MARYLAND DEPARTMENT OF TRANSPORTATION

MARYLAND TRANSIT ADMINISTRATION

BUS STOP DESIGN GUIDE

BALTIMORE LINK

2019 EDITION

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1 Introduction

1.1 About This Guide

The Maryland Department of Transportation Maryland Transit Administration (MDOT MTA) *Bus Stop Design Guide* provides guidance for the design of bus stops. The guide is intended to serve as an internal resource for MDOT MTA, provide guidance to local governments and developers for best integrating MDOT MTA bus stops into their plans, and educate passengers, elected officials, and the public about the planning and design of bus stops.

The design and location of bus stops must be consistent with state and federal laws, regulations, and industry best practices. Previous MDOT MTA design guides have included *Access by Design: Transit's Role in Land Development* in 1988, *Maryland Transit Guidelines* in 2002, and *Bus Stop Guidelines* in 2006. Since the publishing of these guides, new government regulations have been introduced, national interest in public transit has increased, and practices that prioritize transit in transportation networks have proliferated across the United States. Like previous MDOT MTA design guides, this document focuses on the bus network, but also recognizes the connections between bus and rail modes in the MDOT MTA integrated transit network.

The *Bus Stop Design Guide* incorporates best practices from numerous guides from across the United States and around the world, but substantially draws from the *Transit Street Design Guide* by the National Association of City Transportation Officials (NACTO). As stated in the *Transit Street Design Guide*, "reliable public transportation depends on a commitment to transit at every level of design." Using the guidance provided in this document, MDOT MTA will work toward the continued improvement of MDOT MTA bus stops.

The *Bus Stop Design Guide* will be reviewed and revised annually as needed.

Bus Stop Hierarchy and Location defines seven configurations of bus stops and provides guidance for the optimal design of bus stops in diverse street and road contexts, including on streets with dedicated bicycle facilities.

Bus Stop Placement provides guidance about the spacing of bus stops according to context, and describes MDOT MTA processes and procedures for adding, relocating, and removing bus stops. These sections also explain the operational considerations that must be accounted for when siting bus stops.

Bus Stop Design and Amenities classifies bus stops into five tiers based on levels of service and amenities. Requirements for signage and accessibility are provided, and guidelines are presented for bus stop amenities both provided and not provided by MDOT MTA. These sections also outline the Adopt-A-Stop Program.

Appendix A: Resources recognizes the many design guides and other resources that made this guide possible.

Appendix B: Glossary provides readers with a list of common terms used in discussions about public transit.

Appendix C: Bus Stop Sign Designs provides the designs of standard sign types installed at bus stops.

Appendix D: Facilities Engineering Standard Details for Bus Stops presents standard engineering details of standard bus stop infrastructure with goals of simplifying and expediting engineering and approval processes.

1.2 How to Use This Guide

The *Bus Stop Design Guide* is designed to serve as a reference document for many different audiences, including bus passengers, neighborhood associations, elected officials, advocates, real estate developers, transportation planners, bus operators, and anyone who has questions about how and why decisions are made about the location and design of MDOT MTA bus stops.

Readers of the *Bus Stop Design Guide* may want to refer to the following lists to quickly and easily locate answers to their questions about MDOT MTA bus stops.

Transit Riders

MDOT MTA passengers may be interested in the following chapters, sections, and tables of the *Bus Stop Design Guide*:

- Bus Stop Spacing and Optimization (pg. 40)
- Bus Stop Modifications (pg. 43)
- Accessibility (pg. 65)
- Safety and Security (pg. 69)
- Amenities Provided by MDOT MTA (pg. 71)
- Amenities Not Provided by MDOT MTA (pg. 83)
- Summary Table – Bus Stop Features (pg. 92)

Advocates & Elected Officials

Elected officials, neighborhood associations, and transportation advocates may be interested in the following chapters and sections of the *Bus Stop Design Guide*:

- Bus Stop Configurations Overview (pg. 10)
- Bus Stop Spacing and Optimization (pg. 40)
- Bus Stop Modifications (pg. 43)
- Accessibility (pg. 65)
- Safety and Security (pg. 69)
- Amenities Provided by MDOT MTA (pg. 71)
- Amenities Not Provided by MDOT MTA (pg. 83)
- Adopt-A-Stop Program (pg. 91)
- Summary Table – Bus Stop Features (pg. 92)

Planners & Designers

Transportation planners, civil engineers, real estate developers, and local government staff may be interested in the following chapters and sections of the *Bus Stop Design Guide*:

- Bus Stop Hierarchy and Location (pg. 4)
- Bus Stop Spacing and Optimization (pg. 40)
- Modifications During Construction (pg. 48)
- Operational Considerations (pg. 50)

- Summary Table – Preferred Stop Configurations (pg. 57)
- Bus Stop Design and Amenities (pg. 61)
- Appendix C: Bus Stop Sign Designs (pg. 101)
- Appendix D: Facilities Engineering Standard Details for Bus Stops (pg. 107)

Bus Operators

Bus operators may be interested in the following chapter and sections of the *Bus Stop Design Guide*:

- Bus Stop Spacing and Optimization (pg. 40)
- Operational Considerations (pg. 50)
- Signage (pg. 61)
- Operational Enhancements (pg. 88)

2 Bus Stop Hierarchy and Location

2.1 Bus Stop Hierarchy

Bus stops are comprised of many features encompassing signage and wayfinding information, safety and security features, physical accessibility features, street furniture, operational enhancements, and other environmental, artistic, or community enhancements. MDOT MTA has defined five tiers, or categories, of stops in the BaltimoreLink network to fit different levels of service and urban and suburban contexts throughout the transit network and region.

The five tiers of bus stops are organized in hierarchical fashion, with Tier I stops serving the most routes and providing the most amenities and Tier V stops serving the fewest routes at each stop and providing the fewest amenities.

- Tier I – Off-Street Transfer Center
- Tier II – On-Street Transfer Center
- Tier III – Frequent Network Stop
- Tier IV – Standard Bus Stop
- Tier V – Coverage Bus Stop

For a summary table of features and amenities at the five tiers of bus stops and facilities, see Table 22: Bus Stop Features Hierarchy (pg. 92).

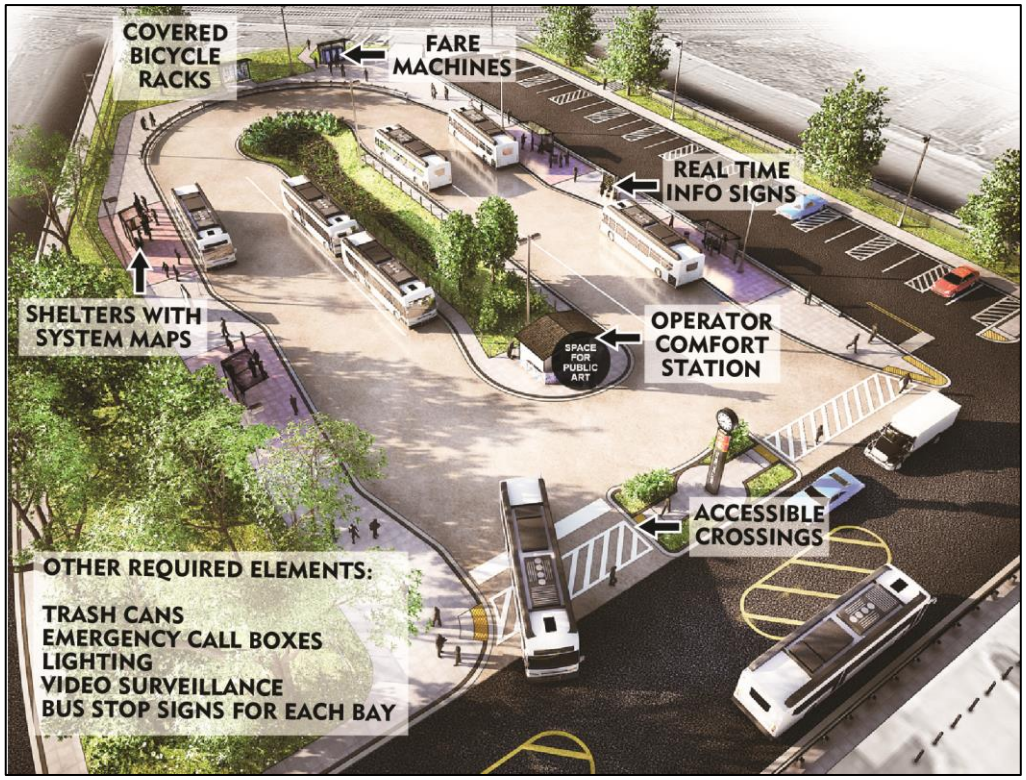
2.1.1 Tier I – Off-Street Transfer Centers

Tier I Off-Street Transfer Centers consist of an off-street bus loop served by several routes, often connected to a rail station to enable passengers to quickly and efficiently transfer between routes and modes. The West Baltimore Transfer Center (Figure 1) and many Metro SubwayLink and Light RailLink stations are Tier I facilities.

Fare machines, covered bicycle racks, and operator comfort stations are required at Tier I Off-Street Transfer Centers (Figure 2), in addition to all amenities required at Tier II On-Street Transfer Centers.

Figure 1: West Baltimore Transfer Center

Figure 2: Model Tier I Off-Street Bus Transfer Center (West Baltimore Transfer Center)



2.1.2 Tier II – On-Street Transfer Centers

Tier II On-Street Transfer Centers combine several on-street bus boarding and alighting areas arranged one after the other on the same block, creating an area where several buses can board and alight passengers at the same time. The University of Maryland Transit Center, Baltimore Arena (Figure 4), and Penn-North Metro SubwayLink station are examples of Tier II facilities.

Emergency call boxes, video surveillance, area maps, and real-time information displays are preferred at Tier II On-Street Transfer Centers (Figure 3). All features required at Tier III Frequent Network Stops are also required at Tier II On-Street Transfer Centers. Features and amenities such as lighting, benches, trash receptacles, bicycle racks, and green infrastructure are not funded, installed, or maintained by MDOT MTA. For further information about Tier II facilities, see the On-Street Transfer Center section.

Figure 3: Model Tier II On-Street Bus Transfer Center

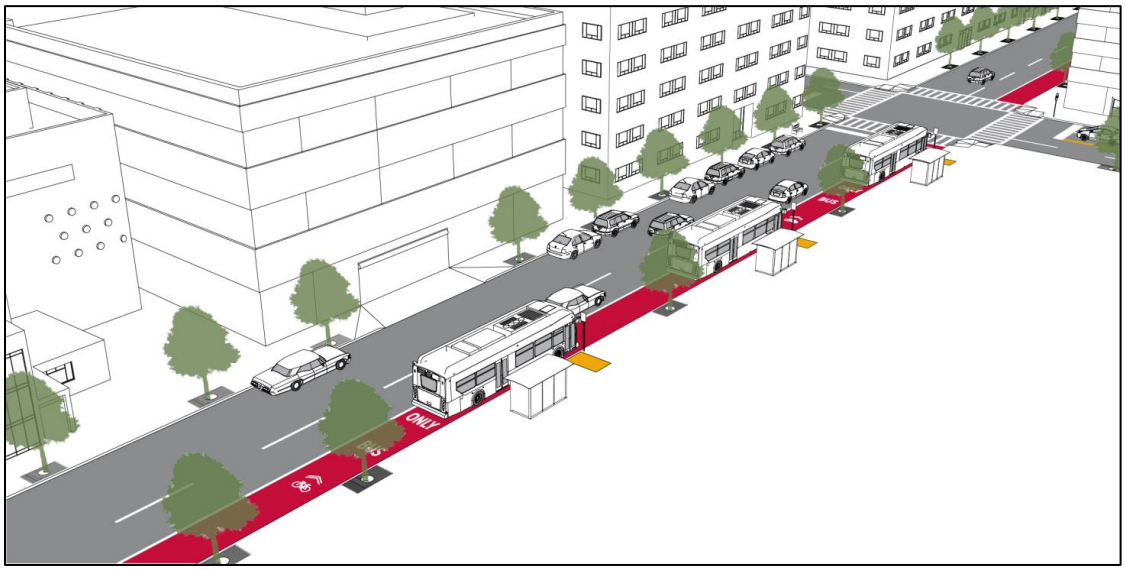
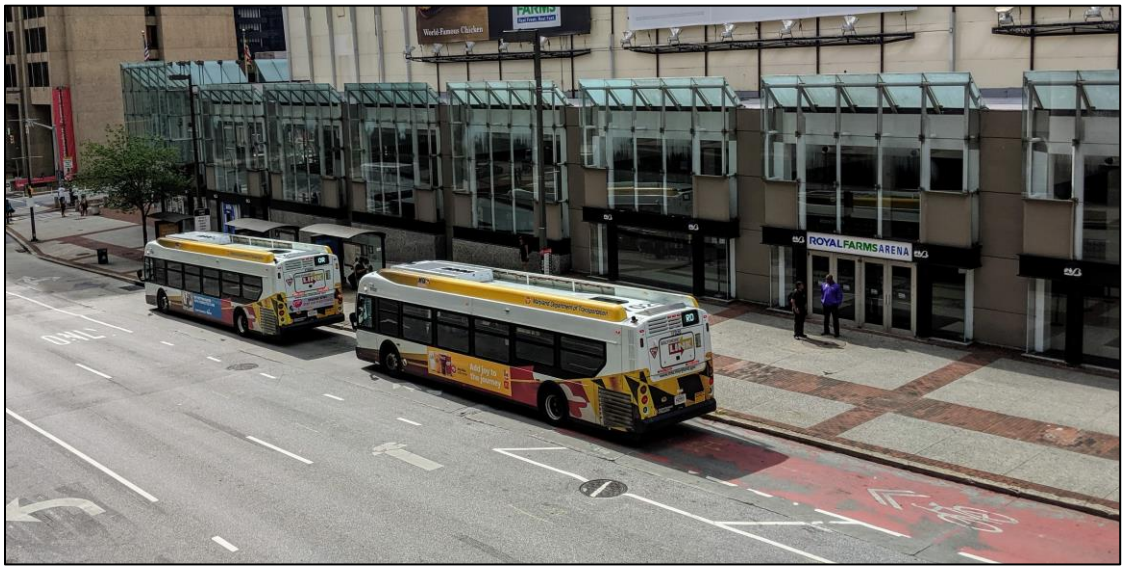


Figure 4: Baltimore Arena On-Street Transfer Center



2.1.3 Tier III – Frequent Network Stops

Tier III stops provide access to the Frequent Transit Network, where buses arrive every 15 minutes or sooner between 7 AM and 7 PM on weekdays. Many Tier III stops are on major streets in city neighborhoods (Figure 6), but others are located on suburban arterial roads. Figure 5 illustrates the design and amenities of a Tier III facility.

A crosswalk at a controlled intersection is required at Tier III Frequent Network Stops, in addition to all features required at Tier IV Standard Bus Stops. In-street concrete bus pads, shelters, and system maps are preferred at Tier III Frequent Network Stops, but shelters are sited according to Eligibility Scoring Criteria. Features and amenities such as lighting, benches, trash receptacles, bicycle racks, and green infrastructure are not funded, installed, or maintained by MDOT MTA.

Figure 5: Model Tier III Frequent Network Bus Stop

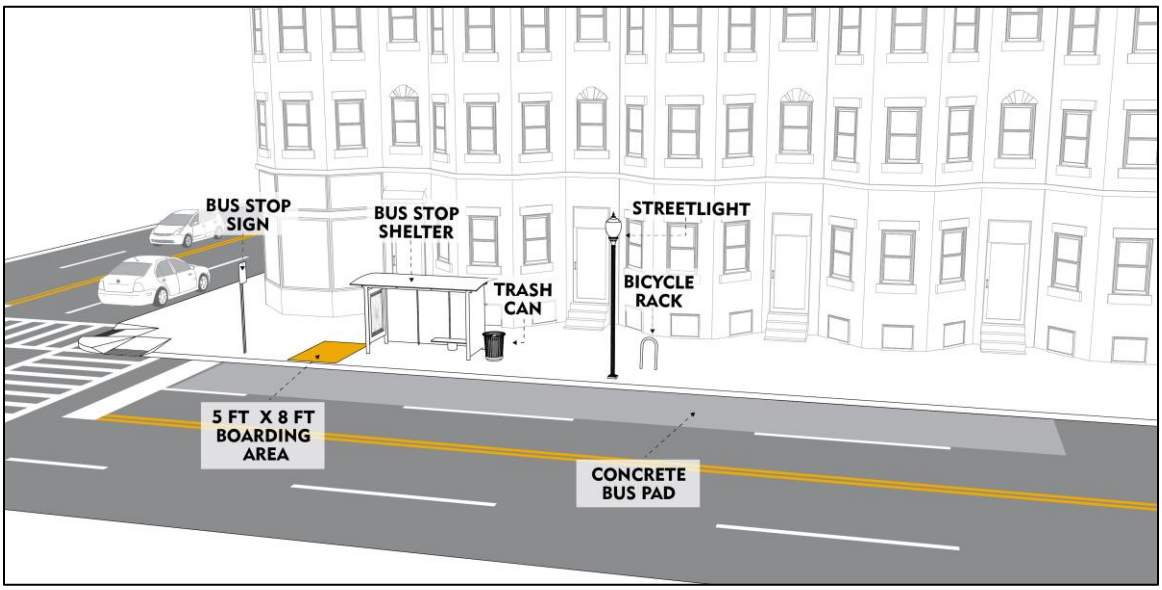


Figure 6: St. Paul Street & 31st Street in Charles Village

2.1.4 Tier IV – Standard Bus Stops

Tier IV stops are basic, on-street bus stops where buses arrive more than 15 minutes apart during the weekday AM peak, midday, and PM peak periods. There are Tier IV stops across the BaltimoreLink network in diverse contexts including suburban main streets (Figure 8), arterial roads, and neighborhood streets. Figure 7 illustrates the design and amenities of a Tier IV stop.

A bus stop sign, accessible boarding and alighting area, accessible crossings and lighting are required at Tier IV Standard Bus Stops. All other features are optional. Features and amenities such as lighting, benches, trash receptacles, bicycle racks, and green infrastructure are not funded, installed, or maintained by MDOT MTA.

Figure 7: Model Tier IV Standard Bus Stop

Figure 8: Harford Road & Hiss Avenue in Parkville

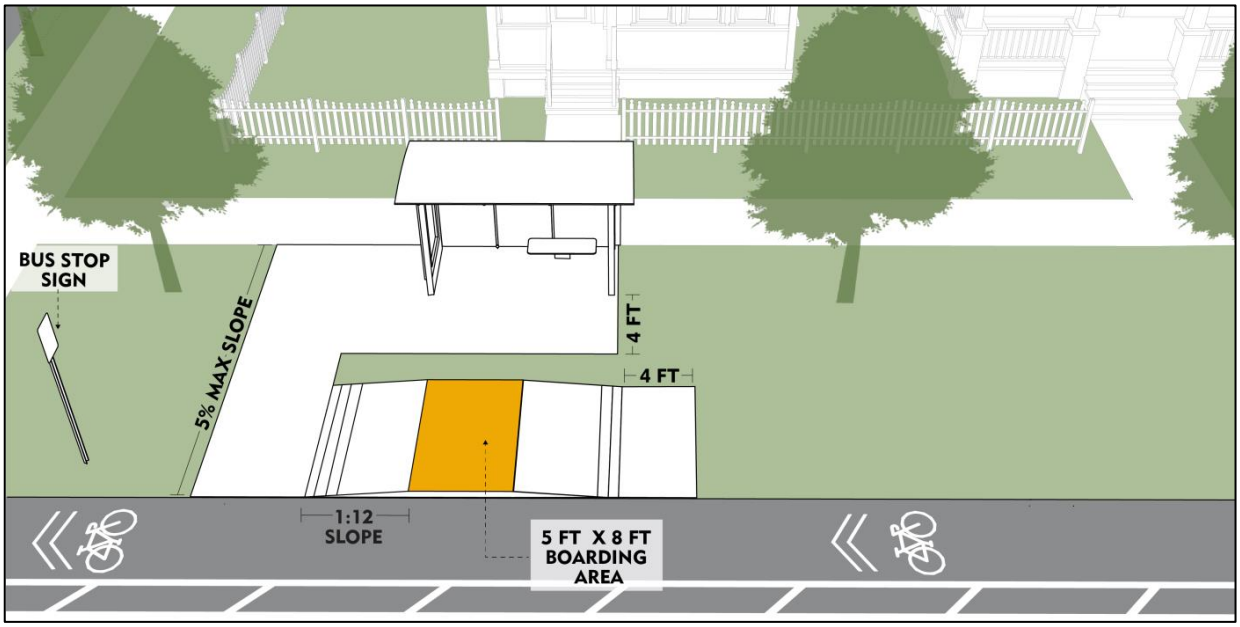
2.1.5 Tier V – Coverage Bus Stop

Tier V stops provide access to the transit network in rural and suburban areas with limited to no sidewalk connectivity. These stops, also known as Coverage Bus Stops, are typically located on rural and suburban arterial roads (Figure 9). Figure 10 illustrates the features and layout of a Tier V facility.

A bus stop sign and accessible boarding and alighting area are required at Tier V Coverage Bus Stops. All other features are optional. Features and amenities such as sidewalks, curb ramps, crosswalks, lighting, benches, trash receptacles, bicycle racks, and green infrastructure are not funded, installed, or maintained by MDOT MTA.

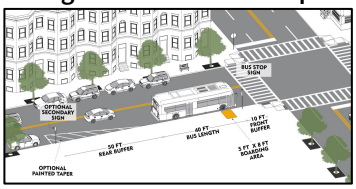
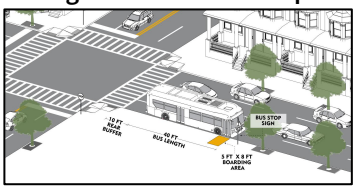
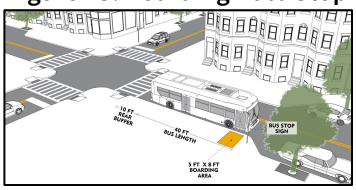
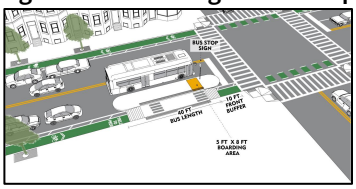
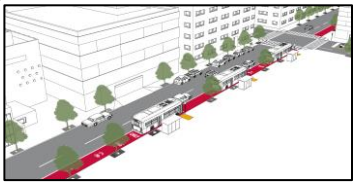
Figure 9: Philadelphia Road & King Henry Circle in Rosedale

Figure 10: Model Tier V Coverage Bus Stop



2.2 Bus Stop Configurations Overview

There are six bus stop configurations, each characterized by the design of the vehicle lanes, curbs, bicycle facilities, and sidewalks in and around the area where buses operate (Figure 11-Figure 16).

Figure 11: Pull-Out Stop  **Figure 12: In-Lane Stop** 	The **Pull-Out Stop** (pg. 11) and **In-Lane Stop** (pg. 18) are the most common configurations of bus stops in the BaltimoreLink network because they can be established with little to no new infrastructure. On streets with vehicle parking, buses shift out of the travel lane and into a section of the vehicle parking lane signed to make a pull-out stop. When passengers have boarded and alighted, the bus pulls back into the travel lane. On streets without vehicle parking, buses use a travel lane adjacent to the curb and make in-lane stops without needing to change lanes.
Figure 13: Boarding Bulb Stop 	The **Boarding Bulb Stop** (pg. 25) is an operationally efficient alternative to the pull-out stop on streets with vehicle parking. It allows buses to stop at an extension of the street curb rather than at a pull-out stop.
Figure 14: Boarding Island Stop  **Figure 15: Shared Cycle Track Stop** 	The **Boarding Island Stop** (pg. 30) and **Shared Cycle Track Stop** (pg. 33) are designed around on-street bicycle facilities. Ordinarily, buses shift across a bike lane to make a stop, potentially putting buses and bicycles in conflict with each other. At a boarding island stop, bicycle traffic moves through a channel behind the stop and passengers wait on an island between the street curb and bike lane or cycle track. At a shared cycle track stop, bus passengers and bicyclists share the space where passengers board and alight. The cycle track ramps up to curb height, continues through the bus boarding area, and then ramps back down to street height.
Figure 16: On-Street Transfer Center 	The **On-Street Transfer Center** (pg. 34) is designed to better organize bus stops served by several routes in busy downtown areas. Instead of signing one stop on a block for several routes, multiple stops are signed, each with one or more routes serving it. On-street transfer centers enable several buses to board and alight passengers at the curb at the same time.

Except for the on-street transfer center, all bus stop configurations can be located at the far side of an intersection (after the intersection), at the near side of an intersection (before the intersection), or mid-block (between intersections). The following sections provide guidance for each bus stop configuration at all three locations.

2.3 Pull-Out Stop

At pull-out stops, buses shift out of the travel lane and into a section of the vehicle parking lane (Figure 17) or a bus bay to board and alight passengers. Once all passengers have boarded and alighted, the bus pulls back into the travel lane. Pull-out stops function better for vehicular traffic than for bus operations, as bus operations are typically slowed by the need to shift in and out of traffic.

While pull-out stops require little new infrastructure on streets with existing vehicle parking, they do require longer clear curb zones than in-lane stops so that transit vehicles can shift in and out of the travel lane safely.

On high-volume streets, through-traffic that will not yield can delay buses significantly in re-entering the travel lane. On routes where buses have difficultly merging back into the travel lane, bus operators will often resort to pulling out of the travel lane only partially to avoid being blocked.[1] In these situations, the bus stop has lost the traffic flow advantage of the pull-out stop configuration and the transit operations advantage of an in-lane design, making it inefficient for all street users. Pull-out stops should therefore be avoided in most cases on high-volume streets.

In most cases, boarding bulb stops are more efficient for bus operations and more comfortable for bus passengers than pull-out stops. Most BaltimoreLink bus stops are pull-out stops because MDOT MTA typically cannot make capital improvements to streets on which it operates bus routes. However, there are some contexts where pull-out stops are preferred over boarding bulb stops:

- On streets where transit is prioritized by utilizing in-lane stop designs but through-traffic flow is still a large concern, periodic pull-out stops can be used to allow vehicles to pass while a bus is boarding and alighting passengers.
- At rail stations without off-street transfer centers, pull-out stops can allow large passenger volumes to make transfers without delaying through traffic.
- In locations where rapid bus service and local bus service share a street, pull-out stops for local service are placed adjacent to in-lane stops for rapid service. This configuration allows rapid services to pass local services, maintaining the integrity of both types of services.
- In locations where an on-street bus layover is needed, pull-out stops can be used as layover areas.

Like all other stops, pull-out stops must provide an ADA-compliant boarding area on a firm, stable surface that measures at least 5 feet parallel to the curb and 8 feet perpendicular to the curb, and is clear of any obstacles. Pedestrian through-traffic should have 8-12 feet of clear sidewalk width on downtown or commercial streets. Boarding bulb stop should be used where there are high volumes of pedestrian traffic.

Pull-out stops can be located at the far side or near side of an intersection, or at mid-block. Pull-out stops are Tier III-IV facilities in the BaltimoreLink Bus Stop Hierarchy.

[1] Transport for London. *Accessible bus stop design guidance*. Bus Stop Priority Team technical advice note BP1/06, Transport for London, UK: 2006.

2.3.1 Far-Side Pull-Out Stop

At far-side pull-out stops, buses proceed through an intersection and then shift out of the travel lane to board and alight passengers at the curb (Figure 17, Figure 18). Among pull-out stops, far-side pull-out stops use curb space most efficiently because they can shift toward the curb in the preceding intersection to pull into the stop. Far-side stops are generally the safest pull-out stop configuration for pedestrians because the buses will not obstruct drivers' views of crossing pedestrians as they would at near-side stops.

Figure 17: Far-side pull-out bus stop for 40 ft. buses

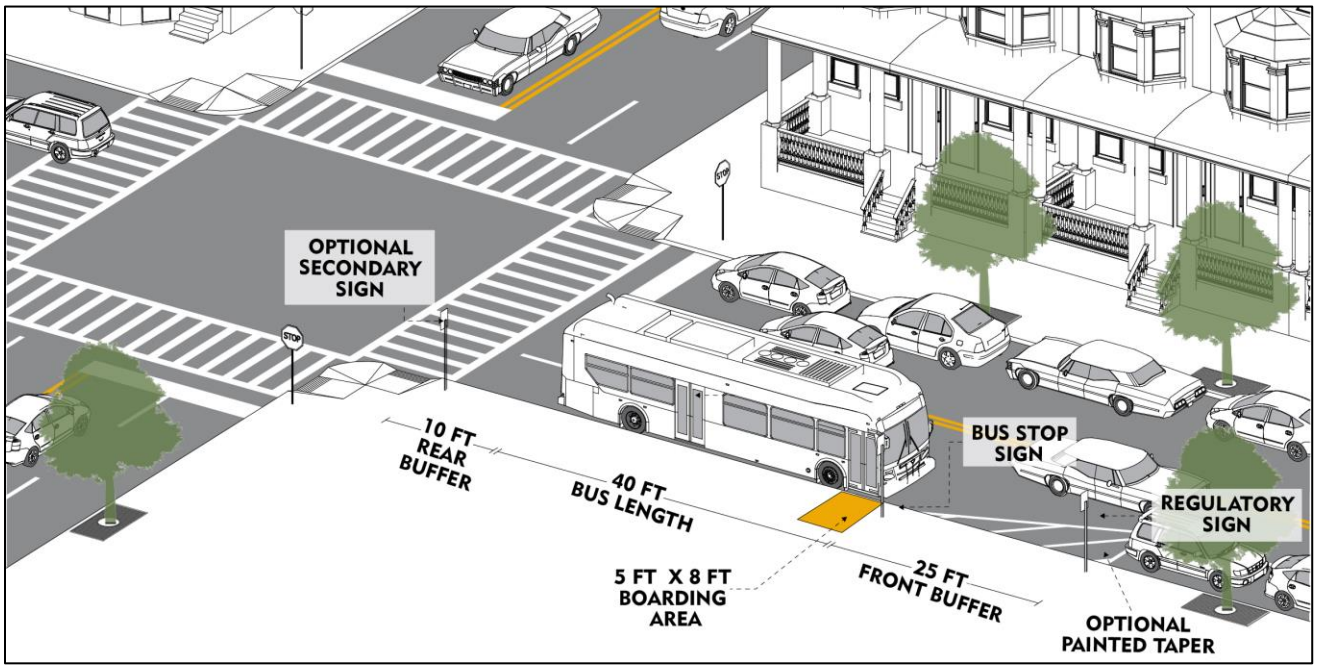
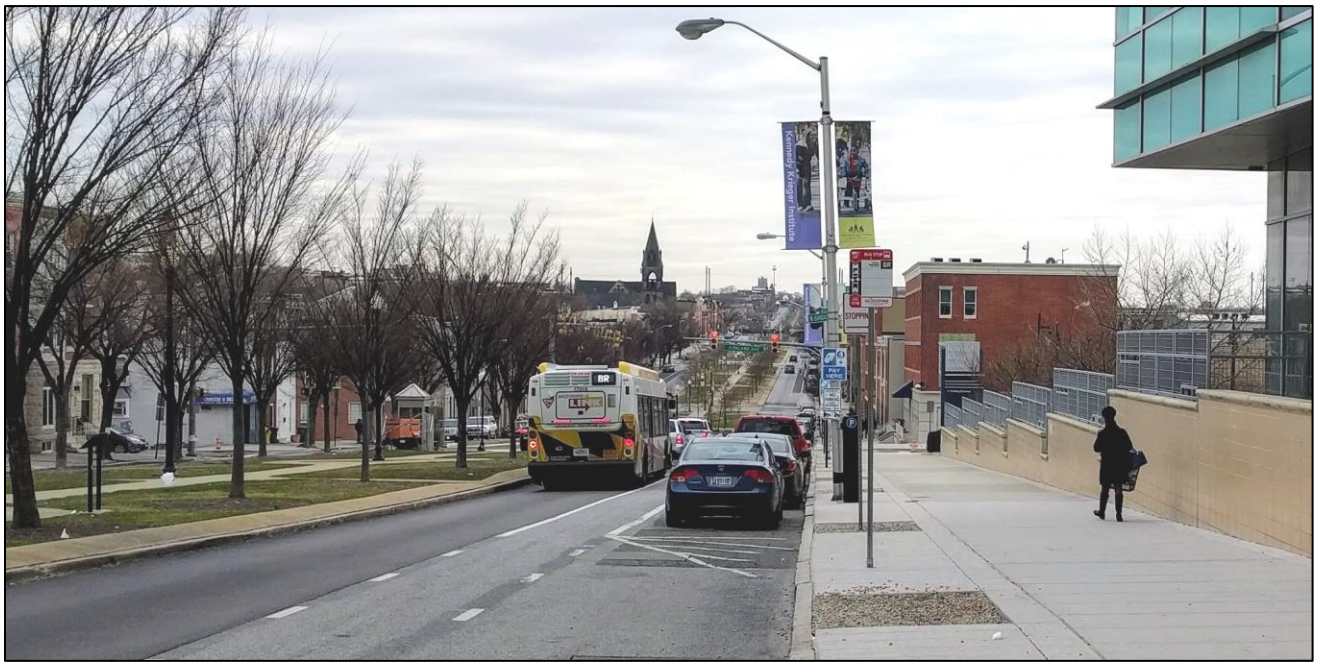


Figure 18: Far-side pull-out stop at Broadway & Madison Avenue at Kennedy Krieger Institute



Guidelines for far-side pull-out stops:

- A pull-out taper at least 25 feet in length should be painted ahead of the boarding area (Figure 17), with a Regulatory Sign installed at the forward edge of the taper.
- The bus stop sign should be installed at the bus boarding area, at the rear edge of the taper.
- Buses should dwell at least 10 feet away from the crosswalk.
- At stops where parking or stopping violations have been observed, a Secondary Sign may be installed to mark the rear of the bus stop.
- A boarding island stop is preferred where there are bicycle facilities, but it is possible to create a far-side pull-out stop between an unprotected bicycle lane and the curb (Figure 17). In these cases, a bus pull-out taper at least 25 feet in length must be painted ahead of the boarding area.

Table 1 prescribes the minimum lengths of far-side pull-out stops, grouped by the length of the largest bus serving the stop. The table also includes the length of bus stops measured in the approximate number of on-street vehicle parking spaces. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 1: Minimum Bus Zone Length at Far-Side, Pull-Out Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Rear Buffer*	Bus Length	Pull-Out Buffer	Total Bus Stop Length	Number of Parking Spaces†
40 ft. (standard)	Far-Side	25	40‡	25	90	5
	Far-Side, after right turn	75	40‡	25	140	7
	Far-Side, after left turn	40	40‡	25	105	5
60 ft. (articulated)	Far-Side	25	60§	25	110	6
	Far-Side, after right turn	75	60§	25	160	8
	Far-Side, after left turn	40	60§	25	125	6

* Rear buffer measured from tangent of intersecting street

† Each parking space 20 ft. in length

‡ Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

§ Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.3.2 Near-Side Pull-Out Stop

At near-side pull-out stops, buses shift out of the travel lane to board and alight passengers at the curb and then proceed through an intersection (Figure 19). Near-side pull-out stops primarily benefit other vehicle traffic. In addition to not obstructing through-traffic, at high traffic volume locations, a near-side stop functions as a right-turn lane when no bus is at the stop (Figure 20).

Figure 19: Near-side pull-out bus stop for 40 ft. buses

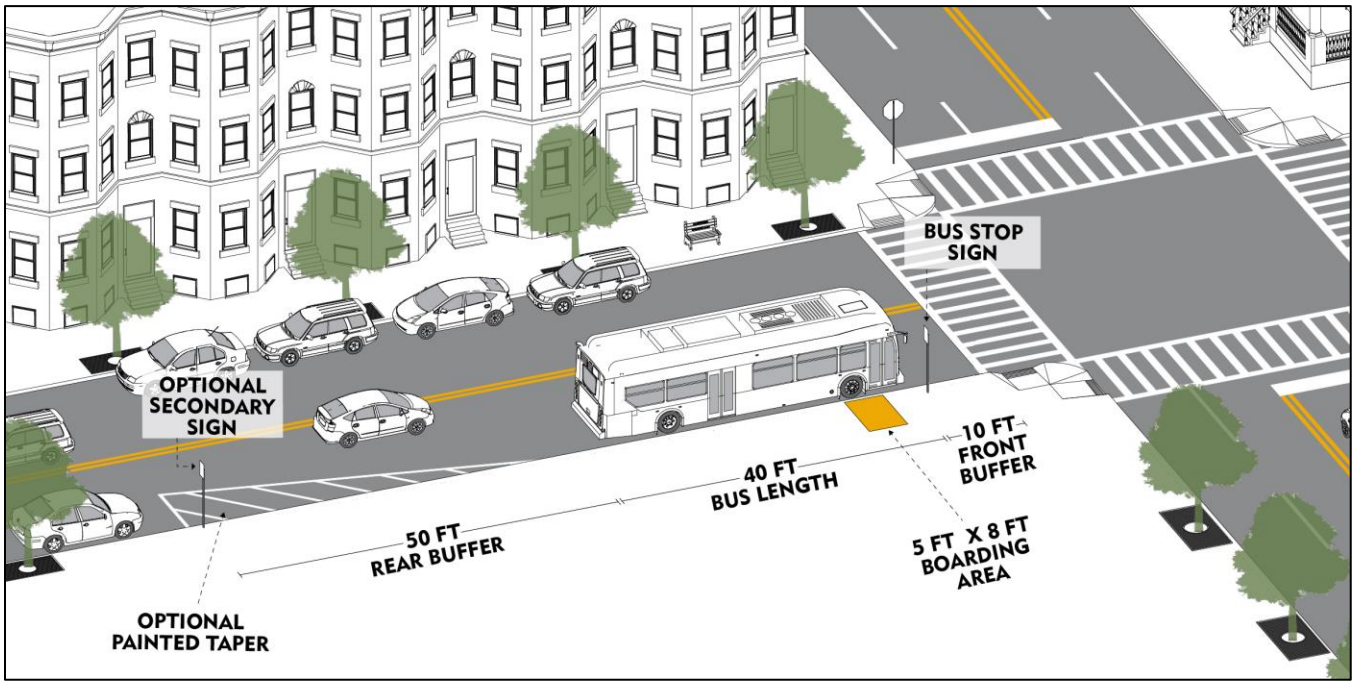
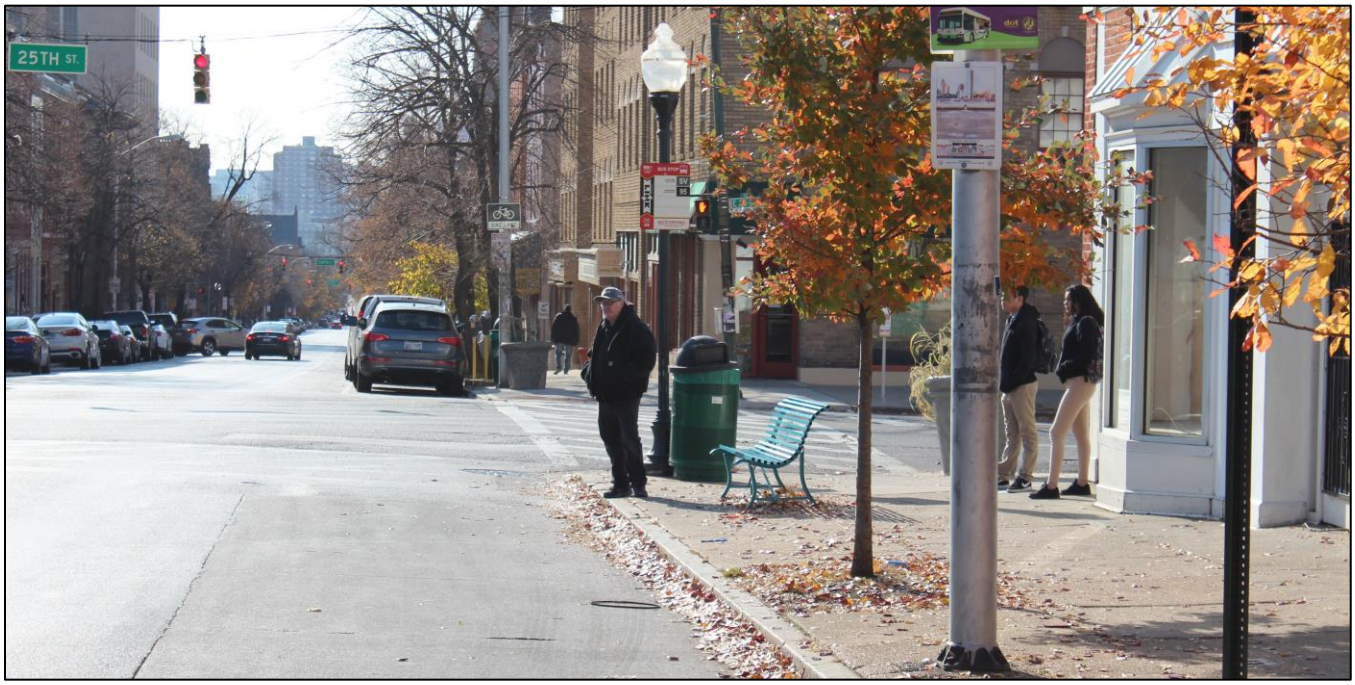


Figure 20: Near-side pull-out stop at 25th Street & St. Paul Street in Old Goucher



Guidelines for near-side pull-out stops:

- A pull-out taper at least 50 feet long should be painted behind the area where buses dwell while boarding and alighting passengers (Figure 19). A Secondary Sign should be installed at the rear edge of the taper.
- Near-side pull-out stops should be utilized only at major near-side destinations, transfer points, queue jump intersections, and locations where problematic conditions such and driveways or missing sidewalks exist at the far-side location.
- The boarding area should be located at least 10 feet from the crosswalk (Figure 19).
- Because drivers may be tempted to turn on red even when a bus is present, near-side stops must be placed close enough to the intersection that right-turning vehicles cannot merge in front of the bus.
- If buses must turn right from a near-side pull-out stop, either a signal phase should be established for the turning bus movement, or the cross street should be designed to accommodate a bus sweeping across the second lane or the oncoming lane.
- At intersections with high traffic volumes, a near-side stop can be used as a queue jump lane when paired with active transit priority.
- A near-side stop can be paired at a street corner with a far-side stop on an intersecting route to better facilitate transfers.

Table 2 prescribes the minimum lengths of near-side pull-out stops, sorted by the length of the largest bus serving the stop. The table also includes the length of bus stops measured in the approximate number of on-street vehicle parking spaces. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 2: Minimum Bus Zone Length at Near-Side, Pull-Out Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Pull-In Buffer	Bus Length	Front Buffer*	Total Bus Stop Length	Number of Parking Spaces†
40 ft. (standard)	Near-Side	50	40‡	10	100	5
60 ft. (articulated)	Near-Side	50	60§	10	120	6

* Front buffer measured from crosswalk

† Each parking space 20 ft. in length

‡ Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

§ Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.3.3 Mid-Block Pull-Out Stop

At mid-block pull-out stops, buses shift out of the travel lane more than 200 feet from an intersection to board and alight passengers at the curb (Figure 21). Mid-block pull-out stops typically require the greatest length of curb space because buses cannot use the length of an intersection to pull in or out of the stop.

Mid-block pull-out stops are typically not preferred but do have a few applications listed in this section. For example, the mid-block stop at the Workforce & Technology Center (Figure 22) provides access to a key destination on a long block.

Figure 21: Mid-block pull-out bus stop for 40 ft. buses

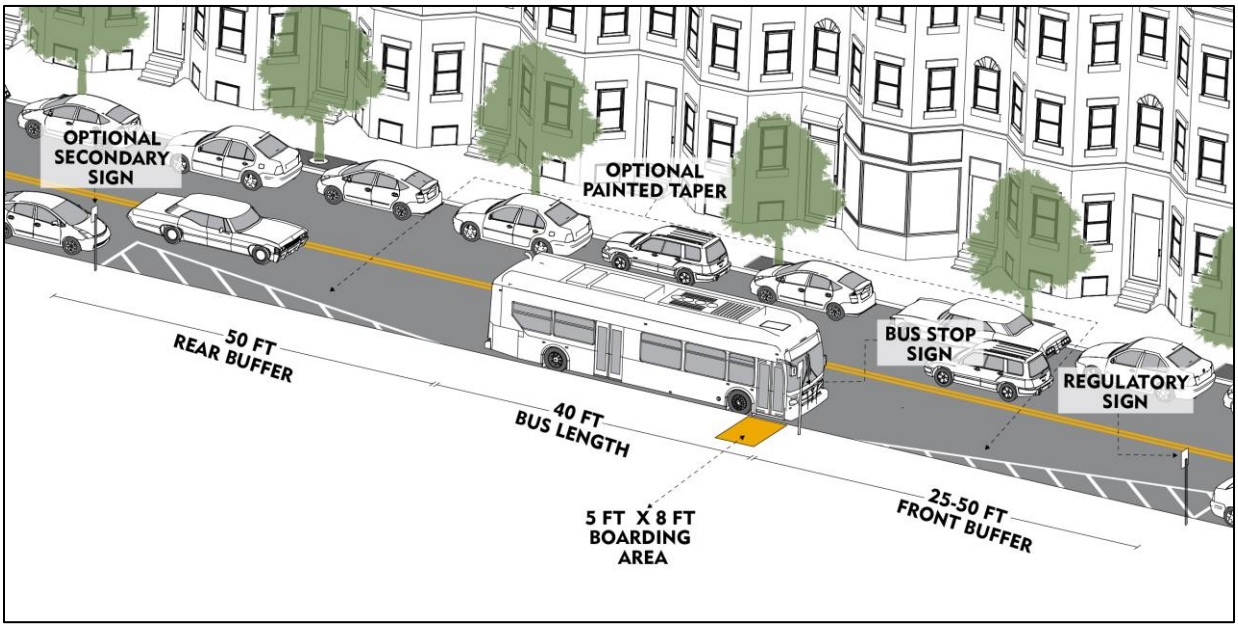


Figure 22: Mid-block pull-out stop on Argonne Drive at the Workforce & Technology Center

Guidelines for mid-block pull-out stops:

- A pull-in taper at least 50 feet long should be painted behind the area where buses dwell while boarding and alighting passengers (Figure 21). A Secondary Sign should be installed at the rear edge of the taper.
- A pull-out taper between 25 and 50 feet long should be painted ahead of the boarding area (Figure 21), with a Regulatory Sign installed at the forward edge of the taper. The minimum length of this front buffer should be based upon the posted speed limit and traffic safety analysis.
- Mid-block pull-out stops should only be used for the following applications:
    - to provide destination access on long blocks,
    - to avoid potentially unsafe conditions at intersections for buses or waiting passengers,
    - to better facilitate transfers at rail stations without off-street bus loops, or
    - to provide space for a bus to layover at the end of a run.
- Signalized or traffic-calmed pedestrian crossings should be provided at mid-block stops.

Table 3 prescribes the minimum lengths of mid-block pull-out stops, sorted by the length of the largest bus serving the stop. The table also includes the length of bus stops measured in the approximate number of on-street vehicle parking spaces. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 3: Minimum Bus Zone Length at Mid-Block, Pull-Out Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Pull-In Buffer	Bus Length	Front Buffer	Total Bus Stop Length	Number of Parking Spaces*
40 ft. (standard)	Mid-Block	50	40†	25-50§	115-140	6-7
60 ft. (articulated)	Mid-Block	50	60‡	25-50§	135-160	7-8

* Each parking space 20 ft. in length

† Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

‡ Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

§ Minimum based upon posted speed limit and traffic safety analysis

2.4 In-Lane Stop

Enabling transit vehicles to make stops without leaving the travel lane is most beneficial for the accessibility and efficient operation of a transit network. At in-lane stops, a bus traveling in a general vehicle travel lane or dedicated transit lane adjacent to the curb stops in that lane to board and alight passengers at the curb (Figure 23).

Because buses do not shift lanes to make in-lane stops, they are not delayed by through-traffic that would prevent them from re-entering traffic at a pull-out stop. Because pull-out delay is one of the most common sources of delay, in-lane stops are one of the most powerful tools for reducing travel time and improving on-time performance. In-lane stops are needed most on streets that are at or near vehicle capacity, on single lane streets, and on streets with long traffic signals.

In-lane stops require little new infrastructure to establish on streets without on-street vehicle parking. In-lane stops also reduce wear on transit vehicles by avoiding lane shifts during braking, thereby saving on maintenance costs. Where on-street vehicle parking is not considered essential, in-lane stops are ideal for efficient transit operations at low capital cost.[2]

Like all other stops, in-lane stops must provide an ADA-compliant boarding area on a firm, stable surface that measures at least 5 feet parallel to the curb and 8 feet perpendicular to the curb, and is clear of any obstacles. Pedestrian through-traffic should have 8-12 feet of clear sidewalk width on downtown or commercial streets.

In-lane stops can be located at the far side or near side of an intersection, or at mid-block. In-lane stops are Tier III-IV facilities in the BaltimoreLink Bus Stop Hierarchy.

[2] Kittleson & Associates, Inc., Parsons Brinkerhoff, KFH Group, Inc., Texas A&M Transportation Institute, and Arup. *Transit Capacity and Quality of Service Manual, Third Edition.* TCRP Report 165, Transportation Research Board, National Academy Press, Washington, DC: 2013.

2.4.1 Far-Side In-Lane Stop

At far-side in-lane stops, buses approach an intersection from a lane adjacent to the curb, proceed through the intersection, and then board and alight passengers at the curb (Figure 23).

Figure 24 illustrates a common use for a far-side in-lane stop; it is located on a multi-lane street without on-street parking. Because dedicated transit lanes enable buses to clear intersections before a signal change more frequently than they would in mixed traffic, far-side in-lane stops are ideal where there are dedicated transit lanes (Figure 25). This positive effect is amplified further with the use of transit signal priority systems.

Figure 23: Far-side in-lane bus stop with dedicated bus lane

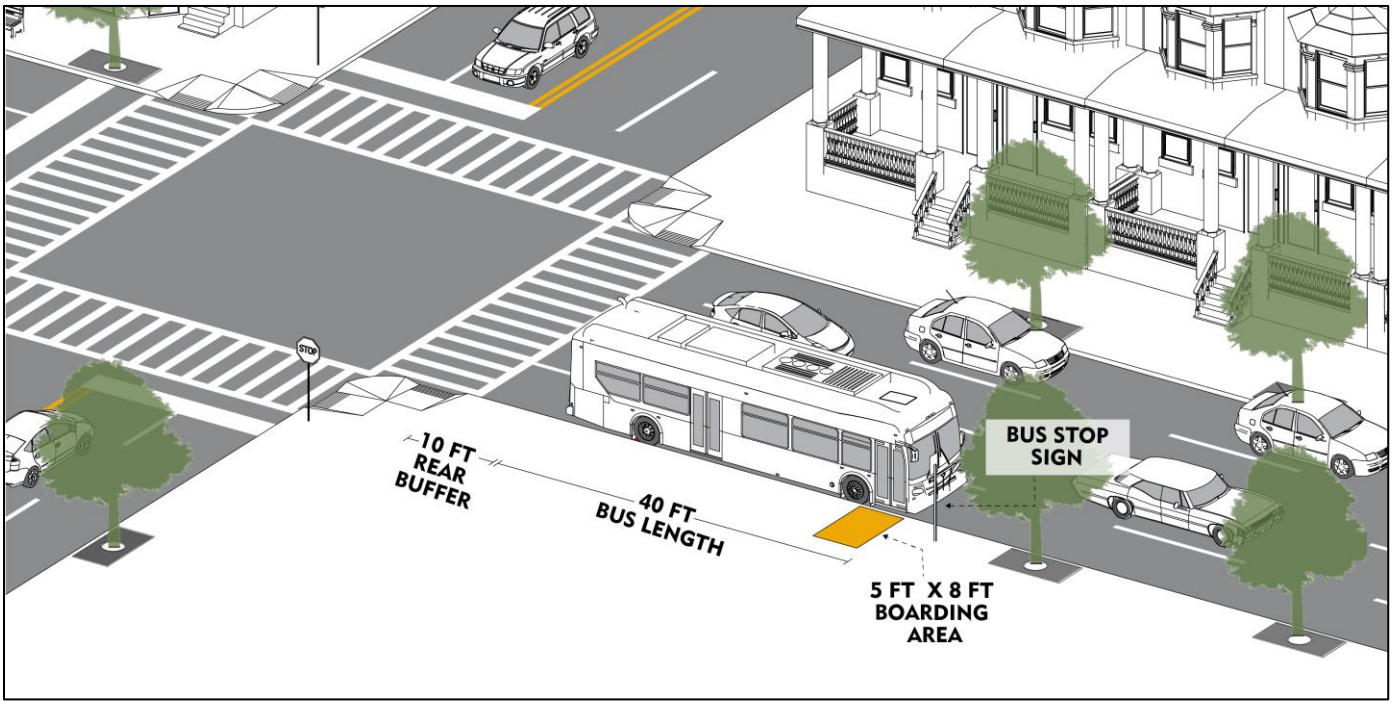


Figure 24: Far-side in-lane stop at Northern Parkway & Loch Raven Boulevard in Northeast Baltimore

Figure 25: Far-side in-lane stop at Lombard Street & Charles Street in Downtown Baltimore

Guidelines for far-side in-lane stops:

- Buses should dwell at least 10 feet away from the crosswalk.
- On single-lane streets with significant traffic volumes, more curb length should be reserved so that vehicles can queue behind the bus but after the intersection.

Table 4 prescribes the minimum lengths of far-side in-lane stops, grouped by the length of the largest bus serving the stop. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 4: Minimum Bus Zone Length at Far-Side, In-Lane Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Rear Buffer*	Bus Length	Total Bus Stop Length
40 ft. (standard)	Far-Side	10	40†	50
	Far-Side, after right turn	55	40†	95
	Far-Side, after left turn	25	40†	65
60 ft. (articulated)	Far-Side	10	60‡	70
	Far-Side, after right turn	55	60‡	115
	Far-Side, after left turn	25	60‡	85

* Rear buffer measured from tangent of intersecting street

† Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

‡ Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.4.2 Near-Side In-Lane Stop

At near-side in-lane stops, buses approach a bus stop from a travel lane adjacent to the curb, board and alight passengers at the curb prior to the intersection, and then proceed through the intersection (Figure 26).

Locating a stop near-side keeps the far side of the intersection clear to receive turns from the cross street. For example, the westbound stop at Washington Boulevard & Monroe Street (Figure 27) is configured as a near-side in-lane stop so that it does not interfere with turning movements from Monroe onto Washington.

Near-side in-lane stops may also be applied where there is insufficient space for the bus to dwell at the far side of the intersection, as is the case at Pratt Street & Calvert Street at the Inner Harbor (Figure 28).

Figure 26: Near-side in-lane bus stop

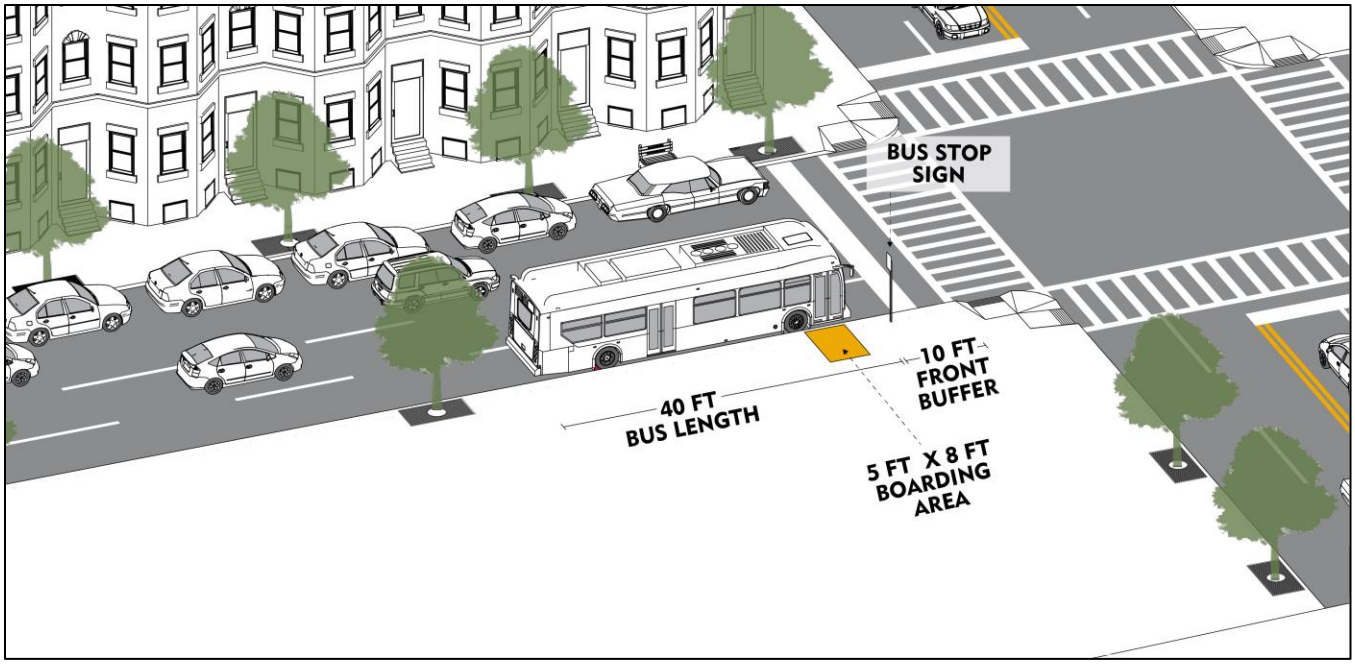
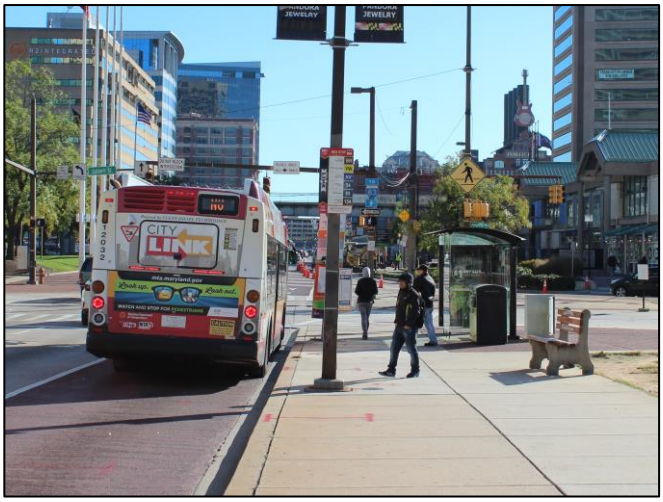


Figure 27: Near-side in-lane stop at Washington Boulevard & Monroe Street at Carroll Park

Figure 28: Near-side in-lane stop at Pratt Street & Calvert Street at the Inner Harbor



Guidelines for near-side in-lane stops:

- The boarding area should be located at least 10 feet from the crosswalk.
- Because drivers of other vehicles may be tempted to turn on red even when a bus is present, near-side stops must be placed close enough to the intersection that right-turning vehicles cannot merge in front of the bus.
- If buses must turn right from a near-side in-lane stop, either a signal phase should be established for the turning bus movement, or the cross street should be designed to accommodate a vehicle sweeping across the second lane or the oncoming lane.

Table 5 prescribes the minimum lengths of near-side in-lane stops, sorted by the length of the largest bus serving the stop. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 5: Minimum Bus Zone Length at Near-Side, In-Lane Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Bus Length	Front Buffer*	Total Bus Stop Length
40 ft. (standard)	Near-Side	40†	10	50
60 ft. (articulated)	Near-Side	60‡	10	70

* Front buffer measured from crosswalk

† Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

‡ Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.4.3 Mid-Block In-Lane Stop

At mid-block pull-out stops, buses board and alight passengers from a travel lane adjacent to the curb, more than 200 feet from an intersection (Figure 29). Mid-block in-lane stops are typically not preferred but do have a few applications listed in this section. For example, the mid-block stop at the League for People with Disabilities (Figure 30) provides access to a key destination on a long block.

Figure 29: Mid-block in-lane bus stop

Figure 30: Mid-block in-lane stop on Cold Spring Lane at the League for People with Disabilities

Guidelines for mid-block in-lane stops:

- Mid-block in-lane stops should only be used for the following applications:
  - to provide destination access on long blocks,
  - to avoid potentially unsafe conditions at intersections for buses or waiting passengers, or
  - to better facilitate transfers at rail stations without off-street bus loops.
- Signalized or traffic-calmed pedestrian crossings should be provided at mid-block stops.

Table 6 prescribes the minimum lengths of mid-block in-lane stops, sorted by the length of the largest bus serving the stop. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 6: Minimum Bus Zone Length at Mid-Block, In-Lane Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Bus Length	Total Bus Stop Length
40 ft. (standard)	Mid-Block	40*	40
60 ft. (articulated)	Mid-Block	60†	60

* Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

† Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.5 Boarding Bulb Stop

A bus boarding bulb is an extension of the curb across an on-street vehicle parking lane, which enables buses to board and alight passengers without shifting lanes on streets with vehicle parking. Boarding bulb stops reduce dwell time at stops and eliminate delay associated with shifting in and out of a travel lane, making them the recommended bus stop configuration for streets with vehicle parking. Boarding bulbs may also be called bus bulbs, curb extensions, or neckdowns.

Benefits of boarding bulb stops:

- Eliminate operational delays associated with pull-out stops on streets that are at or near capacity.
- Significantly reduce the curb length required for the stop (compared to pull-out stops), freeing up curb and sidewalk space toward meeting other goals such as invigorating street life, improving stormwater management, and making space for bike share docks or bicycle racks.
- Improve accessibility by providing a larger boarding area with wider accessible paths to the stop, and by ensuring that all buses will be able to pull to the curb to deploy ramps.
- Create additional waiting area and space for amenities at stops with large passenger volumes.
- Improve the pedestrian experience by freeing up space for pedestrians using the sidewalk, reducing crossing distances, and reducing vehicle travel speeds.
- Reduce bus and pavement wear and tear, reducing maintenance costs.

Like all other stops, boarding bulbs must provide an ADA-compliant boarding area on a firm, stable surface that measures at least 5 feet parallel to the curb and 8 feet perpendicular to the curb, and is clear of any obstacles. Cross slopes on the boarding bulb must not exceed two percent.

Boarding bulbs are not compatible with bicycle facilities on the right side of the street, but boarding island stops and shared cycle track stops are compatible alternatives. Boarding bulbs can be installed at near-side, far-side, and mid-block stops at both signalized and unsignalized intersections.

Constructing boarding bulbs often requires drainage modifications. If existing stormwater catch basins cannot be relocated, trench drains can be used along the length of the boarding bulb to preserve a level, accessible path to the stop. Alternatively, it may also be possible to install a temporary boarding bulb onto existing pavement while funding is sought to construct a permanent facility. See the Pilot and Temporary Enhancements section for more information.

Boarding bulb stops are Tier III-IV facilities in the BaltimoreLink Bus Stop Hierarchy.

2.5.1 Far-Side Boarding Bulb Stop

At far-side boarding bulb stops, buses proceed through the intersection and then board and alight passengers at an extension of the sidewalk (Figure 31). On most streets with vehicle parking, the far-side boarding bulb stop is the preferred bus stop configuration (Figure 32).

Figure 31: Far-side boarding bulb bus stop for 40 ft. buses

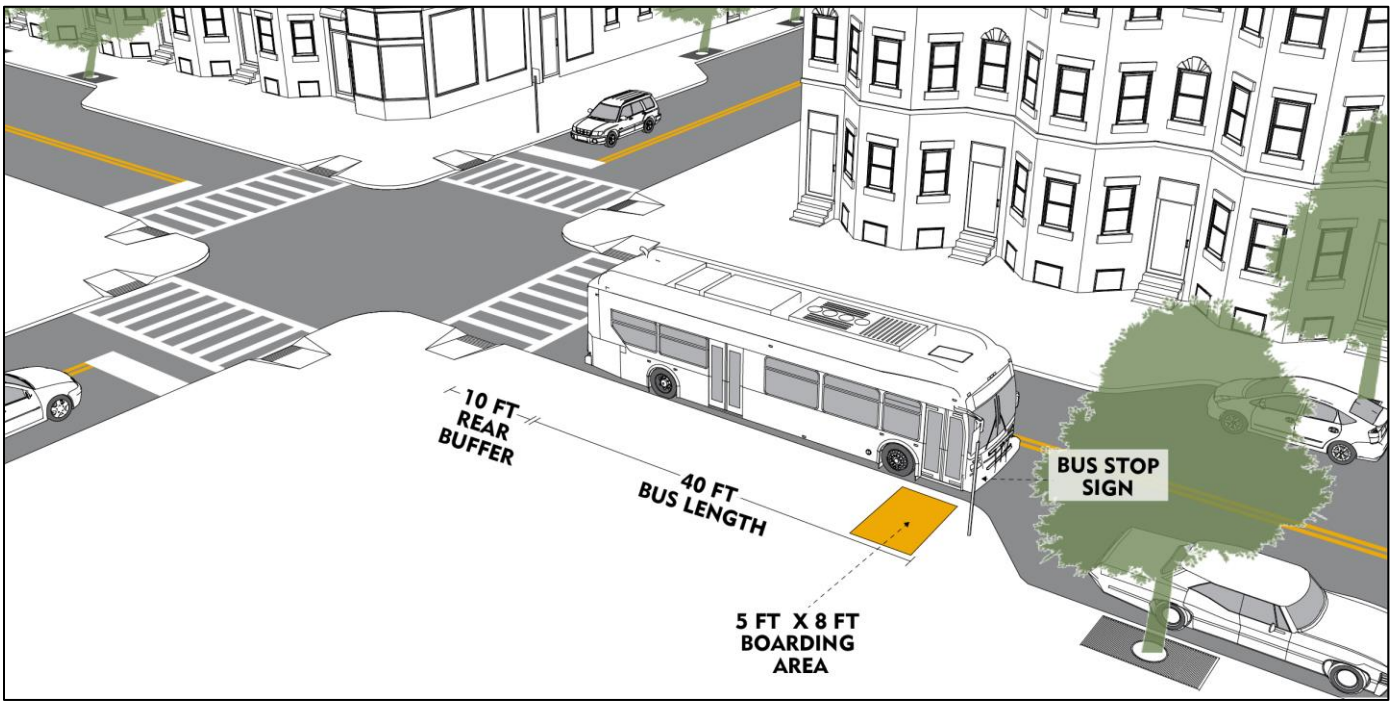


Figure 32: Far-side boarding bulb stop at Boston Street & Ellwood Avenue in Canton

Guidelines for far-side boarding bulb stops:

- Buses should dwell at least 10 feet away from the crosswalk.
- The boarding bulb should extend to within two feet of the travel lane so that buses must make only a minor shift toward the curb.
- On single-lane streets with significant traffic volumes, boarding bulbs should be constructed with greater length so that vehicles can queue behind the bus but after the intersection.
- Far-side boarding bulb stops located after a right turn are strongly discouraged because typical bus turn radii make them difficult to serve.

Table 7 prescribes the minimum lengths of far-side boarding bulb stops, grouped by the length of the largest bus serving the stop. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 7: Minimum Bus Zone Length at Far-Side, Boarding Bulb Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Rear Buffer*	Bus Length	Total Bus Stop Length	Number of Parking Spaces†
40 ft. (standard)	Far-Side	10	40‡	50	3
	Far-Side, after left turn	25	40‡	65	3
60 ft. (articulated)	Far-Side	10	60§	70	4
	Far-Side, after left turn	25	60§	85	4

* Rear buffer measured from tangent of intersecting street

† Each parking space 20 ft. in length

‡ Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

§ Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.5.2 Near-Side Boarding Bulb Stop

At near-side boarding bulb stops, buses approach a bus stop from a travel lane adjacent to on-street parking, board and alight passengers at an extension of the sidewalk prior to the intersection, and then proceed through the intersection (Figure 33, Figure 34). On most streets with vehicle parking, the near-side boarding bulb stop is the second most preferred bus stop configuration after the far-side boarding bulb stop.

Figure 33: Near-side boarding bulb bus stop for 40 ft. buses

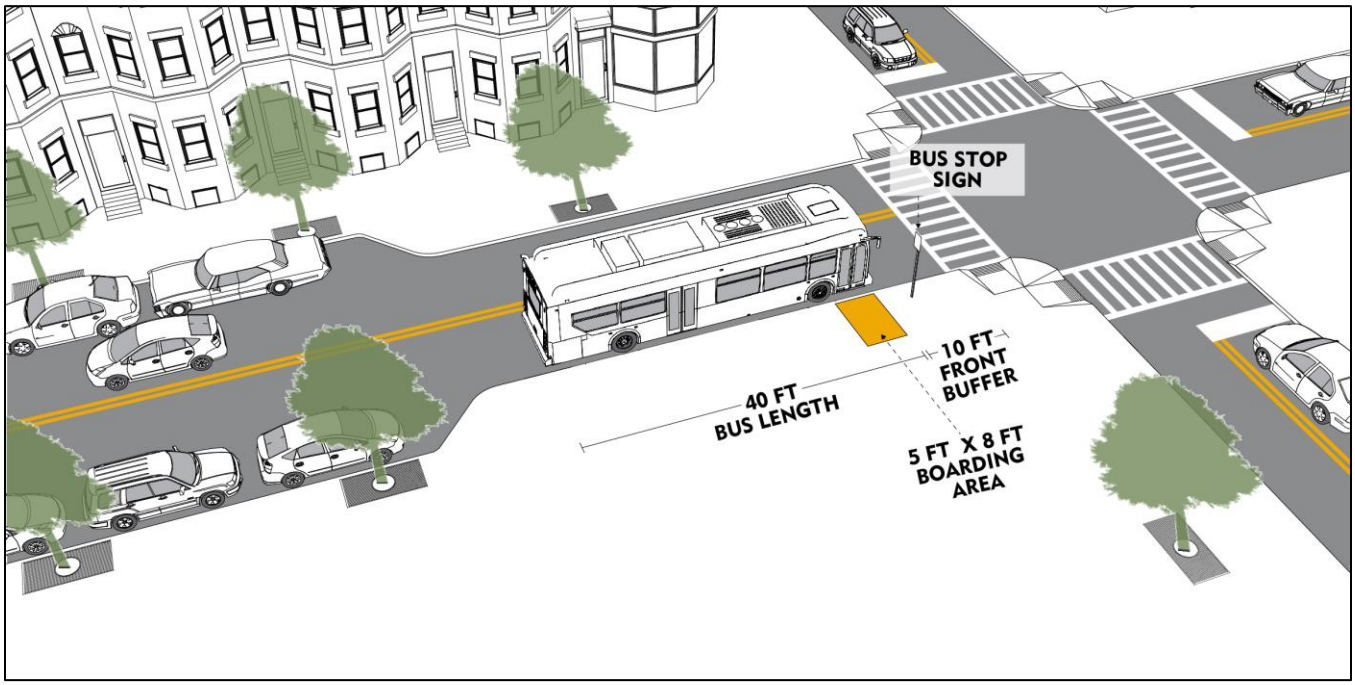


Figure 34: Near-side boarding bulb stop at Wolfe Street & Ashland Avenue at the Johns Hopkins Hospital

Guidelines for far-side boarding bulb stops:

- The boarding area should be located at least 10 feet from the crosswalk.
- The boarding bulb should extend to within two feet of the travel lane so that the bus must make only a minor shift toward the curb.

Table 8 prescribes the minimum lengths of near-side boarding bulb stops, sorted by the length of the largest bus serving the stop. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 8: Minimum Bus Zone Length at Near-Side, Boarding Bulb Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Bus Length	Front Buffer*	Total Bus Stop Length	Number of Parking Spaces†
40 ft. (standard)	Near-Side	40‡	10	50	3
60 ft. (articulated)	Near-Side	60§	10	70	3

* Front buffer measured from crosswalk

† Each parking space 20 ft. in length

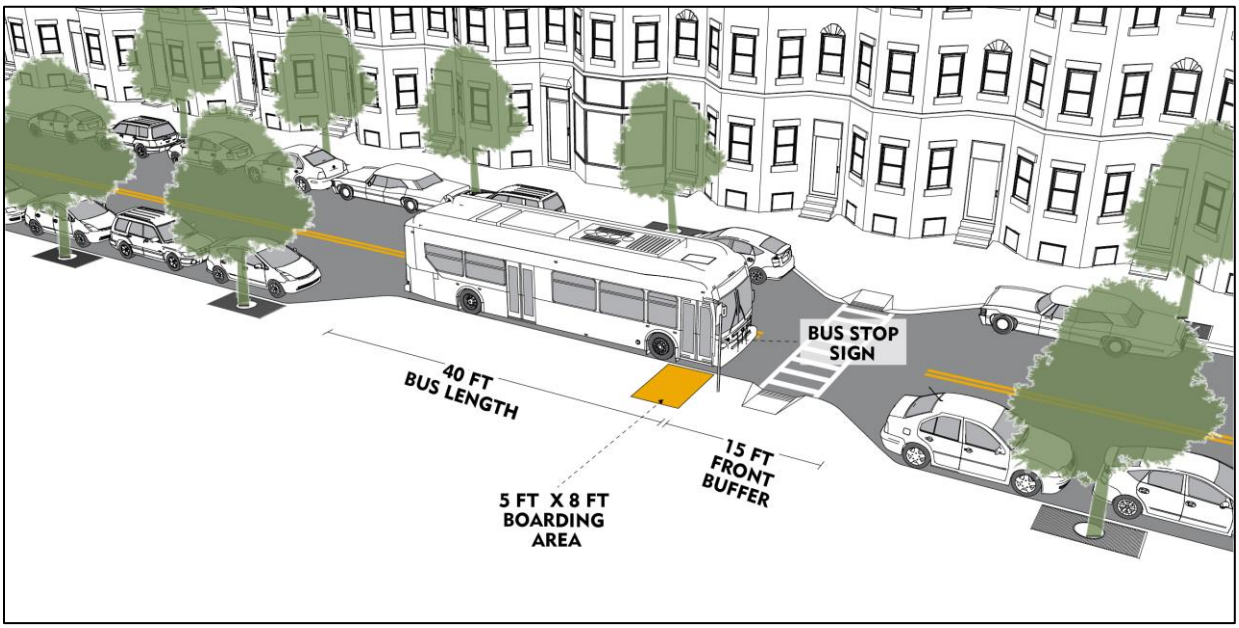
‡ Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

§ Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.5.3 Mid-Block Boarding Bulb Stop

At mid-block boarding bulb stops, buses board and alight passengers at an extension of the sidewalk more than 200 feet from an intersection (Figure 35). Mid-block in-lane stops are typically not preferred but do have a few applications listed in this section.

Figure 35: Mid-block boarding bulb bus stop for 40 ft. buses



Guidelines for mid-block in-lane stops:

- Mid-block boarding bulb stops should only be used for the following applications:
  - to provide destination access on long blocks,
  - to avoid potentially unsafe conditions at intersections for buses or waiting passengers, or
  - to better facilitate transfers at rail stations without off-street bus loops.
- Signalized or traffic-calmed pedestrian crossings should be provided at mid-block stops.

Table 9 prescribes the minimum lengths of mid-block boarding bulb stops, sorted by the length of the largest bus serving the stop. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 9: Minimum Bus Zone Length at Mid-Block, Boarding Bulb Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Bus Length	Front or Rear Buffer	Total Bus Stop Length	Number of Parking Spaces*
40 ft. (standard)	Mid-Block	40†	15	55	3
60 ft. (articulated)	Mid-Block	60‡	15	75	4

* Each parking space 20 ft. in length

† Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

‡ Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.6 Boarding Island Stop

The boarding island stop, also known as a floating bus stop, is a bicycle facility-compatible alternative to the boarding bulb. Boarding islands are boarding and alighting areas separated from the sidewalk by a bike channel (Figure 36, Figure 37). With bicycle traffic traveling behind the stop rather than in front of it, the boarding island eliminates the conflicts found between buses and bicycles at in-lane stops, making the boarding island the recommended bus stop configuration for streets where bicycle facilities exist on or are planned for the right side of the street.

Figure 36: Boarding island bus stop for 40 ft. buses

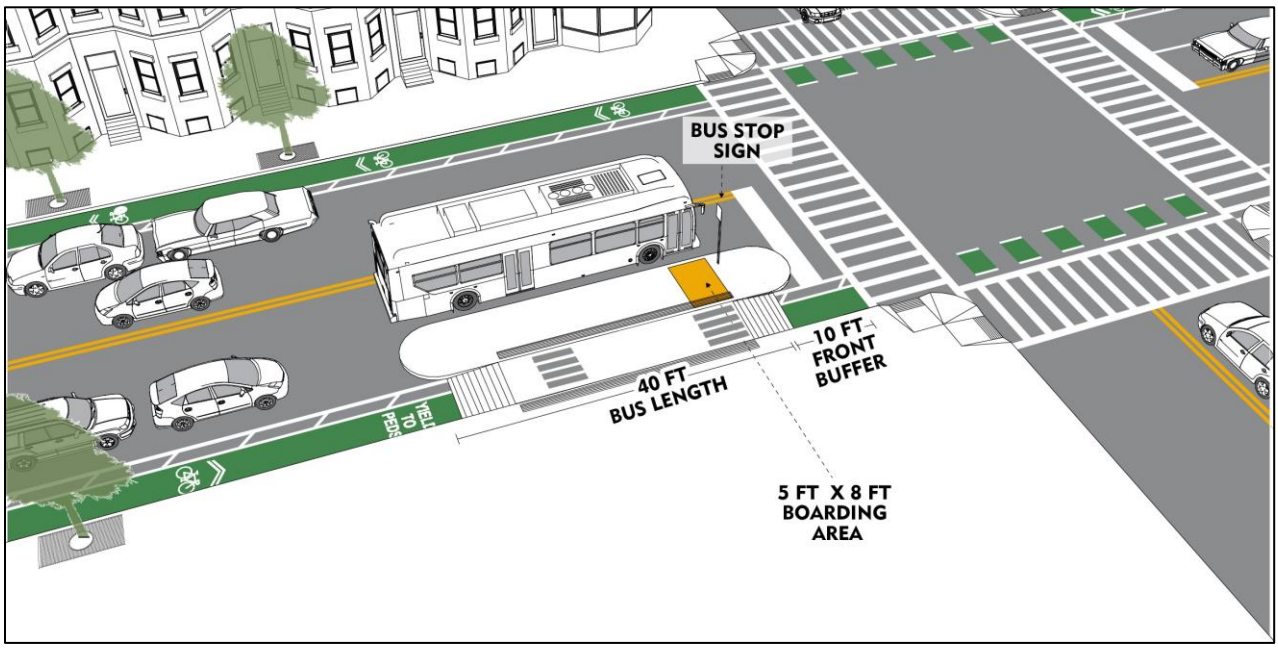


Figure 37: Boarding island stop at Pratt Street & South Street at the Inner Harbor

Guidelines for boarding island stops with a bicycle channel at street level:

- An accessible path must be established from the boarding island to the sidewalk with curb ramps having slopes not exceeding 1:12 (8.33%).
- The boarding island should be constructed at a height that enables level or near-level boarding onto buses.
- Access to the boarding island stop should be provided by a raised crosswalk between the boarding island and sidewalk (Figure 36).
- At concrete boarding island stops, bus stop signage should be installed on the boarding island at the prescribed distance from the curb adjacent to the travel lane. At boarding island stops using Temporary Boarding Platforms, bus stop signage should be located on the existing sidewalk and aligned with the boarding area.

Guidelines for boarding island stops with a bicycle channel at sidewalk level (Figure 37):

- The bicycle channel should be differentiated from the sidewalk and bus stop by using contrasting materials or green color treatments typical for bicycle facilities.

Table 10 prescribes the minimum lengths of boarding island stops, grouped by the length of the largest bus serving the stop. Ramps to boarding island stops may be constructed within either the required rear or front buffer. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 10: Minimum Bus Zone Length at Boarding Island Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Rear Buffer	Bus Length	Front Buffer	Total Bus Stop Length	Number of Parking Spaces*
40 ft. (standard)	Far-Side	10	40†	-	50	3
	Far-Side, after right turn	45	40†	-	85	4
	Far-Side, after left turn	15	40†	-	55	3
	Near-Side	-	40†	10	50	3
	Mid-Block	-	40†	-	40	2
60 ft. (articulated)	Far-Side	10	60‡	-	70	4
	Far-Side, after right turn	45	60‡	-	105	5
	Far-Side, after left turn	15	60‡	-	75	4
	Near-Side	-	60‡	10	70	4
	Mid-Block	-	60‡	-	60	3

* Each parking space 20 ft. in length

† Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

‡ Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.7 Shared Cycle Track Stop

Where right-side bicycle facilities exist, but not enough street width is available to create a bicycle channel behind a boarding island stop, a shared cycle track stop may be installed. At a shared cycle track stop, a bicycle lane or cycle track ramps up to curb height, continues through the boarding area, and then ramps back down to street height (Figure 38). The raised portion of the bicycle facility also serves as the boarding and alighting area.

Figure 38: Shared cycle track bus stop

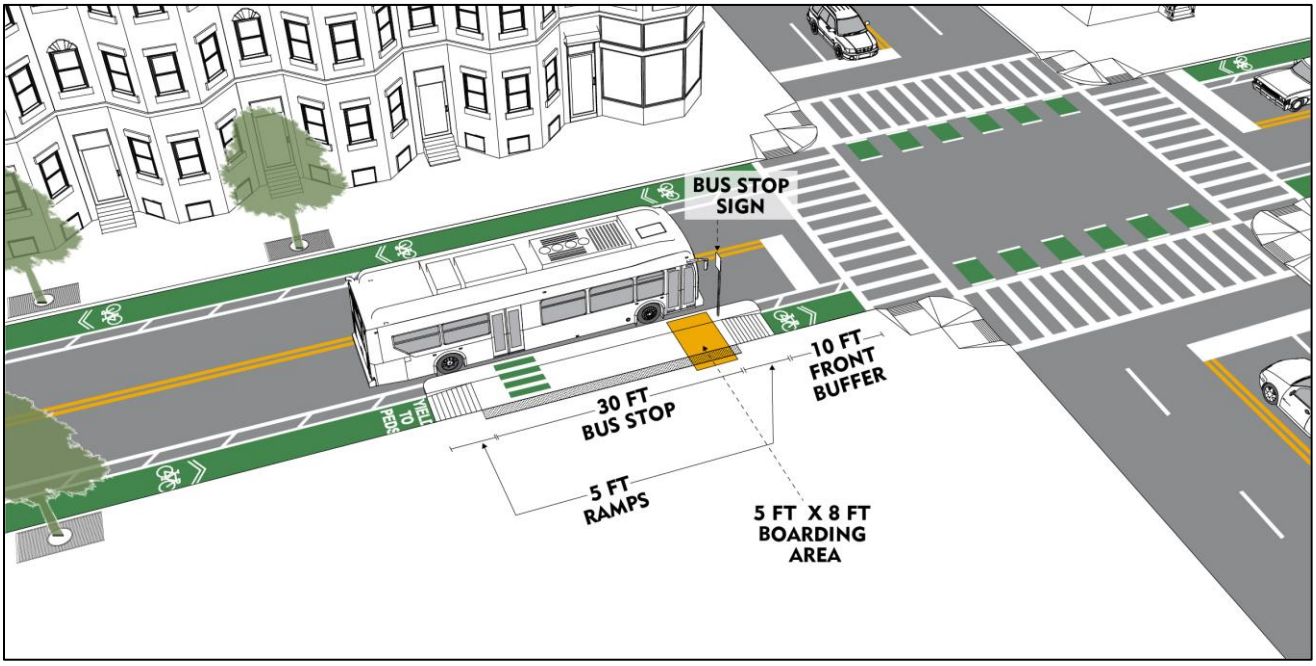


Figure 39: Shared cycle track stop at the Fallsway & Eager Street in Johnston Square

Guidelines for shared cycle track stops:

- The section of the stop adjacent to the curb should be differentiated with pavers or other contrasting material to alert cyclists to the bus stop (Figure 39).
- The slopes of the bicycle ramps on either side of the bus stop should not exceed 1:8.
- Activities that would conflict with bicycle movements or obstruct views of the stop should be at least 20 feet from either bicycle ramp.
- Wheelchair users must have access to a waiting area that is free from conflicts with bicycles. For passengers with visual disabilities, multi-sense information should be provided to ensure they are safe from conflict with bicycles.
- For the safety and accessibility of both transit passengers and bicyclists, the bicycle lane or cycle track should be designed wide enough to be cleared by available sweeping and plowing equipment.

Table 11 prescribes the minimum lengths of boarding island stops, grouped by the length of the largest bus serving the stop. As noted below the table, bus stops scheduled to be served by more than one bus at the same time may require additional length.

Table 11: Minimum Bus Zone Length at Shared Cycle Track Stops (in ft.)

Largest Bus Serving Stop	Stop Location	Rear Buffer	Ramp from Bicycle Facility	Raised Bus Stop	Ramp to Bicycle Facility	Front Buffer	Total Bus Stop Length
40 ft. (standard)	Far-Side	10	5	30*	5	-	50
	Far-Side, after right turn	45	5	30*	5	-	85
	Far-Side, after left turn	15	5	30*	5	-	55
	Near-Side	-	5	30*	5	10	50
	Mid-Block	-	5	30*	5	-	40
60 ft. (articulated)	Far-Side	10	5	50†	5	-	70
	Far-Side, after right turn	45	5	50†	5	-	105
	Far-Side, after left turn	15	5	50†	5	-	75
	Near-Side	-	5	50†	5	10	70
	Mid-Block	-	5	50†	5	-	60

* Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time

† Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time

2.8 On-Street Transfer Center

An on-street bus transfer center, otherwise known as an on-street terminal, combines several bus boarding and alighting areas in series, creating an area where several buses can board and alight passengers at the same time (Figure 40). On-street transfer centers typically assign one or two routes to each individually-signed boarding and alighting area along the curb (Figure 41) or to each sawtooth bus bay (Figure 42). On-street transfer centers increase capacity and reduce transit vehicle congestion where many bus routes converge on the same street. On-street transfer centers are Tier II facilities in the BaltimoreLink Bus Stop Hierarchy.

Figure 40: On-street bus transfer center

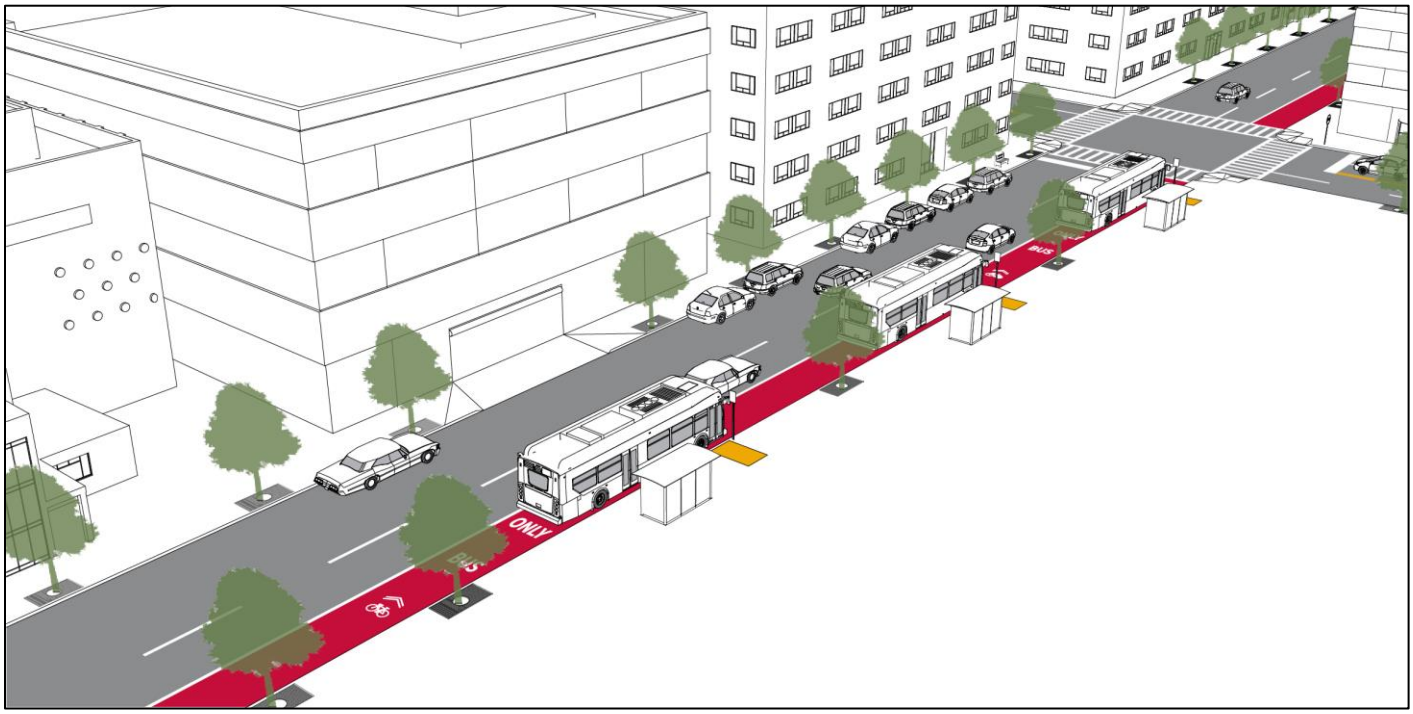


Figure 41: On-street transfer center at the Baltimore Arena

Figure 42: Sawtooth bus bays at the University of Maryland, Baltimore Transit Center

Guidelines for on-street transfer centers:

- If the transfer center is used as a layover point, calculations must be made to ensure adequate space during peak periods.
- Sawtooth bus bays are preferred for their ability to better facilitate bus pull-in, boarding and alighting, and pull-out (Figure 42).
- While it is possible to have an on-street transfer center in a mixed-traffic lane, it is strongly recommended to use at least one dedicated bus lane. Having two adjacent dedicated bus lanes can assist buses with pulling in and out of the transfer center.
- Clear, legible wayfinding information facilitates boarding and transfers and decreases the potential for confusion or stress among passengers. See the Signage section for an alternate bus stop sign design for use at on-street transfer centers.
- Because many passengers wait at and move between bus bays at on-street transfer centers, all activities on the sidewalk unrelated to transit should be prohibited.
- To reduce congestion on the sidewalk, a skip-stop configuration may be established by constructing two on-street transfer centers on the same street, separated by a cross street, and assigning routes to one transfer center but not both. A skip-stop configuration requires clear wayfinding to direct passengers who may need to cross a street to transfer between routes.

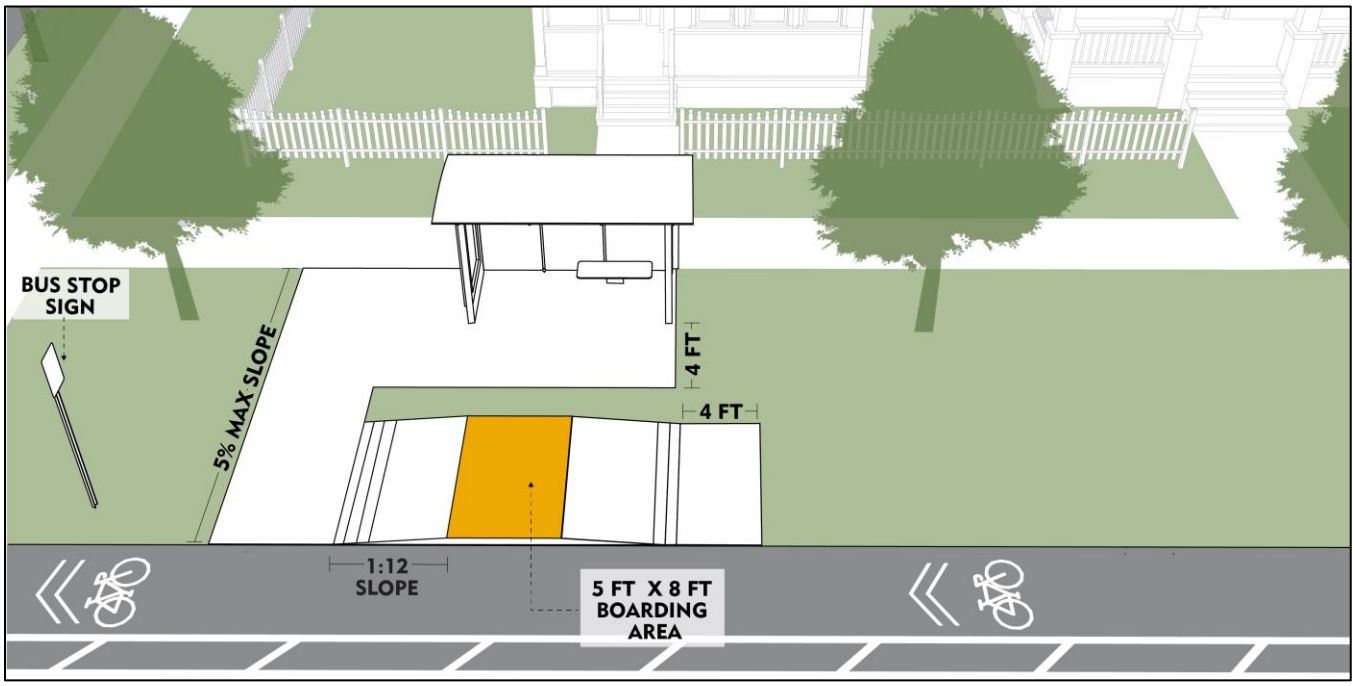
On-street transfer centers are large, complex facilities, each having its own unique operational needs and unique street context. The dimensions of an on-street transfer center shall therefore be determined through a formal engineering and design process.

2.9 Coverage Bus Stop

It may sometimes be appropriate to site a bus stop at a rural or suburban location where there is no sidewalk at the curb, sidewalks are discontinuous, or there is no sidewalk at all. It is possible to construct an ADA-compliant stop at a site where there is only a flush shoulder or curb without a sidewalk. Coverage bus stops are created only on a case-by-case basis and are an exception to the BaltimoreLink Bus Stop Hierarchy.

A Coverage Bus Stop may be created on road with a flush shoulder by constructing an ADA-compliant boarding area on a firm, stable surface that measures at least 5 feet parallel to the curb and 8 feet perpendicular to the curb, and is clear of any obstacles (Figure 43). A ramp with a 1:12 slope or less must provide a path from the ground to the boarding and alighting area.

Figure 43: Coverage bus stop



2.10 Summary Tables – Minimum Bus Zone Lengths

Table 12 prescribes the minimum lengths of bus stops served by 40 ft. standard buses. Table 13 prescribes the minimum lengths of bus stops served by 60 ft. articulated buses. Bus zone lengths in both tables are grouped by stop configuration and sorted by stop location. As noted below the table, bus stops served by more than one frequent bus route may require additional length.

Table 12: Minimum Bus Zone Length at Bus Stops Served by 40 ft. Buses (in ft.)

Stop Config-uration	Stop Location	Rear Buffer*	Ramp from Bicycle Facility	Bus Length†	Pull-Out Buffer	Ramp to Bicycle Facility	Front Buffer‡	Total Bus Stop Length	Number of Parking Spaces§
Pull-Out Stop	Far-Side	25	-	40	25	-	-	90	5
	Far-Side, after right turn	75	-	40	25	-	-	140	7
	Far-Side, after left turn	40	-	40	25	-	-	105	5
	Near-Side	50	-	40	10	-	-	100	5
	Mid-Block	50	-	40	25-50**	-	-	115-140	7-8
In-Lane Stop	Far-Side	10	-	40	-	-	-	50	-
	Far-Side, after right turn	55	-	40	-	-	-	95	-
	Far-Side, after left turn	25	-	40	-	-	-	65	-
	Near-Side	-	-	40	-	-	10	50	-
	Mid-Block	-	-	40	-	-	-	40	-
Boarding Bulb Stop	Far-Side	10	-	40	-	-	-	50	3
	Far-Side, after left turn	25	-	40	-	-	-	65	3
	Near-Side	-	-	40	-	-	10	50	3
	Mid-Block	15††	-	40	-	-	15††	55	3
Boarding Island Stop	Far-Side	10	-	40	-	-	-	50	3
	Far-Side, after right turn	45	-	40	-	-	-	85	4
	Far-Side, after left turn	15	-	40	-	-	-	55	3
	Near-Side	-	-	40	-	-	10	50	3
	Mid-Block	-	-	40	-	-	-	40	2
Shared Cycle Track Stop	Far-Side	10	5	30‖	-	5	-	50	-
	Far-Side, after right turn	45	5	30‖	-	5	-	85	-
	Far-Side, after left turn	15	5	30‖	-	5	-	55	-
	Near-Side	-	5	30‖	-	5	10	50	-
	Mid-Block	-	5	30‖	-	5	-	40	-

* Rear buffer measured from tangent of intersecting street
† Add 45 ft. for each additional 40 ft. bus scheduled to serve the stop at the same time
‡ Front buffer measured from crosswalk
§ Each parking space 20 ft. in length
** Minimum based upon posted speed limit and traffic safety analysis
†† Front or rear buffer depending on location of crosswalk
‖ Raised bus stop

Table 13: Minimum Bus Zone Length at Bus Stops Served by 60 ft. Articulated Buses (in ft.)

Stop Config-uration	Stop Location	Rear Buffer*	Ramp from Bicycle Facility	Bus Length†	Pull-Out Buffer	Ramp to Bicycle Facility	Front Buffer‡	Total Bus Stop Length	Number of Parking Spaces§
Pull-Out Stop	Far-Side	25	-	60	25	-	-	110	6
	Far-Side, after right turn	75	-	60	25	-	-	160	8
	Far-Side, after left turn	40	-	60	25	-	-	125	6
	Near-Side	50	-	60	10	-	-	120	6
	Mid-Block	50	-	60	25-50**	-	-	135-160	7-8
In-Lane Stop	Far-Side	10	-	60	-	-	-	70	-
	Far-Side, after right turn	55	-	60	-	-	-	115	-
	Far-Side, after left turn	25	-	60	-	-	-	85	-
	Near-Side	-	-	60	-	-	10	70	-
	Mid-Block	-	-	60	-	-	-	60	-
Boarding Bulb Stop	Far-Side	10	-	60	-	-	-	70	4
	Far-Side, after left turn	25	-	60	-	-	-	85	4
	Near-Side	-	-	60	-	-	10	70	4
	Mid-Block	15††	-	60	-	-	15††	75	4
Boarding Island Stop	Far-Side	10	-	60	-	-	-	70	4
	Far-Side, after right turn	45	-	60	-	-	-	105	5
	Far-Side, after left turn	15	-	60	-	-	-	75	4
	Near-Side	-	-	60	-	-	10	70	4
	Mid-Block	-	-	60	-	-	-	60	3
Shared Cycle Track Stop	Far-Side	10	5	50‖	-	5	-	70	-
	Far-Side, after right turn	45	5	50‖	-	5	-	105	-
	Far-Side, after left turn	15	5	50‖	-	5	-	75	-
	Near-Side	-	5	50‖	-	5	10	70	-
	Mid-Block	-	5	50‖	-	5	-	60	-

* Rear buffer measured from tangent of intersecting street
† Add 65 ft. for each additional 60 ft. bus scheduled to serve the stop at the same time
‡ Front buffer measured from crosswalk
§ Each parking space 20 ft. in length
** Minimum based upon posted speed limit and traffic safety analysis
†† Front or rear buffer depending on location of crosswalk
‖ Raised bus stop

3 Bus Stop Placement

3.1 Bus Stop Spacing and Optimization

To help buses arrive at predictable intervals and move passengers efficiently, it is vital that bus stops be spaced appropriately. The ideal spacing of the bus stops is based on the density of population and employment around the bus stop. In areas where there are more people living and working, bus stops should be closer together. Based on the number of residents and jobs within walking distance, a bus stop will fall into one of four categories with appropriate spacing as described in Table 14: Bus Stop Spacing Guidelines.

The bus stop spacing guidelines do not imply that all bus stops on a street or road will be served by all MDOT MTA bus services that operate on that street or road. Some bus services, including Express BusLink, may skip stops in an express zone, make limited stops along a segment of a route, or make limited stops along an entire route.

The current MDOT MTA core bus stop network averages four stops per mile, or one stop every quarter mile (1,320 ft.). Target bus stop spacing for CityLink service is five stops per mile (around 1,000 ft.), while LocalLink service averages four stops per mile due to the lower densities along those routes. The target for Express BusLink stop spacing is an average of one to two stops per mile, with some segments serving bus stops every quarter-mile at transfer locations, higher density areas, or trip generators, combined with segments of more than a mile in an express zone with few or no Express BusLink bus stops.

Table 14: Bus Stop Spacing Guidelines

Land Use Type	Land Use Type Example	Stop Spacing	Density[3] (Residents & Jobs)
High-Density Central Business Districts and Suburban Activity Centers	○ Downtown Baltimore ○ Eutaw Place in Bolton Hill ○ Fayette Street in East Baltimore ○ York Road in Towson (Figure 34)	750-1,000 ft. or every 2-3 blocks (5-7 stops per mile)	More than 30 people/acre
Medium-Density Residential/Commercial	○ Liberty Heights Avenue in Park Heights (Figure 45) ○ Ingleside Avenue in Woodlawn	750-1,320 ft. (4-7 stops per mile)	Between 15 and 30 people/acre
Low-Density Residential/Commercial	○ Edmondson Avenue in Catonsville (Figure 46) ○ Philadelphia Road in Rosedale	1,320-2,640 ft. (2-4 stops per mile)	Between 5 and 14 people/acre
Suburban/Rural	○ Ritchie Highway in Pasadena (Figure 47) ○ Eastern Avenue in Middle River	As needed	Less than 5 people/acre

[3] Sum of U.S. Census population and Longitudinal Employer-Household Dynamics (LEHD) employment within 1/4 mile, calculated per acre.

Figure 44: Suburban Activity Center, York Road & Chesapeake Avenue in Towson

Figure 45: Medium-Density Residential, Liberty Heights Avenue & Carsdale Avenue in Park Heights

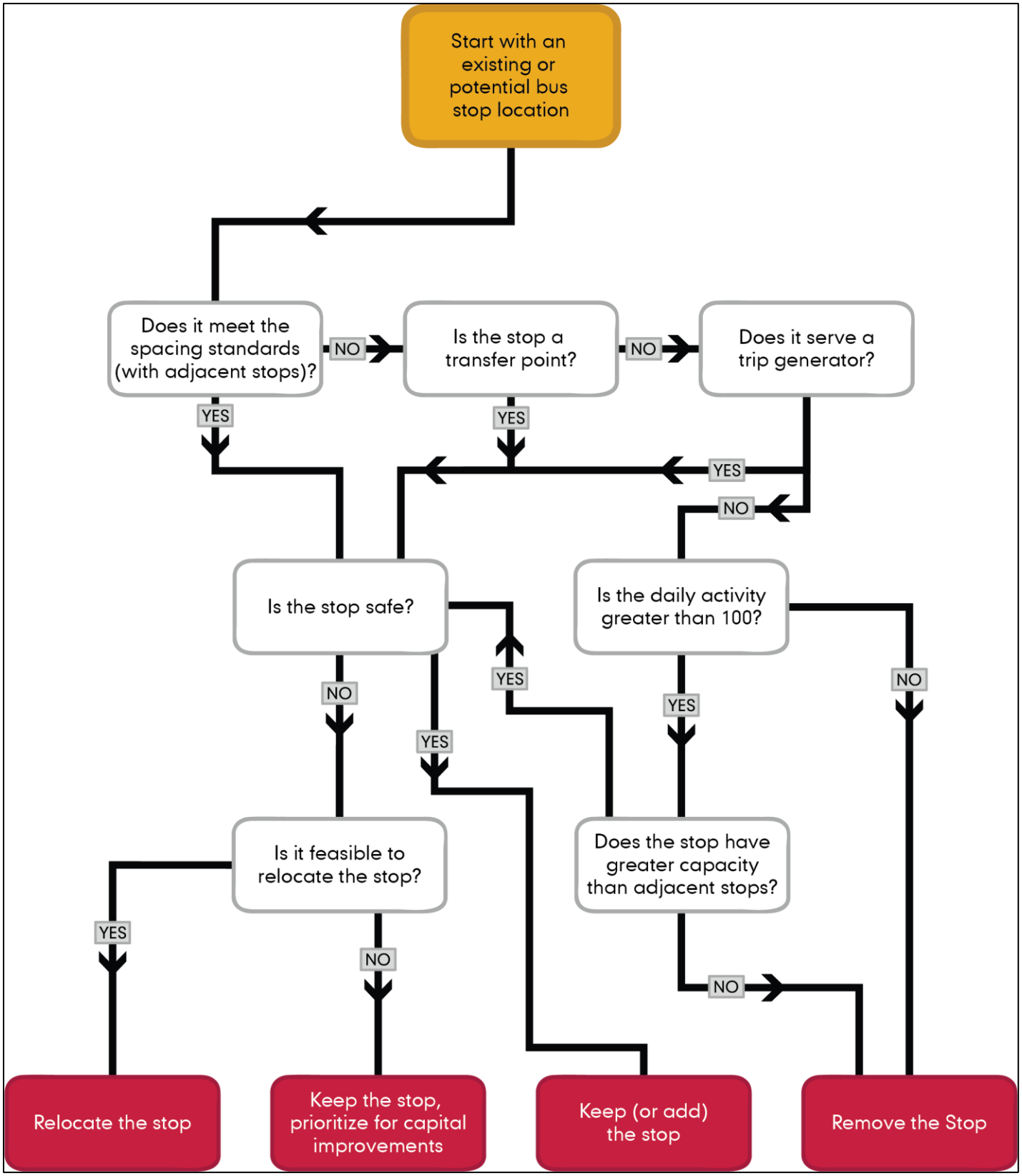
Figure 46: Low-Density Residential, Edmondson Avenue & Osborne Avenue in Catonsville

Figure 47: Suburban/Rural, Ritchie Highway & Hamburg Street in Pasadena

MDOT MTA periodically reviews bus stop spacing throughout an entire route or street/road corridor as part of a comprehensive bus stop optimization process. Bus stop optimization can improve safety for passengers and operators, increase operational efficiency, reduce travel time, improve reliability, and create consistent and predictable spacing between stops. Input is received from operators, transit riders, community groups, elected officials, and MDOT MTA staff on a rolling basis and analyzed based on the nature of the request, existing conditions, and timeframe.

The following flowchart (Figure 48) describes the process for optimizing bus stops on a BaltimoreLink route, with the goals of increasing safety, efficiency, and reliability. Note that because each stop is reviewed in its unique location and context within the transit network, there may be exceptions to the process as described in the flowchart.

Figure 48: Bus stop optimization process (in coordination with other agencies)



3.2 Bus Stop Modifications

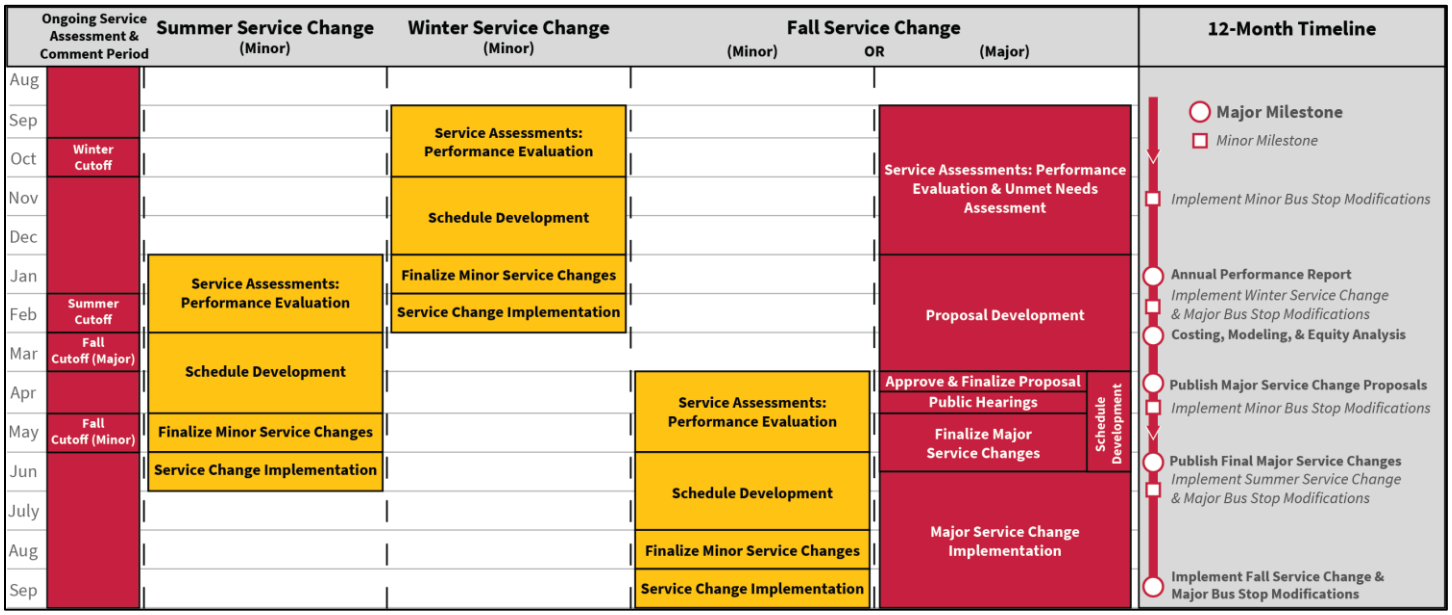
Bus stop modifications may originate through an MDOT MTA analysis of local conditions using the guidelines in this section, or by request from elected officials, community organizations, passengers, or property owners.

Most BaltimoreLink stops are located within the public right-of-way on public property. While not everyone uses public transit, it plays an essential role in the economy upon which all Marylanders depend, and MDOT MTA has a legal obligation to serve people of all races, ethnicities, ages, abilities, and incomes.

Adding, relocating, or removing a bus stop is a complex and costly process that involves many issues related to access, safety, and operational efficiency. Modifying bus stops also requires analysis and coordination among stakeholders.

While MDOT MTA receives requests year-round, MDOT MTA implements modifications to bus stops five times per year (Figure 49). Bus stop modifications are made in conjunction with bus route service changes each February, June, and September. Bus stop modifications may be made between service changes in April and November, but only where a stop has been deemed by MDOT MTA as unsafe (based on the factors listed on pg. 44) and the bus stop is not a timepoint on any BaltimoreLink route (these modifications would adversely affect schedules and operator assignments).

Figure 49: Service Planning Timeline



MDOT MTA attempts to locate bus stops where they will be most convenient, safe, and least intrusive. Most BaltimoreLink stops are located within the public right-of-way on public property. Ultimately, factors related to the access, safety, and security of street and road users take priority and may override the concerns of property owners when determining transit stop locations.

3.2.1 Adding Bus Stops

The BaltimoreLink network has been optimized so that bus stops are generally spaced at appropriate distances to balance access and efficiency. It is neither feasible nor efficient for every origin and destination point in the transit network to have a bus stop directly in front of it. Walking a reasonable distance to start and end each transit trip is a normal part of using public transit.

All new stops must improve the transit network as a whole by strategically improving access to bus routes while maintaining operational efficiencies that enable passengers to reach their destinations quickly and reliably.

The following factors related to access, safety, and operational efficiency are considered when evaluating proposed new bus stop locations:

Access

1) Transit need, defined by demographics, socioeconomics, and other criteria;
2) Access to (and at) the proposed stop in compliance with the Americans with Disabilities Act (ADA), including the boarding and alighting area, sidewalks, curb ramps, and pedestrian crossings;
3) Equity, as defined and measured by Title VI of the Civil Rights Act of 1964;
4) Amenities, including the feasibility of installing seating or a shelter;
5) Block lengths, street connectivity, presence of controlled pedestrian crossings, and topography around the proposed stop;
6) Curb space uses (i.e. loading, parking) and available curb space for buses to dwell.

Safety

1) Lighting, visibility, and protection from vehicle traffic for waiting passengers;
2) Presence of controlled pedestrian crossings;
3) Ease of bus movement in and out of the proposed stop;
4) Volumes and movements of traffic other than transit.

Operational Efficiency

1) Routes that would serve the proposed stop, including their service type (CityLink, LocalLink, or Express BusLink) and their frequency of service;
2) Land uses surrounding the proposed stop and their suitability for transit service;
3) Spacing between adjacent stops and compliance with the Bus Stop Spacing Guidelines (Table 14);
4) Travel time and dwell time effects on bus operations and passengers' trips;
5) Potential ridership, primarily in the form of passengers who currently do not have adequate access to the transit network.

Before a stop is permanently added to the transit network, notification letters are sent to property owners and occupants on the adjacent and opposite block faces. While MDOT MTA can place stops within the public right-of-way if it has received approval from the appropriate local government body, MDOT MTA invites property owners and occupants to provide input.

3.2.2 Relocating Bus Stops

Most BaltimoreLink stops are located within the public right-of-way on public property. MDOT MTA strives to provide safe, efficient, reliable transportation to as many people as possible. The relocation of a bus stop is a complex and costly process that involves a variety of safety and operational considerations, requiring input and cooperation from internal and external stakeholders. Relocating a bus stop is a decision that should not be made lightly.

MDOT MTA engages with adjacent property owners to consider nuisance issues such as littering or rude behavior around its stops.

MDOT MTA relocates bus stops only when there is a major safety concern (based on the factors listed on pg. 44) or there is an opportunity to improve the safety, accessibility, or operational efficiency at a new location that has been evaluated and confirmed by MDOT MTA staff. The same factors related to access, safety, and operational efficiency that are involved in adding a new stop to the network are considered in the evaluation of a potential new location for an existing stop.

3.2.3 Removing Bus Stops

To increase the efficiency of the transit network, MDOT MTA may choose to discontinue a single bus stop or several bus stops on a street segment or route. To remove a stop, MDOT MTA analyzes the stop for safety, accessibility, transfer points, trip generators, ridership, and spacing guidelines (Table 14).

Whenever a bus stop is proposed to be removed, a rider notice will be posted and public comments will be collected during a 30-day period. Comments concerning or originating from persons with disabilities, older adults, and access to public or social services (e.g. schools, libraries, community centers, churches, medical facilities) will be closely reviewed.

Safety/Accessibility

It is vitally important that passengers only access the bus network where it is safe to do so. Because street infrastructure is the responsibility of MDOT SHA and local departments of transportation, MDOT MTA can make only minor accessibility improvements at bus stops. Bus stops without a safe waiting area, sidewalks, crosswalks, or lighting may be relocated to safer and more accessible locations.

The bus stop at Wabash Avenue & Belvedere Avenue (Figure 50) is an example of a stop removed due to safety concerns. This stop was located on a very narrow shoulder between a high-speed arterial road and a tall fence. Because relocating the fence would not have been feasible, and because passengers could access safe alternative stops within a reasonable walking distance, this stop was removed.

In contrast to the former stop on Wabash Avenue that did not meet safety guidelines, the bus stop at Ritchie Highway & MDOT MVA (Figure 51) has a sidewalk connecting the stop to the nearest intersection and adequate area to wait for, board, and alight the bus, despite its similar context on a high-speed arterial road.

Figure 50: Former bus stop not meeting safety guidelines at Wabash Avenue & Belvedere Avenue

Figure 51: Bus stop meeting safety guidelines at Ritchie Highway & MDOT MVA in Glen Burnie

Transfer Points

For the transit network to operate efficiently and effectively, passengers must be able to connect between services. Bus stops should be maintained at locations where passengers can connect to CityLink, LocalLink, Express BusLink, Light RailLink, Metro SubwayLink, Commuter Bus, MARC Train, and other transit providers. Bus stops may be retained at transfer points even if they do not meet spacing guidelines.

Ridership

Because MDOT MTA has limited resources it is sometimes necessary to discontinue service to bus stops that are used by only a small number of passengers. Stops with less than ten boardings and alightings per day may be considered for removal if it is not needed to meet the Bus Stop Spacing Guidelines in Table 14.

A bus stop with more than 100 boardings and alightings per day is a useful stop that should be retained. However, even stops that have more than 100 passengers a day may be removed when they are close to another stop, adjacent to a stop that functions as a transfer point, or adjacent to a stop with greater capacity for waiting passengers or amenities such as a bus shelter.

Trip Generators and Special Considerations

Many origins and destinations in the transit network are very important to serve as directly as possible. Before removing a stop, consideration is given to nearby schools and universities, healthcare facilities, services and dense housing for people with disabilities and older adults, large employers, community centers, and other major points of interest. Bus stops near some trip generators may be retained even if they do not meet spacing guidelines.

3.2.4 Modifications During Construction

Construction and maintenance near bus stops, whether related to public infrastructure or private development, is inevitable. It is vital that state and local government agencies and private developers coordinate with MDOT MTA to ensure that passengers can safely access the transit network during periods of construction or maintenance.

Requirements for construction and maintenance near bus stops:

- Where existing pedestrian routes to bus stops are blocked, alternative routes usable by passengers with disabilities and detectable by passengers with visual impairments must be provided (Figure 52).
    - Alternative routes must have a smooth, continuous hard surface through their entire length.
    - Alternative routes must be signed and utilize barriers and channelizing devices, even if installation of these barriers reduces vehicle capacity of the adjacent roadway (Figure 53).
    - Temporary walkways less than 5 feet wide through their entire length must provide passing spaces 5 feet by 5 feet at intervals no longer than every 200 feet.
- Traffic control devices, including variable message signs, must not interfere with accessible paths to bus stops. If a traffic control device must block access to a bus stop, then an accessible temporary bus stop must be established during construction.
- Where an alternative route to an existing bus stop cannot be provided, both Temporary Traffic Control (TTC) and Maintenance of Traffic (MOT) plans must include a temporary bus stop. Temporary bus stops must be accessible to passengers with disabilities, with accessible boarding and alighting and waiting areas (Figure 54). Appropriate signage and notice must be provided to passengers.
    - A temporary bus stop should be signed by posting a corrugated plastic temporary bus stop sign provided by MDOT MTA (Figure 55)
    - Local government agencies and private developers may mount a temporary bus stop sign on a temporary support they provide during construction.

Guidelines for construction and maintenance near bus stops:

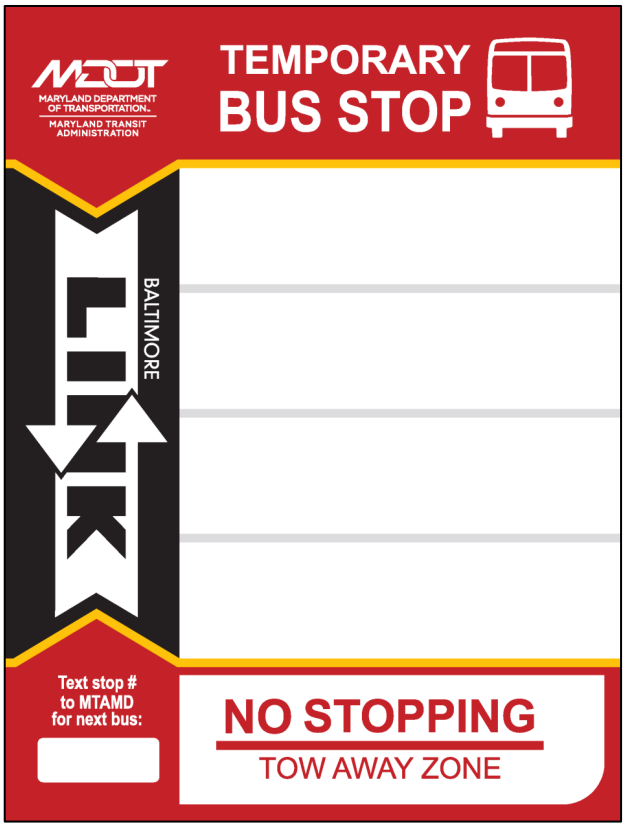
- MDOT MTA should be involved in the planning of traffic control during construction. MDOT MTA seeks to minimize delay for passengers when creating detours, but street closures are not within its jurisdiction.
- Pedestrian routes during construction should be located on the same side of the street as the construction activity to reduce pedestrian crossings.

Figure 52: Construction near a bus stop (credit: FDOT)

Figure 53: Channelized alternative route (credit: Roads & Bridges)

Figure 54: Temporary boarding and alighting area at St. Paul Street & 31st Street in Charles Village

Figure 55: Temporary bus stop sign



3.3 Operational Considerations

3.3.1 Layovers

Layovers are essential to the efficient operation of the BaltimoreLink bus network. Layovers help recover time lost to delays, provide breaks for operators, and enable operators to switch shifts.

Layovers may be located on- or off-street, within the public right-of-way or on private property. Regardless of location, at a layover buses should be expected to dwell for a few minutes or longer several times per day. During this time an operator may need to keep the bus engine idling.

Figure 56: BaltimoreLink layover blade

Size requirements for layovers vary based on the maximum number of buses expected to dwell at the location at the same time. Table 15 prescribes the minimum lengths of bus layover areas based upon the maximum number of buses scheduled to layover at the same time. The minimum lengths account for the space required for each bus to pull into the layover area, layover in a stacked or queued fashion, and pull out independently.

Each layover bay should be signed with a layover blade (Figure 56) to indicate where operators should align the front of the bus. Where the layover area is also a bus stop, the layover blade should be located below the bus stop sign.

Table 15: Minimum Bus Zone Length at Bus Layover Areas (in ft.)*

40 ft. buses \ 60 ft. buses	0	1	2	3	4	5
0	-	110	195	280	365	450
1	90	200	285	370	455	540
2	155	265	350	435	520	605
3	220	330	415	500	585	670
4	285	395	480	565	650	735
5	350	460	545	630	715	800

* An additional 10-25 feet may be required at the front of the layover area to enable buses to maneuver back into the vehicle travel lane.

The following sections about private property, roadway surfaces, turn radii, and driveways provide additional guidance about operational considerations relevant to siting layover locations.

3.3.2 Private Property

In a limited number of cases, MDOT MTA may need to operate transit vehicles on private property. Where a transit route terminus or layover location is located on private property, the viability and success of that route may depend on reliable access to that private property. To formally establish the terms by which transit operates on private property, MDOT MTA seeks to obtain Memoranda of Agreement (MOA) or Memoranda of Understanding (MOU) with property owners. These MOA/MOU consider the span and frequency of transit service and its effects on the built infrastructure and other uses of the property.

Requests for transit service that would operate through private property are analyzed according to MDOT MTA Service Standards and the rule of directness, which requires that bus stops be "on the way" to other destinations following a relatively straight path of travel.

3.3.3 Roadway Surfaces

Roadway surfaces, shoulders, and pull-outs where buses travel must be sufficiently durable to accommodate the repetitive loads of buses. Areas where buses accelerate, decelerate, turn, and layover are of particular concern because of the loads caused by these activities. Roadway surfaces should be constructed to handle vehicles with a gross axle weight of 28,000 pounds to sufficiently accommodate all BaltimoreLink buses. For new public streets and roads, developers must meet the applicable state, county, and municipal standards.

Some BaltimoreLink routes travel on private streets and parking lots that may not be built to meet state, county, or municipal standards. Developers and property owners who want bus stops on private streets or parking lots should make certain that the site infrastructure is constructed to handle vehicles with a gross axle weight of 28,000 pounds. MDOT MTA assumes no responsibility for pavement damage on private property unless specified in a legal agreement.

3.3.4 Turn Radii

Minimizing turning speeds is critical to the safety of pedestrians, who are the most vulnerable street users. Because transit vehicles make wide turns, designing or modifying the geometry of an intersection through corner radii, stop lines, and on-street parking must carefully balance the safe travel of pedestrians and buses.

- Standard 40 ft. and articulated 60 ft. BaltimoreLink buses have an inner turning radius of approximately 22 feet, and an outer turn radius of approximately 44 feet.
- Turning speeds should be limited to 15 miles per hour or less, with turn radii as small as is feasible.
- Curb radii on streets where buses operate should be designed with a target radius of 15 feet.
- Parking may need to be restricted close to a street corner to achieve the required effective turn radii. This is a form of 'daylighting' an intersection (Figure 57, Figure 58).
- A stop line on a receiving street may need to be relocated back from an intersection to achieve the required effective turn radii. This is also a form of 'daylighting' an intersection (Figure 57, Figure 59, Figure 60).
- Other modifications to striping at intersections may be made to achieve the required effective turn radii, including shifting through lanes (Figure 58).
- At intersections where buses turn, bus stops for the turning bus route should be located only on the far side of the intersection.

Where problem turns are identified, MDOT MTA will work with the applicable local jurisdiction or MDOT SHA to propose modifications to stop lines, other striping, and on-street parking.

Figure 57: 40 ft. standard bus turning sweep at 'daylighted' intersection

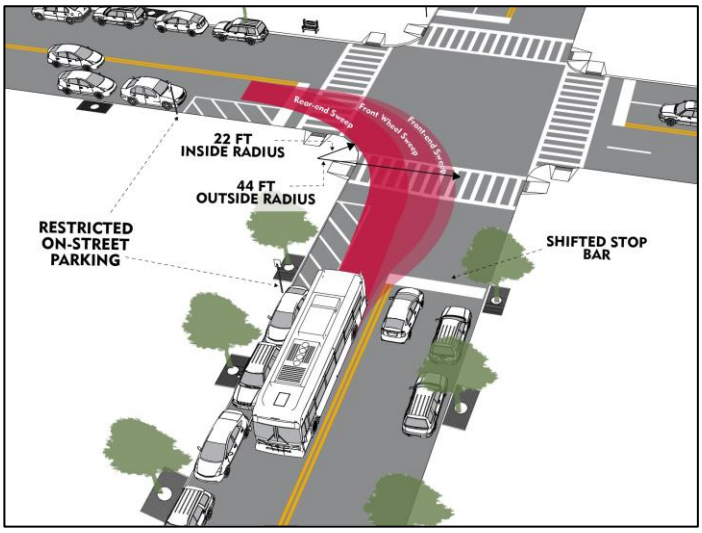


Figure 58: 60 ft. articulated bus turning sweep at intersection with shifted through lane

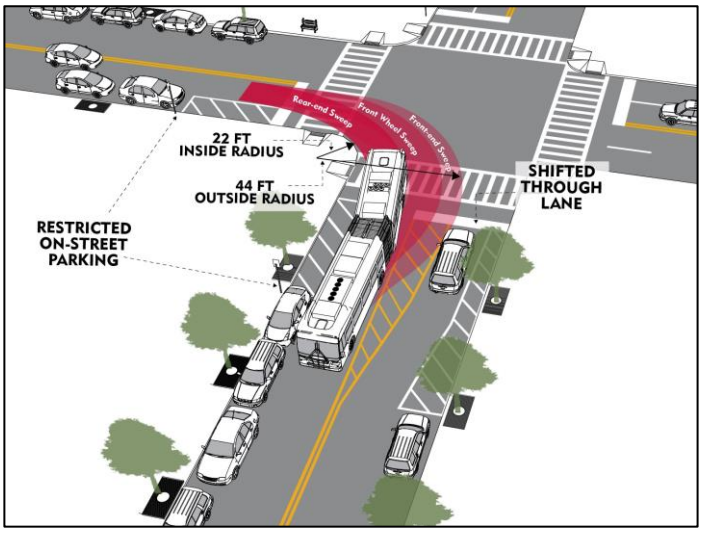


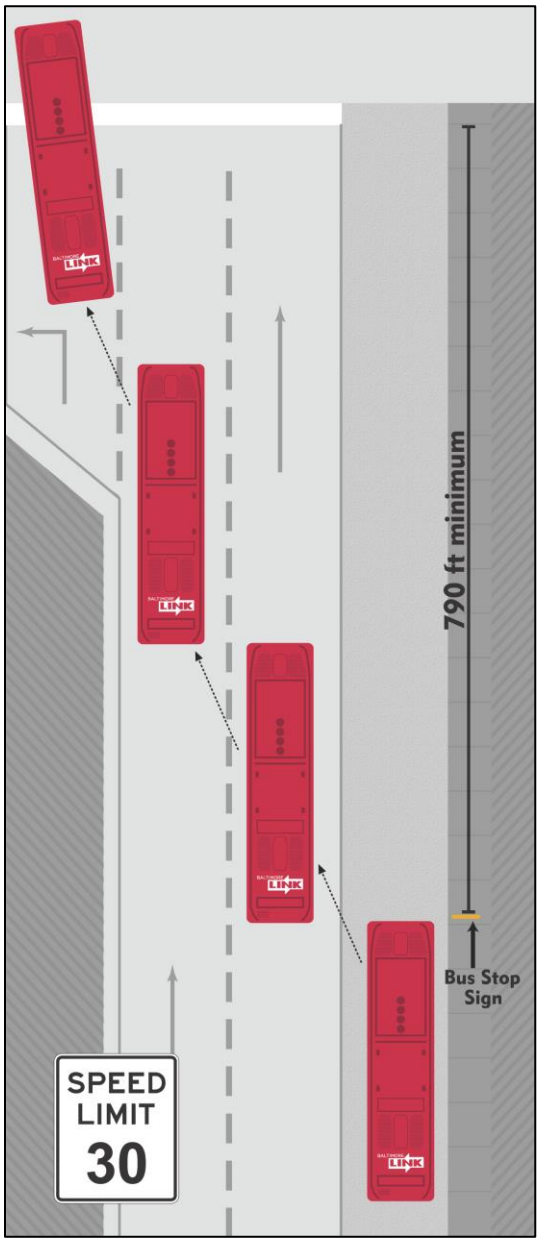
Figure 59: 40 ft. bus turning at intersection with shifted stop bar at Howard Street & 27th Street in Remington

Figure 60: 40 ft. bus turning at intersection with shifted stop bar at Howard Street & 27th Street in Remington

3.3.5 Left Turns

Where a bus operating on a multi-lane street must serve a bus stop before making a left turn to continue its route, there must be adequate distance between the bus stop and intersection for the bus to safely shift into traffic, change lanes, and come to a stop at a signalized intersection.

Figure 61: Example of a left turn approach after a bus stop on a shoulder



The minimum distance between the bus stop and intersection is determined by the posted speed limit and required lane changes, including merging into traffic from a shoulder. Table 16 prescribes the minimum lengths required for a bus to make a left after a bus stop, sorted by posted speed limit.

Table 16: Minimum Distance Between a Bus Stop and Left Turn (in ft.)[4,5]

Posted Speed Limit	Lane Changes			
	1	2	3	4
30 MPH or less	430	610	790	970
35 MPH	625	875	1,125	1,375
40 MPH	780	1,080	1,380	1,680
45 MPH	1,080	1,430	1,780	2,130
50 MPH	1,415	1,865	2,315	2,765
55 MPH	1,830	2,380	2,930	3,480

For example, the LocalLink 76 must serve a bus stop on Wilkens Avenue before making a left turn onto Maiden Choice Lane. The posted speed limit on Wilkens Avenue is 30 MPH, and a bus must make three lane changes (Figure 61) prior to the left turn. Therefore, the total minimum distance between the bus stop and intersection is 790 feet.

For the LocalLink 76 to operate safely, a bus stop at Wilkens Avenue & Pidgeon Court, 450 feet from the intersection with Maiden Choice Lane, was eliminated. The bus stop in service at Wilkens Avenue & Alan Drive, located 1,000 feet from the intersection, complies with the minimum lengths required to safely shift into traffic, change lanes, and come to a stop in the left turn lane at the intersection with Maiden Choice Lane.

[4] American Association of State Highway and Transportation Officials (AASHTO). *A Policy on Geometric Design of Highways and Streets*. American Association of State Highway and Transportation Officials (AASHTO), Washington, DC: 2011.
[5] Illinois Department of Transportation (IDOT). *Bureau of Design and Environment Manual*. Illinois Department of Transportation (IDOT), Springfield, IL: 2010.

3.3.6 Steep Grades

Heavy-duty buses are less able to travel on steep ascending grades than smaller vehicles. Roadway grades should therefore be considered to preserve safety, efficiency, and uniform operation of bus service.

All BaltimoreLink buses are capable of achieving and maintaining a speed of 40 miles per hour on a 2.5 percent ascending grade and 15 miles per hour on a 10 percent ascending grade.[6] Changes in grade on roads and streets with BaltimoreLink bus service should be six percent or less to operate within the limits of the bus suspension and to avoid causing damage to the bus or roadway.

While it is possible for a BaltimoreLink bus to serve a street such as East Saratoga Street in Downtown Baltimore (Figure 62) with a grade of up to 10 percent, bus stops are discouraged in these locations. On such steep grades it would be difficult for passengers with mobility devices to board and difficult for buses to accelerate from the stop.

Figure 62: Steep grade on East Saratoga Street in Downtown Baltimore

[6] Maryland Department of Transportation Maryland Transit Administration. "FY20-FY24 Multiyear Bus Procurement." eMaryland Marketplace, April 14, 2017.

3.3.7 Visibility

Proper visibility, including sight distances for waiting passengers, crossing pedestrians, transit vehicle operators, and other vehicle operators, is an important component of safety at transit stops. Short sight distances due to topography or curves can prevent traffic from stopping safely behind a stopped bus.

- Bus stops shall be located where the road geometry provides safe sightlines for pedestrians, vehicle drivers, and bus operators.
- Bus stops must not be placed over the crest of a hill or around a blind curve, nor located near a corner, curve, gully, traffic island, or intersection if the stop blocks sight lines for pedestrians and vehicle drivers.
- When calculating sightlines or sight distances for a bus stop, the distances should be determined based on target speeds or posted speed limits rather than 85th-percentile design speeds.

For further guidance concerning sight distances, engineers should reference the most recent release of the AASHTO Geometric Design Guide for Transit Facilities on Highways and Streets.

3.3.8 Drainage

Sufficient drainage is necessary at bus stops to ensure that neither the roadway nor boarding and alighting area will be affected by flooding. Poor drainage at a bus stop, accessible path, or pedestrian crossing can make taking transit unpleasant or unsafe for passengers. Bus stops should be located at sites with sufficient drainage to ensure safe and reliable transit operations. MDOT MTA may relocate or temporarily remove from service a stop whose safety has been compromised by flooding.

3.3.9 Loading Zones

At locations with high volumes of freight deliveries, local jurisdictions sometimes establish dedicated on-street loading zones where regular street parking is prohibited during certain hours. Not interfering with loading zones is preferable, but there may be situations where the safest, most accessible location for a bus stop is inside a loading zone. Before creating a stop or relocating a stop in a loading zone, MDOT MTA will obtain permission from the responsible local transportation department.

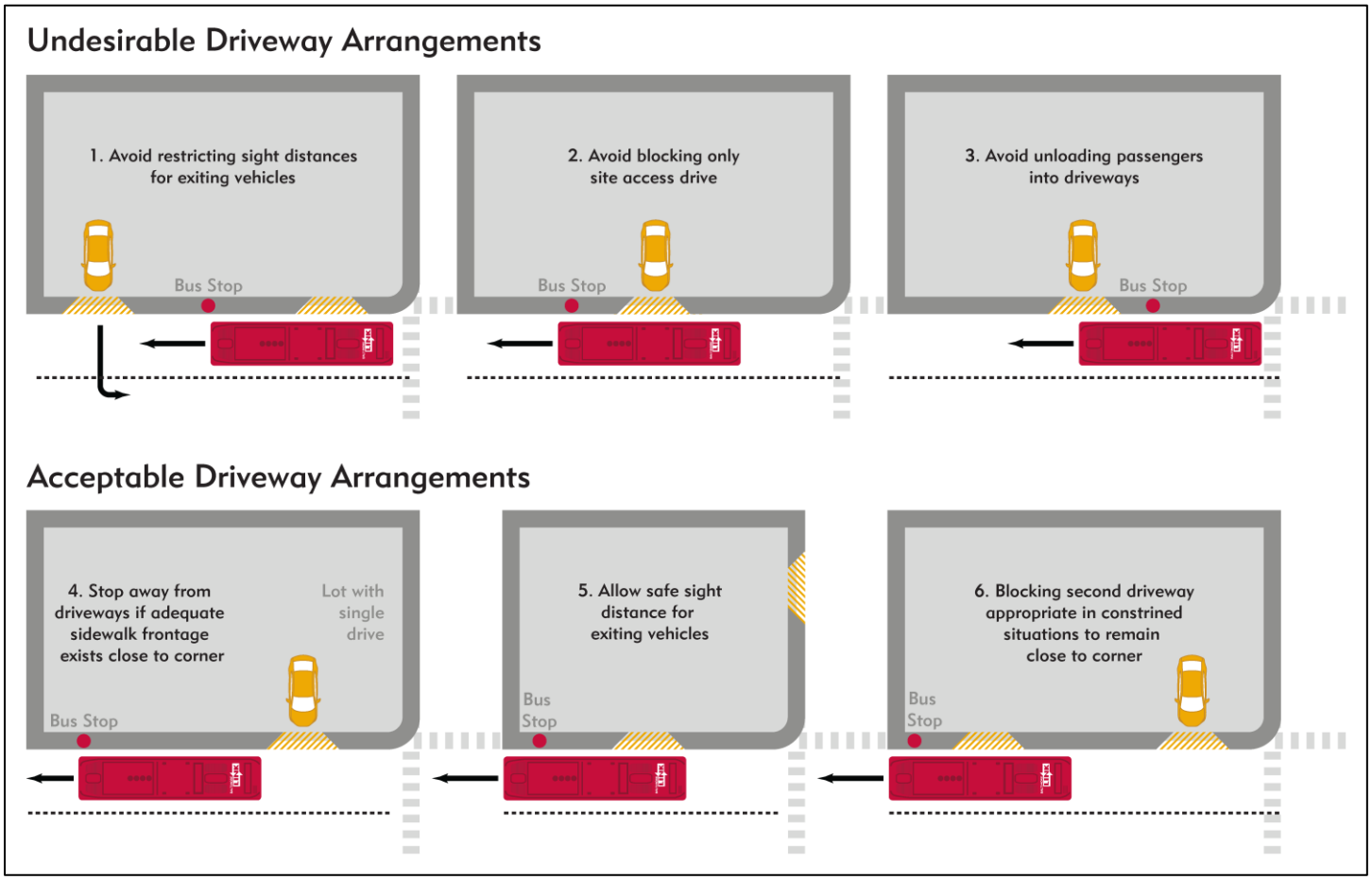
3.3.10 Driveways

Driveways and other curb cuts near bus stops can pose safety hazards for boarding and alighting passengers and transit vehicles. There are six principles that guide the siting of bus stops in relation to driveways, enumerated as follows and illustrated in Figure 63:

1. Avoid restricting sight distances for exiting vehicles.
2. Avoid blocking a driveway that provides the only access to a property.
3. Avoid unloading passengers into driveways.
4. Stop on the far side of a driveway if there is adequate sidewalk length close to the intersection.
5. Allow for safe sight distances for exiting vehicles.
6. Where there are two driveways in a constrained location near an intersection and the best stop location is on the far side of the second driveway, a transit vehicle may block the second driveway.

There may be locations where it is not possible to meet all six principles for driveway arrangements to create or preserve equal access to the transit stop. Safety and accessibility are the most important considerations when siting stops around driveways and curb cuts.

Figure 63: Driveway locations near bus stops



3.4 Summary Table – Preferred Stop Configurations

The following tables provide guidance toward the preferred configuration of bus stop based on local site conditions and bus network conditions. Table 17 makes recommendations for bus stops on streets with on-street vehicle parking and Table 18 makes recommendations for bus stops on streets without on-street vehicle parking.

Table 17: Recommended Bus Stop Configurations for Streets with On-Street Vehicle Parking

Site and Network Conditions	Near-Side Stop	Mid-Block Stop	Far-Side Stop	Other Stop Configuration
Bicycle lane or protected bicycle facility	-	-	-	Boarding island
Bus layover point is needed	-	Mid-block pull-out	-	-
Bus turns at the intersection	-	-	Far-side boarding bulb	-
Congested area with many bus routes serving the same street	-	-	-	On-street transfer center
Dedicated offset transit lane	-	-	Far-side boarding bulb	-
Driveways or no sidewalks on the far side of the intersection	Near-side boarding bulb	-	-	-
High volumes of left-turning transit vehicles and trucks on cross street	-	-	Far-side pull-out	-
Insufficient resources to make capital improvements	-	-	Far-side pull-out	-
Intersecting routes with many passengers transferring	Near-side boarding bulb	-	*On cross street:* Far-side boarding bulb	-
Large passenger volumes	-	-	Far-side boarding bulb	-
Large right-turn volumes onto transit street	Near-side boarding bulb	-	-	-
Local service and rapid service share the street	*Local service:* Near-side pull-out	-	*Express service:* Far-side boarding bulb	-
Long traffic signal cycle	-	-	Far-side boarding bulb	-
Major destination mid-block on a long block	-	Mid-block boarding bulb	-	-

Site and Network Conditions	Near-Side Stop	Mid-Block Stop	Far-Side Stop	Other Stop Configuration
Major destination on the near side of the intersection	Near-side boarding bulb	-	-	-
Queue jump or shared right-turn lane allows bus to advance to the intersection	-	-	Far-side pull-out	-
Rapid or rail transit station at mid-block	-	Mid-block pull-out	-	-
Safer pedestrian crossing conditions at mid-block than at the nearest intersection	-	Mid-block boarding bulb	-	-
Street at or near vehicle capacity	-	-	Far-side boarding bulb	-
Transit signal priority system	-	-	Far-side boarding bulb	-
Transit signal progression favoring transit vehicles	*Alternating:* Far-side pull-out and near-side pull-out	-	*Alternating:* Far-side pull-out and near-side pull-out	-

Table 18: Recommended Bus Stop Configurations for Streets *without* On-Street Vehicle Parking

Site and Network Conditions	Near-Side Stop	Mid-Block Stop	Far-Side Stop	Other Stop Configuration
Bicycle lane or protected bicycle facility	-	-	-	Boarding island
Bicycle lane or protected bicycle facility but insufficient space for bike channel	-	-	-	Shared cycle track
Bus layover point is needed	-	Mid-block in-lane	-	-
Bus turns at the intersection	-	-	Far-side in-lane	-
Congested area with many bus routes on the same street	-	-	-	On-street transfer center
Dedicated curbside transit lane	-	-	Far-side in-lane	-
Driveways or no sidewalks on the far side of the intersection	Near-side in-lane	-	-	-
High volumes of left-turning transit vehicles and trucks on cross street	-	-	Far-side in-lane	-
Intersecting routes with many passengers transferring	Near-side in-lane	-	*On cross street:* Far-side boarding bulb	-
Large passenger volumes	-	-	Far-side in-lane	-
Large right-turn volumes onto transit street	Near-side in-lane	-	-	-
Local service and rapid service share the street	*Local service:* Near-side in-lane	-	*Express service:* Far-side in-lane	-
Long traffic signal cycle	-	-	Far-side in-lane	-
Major destination mid-block on a long block	-	Mid-block in-lane	-	-
Major destination on the near side of the intersection	Near-side in-lane	-	-	-
Rapid or rail transit station at mid-block	-	Mid-block in-lane	-	-

Site and Network Conditions	Near-Side Stop	Mid-Block Stop	Far-Side Stop	Other Stop Configuration
Safer pedestrian crossing conditions at mid-block than at the nearest intersection	-	Mid-block in-lane	-	-
Street at or near vehicle capacity	-	-	Far-side in-lane	-
Transit signal priority system	-	-	Far-side in-lane	-
Transit signal progression favoring transit vehicles[7]	*Alternating:* Far-side in-lane and near-side in-lane	-	*Alternating:* Far-side in-lane and near-side in-lane	-

[7] National Association of City Transportation Officials. *Transit Signal Progression*. Retrieved March 12, 2019. https://nacto.org/publication/transit-street-design-guide/intersections/signals-operations/transit-signal-progression/.

4 Bus Stop Design and Amenities

4.1 Signage

4.1.1 Bus Stop Sign

The bus stop sign is the single most important element of a bus stop, and it must be placed at every single stop in the network. The sign marks the area where passengers should stand while waiting to board a bus, provides passengers with essential information about the routes serving a stop, and serves as a guide for the operator of where to stop. Although passengers have more access to online stop location information than ever before, all passengers rely on bus stop signs to be certain of where they can access the transit network.

As part of the BaltimoreLink complete network redesign and rebranding, MDOT MTA created a new bus stop sign design scheme to be used throughout the bus network (Figure 64). The goal of the new signage is to communicate better information in a clear, easy-to-use fashion at all bus stops. The sign provides the following information:

- Route Identifier: color or number of the route(s) serving the stop.
- Route Destination: direction of travel with destination/terminus/endpoint.
- Route Frequency: headway/frequency of the route (i.e. 'Frequent' if every 15 minutes or better, 'Peak-Only' if service is only available during weekday AM and PM peak periods.
- Route Span: span of service (i.e. '24 hours' if weekday service is available 24 hours a day).
- Stop ID: unique identifier for the stop, used for real-time arrivals information.

At Tier I – Off-Street Transfer Centers and Tier II – On-Street Transfer Centers, the alternate signage design depicted in Figure 65 may be used to better facilitate wayfinding for customers transferring between routes.

Figure 64: BaltimoreLink bus stop sign design elements

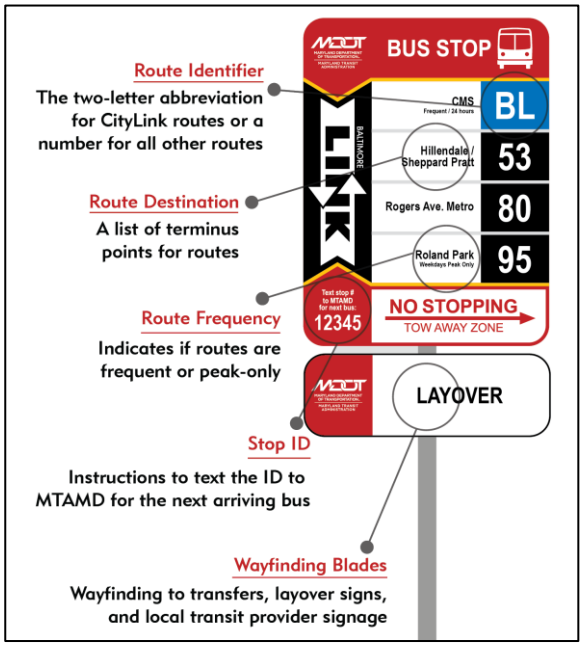


Figure 65: Alternate Tier I/II bus stop sign at West Baltimore Transfer Center

Standard BaltimoreLink bus stop signs also have the following characteristics:

- 18 inches wide and minimum of 24 inches tall; taller signs for stops served by more than 5 routes.
- Contrasting colors, route numbers at least two inches tall, and a reflective finish to make the sign more legible to passengers, even when read from a distance.

To ensure that bus stop signs are clearly visible by passengers, bus operators, and other street users, the following standards must be followed to the maximum extent feasible when installing bus stop signs:

- Where BaltimoreLink bus stops are also served by other transit providers, the BaltimoreLink bus stop sign must be installed at the top of the post.
- The bottom edge of a bus stop sign must be at least 7 feet above the ground and signs must be installed so that the nearest edge of the sign is at least 2 feet from the curb (Figure 66).
- A bus stop sign must be mounted at an angle perpendicular to the street (Figure 67).
- Bus stop signs must neither block nor be blocked by other signs.
- Bus stop signs must not be obscured by trees, bushes, or other objects. Where a sign must be placed at an existing bus stop located at a sidewalk 4 feet or less in width and adjacent to the curb, the sign may be placed at the back of the sidewalk (Figure 68).
- Where a sign is placed adjacent to the travel lane of a road without a curb, the nearest edge of the sign must be at least 6 feet from the edge of pavement.

Figure 66: Bus stop sign height

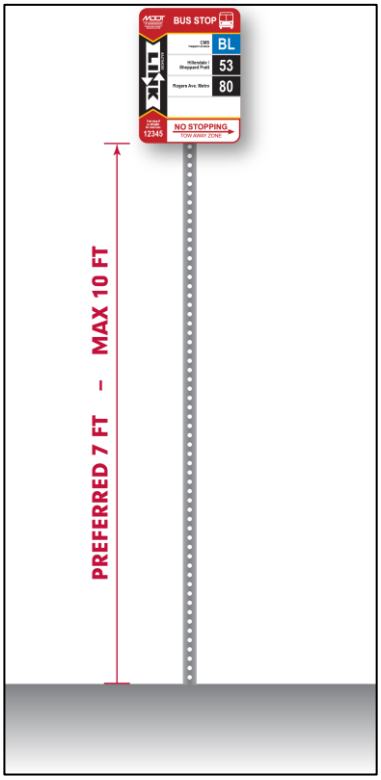


Figure 67: Bus stop sign orientation

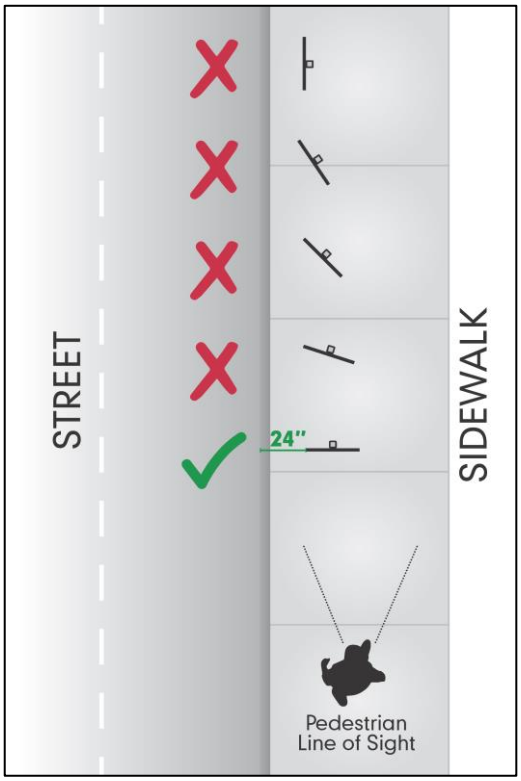
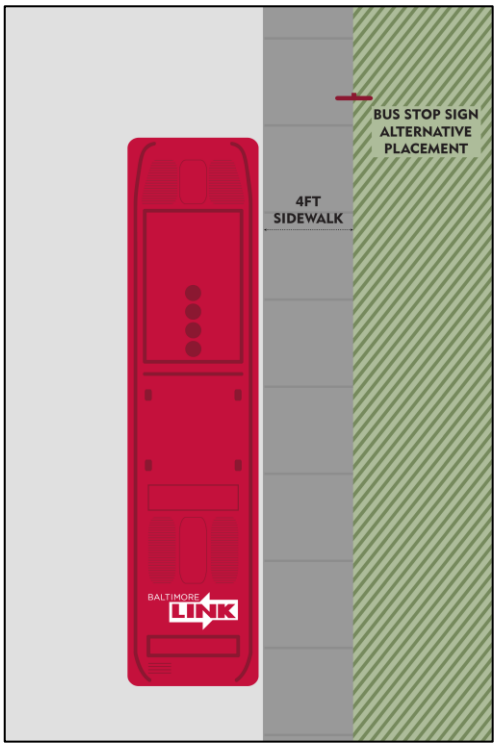


Figure 68: Alternative bus stop sign placement at narrow sidewalk



4.1.2 Supplemental Signs

Signs other than the bus stop sign may be installed by MDOT MTA to provide information to transit passengers and drivers. Secondary and Regulatory Signs communicate to drivers the extents of the bus stop along the curb, where they are prohibited from stopping or parking their vehicles. Blades communicate wayfinding and other information.

Secondary Sign

Secondary Signs are MDOT MTA-branded no stopping signs. These signs, which have an arrow pointing left (downstream), should be installed at the rear of Near-Side Pull-Out Stops and Mid-Block Pull-Out Stops to provide buses with sufficient space to maneuver into and accessibly serve the stop. In Baltimore City, Secondary Signs include “Tow Away Zone" at the bottom (Figure 67), but this element is omitted on Secondary Signs in other jurisdictions.

Figure 69: Secondary Sign for bus stops in Baltimore City

Regulatory Sign

Regulatory Signs are no stopping signs in the style of Manual on Uniform Traffic Control Devices (MUTCD) signage, without MDOT MTA branding (Figure 69). These signs, which have an arrow pointing right (upstream), should be installed at the front of Far-Side Pull-Out Stops and Mid-Block Pull-Out Stops to provide buses with sufficient space to accessibly serve the stop and maneuver back into the travel lane.

Figure 70: Regulatory Sign

Blade Sign

BaltimoreLink bus stop signs have been designed so that blades containing wayfinding and other information can be added beneath the bus stop sign.

Benefits of blades:

- Blades can provide information about nearby bus routes, rail stations, and bike share stations.
- Blades can help facilitate transfers that require passengers to walk a short distance.
- For bus operators, blades can provide information about internal circulation patterns within large campus contexts and mark layover locations (Figure 64).
- Blades can recognize Adopt-A-Stop Program participants.

Requirements for installing blades:

- Blades must be mounted below the standard bus stop sign.
- The bottom of the lowest-mounted wayfinding blade must be at least seven feet above the ground.
- The design and layout of wayfinding signs must be consistent with the BaltimoreLink graphic style.

Distances must be described in blocks or minutes walking rather than miles so that they are more quickly and easily understood.

4.1.3 Information Boxes

Information boxes are multi-sided or cylindrical transparent boxes attached to posts at bus stops (Figure 71).

Benefits of information boxes:

- Maps provide information about destinations and connections on a route (Figure 72).
- Service frequency and operating hours help to guide passengers in how and when to travel (Figure 73).

Requirements for information boxes:

- They should be mounted to the same post or pole as the bus stop sign.
- The bottom of the box must be more than 27 inches above the ground and not protrude more than 4 inches from any side of its support.
- The design and layout of information box inserts must be consistent with other printed materials.

Figure 71: Information box at Fayette Plaza with CityLink Red insert

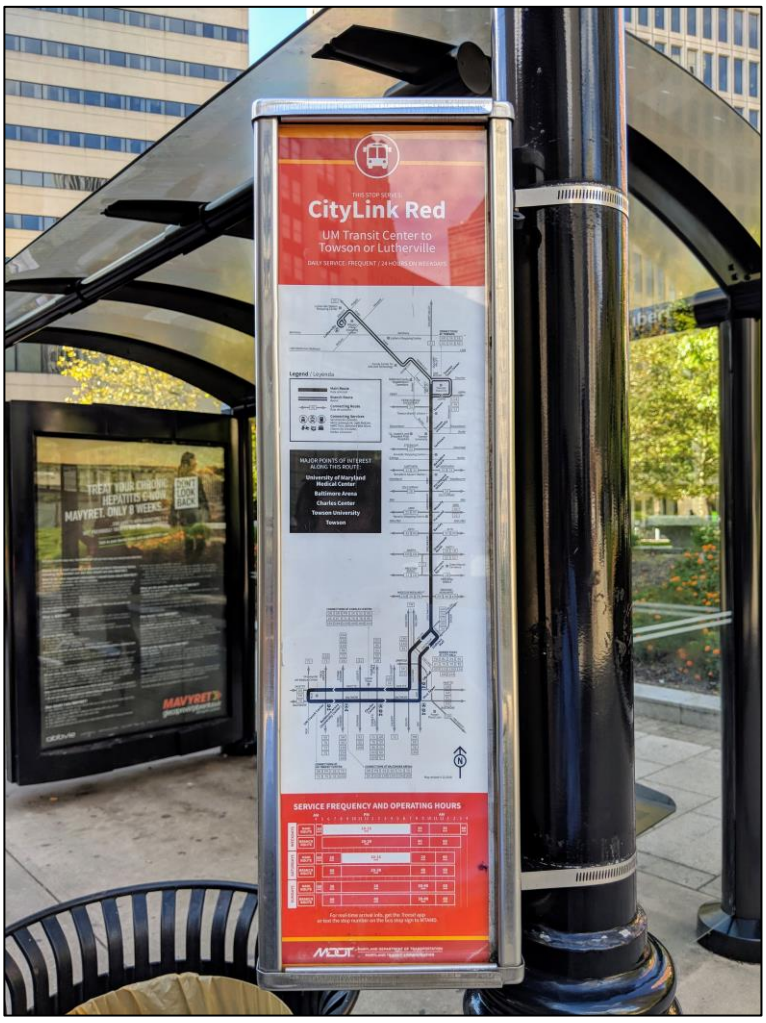


Figure 72: CityLink Red information box insert

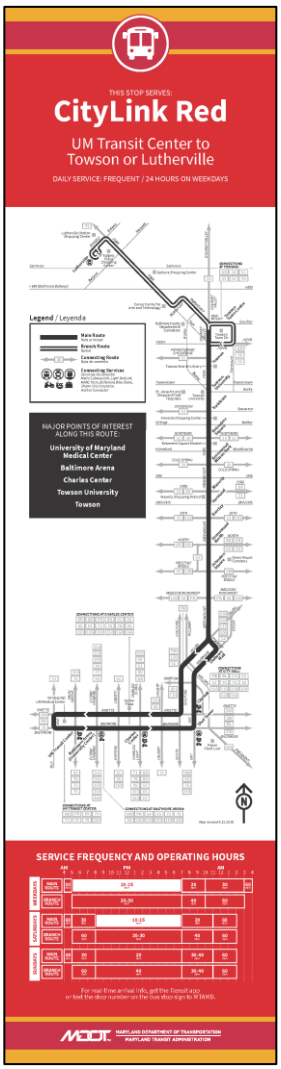
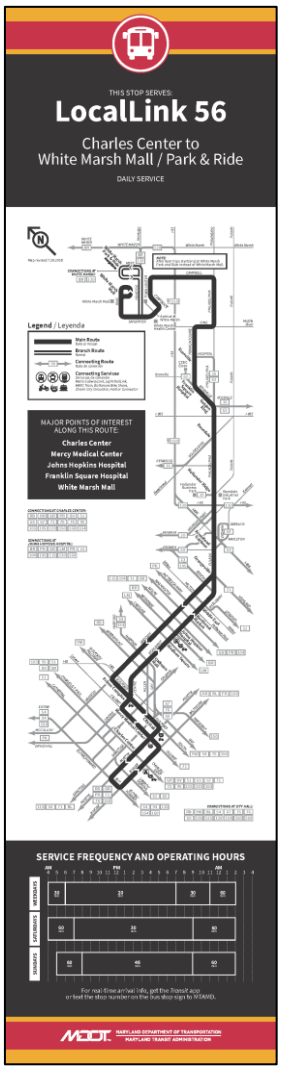


Figure 73: LocalLink 56 information box insert



4.2 Accessibility

Access to bus stops is essential to the success of the transit network. The freedom of travel afforded to transit passengers must be shared by all people in the Baltimore region, regardless of ability.

The basic accessibility requirements of transit stops are derived from the Americans with Disabilities Act (ADA) of 1990. The United States Access Board produces guidelines in accordance with the ADA. The Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) are the primary federal guidelines for accessibility relating to transit facilities.

Beyond these legal requirements and federal guidelines, MDOT MTA seeks to retrofit and expand the BaltimoreLink network through universal design, further facilitating equitable access to the transit network for all users, especially people using mobility devices, older adults, passengers with children and strollers, and passengers carrying groceries or packages.

4.2.1 Accessible Boarding and Alighting Areas

An accessible place to wait for a bus is one of the most essential elements of an accessible transit network. Accessible boarding and alighting areas help to afford equal access to transit for all passengers, including those who use wheelchairs or other mobility devices.

Benefits of accessible boarding and alighting areas:

- Universally-accessible boarding and alighting areas make using transit more comfortable and convenient.
- For passengers who use mobility devices, accessible boarding areas help empower these passengers with the freedom to travel by fixed-route bus services, reducing demand for expensive paratransit trips.

Requirements for accessible boarding and alighting areas:

- Boarding and alighting areas must include at minimum a firm, stable surface that is at least 5 feet parallel to the curb and 8 feet perpendicular to the 8-inch-high curb, and is clear of any obstacles (Figure 74).
- At existing bus stops, the construction of an ADA-compliant concrete landing pad is required when other improvements are constructed.
- The slope of the boarding area parallel to the roadway must be the same as the slope of the roadway itself, allowing a ramp to be deployed from the transit vehicle flush to the boarding area.
- The slope of the boarding area perpendicular to the roadway must be no steeper than 1:48 (approx. 2%).

Guidelines for accessible boarding and alighting areas:

- Accessible boarding and alighting areas should be constructed of a length equal to or greater than the longest bus that serves the stop. At many stops in an urban context, this may require relocating obstacles on an existing sidewalk. At many suburban bus stops, extending an existing sidewalk to the curb may be all that is required.

Figure 74: Accessible boarding and alighting area

4.2.2 Accessible Paths

The accessible boarding and alighting area described in the previous section can only be utilized by all passengers where there is an accessible path to a bus stop from the nearest street crossing.

Benefits of accessible paths to bus stops:

- Universally-accessible paths to bus stops make using transit more comfortable and convenient.
- For passengers who use mobility devices, accessible paths to bus stops empower these passengers with the freedom to travel by fixed-route bus, reducing demand for expensive paratransit trips.

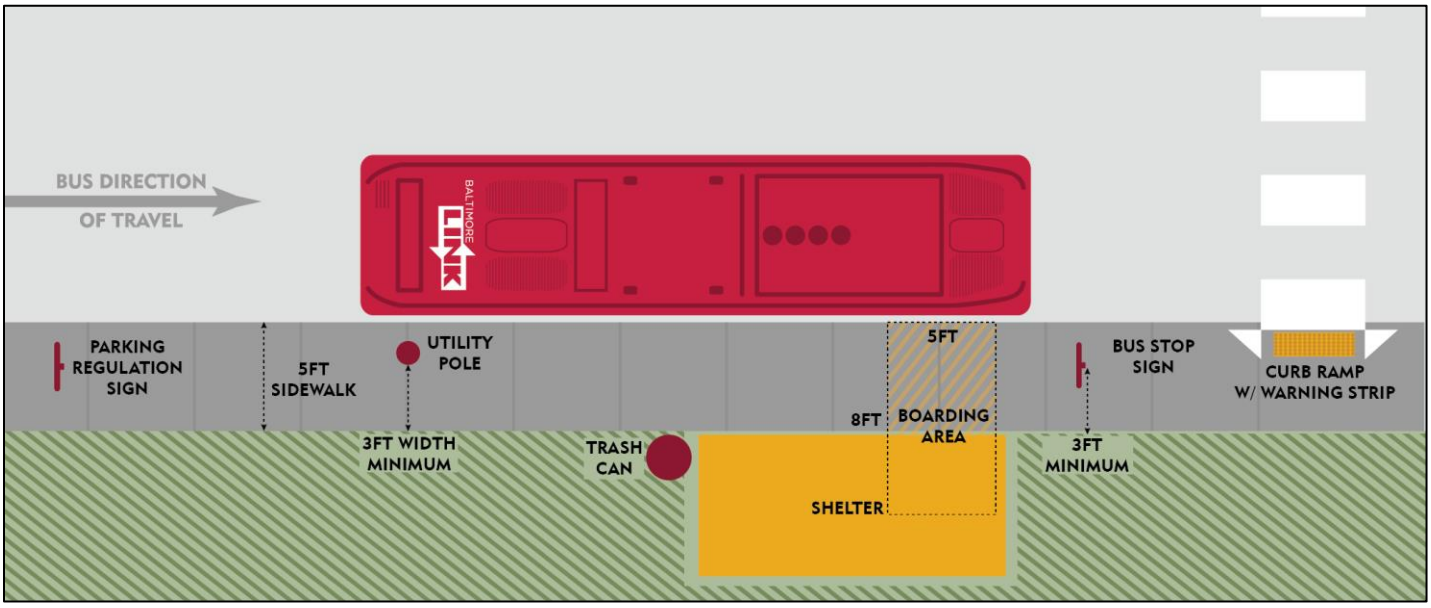
Requirements for accessible paths:

- An accessible path must have a clear, continuous width of at least 3 feet, which is the absolute minimum to allow for the movement of a person with a mobility device. The accessible path must avoid obstructions such as utility poles, streetlights, newspaper boxes, and trash receptacles.
- Vertical clearance along the accessible path must be at least 6 feet 8 inches.
- The grade of the accessible path must match that of the adjacent roadway.

Guidelines for accessible paths:

- An accessible path should be at least 5 feet in width wherever feasible. To afford greater usability, especially where there are high volumes of pedestrian traffic, accessible paths to boarding and alighting areas may have clear widths of 8 feet or more.
- Pedestrian pinch points of less than 6 feet of clear sidewalk width around transit stops should be avoided.

Figure 75: Bus stop layout with ADA-compliant accessible path



4.2.3 Accessible Crossings

Crosswalks must be available and accessible to all transit passengers. Most streets with transit have curbs and therefore have changes in grade, making curb ramps essential at almost every street crossing. Where crosswalks and curb ramps are not continuous on a transit street, people who use mobility devices may travel in the roadway, placing their safety at risk, or they may not travel by fixed-route service at all—instead relying upon expensive paratransit services.

Requirements for accessible crossings per the Americans with Disabilities Act (ADA):

- Crossings must have curb ramps at least 36 inches in width with running slopes not exceeding 8.3 percent.
- Curb ramps must be fully within the width of striped crosswalks.
- Detectable warning strips measuring at least 24 inches perpendicular to the curb must be installed at all curb ramps across their entire width.
- Where there are medians and pedestrian refuges in street crossings, detectable warning strips are required at all transitions to and from the roadway, including at protected bicycle facilities (Figure 76).

Guidelines for accessible crossings:

- Crossings should have curb ramps at least 48 inches in width.
- Detectable warning strips should be applied in a contrasting color from surrounding surfaces.
- Signalized crossings should incorporate pedestrian countdown signals.
- New signalized crossings should include accessible pedestrian signals (APS), which audibly inform pedestrians when it is safe to cross through verbal instructions or rapid percussive sounds.
- Pedestrians should not be required to push an APS button to receive a walk signal.

MDOT MTA does not own street and road right-of-way, except within Tier I – Off-Street Transfer Centers. It is not responsible for designing, installing, or maintaining accessible crossings.

Figure 76: Pedestrian crossing with refuge island and detectable warning strips at Towson Circle

4.3 Safety and Security

MDOT MTA follows the principles of Crime Prevention through Environmental Design (CPTED) in designing and siting bus stops and bus shelters. CPTED principles include natural surveillance, a design strategy keeping intruders under observation and maintaining clear sight lines in all directions. Other CPTED principles are described in this section and the Shelters section.

4.3.1 Lighting

Many passengers regularly wait for the bus before dawn or after dusk, especially during winter and at bus stops served by CityLink routes, where bus service is provided 24 hours per day. Except where installed in MDOT MTA bus shelters, lighting is not funded, installed, or maintained by MDOT MTA.

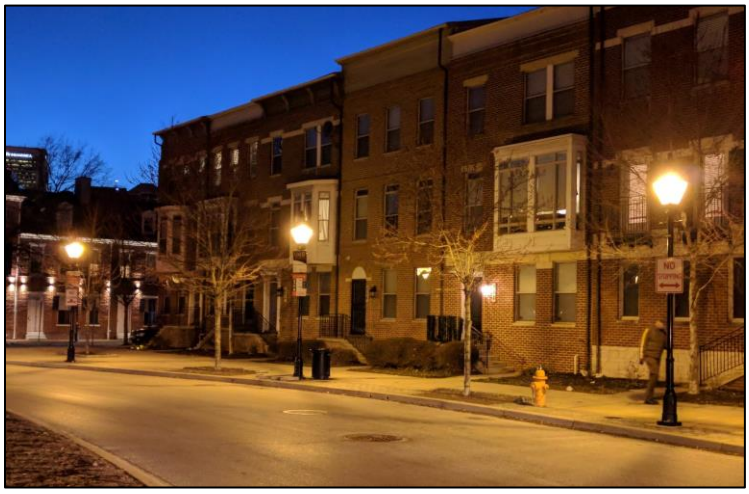
Benefits of lighting:

- Lighting enhances security for waiting passengers.
- Adequate lighting facilitates the visibility of passengers by transit vehicle operators and vehicle operators.
- Along with other security-related improvements, lighting helps to reduce perceived wait times and achieve gender equity in perceived wait times between passengers of different genders.[8]

Guidelines for lighting:

- Bus boarding areas should have between 2 to 5 foot-candles of light at night.[9]
- Pedestrian-scale lighting, with lamps 25 feet high or less, should illuminate every transit stop (Figure 77).
- "Cobra" streetlights provide some light to bus stops, but because they hang over the roadway they are less helpful to transit passengers. Where other street lighting does not exist, bus stops may be placed strategically near or under "cobra" streetlights to provide lighting.

Figure 77: Pedestrian-scale lighting at a bus stop at Albemarle Square



[8] Fan, Yingling, Andrew Guthrie, and David Levinson. *Perception of Waiting Time at Transit Stops and Stations*. University of Minnesota Center for Transportation Studies, Minneapolis, Minnesota: 2015.
[9] Texas A&M Transportation Institute. *Guidelines for the Location and Design of Bus Stops.* TCRP Report 19, Transportation Research Board, National Academy Press, Washington, DC: 1996.

4.3.2 Emergency Call Boxes

An emergency call box is a communications device integrated into a pylon mounted on the sidewalk or some accessible location, which allows a passenger to call emergency services at the press of a button (Figure 78).

Benefits of emergency call boxes:

- At bus stops located in areas with little pedestrian activity or high crime rates, emergency call boxes can increase safety for passengers.

Guidelines for emergency call boxes:

- Emergency call boxes may be installed at Tier I Off-Street Transfer Centers and Tier II On-Street Transfer Centers in areas with high crime rates. MDOT MTA is not responsible for installing emergency call boxes at any other bus stops.
- Emergency call boxes should be made easily identifiable at a distance by a bright blue light at the top of the pylon.
- Emergency call boxes can only be installed where electrical power and telecommunications connections are available. These connections are provided through utility conduit or by solar power and a cellular voice connection, depending on the restrictions of the site.

Figure 78: Emergency call box at the West Baltimore Transfer Center

4.3.3 Video Surveillance

MDOT MTA may conduct electronic video surveillance of its facilities to increase real and perceived safety for passengers. While all BaltimoreLink vehicles are equipped with video and audio recording devices, on-vehicle surveillance cannot protect passengers waiting at a transit stop. To increase the safety of passengers accessing the transit network during late night and early morning hours, video surveillance is typically deployed at Tier I and Tier II facilities served by routes that operate 24 hours per day. Surveillance equipment must be vandal-resistant and positioned to offer an optimal field of view.

4.4 Amenities Provided by MDOT MTA

For the comfort and convenience of its passengers, MDOT MTA provides amenities at some BaltimoreLink bus stops. Shelters with seating are the most common bus stop amenity installed and maintained by MDOT MTA. At Tier I – Off-Street Transfer Centers and Tier II – On-Street Transfer Centers, MDOT MTA provides additional amenities such as real-time information displays, fare machines, covered bicycle parking, and public art. Other amenities are generally the responsibility of local government and private organizations.

4.4.1 Shelters

Shelters provide a comfortable area for passengers to wait, sitting or standing, sheltered from rain, sun, snow, and wind. Providing shelters at key locations in the transit network helps MDOT MTA's commitment to customer service. In the Baltimore region, passengers experience high temperatures and humidity in the summer, occasional snow in the winter, and rain regularly throughout the year. Shelters help moderate more unpleasant aspects of the regional climate, encouraging people to use transit frequently and year-round despite the weather.

The goal for placing shelters within the BaltimoreLink network is to improve comfort for the greatest number of passengers. Shelter locations are chosen using a scoring system described in the Eligibility Scoring Criteria section.

MDOT MTA is committed to maintaining all shelters under its ownership, and contracts with vendors to regularly clean its shelters (Figure 80). Members of the public may report damaged shelters to MDOT MTA. Residents, businesses, property owners, and civic groups may take an active role in keeping shelters clean through the Adopt-A-Stop Program.

Figure 79: "Barrel" shelter at Ritchie Highway & MDOT MVA in Glen Burnie

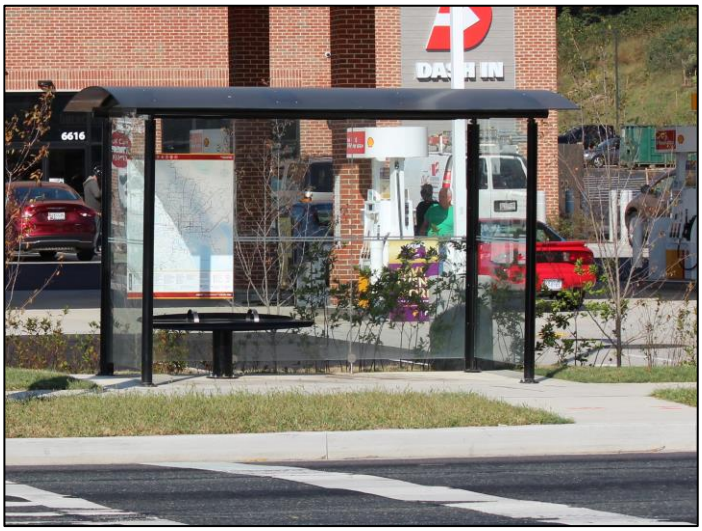


Figure 80: MDOT MTA contractor crew cleaning a bus shelter on Loch Raven Boulevard in Baltimore

Shelter Site Selection

MDOT MTA uses a three-part process to select new bus stop shelter locations. Bus stops are quantitatively scored based on several criteria, measured for installation feasibility and accessibility, and then evaluated for safety and security.

Eligibility Scoring Criteria

MDOT MTA uses a comprehensive scoring system to determine which BaltimoreLink bus stops are eligible to be considered for a bus shelter. The scoring system considers how many people wait at a stop, how long they are likely to wait, and who is likely to be waiting.

Measured by the following criteria, bus stops must score a minimum of 100 points to be eligible for a new shelter:

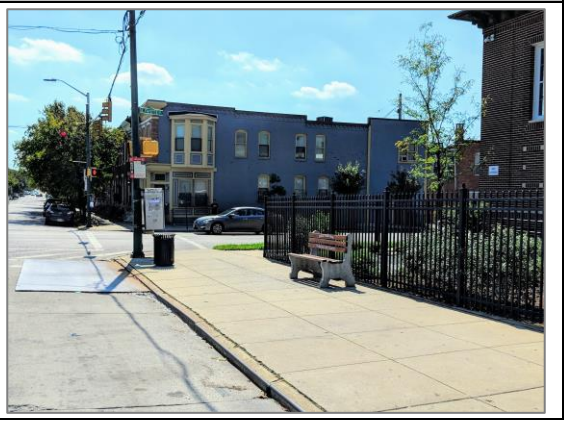
- How many people are waiting?
  - Boardings – 1 point per average weekday boarding
- How long are people waiting? (up to 25 points)
  - Transfers – 15 points if the stop is located at a named place labeled on the official BaltimoreLink system map
  - Frequency – 10 points if the stop is outside of the Frequent Transit Network (less than four buses per hour serve the stop during the weekday AM peak, midday, and PM peak periods)
- Who is waiting? (up to 50 points)
  - Title VI – 25 points if the stop is in a predominantly minority area, low income area, or both (as defined by the FTA and measured at the Census block group-level)
  - Human services facilities – 15 points if one or more of the following are within 750 feet of the stop: assisted living facility, dialysis center, hospital, pharmacy/clinic, public library, public school, recreation center, senior center, or supermarket
  - Operator Reliefs – 10 points if the stop is used by MDOT MTA operators as a relief point

Table 19 and Table 20 provide examples of the shelter scoring criteria applied to two BaltimoreLink bus stops. Stop #12302 at North Avenue & Howard Street has 118 average daily boardings, which makes the stop eligible for a shelter based on boardings alone. Stop #10579 at Linwood Avenue & Fayette Street has 26 average daily boardings but meets all the other scoring criteria, giving it a total score of 101 points, which makes the stop eligible for a shelter.

Table 19: Shelter Scoring for Bus Stop #12302

Stop #12302 North Ave & Howard St EB FS			
Criteria	**Value**	**Points**	
Boardings	118 average daily boardings	118	
Transfers	CityLink Gold to LocalLink 51 and 94	15	
Frequency	14 buses per hour	0	
Title VI	Both predominantly minority and low-income area	25	
Human services facilities	Supermarket, pharmacy within 750 feet	15	
Operator relief	Not an operator relief point	0	
Total		**173**	

Table 20: Shelter Scoring for Bus Stop #10579

Stop #10579 Linwood Ave & Fayette St SB NS			
Criteria	**Value**	**Points**	
Boardings	26 average daily boardings	26	
Transfers	LocalLink 21 to CityLink Blue and CityLink Orange	15	
Frequency	2 buses per hour	10	
Title VI	Both predominantly minority and low-income area	25	
Human services facilities	Library within 750 feet	15	
Operator relief	Operator relief point	10	
Total		**101**	

Accessibility and Installation Feasibility

Bus stops determined eligible for a shelter according to the scoring criteria are analyzed for site suitability, which includes the following factors:

- Shelters must not block accessible boarding areas, bus door opening zones, or posted information.
- A clear path to access the shelter, minimum 48 inches wide and 60 inches preferred, must be available.
- To adequately accommodate passengers with mobility devices, shelters must have a 30 by 48 inches minimum clear floor area and a 48-inch minimum approach to the floor area.

MDOT MTA installs three standard types of shelters: three-sided "Barrel" (Figure 81), one-sided "Cantilever" (Figure 82), and one-sided "Narrow Cantilever" (Figure 83).

Table 21 prescribes the minimum site envelopes required by each shelter type. For the purposes of shelter placement, urban stops are locations where buildings directly front the sidewalk, while suburban bus stops are locations where buildings are set back from the sidewalk. Each possible shelter location has its own environmental, spatial, and operational considerations.

Table 21: Shelter Types with Minimum Site Envelopes (in ft.)

Shelter Type	Dimensions (L x W x H)	Preferred Location	Minimum Site Envelope (L x W)	Minimum Setbacks		
				Front	Rear	Side
Standard *Three-sided Barrel*	12.75 x 7.00 x 7.25	Urban stops with sidewalks 12 or more feet wide	20.75 x 12.00	4/2*	1/4*	4
		Urban boarding bulb stops		4/2*	1/4*	4
		Suburban bus stops		4	n/a	4
Standard *One-sided Cantilever*	12.75 x 7.00 x 7.25	Urban stops with sidewalks between 10 and 12 feet wide with high levels of pedestrian traffic	20.75 x 10.00	2	1	4
Standard *One-sided Narrow Cantilever*	12.25 x 5.00 x 7.25	Urban stops with sidewalks <10 ft. wide with high levels of pedestrian traffic	20.25 x 8.00	2	1	4
		Urban boarding island stops		2	1	4

* Minimum setbacks are either 4 ft. front, 1 ft. rear or 2 ft. front, 4 ft. rear

Figure 81: Three-sided Barrel shelter

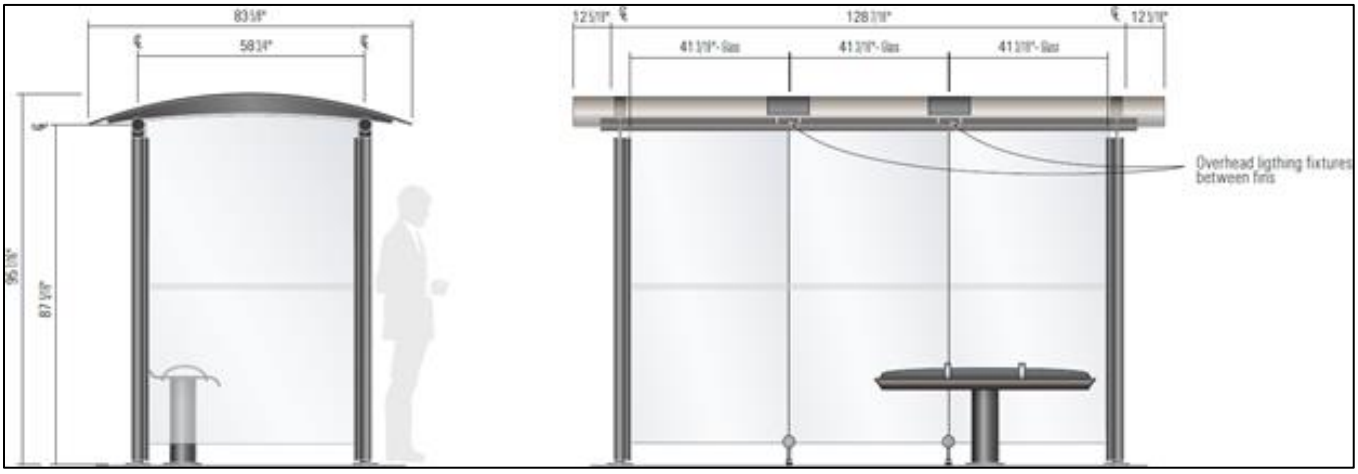


Figure 82: One-sided Cantilever shelter

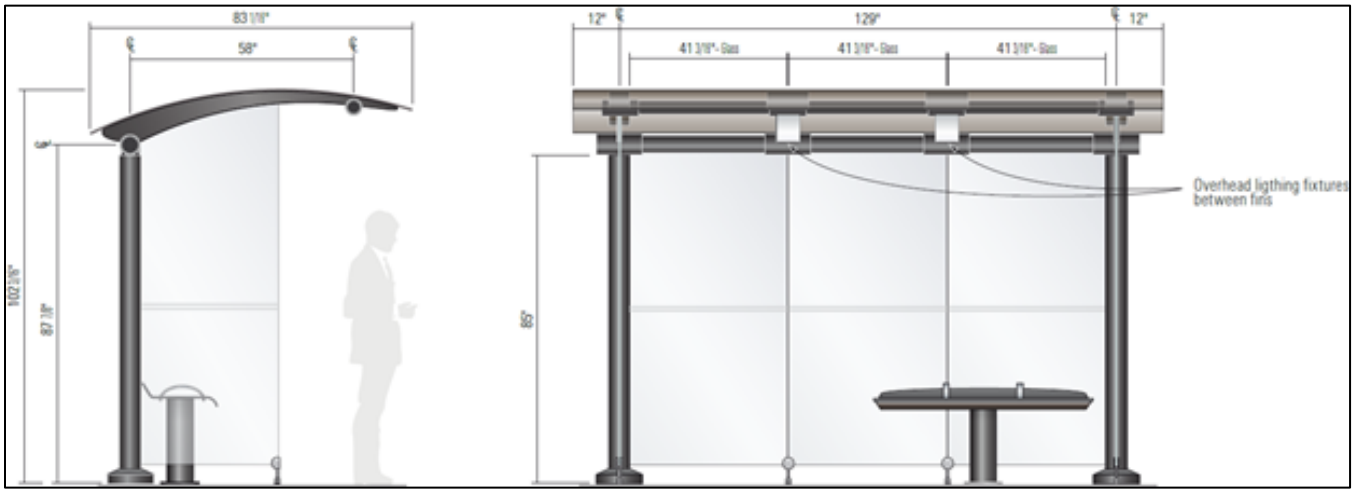
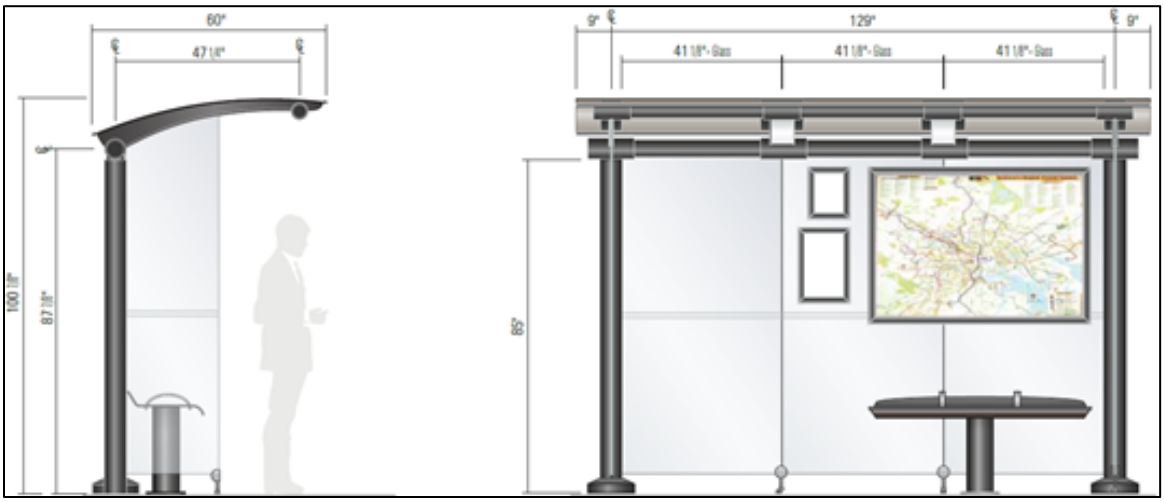


Figure 83: One-sided Narrow Cantilever shelter



Safety and Security

When evaluating a site for bus shelter feasibility, MDOT MTA considers how bus shelters interact with the buildings, vehicles, and pedestrians around them. The following requirements and guidelines apply to safety and security at bus shelters:

- All shelters must be constructed to be durable and easy to maintain.
    - Shelter foundations shall be a minimum 6-inch thick reinforced concrete pad extending at least six inches beyond the shelter footprint.
    - All shelters that could be hit by vehicles must be designed to break away when impacted.
    - Shelters must be constructed of fire retardant and graffiti-proof materials.
    - To prevent the collection of debris, facilitate cleaning, and increase security, shelter walls should not extend all the way to the ground.
- Passengers waiting at shelters must be visible to bus operators and other street users.
    - There must be adequate lines-of-sight to passengers waiting at a shelter. Signage or other obstructions may need to be relocated before installing a shelter.
    - Shelters must have an open side fronting the street, and the side of the shelter facing approaching buses must be open or made of a transparent material.
    - The rear of the shelter must be made of a transparent material.
    - The downstream side of the shelter may be opaque to create space for wayfinding and advertising.
- All new shelters shall include lighting for the waiting area when feasible (Figure 84).
    - Where a utility connection is not available nearby, solar-powered lights may be used.
    - Shelter light fixtures should not be so powerful that they create a spotlight effect that obscures the view of waiting passengers.
    - All lighting fixtures at shelters should be vandal-resistant and have no exposed bulbs or elements.
    - LEDs should be used for their reduced energy costs and long lifespan.
    - Lighting equipment should be accessible for repair and maintenance and use common components to reduce maintenance costs.

Figure 84: Bus shelter with lighting (credit: Noah Hurowitz)

Additional Shelter Guidelines

Maps and Information

Bus shelter design and maintenance should incorporate printed materials to both assist passengers with wayfinding. Shelters may include two more printed wayfinding panels, one on the rear wall and one on either side of the side wall downstream of the bus.

BaltimoreLink system maps help passengers navigate to their destinations and facilitate transfers. System maps have the following requirements and guidelines:

- System maps shall be affixed directly to the rear wall of the shelter or enclosed in a weather- and vandal-proof box. Adhesive vinyl maps should not be mounted across seams between wall panels.
- System maps must be posted on shelters at Tier I – Off-Street Transfer Centers, Tier II – On-Street Transfer Centers, and Tier III – Frequent Network Stops.
- System maps should also be posted in bus shelters at transfer locations and at stops where it is likely that new, visiting, or occasional passengers are likely to interact with the transit network.

Advertising

MDOT MTA reserves the right to contract with companies to provide advertisements on its bus shelters. All outdoor signs on bus shelters are subject to applicable local zoning regulations, standards approved by the Maryland Department of Transportation State Highway Administration, and the Code of Federal Regulations. MDOT MTA may issue further guidelines and requirements for advertising on its property through its procurement processes and contracts with advertising companies. Companies interested in advertising on MDOT MTA facilities and vehicles may visit https://mta.maryland.gov/content/advertising for more information.

4.4.2 Real-Time Information Displays

Real-time information displays, which range from simple one-color, one-line LED text displays to large LCD screens, make bus arrival information immediately available to waiting passengers. MDOT MTA installs real-time information displays at all Tier I – Off-Street Transfer Centers and some Tier II – On-Street Transfer Centers.

Benefits of real-time information displays:

- Real-time information displays increase passenger satisfaction by reducing perceived wait times.
- Real-time information displays enable passengers without mobile devices, especially passengers with low incomes and older adults, to access real-time arrival information.

Guidelines for real-time information displays:

- Displays should be sited and mounted so that they do not interfere with pedestrian traffic.
- Displays should be accompanied by audible announcements for accessibility by passengers with visual impairments. Audible announcements are preferred over tactile signs, which require that the passenger knows the sign exists and can locate it.
- Information communicated through real-time systems should be succinct: the route name or number, the destination/endpoint, and the number of minutes until the vehicle arrives (Figure 85). Displays should not scroll text or cycle screens.
- Displays should not broadcast commercial content.

Figure 85: Real-time information display at Baltimore Street & Charles Street

4.4.3 Fare Machines

Fare machines, also known as ticket vending machines (TVMs) are secure electronic kiosks that allow passengers to purchase single fares, passes, and add value to stored-value CharmCard smart cards. MDOT MTA installs fare machines at all Tier I – Off-Street Transfer Centers and at some Tier II – On-Street Transfer Centers.

Benefits of fare machines:

- Fare machines speed bus boarding by reducing the number of on-board cash payments.
- Fare machines enable passengers to purchase single fares and passes and add value to stored-value CharmCard smart cards using a credit or debit card without creating or managing an online account.

Requirements for fare machines:

- Fare machines must not block accessible paths and boarding areas, bus door opening zones, shelters, or posted information.
- Fare machines must incorporate braille or other tactile labels for buttons and keys and audible instructions for how to use the machine.
- Operable parts of fare machines must be placed at a height between 34 and 48 inches to accommodate passengers using mobility devices.

Figure 86: BaltimoreLink TVM at the West Baltimore Transfer Center

4.4.4 Covered Bicycle Racks

Transit passengers should have flexibility in travelling any segment of their trip by bicycle. MDOT MTA installs covered bicycle racks at all Tier I – Off-Street Transfer Centers and at some Tier II – On-Street Transfer Centers.

Benefits of covered bicycle racks:

- Covered bicycle racks protect bicycles from rain and snow, making bicycling a more attractive transportation option year-round.
- Covered bicycle racks increase the passenger capacity of transfer centers without adding vehicle spaces.

Requirements for bicycle racks:

- Covered bicycle racks must not block accessible paths and boarding areas, bus door opening zones, shelters, or posted information.

Guidelines for bicycle racks:

- Covered bicycle racks should be in areas with adequate lighting to discourage theft.
- Covered bicycle racks should use a high-density design that stacks bicycles using wheel channels and security bars, or hangs bicycles with wheel hooks (Figure 87, Figure 88).
- There should be at least 3 feet of clear area surrounding covered bicycle rack installations to enable passengers to access and maneuver bicycles from all sides.

Figure 87: Covered bicycle rack at Camden Station

Figure 88: Covered bicycle rack at Penn Station

4.4.5 Public Art

With the incorporation of public art, bus stops can be transformed into beautifying community anchors. MDOT MTA commissions public art for some Tier I – Off-Street Transfer Centers and Tier II – On-Street Transfer Centers.

Benefits of public art:

- Public art enhances the qualities of a place, generating more local activity and feeding a virtuous cycle of urban densification that increases transit ridership (Figure 89, Figure 90).
- Public art can provide screening around transit facilities. At the West Baltimore Transfer Center, a map-based public art installation by Cliff Garten Studio screens an operator comfort station (Figure 91).

Guidelines for public art:

- Public art installations must not interfere with accessibility at bus stops and transfer stations.
- MDOT MTA may issue requests for proposals for public art with requirements that address unique site contexts, or review unsolicited requests on a case-by-case basis.

Figure 89: Artistic 'BUS' shelter in Highlandtown

Figure 90: Artistic bus shelter at Library Square in East Baltimore

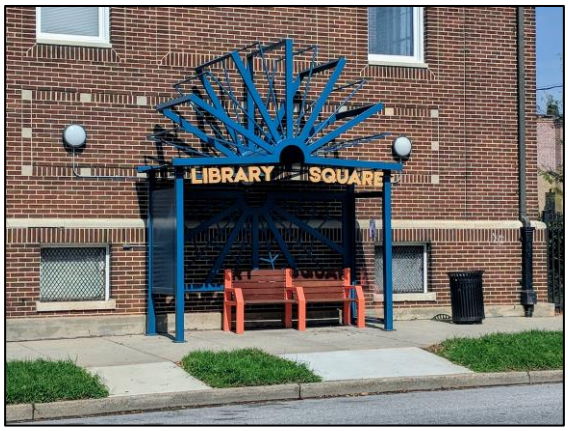
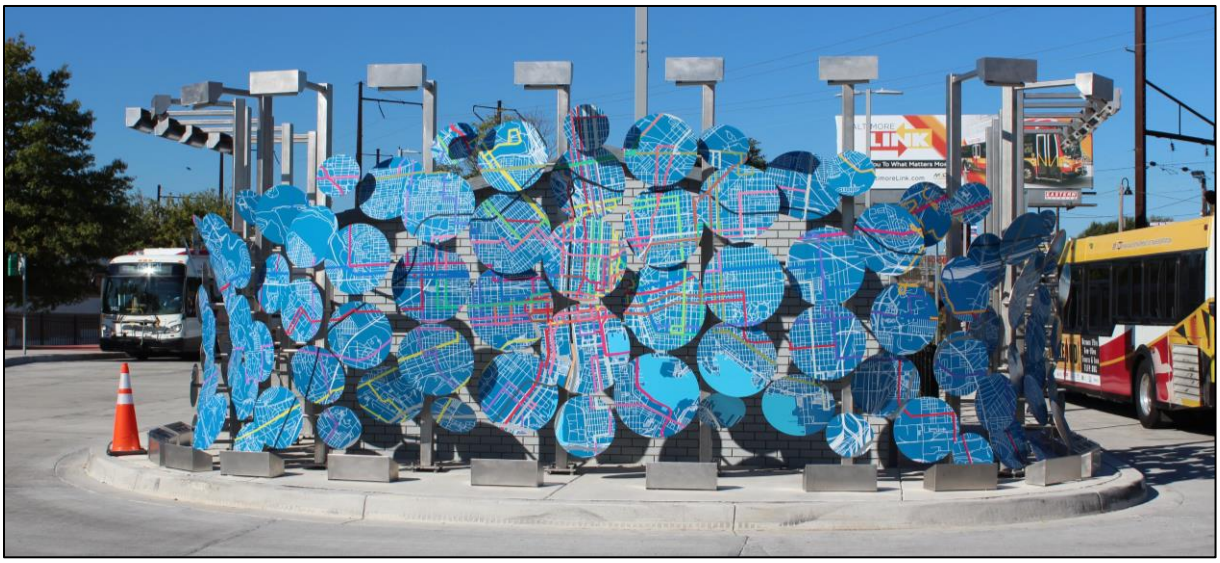


Figure 91: Public art installation at the West Baltimore Transfer Center



4.5 Amenities Not Provided by MDOT MTA

Many of the amenities enjoyed by passengers in the BaltimoreLink network are made available by organizations other than MDOT MTA. Benches, trash receptacles, bicycle racks, and other bus stop amenities are not funded, installed, or maintained by MDOT MTA. In many areas across the BaltimoreLink bus network, local governments, businesses and business improvement districts, neighborhood associations, hospitals, schools, and other organizations fund, install, and maintain amenities at bus stops to enhance the qualities of a place and to encourage use of public transit.

4.5.1 Benches

Having a place to sit while waiting for the bus makes taking transit much more comfortable and accessible. MDOT MTA has resources to install only benches attached to shelters, making seating at bus stops that do not have shelters the responsibility of local governments and private organizations.

MDOT MTA encourages local governments and private organizations to install benches at bus stops to increase passenger comfort, especially at stops with long headways between buses and at stops used frequently by older adults, people with disabilities, and children.

Requirements for benches:

- Benches must not block accessible paths and boarding areas, bus door opening zones, shelters, or posted information.

Guidelines for benches:

- Benches installed at a bus stop should provide a level of comfort appropriate for the typical wait.
- Benches should be at least 43 inches long and 20 inches wide, with the seat 17-19 inches above the ground.
- Benches should be constructed of materials that will not be excessively hot in direct sunlight or cold in freezing temperatures and should shed water easily.
- Benches should be secured to the ground, or heavy enough that they cannot be moved without equipment.

Figure 92: Bench at Dundalk Avenue & Hartwait Street in Southeast Baltimore

4.5.2 Privately-Owned Shelters

Benches and shelters may be provided by private organizations for the benefit of transit passengers, but they must meet the following requirements:

- Not obstruct boarding and alighting areas, accessible paths, door opening zones, or posted information;
- Accessible to all passengers, including passengers who use mobility devices;
- Securely attached to their foundations;
- Located at a safe distance from traffic or other hazards;
- Visible by transit operators and vehicle operators; and
- Adequately lit.

Where seating and shelters are proposed to be installed in the public right-of-way, they must be approved by the appropriate local government body. Private organizations should consult with MDOT MTA before installing a shelter at a MDOT MTA bus stop. Private organizations must adequately maintain the seating and shelters they install so that they are always safe for passengers to use.

Figure 93 and Figure 94 depict shelters installed and maintained by a hospital and a Main Street organization, respectively. MDOT MTA welcomes the assistance that these private organizations provide in improving the transit experience for all passengers.

Figure 93: Privately-owned bus shelter at Loch Raven Boulevard & Belvedere Avenue in Northeast Baltimore

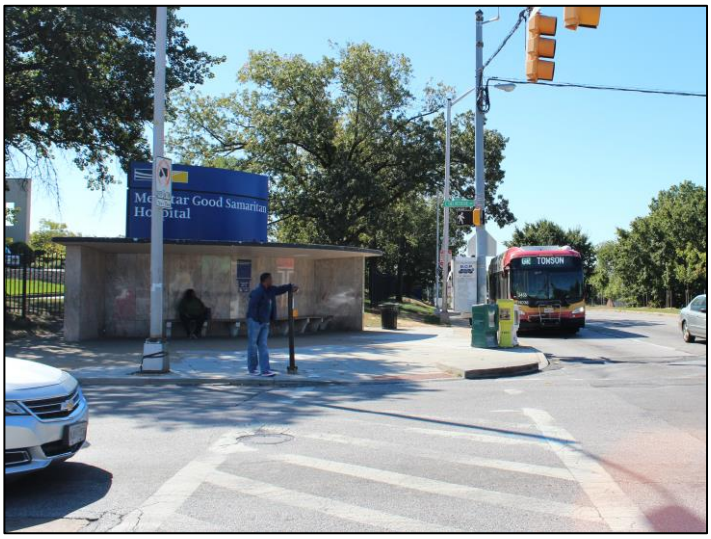


Figure 94: Privately-owned bus shelter at Belair Road & Erdman Avenue in Belair-Edison

4.5.3 Trash Receptacles

Except for trash receptacles at Tier I – Off-Street Transfer Centers and Tier II – On-Street Transfer Centers, trash receptacles at bus stops in the BaltimoreLink network are installed and maintained by local governments and private organizations.

Requirements for trash receptacles:

- Trash receptacles must not block accessible paths and boarding areas, bus door opening zones, shelters, or posted information.

Guidelines for trash receptacles:

- Trash receptacles should be placed at least 3 feet away from benches and shelters.
- Trash receptacles should be secured to the sidewalk to prevent accidental tipping or unauthorized movement.
- Where a private organization proposes to install trash receptacles in the public right-of-way, they must be approved by the appropriate local government body. Figure 95 depicts a trash receptacle provided at a bus stop by a Main Street organization.
- Private organizations and local governments must empty trash receptacles at regular, appropriate intervals so that they are not filled above capacity and do not emit foul odors.

Figure 95: Trash receptacle at Eastern Avenue and South East Avenue on Highlandtown Main Street

4.5.4 Bicycle Racks

Transit passengers should have flexibility in travelling any segment of their trip by bicycle. MDOT MTA encourages local governments and private organizations to install bicycle racks at bus stops.

Benefits of bicycle racks:

- Adequate bicycle parking deters people from locking bicycles to trees, sign poles, benches, and parking meters, and keeps the bus boarding and alighting area clear of bicycles (Figure 97).
- Increase access to BaltimoreLink in suburban areas where residents may live too far from bus stops to reach them by walking in a reasonable amount of time.

Requirements for bicycle racks:

- Bicycle racks must not block accessible paths and boarding areas, bus door opening zones, shelters, or posted information.

Guidelines for bicycle racks:

- Bicycle racks should be constructed of square tubing with a 2 inch minimum outside diameter, and sited in areas with adequate lighting to discourage theft.
- Bicycle racks should be of the “inverted U” design (Figure 96), which supports bicycles by their frames at two points in accordance with the guidelines of the Association of Pedestrian and Bicycle Professionals.
- Bicycle racks affixed to a paved surface should be approximately 3 feet in height.
- Where multiple racks are installed in a row, they should be placed 3 feet apart.
- Where multiple rows of racks are installed to form a “bicycle parking lot,” there should be 4 feet between each row, measured from tire to tire.

Figure 96: Bicycle rack at West Lombard Street & South Carey Street in Hollins Market-Union Square

Figure 97: Bus stop with bicycle rack at Washington Boulevard & Scott Street in Pigtown

4.5.5 Green Infrastructure

Green infrastructure can take several forms including planted trenches or depressions designed to remove silt and pollution from surface runoff water (called bioswales, Figure 98), planter boxes that allow surface runoff to flow and soak through them, and pervious pavement. Where proper attention is paid to infiltration rates and the flows created by storms, green infrastructure at transit stops can help achieve environmental goals without negatively affecting passengers.

Benefits of green infrastructure:

- Green infrastructure helps the State and local governments meet environmental goals, which include improving water quality, reducing loads on water treatment systems, and protecting natural habitats.
- Curb extensions with green infrastructure improve operational efficiency by converting an existing Pull-Out Stop to a Boarding Bulb Stop (Figure 99) and increase passenger comfort by creating space for additional bus stop amenities.

Requirements for green infrastructure:

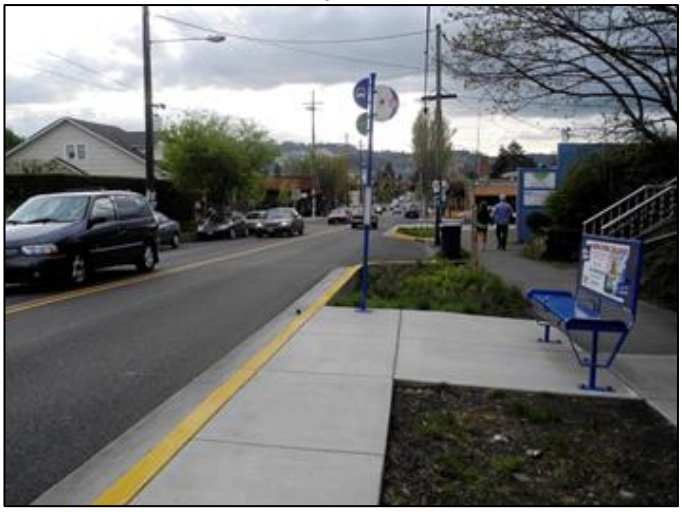
- Curb extensions with green infrastructure at bus stops must provide an ADA-compliant boarding area on a firm, stable surface that measures at least 5 feet parallel to the curb and 8 feet perpendicular to the curb, is connected to the street, sidewalk, or pedestrian way via an accessible path, and is clear of any obstructions.

Guidelines for green infrastructure:

- At bus stops that are eligible for a shelter according to MDOT MTA Shelter Site Selection guidelines, green infrastructure designs should incorporate a concrete pad of sufficient dimensions for shelter installation by MDOT MTA (see Accessibility and Installation Feasibility, pg. 75).
- Curb extensions should include a concrete sidewalk behind the curb at least 4 feet wide, with bioswales and flow-through planters sited at the rear to prevent passengers from trampling plantings (Figure 99).
- Green infrastructure should be adequately maintained to prevent trash accumulation, rodent infestation, and other safety and health nuisances.

Figure 98: Curb extension with bioswale (credit: Portland Bureau of Environmental Services)

Figure 99: Bus boarding bulb stop with bioswale (credit: citymaus/Flickr)



4.6 Operational Enhancements

4.6.1 Concrete Bus Pads

A concrete bus pad is a durable area of the road surface adjacent to a bus stop constructed of reinforced concrete (Figure 100). All Tier I – Off-Street Transfer Centers, Tier II – On-Street Transfer Centers, Tier III – Frequent Network Stops, and layover locations, such as the bus loop pictured in Figure 101, require concrete bus pads.

Benefits of concrete bus pads:

- Concrete bus pads counteract the warping of asphalt pavement under high temperatures, certain soil conditions, and—at locations with underground steam lines—the force and heat generated by heavy bus stopping volumes.
- Concrete bus pads keep their shape even with frequent stopping and starting forces from buses over many years, preventing costly bus suspension repairs.

Guidelines for concrete bus pads:

- Concrete bus pads should be as wide as the travel lane and as long as the bus stop or clear curb zone, whichever is greater.
- Concrete bus pads should be constructed in accordance with the engineering standards of the local jurisdiction.
- Concrete bus pads should end before the crosswalk so that there are no pavement seams in the crosswalk that would affect the mobility of wheelchairs.

Figure 100: Asphalt road with concrete bus pad at Dundalk Avenue & Hartwait Street in Southeast Baltimore

Figure 101: Concrete bus loop at Center Place in Dundalk

4.6.2 Pilot and Temporary Enhancements

MDOT MTA is constantly looking for new and innovative methods of improving BaltimoreLink bus service. From time to time, MDOT MTA may use trials, prototypes, and pilot projects to demonstrate the benefits of enhancements to bus infrastructure. Pilot and temporary enhancements may be tested by MDOT MTA for an appropriate period and, if successful, adopted into the *Bus Stop Design Guide* and made permanent either by keeping the enhancements in place or engineering a permanent replacement of the temporary enhancements. Pilot and temporary enhancements may include but are not limited to those described in this section.

Temporary Boarding Platforms

Modular platforms made of plastic with self-connecting components enable MDOT MTA to pilot boarding bulb and boarding island stops without needing to engineer and construct modifications to street infrastructure. This innovative technology can improve safety and accessibility for bus passengers and other street users at low cost and low risk.

Benefits of temporary boarding platforms:

- Temporary boarding platforms improve operational efficiency by converting a Pull-Out Stop to a Boarding Bulb Stop or Boarding Island Stop (Figure 103) and increase passenger comfort by creating additional waiting area.
- Temporary boarding platforms with integrated bicycle ramps enable State and local governments to pilot dedicated bicycle facilities without negatively affecting bus passengers.

Requirements for temporary boarding platforms:

- Platforms must provide an ADA-compliant boarding area on a firm, stable surface that measures at least 5 feet parallel to the curb and 8 feet perpendicular to the curb, is connected to the street, sidewalk, or pedestrian way via an accessible path, and is clear of any obstructions.
- Platforms must be resistant to physical impacts, loads, UV exposure, and adverse weather conditions.
- Platforms must have reflective edges for visibility by drivers and other street users.
- Bus stop signage shall be located on the existing sidewalk and aligned with the boarding area (Figure 103).

Figure 102: Boarding island stop with temporary platform at Harford Road & Hamilton Avenue in Northeast Baltimore

Figure 103: Bus stop sign placement at boarding island stop with temporary platform

4.6.3 Amenities at Operator Relief Points

To operate a transit network efficiently, it is sometimes necessary for a transit operator to relieve another operator away from an operating division or transfer center. BaltimoreLink bus operators should have a safe, comfortable location to wait with adequate lighting and a bus shelter with seating.

Operator Comfort Stations

For transit operators to provide passengers with safe, efficient, reliable transit service with world-class customer service, they should have access to comfort stations (restroom facilities) during their shifts. These are typically located at the end of the route at layovers, where they interfere least with scheduled bus operations.

Requirements for operator comfort stations:

- For routes with scheduled round trip travel time of less than one hour, restroom facilities are required at or near the layover location at one end of the trip.
- For routes with scheduled round trip travel time of one hour or more, restroom facilities are required at or near the layover locations at both ends of the trip.

Guidelines for comfort stations:

- A layover location is served with restroom facilities if there is an MDOT MTA-owned comfort station or an accommodating business close enough that it can be used within a layover of approximately 10 minutes.
- Comfort stations are strongly recommended where many layovers take place, especially at Tier I – Off-Street Transfer Centers such as the West Baltimore Transfer Center (Figure 104).
- Bus operators are provided with a list of comfort stations available for regular use at layover and relief locations and for emergency use between layover locations. This list is periodically updated.

Figure 104: Comfort station at the West Baltimore Transfer Center

4.7 Adopt-A-Stop Program

Like streets, sidewalks, parks, and squares, bus stops are integral elements of the public spaces that connect communities. The Adopt-A-Stop program empowers residents, businesses, property owners and neighborhood civic groups who want to help keep their communities clean to 'adopt' a BaltimoreLink bus stop. The program helps maintain the large BaltimoreLink bus stop network and foster a sense of investment in the transit network.

Participants in the Adopt-A-Stop program must agree to:

- Regularly clean the adopted stop, including nearby walkways and street areas, at minimum once every other week or more frequently if needed to prevent litter and other debris from accumulating and becoming a nuisance.
- Call immediately for pickup of illegally dumped large, heavy items.
- Report or remove graffiti as soon as possible.
- Clear snow and ice from the stop and adjacent areas, including the shelter where applicable.
- Observe safety guidelines provided on the Adopt-A-Stop homepage.

At adopted bus stops, MDOT MTA:

- Responds to calls about heavy item pickup, graffiti, and snow clearance within two days.
- Coordinates publicity efforts with the adopter to solicit local media coverage, as requested.

After two months of successful adoption, MDOT MTA presents Adopt-A-Stop volunteers with a sign installed at their designated bus stop, recognizing their company or group for its participation along with an adoptee recognition certificate.

To apply, volunteers may choose one or more BaltimoreLink bus stops and fill out the online Adopt-A-Stop agreement form at https://mta.maryland.gov/adopt-a-stop.

Figure 105: Bus stop adopted by the University of Maryland Baltimore-Washington Medical Center.

Figure 106: Signage at bus stop adopted by Zeta Phi Beta, Tau Eta Zeta Chapter

4.8 Summary Table – Bus Stop Features

Table 22 summarizes the features required (●), preferred (⊙), and optional (○) at BaltimoreLink bus stops.

Table 22: Bus Stop Features Hierarchy

	Tier I	Tier II	Tier III	Tier IV	Tier V
Feature	Off-Street Transfer Center	On-Street Transfer Center	Frequent Network Stop	Standard Bus Stop	Coverage Bus Stop
Signage					
Bus stop sign	●	●	●	●	●
Wayfinding blades	●	●	○	○	○
Accessible signage	○	○	○	○	○
Information box	○	○	○	○	○
Accessibility					
Boarding and alighting area	●	●	●	●	●
Path to/from stop	●	●	●	●	○*
Curb ramp at crossing	●	●*	●*	●*	○*
Detectable warning strips at crossing	●	●*	●*	●*	○*
Crosswalk at controlled intersection	●	●*	●*	○*	○*
Crosswalk with pedestrian refuge island	○	○*	○*	○*	○*
Safety and Security					
Lighting	●	●*	●*	●*	⊙*
Emergency call box	●	⊙	○*	○*	○*
Video surveillance	●	⊙	○	○	○
Amenities Provided by MDOT MTA					
Shelter	●	●	⊙	○	○
System map	●	●	⊙	○	○
Area map	●	⊙	○	○	○
Real-time information display	●	⊙	○	○	○
Fare machine	●	○	○	○	○
Covered bicycle rack	●	○	○	○	○
Public art	⊙	○	○	○	○
Amenities Not Provided by MDOT MTA					
Bench	○	○*	○*	○*	○*
Trash receptacle	○	○*	○*	○*	○*
Bicycle rack	○	○*	○*	○*	○*
Green infrastructure	○	○*	○*	○*	○*
Operational Enhancements					
Concrete bus pad (in-street)	●	●	⊙	○	○
Comfort station (for operators)	●	○	○	○	○

* MDOT MTA is not responsible for designing, installing, or maintaining these bus stop features.

Document History

This document will be updated annually as needed by MDOT MTA. Modifications to the *Bus Stop Design Guide* will be noted on this page with each new version.

Appendices

Appendix A: Resources

Americans with Disabilities Act (ADA) of 1990. Public Law 101-336. 108th Congress, 2nd session (July 26, 1990).

Auckland Regional Transport Authority (ARTA). *Bus Stop Infrastructure Design Guidelines*. Auckland, New Zealand: May 2009.

Central Ohio Transit Authority (COTA). *Bus Stop Design Guide*. Columbus, Ohio: 2014.

Champaign-Urbana Urbanized Area Transportation Study (CUUATS). *Transit Facility Guidelines*. Urbana, Illinois: 2013.

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Fan, Yingling, Andrew Guthrie, and David Levinson. *Perception of Waiting Time at Transit Stops and Stations*. University of Minnesota Center for Transportation Studies, Minneapolis, Minnesota: 2015.

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Maryland State Highway Administration (SHA). *Maryland Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)*. Baltimore, Maryland: December 2011.

Maryland Transit Administration (MTA). *Maryland Transit Guidelines*. Baltimore, Maryland: May 2002.

National Association of City Transportation Officials (NACTO). *Transit Street Design Guide*. New York, New York: 2016.

New York City Department of Transportation (DOT). *Street Design Manual*. New York, New York: 2015.

OmniTrans. *Transit Design Guidelines*. San Bernardino, California: March 2013.

Rosenblum, Sandra. *Meeting Transportation Needs in an Aging-Friendly Community.* Journal of the American Society on Aging, San Francisco, California: Summer 2009.

TriMet. *Bus Stops Guidelines*. Portland, Oregon: July 2010.

U.S Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans.* Washington, District of Columbia: October 2008.

United States Access Board. *Americans with Disabilities Act Accessible Guidelines for Buildings and Facilities (ADAAG)*. Washington, District of Columbia: September 2002.

United States Access Board. *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG)*. Washington, District of Columbia: July 2011.

Washington Metropolitan Area Transit Authority (WMATA). *Guidelines for the Design and Placement of Transit Stops*. Washington, District of Columbia: December 2009.

Appendix B: Glossary

Except where noted, definitions are from TCRP 165, *Transit Capacity and Quality of Service Manual (3rd Edition*, 2013).

Accessible path – A pedestrian route for use by passengers to access a boarding and alighting area that has, in accordance with the Americans with Disabilities Act of 1990 (ADA), a clear width of at least 36 inches and vertical clearance of 80 inches along the route.

Accessibility – The measure of the ability or ease of all people to travel among various origins and destinations.

Accessibility, persons with disabilities (full accessibility) – The extent to which facilities are free of barriers and useable by persons with disabilities, including wheelchair users.

Alight – To exit a transportation vehicle.

Alignment – In transportation, the horizontal and vertical layout of a roadway, railroad, transit route, or other facility as it would appear in plan and profile. The alignment is usually described on the plans using technical data, such as grades, coordinates, bearings, and horizontal and vertical curves, see also *roadbed* and *formation*.

Amenity – An object or facility intended to enhance passenger comfort or transit usability.

Americans with Disability Act of 1990 (ADA) – Federal civil rights law which ensures people with disabilities equal opportunity to fully participate in society, the ability to live independently, and the ability to be economically sufficient.

Articulated bus – An extra-long, high-capacity bus that has the rear body section or sections flexibly but permanently connected to the forward section. The arrangement allows the vehicle to bend in curves and yet have no interior barrier to movement between the two parts. Typically, an articulated bus is 54-60 feet long with a passenger seating capacity of 60-80 and a total capacity of 100-140.

Automatic passenger counter (APC) – An automated system that counts the number of passengers boarding and alighting a transit vehicle. The information is used for data analysis, or for real-time activities such as providing signal priority only to buses that are at least half full.

Automatic vehicle location system (AVL) – A system that determines the location of vehicles via electronic equipment that communicates a signal back to a central control facility. AVLs are used for detecting irregularity in service and often combined with a computer-aided dispatch system.

Bicycle lane, unprotected – An exclusive space for bicyclists on the road designated with pavement markings and signage.[10]

Board – To enter a transportation vehicle.

Boarding and alighting area – A firm, stable, and slip-resistant surface that is at least 5 feet parallel to the curb and by at least 8 feet perpendicular to the curb, is clear of any obstacles, and has a cross slope no greater than 2 percent; should maintain vertical clearance and be connected to existing infrastructure via an accessible path.

[10] National Association of City Transportation Officials. *Conventional Bike Lanes*. Retrieved February 10, 2017. http://nacto.org/publication/urban-bikeway-design-guide/bike-lanes/conventional-bike-lanes/.

Boarding island – A pedestrian refuge within the right-of-way and traffic lanes of a highway or street. It is provided at designated transit stops for the protection of passengers from traffic while they wait for and board or alight from transit vehicles.

Bollard – An upright fixed block (usually metal or concrete) used to prevent the unauthorized or unintended entry of vehicles into an area.

Bus – A self-propelled, rubber-tired road vehicle designed to carry a substantial number of passengers (at least 16; legal definitions may differ slightly as to minimum capacity), commonly operated on streets and highways. A bus has enough headroom to allow passengers to stand upright after entering. Propulsion may be by internal combustion engine, electric motors, or hybrid. Smaller capacity road transit vehicles, often without full headroom, are termed vans.

Bus bay – A widening of the street or road that permits buses to stop, without obstructing traffic, while laying over or while passengers board and alight; also known as a blister, duckout, turnout, pullout, pull-off, or lay-by.

Bus bay, sawtooth – A bus bay design where the curb is indented in a sawtooth pattern, allowing buses to enter and exit bus bays independently of other buses. Often used at transit centers.

Bus boarding bulb – An extension of the sidewalk into the roadway for passenger loading without the bus pulling into the curb, gives priority to buses and eases reentry into traffic. Often landscaped and fitted with a bus shelter and other passenger amenities. Also called bus bulge, curb bulge, curb bulb, and curb extension.

Bus lane, dedicated – A highway or street lane reserved primarily for buses, either all day or during specified periods. It may be used by other traffic under certain circumstances, such as making a right or left turn, and by school buses, private shuttle buses, bicycles, and emergency vehicles as described in the traffic laws of the specific jurisdiction.

Bus stop spacing – The distance between consecutive bus stops.

Bus stop zone length – The length of roadway marked or signed as available for use by a bus loading or unloading passengers.

CityLink – Frequent, color-coded bus routes in the BaltimoreLink transit network that operate along major streets and roads in a radial pattern outside Downtown Baltimore and in an interconnected grid in Downtown Baltimore.

Controlled Intersection – Intersection with traffic signals, yield signs or stop signs to control traffic.

Corridor – In planning, a broad geographical band that follows a general directional flow or connects major sources of trips. It may contain many streets and highways and transit lines and routes.

Crosstown service – Non-radial service that does not enter the central business district.

Curb-side stop – A bus stop in the travel lane immediately adjacent to the curb.

Cycle track – An exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. A cycle track is physically separated from motor traffic and distinct from the sidewalk.[11]

[11] National Association of City Transportation Officials. *Cycle Tracks*. Retrieved February 10, 2017. http://nacto.org/publication/urban-bikeway-design-guide/cycle-tracks/.

Destination – The point at which a trip terminates.

Diagram, route – A diagrammatic illustration of the termini and time points or major intermediate stops of a transit route.

Downstream – In the direction of traffic.

Dwell Time – The time a transit vehicle spends at a station or stop, measured as the interval between its stopping and starting.

Express BusLink – Limited stop bus routes in the BaltimoreLink network focused on serving suburb-to-Downtown peak hour commuters on radial routes and suburb-to-suburb trips on orbital routes using major roads and interstate highways.

Far-side stop – A transit stop located beyond an intersection. It requires that transit vehicles cross the intersection between stopping to serve passengers.

Federal Transit Administration (FTA) – A component of the U.S. Department of Transportation, delegated by the Secretary of Transportation to administer the federal transit program under Chapter 53 of Title 49, United States Code and other statutes.

Fixed-route service – Bus service with published schedules or timetables and designated stops where passengers board and alight.

Frequency – The number of transit vehicles on a given route or line, moving in the same direction, that pass a given point within a specified interval of time.

Frequent transit – Transit that operates at a frequency of every 15 minutes or better during AM peak, midday, and PM peak periods.

Grade – Or gradient, the rise in elevation within a specified distance. For example, a 1 percent grade is a 1 ft. rise in elevation in 100 feet of horizontal distance.

Headway – The time interval between the passing of the front ends of successive transit vehicles moving along the same lane or track in the same direction, usually expressed in minutes. Also called frequency.

Intermodal – The ability to connect, and make connections between, modes of transportation; those issues or activities that involve or affect more than one mode of transportation, including transportation connections, cooperation, and coordination of various modes.

Intermodal facility – A transit stop or station at the meeting point of several routes or lines of different modes of transportation. It is located on or off the street and is designed to handle the movement of transit vehicles and the boarding, alighting, and transferring of passengers between different routes, lines, and modes.

LocalLink – Feeder or crosstown bus routes in the BaltimoreLink network that serve areas between and outside CityLink corridors, connect passengers to the frequent transit network, and enable crosstown trips.

Mid-block stop – A transit stop located not at an intersection but between intersections.

Mobility device – Any number of devices, as regulated by the ADA, that assists in mobility; a public entity must permit individuals with mobility impairments to use wheelchairs, scooters, walkers, crutches, canes, braces, or other similar devices designed for use by individuals with mobility impairments in any areas open to pedestrian use.

Mode – Transportation category characterized by specific right-of-way, technological and operational features. A form of travel (for example: walking, cycling, or traveling by bus, train, or automobile).

Near-side stop – A transit stop located on the approach side of an intersection. Transit vehicles stop to serve passengers before crossing the intersection.

Network, radial – In transit operations, a service pattern in which most routes converge into and diverge from a central hub or activity center (e.g. central business district), like the spokes of a wheel. The hub may serve as a major transfer point.

Paratransit – Forms of transportation services that are more flexible and personalized than conventional fixed-route, fixed-schedule service but not including such exclusory services such as charter bus trips. The vehicles for paratransit service are usually low- to medium-capacity highway vehicles, and the service offered is adjustable in various degrees to individual users' needs. MDOT MTA MobilityLink is the largest paratransit service in the Baltimore region.

Park-and-ride (P&R) – An access mode to transit in which passengers drive private automobiles or ride bicycles to a transit station, stop, or carpool/vanpool waiting area and park the vehicle in the area provided for that purpose (park-and-ride lot, park-and-pool lot, commuter parking lot, bicycle rack or locker). They then ride the transit network or take a car or vanpool to their destinations.

Passenger – A person who rides a transportation vehicle, excluding the operator or other crew members of that transportation vehicle. Also known as a customer or rider.

Peak – The period of the day in which the maximum amount of travel occurs, or when demand for transportation service is highest. Peaks may be specified as the morning (AM) or afternoon or evening (PM). Also known as peak period, rush hour(s).

Pedestrian refuge – A space designed for the use and protection of pedestrians, including both the safety zone and the area at the approach that is usually outlined by a protective deflecting or warning devices.

Permeable pavement – Alternative paving surfaces that allow stormwater runoff to filter through voids in the pavement surface into an underlying stone reservoir, where it is temporarily stored and/or infiltrated.[12]

Persons with disabilities – People who have physical or mental impairments that substantially limit one or more major life activities.

Platform – On a bus or streetcar, the front portion where passengers board. On a subway or light rail vehicle, the portion of a transit facility directly adjacent to the tracks or roadway at which transit vehicles stop to load and unload passengers.

[12] Maryland Critical Area Commission, 2011. *Environmental Site Design Criteria for the Maryland Critical* Area. http://dnr.maryland.gov/criticalarea/Documents/PDF/stormwater/DraftManual_ESD_Feb_2013.pdf, accessed February 16, 2017.

Public Rights-of-Way Accessibility Guidelines (PROWAG) – Federal guidelines developed by the United States Access Board that address issues of access for people with disabilities within public rights-of-way. As of February 2017, these guidelines have not yet been adopted as enforceable standards under Title II of the ADA.[13]

Queue – A line of vehicles or people waiting to be served by a system in which the rate of flow from the front of the line determines the average speed within the line; slow-moving vehicles or people joining the rear of the queue are usually considered a part of the queue.

Queue jump – A short section of exclusive or preferential lane that enables buses to bypass an automobile queue or a congested section of traffic. A queue-jump is often used at signal-controlled freeway on-ramps in congested urban areas to allow high-occupancy vehicles preference.

Queue jump lane – Right-turn lane upstream of an intersection that a bus can use to bypass queued traffic at a signal.

Right-of-way (ROW) – A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to transportation purposes. For transit, rights-of-way are categorized by degree of separation: fully controlled without grade crossings, also known as grade-separated, exclusive, or private ROW; longitudinally physically separated from other traffic (by curbs, barriers, grade separation, etc.) but with grade crossings; or surface streets with mixed traffic (although transit may have preferential treatment).

Route – A designated, specified path to which a transit vehicle is assigned. Several routes may traverse a single portion of a road or line.

Shared-use path – A facility for the shared use of pedestrians, bicyclists, runners, and other active, non-motorized transportation users, that is physically separated from motorized vehicular traffic by an open space or barrier and either within the road right-of-way or an independent right-of-way.

Shelter – A structure at a transit stop that provides protection from the weather and may provide seating or schedule information or both for the convenience of waiting passengers.

Shoulder – Edge or border along either side of a roadway, generally delimited by pavement markings, kept clear of all traffic, and used in the event of a breakdown, for evasive action, for use by emergency vehicles, or by cyclists when a bicycle facility is not present.

Span – Number of hours during the day between the start and end of service on a transit route.

Station – An off-street facility (typically) where passengers wait for, board, alight, or transfer between transit vehicles. A station usually provides information and a waiting area and may have boarding and alighting platforms, ticket/fare vending machines, fare collection, and other related facilities.

Stop, transit – An area where passengers wait for, board, alight, and transfer between transit vehicles. It is usually indicated by distinctive signs and by curb or pavement markings. Stops are often designated by the mode offering service, for examples, bus stop, light rail stop.

[13] United States Access Board. *About the Rulemaking on Public Rights-of-Way.* https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way, accessed February 16, 2017.

Time point – A point on a transit route for which the time that transit vehicles are scheduled to pass is specified; usually the leaving time is used.

Timetable – A publicly-available listing of the times at which transit vehicles are due at specified time points, also known as a schedule.

Transit signal priority (TSP) – A system of traffic controls in which buses are given priority over general vehicular traffic, including adjustment of green times for buses or preemption of traffic signals.

Transit network – A multimodal transportation system that consists of several bus, light rail, subway, or commuter trail routes within a defined geographic area.

Travel time – The time duration of a trip made on a single transit vehicle (unlinked trip) or multiple transit vehicles (linked trip).

Trip – One-way movement of a person or vehicle between two points for a specific purpose; sometimes called a one-way trip to distinguish it from a round trip.

Trip generator – A land use from which trips are produced, such as a residence, store, factory, or office.

Universal design – The design of products and environments to be useable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

Upstream – Opposite the direction of traffic.

Walkshed – The land area within a defined walking range of a specified location.

Appendix C: Bus Stop Sign Designs

Concepts: Permanent Signs

Signs for up to five routes are 18" x 24" with 1.5" radius rounded corners. Signs for six or more routes are 18" wide with the same fillets, but their lengths vary depending on the number of routes they need to accomodate.
For all signs, CityLink routes shall be listed first, followed by LocalLink routes, Express BusLink Routes, and Commuter Bus routes respectively.
Numbered routes shall be listed from smallest to largest, while CityLink routes shall be listed in this order: Brown, Red, Pink, Orange, Gold, Yellow, Lime, Green, Blue, Navy, Purple, Silver.

One to Four Routes

For signs with fewer than four routes, all unused ribbons shall be left blank; gray dividers shall remain in place as well

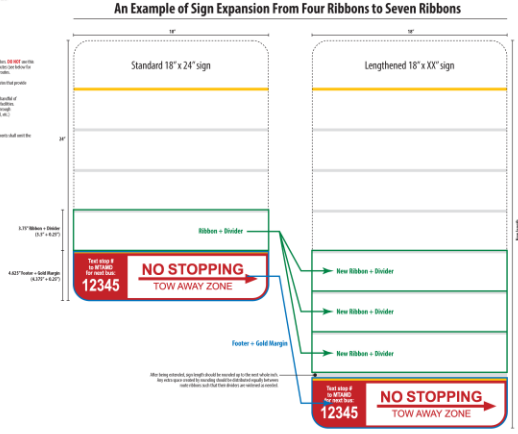
Signs at bus stops in Baltimore County shall **not** contain the "tow away zone" phrase in the footer and the remaining content shall be centered within the footer

Five Routes

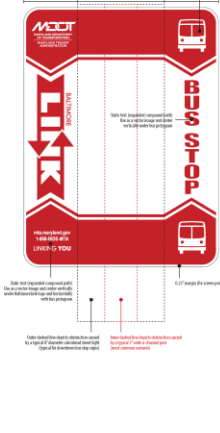
Details: Destination Labeling

Six or More Routes

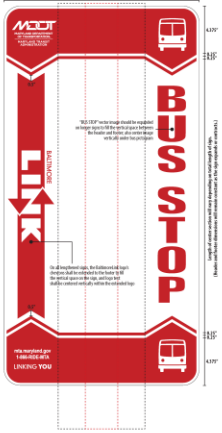
An Example of Sign Expansion From Four Ribbons to Seven Ribbons



One to Five Routes (Back)



Six or More Routes (Back)



Blank Head Sign

This sign is intended for use at the front (parking-adjacent) side of revenue stops as well as at layover locations (non-revenue stops).

Note that headsigns at bus stops in Baltimore County shall **not** contain the "tow away zone" phrase in the footer. Also, this sign should **not** have anything printed on the back; this is to eliminate potential passenger confusion if they were to approach the sign from the back.

Font and Color Assignments

The only dynamic text font used in all concepts is **Arial Narrow** set to the style of **Bold**.
Font size varies by sign component (see above for details).
The sign concepts use these colors:

- **Black:** CMYK 0/0/0/100
- **White:** CMYK 0/0/0/0
- **BaltimoreLink Red:** CMYK 18/100/100/5 *
- **BaltimoreLink Gold:** CMYK 0/25/100/0 *
- **Light Gray:** CMYK 0/0/0/15

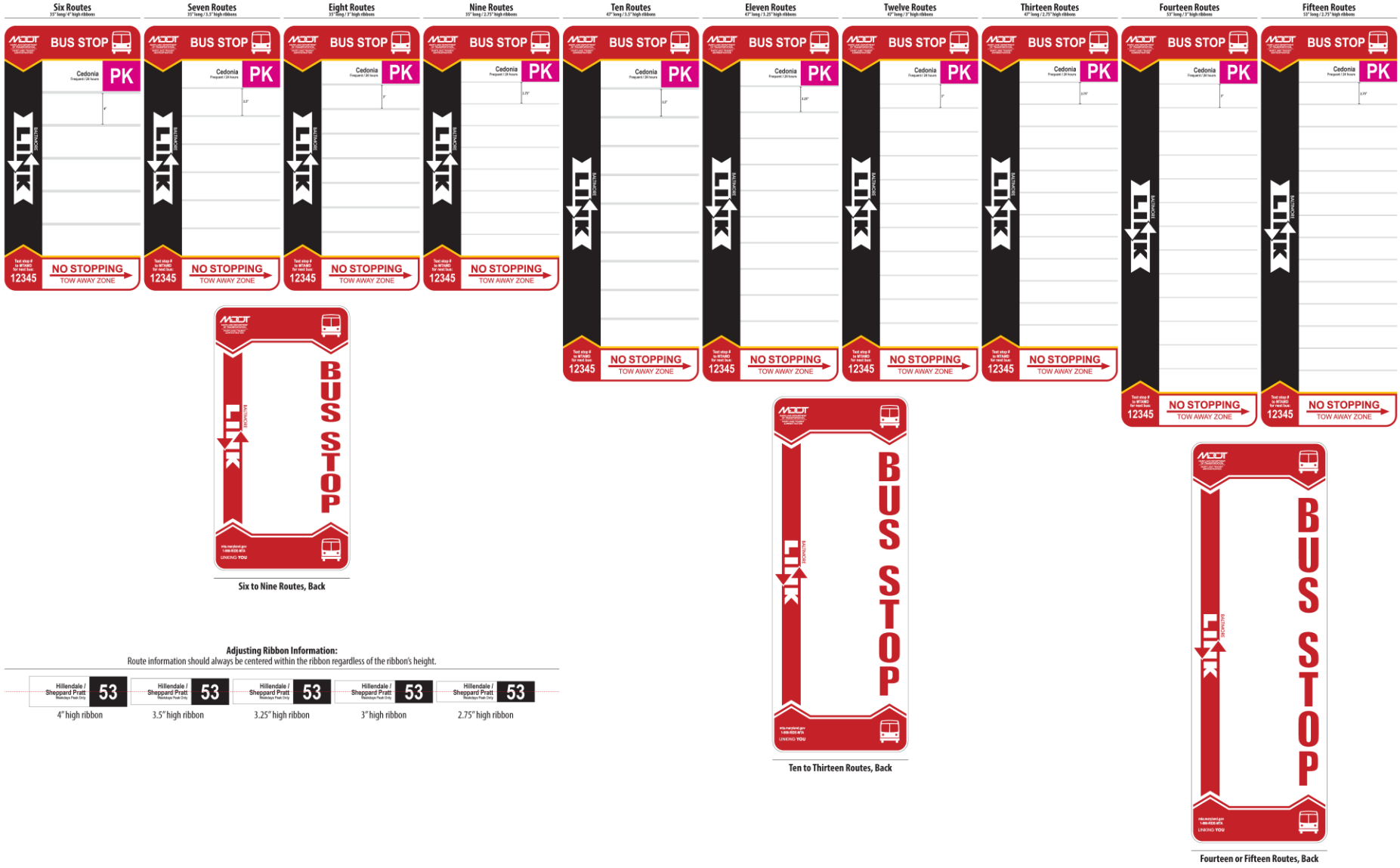
* The official BaltimoreLink colors for Red and Gold are Pantones 200C and 123C respectively, but to avoid color conversion distortions when printing in CMYK, the above equivalent CMYK values for Pantones 200C and 123C have been specified.

- **CityLink Brown:** CMYK 45/65/85/35
- **CityLink Red:** CMYK 0/100/100/10
- **CityLink Pink:** CMYK 0/100/0/10
- **CityLink Orange:** CMYK 0/65/100/5
- **CityLink Gold:** CMYK 40/40/90/20
- **CityLink Yellow:** CMYK 0/0/100/5
- **CityLink Lime:** CMYK 65/20/100/0
- **CityLink Green:** CMYK 100/15/100/15
- **CityLink Blue:** CMYK 100/50/0/0
- **CityLink Navy:** CMYK 100/100/0/0
- **CityLink Purple:** CMYK 50/100/0/10
- **CityLink Silver:** CMYK 30/0/0/70

Mobility Sign

This sign should **not** have anything printed on the back; this is to eliminate potential passenger confusion if they were to approach the sign from the back.

Concept Addendum: Revised and Consolidated Lengths for 6+ Route Signs

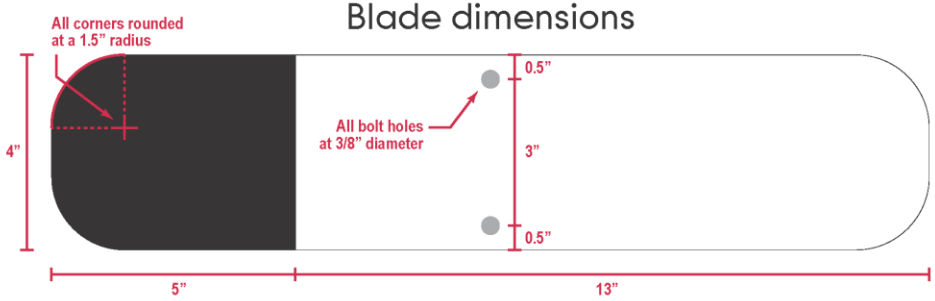


Adopt-A-Stop Blades

All blades are black and white to avoid distracting from the color route information on the primary bus stop signs
The backs of blades are finished with the same white finish as the backs of the primary bus stop signs

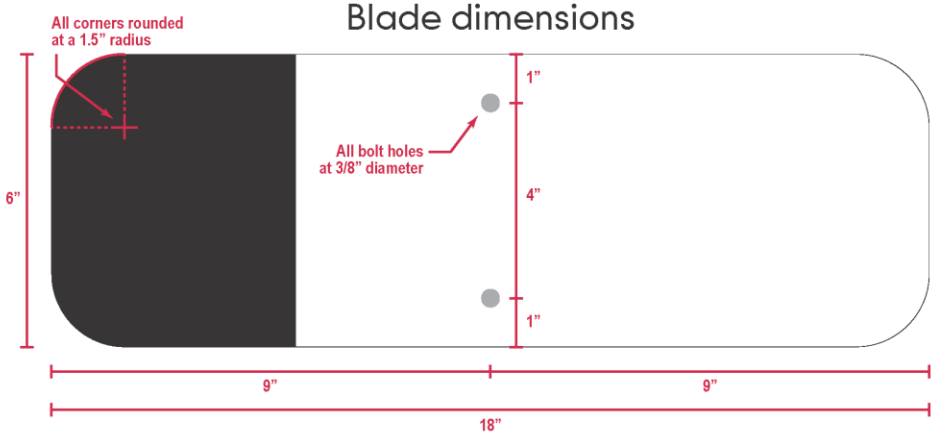
Iteration 1: 4" high for multiple-blade signs

Blade dimensions

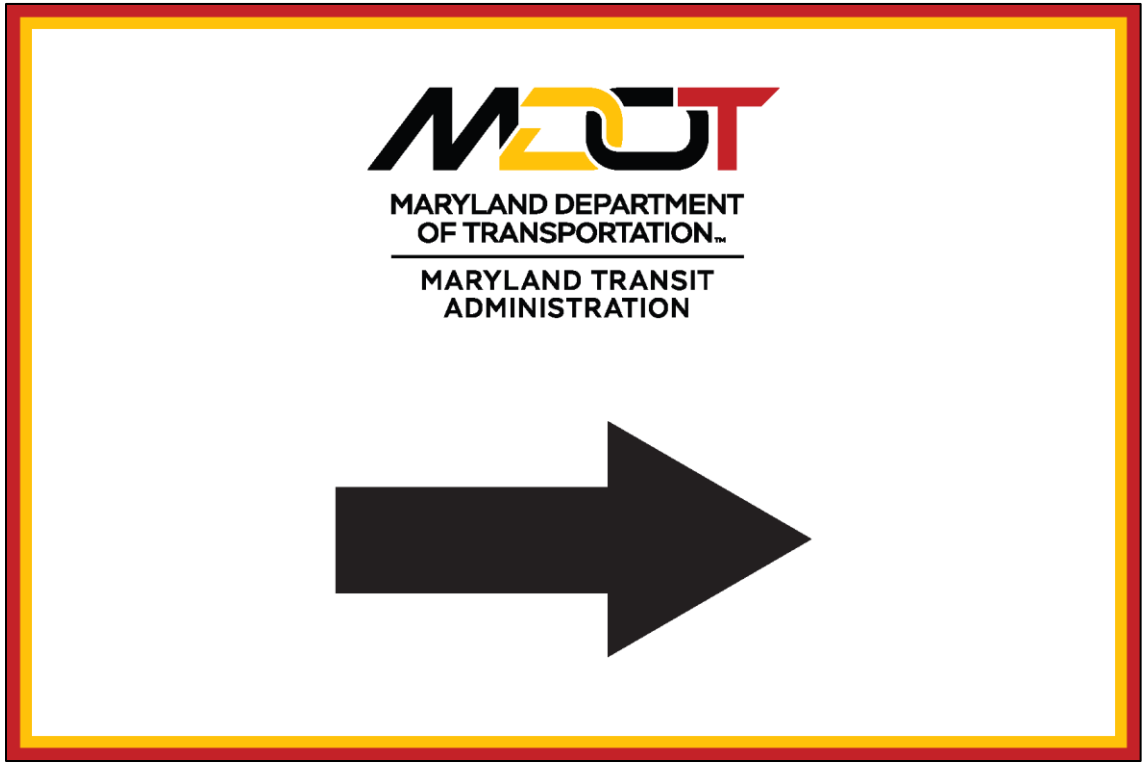


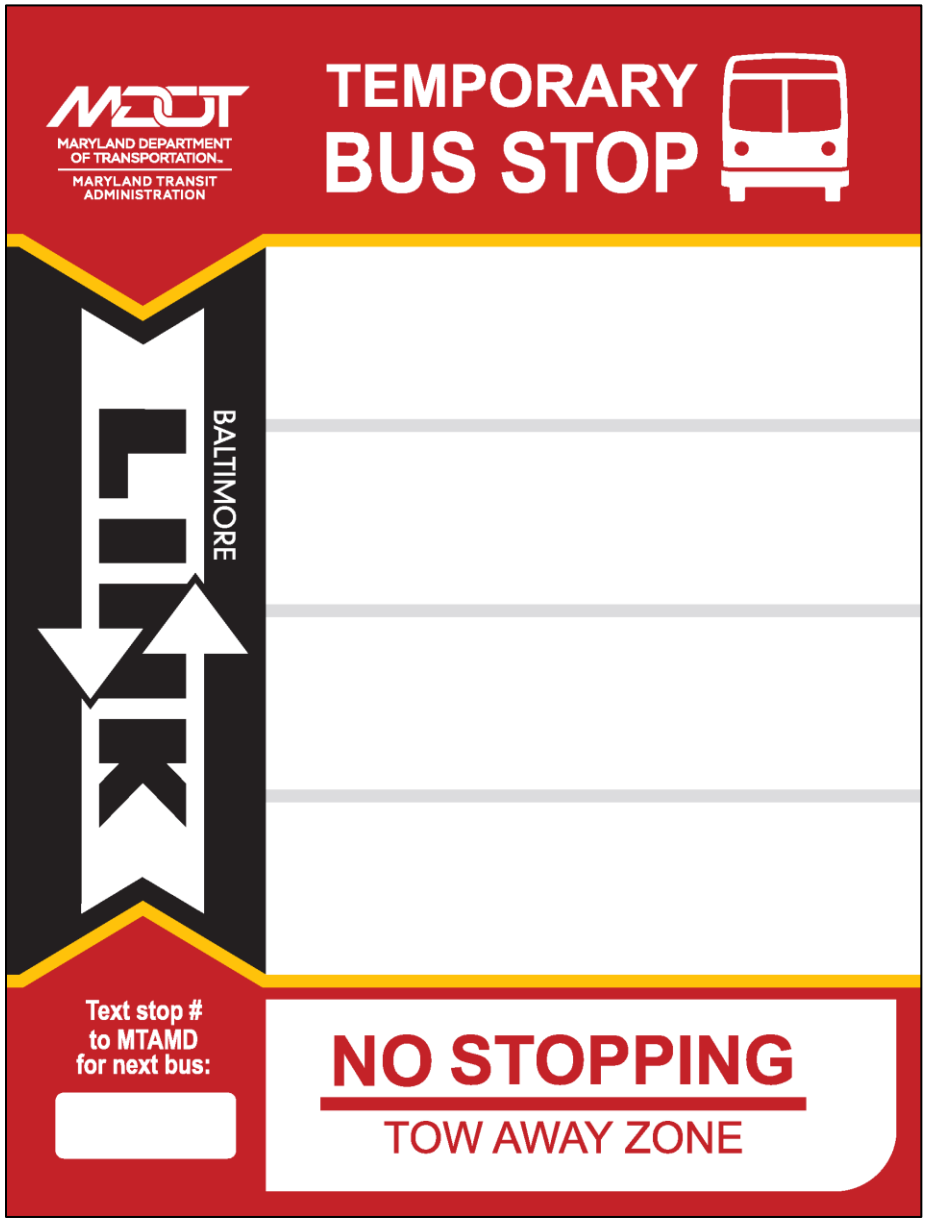
Iteration 2: 6" high for standandalone signs

Blade dimensions




MARYLAND DEPARTMENT
OF TRANSPORTATION
MARYLAND TRANSIT
ADMINISTRATION
LAYOVER


MARYLAND DEPARTMENT
OF TRANSPORTATION
MARYLAND TRANSIT
ADMINISTRATION


MDOT
MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND TRANSIT ADMINISTRATION
TEMPORARY
BUS STOP
BALTIMORE
LINK
Text stop # to MTAMD for next bus:
NO STOPPING
TOW AWAY ZONE

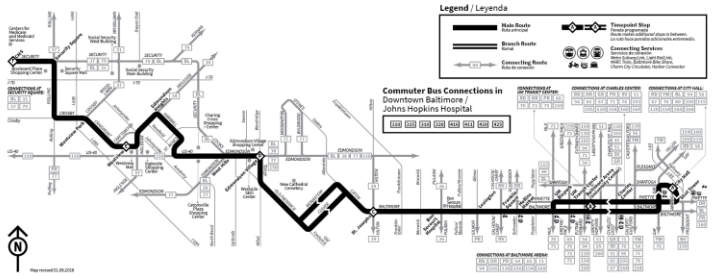
MARYLAND DEPARTMENT OF TRANSPORTATION

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND TRANSIT ADMINISTRATION

RIDER NOTICE

Effective 4/16, LocalLink 78 will serve this stop

Stop #12273



For more information, or to request this information in an alternate format or translated into another language, please contact the department listed below.

Para mayor información, o para solicitar esta información en un formato alternativo o traducido a otro idioma, por favor contacte el departamento enlistado abajo.

欲了解更多信息或索取另一种格式或译成其它语言的本文档，请联系下列部门。

Pour plus d'informations, ou pour obtenir ce information sous un format différent ou traduit dans une autre langue, veuillez contacter le département indiqué ci-dessous.

더 자세한 정보가 필요하시거나, 이 문서에 대한 다른 형식의 복사본 또는 다른 언어로 번역된 복사본이 필요하시면 아래 기재된 부서로 문의하시기 바랍니다.

Para sa higit na impormasyon, o para hilingin ang impormasyong ito na nasa panghalilng format o isinalin sa ibang wika, mangyaring kontakin ang departamento nakalista sa ibaba.

Для получения дополнительной информации или запросить эту информацию в альтернативном формате либо в переводе на другой язык, просьба связаться с указанным отделом.

MDOT MTA Transit Information Contact Center • 410-539-5000 • 866-743-3682 • TTY 410-539-3497 • Maryland Relay Users Dial 7-1-1

BALTIMORE LINK

MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND TRANSIT ADMINISTRATION

mta.maryland.gov

MARYLAND DEPARTMENT OF TRANSPORTATION

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MARYLAND TRANSIT ADMINISTRATION

RIDER NOTICE

Temporarily Discontinued Bus Stop due to construction.

Stop ID: 1259 Route(s): LocalLink 73, Express BusLink 150

Start Date / Time: Monday, April 1, 2019

End Date / Time: Monday, August 26, 2019

PLEASE USE THE FOLLOWING ALTERNATE BUS STOPS:

Route(s)	Stop Name & Direction	Stop ID
LocalLink(s) 73, Express BusLink 150	Southbound Greene Street & Lexington Street	1258
LocalLink(s) 73	Southbound Greene Street & Baltimore Street	1260

For more information, or to request this information in an alternate format or translated into another language, please contact the department listed below.

Para mayor información, o para solicitar esta información en un formato alternativo o traducido a otro idioma, por favor contacte el departamento enlistado abajo.

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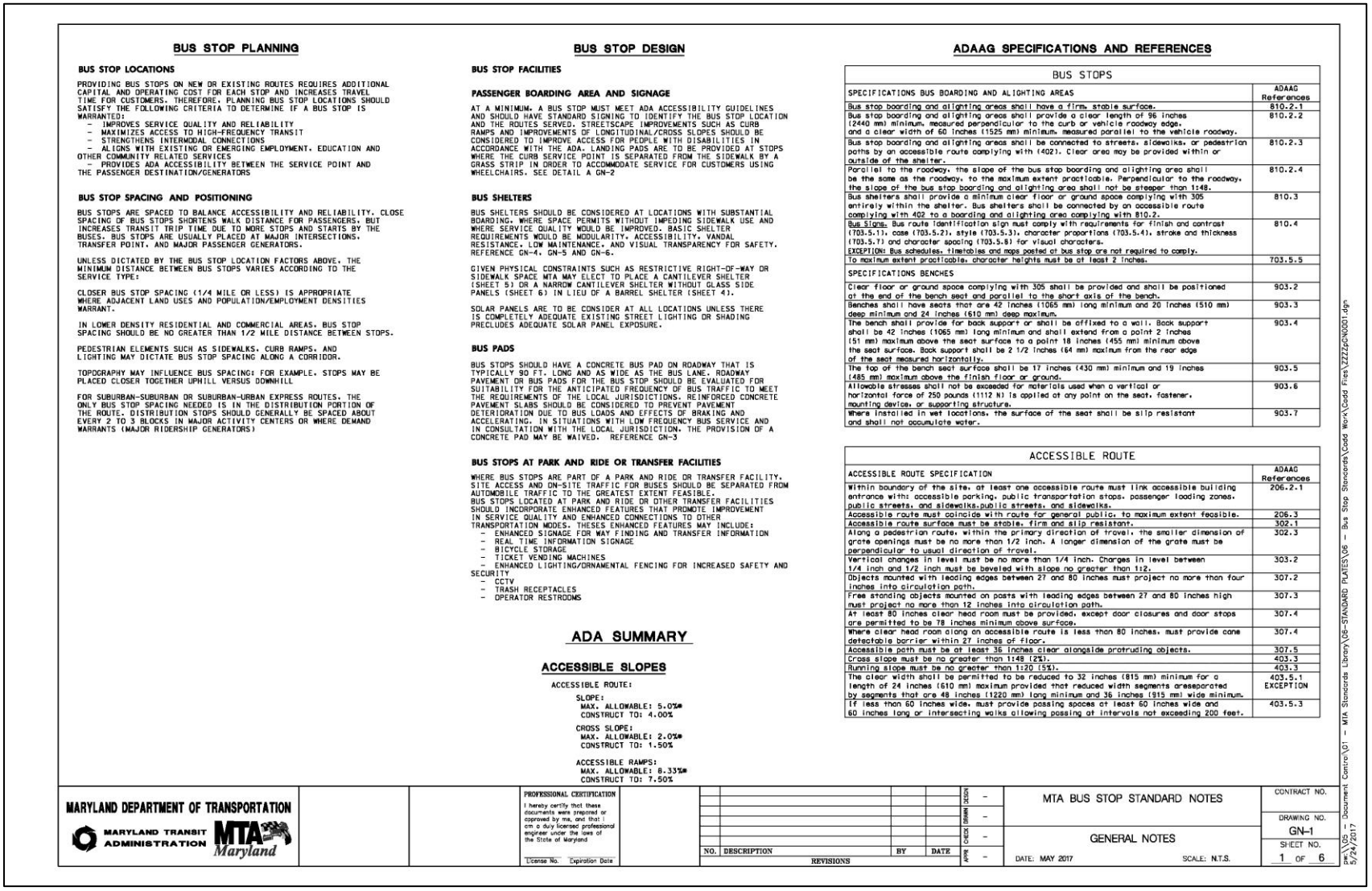
Appendix D: Facilities Engineering Standard Details for Bus Stops



BUS STOP PLANNING

BUS STOP LOCATIONS

PROVIDING BUS STOPS ON NEW OR EXISTING ROUTES REQUIRES ADDITIONAL CAPITAL AND OPERATING COST FOR EACH STOP AND INCREASES TRAVEL TIME FOR CUSTOMERS. THEREFORE, PLANNING BUS STOP LOCATIONS SHOULD SATISFY THE FOLLOWING CRITERIA TO DETERMINE IF A BUS STOP IS WARRANTED:

- IMPROVES SERVICE QUALITY AND RELIABILITY
- MAXIMIZES ACCESS TO HIGH-FREQUENCY TRANSIT
- STRENGTHENS INTERMODAL CONNECTIONS
- ALIGNS WITH EXISTING OR EMERGING EMPLOYMENT, EDUCATION AND OTHER COMMUNITY RELATED SERVICES
- PROVIDES ADA ACCESSIBILITY BETWEEN THE SERVICE POINT AND THE PASSENGER DESTINATION/GENERATORS

BUS STOP SPACING AND POSITIONING

BUS STOPS ARE SPACED TO BALANCE ACCESSIBILITY AND RELIABILITY. CLOSE SPACING OF BUS STOPS SHORTENS WALK DISTANCE FOR PASSENGERS, BUT INCREASES TRANSIT TRIP TIME DUE TO MORE STOPS AND STARTS BY THE BUSES. BUS STOPS ARE USUALLY PLACED AT MAJOR INTERSECTIONS, TRANSFER POINT, AND MAJOR PASSENGER GENERATORS.

UNLESS DICTATED BY THE BUS STOP LOCATION FACTORS ABOVE, THE MINIMUM DISTANCE BETWEEN BUS STOPS VARIES ACCORDING TO THE SERVICE TYPE:

CLOSER BUS STOP SPACING (1/4 MILE OR LESS) IS APPROPRIATE WHERE ADJACENT LAND USES AND POPULATION/EMPLOYMENT DENSITIES WARRANT.

IN LOWER DENSITY RESIDENTIAL AND COMMERCIAL AREAS, BUS STOP SPACING SHOULD BE NO GREATER THAN 1/2 MILE DISTANCE BETWEEN STOPS.

PEDESTRIAN ELEMENTS SUCH AS SIDEWALKS, CURB RAMPS, AND LIGHTING MAY DICTATE BUS STOP SPACING ALONG A CORRIDOR.

TOPOGRAPHY MAY INFLUENCE BUS SPACING: FOR EXAMPLE, STOPS MAY BE PLACED CLOSER TOGETHER UPHILL VERSUS DOWNHILL

FOR SUBURBAN-SUBURBAN OR SUBURBAN-URBAN EXPRESS ROUTES, THE ONLY BUS STOP SPACING NEEDED IS IN THE DISTRIBUTION PORTION OF THE ROUTE. DISTRIBUTION STOPS SHOULD GENERALLY BE SPACED ABOUT EVERY 2 TO 3 BLOCKS IN MAJOR ACTIVITY CENTERS OR WHERE DEMAND WARRANTS (MAJOR RIDERSHIP GENERATORS)

BUS STOP DESIGN

BUS STOP FACILITIES

PASSENGER BOARDING AREA AND SIGNAGE

AT A MINIMUM, A BUS STOP MUST MEET ADA ACCESSIBILITY GUIDELINES AND SHOULD HAVE STANDARD SIGNING TO IDENTIFY THE BUS STOP LOCATION AND THE ROUTES SERVED. STREETSCAPE IMPROVEMENTS SUCH AS CURB RAMPS AND IMPROVEMENTS OF LONGITUDINAL/CROSS SLOPES SHOULD BE CONSIDERED TO IMPROVE ACCESS FOR PEOPLE WITH DISABILITIES IN ACCORDANCE WITH THE ADA. LANDING PADS ARE TO BE PROVIDED AT STOPS WHERE THE CURB SERVICE POINT IS SEPARATED FROM THE SIDEWALK BY A GRASS STRIP IN ORDER TO ACCOMMODATE SERVICE FOR CUSTOMERS USING WHEELCHAIRS. SEE DETAIL A GN-2

BUS SHELTERS

BUS SHELTERS SHOULD BE CONSIDERED AT LOCATIONS WITH SUBSTANTIAL BOARDING. WHERE SPACE PERMITS WITHOUT IMPEDING SIDEWALK USE AND WHERE SERVICE QUALITY WOULD BE IMPROVED. BASIC SHELTER REQUIREMENTS WOULD BE MODULARITY, ACCESSIBILITY, VANDAL RESISTANCE, LOW MAINTENANCE, AND VISUAL TRANSPARENCY FOR SAFETY. REFERENCE GN-4, GN-5 AND GN-6.

GIVEN PHYSICAL CONSTRAINTS SUCH AS RESTRICTIVE RIGHT-OF-WAY OR SIDEWALK SPACE MTA MAY ELECT TO PLACE A CANTILEVER SHELTER (SHEET 5) OR A NARROW CANTILEVER SHELTER WITHOUT GLASS SIDE PANELS (SHEET 6) IN LIEU OF A BARREL SHELTER (SHEET 4).

SOLAR PANELS ARE TO BE CONSIDER AT ALL LOCATIONS UNLESS THERE IS COMPLETELY ADEQUATE EXISTING STREET LIGHTING OR SHADING PRECLUDES ADEQUATE SOLAR PANEL EXPOSURE.

BUS PADS

BUS STOPS SHOULD HAVE A CONCRETE BUS PAD ON ROADWAY THAT IS TYPICALLY 90 FT. LONG AND AS WIDE AS THE BUS LANE. ROADWAY PAVEMENT OR BUS PADS FOR THE BUS STOP SHOULD BE EVALUATED FOR SUITABILITY FOR THE ANTICIPATED FREQUENCY OF BUS TRAFFIC TO MEET THE REQUIREMENTS OF THE LOCAL JURISDICTIONS. REINFORCED CONCRETE PAVEMENT SLABS SHOULD BE CONSIDERED TO PREVENT PAVEMENT DETERIORATION DUE TO BUS LOADS AND EFFECTS OF BRAKING AND ACCELERATING. IN SITUATIONS WITH LOW FREQUENCY BUS SERVICE AND IN CONSULTATION WITH THE LOCAL JURISDICTION, THE PROVISION OF A CONCRETE PAD MAY BE WAIVED. REFERENCE GN-3

BUS STOPS AT PARK AND RIDE OR TRANSFER FACILITIES

WHERE BUS STOPS ARE PART OF A PARK AND RIDE OR TRANSFER FACILITY, SITE ACCESS AND ON-SITE TRAFFIC FOR BUSES SHOULD BE SEPARATED FROM AUTOMOBILE TRAFFIC TO THE GREATEST EXTENT FEASIBLE.
BUS STOPS LOCATED AT PARK AND RIDE OR OTHER TRANSFER FACILITIES SHOULD INCORPORATE ENHANCED FEATURES THAT PROMOTE IMPROVEMENT IN SERVICE QUALITY AND ENHANCED CONNECTIONS TO OTHER TRANSPORTATION MODES. THESES ENHANCED FEATURES MAY INCLUDE:

- ENHANCED SIGNAGE FOR WAY FINDING AND TRANSFER INFORMATION
- REAL TIME INFORMATION SIGNAGE
- BICYCLE STORAGE
- TICKET VENDING MACHINES
- ENHANCED LIGHTING/ORNAMENTAL FENCING FOR INCREASED SAFETY AND SECURITY
- CCTV
- TRASH RECEPTACLES
- OPERATOR RESTROOMS

ADA SUMMARY

ACCESSIBLE SLOPES

ACCESSIBLE ROUTE:

SLOPE:
MAX. ALLOWABLE: 5.0%*
CONSTRUCT TO: 4.00%

CROSS SLOPE:
MAX. ALLOWABLE: 2.0%*
CONSTRUCT TO: 1.50%

ACCESSIBLE RAMPS:
MAX. ALLOWABLE: 8.33%*
CONSTRUCT TO: 7.50%

ADAAG SPECIFICATIONS AND REFERENCES

BUS STOPS

SPECIFICATIONS BUS BOARDING AND ALIGHTING AREAS	ADAAG References
Bus stop boarding and alighting areas shall have a firm, stable surface.	810.2.1
Bus stop boarding and alighting areas shall provide a clear length of 96 inches (2440 mm) minimum, measured perpendicular to the curb or vehicle roadway edge, and a clear width of 60 inches (1525 mm) minimum, measured parallel to the vehicle roadway.	810.2.2
Bus stop boarding and alighting areas shall be connected to streets, sidewalks, or pedestrian paths by an accessible route complying with 402. Clear area may be provided within or outside of the shelter.	810.2.3
Parallel to the roadway, the slope of the bus stop boarding and alighting area shall be the same as the roadway, to the maximum extent practicable. Perpendicular to the roadway, the slope of the bus stop boarding and alighting area shall not be steeper than 1:48.	810.2.4
Bus shelters shall provide a minimum clear floor or ground space complying with 305 entirely within the shelter. Bus shelters shall be connected by an accessible route complying with 402 to a boarding and alighting area complying with 810.2.	810.3
Bus Signs. Bus route identification sign must comply with requirements for finish and contrast (703.5.1), case (703.5.2), style (703.5.3), character proportions (703.5.4), stroke and thickness (703.5.7) and character spacing (703.5.8) for visual characters. EXCEPTION: Bus schedules, timetables and maps posted at bus stop are not required to comply.	810.4
To maximum extent practicable, character heights must be at least 2 inches.	703.5.5
SPECIFICATIONS BENCHES	
Clear floor or ground space complying with 305 shall be provided and shall be positioned at the end of the bench seat and parallel to the short axis of the bench.	903.2
Benches shall have seats that are 42 inches (1065 mm) long minimum and 20 inches (510 mm) deep minimum and 24 inches (610 mm) deep maximum.	903.3
The bench shall provide for back support or shall be affixed to a wall. Back support shall be 42 inches (1065 mm) long minimum and shall extend from a point 2 inches (51 mm) maximum above the seat surface to a point 18 inches (455 mm) minimum above the seat surface. Back support shall be 2 1/2 inches (64 mm) maximum from the rear edge of the seat measured horizontally.	903.4
The top of the bench seat surface shall be 17 inches (430 mm) minimum and 19 inches (485 mm) maximum above the finish floor or ground.	903.5
Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the seat, fastener, mounting device, or supporting structure.	903.6
Where installed in wet locations, the surface of the seat shall be slip resistant and shall not accumulate water.	903.7

ACCESSIBLE ROUTE

ACCESSIBLE ROUTE SPECIFICATION	ADAAG References
Within boundary of the site, at least one accessible route must link accessible building entrance with: accessible parking, public transportation stops, passenger loading zones, public streets, and sidewalks, public streets, and sidewalks.	206.2.1
Accessible route must coincide with route for general public, to maximum extent feasible.	206.3
Accessible route surface must be stable, firm and slip resistant.	302.1
Along a pedestrian route, within the primary direction of travel, the smaller dimension of grate openings must be no more than 1/2 inch. A longer dimension of the grate must be perpendicular to usual direction of travel.	302.3
Vertical changes in level must be no more than 1/4 inch. Changes in level between 1/4 inch and 1/2 inch must be beveled with slope no greater than 1:2.	303.2
Objects mounted with leading edges between 27 and 80 inches must project no more than four inches into circulation path.	307.2
Free standing objects mounted on posts with leading edges between 27 and 80 inches high must project no more than 12 inches into circulation path.	307.3
At least 80 inches clear head room must be provided, except door closures and door stops are permitted to be 78 inches minimum above surface.	307.4
Where clear head room along an accessible route is less than 80 inches, must provide cane detectable barrier within 27 inches of floor.	307.4
Accessible path must be at least 36 inches clear alongside protruding objects.	307.5
Cross slope must be no greater than 1:48 (2%).	403.3
Running slope must be no greater than 1:20 (5%).	403.3
The clear width shall be permitted to be reduced to 32 inches (815 mm) minimum for a length of 24 inches (610 mm) maximum provided that reduced width segments areseparated by segments that are 48 inches (1220 mm) long minimum and 36 inches (915 mm) wide minimum.	403.5.1 EXCEPTION
If less than 60 inches wide, must provide passing spaces at least 60 inches wide and 60 inches long or intersecting walks allowing passing at intervals not exceeding 200 feet.	403.5.3

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MTA BUS STOP STANDARD NOTES
GENERAL NOTES
DATE: MAY 2017 SCALE: N.T.S.

CONTRACT NO.
DRAWING NO. GN-1
SHEET NO. 1 OF 6

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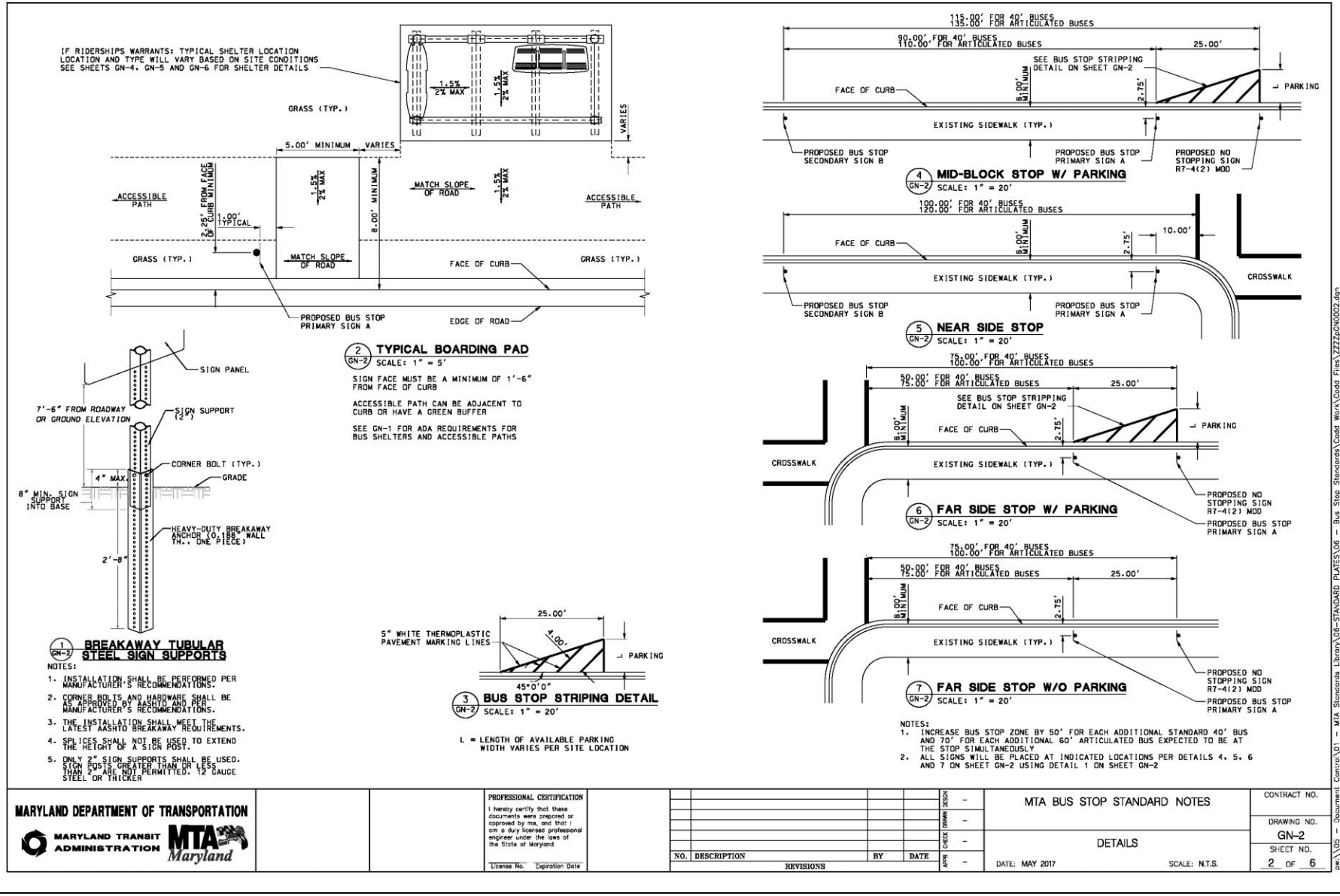
IF RIDERSHIPS WARRANTS: TYPICAL SHELTER LOCATION LOCATION AND TYPE WILL VARY BASED ON SITE CONDITIONS SEE SHEETS GN-4, GN-5 AND GN-6 FOR SHELTER DETAILS
GRASS (TYP.)
1.5% 2% MAX
VARIES
5.00' MINIMUM
ACCESSIBLE PATH
2.25' FROM FACE OF CURB MINIMUM
1.00' TYPICAL
8.00' MINIMUM
MATCH SLOPE OF ROAD
FACE OF CURB
EDGE OF ROAD
PROPOSED BUS STOP PRIMARY SIGN A
2 GN-2 TYPICAL BOARDING PAD
SCALE: 1" = 5'
SIGN FACE MUST BE A MINIMUM OF 1'-6" FROM FACE OF CURB
ACCESSIBLE PATH CAN BE ADJACENT TO CURB OR HAVE A GREEN BUFFER
SEE GN-1 FOR ADA REQUIREMENTS FOR BUS SHELTERS AND ACCESSIBLE PATHS
SIGN PANEL
7'-6" FROM ROADWAY OR GROUND ELEVATION
SIGN SUPPORT (2")
CORNER BOLT (TYP.)
4" MAX.
GRADE
8" MIN. SIGN SUPPORT INTO BASE
HEAVY-DUTY BREAKAWAY ANCHOR (0.188" WALL TH., ONE PIECE)
2'-0"
1 GN-2 BREAKAWAY TUBULAR STEEL SIGN SUPPORTS
NOTES:
1. INSTALLATION SHALL BE PERFORMED PER MANUFACTURER'S RECOMMENDATIONS.
2. CORNER BOLTS AND HARDWARE SHALL BE AS APPROVED BY AASHTO AND PER MANUFACTURER'S RECOMMENDATIONS.
3. THE INSTALLATION SHALL MEET THE LATEST AASHTO BREAKAWAY REQUIREMENTS.
4. SPLICES SHALL NOT BE USED TO EXTEND THE HEIGHT OF A SIGN POST.
5. ONLY 2" SIGN SUPPORTS SHALL BE USED. SIGN POSTS GREATER THAN OR LESS THAN 2" ARE NOT PERMITTED. 12 GAUGE STEEL OR THICKER
25.00'
5" WHITE THERMOPLASTIC PAVEMENT MARKING LINES
4.00'
PARKING
45°0'0"
3 GN-2 BUS STOP STRIPING DETAIL
SCALE: 1" = 20'
L = LENGTH OF AVAILABLE PARKING
WIDTH VARIES PER SITE LOCATION
115.00' FOR 40' BUSES
135.00' FOR ARTICULATED BUSES
90.00' FOR 40' BUSES
110.00' FOR ARTICULATED BUSES
25.00'
SEE BUS STOP STRIPPING DETAIL ON SHEET GN-2
8.00' MINIMUM
2.75'
FACE OF CURB
PARKING
EXISTING SIDEWALK (TYP.)
PROPOSED BUS STOP SECONDARY SIGN B
PROPOSED BUS STOP PRIMARY SIGN A
PROPOSED NO STOPPING SIGN R7-4(2) MOD
4 GN-2 MID-BLOCK STOP W/ PARKING
SCALE: 1" = 20'
100.00' FOR 40' BUSES
120.00' FOR ARTICULATED BUSES
10.00'
CROSSWALK
5 GN-2 NEAR SIDE STOP
SCALE: 1" = 20'
75.00' FOR 40' BUSES
100.00' FOR ARTICULATED BUSES
50.00' FOR 40' BUSES
75.00' FOR ARTICULATED BUSES
6 GN-2 FAR SIDE STOP W/ PARKING
SCALE: 1" = 20'
7 GN-2 FAR SIDE STOP W/O PARKING
SCALE: 1" = 20'
NOTES:
1. INCREASE BUS STOP ZONE BY 50' FOR EACH ADDITIONAL STANDARD 40' BUS AND 70' FOR EACH ADDITIONAL 60' ARTICULATED BUS EXPECTED TO BE AT THE STOP SIMULTANEOUSLY
2. ALL SIGNS WILL BE PLACED AT INDICATED LOCATIONS PER DETAILS 4, 5, 6 AND 7 ON SHEET GN-2 USING DETAIL 1 ON SHEET GN-2
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DETAILS
DATE: MAY 2017
SCALE: N.T.S.
CONTRACT NO.
DRAWING NO. GN-2
SHEET NO. 2 OF 6
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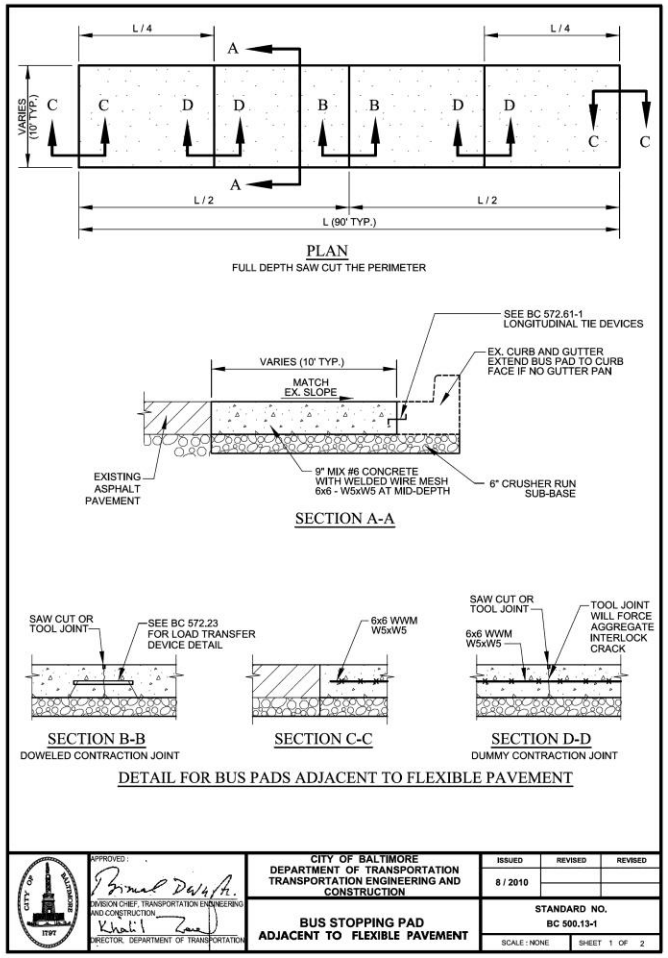

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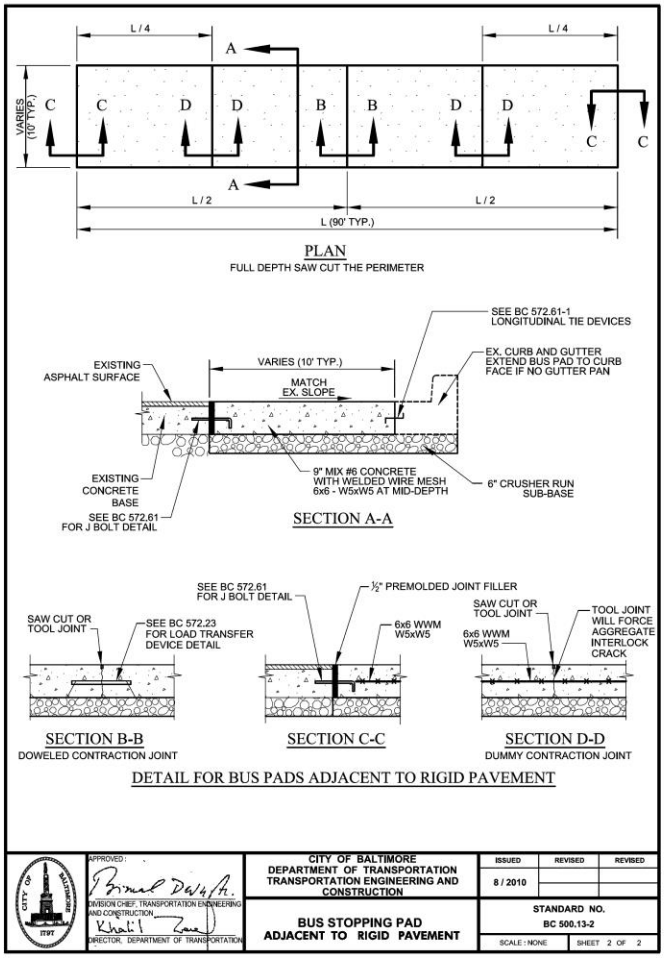
	BUS STOPPING PAD ADJACENT TO FLEXIBLE PAVEMENT	STANDARD NO. BC 500.13-1	SCALE: NONE / SHEET 1 OF 2



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	BUS STOPPING PAD ADJACENT TO RIGID PAVEMENT	STANDARD NO. BC 500.13-2	SCALE: NONE / SHEET 2 OF 2

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MTA BUS STOP STANDARD NOTES

BUS STOPPING PAD STANDARDS

DATE: MAY 2017 SCALE: N.T.S.

CONTRACT NO.
DRAWING NO. GN-3
SHEET NO. 3 OF 6

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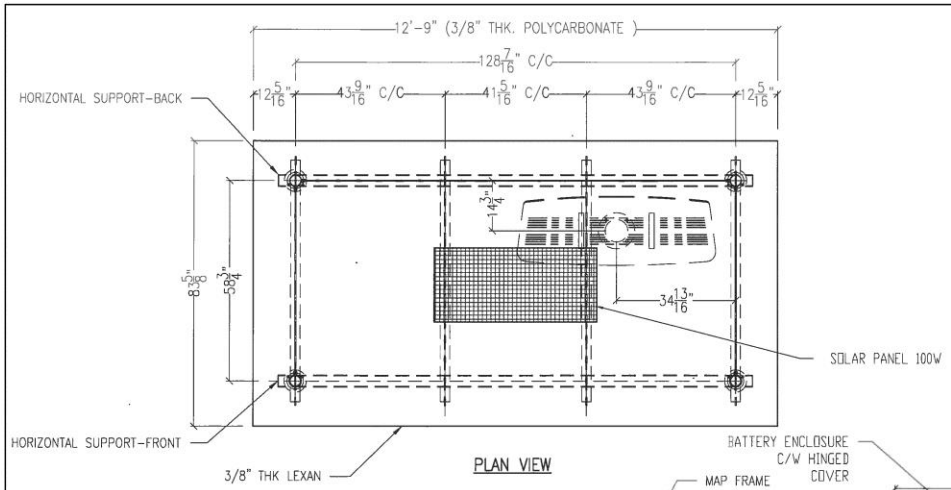
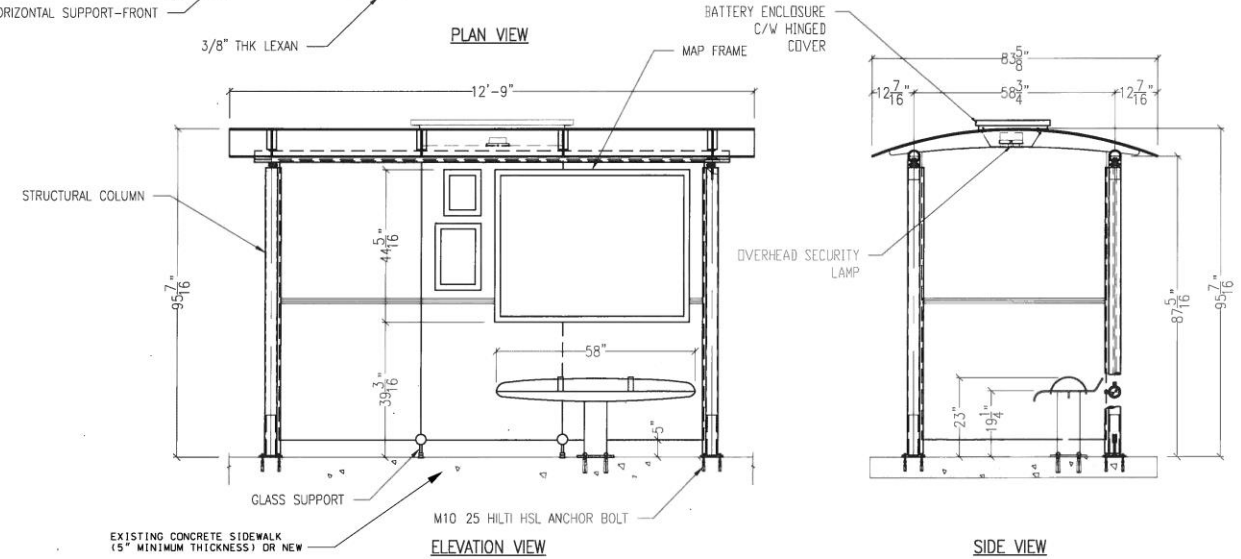


SHELTER S040 BARREL
ITEM 1-OPTION 2
GENERAL LAYOUT
SCALE : 3/8"=1'-0"



BUS TERMINAL BARREL SINGLE SHELTERS
ITEM 1 (OPTION 2) With /SOLAR POWER OVERHEAD SECURITY LIGHT
GENERAL NOTE:
Roof:
Design Loads: – Snow Load: 30 psf
– Wind Load: 48 psf

Aluminum Structure, Base Plates & Connection Plates to be 6061-T6.
– Yield Strength: 39 ksi
– Tensile Strength: 43.5 ksi
Columns to be 6061-T6
– Yield Strength: 39 ksi
– Tensile Strength: 43.5 ksi
Torsion Bars to be 6063-T5
– Yield Strength: 16 ksi
– Tensile Strength: 22 ksi
Welding to conform to AWS Structure Welding Code D1.2 Aluminum or equivalent.
Assembling:
– All bolted Connections to be A325 Bolts (Unless Otherwise Noted)

Shelter structure fabricated of aluminum c/w ⅜"thk. tempered glass at back & sides with silver metallic cerafrit strips .

Aluminum components of shelter received powder coat paint (color T.B.D. by client).
⅜" thk Polycarbonate Roof thermoformed bronze (cold forming not acceptable)

Shelter supplied with following items:
•(1) Three seated steel bench with " e-coat"& black powder coat paint.
(3) Standard "MTA" map frames for 8 ½" x 11", 11x 17" & 42" x 54 ½" paper size.

Glass note: 41 3/16" x 81" X ⅜" Thk. rear glass panels
54 ⅛" X 84 15/16" X ⅜" Thk. side glass panels
are "MTA " STANDARD glass

Illumination & solar power note :
-Self contained solar power security lighting system with remote control capability.
-Illumination requirement-minimun 100 Lux at the ground level, operational from dusk to down with (5) days autonomy.
-Battery life span minimum 3 years

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MTA BUS STOP STANDARD NOTES
TYPICAL BARREL SHELTER
DATE: MAY 2017 SCALE: 36"=1'-0"

CONTRACT NO.
DRAWING NO. GN-4
SHEET NO. 4 OF 6

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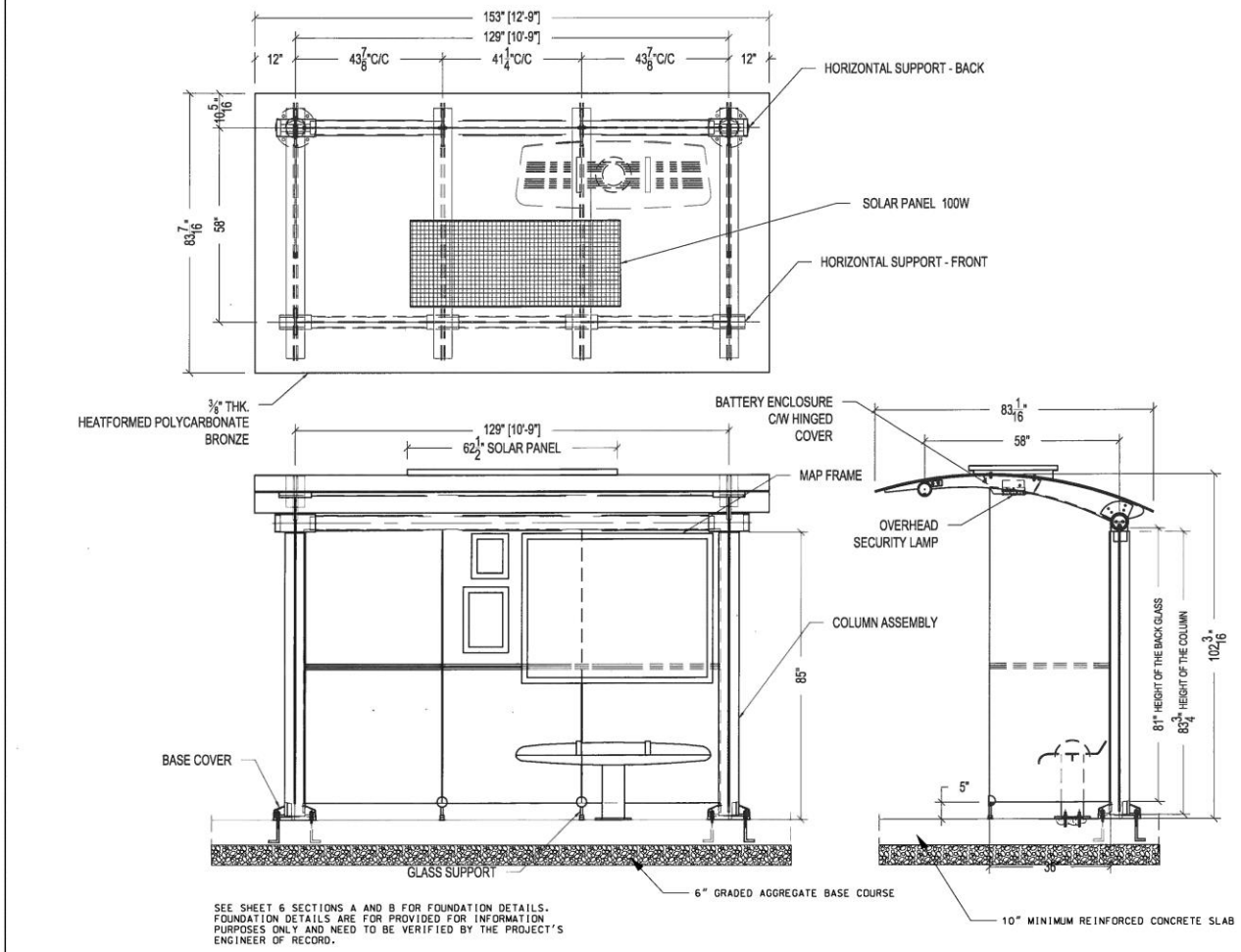

SEE SHEET 6 SECTIONS A AND B FOR FOUNDATION DETAILS. FOUNDATION DETAILS ARE FOR PROVIDED FOR INFORMATION PURPOSES ONLY AND NEED TO BE VERIFIED BY THE PROJECT'S ENGINEER OF RECORD.

CANTILEVER SHELTER ITEM 1 SINGLE SHELTER OPTION 2
(SMALL SIDE GLASS) WITH SOLAR PANEL & BATTERY ENCLOSURE

GENERAL NOTE:

Roof:
Design Loads: – Snow Load: 30 psf
– Wind Load: 48 psf

Aluminum Structure, Base Plates & Connection Plates to be 6061–T6.
– Yield Strength: 39 ksi
– Tensile Strength: 43.5 ksi

Columns to be 6061–T6
– Yield Strength: 39 ksi
– Tensile Strength: 43.5 ksi

Torsion Bars to be 6063–T5
– Yield Strength: 16 ksi
– Tensile Strength: 22 ksi

Welding to conform to AWS Structure Welding Code D1.2 Aluminum or equivalent.

Aluminum components of shelter to receive black powder coat paint (or color T.B.D. by client).
Roof made of ⅜" Thk. polycarbonate thermoformed bronze (cold forming not acceptable).

Assembling:
– All bolted Connections to be A325 Bolts (Unless Otherwise Noted)

GLASS: BACK GLASS: 41⅜" X 81" X ⅜"THK
SIDE GLASS: 36" X 93⅜" X ⅜"THK
All glass panel have silver metallic cerafrit strips

Illumination & solar power note :

–Self contained solar power security lighting system with remote control capability.
–Illumination requirement–minimun 100 Lux at the ground level, operational from dusk to down with (5) days autonomy.
–Battery life span minimum 3 years

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MTA BUS STOP STANDARD NOTES

TYPICAL CANTILEVER SHELTER

DATE: MAY 2017 SCALE: 36" = 1'-0"

CONTRACT NO.
DRAWING NO. GN-5
SHEET NO. 5 OF 6

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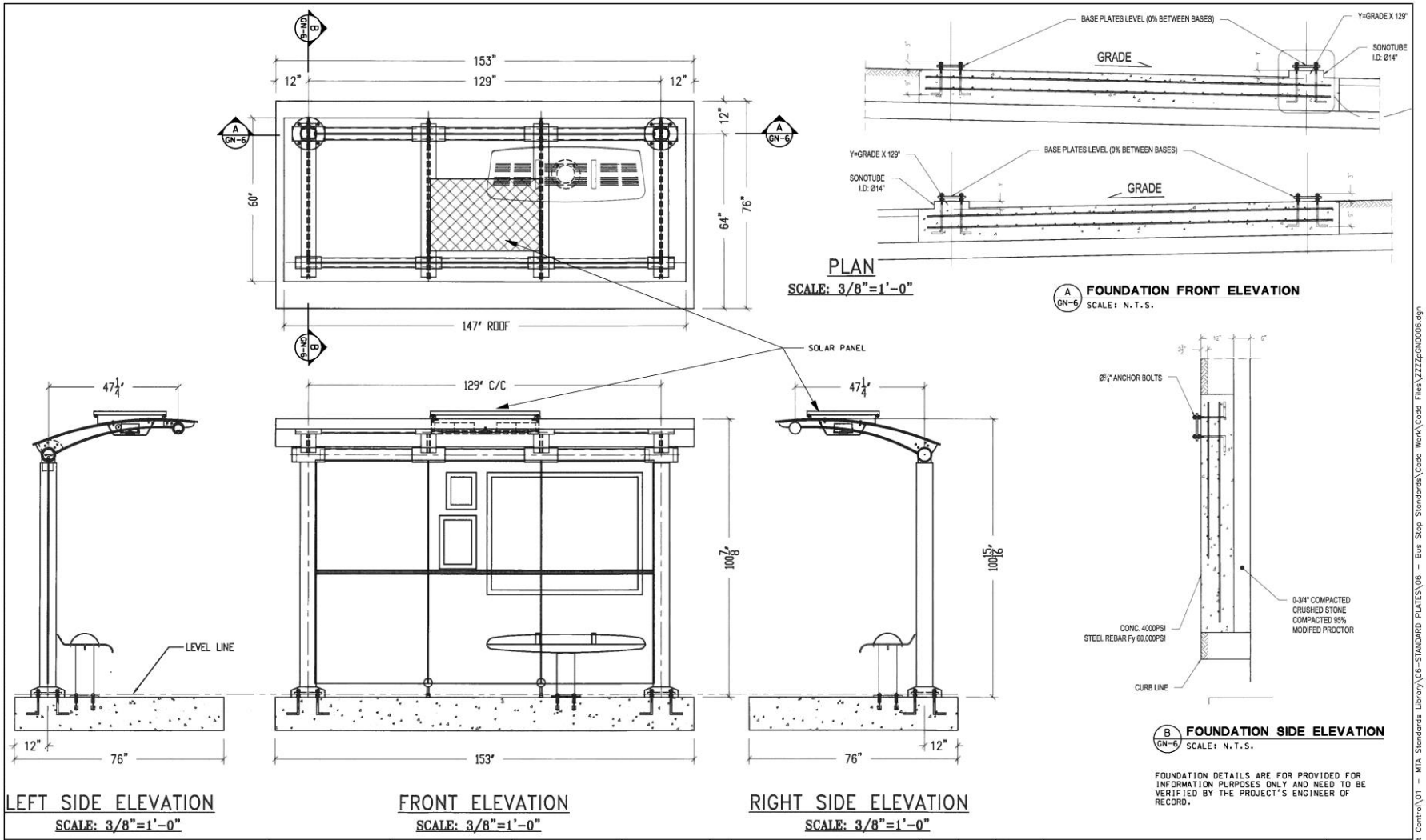
153"
12"
129"
12"
12"
60"
64"
76"
147" ROOF
SOLAR PANEL
PLAN
SCALE: 3/8"=1'-0"
BASE PLATES LEVEL (0% BETWEEN BASES)
Y=GRADE X 129'
SONOTUBE I.D. Ø14"
GRADE
FOUNDATION FRONT ELEVATION
SCALE: N.T.S.
Ø¾" ANCHOR BOLTS
0-3/4" COMPACTED CRUSHED STONE COMPACTED 95% MODIFED PROCTOR
CONC. 4000PSI
STEEL REBAR Fy 60,000PSI
CURB LINE
FOUNDATION SIDE ELEVATION
SCALE: N.T.S.
FOUNDATION DETAILS ARE FOR PROVIDED FOR INFORMATION PURPOSES ONLY AND NEED TO BE VERIFIED BY THE PROJECT'S ENGINEER OF RECORD.
47¼"
129" C/C
47¼"
LEVEL LINE
100⅞"
100⅝"
12"
76"
153"
76"
12"
LEFT SIDE ELEVATION
SCALE: 3/8"=1'-0"
FRONT ELEVATION
SCALE: 3/8"=1'-0"
RIGHT SIDE ELEVATION
SCALE: 3/8"=1'-0"
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MTA BUS STOP STANDARD NOTES
TYPICAL NARROW CANTILEVER SHELTER
DATE: MAY 2017
SCALE: 36"=1'-0"
CONTRACT NO.
DRAWING NO. GN-6
SHEET NO. 6 OF 6
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