# SRTA Bus Stop Design Guidelines

**November 2022**

NELSON NYGAARD

McMAHON

SRTA

# TABLE OF CONTENTS

**Page**

Table of Contents ..... i
Introduction ..... iii
Using the Guidelines ..... iii
Purpose ..... iv
Design Principles ..... iv
Project Background ..... v
**Chapter 1: Bus Stop Placement ..... 1-1**
Bus Stop Spacing ..... 1-1
Context/Environment ..... 1-3
**Chapter 2: Bus Stop Configurations ..... 2-4**
Placement at Intersection ..... 2-4
Bus Stop Configuration/Curbside Interaction ..... 2-10
Bus Stop Length ..... 2-15
Parking Impacts ..... 2-18
**Chapter 3: Accessibility ..... 3-20**
Bus Dimensions ..... 3-21
Americans with Disabilities Act ..... 3-21
State Accessibility Guidelines ..... 3-25
Other Accessibility Components ..... 3-25
**Chapter 4: Amenities ..... 4-28**
Landing Pads ..... 4-29
Bus Stop Signs ..... 4-29
Lighting ..... 4-33
Real-Time Information ..... 4-33
Enhanced Customer Information ..... 4-33
Benches and Seating ..... 4-35
Shelters and Shade ..... 4-36
Bike Racks ..... 4-42
Fare Machines ..... 4-43
Trash Receptacles ..... 4-44
**Chapter 5: Bus Stop Types ..... 5-45**
Bus Stop Types Development Process ..... 5-45
Bus Stop Types ..... 5-46
Amenities by Bus Stop Type ..... 5-51

**Chapter 6: Roadway Context.....6-1**
Bus Pads.....6-1
Striping.....6-3
Bike Accommodations.....6-4
Floating Bus Stops.....6-6
Bus Priority.....6-7
**Chapter 7: Implementation.....7-9**
Bus Stop Location Modifications.....7-9
Bus Stop Improvements.....7-9
Amenity Installation and Maintenance.....7-12
Municipal Responsibilities.....7-15
State Responsibilities.....7-16
Developer Responsibilities.....7-16
**Appendix A: SRTA Bus Turning Radii.....7-17**
**Appendix B: Bus Stop Consolidation Methodology and Implementation Guidance.....7-21**
**Appendix C: Context Analysis.....7-43**

# INTRODUCTION

Bus stops are the first and last touch points of a transit trip used by Southeastern Regional Transit Authority (SRTA) customers in Southeastern Massachusetts. Comfortable, safe, weather-protected, and accessible bus stops facilitate access to work, education, medical, shopping, recreation, and other destinations across the region. In addition, well designed bus stops can improve the experience of taking transit and improve ridership.

## USING THE GUIDELINES

The guidelines are comprised of seven chapters, arranged in consecutive order for bus stop design, from initial planning through to implementation and use by customers.

Figure 1 Table of Chapters

| Chapter | | What Questions it Answers |
|---|---|---|
| | Introduction | What are the design guidelines?<br>Who are they for? |
| | 1 Bus Stop Placement | Where are bus stops located?<br>Why are they important? |
| | 2 Bus Stop Configurations | How can bus stops be configured in different roadway environments? |
| | 3 Accessibility | What requirements must be met or exceeded for a bus stop to be accessible? |
| | 4 Amenities | What amenities can be found at bus stops? How should they be placed? |
| | 5 Typologies | What are the different types of bus stops in the system? How do they differ in terms of their minimum, preferred, and optional amenities? |
| | 6 Roadway Context | What roadway design elements can enhance bus stop visibility? How does the bus stop interact with and support facilities for cycling and transit priority? |

| | | |
|---|---|---|
| | 7 Implementation | How do bus stop investments get prioritized?<br>Who is responsible for adding/removing or improving bus stops?<br>Who installs and maintains amenities? |

# PURPOSE

The purpose of the guidelines is to provide direction on creating a network of bus stops that improve the customer experience and bus operations. While the guidelines are focused on typical SRTA bus stops, amenity standards for SRTA's two transit terminals are also provided. Furthermore, with the exception of federal and state accessibility requirements cited in this document, the guidelines provide recommendations and direction, rather than strict standards. They are intended to be flexible, if need be, to the different situations of each bus stop.

The guidelines should be used as a tool by people involved in bus stop planning and design – planners, engineers, landscape architects, and others, representing SRTA, municipalities, state and regional agencies, consultants, and developers – to build a network of safe and accessible bus stops that not only improve the customer experience, but also benefit bus operations by reducing dwell times and travel times. While the guidelines have a technical audience, anyone who is interested in the details of bus stop design will find these guidelines informative.

SRTA operates in a variety of roadway environments ranging from urban to rural, and entirely on roads that are not owned or maintained by the agency. The existence and conditions of sidewalks and pedestrian crossings vary along these roads, and land use decisions are controlled by municipalities. Thus, these guidelines were developed, and should be followed, with an understanding of SRTA's limited authority over its operating environment.

# DESIGN PRINCIPLES

Accessibility and safety are two key design principles that should be considered in the design of all bus stops. Far-side bus stops (discussed more in Chapter 2) are recommended where feasible. Other design principles include:

- **Comfort and Convenience** - Locate bus stops in places that are convenient to where people are traveling to and from, including concentrations of residences or jobs and major destinations such as social services or shopping plazas. Install amenities where practical, such as shelters, benches, etc. to

enhance the comfort of waiting for a bus. Provide information on available services at bus stops to make it intuitive for customers to know when and where they are traveling. Bus stops should provide adequate space for waiting customers to sit or stand, separate from other pedestrian flows and street traffic.

- **Visibility and Identification** – Place bus stops in easily identifiable locations, so they can be found without difficulty by customers and bus drivers alike. Bus stop areas should be well lit and not physically isolated. Make bus stops a recognizable component of the transit system through branded, identifiable signage.
- **Coordination** – Integrate bus stops into the design of road and sidewalk projects, as well as new developments, rather than placing them as an afterthought.
- **Access** – Site bus stops in areas that provide safe, accessible pedestrian access to the surrounding area, especially to the other side of the street. Well-defined and contiguous pathways, as well as crosswalks, should be provided to and from the bus stop.

The specifications discussed in these guidelines are designed for 40' buses, which are the largest in SRTA's fixed-route bus fleet. Although SRTA operates shorter fixed-route buses, designing for 40' buses provides flexibility for any SRTA bus to serve a bus stop and for SRTA to replace its shorter buses with longer buses in the future.

# PROJECT BACKGROUND

SRTA developed these guidelines to identify and prioritize improvements to bus operations and the experience of bus customers. The agency seeks to address issues with bus stop spacing; curb space; shelter placement, use, and design; and signage through policy changes and capital improvements.

The guidelines rely on best practices documented from a review of several peer transit agency guidelines and guidance from industry organizations, including the American Association of State Highway and Transportation Officials (AASHTO) and National Association of City Transportation Officials (NACTO). In addition, the SRTA guidelines conform with state and federal requirements on bus stops and accessibility.

# CHAPTER 1: BUS STOP PLACEMENT

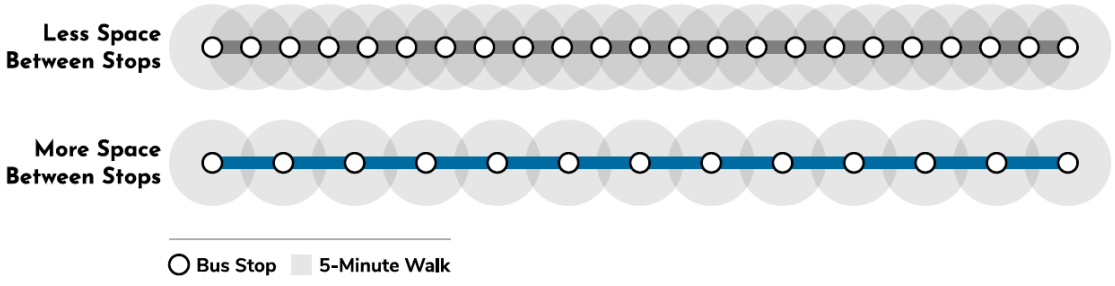
## BUS STOP SPACING

**Bus service runs more efficiently for on-board customers and operators when bus stops are not located at every intersection. This chapter provides guidance on the optimal bus stop spacing that will balance the need for having proximate bus stops to customers with efficient bus stop service.**

The distance between bus stops can both positively and negatively impact peoples' willingness and ability to take the bus, and the experience of the bus ride itself.

Closely spaced bus stops provide shorter walks for people to access bus services but mean the bus must stop more frequently. Frequent stopping increases the travel time for bus riders, which makes it more difficult for people to efficiently travel by bus and may dissuade them from taking the bus at all. Ideal bus stop spacing provides the appropriate balance between easy bus stop access, while avoiding an excessive number of bus stops that drastically impact travel time. Providing fewer, but safer and more accessible, bus stops enables a better experience for people taking the bus than having more bus stops that are not as accessible (see Figure 2).

Figure 2 Closely Spaced Bus Stops Slow Service without Significantly Increasing Access to Transit

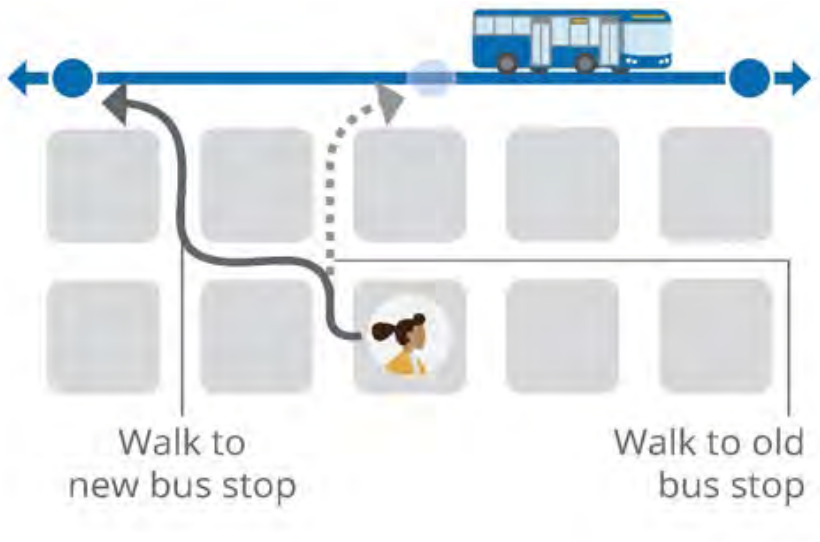



Source: Nelson\Nygaard

Existing SRTA bus stop spacing varies by route, ranging from an average of one bus stop every 620 ft. on the Fall River 1 (South Main) to an average of one bus stop every 3,260 ft. on the Fall River 14 (Swansea Mall). Across the SRTA system, bus stop spacing averages 820 ft (6 stops/mile).

**The recommended bus stop spacing for SRTA service is 1,300 ft.**, or ¼ mile, resulting in four bus stops per mile, which is greater than the average existing bus stop spacing for 18 of the 24 current SRTA routes. This distance can typically be covered in a five to ten-minute walk, meaning most locations along a bus route would be no more than a 5-minute walk between bus stops. As shown in Figure 3, rebalancing closely spaced bus stops maintains walkability to bus stops even if one is removed.

Figure 3 Example Change in Bus Stop Access with Bus Stop Rebalancing

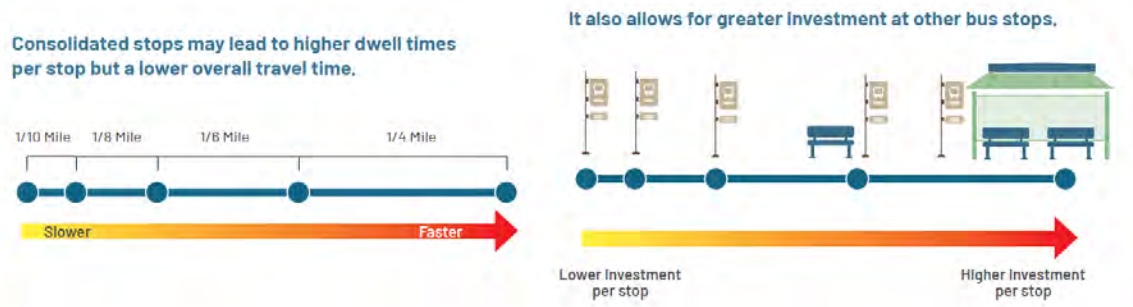



Bus stop spacing of 1,300 ft. will help create optimal conditions for customers, SRTA operators, and others traveling along bus corridors by:

- Reducing conflicts between buses, other vehicles, and cyclists by minimizing the number of times buses need to pull over to access the curb.
- Minimizing curbside space needed for bus stops, which may provide more space for parking along a corridor.
- Maximizing the efficiency of bus service by reducing the number of times the bus stops along a route.
- Enabling upgrades to and maintenance of a greater proportion of bus stops, and/or a higher investment in other bus stops.

Two of these benefits are illustrated in Figure 4.

Figure 4 Benefits of Optimal Bus Stop Spacing




# CONTEXT/ENVIRONMENT

The actual distance between bus stops will not always match recommended guidelines due to variation in the surrounding context and environment. Rural areas without many active/transit-generating land uses may not need bus stops as frequently. Urban areas with higher population densities or other high ridership transit uses may require more frequent bus stops. Major trip generators, such as grocery stores, hospitals, and schools, even if located close together, may necessitate their own bus stop.

Figure 5 provides a range of bus stop spacing guidelines by different land use and density contexts:

Figure 5 Bus Stop Spacing

| Context/Location | Min. (ft.) | Recommended/ Preferred (ft.) |
|---|---|---|
| Moderate-High Density Areas | 750 | 1,300 |
| Low Density Areas | 1,100 | 1,300 |

# CHAPTER 2: BUS STOP CONFIGURATIONS

## PLACEMENT AT INTERSECTION

**Where can you place bus stops at an intersection? How much curb space do buses require? How do bus stops impact parking? This chapter provides insights into these questions, including how to reduce the curbside needs of bus stops.**

There are three primary options for placing bus stops along a road in relation to an intersection, as shown in Figure 6:

- Far-side of an intersection
- Near-side of an intersection
- Mid-block

Figure 6 Common Bus Stop Placements

Source: OmniTrans Transit and Bus Stop Design Guidelines 2013

While each bus stop placement has advantages and disadvantages, far-side bus stops are the preferred placement for pedestrian safety and bus operations, and

they require the least amount of curb space. The advantages and disadvantages of each bus stop placement are outlined in Figure 7.

**FAR-SIDE BUS STOPS ARE RECOMMENDED AND SHOULD BE THE DEFAULT PLACEMENT FOR NEW BUS STOPS**

Figure 7 Advantages and Disadvantages of Bus Stop Placements

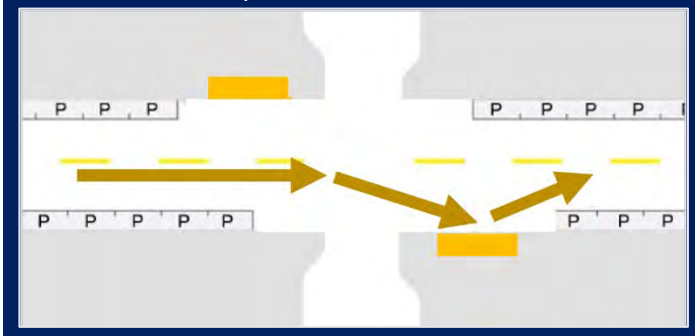
| Bus Stop Placement | Advantages | Disadvantages |
|---|---|---|
| **Far-Side** | • Crosswalks are behind the bus, which encourages pedestrians to walk behind and not in front of the bus<br>• At signalized intersections far-side bus stops allow bus drivers to pull back into traffic while the preceding signal is red<br>• Right turning vehicles do not cross in front of the stopped bus<br>• Transit Signal Priority (TSP) and bus queue jump lanes can be more effectively implemented<br>• Requires less curb space than near-side or mid-block bus stops | • Longer walking distances to the nearest crosswalk and intersection for customers compared to near-side bus stops<br>• Bus may stop twice – at the intersection if traffic signal is red and then at the stop after the intersection<br>• May interfere with right turning vehicles from the cross street |

| | | |
|---|---|---|
| **Near-Side** | • May be ideal where there is a large trip generator on the near-side of the intersection, where buses take a right turn at the intersection, and at unsignalized intersections with stop signs<br>• Typically results in a shorter walk for customers to the nearest crosswalk and intersection compared with far-side stops<br>• Eliminates double stopping of buses before and after an intersection | • Creates site distance concerns for pedestrians in the crosswalk who walk in front of the bus and potentially passing vehicle traffic that has limited visibility of pedestrians crossing in front of the bus<br>• May conflict with right turning vehicles<br>• Incompatible with some transit priority measures<br>• Impacts vehicle flow through an intersection if a bus stops at a green light, which then turns red |
| **Mid-Block** | • Compatible with long blocks, particularly in suburban and rural areas<br>• Can serve large mid-block trip generators<br>• Minimized impacts to traffic flow and sight distances | • Requires the most space of the three bus stop placements<br>• Without a crosswalk, may force customers to cross the road in unsafe conditions<br>• Increased walking distances for customers to the nearest crosswalk and intersection compared with far-side or near-side bus stops |

Examples of these bus stop placements from the SRTA bus system are shown in Figure 8.

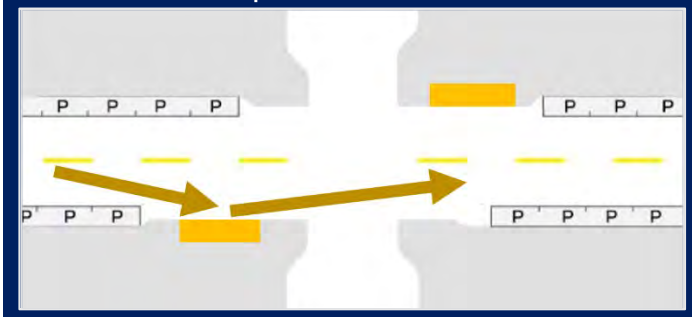
Figure 8 Local Bus Stop Placement Examples

Far-Side Bus Stop



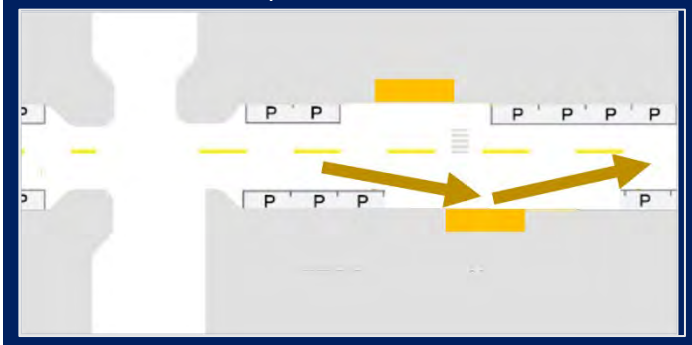
Example: Plymouth Ave. at Niagara St., Fall River

Near-Side Bus Stop



Example: Bedford St. at Quarry St., Fall River

Mid-Block Bus Stop



Example: Bedford St. opposite Wall St., Fall River

Photos: McMahon Associates

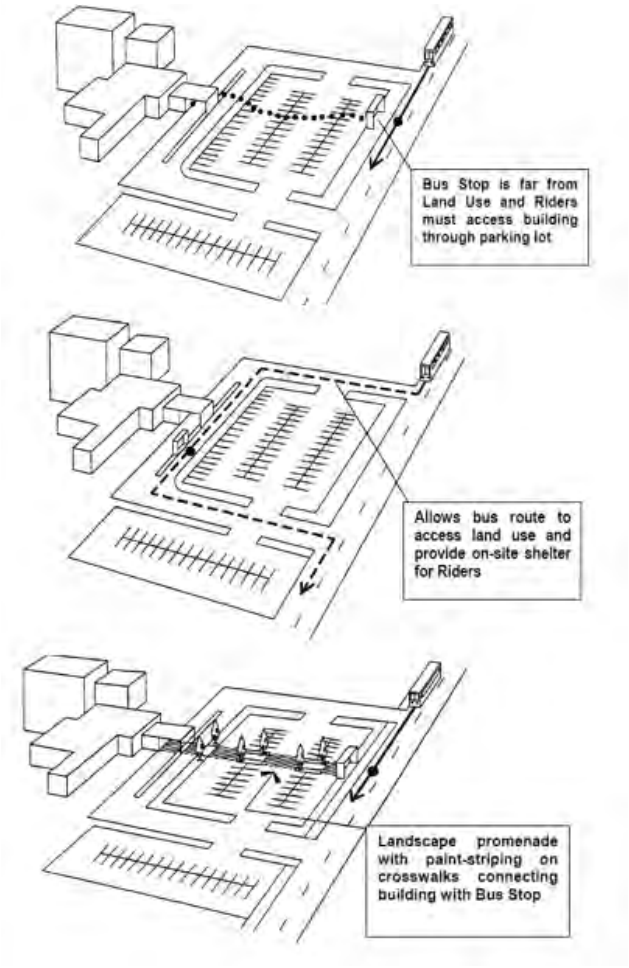
Graphics: NACTO Transit Street Design Guide, lightly modified

Each bus stop location should be evaluated based on the following six operating considerations:

1. **Pedestrian Connections/Safety –** Bus stops should be located where pedestrian connections along and across roads and/or to nearby developments exist. Wide, level crossings and marked, stop controlled crossings are ideal. Bus stops should have good visibility and be protected from vehicle traffic.

***Bus stops should be located along the main roadway and not service the front door of developments with long access driveways or parking lots in front. These route deviations add time to the bus route's scheduled time and slow down bus service.***

Figure 9 Connectivity Between Land Uses and Bus Stops




Graphic: Transit Cooperative Research Program (TCRP), 1996

Figure 9 shows three scenarios for bus stop placement at a development that has a long access driveway or parking lot in front. The recommended scenario is shown last, where the bus stop is located on the roadway and a direct, accessible pedestrian connection to the front of the building is provided.

Other drivers should have sufficient visibility of bus stops to safely see and react to stopped buses (particularly at bus stops where buses stop in the travel lane) and customers crossing the street. In addition, bus drivers need sufficient sight distances to see approaching vehicles and bicyclists when reentering traffic. Sight distances to bus stops is based on the road's speed

limit and should adhere to the standards in Figure 10. The placement of bus stops in areas without adequate sight distance is not recommended.

Figure 10 Site Distances for Siting Bus Stops

| Speed Limit (mph) | Sight Distance (ft) |
|---|---|
| 15 | 200 |
| 20 | 265 |
| 25 | 335 |
| 30 | 400 |
| 35 | 465 |
| 40 | 530 |
| 45 | 600 |
| 50 | 665 |

Adapted from AASHTO 2011 and AASHTO 2016

Assume a 9 second time gap is required for buses to re-enter traffic without undue interference to traffic flow. Calculations are based on time gaps provided in AASHTO 2016, adjusted for right turn movements that AASHTO 2011 considers to be equivalent to pulling into traffic from a bus stop, and intersection sight distance also provided in AASHTO 2011.

2. **Bus Stop Pairs –** Where possible, bus stops for the same route in both directions should be located on opposite sides of the same street to make taking a round trip convenient and intuitive.
3. **Transfer Activity –** Bus stops in areas with high transfer activity should be as close to each other as possible to facilitate quick and easy transfers between routes.
4. **Driveways –** Where feasible, buses should not block driveways that provide the only access to a property, or ideally overhang a driveway, when stopped at a bus stop. Bus stops should also not impair sight lines for vehicles using the driveway, and buses should not pick up or drop off customers in the driveway.
5. **Paratransit Impacts –** Bus stop placement should be considerate of people with mobility impairments and facilitate their use of fixed route service, rather than rely on paratransit service.

6. **Flag Service –** Corridors with flag service should be transitioned to fixed-route service with designated, accessible bus stops as pedestrian infrastructure is built out and as land uses change to become less car-oriented.

# BUS STOP CONFIGURATION/CURBSIDE INTERACTION

**How a bus reaches and serves a bus stop, and how the bus impacts traffic and parking while serving a bus stop, depends on the existing use of the road closest to the curb.**

All four common bus stop configurations – a bus stop in a parking lane, in a travel lane, at a curb extension/bus bulb, or a pull out/bus bay – impact traffic and parking differently. The most common configuration currently in the SRTA service area is a curbside bus stop in either a parking lane or travel lane. Figure 11 shows local examples of these two configurations.

Figure 11 Local Curbside Interaction Examples

**Bus Stop in Parking Lane**

**Bus Stop in Travel Lane**

Ashley Blvd. at Collette St., New Bedford (left); Trusdale Clinic, Fall River (right)

# Curbside – Parking Lane

On corridors with on-street parking, including most corridors serving bus routes in the urban cores of Fall River and New Bedford, bus stops are generally located in the parking lane (see Figure 12). Bus stops in a parking lane allow buses to serve a stop primarily or entirely outside of the travel lane, thereby having minimal effect on traffic flow and reducing the chance of rear-end crashes. However, bus stops in a parking lane are prone to encroachment from adjacent parked vehicles and to drivers who may park in the bus stop.

**When vehicles park in a bus stop located in a parking lane, buses must stop in the travel lane to serve the stop. This creates accessibility and safety concerns for bus passengers who must walk around parked cars and into the street to board a bus.**

**Having bus stops in parking lanes requires diligent enforcement of parking regulations to limit encroachment and allow the bus stop to be safely used as designed.**

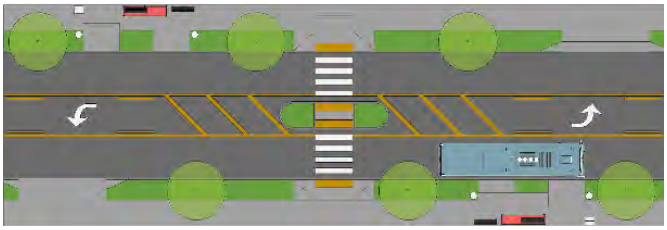
Figure 12 Bus Stop in Parking Lane, Example shown on Plymouth Ave., Fall River

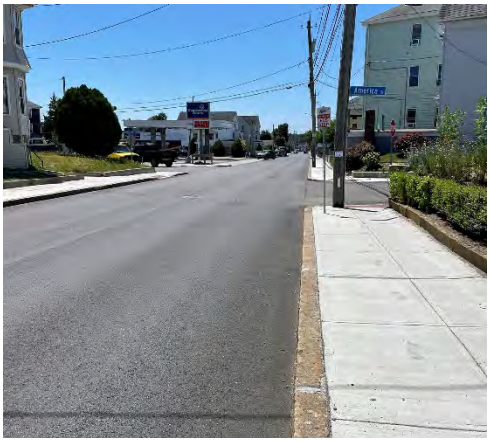
Graphic: Rhode Island Bus Stop Design Guide (2017). Image: McMahon Associates

# Curbside – In-Lane

In-lane bus stops refer to buses that stop in a travel lane (see Figure 13). This may also mean the bus is stopping partially within a shoulder or bike lane along the curb. Bus stops in the travel lane are typically preferred by transit agencies because they eliminate the need for buses to merge into traffic after stopping, which can increase the bus travel time. The tradeoff for having buses stop in the travel lane is that other vehicles or bicyclists may not be able to pass a stopped bus on a road with one travel lane in the direction of the bus route, which may cause queuing and traffic congestion.

Figure 13 In-Lane Bus Stop, Example shown on Stafford Road, Fall River





Graphic: Rhode Island Bus Stop Design Guide (2017) Image: McMahon Associates

# Curb Extension

Curb extensions, which are also known as bump outs or bulb outs, extend the sidewalk into the parking lane at an intersection to facilitate an in-lane bus stop on a road with on street parking or a shoulder (see Figure 14). Curb extensions provide several notable benefits to bus operations and the customer experience, including:

- Reduced parking impacts, in some cases by over 50%.
- Enabling sufficient space for an accessible landing pad on narrow sidewalks.
- Additional space for customers to queue when boarding a bus.
- Reduced dwell time by eliminating the deceleration and acceleration time needed to serve bus stops in the parking lane.
- Shorter crossing distances for people walking across the street.

Curb extensions can take up the entire or partial width of the parking lane. At near-side bus stops, partial curb extensions should only be used if a vehicle can pass a stopped bus without encroaching on the opposing travel lane, or when a vehicle cannot pass a stopped bus. Applying partial curb extensions in these situations only will help prevent issues with pedestrians walking in front of a bus and not expecting a vehicle to pass. Like in-lane bus stops, buses stopped at curb extensions on roads with one travel lane may cause vehicles to queue behind the bus. In addition, curb extensions may impact snowplow operations. The entity responsible for plowing, such as a local Department of Public Works, should be consulted when considering installing a curb extension.

Figure 14 Curb Extension at a Bus Stop, Example Shown in Boston, MA

Graphic: Rhode Island Bus Stop Design Guide (2017)

The design of curb extensions must accommodate the turning radii of SRTA's 40-foot buses. The turning radius for these buses is shown in Appendix A.

# Pull Out/Bus Bay

A pull out bus stop, which is also called a bus bay, allows a bus to stop outside of the travel lane(s) on roads without shoulders or parking lanes. These are typically used on higher speed suburban roads where in-lane bus stops may not be safe, at bus stops with extended dwell times (such as at a mall or supermarket), and at bus stops where buses layover. However, pull out bus stops may create delays for buses re-entering traffic, particularly on roads where traffic volumes exceed 1,000 vehicles per hour per lane.[1] A typical "closed bay" pull out bus stop, which does not have an "open" end in the front or back at an intersection, is shown in Figure 15.

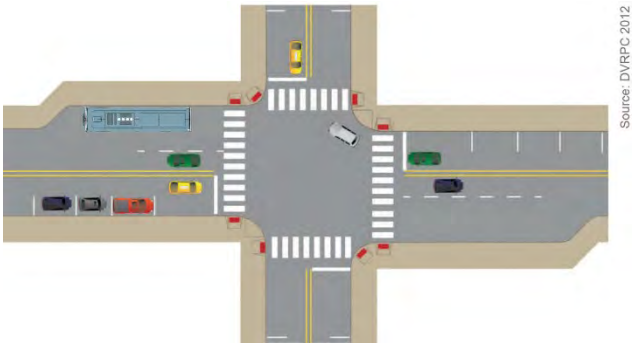
[1] Guide for Geometric Design of Transit Facilities on Highways and Streets. American Association of State Highway and Transportation Officials (AASHTO), Washington, DC: 2014

Figure 15 Closed Bay Pull Out Bus Stop, Example shown at Garfield Ave. at Lowe's, Cranston, RI

Graphic: Rhode Island Bus Stop Design Guide (2017)

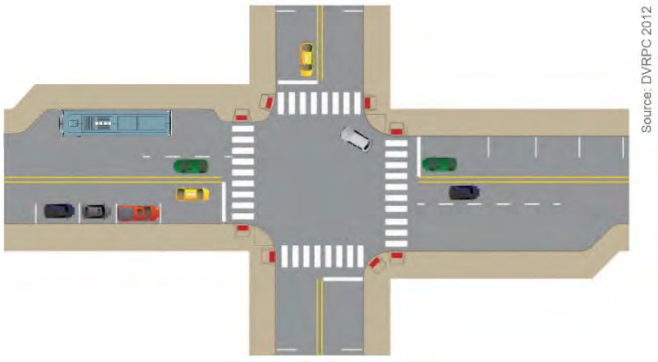
Pull out bus stops can also be partially closed, such as at the near-side or far-side of an intersection. An example is shown in Figure 16. Pull out bus stops at intersections can also be paired with curb extensions at one end, as shown in Figure 17. Pull out bus stops with curb extensions pair the benefits of a pull out bus stop with the benefits of a curb extension, including shortening crossing distances for customers crossing the street.

Figure 16 Partially Closed Pull Out Bus Stop




Source: Delaware Valley Regional Planning Commission/SEPTA Bus Stop Design Guidelines (2012)

Figure 17 Curb Extension Paired with Partially Closed Pull Out Bus Stop




Source: Delaware Valley Regional Planning Commission/SEPTA Bus Stop Design Guidelines (2012)

# BUS STOP LENGTH

**Having bus stops with sufficient lengths are critical to the efficient operations of a bus system and the adherence to federal and state accessibility requirements.**

Safe and accessible bus stops must have sufficient space for a bus to pull into a stop, open both doors onto a sidewalk, and pull out of a bus stop into the travel lane. The minimum length required for bus stops to enable buses to sufficiently access to curb is a function of the length of a bus, bus stop placement, and bus stop configuration. Other factors impacting bus stop lengths include:

- Approach of bus turn movements
- Curb alignment and width of curb extensions and pull outs
- Road speeds, which impact the distances buses need for acceleration and deceleration
- Nearby crosswalks, parking, and driveways. Bus stops should allow stopped buses to clear crosswalks by at least 10 ft.[2]

Bus stops with inadequate space may force buses to stop in the travel lane and prevent customers from safely boarding and alighting the bus, if at all (see Figure 18).

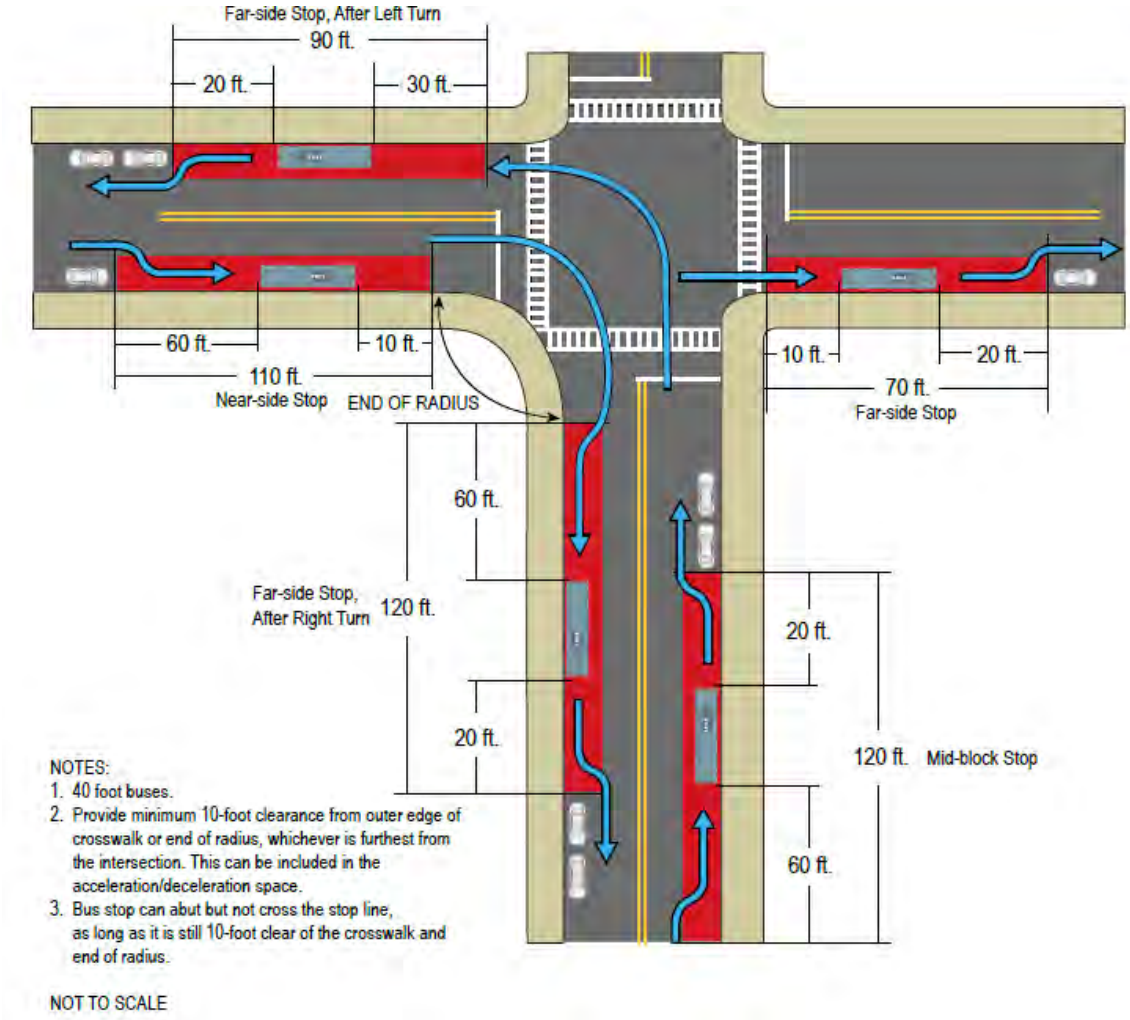
Figure 18 Inaccessible Loading Conditions Example

Source: DNAinfo

[2] At bus stop curb extensions AASHTO (2014) recommends 5 feet of clearance from a crosswalk, while the National Association of City Transportation Officials (NACTO) Transit Street Design Guide (2016) recommends providing at least 10 feet of clearance. The same principle should be applied to curbside stops, and this safety buffer has been adopted by various transit agencies including Southeastern Pennsylvania Transportation Authority (SEPTA), Tri-County Metropolitan Area Transportation District of Oregon (TriMet) and Washington Metropolitan Area Transit Authority (WMATA).

The length requirements for curbside bus stops can vary based on the stop placement. As shown graphically in Figure 19, far-side bus stops typically require the least amount of curb space, 70 ft., although this increases to 90 ft. after a left turn and to 120 ft. after a right turn. By comparison, near-side bus stops are typically 110 ft. And mid-block bus stops are typically 120 ft. Far-side bus stops after buses pass straight through an intersection are preferred to minimize curb space occupied by the bus stop.

Figure 19 Curbside Bus Stop Lengths




Adapted from AASHTO (2014) and Greater Cleveland Regional Transit Authority *Bus Stop Design Guidelines* (2015)

Figure 20 shows the recommended lengths for each component of a bus stop's length based on placement: the deceleration lane, stopping area for a 40' bus, and acceleration lane. Actual bus stop lengths may need to be adjusted based on site

specific conditions. Designing bus stops for a 40' bus ensures that the entire fleet can service a stop, allowing for flexibility in the future if buses are replaced or serve different bus stops; however, if a bus stop will only serve 35' buses there is opportunity to reduce the bus stop length if needed.

State law makes parking in a bus stop illegal, subject to a $100 fine. (MA Gen. Law Ch 90, § 20A)

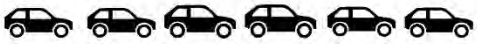
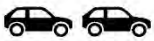
Figure 20 Detailed Bus Stop Lengths for 40' Bus

| Bus Stop Placement | Decel. Lane (ft.) | Stopping Area (ft.) | Accel. Lane (ft.) | Total Length (ft.) |
|---|---|---|---|---|
| Far-Side | 10 | 40 | 20 | 70 |
| Near-Side | 40 | 40 | 10 | 90 |
| Mid-Block | 50 | 40 | 20 | 110 |
| Curb Extension | 0 | 40 | 0 | 40 |
| Pull Out | 60 | 40 | 20 | 120 |

# PARKING IMPACTS

Recommended minimum and preferred bus stop lengths, as well as the equivalent number of spaces for a 40' bus by each bus stop placement and configuration are shown in Figure 21. A 40' bus is the longest in SRTA's current fleet and a typical bus length at many transit agencies. Parking displacement can be reduced if a bus stop is located at a fire hydrant, driveway, and/or the far-side of an intersection. In addition, curb extensions can reduce a bus stop's length and associated parking impacts by over 50%.

Figure 21 Bus Stop Lengths and Parking Equivalent for a 40-Foot Bus

| Stop Placement | Minimum | Preferred | Parking Equivalent |
|---|---|---|---|
| Far-Side | 60 ft. | 70 ft. | |
| Near-Side | 80 ft. | 100 ft. | |
| Mid-Block | 100 ft. | 110 ft. |  |
| Curb Extension | 30 ft. | 40 ft. |  |
| Pull Out | 115 ft. | 120 ft. | |

Assumed length of a parking space is 20 ft.
Total length of the curb extension and pull out do not include the taper.

## How can SRTA Reduce Conflicts Between Bus Stops and Parking?

Clearly defining the bus stop zone and municipal enforcement of no parking in bus stops are priorities for SRTA and two primary ways to reduce conflicts between curbside uses.

It is recommended that SRTA install concrete bus pads at all bus stops to provide definition of the bus stop zone and reduce the need for additional signage at the bus stop. See Chapter 7 for additional details.

Enforcement of no parking in bus stops is a municipal responsibility. Further information is provided in Chapter 8.

*Parking in the bus stop observed on Bedford Street in Fall River. Installation of a concrete pad would create visibility of the bus stop zone.*

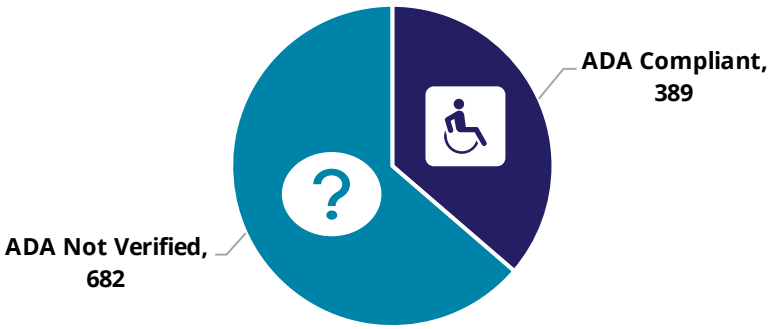
*Left image: Bus stop zones can be well defined with striping if the roadway owner maintains the markings*

# CHAPTER 3: ACCESSIBILITY

**The Americans with Disabilities Act (ADA) requires that bus stops have a minimum 5 ft. wide by 8 ft. deep landing pad and 4 ft. wide clear, unobstructed path of travel between a bus shelter and pedestrian routes.**

Even the best bus service falls short of its full potential if people cannot safely get to/from a bus stop and board/alight a bus. All bus trips start and or end as pedestrian trips and most bus stops exist within a broader network of pedestrian connections. Because of this, accessibility to bus stops, at the stop itself, and through the stop must be considered in bus stop design. As shown in Figure 22, approximately 36% of SRTA's bus stops are verified compliant as of 2017 with the Americans with Disabilities Act (ADA).[3]

Figure 22 SRTA Bus Stop Accessibility




[3] Nelson Nygaard Context Analysis, March 2022. Bus stops classified as "not verified" are a mix of non-compliant and u

# BUS DIMENSIONS

The design of an accessible bus stop must accommodate the buses that serve them. SRTA's existing fleet is primarily comprised of 35' buses and a few 40' buses, with other models being phase out of revenue service. SRTA's 35'-40' buses have wheelchair ramps at the front doors, bike racks to accommodate at least two bikes, front-end kneeling capabilities, and rear doors. SRTA paratransit vehicles rely on a different fleet. Since paratransit vehicles typically do not stop at fixed-route bus stops, they do not need to be considered in the design of fixed-route bus stops.

**At minimum, ADA requires that any new, altered, or relocated bus stops have two accessible features:**

## AMERICANS WITH DISABILITIES ACT

The Americans with Disabilities Act (ADA) is one of America's most comprehensive pieces of civil rights legislation that prohibits discrimination and guarantees that people with disabilities have the same opportunities as everyone else. It is an "equal opportunity" law for people with disabilities. The Department of Justice's revised regulations for Titles II and III of the Americans with Disabilities Act of 1990 (ADA) were published in the Federal Register on September 15, 2010. These regulations adopted revised, enforceable accessibility standards called the 2010 ADA Standards for Accessible Design ("2010 Standards"). On March 15, 2012, compliance with the 2010 Standards was required for new construction and alterations under Titles II and III. March 15, 2012 is also the compliance date for using the 2010 Standards for program accessibility and barrier removal. Section 810 references standards required for Transportation Facilities, including bus stops.

ADA Accessibility Guidelines (ADAAG) were the original guidelines developed by the US Access Board in 1991. The Department of Transportation implemented the ADA regulations by incorporating these guidelines verbatim in an Appendix to the Department of Transportation's Code of Federal Regulations 49, Part 37.

A set of Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG), developed by the US Access Board, provides guidance on ADA design. PROWAG was developed in 2011 but the guidelines have yet to be adopted by the Department of Justice. When they are adopted, they will become enforceable standards under Title II of the ADA.

**1. A 5 feet wide at the curb by 8 feet deep landing pad, also referred to as a landing pad, for someone to board a bus** (e.g., a sidewalk or concrete pad of sufficient dimensions). As shown in Figure 23 and Figure 24, a landing pad is the place where bus customers board and get off a bus at the front door. This is typically adjacent to the bus stop sign. The goal of an accessible landing pad is to provide adequate space with minimal slope for someone to get on and off the bus in a wheelchair.

*Two features are required at bus stops for ADA compliance:*
*1. A 5 ft. x 8 ft. landing pad*
*2. A clear, unobstructed path of travel*

Landing pads must have a firm, stable surface (ideally concrete) and maximum 2% cross slope. They should match the roadway slope as much as possible. Brick or stamped brick landing pads are not desirable due to concerns with leveling, maintenance, and accessibility. A grass strip, gravel, or tree pit are never appropriate for a landing pad.

Figure 23 Landing Pad and Clear Zone Areas at a Bus Stop in Boston, MA

Figure 24 Minimum Landing Pad Dimensions

Source: BCDCOG Transit and Bus Stop Design Guidelines (2021)

**2. A clear, unobstructed accessible path of travel.** While 4 ft. is the standard accessible path width to meet ADA requirements, a 5 ft. accessible path is preferred to allow two wheelchair users to pass one another (see PROWAG guidelines below). A 3 ft. path can be provided in circumstances with extremely limited right-of-way (ROW) and for the shortest distance possible, with a maximum distance of 200 ft., at which point a 5 ft. by 5 ft. passing zone must be provided. A 2 ft. 8 in. (32-inch) wide path of travel is permitted only in extenuating circumstances, such as at unavoidable brief pinch points, such as at a signpost. In cases where a Massachusetts Department of Transportation (MassDOT) or Massachusetts Architectural Access Board (MAAB) directive requires a 4 ft. or 5 ft. sidewalk (see State Accessibility Guidelines below), the 3 ft. ADA minimum is negated. Figure 25 illustrates the preferred, standard, and minimum ADA path of travel clearances at bus stops.

Accessible paths of travel are required in three locations:

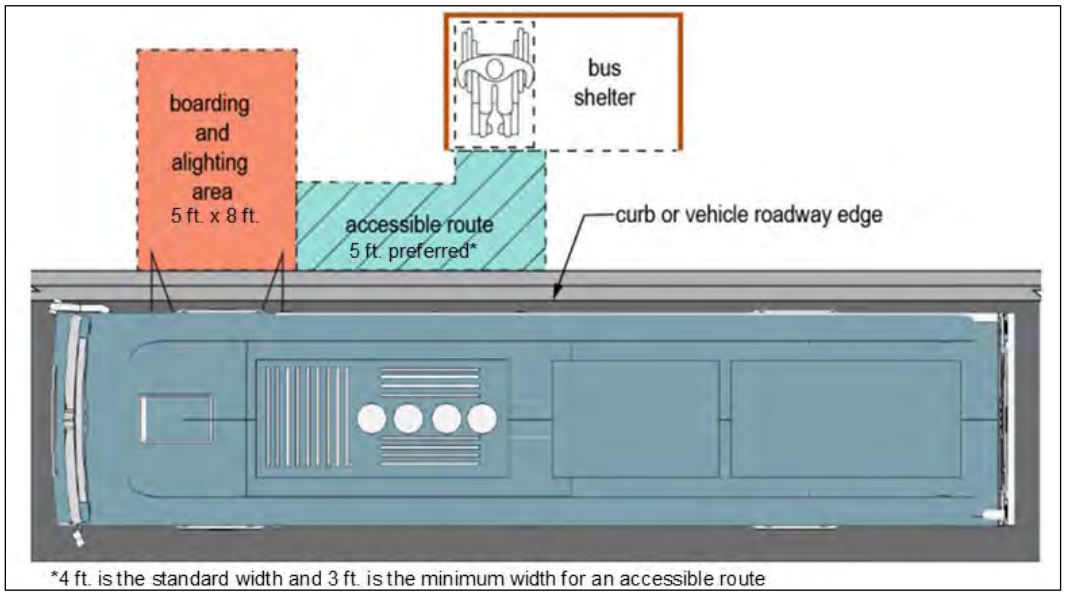
1. Between the landing pad and bus shelter, bench, leaning rail, or other amenities.
2. Between the landing pad and sidewalk and street.
   Bus stops at locations with no connecting sidewalks should be avoided. Not only does an isolated bus stop create safety concerns, but it also cuts off bus customers from the pedestrian network.
3. Horizontally through the bus stop, from one end to the other.

   The path of travel requirement allows for people, particularly users of mobility devices, to navigate through the bus stop. The accessible path of

travel through a bus stop can be behind or in front of customer amenities, such as shelters.

Figure 26, Figure 27, and Figure 28 outline minimum ADA landing pad and path of travel requirements.

Figure 25 Bus Stop ADA Clearances




Source: Rhode Island Bus Stop Design Guide (2017)

Figure 26 Minimum ADA Requirements for Bus Stops Landing Pads

| | |
|---|---|
| **Dimensions** | 5 ft. x 8 ft. |
| **Surface** | Stable, firm |
| **Curb Reveal** | 6 in. preferred, 5 in. min., 7 in. max. |
| **Perpendicular Clearance to Road** | 8 ft. min. |
| **Parallel Clearance to Road** | 5 ft. min. |
| **Cross Slope** | 1:48 max. (2%) |

Figure 27 Accessible Route Between a Landing Pad and Shelter, Sidewalk, Pedestrian Route, or Street

| | |
|---|---|
| **Width** | 3 ft. min., 4 ft. preferred, 5 ft. preferred (PROWAG) |
| **Running Slope** | 1:20 max. (5%) |
| **Cross Slope** | 1:48 max. (2%) |

Figure 28 Accessible Route Through Bus Stop Destinations*

| | |
|---|---|
| **Width** | 4 ft. min., 5 ft. preferred |
| **Cross Slope** | 1:48 max. (2%) |

*May involve coordination with other jurisdictions and property owners

# STATE ACCESSIBILITY GUIDELINES

State-level directives on accessibility apply to access to bus stops, but not the design of bus stops themselves. They include MassDOT Engineering Directive E-12-005: *Walks and Wheelchair Ramps*, which requires a minimum 4 ft. sidewalk (5 ft. is recommended), minimum 3 ft. wide path of travel, and minimum 5 ft. wide ramp at the curb line. These minimum sidewalk and path of travel widths align with those from the Massachusetts Architectural Access Board (MAAB).

# OTHER ACCESSIBILITY COMPONENTS

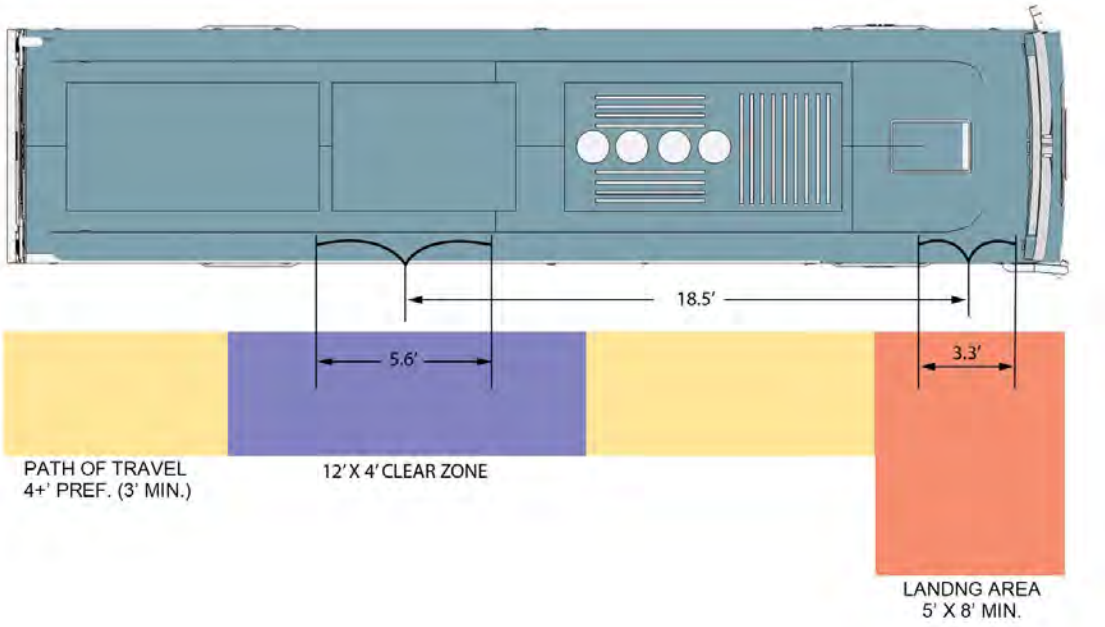
## Clear Zone

Although not required by ADA, clear zones for the rear door of the bus are critical for rear door customer activity to occur safely. The clear zone is the space between the rear door of the bus and sidewalk and should be free of driveways, fire hydrants, trees, poles, and other streetscape items usually found between the sidewalk and street. It should be 12 ft. wide by 4 ft. deep. In areas without a sidewalk buffer such as a grass strip, the clear zone comprises the sidewalk itself. Clear zones should be paved at higher ridership bus stops where rear door alighting is most likely to occur.

Landing pads and clear zones should be designed to accommodate SRTA's current and future bus fleet. SRTA's existing fleet is primarily comprised of 35' buses and a few 40' buses. SRTA may need to revisit landing pad and clear zone placement requirements if plans advance to add buses with different dimensions, including electric buses, to its fleet. To allow both doors of a SRTA fixed-route bus to open at the sidewalk and enable accessible boarding and alighting, a minimum of 23 ft. of

sidewalk is needed. The distance from the center of the clear zone should be 18.5 ft. from the center of the landing pad (see Figure 29).

Figure 29 Clear Zone Shown with Landing Pad




Source: Rhode Island Bus Stop Design Guide (2017), modified

# Bus Stop Signs and Amenities

Accessibility related to the siting of bus stop signs and other customer amenities is an essential component of bus stop design. Amenities that are not properly sited and inhibit a clear 4-ft. path of travel may make a bus stop inaccessible. Although additional accessibility guidelines provided in Figure 30 and Figure 31 are not federal requirements, they should be employed to design bus stops that are accessible for all abilities. Further guidance on the siting of signage and amenities is provided in Chapter 5.

Figure 30 Sign Accessibility Guidelines

| | |
|---|---|
| If Inside the ADA Landing Pad | Landing pad should be 2 ft. wider |
| Distance from Curb/Roadway Edge | 18 in. – 24 in. |
| Vertical Clearance from Ground to Bottom of Sign | 7 ft. min., 8 ft. max. |
| Content, fonts, and sizes must be ADA compliant | |
| Sign should identify the location of the bus stop | |

Figure 31 Amenity Accessibility Guidelines

| | |
|---|---|
| Clearance From Curb | 4 ft. min. not obstructing landing pad or accessible route |
| Clearance Around Shelter | 4 ft., 2 ft. is permitted when the back of the shelter abuts a wall |
| Installation in MassDOT's ROW requires a MassDOT Highway Access Permit. Installation on other public ROW or private property may require a license agreement, an easement and/or maintenance agreement. | |
| | |
| | |

# CHAPTER 4: AMENITIES

Amenities can help retain and attract customers to bus service by protecting customers from the weather, enhancing real and perceived safety, facilitate

**Amenities at bus stops improve the experience of waiting for a bus by providing comfort, safety, and convenience. Prioritizing locations to install amenities, as well as determining and adhering to maintenance responsibilities, will ensure that amenities effectively benefit bus customers in the long term.**

**See Chapter 8 for guidance on prioritizing the installation of bus stop improvements and common installation and maintenance responsibilities for each amenity.**

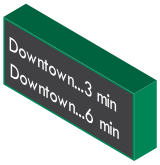
cleanliness, and provide service information.

Amenities covered in this guide include:

Landing pads

Bus stop signs

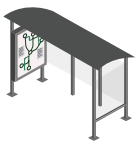
Lighting




Real-time information

Enhanced customer information

Benches and seating



Shelters and shade

Bike racks

Fare machines

Each amenity is discussed in further detail below. As discussed in Chapter 3, amenity placements must abide by ADA clearance and path of travel requirements.

# LANDING PADS

The landing pad, which is also known as a landing pad or boarding area, is the location at the bus's front door where customers get on and off the bus. Bus drivers use landing pads to deploy the bus's ramp when requested or required by customers. Additional information on landing pads, including their ADA requirements, are shown in Chapter 4.

# BUS STOP SIGNS

Every bus stop should have a sign at the front of the bus stop that is easily identifiable by customers and bus drivers and provides information to facilitate use of the transit service. The existing SRTA bus stop sign is comprised of the SRTA logo and "NO PARKING BUS STOP" beneath the logo. A comparison between the existing SRTA sign and a typical MBTA bus stop sign is shown in Figure 32. The SRTA sign lacks information on the route/destination that is served, transit agency contact information, and is not a unique, easily identifiable shaped sign, when compared to MBTA's.

Figure 32 SRTA Bus Stop Sign (left) compared to MBTA Bus Stop Sign

It is recommended that SRTA develop a new bus stop sign. Figure 33 provides a conceptual SRTA bus stop sign illustrating best practices. The sign should be branded and easily identifiable and be used at new bus stops and as a replacement sign at existing bus stops. The sign should include the following information:

- Route number
- Route direction e.g., "NB10 - Dartmouth Mall"
- Stop ID
- SRTA Logo
- SRTA website and customer service phone number
- No stopping

## Bus Stop Sign Best Practices

- Intuitively identify sign with a unique shape
- Provide passenger service and transit agency information
- Reinforce bus stop zone
- Use reflective material to increase visibility for bus and other drivers
- Mount on own post, separated from other signs when possible
- Serve as marketing for transit agency

Designing the sign to be double-sided would provide visibility for customers walking to a bus stop from either direction. In lieu of or in combination with a double-sided sign, SRTA could design a bus stop sign in a unique shape that is easily recognizable from behind. Including a QR code on the sign that can be updated on the back end allows for changing link information without needing to replace the decal or whole sign. Additionally, the sign should be made of fade-resistant material (e.g. – is retroreflective and has UV protection) to minimize maintenance and replacement of signs.

Figure 33 Example Conceptual Design illustrating best practice for a Revamped SRTA Bus Stop Sign

# Customer Information

With the advancement of smartphone technology and improvements in how transit agencies can track buses; detailed, current, and real-time information is now often available at a customer's fingertips. The SRTA Bustracker app provides real-time bus tracking and arrival alerts for customers and can identify the closest bus stop to a user's location. It is anticipated that this will be the primary means by which customers at bus stops will access information on schedules, maps, and bus locations in the near future.

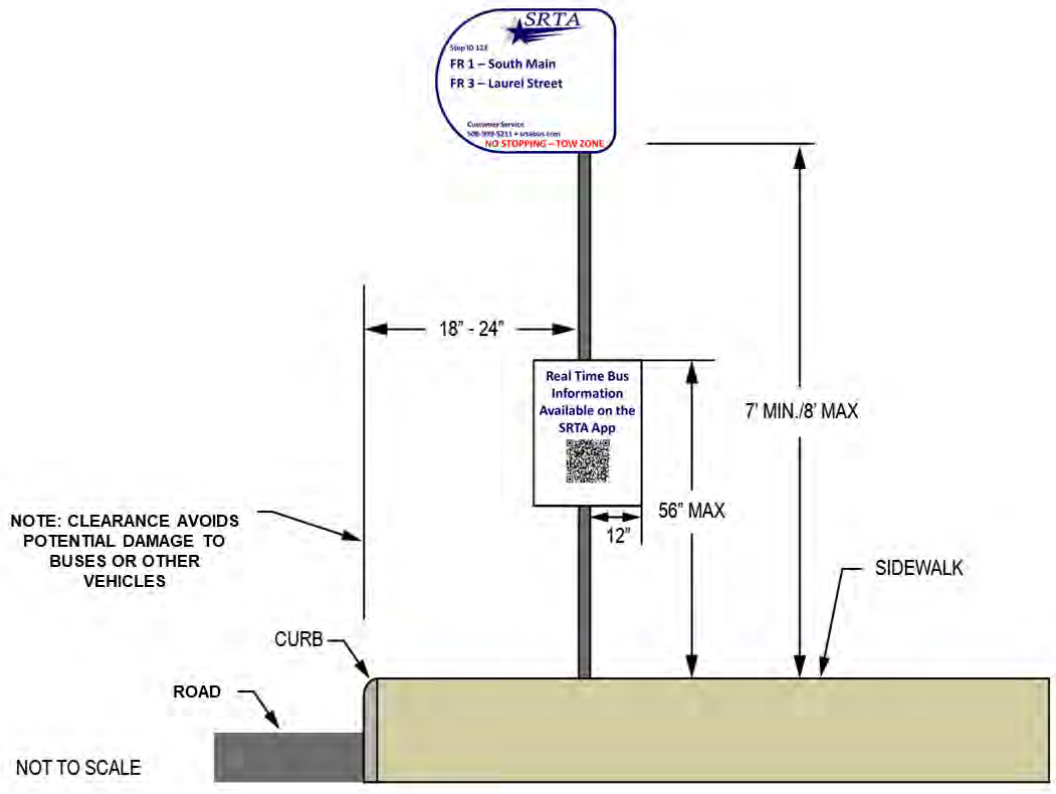
To enable ease of use of the SRTA system, each bus stop should have information directing customers to the app, such as a scannable QR code as well a visible Stop ID for the customer to enter into the app. Due to the continuously evolving nature of smartphone apps, this information should be provided on a secondary sign to avoid the need to refabricate whole signs in the future. This secondary sign should be placed no higher than 56" from the sidewalk.

## Sign Placement Considerations

Sign siting should adhere to the following considerations shown below and in Figure 34.

- The SRTA bus stop sign designates the front of the bus stop.
- Signs should be attached to freestanding posts, not utility poles.
- Signs should be on their own poles and not co-located with other street signs.
- Signposts should be 18-24 in. from the face of curb or edge of driveway.
- Bottom of the sign should be 7 ft. off the ground.
- An accessible path of travel between the sign and back of sidewalk must be maintained.
- Signs should be angled 30-45 degrees facing traffic flow to maximize the visibility to bus drivers. If signage includes customer information, consider angling 90 degrees to the curb so that it is easier for customers to read.

Figure 34 Bus Stop Sign Placement and Clearances




Source: OmniTrans Transit Design Guidelines (2013)

When bus stops are located in a parking lane, a no parking sign should be installed at the rear of the bus stop to avoid parked cars encroaching in the bus stop zone. The Manual on Uniform Traffic Control Devices (MUTCD) "No Parking Bus Stop" signs R7-7, R7-107R/L and R7-107a, one of which is shown in Figure 5-5, could be used by SRTA, municipalities or other landowners to accomplish this.

Figure 35 MUTCD No Parking Bus Stop Sign

# LIGHTING

Well-lit bus stops make customers feel safer, more secure, and more comfortable than bus stops in poorly lit areas. Lighting also helps bus drivers and other drivers see customers at bus stops. SRTA bus stops should be placed in well-lit locations with ample lighting from secondary sources, such as streetlights. At bus stops with shelters, the backlit lighting on a shelter advertising panel can also provide a source of lighting. Customized shelters could also integrate lighting into their shelters.

# REAL-TIME INFORMATION

Access to real-time information for bus location on route and or predicted arrival time at a particular bus stop greatly improves the convenience of bus service by allowing customers to check bus arrival times in advance, thereby minimizing the time they need it wait at a bus stop, particularly if a bus is delayed. Less time spent waiting at a bus stop is more time that can be spent at home, at an activity, etc.

Real-time information can be shown on digital screens or signs at bus stops in a similar manner to the information currently shown in The SRTA Bustracker app. Digital screens or signs may be appropriate at transit centers and high activity bus stops, which are discussed in Chapter 6.

# ENHANCED CUSTOMER INFORMATION

Enhanced customer information includes bus schedules, transit system maps, and local area maps.

Schedules help customers know when buses should arrive. Schedule information is particularly important on lower frequency bus routes so customers can try to avoid waiting for an unreasonable amount of time at a bus stop. Updating physical schedule information at bus stops is resource intensive, as it may need to be

updated several times per year to reflect seasonal service changes. It is also difficult to time updates so bus stops do not have newer schedule information before it takes effect, or too late after it takes effect. For these reasons, schedule information is recommended to be shared digitally, either through a smartphone app or real-time information screens or signs.

Transit system maps provide routing information for an entire bus trip and can be used to identify transfer locations. In addition, system maps can act as advertising for the bus system by showing people all the destinations they can access by bus.

Local area maps provide wayfinding information in areas with many destinations within walking distance, as well as in areas frequented by tourists. These maps can include walking distance radii from the bus stop indicating which destinations are accessible within a 5- or 10-minute walk. Examples of both maps are shown in Figure 5-6.

Figure 36 Local Area Map (RIPTA) and System Map (SRTA)

# BENCHES AND SEATING

The design of free-standing benches should be consistent across the SRTA system to help with the branding of bus stops and the system itself. Benches that are part of shelters are discussed in the Shelters and Shade section.

**Benches are a simpler and lower cost mechanism to provide comfort to bus customers than shelters, particularly on lower frequency and lower ridership routes. They can be better suited than shelters along roads with narrow sidewalks or right-of-way.**

SRTA does not currently have a standard specification for benches. While ADA does not specify guidelines for benches, PROWAG recommends that benches provide back support and armrests to help people sitting and standing. Armrests, particularly center armrests, also deter loitering. Standard benches should be at least 43 inches long (to accommodate 2 persons) and 20-24 inches wide[4] and have a seat height of 17-19 inches.[5] SRTA may choose to procure benches with a seat height closer to 19 inches to accommodate customer feedback on bench comfort.

All benches should have a 5 ft. minimum clearance in front of the bench; 4 ft. for an accessible path of travel plus 1 ft. to accommodate the feet of people sitting on the bench.

A variety of seating types, shown in Figure 44 should be used at SRTA bus stops depending on the context. Typically, benches with a back made of low maintenance material and a seat back are a good option where space allows. In constrained areas, or sidewalks with high volumes of pedestrian traffic, backless benches may be preferable so that people can sit on a bench in both directions. Both benches with and without backs increase the visibility of bus stops for existing and potential customers.

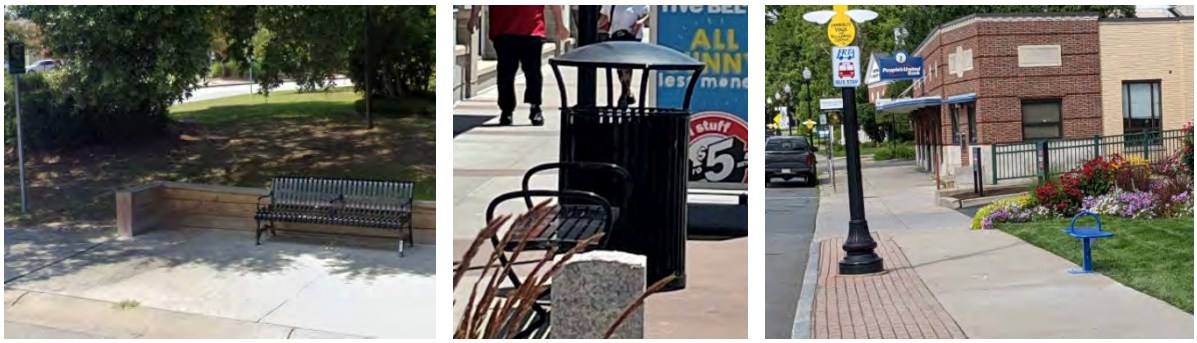
In further constrained areas, or areas with low ridership, stools or “Simme” seats are most appropriate. These can be attached to a bus stop sign post or be freestanding. In both cases, the seats should meet the same accessible path of travel clearances as standard benches (5 ft. clearance to allow for a 4 ft. path of travel and 1 ft. space for feet).

---

[4] NACTO Transit Street Design Guide

[5] PROWAG

Figure 37 Different types of bus stop seating to serve different contexts and ridership levels



Standard Bench in Charleston, SC (left), Backless Bench in SRTA region at SouthCoast Marketplace (middle), and, Simme Bus Stop Seats in Greenfield, MA (right)

**Bench and Stool Siting Considerations**

- Benches should have an unobstructed view of an oncoming bus.
- The back of sidewalk is the ideal position for a bench; however, benches should not be less than 5 feet from the curb when facing the road.
- Accessible paths of travel to and through the bus stop must be maintained.

# SHELTERS AND SHADE

Bus shelters protect waiting customers from the elements and act as an immediate placemaking tool for a transit system. Shelters are often synonymous with bus stops, even if most bus stops do not have shelters.

SRTA does not currently have a standard bus shelter, but the agency's existing shelters often lack visibility inside and out due to tinted panels, creating safety concerns and issues with bus drivers seeing waiting customers, and vice versa. In addition, many of SRTA's existing shelters only have one narrow point of entry, which can also present a concern for personal safety and accessibility.

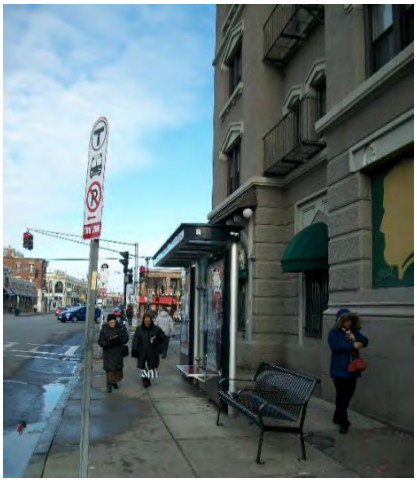
## Design Requirements

Shelter designs should be simple, functional, easy to maintain, and hinder vandalism. It is recommended that SRTA adopt standard off-the-shelf shelters of various sizes that can accommodate different volumes of customers. These specifications can also be shared with a developer who may be interested or required to install a shelter as part of a project.

All shelters should adhere to the following design principles, in addition to meeting ADA requirements, such as providing a minimum 30" wide by 48" deep area within the shelter to accommodate a wheelchair:

- Shelter front and side panels should limit or lack tinting, allowing people inside the shelter to easily see out, and for people outside the shelter to easily see inside.
- Customers should be able to easily see an approaching bus, and bus drivers should be able to easily see customers inside.
- There should be two or more points of entry or one large entry point.
- Materials should be resistant to graffiti, breaking, and shattering.
- If advertising is desirable, there should be sufficient space for advertising and a backlit panel.
- Shelters can vary in both size and panel configuration to fit different contexts. In any scenario, side shelter panels should extend close the ground to provide maximum protection from surrounding elements.
- One rear and two side panels: The 3-sided shelter is the most common configuration. Side panels protect customers from precipitation and wind, as well as provide an area for advertising panels.
- Removable side panels: Removing a side panel can improve circulation into the shelter or allow SRTA to install a second shelter without an adjoining side panel next to it, thus creating one large shelter. On narrow sidewalks, shelters with only rear or only side panels, or with one rear and one side panel, may be used to enable an accessible entry into the bus stop.
- Narrow shelter: A shelter with a narrower depth that only has a back panel to provide shelter from the elements. These are used in locations with narrow sidewalks where otherwise providing an accessible shelter would not be possible.
- Different types of shelters fit different sidewalk widths and allow for a clear path of travel. Examples of different shelter styles are shown in Figure 38 while additional design considerations are outlined in Figure 39.

Figure 38 Shelter Designs Examples



Narrow shelter in MBTA region (top left), Left- and rear-sided MBTA shelter in Boston, MA (top right), RIPTA rapid bus corridor shelter in Providence, RI (bottom left), and backless shelter in Cambridge, MA (bottom right)

Figure 39 Shelter Design Considerations

| Consideration | Details |
|---|---|
| Lighting | Can be provided by secondary sources, including a backlit advertising panel integrated into the shelter or by street lighting. |
| Art | Can be integrated into shelter designs. However, maintenance agreements for art installations should be determined before installation and shelter function should always be prioritized over shelter form. |
| Accessibility | Shelters should not block landing pads or clear zones and their placement should maintain accessible paths of travel to, within, and through the bus stop. |
| Heat | Custom shelters privately owned and maintained can consider adding a heating element to improve customer comfort during winter months |

# Placement Guidelines

Shelters should be placed facing the road, ideally 5 ft. from the landing pad. There should be at least a 4 ft. minimum clear path of travel around the shelter to allow for pedestrians to move through the bus stop and provide sufficient space to maintain the shelter. If this clear path of travel cannot be provided, then a curb extension may be considered to provide additional space at the bus stop, or if optional, work with the abutting property owner to place the shelter outside the public ROW.

Shelters with advertising panels need additional space to ensure the panels are accessible. A minimum of 4 ft. clearance is required for shelters with advertising panels at the front or back of shelters, although a 5 ft. clearance is preferred. Shelters may have a side clearance requirement to access and maintain advertising panels. This specification may vary between shelter manufacturers.

Figure 40 summarizes shelter siting guidelines, which should be adhered to for any shelter size or design. Figure 41 illustrates key shelter placement considerations. The clearances shown are from the shelter, not the shelter foundation. If the foundation is larger than the shelter, these clearances may need to be adjusted accordingly.

Figure 40 Siting Guidelines for Shelters

| Guideline | Distance | Notes and Considerations |
|---|---|---|
| Proximity to bus stop | 50′ | From landing pad (maximum) |
| Distance from back of curb | 6′ | To face of shelter, facing road. Can be reduced if side panel is removed. 2′ acceptable for shelters with no front windscreen and no side panel on one side. |
| Distance from back of curb | 2′ | To back of shelter from back of sidewalk. |
| Distance from back of curb | 2′ | To face of shelter roof/overhang, facing road, to avoid collisions with bus. |
| Distance from building entrance | 10′ | To shelter. Preferable not to locate in front of building access points/storefronts/or building windows used for display. |
| Distance from building face/tall boundary treatment on typical/narrow sidewalks - 12′ or less | 2′ | To back of shelter. With shorter, smaller or more transparent/accessible obstructions such as a planter or fence, 6″ is acceptable, as long as the shelter foundation and footings do not encroach on the abutting property and there is access for maintenance. |
| Distance from building face/tall boundary treatment on wide sidewalks - 13′ or more | 6′ | To back of shelter, allowing the pedestrian path of travel through the bus stop to flow behind the shelter, while customers congregate in the front of the shelter, at the face of sidewalk. |
| Sight distance | 12′ | From beginning or end of curb return of an intersection or large commercial access driveway to avoid obstructing sight distance. |
| Distance from crosswalk | 15′ | - |
| Distance from streetscape elements | 12′ | From fire hydrant |
| | 3′ | From in-ground elements such as manholes, tree grates, handholes, gas gates etc. If the shelter foundation is larger than the floor area of the shelter itself, increase the clearance by the difference between the foundation perimeter and shelter circumference. |
| | 5′ | From tree trunk |
| | 4′ | From other street furniture and vertical sidewalk elements - benches, poles etc. |
| Accessibility clearances | 80″ Min | Vertical clearance |
| | 6′<br>4′ Min | Horizontal clearance - pedestrian path of travel in front of or behind shelter. This may be reduced to 3′ at a pinch point. |

Adapted from OmniTrans Transit Design Guidelines 2013, MBTA 2014

Figure 41 Key Shelter Clearances

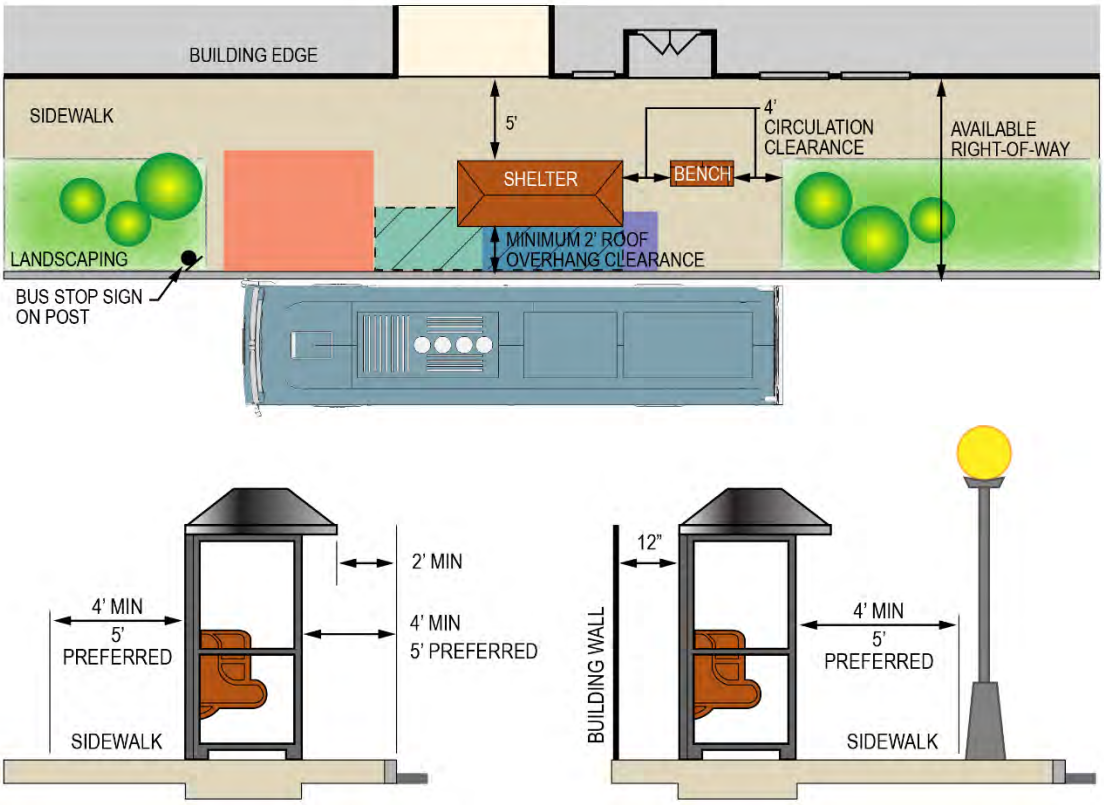



Image adapted from OmniTrans Transit Design Guideline (2013)

## CONSIDERATION FOR CUSTOM SHELTERS

While shelters should be placed based on the prioritization factors described in Chapter 8, municipalities and developers may want to fund shelters at other locations. Third parties such as municipalities and developers may install custom shelters. However, custom shelters should meet SRTA's minimum requirements for design and siting, and the entity that installs the shelter will be responsible for its maintenance, which must be documented in a maintenance agreement with SRTA. All future shelter placements should be evaluated by SRTA to ensure the proposed locations are feasible.

Property ownership should be confirmed prior to shelter installation. Shelters placed on private property will require permission from the property owner, shelters placed on MassDOT property will require an access permit, and shelters placed on municipal property may require municipal approval.

# Advertising

Advertising panels at shelters can provide revenue to transit agencies and or municipalities. Some transit agencies have agreements where a third-party vendor own and/or maintain shelters. While this is beneficial for some agencies, in select cases, transit agencies give some control over shelter placement to the vendor, who may prefer to place shelters with advertising panels where they will get the most attention from drivers, and not where they are most needed by customers.

SRTA currently has a vendor responsible for providing advertising at select shelters through the bus system. The vendor is only responsible for advertising and does not own or maintain shelters.

It is recommended that SRTA own and maintain shelters and rent panels to advertisers. This will allow SRTA to maintain control over shelter placement and maintenance, while enabling flexibility in its relationships with advertisers. Advertising panels on shelters should be prioritized on main corridors and high ridership bus stops.

# BIKE RACKS

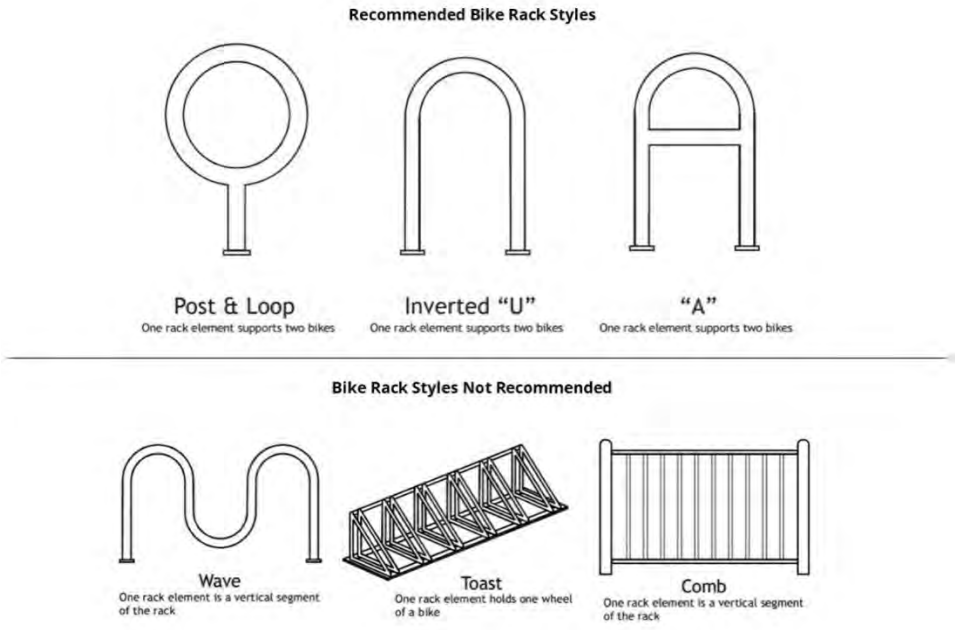
There are a variety of bike rack styles that can be installed at bus stops; however, the chosen style should meet the following considerations:[6]

- Permit the use of a high security lock, such as a U-lock
- Allow the frame of a bike and both wheels to be locked
- Not bend wheels or damage other parts, particularly when multiple bikes are locked

Figure 42 shows the bike rack styles that meet and do not meet these considerations:

[6] Federal Highway Administration University Course on Bicycle and Pedestrian Transportation, Lesson 17: Bicycle Parking and Storage, July 2006.
https://www.fhwa.dot.gov/publications/research/safety/pedbike/05085/pdf/lesson17lo.pdf

Figure 42 Bike Rack Styles




Source: Federal Highway Administration, https://www.fhwa.dot.gov/publications/research/safety/pedbike/05085/pdf/lesson17lo.pdf

In addition, installing canopies over bike racks is a cost-effective means of protecting bikes from inclement weather.

## Bike Rack Siting

When siting bike racks, SRTA should adhere to the following considerations:

- Bike racks must be outside the accessible paths of travel, ADA landing pad, and rear door clear zone.
- The location should be close to the bus stop and in a well-lit, highly visible area.
- Bike racks should be placed on a paved or concrete surface, not on grass or dirt.

# FARE MACHINES

Fare machines are kiosks similar to an ATM or multi-space parking meter where customers can purchase single fare tickets and multi-use passes. Currently, fare machines are located in SRTA's two bus terminals. Fare machines make it easier for customers to pay for a fare by providing flexibility to pay with cash or a card, enable off-board fare collection, and improve bus service by reducing dwell times

associated with cash-on-board payments Fare machines can be hard-wired or solar powered. Fare machine placement considerations include:

- Close to or in the bus stop zone
- Avoid encroachment on the landing pad or clear zone
- Allow for queuing at the machine that does not block an accessible path of travel
- Have sufficient solar exposure, if solar powered
- Does not interfere with or is not blocked by snow removal
- Does not obstruct views of bus drivers or from driveways and intersecting streets
- Does not obstruct access to buildings or street furniture
- Does not block windows

When placed on a sidewalk, fare machines may require a foundation be installed to support the device.

# TRASH RECEPTACLES

Trash and recycling receptacles help reduce litter at bus stops with high ridership and those in retail centers. At bus stops with shelters, trash receptacles can prevent wind-driven trash from accumulating in the shelters.

Emptying trash receptacles can be resource intensive at a network level and is difficult to time. For these reasons, it is recommended that developers or municipalities provide and empty trash receptacles as they likely already have trash services operating near each bus stop. SRTA could develop Memoranda of Understanding (MOUs) with each municipality and developer who provides trash receptacles at bus stops, documenting each entity's responsibilities.

# CHAPTER 5: BUS STOP TYPES

**While each of SRTA's 1,071 bus stops are unique, they generally fall into one of four categories of bus stops based on ridership, operating environment, and surrounding land uses. These categories, or typologies, will provide minimum, preferred, and optional amenities for all of the agency's existing and future bus stops**

Bus stop types categorize bus stops according to the amenities offered, as well as operational, service, and utilization characteristics. These typologies span all bus stops—from transit terminals and very high ridership bus stops—to bus stops with low ridership or only seasonal service. The minimum, preferred, and optional amenities for all of the agency's existing and future bus stops are outlined according to the following four typologies:

- Transit Terminals
- High Activity Bus Stops
- Off-Street Bus Stops
- Standard Bus Stops

These bus stop types aim to provide SRTA with clear and practical guidelines for amenities at bus stops, which support a structure and process to improve the overall transit system quality. No matter how many customers use a bus stop on a given day, each bus stop requires certain key design elements to be safe, accessible, reliable, and comfortable for customers. By formalizing the amenity installation process, SRTA can set clear goals for bus stop quality and provide justification for how and when bus stop upgrades occur.

## BUS STOP TYPES DEVELOPMENT PROCESS

SRTA's bus stop types were developed with close consultation with SRTA planners using findings from a robust context analysis (see Appendix C), recommendations from a peer review of other agencies' bus stop design guidelines, a review of the

regulatory environment in which SRTA operates, and feedback from stakeholder interviews with government officials, planners, and advocacy groups.

The major findings from this process informed the types and which bus stops were categorized into each:

- Bus stops vary widely in terms of amenities provided, curb condition, activity level, and potential customer market
- There exists a relatively small but extremely high concentration of transit demand and activity
- There is great potential to reach many customers with major investment at only a couple dozen bus stops, since ridership and transit activity is concentrated at a small number of bus stops
- Stakeholders will be key in partnering to improve bus stops, since many high- and medium-ridership bus stops are located at major activity centers (i.e., Bristol Community College and New Bedford Market Basket) and/or on private property
- There is a common and well-known lack of ADA compliance at many bus stops
- There is a major opportunity to improve signage and customer information at bus stops

The number of bus stops that fall into each category is a reflects the number of bus stops that would be served by SRTA following potential bus stop consolidation to ensure bus stop spacing is consistent with these guidelines. Appendix B describes the methodology and draft results of bus stop consolidation.

# BUS STOP TYPES

Figure 43 provides a summary of SRTA bus stop types and their characteristics.

Figure 43 SRTA Bus Stop Types Descriptions, Examples, and Characteristics

| Stop Types | Description | Examples | Average Weekday Boardings | Additional Considerations | # of Stops (as of Nov 2022) |
|---|---|---|---|---|---|
| Transit Centers | Official SRTA Transit Terminals | SRTA New Bedford Terminal, SRTA Fall River Terminal | 1,000+ | | 2 |
| High-Activity Bus Stops | Bus stops where ridership, transfer activity, and/or proximity to a major activity center merit higher investment | Trucchi's New Bedford, S Main St. & Broad St., Four Winds future South Coast Rail bus stops | 25 – 60 | | 18 |
| Off-Street Bus Stops | Bus stops located on private property where SRTA has limited control | Market Basket New Bedford, Fairhaven Stop & Shop, Bristol Community College, Seabra Market | Varies, up to 150 | SRTA will need to work with property owners and developers | 35 |
| Standard Bus Stops | The most typical bus stops, often served by 1 route, or on a high-frequency corridor near a High Activity Bus Stop. | Pleasant Street Post Office, Warren St and Plymouth Ave, Tripp Towers | < 25 | Along high-service corridors, most bus stops may be standard bus stops even with higher ridership. | 995 |

# Transit Centers

SRTA maintains two official transit centers: the SRTA New Bedford Terminal and SRTA Fall River Terminal (Figure 44).

Transit centers have the region's highest level of ridership and service, and they will receive the most amenities according to SRTA's bus stop typologies.

Figure 44 Fall River Terminal

# High Activity Bus Stops

As of July 2022, around 18 SRTA bus stops fall into the High Activity Bus Stops category. These bus stops have existing high transit activity and continued potential for growth. They are often located at major destinations, activity centers, or transfer locations. These destinations include but are not limited to hospitals, residential developments, and shopping centers. High Activity Bus Stops may also be located along busy corridors such as County Street, serving a wide variety of destinations both large and small. The Trucchi's bus stop, located on the near-side of Phillips Road at Acushnet Avenue near a Trucchi's grocery store, is one example of a High

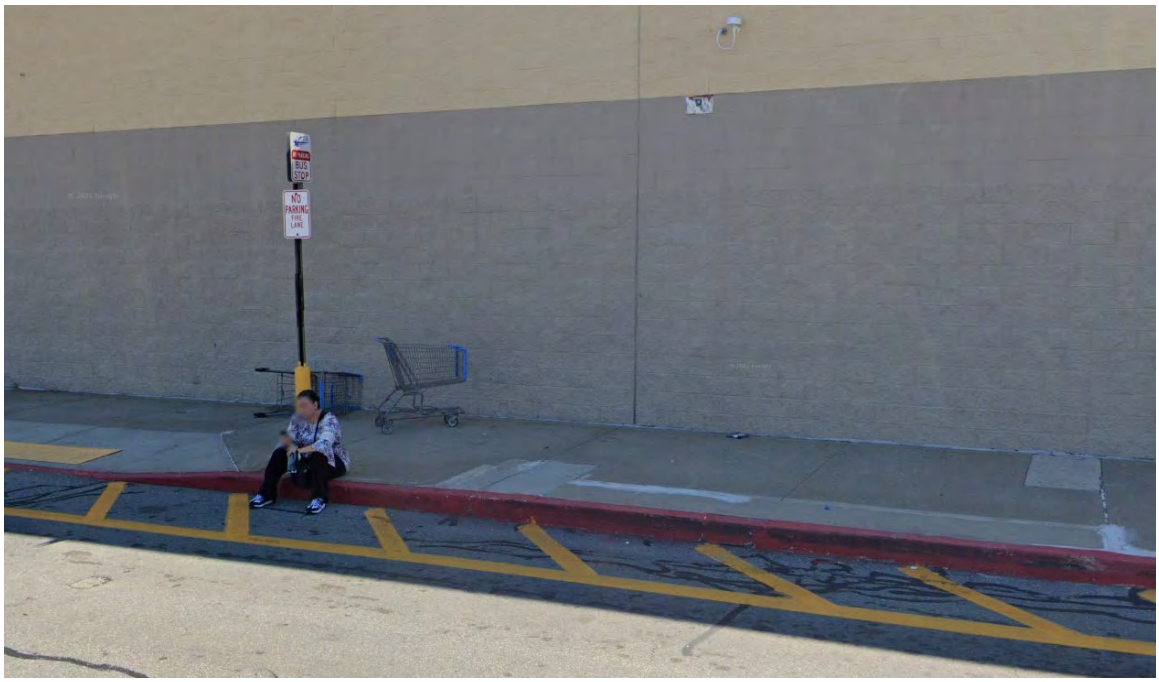
Activity Bus Stop (Figure 45). This type receives more amenities due to the high ridership and importance of these bus stops.

Figure 45 Trucchi's Stop

# Off-Street Bus Stops

As of July 2022, approximately 35 SRTA bus stops fall into the Off-Street Bus Stops category. These bus stops are located on private property, outside of the public ROW. Ridership and number of routes served varies widely. These bus stops often directly serve major retail, employment, and education destinations. Supermarkets and Walmarts are common locations for Off-Street Bus Stops (Figure 46). Other examples include Bristol Community College and Catholic Memorial Home. Because this bus stop type is not under the direct control of a municipality or public agency, minimum requirements only include ADA compliance and a bus stop sign, even at bus stops with very high ridership. Preferred and optional amenities must be negotiated with the property owner. Higher ridership off-street bus stops would preferably have similar amenities to High Activity Bus Stops, while lower ridership bus stops in this type would align more closely with Standard Bus Stops.

Figure 46 Walmart in Fairhaven, MA

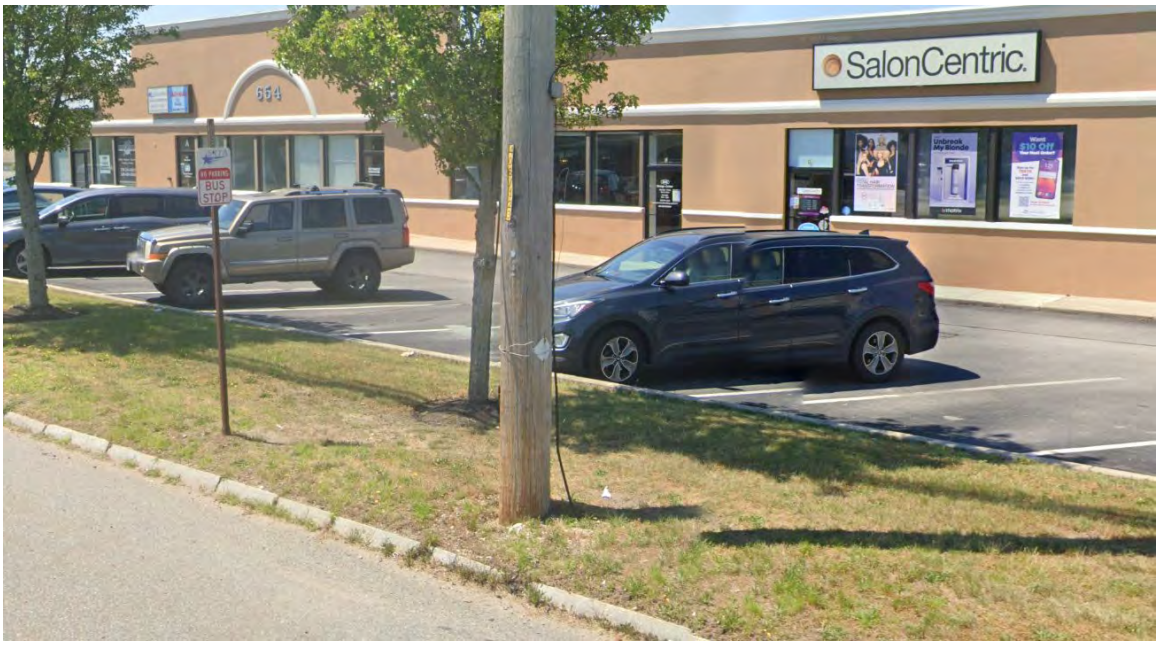



# Standard Bus Stops

The vast majority of SRTA bus stops (about 995) fall into the Standard Bus Stops type. These bus stops experience relatively lower ridership, and many serve only 1 bus route.

Because they range widely in terms of curb condition, ADA compliance, and room available for investment, these bus stops have minimum requirements that require only ADA compliance and a bus stop sign (Figure 47). These bus stops have a longer list of preferred amenities that are recommended to be included where space and funding allow.

Figure 47 Standard Bus Stop Examples




Clockwise: Highland Apartments, State Road at Wolcott Avenue, and 654 State Road

# AMENITIES BY BUS STOP TYPE

Figure 48 shows the minimum (✓), preferred (P), and optional (O) amenities for each of SRTA's four bus stop typologies:

- Minimum amenities are amenities required at each bus stop.
- Preferred amenities are amenities that are recommended for inclusion at bus stops but are not required because physical constraints or other factors may affect the inclusion of those features.
- Optional amenities are the remaining amenities that may feasibly be included at a bus stop.

Figure 48 SRTA Bus Stop Typologies and Amenities

Minimum (✓), Preferred (P), and Optional (O) Amenities

| Bus Stop Types | ADA Compliance | Bus Stop Sign | Lighting | Real-Time Information | Enhanced Customer Information | Trash Receptacle | Bench | Shelter | Bike Rack | Fare Machine | Parking |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| Transit Centers | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | O |
| High-Activity Bus Stops | ✓ | ✓ | ✓ | ✓ | ✓ | O | P | P | O | O | |
| Off-Street Bus Stops | ✓ | ✓ | P | O | P | O | P | P | | | |
| Standard Bus Stops | ✓ | ✓ | P | O | P | O | O | O | O | | |

# CHAPTER 6: ROADWAY CONTEXT

**Essential and supporting elements of bus stops occur both on the sidewalk and on the street. When designing a bus stop, considerations must be made for indicating the bus stop zone on the street, how the bus stop interacts with on-road bicycle facilities, and the potential for transit priority measures.**

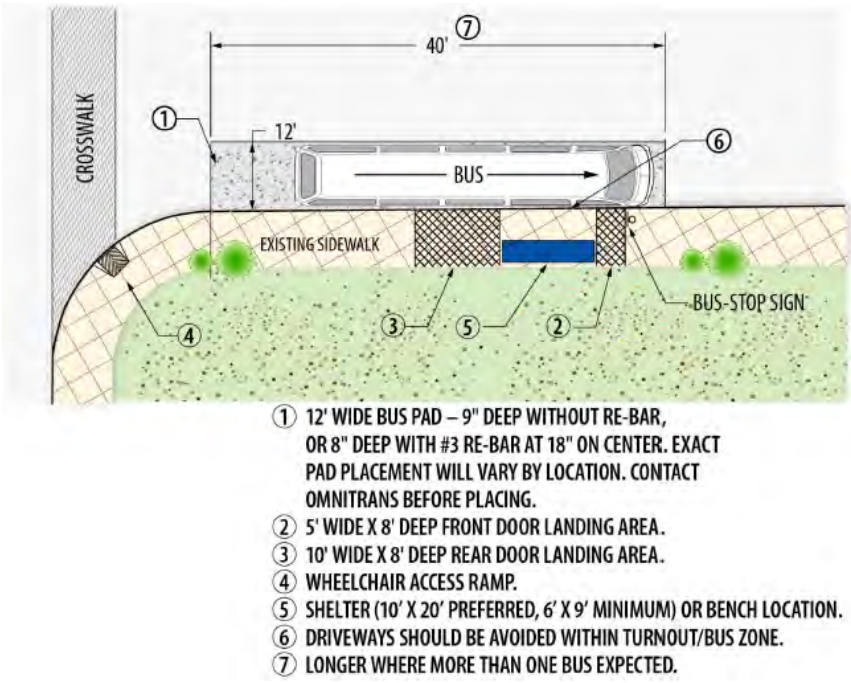
It is important to define the limits of the bus stop, so customers know where to wait, bus drivers know where to stop, and other drivers are aware of where not to park.

## BUS PADS

Bus pads are one method used to define the bus stop zone on the street. Bus pads must be a minimum of 8.5 ft. wide, although a width of up to 12 ft. is ideal to allow for some variability in where the bus driver stops the bus. The length of bus stop pads should cover the entire bus stop zone, including the deceleration and acceleration zones. An example design of a bus pad and its relationship to sidewalk bus stop elements is shown in Figure 49. Bus pads should be installed whenever capital bus stop improvements are made and used in all street contexts to define the bus stop.

Bus pads can be made of concrete or a modified hot asphalt mix (HMA). While concrete bus pads have a higher capital cost than a HMA or striping, they have minimal maintenance costs. In addition, concrete bus pads prevent the rutting of asphalt pavement that often occurs at bus stops due to the repeated movement of heavy buses.

Figure 49: Concrete Bus Pad Detail




Source: OmniTrans Transit Design Guidelines (2013)

HMA which is also known as Airport Mix, is an increasingly popular alternative material to concrete used to define the bus stop zone. It has different specifications than concrete bus pads and is a thicker layer than traditional asphalt used to pave roads. HMA is typically more cost effective to install than concrete and has a quicker curing time. Maintenance of HMA is also generally cheaper than concrete bus pads and it is easier to repair when disturbed by utility work. In addition, HMA provides better traction during wet or winter weather than concrete. However, HMA may require additional maintenance than concrete over the life of the material, but at lower cost.

SRTA should work with design engineers and roadway owners (i.e., municipalities) to determine which material is preferable for them to install and maintain.

**Bus pads should be installed as part of every capital improvement project at SRTA bus stops. Pavement markings can be used as an alternative if a third-party entity, such as a municipality or developer, agrees to maintain and refresh them when needed.**

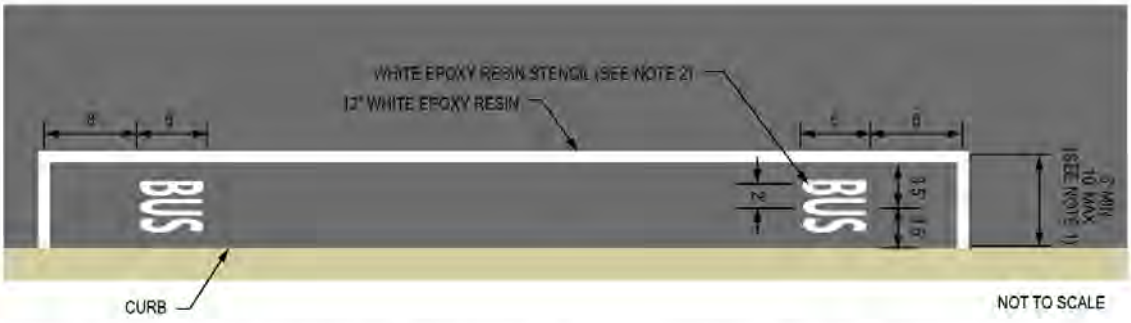
# STRIPING

As an alternative to concrete or HMA bus pads, roadway striping has lower upfront costs, but it must be refreshed when the markings fade. Figure 50 shows an example of a striped bus stop on Rodney French Boulevard in New Bedford.

Figure 50 Bus Stop Striping at the Howland Green Library

There are many different styles of bus stop pavement markings, but it is recommended that "BUS" legends are included in the bus stop zone to clearly indicate that it is an area only for buses. The outer edge of the bus stop zone should be striped with a 12-inch-thick white line. Municipalities may vary from this specification and stripe the bus stop zone lines using the same widths as their parking lane striping width if preferred. Figure 51 provides a striping detail. While SRTA may not apply the markings itself, it can guide municipalities, developers, and other entities who may stripe bus stops to follow these standards.

Figure 51 Bus Stop Striping Detail




NOTES:
1. BUS STOP STRIPING SHOULD MATCH OUTER EDGE OF EXISTING STRIPING. IN LOCATIONS WHERE THERE IS NO EXISTING STRIPING, OUTER EDGE OF BUS STOP STRIPING SHOULD BE 8' FROM FACE OF CURB UNLESS OTHERWISE NOTED.
2. IN CASES WHERE THREE "BUS" STENCILS ARE PROPOSED, THE THIRD STENCIL SHALL BE CENTERED BETWEEN THE FRONT AND REAR "BUS" STENCILS.
3. WHILE EPOXY RESIN IS PREFERRED, WHITE PAINT IS AN ACCEPTABLE ALTERNATIVE.

Thermoplastic striping is preferable to paint for better durability, although paint is an acceptable alternative. SRTA expects that roadway owners – typically municipalities and MassDOT – will maintain bus stop striping throughout the course

of their existing road maintenance responsibilities. Deviation from the recommended striping thickness may occur to match the standards of the respective roadway owners.

# BIKE ACCOMMODATIONS

As municipalities and MassDOT continue to add bicycle infrastructure on roadways across the Commonwealth, it is important that bus stops are designed to support dedicated road space for bicyclists. The cities of Fall River and New Bedford both have bicycle lanes on roadways with SRTA service (see Figure 52). As there is an opportunity to improve these bus stops in the future, and as bicycle facilities in the SRTA service region expand, it is important to consider how bicycle facilities can most safely be integrated with bus stops.

Figure 52 Bike Lanes at Bus Stops on Ashley Blvd., New Bedford (left) and Plymouth Ave., Fall River (right)

Bike lanes at bus stops can be configured in three ways, as shown in Figure 53.

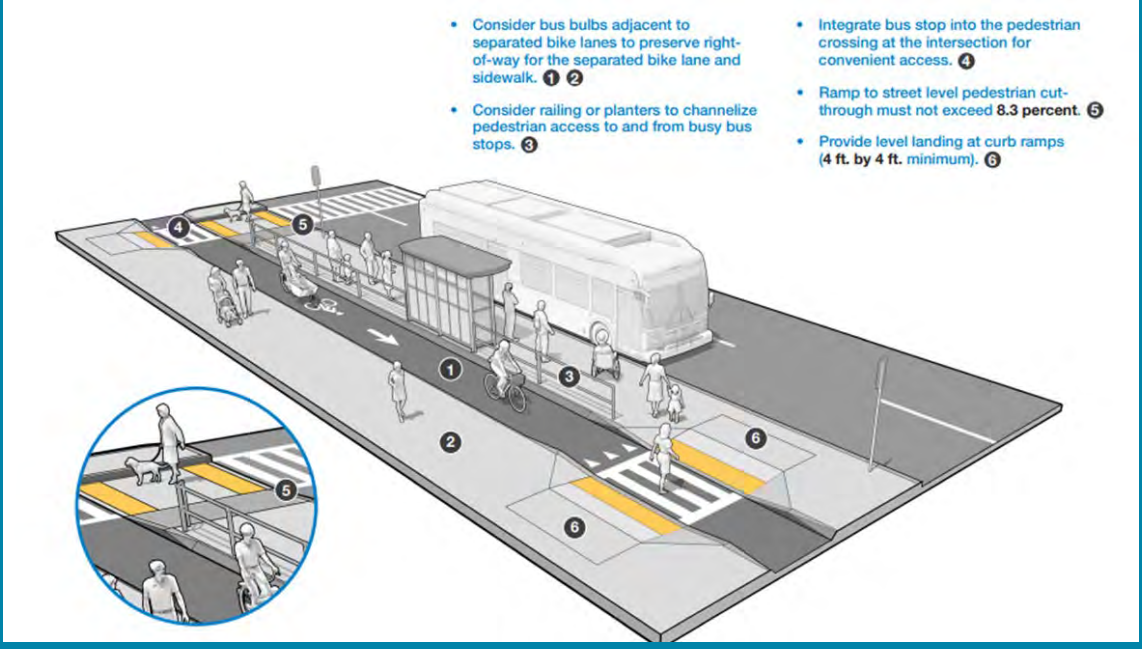
Figure 53 Configurations for Bus and Bike Lane Interactions

| Bike/Bus Lane Configuration | Description | Example |
|---|---|---|
| **Bike Lane Adjacent to Bus Stop** | Bike lanes adjacent to a bus stop are common where the bus stop is not in the travel lane. In these instances, it is recommended that the edge lines of the bike lane are dashed where a bus encroaches on the bike lane, entering or leaving a bus stop. | **Fall River, MA** |
| **Through a Bus Stop** | Buses may stop in a bike lane at bus stops that do not stop fully outside the travel lane. In these instances, the bike lane should have a dashed lane line in the bus stop zone to make bus drivers and bicyclists aware of the dual use of this segment of the bike lane. | **Wakefield, RI** |
| **Behind a Bus Stop (Floating Bus Stop)** | Placing bike lanes behind a bus stop separates the bus stop from the sidewalk network, creating a "floating bus stop" or "bus island." These are particularly useful on roads with high bus ridership and high volumes of people cycling or roads with protected bike lanes. | **Boston, MA** |

# FLOATING BUS STOPS

Floating bus stops are increasingly common and prevent conflicts between buses serving a bus stop and bicyclists in the bike lane. However, floating bus stops require a crosswalk across the bike lane to establish the conflict zone between customers and bicyclists. As with a crosswalk across a traditional travel lane, bicyclists must yield to people walking. The bike lane can be at the same grade as the sidewalk and floating bus stop or at street level, or midway between the sidewalk and street

Chapter 5 of MassDOT's *Separated Bike Lane Planning & Design Guide* contains additional information on floating bus stops, as well as a diagram of a floating bus stop at the far-side of an intersection, shown below.



# BUS PRIORITY

**Well-designed and accessible bus stops can facilitate faster and more reliable bus service.**

Bus stop design is often a component in the design of bus priority corridors to maximize an investment of bus priority elements. The bus stop spacing, placement, configuration, and design considerations outlined in these guidelines can reduce delay in bus operations resulting from the time it takes for a bus to arrive and depart from a bus stop, as well as its dwell time at a bus stop.

This section is intended to provide high-level guidance on bus priority treatments to SRTA and Southeastern Massachusetts municipalities. Detailed guidance on bus priority treatments can be found in the (forthcoming in 2022) MBTA's Transit Priority Toolkit and the NACTO Transit Streets Design Guide.

## Bus Lanes

Bus lanes provide dedicated road space to buses, which can result in significant travel time savings and reliability improvements for buses, particularly on congested corridors.

They can be placed next to a sidewalk/curb or be offset from a sidewalk/curb next to a parking lane. Curbside bus lanes will have in-lane bus stops. Parking off-set bus lanes can be paired with a curb extension or floating bus stop to create an in-lane bus stop and maximize the benefits of the bus lane.

Bus lanes can be operational full or part-time (e.g. – during peak hours) and may be exclusive to buses or shared with bicycles, delivery trucks, or traditional taxis (see bottom of Figure 54). Part-time bus lanes can revert to parking, sometimes in conjunction with a bike lane, during off-peak hours, as seen in Roslindale (see top of Figure 54).

Figure 54 Bus Lanes

Shared part-time bus lane in Boston (Roslindale), MA (top); Exclusive bus lane in Boston (Brighton), MA

Source: Mbta.com

# Traffic Signal Coordination

Traffic signals in close succession should be coordinated to promote the efficient movement of buses and avoid frequent stops at red lights and bus delays due to stop-and-go traffic. SRTA should work with municipalities and MassDOT, who own the traffic signals on SRTA bus routes, to ensure that traffic signals are coordinated where feasible.

# CHAPTER 7: IMPLEMENTATION

**Because SRTA does not own the land at typical on-street bus stops, it is reliant on other parties to construct or approve the construction of new and improved bus stops.**

**With finite resources, SRTA should prioritize bus stop improvements and amenities using objective criteria, the most of important of which is ridership, to maximize improvements for the largest amount of SRTA customers.**

## BUS STOP LOCATION MODIFICATIONS

Adding, removing, or modifying bus stops should follow SRTA's Bus Stop Location Policy. The Policy should be updated so that references to alternative locations for bus stops proposed for removal are consistent with the recommended minimum bus stop spacing based on land use context (see Chapter 2).

## BUS STOP IMPROVEMENTS

Making basic bus stop improvements and installing amenities will primarily occur through two mechanisms: as part of larger roadway or development projects and through standalone bus stop improvements. Standalone bus stop improvements require an objective method to prioritize the installation of amenities since SRTA has finite financial resources that cannot accommodate all improvement requests.

SRTA measures the frequency at which a bus serves customers at a bus stop to normalize boardings and alightings to the number of trips serving a bus stop. SRTA refers to this as "stop use" and it is intended to balance bus stops with low boardings that occur frequently with bus stops that have high boardings that occur infrequently.

SRTA determines bus stop use through a two-step process:

1. Assess whether each bus trip stopped at a bus stop resulted in at least one boarding or one alighting. If there was either one boarding or one

alighting, a value of 1 is assigned to the bus stop for the bus trip; if either is false, a value of 0 is assigned to the bus stop for the trip.

2. Sum the total of the trip values from Step #1 and divide it by the total number of trips serving the bus stop for the period of time being evaluated.

The resulting figure is reported as a percentage. The SRTA systemwide average for bus stop frequency in October 2021 was 14%, which indicates that many bus stops are not used in a typical week.

Figures 8-1 and 8-2 provide two hypothetical examples of calculating bus stop use.

Figure 55 Bus Stop Use Calculation at a Stop with Hourly Weekday Service

| 7AM | 8AM | 9AM | 10AM | 11AM | 12PM | 1PM | 2PM | 3PM | 4PM | 5PM | 6PM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| Value Total = 4 boardings or alightings | | | | | | | | | | | |
| Bus Stop Use = 33% (4 boardings or alightings/12 trips) | | | | | | | | | | | |

Figure 56 Bus Stop Use Calculation at a Stop with Peak Period Weekday Service

| 7AM | 8AM | 9AM | 10AM | 11AM | 12PM | 1PM | 2PM | 3PM | 4PM | 5PM | 6PM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | 0 | 1 | 1 |
| Value Total = 4 boardings or alightings | | | | | | | | | | | |
| Bus Stop Use = 66% (4 boardings or alightings/6 trips) | | | | | | | | | | | |

SRTA should use the following rubric to prioritize the construction of bus stop improvements Figure 57. The draft results of SRTA's bus stop prioritization are described in Appendix B.

Figure 57 Basic Bus Stop Improvement Prioritization Rubric

| Criteria | Thresholds |
|---|---|
| Ridership – Sum of Average Weekday Boardings + Alightings | ▪ 40 points if sum is greater than 40<br>▪ 20 points if sum is between 20 and 40 |
| Ridership Frequency | ▪ 40 points if frequency is more than 1 standard deviation above the average<br>▪ 20 points if frequency is between the average frequency and 1 standard deviation above |
| Existing Sidewalk/Accessibility Conditions, based on three sub-criteria:<br>▪ ADA compliant<br>▪ Hazard-free boarding area<br>▪ Accessible adjacent sidewalk | ▪ 20 points if no criteria met<br>▪ 15 points if one criterion met<br>▪ 10 points if two criteria met |
| Zero Vehicle Households/ Environmental Justice Area | ▪ 10 points if zero-vehicle household percentage for Census Block Group is greater than the average percentage across SRTA's service area<br>▪ -5 points if not located in an Environmental Justice Area, defined as both Low-Income and Minority in Title VI analysis |
| Located adjacent to a point of interest, as defined in the Bus Stop Optimization model | ▪ 10 points |
| Part of Corridor Initiative to Strengthen Neighborhood Identity | ▪ 5 points |

The rubric does not account for the feasibility of shelter installations. At some locations, ROW or other physical constraints may prohibit the installation of a shelter or other amenities.

It is recommended that bus stop improvements be made concurrently for the two bus stops that comprise a bus stop pair, since bus customers typically travel round-trip from the same location. In addition, improving both bus stops in a bus stop pair results in a more efficient use of agency resources (many aspects of design and construction services can be done as one project) than improving bus stops individually. Exceptions can be made if one bus stop is already in good condition.

## Amenity Costs

Although the cost of installing bus stop amenities is often a fraction of the cost of a roadway project, implementing bus stop improvements can get expensive, particularly when looking to improve bus stops along a corridor or systemwide. Figure 58 includes estimates of the capital costs for SRTA-approved amenities. These costs are intended to only provide high-level information on the approximate cost of each amenity. They are subject to change, including due to inflation, local price adjustments and supply chain pressures.

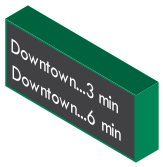
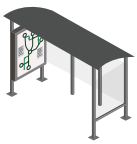
# AMENITY INSTALLATION AND MAINTENANCE

The maintenance and installation of bus stop amenities are often the responsibility of multiple entities, including SRTA, municipalities, MassDOT, and private landowners. Figure 59 details the most common responsibilities for bus amenity installation and upgrades.

Figure 58 Amenity Capital Costs

| Amenity | Est. Capital Cost per Each ($2022 USD) | Cost Source |
|---|---|---|
| Landing Pad | $1,540 ($39/square foot for 8' x 5' pad) | GoCary bid, 2021 |
| Basic Bus Stop Sign and Pole | $800 | GoRaleigh internal costs, 2022 |
| Real-Time Information | $8,000 | GoRaleigh internal costs, 2022 |
| Double-sided Improved Bus Stop Sign | $25+ | JTRAN bid, 2022 |
| Enhanced Customer Information (double-sided informational sign to attach to pole at eye-level) | $25+ | JTRAN bid, 2022 |
| Bench | $1,200 | GoRaleigh internal costs, 2022 |
| Simme-seat | $705 | Simme LLC, 2022 |
| Shelter, includes 1 bench and 1 lean bar | $7,200 | GoRaleigh internal costs, 2022 |
| Bike Rack (U-rack) | $500 | GoRaleigh internal costs, 2022 |
| Trash Receptacle | $800 | GoRaleigh internal costs, 2022 |
| These costs do not include engineering or installation costs. | | |

Figure 59 Amenity Responsibilities

| Amenity | SRTA | Muni/MassDOT/Developer |
|---|---|---|
| **Landing Pad** | Install<br>Coordinate | Install<br>Maintain |
| **Bus Stop Sign** | Install | Coordinate |
| **Street Lighting** | n/a | Install<br>Maintain |
|   **Real Time Information** | Install<br>Maintain | Coordinate |
| **Enhanced Customer Information** | Install<br>Maintain | n/a |
| **Seating** | Install<br>Maintain | Install<br>Maintain (custom) |
|  **Shelters** | Install<br>Maintain | Approve<br>Install<br>Maintain (custom) |
| **Bike Parking** | Install<br>Maintain | Install<br>Maintain |
| **Trash Receptacles** | n/a | Install<br>Empty<br>Maintain |

# MUNICIPAL RESPONSIBILITIES

## Planning

SRTA can encourage municipalities to consider conducting audits of bus stops under its jurisdiction to determine major concerns or accessibility issues. Municipalities may partner with SRTA and/or SRPEDD in these audits. These audits can facilitate the efficient inclusion of bus stop improvements in roadway projects when these projects reach the design phase.

## Construction

SRTA expects that municipalities will upgrade bus stops to be ADA compliant when sidewalks are reconstructed and install bus pads using concrete or hot asphalt mix, or stripe bus stop zones, when roadways are being repaved. Municipalities are strongly encouraged to collaborate with SRTA during the scoping and early design phases of projects impacting bus stops.

For bus stop improvement projects being led by SRTA, the agency will need to coordinate with municipalities or MassDOT for plan review and obtain necessary approvals and permits.

## Operations

To promote efficient operation of the SRTA bus system, SRTA expects that municipalities will fulfill the following procedures:

- Strictly enforce parking regulations at bus stops.
- Maintain amenities that they install, including emptying trash receptacles and maintaining custom shelters.
- Maintain and refresh bus stop striping as part of roadway projects along bus routes.
- Clear snow from the bus stop zone to enable customer access to bus stops. Some of this responsibility may be transferred to abutters by municipal ordinance.

# STATE RESPONSIBILITIES

## Construction

SRTA expects that MassDOT will upgrade bus stops to be ADA compliant when sidewalks are reconstructed and stripe bus stop zones when roadways are being repaved. MassDOT District 5 is strongly encouraged to collaborate with SRTA during the scoping and early design phases of projects impacting bus stops. For bus stop improvement projects being led by SRTA, MassDOT District 5 will need to review and approve plans and issue permits.

## Operations

MassDOT is expected to maintain and refresh bus stop striping as part of roadway projects along bus routes.

# DEVELOPER RESPONSIBILITIES

## Construction

At the direction of municipalities, developers can be required to construct bus stops and provide amenities consistent with the nature of the development and anticipated ridership at the bus stop. Developers are strongly encouraged to collaborate with SRTA on the consideration of amenities to install and consult with SRTA for bus and bus rider roadway design best practices and may be required to evaluate bus schedule impacts if off-street bus stops are proposed.

## Operations

SRTA expects that developers maintain amenities, including regularly emptying trash receptacles and maintain shelters that they install. In addition, developers are responsible for shoveling snow at bus stops on their property to provide a clear path of travel and ensure access.

# APPENDIX A: SRTA BUS TURNING RADII

Figure 60 | 29' Bus Turning Radius

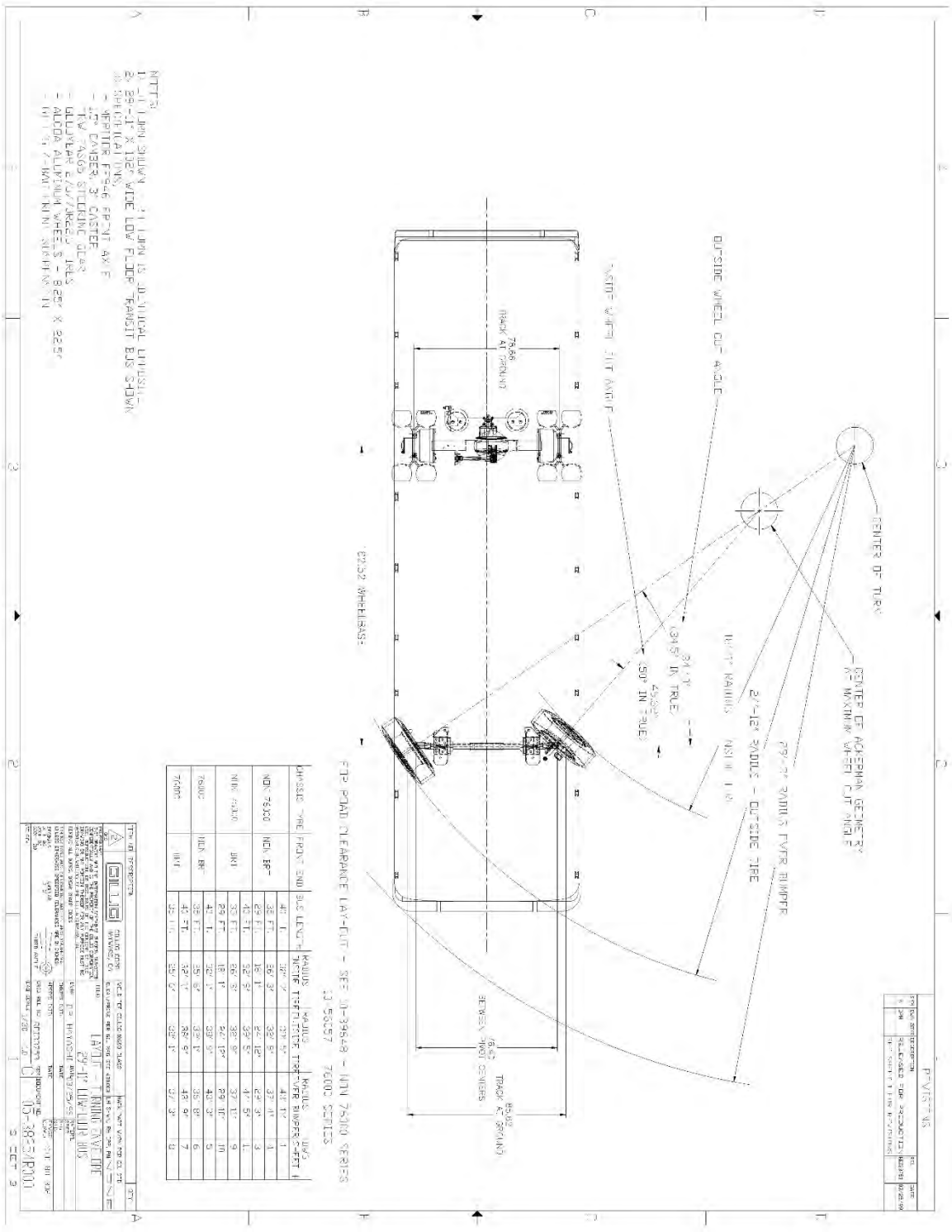
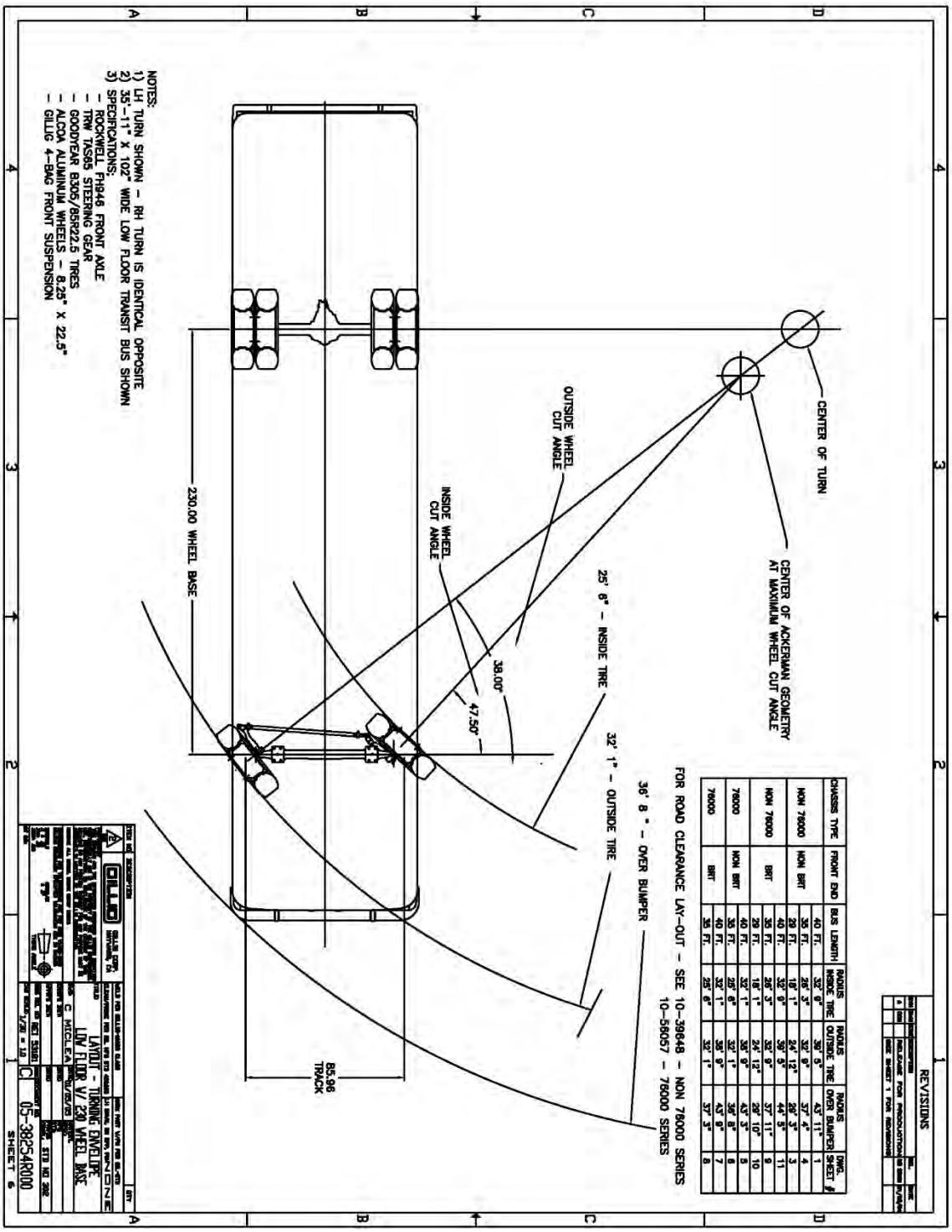
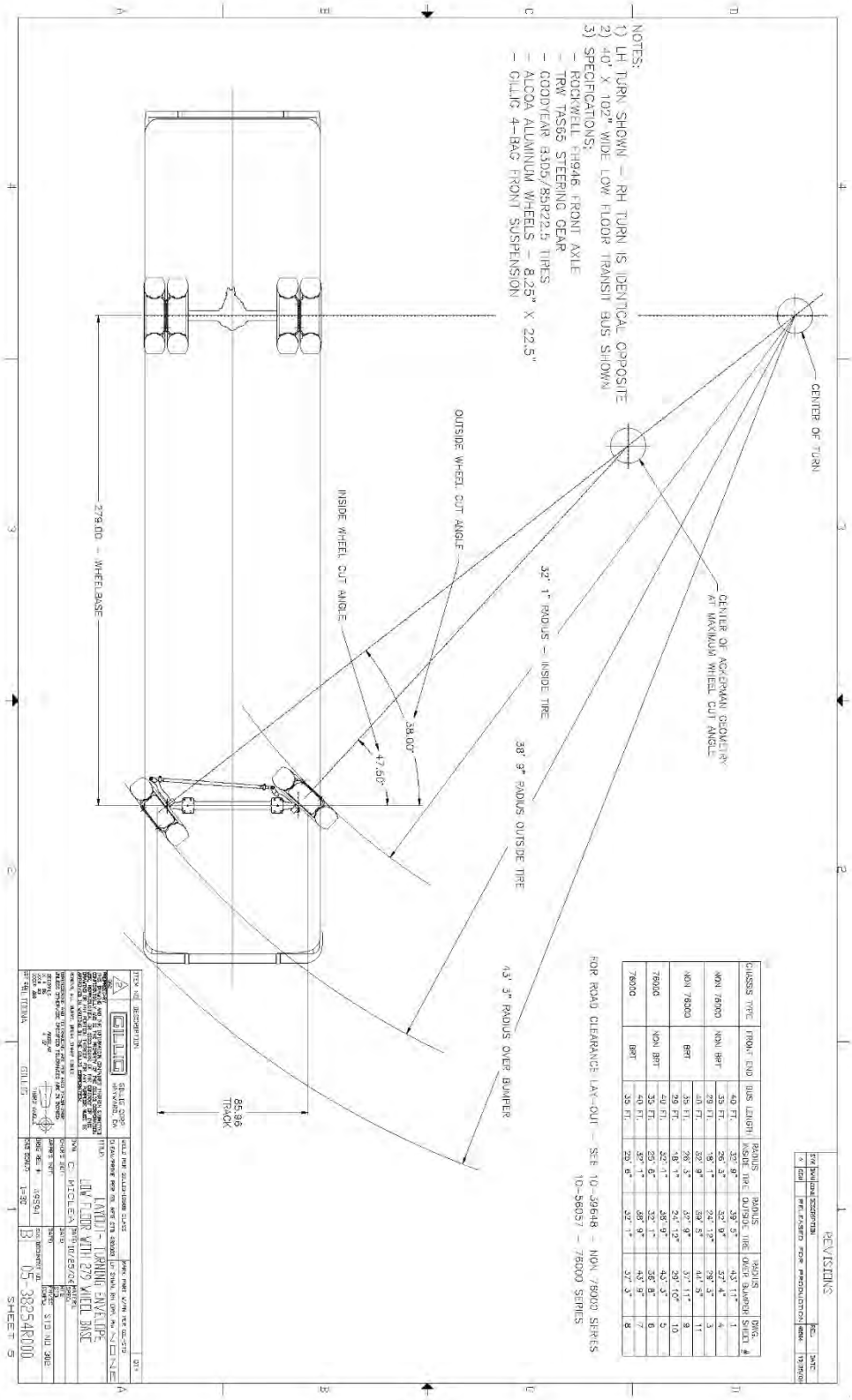


Figure 61 | 35' Bus Turning Radius




| CHASSIS TYPE | FRONT END | BUS LENGTH | RADIUS INSIDE TIRE | RADIUS OUTSIDE TIRE | RADIUS OVER BUMPER | DWG. SHEET # |
|---|---|---|---|---|---|---|
| NON 78000 | NON BRT | 40 FT. | 32' 0" | 38' 5" | 43' 11" | 1 |
| | | 35 FT. | 28' 3" | 32' 8" | 37' 4" | 4 |
| | BRT | 29 FT. | 18' 1" | 24' 12" | 28' 3" | 3 |
| | | 40 FT. | 32' 0" | 38' 5" | 44' 5" | 11 |
| NON 78000 | | 35 FT. | 28' 3" | 32' 9" | 37' 11" | 9 |
| | | 29 FT. | 18' 1" | 24' 12" | 28' 10" | 10 |
| 78000 | NON BRT | 40 FT. | 32' 1" | 38' 9" | 43' 3" | 5 |
| | | 35 FT. | 28' 6" | 32' 1" | 36' 8" | 6 |
| | BRT | 40 FT. | 32' 1" | 38' 9" | 43' 8" | 7 |
| 78000 | | 35 FT. | 28' 6" | 32' 1" | 37' 3" | 8 |

Figure 62 | 40' Bus Turning Radius




| CHASSIS TYPE | FRONT END | BUS LENGTH | RADIUS INSIDE TIRE | RADIUS OUTSIDE TIRE | RADIUS OVER BUMPER | DWG. SHEET # |
|---|---|---|---|---|---|---|
| NON 76000 | NON BRT | 40 FT. | 32' 8" | 38' 5" | 43' 11" | 1 |
| | | 35 FT. | 28' 3" | 32' 9" | 38' 4" | 3 |
| | | 30 FT. | 23' 9" | 27' 5" | 33' 1" | 5 |
| | | 40 FT. | 32' 8" | 38' 5" | 43' 11" | 11 |
| NON 76000 | BRT | 35 FT. | 28' 3" | 32' 9" | 38' 4" | 9 |
| | | 30 FT. | 23' 9" | 27' 5" | 33' 11" | 9 |
| 76000 | NON BRT | 40 FT. | 32' 1" | 38' 9" | 43' 3" | 5 |
| | | 35 FT. | 25' 6" | 32' 1" | 36' 8" | 6 |
| | | 40 FT. | 32' 1" | 38' 9" | 43' 3" | 7 |
| 76000 | BRT | 35 FT. | 25' 6" | 32' 1" | 37' 3" | 8 |

# APPENDIX B: BUS STOP CONSOLIDATION METHODOLOGY AND IMPLEMENTATION GUIDANCE

# BUS STOP CONSOLIDATION METHODOLOGY AND IMPLEMENTATION GUIDANCE

SRTA's Getting On Board bus stop balancing plan would consolidate 261 stops but only 9% of existing boardings. The resulting systemwide bus stop spacing would be ¼ mile, and it would result in 1% fewer residents within ¼ mile of a bus stop. It is expected that with fewer and more consistently spaced stops to serve and maintain, SRTA can provide more reliable service and invest more money to make its bus stops safer, more accessible, and more comfortable.

In accordance with the SRTA Bus Stop Design Guidelines, the project team conducted an analysis of SRTA routes to identify stops for consolidation. This document presents the methodology and results for bus stop consolidation, including the initial model and public feedback received, and guidance on implementing the recommendations.

## BUS STOP OPTIMIZATION MODEL

In determining appropriate bus stop spacing, there are three key variables to consider. These variables are:

1) Walking distance to the bus stop
2) The travel time onboard the bus, and
3) The operating cost required to service all bus stops along the route.

To develop the optimum stop spacing, these variables must strike a balance between the efficient operation of service (faster service) and the need for accessibility (walk distance to bus stops). Research has found that most U.S. transit

agencies have an average stop spacing of 6 – 8 stops per mile[7], SRTA falls into this category, with an average stop spacing of 820 feet[8], or about 6 stops per mile. At these distances, services are favoring access over speed and cost efficiency. This same research has found that a stop spacing of 4 – 5 stops per mile (1,056-1,320 foot spacing) provides the optimum balance of access, service speed, and cost efficiency.

# Model Approach

The bus stop optimization model aims to improve stop spacing while also prioritizing keeping the most desirable and appropriate stops. This process relies on protecting stops that are not appropriate to eliminate, and then scoring the remaining stops using a set of several criteria.

## Protected Stops

Some stops are not appropriate to remove under this process because they are too valuable to the network or the community or are not under SRTA's realm of control. They include:

- Those that serve major points of interest such as
    - Transit centers/terminals
    - Apartment complexes
    - Grocery stores
    - Shopping centers
    - Senior centers/housing
    - Schools/higher education
    - Hospitals/medical centers
    - Major employers
    - Government services/libraries
- Stops with over 20 average daily boardings (40 stops total)

[7] Peter Furth and Adam Rahbee, "Optimal Bus Stop Spacing Through Dynamic Programming and Geographic Modeling", *Transportation Research Record 1731, Paper No. 00-0870* (2000)

[8] Counting stops with a spacing of 2,640 feet (1/2 mile) or less. Stops over this spacing are placed to serve individual locations and not to serve corridors as a whole.

- Stops that are the first stop in any pattern sequence
- Stops on private property
- Time points along the Intercity Route

## Stop Scoring

The remaining stops are scored between a value of 0 and 100. The five scoring characteristics were chosen to prioritize safety, accessibility, high quality operations, and use by passengers.

Table 1 Stop Scoring Criteria

| Characteristic | Score |
|---|---|
| ADA compliant | 20 |
| Far side stop | 20 |
| Boarding area is categorized as safe based on inventory | 20 |
| Has intersection traffic controls (traffic signals, stop or yield sign, of flashing red or yellow light) | 20 |
| Number of average daily boardings[9] | 0-20 |
| **Max Total** | **100** |

# Model Methodology

After stops have been designated as protected or given a score, the model assesses each route by its stop spacing and stop criteria. The model determines if a gap greater than the optimization model spacing threshold (Table 2) would be created by removing the select stop or the stop before and after it in the route sequence. While stops that are too close together can cause inefficiencies in a transit system, stop spacing for bus service that exceeds the optimization model spacing can cause larger than optimal gaps in the service area and discourage passengers with longer walk times.

[9] Stops with over 20 average daily boardings are not scored because they are not considered for elimination.

While 4 to 5 stops per mile (1,056-1,320 foot spacing) is considered the optimal *average* distances between stops, the maximum spacing needs to be higher in order to approach the targeted average spacing. This is because the current spacing is much lower than the optimal spacing, and many stops will not be appropriate to eliminate. In urban areas, a value slightly further than 4 stops per mile will be used as the maximum spacing, and in less dense areas, a value slightly higher than 5 stops per mile will be used as the maximum spacing (see Table 2). Urban areas have better pedestrian environments and higher intersection density, so the bus stops can be spaced further from each other compared to less dense areas.

Table 2 Optimization Model Spacing Thresholds

| Population Density | Inbound Maximum Spacing (ft) | Outbound Maximum Spacing (ft) |
|---|---|---|
| Very High, High, Medium | 1,500 | 1,725 |
| Low | 1,100 | 1,265 |

When the distance between the previous and next stop in the sequence does not exceed the optimization model spacing thresholds, stops are identified as potential candidates for elimination. In instances where a stop is adjacent to other stops which are candidates for elimination, the stop with the lower score is chosen for removal. In some cases, two stops in a row may be eliminated if the optimization model spacing is not exceeded.

Figure 63 Example of Stop Optimization Decision Modeling

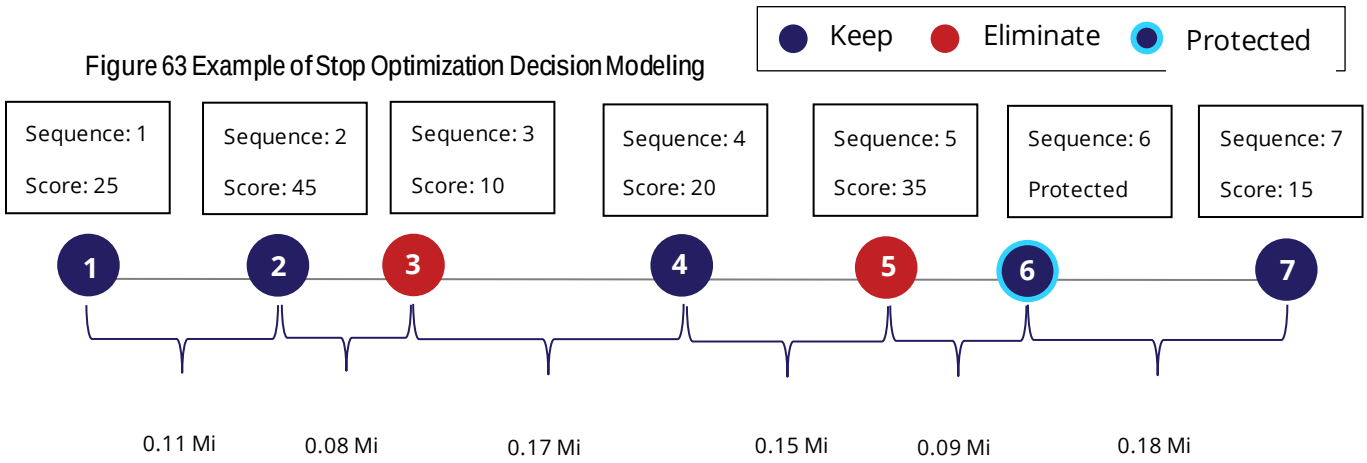



Figure 63 displays how the model iterates through stops and makes decisions about which to keep or eliminate.

- Going in sequential order, stops 2 and 3 are candidates for elimination because the gap between the previous and following stop would not exceed

the optimization model spacing threshold. However, if both were eliminated, the gap would exceed the optimization model spacing threshold, so the model choses the lowest scoring of the two stops. Stop 2 has a higher score than stop 3; therefore, the model would choose to keep stop 2 and eliminate stop 3. Average stop spacing is still being improved, while higher quality stops are also being prioritized.

- Stop 5 is also a candidate for elimination, while stop 4 and stop 6 on either side are not. Eliminating stop 4 would create a gap that exceeds the spacing threshold, and stop 6 is a protected stop, so cannot be eliminated. Even though stop 5 has a higher score than stop 4, it is the only candidate for elimination, and is recommended for elimination.

# Optimization Results for Stop Pairs

Each fixed route is assessed for stop consolidation opportunities by first using those stops serving the inbound direction because boardings generally exceed the outbound direction. Most stops on fixed routes are located near a "partner" stop, (generally immediately across the street and serving trips in the opposite direction) that together, create a "pair" for the area. If a stop in other direction does not have a pair stop, it is called an "orphan" stop.

A stop that is served by multiple routes will be assessed by the combined passenger activity for all routes that serve it; each stop will only have one score (not a separate score for each route it serves). The model will then have the same output for every stop in a multi-route corridor.

Figure 64 Eliminating Inbound and Outbound Pairs

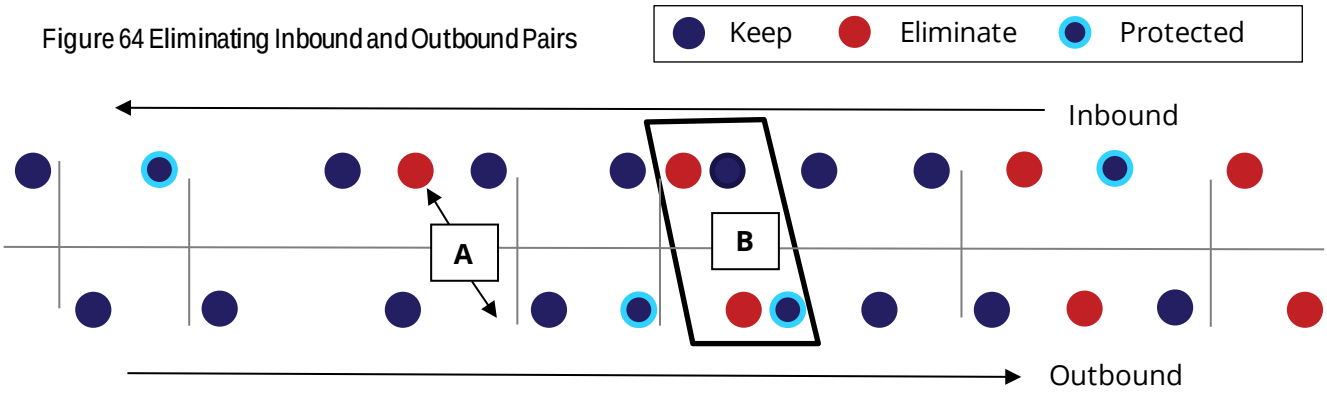



Figure 64 displays an example of eliminating inbound and outbound pairs and orphans.

- In Example A, the inbound stop is chosen for elimination, and because it is an orphan, no outbound stop needs to be considered in order for it to be eliminated.
- In Example B, both of the closely spaced inbound stops could be eliminated, but because the corresponding outbound pair for the stop on the right is protected for eliminiation because it serves a major point of interest, only the pair on the left is eliminated.

It is assumed that the stop spacing between the inbound stops and their corresponding outbound pairs are similar. However, the outbound spacing may be slightly longer in some case. For example, the inbound stop may be near-side, and the outbound stop is far-side, creating a slightly larger stop spacing in the outbound direction. For this reason, a 15% threshold is applied to the gap allowed in the outbound direction (see Table 2).

# INITIAL RESULTS OF BUS STOP OPTIMIZATION MODEL

The project team submitted the initial model results to SRTA staff for review. Of the results, SRTA staff identified 16 stops that should not be consolidated and suggested an additional 24 stops for consolidation.

Incorporating SRTA's edits, 26% of total stops were marked for removal. Of these stops identified for consolidation, they fell into the following Bus Stop Types:

- 98% of stops marked for removal are Standard Typology
- 2% are High Activity Typology.

The proposed consolidation plan, which was presented to the public, affected 9% of boardings and resulted in 1% fewer residents within ¼ of a bus stop.

Figure 65 Initial Consolidation Results for Inbound Fall River Routes

| Route | # of Stops Proposed for Removal | Percentage Removal | Existing Spacing (Mi) | Proposed Spacing (Mi) |
|---|---|---|---|---|
| FR1 | 10 | 36% | 0.11 | 0.18 |
| FR2 | 6 | 17% | 0.30 | 0.36 |
| FR3 | 6 | 24% | 0.13 | 0.17 |
| FR4 | 10 | 32% | 0.14 | 0.21 |
| FR5 | 7 | 26% | 0.19 | 0.26 |
| FR6 | 1 | 9% | 0.20 | 0.22 |

| | | | | |
|---|---|---|---|---|
| FR7 | 6 | 21% | 0.17 | 0.22 |
| FR8 | 5 | 13% | 0.19 | 0.25 |
| FR9 | 5 | 28% | 0.22 | 0.31 |
| FR10 | 9 | 29% | 0.14 | 0.20 |
| FR14 | 3 | 21% | 0.67 | 0.87 |

Figure 66 Initial Consolidation Results for Outbound Fall River Routes

| Route | # of Stops Proposed for Removal | Percentage Removal | Existing Spacing (Mi) | Proposed Spacing (Mi) |
|---|---|---|---|---|
| FR1 | 10 | 40% | 0.12 | 0.21 |
| FR2 | 6 | 17% | 0.17 | 0.21 |
| FR3 | 6 | 29% | 0.15 | 0.23 |
| FR4 | 13 | 39% | 0.13 | 0.22 |
| FR5 | 7 | 33% | 0.16 | 0.24 |
| FR6 | 2 | 17% | 0.22 | 0.20 |
| FR7 | 7 | 27% | 0.19 | 0.21 |
| FR8 | 3 | 8% | 0.19 | 0.25 |
| FR9 | 7 | 28% | 0.20 | 0.28 |
| FR10 | 7 | 33% | 0.15 | 0.23 |
| FR14 | 3 | 17% | 0.58 | 0.76 |

Figure 67 New Bedford Stop Consolidation Results, Inbound

| Route | # of Stops Proposed for Removal | Percentage Removal | Existing Spacing (Mi) | Proposed Spacing (Mi) |
|---|---|---|---|---|
| NB1 | 11 | 39% | 0.11 | 0.18 |
| NB2 | 8 | 26% | 0.16 | 0.21 |
| NB3 | 10 | 29% | 0.14 | 0.21 |
| NB4 | 10 | 28% | 0.14 | 0.19 |
| NB5 | 0 | 0% | 0.37 | 0.37 |
| NB6 | 12 | 33% | 0.13 | 0.20 |
| NB8 | 6 | 24% | 0.14 | 0.19 |
| NB9 | 9 | 12% | 0.23 | 0.28 |
| NB10 | 5 | 22% | 0.16 | 0.21 |
| NB11 | 0 | 0% | 0.32 | 0.32 |
| NB21* | 2 | 8% | 0.51 | 0.56 |

*New Bedford Route 21 is a one-way loop

Figure 68 New Bedford Stop Consolidation Results, Outbound

| Route | # of Stops Proposed for Removal | Percentage Removal | Existing Spacing (Mi) | Proposed Spacing (Mi) |
|---|---|---|---|---|
| NB1 | 11 | 34% | 0.15 | 0.23 |
| NB2 | 11 | 31% | 0.13 | 0.19 |
| NB3 | 12 | 33% | 0.15 | 0.26 |
| NB4 | 13 | 26% | 0.23 | 0.33 |
| NB5 | 3 | 38% | 0.20 | 0.35 |
| NB6 | 8 | 30% | 0.13 | 0.20 |
| NB8 | 9 | 35% | 0.14 | 0.22 |
| NB9 | 14 | 18% | 0.23 | 0.30 |
| NB10 | 7 | 22% | 0.35 | 0.48 |
| NB11 | 3 | 10% | 0.27 | 0.29 |

# PUBLIC ENGAGEMENT

The public was given an opportunity to view and comment in person and online. Public feedback was collected online and through two in-person events. Fliers in English, Spanish, Portuguese, and Haitian Creole advertised the public events and online feedback (Figure 7). Once the public meetings were concluded, the signs were replaced with fliers solely advertising the website.

Figure 69 In Person Open House Advertisement

## In-Person Open Houses

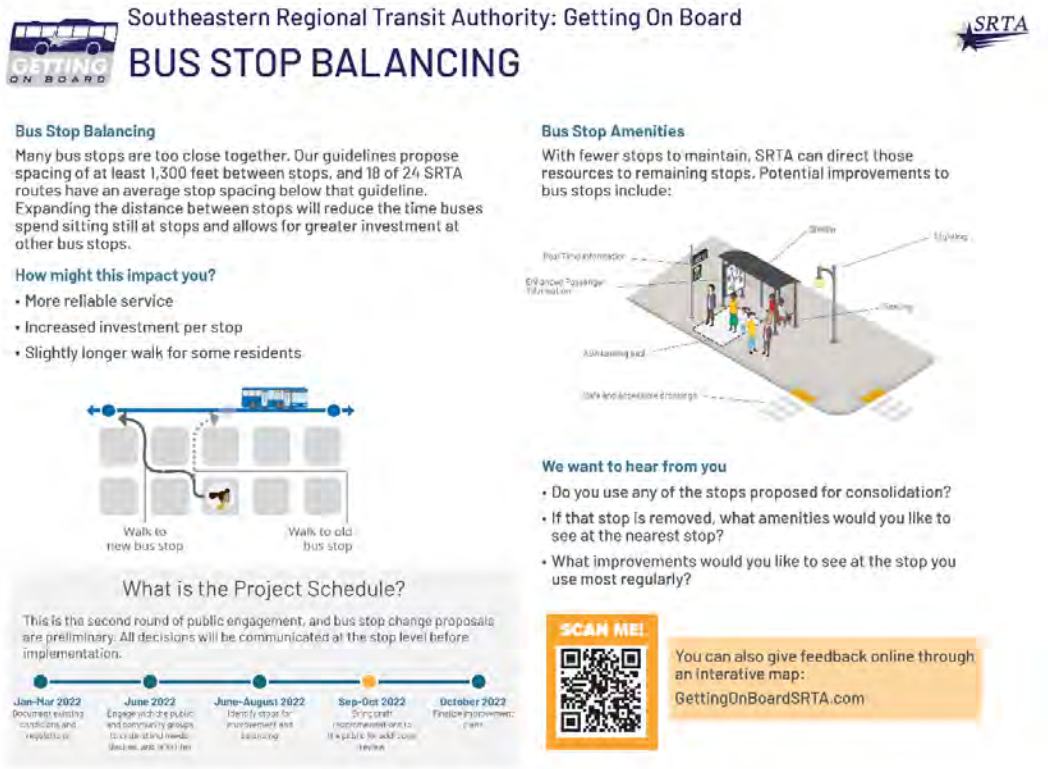
The project team held two public events on October 4th, in the morning at Fall River Bus Terminal and in the afternoon at New Bedford Bus Terminal. Each open house featured three boards giving information on bus stop balancing and its benefits (Figure 70) and maps showing the refined bus stop consolidation proposal (Figure 71). The outreach team also had iPads so that they could show attendees the mapped proposal in more detail. Approximately 40 people engaged with the project team to ask questions and make comments. Comments were recorded via an online webmap tool, described in the Virtual Public Engagement section of this document.

### Feedback Received

Public feedback at the Fall River and New Bedford Bus Terminals ranged from negative (at least one rider told the outreach team that no changes should be made anywhere in the system) to very positive. Most riders that spoke with the outreach team agreed that many stops in the urban areas of Fall River and New Bedford were very closely spaced and that it "made sense" to consolidate closely spaced stops. Several riders also noted that they noticed that buses fall behind schedule during peak hours when riders board at every stop. Several riders learned that the stop

they use every day was proposed to be consolidated, but every affected rider that the outreach team spoke with expressed a willingness to walk a short distance to a nearby stop that would remain.

Figure 70 Public Meeting Board




## Virtual Public Engagement

The website included background information on bus stop balancing, highlighting the benefits of consolidation and how decisions were reached, similar to the information presented on the public meeting boards. The website included a link to access an interactive webmap, where the public could view the stops proposed for consolidation by route (Figure 72). By clicking on a stop, they would be directed to a Google Form pre-filled with that stop ID and make a comment for that stop.

Figure 71 Consolidation Maps Presented on Public Meeting Boards

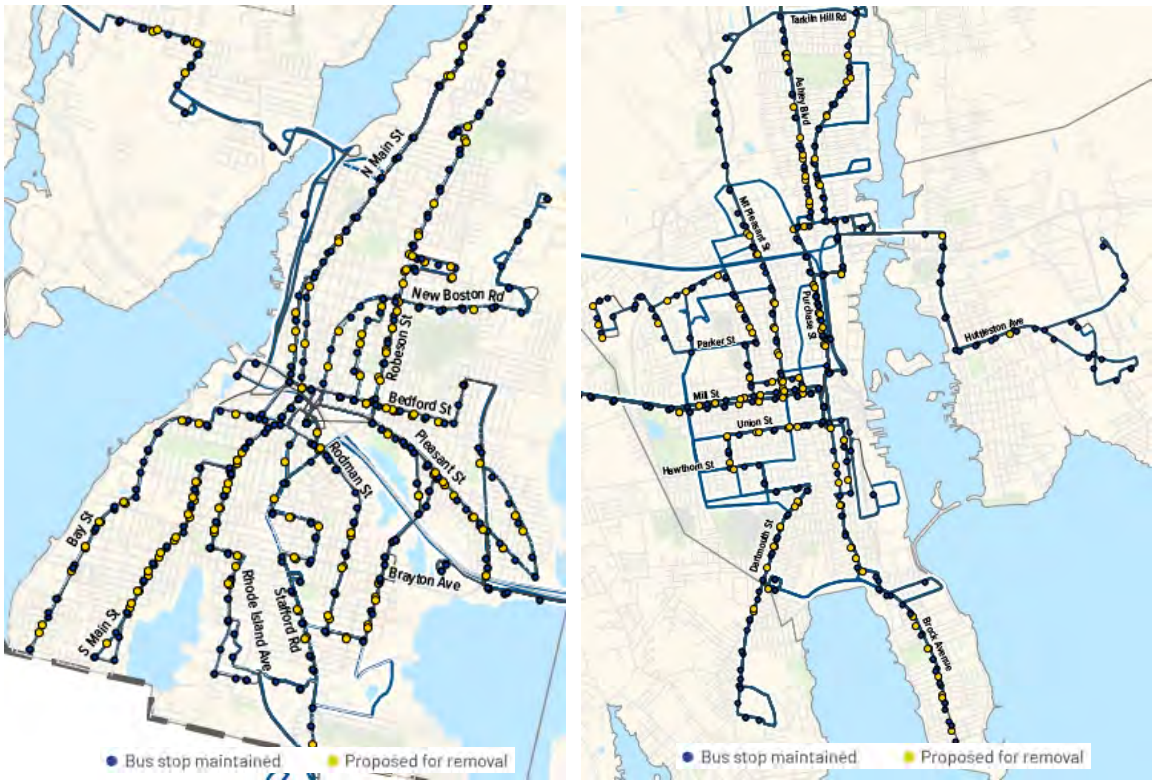
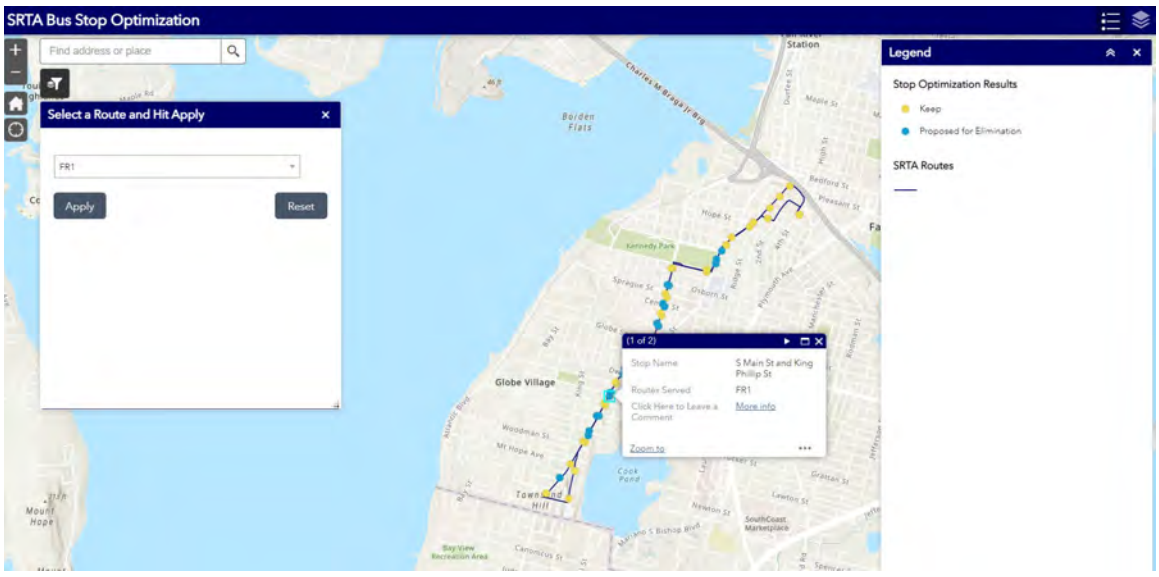



Figure 72 Screenshot of Public-Facing Interactive Map




The map and comment form were available online for 32 days, and 10 comments were submitted. Eight comments were supportive of the recommendations, including from those whose stop was proposed for consolidation. Two comments were opposed to specific stop removals. As a result of these comments, the FR 5

and FR 10 stop at Hartwell St and Brow St in Fall River is being kept in the network instead of eliminated due to its proximity to a large apartment complex with several residents who have mobility concerns. This stop does not have a pair as it is on a one-way street, so no other stop is affected.

# Final Bus Stop Consolidation Results

The full and final list of stops identified for consolidation can be found in the tables below. A map of the final bus stop consolidation results can be viewed online at this link: Final Results Online Map.

Figure 73 Consolidation Results for Inbound Fall River Routes

| Route | Existing Stops | Stops Proposed for Consolidation | Stops Remaining | Existing Spacing (Mi) | Proposed Spacing (Mi) |
|---|---|---|---|---|---|
| FR1 | 28 | 10 | 18 | 0.11 | 0.18 |
| FR2 | 35 | 6 | 29 | 0.30 | 0.36 |
| FR3 | 25 | 6 | 19 | 0.13 | 0.17 |
| FR4 | 31 | 10 | 21 | 0.14 | 0.21 |
| FR5 | 27 | 7 | 20 | 0.19 | 0.26 |
| FR6 | 11 | 1 | 10 | 0.20 | 0.22 |
| FR7 | 28 | 6 | 22 | 0.17 | 0.22 |
| FR8 | 38 | 5 | 33 | 0.19 | 0.25 |
| FR9 | 18 | 5 | 13 | 0.22 | 0.31 |
| FR10 | 31 | 9 | 22 | 0.14 | 0.20 |
| FR14 | 14 | 3 | 11 | 0.67 | 0.87 |

Figure 74 Consolidation Results for Outbound Fall River Routes

| Route | Existing Stops | Stops Proposed for Consolidation | Stops Remaining | Existing Spacing (Mi) | Proposed Spacing (Mi) |
|---|---|---|---|---|---|
| FR1 | 28 | 10 | 18 | 0.12 | 0.21 |
| FR2 | 35 | 6 | 29 | 0.17 | 0.21 |
| FR3 | 25 | 6 | 19 | 0.15 | 0.23 |
| FR4 | 31 | 13 | 18 | 0.13 | 0.22 |
| FR5 | 27 | 7 | 20 | 0.16 | 0.24 |
| FR6 | 11 | 2 | 9 | 0.22 | 0.20 |
| FR7 | 28 | 7 | 21 | 0.19 | 0.21 |
| FR8 | 38 | 3 | 35 | 0.19 | 0.25 |
| FR9 | 28 | 7 | 21 | 0.20 | 0.28 |
| FR10 | 31 | 7 | 24 | 0.15 | 0.23 |
| FR14 | 14 | 3 | 11 | 0.58 | 0.76 |

Figure 75 Consolidation Results for Inbound New Bedford Routes

| Route | Existing Stops | Stops Proposed for Consolidation | Stops Remaining | Existing Spacing (Mi) | Proposed Spacing (Mi) |
|---|---|---|---|---|---|
| NB1 | 28 | 11 | 17 | 0.11 | 0.38 |
| NB2 | 31 | 8 | 23 | 0.16 | 0.43 |
| NB3 | 35 | 10 | 25 | 0.14 | 0.40 |
| NB4 | 36 | 10 | 26 | 0.14 | 0.40 |
| NB5 | 5 | 0 | 5 | 0.37 | 0.76 |
| NB6 | 36 | 12 | 24 | 0.13 | 0.41 |
| NB8 | 25 | 6 | 19 | 0.14 | 0.39 |
| NB9 | 75 | 13 | 62 | 0.23 | 0.58 |
| NB10 | 23 | 5 | 18 | 0.16 | 0.42 |
| NB11 | 19 | 0 | 19 | 0.32 | 0.66 |
| NB21 | 24 | 2 | 22 | 0.51 | 1.15 |

Figure 76 Consolidation Results for Outbound New Bedford Routes

| Route | Existing Stops | Stops Proposed for Consolidation | Stops Remaining | Existing Spacing (Mi) | Proposed Spacing (Mi) |
|---|---|---|---|---|---|
| NB1 | 32 | 10 | 22 | 0.11 | 0.38 |
| NB2 | 36 | 11 | 25 | 0.16 | 0.43 |
| NB3 | 36 | 11 | 25 | 0.14 | 0.40 |
| NB4 | 50 | 13 | 37 | 0.14 | 0.40 |
| NB5 | 8 | 2 | 6 | 0.37 | 0.76 |
| NB6 | 27 | 8 | 19 | 0.13 | 0.41 |
| NB8 | 26 | 9 | 17 | 0.14 | 0.39 |
| NB9 | 77 | 14 | 63 | 0.23 | 0.58 |
| NB10 | 32 | 7 | 25 | 0.16 | 0.42 |
| NB11 | 31 | 3 | 28 | 0.32 | 0.66 |
| NB21 | N/A | N/A | N/A | 0.51 | 1.15 |

# IMPLEMENTATION GUIDANCE FOR BUS STOP CONSOLIDATION

## Notices at Affected Stops

Successfully phasing in bus stop consolidation will require clear and ongoing communication with bus riders. At least two weeks in advance of stop removal, SRTA should hang signs about upcoming removal at the affected stops with the following information provided:

- A notice that the stop is planned for removal
- Directions to the nearest remaining stop in each direction
- A short explanation of the purpose and benefits of stop consolidation
- A link to learn more.

## Coordination with Bus Stop Improvements

Signs can also be placed at stops that score high for receiving amenities improvements/additions (as discussed in the "Bus Stop Improvements" section below), linking the consolidation of stops to systemwide stop improvements to create systemwide support. It is important for SRTA to deliver re-investments as quickly as possible.

When high quality amenities such as shelters, benches, and real-time information are installed, they should be accompanied by a public notice that the investment was made possible by the stop consolidation effort.

### Curb Space Requirements

SRTA should coordinate with municipalities as laid out in the Bus Stop Design Guidelines to upgrade amenities, coordinate stop removal, and improve curb access at bus stops.

With fewer overall stops, there exists the opportunity for SRTA to work with municipalities to ensure all bus stops have adequate curb space for a bus to pull fully in and out. Currently, the typical SRTA bus stop is about 20 feet long, significantly lower than the recommended bus stop length (Figure 77).

Figure 77 Curb Space Requirements by Stop Placement

| Stop Placement | Typical* | Minimum* | Parking Impacts |
|---|---|---|---|
| Far Side | 70 ft. | 60 ft. | |
| Near Side | 90 ft. | 80 ft. | |
| Midblock | 110 ft. | 100 ft. | |
| Curb Extension | 40 ft. | 40 ft. | |
| Pull Out | 120 ft. | 120 ft. | |

*Assumes 40 ft. bus

There is stop placement available for 1,022 of SRTA's existing (pre-consolidation) bus stops. Based on the data available for those stops, and assuming an average of 20 feet for the amount of curb space allocated to each existing stop, the total minimum additional feet of curb space required to ensure all existing SRTA bus stops are compliant with the guidelines would be approximately 62,000 linear feet, or the length of approximately 3,100 parking spaces.

Bus stop consolidation would remove 261 stops, resulting in approximately 5,220 linear feet of curb space, or the length of about 261 parking spots, returned to municipalities. [10] However, SRTA would have to request additional curb space at the stops remaining after consolidation to ensure their compliance with the bus stop design guidelines.

The length of curb space needed to make each bus stop compliant with the guidelines would be approximately 61,700 feet or the length of about 3,100 spaces. This means that SRTA would request a net increase of 46,500 linear feet of curb space from municipalities after bus stops are consolidated. This estimate can be further reduced by the construction of curb extensions, as illustrated in Figure 77.

Figure 78 shows the number of remaining stops by municipality with each placement for those with the data available, and the total minimum curb space needed for buses to comfortably pull in and out of stops. This does not consider existing bus stop space, private property, or outdated or missing data.

[10] This calculation is based on bus stops for which there exists data, so it is likely a slight underestimation. There are 46 stops that lack bus stop placement data in SRTA's inventory.

# Implementation Regulations and Timeline

Before implementation, SRTA should ensure that bus stop locations are consistent with municipal regulations. The City of Fall River requires that all official bus stop locations be adopted into the City's Municipal Code. New Bedford's Traffic Commission requires that bus stop locations be specified by the Commission.[11] SRTA has good working relationships with staff in Fall River and New Bedford, and as discussed in the "Coordination with Municipalities" section below, it is possible that the return of curb space from consolidated stops may help facilitate municipal approval of bus stop consolidation.

To the extent possible, bus stop consolidation should all be done at once so that the network benefits of optimization are felt right away and so that all communication can be done simultaneously. If a systemwide consolidation is infeasible, bus stop consolidation could be done all at once for each city's network since most riders do not transfer between Fall River and New Bedford routes. A third option for implementation would be to roll out bus stop consolidation over the course of one week, focusing on posting notices on affected stops for three routes per day.

SRTA should have a process for responding to complaints as the consolidation program is rolled out. Additional changes may need to be made depending on the public response, and criteria for stop reinstatement should be clear, such as for legitimate accessibility concerns.

[11] For more information, see the Review of Regulatory Environment memorandum.

Figure 78 Bus Stop Location by Municipality After Consolidation

| Municipality | Curb Space Returned due to Consolidation | # of Far Side Stops Remaining | # of Near Side Stops Remaining | # Mid-Block Stops Remaining | Curb Space Needed to be Compliant with Design Guidelines | Difference Between Returned Curb Space and Needed Curb Space |
|---|---|---|---|---|---|---|
| Fall River | 2,580 ft. | 47 | 189 | 76 | 25,540 ft. | 22,960 ft. |
| New Bedford | 2,440 ft. | 49 | 207 | 46 | 24,100 ft. | 21,660 ft. |
| Dartmouth | 100 ft. | 24 | 16 | 24 | 5,120 ft. | 5,020 ft. |
| Westport | 0 ft. | 14 | 10 | 11 | 2,740 ft. | 2,740 ft. |
| Fairhaven | 40 ft. | 3 | 14 | 13 | 2,600 ft. | 2,560 ft. |
| Somerset | 100 ft. | 4 | 4 | 7 | 1,260 ft. | 1,160 ft. |
| Swansea | 0 ft. | 0 | 0 | 3 | 300 ft. | 300 ft. |
| **Total** | 5,260 ft. | 141 | 440 | 180 | 61,660 ft | 56,400 ft. |

The minimum needed curb space assumes no change in stop placement, and no use of curb extensions. For the installation of each curb extension, potentially up to 60 feet of curb space can be returned to municipalities.

# BUS STOP IMPROVEMENTS

One goal of bus stop balancing is to allow for additional investment in remaining stops, and the SRTA Bus Stop Design Guidelines recommend the minimum, preferred, and optional amenities for each typology. Of the 753 SRTA bus stops that remain after consolidation, 16 are High-Activity stops, 35 are Off-Street stops, 700 are Standard stops, and 2 are the Transit Centers.

Figure 79 outlines the unit costs for purchasing minimum and preferred recommended amenities by bus stop type. Lighting is excluded, as ambient street and commercial lighting serves the lighting needs of most stops, and the costs do not include installation or maintenance. "Enhanced Information" is considered a bus stop sign that is slightly larger than a traditional sign that includes decals with additional passenger information, as shown in the Bus Stop Design Guidelines.

Figure 79 Unit Costs of Preferred and Minimum Amenities for Bus Stop Types

| Bus Stop Type | ADA | Sign + Pole | Enhanced Information + Updated Sign | Shelter + Bench | Real-time information |
|---|---|---|---|---|---|
| Unit Cost (2022) | $1,540 | $800 | $60 | $7,200 | $8,000 |
| High Activity | ✓ | ✓ | ✓ | ✓ | ✓ |
| Off-Street | ✓ | ✓ | ✓ | ✓ | - |
| Standard | ✓ | ✓ | ✓ | - | - |

SRTA provided the project team with an inventory of all stops and the existing amenities. For those stops without information, it was assumed that stop had a standard bus stop sign but no other amenities or ADA compliance. Considering these existing conditions, it would cost approximately $1.25 million to purchase the minimum and preferred amenities needed for all stops remaining after bus stop consolidation. SRTA should prioritize these improvements based on the Bus Stop Improvement Prioritization rubric outlined in the Bus Stop Design Guidelines.

The stops proposed to be kept after consolidation were subjected to the prioritization rubric model in the attached spreadsheet. This spreadsheet includes a full breakdown of scoring and can be adjusted and filtered as desired, including what amenities to include for each typology and their estimated costs.

# Highest Scoring Stops by Bus Stop Type

The following tables list the top-scoring stops by type. Ridership is heavily weighted in the prioritization model, with up to 40 points available for high boardings and 40 points for high ridership frequency. Because of inconsistencies with APC data for end-of-line stops, these stops were excluded so as not to move low-ridership stops up the prioritization list due to artificially inflated boardings.

## High Activity Stops

There are 9 High Activity stops remaining after consolidation that are not at the end of a bus line. All but two of these stops are in New Bedford.

Figure 80 Prioritization of High Activity Stops

| Stop ID | Stop Name | Score | Jurisdiction | Cost to Fully Upgrade |
|---|---|---|---|---|
| 5656 | Stafford Rd and Anthony St | 95 | Fall River | $16,800 |
| 5600 | Brock Ave and Frederick St | 85 | New Bedford | $16,800 |
| 5018 | Rodney French Blvd and Welcome S | 80 | New Bedford | $16,800 |
| 5760 | County St and Rivet St | 80 | New Bedford | $16,800 |
| 5141 | Acushnet Ave and Earle St | 70 | New Bedford | $15,260 |
| 5502 | Acushnet Ave and Tallman St | 70 | New Bedford | $15,260 |
| 6078 | St. Luke's Hospital | 65 | New Bedford | $8,060 |
| 5257 | Brock Ave and Rodney French Blvd | 50 | New Bedford | $15,260 |
| 5687 | County St and Pleasant St | 45 | Fall River | $16,800 |

## Off-Street Stops

New Bedford Market Basket is the highest scoring Off-Street stop and is tied as the highest scoring stop in the system with a Standard stop. The table below shows the score and upgrade costs for Off-Street bus stops that scored above 0 and are not at the end of a bus line. Upgrade needs vary widely across off-street stops.

Figure 81 High Scoring Off-Street Stops

| Stop ID | Stop Name | Score | Jurisdiction | Cost to Fully Upgrade |
|---|---|---|---|---|
| 5060 | New Bedford Market Basket | 110 | New Bedford | $2,400 |
| 5051 | Dartmouth Street Stop & Shop | 100 | New Bedford | $7,260 |
| 5256 | King's Highway Stop & Shop | 100 | New Bedford | $1,600 |
| 5031 | Fall River Shopping Plaza | 95 | Fall River | $8,060 |

| | | | | |
|---|---|---|---|---|
| 5283 | Hawthorn Medical | 95 | Dartmouth | $8,800 |
| 5009 | UMass Dartmouth Campus Center | 85 | Dartmouth | $7,260 |
| 5019 | Ann & Hope Plaza | 85 | Dartmouth | $9,600 |
| 5194 | Fairhaven Walmart | 85 | Fairhaven | $7,260 |
| 5352 | UMass Dartmouth Flag Poles | 85 | Dartmouth | $860 |
| 5949 | N Main St Shaw's | 80 | Fall River | $8,800 |
| 5030 | Mariano Bishop Blvd Stop & Shop | 75 | Fall River | $8,060 |
| 5884 | Dartmouth Wal-Mart | 65 | Dartmouth | $9,600 |
| 6067 | Dartmouth Wal-Mart | 65 | Dartmouth | $8,800 |
| 5314 | Swansea Target | 55 | Swansea | $8,800 |
| 5906 | Somerset Stop & Shop | 55 | Somerset | $7,260 |
| 6098 | Amazon | 45 | Fall River | $8,800 |
| 6121 | Tiverton Casino | 45 | Fall River | $8,800 |
| 5817 | Seabra Market | 40 | Fall River | $8,800 |
| 6120 | Atlantic Charter School | 25 | Fall River | $8,800 |
| 5024 | Swansea Crossing | 20 | Swansea | $9,600 |
| 5879 | BJ's Wholesale Club | 20 | Dartmouth | $9,600 |
| 5882 | Ocean State Job Lot | 15 | Dartmouth | $8,800 |
| 6099 | Fairhaven South Coast Health | 15 | Fairhaven | $8,800 |
| 5036 | Aerovox | 10 | New Bedford | $9,600 |

## Standard Stops

The Durfee St and Elm St stop is the highest scoring Standard stop and is tied for the highest scoring stop in the system. The following table includes the stops with scores in or above the 98$^{th}$ percentile of all Standard stops.

Figure 82 High Scoring Standard Stops

| Stop ID | Stop Name | Score | Jurisdiction | Cost to Fully Upgrade |
|---|---|---|---|---|
| 5913 | Durfee St and Elm St | 110 | Fall River | $1,600 |
| 5886 | Bridge St and Fairhaven Commons | 95 | Fairhaven | $1,600 |
| 5100 | St Luke's Hospital | 95 | New Bedford | $60 |
| 5071 | Mt Pleasant St and England St | 90 | New Bedford | $1,600 |
| 5242 | S Main St and Sullivan Dr | 90 | Fall River | $60 |
| 5440 | Brock Ave and Ruth St | 90 | New Bedford | $60 |
| 5292 | Tripp Towers | 90 | New Bedford | $1,600 |
| 5947 | N Main St and Saint James St | 85 | Fall River | $1,600 |

| | | | | |
|---|---|---|---|---|
| 5249 | Bedford St and Eighth St | 85 | Fall River | $60 |
| 6122 | Hartwell St and Brow St | 85 | Fall River | $1,600 |
| 5363 | County St and Rivet St | 80 | New Bedford | $1,600 |
| 5705 | Third District Court | 80 | New Bedford | $60 |
| 5204 | Holmes Apartments | 75 | Fall River | $1,600 |
| 5714 | Pleasant St and Quarry St | 75 | Fall River | $60 |
| 6049 | President Ave McDonald's | 75 | Fall River | $1,600 |
| 5132 | N Front St and Coggeshall St | 70 | New Bedford | $60 |
| 5087 | Mt Pleasant St and Nauset St | 70 | New Bedford | $60 |
| 5136 | Ashley Blvd and Tallman St | 70 | New Bedford | $60 |
| 5143 | Acushnet Ave and Bellville Rd | 70 | New Bedford | $60 |
| 5148 | Acushnet Ave and Sawyer St | 70 | New Bedford | $60 |
| 5185 | N Main St and Pine St | 70 | Fall River | $60 |
| 5532 | Acushnet Ave and Phillips Ave | 70 | New Bedford | $60 |
| 5547 | Ashley Blvd and Holly St | 70 | New Bedford | $60 |

# APPENDIX C: CONTEXT ANALYSIS

GETTING ON BOARD

# SRTA Bus Stop Design Guidelines

## Context Analysis

March 2022

NELSON NYGAARD

# Context Analysis

This Context Analysis provides a baseline understanding of the current conditions and policies related to SRTA's bus stops. The purpose of the Context Analysis is to ensure that SRTA's eventual Bus Stop Design Guidelines are appropriate and service a wide range of locations. Specifically, SRTA's Bus Stop Design Guidelines need to reflect real life conditions, and the policies described therein need to reflect the existing operating environment

Data on amenities and ridership was not available for 46 newer SRTA stops.

**This Context Analysis studies bus stop characteristics in five different categories:**

**Cities and Towns**

- Municipality

**Road Owner & Class**

- Road Class
- Owner (State, local)
- Roadway Flexibility

**Amenities Offered**

- Type and quality
- ADA compliance

**Equity**

- Proximity to transit reliant communities and major activity centers

**Transit Service Level**

- Ridership
- Buses/day
- Spacing

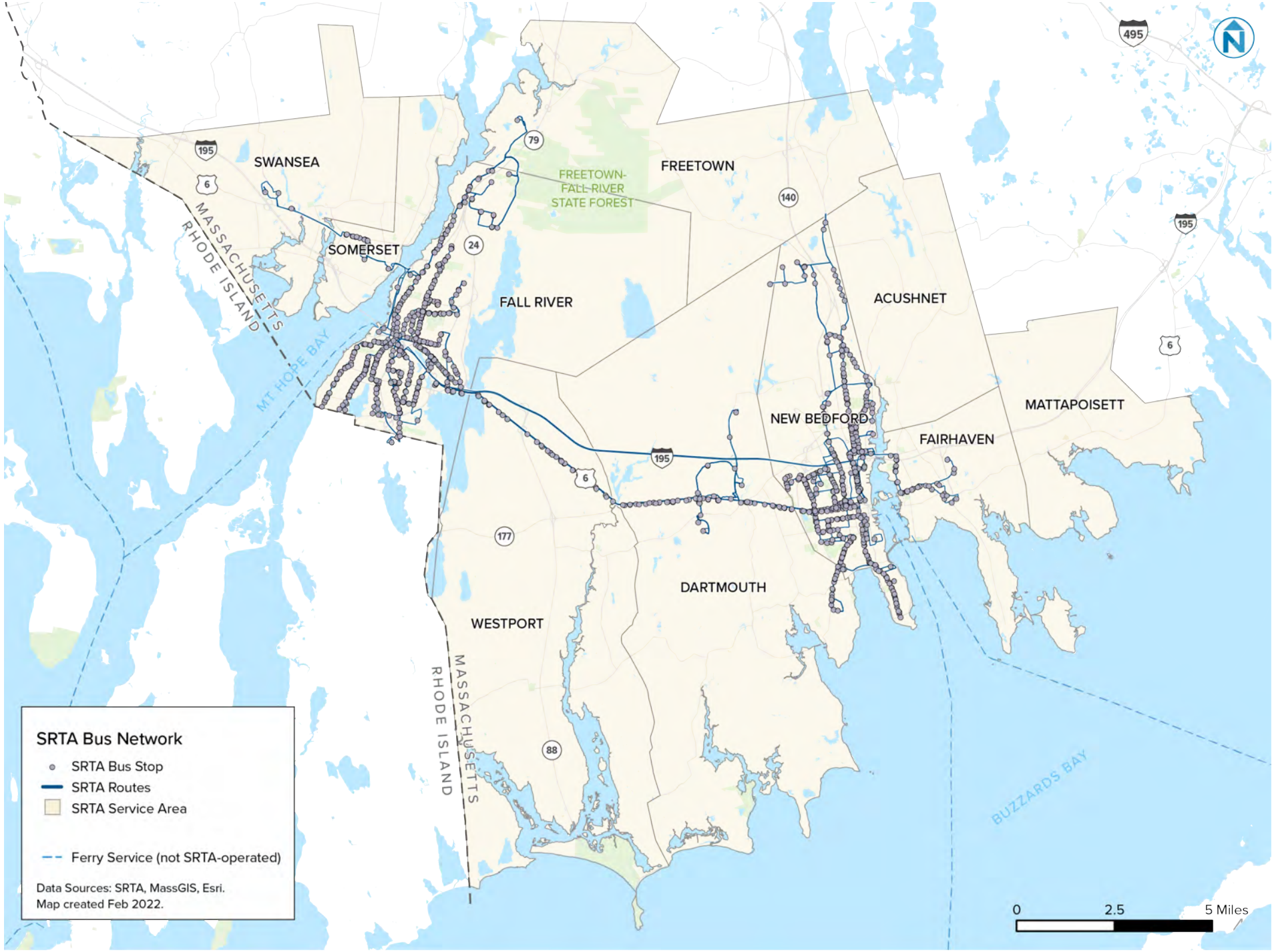
# Cities and Towns

Some municipalities and agencies differ in terms of their design review processes and process for adding or removing stops:

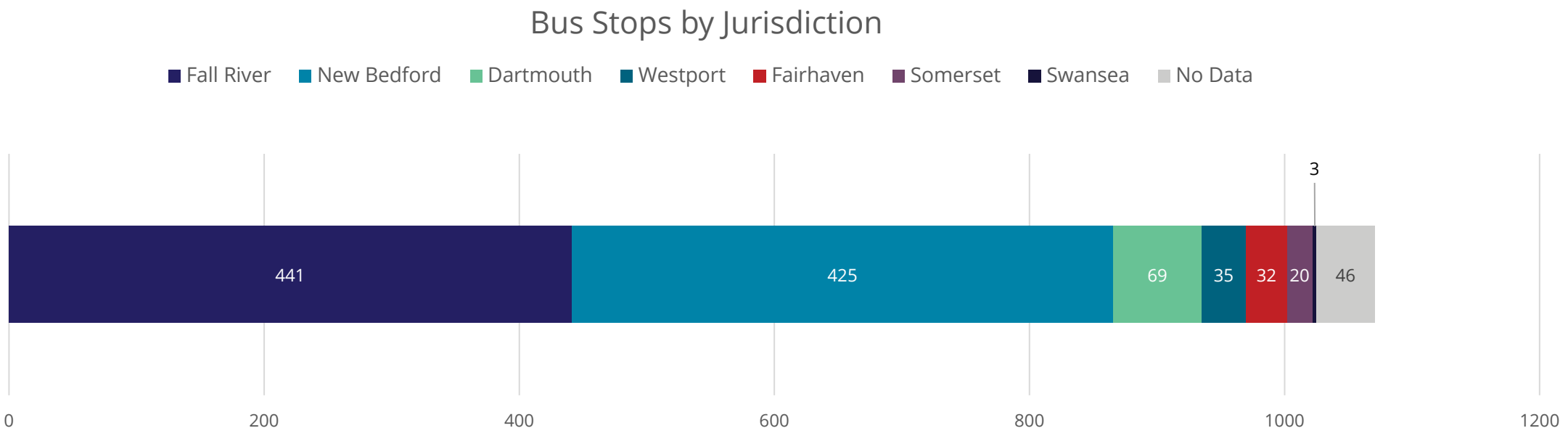
- **New Bedford:** The Traffic Commission requires that bus stop locations be specified by the Commission. The Commission bans vehicular parking in bus stops and permits stops to be installed in parking meter zones.
- **Fall River:** All bus stop locations must be adopted into the City's Municipal Code, requiring SRTA to coordinate with the city to modify locations. The Code bans vehicular parking in bus stops and requires that buses only board or discharge passengers at designated bus stops.

# Stops

- SRTA operates 24 routes and serves 1071 stops
- Stops are mainly located in New Bedford and Fall River, radiating out from the respective urban cores
- Stops are also located in Freetown, Fairhaven, Dartmouth, Westport, Somerset, and Swansea



# Context Analysis: Municipality




| | Stops |
|---|---|
| Fall River | 441 |
| New Bedford | 425 |
| Dartmouth | 69 |
| Westport | 35 |
| Fairhaven | 32 |
| Somerset | 20 |
| Swansea | 3 |
| No Data | 46 |

# Road Owner & Class

State-owned (MassDOT) roads have different requirements and processes than locally-owned roads.

- **MassDOT:** A Highway Access Permit is required for the addition, removal, or modification of a bus stop within or impacting State right-of-way or property. The Permit process includes a multi-step design review process.

Additionally, bus stop designs need to consider street functional classifications, which differ in terms of traffic speed and width:

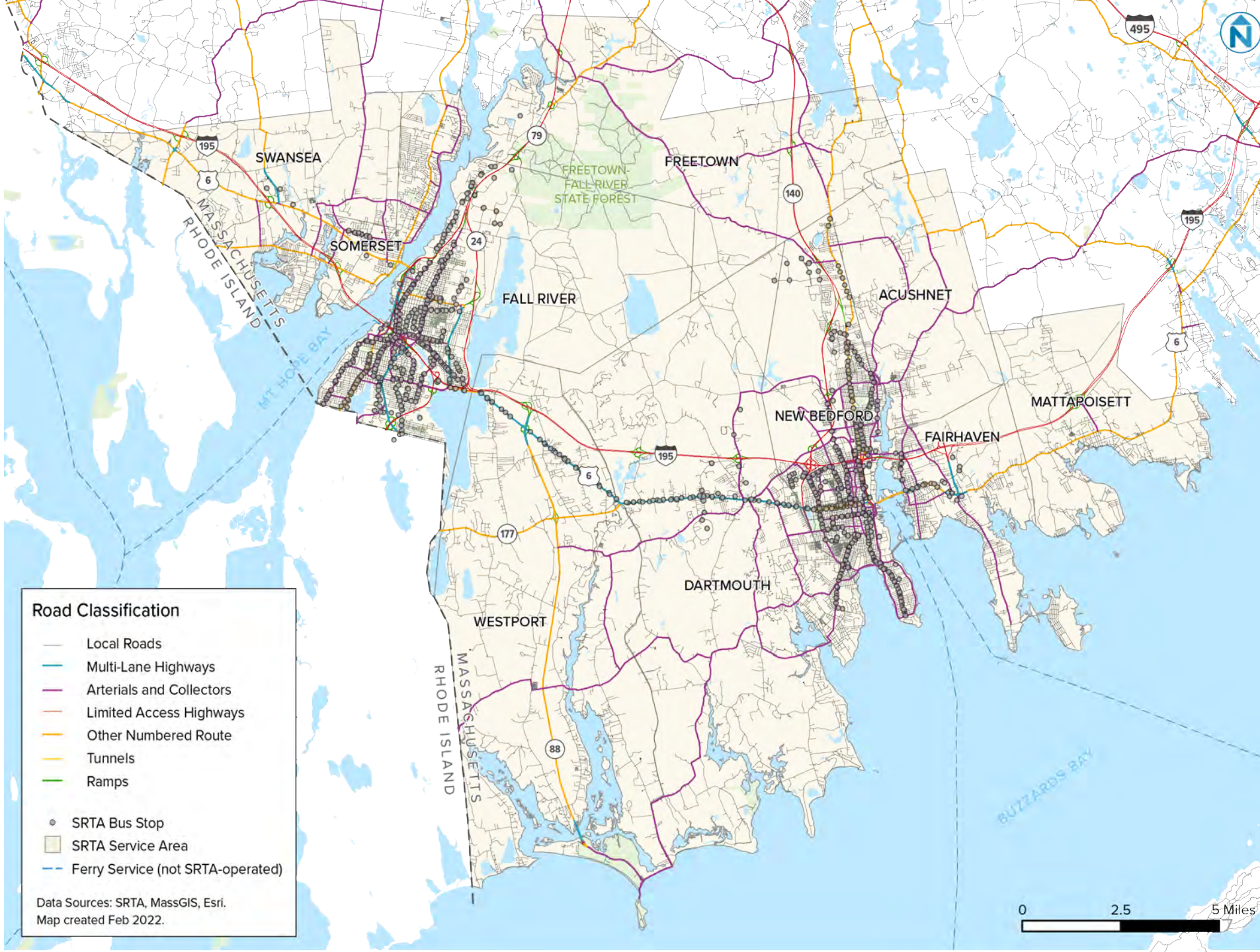
- **Multi-lane highways:** highest speed, widest roads, multiple lanes
- **Arterials and collectors:** higher speeds and wide roads
- **Other numbered routes:** state roads not classified as highways, arterials, or collectors
- **Local roads:** lowest speed and generally 2-lane roads

Roadways differ widely in terms of their **flexibility** for bus stops.

- Rights of way can be **flexible, constrained, or undeveloped.**

# Road Class

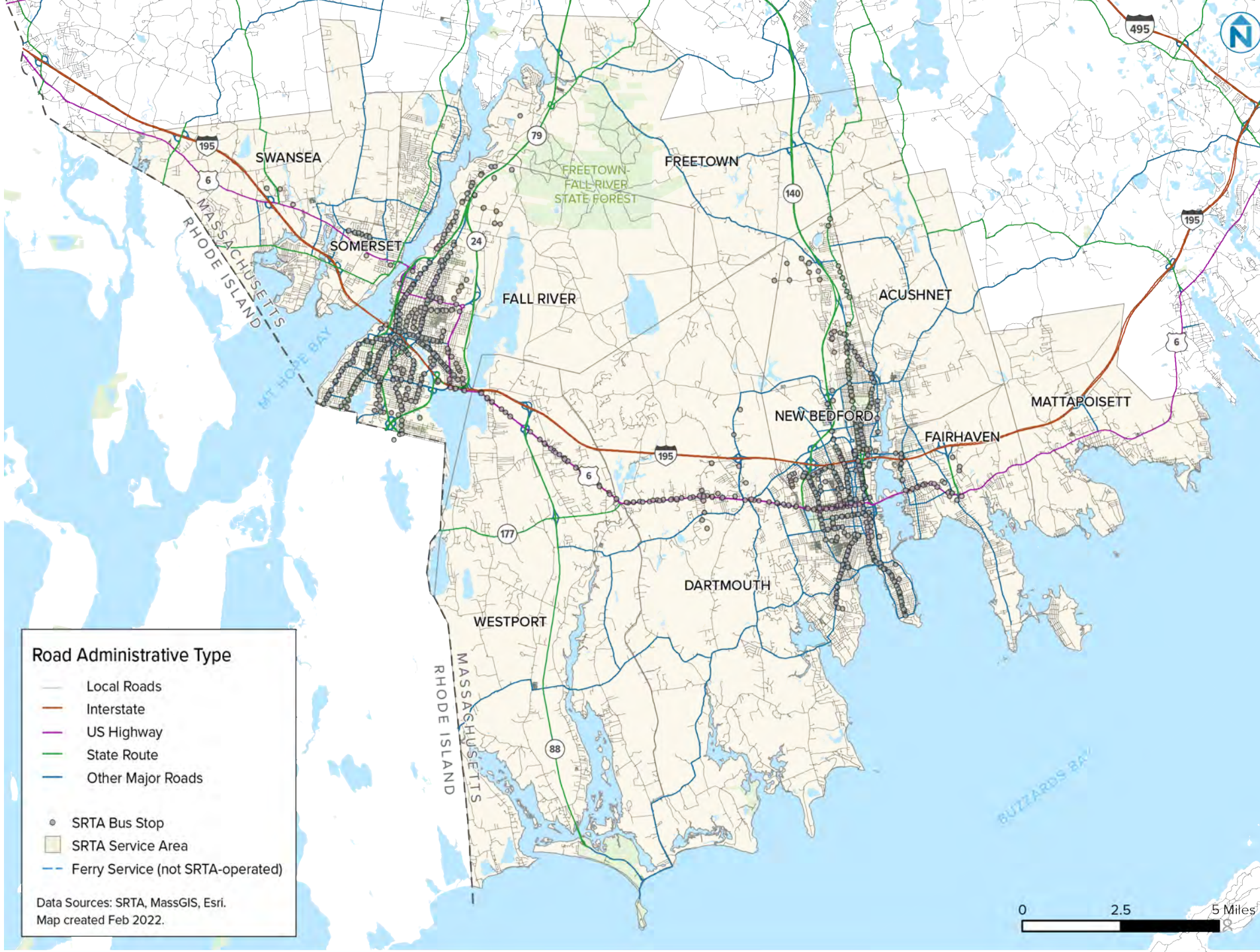
- Routes serving the urban cores of New Bedford and Fall River primarily operate on arterial and collector routes, with some service on local roads.
- The NB9 and NB9X, which connect New Bedford and Fall River, operate on multi-lane and limited access highways respectively.



# Road Owner

- 134 stops are located on US highways
- 94 stops are located on state roads

*“Other Major Roads” are major roads that are not numbered routes and lack administrative data



# Flexible Roadways

Flexible: Highland Apartments (Fall River)

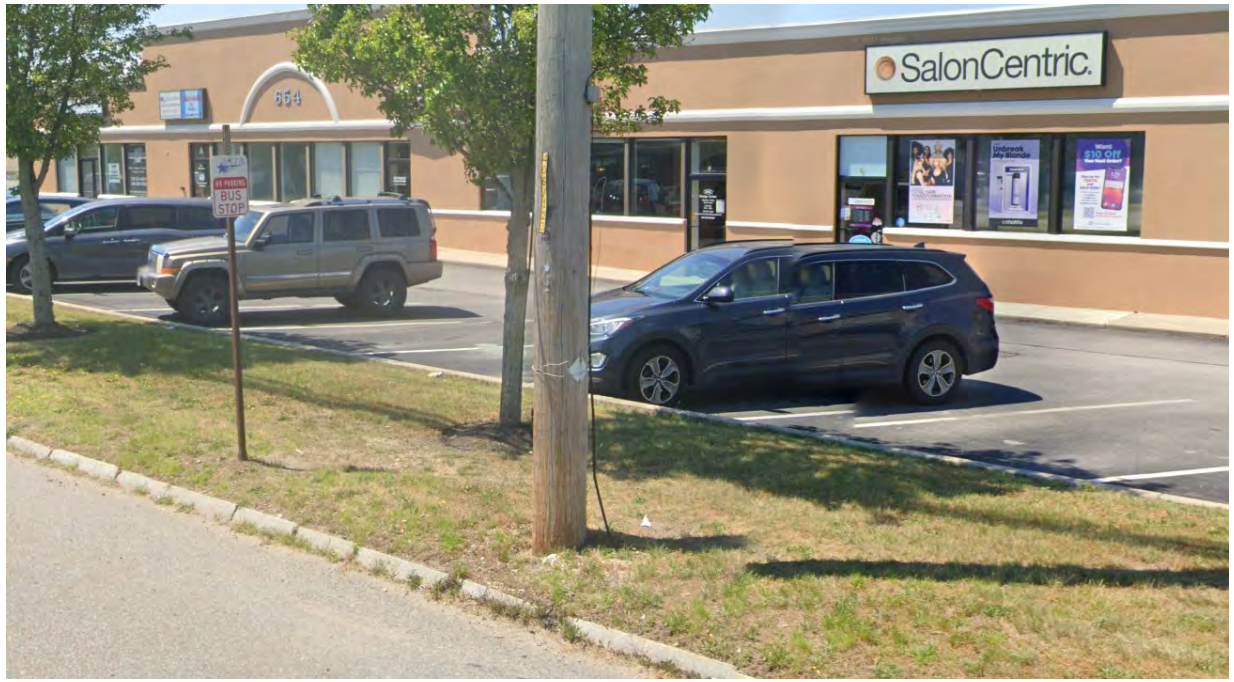
Flexible: Dartmouth Walmart (Dartmouth)

# Constrained Roadways

Constrained: Kempton St and Park St
(New Bedford)

Constrained: State Rd and Wolcott Ave
(Dartmouth)

# Undeveloped Roadways




Undeveloped: 654 State Rd (Dartmouth)

- Undeveloped conditions are common along Route 6 and some other state roads
- Typically lack ADA compliance

# Amenities Offered

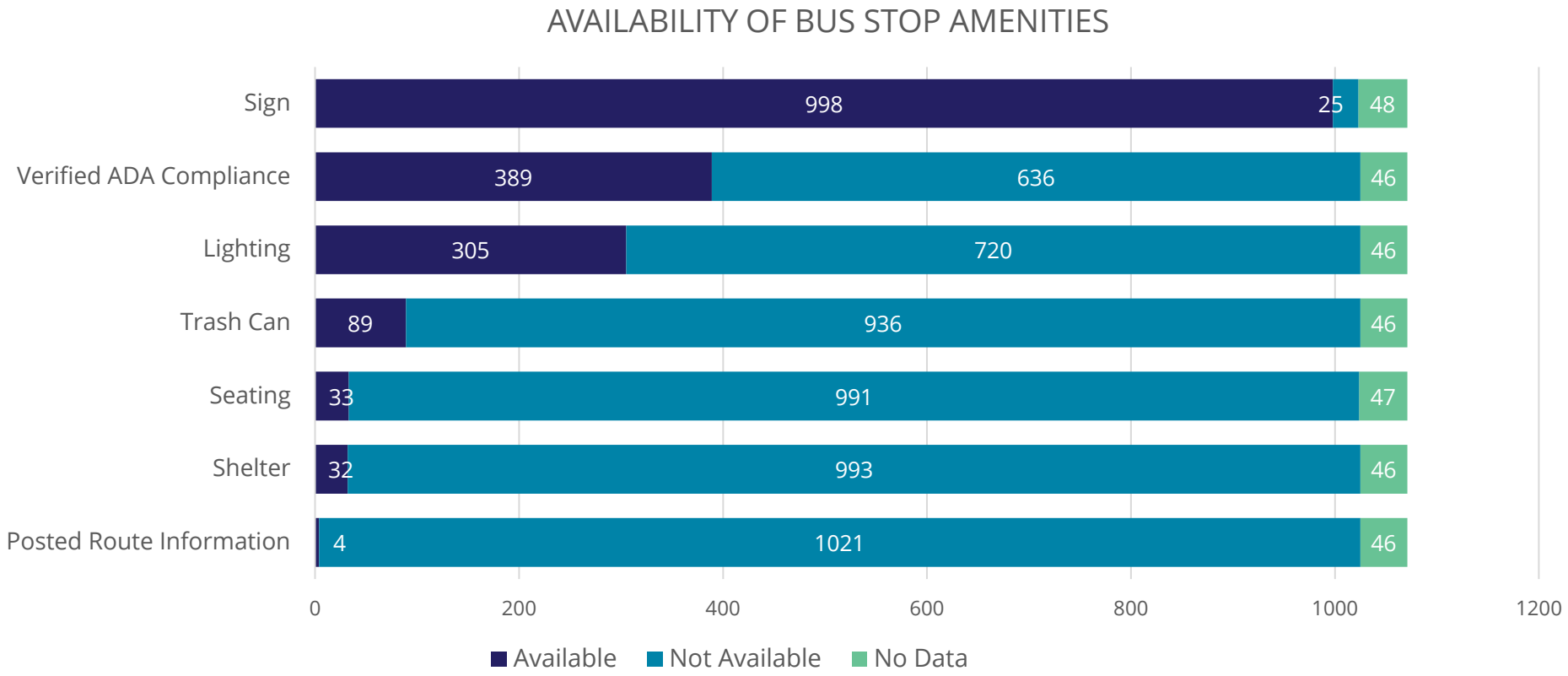
Understanding where amenities are currently offered can guide implementation. High-need stops without any of the following amenities can be prioritized:

- **Sign**
- **ADA compliance**
- **High-quality lighting**
- **Trash cans**
- **Shelter**
- **Benches**
- **Posted route information**

# Context Analysis: Amenities

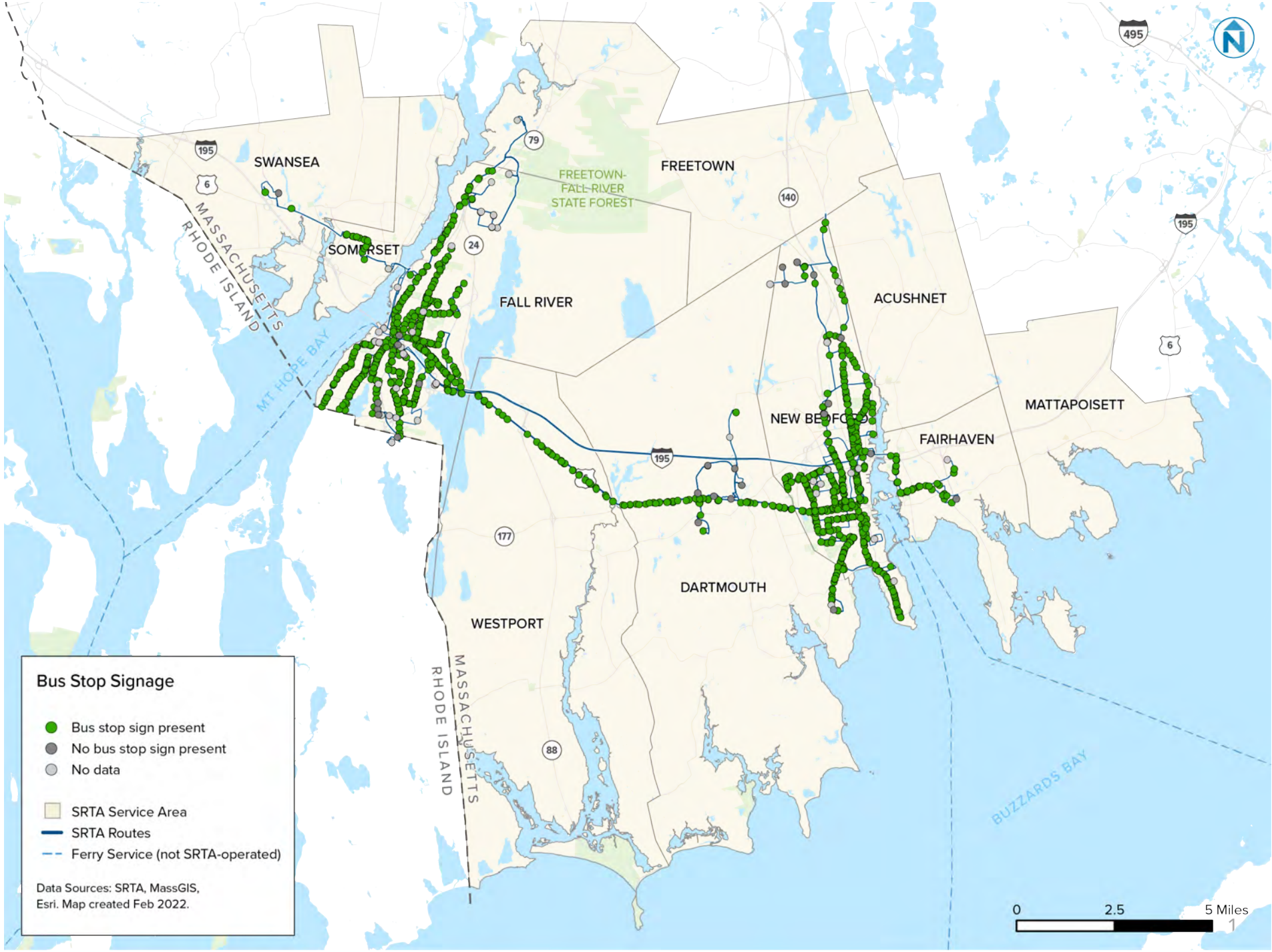
Most SRTA stops have signs, and over a third are ADA compliant. Another common amenity is lighting, which is available at at least 305 stops. Slightly less than 10% of stops have a trash can, and at least 33 stops have seating and 32 have a shelter.

Data on amenities was not available for the 46 newest SRTA stops.



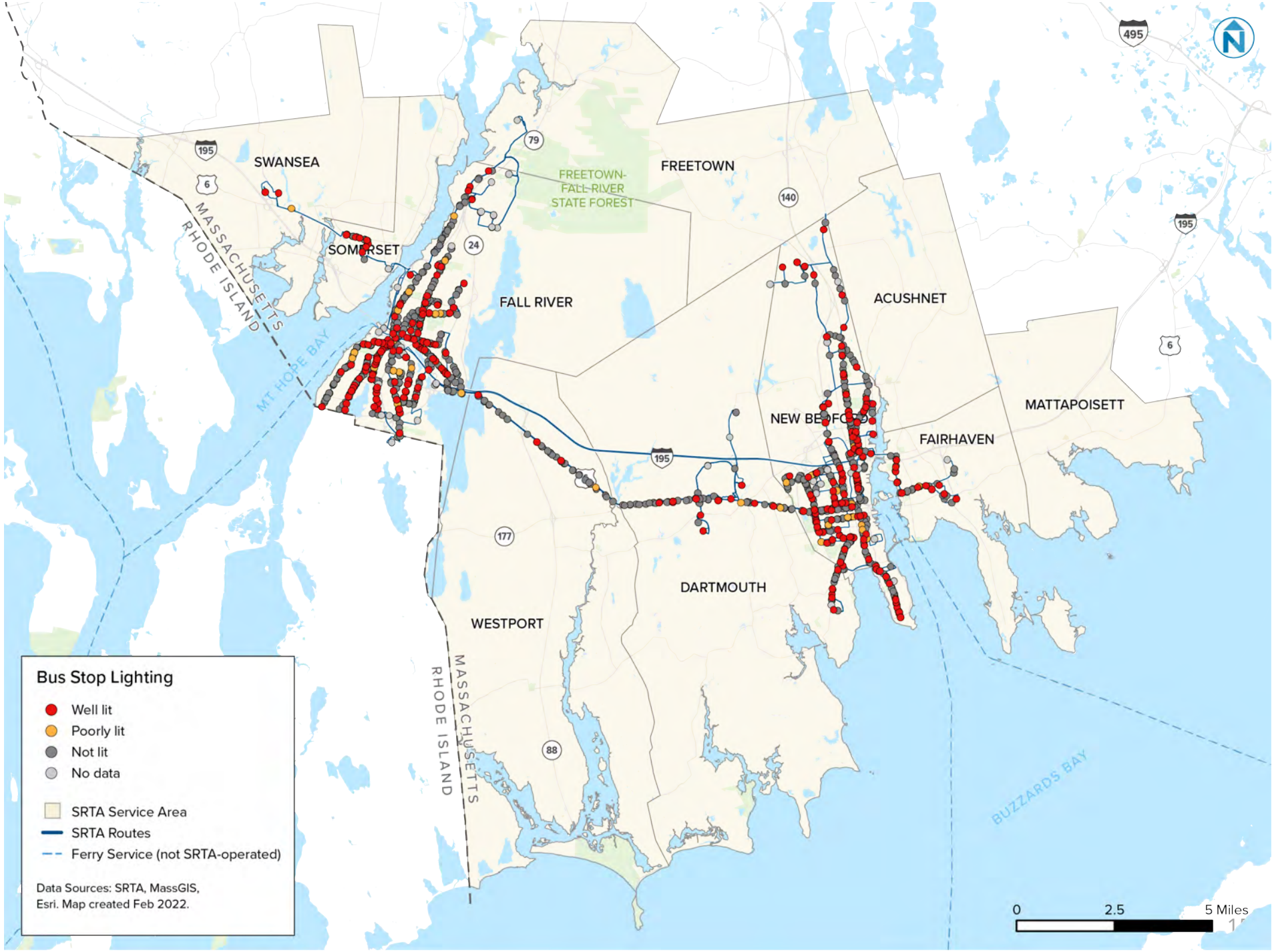
# Bus Stop Sign

- At least 25 stops are missing signs.
- Lack of signs is more prevalent on New Bedford lines.



# Lighting

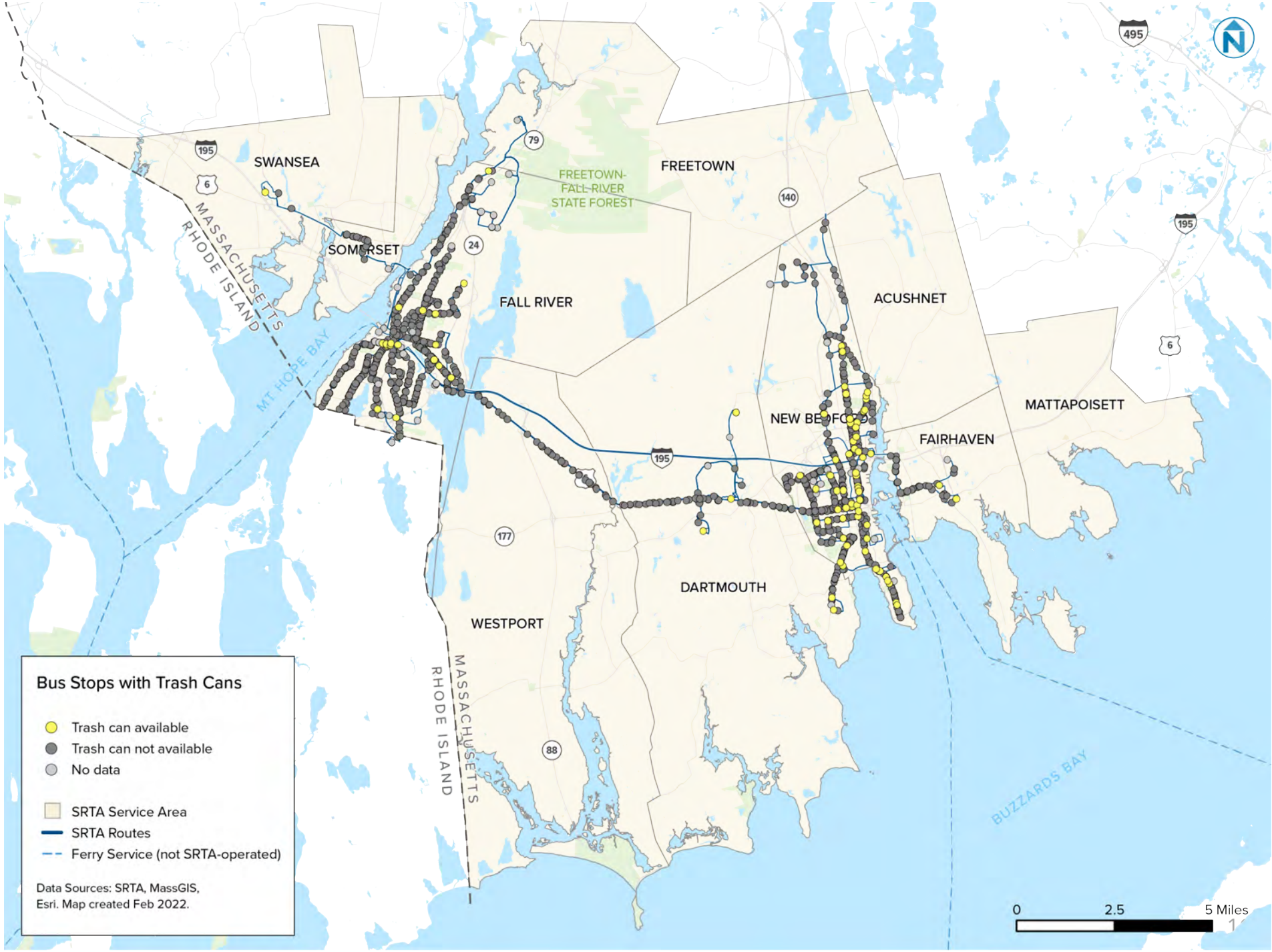
- Most downtown stops in Fall River and New Bedford are well lit.
- 720 stops do not have lighting, with less lighting outside of the urban cores.
- Poorly lit stops are spread through the system.



CONTEXT ANALYSIS

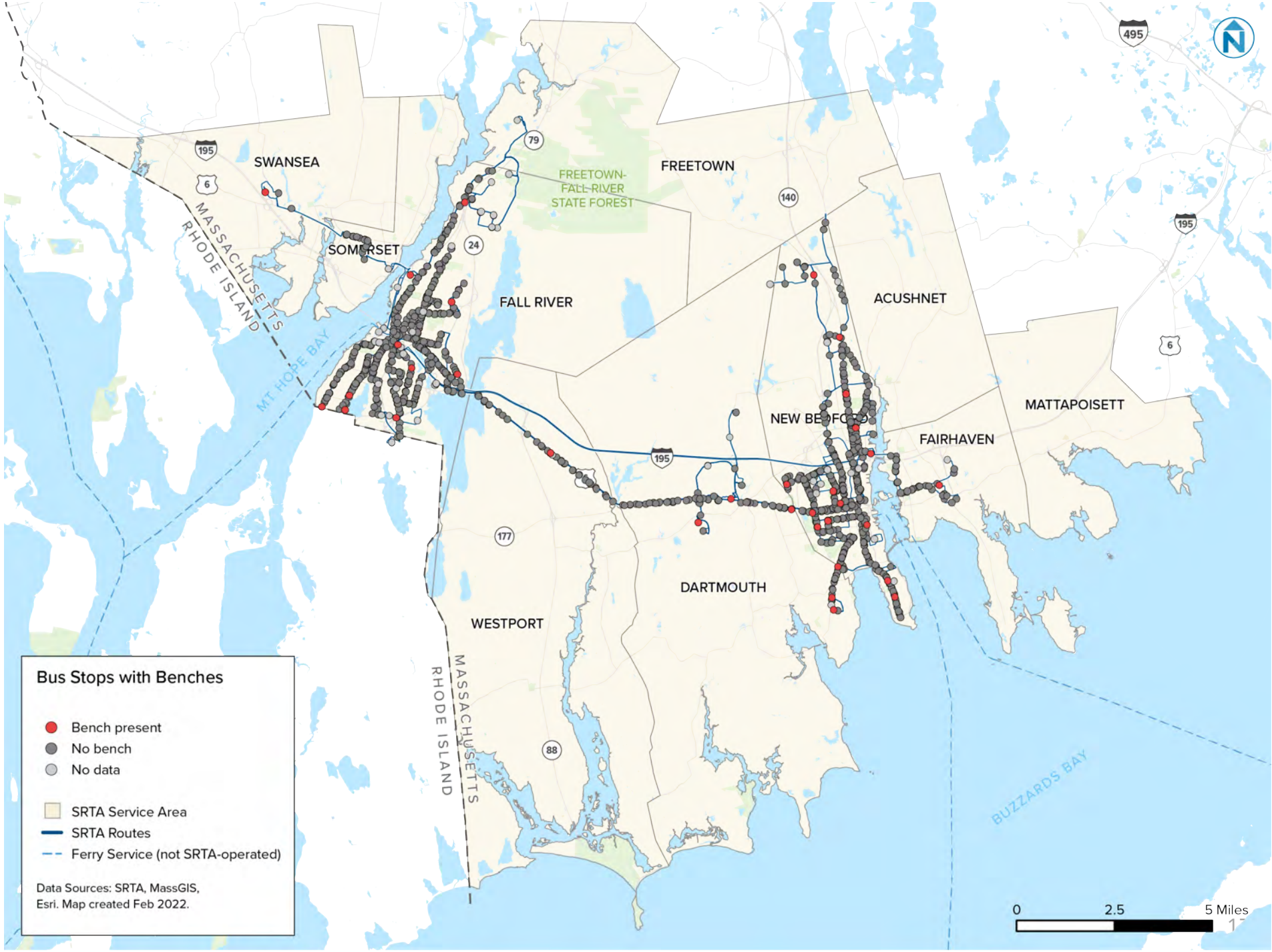
# Trash Cans

- 89 stops have trash receptacles, a majority of which are in New Bedford.



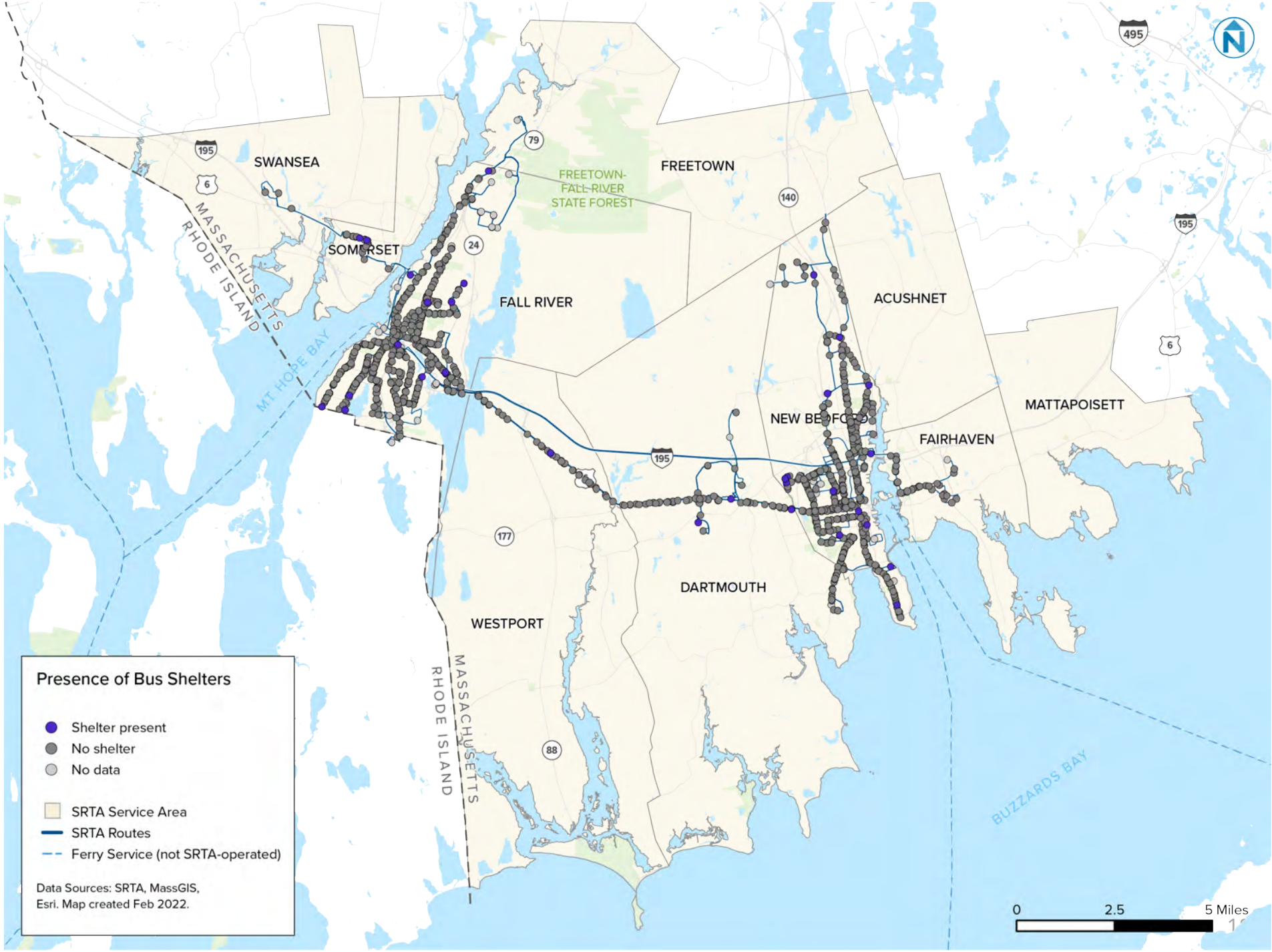
# Seating

- Benches are more often present outside of downtown areas.
- At least 991 stops do not have seating.



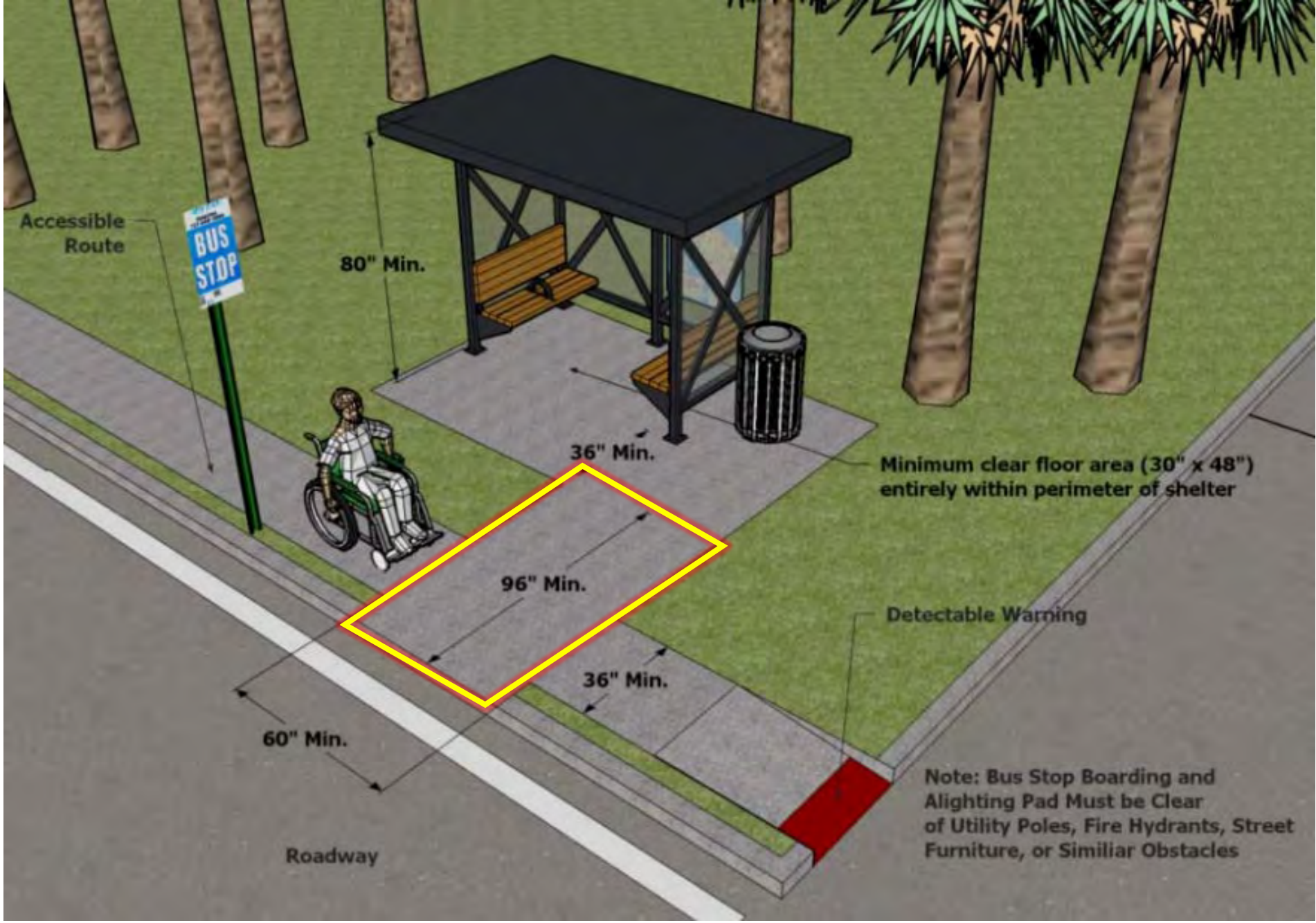
# Shelters

- At least 32 stops have bus shelters.
- These are often the same stops that have benches.
- 2 of the shelters are at the main terminals.



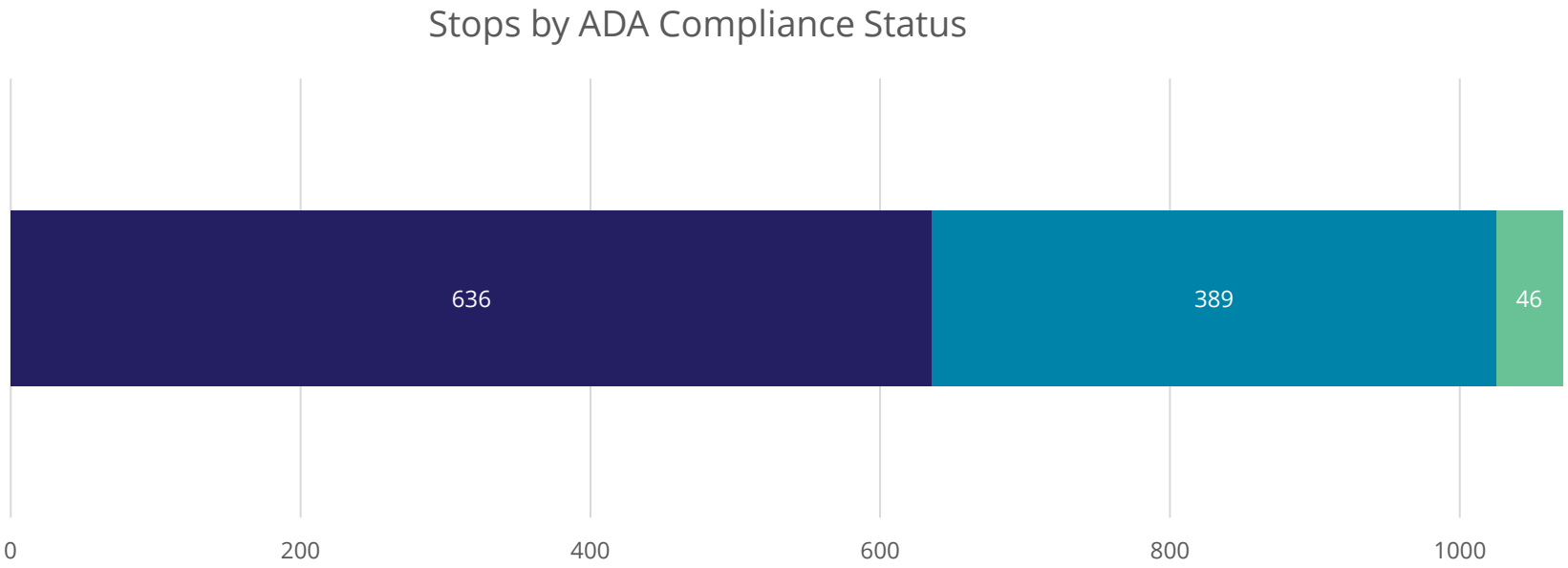
# Overview of ADA Compliance

- **At a minimum, ADA compliance at bus stops requires an 8’ x 5’ hard surface boarding and alighting area**
- Where shelters, sidewalks, and crosswalks are available, ADA requirements also apply.



# Context Analysis: ADA Compliance

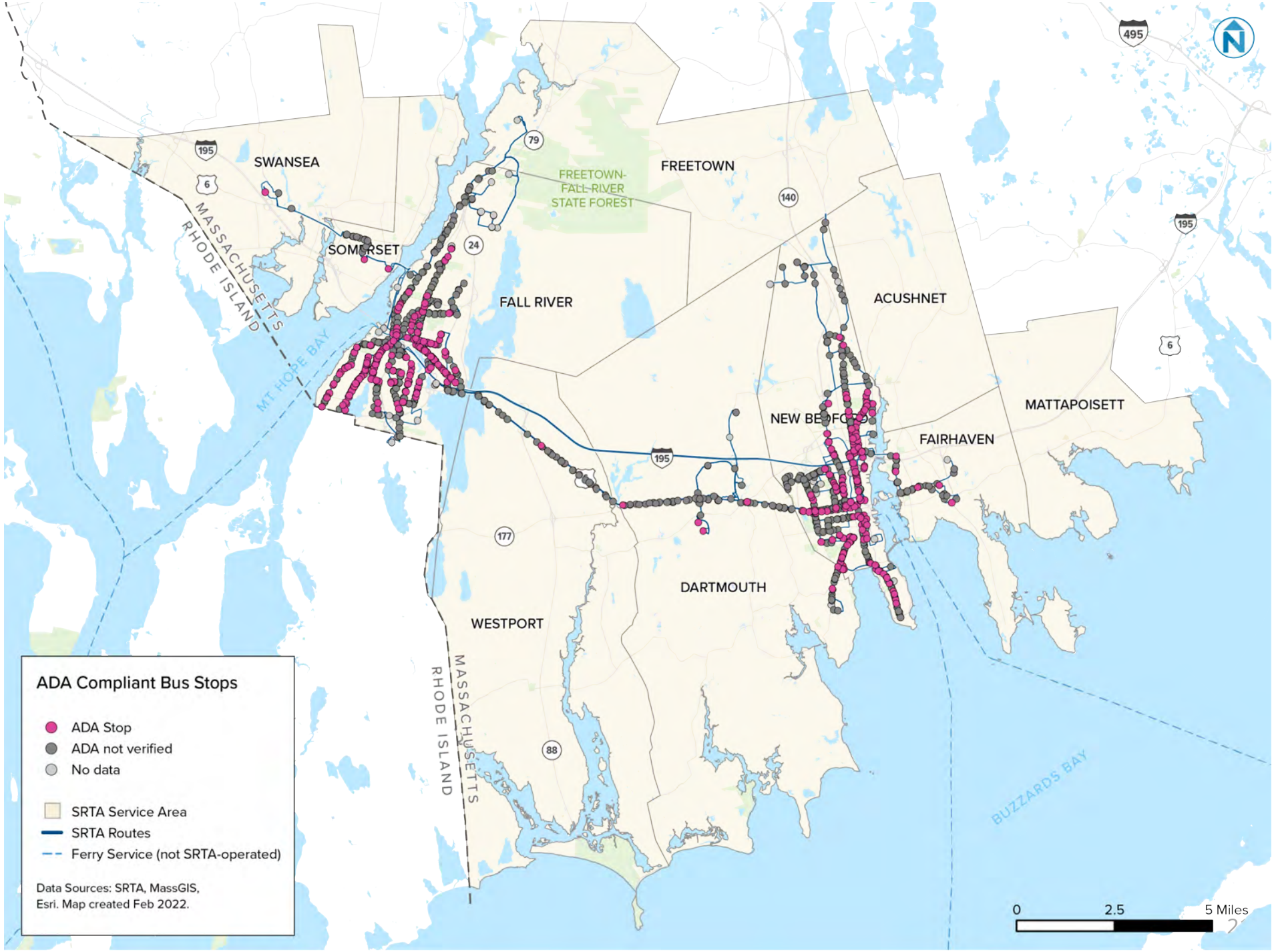
Nearly 400 stops are verified to be ADA compliant. ADA compliance is recorded in multiple ways, and the data likely significantly undercounts the number of ADA-compliant stops by showing likely-compliant sidewalks as “not verified”




| | Stop Count |
|---|---|
| ADA not Verified | 636 |
| ADA Stop | 389 |
| No Data | 46 |

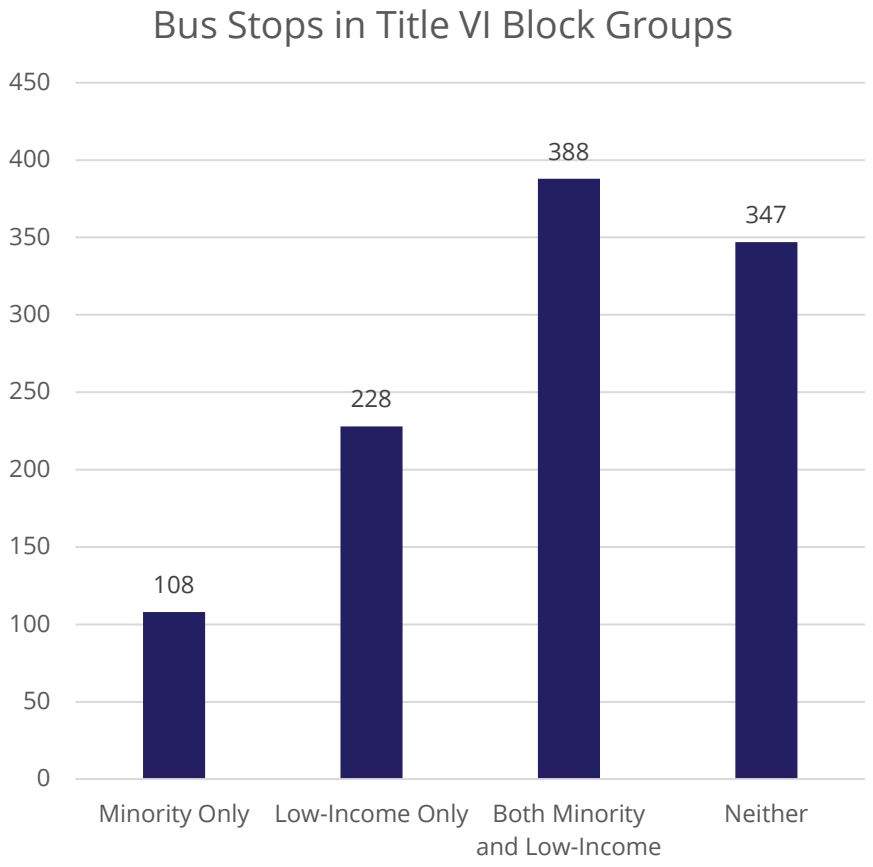
# ADA Stops

- 389 stops have been verified to be ADA compliant.
- These stops tend to be located near the downtowns of Fall River and New Bedford.
- Most stops along the NB9 and NB9X, which connect New Bedford and Fall River, do not have verified ADA compliance.



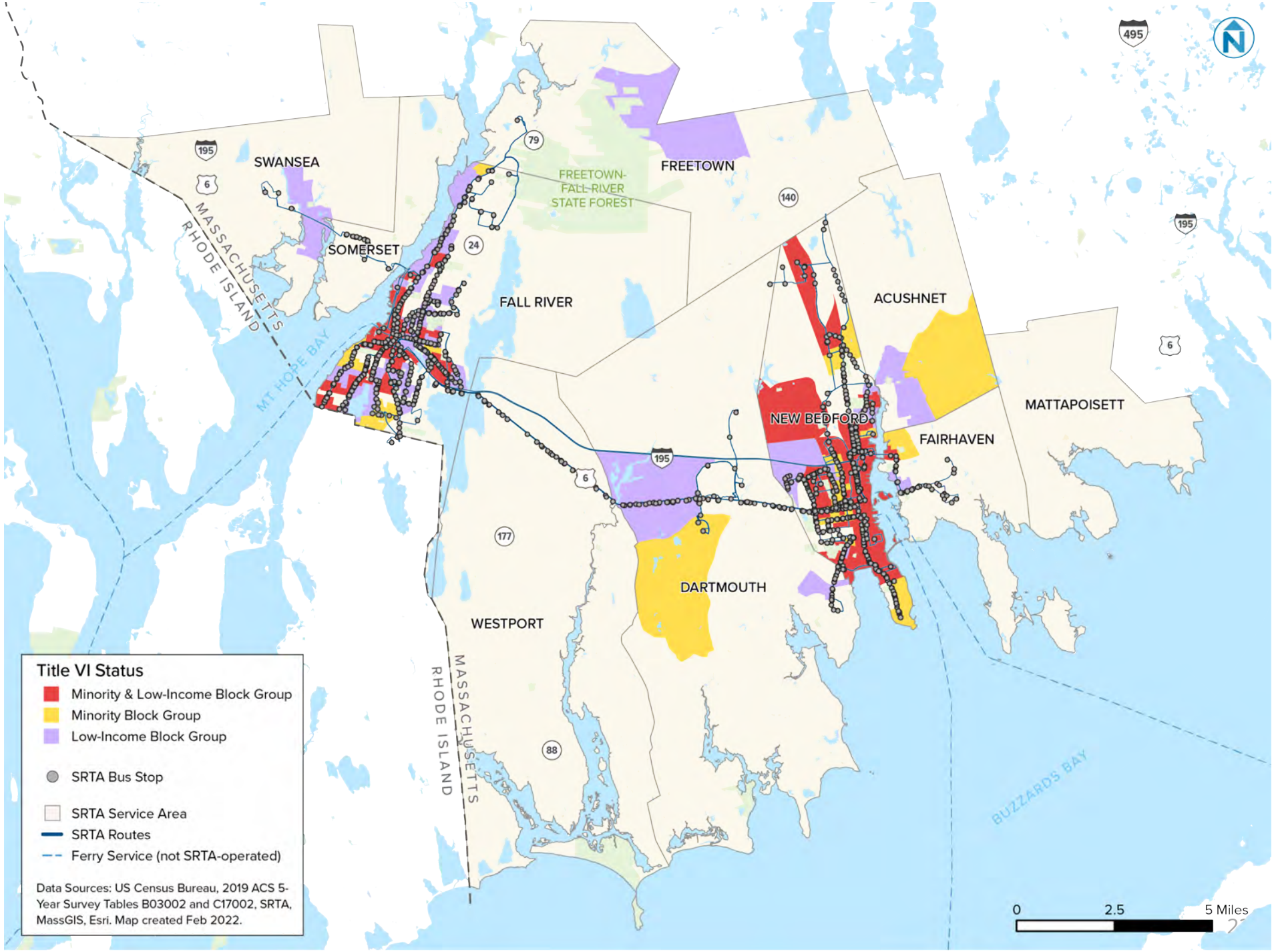
# Equity

- The SRTA service area has a total population of 311,679, of which 21.5% are Hispanic or Latino or a race other than white, and 22.2% are below the federal poverty guideline.
- For Title VI, block groups where the percentages are higher than the overall service area are considered minority, low-income, or both.
- 388 bus stops are in block groups with higher than average low-income and minority populations.



# Equity

- Minority and low-income block groups are concentrated in the urban cores where there are many bus stops
- There are some minority and low-income block groups in Acushnet that lack access to fixed route transit service.



# Transit Service Level

Bus stops with high levels of transfer and ridership activity may be better suited for investment. Bus stops with very infrequent service may also be well suited for improved passenger information. Investing at the handful of very high ridership stops has the potential of reaching many customers quickly.

Data on ridership was not available for 24 new SRTA stops.

Transit service level includes:

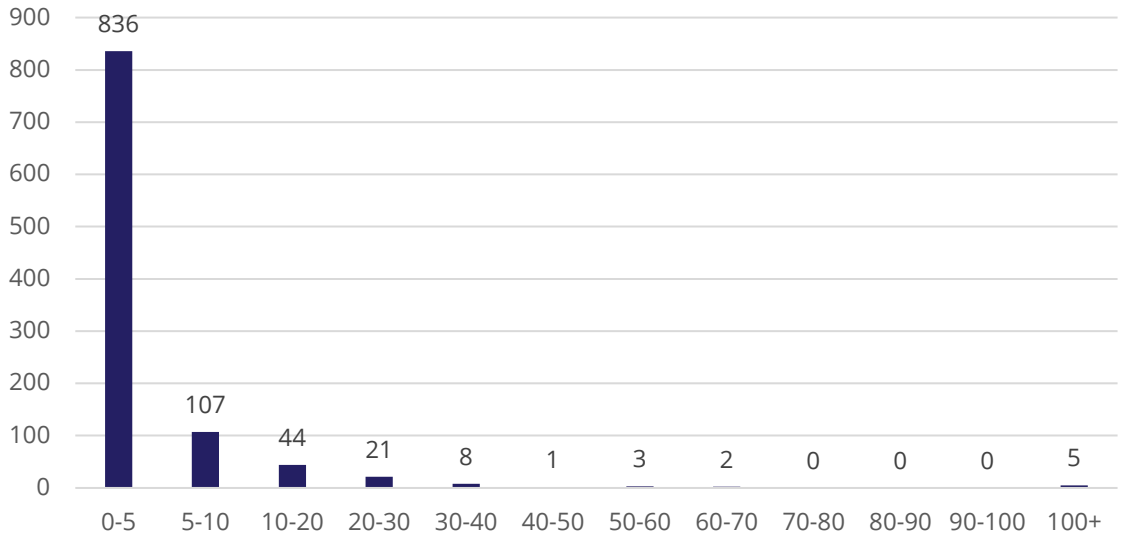
- **Ridership**
- **Routes served**
- **Trips served per day**
- **Stop Spacing by Route**

# Ridership Activity

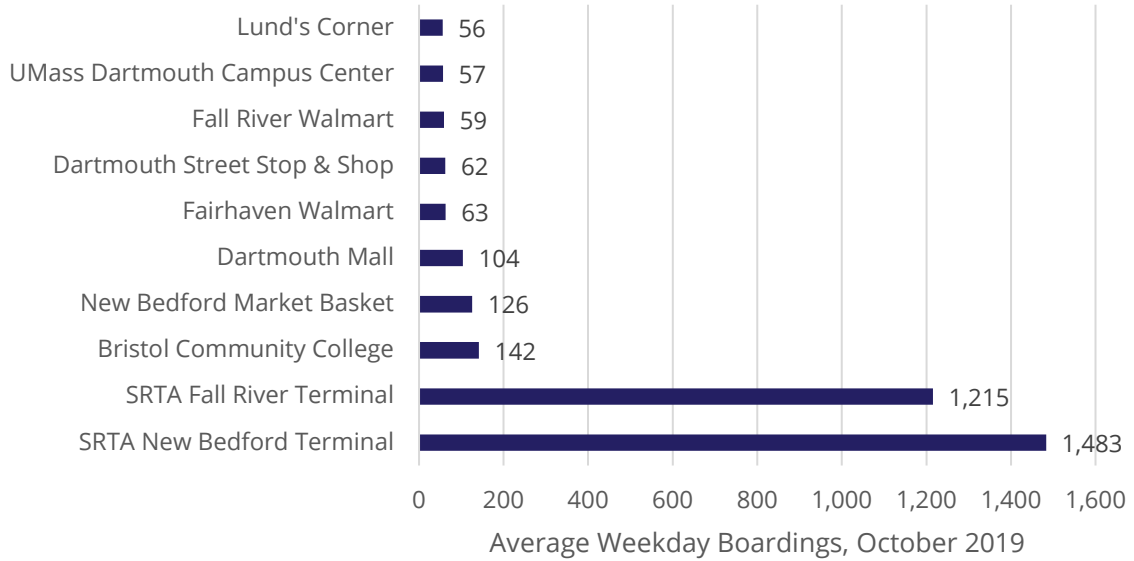
Bus stops with high levels of ridership activity may be better suited for near-term investment. Only 41 stops have more than 20 boardings a day. 44 stops have between 10 and 20 boardings a day.

Outside of the terminals, the highest level of boarding activity occurs at Bristol Community College, area grocery stores, Walmarts, and the Dartmouth Mall. Since these stops are located on private property, there may exist an opportunity to leverage partnerships with these land owners to improve stop quality.

Number of Stops by Average Weekday Boardings, October 2019

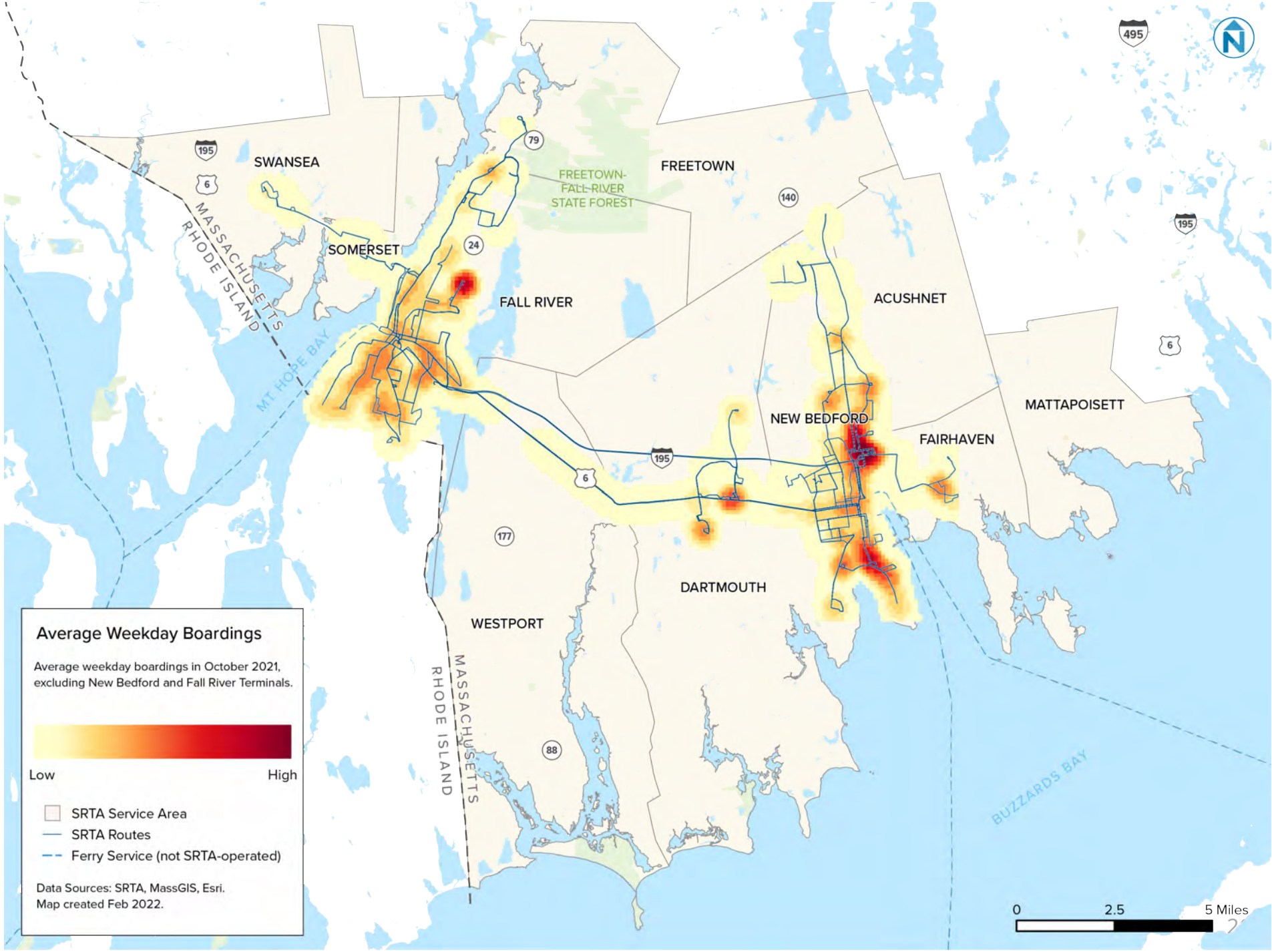



Top 10 Stops by Ridership



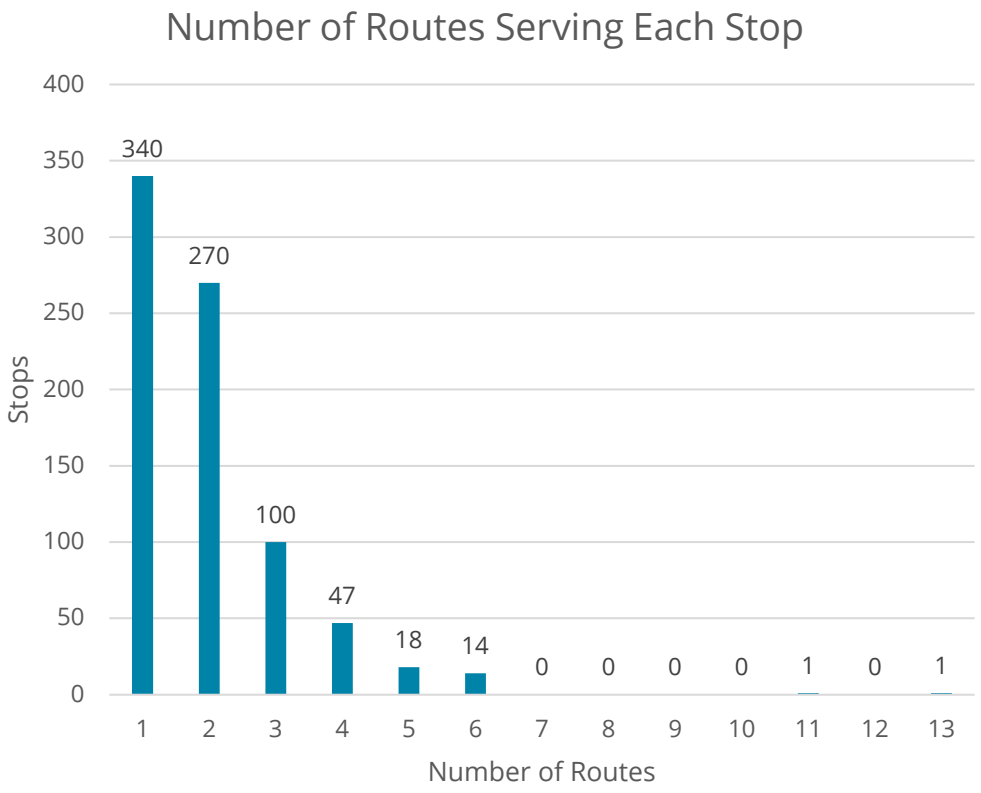
# Ridership

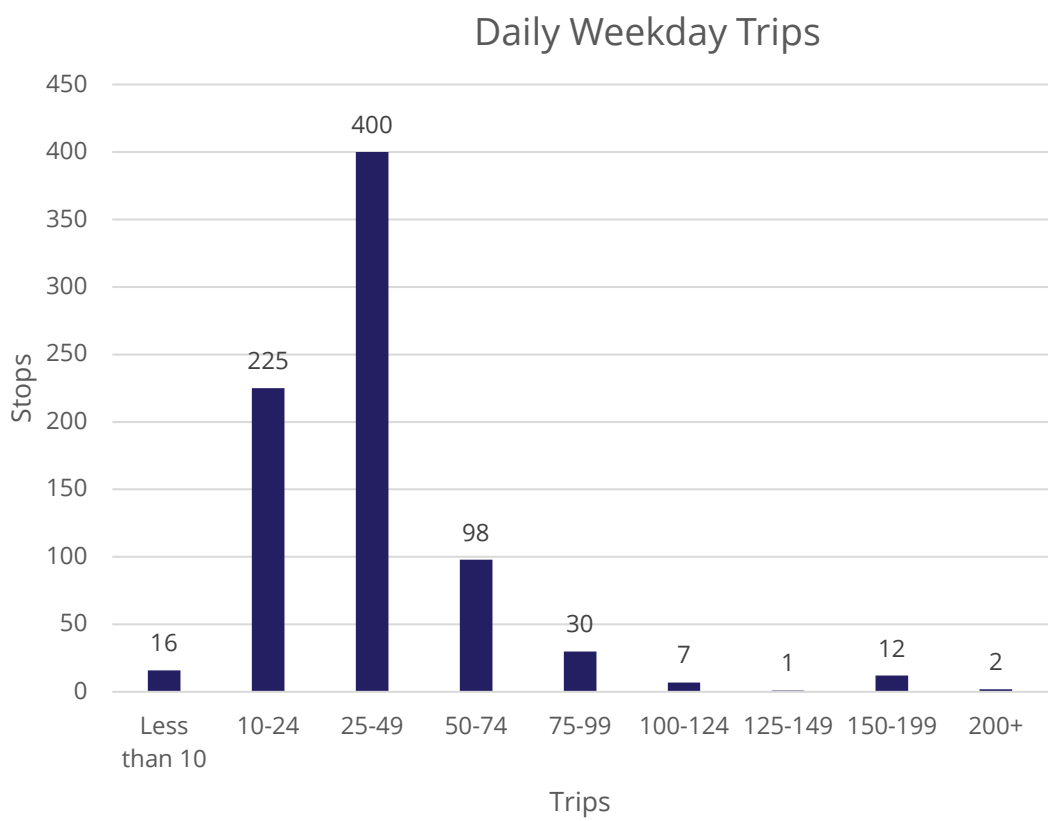
- New Bedford Terminal and Fall River Terminal have the highest number of average boardings, serving many lines.
- Outside of the terminals, there is high ridership at major destinations and corridors:
  - Market Basket shopping center in New Bedford
  - Bristol Community College in Fall River
  - Along County Street and Brock Avenue in New Bedford



# Level of Service

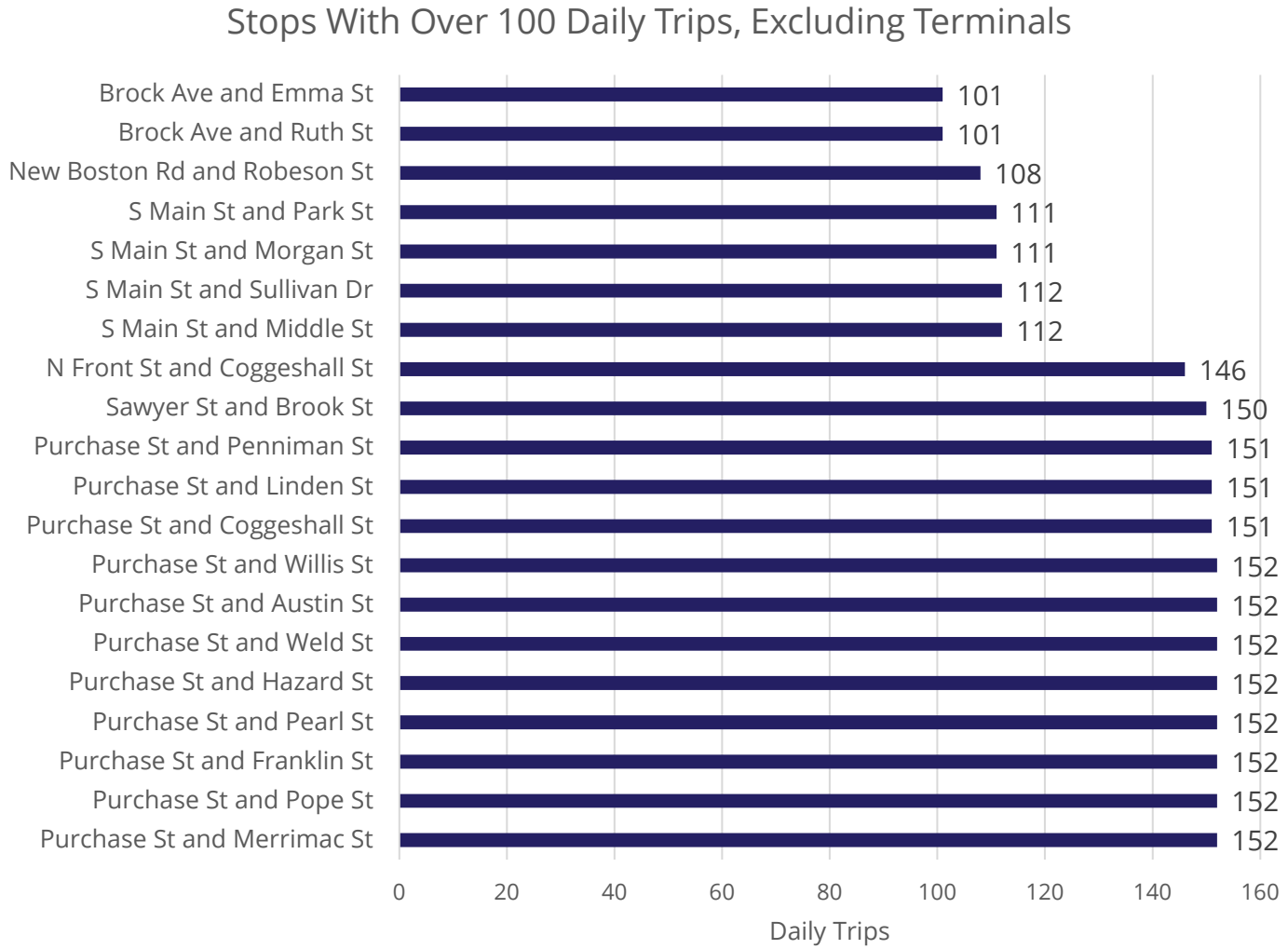
- It is most common for stops to serve a single route.
- Most stops are serviced by fewer than 50 trips per day.



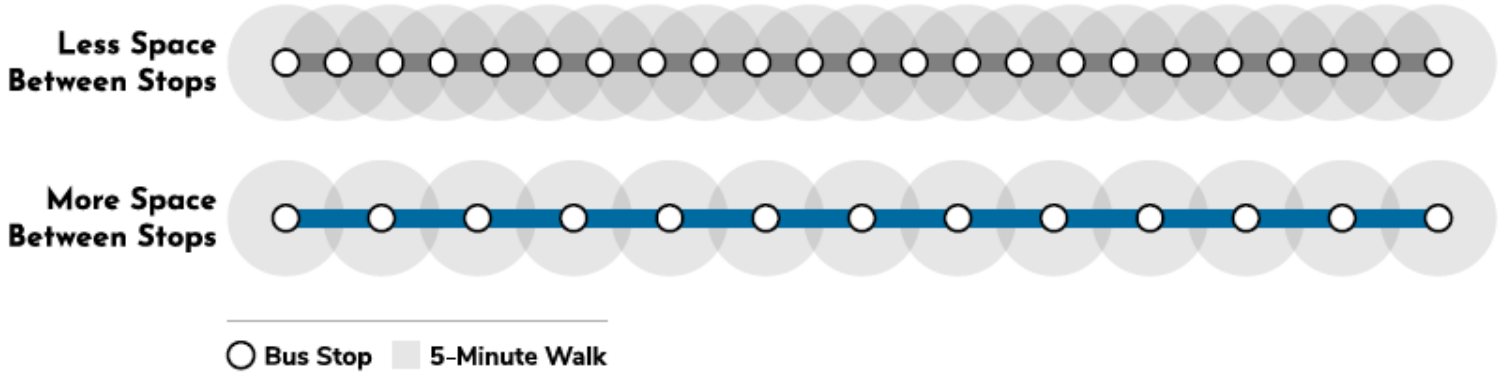
# Level of Service

- Excluding the main terminals, 20 stops are served by more than 100 trips per day.
- These stops tend to be along major corridors, such as Purchase St. and S Main St., where multiple routes run along the same street.



# Overview of Stop Spacing

- The distance between stops significantly impacts travel times and route reliability.
- Healthy stop spacing of 4 to 6 stops per mile balances convenience and speed.
- In areas where there are more people living and working, bus stops should be closer together. Closer stop spacing may also be necessary where there are significant operating considerations or connectivity issues limiting placement.



# Stop Spacing by Route

| Route Number | Average Stop Spacing (feet) | Average Stops per Mile |
|---|---|---|
| FR1 | 616 | 8.6 |
| FR2 | 1,365 | 3.9 |
| FR3 | 735 | 7.2 |
| FR4 | 710 | 7.4 |
| FR5 | 955 | 5.5 |
| FR6 | 1,111 | 4.8 |
| FR7 | 949 | 5.6 |
| FR8 | 988 | 5.3 |
| FR9 | 1,102 | 4.8 |
| FR10 | 761 | 6.9 |
| FR14 | 3,256 | 1.6 |

| Route Number | Average Stop Spacing (feet) | Average Stops per Mile |
|---|---|---|
| NB1 | 688 | 7.7 |
| NB2 | 757 | 7.0 |
| NB3 | 775 | 6.8 |
| NB4 | 755 | 7.0 |
| NB5 | 1,386 | 3.8 |
| NB6 | 684 | 7.7 |
| NB8 | 755 | 7.0 |
| NB9 | 1,255 | 4.2 |
| NB9X | 76,051 | 0.1 |
| NB10 | 1,448 | 3.6 |
| NB11 | 1,512 | 3.5 |
| NB21 | 2,820 | 1.9 |
| NB99 | 1,263 | 4.2 |

# Context Analysis Findings

## Bus stops vary widely in terms of amenities provided, level of service, ridership activity, flexibility for investment, and spacing.

- A high proportion of bus stops are verified ADA compliant
- Stops on regional routes and on suburban roads tend to have the most opportunity for improving amenities
- Shelters and seating are least common amenities available
- 10 routes have very close stop spacing

## There is potential to reach many customers with focused investment at a couple dozen bus stops

- Ridership and transit activity is concentrated at a small number of stops

## Opportunity to leverage partnerships to improve stops located on private property

- Many high- and medium-ridership stops are located at major activity centers (community colleges, Walmarts, Dartmouth Mall, grocery stores)