[2] Design Resources

Introduction

Bus stops are gateways to public transportation services and a key element of a multimodal transportation system. The design of bus stops directly impacts public transportation riders in terms of accessibility, safety, comfort, and convenience. Additionally, the design of bus stops can impact the quality, efficiency, and cost-effectiveness of public transportation operations. Since buses typically operate in mixed traffic on open roadways, bus stop design can also influence traffic safety and operations. Bus stops are part of the built environment and the design should reflect the unique context of the community and surrounding land use. Bus stops can be a focal point, hub, and public gathering place for the community. Bus stops should be more than a sign on a post; they are a community asset that can improve safety, accessibility, and mobility.

This chapter provides design guidance that can improve passenger experiences, bus operations, and community connections at bus stops. It is focused on the design of typical bus stops given that transit hubs or busway stops often require more extensive design and coordination between project partners. This section includes guidance related to bus stop siting and spacing, placement, configuration, bus stop elements, and amenities. Each bus stop is unique and the design must consider the site specific context, potential users, roadway and roadside features, and land use context. This resource guide highlights required and desirable bus stop design elements, as well as key factors to consider during the design process. Planners, engineers, landscape architects, and others can use these resources to create bus stops that improve public transportation and serve as a community asset.

The graphic on page 2-2 provides an high level overview of the key steps for planning and designing a new bus stop. The specific steps will vary based on each transit agency policies and practices, as well as community needs. See Part 1: Planning and Policy Resources and this chapter for additional details regarding each step.

Locating Bus Stops

A bus stop location contributes to the safety of people riding the bus, walking, driving, and the bus operator. It facilitates a safe transit user and pedestrian experience, reliable service, and limits disruption to traffic operations. Public transportation service offers numerous community benefits, and the location of bus stops is a key factor in how well it serves the community.

Designing a bus stop starts by determining demand for the stop and selecting a proper location, which requires consideration of a number of factors. Many transit agencies have specific policies for identifying, evaluating, and establishing bus routes and stops. Coordination with public transit agencies is important because each agency handles this process differently. Page 2-3 lists key questions and factors that transit agencies, municipalities, PennDOT and property owners may consider when evaluating the location of a bus stop.

Basic Bus Stop Design Principles

- Accessible to everyone
- Safe, convenient, and comfortable location
- Visible and easily identifiable
- Good pedestrian access and connections
- Well integrated with surroundings
- Includes amenities to make the wait comfortable
- Supports efficient and effective bus operations

Source: Adapted from Memphis Area Transit Authority (MATA) Bus Stop and Accessibility Guidelines, 2017

Steps for Planning and Designing a Bus Stop

[1] Identify

- **Identify the potential for a new or improved bus stop**

Identify the potential for a new, relocated, or improved bus stop during initial planning/design for projects that meet one of the criteria listed below or based on community requests.

Transportation improvement project nearby

- Roadway, bridge, intersection, or bicycle/pedestrian infrastructure improvement project adjacent to an existing or planned bus route

Land development project nearby, particularly when it may generate transit trips

- Project located adjacent to or within 3/4 mile* of an existing or planned bus route
- Project that is considered a development of regional significance and impact (i.e. proposed project meets PennDOT's criteria for a Transportation Impact Study per PennDOT PUB 282—Appendix A)

Community requests

- Transit riders, community members, property owners, businesses, institutions, municipalities, and other stakeholders can submit requests for bus stop enhancements to the transit agency

Notes:
* 3/4 mile distance is a general guideline and can be modified based on the transit agency

See Appendix A—Model Ordinance Language and Appendix B—Plan Review Checklist for additional information about considering transit as part of the land development review process

[2] Evaluate

- **Coordinate with the transit agency**
- **Evaluate the need and location for a new or improved bus stop**

Coordinate with the transit agency to determine the need, location, and feasibility of serving a potential new or improved bus stop. The transit agency will likely consider a variety of factors in the evaluation process, such as:

- Land use
- Ridership, demographics, and equity
- Transit operations and system performance
- Safety and security
- Pedestrian connections and accessibility
- Roadway operations
- Stop spacing

Evaluation of deviating or providing a new bus route will likely involve consideration of additional factors, including potential costs, benefits, and available resources.

Notes:
Information about transit agencies that serve a particular area of the state is available on PennDOT's website.

No new or improved bus stop

If the transit agency determines that a bus stop is not necessary or feasible based on current conditions, but could be needed in the future, consider reserving right-of-way, providing easements, and/or installing pedestrian infrastructure to support a bus stop in the future.

[3] Design

- **Coordinate with the transit agency, municipality, roadway owner, and adjacent property owner, as needed**
- **Determine bus stop placement and configuration**
- **Determine bus stop elements and amenities**
- **Obtain necessary permits/approvals and execute maintenance agreements**

If the transit agency approves the bus stop location, continue to coordinate with the transit agency and other stakeholders and develop the bus stop design. Key bus stop design components are listed below. If the desired bus stop features cannot be provided, an alternative location may need to be considered.

Stop Placement
Near-side; Far-side; Mid-block; Within a site

Stop Configuration
Curbside/roadside; Curb extension; Bus bay

Stop Elements and Amenities
ADA loading pad; Pedestrian access; Signs; Shelter; Bench; Lighting; Trash receptacle; Bicycle parking; Landscaping

Notes:
See the list of References and Resources for various bus stop design standards and guidelines

Key Factors for Evaluating Bus Stop Locations

Land Use

- What is the land use context and character for the proposed bus stop?
- What major transit generators or activity centers are within walking distance of the bus stop? (Major transit generators include employment centers, shopping centers, schools, civic buildings, medical facilities, senior housing, and multi-family residential complexes.)

Ridership, Demographics, and Equity

- What is the population and employment density, particularly in the area within walking distance to the bus stop?
- What is the potential ridership at the bus stop?
- How will the bus stop impact minority and low-income populations following requirements and guidelines associated with Title VI of the 1964 Civil Rights Act?
- How will the bus stop serve populations that rely on public transportation, including youth, aging adults, persons with disabilities, and individuals without access to a car?

Transit Operations and System Performance

- What is the stop spacing or the distance to the last and next stop?
- Is there a companion bus stop for service in the opposite direction?
- Will the bus stop facilitate connections to other bus routes or public transportation services?
- How will the bus stop impact the bus schedule and overall travel time?
- What is the estimated operational and capital cost of serving the bus stop?

Safety and Security

- Is adequate space available for ADA compliant boarding and alighting areas?
- Is the bus stop in a visible location with adequate lighting?
- Is adequate sight distance available for pedestrians waiting at the stop, for transit operators, and for other drivers?
- Is the bus stop located over the crest of a hill or on a curve in the roadway?
- Are there any walls, landscaping, or other structures that obstruct sight lines and impact passenger safety or security?

Pedestrian Connections and Accessibility

- How far will passengers have to travel to access the bus stop or their destination?
- What pedestrian infrastructure (i.e. sidewalks, paths, trails, curb ramps, crosswalks, pedestrian signals, etc.) is provided to connect the bus stop and destinations?
- What is the width and condition of pedestrian infrastructure near the bus stop and is the infrastructure ADA compliant?
- Is there a crosswalk or connection to the companion bus stop?

Roadway Operations

- What are the traffic volumes and travel speeds at the bus stop?
- What are the number and width of travel lanes?
- Will the bus stop block or impact driveways or turning lanes at intersections?
- Will the bus stop impact on-street parking or loading zones?

Amenities

- What amenities are necessary and appropriate to serve the needs of transit riders and the community?
- Is adequate space available to provide the needed bus stop amenities?

Bus Stop Spacing

Stop spacing is the distance between bus stops on a route. Determining stop spacing involves striking a balance between transit accessibility and operating efficiency. When stops are located close together, passengers have shorter distances to walk and it is more convenient to access the bus service. However, providing more stops can reduce speeds and increase trip times for all bus passengers. Overall, having appropriate stop spacing can improve transit efficiency, cost effectiveness, and attractiveness of the service.

Selecting suitable stop spacing should be based on several factors, including the land use context, pedestrian infrastructure, and the type of transit service. Typical bus stop spacing is listed in the table below. Stops can be placed further apart for express or rapid bus services or in suburban/rural areas where pedestrian infrastructure is well connected.

For reference, SEPTA's minimum stop spacing is 500' and the Port Authority of Allegheny County's minimum stop spacing is 650'.

	Typical Spacing
Urban—Core	600'
Urban	750'
Suburban	1,000'
Rural	1,300'

Source: Adapted from TCRP Report 19, 1996

Title VI Requirements

Title VI, part of the Civil Rights Act of 1964, prohibits exclusion from participating in, denial of benefits of, and discrimination under federally assisted programs on grounds of race, color, or national origin. In Pennsylvania, through PennDOT's Title VI Compliance and Implementation Plan, the grounds for discrimination also extend to persons based on sex, creed, age, disability, low-income, or limited English proficiency (LEP).

As FTA recipients, Pennsylvania MPOs, RPOs, and transit agencies address Title VI compliance by preparing a Title VI Program document per FTA Circular 4702.1B.

All fixed route transit providers include system-wide service standards and policies in their Title VI Program as outlined in Chapter IV of FTA Circular 4702.1B to ensure equitable distribution of transit stops and amenities.

Fixed route transit providers operating 50 or more fixed route vehicles in peak service and located in an urbanized area of 200,000 people or more are also required to address data collection, transit service monitoring, and fare evaluation in their Title VI Program.

Stop Placement

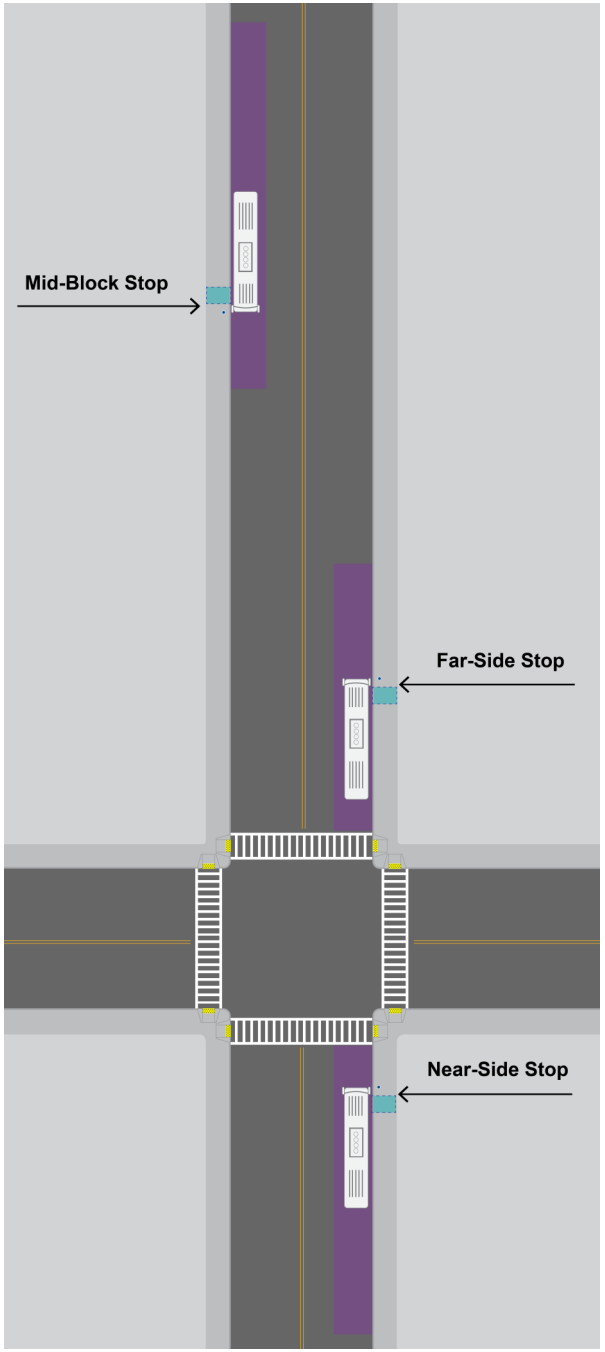
There are three basic locations along a roadway where a bus stop can be placed.

- Far-side: After proceeding through an intersection
- Near-side: Before an intersection
- Mid-block: In between intersections

Bus stops can also be placed off of a public roadway and within a site of a transit center or generator.

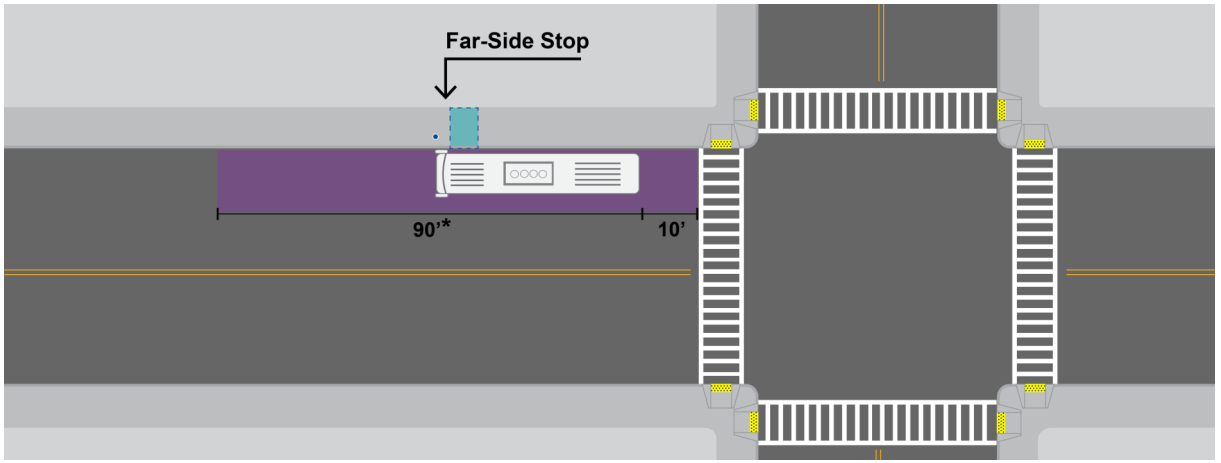
This section provides a description for each of these bus stop placements and the associated advantages and disadvantages. The following figures, depicting the bus stop placement, include desirable dimensions for bus stop zones. A bus stop zone is the general area within the roadway that is used by the bus to pull to the curb or roadway edge and allow passengers to board or alight. The dimensions provided in the following figures and throughout this guide are based on accommodating typical 40' buses. If 60' articulated buses serve the stop, the zone length should be extended by at least 20'. Additionally, the length should be increased if more than one bus is expected to use the stop at one time. Bus stop zones should be at least 10' from a crosswalk. Shorter bus stop zones may be appropriate in certain situations and should be designed through coordination with the public transit agency and municipality.

See Part 3: Bus Stop Typologies for additional illustrations of typical bus stop placements and configurations.



Far-side Stops

Far-side bus stops are located after an adjacent intersection. Far-side stops are preferred by many transit agencies. Compared to other stop placements, far-side stops can potentially decrease conflicts between the bus and other vehicles, provide the opportunity for some separation between passengers and other pedestrians, and minimize impact to on-street parking. Additionally, far-side stops present a lower risk for obstructed views and are a preferred location for pedestrian safety. Since crosswalks are located behind the bus, pedestrians do not cross in front of the bus. Far-side stops are typically more appropriate for signalized intersections where the bus can stop out of the travel lane and intersections with high volumes of right-turns. However, far–side stops may not be appropriate in areas where the stopped bus may interfere with traffic operations.



* 90' is the preferred length for a far-side bus stop zone, but a shorter zone may be acceptable based on coordination with the transit agency and roadway owner. 60' is the recommended minimum length for a far-side bus stop zone. A longer zone may be required if a bus approaches the stop from an immediate left or right turn.

Advantages

- Minimizes conflicts between right turning vehicles and buses
- Allows for additional turning capacity at intersection
- Minimizes line-of-sight conflicts between pedestrians and motorists
- Encourages pedestrians to cross safely behind buses
- Allows for a shorter deceleration zone for the bus (buses may use the intersection to decelerate)
- Buses may use the gap in traffic created by the signal to re-enter the travel lane
- Minimizes area needed for curbside bus stop
- If a bus bay is provided, vehicle capacity through intersection is unaffected
- Appropriate after the route has made a turn

Disadvantages

- Stopped buses may block the intersection
- Stopped buses may block sight lines for pedestrians and vehicles
- Can cause an inefficient "double stop" where the bus stops once for the traffic signal and again for the bus stop
- Potential for rear-end crashes if drivers do not realize the bus is stopping
- May interfere with right turns from the cross street
- May restrict travel lanes on far-side of the intersection

Sources:

SEPTA Bus Stop Design Guidelines, 2019

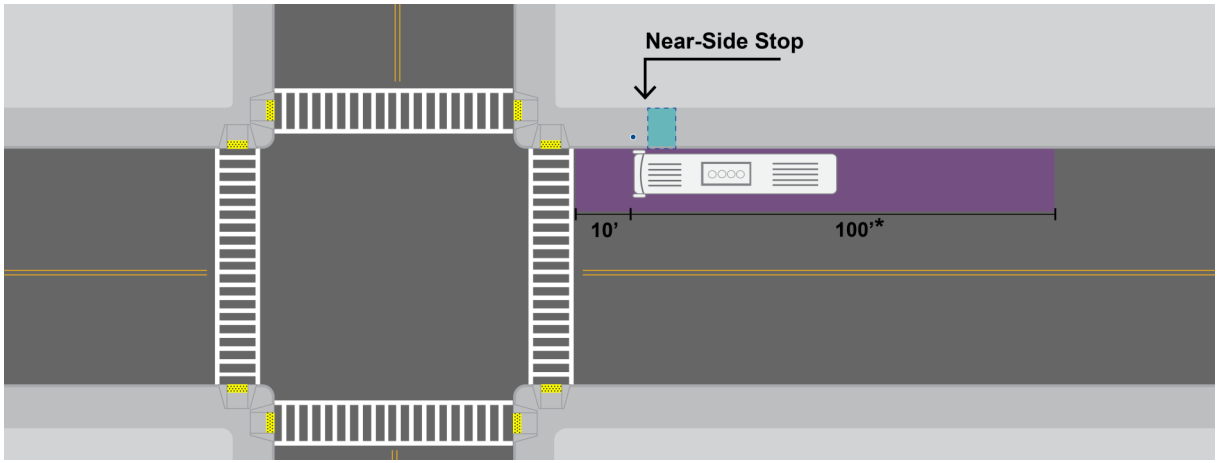
Rhode Island Bus Stop Design Guide, 2017

See Part 3: Bus Stop Typologies, numbers 3 and 6 for examples of far-side stops and additional design considerations. Numbers 1 and 2 could also be used for far-side stops.

Near-side Stops

Near-side bus stops are located before an adjacent intersection. Near-side stops may be appropriate to serve a key transit trip generator or where a bus may be making a right-turn. Additionally, near-side stops may be more appropriate at stop-controlled (non-signalized) intersections to reduce the number of times the bus needs to stop.

Generally, near-side stops are not preferred over far -side stops because of concerns with pedestrian safety. In particular, pedestrians are less visible to bus operators and the bus may obstruct the view of pedestrians crossing the street. Additionally, more space is required for the bus to pull into a near-side stop, which impacts on-street parking.



* 100' is preferred length for a near-side bus stop zone, but a shorter zone may be acceptable based on coordination with the transit agency and roadway owner. 90' is the recommended minimum length for a near-side bus stop zone.

Advantages

- Minimizes interference when traffic is heavy on the far-side of an intersection
- Allows passengers to access the bus closest to the intersection
- Eliminates the potential of a "double stop", because the bus stops once at a traffic signal
- Less potential conflict with traffic turning from the side street
- The bus can use the intersection as acceleration space
- The bus driver has full view of intersection
- Can be coordinated with a far-side stop on the side street to facilitate transfers without the need for passengers to cross the roadway

Disadvantages

- Conflicts between the bus and right-turning vehicles may arise
- The bus may obscure sight lines for pedestrians and motorists at the intersection for both main and side streets
- May present a conflict between pedestrians crossing the intersection and passengers waiting to board
- Buses may sit through multiple signal cycles to allow passengers to board or alight
- Reduces intersection capacity if a bus is stopped during signal green time
- Traffic queue may make it difficult for buses to re-enter travel lane

Sources:

SEPTA Bus Stop Design Guidelines, 2019

Rhode Island Bus Stop Design Guide, 2017

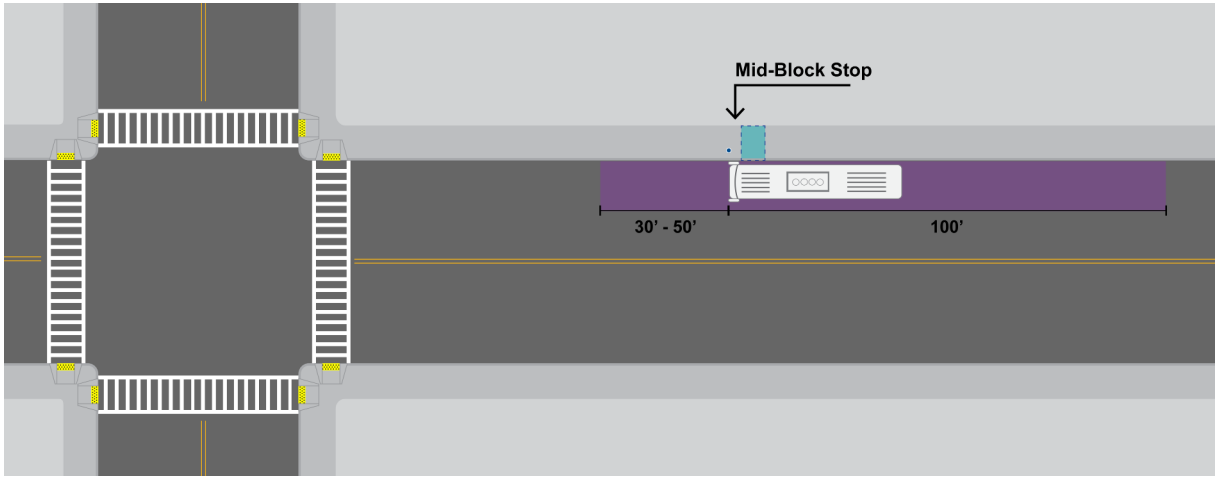
See Part 3: Bus Stop Typologies numbers 4 and 7 for examples of near-side stops and additional design considerations. Numbers 1 and 2 could also be used for near-side stops.

Mid-block Stops

A mid-block bus stop is located between adjacent intersections. Their implementation should only be encouraged where other stop types would not sufficiently serve the needs of transit users.

Mid-block stops may be appropriate in areas where there is insufficient curbside space or vehicle travel lane capacity at adjacent intersections. Mid-block stops can also be used to serve a key origin or destination for transit trips. In particular, mid-block stops may be appropriate in more suburban or rural environments with limited pedestrian infrastructure. However, there are safety concerns when mid-block stops do not have pedestrian crossings to provide access to companion bus stops for a return trip.

Mid-block pedestrian crosswalks require special engineering analysis to determine the appropriateness and effectiveness. PennDOT PUB 46—Traffic Engineering Manual provides criteria for establishing mid-block crossings. Additionally, PennDOT requires an engineering and traffic study for mid-block crosswalks on state owned roadways, known as a TE-113 form. The evaluation and design of a mid-block crosswalk associated with bus stops should be developed through coordination with the municipality and PennDOT (for state owned roadway crossings).



Advantages

- Can minimize sight distance issues for vehicles and pedestrians and be an alternative to near-side and far-side stop types
- May be closer to origins or destinations for passengers
- May result in less interference with traffic flow
- Less conflicts between passengers and walking pedestrians

Disadvantages

- May be a safety concern if no pedestrian infrastructure or no mid-block crossing is provided
- Requires more physical space for the bus to decelerate and accelerate
- Reduces available space for on-street parking

Sources:

SEPTA Bus Stop Design Guidelines, 2019

Rhode Island Bus Stop Design Guide, 2017

See Part 3: Bus Stop Typologies, numbers 1, 2, and 5 for examples of mid-block stops and additional design considerations.

Within a Site

Bus stops within a site should be placed at a location that is safe for pedestrians and for the operation of transit vehicles. This stop placement may be dedicated transit centers or within a major transit generator such as an employment center, entertainment center, retail center, medical facility, or school campus. A bus stop within a site typically requires deviation of the bus route, which adds to the travel time and reduces efficiency.

Bus stops within a site are often located in a parking lot where the interaction between pedestrians, buses, and other vehicles is a safety concern. It is important for the bus stop to be visible and clearly marked. The location should be convenient, but not in an area that conflicts with high pedestrian or vehicle activity areas. In particular, access to fire lanes in front of a building entrance should be maintained. Additionally, pedestrian infrastructure, including sidewalks and clearly marked crosswalks, should be provided to connect the bus stop with the building entrances.

Care must also be taken to design travel lane widths and turning radii within the site to accommodate buses. Locating the bus stop along the main service corridors or the perimeter route within a parking lot may be preferred, since they may already be designed to accommodate delivery trucks or other large vehicles. Bus stops within a site may serve as a bus turnaround, transfer center, or layover location, particularly if at the start/end of a route. If this is the case, bus stops within sites should be configured to accommodate the intended purpose of the stop. Stops may include bus bays so that idle buses do not interfere with the traffic circulation within the site, and may include stop amenities such as shelters or benches for waiting passengers.

For stops near a building entrance, it is important that the stop is located either before or past the main entrance doors and in a location that is clearly identified with signs, pavement markings, or other design treatments. Care must be taken to avoid conflicts areas critical for emergency access and other high activity areas.

Finally, property access agreements between the transit agency and the property owner may be needed for this type of stop.

See Part 3: Bus Stop Typologies, numbers 8A and 8B for examples of stops within a site and additional design considerations.

Bus stop within shopping centers

Source: LANTA (top); Hugh Mose (bottom)

Advantages

- Reduces conflict with other vehicles because the bus stop has a dedicated space
- Bus does not interfere with traffic operations
- Opportunity for the bus stop to be located closer to origins or destinations
- Potential space for amenities at the bus stop
- Bus does not interfere with sight distances for pedestrians or vehicles

Disadvantages

- Buses have to deviate from the route, which increases travel time for all passengers
- Buses may need to navigate tight turns in a parking lot environment
- Passengers may have to negotiate parked cars to access the stop or destinations
- The bus stop may be located in an inconvenient location within the site

Stop Configuration

In addition to the stop placement, there are several different bus stop configuration options. The physical configuration of a stop impacts how riders interact with buses and how stops integrate with roadway, streetscape, and the surrounding environment. This section details possible configurations for five stop types: roadside or curbside stops, curb extensions, bus bays, and special types of stops.

Roadside or Curbside Stops

Roadside or curbside stops are located along the side of a roadway with no modification to the edge of the roadway or curb. Roadside stops are the most common type of bus stop configuration. Roadside stops may be placed within the travel lane, on-street parking lane, or shoulder.

Key considerations for roadside stops include:

- Available curb length or area for the bus stop without physical obstructions
- Available space for waiting areas, ADA access, and pedestrian travel
- Traffic volume, speed, and operations

Travel Lane Configuration

When buses stop in a travel lane, the need for the bus to merge in and out of traffic is eliminated. This improves service reliability and travel time. This stop configuration benefits transit operations, because buses do not have to contend with merging back into the travel lane. However, it may be a hindrance to traffic operations, because the bus blocks the vehicular travel lane. Other vehicles may be permitted to pass the stopped bus, depending upon the roadway width and lane configuration.

Travel lane stops may be located in a right-turn lane. This configuration should be discouraged in most cases because it is difficult for buses to re-enter the travel lane. Additionally, buses may have to contend with turning vehicles and bicyclists when re-entering the travel lane. However, if the bus route turns at the immediate intersection, this stop configuration may be beneficial to transit operations.

Parking Lane Configuration

In areas where on-street parking is permitted, a roadside stop will generally fall within the parking lane. It may be necessary to remove a certain number of parking spaces to facilitate this stop type. Impacts to on-street parking can be minimized if stops are located near areas where parking is already prohibited; such as near fire hydrants, intersections, or driveways.

Shoulder Configuration

Depending on the shoulder width, shoulder stops require buses to fully or partially exit the travel lane. This presents similar benefits and limitations as those referenced with travel lane and parking lane configurations. If there is sufficient width for buses to fully exit the travel lane, buses will need to perform a merge to re-enter the traffic flow. However, if the shoulders are narrow, buses may still impede the regular flow of traffic. Thus, it may be safer for buses to stop fully within the travel lane.

Curb Extensions

Stops with a curb extension or bus bulb have a physical extension of the curb line and sidewalk area into the parking lane or shoulder. This configuration creates additional space for the bus stop and allows the bus to stop in the travel lane. A wider sidewalk improves pedestrian circulation by creating a wider area for pedestrians behind the bus stop zone. It also creates additional space for bus stop features, such as shelters, benches, waste receptacles, and bicycle racks. By stopping in the travel lane, rather than waiting for gaps in traffic to re-enter the travel lane, buses may continue in-lane directly after stopping, thereby, increasing transit efficiencies. Additionally, a curb extension requires less curbside area than a roadside stop, which can reduce impacts for on-street parking.

Curb extensions for bus stops at intersections can also reduce pedestrian crossing distances and help to calm traffic. However, the turning radii should be considered to accommodate the appropriate vehicles utilizing the intersection. Specifically, a curb extension located at a near-side bus stop should consider the turning radii of the bus if the bus is to make a right turn to continue its route.

Curb extensions are typically used on roadways for near-side stops in an urban or small town context where on-street parking is provided. Additionally, curb extensions are most appropriate on roadways with lower speeds. Curb extensions are often installed in locations with frequent transit service, higher bus ridership, and more pedestrian activity.

Curb extensions have the potential to cause vehicle queues behind a stopped bus, similar to a roadside stop in a travel lane. Curb extensions also have a higher capital cost and require drainage modifications or new structures, or the relocation of utilities.

PennDOT PUB 383 - Pennsylvania's Traffic Calming Handbook and NACTO's Urban Street Design Guide provide additional information regarding the use, effectiveness, and design of curb extensions.

See Part 3: Bus Stop Typologies, number 7 for an example of a stop with a curb extension and additional design considerations.

Curb extension bus stop with a shelter

Source: Port Authority of Allegheny County, Google Street View

Advantages

- Provides easy access to the bus stop for the driver
- Reduces delay caused by the bus re-entering traffic
- Provides additional sidewalk area for pedestrians and waiting passengers
- Provides additional space for bus stop features
- Reduces pedestrian crossing distance
- Uses the least amount of curb space and removes fewer parking spaces compared to a roadside stop

Disadvantages

- Can cause traffic to queue behind a stopped bus
- Boarding and alighting occurs with the bus in the travel lane
- More expensive than a roadside stop, particularly with potential drainage improvements
- Difficult to relocate due to infrastructure costs
- May cause stormwater ponding and drainage issues
- May impact on-street parking, bicycle lanes, and snow removal

Sources:

SEPTA Bus Stop Design Guidelines, 2019

Rhode Island Bus Stop Design Guide, 2017

Bus Bays

A bus bay, which can also be referred to as a pull out or turn out, includes a designated area for buses to stop that does not block a travel lane while loading and unloading passengers. A bus bay may typically consist of an entrance taper, stopping zone, and exit taper, but can include additional space for accelerating or decelerating outside of the travel lane. Bus bays require the curb to be setback away from the travel lane. This stop configuration type allows traffic to pass around the stopped bus.

Bus bays are often appropriate for roadways with higher traffic volumes and speeds, typically in rural or suburban contexts. In these situations, removing the bus from the travel lane provides a distinct safety benefit. Additionally, a bus bay can be used for locations with a layover, where the bus dwells for a longer period of time to maintain the schedule or provide a break for the driver. Also, bus bays may be beneficial for stops where boarding and alighting times may be longer, due to high ridership or passengers carrying packages.

Bus bays do require more space than roadside stops. In particular, bus bays can reduce sidewalk space at the stop. As a result, bus bays are often constructed as part of an adjacent land development project. Additionally, bus bays can delay bus service due to the time to re-enter traffic.

See Part 3: Bus Stop Typologies, number 5 for an example of a stop with a bus bay and additional design considerations.

Bus bay designs are typically considered either open or closed. As described above, a closed bus bay has a taper on both ends. An open bus bay is a variation with a taper at only one end. An open bus bay can be placed at the near-side or far-side of an intersection and is open to traffic on its end closest to the intersection. The design enables the bus to use space within an intersection to pull in or out of traffic.

The design of a bus bay should be closely coordinated with the transit agency and the municipality. Additional design guidance for bus bays is available in the following references:

- APA Urban Design Standards
- AASHTO Guide for the Geometric Design of Transit Facilities on Highways and Streets, 2014
- TCRP Report 19 – Guidelines for the Location and Design of Bus Stops, 1996

Bus bays along Fourth Street (SR 412) in Bethlehem, Northampton County

Source: LANTA

Advantages

- Provides protected area for a stopped bus, particularly for a longer dwell time or layover
- Allows buses to drop off and pick up passengers outside the travel lane
- Minimizes traffic delays due to bus operations
- Improves safety for passengers by increasing the distance between passengers and moving traffic

Disadvantages

- May be difficult for the bus to re-enter traffic, especially on high speed or high volume roadways
- May reduce on-street parking
- May reduce sidewalk space
- More expensive than a roadside stop
- Difficult to relocate due to infrastructure costs

Sources:

SEPTA Bus Stop Design Guidelines, 2019

Rhode Island Bus Stop Design Guide, 2017

Special Stops

Special stop configurations may be warranted in areas where there is high ridership, transfers, or special safety considerations.

Transfer Center

Transfer centers are stops that allow passengers to switch between routes. Frequently, passengers must wait at a stop for several minutes until their next bus arrives. A comfortable stop area that provides amenities such as a shelter, benches, etc. can improve the passenger experience. Bus stop signage and information are important features of transfer centers, possibly including real-time bus arrival or departure information.

Super Stop or Mobility Hub

Super stops, also known as mobility hubs, provide numerous amenities and connections to make the bus stop a hub for the community. These stops may integrate multiple transportation modes, including public transportation, bicycle share, bicycle parking, ride-share, or park-and-rides. Additionally, super stops or mobility hubs may serve as transfer centers or layover areas for buses. These type of stops typically include amenities for both transit riders and community members, such as shelters, benches, picnic table, or other public gathering spaces. These stops may have enhanced signage, public art, or other features to increase the visibility. Super stops can be small scale to serve a neighborhood or larger scale to support regional mobility. Pedestrian infrastructure and wayfinding signs are important to provide connections between transportation modes and destinations in the surrounding area.

Boarding Island

Boarding islands are separated from the sidewalk by a bike lane or travel lane. This configuration provides the opportunity for bicycles or other vehicles to pass to the right of the passenger waiting area, thus improving safety. This type of stop is more appropriate in an urban environment with high transit frequency and ridership.

Super Stop located in a shopping center in Robinson Township, Allegheny County

Source: Airport Corridor Transportation Association (ACTA), actapgh.org

Transit Vehicles

The design of a bus stop must be based on the transit vehicles that will be servicing the stop. In particular, it is important to consider the vehicle specifications (length and door locations), as well as turning radii and vertical and horizontal clearances.

Length

The length of the transit vehicle is one of the key dimensions used to determine the space needed for a bus stop. The design dimensions provided in this guide are based on a 40’ long bus, which is one of the more common bus sizes in the United States. The most common sizes of buses operating in Pennsylvania are 35’ and 40’. Transit vehicle fleets however, differ from agency to agency. For example, some agencies operate articulated buses, which are typically 60’ long and would require different design dimensions for bus stops.

In general, design guidelines based on 40' transit vehicle should be increased by 20' to accommodate articulated buses or reduced by 5' to accommodate 35' buses.

Even though these are standard and common sizes, there are differences in specific dimensions and operational characteristics based on the make and model of the bus. In particular, the distance between the front and rear doors will depend on the make and model of the bus. Additionally, bus features can impact the length needed for a bus stop. For example, accommodating loading and unloading bicycles from racks on the front of a bus typically requires an additional six feet for the loading zone. Therefore, it is important for transit agencies to be involved in the design of any bus stop to ensure that specific transit vehicles serving the stop will be accommodated.

Width and Clearances

A standard 40' bus is typically 8.5' wide without mirrors and 10.5' wide with mirrors. Both horizontal and vertical clearances should be considered in the design of bus routes and stops.

- Per PennDOT PUB 13: Design Manual, Part 2, the preferred travel lane width for regular transit routes is 12'.
- Obstructions, such as signs and vegetation, should not be located within 2' of the curb or edge of the travel lane.
- Overhead obstructions should be at least 12' above the roadway.

Turning Radii

Turning radii of buses must be considered, particularly when the bus makes a turn or deviates from the primary route. In general for a 40' bus, the minimum outer radius is 50' and the minimum inner radius is 30'.

Other Siting and Design Considerations

This section summarizes some additional siting and design considerations that are important for bus stops with various placement or configuration options.

Driveways and Access Management

Bus stops located adjacent to driveways may pose safety concerns, particularly due to conflicts between buses, vehicles entering or exiting the driveway, and waiting passengers. It is preferable that bus stops are not located near a driveway. But, in some situations, locating a bus stop near a driveway is the only option or is preferred due to other constraints.

Listed below are several guidelines that should be followed when bus stops are located near a driveway.

- Place bus stops where driveways are behind the stopped bus to provide visibility for vehicles accessing the driveway and minimize conflicts between buses and vehicles
- Fully block a driveway rather than partially block a driveway to prevent vehicles from making unsafe maneuvers around the stopped bus

- If there are multiple driveways, keep one driveway open while the bus is stopped for passenger loading/unloading
- Provide space adjacent and separate from the driveway for boarding, alighting, and waiting passengers. The boarding and alighting areas must meet ADA requirements.
- Ensure that bus stop infrastructure, including shelters and benches, does not block the view of vehicles entering or exiting the driveway

Additionally, access management strategies, such as reducing the number of driveways and increasing spacing between driveways, can reduce conflicts between buses, vehicles, and pedestrians.

Sight Lines and Sight Distance

Proper sight lines and sight distances at bus stops are important for waiting passengers, pedestrians, bus operators, and other motorists. The roadway geometry, topography, and other obstructions must be considered as part of the bus stop placement and design. Parked vehicles, signs, trees, and landscaping can obstruct the views, particularly of a driver or waiting passenger.

For optimal sight distance, a bus stop should not be located over the crest of a hill or immediately after a curve in the roadway. Vehicles following a bus need to have good visibility of stopped buses, particularly when bus stops are located in the travel lane. Similarly, bus drivers need to be able to see vehicles approaching from behind when exiting a stop. Additionally, sight lines and distances must be considered when a stop is located at an intersection or driveway, particularly for vehicular access and turning movements when a bus is stopped. A bus stop should be sited to meet minimum stopping sight distance provided by AASHTO and additional guidance is included in the most recent version of the AASHTO Geometric Design Guide for Transit Facilities on Highways and Streets.

Curb Management and Parking Restrictions

When bus stops are located in areas where on-street parking or loading is permitted, the interaction of buses with parked vehicles should be considered. On -street parking should be prohibited or restricted at the bus stop to provide sufficient space for buses to decelerate, stop, and accelerate. Parking restrictions can be implemented with pavement markings, signs, and/or painted curbs. These treatments should be applied to the limits of the bus stop zone to clearly define the no parking zone. There may be situations where a shared bus stop and loading zone can be provided, particularly if they are used at different times of the day. Also, any restrictions related to on -street parking or loading may require targeted enforcement to ensure that bus stop areas are clear. The transit agency and local jurisdiction should coordinate closely on all strategies for curbside management at bus stops.

Bicycle Lanes

When a bicycle lane is located in an area with a bus stop, special pavement markings or infrastructure improvements should be considered to ensure the safety of all road users. Sufficient sight distance for

No parking signs for bus stops

Source: MUTCD, 2009

bicyclists to see stopped transit vehicles and for transit operators to see cyclists is needed.

In urban areas with a high number of transit riders and bicyclists, it may be appropriate to physically separate or relocate the bicycle lane. A floating bus stop, is a bus island for passengers where the bicycle lane is shifted to run behind the island, rather than through or alongside the bus stop.

For more rural or suburban contexts with lower volume of transit riders and bicyclists, pavement markings and signage can be used to designate a transition area where the bus can cross over or pull into the bicycle lane and allow riders to pick-up or drop-off at the curb. This could include providing a dashed line and bike lane symbol markings prior to and along the bus stop and consistent with Manual on Uniform Traffic Control Devices (MUTCD) to make both the cyclists and bus drivers aware of the potential conflicts in these areas. Other options could include green colored bicycle lane markings at the bus stop to identify the conflict area, shared "BUS BIKE ONLY" pavement markings, or discontinuing the bicycle lane at the transit stop.

Pavement Markings and Signage

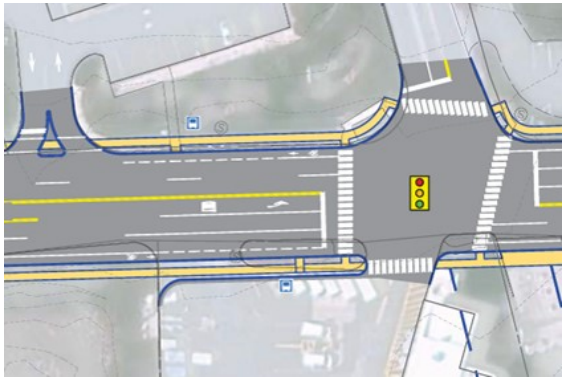
All bus stops should include appropriate pavement markings and signs that indicate the area is designated for the explicit use of buses. Such pavement markings and signs must conform with the most recent edition of the MUTCD. The MUTCD includes guidelines for regulatory signs for no parking at bus stops, as well as "BUS ONLY" legend markings for preferential lane use.

Pavement Material

Buses are heavy vehicles and the acceleration, deceleration, and stopping at bus stops can accelerate degradation of the pavement material. Asphalt, in particular, can warp and rut due to force and heat generated by buses. It may be appropriate to consider concrete for the roadway surface, particularly in areas with frequent transit service, where buses are expected to stop for extended periods, or where rutting or other maintenance issues have occurred. Compared to asphalt, concrete is more durable and less prone to rutting or warping. However, providing a concrete pad at the bus stop can create additional maintenance concerns due to the interface between different materials. Pavement materials for bus stops should be designed and coordinated with the entity that owns and maintains the roadway according to their pavement material standards and specifications.

Traffic Signals

When bus stops are located near signalized intersections, the traffic signal equipment and timing can help provide a safe pedestrian crossing and connection for transit riders. The signal should include an ADA accessible pedestrian signal and pedestrian push button. Additionally, the traffic signal timing should include adequate time for pedestrian crossings, with consideration for the population that may be crossing at the location. In some locations with heavy right or left turning volumes, providing a leading pedestrian interval may be appropriate. A leading pedestrian interval



Conceptual plan for pavement markings for bicycle lanes at bus stops in a suburban context

Source: Route 30 Corridor Study, East Whiteland Township, 2018

gives pedestrians a 3 to 7 second head start prior to the green signal for the same direction of travel.

Transit Signal Priority (TSP)

Most buses operate in mixed traffic and experience delay due to traffic signals. Transit Signal Priority (TSP) involves providing preferential signal timing and phasing to buses, which can reduce travel times and make transit service more efficient, reliable, and boost ridership. TSP is most appropriate for corridors with traffic congestion and high transit ridership, where improved signal timing and phasing can significantly enhance the bus service. TSP involves a number of strategies that provide priority signal operations to the bus. Typically, TSP includes automatic detection of a bus that is approaching a traffic signal and modification of the signal operations to give preferential treatment to the bus. This can include an early green phase, extended green phase, or special or modified signal phasing. TSP is typically implemented at multiple signalized intersections along a bus route, which provides cumulative travel time savings. There are different types of TSP technologies that can be deployed, depending upon the transit system, transit service, traffic signals, and traffic conditions.

Most traffic signals in Pennsylvania are owned and maintained by municipalities. PennDOT reviews and approves traffic signal permit plans. Therefore, implementation of any TSP measure requires close coordination between the public transit agency, one or more municipalities along a bus route, and PennDOT.

Queue Jump and Bypass Lanes

Queue jump and bypass lanes provide restricted lanes for buses to use to bypass queued vehicles at a signalized intersection. Both types of lanes are relatively short lanes adjacent to the travel lanes where buses can travel around traffic congestion. Queue jump and bypass lanes can reduce travel time and improve reliability, particularly when implemented in conjunction with TSP. These lanes are most appropriate for urban environments and corridors with frequent transit service, high traffic volumes and congestion, and where land or space is available to construct the infrastructure.

A queue jump lane can have a leading bus interval or active signal priority that provides an early green light. Queue jump lanes can be combined with right turn lanes, if the right turn volume is low.

A bypass lane or short transit lane may not have leading or priority signalization, but typically continues through an intersection to a far-side stop. A bypass lane is not combined with a right-turn lane and allows the bus to bypass queues in through lanes and right-turn lanes.

Roundabouts

The location and design of a bus stop at a roundabout should be placed to avoid a stopped bus from blocking traffic and creating a queue that interferes with circulation in the roundabout. Sometimes, it is beneficial to locate the stop further away from the roundabout or provide a bus bay. Pedestrian access and safety to the stop is also an important consideration for the bus stop design.

SEPTA near-side bus stop at a roundabout in Swarthmore Borough, Delaware County

Bus Stop Elements

Bus stop elements are curbside facilities located at a bus stop that are designed and intended to provide safe access to the bus service, make the stop visible, and enhance the comfort of waiting passengers. Since all transit riders are pedestrians before and after they ride the bus, pedestrian access and connectivity is an essential component of transit services and a key consideration for the design of all bus stop elements.

A fundamental and universal element is a bus stop location sign that indicates the transit agency and routes that serve the stop. All new, altered, or relocated bus stops shall comply with regulations of the Americans with Disabilities Act of 1990 (ADA). At a minimum, an ADA accessible bus stop shall include an ADA loading pad and pedestrian accessible route to the adjacent sidewalk, path, or public right-of-way. Beyond the minimum requirements, there are several desirable elements, including a clear zone for rear door access and parking restrictions, if applicable. Bus shelters, benches, and other amenities are optional, but can significantly improve the passenger waiting experience and help increase the visibility of bus stops. Having an accessible and well designed bus stop with appropriate amenities can also help to promote the use of public transportation. This section highlights the purpose and basic design guidance for various bus stop elements. The bus stop elements are the building blocks to make bus stops safe, accessible, convenient, comfortable, and attractive.

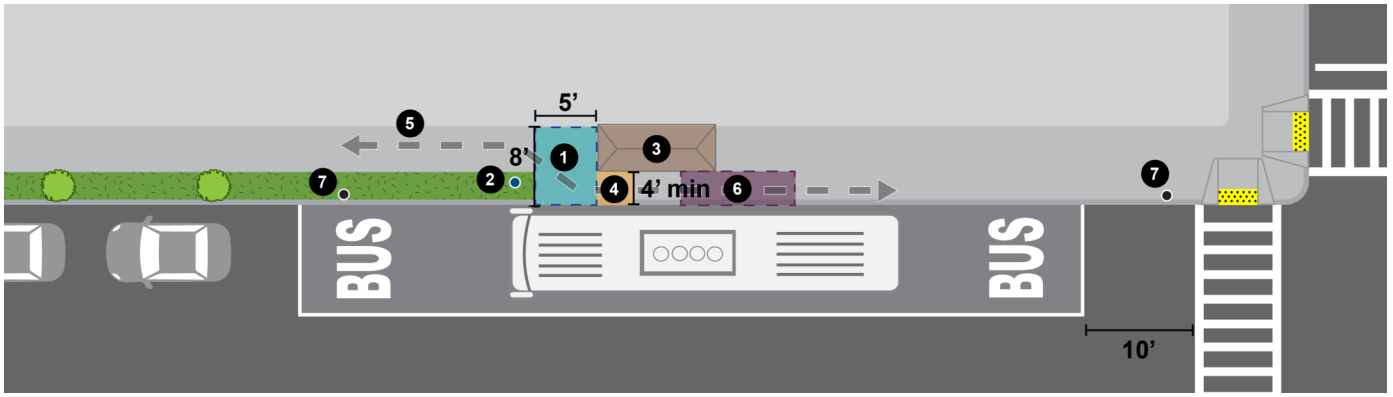
The graphics on the following page provide general illustrations of key bus stop elements for a typical stop and summarize general design guidelines. Part 3: Bus Stop Typologies provides additional examples of bus stop configurations and the potential placement of bus stop elements.

Bus stop with a shelter and lighting for LANTA serving commercial developments in Lower Macungie Township, Lehigh County

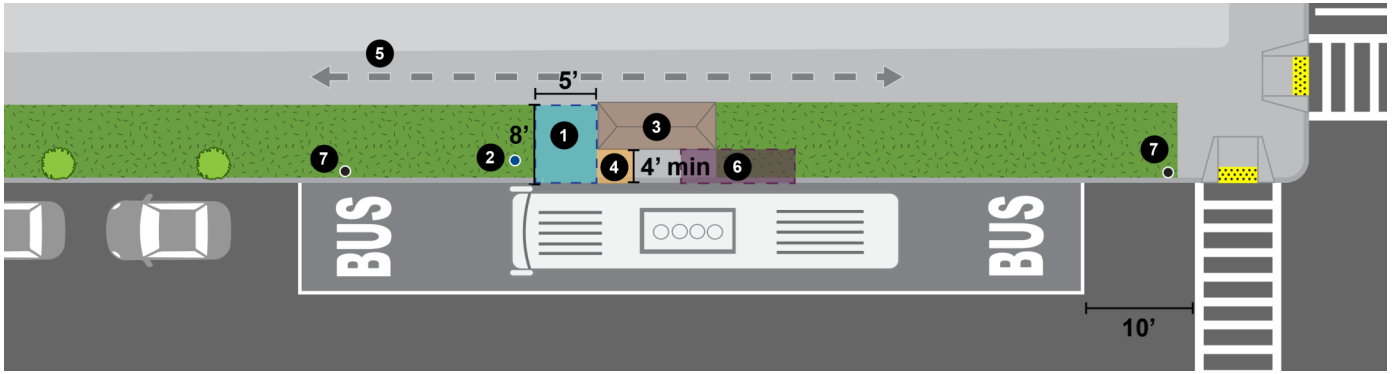
Source: Google Earth

Basic Bus Stop Elements

Sidewalk separated from the curb with a narrow verge



Sidewalk separated from the curb with a wide verge

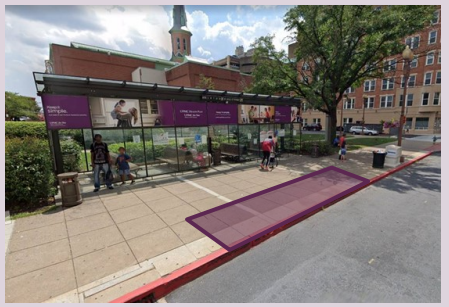


Plan View

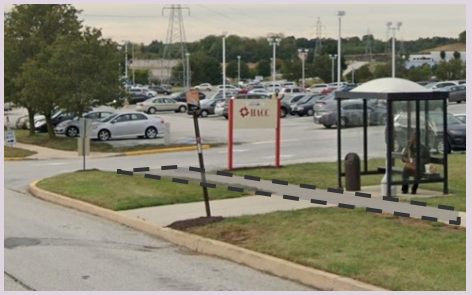
Not to Scale

7 No parking signs or designation (if applicable)

6 Clear zone for rear door and waiting area

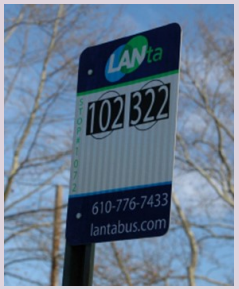


5 Accessible route (through the stop and to destinations)



1 ADA loading pad

2 Bus stop sign



3 Shelter, bench or other street furniture (optional)

4 Accessible route (to the shelter)

Image credits: Google Earth, LANTA, DVRPC

Basic Bus Stop Elements (continued)

1 ADA loading pad

- Firm and stable surface, typically concrete
- Minimum clear length of 8' measured perpendicular to the roadway.
- Minimum clear width of 5' measured parallel to the roadway. Wider pad is desirable.
- Maximum cross slope is 1:48

2 Bus stop location sign

- Minimum 2' between the sign support structure and the curb/edge of the roadway
- Minimum 2' from ADA loading pad
- Vertical clearance from the ground to the bottom of the sign between 7' and 8'
- Not obstructing pedestrian accessible route
- Mounted on a post (or a shelter) that does not include any traffic control devices

3 Shelter, bench, bicycle parking, lighting trash receptacle and other amenities (optional)

Shelters

- Minimum clearance of 4' from the curb and not obstructing the clear area for the ADA loading pad or the pedestrian accessible route
- Minimum clearance of 4' around the shelter, which may be reduced to 2' for the distance between the back of the shelter and a building face or wall
- Installation in PennDOT's right-of-way requires a Transit Shelter Right-of-Way Placement Agreement. Installation on other public right-of-way or private property may require an easement and/or maintenance agreement.

4 Accessible route (between the ADA loading pad and the shelter)

- Desirable minimum width of 4' with a required minimum clear width of 3'
- Maximum running slope is 1:20
- Maximum cross slope is 1:48

5 Accessible route (through the stop and to destinations)

- Firm, stable, and slip resistant surface
- Desirable minimum width of 5' with a required minimum clear width of 4'
- Maximum cross slope is 1:48
- Note: There may be limitations to providing ADA compliant accessible routes to bus stops. Providing sidewalks, crosswalks and other pedestrian infrastructure for accessible routes may involve coordination between municipalities, PennDOT, transit agencies, and/or property owners.

6 Clear zone for rear door access and waiting area

- Level area free of obstructions to wait for the bus and access the bus via the rear door
- The size of the waiting area should be based on ridership at the bus stop
- For rear door access, the desirable minimum length is 4' measured perpendicular to the roadway and the desirable minimum width is 10' measured parallel to the roadway
- Desirable paved surface, but can be grass

7 No parking signs or designation (if applicable)

- No parking may be designated with signs, painted curbs, and/or pavement markings
- Municipalities are responsible for no parking designations, as well as pavement markings for the bus stop

ADA Accessibility and Pedestrian Access

ADA regulations grant persons with disabilities the same rights and responsibilities available to all individuals. Transit agencies and other entities follow specific requirements to ensure that services, vehicles, and public transportation facilities are accessible and usable by persons with disabilities. Requirements for ADA regulations applicable to bus stops can be found in the U.S. Department of Transportation's ADA Standards for Transportation Facilities - Sections 402 and 810.2—810.4. FTA Circular 4710.1 is also a helpful resource that provides transit agency requirements related to ADA accessible bus stops and ADA accessible routes to bus stops. Transit agencies should be consulted and involved in the design process for all bus stops.

ADA Loading Pad

An ADA loading pad is level area with a firm, stable surface where the front (or the accessible) door of the bus opens to receive and discharge passengers. The basic and minimum requirements for ADA loading pads are summarized below.

- Firm and stable surface
- Minimum clear length of 8' measured perpendicular to the roadway
- Minimum clear width of 5' measured parallel to the roadway
- Connected to sidewalks, pedestrian paths, streets, or the public right-of-way by a pedestrian accessible route
- Maximum cross slope is 1:48
- Longitudinal slope following the roadway

Existing conditions, ridership numbers and demographics, specifications and features for transit vehicles servicing the stop, and other factors should be considered when designing an ADA compliant loading pad. The dimensions required for ADA accessibility should be considered the minimum size for a loading pad. It is preferable to provide a larger ADA loading pad with sufficient space for boarding and alighting. A wider loading pad can also provide additional space for passengers to wait for the bus and reduce conflicts with other pedestrians using the sidewalk. Additionally, a wider loading pad eases bus operations and gives the bus operator more space to properly pull the bus to the curb at the stop.

The ADA loading pad is typically integrated with the adjacent sidewalk, but may be a stand-alone facility in locations where a sidewalk connection is not feasible. There are various options for providing the ADA loading area, depending upon the width and design of the sidewalk. The graphic on the following page shows two typical configurations for ADA loading pads that are integrated with an adjacent sidewalk. The ADA loading pad is typically concrete to provide a firm and stable surface. Providing the ADA loading pad at curb height is preferred to ensure that a ramp deployed from the bus does not exceed the maximum slope of 1:6 to meet ADA requirements.

When a Bus Stop is Not Accessible

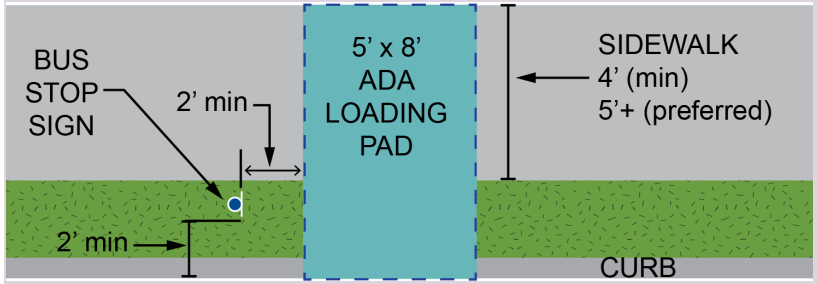
If a bus stop or route to a bus stop is not accessible for a passenger, they may request a reasonable modification from the operator to slightly adjust the boarding/alighting location to an accessible location. The individual with disabilities may also be eligible for complementary paratransit, at least on a conditional basis. See FTA Circular 4710.1 for additional information.

ADA loading pads

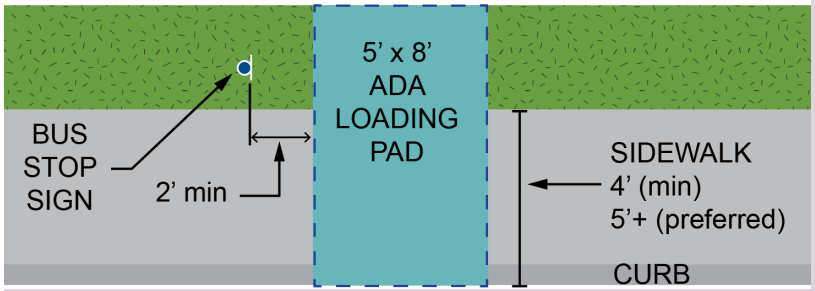
Source: Google Earth, Skillings Connolly, Inc.

Typical ADA Loading Pad Configurations

Sidewalk Separated from Curb (with Grass/Landscaped Verge)



Sidewalk Adjacent to Curb (without Grass/Landscaped Verge)



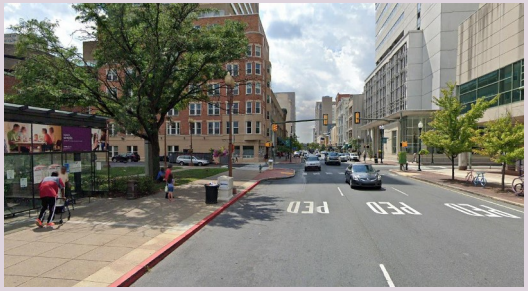


Image Source: Google Earth

Image Source: Google Earth

Clear Zone for Rear Door Access and Waiting Areas

In addition to the ADA loading pad, bus stops should have an adequate waiting area for passengers and clear zone for rear door access to/from the bus. Although there are no ADA requirements for waiting areas or clear zones, it is desirable to provide a level area that is free of obstructions. In particular, driveways, utility poles, hydrants, bus stop amenities, and other street furniture should not be placed within the clear zone. It is desirable for the clear zone to be paved, but it can be grass. Additionally, it is preferred to have the clear zone integrated with or connected to an adjacent sidewalk or pedestrian path. While there are no specific ADA requirements for the dimensions of the clear zone, it is desirable to provide a clear area that is at least 4' long measured perpendicular to the roadway and 10' wide measured parallel to the roadway. The location and width of the clear zone should be based on the buses that will serve the bus stop and is dependent upon the distance between the center line of the front door and the center line of a rear door. For 40' standard buses, this distance is typically 19' to 20'.

Pedestrian Accessible Connections

Pedestrian connectivity is a critical element of bus stop design. An ADA compliant bus stop must include the following connections via a pedestrian accessible route:

- ADA loading pads to bus shelters
- ADA loading pads to sidewalks, pedestrian paths, or streets

This means a clear, unobstructed, and ADA compliant path of travel is provided between these bus stop elements. The accessible route should be at least 4' wide, but can be reduced to 3' and still comply with ADA requirements. ADA requirements for accessible routes are provided in U.S. Department of Transportation's ADA Standards for Transportation Facilities - Section 402.

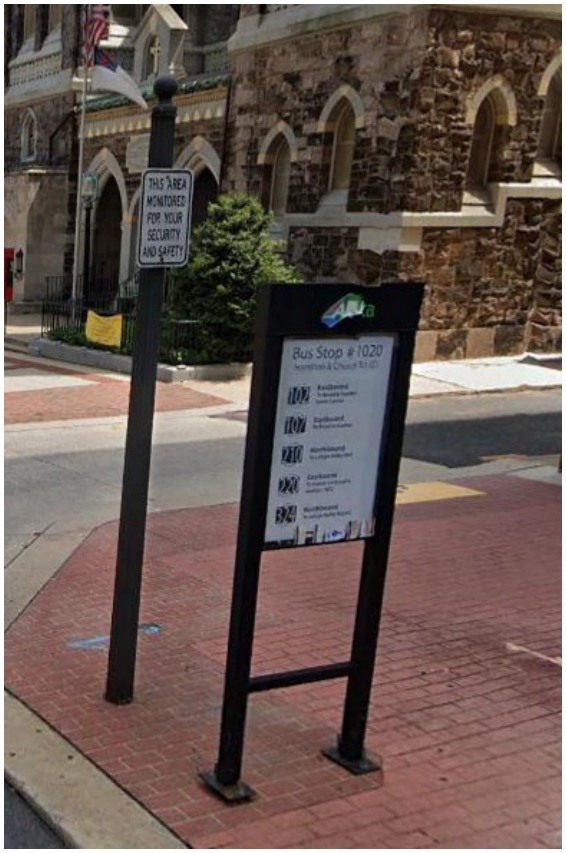
Pedestrian accessible routes should also be provided to other bus stop elements and amenities, such as information signs, benches, and trash receptacles. It is also important to maintain pedestrian accessible routes through a bus stop, particularly when bus stop elements are integrated with the sidewalk or other streetscape features. Pedestrian accessible connections via sidewalks, paths, or trails should also be provided to nearby intersections, crosswalks, and also directly to key transit generators.

While the overall goal is to provide ADA compliant pedestrian connections to bus stops, the ability to provide an accessible route may be limited. For example, transit agencies may not have the authority or ability to provide sidewalks or pedestrian connections to bus stops. Sidewalks and pedestrian infrastructure is typically owned and maintained by a municipality or private property owner. The ability to provide pedestrian connections may be limited by access to private property and may require approval from property owners. In addition, crosswalk treatments, including pavement markings or pedestrian signals, are typically owned and maintained by municipalities. The design and implementation of crosswalk treatments for an accessible route will require coordination with the governmental entity responsible for the roadway.

Signs and Information

Bus Stop Location Signs

All bus stops should include at least one sign that identifies the location of the bus stop. Bus stop location signs can also help to promote available transit services and convey the operator. Clear signage helps passengers confirm that they are at the right location to board a bus. Bus stop location signs are not traffic control devices. The bus stop location sign typically includes the name or logo of the transit agency and a listing of the bus routes serving the stop. In addition, some bus stop location signs include a bus stop ID number, a phone number for customer service, or information regarding online applications for bus location and schedule information. Bus stop location signs are typically designed, installed, and maintained by transit agencies. All sign content, including font and letter sizing, should be ADA-compliant.



Bus stop pillar sign for LANTA in Allentown, Lehigh County

Source: Google Earth

Key guidelines for the placing of bus stop signs are summarized below.

- Bus stop location signs shall be placed to clearly identify the location where passengers access the bus service.
- The bus stop sign shall be located in close proximity, but not within the ADA loading pad.
- The bus stop location sign should not obstruct pedestrian accessible connections at the stop.
- The sign post shall be located a minimum 2' from the curb or roadway edge, as well as driveways.
- The vertical clearance from the ground to the bottom of the sign shall be between 7' and 8'.
- The sign shall be visible to approaching buses and other traffic, as well as pedestrians on the sidewalk. It shall not be blocked by trees, signs, or other obstacles.
- To minimize clutter or conflicts, bus stop signs shall be mounted on either their own post or on another existing pole or bus shelter. Bus stop location signs shall not be mounted on the same pole as a traffic control device.
- Bus stop signs should be retroreflective to increase visibility for bus operators and other drivers.
- Consider a unique pole design, incorporating tactile features, or using technology to help people with visual impairments identify the bus stop.

Bus Stop Passenger Information Signs

At some stops, especially stops with higher ridership or multiple bus routes, it may be beneficial to provide additional passenger information. This may include schedules or timetables, fares and fare zones, route maps, system maps, or neighborhood wayfinding maps. Passenger information signs could also include electronic displays with real-time information for the arrival of the next bus. Electronic displays require power and additional provisions for maintenance.

Shelters

Bus shelters provide a comfortable area protected from the rain, sun, snow, and wind for passengers to stand or sit while waiting for a bus. Shelters can provide other benefits, including providing protected seating; increasing visibility of a bus stop; and incorporating passenger information, lighting, or other features. Though bus shelters provide many benefits to transit users, they are optional and may not be necessary, feasible, or appropriate for some bus stops.

Some transit agencies utilize criteria to determine when a shelter is warranted, such as the number of boardings, transfers, transit dependent population, and nearby land uses or facilities. Other factors to consider include frequency, bus layovers, and operator relief points.

Ridership: The number of passengers utilizing a bus stop is an important factor in determining if a

Bus shelters in Monroe County

Source: Monroe County Transit Authority

shelter is warranted. Shelters are often considered at bus stops with a higher number of boardings.

Transfers: Stops that are designated transfer locations have an increased likelihood that passengers will be waiting for a bus at that location.

Demographics: Demographics may also have an impact on the decision to locate a shelter at a given stop location. Persons living with a disability or aging adults may benefit greatly from the increased protection and security provided by a bus shelter. Additional consideration should also be given to areas where low income or minority individuals live or work.

Land Use: Bus stops near vital services such as assisted living facilities, dialysis centers, hospitals, pharmacies, clinics, public libraries, recreation centers, schools, supermarkets or other shopping centers are also candidates for shelters. Shelters can sometime have multiple uses. For example, shelters located near residential communities may be used by school students.

Location

Bus shelters may be located either in the public right-of-way or on private property. There are different requirements given the ownership of the property that shelters are located on.

Public Right-of-Way: Shelters located within the public right-of-way are subject to the requirements of the entity that owns the right-of-way, typically the state under the jurisdiction of PennDOT or the local municipality. For any shelter in state owned right-of-way, PennDOT requires a Transit Shelter Right-of-Way Placement Agreement. The location and design of the shelter and execution of the agreement must be coordinated with the transit agency, PennDOT District, and PennDOT Central Office. For shelters within municipally owned right-of-way, the municipality may have special requirements for shelter installation and maintenance. The location and design of the shelter should be coordinated with the transit agency and municipality.

Private Property: New shelters on private property would likely be subject to the applicable zoning and/or subdivision and land development ordinance of the local municipality and also subject to approval by the public transit agency and/or private property owner. The transit agency may require an agreement to specify that the shelter will be open and accessible and address installation and maintenance responsibilities. The private property owner may require an agreement to, among other requirements, grant the transit agency access to the property, waive property owner from certain liabilities, and specify shelter maintenance responsibilities.

Ownership and Maintenance

Shelters may be provided and installed by transit agencies, local municipalities, advertising agencies, property owners, non-profit organizations, or through some type of partnership between multiple entities. Advertising panels may be installed to help offset some of the capital and maintenance costs of shelters.

Shelters should be regularly maintained to uphold a standard and inviting appearance for transit users. Maintenance includes replacement of panels, cleaning, painting, and removal of trash. To maintain access for riders, an entity should be responsible for removing snow around bus shelters.

Placement and Design

The design of shelters shall meet ADA standards and be simple, functional, and easily to maintain. The minimum ADA requirements for bus shelters are included in the U.S. Department of Transportation's ADA Standards for Transportation Facilities - Section 810.3 and summarized below.

- The bus shelter shall be connected to the ADA loading pad by a pedestrian accessible route.
- The bus shelter shall not obstruct the minimum clear area of the ADA loading pad for boarding and alighting, which is 5' measured parallel to the roadway and 8' measured perpendicular to the roadway.
- The interior of the bus shelter should comply with ADA requirements including access points between panels, circulation space within the shelter, and seating. For example, the shelter shall have a minimum clear floor area of 30" by 48". Openings between panels shall have a minimum clear width of 3'. The slope of the foundation for the shelter shall not be greater than 1:48.

Beyond these minimum requirements to comply with ADA standards, bus shelters should be placed appropriately to ensure safety of passengers, buses, pedestrians, and other road users.

- A shelter shall be located near the front end of the bus stop zone and preferably close to the ADA loading pad. A bus shelter can be integrated with the ADA loading pad, but shall not obstruct the minimum clear area of 5' by 8'.
- Shelters shall be placed in such a manner to not interfere with the accessibility of passengers or of passing pedestrians. A minimum clearance of 4' shall be maintained around the shelter, but may be reduced to 2' for the distance behind the back of the shelter and a building face, wall, or similar vertical barrier.
- A bus shelter shall be connected via a pedestrian accessible route to the ADA loading pad and to an adjacent sidewalk, path, or trail that is a minimum of 4' wide (and preferably 5' wide).
- A shelter shall not block the clear zone for rear door boarding or alighting.
- A shelter shall be at least 4' from the curb or roadway edge.
- A shelter should have good visibility for approaching buses to maintain safety for passengers.
- A shelter should not obstruct sight lines. Special consideration should be given for shelters placed near intersections or driveways.
- The design of the shelter should consider potential weather conditions. For example, the

shelter may be enclosed on up to three sides with partial enclosure of a fourth side for protection against wind or other weather elements.

- Any advertising on side panels shall generally be placed farthest from oncoming traffic and perpendicular to the road. Advertising panels shall not obstruct sight lines for pedestrians, transit vehicles, or other road users.
- Lighting, which can be solar powered and integrated with the shelter, is important for visibility, safety, and security.
- Any lighting shall not conflict with nearby traffic control devices and shall be shielded from abutting residential properties.
- Potential shared uses, such as use of the shelter by school students, should be considered during the design process.

Bus shelters can vary greatly in terms of style, size, shape, and functionality. The size and design of the shelter is often dependent upon the space available, ridership, and context at a given location. Typically, a shelter includes a roof, rear panel, and two side panels. However, the number and location of panels surrounding the shelter may vary. In particular, some narrow shelters have a rear panel only or side panels only. For security and safety purposes, the majority of the side and rear panels of the shelter shall be constructed of a clear, shatter resistant material. Shelters may incorporate other features or amenities, such as integrated benches, trash receptacles, interior/exterior lighting, printed or electronic informational signs, heating systems, Wifi connections, and solar panels.

Some transit agencies have standard bus shelter designs and a variety of prefabricated shelters are available. Generally, prefabricated shelters are available in standard sizes, styles, or modular designs. For example, a typical shelter is 5' wide, but the length can vary between 9' and 20'. There are also narrower shelter designs for constrained locations. The use of prefabricated shelters may be beneficial to ensure that replacement parts are readily available in the case that shelters are damaged. All prefabricated shelters shall meet ADA standards and be installed according to the manufacturer's specification, which typically require a concrete foundation.

Signage and Displays

Bus shelters may include signage that serves two very distinct purposes. Informational signage serves the needs of passengers, while advertising signage may offset the cost of construction and maintenance of the shelter.

Informational Signs: A bus stop location sign that identifies the stop can be integrated with the shelter or the shelter may include additional information displays, such as route maps or schedules. Electronic signs that indicate when the next bus will arrive may also be incorporated, but require additional capital and operational investment.

Advertising: Advertising displays are often incorporated into the side panels of bus shelters. Revenue from this advertising can be used to offset

the cost of installing and maintaining the shelter. In some cases, advertising agencies may install and maintain shelters, typically as part of an agreement with a municipality or transit agency. Care must be taken with the placement of advertisements to maintain clear sight lines for waiting passengers and transit vehicle operators.

Other Bus Stop Amenities

There are a number of amenities or street furniture that can be provided at bus stops to increase the comfort and convenience for waiting passengers. Additionally, these elements can make the bus stop more attractive and help integrate the bus stop with the surrounding land uses. The amenities will likely be used by both transit riders and non-transit riders.

The siting and design of these types of amenities should be coordinated with the municipality and transit agency. The amenities shall be sited in locations close to the bus stop, but not obstruct the ADA loading pad, clear zone for rear door boarding, shelter access, or pedestrian access through the bus stop. Ideally, amenities for bus stops should look consistent with other streetscape features in the area. Additionally, provisions and agreements for ongoing maintenance should be identified prior to installation. Installing and maintaining these types of amenities can be accomplished through partnerships. For example, if an entity already owns and maintains street furniture along a bus route, it may be cost-effective for that entity to maintain amenities provided at a bus stop.

Benches

Stand alone benches can be installed at a bus stop and can provide a safe and comfortable place to wait for a bus. Benches are often installed at stops with higher ridership and in locations where a shelter is not feasible or desirable. Compared with shelters, benches are generally lower cost, easier to install, and require less space; therefore, they can be located in constrained locations. The Revised Draft Guidelines for Accessible Public Rights-of-Way notes that outdoor benches should have back support, armrests, and a seat height of 17” to 19” above the ground. The National Association of City Transportation Officials (NACTO) Transit Street Design Guide recommends benches for bus stops be at least 43” long and 20” to 24” wide.

In general, the back of a sidewalk provides the safest, driest, and best view of passengers waiting for a bus. Benches shall be placed in a location with a clear view of the approaching bus. Additionally, benches shall not obstruct the boarding and alighting areas and pedestrian routes. For example, in addition to a 4’ wide pedestrian access route through the bus stop, an additional 1’ clearance should be provided in front of the bench to account for knee and toe clearance.

Stools can be an alternative to benches in locations with constrained space and low to moderate ridership. Leaning rails are another alternative that can be located within shelters, mounted on walls, or freestanding. Leaning rails improve comfort for passengers waiting for a bus and can be relatively

Play bus stop with a bench on West Market Street in the City of York

Source: rabbittransit

low cost and easy to install, particularly compared to a bench or shelter. The design and placement of leaning rails shall comply with ADA standards.

Bicycle Parking

Bicycle parking at bus stops can expand connections between transit and key origins and destinations. Bike parking can help provide first-mile and last-mile connections for transit services. Bicycle parking at a bus stop could include a single bicycle rack, larger rack for multiple bikes, bicycle lockers, or even a bike share station. Care should be given in the siting of bicycle parking to ensure that parked bicycles do not obstruct access to the bus stop or access along the pedestrian route through the stop. Additionally, in terms of safety and security, bicycle parking should be visible and preferable in locations that are well lit. Municipal subdivision and land development ordinances may include specific requirements for bicycle parking.

Trash Receptacles

Trash and recycling receptacles can help to keep bus stops clean and attractive. Trash receptacles are often considered for bus stops with high ridership and bus stops with shelters because wind-blown debris can accumulate at shelters. Trash receptacles come in a wide variety of shapes, sizes, and styles. For ease of collection, trash containers should be located 1' to 2' from the back of the curb.

Lighting

Bus stops should be appropriately illuminated for rider comfort and safety. Proper lighting ensures a bus operator can see the bus stop and waiting passengers and can also deter criminal activities. Lighting can be integrated with other bus stop infrastructure, such as shelters and signs. Solar and LED lighting are more sustainable lighting options that are available for bus stop infrastructure. Care must be given to avoid conflicts with traffic control devices.

The American Public Transit Association (APTA) provides the following recommendations for proper lighting levels at bus stops:

- Use multiple lights rather than single fittings to provide consistent lighting levels and to reduce contrast between shadow and light
- Place lighting where it will not be blocked by mature vegetation
- Avoid placement of unshielded lighting at eye level
- If possible, install lighting at height levels that resist vandalism
- Use downward lighting
- Maximize use of existing lighting when possible.

Source: APTA Bus Stop Design and Placement Security Considerations, 2010

Landscaping and Stormwater Management

Trees and landscaping can make a bus stop more inviting and attractive and can often be placed to provide natural shelter from the sun, wind, or rain. However, landscaping should not obstruct boarding and alighting areas; visibility of signage; or clear views for the bus operator and passengers. For example, a planting area or green infrastructure should not be placed within the clear zone for the rear door. Municipal subdivision and land development ordinances often include requirements for landscaping, including specific requirements and species for street trees. Maintenance should also be considered during the selection of plants or trees and the design of any landscaped areas.

Maintenance

Bus stop infrastructure requires routine and ongoing maintenance, as well as repairs and sometimes full replacement. Routine maintenance can include emptying trash receptacles, clearing trash from shelters, replacing signs, shelter cleaning, or removing graffiti. Additionally, some maintenance activities may be related to seasonal conditions, such as clearing snow and ice from ADA loading pads, sidewalks, and shelters. More significant repairs could include replacing broken panels on a shelter or completely replacing a bench or shelter.

When bus stop infrastructure is designed and installed, there should be a written agreement between responsible entities to properly maintain a stand-alone ADA loading pad, bench, trash receptacle, or bus shelter. There are a number of entities that could take responsibility for maintenance, including transit agencies, municipalities, advertising agencies, private developers or property owners, and non-profit organizations. Additionally, maintenance can be provided as a partnership between different entities. Entities should have a general maintenance or inspection plan that identifies the schedule for checking on the condition of the bus stop infrastructure or performing routine maintenance, such as emptying a trash receptacle. Entities should consider and provide a way for passengers or the public to report damage or unsanitary conditions. Additionally, entities should plan and budget for more significant repairs and upgrades and potentially lifecycle replacement.