or biking, compared to 49% who drive alone and 17% that are dropped off by a personal vehicle. However, there is wide variation between stations, primarily based on neighborhood context. Driving and parking accounts for more than 75% of access mode share at just seven commuter rail stations. **Therefore, at nearly all commuter rail stations in the system, a significant proportion of riders are finding alternative means of access beyond using MBTA and municipal car parking—and at many stations, walking is as important as driving, if not the primary station access mode.** Figure 3-9 illustrates where walk and bike access is most prevalent, primarily in the inner core and denser, walkable communities inside the Interstate 95/Route 128 belt.

At the 110 stations with parking, utilization is much more varied than on the rapid transit network—35 commuter rail stations have utilization above 90%, and 15 stations have less than 50% utilization (Figure 3-9). There are several lines with long segments where all the stations are above 90% utilization, including on the Providence Line from South Attleboro to Sharon and on the Fitchburg Line from Shirley to Littleton/495.

The commuter rail network pull riders from a smaller catchment area than the rapid transit network. About 55% of riders that park at access commuter rail stations drive fewer than four miles, compared to just one-third of riders that park at rapid transit stations. At stations in town centers, drive and park access is often even more local—with many stations where over half of these trips start within about two miles. However, similarly to the rapid transit network, end-of-line commuter rail stations and stations with easier highway access often play a more regional role.

Like rapid transit stations, access profiles vary across the commuter rail system and are summarized by the following station types: town centers, neighborhood stations, urban centers, regional park-and-rides, and local park-and-rides.

Town Centers

These stations are typically in the center of walkable suburban downtowns and riders use a mix of modes to access them. Overall, 38% of riders reach town center stations by walking or biking, compared to 47% who drive and park or carpool. However, at 23 town center stations, as many or more people walk or bike to access transit as drive and park or carpool. All town center stations have some bike parking—typically between five and 25 spaces—with a wide range of utilization.

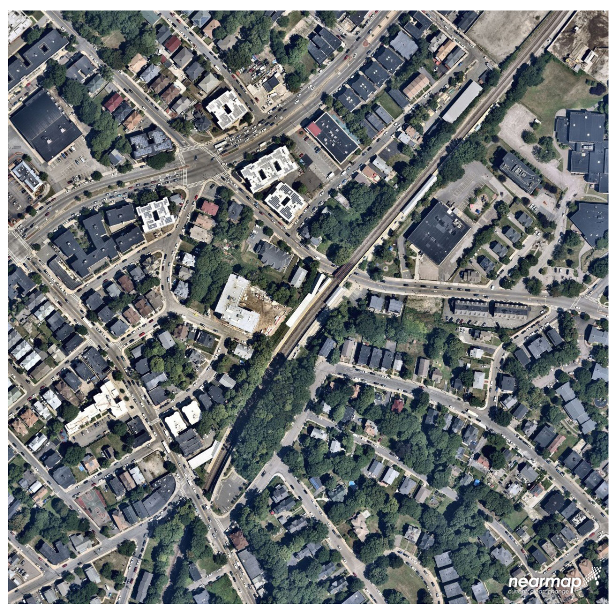
Car parking lots at town center stations typically have high utilization, but primarily draw riders driving a short distance to access transit. At 16 of 30 stations with available data, at least half of drive and park access trips are less than two miles. Most town center stations have between 100 and 300 car parking spaces, smaller than a typical park-and-ride, but often the largest single car parking facility in the town's center. Nineteen town center stations have greater than 90% parking utilization on a typical weekday, and a further 14 have between 75% and 90% utilization.

Andover Station
Image Source: NearMap

Neighborhood

These stations are primarily accessed by walking and typically have limited or no car parking. Neighborhood stations are located both in and near the inner core—most notably along the Fairmount and Needham Lines—and in residential and light industrial areas in suburban communities. Neighborhood stations have a very high share (70%) of riders who walk or bike to the station, compared to just 23% who drive and park or carpool.

Neighborhood stations that do have car parking generally have very small lots with fewer than 60 spaces. Parking utilization varies widely between stations, but most drive and park trips are local—with half of riders driving less than about two miles and over 75% of riders driving less than four miles to access these stations. Several Fairmount Line stations have local bus connections, though none currently serve as high volume transfer points between bus and rail services.



Four Corners/Geneva Station
Image Source: NearMap

Urban Centers

These stations are in the center of more densely populated communities outside the inner core—including Gateway Cities. Like town center stations, riders use a wider range of access modes than at the park-and-rides described below. These stations, however, often have large car parking garages and also function as bus hubs for RTA and MBTA services. With some exceptions, car parking at these stations rarely reach more than 75% occupancy. Yet, due to lower overall ridership volumes, most urban center stations have more riders driving and parking or carpooling (47%) than walking or biking (31%).

Brockton Station

Image Source: NearMap

Car Parking and Access on the Needham Line

The Needham Line, which is mostly comprised of neighborhood and town center stations, serves as an example illustrating the role of car parking in station access. Parking is functionally at capacity, but many alternatives exist. All parking facilities along the line are above 75% utilization, and over 91% of the spaces on the entire line are in use. However, 78% of Needham Line riders walk to access their station, compared to 16% who drive and park. Parking capacity on the line has decreased in the past decade, while ridership rose 15% between 2012 and 2018. Thus, additional car capacity could be considered, but so could further reductions in car parking in favor of investments in pedestrian and bike access to reduce the number of short distance driving trips while maintaining ridership.

Source: Nearmap

Regional Park-and-Rides

These stations have large car parking facilities and are usually located near regional highways, such as Route 128 and Interstate 495, and/or are outer end-of-line stations. Mostly isolated from residential neighborhoods, 68% of riders access these stations by driving and parking, often driving from a wider catchment area than local stations. Nearly two-thirds of people who park at these stations drive farther than four miles, though trips are shorter on average than to regional rapid transit stations. Few riders walk or bike to these station, with all but three having walking mode shares below 10%.

Car parking utilization rates at regional park-and-rides are more varied than those at town center and neighborhood stations. Less than 75% of car parking spaces are utilized at six regional park-and-rides on a typical weekday—including at the four largest commuter rail park-and-rides in the network (Route 128, Hingham Ferry Terminal, Anderson/Woburn, and Kingston). However, smaller regional park-and-rides are more heavily utilized, with five stations—each with less than 600 spaces—having greater than 90% utilization.

Forge Park/495 Station
Image Source: NearMap

Local Park-and-Rides

These stations have smaller car parking facilities and are usually located within one to three miles of a suburban town center. Sixty-seven percent of riders access these stations by driving and parking (including carpools), but these driving access trips are shorter than to regional stations–with about two-thirds of riders driving less than four miles to access the station (compared to about one-third at regional park-and-rides). Eighteen percent of riders are dropped off at these stations.

While driving and parking is the predominant access mode at most local park-and-rides, car parking utilization varies widely. Car parking utilization exceeds 90% at six stations but is less than 75% at fourteen stations.

West Hingham Station
Image Source: NearMap

Figure 3-9 Walk and Bike Access at Commuter Rail Stations

Source: 2015-2017 MBTA Systemwide Passenger Survey

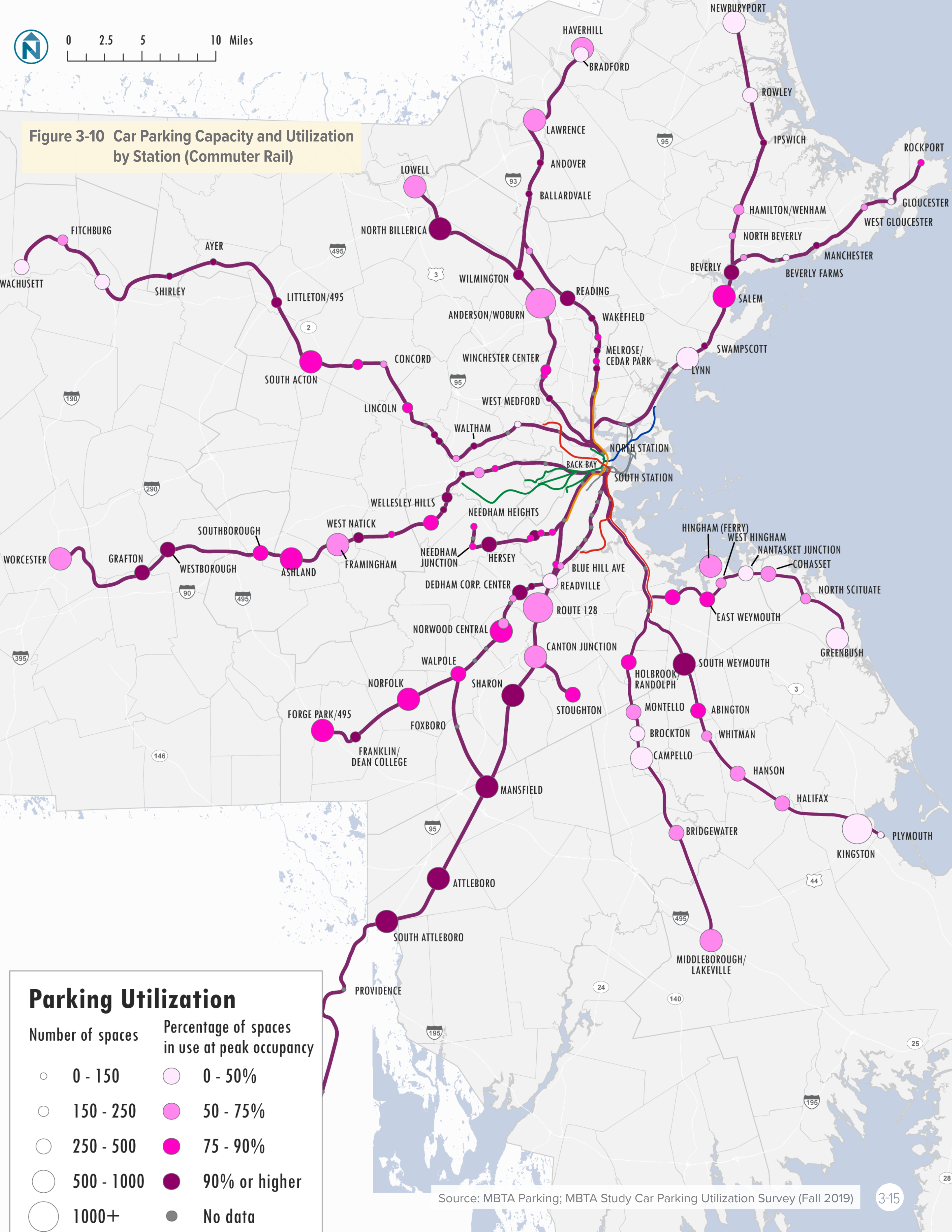


Figure 3-10 Car Parking Capacity and Utilization by Station (Commuter Rail)

Source: MBTA Parking; MBTA Study Car Parking Utilization Survey (Fall 2019)

Systemwide Access Trends

In addition to identifying and analyzing station types to understand the nuances of access across the rapid transit and commuter rail networks, this study also performed analyses at the system level. These systemwide analyses found:

- Dense areas near stations show the greatest potential for ridership growth
- Parking lots are often full, but many riders drive short distances to get to stations
- Pedestrian and bike conditions vary, and improvements pose opportunity

DENSE AREAS NEAR STATIONS SHOW THE GREATEST POTENTIAL FOR RIDERSHIP GROWTH

One of the primary goals of improving station access is attracting new riders to transit—an outcome that supports our region's sustainability goals. A key element for increasing transit ridership is making transit more competitive with other options. Improving station access options can make transit more competitive in many ways, primarily through reducing access time (and thus overall travel time) and reducing barriers that restrict riders from accessing rail transit at all. These barriers range from poor conditions for pedestrians and people riding bikes to a lack of bus connections or full car parking lots.

This study took a high level systemwide approach to understanding how transit access impacts transit competitiveness, designed to augment other analyses performed at the station-level. This analysis focused on where people who currently and potentially could use rail transit begin their trips across the entire system to assess where the greatest amount of overall travel demand is in our system.

To better understand where existing and potential riders begin their trips, the project team used location-based services (LBS) data to analyze all trips—regardless of mode—from communities throughout the Greater Boston Area to Boston's primary employment centers.[3] These employment centers are the destinations for most existing MBTA commuter rail trips and for a high proportion of trips made on the rapid transit and bus networks. Trips to primary employment centers do not account for all trips, as many people use MBTA services for purposes beyond commuting. However, these trips have a specific impact on station access constraints—especially for car parking, which at nearly all stations reaches peak utilization by the end of morning rush hour.

All trips in the LBS dataset were allocated to the nearest commuter rail and rapid transit stations. Trips from areas located near both types of stations were apportioned based on observed data demonstrating a preference to travel farther to access rapid transit.[4] Trips occurring entirely within the major employment centers in the inner core (e.g., within downtown Boston or Kendall Square) were excluded as the data were not granular enough to identify whether transit would have been a reasonable option for that trip.

3 Analyzed employment centers included Downtown Boston, Back Bay, South Boston Waterfront, Logan Airport, Longwood Medical Area, and parts of Cambridge and Somerville.

4 Trips were then assigned to the closest commuter rail and rapid transit stations, with trips assigned proportionately between the two service types based on the distance to each station. For example, the closer an analysis zone was to a rapid transit station compared to a commuter rail station, the higher the proportion of trips from that zone assigned to the rapid transit station. This methodology was developed based on observed data showing that riders are willing to drive farther to access more frequent, and often cheaper, rapid transit service. The assigned trips to each station are the estimated addressable market at that station. In general, the project team found a relationship between the total ridership and the addressable market assigned to each station. (or groups of adjacent stations).

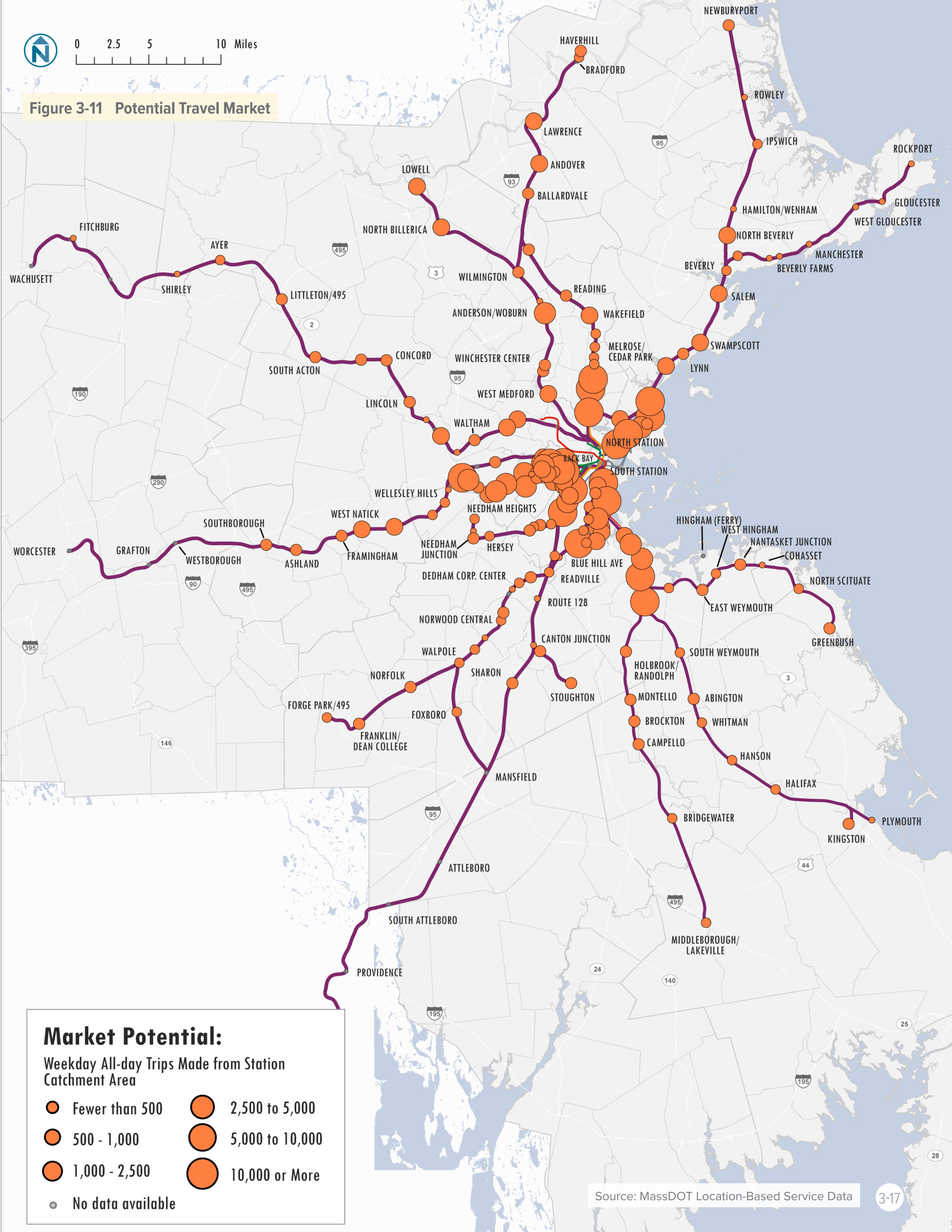


Figure 3-11 Potential Travel Market

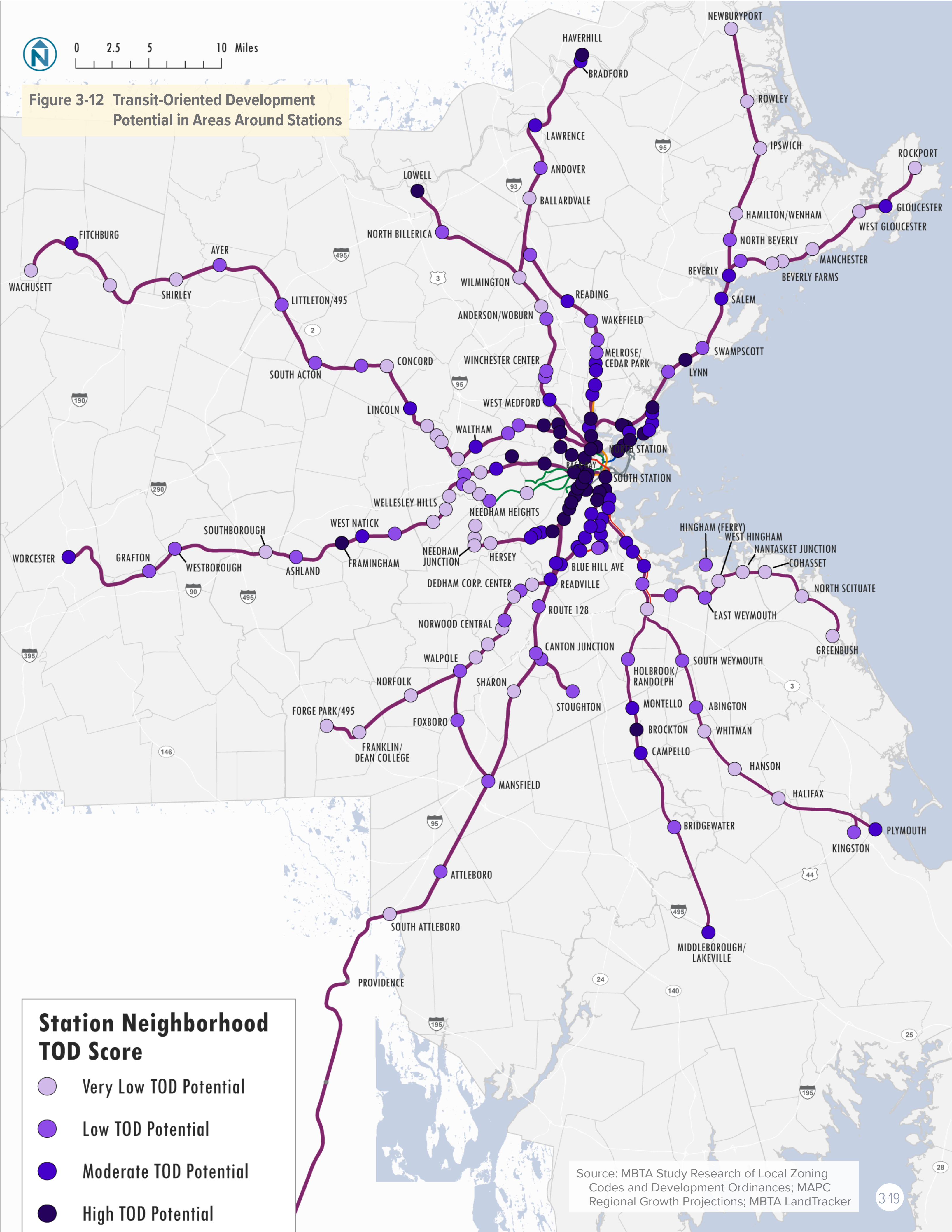
As was expected, existing and potential demand for station access increases significantly in areas closer to the major employment centers (Figure 3-13)—with nearly 80% of all trips occurring within the catchment area of rapid transit. In general, the areas with a greater volume of travel to the major employment hubs correlates with transit ridership—stations with higher ridership are in areas that show higher levels of trip-making across all modes. On the commuter rail network, demand was observed to be most concentrated at urban center and town center stations, especially in suburbs near Route 128 and in North Shore communities like Salem.

Land Use and Housing Patterns Impact Demand

Population density, as shaped by land use and housing patterns, helps explain why so much of the potential demand comes from areas in the inner core and areas near stations. Those are the areas where more people live, so it follows that those are the areas where there are more people who need to travel to employment hubs and other locations. Analysis of development patterns around stations supports this finding. Figure 3-12 illustrates the locations that may support the potential for future development within half a mile of a station (i.e., transit-oriented development) based on existing and projected density, as well as qualitative measures like zoning and master plan provisions. These qualitative measures could change as housing and zoning changes occur over time in communities in the region.

These high potential areas are largely located within Interstate 95/Route 128, as well as in Gateway Cities. In addition to demonstrating the relationship between current development and demand, this analysis illustrates where future demand, due to population growth, is mostly likely to occur. However, increasing housing near transit in any community could support easier access to these services for more people. Working with the various area stakeholders, all municipalities can create and enhance environments where transit, communities and businesses can thrive. In some instances, mixed-use developments can achieve multiple contextually-appropriate community goals, while also enhancing access to transit for both inbound and outbound uses. In other instances, development near enough to transit for pedestrian and bike access can support environmental and health outcomes, and expand access for those without vehicles.

Figure 3-12 Transit-Oriented Development Potential in Areas Around Stations



Source: MBTA Study Research of Local Zoning Codes and Development Ordinances; MAPC Regional Growth Projections; MBTA LandTracker

Image from Brydon McCluskey on Unsplash

PARKING LOTS ARE OFTEN FULL, BUT MANY RIDERS DRIVE SHORT DISTANCES TO GET TO STATIONS

The station access profiles above show that car parking supply and availability places different opportunities and constraints at stations based on their context within the system. At rapid transit stations, most car parking is fully utilized, but driving and parking plays a small role for overall access compared to walking and buses. Car parking plays a variety of roles within the commuter rail network, serving as the primary means of access at many regional and local park-and-rides and one of several access options at more walkable town center, urban center, and neighborhood stations. Therefore, at some stations, a full car parking lot may restrict access for most riders (unless they can be dropped off). But at other stations, most riders can still access the station by walking, biking, or buses even when car parking is full. Some riders may also choose or need to rely on driving and parking for short access trips—even when other options are available—due to their mobility needs or to maintain daily obligations that may require a vehicle.

These varying access profiles and roles for car parking raise the question: Where do riders that drive and park at stations come from?

The five-digit zip code origins of vehicles parked at MBTA-owned car parking lots were analyzed to help estimate the drive and park catchment areas of selected stations. Zip codes are often large and vary widely in size, shape, and population distribution, especially in lower density suburban communities. Therefore, the population-weighted center of the zip codes was used to estimate the average trip distance between each station and zip code. Trip distances were then grouped into four categories: less than 2 miles, 2-4 miles, 4-8 miles, and 8+ miles. These categories each represent a unique catchment market that have opportunities to support different station access options. Many people in zip codes with population centers within 0-2 miles live within a 10-minute walk or bike ride of a station, and most—though not all—live within a 20-minute bike ride. Trips from zip codes with population centers beyond four miles from a station almost always start beyond the immediate station area–with access opportunities limited to driving and parking, pickup and dropoff, and connecting bus options (where available).

The vehicle origin analysis found significant variation in how riders use MBTA car parking, with distinct patterns based on station type. Key findings include:

- **The MBTA parking system serves both local and regional drive and park access trips.** At the 90 stations with available data, about 30% of riders that drive and park travel less than two miles to access transit, 20% travel 2-4 miles, 20% travel 4-8 miles, and 30% travel more than eight miles. This means about half of riders that drive and park are making local access trips of less than four miles—typically from the station municipality or an immediately adjacent municipality and half of riders are making longer, regional access trips from beyond four miles.
- **Rapid transit riders travel farther to drive and park than commuter rail riders.** About two-thirds of rapid transit riders who drive and park come from farther than four miles, compared to about 45% of commuter rail riders. Riders are likely willing to drive farther to access rapid

transit due to a combination of longer service hours, more frequent service, and lower fares.

- **There is significant variation in drive access distance between station types.** At 40 stations, more than half of riders who drive and park travel less than about two miles to access the station. These stations are mostly town center and neighborhood commuter rail stations and neighborhood rapid transit stations. At local park-and-rides, riders most often drive two to four miles. Conversely, there are eight stations where more than half riders travel more than eight miles to drive and park. These stations are almost exclusively regional rapid transit and regional Park-and-Ride commuter rail stations.
- **End-of-line stations and stations with nearby highway access serve significantly more regional trips than other stations.** About 70% of drive and park trips at regional rapid transit stations and just over 60% of drive and park trips at regional commuter rail stations begin farther than four miles from the station. Conversely, only 35% of drive and park access trips at town center stations are longer than four miles.
- **Rapid transit park-and-rides closer to employment centers in the Inner Core typically serve more local drive and park access trips than end-of-line stations.** At nine rapid transit (and bus) stations, more than half of riders drive less than about two miles to park. Some of these stations—such as Orient Heights and Watertown Yard—primarily serve short access trips. Others—such as Suffolk Downs and Malden Center—also serve many regional access trips. Providing more walking, biking, and transit options for people who currently drive short distances to these stations could open more spaces for riders driving longer distances to access rapid transit.
- **Town center and neighborhood commuter rail stations mostly serve local drive and park access trips.** At 22 of 38 town center and neighborhood stations with available data, more than half of riders that drive and park come from less than about two miles away. These stations are generally in walkable areas with greater population density, and thus improvements to walking, biking, and transit access could provide more options for people who currently drive and park.
- **There is not a strong relationship between drive and park travel distance and car parking utilization.** Thirty-four stations with available data have greater than 90% car parking utilization. At 22 of these stations, more than half of riders who drive and park travel less than about four miles. At the remaining 12 stations, more than half riders who drive and park travel more than about four miles. This ratio is similar at stations with less than 75% utilization. This finding suggests that car parking utilization at a given station may be more related to facility size, neighborhood characteristics, alterative access options, and available transit service than to average drive access distance.

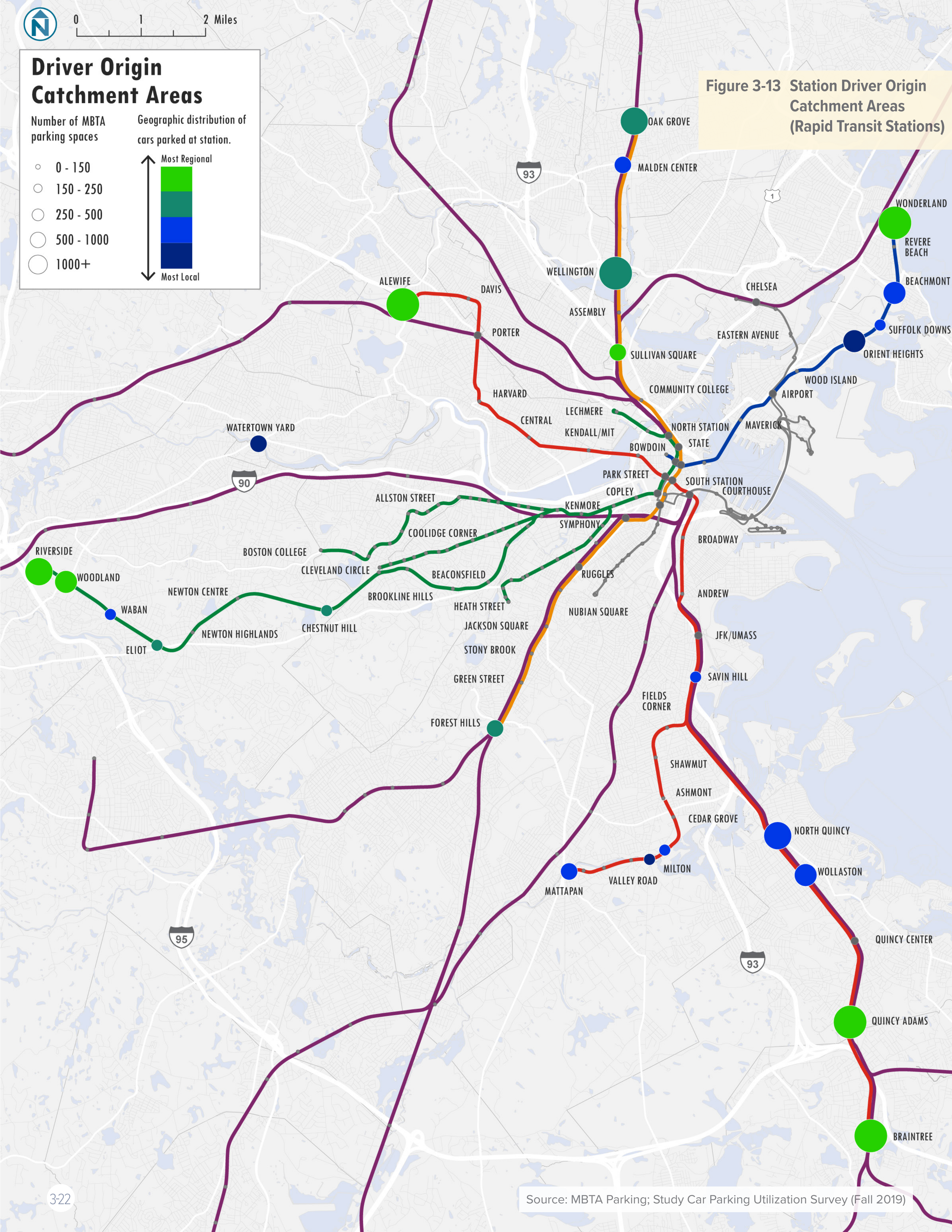


Figure 3-13 Station Driver Origin Catchment Areas (Rapid Transit Stations)

Source: MBTA Parking; Study Car Parking Utilization Survey (Fall 2019)

Figure 3-14 Station Driver Origin Catchment Areas (Commuter Rail Stations)

Source: MBTA Parking; Study Car Parking Utilization Survey (Fall 2019)

Parking Capacity Doesn't Explain Everything—Assessing Train Boarding Times Reveals Capacity Needs

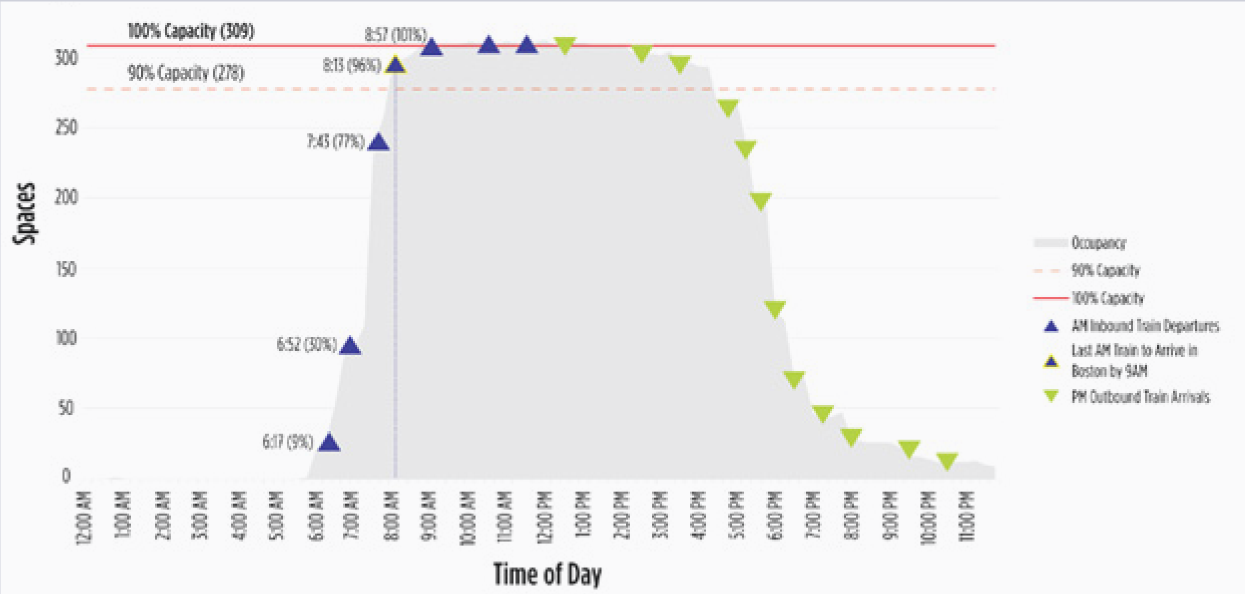
For parking lots that fill to 100% capacity, it is also important to understand in greater detail not only where riders are coming from, but also when they need to use transit. The following examples reveal how parking capacity tells only part of the story around access needs, as parking can play very different roles at stations that have similar, high levels of utilization.

CASE STUDY: Hersey

Hersey is a town center commuter rail station in Needham. The station car parking lot is fully used on weekdays, but based on real-time utilization counts, the lot does not fill up until the last morning peak train (see graph below). Utilization surpasses 90% for the 8:13 a.m. train and reaches 101% at 8:57 a.m. Additionally, 48% of riders currently access the station through walking and biking, and 70% of those who do drive come from within approximately two miles of the station.

The surrounding area is walkable and connected to a high-comfort walking and biking network to the north and east. Thus, Hersey presents an example of a station with likely the right amount of parking. Effective access improvement strategies could include proactive car parking management, as well as investments in enhanced walking and biking infrastructure to give more options for people making short access trips.

Hersey Car Parking Occupancy by Hour



Source: Study Car Parking Utilization Survey (Fall 2019)

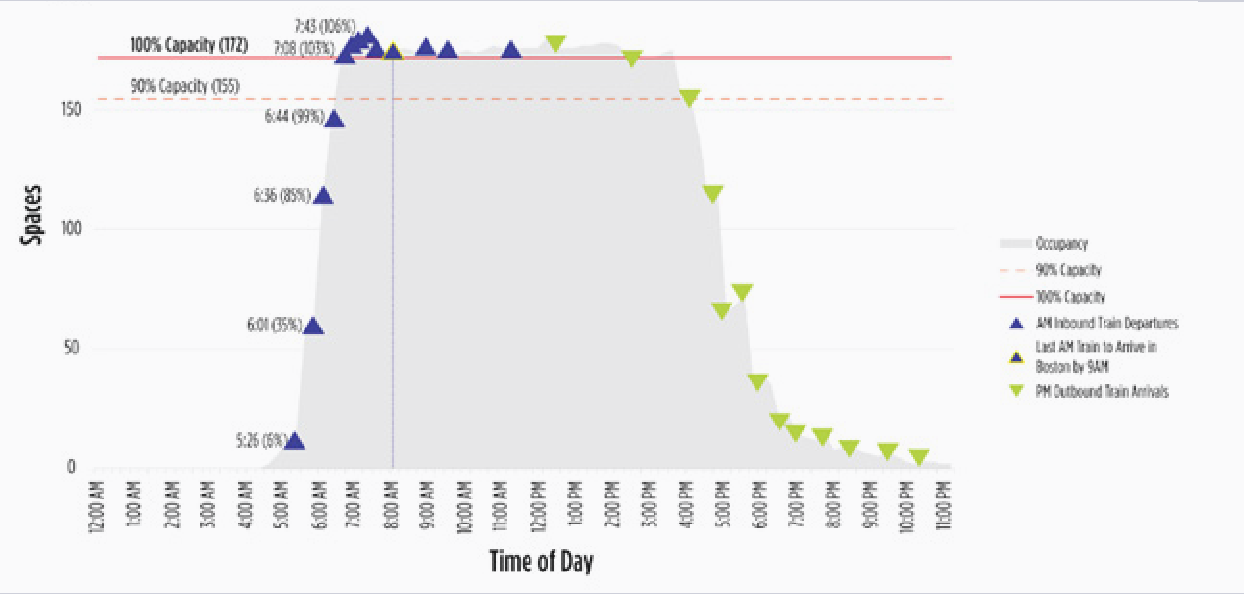
Source: MBTA Website

CASE STUDY: West Natick

West Natick is a local park-and-ride commuter rail station in Natick. All car parking spaces are full by the 6:44 a.m. train, but only 33% of riders each morning have boarded the commuter rail service by the time the parking lot reaches capacity. Thus, people primarily access West Natick station through other modes—with 61% of riders walking or biking compared to only 21% of riders who drive and park or carpool.

Many of the riders that do drive and park come from a relatively short distance—about 40% come from within about two miles of the station, and an additional 30% come from about two to four miles. This access profile may indicate that a holistic approach—focused on car parking management, pedestrian, biking, and transit—may be an effective strategy for improving access and increasing ridership at West Natick.

West Natick Car Parking Occupancy by Hour



Source: Study Car Parking Utilization Survey (Fall 2019)

PEDESTRIAN AND BIKE CONDITIONS VARY, IMPROVEMENTS POSE OPPORTUNITY

The **2019 Massachusetts Pedestrian Transportation Plan** and the **2019 Massachusetts Bicycle Transportation Plan** detail an approach and best practices for improving conditions for pedestrians and people biking throughout the state. Increasing access to transit is a key goal of both plans—with a focus on creating direct, safe, and accessible paths for pedestrians and expanding high-comfort bikeway networks for people biking. High-comfort bikeways are streets suitable for people of all ages and abilities riding bikes—including shared use paths, major arterials with separated bike infrastructure, and all neighborhood streets with lower traffic volumes and speed limits.

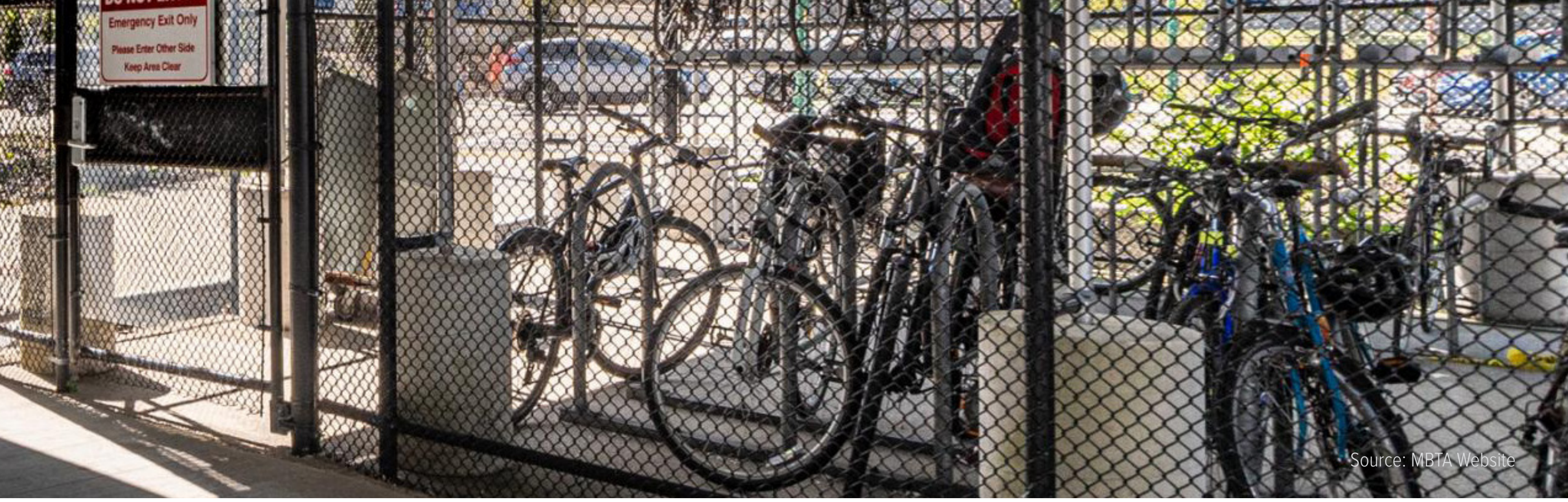
The relationship between station access profiles and conditions for pedestrians and people biking helps illustrate how existing pedestrian and bike infrastructure expands or increases access to transit.

Walkability

The project team conducted a walkability analysis to understand walking conditions within each station area. For walkability, the team analyzed the presence of sidewalks and frequency of street intersections within a half mile of each station. Streets with greater sidewalk coverage (on both sides) are considered walkable, as are street networks with a relatively greater density of intersections. Each station was given a walkability percentage. They range as low as 3% to as high as 83%, though many are on the lower side (see Figure 3-15).

In general, sidewalk and pedestrian infrastructure is good at stations in the inner core, historic town centers, and Gateway Cities, where there is a higher density of existing and potential riders within walking distance of the station. However, walkability alone is not an indicator of high walking access. Many urban center commuter rail stations, including Haverhill, Fitchburg, and Attleboro, have high walkability scores but comparatively low walk or bike access mode shares. Additionally, stations with higher walkability scores typically have ample potential for walking improvements. In these walkable neighborhoods, small adjustments in street and intersection design, including lighting, may enhance safety and create more comfortable conditions for walking to transit.

Most stations with low walkability scores are in lower-density suburban areas with more disconnected street networks (often due to at-grade rail lines). At some of these stations, significant improvements would be difficult and provide minimal benefits for riders since few people live within walking distance (half a mile) of the station. For example, Route 128, a regional park-and-ride, has a low 19.7% walkability score, but only 450 people live within a 10-minute walk of the station. Focusing on increasing walking at a station like this will likely yield limited results, as its primary role in the system is to attract riders from a regional catchment area.



Source: MBTA Website

Bikeability

Biking is not currently a major access mode for MBTA riders. Apart from select high-use stations like Alewife (which is near a high-comfort bikeway), bike parking is not fully utilized, with an average of 29% at commuter rail stations and 37% at rapid transit stations. Utilization of bike parking is likely impacted by the quality of the bike parking infrastructure available at different stations, as well as the availability of safe and comfortable bike access to stations from surrounding areas. However, given the portion of current and potential access trips made from within a short distance of a station, there are significant opportunities to expand biking as a station access mode—particularly for trips made within 1.67 miles of a station (or about a 10-minute bike ride).

The project team conducted a bikeability analysis to understand existing conditions for biking around each station. The bikeability analysis focused on the size of the area connected to each station by streets that are comfortable for most people biking. For this analysis, high-comfort streets for biking were defined as major arterials with dedicated bike facilities (such as separated bike lanes) and all neighborhood streets.[5] Each station received a bikeability score based on the percentage of streets within 1.67 miles of a station that (1) meet the definition of high-comfort and (2) are connected directly to the station via other high-comfort streets.

Biking conditions in neighborhoods around MBTA stations are often worse than walking conditions. Across the entire MBTA network, only 38% of streets within a 10-minute bike ride are both "high-comfort" and provide direct access to a rail station.

Three quarters of stations have bikeability scores below 40%. Many of these lower scoring stations are rapid transit core and neighborhood stations, as well as urban center stations. These station areas often have sidewalks and dense street grids, and thus have high walkability scores, but they lack the dedicated infrastructure—like separated bike lanes or shared use paths—needed to enable people to feel safe while biking. In some of these areas, expanding the high-comfort bike network may only require filling in small network gaps around the station, while in others, more significant efforts may be needed to safely connect people biking from surrounding neighborhoods.

Town center stations in inner suburbs, like Needham and Melrose, have great potential for improving bikeability. While these stations may not necessarily have extensive dedicated bike infrastructure, they are located adjacent to residential areas with dense grids of neighborhood streets that most bike riders will find comfortable. By improving station amenities for bikes, like bike parking, and spot treatments on the street network, the number of people biking will likely increase, without needing significant investments in new shared use paths or bike lanes. However, shared use paths and bike lanes can also provide a significant benefit to access. As seen at Alewife and the Minuteman trail, if there is a dedicated, well-maintained bike connection to a rail station, people will use it.

5 See Page 28 of the **Massachusetts Municipal Resource Guide for Bikeability** for a more detailed overview of high-comfort bike infrastructure.

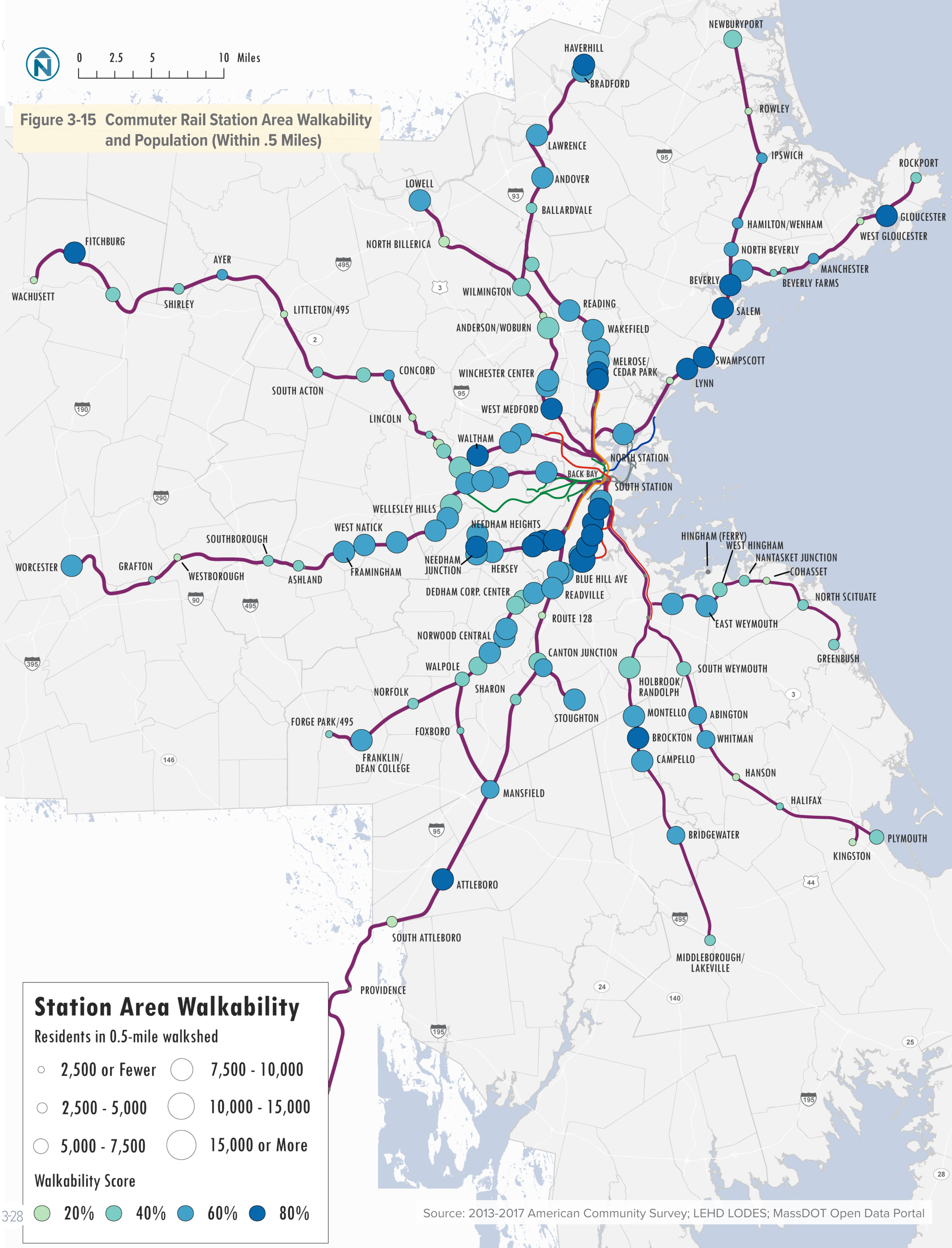


Figure 3-15 Commuter Rail Station Area Walkability and Population (Within .5 Miles)

Source: 2013-2017 American Community Survey; LEHD LODES; MassDOT Open Data Portal

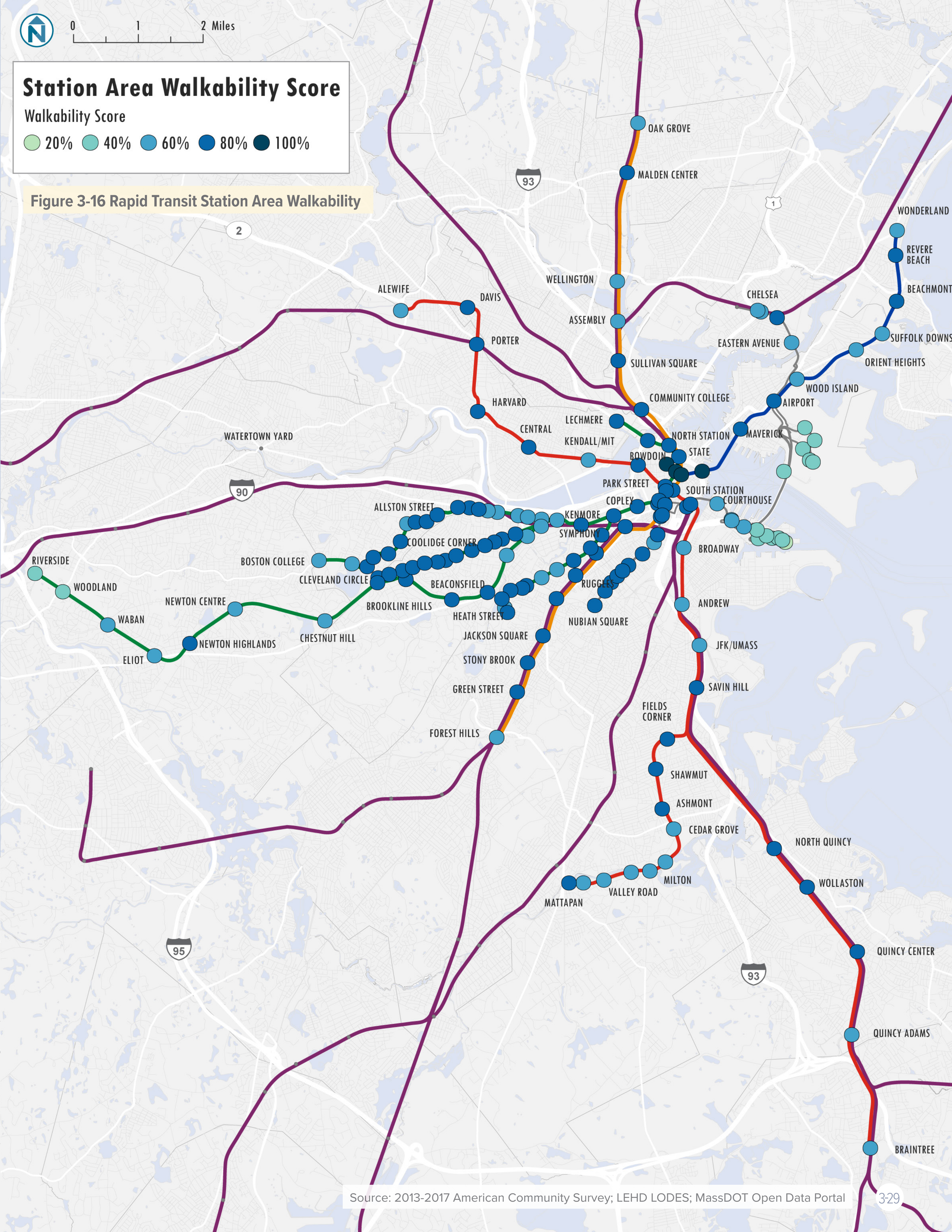
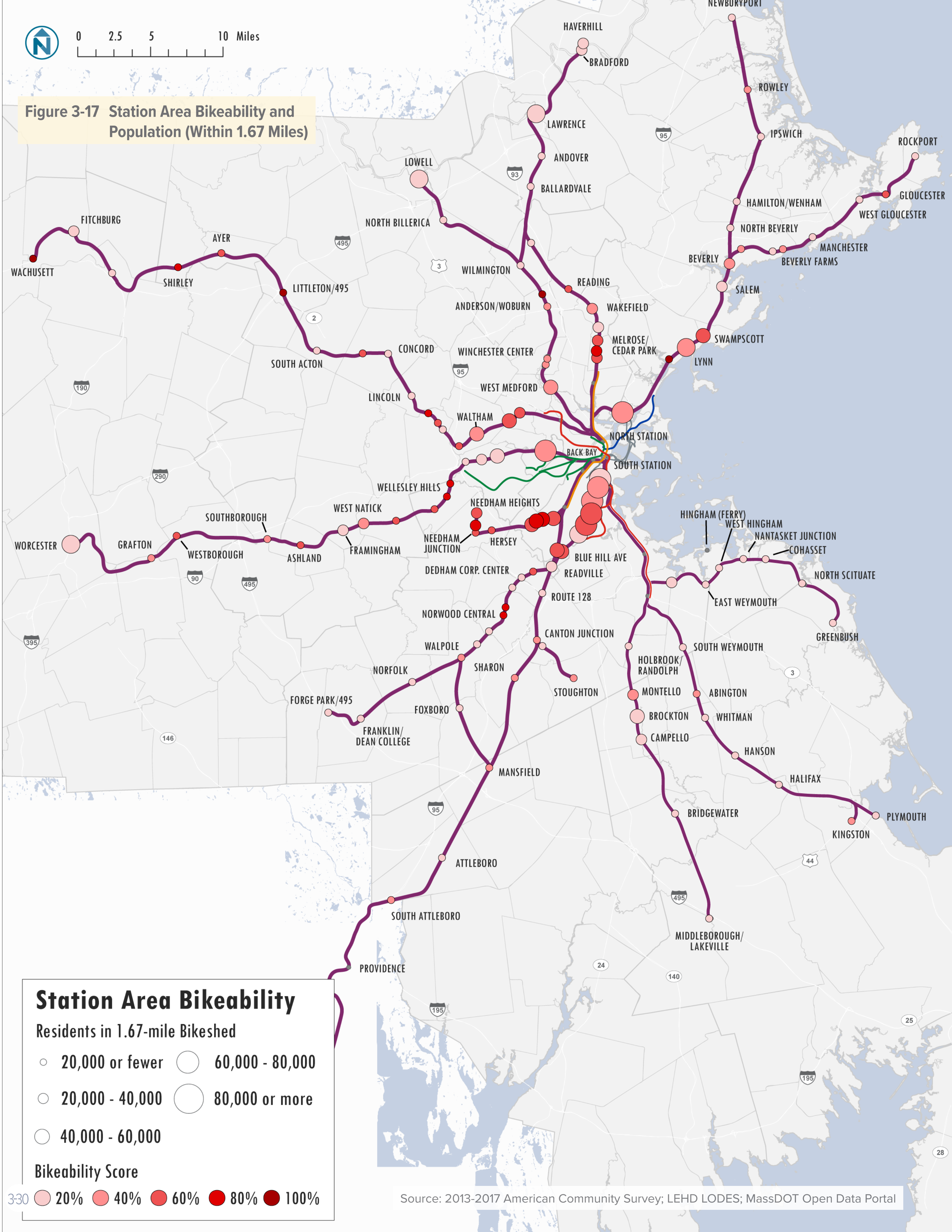


Figure 3-16 Rapid Transit Station Area Walkability

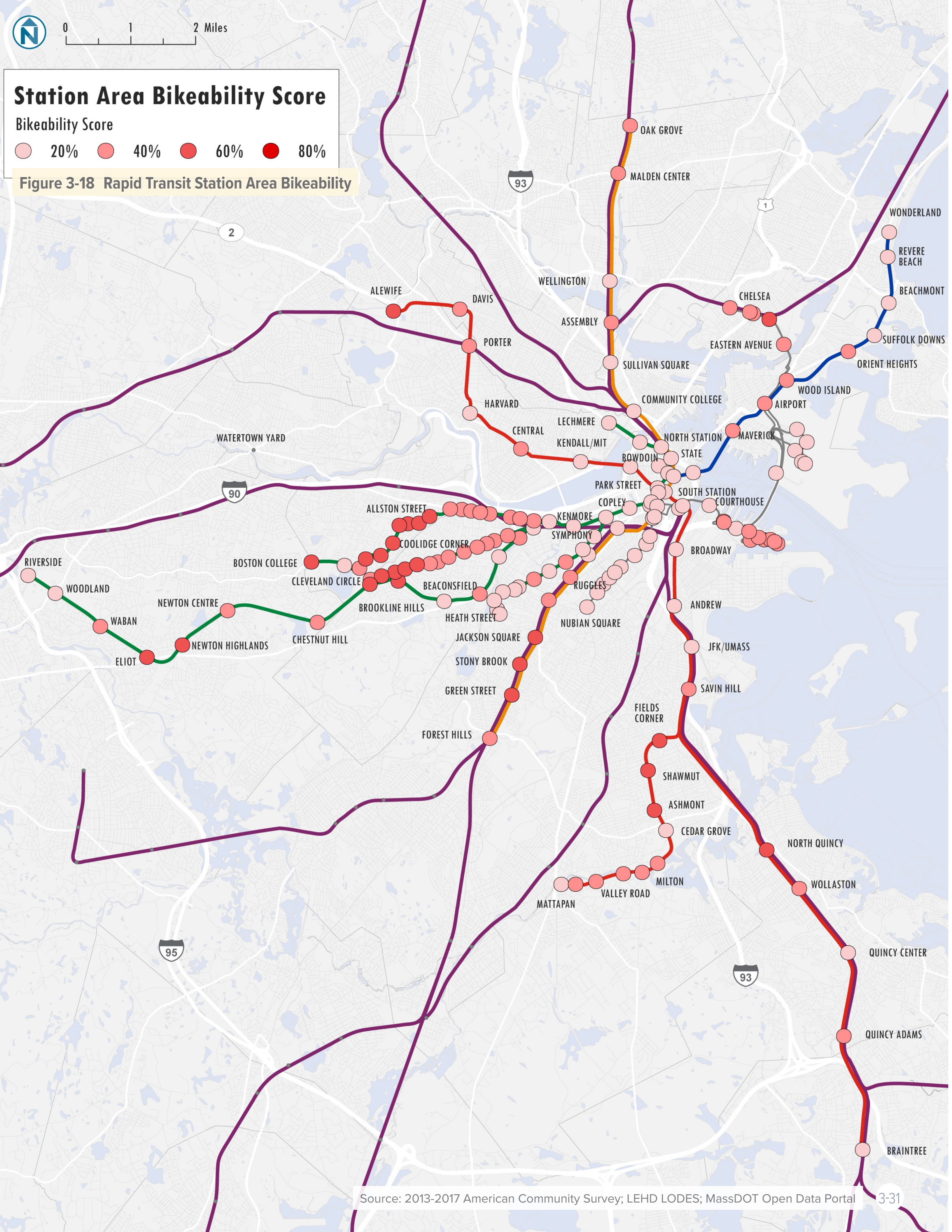
Source: 2013-2017 American Community Survey; LEHD LODES; MassDOT Open Data Portal

Figure 3-17 Station Area Bikeability and Population (Within 1.67 Miles)



Source: 2013-2017 American Community Survey; LEHD LODES; MassDOT Open Data Portal

Figure 3-18 Rapid Transit Station Area Bikeability



Source: 2013-2017 American Community Survey; LEHD LODES; MassDOT Open Data Portal

STATION ACCESS PLAYBOOK

STRATEGIES FOR ENHANCING STATION ACCESS

The key findings from this study reveal the potential for station access improvements to unlock new ridership and benefit people who use transit.

In particular, they demonstrate how station access is more complicated than just considering car parking alone. Many stations with large, full parking lots draw more riders on other modes. At some, like Alewife, more people arrive by bus than park in the garage. There is also potential for attracting new riders from areas that are close to stations. These findings suggest that investing in walking, biking, and transit improvements may yield the greatest benefit for both existing and potential riders.

Car parking will continue to play an important role in access—both for people making longer trips to access transit and for people that must rely on cars for mobility. However, car parking expansion should be pursued strategically, because it provides an inefficient form of access. One car parking space typically provides access to just one rider each day—and costs $10,000 to $50,000 or more to create. By comparison, investments to improve pedestrian and bicycle access can often provide access to more riders at a lower cost in areas with sufficient local demand and can support other community mobility needs.

Station design also plays a critical role in ensuring people can seamlessly access transit. Well-designed stations use infrastructure and management strategies that prioritize the ways people are mostly likely to access transit. Stations should be deliberately easy to navigate, with clear and accessible pathways for pedestrians and people biking. Bike parking should be provided at stations with sufficient demand. Curb space should be actively managed, ensuring easy, reliable pickup and dropoffs, bus operations, and shuttle service. As the MBTA makes upgrades to stations to address safety, state of good repair, and operational issues, incorporating these principles will help improve access as well.

The recommendations from this study are presented in the following two chapters, which in combination are referred to as a "Station Access Playbook." This Playbook is a toolkit that can serve as a universal resource for all entities responsible for station access—including local city and town planners, infrastructure owners, MassDOT and MBTA departments, connecting service operators, and private mobility providers. It includes a range of potential capital investments, policies, and guidelines for increasing and managing station access, as well as the applicability of each strategy based on station context. It is organized into two sections:

- **Addressing Access Demand:** Introduces a four step approach for the MBTA and its local partners to address demand for station access. This process considers all potential improvement options and management strategies including solutions that are potentially more effective and less costly than building new car parking.
- **Addressing Station Design:** Highlights priority station design strategies that the MBTA can implement as it makes station upgrades through its capital plan to facilitate station access across all modes and contexts.

4 Station Access Playbook: *Addressing Access Demand*

This chapter introduces a four step approach for the MBTA and its local partners to determine which strategies have the greatest potential to address demand for station access.

The approach focuses first on understanding existing and potential access markets, primarily using data and tools created through this study. It then presents a roadmap for determining whether car parking management or improvements to pedestrian, biking or transit connections could best meet the access need identified. The process concludes with options for strategically expanding car parking when warranted. The end of this chapter lists resources that municipalities and other local partners can use as they work through this process.

PLAYBOOK OVERVIEW: A HOLISTIC APPROACH TO IMPROVING STATION ACCESS

1. Understand the Market

- Determine the station access profile
  - Identify how riders currently access the station and how potential new riders would likely access the station, using outputs from this study, augmented by other information as needed.
- Review the broader access market
  - Review the relationship of the target station to other nearby stations—with a focus on the potential for complementary investments across multiple stations to improve access more efficiently and effectively.

2. Better Manage Existing Car Parking Assets

- Use pricing to reach optimal utilization
  - **Works best at:** Stations with 90%+ car parking utilization, especially those (1) where another station within a 10-minute drive and has less than 75% utilization and (2) stations with a high rate of local drive access trips.
- Simplify car parking management practices
  - **Works best at:** Stations with a high rate of local drive access trips.
- Repurpose car parking for TOD (or other access improvements)
  - **Work best at:** Stations where (1) TOD is market viable and would increase overall transit use and (2a) there are other underutilized or expandable car parking options nearby or (2b) there are high rates of local drive access trips.

3. Implement Pedestrian, Biking, and Transit Options

- Pedestrian access opportunities
  - **Works best at:** rapid transit stations, as well as urban center, town center, and neighborhood commuter rail stations.
- Bike access opportunities
  - **Works best at:** rapid transit stations, as well as urban center, town center, and neighborhood commuter rail stations. Some strategies, especially shared use paths, can also increase bike access at regional and local park-and-ride stations.
- Transit and shuttle opportunities
  - **Works best at:** rapid transit stations, especially end-of-the-line stations near higher density suburbs, as well as, urban center stations with high car parking utilization. Shuttle services for targeted markets can be effective at all station types.

4. Strategically Expand Car Parking Supply

- Leverage shared parking
  - **Works best at:** town center, urban center, and some rapid transit stations, where there is nearby municipal or private parking available.
- Expand commuter car parking
  - **Works best at:** park-and-ride stations with a high rate of regional access trips and there are limited opportunities for walking, biking, or transit improvements.

1. Understand the Market

DETERMINE THE STATION PROFILE

Before identifying potential access enhancement approaches—especially car parking expansion—it is important to understand how people currently access and could potentially access a given station.

As part of this study, MassDOT and the MBTA aggregated and evaluated numerous datasets to create an access profile for each station. These access profiles served as the basis for eight composite station types—each with fundamentally different access characteristics and opportunities for improvement. As described in the key findings chapter above, these station types are primarily based on: (1) transit service type rapid transit or commuter rail, (2) current access characteristics (mode share, local vs. regional), and (3) neighborhood characteristics (density and land use mix).

In many cases, this study's composite station types and related recommendations provide adequate information to initiate station access planning decisions. In some cases, the MBTA and municipalities could consider additional market research, typically when:

- **Large-scale physical investments** are being considered, such as a new car parking garage.
- **Identified potential investments at one station** could have significant impacts on access at other stations in the broader access market.

This additional research could include a rider survey focused on how riders choose their access mode and station, as well as the factors that could influence them to change how they access transit.

REVIEW THE BROADER ACCESS MARKET

Stations and their access markets do not exist in isolation. Many riders throughout the network, especially within and around Route 128, have access to multiple MBTA stations. Even when there is only one station within short distance, the survey data described in the key findings show that riders with access to a car or connecting bus service are often wiling to travel further to access more frequent rapid transit services.

Station access planning decisions therefore cannot be made on a station-by-station basis. When considering changes that impact longer distance drive or bus access trips, it is important to consider opportunities and tradeoffs across multiple stations. Evaluating a broader market can help identify complementary investments across several stations, and even several modes that can enhance access and more cost-efficiently serve other goals.

Potential examples of this approach and resulting outcomes include:

- **A target station has a full car parking lot, but other stations nearby have available supply.** In this case, pricing and management changes may be a better solution than car parking expansion.
- **A target station has strong TOD potential, but also has high car parking utilization.** Other nearby stations with available car parking capacity or room for expansion could lead to the consideration of an agreement whereby TOD is provided at the focus station without replacement car parking, and driving access is provided or better managed at the associated nearby stations.

2. Better Manage Existing Car Parking Assets

USE PRICING TO REACH OPTIMAL UTILIZATION

The entities that control station parking—including the MBTA, RTAs, and municipalities—can influence car parking demand and utilization through two means: the number of car parking spaces provided, and the price charged for using those spaces. Rates are far easier to adjust than supply. While more attention is often given to car parking supply, car parking rates can also serve as a management tool. Where parking rates are set too low, more people with multiple access options may choose to drive—resulting in full parking lots earlier in the morning and restricting access for people who must drive to their local station.

The **MBTA Parking Pricing Policy**, adopted in 2018, established that the MBTA will use pricing as a mechanism for both managing utilization and achieving a range of agency objectives, including improving customer experience. The policy outlines a process for adjusting parking rates at facilities managed by the MBTA up to four times each year, increasing rates at stations that are full and decreasing rates at stations with significant available capacity. In combination, this policy is designed to (1) work to ensure that some spaces are available at all stations throughout the day and (2) increase overall system utilization by encouraging riders with options to use stations that have lower utilization (and therefore lower parking rates).

Using pricing changes to reach an optimal facility utilization (90-95%) can be an effective strategy at all MBTA stations with car parking. There are several use cases where pricing can be a particularly effective strategy:

- **Stations with high car parking utilization, a high rate of short drive access trips, and a high potential for walking, biking, or transit access.** These are often town center and urban center commuter rail stations, as well as rapid transit stations that are not terminals and lack strong highway access.
- **Stations with high car parking utilization that are near stations with lower car parking utilization (75% or less).** Pricing changes can encourage some riders to drive to access cheaper parking, which can increase car parking availability in the broader access market without the need for expansion.

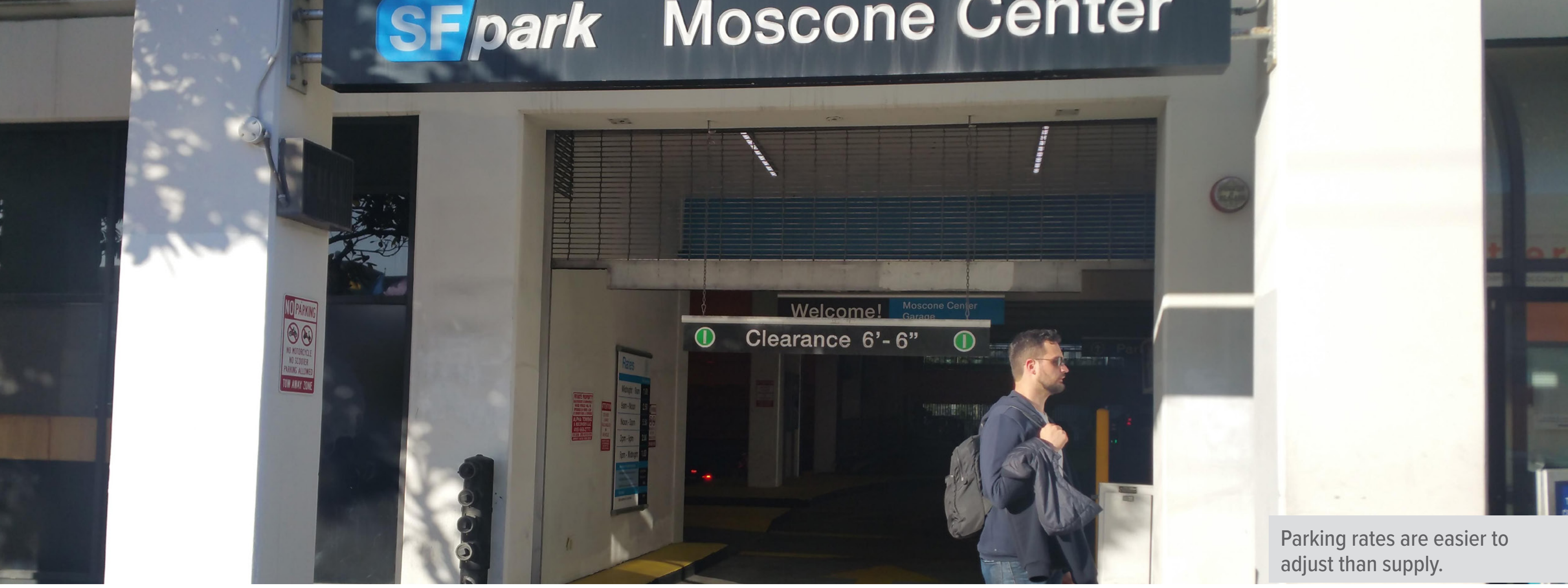
Figure 4-1 shows car parking facilities with greater than 90% utilization and less than 75% utilization, highlighting clusters where both types are within close proximity.

Works best at..

Stations with 90%+ car parking utilization, especially those (1) where a station within a 10-minute drive has less than 75% utilization and (2) stations with a high rate of local drive access trips.

Figure 4-1 Car Parking Facilities with Utilization Greater than 90% or Less than 75%

Source: MBTA Study Car Parking Utilization Survey (Fall 2019)



Parking rates are easier to adjust than supply.

SIMPLIFY CAR PARKING MANAGEMENT PRACTICES

Parking lots at MBTA stations have a variety of management approaches—with the MBTA, RTAs, and municipalities each managing their assets differently. Stations have different parking fee structures, require riders to use different payment methods, and have varying restrictions on who can use specific facilities or spaces (such as residency or permit restrictions). This can send mixed messages to riders and change access incentives and patterns in unexpected ways. Some management practices overinflate demand for car parking by underpricing spaces, reducing the availability of parking spaces for riders who are traveling longer distances to access a station.

Best practices in parking management applied consistently across parking supply can help remove the most problematic inefficiencies. These best practices include:

- **Charge a daily or hourly rate for parking** rather than providing monthly or weekly pass options. The latter incurs sunk cost and incentivizes more driving and parking.
- **Make paying for parking as easy and frictionless as possible.**
- **Simplify regulations and price structures.** Consistent rules that apply to all people driving and parking removes confusion and improves customer experience.
- **Use pricing, rather than access restrictions**, to ensure that some car parking spaces are available at all facilities throughout the day. Avoid restricting spaces to residents of a particular municipality, as well as other restrictions that limit spaces to certain groups of people—such as premium and permit spaces. These practices may encourage short driving trips and leave other possible spaces underutilized.
- **Provide useful information about parking locations, rules, availability, and price** so people can more easily access the MBTA system by car and make informed travel choices. Provide similar information about pedestrian, bike, and transit access options so that riders have full information to choose the access option that works best for them.
- **Use existing MBTA digital assets** such as digital billboards, outdoor information panels or variable message signs (VMS) to provide real-time travel information that includes parking availability.
- **Manage parking pricing to maintain at least five percent availability** throughout the day, as parking availability directly creates station access for some riders.

Technology investments to support these best practices should focus on occupancy data feeds, simplified payment options, electronic parking rate signage, and the use of fixed License Plate Recognition as the basis for managing lots and garages, rather than traditional control systems.

Works best at..

Stations with a high rate of local drive access trips.

REPURPOSE CAR PARKING FOR TOD (OR OTHER ACCESS IMPROVEMENTS)

The MBTA, municipalities, and other station owners hold a limited amount of land around each station and typically have few options for expansion. At many stations, particularly commuter rail stations, land is used for surface car parking lots and provides a limited and fixed amount of station access opportunities. Even when fully utilized, car parking is not always the most effective and efficient use of station area land.

Repurposing some, or all of the car parking spaces available for alternative uses may be appropriate at some stations—especially at rapid transit, urban center, town center, and neighborhood stations—where many riders are driving a short distance to access transit. Potential adverse effects on riders who currently drive and park at a station should be balanced with the potential benefits of an alternative use.

Alternative uses may include transit-oriented development or other design improvements described in Chapter 5.

Transit-oriented development can help improve station access by enabling more people to live within walking distance of transit. However, these benefits are only fully realized if (1) the people living and working in transit-adjacent developments regularly use transit services and (2) the construction of new developments does not substantially reduce access for existing transit riders. Transit-oriented developments can generate greater transit ridership when they are located within a few blocks of a station; have a mix of uses and residences available to households at different income levels (in particular households under 80% area median income (AMI) which are more transit dependent and own fewer vehicles); and are in locations that already are densely populated and have frequent transit service.[1]

Works best at..

Works best at: Stations where (1) TOD is market-viable and would increase overall transit use and (2a) there are other underutilized or expandable car parking options nearby or (2b) there is a high rates of local drive access trips.

1 For additional information about transit-oriented development best practices, as well as the potential for transit-oriented development in the MBTA service area, see studies by the **Metropolitan Area Planning Council** and the **Massachusetts Housing Partnership.**

BART Parking Replacement Model

Transit-oriented development has the potential to both increase transit agency revenue and attract new riders. But it can also impact station access options for existing riders—especially when car parking is reduced or removed. In 2005, Bay Area Rapid Transit (BART) developed a **parking replacement model** that projects the revenue and ridership impact of various development scenarios. The model incorporates access mode split, system capacity, land use, and local context data, and then projects the impact of developments of various sizes, use mixes, and commuter car parking replacement rates. BART has incorporated use of the model as part of their **TOD Guidelines** and development permitting process.

The **MBTA/MassDOT Transit-Oriented Development Policies and Guidelines** are a non-regulatory statement of policy that outline how the agencies approach development at and around MBTA stations. The policies and guidelines prioritize dense, mixed-use development, with a focus on promoting equitable development—including affordable housing—and a transit-supportive public realm. The agencies do not require 1:1 replacement of commuter car parking, instead making a case-by-case assessment of how changes to available car parking will affect ridership, revenue, and future access demand.

TOD should prioritize protecting the interests of transit as a preferred transportation mode, which is achievable when mixed-use developments orient place-making around stations and make transit a business and residential priority. Larger developments should make use of the MBTA's corporate pass products to include them as a benefit for tenant agreements. Further, transit mitigation measures must be considered if an increase in utilization is anticipated for an at- or near-capacity service, so as to not displace access for riders, most especially those that are transit-dependent. Mitigation measures can include earmarked funds for bus shelters and amenities, funding bicycle or micromobility facilities at or near the station, or other elements grounded in area community need.

Transit-Oriented Development enables more people to walk to transit.

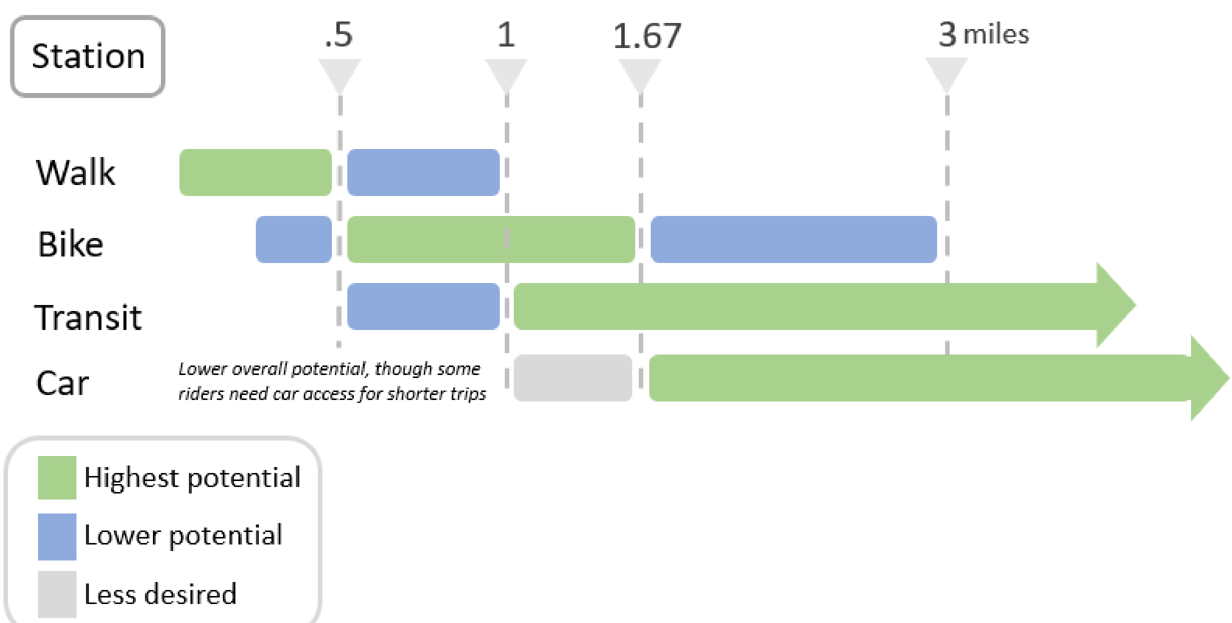
3. Implement Pedestrian, Biking, and Transit Options

PEDESTRIAN, BIKE, TRANSIT, AND PICKUP/DROPOFF ACCESS IMPROVEMENTS

Current travel patterns and the potential for growing future travel markets vary across the system–shaped by distance, context, and available infrastructure. On the rapid transit network, over 90% of riders currently choose to access their station by walking or taking a bus—with walking as the dominant mode. Bike access can extend the distance riders are willing to travel to a station without using a car or when transit is not available, and thus should also be a fundamental part of station access planning. In general, riders will typically walk or bike for at least 10 minutes to access a station, which is about a half-mile of walking or 1.67 miles of biking, as established in the 2019 Massachusetts Statewide Pedestrian and Bicycle Transportation Plans.

Beyond 10 minutes, some riders will choose to walk or bike a further distance, while others will choose to take a local bus or shuttle, to drive and park, or to be dropped off at the station. This category, those traveling longer than 10 minutes, includes a diversity of behavior and travel choices, highly dependent on neighborhood characteristics and the availability, quality, and reliability of different station access options.

The **2019 Massachusetts Pedestrian Transportation Plan** and the **2019 Massachusetts Bicycle Transportation Plan** detail approaches and best practices for improving conditions for pedestrians and people biking throughout the state. The recommendations below build upon these plans with a specific focus on improving pedestrian and bike access to rail stations. These recommendations also have compounding benefits: as many rail stations are located in town and neighborhood centers, increasing pedestrian and biking access to rail stations will also increase community connectivity more generally.



PEDESTRIAN ACCESS OPPORTUNITIES

Rail stations are only the start or end to one leg of a trip. To effectively support walking to and from rail stations, investments are needed to make walking safe, inviting, and comfortable in surrounding communities. Often, focus is placed on improving pedestrian facilities in the immediate vicinity of a station, but a pedestrian-minded environment may disappear within a few blocks. To address such challenges, a holistic approach to planning pedestrian networks that expands beyond sidewalks is necessary to ensure people walking have the same level of access as other modes. Considerations for facilitating pedestrian access and connectivity to make walking to and from a rail station a better option for riders include:

- **Creating direct pedestrian and bike paths to station entrances.** Access can be improved through strategically locating signalized intersection crossings, track crossings, and sidewalks; providing protected bike facilities; and connecting to path segments.
- **Ensuring that paths to stations are fully accessible**—including, but not limited to, wide and maintained sidewalks, ADA-complaint curb ramps, and vibrotactile pedestrian signals. These types of efforts should coordinate with ongoing MBTA efforts to make all rail stations accessible through the Program for Accessible Transportation Infrastructure (PATI).

Works best at..

Rapid transit stations, as well as urban center, town center, and neighborhood commuter rail stations.

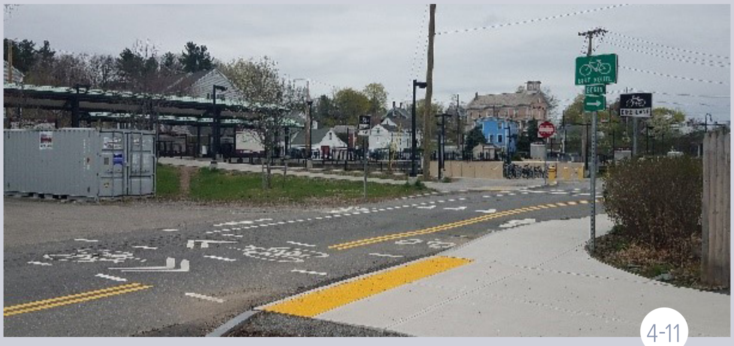
Municipalities can also use proximity to transit as an evaluation criteria while prioritizing projects in their ADA Transition Plans.

- **Making station areas safer** by implementing projects that address crash hotspots.
- **Implementing systemic safety improvements** including reducing speed limits on streets around stations; decreasing turn radii at intersections, providing temporary separated bike facilities and bulbouts; and improving crossings.
- **Installing pedestrian scale lighting** that generates an inviting and safe environment for all modes of transportation in evenings.
- **Designing effective wayfinding** that directs people walking to key destinations in a community. Wayfinding can be made more accessible to pedestrians by noting the walking time required to reach a destination.

- **Incorporating well-designed landscaping to support traffic calming.** Landscaping can provide a barrier between pedestrians and traffic in some contexts and can provide shade during the summer while creating a pleasant environment for people walking.
- **Building curb ramps** (in compliance with state and federal regulations in 521 CMR and ADAAG) at all legs of an intersection to support accessibility for people of all mobility capabilities and needs.
- **Creating enough crossing opportunities to allow people walking to reach their destinations safely.** Crossing locations may be limited particularly in areas with large block sizes. In an urban environment, crossing opportunities should exist in intervals of approximately 500 feet or a two-minute walk. At intersections and/or where midblock crossings are required, various tools can be utilized to make crossings safer, including:
  - **High-visibility crosswalks**, such as continental- or ladder-type crosswalks, to enhance visibility of people walking. Sidewalk bulbouts to enhance visibility and limit the crossing distance for people walking, and therefore tighten curb radii to require drivers to slow before a turning movement.
  - **Pedestrian refuge islands** or medians for people walking to wait if the crossing distance is too wide to cross in allotted time.
  - **Rectangular rapid flashing beacons** (RRFB's) and/or overhead pedestrian hybrid beacons that utilize flashing lights to call attention to people crossing at unsignalized locations.
- **Using leading pedestrian intervals** to provide pedestrians a few seconds to begin crossing the street before corresponding traffic receives a green light. This head start for pedestrians reduces opportunities for conflicts within a crosswalk or at intersections.
- **Using exclusive pedestrian phases at intersections with high pedestrian volumes** to create a dedicated pedestrian only phase. Such a treatment may increase overall signal cycle time.

Walking and Biking Connectivity Improvements at South Acton Station

Contraflow lane, crossing, and signage upgrades on Maple Street allow people walking and biking to have convenient and comfortable connectivity between the terminus of the Assabet River Rail Trail and South Acton Station.



Investments are needed to make walking safe, inviting, and comfortable.

BIKE ACCESS OPPORTUNITIES

The **2019 Massachusetts Bicycle Transportation Plan** and companion **Municipal Resource Guide for Bikeability** detail approaches and best practices for improving conditions for people biking throughout the state. A key focus of the plan is to increase the percentage of everyday trips made by bicycling, primarily through the creation and expansion of high-comfort bikeway networks. High-comfort bikeways are streets suitable for people of all ages and abilities to ride their bikes—including shared use paths, major arterials with separated bike infrastructure, and all neighborhood streets with lower traffic volumes and speed limits.

Works best at..

Rapid transit stations, as well as urban center, town center, and neighborhood commuter rail stations. Some strategies, especially shared use paths, can also increase bike access at regional and local park-and-ride stations.

High-comfort bikeway networks are critical for enabling more riders to bike to MBTA stations. Without them, many people will not consider biking to access transit. There are three primary ways to expand high-comfort networks around stations: low-cost improvements to connect neighborhood streets, separated facilities on major station access corridors, and shared use paths to transit.

Low-Cost Improvements to Connect Neighborhood Streets

Some MBTA stations are directly connected to their surrounding neighborhoods via lower volume and speed streets. At these stations, riders may be able to comfortably bike to and from the station without riding on a major arterial; however, the most comfortable path for biking is not always the most direct path. Small gaps in high-comfort networks can make it more difficult for a neighborhood to bike to transit. These bikeability challenges may be addressable without a major infrastructure project, using strategies such as:

- **Wayfinding signage providing directions to the station along with pavement paint applications.** Together, these strategies assure people biking that they are on the most direct and safe path to a station.
- **Painted buffers or other pavement markings alongside bike lanes** can help to visually narrow the street from a motorist's perspective, reducing speeding and making streets more inviting for people biking.
- **Contra-flow bike lanes on one-way streets and bollards at intersections** can increase neighborhood network connectivity.

Separated Facilities on Major Station Access Corridors

Many MBTA stations are located on or near major arterials and at some stations these arterials are the only way people can directly access the station entrance. These arterials, also known as station access corridors, are critical for all modes of access—pedestrian, bike, transit, and driving. Due to higher volumes and speeds, many station access corridors are not comfortable for people biking without dedicated facilities. At stations without direct connections to neighborhood streets, the lack of dedicated facilities on station access corridors may prevent riders from accessing transit by bike at all.

The **MassDOT Separated Bike Lane Planning and Design Guide** and the **NACTO Urban Bikeway Design Guide**, among others, provide detailed resources for increasing the bikeability of major arterials. There are, however, several design elements that are especially critical for station access corridors:

- **Physical Separation:** Whenever possible, primary station access corridors should have physically separated bike infrastructure. Physical separation will make biking a more comfortable and viable option for a wider range of transit riders.
- **Wider Facilities:** Transit stations attract very high volumes of people at peak commuting times—especially at commuter rail stations where the schedule is more limited than rapid transit and riders arrived at more clustered times. Physically separated bike facilities should be designed to accommodate peak period station access volumes whenever space is available, which may require wider than standard facilities at higher ridership stations.
- **Wayfinding:** Directional signage can help indicate where parking is available for bikes near stations. This type of signage should be placed along the most direct high-comfort paths to stations.
- **Lighting:** Trails and urban cycling facilities become less attractive for commuting after dark if they do not have adequate lighting. Adding human-scale lighting should be prioritized for the stations with the highest biking and walking potential and especially for those that are located in less populated areas.

Bruce Freeman Trail

Shared Use Paths to Transit Stations

Shared use paths increase the distance people on bikes can comfortably travel, significantly expanding bike access. Shared use path connections can be particularly beneficial for making it easier to bike to rapid transit terminal and suburban commuter rail stations, as these stations are often in less dense and more auto-centric areas that require people to bike farther in less comfortable conditions. At Alewife, for example, hundreds of riders each day access the Red Line by biking from Arlington and Lexington on the Minuteman Commuter Bikeway.

MassDOT, through the MassTrails initiative, and municipalities throughout the state are working to expand the shared use path network, often along railroad spurs that formally connected to active rail lines. Many of these paths provide direct access between residential neighborhoods and MBTA stations. A recently completed segment of the Bruce Freeman Rail Trail, for example, connects neighborhoods in Acton and Concord to West Concord Station. Similarly, the Assabet River Rail Trail connects Maynard to the South Acton Station and the Clipper City Rail Trail connects Downtown Newburyport to its MBTA station.

While shared use paths can make it easier to access transit, some have gaps in high-comfort infrastructure as they approach the town centers where MBTA stations are often located. If the goal of a shared use path is to improve access to transit, the facility should:

- **Have direct, high-comfort connections to nearby transit stations.** These connections will often require dedicated bike infrastructure on local roads between path access points and the station entrance.
- **Be designed to provide adequate space for people walking and biking for recreation and commuting**, either by making the path wider or separating the modes in adjacent paths.
- **Have numerous access points** that ensure strong connectivity to adjacent residential neighborhoods.
- **Have adequate lighting** for early morning and evening commutes.
- **Have comfortable and secure bike parking at key locations** near the path especially at locations where transit commuters may trip chain (such as to grocery stores and daycare facilities).
- **Be advertised actively as a transit access option** including wayfinding signage indicating the travel time to the nearest rail station.
- **Have a plan and funding for ongoing maintenance,** especially snow removal in the winter (including the appropriate equipment for fully clearing the path).

Buses enable riders to access stations from both short and long distances without a car.

TRANSIT AND SHUTTLE CONNECTION OPPORTUNITIES

Implement Transit Priority Along Station Access Corridors and in Station Areas

Tens of thousands of riders use MBTA and RTA bus services as their primary station access options. Buses enable riders to access stations from both short and long distances without a car. They also provide a resilient alternative for pedestrians and people riding bikes during inclement weather or for households that sometimes cannot leave a car parked at the station. As congestion throughout the region continues to increase, **local buses are becoming slower and less reliable**. Slower buses mean slower station access times and longer overall trip times for many riders. It also means that the MBTA must operate more buses to provide the same service frequency as it has in the past.

Municipalities operate and maintain most local streets, and thus have a powerful tool to improve local bus service: transit priority. Transit priority measures such as bus only lanes, transit signal priority, and queue jumps can help make buses run faster and more reliably—providing time savings that can be re-invested in more frequent service. Implementing transit priority along station access corridors and in immediate station areas is critical for improving station access for people using buses—similar to how the creation of high-comfort infrastructure on station access corridors is critical for people using bikes.

The MBTA Transit Priority Group regularly supports municipalities in designing and implementing transit priority projects on municipal streets. The group is also currently working to develop a transit priority toolkit to further assist municipalities. Transit priority strategies include, but are not limited to:

Works best at..

Rapid transit stations especially terminal stations near higher density suburbs and at Urban Center stations with high car parking utilization. Shuttle services for targeted markets can be effective at all station types.

Bus Only Lanes: Bus only lanes provide dedicated road space for bus operations improving travel times and reliability. Bus only lanes can be implemented in numerous ways and have differing access restrictions. In the Boston area, most bus lanes are side-running—either on the outside of car parking lanes or in lieu of car parking. Bus lanes can also be installed in the median—like the Green Line is on Commonwealth Avenue—an approach that often costs more to build than side-running lanes but reduces the likelihood that other vehicles will use or stop in the lane. Some bus lanes such as Washington Street in Roslindale and on Broadway in Everett, are restricted to buses only during rush hour and revert to car parking at other times. Others, such as Brighton Avenue in Allston and Broadway in Somerville, are restricted only to buses, bikes, and emergency vehicles throughout the day.

Transit Signal Priority: Transit signal priority is a general term for different strategies that prioritize the reliable movement of transit vehicles through an intersection. There are three main types of transit signal priority: (1) preemption—where buses always receive green lights as they approach an intersection (similar to police and fire vehicles in some signal systems), (2) active—where signals change as buses approach intersections under certain conditions, and (3) passive—where standard signal timing is designed to improve bus operations but signals do not change based on the presence of a bus. In the Boston area, transit signal priority is most commonly implemented as an active system—where green lights are extended as buses approach an intersection so that they can make it through without stopping.

Queue Jumps: Queue jumps are short, dedicated roadway segments that let buses bypass general vehicle traffic at intersections. They are often paired with transit signal priority and enable a bus to both bypass traffic waiting at an intersection and get a head start on the next section of the road. Queue jumps are a helpful transit priority tool at locations where intersection delays, rather than congestion along the entire road, are the primary cause of reduced bus speed and reliability.

Station Area Bus Priority: Many transit stations are located at the intersection of major roadways, where intersection designs, signal timing, and lane allocations are typically designed to maximize general vehicle throughput. At major MBTA bus hubs, hundreds of buses carrying thousands of passengers pass through station area intersections daily. Station area roadway designs can significantly increase bus travel times and delay—due to long signal phases, extra turning movements, or vehicle queuing in travel or turn lanes used by buses to approach stations. When possible, roadways and intersections near stations with major bus hubs should be designed to shorten and prioritize bus movements—including queue jumps, dedicated signal phases, and when necessary, dedicated turning movements restricted to buses.

Add New or Improved MBTA Bus Connections to Rail Stations

MBTA bus routes are designed to carry high volumes of riders, and the agency prioritizes high frequency bus service in areas with greater than 7,000 people per square mile.[2] MBTA routes also operate on key corridors in lower density neighborhoods, especially in places where a greater number of people rely primarily on transit for mobility.

Within and around Route 128, there is potential for new or enhanced MBTA bus services to further expand station access opportunities for riders traveling both short and long distances. However, to increase service frequency or add new routes, the MBTA will need to make changes to existing services or expand its maintenance facilities, which are currently at capacity. The MBTA is currently working to redesign and expand garages through the **Bus Facility Modernization** program, as well as, evaluating changes to the bus network through the Bus Network Redesign project.

2 See "Coverage Standard" in the **MBTA Service Delivery Policy**

Washington Street Bus/Bike Lane

Washington Street in Roslindale feeds into Forest Hills Station. It is one of the most critical station access corridors in the MBTA system, with almost 3,200 people alone riding buses to the Orange Line between 5 a.m. and 9 a.m. The street is typically congested during this time with buses taking as much as 15 minutes to travel 1.2 miles. In May 2018, the City of Boston in partnership with MassDOT and the MBTA, installed a northbound bus lane on Washington Street between Roslindale Square and Forest Hills Station—initially as a pilot, before quickly transitioning to a permanent design. The bus lane has reduced travel times on Washington Street by 20-25% during the worst hour of congestion—making it easier and faster for Roslindale, West Roxbury, Hyde Park, and Mattapan residents to access rail transit.

Source: MassDOT

After additional capacity is established, opportunities to improve and expand MBTA services to improve station access include:

- **Adding new or improved express or regional bus routes that connect rapid transit terminals to suburban communities beyond the rapid transit network.** These routes can often serve longer distance access trips that would otherwise be made by driving and parking. New or expanded services should be prioritized at rapid transit terminals with a higher rate of regional drive and park trips, especially those where riders are driving from higher density communities (such as at Wonderland, Oak Grove, and Alewife). In some instances, there may also be an opportunity to add bus routes that provide direct service from suburban locations to major employment centers.
- **Adding new or improved local bus routes that provide access to rapid transit stations where a high rate of riders are traveling less than two miles to drive and park.** New or improved bus routes at these stations could provide an alternative for some riders that currently drive and park, which could lead to more parking spaces for riders traveling from locations where transit is not a viable access option.
- **Increasing service frequency and span on existing routes throughout the bus network that have a high rate of bus-rail transfers.** These changes will reduce transfer times, decrease crowding, and make it easier for people to access rapid transit early in the morning and late at night.

Improve RTA and Municipal Bus Connections to Rail Stations

Regional Transit Authorities (RTAs) and some municipalities operate bus services that provide access to MBTA commuter rail stations, primarily within Gateway Cities and surrounding communities. Often RTA bus hubs are located at or near MBTA stations, such as the Brockton Area Transit Authority (BAT) hub at Brockton Station and the Greater Attleboro Taunton Regional Transit Authority (GATRA) hub at Attleboro Station.

While RTA bus services primarily serve local trips, there are some opportunities to make improvements that facilitate access to commuter rail. These include:

- **Coordinating RTA bus schedules with commuter rail train arrival and departure times** especially inbound trains in the morning and outbound trains in the evening.
- **Adding or modifying services to provide transit options for people currently driving to urban center stations with high parking utilization**.
- **Adding or modifying services to provide first/last mile connections** from MBTA stations to major suburban employment centers, enabling more riders to use commuter rail for reverse commutes.
- **Increasing customer information** about how to use RTA services to connect to commuter rail such as noting on schedules which bus trips provide the best connections to trains.

Encourage TMAs and Employers to Introduce First/Last Mile Options

Several Transportation Management Associations (TMAs) and individual employers operate shuttles that connect to MBTA stations. These shuttles operate in a wide range of contexts but are typically designed to provide first/last mile connections to employers that are beyond walking distance of an MBTA rail station. For example, the Route 128 Business Council operates shuttles from the Alewife, Newton Highlands, and Waltham station to serve people making reverse commutes to suburban office parks. The EZ-Ride Shuttle, operated by the Charles River TMA, provides a last mile connection between North Station and employers in Kendall Square.

TMA and employer shuttles provide specialized services designed to meet the needs of a targeted market. Shuttles are typically initiated in partnership with specific employers and designed to meet predictable employee needs. It is therefore often possible to provide TMA shuttles in areas that otherwise would not support fixed route services such as suburban office parks. There could be opportunities for additional TMA or employer shuttle routes throughout the commuter rail network, especially service that provides connections to suburban office complexes adjacent to major highway corridors.

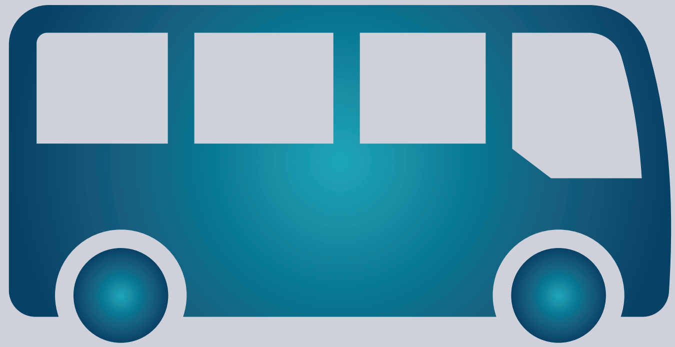
MBTA Bus Network Redesign

MassDOT and the MBTA are currently undertaking a complete reimagining of the MBTA's bus network. The **Bus Network Redesign** aims to simplify and modernize the bus network, making transit more equitable and a more competitive mode. MassDOT and the MBTA are exploring a wide range of potential changes to the bus network, including modifications to route design, frequency of service, span of service, stop spacing, and coverage area. As an initial step in this process, the project team is conducting a comprehensive market analysis that uses observed data to determine where people are traveling and for which trips transit is potentially most competitive with driving. The study presents a prime opportunity to redefine and expand the role of buses for station access—both at the rapid transit stations where thousands of riders currently transfer between buses and trains and at additional rapid transit and commuter rail stations where buses could play a larger role in short and long access trips. The study is also exploring new roles for buses more generally such as providing more service that directly brings riders to their destinations without transferring to the rapid transit network.

Commuter Rail Shuttles for Residential Complexes

Numerous residential complexes throughout the Greater Boston Area offer regularly scheduled shuttle services that connect residents to commuter rail and rapid transit stations. Examples include:

- The Cirrus Apartments in Ashland operate a shuttle van to the nearby commuter rail station during morning and evening rush hour.
- Several apartment complexes at Overlook Ridge in Malden operate shuttle service to both Malden Center station on the Orange Line and directly to Downtown Boston.
- Meriel Marina Bay in Quincy operates shuttle service to North Quincy station on the Red Line.



Work with Developers and Property Managers to Introduce New Shuttle Options for Residential Complexes

New residential developments can increase demand for car parking at MBTA stations especially in lower density, more auto-oriented suburbs. This increase in demand can be particularly problematic at regional and local park-and-ride stations with high car parking utilization, where riders may have few other options for accessing transit.

Shuttles between larger scale residential complexes and MBTA stations can help reduce this demand by providing an alternative access option. Like TMA-provided service, these shuttles are targeted to meet the specific needs of one or several residential complexes. They often only provide trips that connect to select peak period commuter rail trains. This service design enables these shuttles to operate efficiently in suburban areas that otherwise could not support fixed-route transit services.

Some developers and property managers choose to operate shuttles to MBTA stations as an amenity for residents. Municipalities can also work to include a requirement to provide shuttle services as part of development mitigation or transportation demand management agreement.

4. Strategically Add Car Parking Supply

LEVERAGE SHARED PARKING

Works best at..

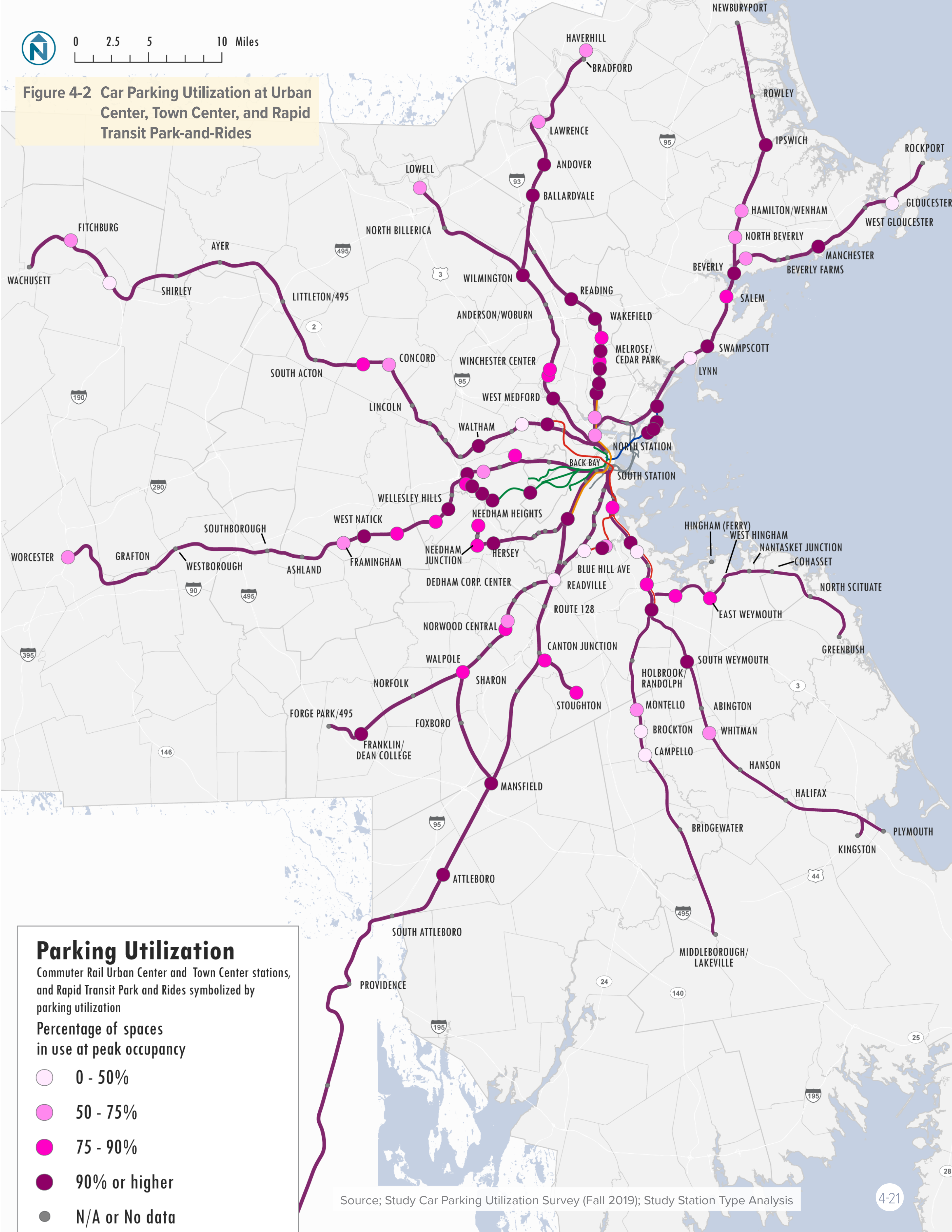
Town center, urban center, and some rapid transit stations, where there is nearby municipal or private parking available.

Many MBTA stations are in town or neighborhood centers, adjacent to community retail, offices, and dense housing. These centers can have an abundance of car parking spaces spread across numerous lots and garages, each managed by different parties and restricted to a specific property or purpose. However, different land uses generate unique levels and patterns of parking demand. The same parking lot that was filled with the vehicles of office workers during the day could be used to accommodate people eating at restaurants at night.

MBTA parking lots and garages many times are the largest car parking facility in a town or neighborhood center. The strong and predictable weekday peak demand pattern of MBTA park/ride demand presents a vital opportunity to leverage its parking assets to support nearby uses with contrasting demand patterns. This could greatly reduce pressure on property owners and municipalities to provide more car parking for residents and businesses. If daytime sharing arrangements can be reached to provide MBTA riders access to spaces that are underutilized during weekday hours, **shared parking can reduce the need to expand commuter parking capacity at stations.**

Several municipalities in Massachusetts and across the county have adopted shared parking as a strategy to better manage existing parking resources and reduce the need to build more spaces. Similarly, the MassDOT/MBTA TOD Policies and Guidelines affirm a policy of right-sizing the overall parking supply in TOD settings including through shared parking. Under a shared parking model, car parking facilities are formally opened to different user groups at different times—with the goal of maximizing the usage of each parking space throughout the day and week. For example, a retail center parking lot, used by business customers during the day, would become available to residents at an adjacent apartment building at night. Shared parking arrangements allow for full sharing, as well as, providing the ability to limit sharing to user type, time of day, or location. Communities in the Commonwealth can enact shared parking arrangements within municipal codes and practices to help them better manage downtown parking. The MBTA and municipalities could work together, as well as with private property owners to systematically institute shared parking agreements across the system. These agreements could both increase the number of car parking spaces available for commuters and make station car parking spaces available for resident and business parking during non-commute times. Overbuilding the parking supply with dedicated parking segmented by use can result in suboptimal utilization, parking is expensive to build and manage.

Shared parking is most effective at town center, urban center, and select rapid transit stations, where there is often both higher demand for and a greater supply of commuter, residential, and commercial car parking. Figure 4-2 shows the locations of these stations, as well their current car parking



0 2.5 5 10 Miles
Figure 4-2 Car Parking Utilization at Urban Center, Town Center, and Rapid Transit Park-and-Rides
NEWBURYPORT
HAVERHILL
BRADFORD
ROWLEY
LAWRENCE
IPSWICH
ROCKPORT
ANDOVER
LOWELL
BALLARDVALE
GLOUCESTER
HAMILTON/WENHAM
WEST GLOUCESTER
FITCHBURG
NORTH BILLERICA
NORTH BEVERLY
AYER
MANCHESTER
BEVERLY
BEVERLY FARMS
WACHUSETT
WILMINGTON
SHIRLEY
LITTLETON/495
READING
SALEM
ANDERSON/WOBURN
WAKEFIELD
SWAMPSCOTT
MELROSE/ CEDAR PARK
CONCORD
WINCHESTER CENTER
LYNN
SOUTH ACTON
WEST MEDFORD
LINCOLN
WALTHAM
NORTH STATION
BACK BAY
SOUTH STATION
WELLESLEY HILLS
NEEDHAM HEIGHTS
WEST NATICK
HINGHAM (FERRY)
SOUTHBOROUGH
WEST HINGHAM
NANTASKET JUNCTION
NEEDHAM JUNCTION
COHASSET
WORCESTER
GRAFTON
HERSEY
WESTBOROUGH
FRAMINGHAM
ASHLAND
BLUE HILL AVE
NORTH SCITUATE
DEDHAM CORP. CENTER
READVILLE
EAST WEYMOUTH
ROUTE 128
NORWOOD CENTRAL
CANTON JUNCTION
GREENBUSH
WALPOLE
SOUTH WEYMOUTH
HOLBROOK/ RANDOLPH
SHARON
NORFOLK
STOUGHTON
MONTELLO
ABINGTON
FORGE PARK/495
FOXBORO
BROCKTON
WHITMAN
FRANKLIN/ DEAN COLLEGE
CAMPELLO
HANSON
MANSFIELD
HALIFAX
BRIDGEWATER
PLYMOUTH
KINGSTON
ATTLEBORO
SOUTH ATTLEBORO
MIDDLEBOROUGH/ LAKEVILLE
PROVIDENCE
Parking Utilization
Commuter Rail Urban Center and Town Center stations, and Rapid Transit Park and Rides symbolized by parking utilization
Percentage of spaces in use at peak occupancy
0 - 50%
50 - 75%
75 - 90%
90% or higher
N/A or No data
Source; Study Car Parking Utilization Survey (Fall 2019); Study Station Type Analysis

utilization. Shared parking strategies at these stations could include:

- Making station-adjacent residential, retail, and commercial parking available for MBTA commuter parking on weekdays from the morning through evening rush hour.
- Allowing overnight parking, either unrestricted or by permit, at MBTA commuter parking lots—providing parking to residents living near stations.
- Introducing fees with shorter time intervals at MBTA commuter parking lots on weeknights and weekends—enabling more people to use MBTA parking at times when commuter demand is low.
- Instituting fees at MBTA commuter parking lots with low weekday utilization that provide shorter time intervals—bringing the unused commuter parking supply into the general parking system.
- Creating a shared parking strategy as part of the project development process for transit-oriented development.
- Extend MBTA parking payment and enforcement technologies beyond the station through agreements for municipal or privately-held lands when such enforcement represents a barrier or burden to the land owner(s).

Shared Parking in Practice

While permutations will vary by station based on available infrastructure, there are standard frameworks and practices to enable shared parking. These models proactively address maintenance, liability, and revenue considerations that are critical to implementation. A proactive framework can remove uncertainty and logistical hurdles to establishing these arrangements across the system. This framework should address both scenarios: the MBTA sharing its spaces, and communities sharing municipal or private spaces.

Added maintenance, operations, and enforcement costs can be met by the party seeking the added parking capacity to reduce this common barrier. Increased insurance premium costs can also be passed to the party seeking supply. If the shared parking can be managed as paid parking, the revenue generated by the increased use of the shared spaces creates new incentives to facilitate negotiated arrangements.

The advent of pay-by-phone services—such as the system used at MBTA managed parking lots—has made this shared parking approach far more feasible, especially for privately owned parking facilities that experience significant excess capacity during a predictable “off-hour” schedule. Often, the revenue that goes directly to the lot owner via the pay-by-phone vendor greatly exceeds incurred insurance premiums and other cost increases, creating a powerful incentive to make these spaces available. This approach has resulted in significantly increased parking capacity in evening-based activity centers within the transit-oriented district areas of the South End District of Charlotte, NC—with office property owners selling spaces for five dollars per evening or weekend day in this former manufacturing district served by the CATS Blue Line light rail.

Some sharing arrangements are straightforward and can be advanced with minor analysis. In more complex downtowns, a parking study is useful to fully understanding and operationalizing a shared parking environment.

EXPAND COMMUTER CAR PARKING

As demand for transit grows, there will be cases where the MBTA or municipalities may consider building new car parking. Car parking is most effective at stations that attract riders traveling from farther distances that also lack alternative station access options. These stations are most often regional park-and-rides, which attract riders accessing commuter rail from lower density suburbs far from stations. However, they may also include regional rapid transit stations—especially at stations serving long distance access trips from places where bus service is not viable—and at local park-and-ride stations, where riders may live too far from stations for investments in walking or biking access to be effective.

There are real opportunities in many cases to improve pedestrian, bike, and transit access throughout the MBTA system and these should be explored before the MBTA pursues parking expansion. Additionally, car parking expansion requires both initial capital spending and ongoing maintenance. A typical surface parking space costs between $5,000 and $15,000, while garage parking spaces can typically cost between $25,000 to $50,000 but also can cost more. A surface parking space costs about $140 to maintain annually, while a garage space costs about $300 to maintain annually. These costs do not take into account lost spaces and revenue during heavy snow seasons and associated snow removal, which can exceed $25,000 per surface lot. As a result, the MBTA should prioritize available resources for car parking expansion at:

- **Stations with greater than 90% car parking utilization** and where there are no stations with less than 90% utilization available within a 10-minute drive (Figure 4-3 shows stations with greater than 90% car parking utilization and their catchment market).
- **Stations with a higher rate of drive access trips originating from farther than four miles from the station**—indicating that the station has a more regional travel market.
- **Stations with lower populations and job densities** within a 10-minute walk (half a mile) or 10-minute bike ride (1.67 miles) of a station.
- **Stations where the surrounding roadway infrastructure has the capacity to absorb additional traffic** generated by a larger parking facility.

Works best at..

Park-and-ride stations with a high rate of regional access trips and limited to no or limited opportunities for walking, biking, or transit improvements.

When Parking is Built

The design and location of new/expanded parking facilities should ensure that parking is integrated with the flow of access for other modes and does not create conflicts. Entry and exit points and internal right-of-way should prioritize the safety and needs of pedestrians and people bicycling, while also ensuring that services that carry more people—such as buses—are able to flow through stations with minimal conflict from private vehicles. As much as is feasible, driveways should connect to alleys or side streets, with driveways and parking areas located away from the primary walk, bike, and transit connections at the main station entrance.

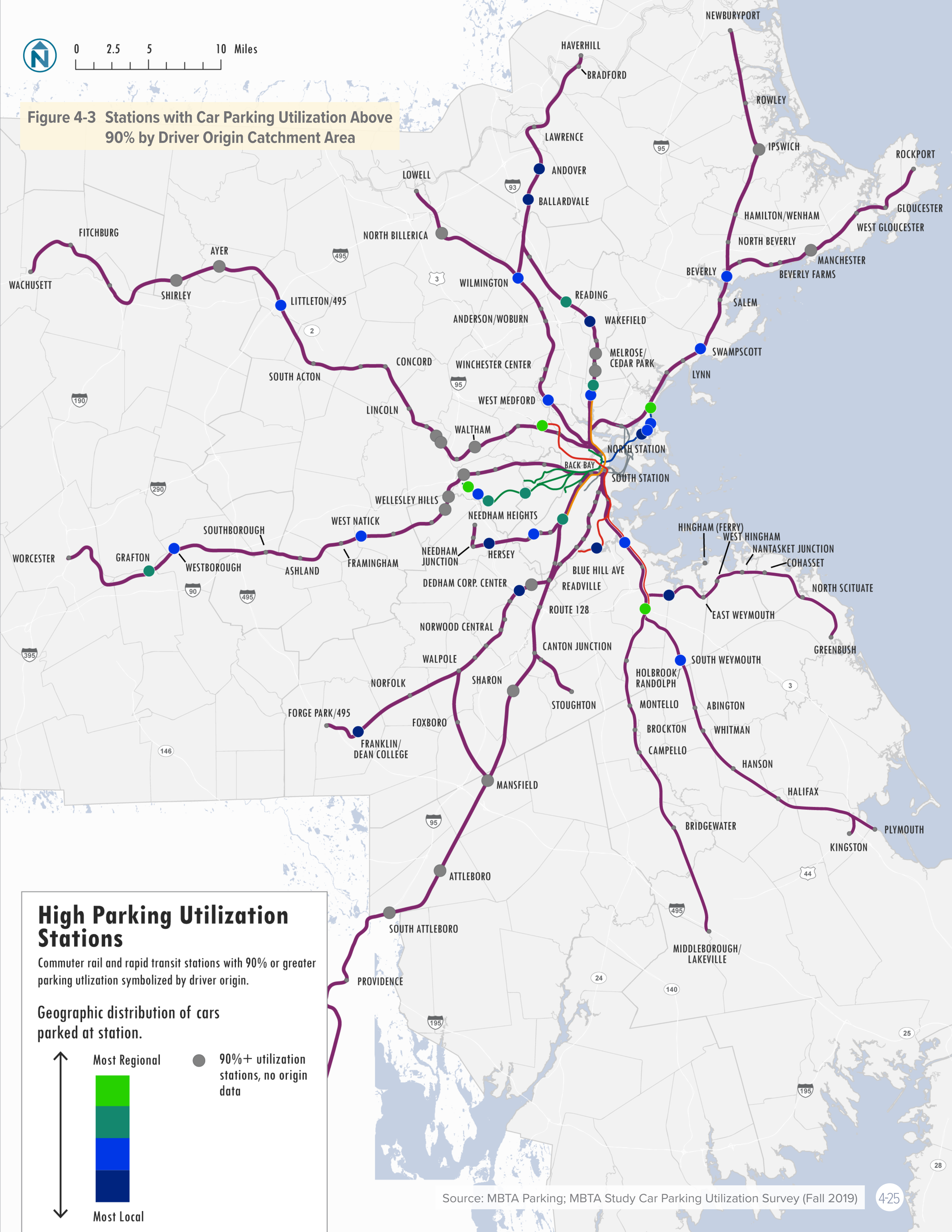
Within this context, parking facility design and location should prioritize:

- Direct, accessible paths and minimized walking distances for ADA-designated spaces
- Safe, direct, and convenient paths for parking customers to access station services and amenities
- Wayfinding, regulation, payment technology, and access design that encourages shared use of park-and-ride spaces during off-peak hours, particularly in support of local businesses and affordable housing opportunities
- Design and management of curbside parking on internal and adjacent streets to minimize pickup and dropoff traffic impacts
- Management of curbside parking on adjacent streets to reduce station area vehicle speeds and buffer active mode station access routes from vehicle traffic

When parking structures are included, design and location should prioritize:

- Scales and forms that do not overwhelm the station area or surrounding areas
- Entry/exit point volumes and locations that minimize rush hour congestion
- Wayfinding and facility design features that guide drivers to the most appropriate entries and parking areas to quickly find the parking options that meet their needs, such as ADA spaces
- Pedestrian exits onto primary station or platform access paths

Figure 4-3 Stations with Car Parking Utilization Above 90% by Driver Origin Catchment Area



Source: MBTA Parking; MBTA Study Car Parking Utilization Survey (Fall 2019)

KEY PLANNING, DESIGN, AND FUNDING RESOURCES

Pedestrian and Bike Access

- The MassDOT Municipal Resource Guides for **Walkability** and **Bikeability** provide best practices for developing municipal pedestrian and bike transportation plans, as well as offering an overview of best practices and additional resources for pedestrian and bike planning and design.
- The **MassDOT Separated Bike Lane Planning & Design Guide** provide best practices for planning, evaluating, and designing separated bike lanes. NACTO has also published a complementary **Urban Bikeway Design Guide**.
- **Achieving Multimodal Networks**, published by the Federal Highway Administration (FHWA), provides guidance for developing multimodal transportation networks.
- **Controlling Criteria and Design Justification Process for MassDOT Highway Division Projects** is an engineering directive that lays out design criteria for pedestrian facilities, bicycle facilities, and access to transit accommodations.
- The **Local Access Score**, developed by MAPC, identifies the most critical streets for pedestrians and people riding bikes throughout the state. The composite score includes a subscore that specifically measures the importance of different streets for facilitating access to transit. Municipalities can use both the composite score and the transit access score to prioritize pedestrian and bike infrastructure investments that increase access to rail stations.
- Resources for standard bikeway wayfinding designs are available from **NACTO**.
- MassTrails will soon release a comprehensive guide for bicycle wayfinding in Massachusetts. NACTO has also published a complementary **Bike Route Wayfinding Signage and Markings System**.
- The **Tactical Urbanist's Guide** developed by The Street Plans Collaborative, provides resources for implementing pilot and quick-build projects for increasing pedestrian and bike connectivity, including recommendations for materials.

- Trailnet's **Slow Your Street Guide** provides a guide for designing and implementing traffic calming projects.
- MassDOT has developed **guidelines and a report template for Road Safety Audits**. These audits can serve as a framework for identifying spot safety improvements and are required to be completed as part of 25% design plans for Highway Safety Improvement Program.
- Projects that improve pedestrian and bike safety may be eligible for funding through the **Highway Safety Improvement Program**.
- MassDOT aggregates statewide crash data, which can be parsed to identify crashes involving pedestrians and people riding bikes using the **Crash Data Portal**.
- The FHWA provides a number of resources for analyzing and addressing traffic safety issues as part of its **Safety Culture and the Zero Deaths Vision** initiative.
- The MBTA will soon publish The Design Guide to Access, which will provide best practices in universal design and specific design expectations for accessible transit access.
- The **MassTrails Shared Use Path Planning and Design Guide** provides best practices for designing shared use paths, as well as an Excel tool for cost estimation. This guide is an in-progress document, with further components planned for a future release.
- The **Complete Streets Funding Program** provides up to provides eligible municipalities up to $500,000 for the construction of pedestrian and bike improvement projects. The program also provides up to $50,000 in technical assistance funding to help municipalities develop Complete Streets Prioritization Plans.
- The **MassWorks Infrastructure Program** provides municipalities with grants for public infrastructure projects that support the development of multi-family housing—often including pedestrian, bike, and streetscape enhancement projects.
- Most pedestrian and bike infrastructure projects are eligible for reimbursement through the **Chapter 90 Program**.
- **Municipal Rideshare Funds** can be used for pedestrian and bike safety and accessibility improvements, among other eligible uses.
- MassTrails provides reimbursable grants of up to $300,000 for shared use path project development, design, engineering, permitting, construction, and maintenance. **MassTrails Grants** are awarded annually and require proponents to cover at least 20% of the total project cost with matching funds. Shared use path design and/or construction can also be funded through a variety of state and federal programs, such as the **Chapter 90 Program**, the **Recreational Trails Program**, **Community Preservation Act** funds, and the **Complete Streets Funding Program**.

Transit and Shuttles

- The MassDOT and the MBTA have several ongoing initiatives to improve MBTA bus service through the **Better Bus Project**.
- **MassCommute** provides resources for employers and communities seeking to form or participate in a Transportation Management Association.
- The **NACTO Transit Street Design Guide** provides best practices for street designs that prioritize and improve transit operations. The MBTA is currently developing its own transit priority toolkit. Toolkits developed by other transit agencies, such as **TransLink** in Vancouver and **MDOT MTA** in Baltimore, can also serve as resources.
- The **CTPS Transit Signal Priority Guidebook** provides a roadmap for designing, implementing, and evaluating a transit priority system, with specific guidance related to TSP in the MBTA region.
- The **MBTA Bus Stop Planning and Design Guidelines** provides standards for bus stop design and spacing related to roadway configurations that support reliable bus operations and the design and placement of amenities.
- Short-term pilots can be an effective strategy for understanding the benefits and tradeoffs of transit priority projects. **Best Practices in Implementing Tactical Transit Lanes**, produced by UCLA Institute of Transportation Studies, provides a guidebook for planning, implementing, and evaluating bus only lane pilots.
- MassDOT Rail and Transit Division's **Workforce Transportation Program** provides targeted operating assistance grants for workforce transportation services provided by municipalities, employers, TMAs, RTAs, and others.
- The **Community Connections Funding Program** provides funding for transit priority projects, first/last mile services, and community transportation services. The program is available to municipalities and RTAs in the Boston MPO region.
- The forthcoming MBTA Transit Priority Toolkit provides best practices and guidelines for implementing transit priority projects, such as bus lanes or transit signal priority.

Transit-Oriented Development

- The **MBTA/MassDOT Transit-Oriented Development Policies and Guidelines** are a non-regulatory statement of policy that outline how the agencies approach development at and around MBTA stations. The document also includes best practices for transit-oriented development implementation and design.

Car Parking

- The Executive Office of Energy and Environmental Affair's Smart Growth/Smart Energy Toolkit includes a **Smart Parking module** that outlines various options for improving parking management, including case studies on implemented shared parking programs in Massachusetts.
- The **Metropolitan Area Planning Council (MAPC) resource library** includes information, resources, and examples of shared parking systems.
- **Shared Parking**, published by the Urban Land Institute, provides information about how to plan shared parking systems and project the parking dynamics of different land uses.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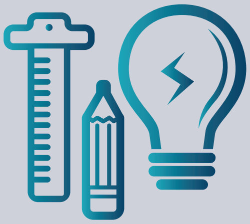
5 Station Access Playbook: *Addressing Station Design*

This chapter highlights priority strategies that the MBTA can incorporate in station design to facilitate station access across all modes and contexts.

Safety, operational need, and state of good repair largely drive the prioritization of capital improvement projects at MBTA stations included in the fiscally constrained Capital Improvement Plan. The strategies described in this chapter should be considered once a station is identified for an improvement and integrated into the design when feasible to maximize station access. The strategies play a significant role in station access, enabling riders to seamlessly transition between their preferred access mode and rail or bus service. They are also important for facilitating operations—without available and effectively managed curb and layover space, the MBTA and other operators cannot operate buses or shuttles.

This chapter is organized into four sections:

- Intuitive Station Design
- Manage the Curb to Increase Access
- Enhance Bike Parking
- Improve Station Area Transit Operations



MBTA Station Design Standards and Guidelines

The MBTA has **specific standards and guidelines** for the construction and maintenance of MBTA rapid transit and commuter rail stations. The key standards for station design were last comprehensively updated in 1996. The MBTA's Office of the Chief Engineer is currently working to update elements of these design standards, including standards for bike parking design and busway design. The strategies included in this Playbook are not engineering design standards, but are instead meant to complement and inform ongoing efforts to update station design practices.

Incorporate Intuitive Station Design

Stations should be easy to use for all patrons, with increased emphasis on people accessing the station by walking, biking, or bus.

This includes the transition from the station neighborhood into the station itself. When developing new transfer facilities or improving existing intermodal facilities, deliberate design choices should be made to maximize accessibility and wayfinding. Priorities to consider include:

- **Managing traffic flow** to prioritize pedestrian, bike, and bus movement in the vicinity of intermodal transit facilities
- **Ensuring transit facilities are designed to accommodate existing and future passenger and bus volumes**
- **Enhancing pedestrian and bike connections between transit modes** through crossing improvements, priority bike and pedestrian signal phasing, pedestrian lighting, universal design features, and appropriate bike parking types for each facility
- **Providing clear wayfinding and widely available transit information** (preferably real-time) to reinforce intermodal connections

Regardless of access mode, all users that enter a station become pedestrians before boarding a transit vehicle. Therefore, the design of the station the design of the station should feel intuitive, with wayfinding as a complement rather than a necessity for station navigation. **Pedestrians are particularly sensitive to trip distance** and seek out the most direct routes possible. A 2012 Transit Cooperative Research Program report surveyed people walking to transit stations and found that pedestrians prioritize the shortest route, and that walk distance is an important factor in mode choice.[1] Reducing the sense of exposure to perceived uncomfortable or unsafe environments can also improve walkability. Stations often balance design features for multiple access modes, and it is important to remember that people walking are the most sensitive to any deviation in pathways.

1 Transit Cooperative Research Program (TCRP) Report 95: Pedestrian and Bicycle Facilities: Traveler Response to Transportation System Changes (2012)

SAFETY

Real and perceived safety at stations and stops is an important overarching station access goal. In addition to engineering features that focus on safe interaction with rail vehicles (e.g., tactile yellow strips), the following safety features support rider safety was traveling through stations.

Designing transit stations and stops to **improve sight lines** increases the natural surveillance of an area. Approaches includes increased transparency in doors and windows to improve visibility into public areas. Better natural surveillance of a station makes riders safer, because increased visibility can help to discourage unintended uses of a transit facility.

Lighting affects transit patrons' perception of safety and security at stops. Good lighting can enhance a waiting passenger's sense of comfort and security, while poor lighting may encourage unintended use of the facility, especially when dark. Lighting at bus stop facilities also allows bus operators to see waiting passengers and illuminates route and schedule information for patrons.

Emergency call boxes are commonly used safety resources at universities, colleges and other public areas. They are typically used in areas with little foot traffic or other physical security presence. Call boxes create a highly visible and accessible way to reach local law enforcement. A widespread blue light emergency call box network may help passengers to feel safer while traveling.

ACCESSIBILITY

The MBTA has riders of all ages and abilities, and all make trips for a wide range of purposes. Older adults and people with disabilities face unique transportation constraints, as they are less likely to be able to drive or walk long distances to access fixed-route transit. Universal design, the practice of creating physical spaces that are accessible to all people, regardless of age, disability, or other factors, benefits all MBTA riders by making stations easier and more seamless to navigate. These features are essential for MBTA riders with disabilities, as they are required under the Americans with Disabilities Act (ADA), and remove barriers to station access.

The MBTA's Plan for Accessible Transit Infrastructure (PATI) is part of a systematic approach to remove barriers to access and maintain accessibility features. PATI has documented and assessed barriers across different parts of the MBTA system, and it prioritizes continuous progress across all modes. PATI prioritizes the most critical gaps by emphasizing the locations most important to people with disabilities; generating cost/benefit scores, and identifying how quickly as many barriers as possible can be eliminated. It also includes systemwide programs, such as installing or repairing automatic door openers, placing visual contrast on stairways, and prioritizing path of travel repairs to sidewalks, walkways, signals, and curb ramps.

The MBTA's Office of System-Wide Accessibility (SWA) oversees PATI and other initiatives including the development of the Design Guide for Access, which will help the MBTA and its design consultants and contractors incorporate universal design into projects and streamline the internal review process.

ACCESSIBILITY *(continued)*

Providing transit services that are universally accessible expands personal mobility, independence, and transportation affordability. Several considerations for making transit facilities more inclusive include:

- **Barrier-free crossings, sidewalks, and walkways** between external station access points and station entrances continuing all the way to transit vehicle boarding areas.
- **Barrier-free connections** to and from dropoff zones, busways, and accessible parking spaces.
- **ADA-compliant ramps and ramp systems** where elevation changes are necessary, and/or redundant elevator systems.
- **Accessible entrances** with functioning automatic doors.
- **Signs** that direct users to the nearest accessible entrance.
- **Detectable warning panels at platform edges** and areas where vehicles may cross a pedestrian's path.
- **Level boarding.**
- **Designated pickup areas**, where appropriate, with shelters for paratransit riders to meet RIDE vehicles; these zones can be shared with other pickup/dropoff activities.
- **Obstacle-free connections** to taxis, pickup and dropoff points, and park-and-ride lots.
- **ADA car parking spaces** sited in locations that both connect to accessible paths of travel and are close to level boarding locations (especially at commuter rail stations without full high level platforms).

Going beyond what is required by ADA, information provided in audio, visual, and tactile formats should consider cultural and language differences, limited literacy or English proficiency, as well as accommodations for those with restricted mobility and visual acuity. Where applicable, stations should include current information via the BlindWays app for riders with visual impairments to navigate to bus stop boarding areas.

Image from Getty Images

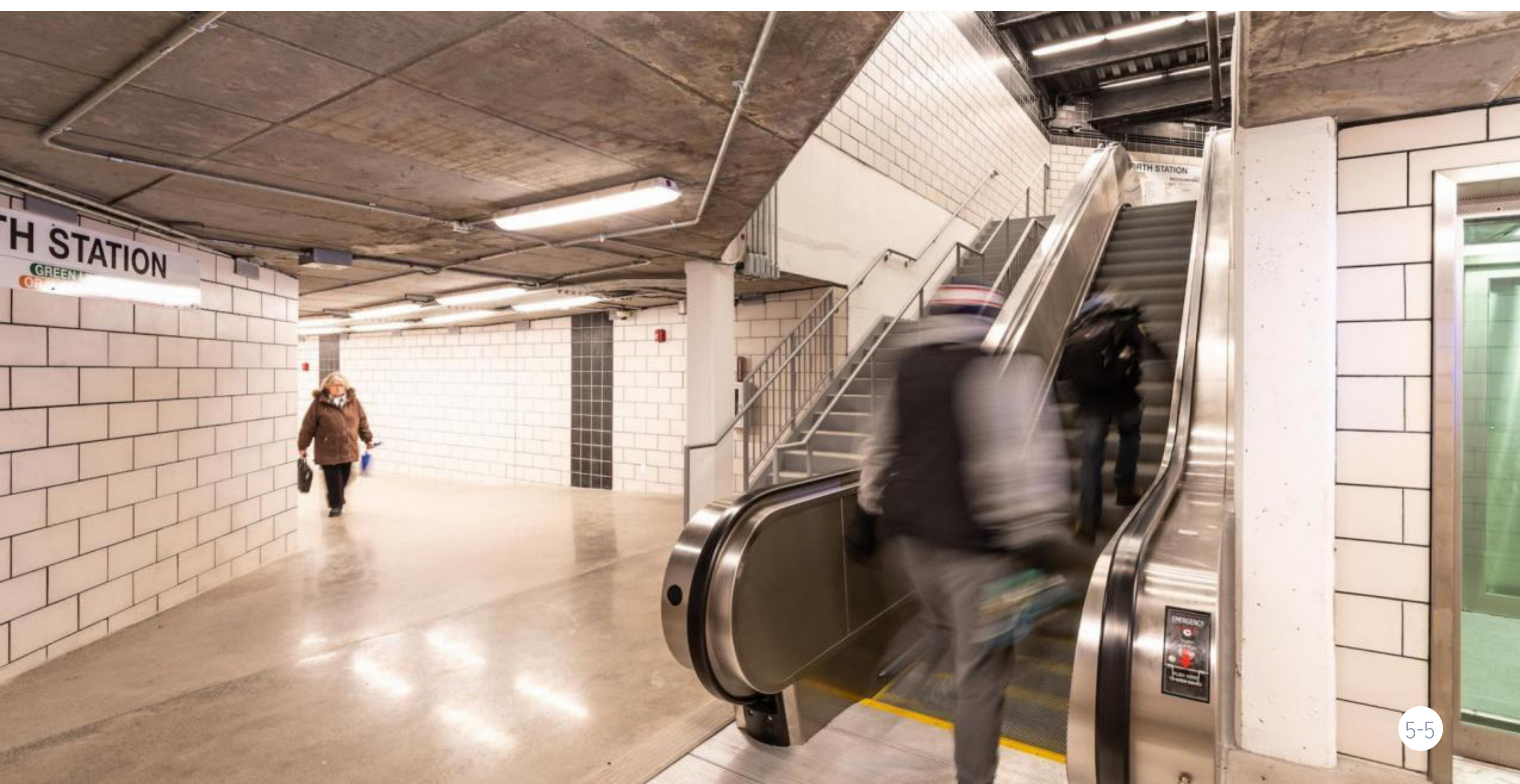
STATION ENTRANCES AND CIRCULATION

The placement of station entrances plays a major role in determining walk access times. Many MBTA rapid transit and commuter rail stations have multiple entrances, enabling fast and direct access to service in both directions. But some stations have only a single entrance at one end of a platform and others have entrances which provide access to service in only one direction. These configurations can significantly increase overall travel time by requiring riders to walk further to enter or exit a station.

Where feasible and beneficial to a high volume of riders, the MBTA should consider enhancing station entrances and improving internal circulation. Design features could include:

- **Adding new entrances or reopening currently closed entrances** as part of transit-oriented development projects.
- **Installing fare collection systems** at station access points that currently are exit only.
- **Constructing footbridges or underpasses** that enable riders at commuter rail stations to move between inbound and outbound platforms.

Some of these enhancements also benefit overall egress capacity, including during an emergency. Improved wayfinding (discussed further in this chapter) can also serve as an interim improvement or alternative to adding station entrances. Wayfinding maps and signage could, for example, direct riders to the nearest station entrance that provides access to service running in the opposite direction.



STATION WAYFINDING FOR MULTIMODAL ACCESS

Wayfinding refers to a system of information that guides people through a physical environment—e.g., a train, station, or station area—and enhances their understanding and experience of the space. Effective wayfinding systems are especially helpful in high-stress environments, contributing to a sense of safety, security, and well-being. Wayfinding extends beyond signage, and also includes architecture, lighting, art, technology, and landscape design. Wayfinding to and from destinations near a station is a powerful tool to make the transit experience more convenient and easier to understand.

In 2015, the MBTA developed a unified wayfinding and signage system for its rail stations and bus stops. In recent years, the MBTA has invested in station signage packages, especially at high ridership stations, to improve internal movement. However, these standards focus primarily on circulation within stations and there is an opportunity to expand wayfinding to support station access more broadly.

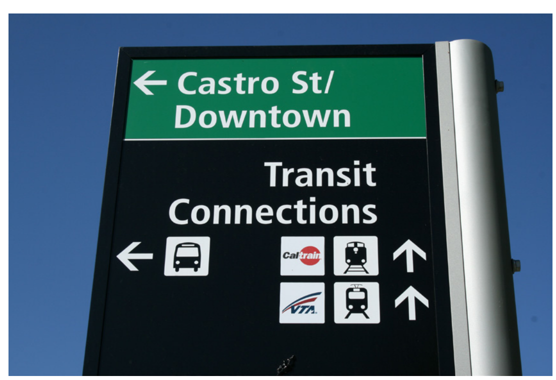
The MBTA's wayfinding standards and guidelines can be augmented to support station access by:

- **Expand the standard wayfinding sign package** to provide more intuitive wayfinding between rail station entrances and bus stops. At Central Square in Cambridge, for example, the transfer to the outbound 70 bus service is located a block from the station on a minor side street—difficult to locate without signage.
- **Use symbology, letters, or numerals** for each station access point and integrating them into station signage.
- **Work with municipalities to incorporate more context-specific wayfinding** in station areas.
- **Develop standards for temporary wayfinding measures** for special events and for ongoing service disruptions due to construction (described below).

In general, transit access wayfinding signage should:

- **Prioritize where passengers make multimodal connections**, particularly when connecting buses do not directly reach a rail station.
- **Integrate with station wayfinding to key destinations.**
- **Be consistent** in design and tone.
- **Provide information that is easily understood** by visitors, new transit riders, and everyday commuters.

Signage types include stop and station identification, route destination, nearby destinations, amenities, and access routing signage. Integrating intermodal connections such as bus feeder routes into wayfinding helps make connections seamless and legible. Visual and audible announcements and passenger information are critical to enhancing comfort and convenience for all users but are particularly important for users with sight or hearing impairments.



Wayfinding near a transit station in Mountain View, California

Temporary Wayfinding for Ongoing Service Disruptions

The MBTA's wayfinding package could be updated to include temporary wayfinding during construction and maintenance, a need identified during intra-agency project outreach. Because bus-to-rail transfer challenges can be exacerbated during renovations, it will take deliberate planning to ensure that the customer experience is preserved or enhanced during ongoing or upcoming projects. Considerations for meeting ADA accessibility standards also apply to temporary wayfinding signage; examples include brighter lights at stations and stops, easy-to-read fonts, lighted signage, and signs utilizing graphics plus other common languages.

Watertown Square Bus Transfers and Wayfinding

Watertown Square and Watertown Yard are two important bus hubs located in close proximity. Together they serve seven bus routes, including two key bus routes (Route 57 at Watertown Yard and Route 71 at Watertown Square) that have among the highest ridership in the network. Unlike most MBTA bus hubs, Watertown Square does not have a single central busway for all routes, and is also separated from Watertown Yard by a major intersection and the Charles River. Transfers between bus routes often involve long walks and crossing several streets.

To transfer from Route 70 to Route 57 (shown as a pink line in the aerial to the right), riders must walk for five minutes, cross the Charles River, and correctly identify Route 57's off-street stop location in Watertown Yard. There is currently no wayfinding signage, apart from standard bus stop signs, to assist passengers making this transfer. The transfer experience at Watertown could be greatly improved with additions to the wayfinding system, such as:

- **Providing a unique number for each bus stop**.
- **Adding area maps at each bus stop** that show all stops in Watertown Square and which routes serve them.
- **Adding directional signage to assist riders traveling between stops.** This signage should include the stop number, as well as the number and direction of routes that serve the stop.

While this scenario is somewhat unique, these improvements would be beneficial at many MBTA rail stations with multiple or difficult-to-find bus stop locations. Examples include the Route 70 outbound stop at Central Square, Route 87 stops at Porter Square, Route 42 stops at Green Street, and Route 19 and Route 23 service at Four Corners/Geneva.

Manage the Curb to Increase Access

CURB SPACE ALLOCATION

Demand for curb space varies by MBTA station location and is dependent on each station's context, user types, and amenities. Identifying use and space demands for a stations' curb will help the MBTA optimally plan and allocate curb space.

Data can be a key hurdle for curb allocation. Station visits and observations during peak commute hours can be used to understand the number of personal vehicle pickups and dropoffs and bike parking utilization. Ridehailing (taxi/transportation network companies [TNC]), micromobility (bike, e-scooter or other emerging mobility devices), and private shuttle trip data can provide insight into the number of trips originating and terminating at stations, peak trip times, and any trip variations by day of week. Once data sources and collection methodologies have been identified and standardized, the MBTA could create a database for a curb use data inventory. Data consistency and a centralized location will ensure that all stakeholders have access to the same information. One potential model for the MBTA could be **San Francisco Municipal Transportation Agency's February 2020 Curb Management Strategy**, which details the agency's plans for data standardization and interagency use.

This study did not include a review of curb demand data to measure or project different curb pressures across stations. However, curb demand data will be highly useful in confirming which of these curb strategies to pursue at specific stations or typologies and how to allocate curb space. Curb demand data can be collected by manual observation or video counts for all modes—particularly during peak periods. Some modal data may be available by data feed, but likely not widely so, and often only for certain uses.. In future years, it is possible that broader adoption of curb mobility data standards will make curb and similar mobility data more available in an ongoing fashion. For now, video and manual data collection approaches are likely the most effective and accurate approach. Given the effort involved, data collection can be prioritized at stations with known accessibility conflicts, where curb space is most highly used, and where there are pressing questions of how to arrange space to maximize station access. Simply allocating based on productivity or demand may hinder other modes or goals. Meanwhile some curb uses, such as buses and paratransit, ideally need separated space to avoid conflicts with other uses.

Curb space allocation and design decisions should be based on a consistent hierarchy of station access priorities. Identifying curb function priorities by context and station typology can help with these decisions. Recommended prioritization and treatment strategies are shown in Figure 5-1.

Figure 5-1 Arranging Curb Uses at Stations

Curb Use	Hierarchy, Placement, or Role	Which Stations	How to Observe Demand (Near-Term)
Paratransit	Closest access to station entrance	All	RIDE trip origin and destination data; On-Demand Paratransit Pilot Program data
Transit Use (Bus)	Second closest access if it has been determined that bus connection will directly access the station. Considering feasibility of route deviation, this is not always possible. If buses directly access the station, the stop should be closer to the station than the nearest parking stall. Regardless of location, bus stops must be designed to avoid conflicts with other modes to ensure easy curb access.	All, with emphasis on stations with the most customers accessing the station by bus.	Service and ridership data
Private Shuttles	Provide space for shuttles, in scale with capacity and demand. In high volume contexts where shuttles serve as a large first/last mile resource, dedicated space is warranted. In lower volume locations, mixing with other modes (besides paratransit or transit) is acceptable.	Demand will vary significantly. Stations with high observed shuttle demand are at suburban stations near large offices, such as those found along the Route 128, Interstate 495, and Route 9 corridors.	No regional tracking system exists so there will be a need to rely on observed data and/or coordinate with private service operators.
Bike Access and Parking	The location and quality of bike parking is essential to increasing bike access systemwide. Standards for placement and type should be followed.	Minimum level for all stations but prioritize investment according to the demand analysis.	Field observations and latent demand estimates based on ridership and station type
Micromobility Parking	Provide easy access to the station entrance (closer than the nearest parking space) without interfering with pedestrian, paratransit, or bus movements. Group and make visible to increase usage.	Only some stations are in municipalities with micromobility programs.	No regional data sharing agreement in place, so must rely on data provided directly by vendors, or on municipal data or observations.
Pickup/ Dropoff (Personal and Taxi/ Ridehailing)	At high volume stations if room is available, ridehailing and personal vehicle loading should ideally be separated. In low volume stations, can be combined.	Some element at most stations. More central locations may see increased TNC activity.	For personal dropoffs, the dropoff mode percent by station available. For other modes, no regional data sharing is in place, so must rely on observations or establish data sharing agreements.

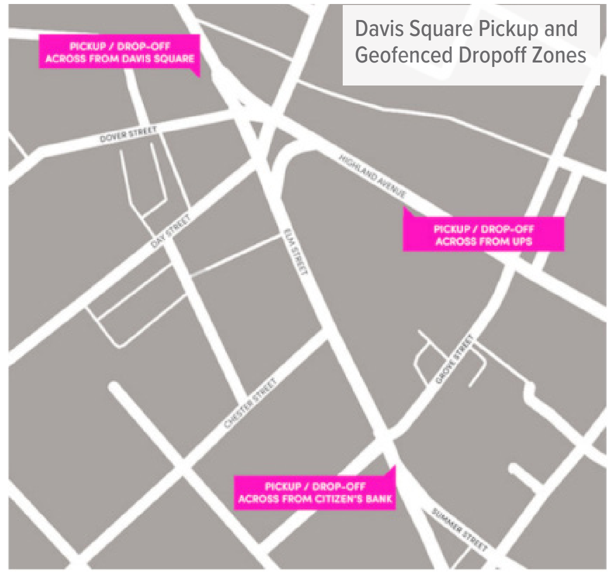
PICKUP AND DROPOFF FACILITIES

Pickup and dropoff facilities receive a variety of users, including personal vehicles, taxis, ridehailing, and private shuttles. At stations where curb and pickup and dropoff demand is high, it is critical to ensure that the station is designed so that these modes do not disrupt or inconvenience pedestrian, bike, or transit access. People walking, biking, or taking transit should have the closest facilities, separated to ensure mixed traffic does not slow down or inhibit access by higher capacity or more vulnerable modes.

Many of these uses, and ridehailing in particular, tend to have fluctuating demand throughout the day, and demand patterns that can change more often than other access modes. Some cities allow private shuttles to use transit stops, while others require that private vehicles use general load/unload zones, and still others have created special shuttle loading zones. How pickup and dropoff zones are managed is an accessibility issue. If ridehailing vehicles or shuttles block an MBTA bus then that bus is rendered inaccessible to persons with disabilities.

For ridehailing vehicles and taxis, there will be some variation by station location. Many transit agencies simply allow these services to use the same curb space as personal vehicles, and in low volume locations, this approach may be sufficient. However, at stations with more competition for the curb, it may be wise to separate these uses by designating particular locations for taxi and ridehailing use. These could be supported by clear signage and geofenced as described below to ensure passenger and driver awareness and compliance.

In developing an approach for how private shuttles should interact with the curb, there will be some variation by station location, but a commitment to protecting MBTA bus access to the curb is critical. The MBTA should develop private shuttle strategies that include implementing a curb use permit requiring data on operator trips, ridership, and schedule to be shared with the MBTA. The private shuttle data can help inform curb allocations and uses, as well as inform expected congestion at stations. Private shuttles should not be allowed to use curb space within stations for layovers as this could cause unnecessary congestion. Typically, private shuttle vehicles are not larger than 40 feet.



Commuter rail stations have compressed demand windows for pickup and dropoff activity. At most commuter rail stations, ridership is constrained to just a few peak period morning inbound and evening outbound trains. Thus, mornings typically bring a large influx of cars (personal or ridehailing) coming into the station at the same time and in the evenings there are large queues of personal vehicles waiting to pick up people in the short window of time before a train arrives. The situation then becomes that a large number of vehicles exit the station at the same time including the people that have parked. Often, these pickup and parked vehicle egress points are the same, and often do not have traffic lights.

Designated Micromobility Parking Area
Source: Transportation for America

FUTUREPROOF FOR NEW PRESSURES

Organizing Ridehailing and Micromobility Activity at Stations

Micromobility and ridehailing services can increase access to transit stations by providing first- and last-mile options for riders. However, as their presence at stations increases rapidly, in tandem with rider adoption, these services also compete for limited curb and parking space, particularly at peak train arrival and departure times. Existing signage and space allocation policies at stations may not clearly designate where such vehicles should stop or park, creating confusion and confusion and congestion. If ridehailing activity blocks MBTA bus access to the curb, it creates an immediate bus accessibility problem.

The MBTA should collect or obtain data to identify the volume and usage patterns of ridehailing and micromobility services at its stations, which can then be analyzed to determine the quantity of curb and parking spaces that should be allocated to accommodate those activities at different sites. By working with municipalities and the companies themselves, the MBTA can greatly improve overall flow at the curb and the rider experience by using digital and physical tools such as new parking treatments and in-app geofencing.

- Parking needs and protocols are not uniform across all shared mobility services or throughout a service area. Device parking requirements can also vary based on infrastructure and land use. For that reason, shared mobility management approaches should differ by station typology.
- Geofencing is a powerful tool that creates a virtual perimeter for users (and drivers), regulating where ridehailing vehicles and micromobility devices can be picked up, dropped off, or parked. The geofences are visible on a digital platform, in apps and often on provider websites to augment physical wayfinding signage, and can be tied to penalties if services are used incorrectly.
- The ease of obtaining activity data regarding usage of shared mobility providers varies greatly across different service categories. Micromobility services provided by cities (such as a bike share system) and those in which the city has permit requirements that mandate transparent data reporting may offer readily available datasets for the MBTA to analyze. However, ridehailing service data is subject to different regulatory requirements and is generally harder to obtain outside of voluntary bilateral partnership agreements with the operators themselves. The MBTA may wish to consider data partnership agreements with these operators tied to preferred or expanded curb access and signage, as has been required in existing opportunities for micromobility pilot partnerships. In the absence of such agreements, manual data collection at targeted stations may be required to quantify the volume of ridehailing activity at station curbs.

- Shared mobility providers are already incentivized to perform rebalancing practices for services. If this proves insufficient to result in consistent availability, the MBTA should coordinate with relevant municipalities to craft or adjust permit conditions regarding deployment at transit stations. Ideally these permit conditions would be applied as uniformly as possible across the region for the sake of consistent customer experience.

These policies can be incorporated into municipal permitting processes and state policy frameworks. The MBTA should coordinate with appropriate stakeholders to ensure that micromobility and ridehailing policies meet station and rider needs.

Micromobility Staging Areas

Micromobility device placement can take many forms, from designated pickup and dropoff zones to the use of existing infrastructure. Micromobility parking typologies can vary by station, taking into account existing amenities and improvement priorities, but should support an intuitive customer experience.

The Greater Boston region's bike share program uses docking stations, which may require additional infrastructure at stations with high bike usage or potential bike usage. The docks should have dedicated station space ensuring bikes can be used properly and quickly without interference by motorized vehicles, transit, other micromobility services, or personal bikes. Other micromobility services could be parked adjacent to bike share docks. E-scooters and dockless bikes could use demarcated corrals for parking at MBTA stations as a method for decreasing right-of-way obstacles for pedestrians and motorized vehicles. The **NACTO Shared Micromobility Guidelines** illustrate sidewalk and on-street parking options and provide an inventory table of municipal parking requirements. These examples can help guide the MBTA and partnering agencies in creating policies for station micromobility device placement.

Preparing to Respond to New Service Types

The shared mobility industry is in a constant state of evolution. In recent years, the pace of experimentation with new service categories, vehicle types, and business models has increased rapidly. The MBTA should prepare for the future emergence of additional mobility service types by developing a clear framework today–including departmental roles; assigned responsibilities; external engagement processes; and performance criteria—for rapidly determining how such services will be managed if and when they arrive. For example, companies offering shared fleets of low-speed, free-floating electric motorcycles emerged in late 2019 in several United States cities. These services have different needs regarding parking access and right-of-way usage than either ridehailing or scooter services. In years to come, automated passenger vehicles may begin appearing for personal or shared use with their own distinct needs for station access. Preparing clear policies and procedures for engaging with such providers and managing their impacts at stations upon their arrival in the Boston region would prevent lengthy delays and externalities associated with their unmanaged presence.

Enhance Bike Parking

High-quality bike parking can make the experience of biking to a station not only possible but more enjoyable and can increase the likelihood that passengers will continue to bike to transit. Aside from these benefits, adequate and attractive bike parking is also an accessibility and safety issue.

When there is not enough bike parking, people default to locking their bikes in a variety of places, which can impact accessible pathways for elderly people or people with mobility limitations or visual impairments.

As a more structured bike parking program has the potential to address many of the issues detailed in this report, the MBTA is currently developing a manual of standards and guidance for bike parking planning, design, procurement, and wayfinding. Additional next steps could include:

- **In the short-term, prioritize bike parking expansion at stations where existing bike parking regularly fills** and there is potential for significant growth in bike access trips even without major infrastructure investments—such as Alewife, Green Street, Reading, Swampscott, and Natick Center.
- **As sustainable funding resources are identified, develop capital programs to expand and upgrade bike parking**

Adding Bike Parking at Transit Stations

How much bike parking is needed at a station?

There should typically be enough bike parking at a given station to accommodate at least five percent of morning peak period ridership on weekdays. The MBTA should consider providing facilities in excess of this standard at stations with comprehensive high-comfort bike networks or major regional shared use paths in proximity to the station.

What type of bike parking should be built at a station?

Inverted-U racks or post-and-ring racks that are covered by shelter and located in highly visible, well-lit areas should be considered when feasible. For cages, double decker racks are ideal where feasible. Bike parking design should also consider the wide range of bike designs and types—such as cargo bikes, tricycles, and electric bikes.

Why build bike parking where utilization is not 100%?

People riding bikes can be sensitive to small details in bike parking design. For example, hanger-style or schoolyard-style racks can prevent people from locking up a bike safely. It is not unusual for an inadequate rack style that is technically only partially full to be perceived as having no additional capacity, if a person cannot safely and easily lock their bike.

Replacing lesser quality bike parking can induce demand at stations with high potential for bike access. If a station already has high-quality covered bike parking that is not fully utilized, there may not be a need to add more. At stations with lower quality bike parking, upgrading spaces to inverted-U racks or bike lockers may enable more people to bike to transit.

Sheltered inverted-U racks at Binghamton Station

systemwide—prioritized first at stations where more people can access the station via existing high-comfort bike infrastructure.

- **Ensure there are clear roles and responsibilities within the agency** for siting, building, and maintaining bike parking assets (see “Gap Identified: MBTA Manager of Bike Parking and Access”).
- **Communicate the supply and typical availability**.

In addition to enhancing bike parking, it is also essential to ensure that the station’s bike parking is connected to the neighborhood bicycling network. Bike connections to and from station bike parking should be elevated in MBTA station site plans. For example, stations with high potential for bicycling from surrounding high-comfort networks should include dedicated bike connections to station bike parking.

Stations should provide a seamless, highly visible connection from train platforms to bikeway connections, with bike parking sited accordingly. This connection begins on MBTA property and should lead directly to off-site bikeways. These same siting principles also apply to the region’s bike share system docks at MBTA stations, as well as other micromobility devices. Bikeways on MBTA property should be physically separated from cars, and people riding bikes should be separated from pedestrians at stations with high passenger volumes.

Gap Identified—
MBTA Program Manager for Bike Parking and Access

The MBTA Commercial Programs and Strategies department has staff dedicated to the administration and management of the MBTA car parking system. The MBTA currently, however, lacks a similar program manager for bike parking and access. The MBTA should identify a program manager for bike parking and access who will:

- Administer and manage the MBTA’s bike parking assets, including the Pedal-and-Park system.
- Administer, manage, and assist in the planning of third-party micromobility services, such as bike share, that operate or site docking stations at MBTA stations.
- Engage in, champion, and partner with emerging micromobility providers that facilitate station access, such as dockless providers that can add capacity while using less space.
- Identify stations with a need for expanded or upgraded bike parking and amenities, and work with MBTA Capital Delivery and MBTA Office of Chief Engineer to plan, prioritize, program, and design investments when funding is available.
- Coordinate with the MassDOT Director of Sustainable Mobility and other relevant staff to assist state and municipal departments seeking to make investments that enhance bike access to MBTA stations.
- Assist Central Transportation Planning Staff in monitoring the utilization and condition of the MBTA’s bike parking assets.
- Work with relevant MBTA departments to improve customer information and actively market biking as a transit access option.

Improve Station Area Transit Operations

Ensuring buses can easily and efficiently move through station areas reduces transfer times for passengers.

BUS CIRCULATION AND STOP DESIGN

A shorter transfer time makes using the bus a more attractive access mode, particularly as studies show that travelers prioritize quick and seamless transfers and are sensitive to transfer time in making travel decisions. Some strategies that the MBTA should consider within and adjacent to transit stations can include the following, depending on local context:

- **Reduce interactions between buses and pedestrians:** Pedestrians crossing in front of buses delays them entering and exiting a station and increases the safety risk for pedestrians. By examining potential conflict points and developing appropriate channelization (e.g., natural barriers, station design) and selection of appropriate access points, safety and bus operations can be improved. Placing bus stops on the far side of intersections and crosswalks is generally preferred, as this placement encourages pedestrians to walk behind the bus—reducing conflicts and increasing safety.
- **Limit use of traffic calming in bus path of travel:** Traffic calming devices, such as raised crosswalks and intersections, bulbouts, speed humps/cushions, and tight curb radii should be avoided along the bus path of travel in the immediate vicinity around a transit station as it has the potential to delay buses entering and exiting a station, or worse, force a circuitous routing into/out of the station.
- **Clearly demarcate, and when possible, physically separate, bus stops from other pickup and dropoff activities at the curb:** Restricting use of the curb at a station to buses ensures that they can pick up and discharge passengers without delay. Creating more delineation between bus and general curb space will help to restrict personal vehicles from creating traffic conflicts.
- **Plan convenient and efficient bus stop locations at midpoint stations:** Many MBTA bus routes terminate at rail stations, rather than serving them as midpoints—reflecting the bus network's focus on direct access to rapid transit. As the MBTA reimagines the role of the bus network, there may be more crosstown routes that serve multiple rail stations. On bus routes with rail stations at midpoints, running through a station busway may increase travel times for many riders while providing only minor benefits for riders boarding or alighting at the midpoint station. Rather than deviating the route through the station busway, the MBTA could instead place stops on-street near stations and provide a high-quality walking connection with effective wayfinding.
- **Construct a busway to accommodate buses at the station where appropriate:** Expanding beyond separated bus stops, busways can provide significant operational benefits by reducing conflicts with other modes and providing space for layover—especially at stations where many bus routes terminate. The MBTA has regularly incorporated busways as part of rapid transit station designs, especially at regional rapid transit stations. When feasible, the MBTA should add new busways or expand busways at stations where many bus routes terminate. Busways should also be considered at stations with a high volume of pickup and dropoff activity that conflicts with bus operations—such as at high ridership commuter rail stations served by bus routes. The MBTA is currently updating its busway design standards to better reflect best practices and anticipated future operating conditions.

Off-Street Bus Layover Renderings (Seattle)
Source: King County Metro

BUS LAYOVER SPACE

Layover space is critical for successful daily transit operations, and serves a variety of purposes such as:

- Ensuring that riders receive reliable transit service, especially in congested areas
- Allowing buses to recover from delays
- Allowing opportunities to wait if a trip is running ahead of schedule
- Providing a comfort break for the driver or a shift change between drivers

At rail stations, **the amount of available layover space is a direct constraint on bus service frequency—especially at peak periods.** In most cases, additional bus service cannot be added if layover space is unavailable. Additionally, bus routes operate most efficiently when layover space is provided at both ends of the route. This typically means that on-street layover space is required at route termini that are not at rail stations with busways.

Station renovations provide a strategic opportunity to secure additional on- and off-street layover space—enabling more frequent and reliable bus service. Existing and future layover needs should be an input for all station renovation projects. Layover needs should be determined in coordination with MBTA Service Planning and other relevant departments, and reflect the outcomes of the Bus Network Redesign initiative and other long-term bus planning considerations. Space need calculations should also consider potential demand for third-party transit services, such as shuttles operated by Transportation Management Associations—and provide layover space separate from MBTA bus operations. When feasible, station designs should include room for future expansion of layover locations, reducing the potential for lack of layover space to restrict future increases in bus service.

Bus Electric Charging Methods
(left to right) Plug-in charger, overhead inverted pantograph charger, and wireless induction charger. Source: Nelson\Nygaard

BUS ELECTRIC VEHICLE CHARGING AND LAYOVER

Bus layover space should anticipate future design specifications. MBTA is currently exploring opportunities to introduce additional battery electric buses into its bus fleet. The MBTA is currently operating five battery electric buses out of its Southampton garage and investigating the infrastructure needs associated with a larger fleet These vehicles require ongoing battery charging, which often occurs at layover locations in other transit agencies where they are used. In some circumstances, charging may result in longer layover times and a need for additional curb space dedicated for layover. Current operations in the U.S. use one of three charging methods (or a combination thereof):

- **Plug-in charging:** Plugging the bus in, typically for extended periods of time at night or when buses are not in service.
- **Overhead conductive charging:** An overhead charger contacts the roof of the bus. This is often done throughout the day for short periods of time at layover points, to continuously recharge batteries and extend vehicle range.
- **Wireless inductive charging:** A charger embedded in the pavement wirelessly charges batteries through the bottom of the bus. This is often done throughout the day for short periods of time, to continuously recharge batteries and extend vehicle range. Early implementations of these chargers have been in layover zones, where electric vehicles 'top-up' before continuing service.

The cost to purchase and install these charging systems ranges dramatically, depending on power or wattage of the charger; amount of electrical infrastructure required; general site conditions; and the extent to which indirect services and costs are required (e.g., consulting, engineering, design). These interventions carry costs and uncertainties inherent with new technologies and systems. Implementation hurdles include obtaining funding, coordinating with utilities, and siting them in ideal locations for charging. Bus electric vehicle charging will be a long-term consideration for station design, once the technology is ready for implementation.

The scale of the regional transit network will likely require coordinated implementation of charging technologies to ensure range requirements can be met. When these systems are ready for implementation, charging spaces should be first prioritized at major transfer points with the most bus activity.