



CHAPTER 4 DESIGN GUIDANCE



4 Design Guidance

The recommended pedestrian network in this Plan is bold, but the direction for implementation is clear and the tools are relatively simple. Bellingham can combine standard street elements and best practices in pedestrian facility design to create a safe and enjoyable experience for all.

This chapter summarizes the City's existing standards for sidewalks and intersections. The summary is followed by a discussion of guiding principles for pedestrian design and the needs of various pedestrians of all ages and abilities. Finally, the chapter provides recommendations for best practices to serve as guidance for implementation of the infrastructure projects recommended in this Plan.

4.1 City of Bellingham Roadway Design Guidelines and Standards

The City of Bellingham's road designs are based upon state and national guidelines. There is some variation as described in the municipal code, the Development Guidelines and Improvement Standards, and urban village or neighborhood planning documents, such as the City Center and the Waterfront District plans. Careful attention is paid to street design, sidewalk design, and street crossings. While robust guidance for pedestrians exists within current planning documents and city code there is a need to enhance standards and coordinate the existing standards for clarity and consistency. The following is a brief summary of existing design guidance as it relates to sidewalks, intersections, and crossings.

4.1.1 Sidewalks

The City of Bellingham's sidewalk standards meet or exceed minimum federal and State of Washington standards. According to the municipal code, minimum width for sidewalks in Bellingham is five feet, wide enough for two people to walk side by side. However, sidewalks of this width assume minimal pedestrian traffic and no amenities, such as benches and other appurtenances, encroaching from the curb zone or storefront/activity zone into the movement zone. Sidewalk width should be designed to meet the anticipated walking demand and provide buffer space between motor vehicle lanes and spaces for walking, sitting, and lingering. The best practices included in this Plan are intended to guide the City through the implementation of projects and provide a consistent set of pedestrian design tools, which can be applied to sidewalk development throughout the city.

The Municipal Code and Development Guidelines and Improvement Standards provide direction on the provision of sidewalk by functional classification as follows:

- Parkways – Not required
- Primary (Major Arterials) – Required on both sides with 5' walkway minimum in residential areas and wider in commercial areas
- Secondary Arterials – 5' minimum width on both sides
- Collector Arterials – 5' minimum width on both sides
- Residential Access Streets – 5' minimum width on both sides

- Residential Access Streets, Lake Whatcom Watershed - The city standard under this section shall be a 5' sidewalk on one side of the street; the city minimum standard under this section does not require a sidewalk but does require a 4' minimum grass bench on one side of the street.
- Commercial and Business Streets - Both sides with 8' minimum width on 60' right-of-way and 10' minimum on 80' right-of-way; pedestrian traffic should be encouraged
- Industrial Streets - one side with 5' width as minimum

Sidewalks should be wide enough to support the expected pedestrian volumes in the movement zone. The commercial and business street standard in the municipal code is augmented by policies and regulations related to sidewalk cafés. Annual permits must be obtained to use sidewalk space and operate a café with outdoor seating. To ensure that sidewalk café's do not impede pedestrian movement, the City has established the guidelines for permit approval. The café permitting guidelines are summarized below.

A sidewalk café will only be allowed where the following is true:

- The sidewalk, as measured from the property line to the curb, is at least 8 feet wide.
- The area is adjacent to the business.

The area for roadway side features (trees, bike racks, lights, parking meters) shall be three feet and the pedestrian passage area shall be five feet. Parking strips with pavers may not be used for pedestrian passage or the sidewalk café. The area reserved for pedestrian travel is called the Clear Pedestrian Zone. This area must be free of all roadway side features as noted above.

4.1.2 Intersections and Crossings

The intersection of two streets provides a legal and expected place for pedestrians to cross the street. Although all intersections are legal crossings, the provision of special crossing treatments can increase driver awareness of pedestrians and create a more comfortable pedestrian experience.

The City Center Design Guidelines recommend a graduated approach to the provision of curb extensions, specialty pavement markings for crosswalks, and intersection markings dependent upon pedestrian use and possible conflicts at intersections. Intersection designs could include a tiered level of crosswalk and intersection designs in response to varying levels of use of intersections. As a general rule, intersections most critical to the pedestrian circulation system are recommended to receive the highest levels of improvement. This intersection typology is the most detailed design guidance for the City but has not yet been incorporated in the street standards.

During the development of this Plan, the City concurrently worked on development of detailed crosswalk installation guidelines that provide guidance for the provision of marked crosswalks at controlled and uncontrolled intersections. The guidelines also apply to mid-block crossings where evidence of high pedestrian use and safety concerns exist. In general, marked crosswalks are not considered on streets with 1,500 or fewer cars per day. The guidelines set minimum pedestrian volume thresholds in order to recommend a marked crosswalk. In addition, the installation guidelines provide information to help engineers determine appropriate crossing types. These guidelines should be used in combination with the best practices discussed later in this chapter to guide implementation of the projects defined in this Plan.

4.2 Design Needs of Pedestrians

Types of Pedestrians

Pedestrians are not all alike and the transportation network should accommodate a variety of needs, abilities, and possible impairments. Age is one major factor that affects pedestrians' physical characteristics, walking speed, and environmental perception. Children have low eye height and walk at slower speeds than adults walk. They also perceive the environment differently at various stages of their cognitive development. Older adults walk more slowly and may require assistive devices for walking stability, sight, and hearing. Table 4-2 summarizes common pedestrian characteristics for various age groups.

Table 4-2 Pedestrian Characteristics by Age

Age	Characteristics
0-4	Learning to walk Requires constant adult supervision Developing peripheral vision and depth perception
5-8	Increasing independence, but still requires supervision Poor depth perception
9-13	Susceptible to “dart out” intersection dash Poor judgment Sense of invulnerability
14-18	Improved awareness of traffic environment Poor judgment
19-40	Active, fully aware of traffic environment
41-65	Slowing of reflexes
65+	Difficulty crossing street Vision loss Difficulty hearing vehicles approaching from behind

Source: AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (July 2004), Exhibit 2-1.

The MUTCD recommends a normal walking speed of three and a half feet per second when calculating the pedestrian clearance interval at traffic signals. The walking speed can drop to three feet per second for areas with older populations and persons with mobility impairments. While the type and degree of mobility impairment varies greatly across the population, the transportation system should accommodate these users to the greatest reasonable extent.

Table 4-3 summarizes common physical and cognitive impairments, how they affect personal mobility, and recommendations for improved pedestrian-friendly design.

Table 4-3 Disabled Pedestrian Design Considerations

Impairment	Effect on Mobility	Design Solution
Wheelchair and Scooter Users	Difficulty propelling over uneven or soft surfaces	Firm, stable surfaces and structures, including ramps or beveled edges
	Cross-slopes cause wheelchairs to veer downhill	Cross-slopes to less than two percent
	Require wider path of travel	Sufficient width and maneuvering space
Walking Aid Users	Difficulty negotiating steep grades and cross slopes; decreased stability	Smooth, non-slippery travel surface
	Slower walking speed and reduced endurance; reduced ability to react	Longer pedestrian signal cycles, shorter crossing distances, median refuges, and street furniture
Hearing Impairment	Less able to detect oncoming hazards at locations with limited sight lines (e.g. driveways, angled intersections, right-turn slip lanes) and complex intersections	Longer pedestrian signal cycles, clear sight distances, highly visible pedestrian signals and markings
Vision Impairment	Limited perception of path ahead and obstacles	Accessible text (larger print and raised text), accessible pedestrian signals (APS), guide strips and detectable warning surfaces, safety barriers, and lighting
	Reliance on memory	
	Reliance on non-visual indicators (e.g. sound and texture)	
Cognitive Impairment	Varies greatly. Can affect ability to perceive, recognize, understand, interpret, and respond to information	Signs with pictures, universal symbols, and colors, rather than text

4.3 Pedestrian Design Best Practices

The following sections provide best practices by facility type from public agencies and municipalities nationwide. Treatments are covered within a single sheet tabular format relaying important design information and discussion, example photos, schematics (if applicable), and existing summary guidance from current or upcoming draft standards. Existing City of Bellingham standards were integrated and should be the first source of information when seeking to implement any of the treatments featured here.

Design guidelines are flexible and should be applied using professional judgment. This document references specific national guidelines for pedestrian facility design. Statutory and regulatory guidance may change. For this reason, the guidance and recommendations in this document function to complement other resources considered during a design process, and in all cases sound engineering judgment should be used.

The following are guiding principles for these pedestrian design guidelines:

- The walking environment should be safe. Sidewalks, crossings, and shared-use paths should be free of hazards and minimize conflicts with external factors, such as noise, vehicular traffic, and protruding architectural elements.
- The pedestrian network should be accessible. Sidewalks, shared-use paths, and crosswalks should ensure the mobility of all users by accommodating the needs of people regardless of age or ability. In areas with specific needs (e.g. schools), improvements should accommodate the needs of the target population.
- The pedestrian network should connect to places people want to go. The pedestrian network should provide continuous direct routes and convenient connections between destinations such as homes, schools, shopping areas, public services, recreational opportunities, and transit.
- The walking environment should be clear and easy to use. Sidewalks, shared-use paths, and crossings should allow all people to easily find a direct route to a destination with minimal delays, regardless of whether these persons have mobility, sensory, or cognitive disability impairments.
- The walking environment should include inviting public spaces. Good design should integrate with and support the development of complementary uses and should encourage preservation and construction of art, landscaping, and other items that add value to public ways. These components might include open spaces such as plazas, courtyards and squares, and amenities like street furniture, banners, art, plantings, and special paving. These along with historical elements and cultural references, should promote a sense of place. Public activities should be encouraged and the municipal code should permit commercial activities such as dining, vending, and advertising when they do not interfere with safety and accessibility.

4.3.1 Sidewalks

Sidewalks are the most fundamental element of the walking network, as they provide an area for pedestrian travel that is separated from vehicle traffic. Sidewalks are typically constructed out of concrete and are separated from the roadway by a curb or gutter and sometimes a landscaped planting strip area. Sidewalks are a common application in both urban and suburban environments.

Attributes of well-designed sidewalks include the following:

Accessibility: A network of sidewalks should be accessible to all users.

Adequate width: Two people should be able to walk side by side and pass a third comfortably. Different walking speeds should be possible. In areas of intense pedestrian use, sidewalks should accommodate the high volume of walkers.

Safety: Design features of the sidewalk should allow pedestrians to have a sense of security and predictability. Sidewalk users should not feel they are at risk due to the presence of adjacent traffic.

Continuity: Walking routes should be obvious and should not require pedestrians to travel out of their way unnecessarily.

Landscaping: Plantings and street trees should contribute to the overall psychological and visual comfort of sidewalk users, and should be designed in a manner that contributes to the safety of people.

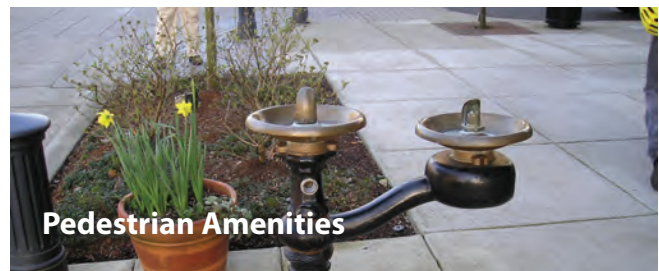
Drainage: Sidewalks should be well graded to minimize standing water.

Social space: There should be places for standing, visiting, and sitting. The sidewalk area should be a place where adults and children can safely participate in public life.

Quality of place: Sidewalks should contribute to the character of neighborhoods and business districts.

This Section Includes:

- Zones in the Sidewalk Corridor
- Sidewalk Widths
- Addressing Sidewalk Obstructions
- Pedestrian Amenities
- Pedestrian Access in Construction and Repair Zones

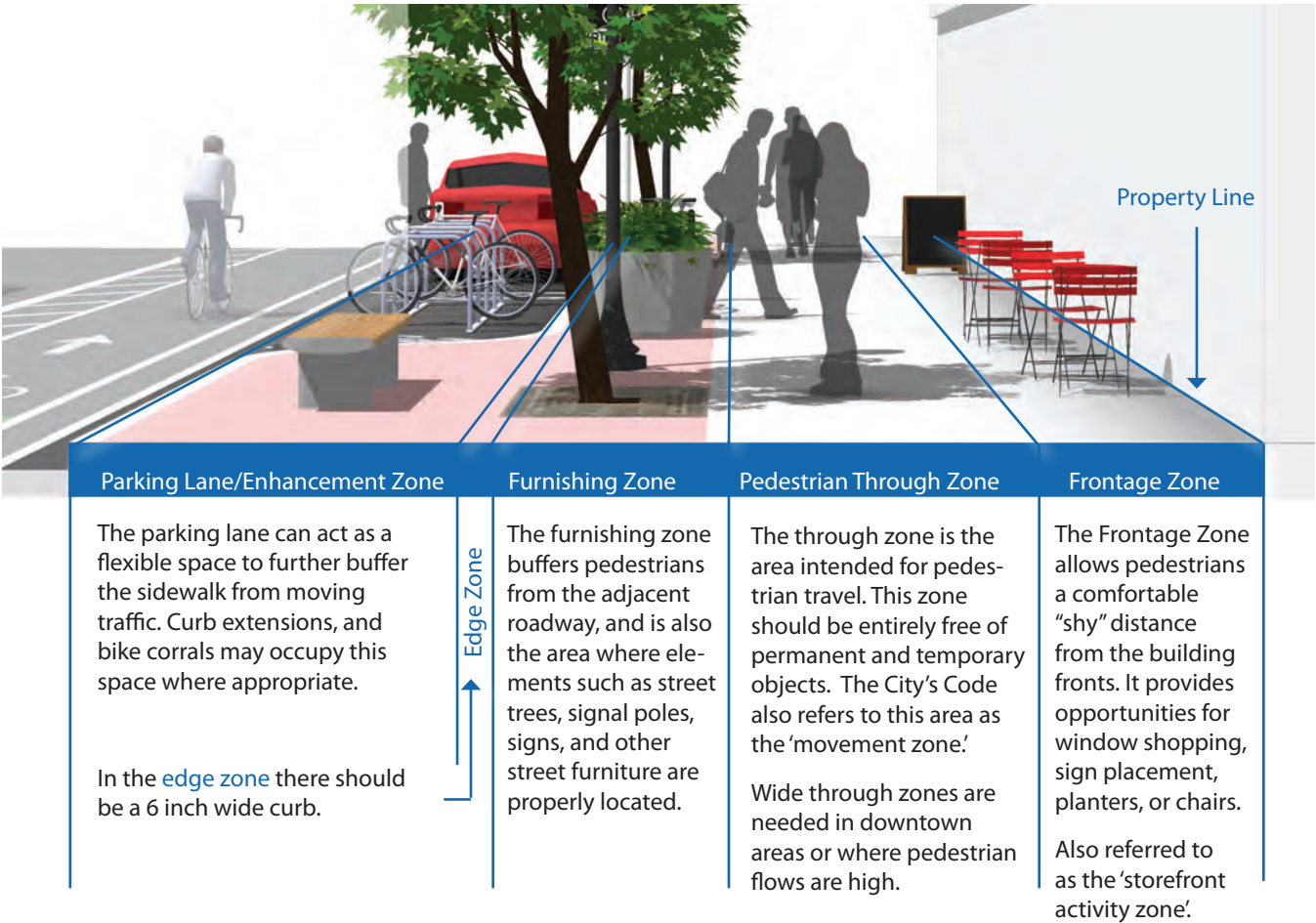


Sidewalks

Zones in the Sidewalk Corridor

Description

Sidewalks are the most fundamental element of the walking network, as they provide an area for pedestrian travel separated from vehicle traffic. A variety of considerations are important in sidewalk design. Providing adequate and accessible facilities can lead to increased numbers of people walking, improved safety, and the creation of social space.



Discussion

Sidewalks should be more than areas to travel; they should provide places for people to interact. There should be places for standing, visiting, and sitting. Sidewalks should contribute to the character of neighborhoods and business districts, strengthen their identity, and be an area where adults and children can safely participate in public life.

Additional References and Guidelines

United States Access Board. (2002). Accessibility Guidelines for Buildings and Facilities.
United States Access Board. (2007). Public Rights-of-Way Accessibility Guidelines (PROWAG).
AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.

Materials and Maintenance

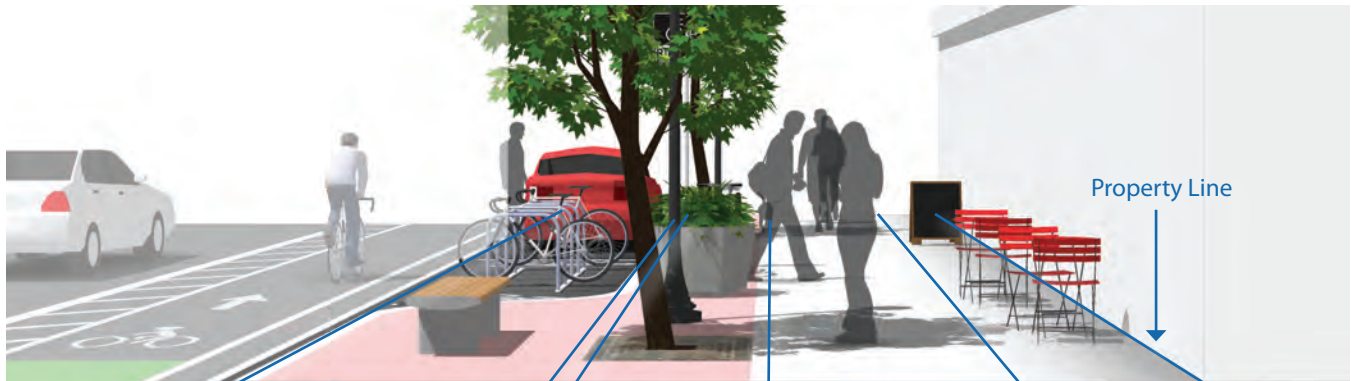
Sidewalks are typically constructed out of concrete and are separated from the roadway by a curb or gutter and sometimes a landscaped boulevard. Colored, patterned, or stamped concrete can add distinctive visual appeal.

Sidewalks

Sidewalk Widths

Description

The width and design of sidewalks will vary depending on street context, functional classification, and pedestrian demand. Below are preferred widths of each sidewalk zone according to general street type. Standardizing sidewalk guidelines for different areas of the city, dependent on the above listed factors, ensures a minimum level of quality for all sidewalks.



Street Classification	Parking Lane/ Enhancement Zone	Furnishing Zone	Pedestrian Through Zone	Frontage Zone	Total
Local Streets	Varies	2 - 5 feet	4 - 6 feet	N/A	6.5 - 10 feet
Commercial Areas	Varies	4 - 6 feet	6 - 12 feet	2.5 - 10 feet	11 - 28 feet
Arterials and Collectors	Varies	2 - 6 feet	4 - 8 feet	2.5 - 5 feet	10 - 19 feet

↑
Six feet enables two pedestrians
(including wheelchair users) to
walk side by side, or to pass each
other comfortably

Discussion

It is important to provide adequate width along a sidewalk corridor. Two people should be able to walk side by side and pass a third comfortably. In areas of high demand sidewalks should contain adequate width to accommodate the high volumes and different walking speeds of pedestrians. The Americans with Disabilities Act requires a 4 foot clear width in the pedestrian zone plus 5 foot passing areas every 200 feet.

Additional References and Guidelines

United States Access Board. (2007). Public Rights-of-Way Accessibility Guidelines (PROWAG).
AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.

Materials and Maintenance

Sidewalks are typically constructed out of concrete and are separated from the roadway by a curb or gutter and sometimes a landscaped boulevard. Surfaces must be firm, stable, and slip resistant.

Sidewalks

Sidewalk Obstructions and Driveway Ramps

Description

Obstructions to pedestrian travel in the sidewalk corridor typically include driveway ramps, curb ramps, sign posts, utility and signal poles, mailboxes, fire hydrants and street furniture.

Guidance

Reducing the number of access points reduces the need for special provisions. This strategy should be pursued first.

Obstructions should be placed between the sidewalk and the roadway to create a buffer for increased pedestrian comfort.

Dipping the entire sidewalk at the driveway approaches keeps the cross-slope at a constant grade. (The least preferred driveway option)

Where constraints preclude a planter strip, wrapping the sidewalk around the driveway provides adequate driveway ramp space.

When sidewalks abut hedges, fences, or buildings, an additional two feet of lateral clearance should be added to provide appropriate shy distance.



Planter strips allow sidewalks to remain level, with the driveway grade change occurring within the planter strip.

When sidewalks abut angled on-street parking, sidewalks should be widened 2-3 feet to accommodate overhanging vehicles.

Discussion

Driveways are a common sidewalk obstruction, especially for wheelchair users. When constraints only allow curb-tight sidewalks, dipping the entire sidewalk at the driveway approaches keeps the cross-slope at a constant grade. However, this may be uncomfortable for pedestrians and could create drainage problems behind the sidewalk.

Additional References and Guidelines

United States Access Board. (2002). Accessibility Guidelines for Buildings and Facilities.
 United States Access Board. (2007). Public Rights-of-Way Accessibility Guidelines (PROWAG).
 AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.

Materials and Maintenance

Surfaces must be firm, stable, and slip resistant.

Pedestrian Amenities

Pedestrian Amenities

Street Trees

In addition to their aesthetic and environmental value, street trees can slow traffic and improve safety for pedestrians. Trees add visual interest to streets and narrow the street's visual corridor, which may cause drivers to slow down. It is important that trees do not block light or the vision triangle.

Street Furniture

Providing benches at key rest areas and viewpoints encourages people of all ages to use the walkways by ensuring that they have a place to rest along the way. Benches should be 20" tall to accommodate elderly pedestrians comfortably. Benches can be simple (e.g., wood slats) or more ornate (e.g., stone, wrought iron, concrete). If alongside a parking zone, street furniture must be 3 feet from the curbface.

Green Features

Green stormwater strategies may include bioretention swales, rain gardens, tree box filters, and pervious pavements (pervious concrete, asphalt, and pavers).

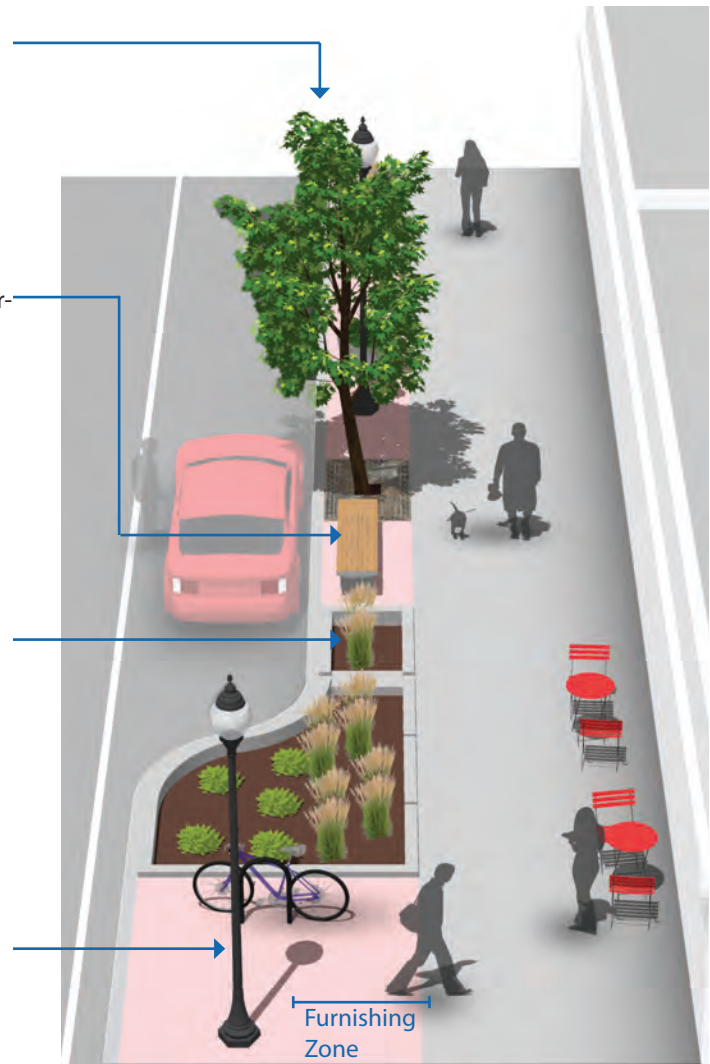
Bioswales are natural landscape elements that manage water runoff from a paved surface. Plants in the swale trap pollutants and silt from entering a river system.

Lighting

Pedestrian scale lighting improves visibility for both pedestrians and motorists - particularly at intersections. Pedestrian scale lighting can provide a vertical buffer between the sidewalk and the street, defining pedestrian areas. Pedestrian scale lighting should be used in areas of high pedestrian activity.

Description

A variety of streetscape elements can define the pedestrian realm, offer protection from moving vehicles, and enhance the walking experience. Key features are presented below.



Discussion

Additional pedestrian amenities such as banners, public art, special paving, along with historical elements and cultural references, promote a sense of place. Public activities should be encouraged and commercial activities (such as dining, vending and advertising) may be permitted when they do not interfere with safety and accessibility.

Pedestrian amenities should be placed in the furnishing zone on a sidewalk corridor. See [Zones in the Sidewalk Corridor](#) for a discussion of the functional parts of a sidewalk. Signs, meters, and tree wells should go between parking spaces.

Additional References and Guidelines

United States Access Board. (2007). Public Rights-of-Way Accessibility Guidelines (PROWAG).

Materials and Maintenance

Establishing and caring for your young street trees is essential to their health. Green features may require routine maintenance, including sediment and trash removal, and clearing curb openings and overflow drains.

Construction and Repair Zones

Pedestrian Access Through Construction Areas

Description

Measures should be taken to provide for the continuity of a pedestrian's trip through a construction closure. Only in rare cases should pedestrians be detoured to another street when travel lanes remain open.

Guidance

- Pedestrians should be provided with a safe, accessible, convenient path that replicates, as nearly as practical, the most desirable characteristics of the existing sidewalks or footpaths. The alternate circulation path shall be parallel to the disrupted pedestrian access route, be located on the same side of the street, and accommodate the disabled.
- The alternate route should have a width of 5 feet minimum, and an additional foot of width for each vertical element along the route.
- In rare cases where access is not available on the same side of the street, the alternate pedestrian route may be located on the opposite side of the street as long as the distance of the disrupted pedestrian route does not exceed 300 feet.
- Signage related to construction activities shall be placed in a location that does not obstruct the path of bicycles or pedestrians, including bicycle lanes, wide curb lanes, or sidewalks.
- During long-term construction provide sheltered, covered walkways in commercial districts.



Discussion

The removal of a pedestrian access route, curb ramp, or pedestrian street crossing, even for a short time, may severely limit or totally preclude pedestrians, especially those with a disability, from navigating in the public right-of-way. It might also preclude access to buildings, facilities, or sites on adjacent properties.

Additional References and Guidelines

FHWA. (2009). Manual on Uniform Traffic Control Devices.
AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.

Materials and Maintenance

The alternate route should include sidewalks and pedestrian access routes, curb ramps, pedestrian crossings, lighting, and all other elements included in these standards.

4.3.2 Pedestrians at Intersections

Attributes of pedestrian-friendly intersection design include the following:

Clear Space: Corners should be clear of obstructions. They should also have enough room for curb ramps, for transit stops where appropriate, and for street conversations where pedestrians might congregate.

Visibility: It is critical that pedestrians on the corner have a good view of vehicle travel lanes and that motorists in the travel lanes can easily see waiting pedestrians.

Legibility: Symbols, markings, and signs used at corners should clearly indicate what actions the pedestrian should take.

Accessibility: All corner features, such as curb ramps, landings, call buttons, signs, symbols, markings, and textures, should meet accessibility standards and follow universal design principles.

Separation from Traffic: Corner design and construction should be effective in discouraging turning vehicles from driving over the pedestrian area. Crossing distances should be minimized.

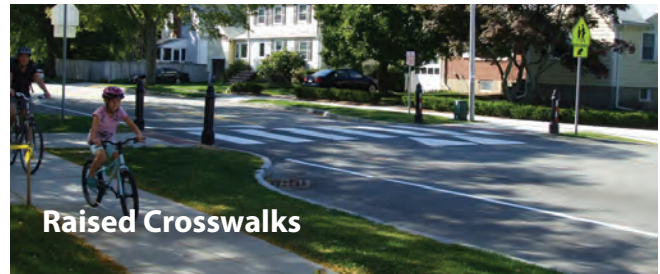
Lighting: Adequate lighting is an important aspect of visibility, legibility, and accessibility.

These attributes will vary with context but should be considered in all design processes. For example, suburban and rural intersections may have limited or no signing. However, legibility regarding appropriate pedestrian movements should still be taken into account during design.

See [Crossing Beacons and Signals](#) for a discussion of signalization in support of pedestrians.

This Section Includes:

- Marked Crosswalks
- Raised Crosswalks
- Reducing Crossing Distance
 - Median Refuge Islands
 - Minimizing Curb Radii
 - Curb Extensions
- Minimizing Conflict with Automobiles
 - Advance Stop Bars
 - Parking Control
- ADA Compliant Curb Ramps



Marked Crosswalks

Marked Crosswalks

Guidance

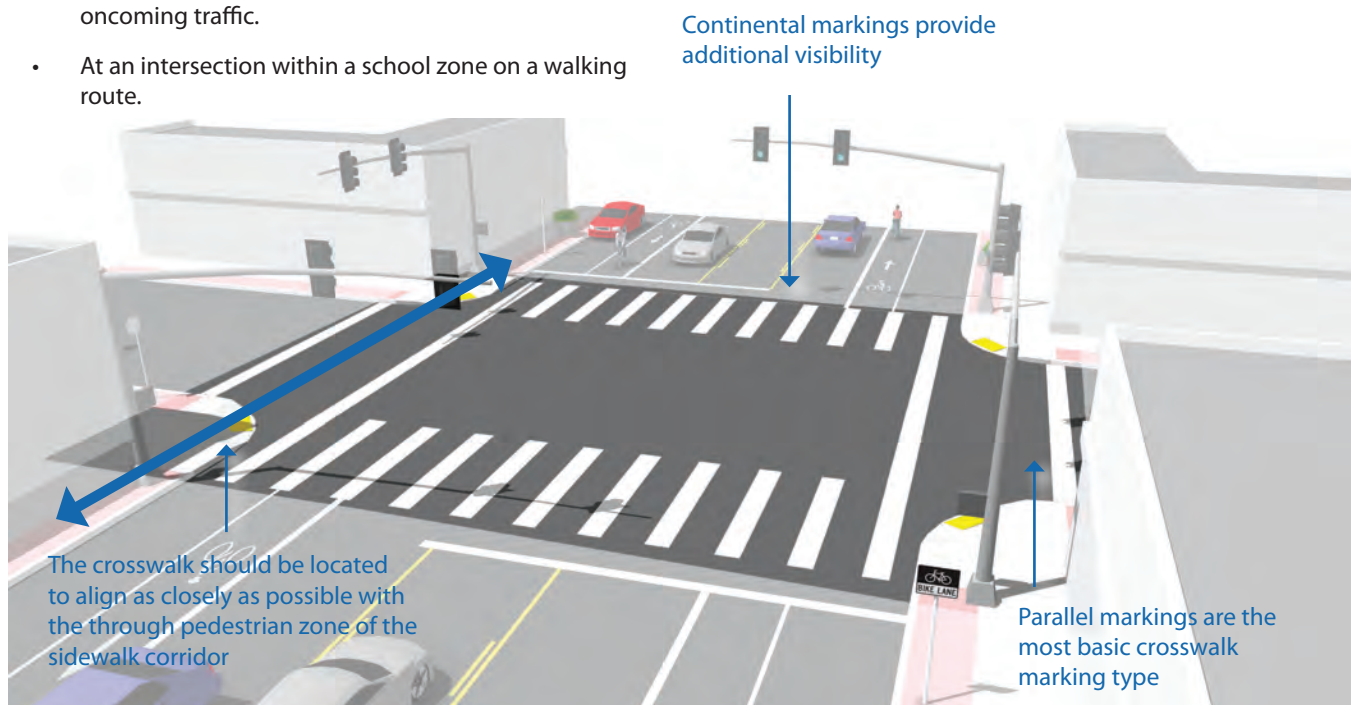
At signalized intersections, all crosswalks should be marked. At unsignalized intersections, crosswalks may be marked under the following conditions:

- At a complex intersection, to orient pedestrians in finding their way across.
- At an offset intersection, to show pedestrians the shortest route across traffic with the least exposure to vehicular traffic and traffic conflicts.
- At an intersection with visibility constraints, to position pedestrians where they can best be seen by oncoming traffic.
- At an intersection within a school zone on a walking route.

Description

A marked crosswalk signals to motorists that they must stop for pedestrians and encourages pedestrians to cross at designated locations. Installing crosswalks alone will not necessarily make crossings safer especially on multi-lane roadways.

At mid-block locations, crosswalks can be marked where there is a demand for crossing and there are no nearby marked crosswalks.



Discussion

Continental crosswalk markings should be used at crossings with high pedestrian use or where vulnerable pedestrians are expected, including at school crossings, across arterial streets for pedestrian-only signals, at mid-block crosswalks, and at intersections where there is expected high pedestrian use and the crossing is not controlled by signals or stop signs.

See [Intersection Signalization](#) for a discussion of enhancing pedestrian crossings.

Additional References and Guidelines

FHWA. (2009). Manual on Uniform Traffic Control Devices. (3B.18)
 AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.
 FHWA. (2005). Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations.
 FHWA. (2010). Crosswalk Marking Field Visibility Study.

Materials and Maintenance

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority. Thermoplastic markings offer increased durability than conventional paint.

Marked Crosswalks

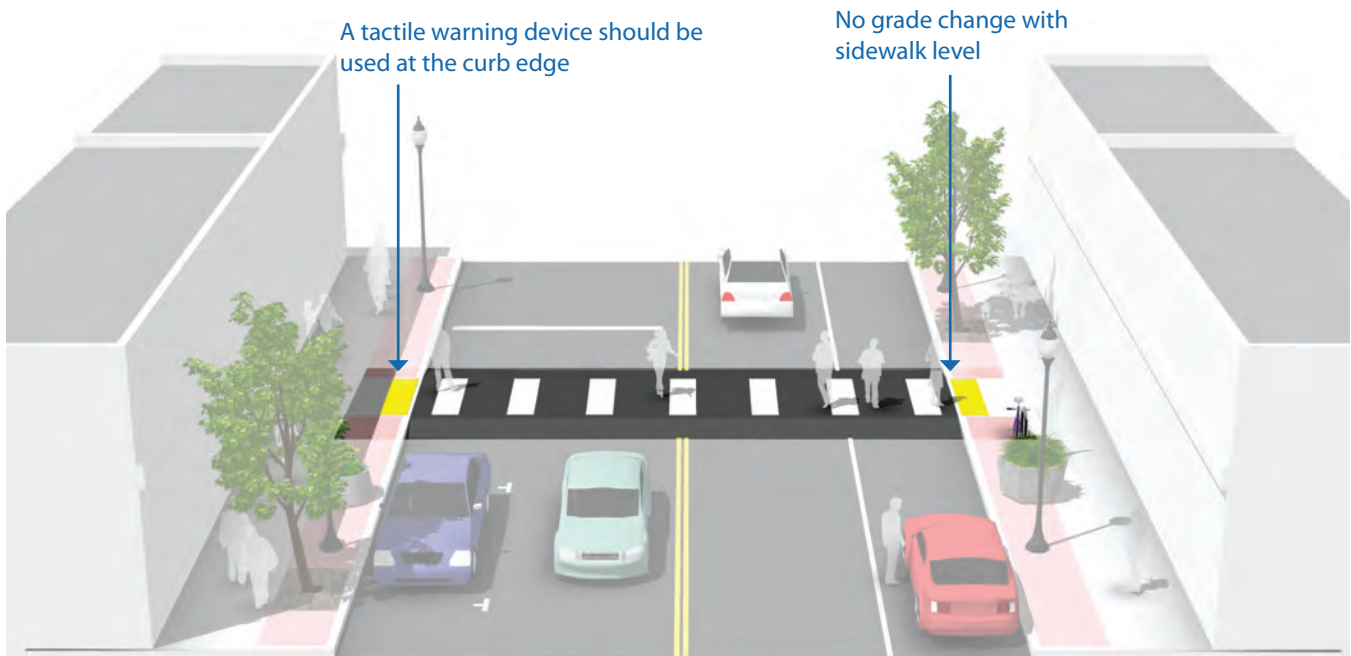
Raised Crosswalks

Guidance

- Use detectable warnings at the curb edges to alert vision-impaired pedestrians that they are entering the roadway.
- Approaches to the raised crosswalk may be designed to be similar to speed humps.
- Raised crosswalks can also be used as a traffic calming treatment.

Description

A raised crosswalk or intersection can eliminate grade changes from the pedestrian path and give pedestrians greater prominence as they cross the street. Raised crosswalks should be used only in very limited cases where a special emphasis on pedestrians is desired; review on a case-by-case basis.



Discussion

Like speed humps, raised crosswalks have a traffic slowing effect which may be unsuitable on emergency response routes.

Additional References and Guidelines

FHWA. (2009). Manual on Uniform Traffic Control Devices. (3B.18)
AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.
USDOJ. (2010). ADA Standards for Accessible Design.

Materials and Maintenance

Because the effectiveness of marked crossings depends entirely on their visibility, maintaining marked crossings should be a high priority.

Reducing Crossing Distance

Median Refuge Islands

Guidance

- Refuge islands can be applied on any roadway with more than two lanes of traffic.
- Appropriate at signalized or unsignalized crosswalks
- The refuge island must be accessible, preferably with an at-grade passage through the island rather than ramps and landings.
- The island should be at least 6 feet wide between travel lanes and at least 20' long
- The refuge area should be wide enough (> 6 feet) to accommodate bikes with trailers and wheelchair users
- On streets with speeds higher than 25 mph there should also be double centerline markings, reflectors, and "KEEP RIGHT" signage.

Description

Median refuge islands are located at the mid-point of a marked crossing and help improve pedestrian safety by allowing pedestrians to cross one direction of traffic at a time. Refuge islands minimize pedestrian exposure by shortening crossing distance and increasing the number of available gaps for crossing.

Cut through median islands are preferred over curb ramps to better accommodate bicyclists.



Discussion

If a refuge island is landscaped, the landscaping should not compromise the visibility of pedestrians crossing in the crosswalk. Shrubs and ground plantings should be no higher than 1 ft 6 in.

On multi-lane roadways, consider configuration with **active warning beacons** for improved yielding compliance.

Additional References and Guidelines

FHWA. (2009). Manual on Uniform Traffic Control Devices.
 AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.
 NACTO. (2011). Urban Bikeway Design Guide.

Materials and Maintenance

Refuge islands may collect road debris and may require somewhat frequent maintenance. Refuge islands should be visible to snow plow crews and should be kept free of snow berms that block access.

Reducing Crossing Distance

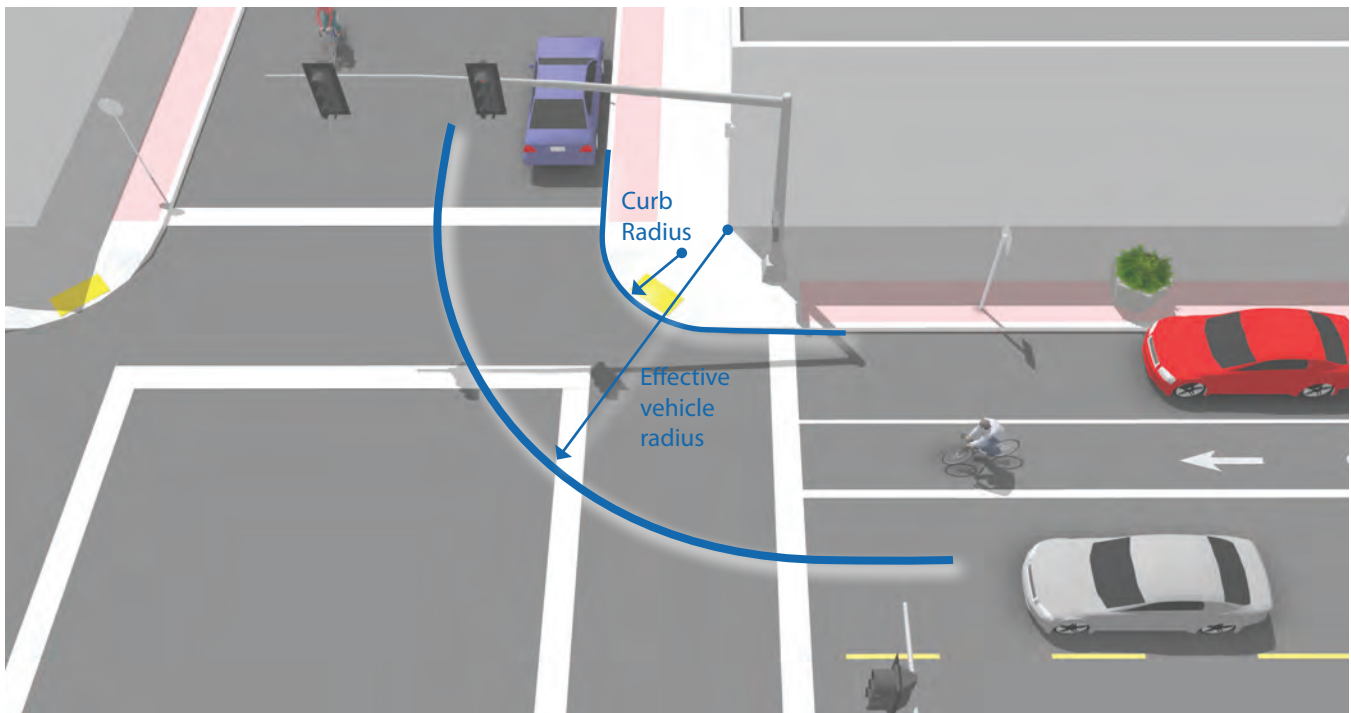
Minimizing Curb Radii

Guidance

The radius may be as small as 3 feet where there are no turning movements, or 5 feet where there are turning movements and there is adequate street width and a larger effective curb radius created by parking or bike lanes.

Description

The size of a curb's radius can have a significant impact on pedestrian comfort and safety. A smaller curb radius provides more pedestrian space at the corner, allows more flexibility in the placement of curb ramps, results in a shorter crossing distance, and requires vehicles to slow more on the intersection approach. During the design phase, the chosen radius should be the smallest possible for the circumstances.



Discussion

Several factors govern the choice of curb radius in any given location. These include the desired pedestrian area of the corner, traffic turning movements, the turning radius of the design vehicle, the geometry of the intersection, the street classifications, and whether there is parking or a bike lane (or both) between the travel lane and the curb.

Additional References and Guidelines

AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.
AASHTO. (2004). A Policy on Geometric Design of Highways and Streets.

Materials and Maintenance

A small curb radius is also beneficial for street sweeping operations.

Reducing Crossing Distance

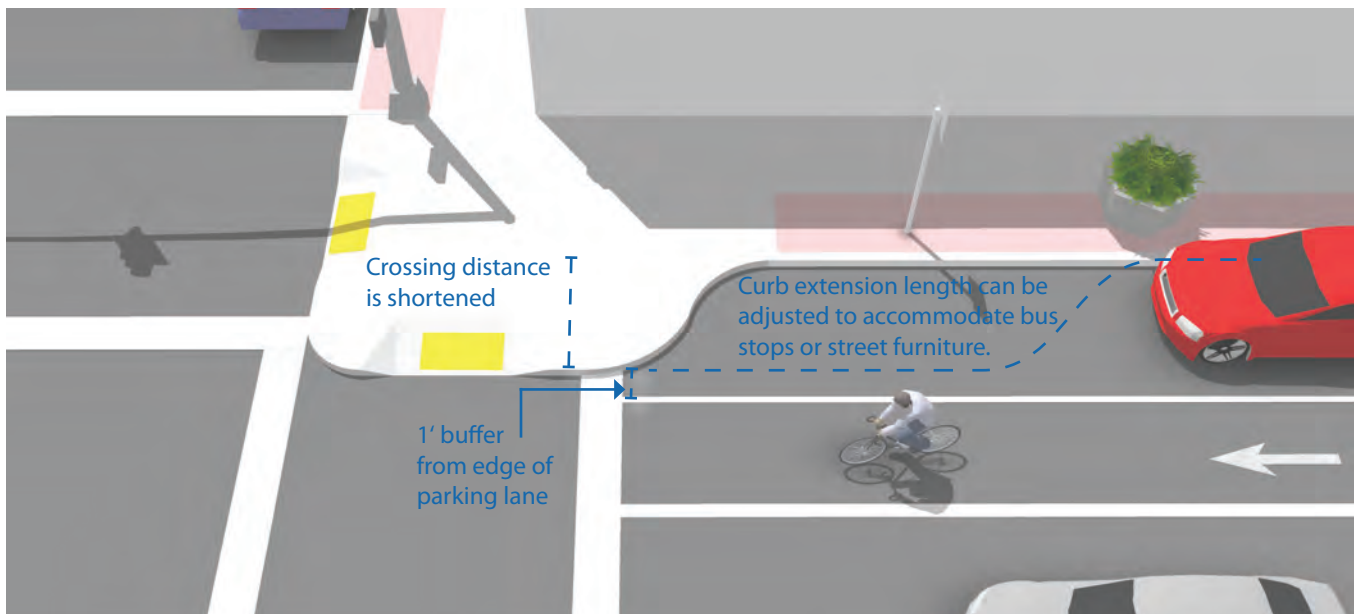
Curb Extensions

Guidance

- In most cases, the curb extensions should be designed to transition between the extended curb and the running curb in the shortest practicable distance giving consideration to sight distance issues with parked cars.
- For purposes of efficient street sweeping, the minimum radius for the reverse curves of the transition is 10 feet and the two radii should be balanced to be nearly equal
- Curb extensions should terminate one foot short of the parking lane to maximize bicyclist safety.
- The curb extensions length at non-signalized intersections should be based on roadway speed limit.

Description

Curb extensions minimize pedestrian exposure during crossing by shortening crossing distance and give pedestrians a better chance to see and be seen before committing to crossing. They are appropriate for any crosswalk where it is desirable to shorten the crossing distance and there is a parking lane adjacent to the curb.



Discussion

If there is no parking lane, adding curb extensions may be a problem for bicycle travel and truck or bus turning movements.

If a refuge island is landscaped, the landscaping should not compromise the visibility of pedestrians crossing in the crosswalk. Shrubs and ground plantings should be no higher than 1 ft 6 in.

Additional References and Guidelines

AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.
 AASHTO. (2004). A Policy on Geometric Design of Highways and Streets.

Materials and Maintenance

Planted curb extensions may be designed as a bioswale, a vegetated system for stormwater management.

Minimizing Conflict with Automobiles

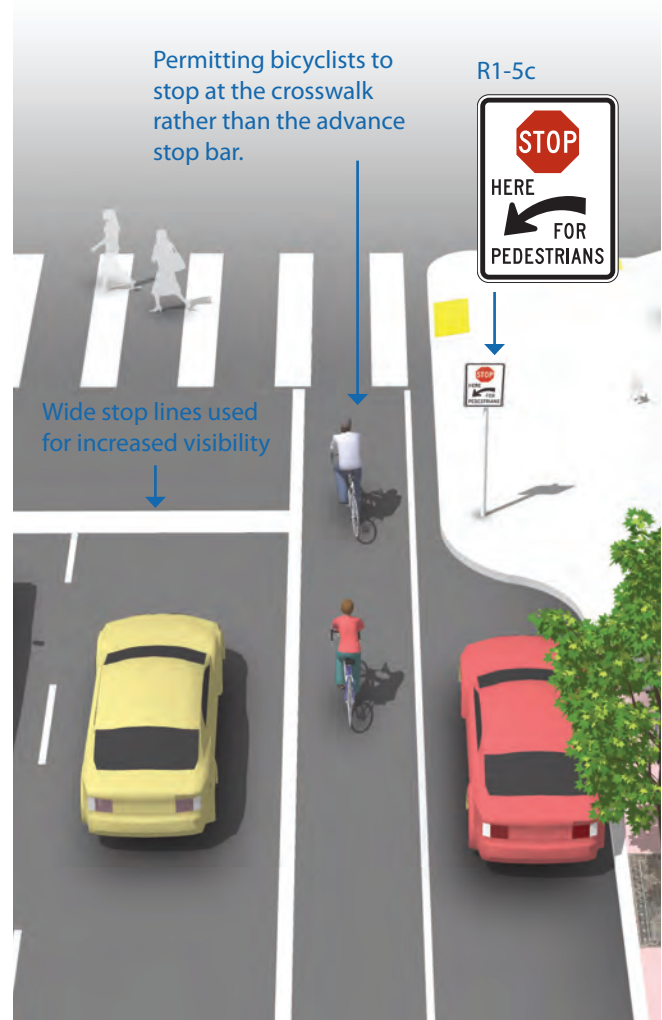
Advance Stop Bar

Description

Advance stop bars increase pedestrian comfort and safety by stopping motor vehicles well in advance of marked crosswalks, allowing vehicle operators a better line of sight of pedestrians and giving inner lane motor vehicle traffic time to stop for pedestrians.

Guidance

- On streets with at least two travel lanes in each direction.
- Prior to a marked crosswalk
- In one or both directions of motor vehicle travel
- Recommended 30 feet in advance of the crosswalk
- Should be accompanied by a “Stop Here for Pedestrians” sign



Discussion

If a bicycle lane is present, mark the advance stop bar to permit bicyclists to stop at the crosswalk ahead of the stop bar.

Additional References and Guidelines

FHWA. (2009). Manual on Uniform Traffic Control Devices.

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Minimizing Conflict with Automobiles

Parking Control

Guidance

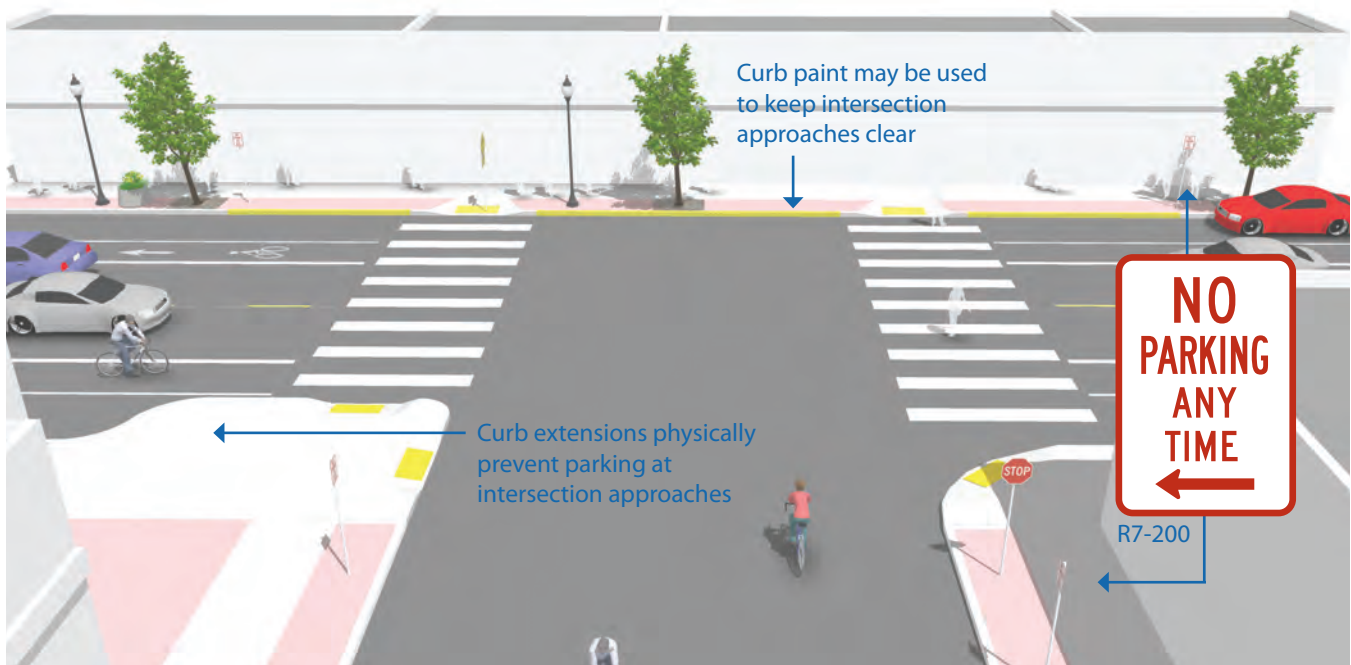
Curb extensions, 'No Parking' signage, or curb paint can be used to keep the approach to intersections clear of parked vehicles.

At "T" and offset intersections, where the boundaries of the intersection may not be obvious, this prohibition should be made clear with signage.

Parking shall not be allowed within any type of intersection adjacent to schools, school crosswalks, and parks. This includes "T" and offset intersections.

Description

Parking control involves restricting or reducing on-street parking near intersections with high pedestrian activity. Locating parking away from the intersection improves motorist's visibility on the approach to the intersection and crosswalk. Improved sight lines at intersections reduces conflicts between motorists and pedestrians.



Discussion

In areas where there is high parking demand parking, compact vehicles may be allowed within "T" or offset intersections and on either side of the crosswalk. At these locations, signs will be placed to prohibit parking within the designated crosswalk areas, and additional enforcement should be provided, particularly when the treatment is new.

Additional References and Guidelines

AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.
AASHTO. (2004). A Policy on Geometric Design of Highways and Streets.

Materials and Maintenance

Signage and striping require routine maintenance.

ADA Compliant Curb Ramps

ADA Compliant Curb Ramps

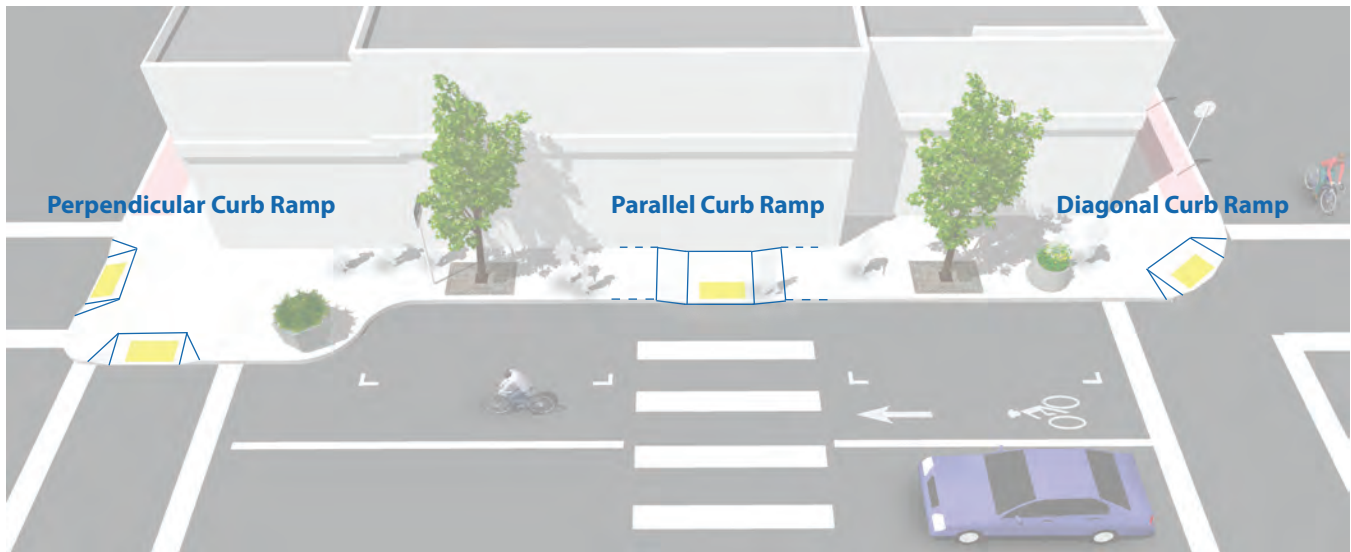
Guidance

- The landing at the top of a ramp shall be at least 4 feet long and at least the same width as the ramp itself.
- The ramp shall slope no more than 1:50 (2.0%) in any direction.
- If the ramp runs directly into a crosswalk, the landing at the bottom will be in the roadway.
- If the ramp lands on a dropped landing within the sidewalk or corner area where someone in a wheel-chair may have to change direction, the landing must be a minimum of 5 feet long and at least as wide as the ramp, although a width of 5 feet is preferred.

Description

Curb ramps are the design elements that allow all users to make the transition from the street to the sidewalk. There are a number of factors to be considered in the design and placement of curb ramps at corners. Properly designed curb ramps ensure that the sidewalk is accessible from the roadway. A sidewalk without a curb ramp can be useless to someone in a wheelchair, forcing them back to a driveway and out into the street for access.

Curb ramps shall be located so that they do not project into vehicular traffic lanes, parking spaces, or parking access aisles



Crosswalk spacing not to scale. For illustration purposes only.

Discussion

The edge of an ADA compliant curb ramp will be marked with a tactile warning device (also known as truncated domes) to alert people with visual impairments to changes in the pedestrian environment. Contrast between the raised tactile device and the surrounding infrastructure is important so that the change is readily evident. These devices are most effective when adjacent to smooth pavement so the difference is easily detected. The devices must provide color contrast so partially sighted people can see them.

Additional References and Guidelines

United States Access Board. (2002). Accessibility Guidelines for Buildings and Facilities.
United States Access Board. (2007). Public Rights-of-Way Accessibility Guidelines (PROWAG).
USDOJ. (2010). ADA Standards for Accessible Design.

Materials and Maintenance

It is critical that the interface between a curb ramp and the street be maintained adequately. Asphalt street sections can develop potholes in the at the foot of the ramp, which can catch the front wheels of a wheelchair.

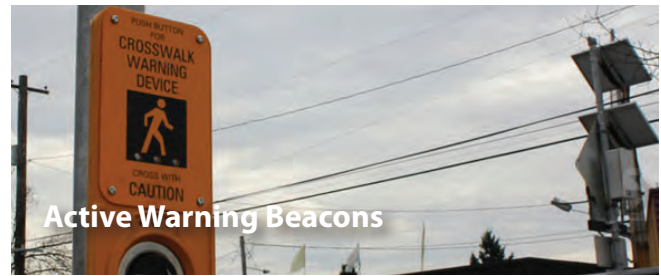
Crossing Beacons and Signals

Crossing beacons and signals facilitate crossings of roadways for pedestrians and bicyclists. Beacons make crossing intersections safer by clarifying when to enter an intersection and by alerting motorists to the presence of pedestrians in the crosswalk.

Flashing amber warning beacons can be utilized at unsignalized intersection crossings. Push buttons, signage, and pavement markings may be used to highlight these facilities for pedestrians, bicyclists and motorists.

Determining which type of signal or beacon to use for a particular intersection depends on a variety of factors. These include speed limits, Average Daily Traffic (ADT), and the anticipated levels of pedestrian and bicycle crossing traffic.

An intersection with crossing beacons may reduce stress and delays for a crossing users, and discourage illegal and unsafe crossing maneuvers.



This Section Includes:

- Accommodating Pedestrians at Signalized Intersections
- Active Warning Beacons
- Hybrid Beacon for Mid-Block Crossing

Signalization

Accommodating Pedestrians at Signalized Crossings

Description

Pedestrian Signal Head

Pedestrian signal indicators demonstrate to pedestrians when to cross at a signalized crosswalk. All traffic signals should be equipped with pedestrian signal indications except where pedestrian crossing is prohibited by signage.

Countdown pedestrian signals are particularly valuable for pedestrians, as they indicate whether a pedestrian has time to cross the street before the signal phase ends. Countdown signals should be used at all signalized intersections.

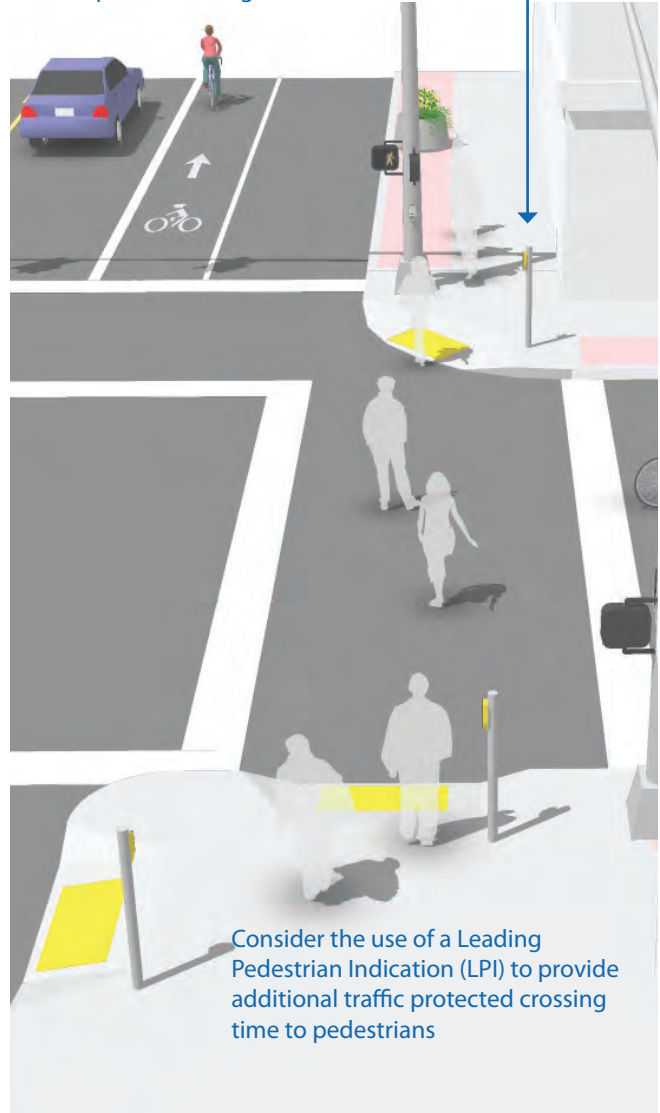
Signal Timing

Providing adequate pedestrian crossing time is a critical element of the walking environment at signalized intersections. The MUTCD recommends traffic signal timing to assume a pedestrian walking speed of 4 feet per second, meaning that the length of a signal phase with parallel pedestrian movements should provide sufficient time for a pedestrian to safely cross the adjacent street.

At crossings where children, older pedestrians or pedestrians with disabilities are expected, crossing speeds as low as 3 feet per second may be assumed. Special pedestrian phases can be used to provide greater visibility or more crossing time for pedestrians at certain intersections.

In busy pedestrian areas such as downtown, the pedestrian signal indication should be built into each signal phase, eliminating the requirement for a pedestrian to actuate the signal by pushing a button.

Audible pedestrian traffic signals provide crossing assistance to pedestrians with vision impairment at signalized intersections



Consider the use of a Leading Pedestrian Indication (LPI) to provide additional traffic protected crossing time to pedestrians

Discussion

When push buttons are used, they should be located so that someone in a wheelchair can reach the button from a level area of the sidewalk without deviating significantly from the natural line of travel into the crosswalk, and should be marked (for example, with arrows) so that it is clear which signal is affected.

In areas with very heavy pedestrian traffic, consider an all-pedestrian signal phase to give pedestrians free passage in the intersection when all motor vehicle traffic movements are stopped.

Additional References and Guidelines

United States Access Board. (2007). Public Rights-of-Way Accessibility Guidelines (PROWAG).
AASHTO. (2004). Guide for the Planning, Design, and Operation of Pedestrian Facilities.

Materials and Maintenance

Depending on power supply, maintenance can be minimal. If solar power is used, flashing beacons should run for years without issue.

Signalization

Active Warning Beacons

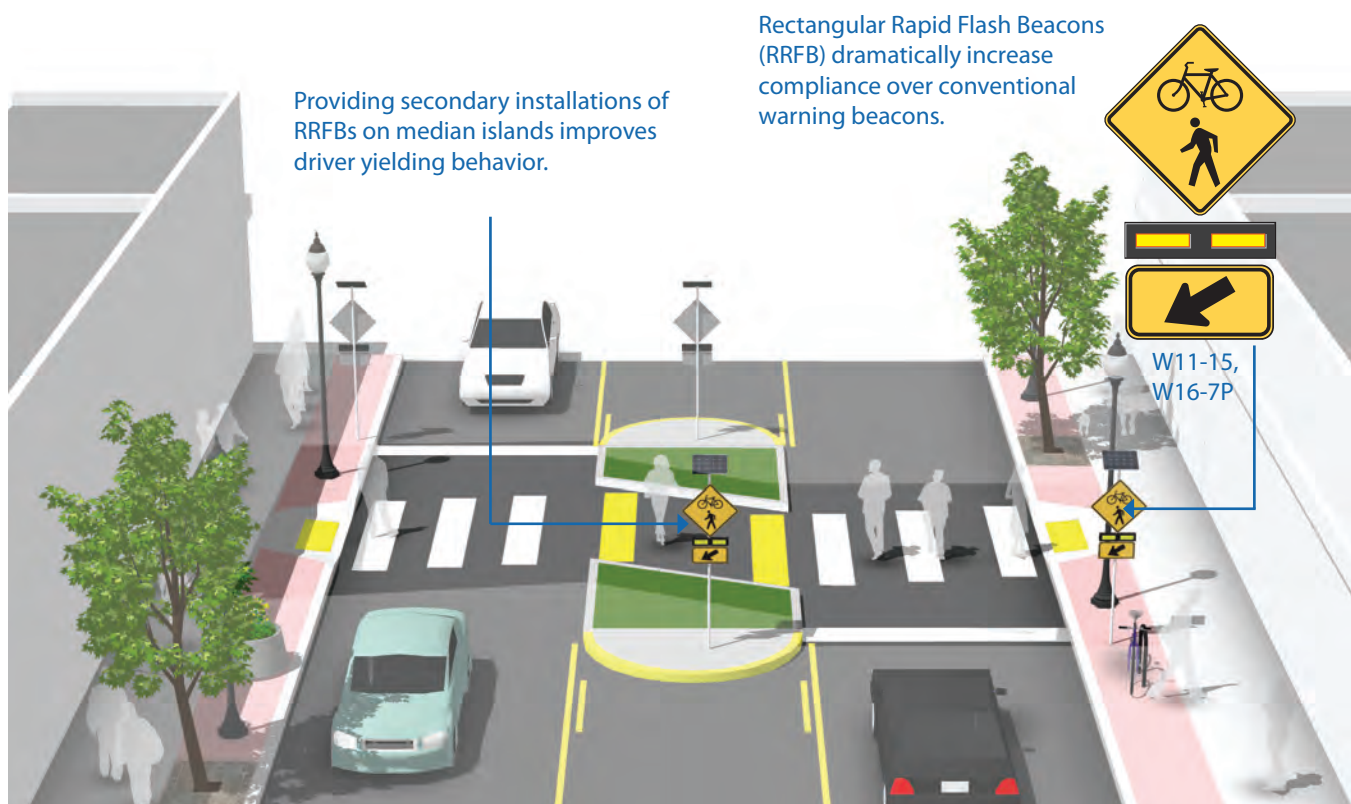
Guidance

- Warning beacons shall not be used at crosswalks controlled by YIELD signs, STOP signs, or traffic signals.
- Warning beacons shall initiate operation based on pedestrian or bicyclist actuation and shall cease operation at a predetermined time after actuation or, with passive detection, after the pedestrian or bicyclist clears the crosswalk.

Description

Active warning beacons are user actuated illuminated devices designed to increase motor vehicle yielding compliance at crossings of multi lane or high volume roadways.

Types of active warning beacons include conventional circular yellow flashing beacons, in-roadway warning lights, or Rectangular Rapid Flash Beacons (RRFB).



Discussion

Rectangular rapid flash beacons have the most increased compliance of all the warning beacon enhancement options.

A study of the effectiveness of going from a no-beacon arrangement to a two-beacon RRFB installation increased yielding from 18 percent to 81 percent. A four-beacon arrangement raised compliance to 88 percent. Additional studies over long term installations show little to no decrease in yielding behavior over time.

Additional References and Guidelines

NACTO. (2011). Urban Bikeway Design Guide.
 FHWA. (2009). Manual on Uniform Traffic Control Devices.
 FHWA. (2008). MUTCD - Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11)

Materials and Maintenance

Depending on power supply, maintenance can be minimal. If solar power is used, RRFBs should run for years without issue.

Signalization

Hybrid Beacon for Mid-Block Crossing

Guidance

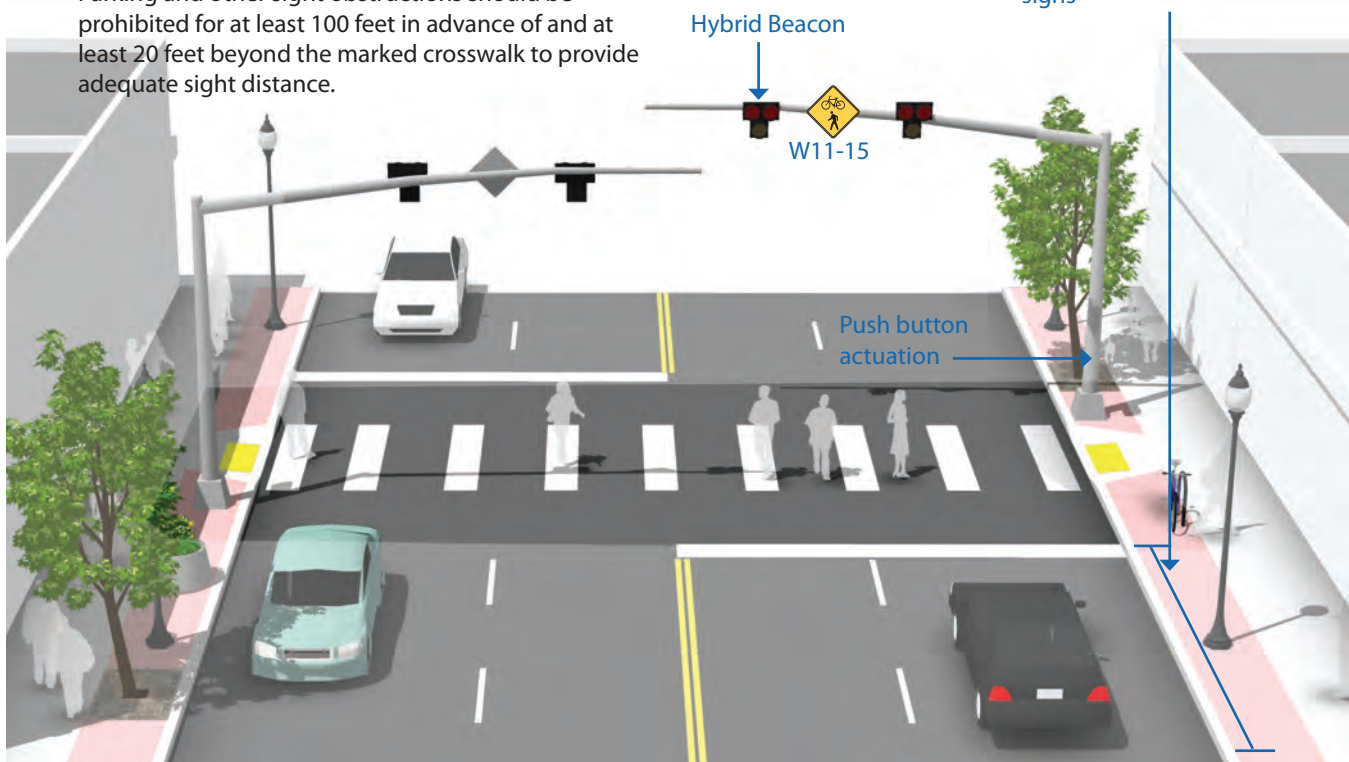
Hybrid beacons may be installed without meeting traffic signal control warrants if roadway speeds and volumes are excessive for comfortable pedestrian crossings.

- If installed within a signal system, signal engineers should evaluate the need for the hybrid signal to be coordinated with other signals.
- Parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk to provide adequate sight distance.

Description

Hybrid beacons are used to improve non-motorized crossings of major streets. A hybrid beacon consists of a signal head with two red lenses over a single yellow lens on the major street, and a pedestrian signal head for the crosswalk.

Should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs



Discussion

Hybrid beacon signals are normally activated by push buttons, but may also be triggered by infrared, microwave or video detectors. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street.

Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity, and safety.

Additional References and Guidelines

FHWA. (2009). Manual on Uniform Traffic Control Devices.
NACTO. (2011). Urban Bikeway Design Guide.

Materials and Maintenance

Hybrid beacons are subject to the same maintenance needs and requirements as standard traffic signals. Signing and striping need to be maintained to help users understand any unfamiliar traffic control.

4.3.3 Shared-Use Paths

A shared-use path allows for off-street pedestrian travel and may be shared with bicyclists, skaters, wheelchair users, joggers, and other non-motorized users. These facilities are frequently found in parks, along rivers and beaches, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles. Path facilities can also include amenities such as lighting, signage, and fencing (where appropriate).

Key features of shared-use paths include the following:

- Frequent access points from the local road network.
- Directional signs to direct users to and from the path.
- A limited number of at-grade crossings with streets or driveways.
- Terminating the path where it is easily accessible to and from the street system.
- Separate treads for pedestrians and bicyclists when heavy use is expected.



This Section Includes:

- General Design Practices
- Local Neighborhood Accessways

Shared Use Paths

General Design Practices

Description

Shared-use paths can provide a desirable facility, particularly for recreation, and for users of all skill levels preferring separation from traffic. Shared-use paths should generally provide directional travel opportunities not provided by sidewalks on existing roadways.

Guidance

Width

- 8 feet is the minimum allowed for a two-way shared use path and is only recommended for low traffic situations.
- 10 feet is recommended in most situations and will be adequate for moderate to heavy use.
- 12 feet is recommended for heavy use situations with high concentrations of multiple users. A separate track (5 feet minimum) can be provided for bicycle use.

Lateral Clearance

- A 2-foot or greater shoulder should be provided on both sides of the path. An additional foot of lateral clearance (total of 3 feet) is required by the MUTCD for the installation of signage or other furnishings.

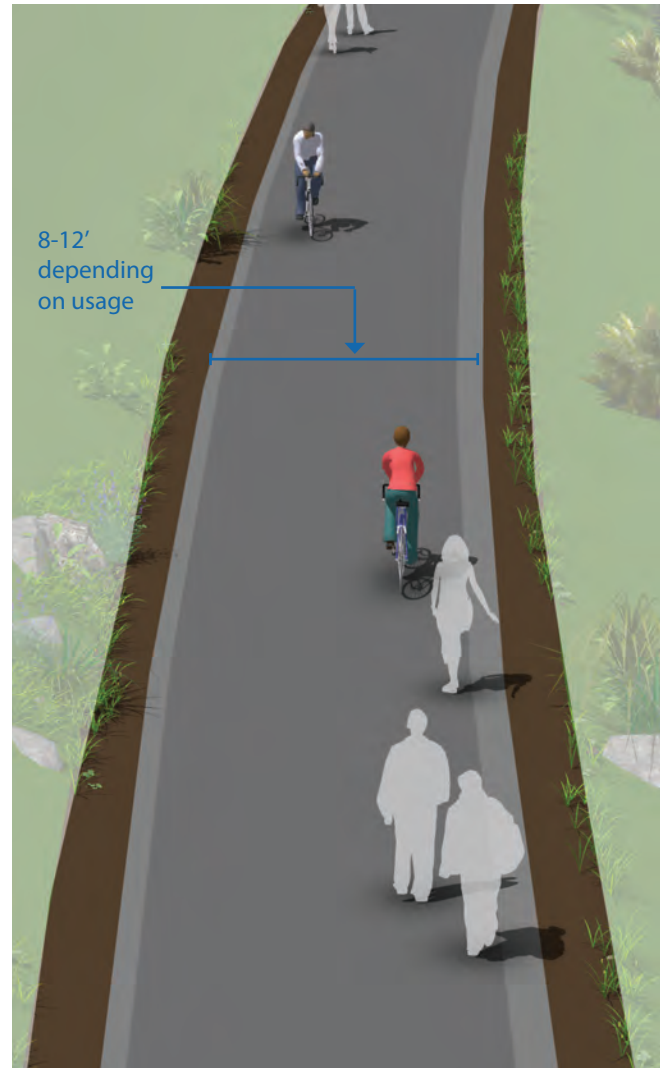
Overhead Clearance

- Clearance to overhead obstructions should be 8 feet minimum, with 10 feet recommended.

Striping

- When striping is required, use a 4 inch dashed yellow centerline stripe with 4 inch solid white edge lines.
- Solid centerlines can be provided on tight or blind corners, and on the approaches to roadway crossings.

Terminate the path where it is easily accessible to and from the street system, preferably at a controlled intersection or at the beginning of a dead-end street.



Discussion

The AASHTO Guide for the Development of Bicycle Facilities generally recommend against the development of **shared use paths along roadways**. Also known as “sidepaths”, these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding when either entering or exiting the path. However, as an alternative to a typical sidewalk, sidepaths provide a desirable separated option for pedestrians.

Additional References and Guidelines

AASHTO. (1999). Guide for the Development of Bicycle Facilities.
 FHWA. (2009). Manual on Uniform Traffic Control Devices.
 Flink, C. (1993). Greenways: A Guide To Planning Design And Development.

Materials and Maintenance

Asphalt is the most common surface for shared -use paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path

Shared Use Paths

Sidepaths Along Roadways

Description

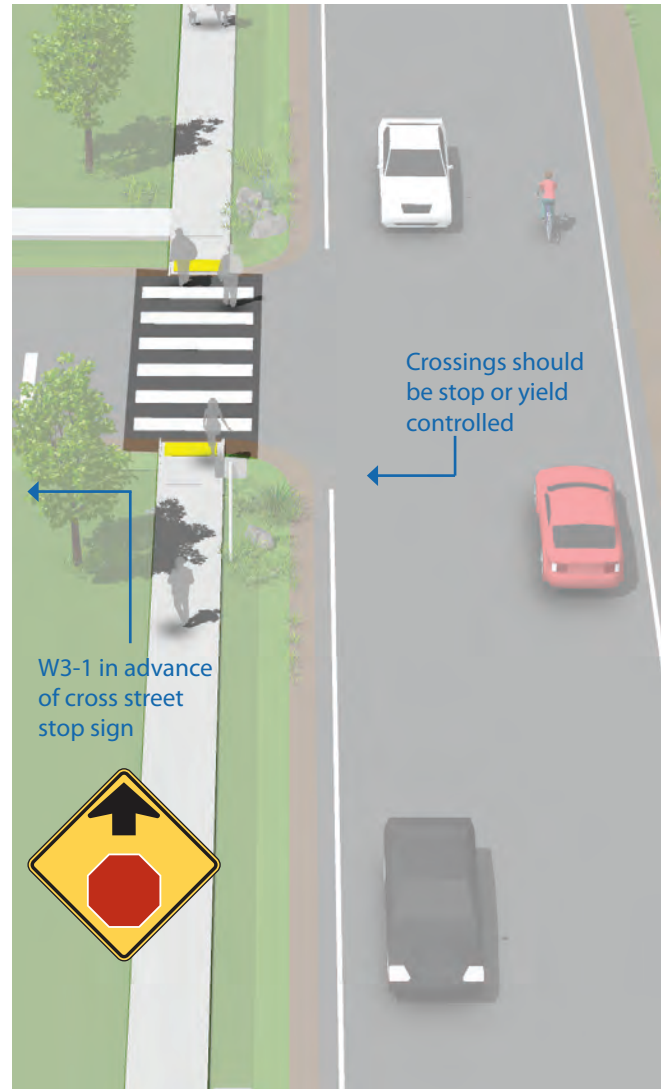
A sidepath provides a separated facility for pedestrians that does not require full curb and gutter. The facility should have a hard, level surface, placed between private property and the travel lanes. Sidepaths can be straight or can meander and can be constructed out of concrete, pervious concrete, asphalt, porous asphalt, or crushed stone.

Where sidewalks traditionally require installation of a curb and gutter to manage stormwater runoff, trails or sidepaths may lend themselves to using other stormwater management methods, such as low impact development. Using permeable paving and bioretention facilities, sidepaths can be installed on residential streets.

The AASHTO Guide for the Development of Bicycle Facilities generally recommends against the development of shared-use paths directly adjacent to roadways.

Guidance

- Sidepaths should be a minimum of 6 feet wide.
- Bicycle lanes should be provided as an alternate (more transportation-oriented) facility whenever possible.
- If a separate bicycle facility is not possible, 8 feet is the minimum allowed for a two-way sidepath and is only recommended for low traffic situations.
- 10 feet is recommended in most situations and will be adequate for moderate to heavy use.



Discussion

When used along roadways with heavier traffic volumes and speeds, the sidepath will be used by both bicyclists and pedestrians and should be designed to accommodate multiple users safely.

Additional References and Guidelines

AASHTO, A Policy on Geometric Design of Highways and Streets, 6th Edition

Access Board, Accessible Rights of Way: A Design Guide, <http://www.access-board.gov/prowac/>

Materials and Maintenance

Asphalt is the most common surface for narrow sidepaths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled joints improve the experience of

Shared Use Path

Local Neighborhood Accessways

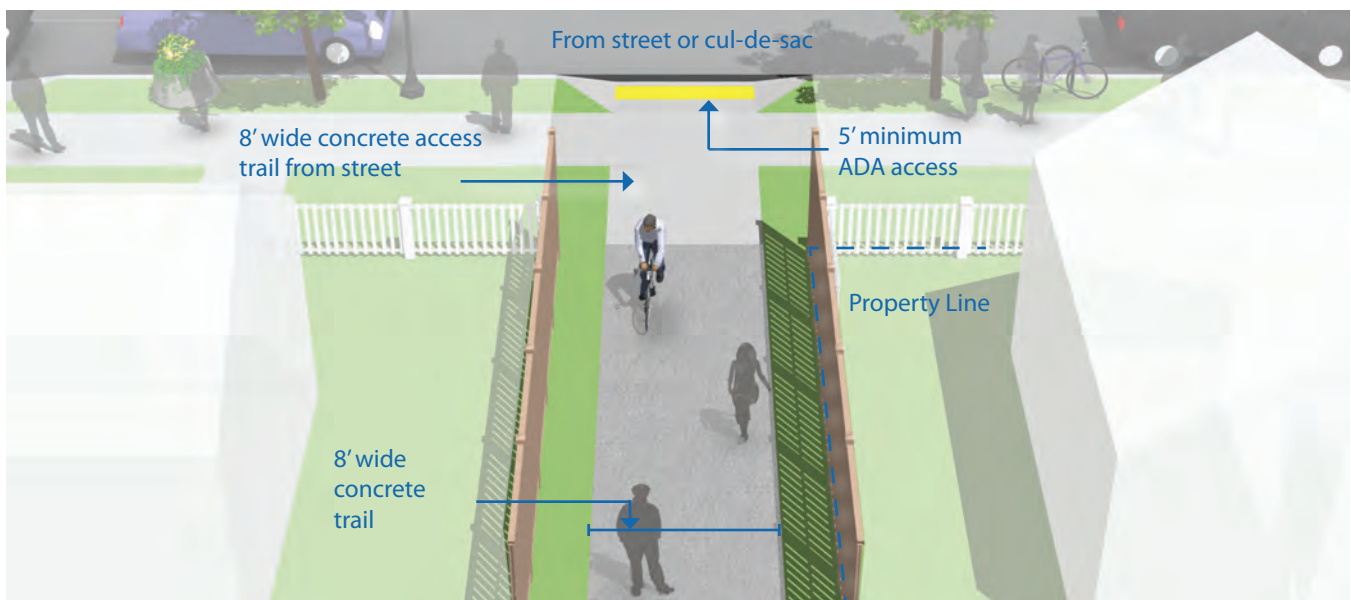
Guidance

- Neighborhood accessways should remain open to the public.
- Trail surfaces shall be at least 8 feet wide to accommodate emergency and maintenance vehicles, meet ADA requirements and be considered suitable for multi-use.
- Trail widths should be designed to be less than 8 feet wide only when necessary to protect large mature native trees over 18 inches in caliper, wetlands or other ecologically sensitive areas.

Description

Neighborhood accessways provide residential areas with direct pedestrian access to commercial services, parks, trails, greenspaces, and other recreational areas. They most often serve as small trail connections to and from the larger trail network, typically having their own rights-of-way and easements.

Additionally, these smaller trails can be used to provide bicycle and pedestrian connections between dead-end streets, cul-de-sacs, and access to nearby destinations not provided by the street network.



Discussion

Neighborhood accessways should be designed into new subdivisions at every opportunity and should be required by City and County subdivision regulations.

For existing subdivisions, Neighborhood and homeowner association groups are encouraged to identify locations where such connects would be desirable.

Additional References and Guidelines

AASHTO. (1999). Guide for the Development of Bicycle Facilities.
FHWA. (2009). Manual on Uniform Traffic Control Devices.
FHWA. (2006). Federal Highway Administration University Course on Bicycle and Pedestrian Transportation. Lesson 19: Greenways and Shared Use Paths.

Materials and Maintenance

The use of concrete for paths has proven to be more durable over the long term than asphalt.