

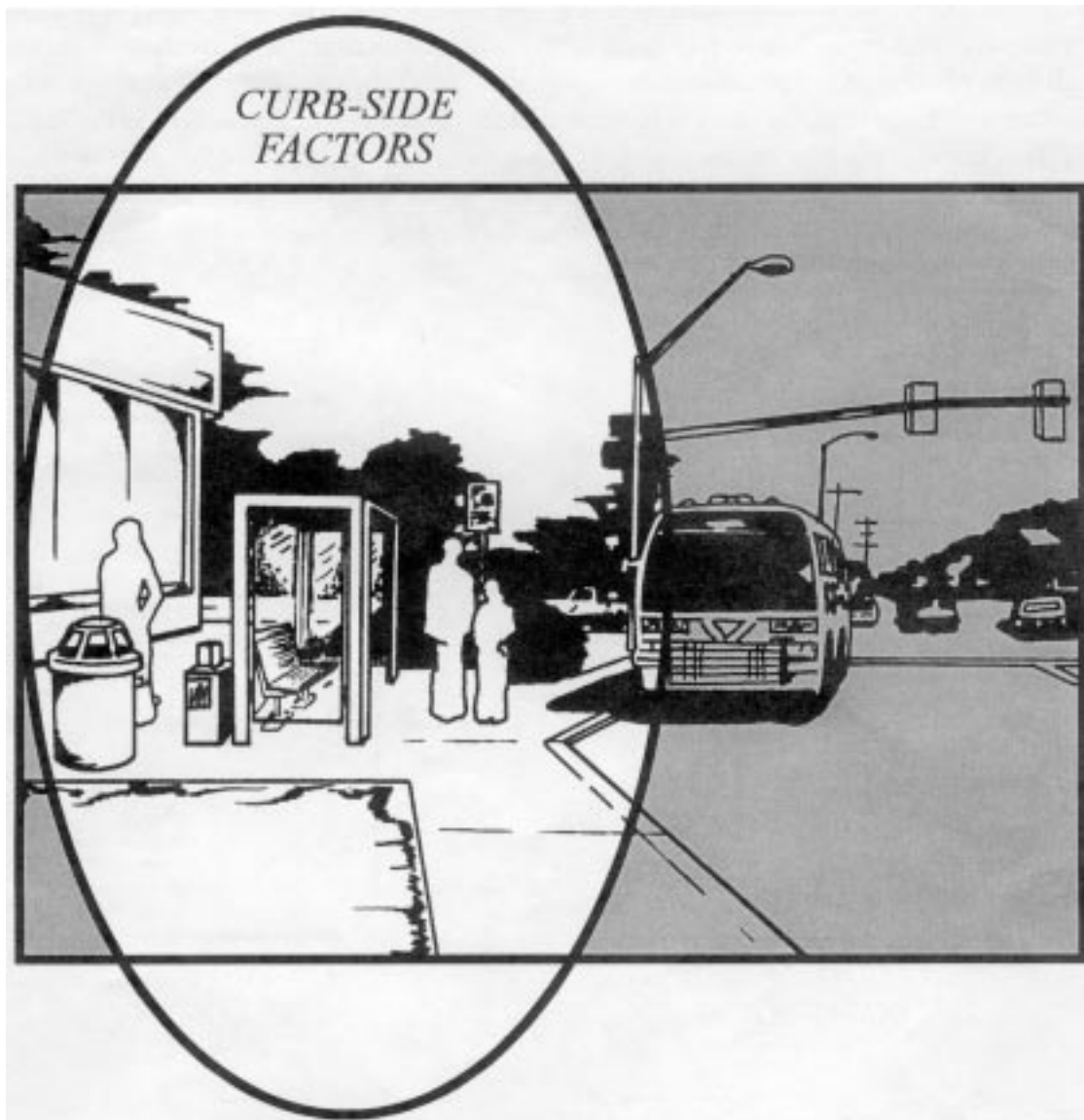
# CURB-SIDE FACTORS

Chapter

4

ORGANIZATION

Curb-side factors include those factors and issues that can affect the comfort, safety, and convenience of bus patrons. The information in this chapter can be used by transit professionals to provide safe, clean facilities at the bus stop. The chapter also provides information on how to choose bus stop locations that improve access and convenience in pedestrian-friendly communities. Areas of discussion include shelter design and placement, amenities, and enhancing bus patron comfort at bus stops. Also of value to transit professionals are tables that compare the advantages and disadvantages of the various amenities that can be included at the bus stop. A checklist provided at the end of the chapter refers to the various curb-side elements associated with bus stop design and location.



Providing defined access to and from the bus stop is important. Sidewalks should be constructed of impervious non-slip material and should be well drained. Access to the bus stop from the intersection or land use should be as direct as possible. When possible, sidewalks and bus stops should be coordinated with existing street lights to provide a minimum level of lighting and security. To accommodate wheelchairs, sidewalks should be a minimum of 3 feet wide (preferably 4 to 5 feet wide) and equipped with wheelchair ramps at all intersections. Other improvements include defined pedestrian crosswalks and signals at intersections. Pedestrian enhancements, such as sidewalks, should be coordinated with roadway improvements to help improve bus patron comfort and convenience.

Installation of a discontinuous sidewalk from the intersection to the bus stop is one way to achieve greater patron access to the bus stop in areas with limited or no sidewalk coverage. Although, the sidewalk may not continue toward the next land use or along the roadway, this strategy is the first step toward providing complete access to the bus stop. This ensures that access to the bus stop is not through uneven grass or exposed soil, which can be further impaired by poor drainage and surface changes during inclement weather. People who are elderly or have disabilities may find access to the bus stop difficult as well. See Figure 24 for an example.

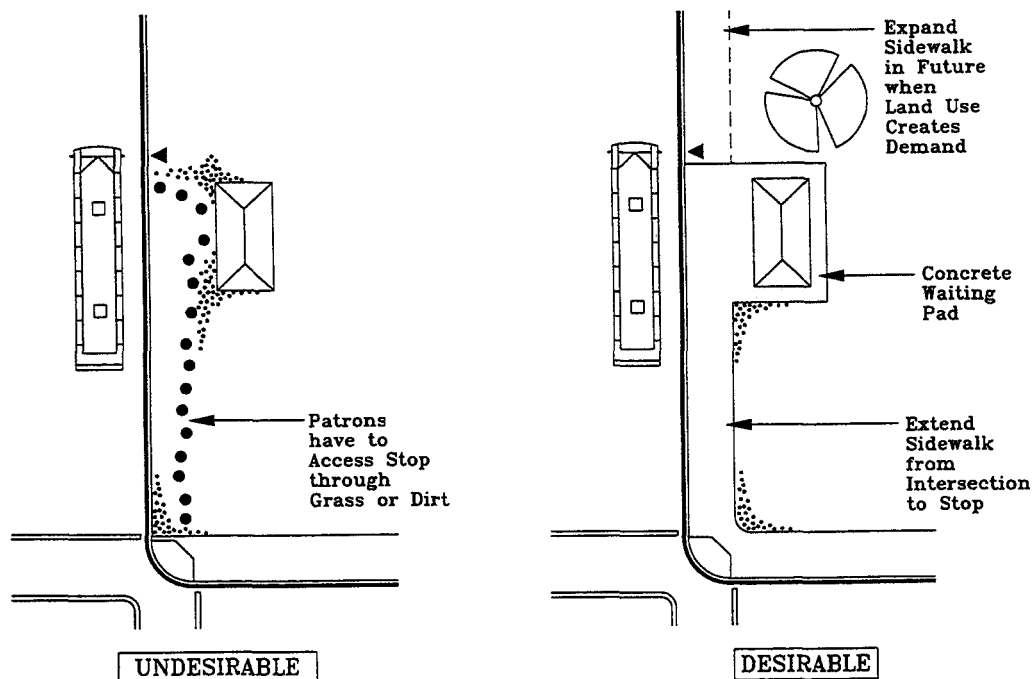


Figure 24. Example of Providing Access In Developing Regions.

Bus patrons should encounter defined pathways from the sidewalk to the back-face of the curb. To prevent poor access from the sidewalk to the curb, a waiting pad and an accessway from the waiting pad to the curb should be installed. When the sidewalk is parallel and directly adjacent to the curb, the waiting pad should be installed directly behind the sidewalk. However, when the sidewalk is far from the curb, paved access from the waiting pad to the curb is necessary. The waiting pad and accessway should be constructed of impervious non-slip material, preferably concrete or asphalt, and have proper drainage. Figure 25 presents two different waiting pad location scenarios for providing paved connections between the bus waiting pad and the curb.

Patrons should not have to walk through grass or exposed soil to reach the bus. In such cases, the areas between the sidewalk, bus stop, and curb can become worn and decline to muddy areas during inclement weather. Snow accumulation from road clearings during the winter months can also create additional access problems in the space between the sidewalk and curb.

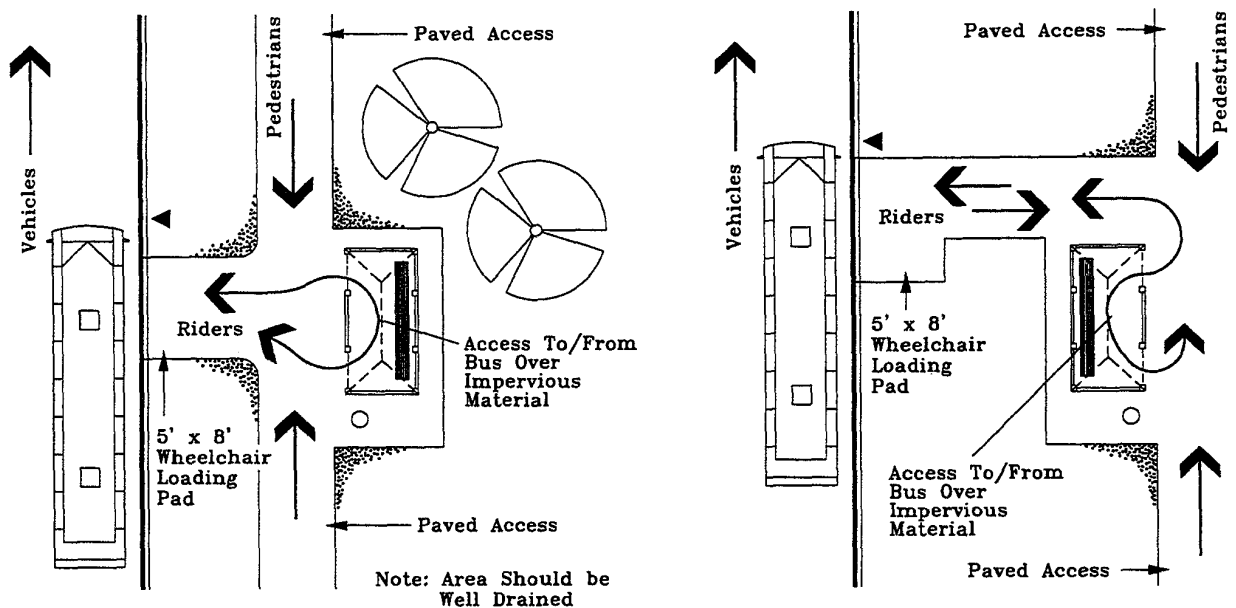


Figure 25. Examples of Providing Access from the Waiting Pad to the Curb.

### PEDESTRIAN ACCESS—Coordinating Access with Commercial or Business Development

A strategy to improve pedestrian access at or to bus stops is to coordinate development with the location of the bus stop. Coordination and cooperation with the landowner or developer can enhance the connectivity between the land use and the bus stop. To ensure optimum bus stop placement, coordination should occur during the planning/development phase. Pedestrian improvements include defined or designated walkways through parking lots and openings or gates through walls. Accessways can be as elaborate as a landscaped sidewalk through the parking lot or as minimal as painted walkways that caution drivers and direct pedestrians. As with any pedestrian improvement, strict adherence to mobility clearances, widths, and slopes should be followed to improve access for persons with disabilities. Safety improvements and shorter walking times can be achieved by implementing such strategies.

Another solution is to place buildings closer to the road and place parking to the rear and sides of buildings. Figure 26 is an example of coordinating transit with a hypothetical business office complex by designing defined pedestrian accessways and providing a gate through the fence. Another example of re-orienting the building or changing the location of the parking is illustrated in Chapter 2 as a Hypothetical Medical Center.

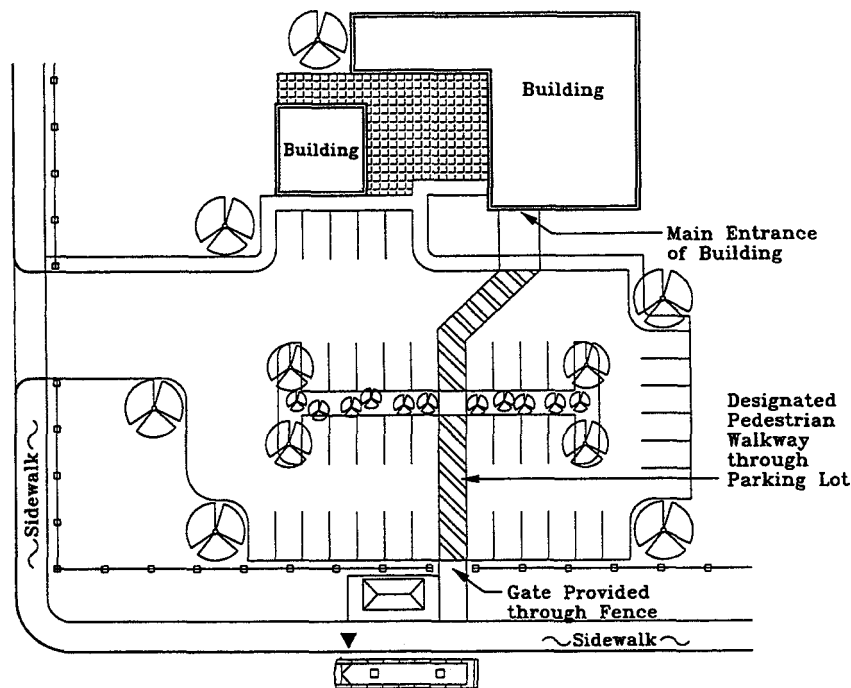


Figure 26. Pedestrian Improvements at a Hypothetical Business Complex.

Bus passengers need efficient ways to reach the bus stop from their residences. Transit agencies need to be involved early in the development approval process to reduce walking times and improve direct access to and from the bus stop. Sidewalk placement that is coordinated with land use and bus stop locations is critical to encouraging the use of transit.

Concerns over residential security have led to a proliferation of walled residential communities that restrict access to a limited number of entry and exit points. By doing so, walking times to bus stops may be increased because direct access may not be available. Circuitous or curvilinear sidewalks can also increase walking times and create coordination problems for the transit agency when choosing the final bus stop location. Curvilinear sidewalks along a street may not align with the final stop destination and may result in access problems through grass, berms, or other landscaping features.

Coordinating sidewalk design and placement is needed between developers and transit agencies to ensure direct access to a paved bus stop. Designing gates, openings through walls, and installing direct sidewalks in residential communities can be coordinated with developers to reduce walking times from the land use to the bus stop. Figure 27 is an example of coordinating access points and sidewalk design with the location of the bus stop.

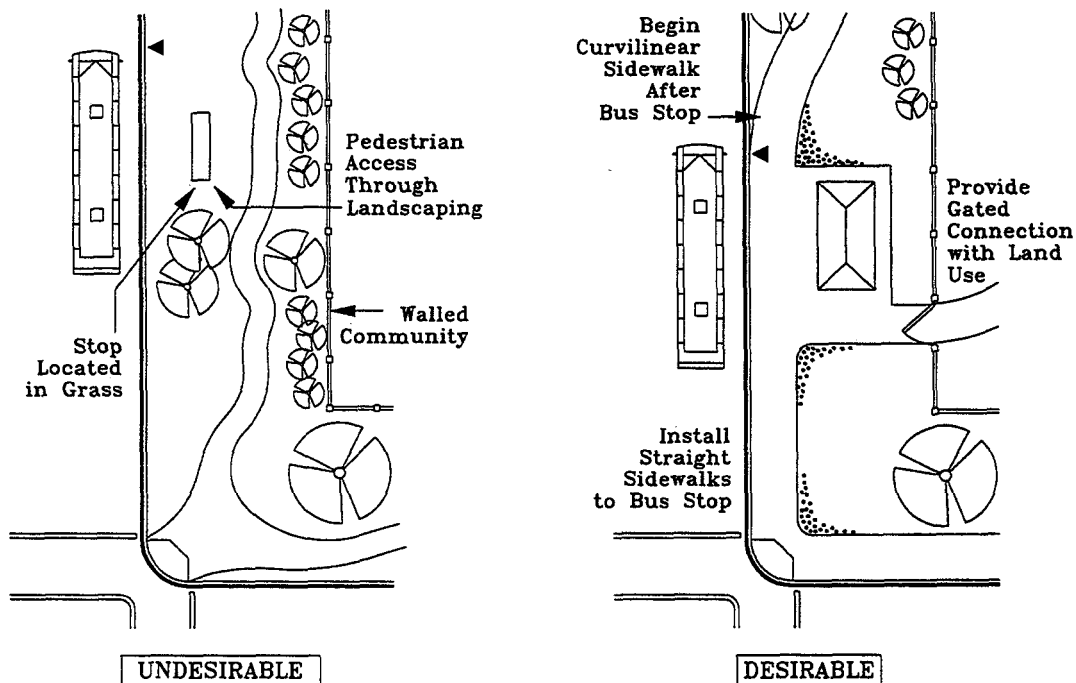


Figure 27. Example of Coordinating Transit with Residential Development Patterns.

The Americans with Disabilities Act of 1990 (ADA) is broad legislation intended to make American society more accessible to people with disabilities. It consists of five sections or titles (employment, public services, public accommodations, telecommunications, and miscellaneous). Titles II and III (public services and public accommodations) affect bus stop planning, design, and construction. Although the definition of disability under the ADA is broad, bus stop placement and design most directly affect persons with mobility and visual impairments. These impairments, which relate to the more physical aspects of bus stop accessibility, have received the most attention.

Making new stops conform to ADA physical dimension requirements is relatively easy. Modifying existing stops to comply with ADA, though desirable from an accessibility perspective, is not required under ADA. Modification of existing stops is more difficult, especially if the stops are at sites with limited easement or not subject to the transit agency's control, such as shopping malls, on state rights-of-way, or suburban subdivisions.

The ADA, however, is concerned with more than physical dimensions. It also involves accessibility from the point of origin to the final destination. For example, to get to the bus stop, individuals with limited mobility or vision need a path that is free of obstacles, as well as a final destination that is accessible. A barrier-free bus stop or shelter is of little value if the final destination is not accessible. Though the ADA does not require retrofitting transit vehicles with lifts, an accessible vehicle is clearly a critical link in the barrier-free trip. Full accessibility is more difficult to achieve when different organizations are responsible for different portions of the path (which is usually the case). Either way, the "equal access" provisions of the ADA require that the route for persons with limited mobility or vision be as accessible as the route used by those without disabilities. A person with disabilities should not have to travel further, or use a roundabout route, to get to a designated area.

### **Basic Principles for Bus Stop Design and Location to Conform to ADA**

Basic aspects of design exist that encourage accessibility and are applicable to most situations. Specific dimensions are available from several references, some of which are listed below. Some general design considerations involve obstacles, surfaces, signs, and telephones.

## Obstacles

Examine all the paths planned from the alighting point at the bus stop to destinations off the bus stop premises. Determine whether any protrusions exist that might restrict wheelchair movements. If protrusions exist and they are higher than 27 inches or lower than 80 inches, a person with a vision impairment may not be able to detect an obstacle (such as a phone kiosk) with a cane. A guide dog may not lead the person with the impairment out of the path. Although it may not be the transit agency's responsibility to address accessibility problems along the entire path, an obstacle anywhere along the path may make it inaccessible for some transit users with disabilities.

## Surfaces

Surfaces must be stable, firm, and slip-resistant. Such provisions are beneficial for all transit users, but especially for those who have disabilities. Avoid abrupt changes in grade, and bevel those that cannot be eliminated. Any drop greater than 1/2 inch or surface grade steeper than 1:20 requires a ramp.

## Signs

Signs providing route designations, bus numbers, destinations, and access information must be designed for use by transit riders with vision impairments. Specific guidelines are given for these signs in Section 4.30 of *Accessibility Guidelines for Buildings and Facilities, Transportation Facilities and Transportation Vehicles*. In some cases, two sets of signs may be needed to ensure visibility for most users and to assist users with sight limitations. Route maps or timetables are not required at the stop, though such information would be valuable to all passengers.

## Telephones

Telephones at bus stops are not required under ADA, but if telephones are in place, they must not obstruct access to the facility and must be suitable for users with hearing impairments. At least one phone must be accessible for wheelchair users. Telephone directories must also be accessible.

Figure 28 illustrates a design approach to a bus stop with a shelter that would meet ADA requirements.

## Accessible Bus Stop Pad & Shelter Minimum Dimensions

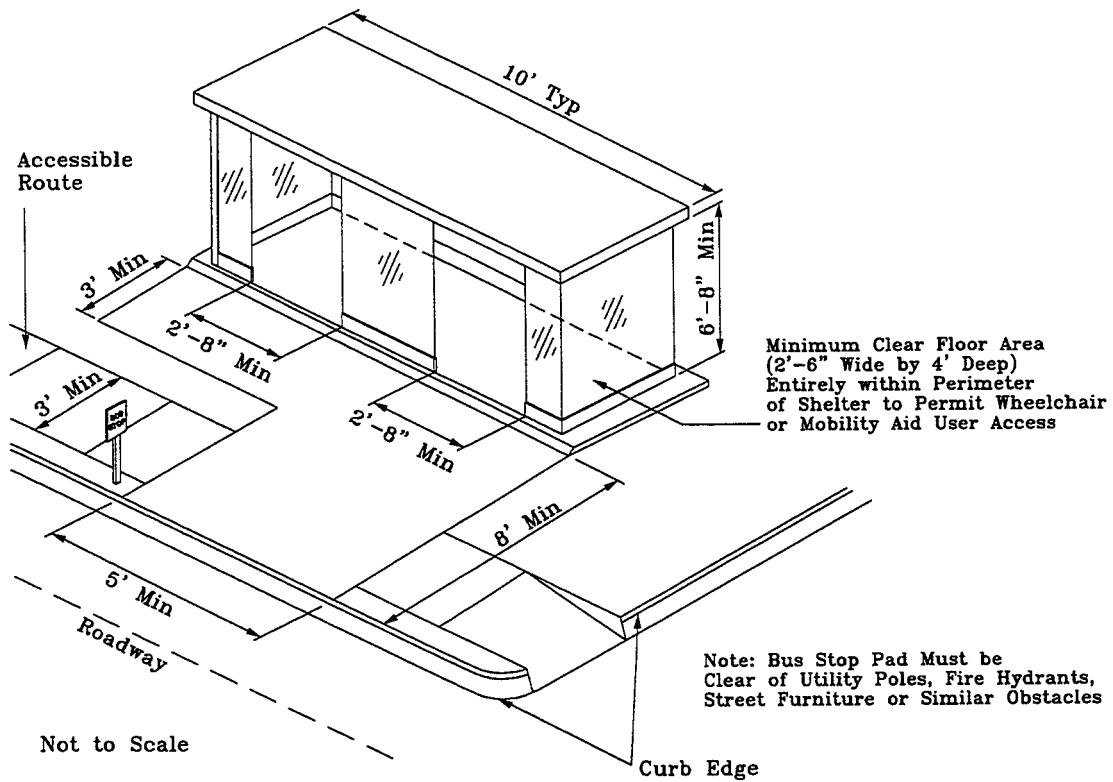


Figure 28. Shelter Design Example to Meet ADA Requirements.



## Resources and References

An excellent guide to the design of bus stops (as well as other facilities) for ADA compliance is

*Americans with Disabilities Act: Accessibility Guidelines for Buildings and Facilities, Transportation Facilities, and Transportation Vehicles.* U. S. Architectural and Transportation Barriers Compliance Board, Washington, DC, 1994. It is commonly known as the *ADA Guide*.

Another useful publication, which translates the *ADA Guide* accessibility guidelines into specific design parameters, is

*Accessibility Handbook for Transit Facilities.* Federal Transit Administration, Report No. FTA-MA-06-0200-92-1, July 1992. Prepared by the Ketron Division of Bionetics Corp. This document is available through the National Technical Information Service (NTIS), Springfield, VA 22161.

As civil rights legislation, the ADA goes beyond physical dimensions to include policy and practice. Many of these issues will be resolved through experience and in the courts. Various sources are available for monitoring the current status of the ADA and its specific provisions. These include legal journals, ADA-specific newsletters, and World Wide Web "home pages." Examples of each are as follows:

*Temple Law Review* and *Transportation Law Journal*—both frequently publish analyses of the original ADA legislation and recent developments, as do other legal journals.

*TD Access & Safety Report*—provides information on access, safety, and liability relating to the transportation of people with disabilities and the transportation-disadvantaged. Published by Serif Press, Inc., 1331 H Street, NW, Washington, DC, 20005.

Americans with Disabilities Act Document Center (<http://janweb.icdi.wvu.edu/kinder/>)—This website, sponsored by the National Institute on Disability and Rehabilitation Research, contains copies of ADA regulations and technical manuals prepared or reviewed by EEOC or the Department of Justice. Links to other Internet sources are also provided.

A waiting or accessory pad is a paved area at a bus stop provided for bus patrons and can contain either a bench or a bus shelter. Amenities, such as trash receptacles or bike racks, can also be located on the waiting pad. The size of the waiting pad depends on several factors. The length and width of shelters and benches, clearance requirements for street furniture, location of wheelchair lift extension (front or back door of bus), and the length of the bus are common size-determining factors. Transit agencies, typically, have one or two accessory-pad variations to accommodate different configurations and components that may be installed. Figure 29 illustrates elements that may influence the size and shape of the waiting pad.

Waiting pads are usually separated from the sidewalk to preserve general pedestrian flow. It is generally recommended that 5 feet of clearance be preserved on sidewalks to reduce potential pedestrian conflicts and limit congestion during boardings and alightings. The pad can be located on either side of the sidewalk, depending on available right-of-way space, utility poles, or buildings. In either case, a paved surface should be provided from the waiting pad to the back-face of the curb to enhance access and comfort. ADA mobility guidelines should be followed when street furniture is to be included on a waiting pad. A waiting pad should accommodate a 5-foot (measured parallel to the street) by 8-foot (measured from the back face of the curb) wheelchair landing pad that is free of all street furniture and overhangs.

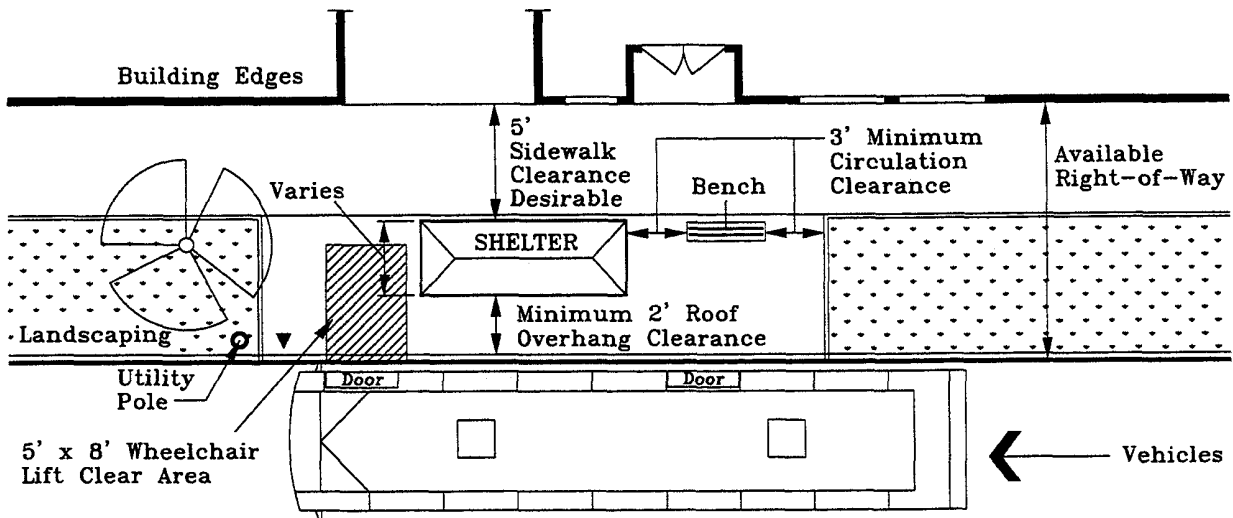


Figure 29. Example of Influential Factors on Waiting Pad Size.

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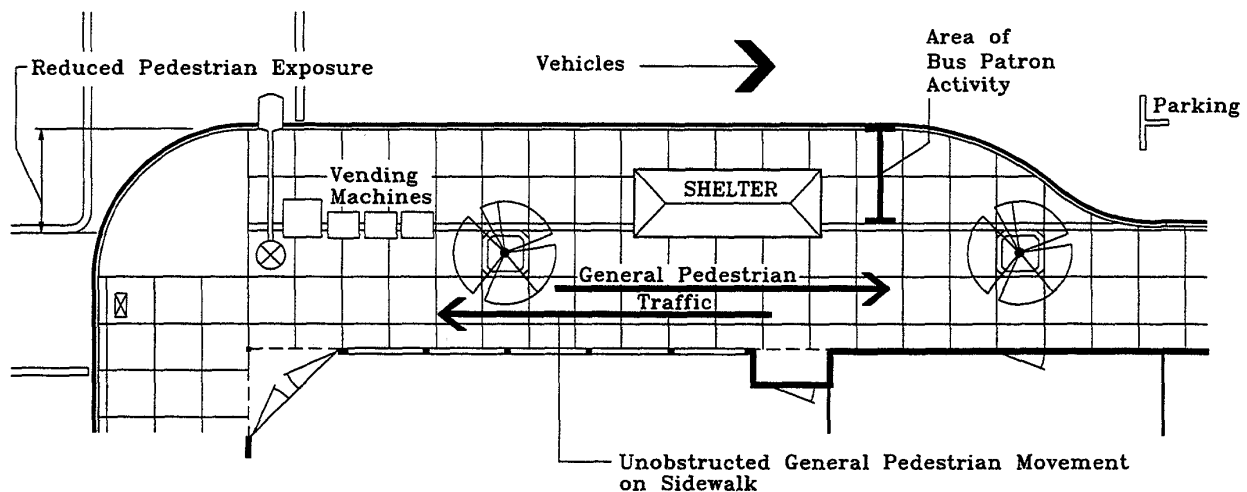
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## WAITING OR ACCESSORY PADS—Nubs

Nubs, also known as bus bulbs or curb extensions, solve the problem of locating bus patron amenities in dense urban environments with considerable pedestrian traffic. A nub is essentially a sidewalk extension through the parking lane that becomes directly adjacent to the travel lane. When space limitations prevent the inclusion of amenities, nubs create additional space at a bus stop for shelters, benches, and other transit patron improvements along sidewalks. Nubs provide enough space for bus patrons to comfortably board and alight from the bus away from nearby general pedestrian traffic. Nubs also shorten the pedestrian walking distance across a street, which reduces pedestrian exposure to on-street vehicles.

Transit agencies should consider the use of nubs at sites along crowded city sidewalks with high patron volumes, where parking along the curb is permitted. Figure 30 is a plan view example of a typical nub configuration.



**Figure 30. Separating Bus Activities and General Pedestrian Traffic with Nubs.**

A bus shelter provides protection from the elements and seating while waiting for a bus. Standardized shelters exist that accommodate various site demands and different passenger volumes. Typically, a shelter is constructed of clear side-panels for clear visibility. Depending on demand and frequency of service, a bus shelter may also have a bench.

The decision to install a shelter is a result of systemwide policy among transit agencies. Many criteria exist to determine shelter installation at a bus stop. In most instances, the estimated number of passenger boardings has the greatest influence. Suggested boarding levels by area type used to decide when to install a shelter are as follows (these values represent a composite of prevailing practices):

<u>Location</u>	<u>Boarding</u>
Rural	10 boardings per day
Suburban	25 boardings per day
Urban	50 to 100 boardings per day

Other criteria used to evaluate the potential for inclusion of a shelter include

- number of transfers at a stop
- availability of space to construct shelters and waiting areas
- number of elderly or physically challenged individuals in the area
- proximity to major activity centers
- frequency of service
- adjacent land use compatibility

Priority may or may not be given to each of these items depending on policy. System equity or funding availability can cause the installation decision to be made on a case-by-case basis. Local priorities and neighborhood requests can also influence the decision to include a shelter at a bus stop.

Other factors that can influence the size of the shelter include availability of right-of-way width, existing street furniture, utility pole locations, landscaping, existing structures, and maintaining proper circulation distances around existing site features.

Ideally, the final location of a bus stop shelter should enhance the circulation patterns of patrons, reduce the amount of pedestrian congestion at a bus stop, and reduce conflict with nearby pedestrian activities. The location of the curb and sidewalk and the amount of available right-of-way can be determining factors for locating a bus stop shelter. The following placement guidelines should be used when placing a bus stop shelter on a site (see also Figure 31):

- Bus stop shelters should not be placed in the 5-foot-by-8-foot wheelchair landing pad.
- General ADA mobility clearance guidelines should be followed around the shelter and between the shelter and other street furniture.
- Locating shelters directly on the sidewalk or overhanging a nearby sidewalk should be avoided because this may block or restrict general pedestrian traffic. A clearance of 3 feet should be maintained around the shelter and an adjacent sidewalk (more is preferred).
- To permit clear passage of the bus and its side mirror, a minimum distance of 2 feet should be maintained between the back-face of the curb and the roof or panels of the shelter. Greater distances are preferred to separate waiting passengers from nearby vehicular traffic.
- The shelter should be located as close as possible to the end of the bus stop zone so it is highly visible to approaching buses and passing traffic. The walking distance from the shelter to the bus is also reduced.
- Locating bus stop shelters in front of store windows should be avoided when possible so as not to interfere with advertisements and displays.
- When shelters are directly adjacent to a building, a 12-inch clear space should be preserved to permit trash removal or cleaning of the shelter.

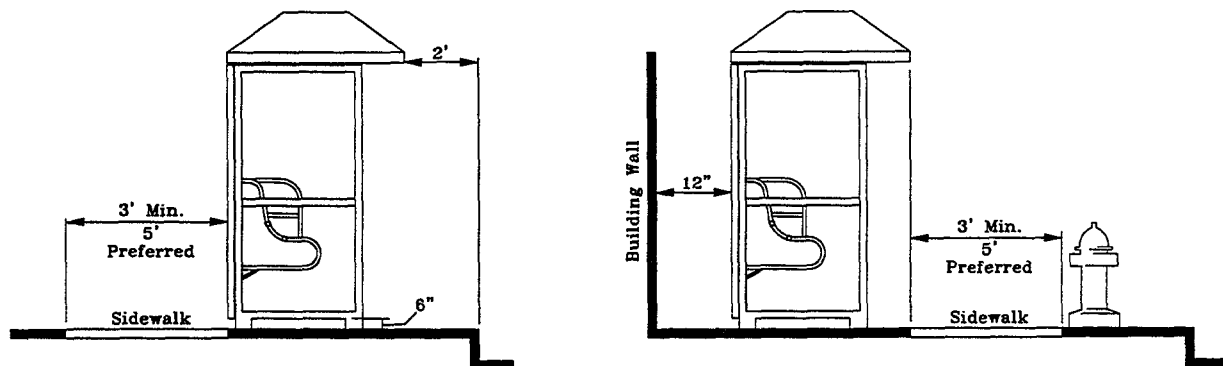


Figure 31. Shelter Clearance Guidelines.

In orienting and configuring bus shelters, personnel should consider the environmental characteristics of each site, because placement and design can positively or negatively influence passenger comfort. For example, in very hot climates, particularly in areas with few tall trees, bus shelters may be uncomfortable if they face directly east or west. However, this orientation may be appropriate in cooler climates during the winter months. When shelter interiors are uncomfortable, patrons will seek relief from the elements outside the shelter, appropriating walls or window ledges of nearby private property for their use. Transit agencies should be sensitive to this issue when locating a bus stop shelter.

Different bus shelter configurations can be used to reflect site or regional characteristics (see Figure 32). Shelters can be completely open to permit unlimited movement of air, or panels can be erected to keep the interior of the bus shelter warm. For southern climates, perforated panels can be used to reduce the glare while permitting ventilation. Alternatively, shelters can be fully enclosed by solid panels and the back of the shelter may be rotated to face the street to protect waiting passengers from splashing water or snow build-up. To enhance ventilation and to reduce the clutter that can accumulate inside a shelter, a 6-inch clearance between the ground and the bottom of the panels is standard in fully enclosed shelters. In any case, shelters should be coordinated with landscaping to provide maximum protection from the elements and to enhance the visual quality of the bus stop (see Figure 33). Shade trees reduce heat at a site and provide additional shade for patrons waiting outside the shelter. Technology, such as misters or evapo-cooling towers, can also be used to enhance the interior environment, however, such technology is expensive and maintenance-intensive.

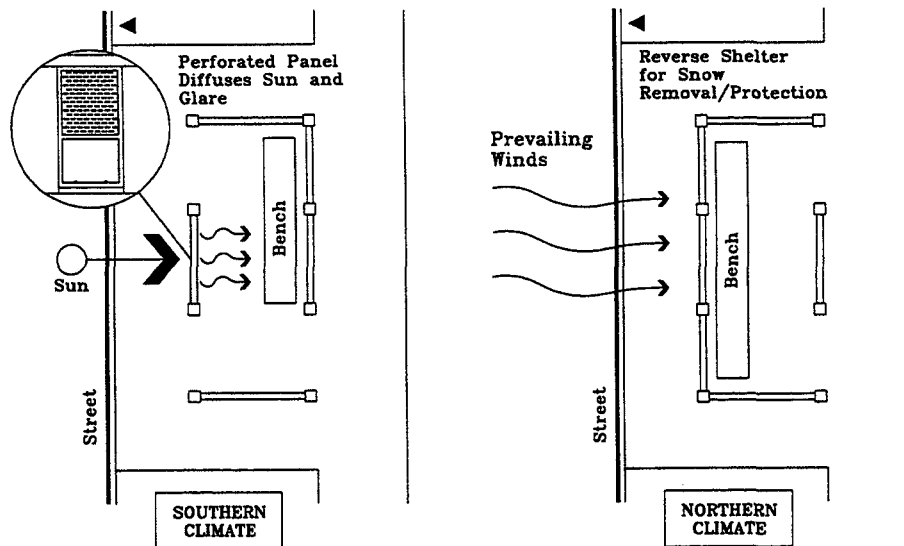


Figure 32. Examples of Orientation and Panel Placement to Improve Interior Comfort.

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## SHELTERS—Configurations and Orientations

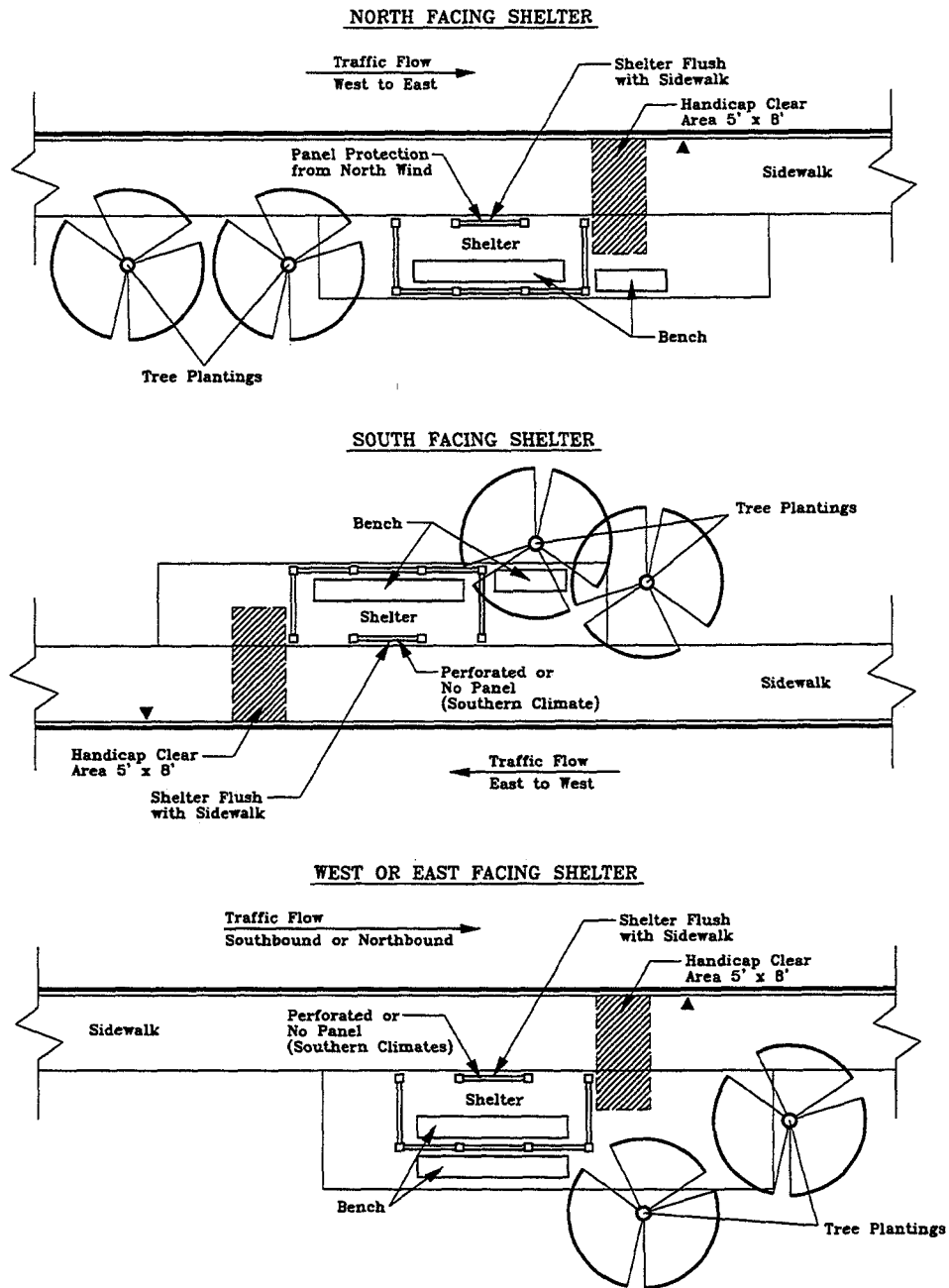


Figure 33. Placement and Orientation Options.

Many transit agencies have paid advertising in bus shelters to supplement funding and to provide other benefits. An advertising-in-shelters program provides the opportunity to install bus shelters at bus stops that otherwise would not receive one. As part of the contract, the advertising company installs the shelter or kiosk. Other benefits of this program include regular maintenance of the bus stop shelters and facilities, including trash removal and installation of interior lighting at selected sites, by the advertising agency.

The advertisements are placed on panels attached to the bus shelter to take advantage of the visibility that the bus stop receives from passing traffic. Backlighting is sometimes used to display the images at night. Advertisements do not necessarily have to be attached to the shelter. In some areas, kiosks are used to display advertisements. Depending on design, the kiosk may provide additional protection from the elements at a bus stop.

Issues associated with advertisements placed on shelters and kiosks include compatibility with local land uses, ordinances, and safety. The signs can conflict with color schemes or limit views of adjacent store fronts. Advertising at bus stops must also comply with local sign ordinances, which may hinder installation in some communities.

Passenger and pedestrian safety and security are of greater concern at shelters with advertising. The advertising panels may limit views in and around a bus stop, making it difficult for bus drivers to see patrons. The panels can also reduce incidental surveillance from passing traffic. To prevent restricted sight lines, advertising panels and kiosks should be placed downstream of the traffic flow. An approaching bus driver should be able to view the interior of the shelter easily. Indirect surveillance from passing traffic should be preserved through proper placement of the panels (see Figure 34).



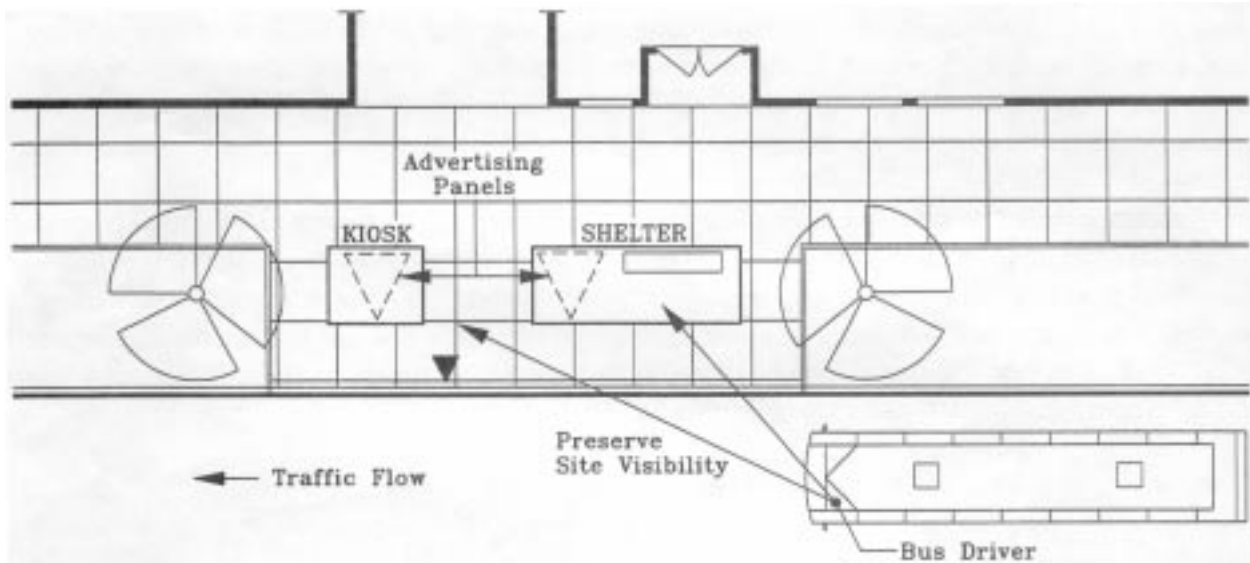


Figure 34. Placement Recommendations for Advertising Panels and Kiosks.

Private developers can also provide bus stop shelters. Typically, these shelters are constructed to serve a specific development, neighborhood, complex, or shopping mall. Facilities range in scope from a single stop to a series of coordinated stops serving an entire residential development or office park. The designs are often striking and closely linked visually with the major design features of the central structure, building, or neighborhood.

Bus shelters installed by developers should meet transit agency requirements. These requirements include an acceptable location, safe pedestrian access (i.e., direct sidewalk to the shelter), visibility for vehicles and waiting passengers, access for those with mobility impairments, and signage. Shelter ownership and long-term maintenance responsibilities should be determined before installation. Bus stop location decisions should be made collaboratively by the transit agency and the developer.

When private development and transit service collaborate on shelter installation, the benefits to both are numerous. Transit considerations are factored into the development from the beginning. The development itself may become more transit-friendly through combined transit agency/developer design of routes to provide service to the new development's residents. From the developer's standpoint, designing for transit improves the overall accessibility of the development, may increase the feasible density of the development, may reduce parking requirements, and may increase pedestrian traffic. These factors may have a positive effect on lease (especially retail) value. Improved accessibility can also make recruiting employees easier. Figure 35 is an example of a developer-installed shelter.



**Figure 35. Developer-Installed Shelter.**

Transit agencies can use artist-designed stops and shelters or other methods to ensure that stops and shelter designs have a theme. One approach is to commission local artists to design or decorate a shelter or waiting area. This requires considerable coordination, the support of the neighborhood, a public relations effort sufficient to generate the interest of local artists, and, ideally, sponsorship by some civic organization. Figure 36 shows an example of a shelter designed by a local artist.

Customized or artistically designed bus stops can make waiting for a bus more pleasant. Innovative designs may also help provide a covered shelter or seating (e.g., flip-seats or awnings) for passengers at locations that do not have sufficient space. However, custom-designed passenger waiting areas should not obscure identification of the bus stop. Transit agency bus stop signs and schedule displays should be available at these types of bus stops. The functionality of the stop should not be compromised in the name of art—the stop should provide as much patron comfort, safety, and security as possible.

Neighborhood or business interests may also want the shelters and bus stop signs to reflect the character of the district. One method is to develop a distinct color or logo for each neighborhood or route group. This can be implemented by the transit agency with appropriate coordination and participation from the neighborhoods.



**Figure 36. Artistic Shelter.**

A bench, even without a bus shelter, provides comfort and convenience at bus stops. As with shelters, benches are usually installed on the basis of existing or projected ridership figures. Ridership figures below those justifying a bus shelter are commonly used. Other factors used in determining bench-only locations include the following:

- The width of the bus stop location.
- Bus stops with long headways and little protection from the weather.
- Locations where the landowner has denied permission to construct a shelter.
- Sites that are frequently used by elderly people or people with disabilities.
- Evidence that transit patrons are sitting or standing on nearby land or structures.

Two factors that greatly influence the use of benches are crowding at a site and the environment at a site. Crowding limits patrons choices about sitting and waiting and forces patrons to wait around, rather than in, the bus stop. Uncomfortable bus stop environmental conditions, such as heat and sun, can also discourage use of the bench.

Preserving minimum circulation guidelines, coordinating with existing landscaping, and providing additional waiting areas can improve bench and site utilization. The following bench placement guidelines are recommended:

- Avoid locating benches in completely exposed locations. Coordinate bench locations with existing shade trees if possible. Otherwise, install landscaping to provide protection from the wind and other elements.
- Coordinate bench locations with existing street lights to increase visibility and enhance security at a stop.
- Locate benches on a non-slip, properly drained, concrete pad. Avoid locating benches in undeveloped areas of the right-of-way.
- Locate benches away from driveways to enhance patron safety and comfort.

- Maintain a minimum separation of 2 feet (preferably 4 feet) between the bench and the back-face of the curb. As the traffic speed of the adjacent road increases, the distance from the bench to the curb should be increased to ensure patron safety and comfort.
- Maintain general ADA mobility clearances between the bench and other street furniture or utilities at a bus stop.
- Do not install the bench on the 5-foot by 8-foot wheelchair landing pad.
- At bench-only stops, additional waiting room near the bench should be provided (preferably protected by landscaping) to encourage bus patrons to wait at the bus stop.

Figure 37 provides an example of the circulation requirements at a bench-only bus stop with additional seating provided.

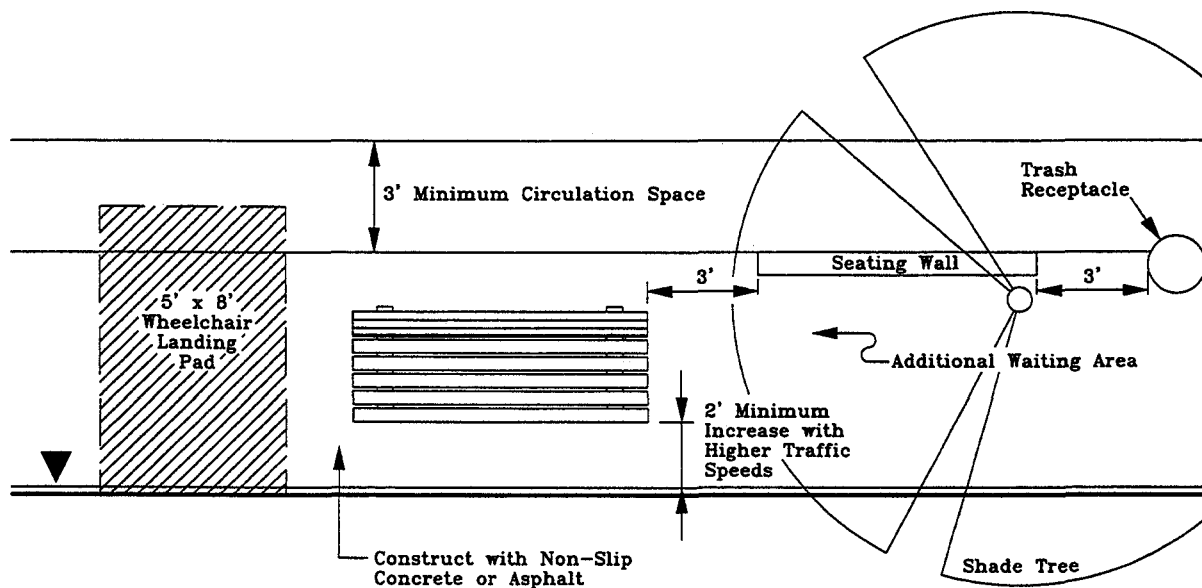


Figure 37. Conceptual Bench and Waiting Pad Design.

Route and passenger information can be displayed in various ways. A flag sign is the most common method used by transit agencies to display information. Placement and design guidelines for flag signs are discussed in Chapter 3. Installation of schedule holders or schedule and route information on the shelters are also commonly used.

The actual displays mounted on the sign can include the transit agency logo, route numbers available at the stop, type of route (local or express), and destination for a limited number of routes. Detailed guidelines for the design of bus stop signs can be found in *TCRP Report 12*, "Guidelines for Transit Facility Signing and Graphics," and should be referenced for greater detail.

Schedule holders are included at sites with large passenger volumes. The schedule holders can be mounted on the flag sign or inside a shelter. According to "Guidelines for Transit Facility Signing and Graphics," information in Braille can be provided when a four-sided information holder is used. A route plaque and an information holder mounted to a sign post are shown in Figure 38.

Interior panels of shelters also can be used for posting route and schedule information. Side panels may be large enough to display the entire system map and can include backlighting for display at night. Shelters that lack side panels can display route and schedule information on the interior roof of the shelter. Some recommendations for route or patron information display are as follows:

- Provide updated information when changes are made to routes and schedules.
- Consider the quality and appearance of information displays. A visually poor route map conveys a negative impression of the system.
- Make information displays permanent. Temporary methods for displaying information (such as tape-mounting) create a cluttered, unsophisticated appearance at the bus stop.
- Follow ADA clearance, mobility, and visual guidelines for access of information by individuals with impairments.

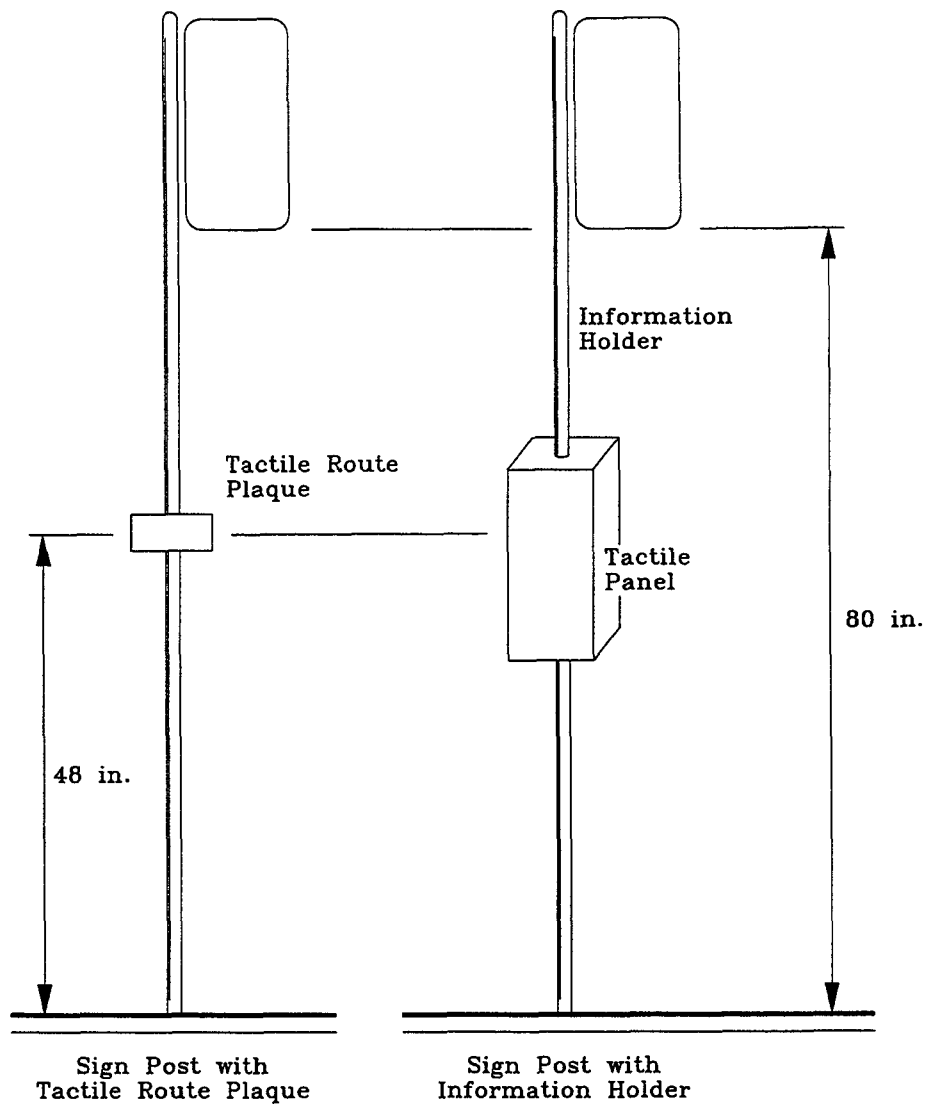


Figure 38. Examples of Passenger Information Holders.

Vending machines can provide passengers with reading material while they wait for the bus. However, for local, non-commuter routes, vending machines can be undesirable for many reasons. The machines are often poorly maintained and reduce the amount of room for mobility and waiting (see Figure 39). Perhaps the greatest effect, though, is that trash accumulates at bus stops with vending machines. Trash removal is time-consuming and costly.

The existence of vending machines at or near bus stops does not appear to be the result of transit agency policy. Rather, it is a result of newsprint companies aggressively pursuing a high-profile site. Transit agencies have limited regulatory authority concerning the placement of vending machines.

Transit agencies, if given the opportunity, should review the need for the installation of vending machines at bus stops. The benefits to patrons of having the machines near the stop versus having to maintain trash receptacles and keep the area free of improperly disposed material should be reviewed. Vending machines at a bus stop should be anchored to the ground to reduce vandalism. ADA mobility guidelines should be followed for improved site circulation (e.g., the location of the vending machines should not obstruct the wheelchair landing pad area).



**Figure 39. Image of Vending Machines at a Bus Stop.**



Bicycle storage facilities, such as bike racks, may be provided at bus stops for the convenience of bicyclists using transit. Designated storage facilities discourage bicycle riders from locking bikes onto the bus facilities or on an adjacent property. Proper storage of bicycles can reduce the amount of visual clutter at a stop by confining bikes to one area. Recommendations regarding bicycle storage facilities are as follows:

- Provide paved access to the bus stop and construct the waiting area with non-slip concrete or asphalt that is properly drained.
- Locate the storage area away from other pedestrian or patron activities to improve safety and reduce congestion.
- Coordinate the location of the storage area with existing on-site lighting.
- Do not locate the storage area where views into the area are restricted by the shelter, landscaping, or existing site elements, such as walls.

Many prefabricated storage methods are available, however, as bicycle prices have escalated in recent years, interest has grown in storing bikes in completely enclosed containers called bike lockers (see Figure 40) or taking bikes on the bus. Although the transit agency can obtain revenue from renting bicycle lockers to patrons, bike lockers are large and awkward to place next to bus stop shelters on sidewalks and present additional surfaces at a bus stop for graffiti. For these reasons, they can be expensive to maintain.

It appears bicycle storage is associated with the commuter market and should be installed when demand warrants, which is primarily at major suburban stops. Where substantial bike activity exists, such as in university towns, on-vehicle bike programs are a major asset. Regional demographics should be carefully reviewed prior to implementing such a program.



**Figure 40. Example of a Bike Locker.**

Trash receptacles can improve the appearance of a bus stop by providing a place to dispose of trash. The installation of trash receptacles is typically a systemwide decision and the size, shape, and color reflect transit agency policy. Not all bus stops have trash receptacles. Low patron volumes may not justify the inclusion of this amenity at a bus stop; however, litter at a site may warrant the inclusion of a trash receptacle at an otherwise low-volume location.

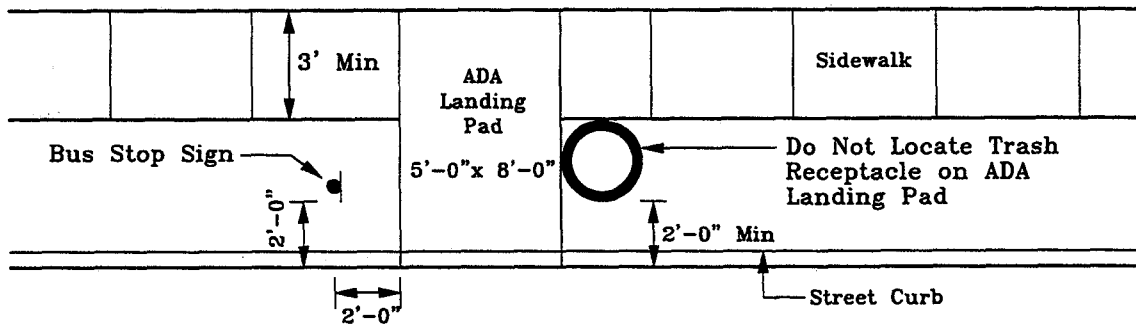
Problems can arise when the receptacles are not regularly maintained or when the bus stop is next to a land use that generates considerable trash such as convenience stores and fast food restaurants. In such cases, transit agencies should work with these establishments to define maintenance responsibilities for the bus stop and the area around the businesses. Businesses and community groups typically are reluctant to agree to maintaining trash receptacles at public sites.

Recommendations regarding installing a trash receptacle at a bus stop are as follows:

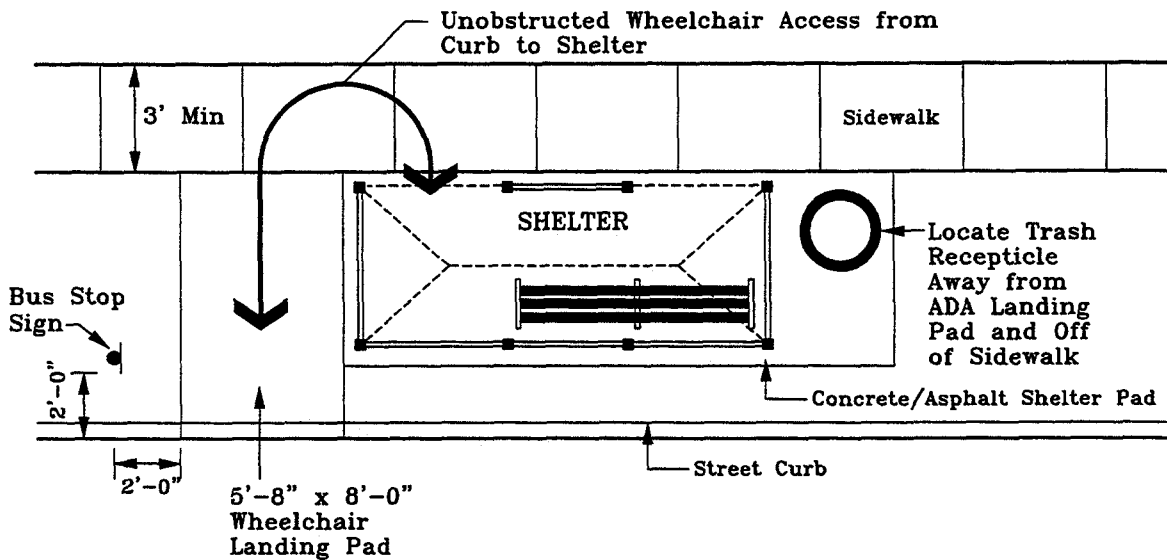
- Anchor the receptacle securely to the ground to reduce unauthorized movement.
- Locate the receptacle away from wheelchair landing pad areas and allow for at least a 3-foot separation from other street furniture.
- Locate the receptacle at least 2 feet from the back of the curb.
- Ensure that the receptacle, when adjacent to the roadway, does not visually obstruct nearby driveways or land uses.
- Avoid installing receptacles that have ledges or other design features that permit liquids to pool or remain near the receptacle—this may attract insects.
- Avoid locating the receptacle in direct sunlight. The heat may encourage foul odors to develop.

Figure 41 shows the minimum circulation and separation requirements for trash receptacles at bus stops.

### WITHOUT BUS SHELTER



### WITH BUS SHELTER



### PLAN VIEW

Figure 41. Trash Receptacle Placement Guidelines.

Phones at bus stops offer many potential benefits for bus patrons. Patrons can make personal and emergency calls while waiting for the bus. Phones also can provide real-time bus arrival information. Figure 42 shows a phone at a bus stop. Some transit agencies have explicit policies regarding the installation of phones at bus stops. Experience with phones at bus stops has been mixed. For example, inclusion of phones at bus stops can create opportunities for illegal or unintended activities, such as drug dealing and loitering, in and around bus stops. Loitering by non-bus patrons at bus stops appears to increase with the installation of phones; this may discourage bus patrons from using the facility. Transit agencies should review the potential consequences of installing a phone at a bus stop prior to installation.

When locating a phone at a bus stop, the following guidelines should be considered:

- Separate the phone and the bus stop waiting area by distance when possible.
- Follow general ADA site circulation guidelines.
- Remove the return phone number attached to the phone.
- Limit the phone to outward calls only.



**Figure 42. Example of a Phone at a Bus Stop.**

# CURB-SIDE FACTORS

Chapter

4

## AMENITIES—Shopping Cart Storage Area

Proper storage for shopping carts at bus stops adjacent to commercial shopping centers is needed. Because such bus stops normally do not have storage facilities for shopping carts, carts often litter the area around the stop and along the sidewalk accessing the stop. The sight of haphazardly placed shopping carts around a bus stop is visually unappealing and can block sidewalk access. Figure 43 shows shopping carts abandoned at a bus stop.

Because the shopping carts are generated by the shopping center, agreements should be made between the land owner and the transit agency to remove the carts regularly. Frequently, however, the time between removals is too long and shopping carts accumulate at a bus stop. One solution is to install a storage facility near the bus stop to prevent random storage in and around the stop. Factors affecting installation of a storage facility include the location of the sidewalk, available right-of-way, utilities, landscaping, terrain, and cost. Any cart storage facility should follow the general site circulation guidelines and remain clear of the sidewalk and wheelchair landing pad area.

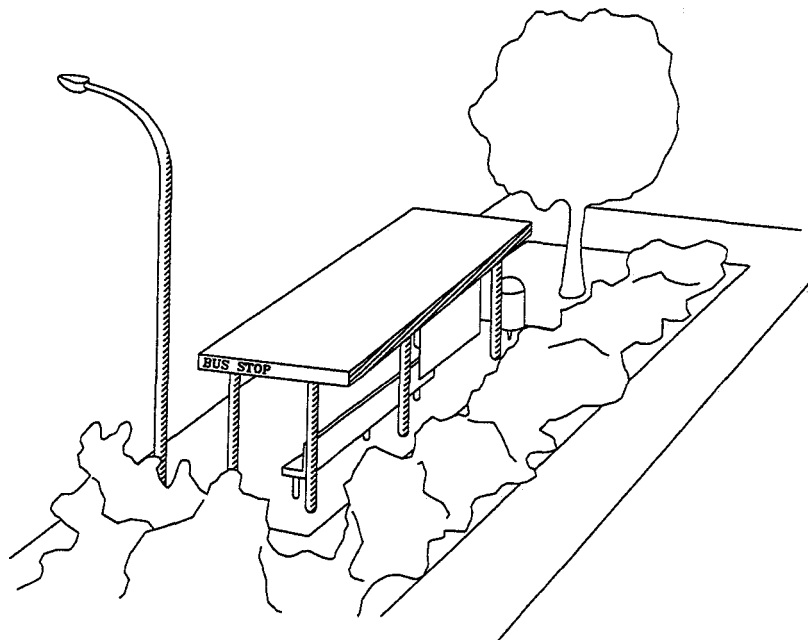


**Figure 43. Shopping Carts Abandoned at a Bus Stop.**

Lighting affects bus patrons' perception of safety and security at a bus stop, as well as the use of the site by non-bus patrons. Good lighting can enhance a waiting passenger's sense of comfort and security; poor lighting may encourage unintended use of the facility by non-bus patrons, especially after hours. Lighting is particularly important in northern climates where patrons may arrive and return to the stop in darkness during the winter season. Illumination requirements are often a policy of individual transit agencies; however, installing lighting that provides between 2 to 5 footcandles is the general recommendation.

Cost and availability of power influence the decision to install direct lighting at a bus stop. Direct lighting is expensive and difficult to achieve at remote locations. When installing direct lighting at a bus stop, the fixtures should be vandalproof but easily maintained. For example, avoid using exposed bulbs or elements that can be easily tampered with or destroyed.

A cost-effective approach to providing indirect lighting at a site is to locate bus stops near existing street lights. When coordinating bus shelter or bench locations with existing street lights, the minimum clearance guidelines for the wheelchairs should be followed. Figure 44 is an example of coordinating a shelter with an existing street light.



**Figure 44. Example of Coordinating Shelter Locations with an Existing Street Light.**

Passenger security is a major issue in bus stop design and location, because the design and location of the bus stop can positively or negatively influence a bus patron's perception of that bus stop. From the perspective of security, landscaping, walls, advertising panels, and solid structures can restrict sight lines and provide spaces to hide. Each of these items can be an integral part of the bus stop, either by design or by proximity of existing land uses. Therefore, the transit agency should carefully review which amenities are to be included at a bus stop and consider any factors that may influence security. Other sections of this document have discussed some of these concepts and should be referenced. Some guidelines regarding security at bus stops are as follows:

- Bus stop shelters should be constructed of materials that allow clear, unobstructed visibility of and to patrons waiting inside.
- Bus stops should be at highly visible sites that permit approaching bus drivers and passing vehicular traffic to see the bus stop clearly.
- Landscaping elements that grow to heights that would reduce visibility into and out of the bus stop should be avoided. Low-growing shrubbery and ground cover and deciduous shade trees are preferred at bus stops. Evergreen trees provide a visual barrier and should be avoided.
- Bus stops, whenever possible, should be coordinated with existing street lighting to improve visibility.
- Bus stops should be next to existing land uses, such as stores and businesses, to enhance surveillance of the site.

**CURB-SIDE FACTORS****AMENITIES—Advantages and Disadvantages**

<b>Amenity</b>	<b>Advantages</b>	<b>Disadvantages</b>
<b>Shelters</b>	<ul style="list-style-type: none"> <li>• Provide a place of comfort for waiting passengers</li> <li>• Provide protection from elements (sun, glare, wind, rain, snow)</li> <li>• Help identify the transit system</li> <li>• Can provide a venue for establishing lighting at a site</li> <li>• Can provide a space to install route and schedule information</li> </ul>	<ul style="list-style-type: none"> <li>• Require maintenance, trash collection</li> <li>• May be used by graffiti artists</li> </ul>
<b>Shelters (Advertising)</b>	<ul style="list-style-type: none"> <li>• Can be impetus for installing lighting at stop</li> <li>• Are often maintained by advertising company</li> </ul>	<ul style="list-style-type: none"> <li>• Can reduce sight lines if panels are improperly located</li> <li>• Must be compatible with local sign ordinances and land uses</li> </ul>
<b>Benches</b>	<ul style="list-style-type: none"> <li>• Provide comfort for patrons</li> <li>• Help identify the stop</li> <li>• Are a low-cost amenity when compared to installing a shelter</li> </ul>	<ul style="list-style-type: none"> <li>• Require maintenance</li> <li>• May be used by graffiti artists</li> </ul>
<b>Vending Machines</b>	<ul style="list-style-type: none"> <li>• Provide waiting patrons with reading material</li> </ul>	<ul style="list-style-type: none"> <li>• Increase trash accumulation at a site</li> <li>• May have poor visual appearance</li> <li>• Reduce circulation space</li> <li>• Can be vandalized</li> </ul>
<b>Lighting</b>	<ul style="list-style-type: none"> <li>• Increases visibility</li> <li>• Increases perceptions of comfort and security by patrons</li> <li>• Discourages “after hours” use of bus stop facilities by indigents</li> </ul>	<ul style="list-style-type: none"> <li>• Requires maintenance of lighting elements</li> <li>• Can be costly</li> </ul>



# CURB-SIDE FACTORS

Chapter

4

## AMENITIES—Advantages and Disadvantages

Amenity	Advantages	Disadvantages
<b>Trash Receptacles</b>	<ul style="list-style-type: none"><li>• Provide place to discard trash</li><li>• Keep bus stop clean</li></ul>	<ul style="list-style-type: none"><li>• May be costly to maintain</li><li>• May be used by customers of nearby land use (i.e., fast food restaurant)</li><li>• May smell</li></ul>
<b>Phones</b>	<ul style="list-style-type: none"><li>• Are convenient for bus patrons</li><li>• Provide access to transit information</li></ul>	<ul style="list-style-type: none"><li>• May encourage loitering at or near bus stop by non-bus patrons</li><li>• May encourage illegal activities at bus stop</li></ul>
<b>Route or Schedule Information</b>	<ul style="list-style-type: none"><li>• Is useful to first time riders</li><li>• Helps identify the bus stop</li><li>• Can communicate general system information</li></ul>	<ul style="list-style-type: none"><li>• Must be maintained to provide current route or schedule information</li><li>• May be popular surface for graffiti</li></ul>

Various materials can be used to construct a bus stop. The best materials are those that are weather-resistant, can withstand continual use, and can be easily maintained. The ease with which a particular material can be vandalized can reduce its desirability; easy-to-clean materials are desirable. Primarily, wood, metal, concrete, glass, and plastics are used at bus stops.

Wood, sometimes used for benches, is rarely used to construct other elements because it is easily vandalized and weathers badly.

Metal is frequently used to construct shelters, benches, bike racks, and trash receptacles. Aluminum, although fairly inexpensive and easy to work with, is soft and easily scratched. Its high recyclability makes it a target for theft by unscrupulous recyclers. As with any item or material, objects should be properly affixed to prevent/discourage unauthorized removal. Metal, in combination with a plastic coating, is a good material for benches, especially when a wire mesh design is used. The design resists everyday wear and tear and graffiti.

The best use of concrete at bus stops is in the paving. Concrete, an excellent non-slip surface, can be easily poured on site to construct sidewalks, waiting pads, and connections between the stop and the curb. Concrete is too heavy and cumbersome to use in other elements at a bus stop.

Plastic is used for paneling and roofing on shelters. The material is lightweight and can be installed with minimal effort. Clear plastic permits the interior of the shelter to be visible from a distance, which enhances security. Depending on the desired effect, plastic can be frosted to reduce the amount of sun entering the shelter or left clear to permit sun exposure. A major disadvantage of plastic is that it is easily damaged or destroyed by vandalism—the material can be scratched or kicked out from its holdings. Plastic declines over time by becoming translucent and scratched, and harsh chemical cleaners can expedite the decline.

Tempered glass is primarily used for side panels on shelters. Visually, the material is more pleasing than plastic and withstands environmental demands better than plastic. Unlike plastic, the material is not damaged by repeated cleaning; broken glass, however, can create a hazard for waiting passengers. Improperly anchored objects, such as vending machines and trash receptacles, should be avoided at bus stops with glass because they can be used to destroy glass panels or roofs.

# CURB-SIDE FACTORS

Chapter

4

## AMENITIES—Materials Advantages and Disadvantages

<b>Material</b>	<b>Advantages</b>	<b>Disadvantages</b>
<b>Wood</b>	<ul style="list-style-type: none"><li>• Is used to construct benches</li><li>• Is repaired or replaced easily</li></ul>	<ul style="list-style-type: none"><li>• Weathers easily</li><li>• Can be vandalized easily</li></ul>
<b>Metal (Aluminum)</b>	<ul style="list-style-type: none"><li>• Resists weathering</li><li>• Can be used to construct multiple elements at a bus stop</li><li>• Can be inexpensive</li></ul>	<ul style="list-style-type: none"><li>• Can be scratched easily (vandalism problem)</li></ul>
<b>Concrete</b>	<ul style="list-style-type: none"><li>• Can be installed as a non-slip paving surface</li></ul>	<ul style="list-style-type: none"><li>• Is too heavy and cumbersome for use other than paving</li></ul>
<b>Plastic</b>	<ul style="list-style-type: none"><li>• Is lightweight</li><li>• Allows unobstructed view into and out of shelter</li><li>• Can be formed into different shapes</li></ul>	<ul style="list-style-type: none"><li>• Declines with exposure to sun and repeated cleaning</li><li>• Can be scratched easily</li></ul>
<b>Glass (Tempered)</b>	<ul style="list-style-type: none"><li>• Withstands environmental demands better than plastic</li><li>• Can be cleaned easily</li><li>• Can be perceived as more attractive than plastic</li><li>• Allows unobstructed view into and out of shelter</li></ul>	<ul style="list-style-type: none"><li>• Can be broken, which can present a safety hazard to patrons</li></ul>

## CURB-SIDE PLACEMENT CHECKLIST

This section of the guidelines lists topics that should be reviewed to enhance patron comfort, convenience, and security. The topics range from the general (such as locating a bus stop in the community) to the specific (such as preserving sight lines).

- **Location Within the Community:** The location of the bus stop should be coordinated with the business community and neighborhood. Businesses want to preserve clear views of storefronts and maintain open circulation spaces in and around the storefronts. Although improperly located shelters can obstruct business activities, bus stops can enhance both transit and business activities when sited properly.

Homeowners are another influential voice in the community. Typically, they do not want stops in front of their properties. Efforts to maintain bus stops in residential neighborhoods may reduce the "not-in-my-backyard" attitudes.

Coordination between governmental agencies can enhance or impede this process. Liability can be a major issue for governmental agencies and businesses. This is especially true when improvements are made to sidewalks at or near bus stops. Transit agencies can create their own regulatory hurdles to avoid liability. However, this action comes at the expense of the transit patron, the ultimate customer. Coordination and cooperation can improve this process.

- **Compatibility:** Bus stops should be located so as to limit conflicts with pedestrians and other activities. Bus stops that create conflict points with pedestrians and bicyclists or reduce the capacity of existing sidewalks should be avoided. Benches, shelters, and other bus-related facilities should be separated from pedestrian or bicycle facilities when space permits. Because bus stops are commonly placed near parking lots, bollards and/or a raised curb would prevent cars from damaging bus facilities (e.g., bus shelters) or interfering with bus activities and patrons.

Bus stops should be located so as to provide safe separation of passengers and vehicles from nearby land uses. They should not be directly next to the curb, which puts patrons close to passing vehicles. This is especially true for stops on roads with high traffic speeds. The zone of comfort or separation for patrons from high speed traffic may be violated when the shelter or bench is too close to the edge of the roadway. The minimum acceptable offset for benches and shelters from the back face of the curb is 2 feet. This distance should increase with higher speed limits.

- **Direct Access to Bus Stop:** Landscaping, berms, security walls, large parking lots, and circuitous sidewalks can decrease the convenience of using transit by increasing the walking time between the origin or destination and the bus stop. Direct access to and from the bus stop is critical to the convenience of using transit. The transit agency can work with local jurisdictions or developers to ensure that direct sidewalks are installed near bus stops from the intersection or adjacent land uses. Defined paths or walkways can be installed through parking lots or landscaping to reduce walking times and improve safety.
  
- **Impervious Ground Surfaces:** Avoid locating bus stops on exposed soil, grass, or uneven ground. For passenger comfort and convenience, a waiting pad constructed of impervious non-slip material should be provided at the bus stop. This should be graded for proper runoff control and meet ADA requirements for cross slopes. The bus stop should be coordinated with existing sidewalks to provide defined and controlled access to the stop. In developing areas, the transit agency can coordinate bus stop location with sidewalk locations and installation through local jurisdictions or developers.
  
- **Proper Pedestrian Circulation:** Utility poles, fire hydrants, and street furniture can reduce the available space for bus patrons to maneuver. Avoid locating stops near items that may restrict proper movement in and around a bus stop.

Appropriate spacing of items at a bus stop should also be maintained to allow proper access for wheelchairs and pass-by pedestrian traffic. Shelters, benches, utility poles, and other street furniture should not intrude on the ADA landing pad, which should be at least 5 feet (measured parallel to the curb) by 8 feet (measured perpendicular from the back face of the curb). At least 3 feet of clearance should be maintained to enable wheelchair access to and from the stop and around any transit amenities, posts, poles, fire hydrants, vending machines, or other fixtures that might be present. Ideally, high-volume stops should have clear pedestrian access from both bus doors.

## CURB-SIDE PLACEMENT CHECKLIST

- **Existing Street Furniture:** Selecting sites with existing street furniture can save the transit system money while providing patrons with amenities, such as benches, vending machines, and phones. The transit agency should review the condition of the amenities to make sure the items are properly maintained and free of graffiti or other signs of wear. The transit agency should also note the placement of any existing street furniture. When additional improvements are made to the site because of the installation of a bus stop, the location of existing street furniture may reduce circulation space and accessibility.
  
- **Environmental Treatments:** Existing site conditions can be used to enhance the environmental comfort of a bus stop. Sun/shade patterns provided by existing vegetation or structures can contribute to the comfort of waiting bus patrons. The final design of the bus stop shelter should also respond to the environmental demands of a site (e.g., sun/shade patterns, winds, and precipitation). Panel placement, orientation, and materials should be selected to provide maximum comfort to patrons. The site should also be well drained.
  
- **Security:** Perception of security at a bus stop can have a significant influence on the comfort level of patrons using that bus stop. To enhance the security of bus stops, regularly remove graffiti and trash (to discourage repeat occurrences), ensure indirect surveillance from nearby land uses and passing traffic, and avoid locating stops where there is opportunity for concealment. When landscaping is involved, use low-growing shrubs that preserve sight lines.
  
- **Lighting:** Bus stops may include lighting or be located near existing street lights that provide indirect lighting to enhance the security of a stop. Interior shelter lighting can be a critical amenity when patrons arrive and return in the dark. The interior lighting elements should be resistant to vandalism and be maintained regularly. Bus shelters without interior lights should, whenever possible, have translucent roofs.

Pedestrian-oriented lighting should be encouraged in new developments or when major infrastructure work is being planned. Indirect lighting from nearby businesses can also enhance surveillance of the site from these land uses.

- **Sight Line:** The bus stop should be clearly visible for both safety and security reasons. Stops obscured by existing structures or vegetation are difficult for bus drivers to see. Passing vehicles may be unaware of the presence of pedestrians near or on the roadways; this increases the chance that accidents will occur. Right turns on red can increase the likelihood of pedestrian-vehicle conflicts. The bus stop site should be inspected carefully to detect any potential sight-related problems.

For security reasons, sight lines should be preserved to maintain direct and indirect surveillance of the bus stop. Landscaping, walls, advertising panels, and structures can restrict sight lines and provide spaces to hide. Bus stops should be easily viewed from nearby land uses and passing traffic to enhance the security of the stop. Bus shelters should be constructed of materials that allow clear, unobstructed visibility of patrons waiting inside. Bus patrons also need to be able to observe their surroundings when inside the shelter.

- **Maintenance:** Proper maintenance of bus facilities is crucial to preserving a positive image of a transit system. Trash and graffiti should be removed as soon as possible to prevent further degradation of the facilities. A database containing maintenance schedules can be created to track the condition of the facilities, including pavement surface conditions; age of the facilities; history of damage; and condition of shelter, benches, or other transit amenities.

Bus stop maintenance can be costly and time-consuming. Working agreements with local businesses or commercial centers can reduce the financial responsibilities of the transit agency. For stops next to convenience stores, the transit agency should try to obtain a working agreement with the local store or businesses to provide trash removal and general maintenance at the bus stop. This should include snow removal.

Agreements with commercial-strip centers should also be obtained to remove used shopping carts from a bus stop regularly. Shopping carts abandoned around bus stops are visually unappealing and restrict movement through a site.

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**accessway** - a paved connection, preferably non-slip concrete or asphalt, that connects the bus stop waiting pad with the back face of the curb.

**adaptive use** - an individual's spontaneous, creative use of a facility or structure in ways that differ from or go beyond the intended use or the formal design.

**advertising shelter** - a bus shelter that is installed by an advertising agency for the purpose of obtaining a high-visibility location for advertisements. By agreement, the bus shelter conforms to the transit agency specifications but is maintained by the advertising company.

**ADA** - American's with Disabilities Act of 1990. The Act supplants a patchwork of previous accessibility and barrier-free legislation with a comprehensive set of requirements and guidelines for providing *reasonable* access to and use of building, facilities, and transportation.

**amenities** - things that provide or increase comfort or convenience.

**bollards** - a concrete or metal post placed into the ground behind a bus shelter to protect the bus shelter from vehicular damage.

**bus bay** - a specially constructed area off the normal roadway section for bus loading and unloading.

**bus stop spacing** - the distance between consecutive stops.

**bus stop zone length** - the length of a roadway marked or signed as available for use by a bus loading or unloading passengers.

**curb-side factors** - factors that are located off the roadway that affect patron comfort, convenience, and safety.

**curb-side stop** - a bus stop in the travel lane immediately adjacent to the curb.

**detector** - a device that measures the presence of vehicles on a roadway.

**discontinuous sidewalk** - a sidewalk that is constructed to connect the bus stop with the nearest intersection. The sidewalk does not extend beyond the bus stop.

**downstream** - in the direction of traffic.

**dwelt time** - the time a bus spends at a stop, measured as the interval between its stopping and starting.

**far-side stop** - a bus stop located immediately after an intersection.

**headway** - the interval between the passing of the front ends of successive buses moving along the same lane in the same direction, usually expressed in minutes.

**layover** - time built into a schedule between arrivals and departures, used for the recovery of delays and preparation for the return trip.

**midblock stop** - a bus stop within the block.

**near-side stop** - a bus stop located immediately before an intersection.

**nub** - a stop where the sidewalk is extended into the parking lane, which allows the bus to pick up passengers without leaving the travel lane, also known as bus bulbs or curb extensions.

**open bus bay** - a bus bay designed with bay "open" to the upstream intersection.

**queue jumper bus bay** - a bus bay designed to provide priority treatment for buses, allowing them to use right-turn lanes to bypass queued traffic at congested intersections and access a far-side open bus bay.

**queue jumper lane** - right-turn lane upstream of an intersection that a bus can use to bypass queue traffic at a signal.

**roadway geometry** - the proportioning of the physical elements of a roadway, such as vertical and horizontal curves, lane widths, cross sections, and bus bays.

**shelter** - a curb-side amenity designed to provide protection and relief from the elements and a place to sit while patrons wait for the bus.

**sight distance** - the portion of the highway environment visible to the driver.

**street-side factors** - factors associated with the roadway that influence bus operations.

# GLOSSARY

Chapter

5

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## TERMS AND DEFINITIONS

**TCRP** - Transit Cooperative Research Program of the Transportation Research Board.

**upstream** - toward the source of traffic.

**waiting or accessory pad** - a paved area that is provided for bus patrons and may contain a bench or shelter.

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## **APPENDIXES A-C**

Appendixes A through C as submitted by the research agency are not published herein, but are available for loan on request to the TCRP.

Appendix A - Literature Search

Appendix B - Review of Transit Agencies' Manuals

Appendix C - Survey Findings