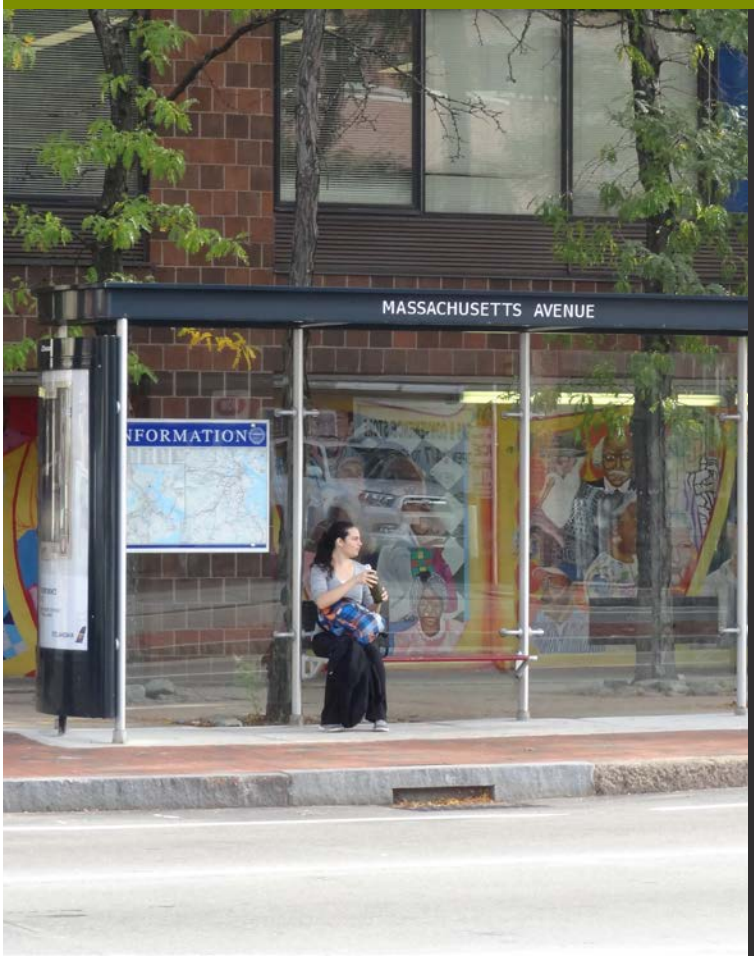
BUS STOPS



Bus stops are critical connection points between modes of transportation. Pedestrians, bicyclists, and transferring passengers need to access bus stops. Bus stops are often located in areas with high pedestrian volumes, such as near transportation centers and business districts, but they also serve suburban and rural areas where buses may be the only form of transit. Bus stops should be comfortable, safe, convenient, and designed for the local context. They should complement the larger transportation network.

Accessibility is an essential part in determining bus stop location and layout. In many areas outside urban, low-speed environments, designers need to consider roadway clear-zone requirements and roadside drainage features, which may present challenges to bus stop access. As a method to improve safety, designers sometimes develop "forgiving" roadway designs that include relatively large clear zones. However, this approach may preclude the inclusion of desirable bus stop elements such as bus shelters. The **2011 AASHTO Green Book** identifies flexibility in the clear-zone requirements, where engineering judgment and local context should be used to select an appropriate clear-zone distance for the specific road and bus stop location.

KEY DESIGN FLEXIBILITY

The **2011 AASHTO Roadside Design Guide** provides the basis for design when selecting a clear zone for a roadway. There is flexibility in the clear-zone requirements outlined in the Roadside Design Guide:

"While clear zone dimensions are provided in this guide, they should not be viewed as either absolute or precise. It is expected that the establishment of roadside design criteria and the design of the roadside is a site- or project-specific task for the designer. Also, the Roadside Design Guide suggests that more than one solution may be evident or appropriate for a given set of conditions."

AASHTO Flexibility Guide 2004, p. 69

OTHER RESOURCES

"Pedestrian access from the catchment areas surrounding bus stops should be convenient, direct, and safe. Connecting streets should be used where available. In other cases, pedestrian connection between bus stops and surrounding neighborhoods should be provided."

AASHTO Transit Guide 2014, p. 5-11

"For clear zones, the criteria in the AASHTO Roadside Design Guide should be treated as guidance and not as a national standard requiring a design exception if not numerically met."

FHWA Flexibility in Highway Design 1997, p. 38

"Social safety and traffic safety at transit stops are critical for riders and impact their decisions about where and when to take transit. Prioritizing walking access to transit stops, including direct routes and convenient, low-delay pedestrian crossings, is vital to achieving a safe system."

NACTO Transit Street Design Guide 2016, p. 58

"The suggested clear-zone distances in Table 3-1 are based on limited empirical data that then were extrapolated to provide data for a wide range of conditions…Appropriate application of the clear-zone concept often will result in more than one possible solution."

AASHTO Roadside Design Guide 2011, p. 3-10

APPLYING DESIGN FLEXIBILITY

NETWORK

An accessible route, whether a sidewalk (1), path, or shoulder, must connect to the stop. This may require adding new sidewalks or locating the bus stop where an accessible route already exists. Bus stops should be located where there is existing or future demand, "such as office buildings, schools, medical centers, and apartment complexes. They should also be placed at locations where they connect with other transit lines and major cross-streets" **(AASHTO Transit Guide 2014, p. 5-1)**. Both at intersections and midblock, designers should consider if a marked crosswalk and/or additional crossing treatments are necessary. For more information, refer to the design topic on **Enhanced Crossing Treatments**.

CLEAR ZONES

There is a great deal of flexibility afforded to the designer in the selection and application of clear zones. The **AASHTO Roadside Design Guide** provides a range of recommendations for clear zones based on the design speed, average daily traffic of the roadway, and the slope of the area beyond the traveled way **(2011, p. 3-2)**.

While the recommendations in the **2011 AASHTO Roadside Design Guide** are the beginning point, engineering judgment and local context should be applied when determining the clear-zone distance. **AASHTO Flexibility in Highway Design** states that determining the clear zone is a project-specific task, and that the width may be limited by right-of-way constraints or the need to provide pedestrian facilities **(2004, p. 68)**. The location of, and access to and from, a bus stop may be considered as an appropriate reason to reduce the clear-zone width if needed. (2) Additionally, in low-speed urban environments, the **AASHTO Roadside Design Guide** recognizes that there are practical limitations to clear zones and recommends minimum lateral offsets instead **(2011, p. 10-1)**.

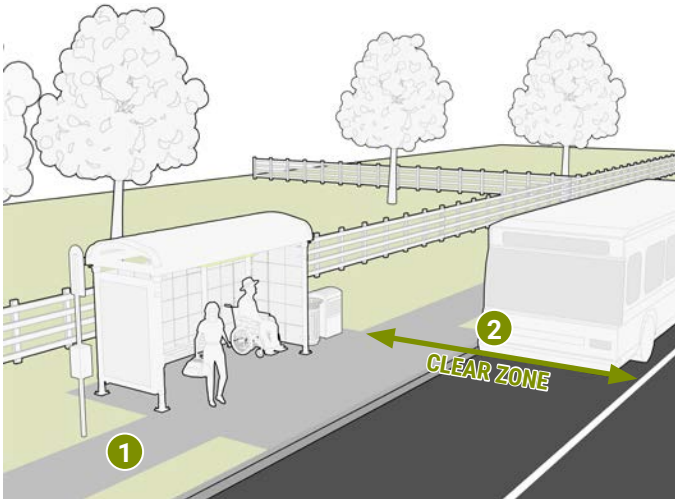
The designer should consider the crash history of a particular road when setting a clear-zone width or locating a bus stop. Other on-roadway treatments including pavement markings, rumble strips, signs, and delineators should be considered when reduced clear-zone width is necessary.

PEDESTRIAN ACCESS TO A BUS STOP ON A SHOULDER

In some cases, such as rural settings, a roadway shoulder may provide the only access to a bus stop. "Where a shoulder serves as part of a pedestrian access route, it must meet ADA requirements for pedestrian walkways to the maximum extent possible" **(AASHTO Pedestrian Guide 2004, p. 55)**.

BUS STOP PLACEMENT

Bus stops should be placed as close to the travel way as reasonable, once clear zones are considered. Placing the stop closer to the road increases visibility of the stop users and may result in a more direct access route. Additionally, in a retrofit installation, placing the bus stop and shelter close to the travel way reduces impacts to right-of-way.



BUS STOP ON ROAD WITH SHOULDER

At intersections, bus stops can be placed far-side (immediately after an intersection) or near-side (immediately before an intersection). Generally, transit agencies prefer far-side stops when traffic flows are heavy, where there are sight distance problems, and where buses turn left. Near-side located bus stops may be appropriate where traffic flow is lower or where transit riders can more easily transfer without crossing the street. Stops can also be placed midblock where there are major passenger generators or where space next to an intersection is insufficient. For more information, refer to the design topic on **Transit Conflicts**.

BUS STOP DESIGN

Bus stop design must be accessible to all transit users, including people with disabilities. Boarding areas must be connected to streets, sidewalks, or pedestrian circulation paths by pedestrian access routes **(PROWAG 2011, R308; and ADAAG 810.2.3)**. An 8-foot minimum by 5-foot minimum boarding and alighting area (3) free of obstructions is required for accessibility.

Bus stops should be at least 10 feet wide (measured perpendicular from the street) where possible, and long enough to accommodate the bus stop elements (i.e., boarding and alighting area, shelter, etc.) and to coordinate with the front and rear doors of the buses serving the stop to ensure accessibility. (4) Where bus stops are adjacent to sidewalks, the sidewalk width may be included in the bus stop width, as long as the cross slope meets accessibility requirements. The **AASHTO Transit Guide** provides additional guidance on bus stop design **(2014, p. 5-28)**.

On lower-speed roadways, vertical curbs should be provided at bus stops, which increases the efficiency and accessibility of boarding and alighting. Curb heights between 6–9 inches accommodate both low floor buses, people with mobility

disabilities, or passengers with strollers **(AASHTO Transit Guide 2014, p. 5-29)**.

In a rural setting with higher-speed roadways, vertical curbs should not be used at bus stops. Sloping type curbs with a height not exceeding 4 inches are appropriate **(AASHTO Green Book 2011, p. 4-19)**.

The lighting, visibility, and accessibility should be continuous and consistent between the bus stop and any connecting access routes. All bus stops must be accessible with hard-surfaced sidewalks or pathways that are cleared and maintained in all seasons **(AASHTO Transit Guide 2014, p. 5-29)**.

Note that there can often be conflicts between bicycles, buses, and boarding passengers. For more information, see the design topic on **Transit Conflicts**.

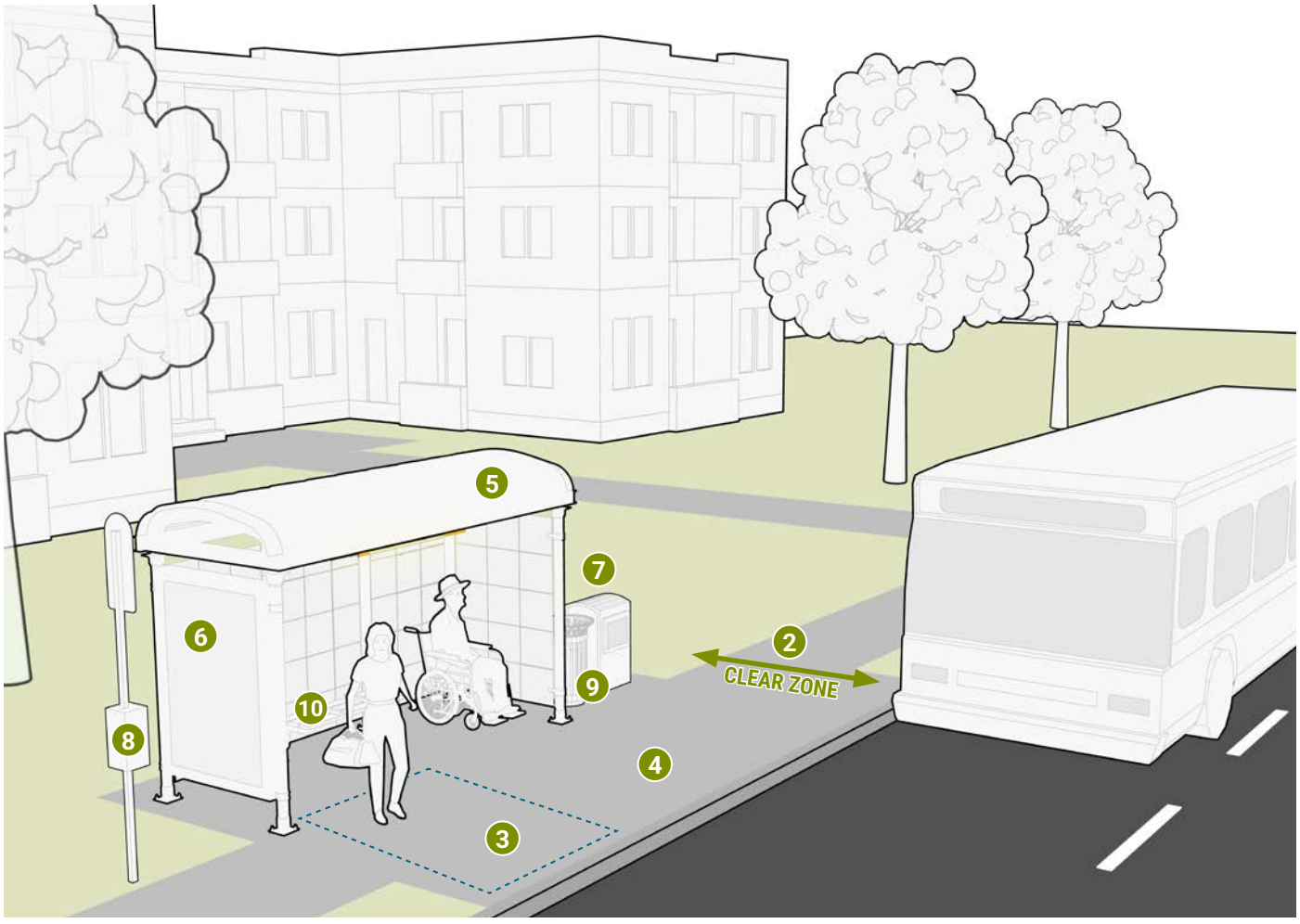
BUS STOP ELEMENTS

Bus stops with elements, such as shelters, benches, and in-shelter lighting increase the comfort, convenience, and visibility of patrons and the stop itself. This investment in infrastructure can raise the overall attractiveness of bus service and help meet a transit agency's targets for ridership growth.

Several factors should be considered when establishing warrants and priorities for shelters 5, including the "number of passengers using the stop, average passenger waiting time, degree of exposure to weather, availability of alternative shelter nearby, adequacy of sidewalk width to accommodate shelter, proximity of suitable street lighting, and absence of obstructions that limit visibility of shelter **(AASHTO Transit Guide 2014, p. 5-30)**. **The Easter Seals Project Action (ESPA) Toolkit for the Assessment of Bus Stop Accessibility and Safety** recommend shelters be provided when 25 or more persons use a bus stop in a suburban setting per day, and 10 or more persons in a rural setting.

Outfitting bus shelters with advertising 6 can help offset the cost of bus shelter installation and maintenance, but may reduce visibility and intersection sight lines.

Additional bus stop amenities include benches, lighting, newspaper vending machines 7, route/schedule information 8, trash receptacles 9, and bicycle parking. Benches 10 and clear spaces for wheelchairs provide comfort, help identify the stop, and are often included within the shelter. In-shelter lighting increases visibility and enhances comfort and sense of security. Bicycle parking should be considered in locations where it is anticipated that transit users would ride to the stop, for example at stops serving longer-distance express buses.



BUS STOP ON ROAD WITHOUT SHOULDER

CASE STUDIES

STOP REQUEST LIGHTS
SEATTLE, WA

King County Metro Transit installed solar-powered beacon pole lights at existing and new bus stops to reduce the number of people passed by and not picked up due to low light levels and poor visibility. Metro focused on installing these systems at locations that were especially dark, or where roadway speeds were 35 mi/h or higher. The beacon pole light system allows passengers to activate a light which alerts bus drivers that someone is waiting at the stop. This system includes braille identification plates for people with visual disabilities, and can also include other features such as a locator tone to alert users of the location of the beacon. There has been positive feedback from Metro bus drivers because the lights allow them to make planned, smooth transitions to the stop. This has reduced last-minute braking, which often occurs when visibility is poor.

BUS STOP IMPROVEMENT PROGRAM
MONTGOMERY COUNTY, MD

Starting in 2006, the Montgomery County Department of Transportation began an effort to upgrade all of its 5,400 bus stops to improve pedestrian access and to be fully ADA compliant. The effort began with a detailed inventory: each bus stop location was geocoded and 150 attributes were collected. The County identified 3,400 bus stops that needed improvements for a total cost of $11 million. Improvements included relocating bus stops, installing curb ramps, adding or extending sidewalks, and installing crosswalks and island cut-throughs. At locations with relatively steep slopes, the county installed knee walls (shown to the right) to prevent wheelchairs from rolling and to provide seating space. Field design was key to the success and quick implementation of these improvements. County planners, traffic engineers, and construction contractors met in the field with Maryland State Highway Administration engineers to mark locations of new sidewalk, signs, and pavement markings. To date, most of the bus stops have been improved. Between FY2007 and FY2015, the County spent approximately $8.2 million to construct over 3,000 concrete boarding and alighting areas, over 85,000 ft^2 of sidewalk, and over 1,200 curb ramps.