Rhode Island Bus Stop Design Guide

RHODE ISLAND PUBLIC TRANSIT AUTHORITY

RI dot
Driven to get you there

Prepared by:
McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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RHODE ISLAND STATEWIDE PLANNING PROGRAM

For questions, comments or feedback on the Rhode Island Bus Stop Design Guide please email: designguide@ripta.com.
To download the guide visit www.ripta.com.

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Foreword

Greetings,

A bus stop can be considered the "front door" to public transportation use. Because of that, it is critically important to the Rhode Island Public Transit Authority (RIPTA) that our stops welcome passengers to an environment that is comfortable, consistent, clearly-defined and above all else, safe.

With more than 4,000 bus stops in the State of Rhode Island, RIPTA has many opportunities to welcome passengers on a daily basis. From the busiest bus stops in Providence and Pawtucket to more rural stops in other communities, RIPTA has a responsibility to ensure that each stop creates the same welcoming, accessible and safe environment to our statewide transit network. With so many bus routes on State roads, the Rhode Island Department of Transportation (RIDOT) is an essential partner in this effort.

To that end, it gives us great pride to present the Rhode Island Bus Stop Design Guide. In partnership with RIDOT, RIPTA has been hard at work to create a manual that will assist the State, municipalities, and private developers in the future development of bus stops – whether it be a simple roadside stop or a shelter with more amenities. Among other things, it takes into consideration pedestrian safety, the need to be part of a community's streetscape, and the goal of providing more transit information wherever possible.

The Guide represents a timely addition to RIDOT's new project management approach to delivering highway infrastructure projects. RIDOT project managers will now have the transit-specific tools and resources on hand as highway projects that affect RIPTA's operations are scoped and designed. With this Guide as a resource, RIDOT and RIPTA will improve the delivery of road, bridge, and transit projects, which benefits both agencies and all users of Rhode Island's transportation network. This Guide will set a standard for bus stops to make sure that the needs of our passengers are addressed in a variety of settings.

Ray Studley
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Disclaimer: The Rhode Island Bus Stop Design Guide is intended to be a guiding document that meets or exceeds current state and federal regulations, and provides a toolbox of options and sample scenarios to apply as part of bus stop design. It is not intended to cover every eventuality in bus stop design, and planning/engineering judgement must be used to determine the ideal bus stop design for each unique location.

GLOSSARY

Accessible Path of Travel – Includes a continuous, unobstructed way of pedestrian passage by means of which an area may be approached, entered, and exited. An accessible path of travel may consist of walks and sidewalks, curb ramps and exterior pedestrian ramps, or a combination of these elements.

ADA – The American's 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.

ADAAG – 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.

Bike Lane – A designated lane on a roadway that provides an exclusive space for bicycle travel. Lanes may be painted or designated by a single white line and bicycle symbols. Colored paint can provide added emphasis.

Bike Sharrow – A symbol painted on a roadway to indicate a lane shared by bicycles and vehicles. It reminds drivers to share the lane with bicyclists.

Bus Stop Checklist – A checklist or inspection form for an existing bus stop, or proposed new bus stop location, to determine its compliance with RIPTA and ADA bus stop design guidelines.

Bus Island – A curb extension at a bus stop where the bike lane runs behind the passenger waiting area, effectively creating an island (also referred to as a floating bus stop or bus stop bypass).

Bus Lane – A segment of the roadway designated exclusively for use by buses, to improve travel times and reliability. Bus lanes are commonly painted in red.

Bus Queue Jump Lane – A short stretch of bus lane, which sometimes includes right turning vehicles, on an intersection approach, allowing buses to jump to the front of a line of waiting vehicles. It can be combined with an advance green signal for buses only.

Clear Zone – A clear and level landing area required at the back door of the bus.

Complete Streets – Roadways designed to accommodate users of all ages and abilities traveling by all modes, including walking, biking, driving, and transit. The Rhode Island General Assembly passed a complete streets law in June 2012 to integrate all modes into roadway design and construction projects.

Curb Extension – An extension of the sidewalk into the parking lane to narrow the roadway and provide additional pedestrian space (also referred to as a bulb-out or neckdown, and at bus stops – a bus nub).

Curb Ramp – A ramp provided to transition between the roadway and sidewalk.

Dwell Time – The time a bus spends at a scheduled stop without moving.

Far-side – Located after an intersection crossing.

Landing Area – An ADA compliant boarding and alighting area required at the front door boarding area of a bus stop. This must be at least a 5-foot wide by 8-foot deep obstruction free area on the sidewalk, on a firm and stable surface, with a cross slope of less than 2%. The landing area cannot encompass a grass strip, tree pit or similar soft surface, or include dirt or gravel (also referred to as a landing pad).

Mid-block – Located in between two intersections.

Near-side – Located before an intersection crossing.

PEEP – Is RIPTA's Passenger Experience Enhancement Program, a complete streets approach to improving bus stop infrastructure to be safe, accessible, welcoming and consistent across the State of Rhode Island. The design guide is part of PEEP along with other initiatives such as the new shelter contract, bus stop sign redesign etc.

Pull Out – An area on the side of a roadway, indented into the sidewalk, where buses can pull out of the general flow of traffic (also referred to as a bus bay, cut out and turn out).

PROWAG – A set of Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG), developed by the US Access Board, that provides guidance on ADA design. PROWAG was developed in 2011 but 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. Several agencies, including RIDOT, have already chosen to follow PROWAG when at all feasible.

Transit Signal Priority (TSP) – A method of signal timing that prompts the signal to wait or change for an approaching bus, giving priority to transit vehicles at an intersection.

Chapter 1

Introduction

1 Introduction

Bus stops are the gateway to the majority of Rhode Island's transit service. With well-designed bus stops that provide for the safety, comfort and accessibility of riders, riders experience increased mobility and access to bus service.

1.1 Purpose

The purpose and goals of the Rhode Island Bus Stop Design Guide are to:

- Establish clear guidance on how to consider and better integrate transit into the roadway network throughout the State, and
- Provide design guidance that will improve bus operations and the passenger experience at bus stops.

It is focused on the design of typical Rhode Island Public Transit Authority (RIPTA) bus stops, not "super-stops", busways or transit hubs, where a more extensive design would likely be required.

Incorporating bus stop design into roadway projects is an efficient and direct way to improve transit infrastructure across the State. Most roadway projects include sidewalk reconstruction, curb ramps, alterations to curbs, and streetscape improvements that enhance the pedestrian environment. These same elements are critical components of bus stop design. When roadway projects alter these elements at or near bus stops, they directly impact access to bus stops. When RIPTA, the Rhode Island Department of Transportation (RIDOT), municipalities, other agencies or private entities alter the roadway or sidewalk at a bus stop, they have a legal obligation to make the bus stop compliant with the Americans with Disabilities Act (ADA).

There is a need to create guidelines to ensure the proper placement and consistent consideration of passenger amenities at RIPTA's 3,800 bus stops that facilitate an average daily ridership of 56,000 (FY2016).

As part of Federal Highway Administration's (FHWA) regulatory responsibility under Title II of the ADA and Section 504 of the Rehabilitation Act of 1973 (504), the FHWA ensures that recipients of federal aid, and state and local entities that are responsible for roadways and pedestrian facilities, do not discriminate on the basis of disability in any highway transportation program, activity, service or benefit they provide to the general public; and that people with disabilities have equitable opportunities to use the public right-of-way.

The bus stop design guide illustrates to planners, engineers, landscape architects and others, that bus stops are not just a sign on a post, but an opportunity to improve access and mobility for the community. The guide shows municipalities and others how to incorporate transit improvements into roadway design and

streetscape projects. It helps create bus stop zones that work operationally for RIPTA, meet ADA requirements, provide comfort for riders, and maintain a safe pedestrian environment. The guide also benefits the general public by providing details on the elements of bus stop design and RIPTA's goals and practices, to enable them to advocate for their needs as transit riders.

The guide is intended to provide direction on safe and accessible bus stop design and criteria for evaluation, but should be site sensitive and used in conjunction with planning/ engineering judgment, and appropriate laws, ordinances, and regulations. Questions regarding the guide, and particularly deviation from the recommendations outlined in this guide, should be directed to RIPTA's Planning Department at designguide@ripta.com.

1.2 Project Background

The Rhode Island Bus Stop Design Guide was initiated in response to a complete streets law (General Law 24-16-2) passed by the Rhode Island General Assembly in 2012, calling for the accommodation of all users in all roadway construction projects. Its development has been a collaborative effort between RIPTA and RIDOT, with input from local municipalities, stakeholders, and RIPTA riders. Details of the public process are provided in Appendix A. The guide conforms to state and federal regulations, as well as having consideration for national guiding documents, and has been drafted following a review of several peer transit agency guidelines. Further details on the peer review are provided in Appendix A.

Municipal representatives, advocates and riders gathered at the Newport Gateway Center to view a presentation on the design guide and sample bus stop scenarios, and provide feedback

Why create a bus stop design guide?

- **Address safety concerns**
- **Improve accessibility**
- **Enhance service operations**
- **Provide better passenger amenities**
- **Provide consistency in planning and design of bus stops**
- **Establish best practices to be followed**
- **Address Rhode Island-specific conditions**
- **Improve collaboration between RIPTA, RIDOT, municipalities and other affected agencies**

Interagency coordination is necessary for successful implementation of bus stop design, construction and maintenance. With different jurisdictions controlling the roadway and sidewalk, state and local agencies must work together. For example, the majority of roadways RIPTA operates on are under RIDOT

jurisdiction, though some fall under municipal jurisdiction, while the sidewalks are generally maintained by the local municipality.

Procedures were recently put in place at RIDOT to ensure that RIPTA is notified of any project within one quarter of a mile of RIPTA service or bus stop, during the early stages of a project, when a detailed scope of work is being developed. RIPTA then has the opportunity to be involved through the life of a project, for a portion of it, or not at all. Regardless of RIPTA's chosen level of involvement, RIDOT will provide RIPTA with the project's first design plan submission for review and comment.

Municipalities are strongly encouraged to contact RIPTA's Planning Department at designguide@ripta.com when their projects are similarly located and have the potential to impact RIPTA service area, to ensure that bus operations, rider needs and bus stop maintenance are appropriately addressed. Furthermore, RIPTA would like to work with each of the Rhode Island municipalities to establish similar relationships and protocols for their projects. As a first step to this, RIPTA will be providing electronic and hard copies of this guide to each municipality in their service area, and offer training sessions for municipal staff on aspects of bus stop design.

1.3 Guide Outline

In addition to creating safer, more accessible and user-friendly bus stops, this guide supports improved and more streamlined bus service. Several of the elements considered in good bus stop design minimize delay incurred at signalized intersections when buses need to re-enter traffic flow, as well as when passengers board and alight the bus.

RIPTA operates in a variety of different roadway environments with varying types of pedestrian facilities, such as downtown areas, urban, suburban, and rural streets, as well as on private properties such as shopping malls, apartment complexes, office parks, hospitals, and college campuses. Sample bus stop designs for a variety of different environments are therefore provided for guidance, including:

- Urban downtown areas with wide sidewalks which provide an opportunity for various transportation infrastructure and pedestrian accommodations
- Suburban areas with narrow sidewalks or no sidewalks on one or both sides of the roadway
- Constrained areas with limited right-of-way
- Off-street locations without providing service to the front door

The guide addresses bus stop spacing, placement, configuration, and length, ADA requirements and pedestrian accessibility, signs and other streetscape elements, roadway design considerations, and design and siting of rider amenities.

Elements of Bus Stop Design:

- **Bus Stop Spacing and Siting**
- **ADA Accessibility**
- **Pedestrian Connectivity/ Access**
- **Streetscape Elements**
- **Roadway Design**
- **Pedestrian and Rider Amenities**

Figure 1.1 illustrates the various steps involved in creating the ideal bus stop. If each of the components of the bus stop design cannot be incorporated, it may mean that an alternate location for the stop may need to be identified. A detailed bus stop checklist is also provided in Appendix B, which can aid with reviewing the condition of a bus stop and planning and designing for improvements.

Figure 1.1 Steps to Planning and Designing a Bus Stop

Chapter 2

Bus Stop Placement

2 Bus Stop Placement

2.1 Stop Spacing

Appropriate spacing of bus stops helps to maintain service flow and reliability, and minimize the stop/start feeling, but should also be appropriate to the type of bus service operating, such as local versus express service. Determining stop spacing involves striking a balance between locating stops close enough so that riders have a short, convenient walk, while minimizing the number of times the bus has to stop, in order to provide the most efficient service. While the dwell time to board and alight passengers generally remains constant regardless of the number of stops, the deceleration time entering stops and accelerating time exiting stops can be reduced with less stops. Stop spacing is also influenced by other considerations, as described in the bus stop siting section.

Optimal stop spacing is more or less equidistant, and maximizes efficiency of the service. Location of stops in pairs makes the service easier and more predictable to use, and stops are easier to maintain. Stop pairs serving routes in opposing directions should ideally be situated across the street from one another, but in a staggered position, so riders can easily locate the stop for their return trip. Pairs of stops should ideally be connected via a crosswalk so that riders have safe crossings for both directions of their trip. The addition of a crosswalk to connect bus stops should be evaluated using FHWA (2015) crosswalk guidelines and will need to be approved by the municipality, or on RIDOT roadways – the State Traffic Commission.

Fewer stops reduces conflicts between buses and other vehicles and bicyclists when buses move between the travel lane and the bus stop. A reduction in the number of stops can also help to negate or offset the loss of on-street parking, when adjusting existing stop lengths to provide sufficient curbside space for buses to enter and exit a bus stop.

When planning or designing at the corridor-level, planners and engineers are encouraged to review RIPTA's stop spacing policy, detailed in their Comprehensive Operational Analysis Service Guidelines and provided in Table 2.1, for improvements, and suggest retention, relocation, elimination or addition of stops, as appropriate. Siting criteria included in this guide should also be considered.

2.2 Bus Stop Siting

The optimal stop location should minimize or improve travel times, maximize reliability and route efficiency, and be safe and accessible, while maintaining and or enhancing rider access to destinations and amenities. The siting of a bus stop not only impacts transit riders, but also drivers, pedestrians, and cyclists in the vicinity of the stop.

Multiple factors are used to determine the appropriate siting of a bus stop including:

A. Demographics and Land Use

Ridership – Assess both existing and projected boardings and alightings, as well as the ridership profile (for example, seniors or

Table 2.1 Bus Stop Spacing

	Location	Rapid Bus	Key Corridor	Urban Radial	Non-urban/ Suburban/ Crosstown	Regional	Express/ Commuter	Flex
Minimum Stop Spacing (Feet)	Moderate to high density areas	1,100	900	900	660	900	900	n/a
	Low density areas	1,300	1,300	1,300	1,100	1,100	1,100	n/a
Maximum Stops per Mile	Moderate to high density areas	5	6	6	8	6	6	n/a
	Low density areas	4	4	4	5	5	5	n/a

Notes: Moderate to high density = greater than or equal to 4,000 persons per square mile = less than 4,000 persons per square mile

students) at the stop. Low ridership stops, in particular those in close proximity to higher ridership stops, may be considered for consolidation or removal. The threshold for a low ridership stop will be determined when it is compared to ridership at other stops along the same, or similar bus route, and the frequency of service provided at the stop.

The total ridership on the route is not anticipated to change when bus stop locations change or are optimized, as riders who currently use a stop that is slated for relocation or removal would typically walk to the next closest stop.

Mid-block RIPTA stop at Providence Housing Authority's Carroll Towers, at Smith Street at Common Street in Providence, RI

Existing and Future Land Uses – Note sensitive land uses, including medical facilities, municipal buildings and senior housing, and major transit trip generators, such as shopping malls, schools, and dense commercial or residential complexes. Stop locations may be adjusted or added to provide better access to rider origins and destinations, although this will also be dependent on pedestrian connections and conditions.

B. Existing Service and Rider Amenities

Bus Route Connections – Consideration should be given to maintaining and or improving bus stops serving parallel and traversing bus routes. Under certain circumstances, the relocation of an existing bus stop may be necessary, and it may increase the distance for riders transferring between traversing routes. Priority should be given to relocating the stop within close proximity of its former location, thereby minimizing the additional distance a transferring rider would have to walk between stops.

Rider Amenities – Evaluate opportunities to add amenities to new or existing stops and retention/relocation or upgrading of amenities at existing stops.

C. Pedestrian Environment

Connections and Condition – Sidewalks immediately at the stop and connected to the bus stop, as well as to the surrounding area, is an important consideration. Bus stops should be established or relocated to better, more level sidewalk surfaces, away from pinch points, and/or to wider sidewalk areas.

Crossings – Bus stops should connect to a marked pedestrian crossing, preferably a crosswalk behind the stop, so that riders are encouraged to cross behind the bus. Ideally crossings should be signalized, especially in high traffic volume and higher speed environments. Intersections and at-grade driveway crossings should have existing or the potential to add ADA-compliant curb ramps.

D. Safety

Lighting – Provide safety and security for riders, and better visibility for bus operators of waiting passengers at a well-lit stop. Lighting can be cast by pedestrian scale lighting, lighted shelters, overhead street lights or brightly lit signs.

Sight Distance – Consider sight distance for transit riders, bus operators and other drivers. Avoid obstructions to sightlines between bus operators and transit riders such as trees, signs, buildings, shelters, and topography.

For optimal sight distance between bus operators and other drivers, bus stops should not be located over the crest of a hill, immediately in or after curve in the roadway to the right, or at locations that might prevent visible connectivity between buses and other vehicles.

Following vehicles need to have good visibility of stopped buses, particularly when bus stops are located in the travel lane, as well as buses decelerating to enter a stop and accelerating when exiting a stop. Similarly, bus drivers need to be able to see vehicles approaching from behind when exiting a stop. Table 2.2 provides the recommended sight distance for bus stops, given the posted speed limit. At a minimum bus stops should be sited to meet the minimum stopping sight distance provided by AASHTO.

It is not recommended to place stops where there is inadequate sight distance, and existing poorly visible stops should be considered for relocation or removal. In addition, stopped buses can impact sight distance for vehicles exiting side streets. Depending on the location of the stop relative to the intersection, different vehicular turn movements can be affected.

Table 2.2 Sight Distance for Siting Bus Stops[1]

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

Source: Adapted from AASHTO 2016 and AASHTO 2011.

Notes: Assume a 9 second time gap is required for buses to re-enter traffic without undue interference to traffic flow.

[1]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.

E. Placement at the Intersection

There are three general placement options for bus stops along a roadway, as depicted in Figure 2.1:

- Far-side of an intersection or large commercial access driveway
- Near-side of an intersection or large commercial access driveway
- Mid-block

Table 2.3 provides a comprehensive comparison of advantages and disadvantages between each bus stop location, and key points are summarized below.

Far-side stops are located after the intersection, and are generally preferred by RIPTA and RIDOT because:

- Crosswalks are located behind the stop, encouraging pedestrians to cross behind, and not in front of a bus
- At signalized intersections bus operators can utilize opportunities in the signal phasing and gaps in traffic flow to re-enter the travel lane
- Transit priority measures, including bus queue jump lanes and transit signal priority, can more easily and effectively be used in conjunction with far-side stops

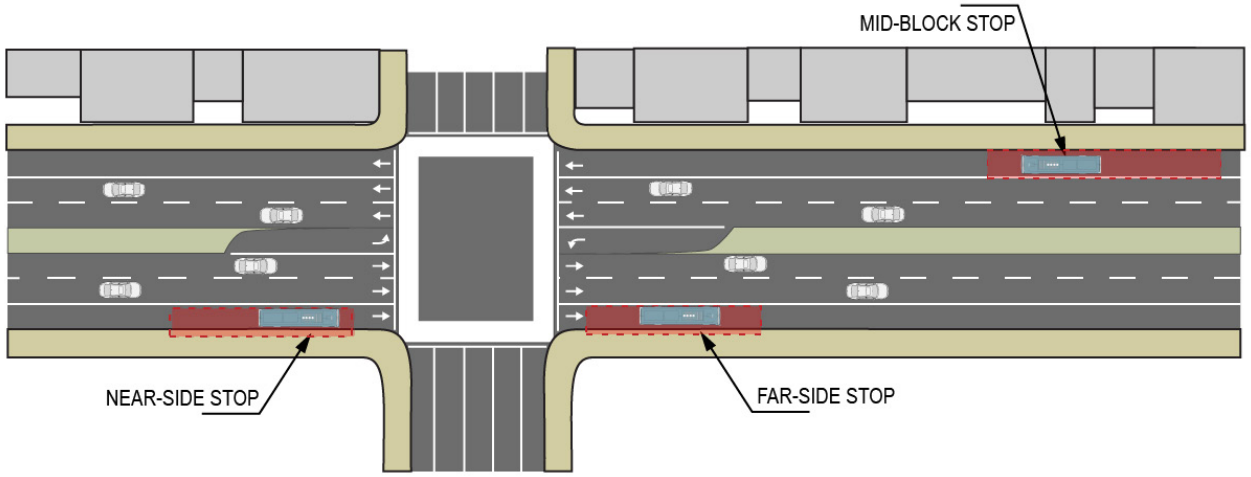


Figure 2.1 Far-side, Near-side and Mid-block Located Bus Stops[2]

Far-side RIPTA stop on Broad Street at Fricker Street in Providence, RI

- At curbside stops buses can utilize the intersection to pull into a stop, thereby requiring less curb space and minimizing the impacts to on-street parking

However, far-side stops can cause vehicles to block the intersection if traffic is held up behind a stopped bus.

Near-side stops are located before the intersection, and may be used:

- At stop-controlled intersections to reduce the number of times the bus needs to stop
- If there is a large trip generator on that side of the intersection
- If a shared stop is desired to facilitate through and right turning bus movements

[2]Adapted from OmniTrans 2013

Table 2.3 Advantages and Disadvantages of Bus Stop Locations[3]

	Advantages	Disadvantages
Far-Side Stop	• Minimizes conflicts between right turning vehicles and buses • Provides additional right-turn capacity by making curb lane available for traffic at intersections • Minimizes sight-distance problems on approaches to intersection, including visibility of traffic control devices. The stopped bus does not obscure sight distance to the left for vehicles entering or crossing from the side street • Encourages pedestrians to cross behind the bus • Creates longer deceleration distances for buses since the bus can use the intersection to decelerate • Results in bus drivers being able to take advantage of the gaps in traffic flow that are created at signalized intersections • Sight distance is improved for pedestrians at intersections where heavy traffic flows diverge, causing traffic volumes to be lighter on the leaving side than on the approaching side, far-side stops will minimize interference with major flows • Waiting passengers accumulate at less crowded sections of sidewalks rather than close to the intersection • Passengers are encouraged to leave by the rear door, since it is closer to the street corner, and as a result loading and unloading time is reduced • Conducive to bus signal priorities at signalized intersections • Minimizes area needed for curbside bus stop • If a pull out is provided, vehicle capacity through intersection is unaffected • Appropriate after the route has made a turn	• Could result in traffic queued into the intersection when a bus is stopped in the travel lane or more buses than fit at the stop arrive at the same time • May obscure sight distance for crossing vehicles, for example to the right of drivers entering from the cross street to the right of the bus • If signal priority is not in use, can cause a bus to stop far-side after stopping for a red light, which interferes with both bus operations and other traffic • May increase the number of rear-end collisions since drivers do not expect buses to stop again after stopping at a red light and proceeding across an intersection • May increase sight distance problems for crossing pedestrians • May cause passengers to access buses further from crosswalk • May interfere with right turn movement from cross street • May require double stopping if there is also a nearside stop (although one or the other should be considered for removal) • May restrict or choke travel lanes on the far-side of the intersection

[3]Adapted from AASHTO 2014, UTA 2014 and OmniTrans 2013

Table 2.3: Advantages and Disadvantages of Bus Stop Locations (cont'd)

	Advantages	Disadvantages
Near-Side Stop	• Minimizes interference when traffic is heavy on the far-side of the intersection • Allows passengers to access buses closest to crosswalk • Results in the width of the intersection being available for the driver to pull away from curb • Allows passengers to board and alight while the bus is stopped at a red light • Eliminates the potential of double stopping, especially at stop controlled intersections • Provides drivers with the opportunity to look for oncoming and crossing traffic, including other buses with potential passengers (to improve transfers) • Less potential conflict with traffic turning onto the bus route street from a side street	• Increases conflicts with right-turning vehicles • Buses moving around stopped vehicles may conflict with moving traffic in adjacent lane • Limits traffic signal priorities • May block the through lane during peak period with queuing buses • May result in stopped buses obscuring curbside traffic control devices and crossing • May cause sight distance to be obscured for cross vehicles stopped to the right of the bus • Increases sight distance problems for crossing pedestrians • Reduces capacity of bus stop if bus is ready to go but stopped by a red signal • Reduces capacity of the intersection a when bus is stopped during available green time • If located at a signalized intersection, and buses need to exit the traffic stream, a traffic queue at a signal may make it difficult for buses to exit and merge back into traffic
Mid-Block Stop	• Can minimize sight distance problems for vehicles and pedestrians • May be closer to passenger origins or destinations on long blocks • May result in less interference with traffic flow • May result in passenger waiting areas experiencing less pedestrian congestion • Less conflicts between waiting and walking pedestrians	• Requires the most curb clearance of the three options, unless a mid-block curb extension is provided • Without a crosswalk can encourage passengers to cross the street mid-block (jaywalking) • Increases walking distance for passengers crossing at intersections

Near-side stops are generally not preferred over far-side stops because:

- Crosswalks are located in front of the stop and less visible to bus operators
- Crossing bus riders/pedestrians have the potential to further delay the bus
- At signalized intersections buses have the potential to be stopped twice, once serving the stop, and again for the traffic signal, increasing delays to service, affecting the passenger experience
- Buses require more space to pull into a stop, increasing the impacts to on-street parking
- Right turning vehicles and through moving buses have the potential to be in conflict with each other
- It is more difficult to integrate bus priority measures

Mid-block stops are located somewhere along a block, usually between two intersections or large commercial access driveways, for example the stop at Carroll Towers shown previously in section 2.2.A. They are generally not preferred over far-side or near-side stops unless there is a large trip generator mid-block, or there is insufficient curbside space or vehicle travel lane capacity at the intersection. Mid-block pedestrian crossings

Near-side RIPTA stop in parking lane on Route 114 at Child Street/Route 103 in Warren, RI

are less desirable and so it may be difficult to directly connect a bus stop and crosswalk, especially when an intersection is close by, but not immediately adjacent to the stop.

2.3 Bus Stop Roadway Configuration

While the stop location generally determines how buses approach stops and engage with traffic operations, the physical configuration of stops impact how riders interact with the transit system, and how it integrates with the streetscape and surrounding environment. There are essentially three different types of bus stop configurations that should be considered:

- Curbside in a travel lane, shoulder or parking lane
- At a curb extension
- In a pull out

A. Curbside

Curbside bus stops are currently the most common form of bus stop configuration in Rhode Island. They are located adjacent to the roadway's existing curb line and entail the bus stopping in the parking lane, travel lane, or shoulder.

Parking Lane

In areas with on-street parking, a curbside bus stop will generally fall within the parking lane, and will necessitate the removal of parking spaces. A typical 40-foot bus is equivalent to two on-street parking spaces; however, additional curb space is needed for the entry and exit zones for deceleration and acceleration between parked vehicles. The parking impacts of bus stops in the parking lane can be reduced if there is a hydrant situated within the stop, or a driveway is located in the deceleration and or acceleration zones. A graphic depicting a bus stop in a parking lane is shown in Figure 2.2.

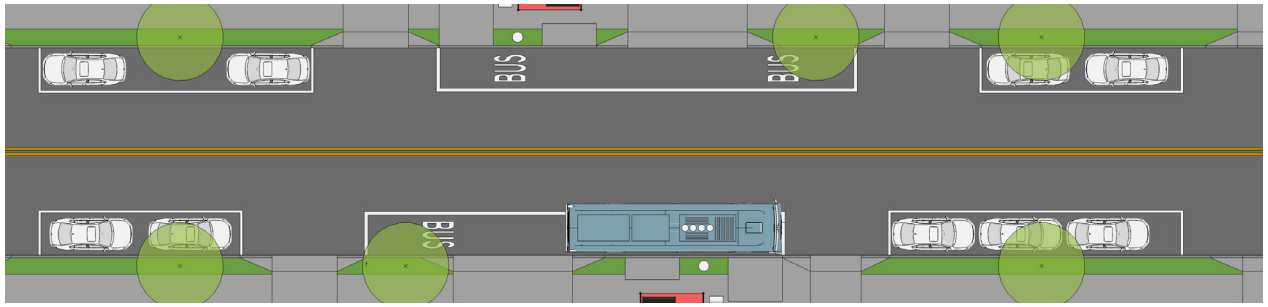


Figure 2.2 Bus Stop in Parking Lane

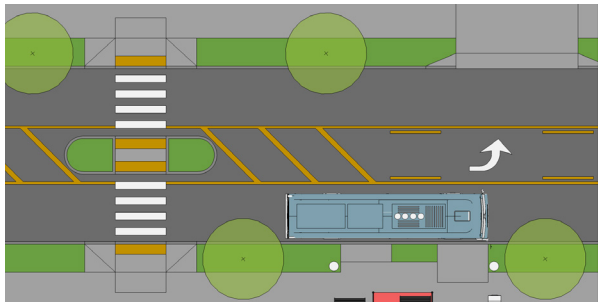


Figure 2.3 Bus Stop in Travel Lane

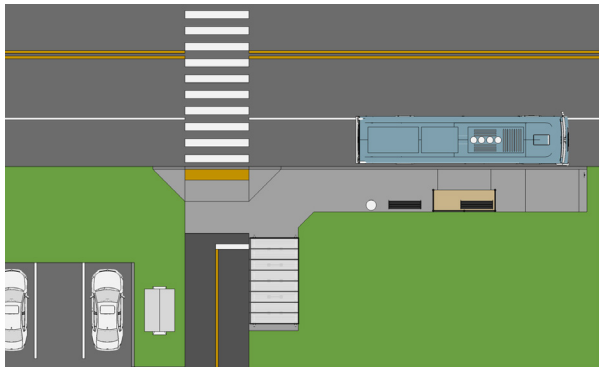


Figure 2.4 Bus Stop in Shoulder

Travel Lane or Shoulder

Buses stopping in a travel lane, including a bike lane, or shoulder, eliminate the need for the bus to merge in and out of traffic, which improves service reliability and travel time. However, it may cause the bus to temporarily block other vehicles. This type of stop is preferred by transit agencies, but is concerning to traffic engineers due to the impact on traffic operations. Graphics depicting bus stops in a travel lane and a wide shoulder are shown in Figure 2.3 and Figure 2.4.

Curbside bus stops require sharing sidewalk space with other activities, but can still be desirable where:

- Curb length is adequate
- No physical obstructions are within the bus stop zone and there are no driveways to hinder boardings and alightings
- Access can be provided for passengers with disabilities
- Adequate space can be provided for waiting passengers as well as other pedestrians
- Space is available for rider amenities

Bus stops in right turn lanes are generally discouraged to prevent conflicts with vehicles that may utilize the adjacent travel lane and cut in front of a bus, a movement that is not always visible to bus operators. It is more appropriate to have a near-side bus stop in a travel lane if right turns are prohibited, such as at an intersection where the cross street to the right is one-way approaching the intersection.

Alternatives to curbside stops that can further enhance the rider/pedestrian/bicycling environment, and/or provide more priority for transit operations, include bus stop curb extensions (also referred to as bus bulbs, nubs or bump outs) and pull outs (also referred to as bus bays, turn outs, or cut outs). These stop configurations are discussed in detail below, and the advantages and disadvantages of each stop type are summarized in Table 2.4.

B. Curb Extension

Curb extensions require extending the curb line and sidewalk area into the parking lane to create additional pedestrian space at the bus stop, and enable the bus to stop in the travel lane. Widening the sidewalk improves

Table 2.4 Advantages and Disadvantages of Curb Extensions and Pull Outs

	Advantages	Disadvantages
Curb Extension (Bus Bulb)	*For Transit Operations* • Improves safety for passengers while alighting and boarding • Provides easy access for driver to bus stop • Eliminates delay for bus returning to travel stream *For Traffic Management* • Improves speed for transit as compared to pull out • Used in combination with parking in the curb lane • Removes fewer parking spaces for the bus stop than curbside stop or bus pull out *For Pedestrians* • Provides additional sidewalk area for pedestrians and bus riders to wait for bus • Reduces pedestrian distance to cross street	*For Transit Operations* • Bus is not removed from travel lane while passengers alight and board • Requires a larger capital investment than curbside bus stop; more difficult to relocate *For Traffic Management* • Impacts other vehicles that may queue behind bus • Other drivers may make unsafe lane changes to avoid stopping behind a bus
Pull Out (Bus Bay)	*For Transit Operations* • Provides a protected area away from moving traffic for bus stopped for a long dwell time or layover • Allows buses to drop off and pick up passengers outside travel lanes *For Traffic Management* • Bus stops out of moving traffic lane • Minimizes traffic delays due to bus operations *For Pedestrians* • Improves safety for passenger boarding and alighting by increasing the distance between passengers and moving traffic	*For Transit Operations* • May present problems to bus drivers trying to re-enter traffic, especially in high-speed or high-volume traffic • Requires infrastructure modifications; more difficult to relocate *For Traffic Management* • Creates bus/vehicle conflicts when buses re-enter a busy travel lane • May reduce parking space curbside *For Pedestrians* • May reduce sidewalk space and increase pedestrian congestion

the passenger experience by providing more waiting space for riders and can allow for the integration of bus stop amenities, particularly shelters. Figure 2.5 shows a curb extension where the shelter did not encroach upon the original sidewalk area. Curb extensions can allow for a wider and clearer path of travel for other pedestrians behind the bus stop zone. By stopping in the travel lane, rather than waiting for gaps in traffic to re-enter the travel lane, buses can continue in-lane directly after stopping, which improves the travel time for riders on the bus.

Bus stop curb extensions at the near-side and far-side of intersections are typically extended to include the adjacent pedestrian curb ramp, which reduces the intersection crossing distance for all pedestrians, including transit riders. New corner radii should be designed to accommodate the existing bus fleet and future service and equipment needs. Right turn restrictions may be required if there is a tighter corner radius. The American Association of State Highway and Transportation Officials (AASHTO) specifies a 50- to 55-foot radius to accommodate urban transit and intercity buses. A turning radius template for one of RIPTA's existing vehicles – a 40-foot Gillig, is provided in Appendix C. A summary of the recommended curb radius for a 90-degree turn to avoid encroachment in the opposing lane, based on the width of approaching lanes and entrance lanes, is also provided in Appendix C.

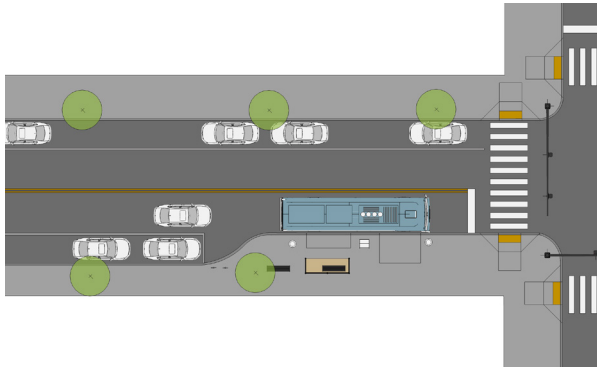


Figure 2.5 Bus Stop Curb Extension

Far-side bus stop curb extension

Near-side curb extension with realigned curb ramp at an MBTA bus stop in Cambridge, MA

Stops with curb extensions can also be alternated with pull out stops to allow vehicles to pass buses where traffic build up is a concern.

Curb extensions do not necessarily need to extend into the entire parking lane. A partial curb extension can widen the sidewalk, but still allow drivers to pass a stopped bus. This type of curb extension should be installed with caution, especially at near-side stops at unsignalized intersections, as pedestrians crossing in front of the stop may not anticipate vehicles passing a stopped bus. A partial curb extension should only be provided if the adjacent travel lane is wide enough to accommodate a stopped bus and a passing vehicle, without encroaching on the opposing travel lane, or the travel lane is sufficiently narrow that vehicles will not attempt to pass a stopped bus.

From a traffic operations perspective, use of curb extensions may need to be coordinated closely with RIDOT and local municipalities,

and may be determined based on traffic volumes or delay criteria, the presence of a single wide travel lane, or two travel lanes, to allow passing of stopped buses, or on a case-by-case basis. Curb extensions have the potential to cause vehicles to queue behind a stopped bus (unless two travel lanes are present) and may encourage drivers to make unsafe movements when changing lanes to avoid a stopped bus.

Applicability of Curb Extensions:

- **Frequent transit service**
- **High bus stop ridership**
- **High volume of pedestrian activity**
- **Crowded sidewalks**
- **Desire to reduce pedestrian crossings distance**
- **Low roadway operating speeds**
- **Traffic calming technique**
- **Conditions where bus operators find difficulty in re-entering the traffic stream or merging buses cause traffic delays**
- **Desire for bus stop in travel lane**
- **Adequate right-of-way and adjacent parking lanes are available**
- **Can be used to protect bike lanes, creating a floating bus stop**

Capital costs to construct curb extensions will be higher than for conventional curbside bus stops. There may also be additional costs due to relocation of drainage structures and utilities that should be considered. It may also be necessary to rework drainage patterns to prevent water from ponding near the stop.

C. Pull Out

A bus pull out allows buses to stop without impeding traffic flow by pulling into a bus stop zone and out of the main travel lane. They are most appropriate along higher speed suburban/rural roadways, or where there are extended dwell times, such as at a layover location or at commercial establishments such as a grocery store or mall when boardings can be slower with passengers carrying packages. Passenger safety is improved by providing more distance between the boarding and alighting area, and moving traffic. A typical bus pull out is depicted in Figure 2.6.

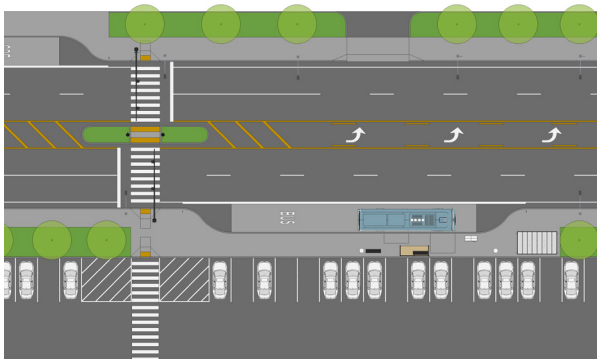


Figure 2.6 Bus Stop Pull Out

RIPTA stops with bus pull outs on Garfield Avenue in Cranston, RI

Although there are clear benefits of buses pulling out of the travel lane, pull outs can also delay bus service, as buses may have to wait for a gap in traffic in order to re-enter the travel lane. Delay for buses re-entering traffic may occur on roadways where traffic exceeds 1,000 vehicles per hour per lane[4]. Pull outs also reduce the sidewalk space at a stop, which can have a negative impact on the passenger waiting area and incorporation of amenities at stops. They are typically constructed when there is a wide right-of-way available, or the abutting property owner provides an easement for the construction of the sidewalk and/or pull out.

The most typical pull out is a closed bay, as shown in Figure 2.6, but pull outs can also be configured as open, or partially open.

An open pull out is open to traffic on its end closest to the intersection and can be situated on the far-side or near-side of the intersection.

A far-side open pull out is open on the bus stop approach. The curbside space is shortened, as the bus can use the intersection to pull in, but buses may be delayed in re-entering traffic on high volume streets. An example of a far-side open pull out is provided in Figure 2.7.

[4]AASHTO 2014
[5]Adapted from Delaware Valley Regional Planning Commission (DVRPC) 2012
[6]AASHTO 2014

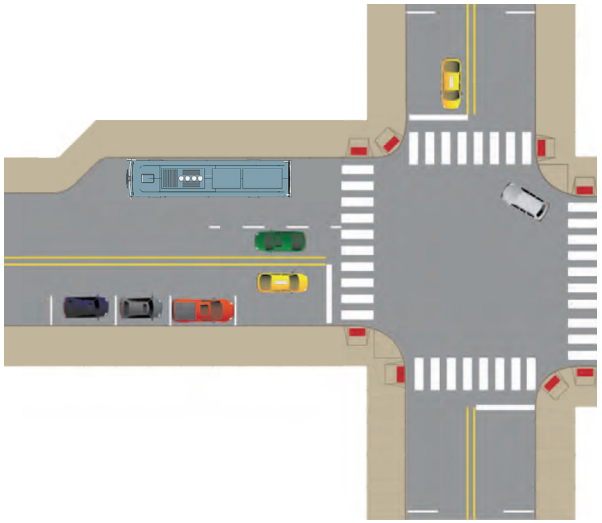


Figure 2.7 Far-side Open Bus Stop Pull Out[5]

A near-side open pull out is open on the bus stop egress. This configuration can be used to enhance bus operations at high traffic volume intersections when used with queue jump lanes and active transit signal priority.

A partial open pull out is closed on one side with a partial curb extension on the other side at the pedestrian crossing. This configuration reduces the pedestrian crossing distance, but also allows easier access or egress from the pull out, compared to a closed pull out. It can be provided on the near-side or far-side of an intersection. An example of a far-side partial open pull out is provided in Figure 2.8.

Use Bus Stop Pull Outs where [6]:

- **There is available sidewalk or other space, without adversely affecting pedestrian movement on the sidewalk**
- **Travel speeds are high (greater than 40 miles per hour) and passenger safety is a concern**
- **Vehicle/bus conflicts warrant separation of transit and passenger vehicles**
- **There is a history of repeated traffic and/or pedestrian crashes at the stop**
- **Stop boardings exceed 20 to 40 riders per hour**
- **Layover space for the end of the trip, or time point with extended dwell time (10 to 30 seconds per bus) is needed**
- **The curb lane is used by moving traffic and traffic volumes in the curb lane are between 250 and 500 vehicles during the peak hour**
- **Sight distance to the stop prevents traffic from safely stopping behind a stopped bus**

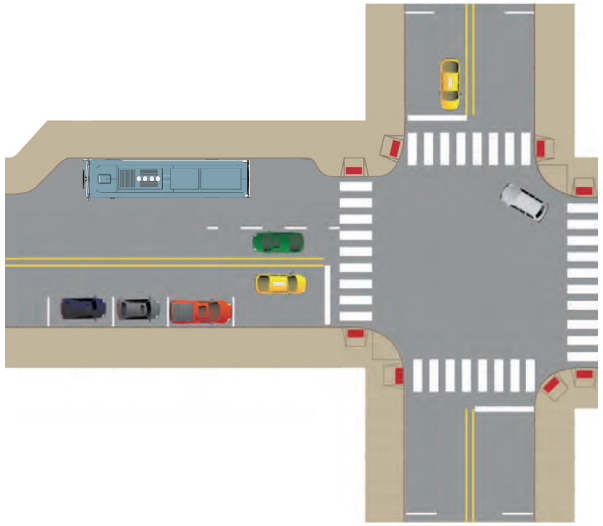


Figure 2.8 Far-side Partial Open Bus Stop Pull Out[7]

2.4 Bus Stop Length

There must be enough curbside space to enable bus operators to pull the bus parallel to the curb, open both doors onto the sidewalk, and pull out of the stop into the travel lane. Sufficient bus stop length will prevent buses from straddling crosswalks, blocking access for pedestrians, and will provide sufficient clearances from crosswalks. The bus stop length required varies depending on several factors:

- Location of the stop relative to the intersection
- Stop configuration
- Approach of bus turn movements
- Angle of the taper at curb extensions and pull outs
- Roadway speed, and thereby deceleration and acceleration space
- Presence of crosswalks, parking and driveways
- Location of landscaping and street furniture along the sidewalk edge
- Number of buses serving and/or laying over at the stop

Table 2.5 provides the stop lengths required for a 40-foot bus for different stop placements and configurations, as well as their equivalent length in parking spaces. Impacts to parking can be minimized by utilizing driveway space and sidewalk areas with hydrants, where parking is already prohibited. The length of the bus stop should be sufficient for the bus to clear crosswalks by 10 feet[8]. This clearance can be included in the acceleration and deceleration zones.

Table 2.5 Bus Stop Lengths

Stop Placement	Decel. Lane (feet)	Stopping Area (feet)	Accel. Lane (feet)	Total (feet)	# Parking Spaces
Far-side	10	40	20	70	4
Far-side, after left turn	30	40	20	90	5
Far-side, after right turn	60	40	20	120	6
Near-side	60	40	10	110	6
Mid-block	60	40	20	120	6
Curb extension	n/a	40	n/a	40	2
Pull Out (Closed Bay)	60	40	20	120	6+

Notes: Assumed length of a parking space is 20 feet.
Total length of the curb extension and pull out does not include the taper.

[7]Adapted from DVRPC 2012
[8]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).

RIPTA stop on Route 114 at Child Street/Route 103 in Warren, RI has insufficient stop length to enable the bus to pull parallel to the curb

Bus stop lengths may need to be adjusted based on site specific conditions, and if more than one bus is expected to service a stop at one time, the bus stop length should be increased by 50 feet for each additional 40-foot bus[9], allowing for 5-10 feet between each queuing vehicle[10].

A. For Curbside Stops

The stop length of a curbside stop in a parking lane is made up of three components: the deceleration zone, the stopping zone, and the acceleration zone. The typical dimensions for curbside stops in a parking lane are shown in Figure 2.9.

[9]AASHTO 2014
[10]Boyle 2015
[11]Adapted from AASHTO 2014 and GCRTA 2015

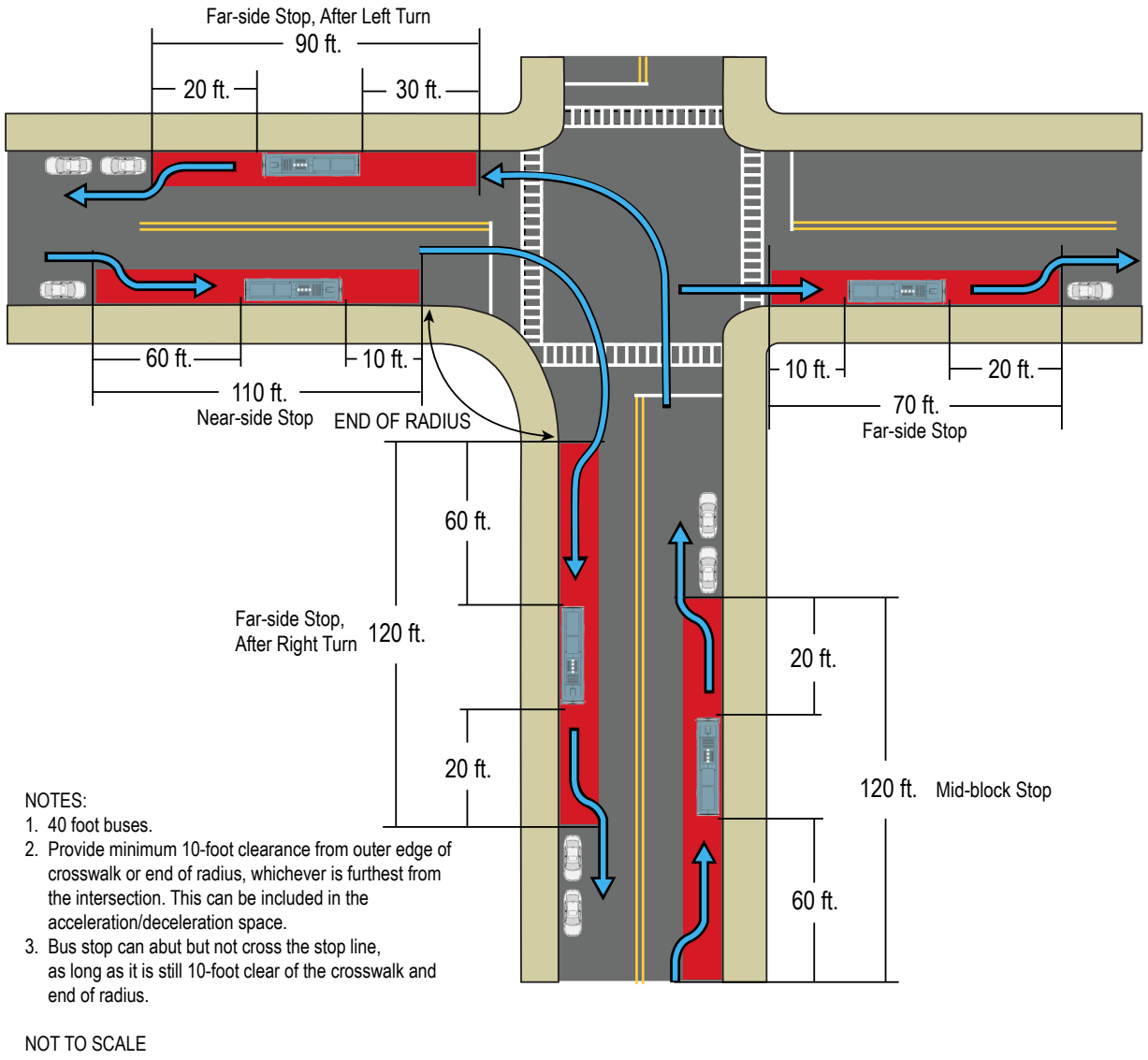


Figure 2.9 Curbside Bus Stop Lengths[11]

RIPTA stop on Hope Street at Lauriston Street in Providence, RI has a curb extension to the rear of the stop, prohibiting the bus operator from pulling to the curb, forcing them to discharge passengers in the roadway rather than onto the sidewalk

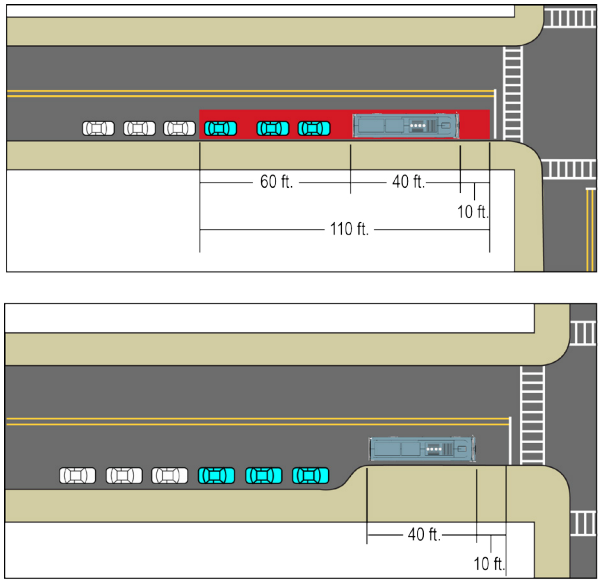
Curb extensions for pedestrian crossings before and after bus stops also impact the stop length as they create barriers at the intersection that would otherwise be utilized for bus turn movements, i.e. for exit movements from a near-side stop, and entry movements into a far-side stop. Curb extensions at one end of a stop with parking at the other end creates the same conditions as a mid-block stop, with parking at both ends.

For bus stops in a travel lane or shoulder, the bus stop length is generally irrelevant, as the full length of the travel lane or shoulder is available for the bus stop zone. Where on-street parking terminates just before the intersection in order to facilitate an additional travel or turn lane, the length of that lane should meet or exceed the equivalent curb space needed for a near-side bus stop. The travel or turn lane may need to be extended, or a no parking area provided, to facilitate access to the stop.

B. At Curb Extensions

Curb extensions at bus stops help to minimize parking impacts, as less curb space and no acceleration and deceleration zones are needed, when compared to a typical curbside bus stop, as shown in Figure 2.10.

[12]Adapted from GCRTA 2015



NOT TO SCALE

Figure 2.10 Parking Impacts of a Curbside Stop Compared to a Bus Stop Curb Extension[12]

Curb extensions are generally 40 feet long, excluding the taper. At near-side and mid-block curb extensions, 40 feet will enable parking movements to occur while a bus is stopped. It could be as short as 30 feet, which enables both doors to open onto the sidewalk; however, this results in the rear part of the bus overhanging and could obstruct parking access.

A far-side curb extension could be extended to provide room for vehicles to queue behind a stopped bus, as illustrated at the floating

Source: NACTO 2016

Figure 2.11 Floating Bus Stop Far-side

Bus stop curb extension at the RIPTA stop on Dyer Street at Ship Street in Providence, RI

bus stop in Figure 2.11. The curb extension would also need to be longer if it becomes a floating bus stop with a crossing ahead of the stop, as well as behind it.

Curb extensions should be designed to ensure that buses stop at least 10 feet clear of crosswalks (NACTO 2016).

AASHTO recommends a 6-foot minimum curb extension in an 8-foot parking lane, as shown at a near-side stop in Figure 2.12, leaving a 2-foot offset between the edge of curb edge and the travel lane. NACTO also recommends a 6-foot minimum, but states that the width should reflect the need for maneuvering and accommodation of stop amenities, and 8-10 feet is preferred. Figure 2.13 depicts a curb extension at a far-side stop.

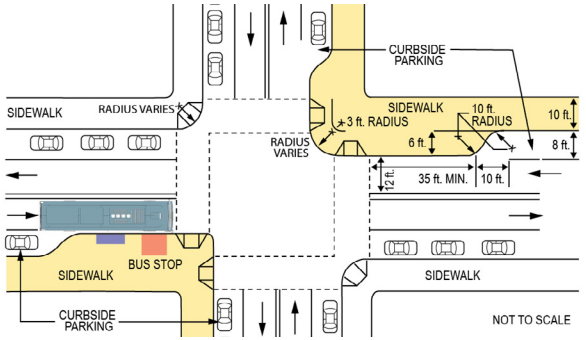


Figure 2.12 Bus Stop Curb Extension Near-side[13]

[13]Adapted from AASHTO 2014

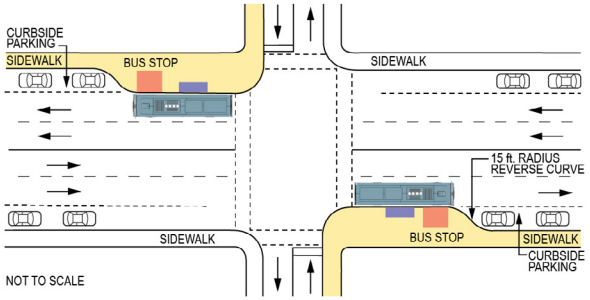
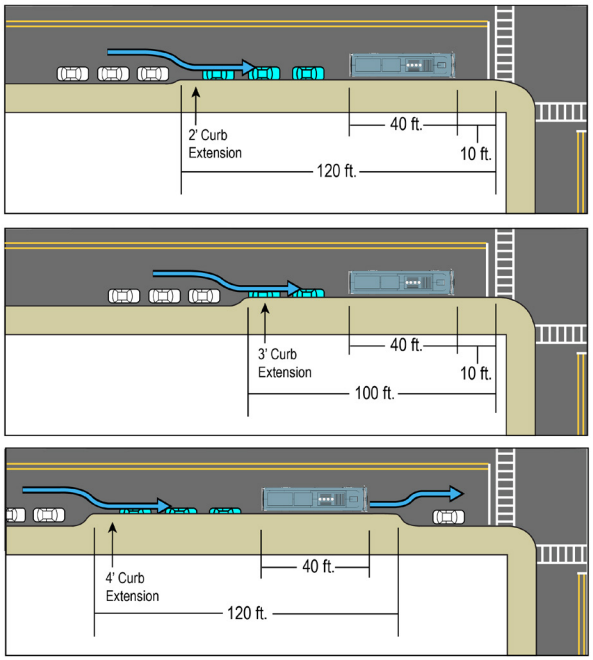
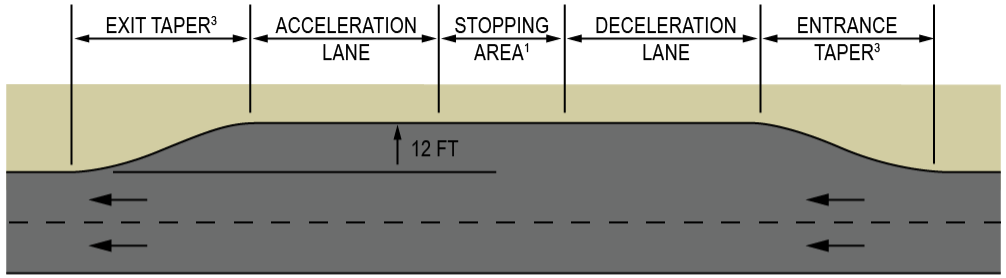


Figure 2.13 Bus Stop Curb Extension Far-side[14]



NOT TO SCALE

Figure 2.14 Partial Curb Extension Lengths and Parking Impacts[15]



NOT TO SCALE

(1) The bus stopping area should be 50 ft for each 40-ft bus expected to be at the stop at the same time.
(2) The width of the pull out should be at least 12 ft, excluding gutter width. A pull out 10 ft in width may be acceptable with traffic speeds less than 30 m.p.h.
(3) Taper lengths are a function of the roadway through speed and the width of the pull out. A taper of 5:1 is the recommended minimum for an entrance taper from an arterial street into a pull out. The recommended taper for re-entry into the traffic stream is not sharper than 3:1.

Figure 2.15 Pull Out Dimensions[16]

Narrower or partial curb extensions could be explored and will vary in length and parking impacts, depending on the depth of the curb extension, as shown in the example scenarios provided in Figure 2.14.

C. At Pull Outs

Dimensions for a bus pull out are provided in Figure 2.15. The width of the pull out should be 12 feet, though a 10-foot width is acceptable with traffic speeds less than 30 miles per hour.

The length of the pull out is determined by the tapers, and entry and exit speed of the bus, as well as traffic speed and volumes and frequency of gaps in traffic flow. While some guidance is provided by AASHTO, pull outs in Rhode Island typically occur in lower speed environments and should generally be 120 feet long with a taper of 5:1 on the approach and 3:1 on the egress, assuming a vehicle speed of 10 miles per hour or less.

[14]Adapted from AASHTO 2014
[15]Adapted from GCRTA 2015
[16]Adapted from AASHTO 2014

Chapter 3

PEDESTRIAN CONNECTIVITY AND ADA ACCESSIBILITY

3 Pedestrian Connectivity and ADA Accessibility

Transit riders are pedestrians before and after they ride the bus. Pedestrian connectivity at, within, and beyond a bus stop is an essential component of providing bus service. Standard elements of pedestrian connectivity include:

- A clear and level landing area at the front door of the bus,
- a clear zone at the back door of the bus, and
- a clear path of travel to the sidewalk.

Ideally, the sidewalk at a bus stop connects to a surrounding sidewalk network, providing access to riders' origins and destinations. It is important to place priority on creating sidewalks adjacent to bus stops to provide this basic level of safety and comfort for passengers.

Bus stops should also comply with the Americans with Disabilities Act (ADA)[17] accessibility requirements which require a bus stop boarding and alighting area (the landing area, also referred to as a landing pad) at the front door boarding area, and an accessible route between the landing area, sidewalk and bus shelters. A clear zone at the rear door, and other pedestrian facilities connecting bus stops with the sidewalk network, are required by RIPTA.

RIPTA stop on Blackstone Boulevard at the entrance to Butler Hospital Campus in Providence, RI has no landing area or sidewalk connection. On the other side of the driveway lies the path to the campus; no crosswalk connects the stop and the path

RIPTA stop on Taunton Avenue at Grosvenor Avenue, in East Providence, RI provides a wide sidewalk for the bus stop landing area and path of travel through the stop

Landing areas and clear zones should be laid out to accommodate the bus fleet in operation. The RIPTA bus fleet is currently comprised of 35-foot and 40-foot buses, with both front and rear doors. The minimum amount of curb space needed to accommodate both doors opening onto the sidewalk from any

[17]Section 810 – Transportation Facilities in the 2010 ADA Standards for Accessible Design

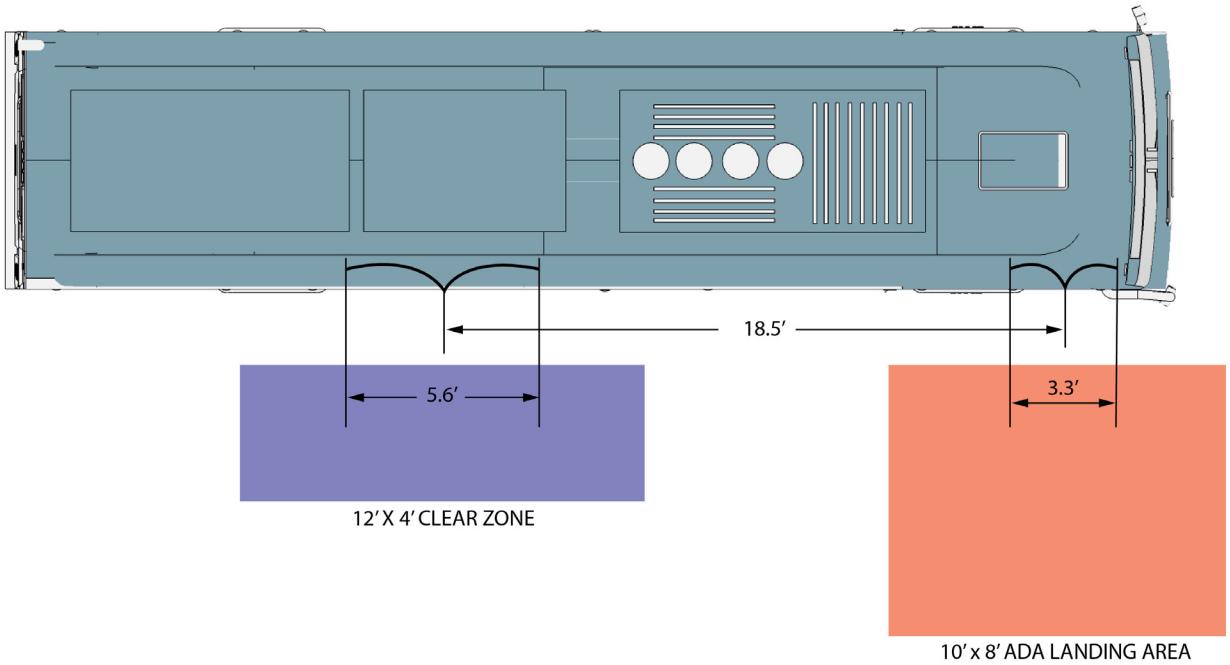


Figure 3.1 Landing Area and Clear Zone

RIPTA bus is 23 feet. The distance from the center line of the front door to the center line of a combination of all rear door locations on RIPTA's existing fleet is 18.5 feet. Vehicle specifications and graphics depicting these dimensions are provided in Appendix C, and a summary is provided in Figure 3.1.

Municipalities could benefit from performing an audit of each bus stop to identify major deficiencies and barriers to accessing bus stops. This audit process will help identify the type of bus stop improvements needed at each stop, prioritize or target areas with major and minor deficiencies, and help communities be ready to engage in the design process as roadway projects are initiated. A bus stop checklist to conduct this audit is provided in Appendix B. Through current and future projects, pedestrian facilities at bus stops, including sidewalks, crossings, curb ramps and lighting, would be improved over time to meet ADA and RIPTA requirements, and enable the addition of bus stop amenities.

Questions regarding ADA compliance at bus stops should be directed to the Governor's Office on Disability. For projects that cannot meet ADA requirements at bus stops, the Governor's Office on Disability must be advised and a variance approved.

For any project that cannot meet RIPTA's requirements at bus stops, RIPTA shall be notified of the problem, challenges, and solutions considered but not feasible, in order that the appropriate action can be taken, which may or may not include relocation or closure of the stop, or a change in the service route.

3.1 Landing Area

The ADA guidelines require that a minimum width of 5 feet along the curb, and a minimum depth of 8 feet perpendicular to the curb, be provided at the landing area, to the extent feasible and within the control of the transit agency. It should be a firm, stable surface, with a maximum 2% cross slope. Parallel to the roadway, the landing area should match the roadway running slope to the maximum extent practicable. For RIPTA bus stops, a 10-foot wide and 8-foot deep landing area is required in order to provide sufficient boarding and alighting space for passengers.

The landing area should be concrete. Brick sidewalks or brick patterns integrated with concrete sidewalks are not desired due to leveling and maintenance concerns. If bricks are used, they should be wire-cut for a smoother finish. The landing area cannot encompass uneven or rough surfaces, such as a grass strip or tree pit, or contain dirt or gravel, or be located in a driveway.

RIPTA stop at Bryant University in North Smithfield, RI has a grass strip in the landing area

RIPTA stop on Toll Road at Bald Hill Road/Route 2 in, Warwick, RI has a driveway in the landing area

Low curbs, or areas without curbs, pose accessibility challenges for the elderly, persons with mobility impairments, and passengers with strollers. At the landing area, the vertical step between the sidewalk and the bus (or bus ramp) must not exceed 5/8 inch, with a maximum horizontal gap of 3 inches. To minimize the vertical gap and for near-level boarding, the ramp must not rise more than 3 inches or exceed 1:8 slope[18].

The Rhode Island Standard Details call for a curb reveal of 6 inches. However, there is some flexibility to this standard, as AASHTO (2011) permits a reveal between 4 and 8 inches, depending on the facility type and other factors. With RIPTA vehicles' floor to ground height of 12 inches (8 inches when the bus is kneeled) a near-level boarding can be achieved with an 8-inch high curb reveal. RIPTA therefore recommends an 8-inch curb reveal, where feasible based on engineering judgement, safety, and accessibility best practices, to maximize the efficiency and accessibility of its passenger service. The curb reveal should not be more than 8 inches.

RIPTA stop at East Side Market in Providence, RI lacks any curb reveal at the sidewalk edge

If a sidewalk is being reconstructed to accommodate an ADA-compliant landing area, consideration should be given to features at the back of the sidewalk. Building entrances, walkways, stairways and other entry points should not be negatively altered and affect access to abutting properties. If the curb cannot be raised, and there is an access point at back of sidewalk, consideration should be given to moving the landing area, and potentially the stop.

On narrow sidewalks (less than 8 feet wide), a 5-foot by 5-foot area on both sides of the back of the landing area should remain clear of obstructions.

[18]NACTO 2016 (FTA 2007)

The location of the landing area is primarily dependent on the siting of the stop relative to the intersection, and secondarily, on the availability of sidewalk space to accommodate an ADA-complaint landing area. Assuming the bus stop sign is placed at the front most point of the bus stop zone, the center line of the landing area would be located 14 to 24 feet back from the sign, as shown in Table 3.1.

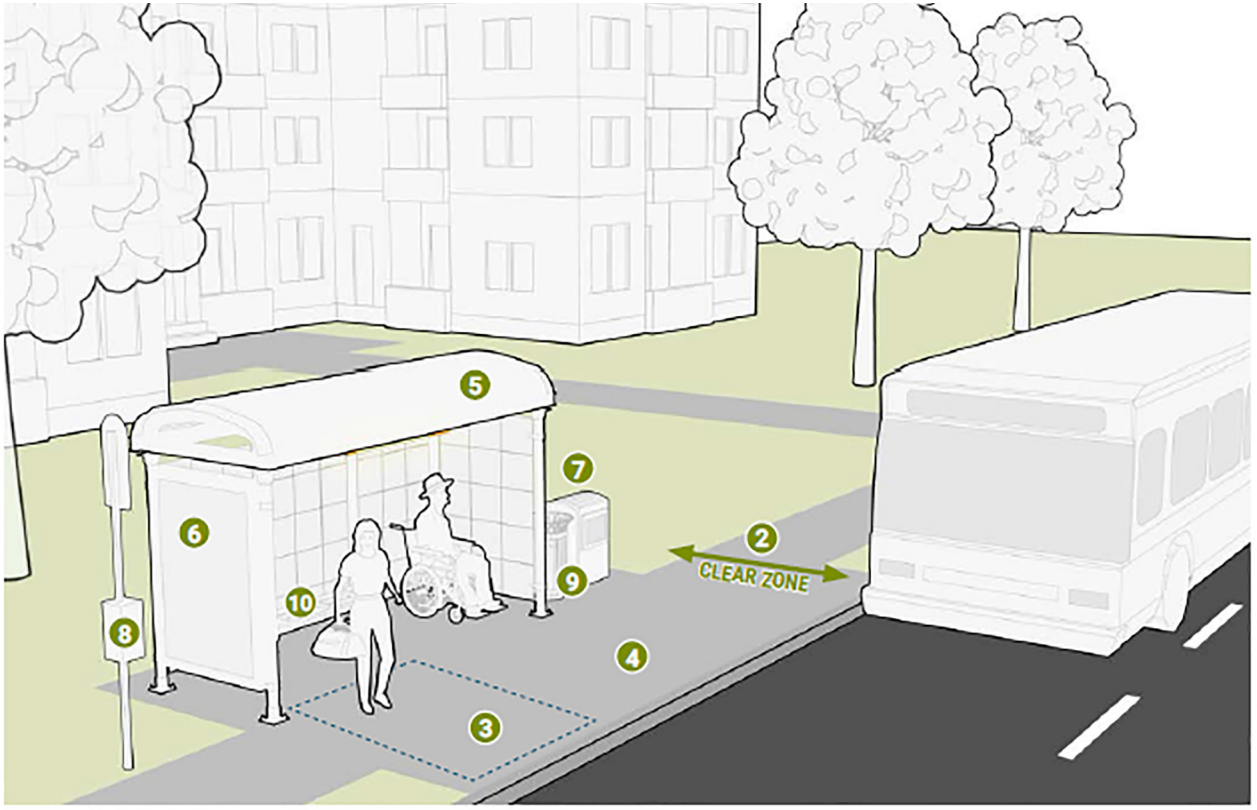
Table 3.1 Landing Area Location

Stop Placement	Distance from the center line of the landing area to the bus stop sign (feet)
Far-side	24
Near-side	14
Mid-block	24

If sidewalk obstructions or constructability issues prevent the landing area from being located in the ideal location, the landing area should be moved forward at far-side stops and further back from the intersection at near-side stops, both of which will result in longer than typical stop lengths. The extra stop length can be calculated by measuring the increased distance away from the ideal landing area location. At mid-block stops the landing area can be shifted in either direction, which may or may not affect the stop length.

3.2 Clear Zone

For rear door passenger activity, bus stops should also have clear zones (see Figure 3.2). The clear zone is the space located where the back doors of the bus open onto the sidewalk. The clear zone should be free of driveways, curb ramps and obstructions such as utility poles, hydrants, and other street furniture. Although there is no requirement for the clear zone to be ADA-compliant, it is desirable, and at minimum should be a level surface area. The clear zone should be 12 feet wide by 4 feet deep.



Source: FHWA 2016

Figure 3.2 Bus Stop with Clear Zone

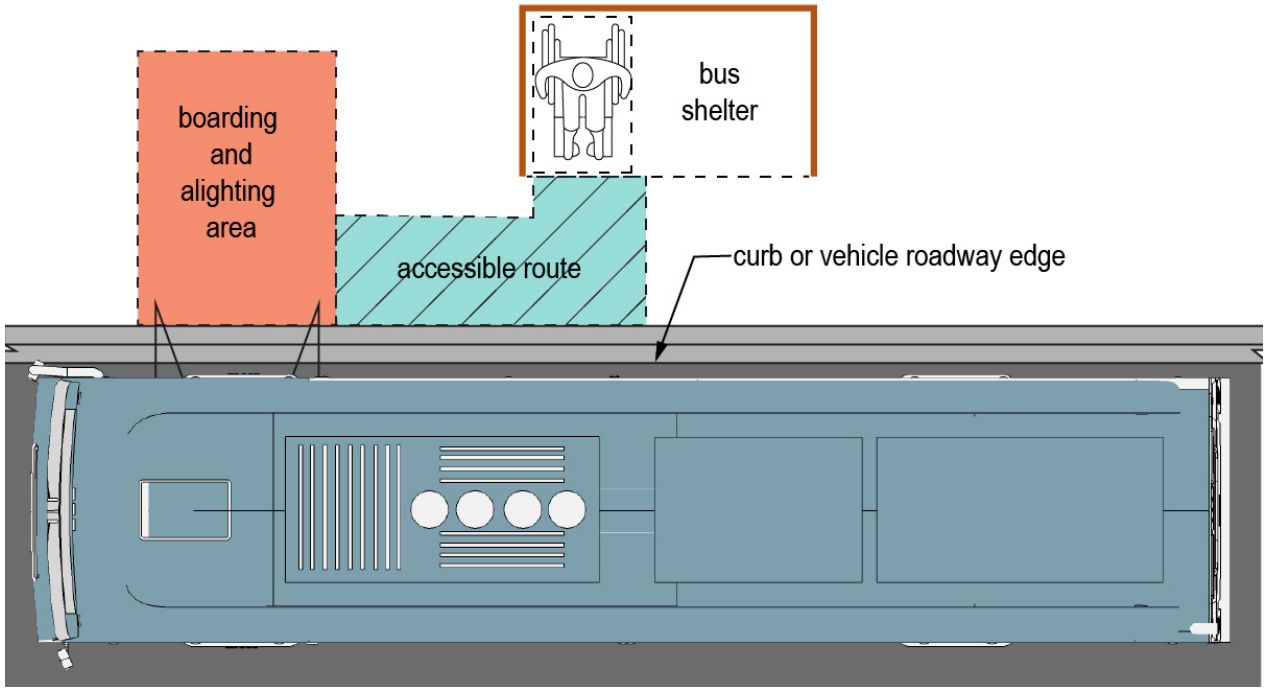


Figure 3.3 Accessible Route to/from Landing Area[19]

3.3 Path of Travel

The critical path of travel at a bus stop is the connection between the landing area and the sidewalk and bus shelters. The ADA requires that there be an accessible route between these elements, per Figure 3.3. RIPTA also encourages and requires other pedestrian facilities at bus stops as follows.

A. To Shelters/Benches/Other Amenities

Bus shelters shall be connected to the landing area by an accessible route[20]. This means that a clear, unobstructed, ADA-compliant path of travel must be provided. RIPTA requires a minimum 4-foot wide path, which conforms with RIDOT standards and the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) pedestrian access route, even

though the ADA requires a minimum 3-foot wide path. Although not desirable, the width may be reduced at pinch points, for example at a utility pole, to 3 feet, as long as the other clearances are met. The ADA guidelines allow for a minimum 32 inches; however, this should not be permitted without exceptional, extenuating circumstances. To the extent feasible this accessible path of travel should be provided to other bus stop amenities as well.

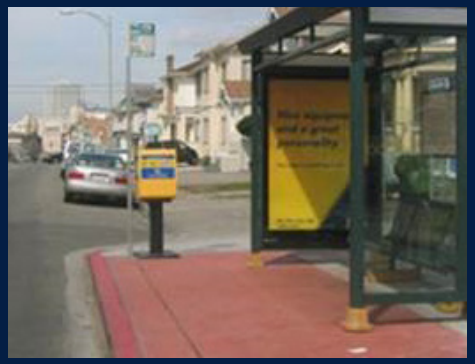
B. To The Sidewalk and Sidewalk Network

The ADA requires that bus stop boarding and alighting areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route. Sidewalks that provide adequate access will not only be connected

[19]Adapted from ADA 2010
[20]Per Section 810 and Chapter 4 of the ADA guidelines

Sidewalk and Edge Treatments

1. Painted or in-mix colored concrete. (Oakland, CA)



2. Brick edge between the sidewalk and the curb distinguishes the bus stop zone. If the sidewalk is brick, altering the pattern can also provide distinction. (Dublin, Ireland)

3. Textured sidewalk with features to designate the boarding area. (Brisbane, Australia)

4. Tactile warning strip. (Puget Sound, WA)

5. Alternative curb design that could be angled at the face of curb and or tactile treatment at top of curb. (Dublin, Ireland)

RIPTA stop on Wampanoag Trail in East Providence, RI with no connecting sidewalk

to the stop, but will also be connected to a sidewalk network. Bus stops should not be isolated or located on an island, on unpaved areas, or where there is a solid platform or pad, but no connecting sidewalk. Pedestrians are likely to feel stranded and potentially unsafe if a bus stop is located in the middle of moving vehicles, or between two driveways, especially those that are heavily utilized.

The appropriate dimensions to provide an adequate amount of pedestrian waiting space is determined by conducting a pedestrian

[21]APTA 2010

RIPTA stop on Exchange Terrace in Providence, RI connected to a sidewalk and sidewalk network

level of service (LOS) analysis for queuing areas, which is specified in the AASHTO Guide for Geometric Design of Transit Facilities on Highways and Streets.

Sidewalk treatments can be used at bus stops to provide contrast with adjacent surfaces and additional emphasis on the stop, making stops more visible, safer and accessible for riders, especially seniors and persons with disabilities. Treatments may include colored concrete, textured sidewalks, pavers, truncated domes/ detectable warning strips, or simply altering the pattern of the sidewalk panels. APTA suggests that detectable warning strips can be placed at the edge of the curb by the door zone to indicate the boarding area[21], while NACTO recommends detectable warning strips be at least 24 inches deep along the entire curb edge of the bus stop.

NACTO also recommends that it is best to use consistent colors to delineate modal zones and edges, for example red/terracotta to indicate bus lanes or stops, and green for bike lanes or crossings. Color repetition reinforces legibility and should be used at conflict zones.

C. Through the Stop

RIPTA also requires a minimum 4-foot accessible path of travel through the stop, although 5 or 6 feet is more desirable. These standards are above and beyond the ADA guidelines, which call for a minimum 3-foot horizontal clearance (32 inches at narrow

pinch), but allow for a more comfortable space for both riders and passing pedestrians. The path of travel through the stop should be maximized to the extent feasible, while meeting other bus stop design requirements and guidelines.

These clearances are particularly important at bus stops where there are a lot of pedestrian movements in a variety of directions. Dimensions of a typical pedestrian path of travel through a stop are depicted in Figure 3.4.

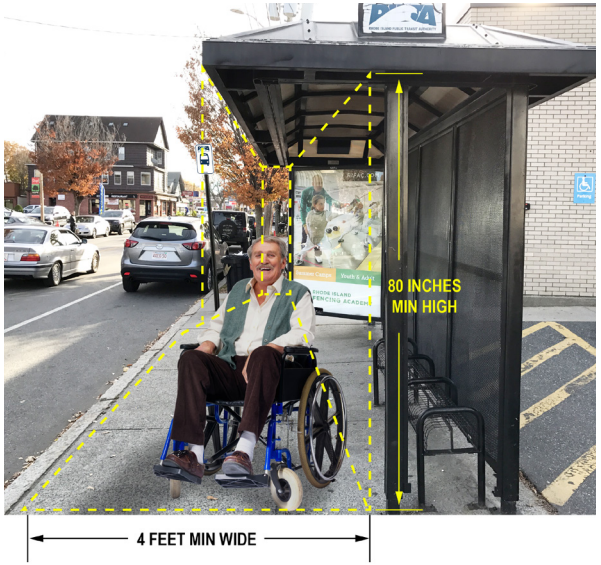


Figure 3.4 Pedestrian Vertical and Horizontal Clearances[22]

[22]Adapted from OmniTrans 2013

Sidewalks at bus stops should also be free of vegetation that can narrow the path of travel along the sidewalk.

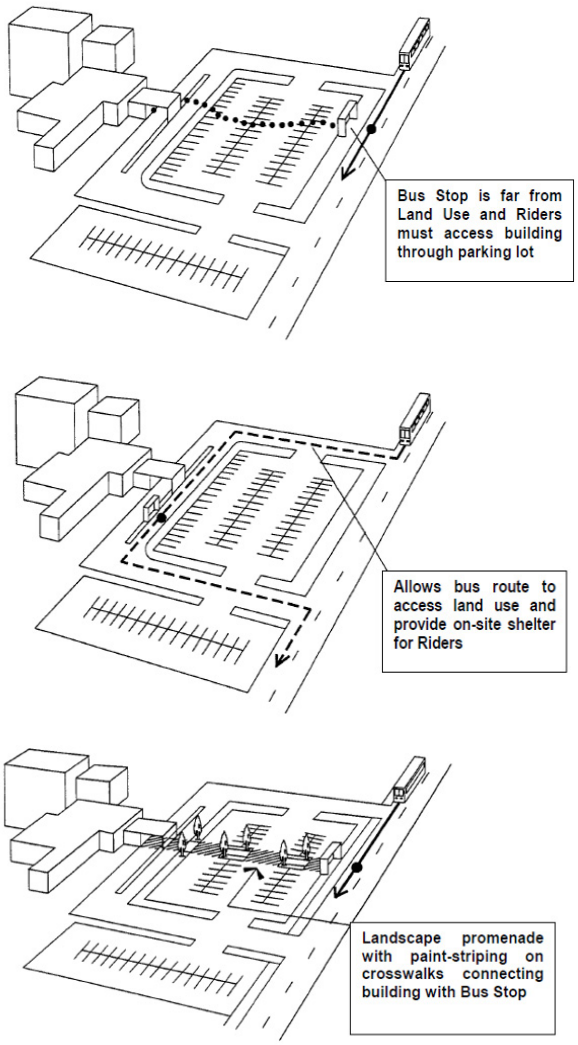
D. To an Intersection or Crossing

Connectivity to bus stops is a crucial aspect of bus stop design. If passengers cannot physically get to a bus stop, they may choose not to use the service. RIPTA requires sidewalks at bus stops to be connected to visible crosswalks with curb ramps, and ideally to be signalized on higher speed or volume roadways.

Enhanced crossing treatments such as curb extensions, pedestrian refuge islands, raised crosswalks, and hybrid or flashing beacons may be warranted at specific locations. These locations may have:

- High pedestrian volumes,
- Limited sight distance, or
- High speeds

RIPTA stop on Broadway at Knight Street, Providence, RI connects to crosswalks and curb ramps on all four approaches and corners of the intersection



Source: TCRP 1996

Figure 3.5 Connectivity Between Land Uses and Bus Stops

These treatments reduce the crossing distance and/or increase pedestrian safety for riders. Missing curb ramps create an access barrier for seniors, passengers with disabilities, and riders with strollers, shopping carts or luggage. For details on curb ramp construction, refer to the Rhode Island Standard Details.

E. To Transit Generators

Bus stops should be connected to a sidewalk, and ideally a sidewalk network, so that there are safe pedestrian connections for riders between the bus stop and their point of origin or destination. A bus stop should not be located where it is inconvenient, unsafe, or unpleasant to get to and from the stop, such as crossing through a large parking lot. In suburban settings or large commercial parking lots, bus stops may be placed near a building entrance, providing a convenient and safe stop for passengers; however, deviation of bus routes to directly service a property is implemented solely at RIPTA's discretion.

Figure 3.5 illustrates three scenarios for stop location for a building with a large setback and parking lot in front. The last option in this scenario, with the stop placed on the primary roadway with a direct pedestrian connection to the building entrance via a marked pedestrian path or landscaped promenade, is the preferred scenario. It provides a clear path of travel to the passenger origin/ destination, and does not delay the bus, compared to the first option in Figure 3.5. For direct service to a facility or building with a bus route deviation, refer to RIPTA's Service Guidelines.

Chapter 4

Streetscape

4 Streetscape

4.1 Bus Stop Signs

All bus stops should be anchored with at least one RIPTA bus stop sign at the front of the stop that is visible to both riders and bus operators. The current RIPTA bus stop sign standard includes the agency name and logo, a bus symbol, sometimes the words "bus stop", and a 7-digit phone number for schedule information. The sign is a standard parking regulatory sign size at 12 inches wide by 18 inches tall.

Due to the absence of parking regulations on the current RIPTA bus stop sign, supplemental standard "No Parking Bus Stop" signs should be provided at both the front and the rear of the bus stop zone, to clearly delineate the bus stop and no parking area.

Three sign codes are provided in the Manual on Uniform Traffic Control Devices (MUTCD) for "No Parking Bus Stop": R7-7, R7-107 and R7-107a. R7-107, as shown in Figure 4.1, shall be used at RIPTA bus stops. The arrow should point in the direction of the no parking area, which will be right-pointing at the front of the stop, and left-pointing at the rear of the stop. The sign codes for left-pointing and right-pointing arrows are R7-107L, and R7-107R respectively. The sign code for two-direction arrows (used at the center of long stops) is R7-107D.

Figure 4.1 No Parking Bus Stop Sign

No parking signs are not required when a bus stop is located in a travel lane or shoulder. If a bus stop is located in a bike lane, a "No Parking Bike Lane" sign should be considered, as shown in Figure 4.2.

Figure 4.2 Signage at a Conceptual RIPTA Bus Stop in Bike Lane on Toll Gate Road at Bald Hill Road in Warwick, RI

Bus Stop Signs should:

- **Identify the stop**
- **Provide passenger service information**
- **Function as marketing for RIPTA service**
- **Delineate parking limits**
- **Reinforce the bus stop zone for an accessible stop**

Framed SCAT bus stop sign in Siesta Key, Sarasota County, FL

Bus stop signs should be retroreflective to increase visibility for bus operators and other drivers in the dark.

Bus stop signs may be considered for framing to coordinate with other street furniture and provide more context sensitivity in historic or beautified neighborhoods and downtown areas.

Following the adoption of this guide RIPTA plans to redesign its bus stop sign. Contact RIPTA's Planning Department at designguide@ripta.com to request a bus stop sign(s).

[23]Should RIPTA redesign its bus stop sign to be larger in the future, an alternative support structure may be required.

4.2 Siting Bus Stop Signs

Multiple factors need to be considered when siting bus stop signs, including ADA requirements, passenger safety, visibility, right-of-way, and other street furniture.

A. Support Structure

Bus stop signs shall be mounted on their own post. Historically bus stop signs have been mounted on light poles, utility poles, signal poles, etc. Should the position of these existing structures coincide with the appropriate placement of a sign post, they may be considered for mounting bus stop signs to minimize street furniture clutter. If there are existing signs on these poles, the vertical clearance required may not be met, and so an additional sign post may ultimately be required. Signs should not be installed on bus shelters, where they are less visible from the roadway, and encroach on the pedestrian path of travel.

U-channel posts, in accordance with RIDOT standard detail 24.6.0, shall be used to support bus stop signs[23], unless an alternate style is required by the local municipality. Posts should be installed at least 4 feet deep for sufficient support, and should enable the signs to be mounted at the correct orientation, per RIPTA requirements described below.

B. Location

The installation location of the bus stop sign and no parking sign, and the distance between the two signs, should correspond to the appropriate bus stop lengths as provided in Table 2.5, and be adjusted, as necessary, based on specific site conditions or constraints.

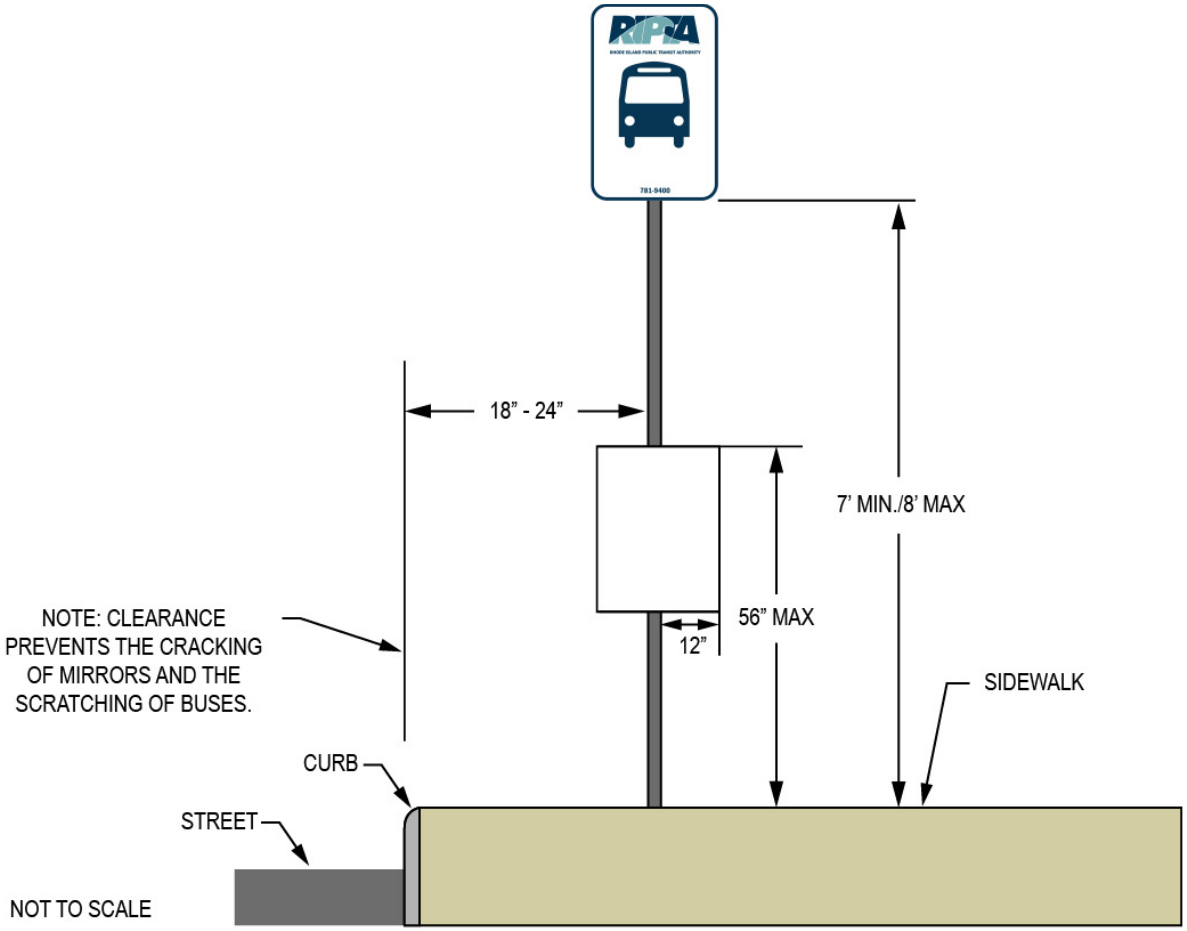


Figure 4.3 Bus Stop Sign and Post Placement[24]

Sign posts should be installed 18 to 24 inches off the back of the curb, to avoid being hit by a bus or other vehicle, as shown in Figure 4.3. A minimum 4-foot clear path of travel should be provided on the other side of the post, although this could be reduced to 3 feet, if necessary, so long as other clearance requirements are met.

[24]Adapted from OmniTrans 2013

Sign post installations at driveways should be positioned a minimum of 18 inches off the back of the curb and 3 feet from the edge of the driveway to prevent it being hit by a vehicle turning into or out of a driveway, as shown in Figure 4.4. If there are large commercial vehicles active in the driveway, additional clearance may be warranted.

On very narrow sidewalks (5 feet or less), which do not and cannot meet ADA requirements for a bus stop landing area, consideration may be given to locating signs and posts at the back of the sidewalk, within the public right-of-way.

C. Orientation

The bus stop sign should be set at an angle of not less than 30 degrees, nor more than 45 degrees with the line of traffic flow, in order to be visible to approaching buses and other traffic, as well as to pedestrians on the sidewalk. If additional passenger information is added to bus stop signs in the future, consideration should be given to orienting RIPTA bus stop signs perpendicular to the curb to ensure riders can safely read the signs away from the curb edge.

No parking signs should also be set at an angle of not less than 30 degrees nor more than 45 degrees with the line of traffic flow in order to be visible to approaching drivers.

Guidelines to site bus stop signs include:

- **Locate RIPTA bus stop sign at the front of the bus stop to identify the front limits of the bus stop zone**
- **Add No Parking Bus Stop sign to define limits of bus stop zone in no parking areas**
- **Mount signs on a U-channel, breakaway post**
- **Signs shall be independent of other signs, when possible**
- **Sign height is 7 feet minimum and 8 feet maximum above the ground**
- **Sign orientation is 30 to 45 degrees with the line of traffic flow**
- **Install sign post 18 to 24 inches from the back of the curb**
- **Install sign post out of the 4-foot ADA path of travel (minimum 3-foot)**

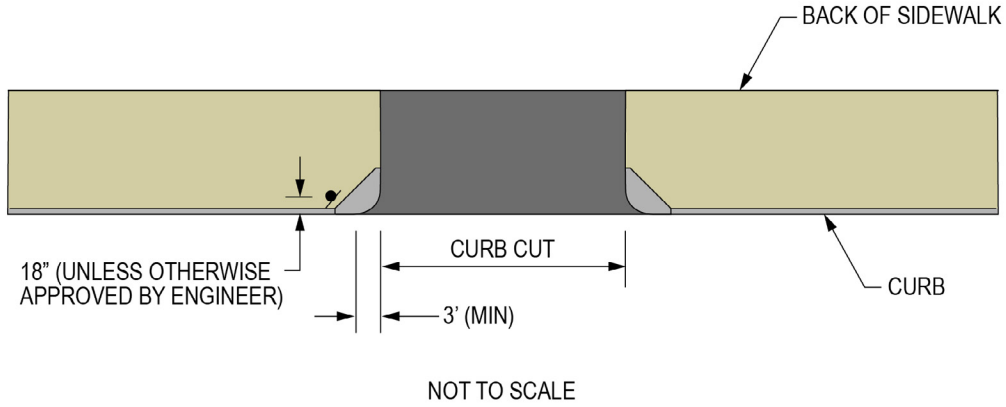


Figure 4.4 Bus Stop Sign Placement at Driveway

D. Vertical Clearance

Signs should not be placed so low to the ground that pedestrians may hit their head, nor too high that they become illegible. The MUTCD calls for a minimum 7 feet of vertical clearance above the ground for signs, as shown in Figure 4.3. To maintain good visibility, the bottom of the sign should not be installed higher than 8 feet above the ground. Additionally, overhanging branches and other vegetation should be trimmed back to allow for sign visibility.

If additional passenger amenities such as information panels are provided, these should be installed where the top of the panel is no higher than 56 inches from the ground.

4.3 Lighting

Passengers feel more comfortable, safe and secure at bus stops when they are well lit. Feedback from riders during the community engagement process for the guide exhibited an overwhelming concern for lighting at bus stops for transit users in urban, suburban and rural areas. Specifically, lighting needs to be improved on low-frequency rural routes where street lights are not prevalent. Riders reported using phones with flashlights to flag down buses. Lighting helps bus operators and other drivers see waiting passengers.

Bus stops can be adequately lit by surrounding overhead street lighting, back lit signs or as part of a bus shelter structure, or they may require additional lighting. NACTO recommends

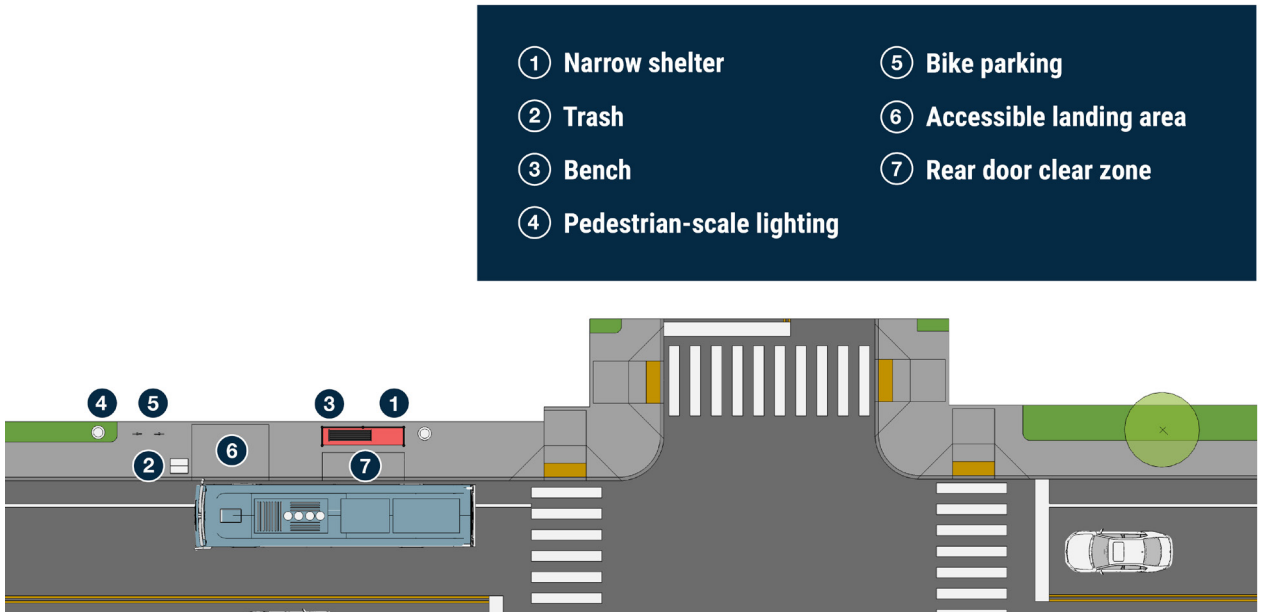


Figure 4.5 Pedestrian-scale Lighting at a Bus Stop

gradually increasing the illumination of street lighting closer to bus stops. Lighting installed at bus stops should be pedestrian scale with lamps less than 25 feet high, and be proximate to the passenger waiting area, as shown in Figure 4.5[25]. The potential negative impacts of increased lighting to abutters of bus stops should be considered. This issue can be mitigated by installing dark sky friendly light fixtures that minimize light glare upward into the night sky, and are more appropriate for stop-specific lighting. Light sensors could also be considered, thereby limiting the activation of lighting when there is passenger activity at a stop.

[25]NACTO 2016

4.4 LANDSCAPING

Landscaping helps enhance the level of passenger comfort at a stop and improve the attractiveness of transit service. Trees at bus stops can help provide shade and protection from adverse weather. As shown in Figure 4.6

Figure 4.6 Landscaping at a Conceptual RIPTA Bus Stop on Route 114 at Child Street/Route 103 in Warren, RI

Measures to ensure landscaping does not impact the visibility or accessibility of stops include:

- **Trimming tree branches and shrubs so that they do not pose an obstacle to bus boarding and alighting or impede visibility. Tree branches should not extend lower than 80 inches above the path of travel**
- **Maintaining shrubs and vegetation along all sidewalks used to access bus stops to allow full utilization of the paved sidewalk width and to enhance pedestrian safety**
- **Maintaining a grass-free 10-foot by 8-foot landing area**
- **Planting trees outside of the clear zone area**
- **Using curb extensions to maintain horizontal tree lines and also meet ADA requirements for sidewalk conditions**
- **Replacing older tree grates located in the path of the travel that are not ADA compliant**

bus stops can be enhanced, while retaining existing mature trees.

Use of landscaping elements such as grass, trees, and shrubs must have consideration for passenger safety and accessibility, as well as maintenance. Public comments reflect a concern over stop visibility due to poorly defined sidewalk and boarding areas in grass strips, overhanging tree branches, and overgrown grass strips and vegetation, particularly in rural and suburban areas on roadways with narrow sidewalks.

Curb extension at an MBTA bus stop in Boston, MA allowed for the retention of an existing tree and the addition of rider amenities. Abutters added to the aesthetics with planters

Overgrown shrubs overhang benches at an MBTA bus stop

Chapter 5

Roadway Design

5 Roadway Design

5.1 Bus Stop Striping

Striping bus stops in the roadway enhances the visibility of bus stops for bus operators, drivers and riders, and reinforces the bus stop zone in on-street parking areas. Vehicles obstructing bus stops slow down service and present an accessibility issue for bus drivers pulling into the stop.

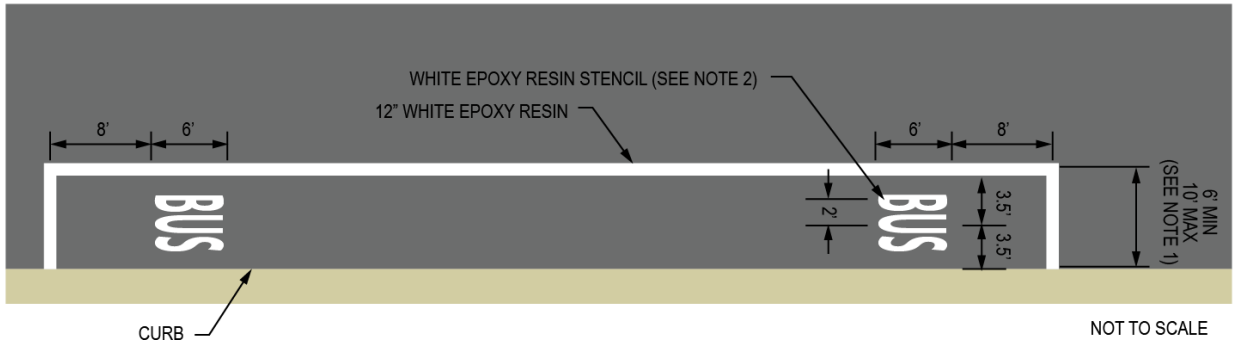
While various striping styles currently exist across the State, RIPTA's preference for striping future bus stops is to include the word "BUS" at the top and bottom of the bus stop zone. If the bus stop is unusually long an additional word "BUS" may be added in the middle. The word "BUS" must be oriented in the direction of travel. The bus stop zone should be encased in a 12-inch thick line delineating the bus stop zone. Adoption of the bus stop striping detail, shown in Figure 5.1, will result in consistency at bus stops across the State.

Bus stop striping should be adjusted when bus stops are located adjacent to bicycle accommodations, as described in Section 5.4.

For durability, RIDOT prefers epoxy resin; however, paint is acceptable. RIPTA foresees the ongoing maintenance of bus stop striping as a RIDOT/municipal responsibility, to coincide with the roadway jurisdiction and maintenance responsibilities. In light of this, RIPTA may be flexible with the line thickness and width of the bus stop zone, to align with adjacent parking lanes, for ease of maintenance, however the overall length of the bus stop zone must meet RIPTA requirements.

RIPTA would also like to see colored pavement at bus stops. Red is the preferred color for pavement within the bus stop pavement markings, as it provides additional emphasis

A vehicle parks in the RIPTA stop on Route 114 at Child Street/Route 103 in Warren, RI forcing bus operators to stop in the travel lane, far from the curb, and riders to step into the roadway to access the bus. Bus stop striping, and a no parking sign at the rear of the stop, would help to better define the bus stop limits



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.

Figure 5.1 Bus Stop Striping Detail

Figure 5.2 Conceptual Red Painted RIPTA Bus Stop on Child Street/Route 103 in Warren, RI

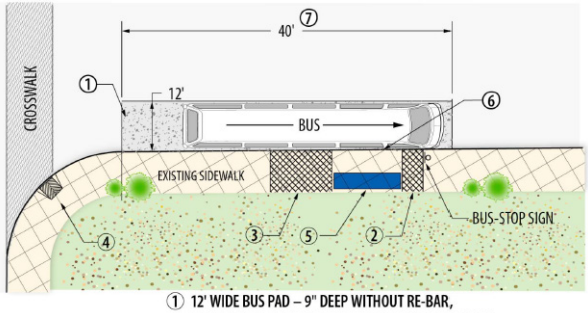
Bus stop in New Haven, CT has a stamped colored asphalt treatment

on and visibility of the stop, as shown in Figure 5.2. This can be achieved using colored asphalt or concrete or through a paint application.

5.2 Cement Concrete Bus Pads

Cement concrete bus pads are a preferred substitute for conventional asphalt paving, which is prone to distortion by constant bus turn movements at the stop. They are more durable and recommended at frequently served bus stops or where rutting has occurred. Bus pads, or platforms, shall be at least 8.5 feet wide to accommodate both wheels of a bus, but could be as wide as 12 feet to allow for bus operator driving variability, according to NACTO. If adjacent to a bike lane, the concrete pad should extend to the inner or outer edge of the bike lane to prevent the creation of a longitudinal seam within the bike lane.

Bus pads must stretch the length of the bus stop, encompassing the entire bus stop zone in the roadway, in order to be long enough to cover the length of the bus and the deceleration and acceleration zones, where most of the roadway wear and tear occurs. An example of a concept design for a concrete bus pad from OmniTrans is provided in Figure 5.3.



Source: OmniTrans 2013

Figure 5.3 Concrete Bus Pad

Concrete bus pad at the former Peter Pan stop on Washington Street at Kennedy Plaza in Providence, RI

Marshalls "Bus Stop Kerb" with channel unit

5.3 Gutter Treatment

Consideration may be given to specialized gutter treatments to help bus operators assess the position of the vehicle and allow them to come as close to the curb as possible. Some vendors offer a curb system that includes a channel unit, which includes a rumble strip to guide drivers. This functions somewhat similarly to the bumper shown alongside the tactile warning strip at the bus stop in Puget Sound, shown in Section 3.3, and in place along CTFastrak's fixed guideway in Hartford, CT.

5.4 Bicycle Accommodations

As the popularity of biking as an alternative mode of transportation increases in Rhode Island, and more on-street bike infrastructure is added, it is critical to address the relationship between bicycle accommodations and bus stops. Bicycle accommodations alongside bus stops could take multiple forms. Bike lanes can be generally configured in three ways:

A. Adjacent to a Bus Stop

For bus stops in parking lanes that are adjacent to a traditional on-street bike lane, it is customary to dash the outer edge of the bus stop and the bike lane striping where the bus

Figure 5.4 Striping at a Conceptual RIPTA Bus Stop in Bike Lane on Toll Gate Road at Bald Hill Road in Warwick, RI

crosses over and/or might encroach on the bike lane. Door zone markings should also be provided in the bike lane.

B. Through a Bus Stop

When a bus stop is located within a curbside on-street bike lane, AASHTO's Guide for the Development of Bicycle Facilities allows for the bike lane markings to be continuous or dashed. Since the bus will stop and block the bike lane and part of the travel lane, the condition for bicyclists is changing and so RIPTA recommends dashing the bike lane marking, as shown in Figure 5.4, to provide awareness of the change in use of the bicycle facility.

C. Behind a Bus Stop

Placing bike lanes behind a bus stop, effectively creating a "floating bus stop" or "bus island", is a relatively new concept, but is now an accepted design practice.

The design not only separates the passenger space from other pedestrian activity on the sidewalk, but also separates bicyclists from vehicular traffic, eliminating conflicts. Bike lanes can be flush with the sidewalk grade or at roadway grade, or lower than the sidewalk and curb extension grades, but connected via a crosswalk and curb ramps. A graphic and rendering depicting a floating bus stop are shown in Figure 5.5 and Figure 5.6.

Bus islands are best used on streets with moderate to high bus frequency, and high bus ridership, pedestrian and bicycle volumes. Although there is the potential for conflicts between bicyclists and crossing bus riders, bicyclists must yield to pedestrians. Signing and striping at the bike lane, as shown in Figure 5.5, emphasizes this.

Since buses are stopping at the floating bus stop in the travel lane, striping of the roadway is not required. The bike lane will include

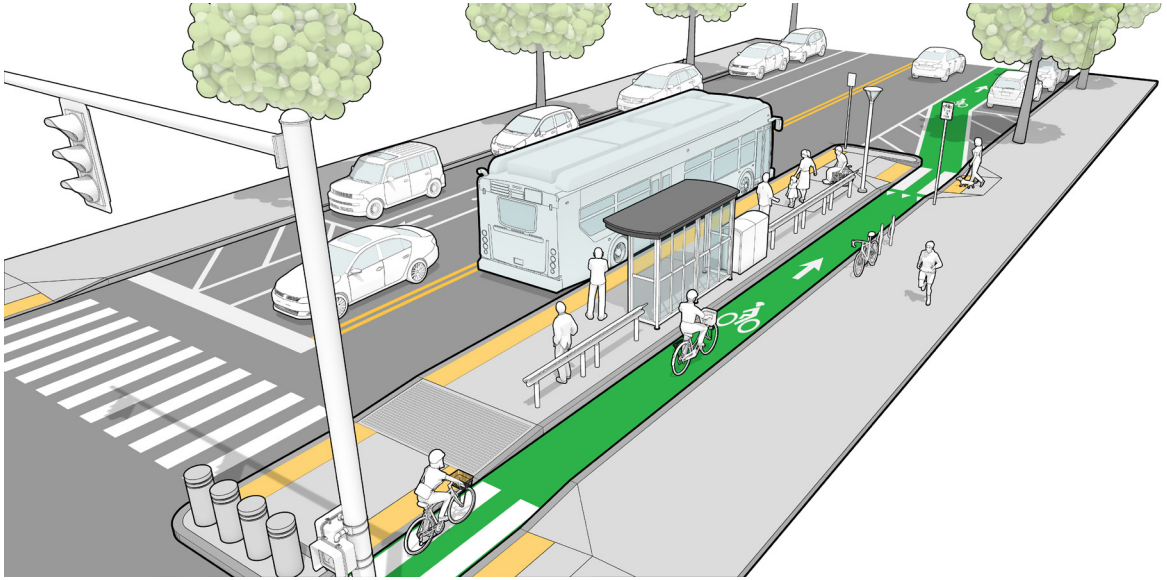


Figure 5.5 Floating Bus Stop

Figure 5.6 Conceptual RIPTA Floating Bus Stop on Broadway at Knight Street in Providence, RI

some striping, at a minimum a bike symbol, and yield marks for crossing pedestrians. The bike lane could be at street level or sidewalk level, or somewhere in between and may or may not be painted.

In the absence of RIDOT and municipal standards for bicycle infrastructure design and the integration with bus stops, refer to NACTO's Transit Street Design Guide (2016) and AASHTO's Guide for the Development of Bicycle Facilities (2012), or more current design guides, for additional guidance.

5.5 Bus Priority Measures

Although bus priority measures are not directly related to bus stop design, the location of stops, as previously discussed in section 2.2, can enable the addition of bus priority measures.

During the development of this guide, the first separated bike lane and floating bus stop in Rhode Island was constructed on Fountain Street in downtown Providence.

A. Bus Lanes

Exclusive bus lanes are travel lanes dedicated to bus use that improve speed and reliability.

Bicycle facilities may be incorporated to become a shared bus/bicycle lane. However, RIPTA will only consider these facilities on a case-by-case basis and the shared facility must be approved by RIPTA.

Bus lanes are commonly painted red, and outlined with a solid white line with a "BUS ONLY" stencil. If shared with bicycles, sharrows can be added or "BUS BIKE ONLY".

Shared bus-bike lane in Boston, MA

For bus stops located within a bus lane, buses pull to the curb, as they would if located in a travel lane or shoulder. No additional striping beyond the bus lane are required.

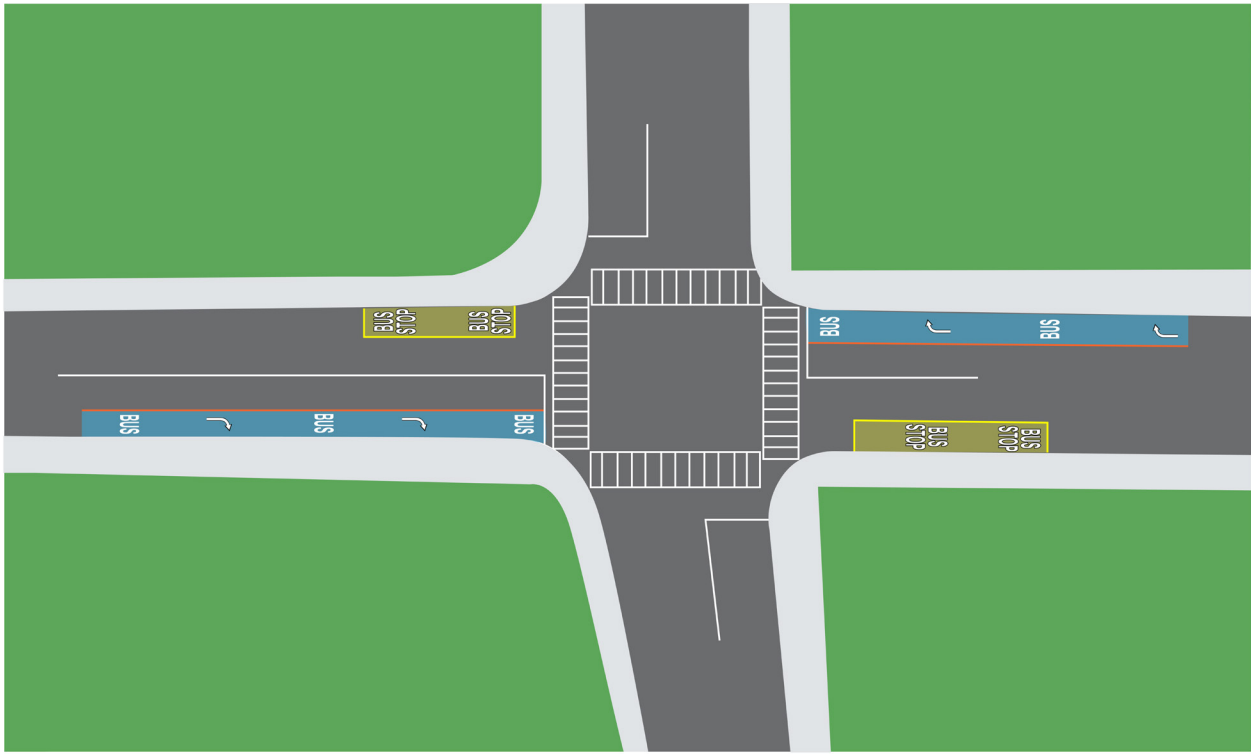


Figure 5.7 Bus Queue Jump Lane Shared with Right Turn Lane

B. Bus Queue Jump Lanes

Bus queue jump (or by-pass) lanes are essentially short bus lanes, sometimes shared with right turns and bicycles, located on an intersection approach. They allow buses to by-pass a queue of waiting vehicles by using the parallel curbside travel lane to "jump the queue". These lanes typically coincide with far-side bus stops and can be combined with transit signal priority (TSP). The placement of a typical queue jump lane on an intersection approach is illustrated in Figure 5.7.

C. Transit Signal Priority

TSP provides buses approaching an intersection with an extended or early green time so there is minimal or no wait time for buses at the intersection. It can provide an advanced signal phase for buses, only if it is used in conjunction with a bus lane or bus queue jump lane.

TSP is currently provided along RIPTA's R-Line

For additional information on implementing bus priority measures across Rhode Island, please refer to RIPTA's TSP Expansion Study (2016).

Chapter 6

Amenities

6 Amenities

6.1 Introduction

Amenities provide comfort for passengers, improve the passenger waiting experience and help increase the visibility of bus stops. They can also help to retain and attract additional transit riders to the service. Shelters provide protection from the elements, benches provide seating, trash receptacles help keep the stop clean, maps and schedule displays provide rider information and bike racks can provide riders with an alternative mode choice to travel the first and/or last mile between their origin/destination and the bus stop.

About 375 shelters and 20 free standing benches are currently provided at bus stops across the State, but these represent less than 10% of stops. Therefore, the vast majority of bus stops in Rhode Island lack these type of amenities.

Advantages and disadvantages of different types of amenities are listed in Table 6.1

Table 6.1 Advantages and Disadvantages of Passengers Amenities at Bus Stops

	Advantages	Disadvantages
Shelters	• Provide comfort for waiting passengers • Provide protection from climate-related elements (sun, glare, wind, rain, snow) • Help identify the stop • Provide opportunity to generate advertising revenue	• Require maintenance, trash collection • May be defaced by graffiti
Benches	• Provide comfort for waiting passengers • Help identify the stop • Low cost when compared to installing a shelter	• Require maintenance • May be defaced by graffiti
Trash Receptacles	• Provide place to discard trash • Keep bus stop clean	• May be costly to maintain • May have a bad odor • May increase security risk
Route or Schedule Information	• Is useful for first-time or infrequent riders • Helps identify bus stop • Can communicate general system information	• Must be maintained to provide current information • May be defaced by graffiti
Newspaper/ Vending Machines	• Provide reading material for waiting passengers	• Increase trash accumulation • May have poor visual appearance • Reduce circulation spaoe • Can be vandalized

Source: AASHTO 2014

6.2 Shelters

Shelters at bus stops can:

- help to increase the visibility of a stop
- be used to incorporate various forms of rider information
- protect passengers from the sun, wind, rain and snow
- provide protected seating
- provide additional lighting

A. Shelter Design

Existing shelters at RIPTA bus stops are a mix of LAMAR advertising shelters, and a number of other shelters that have been designed and/or provided by municipalities, property owners etc. Custom shelters are provided on the R-Line and at Kennedy Plaza, but these are not considered "typical bus stops" and therefore should not be used as a future model. All existing shelters vary in style, size and shape, and functionality.

RIPTA anticipates issuing a Request for Proposals (RFP) from interested vendors for a future shelter program in 2017. The design and siting elements described below will form the basis of that RFP, but the final design of shelters at typical Rhode Island bus stops will be determined as part of that new contract.

The design of shelters should be simple, functional, and easy to maintain. The size of shelters will largely be dependent upon the amount of available sidewalk space. The typical depth of an off-the-shelf (standard) shelter is five feet, but the length can vary more substantially from 10 to 20 feet. Narrow style shelters, typically two to three feet deep, are generally available for narrower sidewalks.

Custom designed shelters can also be explored. While they are costlier to purchase and maintain than off-the-shelf designs, they can be designed to be more aesthetically pleasing and customized to meet the character of the neighborhood, for example a historic downtown. Art may be integrated, and the shelter tailored specifically to the stop location or community; however, riders explicitly expressed concern about the practicality of "artsy" shelters that have been installed in Rhode Island to date. Functionality therefore should be prioritized over art.

Narrow shelter design with no side panels in Boston, MA

Standard shelter size with a rear and two side panels in Brookline, MA

Consideration should be given to shelter panels that extend close to the ground to maximize protection from the elements. The number and location of panels surrounding a shelter may vary, including:

- Rear and two side panels – most common
- Rear and one side panel – allows for side access when a shelter needs to be offset close to the curb and face the roadway
- Rear panel only – ideal for narrow sidewalks; can have an access point at the rear also
- Side panels only – also ideal for narrow sidewalks and easy access from the front and back of the shelter
- Rear, side and front panels, which offer the most protection for passengers

All shelters will come with a roof, which may vary in size and not necessarily provide coverage that corresponds with the panels that support it. Standard shelters may allow a side panel to be removed for access, and therefore the roof would only be supported by the rear and one side panel, and potentially a post on the open side. Narrower shelters could have a standard roof size supported only by a rear panel, or by a rear and short side panels.

Custom designed shelter design with the side glass panel omitted in Boston, MA due to the proximity of the shelter to the curb

Shelter in Cambridge, MA with rear panels and access between the rear panels

Narrow style shelter with standard roof size and a green roof in Boston, MA

Solar panels may be added for power, and green roofs may also be considered.

Interior lighting in shelters should be considered, especially where existing street lights are absent. Lighting can be powered by a direct connection, battery or solar energy. If a direct connection is desired or required, shelter placement proximate to a utility connection will help to minimize costs to connect to an existing service. Solar panels must be oriented towards the sun, and may be used to power amenities such as cell phone charging stations. It is recommended to use solar technology to provide lighting where feasible.

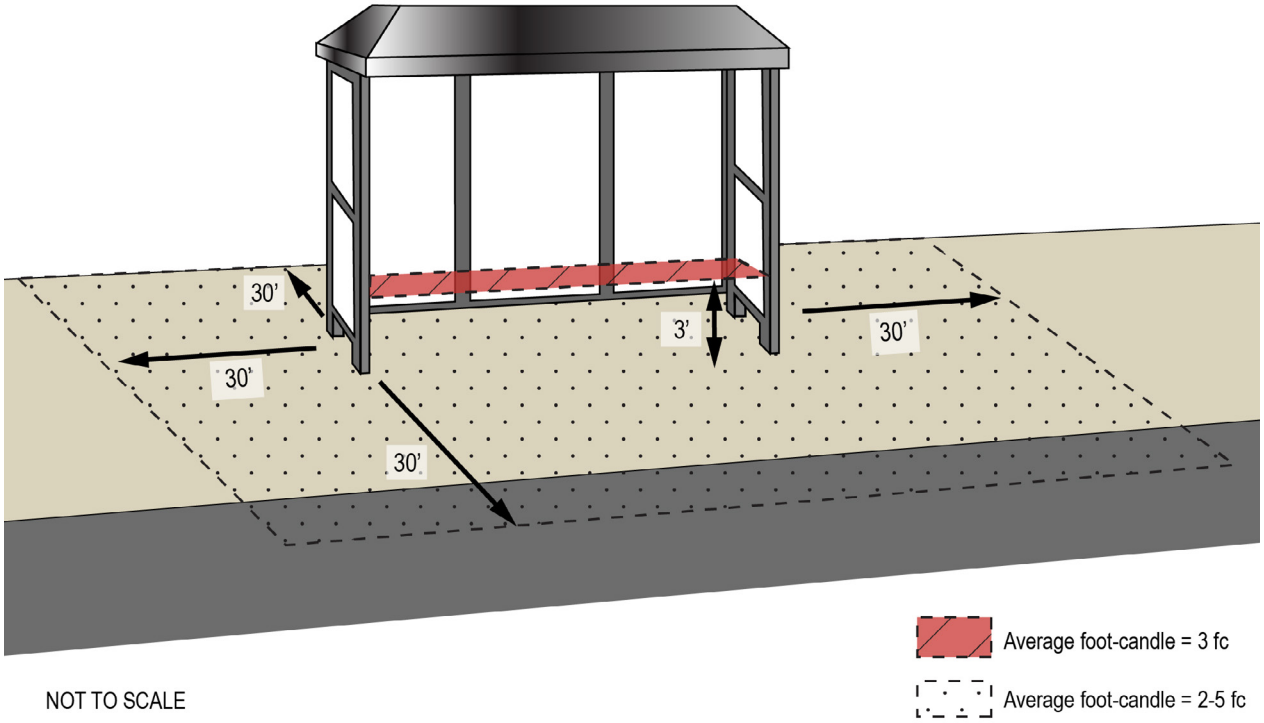


Figure 6.1 Shelter Lighting Guidelines

Interior shelter lighting should be appropriately illuminated for rider comfort and safety. It should provide for a 3 foot-candle average within the physical limits of the shelter, measured at a height of 3 feet above the ground. Lighting external to the shelter should provide a 2 to 5 foot-candle average in the area extending 30 feet in all directions from all sides of the shelter[26], as shown in Figure 6.1. Light sensors could be installed to activate only when there is passenger activity at the shelter to minimize the use of lighting. Stops with shelters can also be lit through advertising panel backlights. Shelter lighting should be provided and maintained along with the shelter.

[26]NACTO 2016

Heated shelter along MBTA's Silver Line in Boston, MA

More elaborate shelter designs can also include a heating system, although heated shelters can be expensive to maintain, and its programming needs to be carefully managed to avoid abusive use.

Benches should be integrated into the shelter design, or the design of the shelter should be able to accommodate the addition of a freestanding bench, which will be discussed in section 6.3.

All aspects of the shelter design shall meet ADA requirements, including but not limited to access points between panels, clearance and circulation space within the shelter, seating etc.

Passenger service information may also be integrated and include the following:

- □ RIPTA logo
- □ stop name, address or location
- □ maps and wayfinding
- □ schedule information (real-time or hard copy display)
- □ RIPTA and or maintenance responsibility information (e.g. broken glass repairs, dated information, snow removal etc.)

If a stand-alone shelter cannot be provided due to sidewalk restrictions, other options, including awnings or expanded roof lines on abutting buildings that can overhang the sidewalk, should be considered.

While some of the off-the-shelf shelters can be bolted to the existing sidewalk, the majority of designs require a foundation. Cement concrete sidewalks in Rhode Island are generally 4" thick, which do not adequately support the wind loads of a typical shelter. A shelter foundation is likely to require a concrete slab that is about 12" thick. The area will depend on the size of the shelter, but since footings can extend beyond the panel circumference, the foundation is likely to be slightly larger than the floor area of the shelter. Shelter foundation specifications should be provided with any shelter design that RIPTA adopts.

[27]NACTO 2016

B. Shelter Siting

There must be an ADA compliant landing area and path of travel between the landing area and the shelter before a new shelter is provided at a stop.

Shelters should be appropriately placed to maintain safety and good visibility of approaching buses, free of streetscape and landscape elements in the line of sight, and ideally outside of, and at least 5 feet clear of the landing area. They should face the roadway, although under extreme circumstances a shelter facing away from the roadway may be acceptable.

Ideally a 4-foot clear path of travel around shelters should be provided[27]. This provides access for trash removal, cleaning, and maintenance. If sufficient sidewalk space is not available, a curb extension could be explored, and/or a right of way easement may be investigated on the adjacent property if the land is public or developer-owned.

On shelters that include advertising panels, additional clearance may be required for access to that panel from the exterior, rather than the interior of the shelter. Four feet clearance from a shelter is the minimum in both the front and the back, but 5 feet is preferred.

Figure 6.2, adapted from the OmniTrans Transit Design Guidelines, illustrates the key clearances around shelter placement, while more specific siting requirements are provided in Table 6.2 and illustrated in Figure 6.3. While the clearances noted in these tables and figures refer to the distance to the shelter, if the shelter foundation is larger than the shelter itself, the clearances for in-ground features should be adjusted accordingly.

RIPTA R-Line shelter on Broad Street at Fricker Street is recessed from the sidewalk on the abutting property of Providence Career and Technology Academy, Providence, RI

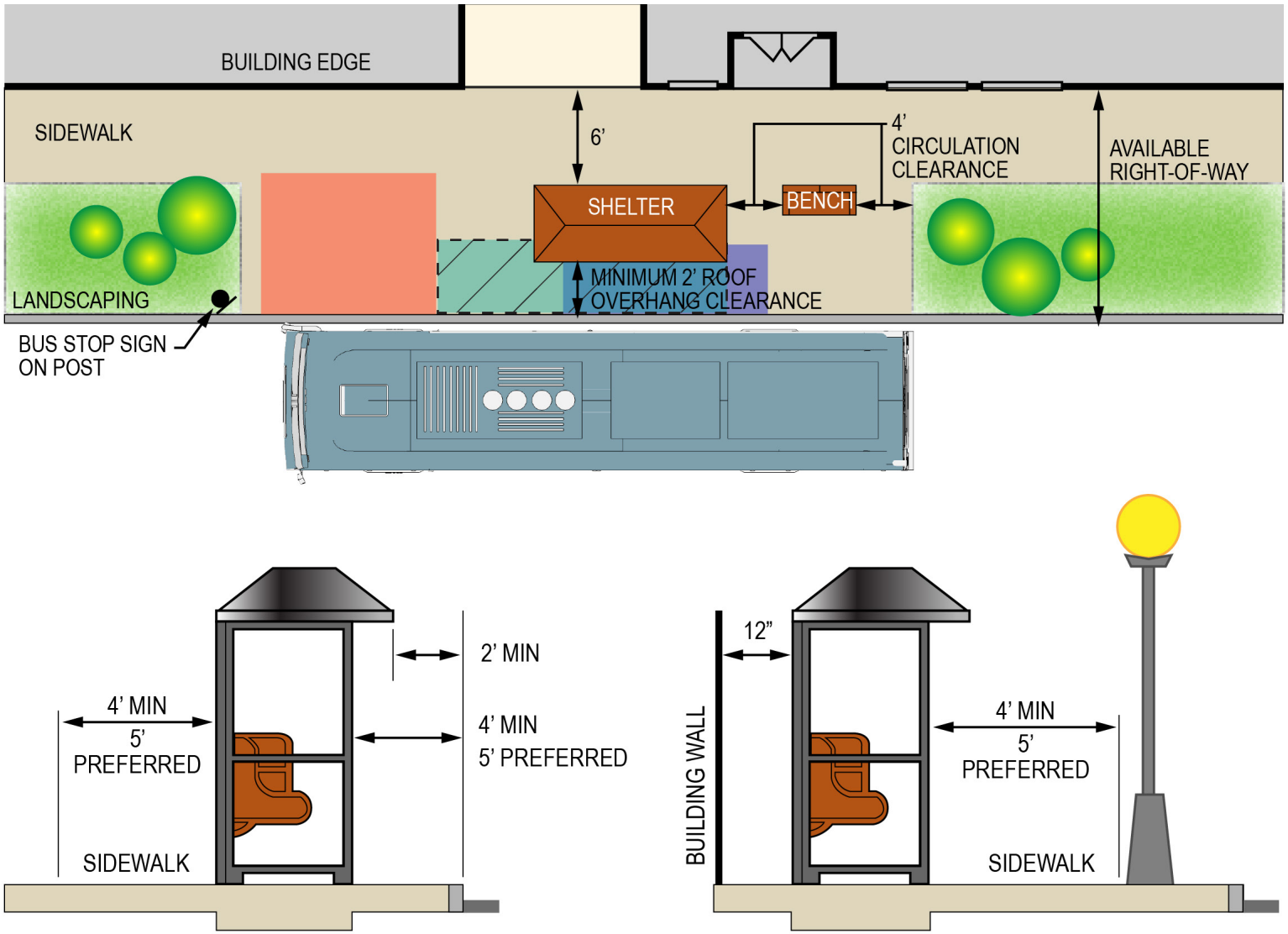


Figure 6.2 Key Shelter Clearances[28]

[28]Adapted from OmniTrans 2013

Table 6.2 Siting Guidelines for Shelters[29]

Guideline	Distance	Notes and Considerations
Proximity to bus stop	50’	From landing area (maximum)
Distance from back of curb	6’	To face of shelter, facing roadway. 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, facing away roadway (towards back of sidewalk).
Distance from back of curb	2’	To shelter roof/overhang, to avoid collisions with bus side mirrors.
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 stop to flow behind the shelter, while riders 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’ 4’ Min	Horizontal clearance - pedestrian path of travel in front of or behind shelter. This may be reduced to 3’ at a pinch point.

[29]Adapted from OmniTrans 2013, MBTA 2014

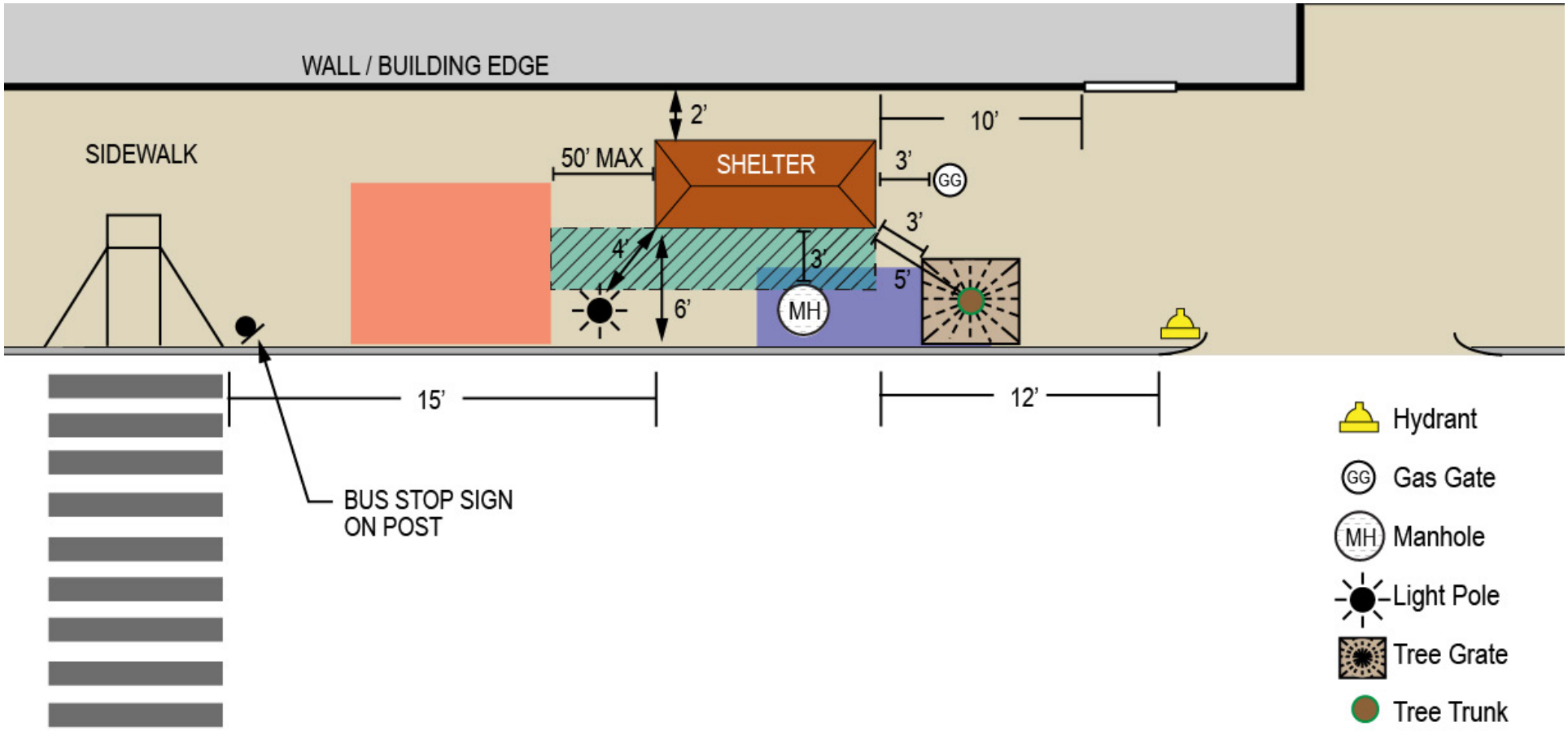


Figure 6.3 Detailed Shelter Clearances[30]

[30]Adapted from OmniTrans 2013

6.3 Benches

Benches may be installed as stand-alone (or free standing) seating at a bus stop or added as a separate element underneath or integrated into a shelter. Benches as part of the shelter design were discussed in the previous section – Shelters, and so free standing benches will be the focus of this section.

Freestanding benches are a relatively low-cost bus stop amenity that can provide riders with some level of comfort, especially on bus routes that do not run very frequently, and at bus stops that have lower ridership, where a more substantial investment in a bus shelter may not be viable. Benches are relatively simple to install and more easily accommodated on narrower, constrained sidewalks, and where a shelter might not be feasible.

A. Bench Design

Standardizing the style of bench would provide continuity and consistency and improve the overall visual aesthetic of bus stops.

While the ADA does provide guidance on outdoor benches, PROWAG indicates that "benches that provide full back support and armrests to assist sitting and standing are more usable by pedestrians with disabilities" (PROWAG, Section R212.6, 2011). PROWAG also recommends a seat height of 17 inches minimum and 19 inches maximum above the ground. The size of a bench could vary to provide seating for between one and four people, but NACTO recommends that benches be 43 inches long and 20-24 inches wide. End-cap armrests/anti-vagrant bars, and additional center anti-vagrant bars, should also be considered.

Two benches accommodate seating for up to eight people at an MBTA bus stop in Brookline, MA

As a unique alternative to typical freestanding benches, one, two or more stools (similar to the "Simme Bus Stop Seating System") [Simme] may be considered at low ridership stops and/or where there are narrow sidewalks. Stools may be freestanding, or may be attached to the bus stop sign post, although the orientation and position of the seat relative to passenger safety and proximity should be factored in. This is addressed in more detail in the next section – Bench Siting.

Simme Bus Stop Seating System

Leaning rails may also be used in place of traditional benches. They are particularly useful at floating bus stops, as shown in Figure 6.4, as they help establish a narrow barrier between the bus island and the bike lane behind it, deterring riders from crossing the bike lane in non-designated spots. NACTO recommends leaning rails of 30-38 inches in length.

Stools and leaning rails both increase rider comfort, while deterring loitering at bus stops.

Figure 6.4 Leaning Rail at a Conceptual RIPTA Bus Stop on Broadway at Knight Street in Providence, RI

While a specific bench design has not been adopted by RIPTA, RIPTA would like to see some consistency in the design such as steel fabrication for longevity, rust resistance, and vandal resistance, and finished in graffiti-resistant, black, high gloss paint for coordination with other street furniture.

B. Bench Siting

The orientation of benches is an important factor in placement. Having an unobstructed view of an oncoming bus is critical for waiting passengers, so shelters or trees within the line of sight should be avoided.

The back of sidewalk generally provides the safest, driest and best view for riders waiting on a bench, but 5-foot clearance also needs to be provided (4-foot wide path of travel should be maintained through the bus stop for ADA access, with an additional 1-foot of space required for knee and toe clearance). They are also less likely to be buried in snow banks, compared to benches positioned closer to the curb.

If the sidewalk is wide enough, a position perpendicular to the curb might be appropriate, providing the most direct view of an oncoming bus for riders.

A bench facing the back of sidewalk might be needed if there is a lot of street furniture curbside along a narrow sidewalk, and/or there are numerous entryways at the back of sidewalk, posing a challenge to find a clear space at the back of sidewalk.

In general, benches facing the roadway at the edge of the road should be avoided, unless the sidewalk is particularly wide, as people's feet are likely to encroach on the curb or roadway and they risk falling into the path of an oncoming bus. Backless benches are an alternative option in constrained areas.

Stools should generally be installed at the back of sidewalk. When the stool, or the post to which it is attached, is located at a curb extension (Figure 6.5) or adjacent to parking, the stool may be installed at the face

Bench perpendicular to the curb at an MBTA bus stop in Cambridge, MA

Benches should not be positioned less than 5 feet from the curb when facing the roadway

of sidewalk. However, the stool should be installed and oriented away from the roadway, on the sidewalk side of the support post, so the distance to the curb edge is maximized.

Backless bench

Figure 6.5 Stool at a Conceptual RIPTA Bus Stop on Route 114 at Child Street/Route 103 in Warren, RI

The stool should provide good visibility of an oncoming bus, and be visible itself, especially in rural areas where roadway speeds may be higher.

Snow removal by hand is recommended to minimize damage to the stool. A stool at the back of the sidewalk may be struck by a sidewalk clearing bob-cat, and so snow removal techniques should also be factored into siting stools.

When to Provide a Bench[31]

- **The bus stop has at least 10 average daily boardings**
- **As an alternative to a shelter due to site constraints**
- **A request was made by, or the stop is known to serve, seniors or persons with disabilities**
- **There is evidence of riders sitting on steps, walls, etc. of the abutting property**
- **The stop services a low frequency non-urban/ suburban/crosstown bus route, of one hour or more during peak periods, and two hours or more during off-peak periods**

Before a new bench is provided at any stop the landing area and the path of travel between the landing area and the bench should be determined ADA compliant.

6.4 Bicycle Parking

The installation of bicycle parking at bus stops expands rider connections to and from origins/destinations, especially for first-mile last-mile connections, and can incentivize transit users to ride their bicycle to access transit. Furthermore, they provide a bicycle parking option for riders if the bicycle rack on the bus is already at capacity.

As Providence, Newport and other municipalities explore bike share options, the location of bus stops should be factored into the bike share planning process.

A. Bike Rack Design

Bicycle parking at typical stops should include a bike rack, although bike lockers or bicycle cages maybe considered at higher ridership stops. Providing sufficient designated bicycle parking prevents bicycles from being locked to other streetscape objects such as poles and fences, which helps improve the attractiveness of the surrounding environment.

[31]MBTA 2014

Inverted U style bike rack at RIPTA stop on North Main Street, Providence, RI

Ring and post style bike rack on Weybosset Street, Providence, RI

Inverted U-shaped bike racks are currently provided on the R-Line, while ring and post styles can be found elsewhere in the State. While a specific design of bike racks has not been adopted by RIPTA, they should have at least two points of contact with the bike and be consistent with the design of other bus stop amenities, as described in the bench design. The Association of Pedestrian and Bicycle Professionals (APBP) provides guidance on good bike parking design in their guide "Essentials of Bike Parking: Selecting and Installing Bike Parking that Works (2015)".

B. Bike Rack Siting

Bike racks should be placed outside of the path of travel in the bus stop, and positioned so that no matter how a bicycle is locked to it, it will not obstruct the path of travel. Guidelines for the placement of bike racks include:

- Locate at a convenient location proximate to the bus stop and within sight of passengers
- Locate outside of the ADA path of travel, as well as outside of the bus stop zone encompassing the landing area and clear zone, and the area in between
- Ensure easy and unobstructed access to bike racks
- Ensure the visibility of bike racks, including non-restricted views from landscaping, shelters, or walls and under adequate street lighting for security
- Consider covered or weather protected locations as an added benefit to bicyclists
- At floating bus stops, place at the sidewalk edge, to essentially function as a barrier to discourage riders and pedestrians from crossing into the bike lane, except at the designated crossing

6.5 Trash Receptacles

The addition of trash/recycling receptacles, and or trash/recycling solar compactors is important, particularly at higher ridership stops, at stops within commercial areas and retail centers, and stops with shelters. Trash at bus stops was an issue raised on several occasions during the community process.

Trash accumulation can be problematic at shelters as they can catch wind-blown debris, but the addition of trash receptacles alongside shelters should help keep the overall buildup of trash to a minimum.

A. Trash Receptacle Design

A regular open container trash receptacle is ideal for lower ridership stops. RIPTA's preference would be for a bomb-proof trash receptacle, although they recongize that this maybe cost-prohibitive for most stops. Similar to other amenities discussed, while a specific design of trash receptacle has not been adopted by RIPTA, it should be consistent with the design of other bus stop amenities, as previously described.

Ideally trash receptacles should be accompanied by recycling receptacles, with a similar but slightly different style. Multi-compartment receptacles may also be considered.

Steel trash receptacle installed on Washington Street in Providence, RI

A multi-compartment receptacle outside City Hall in Providence, RI

Big Belly Solar compactor at an MBTA bus stop in Boston, MA

At higher ridership bus stops solar powered trash compactors (such as the Big Belly Solar) should be installed. Wifi-enabled compactors are also available that notify refuse collection departments when receptacles need to be emptied. These are a battery-charged device.

Both trash receptacles and solar compactors are about 2 feet wide in diameter.

B. Trash Receptacle Siting

Trash containers should be sited in shady areas away from seating areas, but in close proximity to boarding/alighting areas. Solar powered trash compactors should be placed with access to sunlight. All trash containers should also be located where they will not inhibit or obstruct accessible boarding/ alighting or sidewalk usage. They should not be provided in enclosed alcoves and alleyways.[32] The minimum sidewalk width required to accommodate a trash receptacle is 7.5 feet.

For ease of collection they should be located close to the curb and installed at least 1 foot off the back of curb[33], to maximize the path of travel through the stop. At stops with wider sidewalks this offset could be increased to a maximum 2 feet.

[32]APTA 2013
[33]MBTA 2014

6.6 Provision and Maintenance

RIPTA encourages provision of bus stop rider amenities, from shelters and benches, to bike racks and waste receptacles, solely by, or in partnership with, local municipalities or property owners. Advertising panels or small plaques may be installed on the amenities to acknowledge donors and maintenance owners. Advertising may help to offset some of the capital and maintenance costs.

Maintenance should include glass replacement in shelters, cleaning and painting of amenities, removal of trash and emptying of trash receptacles and compactors. Property owners should be encouraged to remove snow around amenities, as they do the sidewalk, to maintain access for riders. Snow that is not removed can become more difficult to remove once it freezes and pose a hazard for seniors and persons with disabilities. Maintaining a section of the bus stop zone for snow disposal and storage should be considered in the bus stop design, especially when there are occasions with substantial snow accumulation and it is not trucked off-site.

6.7 Passenger Information and Other Amenities

Providing information at bus stops in traditional and technical formats is an important aspect of rider convenience and comfort.

Traditional methods to provide schedules with maps, trip times or route frequencies, are currently provided on the R-Line stop, but could be expanded to include typical bus stops. Wayfinding maps to specific local destinations are beneficial for integrating bus stops into the surrounding neighborhood and providing an immediate means for new riders to find their way.

Wayfinding and Schedule Information at a RIPTA R-Line stop

Technological advances provide for the incorporation of more real-time information at stops, and may include:

- Electronic countdown signs showing “next-bus” arrival information (This is a greater capital and operational investment since it requires power and a data connection)
- Unique QR codes on bus stop sign posts for riders to scan for real time information

Real-time transit displays at a café in Arlington, VA

Although many riders may choose to use smart phones and tablets to access maps, schedules, and real-time arrival information, providing static maps, schedules, and real time information at stops is still an important component of providing an equitable service that is easy to use for all riders, including those without personal technology available.

Additional rider amenities that may be considered at bus stops include newspaper boxes, phone chargers, a book exchange or bus stop library, or even a swing.

6.8 Criteria to Add Amenities

Due to limited resources and physical space, among other factors, it is not feasible to install all amenities at all bus stops. The criteria listed in this section provides a method to evaluate bus stops for the potential integration of amenities into bus stop design. Existing site conditions and pedestrian infrastructure, public right-of-way availability, access and safety issues, resource availability, maintenance of amenities, and other concerns should be reviewed and addressed.

Criteria for the integration of amenities is divided into two categories; primary criteria and secondary criteria, as provided in Table 6.3.

Shelters

Specific criteria to determine how to distribute new shelters across the RIPTA system includes consideration of the following factors:

- Meeting the minimum threshold of boardings
- Rider requests for a shelter at a particular bus stop
- A RIPTA-led bus stop or bus corridor improvement program that recommends a new shelter or replacement of an existing shelter
- A municipality or private entity wishing to install their own shelter at a stop

Specific criteria for determining whether a shelter should be considered eligible for a stop is provided in Table 6.4. Each criterion is given a total number of points. A location with 100 points or more is considered eligible for a shelter. The primary consideration in placing a shelter at a stop is the total number of boardings. Boardings are used rather than total ridership, as they are more indicative of the number of passengers who will be waiting for the bus at a stop. Meeting these criteria does not guarantee the installation of a shelter. Local priorities and neighborhood requests, as mentioned above, can also influence the decision to add a shelter.

The process for selecting a stop for shelter installation includes the following steps:

1. Meets eligibility criteria of at least 100 points
2. Passes a site suitability test:
   - Adequate physical space and clearances
   - Proximity of proposed shelter to bus stop. Not greater than 50’ from bus boarding area
   - Permission from site owner to install shelter
   - Notify/obtain abutter approval – may or may not be necessary depending on the shelter’s proximity to and setback from property line
   - Community and municipal approval for advertising shelters
3. Conforms to Title VI requirements
4. Meets accessibility requirements – the stop is ADA accessible or will be reconstructed to meet ADA before shelter is installed, and
5. Shelter maintenance agreement is in place.

Table 6.3 Criteria to Add Amenities to Bus Stops

Primary Criteria	Daily Boardings	The number of boardings is a primary indicator of the use of a bus stop. Bus stop amenities are of greater importance at stops where there are many passengers waiting to board the bus. Evaluation should be done to determine which stops have the most number of boardings rather than overall stop activity. Stops that riders primarily use for alighting do not have as much of a need for amenities as stops that have greater sums of boardings. The number of boardings at a stop is the most influential factor in determining the placement of a bus stop amenity.
	<100	Seating on hard surface; bike rack; route information panel with instructions on accessing real time arrival data
	100 to 149	Small shelter with bench; bike rack; trash receptacle; current bus schedule; route information panel with instructions on accessing real-time arrival data
	150 to 199	Medium-size shelter with bench; bike rack; trash receptacle; current bus schedule; real time bus data; landscaping within 10’ of primary bus stop feature
	≥200	Large/custom shelter with bench; bike rack; trash receptacle; current bus schedule; real time bus data; landscaping within 10’ of primary bus stop feature
	Condition of Existing Amenity	If the condition of an amenity is such that it poses a danger to the surrounding community it should be repaired or removed immediately and should be given priority to be replaced, so long as it still meets the initial criteria for its placement.
	Transfer Location	Transfer points require passengers to switch between routes or modes. This frequently requires passengers to wait at a stop. When possible efforts should be made to provide a comfortable area at stops where it is common for passengers to wait to connect with other routes or modes. The number of transfers at a stop is an influential factor.
	Equitable Distribution	In order to comply with Title VI requirements, there should be an equitable distribution of passenger amenities between Title VI and Non-Title VI areas.
	Maintenance Agreement	Responsibility for maintenance of the amenity, needs to be established in advance of installation, by way of a Memorandum of Understanding.
Secondary Criteria	Availability of Right-of-Way	The associated costs of land acquisition and construction should be evaluated and weighted against the benefit generated from adding a particular amenity to a stop. In some cases it may not be practical to add an amenity to a location if the site is so physically constrained that it becomes cost-prohibitive. Availability of necessary right-of-way and/or the ability of adjacent property owner to dedicate or sell the necessary right-of-way.
	Special Needs Locations	Occasionally there is a need for amenities to accommodate those who are vulnerable and require special needs. Consider the number of seniors or physically challenged individuals in the area. The number of requests and the number of times that the bus ramp is deployed at a particular stop are influential factors.
	Requests for Shelter	It is common for RIPTA to receive requests for shelters and these requests are to be evaluated against the other criteria, however the number of requests may influence the priority of the evaluation.
	Existing Amenities	If there are existing amenities, such as a bench, and it meets the primary criteria the stop should be considered for an upgrade. Otherwise the location should be removed from the list for bus stop enhancements.
	Future Capital Project	In conjunction with long range plans for transportation projects, amenity locations should be considered in areas where there is likely to be a major node (station) along a corridor.

Table 6.4 Shelter Eligibility Test Criteria

Factor	Criteria	Points
Customer boardings	100+ average daily boardings	100
	50+	50
Key route/Future capital project	Proximity to potential transit development/ location along a key transit corridor. Considered in relation to long range plans	20
Economic development	Proximity to large employment center such as a retail center, hospital, key municipal buildings, entertainment/cultural center etc.	20
Demographics	Proximity to high transit generators such as medical facilities, senior housing, and other uses, utilized by significant numbers of elderly persons and/or persons with disabilities	20
Minority/Low income areas	Equitable distribution of shelters between Title VI/EJ Communities and non-Title VI/EJ communities	15
Frequency of service	Gives priority to stops with less frequent service, which have longer wait times for customers	15
Connectivity	Serves as a common transfer point to other routes or modes	10
Requests for shelters	Multiple customer requests	5
Existing site infrastructure	Available right-of-way, and accessible existing pedestrian infrastructure	5
Site conditions	Bus stops with unusually high exposure to adverse weather elements	5
Poor existing shelter condition	For stops with shelters in deteriorating condition	5

6.9 Developer Responsibilities

Developers can be responsible for providing and maintaining the amenities described in this chapter when they construct or renovate a development adjacent to an existing or proposed bus stop. It is the responsibility of local municipalities to require the placement of shelters that conform to federal, state and local standards, as well as RIPTA requirements outlined in this guide.

Design plans should be submitted to RIPTA at designguide@ripta.com to ensure proper coordination and placement of bus stop amenities.

Chapter 7

Design Examples

7 Design Examples

Several bus stops layouts and designs have been presented throughout previous chapters of the guide. This chapter provides a collection of the different alternatives or scenarios, with summary points for consideration of these sample layouts, as well as some before and after photo renderings of existing RIPTA bus stops.

The sample bus stop designs are provided as a toolbox of options. They are not intended to cover every eventuality in bus stop design, and planning/engineering judgement must be used to determine the ideal bus stop design for each unique location.

In its simplest most basic form, the ideal layout of a typical RIPTA bus stop is provided in Figure 7.1, using a far-side location as an example.

7.1 Sample Bus Stop Layouts

Figure 7.2 through Figure 7.12 provide a series of sample bus stop layouts created in a variety of bus stop environments. These samples are provided for guidance only. Specific site conditions at actual bus stops will determine the final layout and type of improvements and amenities that can be made at any respective stop within the RIPTA service area.

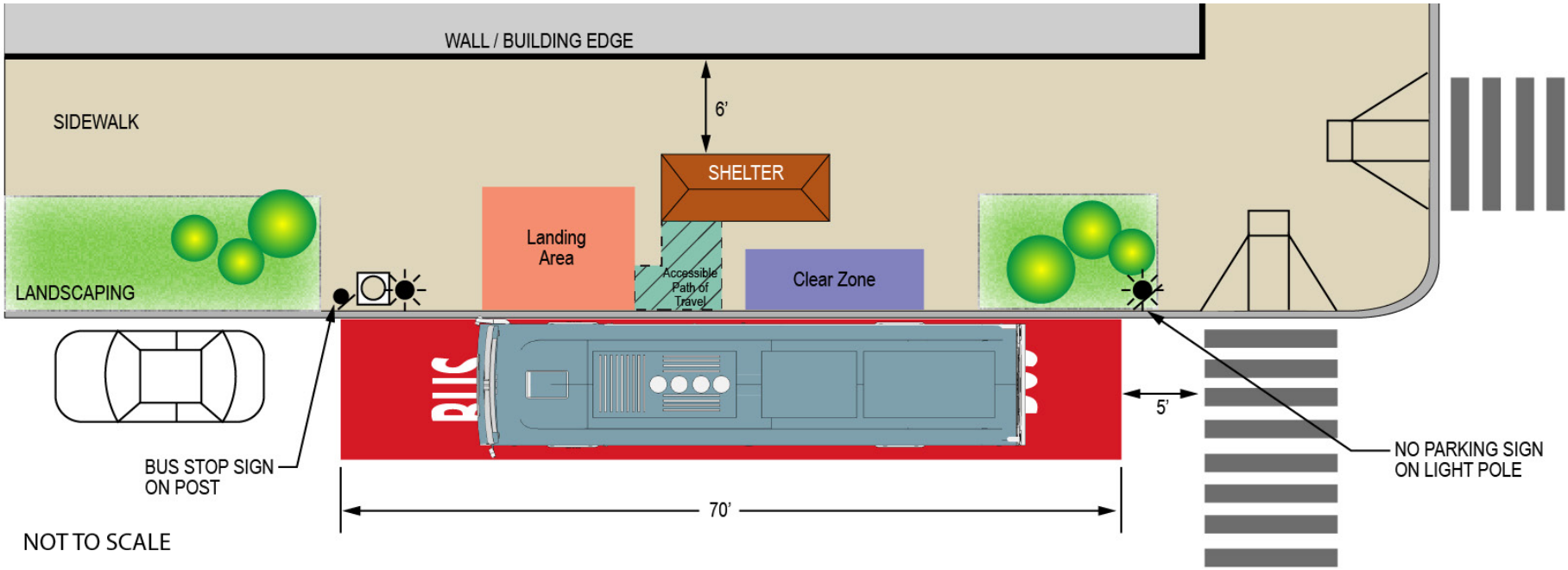
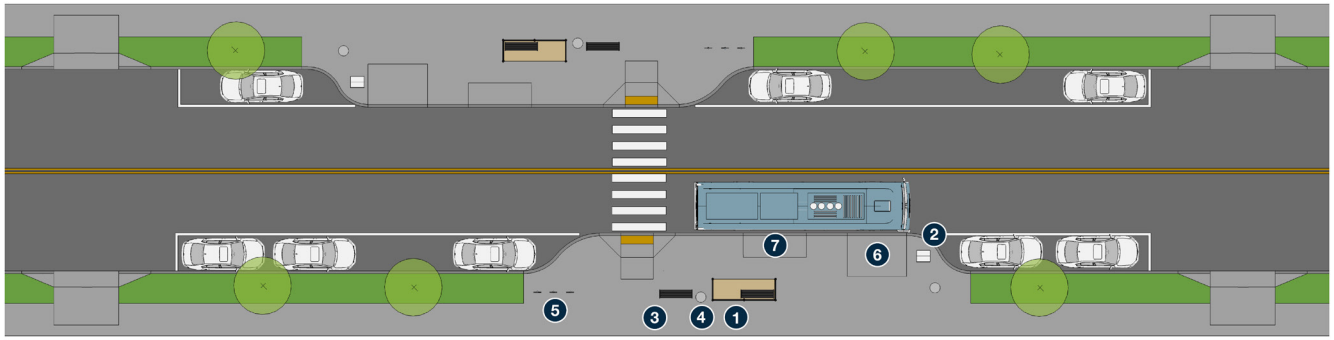
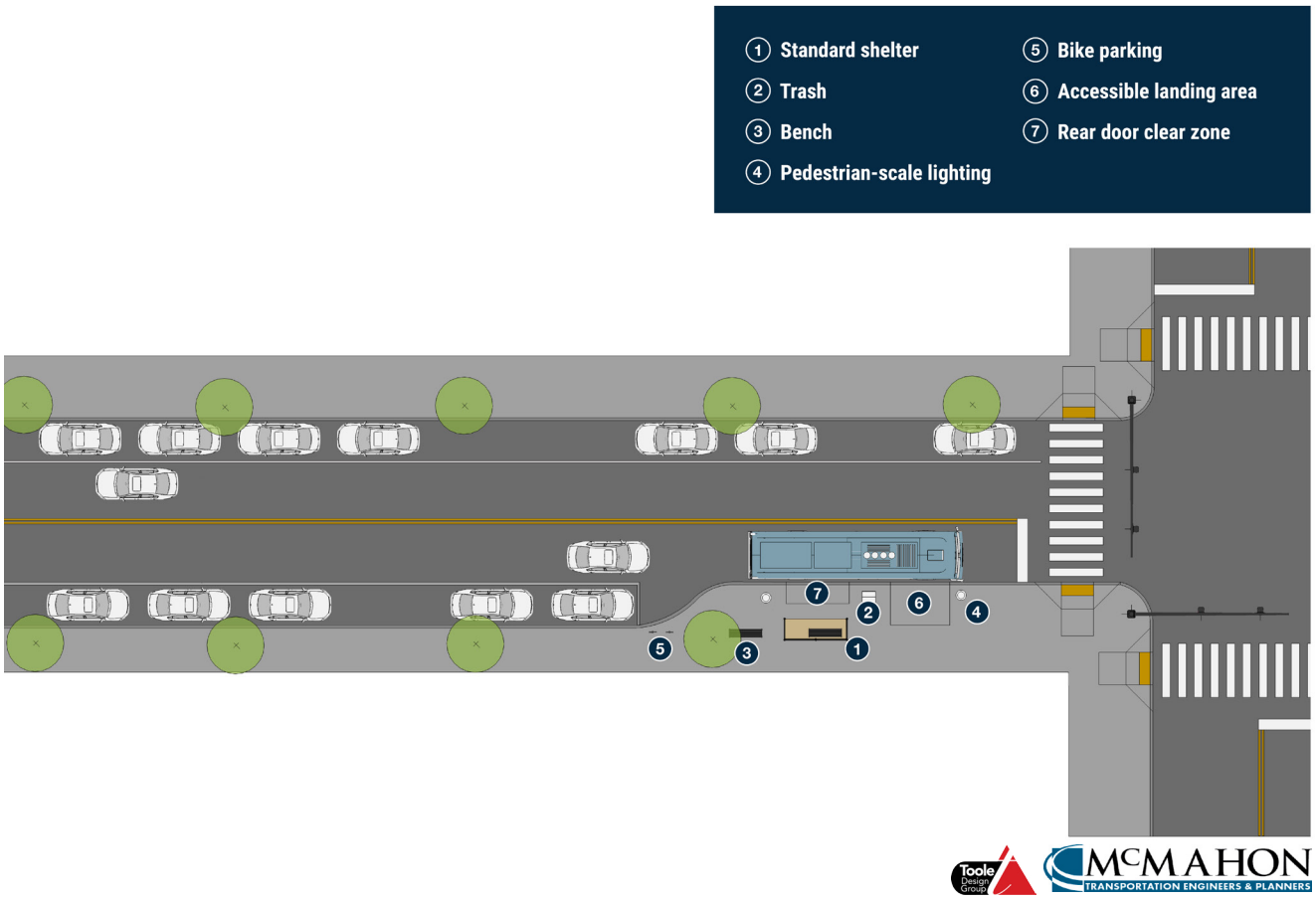


Figure 7.1 Ideal Bus Stop Layout



- Improve/save travel time for buses by stopping in-lane and not having to re-enter traffic
- Widen sidewalk to provide more space for passengers at high ridership stops, and to install amenities
- Impacts vehicular traffic operations and bicycle flow on single-lane roadways
- Extendable to incorporate and bump out the pedestrian crossing, improving pedestrian visibility and reducing crossing distance
- Minimal impact on on-street parking
- Most likely location is in an urban area, with high pedestrian activity, but narrow sidewalks, and low roadway design speed
- Could be shortened and implemented in the middle of on-street parking (bus can overhang vehicles parked behind the curb extension as long as the landing area and clear zone is provided)
- A partial curb extension may only be considered in consultation with RIPTA and/or where:
  - Parking demand may be less
  - It can allow slow and careful passing of the bus, without encroaching on the opposing travel lane

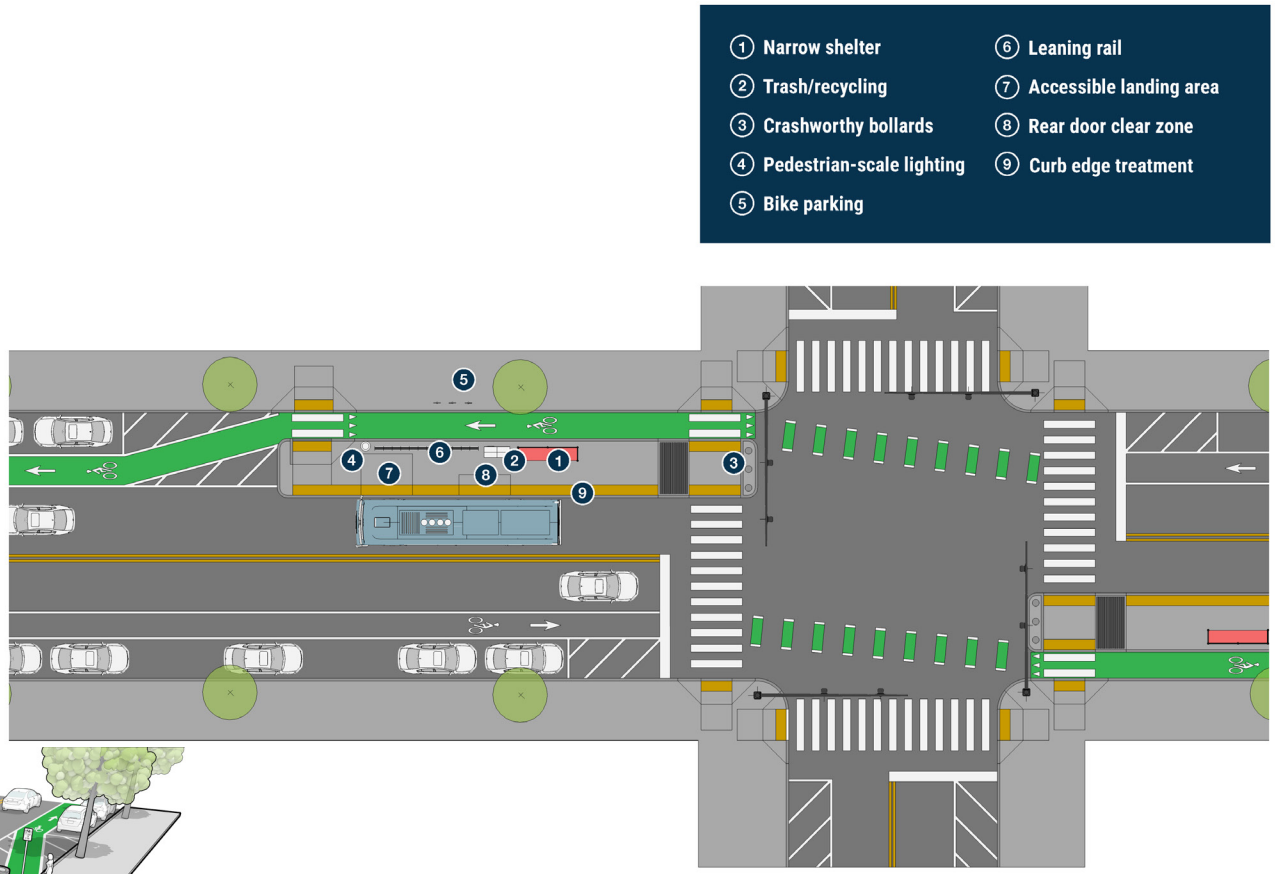
Figure 7.2 Bus Stop Curb Extension (Far-side of Crosswalk)



- Improve/save travel time for buses by stopping in-lane and not having to re-enter traffic
- Widen sidewalk to provide more space for passengers at high ridership stops, and to install amenities
- Impacts vehicular traffic operations and bicycle flow on single lane roadways
- Extendable to incorporate and bump out the pedestrian crossing, improving pedestrian visibility and reducing crossing distance
- Minimal impact on on-street parking
- Allows for connectivity to other routes where bus routes may split prior to the intersection
- High transit generator may abut the stop
- Most likely location is in an urban area, with high pedestrian activity, but narrow sidewalks, and low roadway design speed
- A partial curb extension may only be considered in consultation with RIPTA and/or where:
  - Parking demand may be less
  - It can allow slow and careful passing of the bus, without encroaching on the opposing travel lane and maintain a safe crossing for pedestrians in front of the bus

Figure 7.3 Bus Stop Curb Extension (Near-side of Crosswalk)

- Use with a separated bike lane (at street or sidewalk level) at high ridership bus stops
- Bus island can be lengthened to accommodate 2 buses
- Pedestrian access at the end of the island at a far-side stop should be provided
- Green paint adds emphasis to the conflict zone
- Agreements for maintenance and snow removal on bus island will need to be established
- Most likely to be implemented in an urban environment



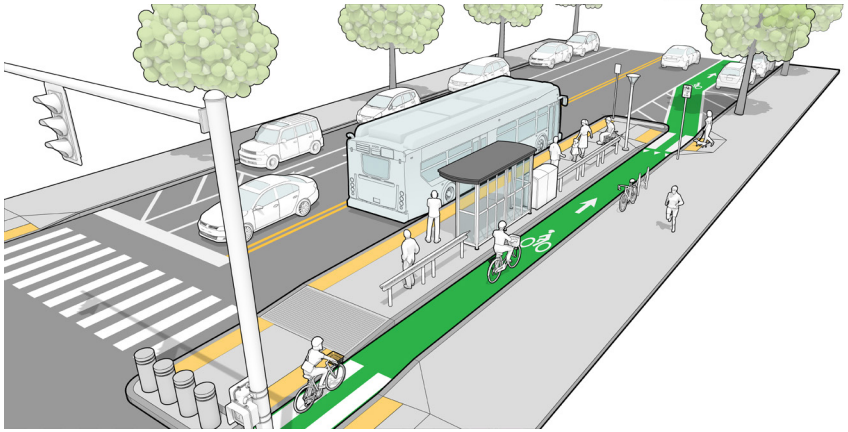
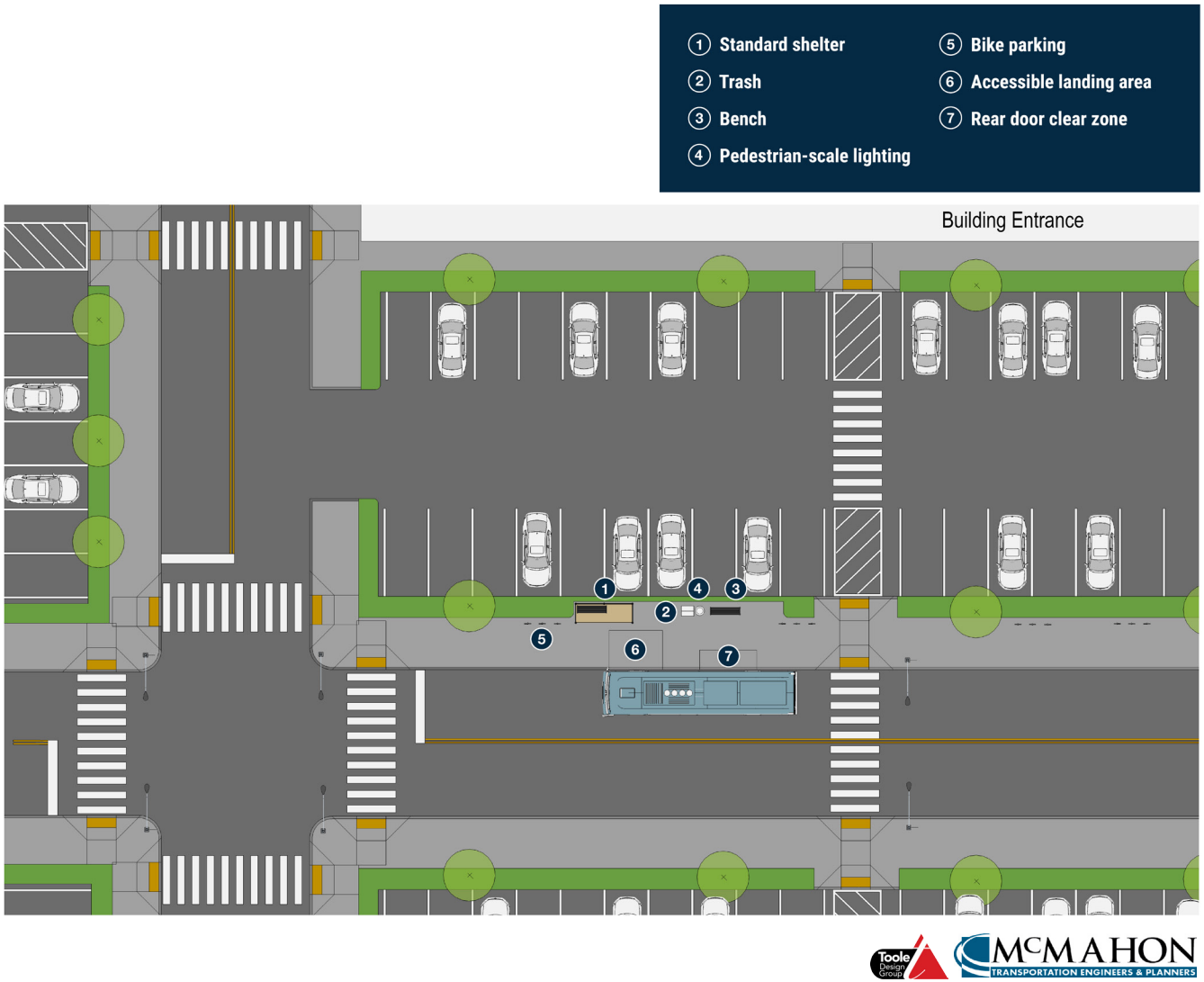
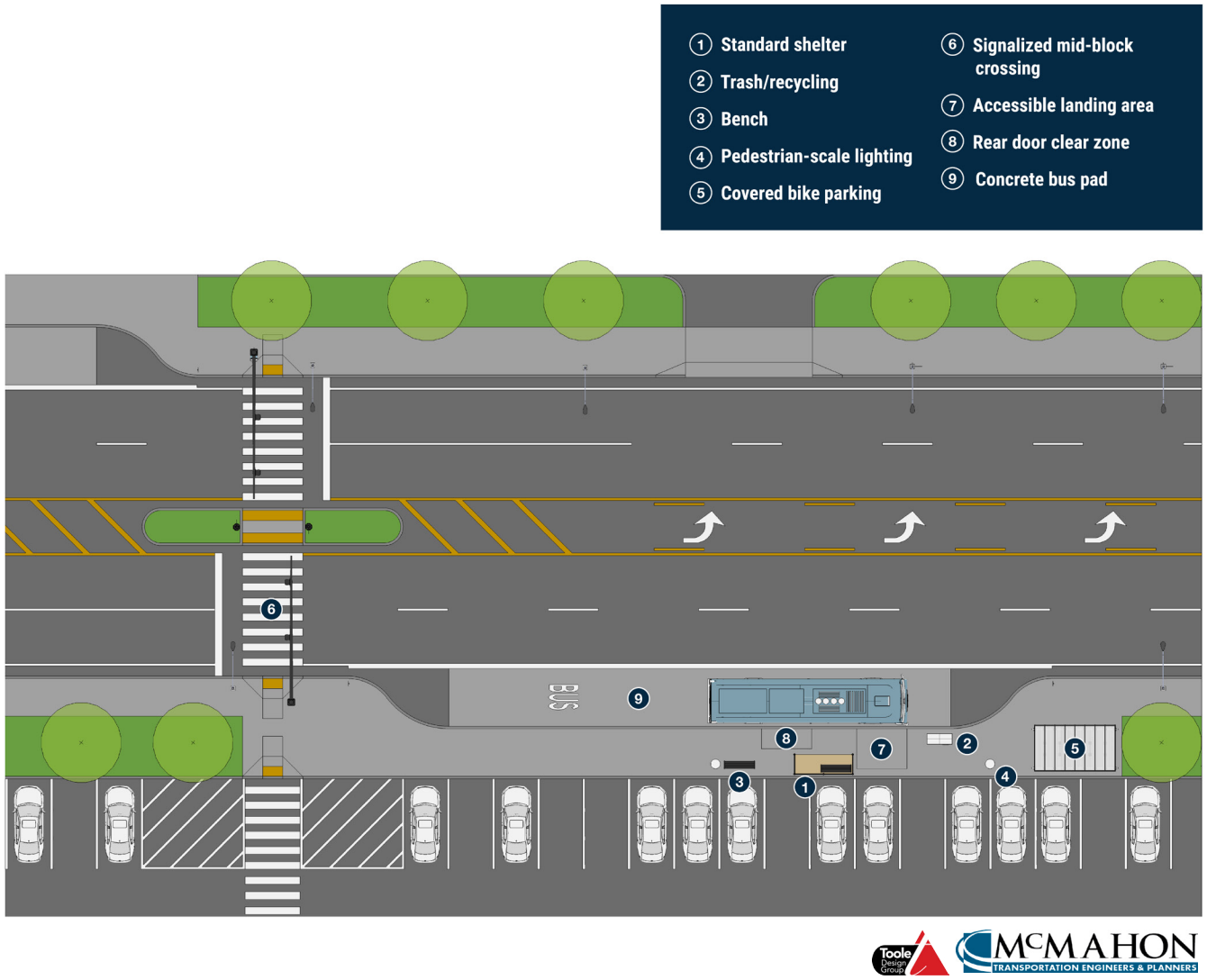


Figure 7.4 Floating Bus Stop



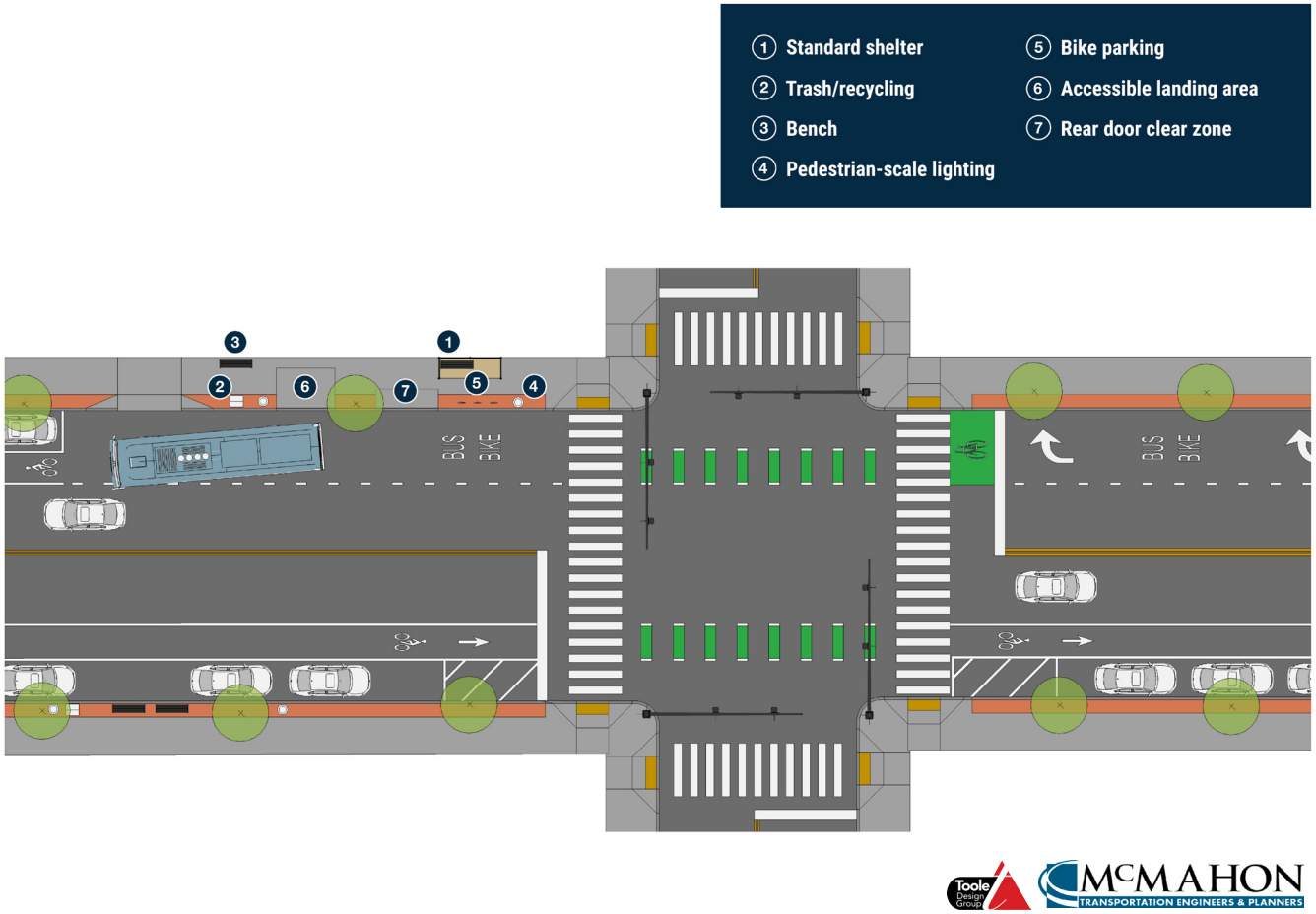
- Use where bus stops may be located on a private roadway in the middle of large parking areas
- Maintains full access to the fire lane abutting the private development
- Avoids narrow parking aisles
- Good pedestrian connections to the entrance should be provided
- At retail centers locate cart corrals close to bus stop (See Figure 7.12)
- Could be applicable in urban, suburban, or rural environments at various types of retail or commercial developments

Figure 7.5 Off-Street Bus Stop



- Use at stops with high boardings and or where ridership may be slower to board e.g. close to mall/grocery store when passengers are carrying shopping bags
- Use at layover points where buses dwell for longer
- Safer in high speed environments
- Locate after crosswalks and traffic signals to minimize delay re-entering traffic flow
- Most likely to be implemented in suburban or rural environments

Figure 7.6 Bus Stop Pull Out



- Bus stop curbside next to on-street parking is the most common existing stop configuration
- Use bus queue jump at a signalized intersection in conjunction with a far-side stop
- Bus queue jumps can be combined with bikes, and right turns
- Bus queue jumps can be used exclusively by buses, but if curbside there must be signal control to prevent right turns in front of the bus, or right turns should be banned
- Exclusive bus queue jumps can be set up between an exclusive right turn lane curbside, and travel lane(s) for other movements
- Bus queue jump ideally used in conjunction with transit signal priority
- Bike box (i.e. a designated area at the head of a travel lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase) to be determined on site specific basis; added benefit when buses are not present on the approach

Figure 7.7 Bus Stop in Parking Lane with Bus Queue Jump Lane

- Typical curbside stop next to on-street parking, but pedestrian curb extension creates an obstruction to access the stop; essentially requiring the same curbside space as a mid-block curbside stop
- Improves pedestrian visibility

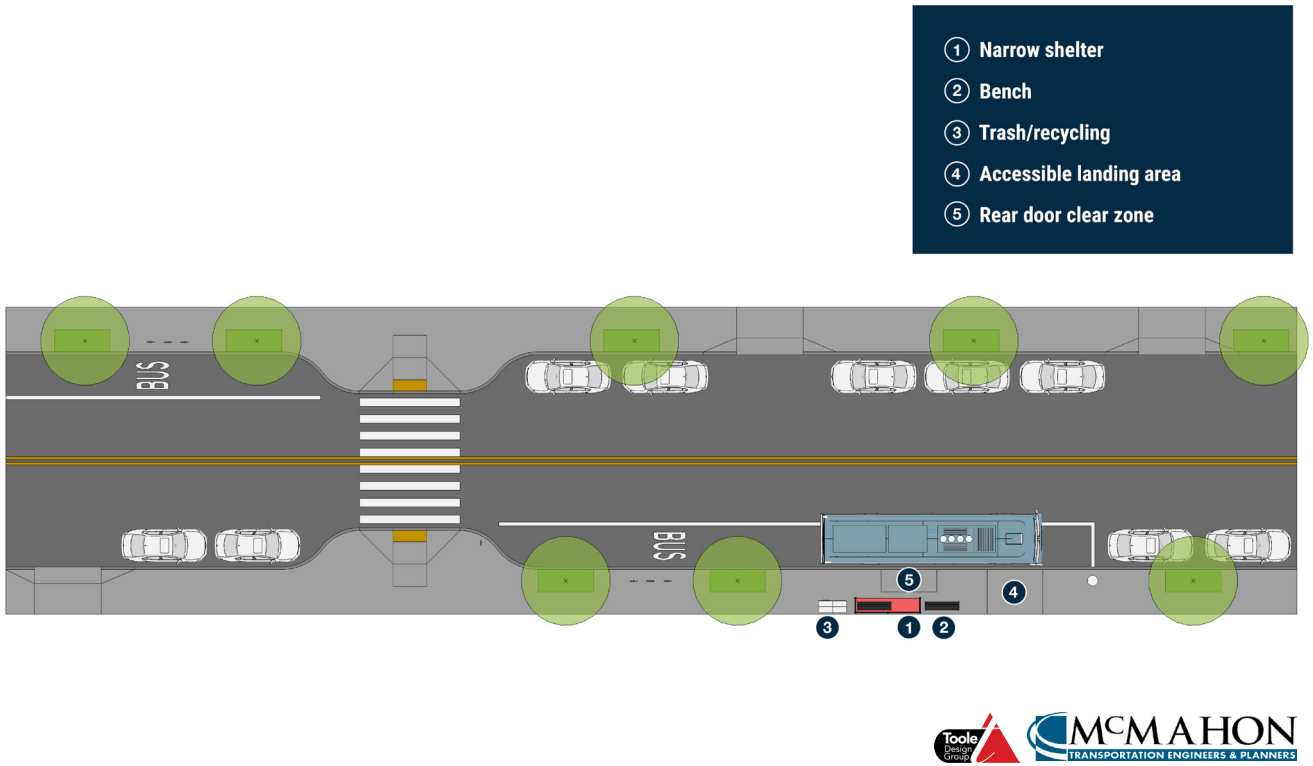
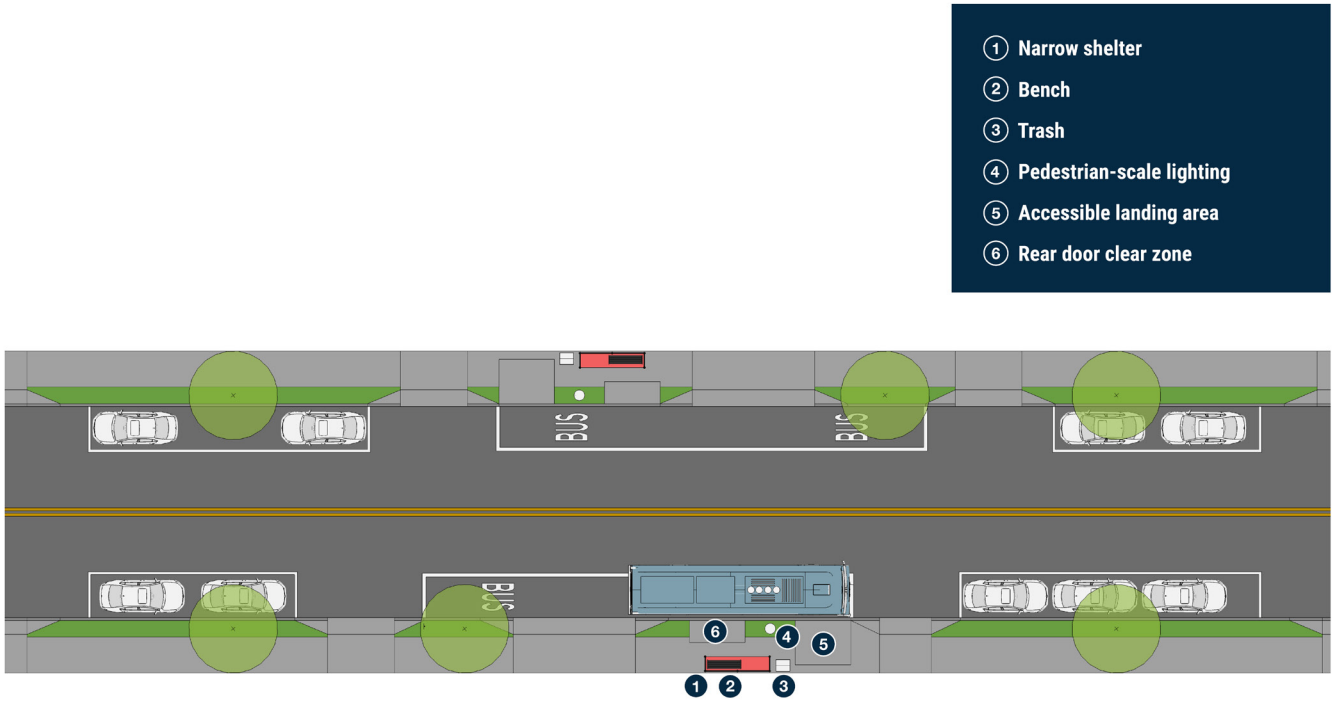


Figure 7.8 Bus Stop in Parking Lane After Pedestrian Curb Extension



- Most likely to be applied on a neighborhood street with lots of residential driveways, or along a commercial strip of roadway
- Continuous dedicated space for pedestrians is minimal
- Bus stop may need to straddle driveway(s)
- No parking area beyond the driveway may also be required
- Allows for minimal operator error connecting to a level landing area
- Grass strip between landing area and clear zone is ideally removed to maximize the waiting environment

Figure 7.9 Bus Stop in Parking Lane with Multiple Curb-cuts

- Use on roadways with no on-street parking
- Locate after crosswalks to minimize opportunity for unsafe overtaking
- On two-way center turn lane roadways exercise caution in design to minimize unsafe overtaking
- Provide concrete sidewalk at the landing area and clear zone, and ideally in between, to maximize rider waiting area and wider passage for other pedestrians

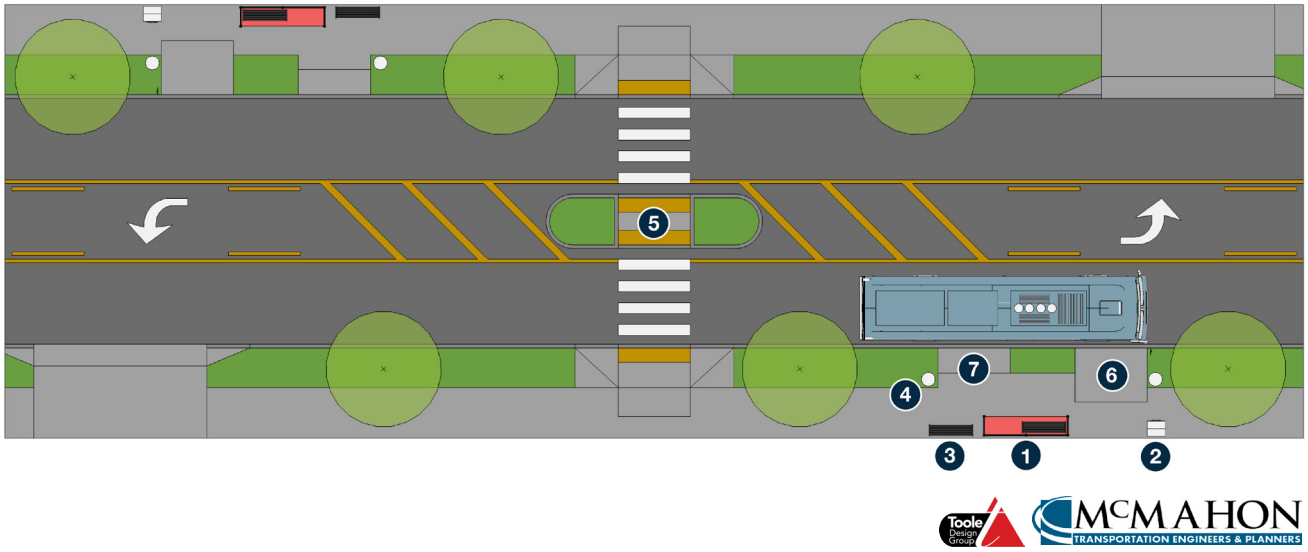
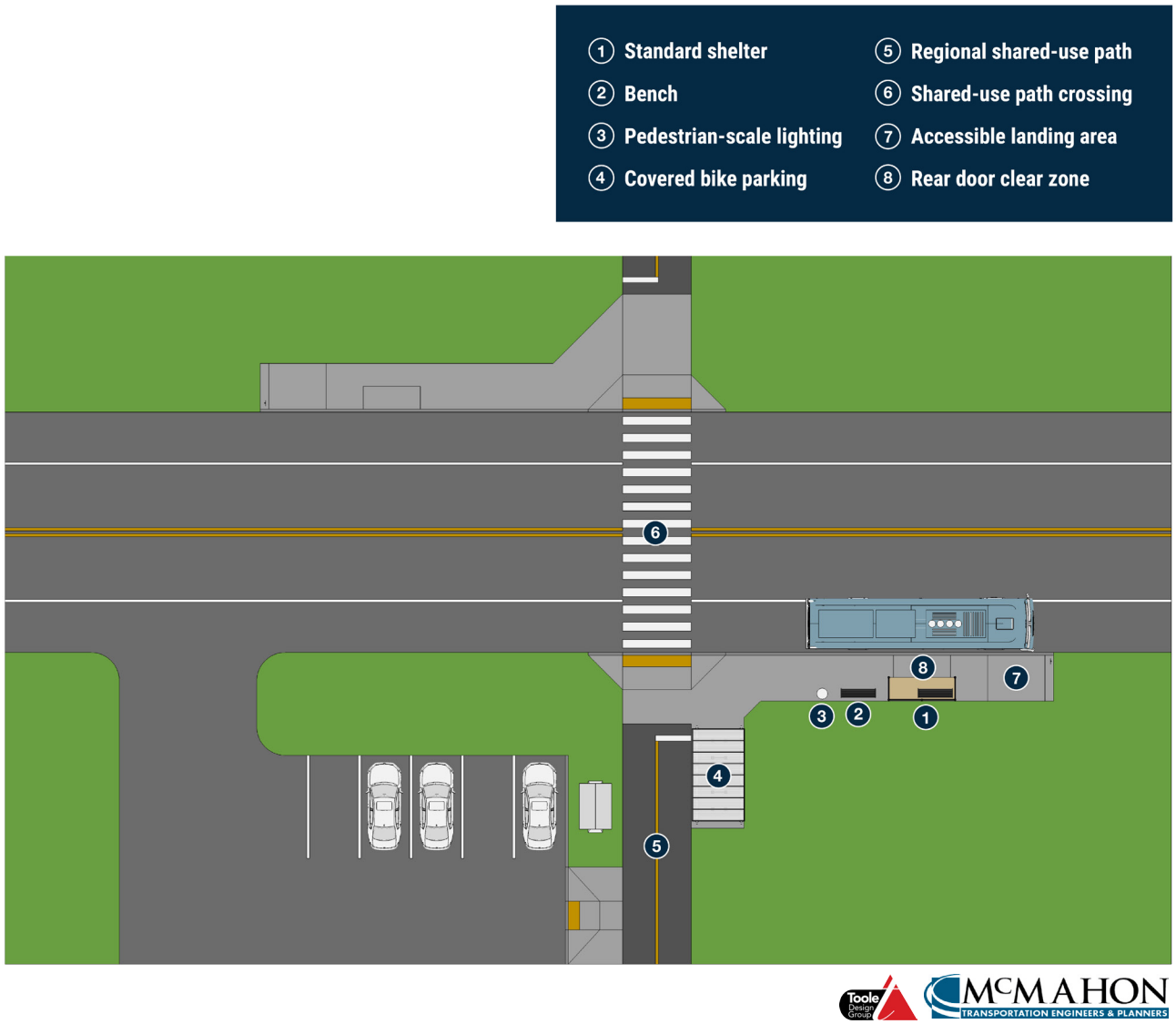


Figure 7.10 Bus Stop in Travel Lane



- Locate away from driveways for drivers gathering speed to enter the travel lane
- Most likely to be applied in rural or less developed areas, in higher speed roadway environments
- Bus should be able to stop within the shoulder and not encroach on the adjacent travel lane. If the shoulder is narrow the speed of the roadway should be lower as buses will most likely block passing traffic
- Locate after crosswalks to maximize pedestrian visibility, especially on higher speed roadways
- Connect bus stop to existing sidewalk if within 100-200' of the stop to maximize connectivity
- If a pair of stops show that one stop has very high boardings and few alightings; and the other stop few boardings and very high alightings; amenities and sidewalk provision should be reflective of these unique conditions
- If existing sidewalk is too narrow and right of way is too constrained or inappropriate for a curb extension, consider encroachment and or easement on abutting property for minimum 8' wide sidewalk

Figure 7.11 Bus Stop in Shoulder

- ☐ Use when bus stop is shared with bike lane
- ☐ Stopped buses block through access for bicyclists
- ☐ Buffered separated bike lane provides more protection for bicyclists than conventional on-street bike lanes

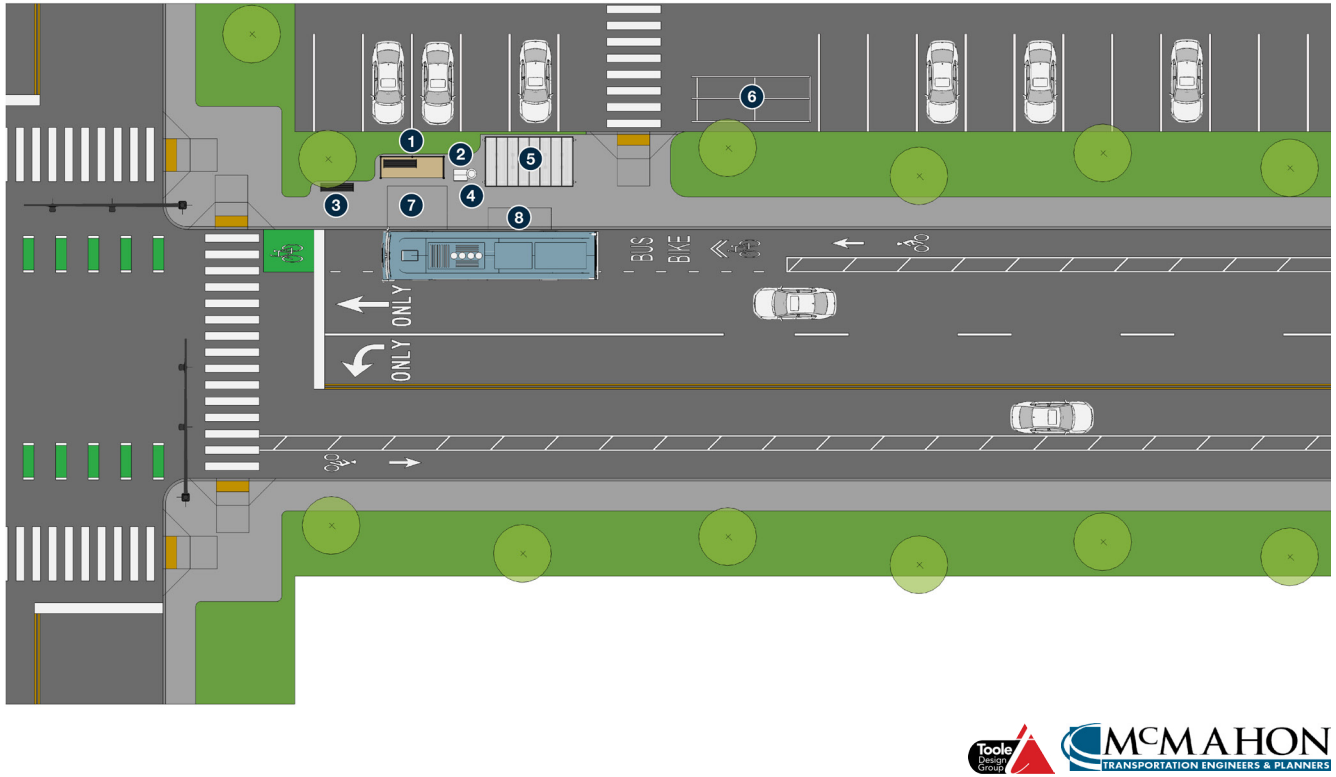


Figure 7.12 Bus Stop in Buffered Bike Lane

7.2 Sample Bus Stop Before and After Photos and Renderings

A sample of before and after photos illustrating a variety of different improvements to three RIPTA bus stops are provided in Figure 7.13 through Figure 7.15.

Before

After

Figure 7.13 Conceptual RIPTA Floating Bus Stop on Broadway at Knight Street in Providence, RI

Before

After

Figure 7.14 Conceptual RIPTA Curbside Bus Stop on Route 114 at Child Street/Route 103 in Warren, RI

Before

After

Figure 7.15 Conceptual RIPTA Bus Stop in Bike Lane on Toll Gate Road at Bald Hill Road in Warwick, RI

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Photo Credits

McMahon Associates: All photos except those otherwise noted.

Pamela M. Sherrill Planning, LLC: 2 (meeting), 40

Toole Design Group: 11, 18, 23 (Taunton Avenue), 25 (Toll Road), 28 (Puget Sound), 30 (Broadway), 39, 43 (Fountain Street - left)

New York City Department of Transportation: 14 (Far-side)

Google: 15

archiexpo.com: 41 (Marshalls) (http://www.archiexpo.com/prod/marshalls-plc/product-70068-1482605.html)

ggwash.org: 58 (Arlington, VA) (https://ggwash.org/view/11801/experimental-real-time-transit-screens-come-to-arlington-dc)

Appendix A

Public Process and Peer Review Summaries

Summary of Public Process

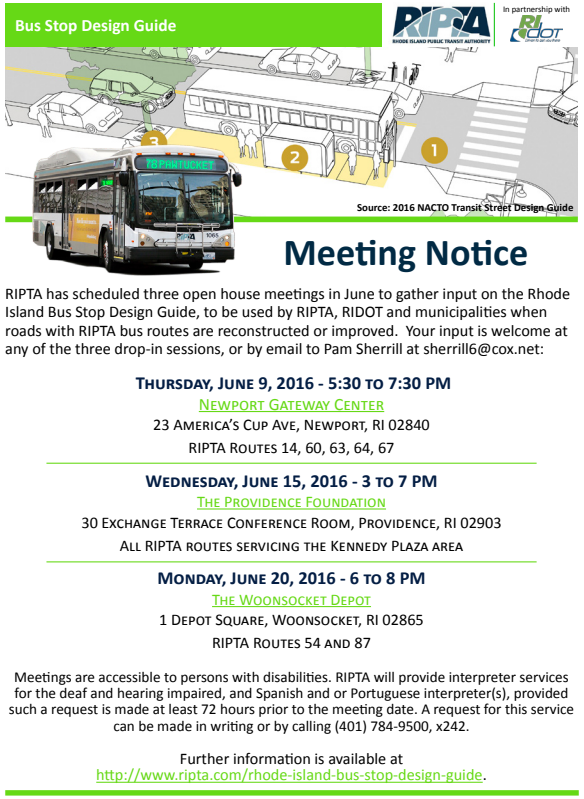
Public input was a critical component to the development of the guide. Agency and public stakeholders were engaged to help inform the creation, operation, and maintenance of proposed sample bus stop designs. Developing an informed guide that reflects the input of a diverse group of stakeholders, including the general public, municipal, and state agencies, and the design community was a key goal of the process.

Public and stakeholder engagement for the guide was bolstered around the following three well-publicized community meetings held in June 2016:

- Thursday, June 9, 2016 5:30-7:30 PM at Newport Gateway Center, 23 America's Cup Ave, Newport, RI
- Wednesday, June 15, 2016, 3-7PM at Providence Foundation, 30 Exchange Terrace Conference Room, Providence RI
- Monday, June 20 2016 6-8PM at 1 Depot Square, Woonsocket RI

Publicity for the meetings and requests for comments capitalized on the use of digital media through RIPTA's website with a press release, posting on RIPTA's social media, and meeting announcements in the June and July editions of the RIPTA newsletter. A project webpage was developed to include an overview of the project, meeting dates, project contact details, presentations and the sample bus stop designs displayed at each meeting. The RIPTA e-news database was used to distribute meeting invitations. Meetings were advertised on RIDOT's calendar of events, and meeting information and flyers were included in the Rhode Island Statewide Planning and Women in Transportation (WTS) newsletters. To reach out to representatives of those who are transit dependent, invitations were emailed to the RI Governor's Commission on Disabilities, RI Department of Human Services Division of Elderly Affairs, AARP, and local community groups such as the East Bay Community Action Program, the NAACP Newport County Branch, and the Martin Luther King Center.

Approximately 190 email invitations were distributed to individuals and organizations for distribution to their membership. Invitations and reminders were emailed to state agencies and the chief municipal official, clerk, planner and public works director in all 39 Rhode Island communities. Email distributions were made to various organizations including chambers of commerce, bicycle advocacy organizations, and professional engineering and planning organizations. Email invitations were also extended to the colleges and universities enrolled in the UPass program. Meeting announcements were made at RIPTA's Accessible Transportation Advisory Committee (ATAC), the Rhode Island Statewide Planning Transportation Advisory Committee, and Grow Smart RI. An eye-catching one-page flyer was prepared for digital distribution and print display.


Bus Stop Design Guide

In partnership with

Source: 2016 NACTO Transit Street Design Guide

Meeting Notice

RIPTA has scheduled three open house meetings in June to gather input on the Rhode Island Bus Stop Design Guide, to be used by RIPTA, RIDOT and municipalities when roads with RIPTA bus routes are reconstructed or improved. Your input is welcome at any of the three drop-in sessions, or by email to Pam Sherrill at sherrill6@cox.net:

Thursday, June 9, 2016 - 5:30 to 7:30 PM
Newport Gateway Center
23 America's Cup Ave, Newport, RI 02840
RIPTA Routes 14, 60, 63, 64, 67

Wednesday, June 15, 2016 - 3 to 7 PM
The Providence Foundation
30 Exchange Terrace Conference Room, Providence, RI 02903
All RIPTA routes servicing the Kennedy Plaza area

Monday, June 20, 2016 - 6 to 8 PM
The Woonsocket Depot
1 Depot Square, Woonsocket, RI 02865
RIPTA Routes 54 and 87

Meetings are accessible to persons with disabilities. RIPTA will provide interpreter services for the deaf and hearing impaired, and Spanish and or Portuguese interpreter(s), provided such a request is made at least 72 hours prior to the meeting date. A request for this service can be made in writing or by calling (401) 784-9500, x242.

Further information is available at http://www.ripta.com/rhode-island-bus-stop-design-guide.

To ensure meaningful access to programs and activities by persons with limited English proficiency (LEP), interpreters were available upon request. Meeting locations were selected to be accessible to RIPTA fixed route bus service, in accordance with Environmental Justice considerations and local community organizations were invited in accordance with Title VI.

The first evening public meeting, held at the Newport Gateway Center on June 9, 2016, was attended by 9 members of the public. The second afternoon-evening drop-in meeting was held at the Providence Foundation on June 15, 2016, was attended by 15 of the general public. The third evening meeting, held at the Woonsocket Depot on June 20, 2016, was attended by 3. Comments were recorded during each meeting, and email and Facebook comments were welcomed during the public comment period that was extended to July 15, 2016.

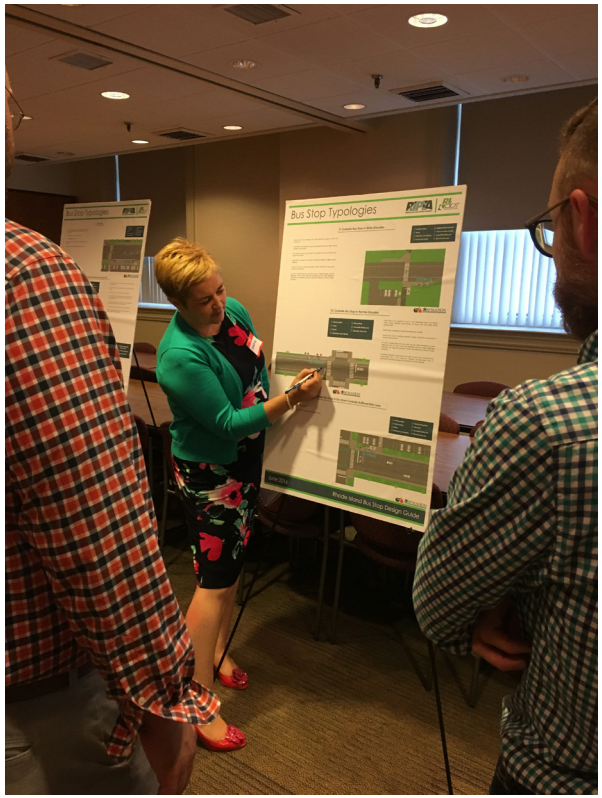
Newport Gateway Center audience listens to presentation on bus stop design typologies at the June 9, 2016 meeting

103 public comments were collected over the course of the public outreach period. A summary of the comments are provided on the following pages.

Greg Nordin, RIPTA Associate Director of Planning presents PEEP, RIPTA's Passenger Experience Enhancement Program at the Woonsocket Depot meeting on June 20, 2016

Comment Summary

The following summarizes both public meeting, email and RIPTA Facebook comments.



Sandra Clarey, McMahon project manager, explains bus stop typology detail at the Providence Foundation meeting on June 15, 2016

Comments on Typologies

1. Bus Stop Curb Extension (Full Width, Far-side of Crosswalk). There is concern that this typology may encourage vehicles to pass a bus at a stop and that this could affect passenger safety for those crossing the street. Typologies 1, 2, and 3 all include curb extensions that both reduce on-street parking and pose potential safety conflicts for cyclists.
2. Bus Stop Curb Extension (Full Width, Near-side of Crosswalk). A commenter asked if a bus lane could later be added if there is a curb extension.
3. Bus Stop Curb Extension (Partial Width, Near-side of Crosswalk). Concern was expressed that a pedestrian/crossing and bike safety conflict could result if vehicles pull out around a bus. Pedestrians crossing the street in front of a bus may be limited in their ability to see vehicles passing the bus.
4. Floating Bus Island. There was strong interest in this innovative typology which integrates a curbside bike lane with a pedestrian crosswalk to a bus stop on a designated island. One commenter did not concur with the use of this application in an urban setting where there may be limited street width and high demand for on street parking. He felt this could be more appropriate for use in a high priority bike corridor where pedestrian and transit use are secondary. Concern was expressed for the safety of pedestrians crossing the bike lane and one suggested a speed hump at the crosswalk. One indicated that the floating island concept could be applied with a road diet (reduction of a four-lane roadway with narrow shoulders to one lane in each direction with a shared left turning lane).
5. Off-Street Bus Stop. One commenter expressed concern that these stops should be avoided along high-traffic routes with numerous traffic signals, since they affect travel times, ultimately making service less predictable and reliable. He indicated that this a major concern on low-frequency routes where a deviation of more than a minute or two may leave riders waiting for up to two hours. Others reinforced the need for these popular bus stops at large format stores such as supermarkets and Walmarts and reiterated the need to provide shelters with benches.
6. Bus Bay. No comment.
7. Bus Stop with Bus Queue Jump Lane. Support was expressed for traffic signal priority and for consideration of a bike box. What is a bike box?
8. In-Lane Bus Stop. There was much discussion regarding the use of this typology for roads proposed for a road diet. RIDOT has supported restriping of many such roads to improve safety, reduce travel speeds, and facilitate use by various travel modes including transit and bikes. Examples discussed included Post Road in North Kingstown which may have insufficient right of way for wide sidewalks, and Fruit Hill Avenue in North Providence which included landscaped bump outs as a traffic calming device.
9. Curbside Bus Stop in Wide Shoulder. No comment.
10. Curbside Bus stop in Narrow Shoulder. One commenter indicated that this typology may be appropriate for high volume four-lane 30 mph roads such as Newport Avenue in East Providence and Pawtucket. Similar comments to #3, above, were expressed where there is the potential for conflict between pedestrians/crossing when vehicular traffic passes a bus in a narrow shoulder.
11. Curbside Bus Stop in On-Street Curbside Buffered Bike Lane. Support was expressed by the biking community

for options that integrate bike use in a complete street concept.

12. Curbside Bus Stop after Pedestrian Curb Extension. No comment.
13. Curbside Bus Stop amongst Multiple Curb-cuts. Comments were made regarding the need to provide paved surfaces at the front and rear landings so that passengers don't have to wait or alight onto grass, mud, or snow. Another supported retention of grass along the remainder of the bus pullover.
14. Curbside Bus Stop adjacent to Raised Separated Bike Lane. The biking community supported consideration of integrating a raised bike lane into a transit typology. There was concern from others, however, that there could be a conflict between alighting transit passengers and bikers.

General Comments

The following is a summary of key issues in alphabetical order. Additionally, one commenter requested that a Kent County meeting location be considered for future meetings.

ADA Accessibility. Emergency boxes and utility cabinets should not block accessibility. If sufficient right of way is not available for an 8-foot landing, what are a community's options. It is important to negotiate an ADA-compliant landing pad with the relevant body during street redesign/reconstruction to ensure that adequate right of way is available. Likewise, it is important to negotiate easements with adjacent developers who propose to expand or develop an adjacent bus stop to assure that an 8-foot landing may be constructed in accordance with ADA requirements.

Amenities. A hierarchy of amenities such as signage, shelter, benches, trash receptacles, and lighting should be identified for transit stops.

Benches. The importance of seating at bus stops was cited by many. There was support for use of single occupant benches and leaning rails as a way to deter idling at stops.

Bike considerations (not specific to typologies). Bike lanes (protected or buffered) near bus stops are a great idea and are important to the development of a bike lane network. Many residents of Pawtucket, Central Falls (and other urban areas) do not own cars and would be better served with improved bike infrastructure.

Bus stop priorities. One commenter asked that a prioritized list of amenities be created. Ideally shelter from the elements would be a top priority, followed by seating and trash/recycling facilities, respectively. These facilities should be located along all routes, particularly those with low-frequency service.

Bus stop siting and service considerations. Criteria should be included for locating new bus stops. Thought should be put into locating bus stops where people want to go, and then adding others in between as needed. An example would be Providence stops at Hope High, East Side Y, Rochambeau Public Library, and the Miriam Hospital, and then added others as needed in between (to keep down to RIPTA's maximum between-stop distance). This would make it easier to market the stops, and would work better for more people.

Bus frequency was reported to be an important factor in getting people out of their own cars and into transit. "A bus stop can only be so nice if the buses are spaced too far apart".

Curb extensions. One commenter supports typologies with curb extensions since they improve safety for pedestrians. Minimizing the crossing distance for pedestrians makes riding the bus much more appealing. Bump outs and small turning radii make walking safer and more realistic for all users. "Once RIPTA riders get off the bus, we are pedestrians!"

Enforcement. It should be clear who is responsible for enforcing No Parking at bus stops. Increased police presence is requested at Kennedy Plaza to improve safety and security.

Maintenance. Both transit users and municipalities are concerned with trash and snow removal. Litter continues to be a problem at shelters since they catch wind-blown debris. When snow is not cleared from bus stops, it may be dangerous or impossible for passengers to reach the stop. Snow is an especial concern for transit passengers who are disabled or elderly. Sufficient area should be designated for snow piles at bus stops. Once trash becomes frozen into snow piles that it is difficult to remove. These concerns should be addressed in RIPTA's upcoming shelter advertising contract.

Pavement treatment. A different edge or sidewalk pavement treatment (texture) should be used at bus stops. "Continental" zebra striped crosswalks are much more visible than "two lines" crosswalks. Brick pavers, which look great on a rendering, are not necessarily visible to drivers. Bus stop pavement markings, paint or texture should be considered to clearly delineate use. Pavement markings should conform to municipal rules and standards. Concrete pads should be provided when the bus stop is located at a driveway.

PEEP, RIPTA's Passenger Experience Enhancement Program. Municipal GIS maps of sidewalks could be enhanced with information available from RIPTA on boarding numbers/ridership. Bike Newport and potentially other bike advocacy organizations could benefit from RIPTA funding for bike improvements at bus stops.

Road design. One commented on the importance of redesigning streets that are now designed to the advantage of motorists, with little concern for pedestrian or transit users. Streets such as Exchange Street (Goff Street) in Pawtucket are overdesigned (large turning radii, excessive lane widths, number of lanes) leads to speeding and creates a very poor environment for transit riders. Any way to narrow the lanes, reduce the number of lanes and add bump outs would be a significant improvement. Turn slips (protected turn lanes) that force pedestrians to cross multiple lanes of traffic to get across the street should be avoided in all urban areas such as downtown Pawtucket.

Safety. Lighting and security at bus stops were overwhelming concerns of transit users in both urban and rural areas. Security was a recurrent theme at Kennedy Plaza. Although the design looks good on a plan, actual transit users report this is not a safe place to be. "I feel, as every other person that rides RIPTA, it is not designed for your passengers but a better place for homeless to shelter… That is one concern that needs to be addressed. I do not see security at all."

In rural / suburban areas there was a concern about safety and visibility of bus stops, especially along roads with narrow sidewalks, grass edges, overhanging trees and vegetation, when it is dark (e.g. along East Main Road in Middletown). Some people use their phones with flashlights to flag down the bus, stepping into the roadway, which is not safe.

All stops should be lit, either from external/ independent street lights or solar powered lights for the safety of riders and ensuring their visibility to bus drivers. This is particularly important on low-frequency rural routes where streetlights are not prevalent and in the winter months when it is often dark during peak service hours. Dark-sky compliant lighting should be installed where bus stop lighting is provided. Lighting on the R-Line (and other areas with wide sidewalks) is reported to be too dim for adequate perception of safety.

An additional safety concern is the report that bus drivers speed through crosswalks. "How many accidents do you have to have before

you take it serious(ly)?" This was followed by a Facebook post that a transit rider almost got hit trying to get home.

Sidewalks. Provision of paved sidewalks in rural areas served by RIPTA is important so that transit passengers and other pedestrians do not have to walk in the street or through mud or snow. Blind corners and limited sight distance on roads without sidewalks adversely affects the safety of pedestrians including those who are transit dependent.

Shelter design. Many commented on the existing LAMAR advertising shelters. G. Nordin explained that this contract will be advertised in 2017 and it is anticipated that design and maintenance should improve. The following were comments raised:

- The current shelter design at Kennedy Plaza is good but there should be more benches for seating. The commenter suggested that this design should be a model for shelters throughout the State. He noted that shelters at the X, Y and Z stops went into service without installation of glass panels.
- Various shelter typologies were requested (reported to be part of the upcoming shelter advertising contract). Commenters requested that a variety of designs be presented or that communities and developers be allowed to design a shelter that reflects the local vernacular. Maximum use of transparency would reduce the visual impact of shelters (i.e., reduced advertisements).
- Shelter roofs must provide an adequate overhang for protection from sun, rain and snow. Windbreaks are an important function of shelters. Side panels should extend to the ground so that wind does not whip underneath.
- Adequate benches and seating should be provided. Examples of good shelters are at Rhode Island College; a bad example is the "arty" shelter with boulder seating at Rochambeau Library on Hope Street in Providence.
- Design of "arty" shelters should be reviewed to assure they are ADA-accessible and functional for the comfort of transit users.
- Maintenance, graffiti, and litter in shelters are ongoing issues for local communities. Shelters must not block the sidewalk.

Signage. The need for bus stop identification and information on schedule and route were a repeating theme for commenters. G. Nordin announced at the meetings that RIPTA will be redesigning bus stop signs in the near future and signage and pole design will be appended to the Bus Stop Design Guide. Signage initiatives should involve ATAC.

Comments regarding bus stop signage were varied. Many bus stops are not signed. Bus stop signs need to be bigger and lower. Some are too high or tree-covered. Signs should be posted on both side of the pole or there needs to be a distinguishable sign that is visible from any side. Durability of signs should be a consideration. Many of the metal signs are rusted (plastic may be an option).

Signage should provide, at a minimum, a list of routes serving the stop and their schedules. This is valuable not just at transfer bus stops but at low-frequency stops where buses may only come once in a two-hour window. A frequent complaint was that a sign should be posted at bus stops when there is a schedule change.

Several commenters discussed the immediate need for real time information on bus arrivals. This is an important consideration for commuters. Live tracking has been in use in medium and large size cities for over a decade. RIPTA riders need this technology.

Real time displays will likely be limited to use at bus hubs and junctions of bus lines.

There is a concern, however, that assumption of smart phone use for trip information has socio-economic implications since use may be limited for many bus passengers.

Conclusion

Comments will be addressed in the final product.

Summary of Peer Review

To inform this guide on best practices in the development of bus stop design guidelines a peer review was performed. Bus stop design manuals created by five peer transit agencies were reviewed for their use of recent, valuable, comparable, and visually interesting guidelines on transit design. The five transit agencies selected for the peer review include:

- Massachusetts Bay Transportation Authority (MBTA)
- Utah Transit Authority (UTA)
- Greater Cleveland Regional Transit Authority (RTA)
- OmniTrans (based in San Bernadino County, California)
- Los Angeles County Metropolitan Transportation Authority (LA Metro)

These agencies were selected for their similar size to RIPTA and for the similar relationship to their respective state department of transportation (DOT), as RIPTA has with RIDOT. They also represent industry leaders in best practices and state of the art transit systems in North America, and have been updated within the past three years. Each manual was reviewed with their best practices and areas for improvement identified.

Best Practices for Bus Stop Design Manuals

- **Clear and Concise Design and Text**
- **Use of Visual Aids**
- **Inclusion of Bike-Bus Design Standards**
- **Relation to Service Improvements**
- **Inclusion of Criteria and/or Checklist**
- **Addresses Public Accessibility and Engagement**
- **Discusses Document Updates**

Appendix B

Bus Stop Checklist

RIPTA BUS STOP CHECK LIST

Routes Served	Municipality	Stop Name/Location/Street and Cross Street	Stop ID#
			GPS Tag:

Near-side ☐ Far-side ☐ Mid-block ☐	Bus Route Direction: Northbound ☐ Southbound ☐	Name:
Island ☐ Freeway bus pad ☐	Eastbound ☐ Westbound ☐ More than one direction ☐	Date:
Other _____	Terminus ☐ Other _____	

SECTION A: SKETCH

Prepare sketches of the existing or proposed bus stop layout and locus, extending to adjacent cross street or crosswalk. [A] & [B] refer to sketch that element should be shown:

-Street Name/Address/Landmark if Mid-block Stop [A]
-Crosswalks, Curb Ramps, Driveways [A]
-Adjacent Curbside Regulations/Usage [A]
-Adjacent Roadway Striping/Lane Configuration [A]
-Nearby Bus Stop Pair [A]
-Abutting Land-use/Property Address [B]
-Back of Sidewalk Boundary Type [B]
-Back of Sidewalk Doorways/Entries [B]
-Existing/Proposed Signs/Posts [B]
-Bus Stop Length (distance sign to sign) [B]
-Traffic & Pedestrian Signals [B]
-In Ground Features (Manholes, Catch Basins etc.) [B]
-Existing/Proposed Landing Area [B]
-Existing/Proposed Rear Door Clear Zone [B]
-Street Furniture/Amenities [B]
-Other Notable Features [B] or [B]

Include sidewalk widths and distances between features (within the bus stop and to the nearest crosswalk/curb ramp), where a 4' wide clear path of travel may be questionable.

BUS STOP LOCUS [A]

BUS STOP LAYOUT [B]

	Stop ID

Section B: General Information

	Yes	No	Notes:
Is there a sidewalk?	☐	☐	
Is there seating available?	☐	☐	
Is there a shelter?	☐	☐	
Is there a trash receptacle?	☐	☐	
Is there lighting at the stop?	☐	☐	
Is there route/schedule/map information posted?	☐	☐	

Section C: Sidewalk Within Bus Stop Zone

Is there an accessible 10' wide x 8' deep landing area? Yes ☐ No ☐

If not, what are the dimensions? Width:____ Depth: ____

Show on Section A Sketch. Designated landing area centerline is located in proximity to RIPTA bus stop sign. Near-side stop = 14', Far-side or Mid-block stop =24'

Does the landing area have a cross slope of 2% or less? Yes ☐ No ☐

If not, what is the cross slope? (if varies, indicate range) _____ %

Are there elements that obstruct the landing area? (trees, trash receptacles) news boxes, bike racks, sign posts, poles etc.) Yes ☐ No ☐

What is the material of the landing area?

Asphalt ☐ Dirt/Gravel ☐ Pavers ☐ Other (specify): _____

Concrete ☐ Grass ☐ Brick ☐

What is the material of the sidewalk?

Asphalt ☐ Dirt/Gravel ☐ Pavers ☐ Other (specify): _____

Concrete ☐ Grass ☐ Brick ☐

Is there a curb? Yes ☐ No ☐

Type/Material (e.g. Granite, asphalt, concrete) _____

Are there physical barriers that constrict the width of the sidewalk to less than 4' within the bus stop? If yes, show on sketch and specify Yes ☐ No ☐

Are there problems with the sidewalk and landing area surface? If yes, show on sketch and specify Yes ☐ No ☐

Is a hollow sidewalk readily apparent? Yes ☐ No ☐

Rank the condition of the sidewalk in the vicinity of the landing area: (Circle One)

1 = hazardous - large breaks, cracks, root uplifting; dangerous for normal use and/or difficult for a wheelchair

2 = in poor shape though not hazardous - very rough, some root uplifting, cracks, breaks

3 = fair - minor root uplifting, minor cracks or breaks

4 = good - not perfect but no immediate repairs needed

5 = cosmetically excellent; new

If not accessible, is it feasible to shift stop to an alternate location nearby? Yes ☐ No ☐

Indicate alternate location on sketch

Is there a level and clear boarding area at the back door of the bus? Yes ☐ No ☐

RIPTA BUS STOP CHECK LIST

	Stop ID

Section D: Seating (if applicable)

What type of seating is available?

Bench (freestanding) ☐ Other (specify): _____

Bench (inside shelter) ☐

Fold down bench ☐

What is the height of the bench (in inches)? _____

What direction does the bench face? Towards roadway ☐ Away from roadway ☐

Rank the condition of each bench (circle one)

1 = hazardous - broken, someone could get hurt from normal use

2 = in poor shape though not hazardous

3 = fair - needs repainting/cosmetic attention, protuding but not hazardous bolts

4 = good - not perfect but no immediate repairs needed

5 = cosmetically excellent; new

Section E: Shelter (if applicable)

What type of shelter is it?

Lamar ☐ Other ☐ Other (Specify) _____

For Other, provide following interior measurements (in inches):

Depth _____ Width _____ Height _____ Width of entrance _____

Roof depth (if deeper than side panels) _____

Distance from front of shelter (windscreen and/or post) to curb _____ Feet

Distance from back of shelter/windscreen to back of sidewalk or building/fence/wall _____ Feet

Is the shelter in the middle of the sidewalk and obstructing general pedestrian path of travel? ☐ Yes ☐ No

Is there a 32" long x 48" wide accessible space fully within, and under the shelter roof? ☐ Yes ☐ No

Cross slope of the shelter's accessible space (next to bench, unless space is elsewhere) _____ %

Does the accessible space obstruct other customers from accessing to the shelter? ☐ Yes ☐ No

Does the shelter have power? (not including solar or battery) ☐ Yes ☐ No

RIPTA BUS STOP CHECK LIST

	Stop ID

Section F: Information Features

Is there a RIPTA bus stop sign at the front of the stop?	**Yes** ☐ **No** ☐
What is the height of the bottom of the front sign? **Less than 7'** ☐ **Between 7' - 10'** ☐ **Greater than 10'** ☐	
What is the sign face orientation to the curb? **Parallel** ☐ **Perpendicular** ☐ **angled** ☐ **Other (specify)**_____	
What is the distance from the pole to the street edge/curb?	_____**Feet**
Is sign mounted on its own post? If not, describe.	**Yes** ☐ **No** ☐ _____
Is there a Bus Stop No Parking sign at the rear of the stop?	**Yes** ☐ **No** ☐
What is the height of the bottom of the rear sign? **Less than 7'** ☐ **Between 7' - 10'** ☐ **Greater than 10'** ☐ **N/A** ☐	
What is the sign face orientation to the curb? **Parallel** ☐ **Perpendicular** ☐ **Angled** ☐ **Other (specify)**_____	
What is the distance from the pole to the street edge/curb?	_____**Feet**
Is sign mounted on its own post? If not, describe.	**Yes** ☐ **No** ☐ _____
Do bus stop arrows point towards each other?	**Yes** ☐ **No** ☐
Are existing signs and/or posts damaged, worn or not secured?	**Yes** ☐ **No** ☐
Is highest text/information below 60" above the ground?	**Yes** ☐ **No** ☐
How long is the bus stop (between signs)?	_____**Feet**
Is parking currently allowed in the bus stop	**Yes** ☐ **No** ☐

	Stop ID

Section G: Getting to the Bus Stop

How wide is the sidewalk? _____ **Feet**
If it varies, indicate on Section A Sketch

Does sidewalk provide a 4' wide clear path of travel? **Yes** ☐ **No** ☐
If not, indicate constraints on Section A sketch

Rank the condition of the sidewalk between the bus stop and the nearest crosswalk: (circle one)
1 = hazardous - large breaks, cracks, root uplifting; dangerous for normal use/difficult for a wheelchair
2 = in poor shape though not hazardous - very rough, some root uplifting, cracks, breaks
3 = fair - minor root uplifting, minor cracks or breaks
4 = good - not perfect but no immediate repairs needed
5 = cosmetically excellent; new

Is there a crosswalk connecting the inbound and outbound bus stops? **Yes** ☐ **No** ☐

Does the sidewalk connect to nearby crosswalks and/or street crossings? **Yes** ☐ **No** ☐
If so, show nearest on Section A Sketch

Are there curb ramps at both sides of each crossing? **Yes** ☐ **No** ☐
Show all on Section A Sketch

For each curb ramp, indicate the following: (Indicate letter for each curb ramp on Section A Sketch)
Note the ramp closest to the stop, and note others in a clockwise direction from that ramp.

Curb Ramp	Is there a detectable panel?	What is the running slope?	Is ponding visible?
A	Yes ☐ No ☐	_____ %	Yes ☐ No ☐
B	Yes ☐ No ☐	_____ %	Yes ☐ No ☐
C	Yes ☐ No ☐	_____ %	Yes ☐ No ☐
D	Yes ☐ No ☐	_____ %	Yes ☐ No ☐
E	Yes ☐ No ☐	_____ %	Yes ☐ No ☐
F	Yes ☐ No ☐	_____ %	Yes ☐ No ☐
G	Yes ☐ No ☐	_____ %	Yes ☐ No ☐
H	Yes ☐ No ☐	_____ %	Yes ☐ No ☐

Who owns/controls the sidewalk?
RIDOT ☐ **Municipality** ☐ **RIPTA** ☐ **Other (specify)** _____

What other pedestrian features are located near the bus stop? (check all that apply and indicate on Sketch)
Visible Crosswalk ☐ Pedestrian Signal ☐ Traffic Signal ☐ Accessible Pedestrian Signal (APS) ☐

			Stop ID

Section H: Miscellaneous

Does bus stop create any potential traffic hazards?
If yes, check all that apply:

- Sight line: bus stop is just over the crest of a hill ☐
- Sight line: bus stop is just after a curve in the road ☐
- A stopped bus straddles a crosswalk ☐
- Bus stop is near an at-grade railroad crossing ☐
- Bus stop just before a crosswalk ☐
- Adjacent to high speed traffic (40mph+) ☐
- No crosswalk ☐
- Other (specify) _____

How many total travel lanes are on both sides of the road? _____

How many parking lanes? _____

How many bike lanes? _____

Where is the bus stop area located?

- In travel lane ☐
- In right turn only lane ☐
- Paved shoulder ☐
- Unpaved shoulder ☐
- No parking portion of street parking lane ☐
- Bus lane/pull out area ☐
- Off street ☐

Is there a reciprical bus stop? Yes ☐ No ☐

RIPTA

BUS STOP CHECK LIST

			Stop ID

Existing Stop ☐ Proposed Stop ☐

Bus Stop Path of Travel

	CS (%)	CR (in)	D (ft)	
				To shelter/bench and/or nearest crosswalk/street crossing
Landing Area				
				To shelter/bench and/or nearest crosswalk
	CS (%)	CR (in)	D (ft)	

Bus Direction of Travel

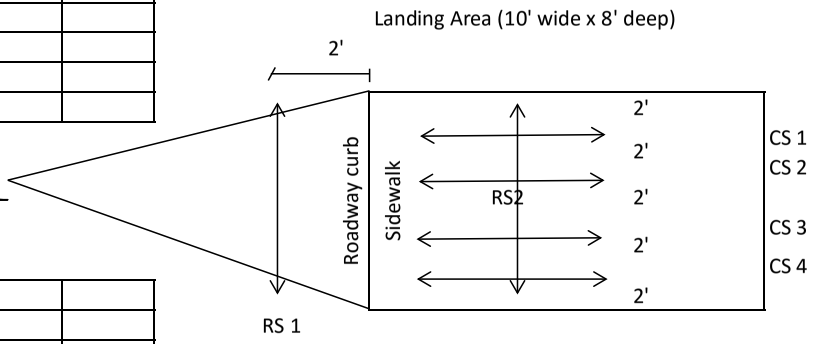
Instructions:

1) Record cross slopes between landing area and existing shelter, bench, nearest street crossing/crosswalk*

2) measure cross-slopes at 5' intervals to shelters/benches and 10' elsewhere.

3) Indicate centerline of landing area on Section A Sketch with a dimension to a fixed point.

**For mid-block stops or stops significantly distant from a street crossing or crosswalk, record cross slopes to nearest driveway*



Landing Area

Distance from existing bus stop sign to centerline of landing area: _____ Feet

(if not existing bus stop sign, specify other reference point)

	CS(%)	CR(in)
RS 1		
RS 2		
CS 1		
CS 2		
CS 3		
CS 4		

CS = cross-slope

CR = curb reveal - measure if CS > 2%

D = distance from previous measurement (5' or 10')

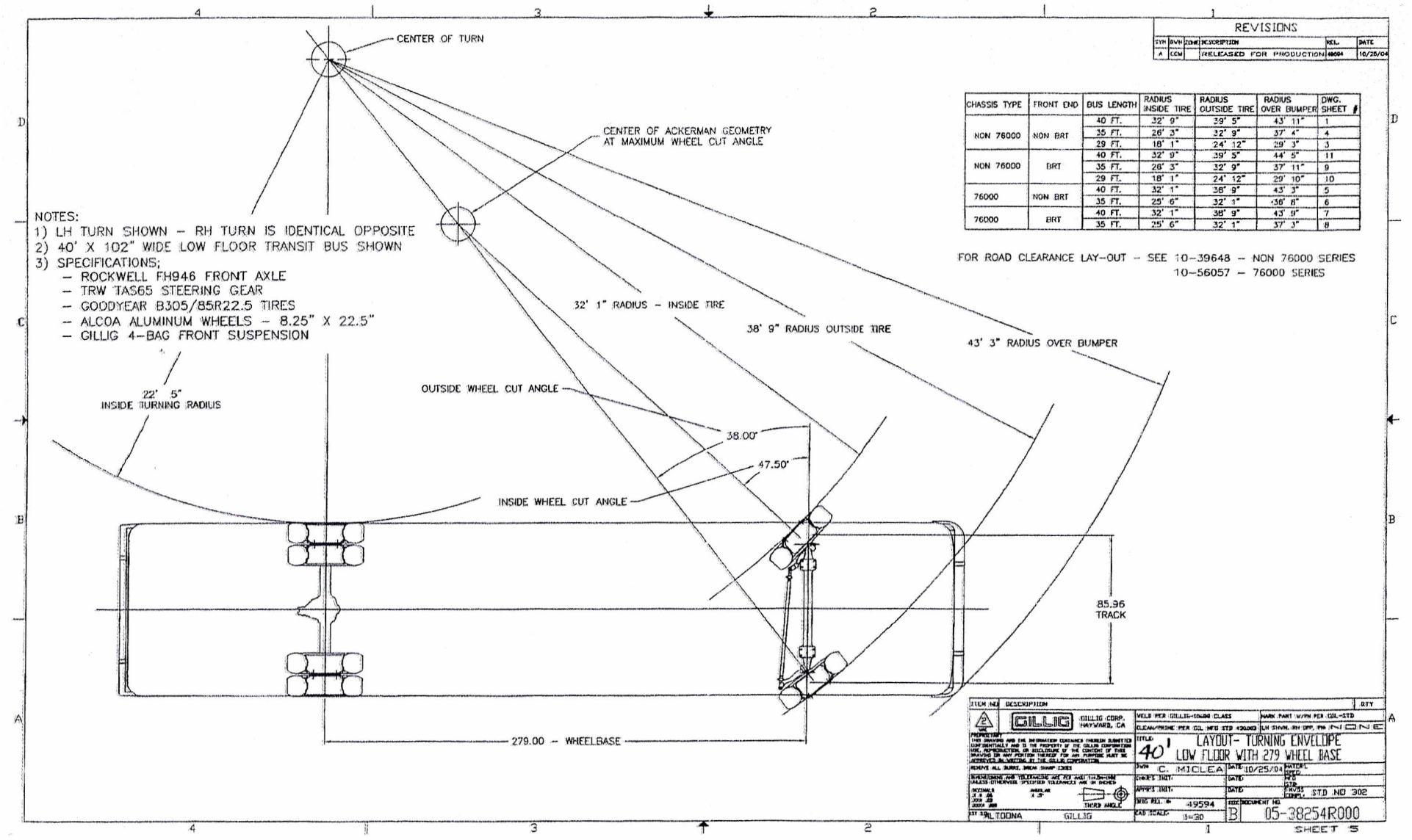
RS = running slope

NOTE: All dimensions are based on field measurements only and are not based on detailed survey.

Appendix C

Turn Radii and Vehicle Specifications

Gillig – 40-foot Turn Radius Template



Recommended Curb Radii for Right Turn Movements

Width of Approach Lane	Width of Entered Lane (ft)	Recommended Curb Radius (ft)
12 ft (i.e. one lane)	12	50
	16	45
	20	40
	24	35
16 ft (i.e. one lane with 4 ft shoulder)	12	45
	16	40
	20	30
	24	25
20 ft (i.e. one lane with parking)	12	40
	16	35
	20	30
	24	25

Source: AASHTO 2014

Vehicle Specifications