AASHTO

Craig Thompson, *President*
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April 2024 ERRATA for *Guide for the Planning, Design, and Operation of Pedestrian Facilities*, 2nd Edition (GPF-2)

April 2024

Dear Customer:

AASHTO has issued an erratum, which includes technical revisions, for the *Guide for the Planning, Design, and Operation of Pedestrian Facilities*, 2nd Edition (GPF-2).

If you need to download this file again, it can be found on AASHTO's website at:

https://downloads.transportation.org/GPF-2-Errata.pdf

The changes in this erratum are detailed in the table. The figures with corrections do not have any special formatting. All pages with corrections have a gray box in the page header reading as follows:

April 2024 Errata

AASHTO staff sincerely apologizes for any inconvenience.

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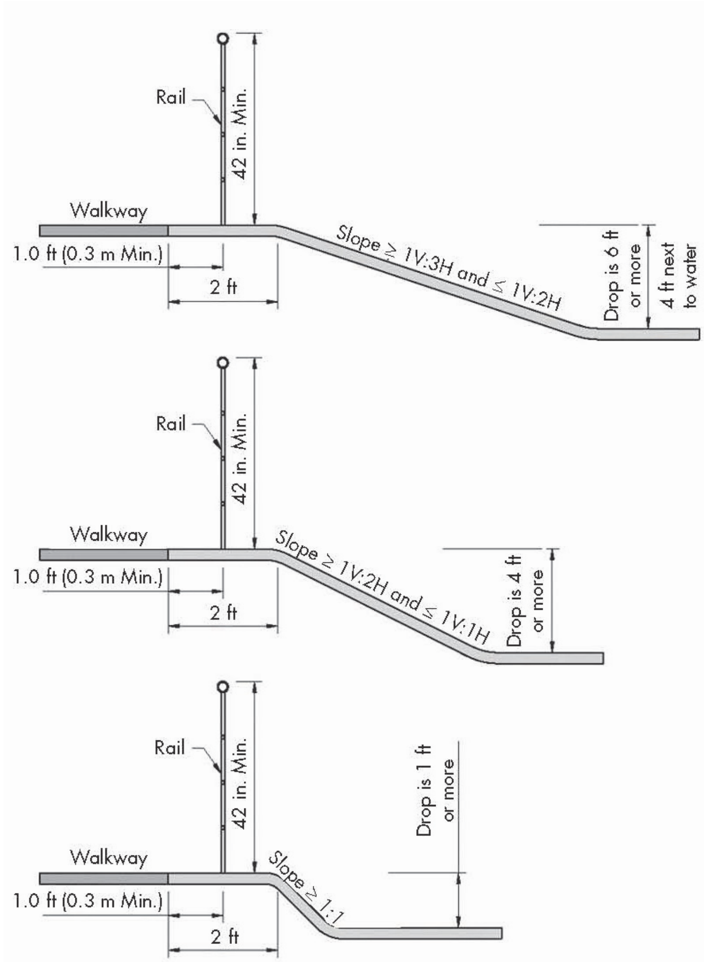
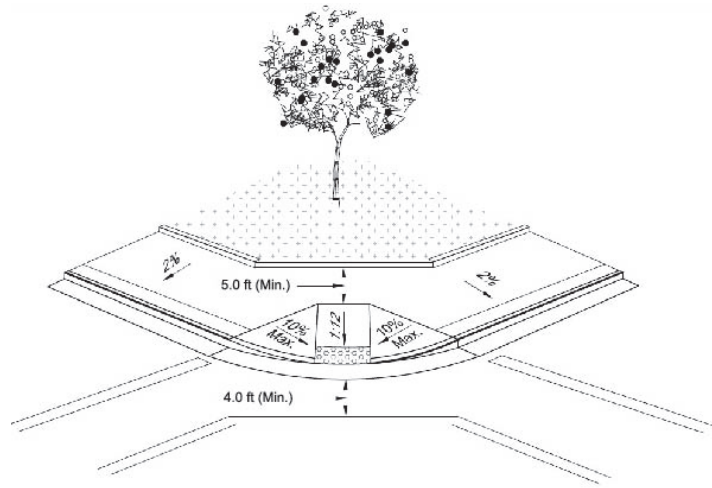
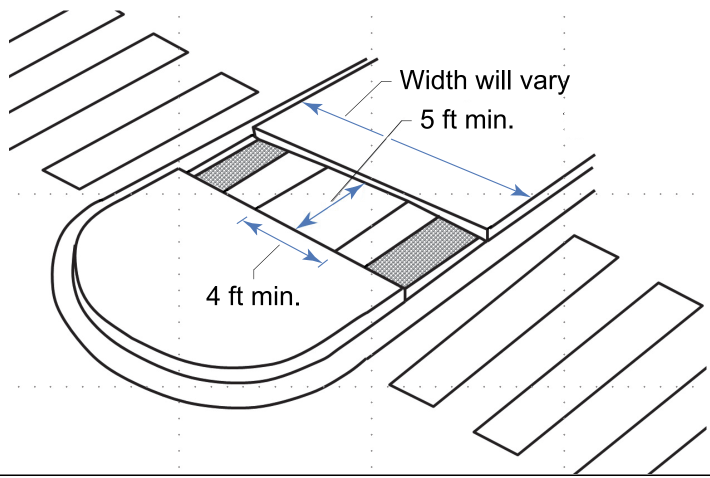
List of Errata for *Pedestrian Guide*, 2nd Edition (GPF-2)

Original Page	Section	Existing Text	Corrected Text
2-7	Figure 2-5	In Figure 2-5, there are two instances of “200” on the y axis, Speed (ft/min)	The lower value is on the y axis is “100.”
3-19	Figure 3-7	In Figure 3-7, “2 in.” is the wrong dimension.	The correct dimension is “2 ft” as shown below: 
3-47	Figure 3-27	One of the sidewalk dimensions is incorrect.	Of the two occurrences of “4.0 ft”, the top one should be “5.0 ft” as shown below:

List of Errata for *Pedestrian Guide*, 2nd Edition (GPF-2)

Original Page	Section	Existing Text	Corrected Text
			
3-62	Figure 3-36	Figure 3-36 is missing some dimensions and lines.	The correct figure is shown below: 
3-75	Figure 3-44	Figure 3-44's notes are missing.	Notes are included: A Advance warning signs and solid centerline striping should be placed at the required stopping sight distance from the roadway edge, but not less than 50 ft (15 m) B W11 series sign is required, supplemental plaques are optional.

2.4.1 Temporal Characteristics

2.4.1.1 Walking Speeds

Pedestrian walking speeds range from approximately 3.0 to 4.0 ft/s (0.9 to 1.2 m/s) (AASHTO, 2018a). The MUTCD recommends and PROWAG proposes using a normal walking speed of 3.5 ft/s (1.06 m/s) or less for calculating pedestrian clearance intervals for traffic signals (FHWA, 2009; U.S. Access Board, 2011). In areas where the population includes a large proportion of older pedestrians or pedestrians with physical disabilities, a slower walking speed, such as 3.0 ft/s (0.91 m/s), may be used for design. The HCM provides criteria for slower walking speed consideration (TRB, 2016). Other factors that affect walking speed include air temperature, precipitation (rain, snow, and ice), time of day, and trip purpose. Walking speeds are typically faster at midblock locations than at intersections.

2.4.1.2 Pedestrian Flow Rate

Pedestrian flow rate is a measure of how many pedestrians travel along a sidewalk per unit of time and is often measured in terms of pedestrians per minute per foot of sidewalk width. Where there are few pedestrians on a walkway, pedestrians can choose faster walking speeds. As sidewalk congestion increases, walking speeds decrease with closer interactions among pedestrians (TRB, 2016). As the volume of pedestrians increases, pedestrian flow rate can increase until the point when volumes become so high that pedestrian walking speed is slowed, at which point the flow rate begins to fall.

The relationship between walking speed and pedestrian congestion is shown in Figure 2-5. This graphic assumes linear flow. However, in urban environments, pedestrian traffic is often much more complicated than simply two flows moving in opposite directions. Cross-flows, for example, can occur at intersections, building entrances, or on-street parking locations. Stationary pedestrians can become obstructions to the sidewalk flow and should be accounted for when calculating effective sidewalk width. Pedestrian flow rates should be considered when determining the width of the pedestrian zone on a sidewalk.

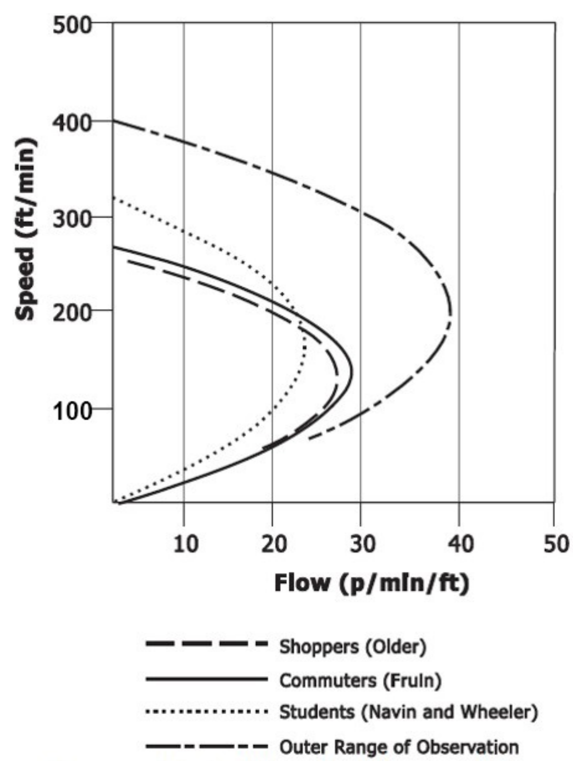


Figure 2-5. Relationships between Pedestrian Speed and Flow (TRB, 2016; adapted from Pushkarev and Zupan, 1977)

2.4.1.3 Pedestrian Start-up Time

When crossing the street, there is a delay between when the WALKING PERSON indication appears and when pedestrians step off the curb to begin crossing. The pedestrian start-up time allows pedestrians to perceive, and then react to the changing indication, and to scan the environment for encroaching vehicles. Pedestrian perception-reaction times can vary from 0.8 to 3 seconds (Fugger et al., 2000; Knoblauch et al., 1996). The HCM suggests 3 seconds as a reasonable value for pedestrian start-up time (TRB, 2016).

2.4.1.4 Pedestrian Stopping Distances

Pedestrian stopping distance is the distance traveled by a pedestrian while perceiving the need to stop, reacting to that need, and stopping. While many pedestrians can stop quickly when walking, others, such as persons using crutches or walkers, may have difficulty stopping quickly, particularly on a downgrade. Some wheelchair users may need up to 20 ft (6.09 m) to react and stop (Petritsch et al., 2004). Stopping distance increases on downhill slopes.

2.4.2 Spatial Characteristics

2.4.2.1 Spatial Needs of Pedestrians

In general, a simple ellipse of 1.5 by 2 ft (0.46 by 0.61 m) can be used to approximate minimum spatial needs for a single standing pedestrian (see Figure 2-6). In the design of pedestrian facilities, an area of 8 ft^2 (0.74 m^2) should be used to provide for personal comfort with regard to the proximity of other pedestrians and to facilitate orderly flow of traffic on the walkway (TRB, 2016), but the context of the facility should also be considered when deciding special requirements. For example, in larger urban areas, less space tends to be available or expected by pedestrians, so it may be possible to reduce the space provided.

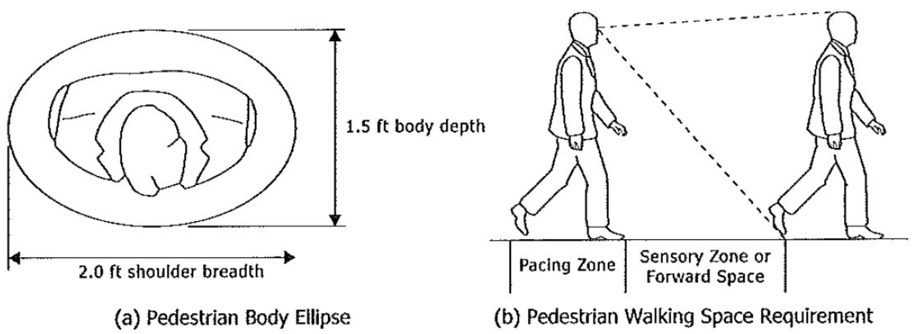


Figure 2-6. Pedestrian Body Ellipse for Standing Areas and Pedestrian Walking Space Needs [adapted from (TRB, 2016)]

The space available in front of a pedestrian affects pedestrian walking speed and flow rates. This space includes the pacing zone (space in which to make the next step) and the sensory zone (buffer space to the next pedestrian) (TRB, 2016).

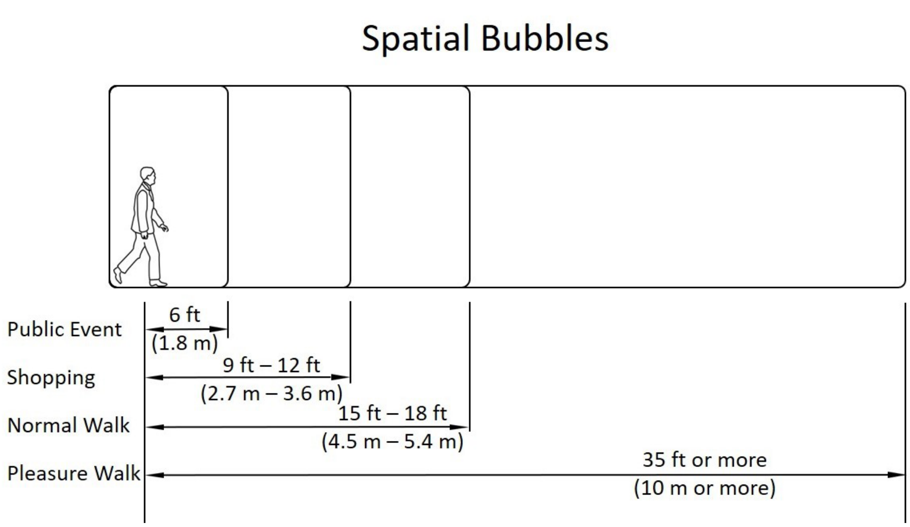


Figure 2-7. Preferred Distance of Unobstructed Forward Vision Based on Different Types of Walking (Washington State DOT, 1997)

Two people walking side-by-side, or passing one another, generally need 4.7 ft (1.4 m) of lateral space, while two persons in wheelchairs need a minimum of 5 ft (1.5 m) to pass one another. When pedestrian volumes increase within a given amount of space, walking rates become slower due to the decreased square footage available per person. A means of conveying this principle is the spatial bubble, which is the preferred distance of unobstructed forward vision while walking under various circumstances. Figure 2-7 illustrates the a railing or fence to separate pedestrians from the adjacent drop-off. Depending upon the height of the embankment, slope of the adjacent roadside, and the conditions at the bottom of the slope, barriers or rails are recommended if any of the following situations occur within 2 ft (0.6 m) of the sidewalk (see Figure 3-7):

- slopes between 1V:3H and 1V:2H, with a drop of 6 ft (1.8 m) or greater;
- slopes of between 1V:3H and 1V:2H, adjacent to a parallel body of water or other substantial obstacle;
- slopes of between 1V:2H and 1V:1H, with a drop of 4 ft (1.2 m) or greater; or
- slopes of 1V:1H or steeper, with a drop of 1 ft (30.5 cm) or greater.

Pedestrian railings should be consistent with AASHTO's *LRFD Bridge Design Specifications* (AASHTO, 2020).

3.3.8 Driveway Crossing Design

Operationally, each driveway crossing is a potential conflict point, where pedestrians should be aware of threats posed by entering or exiting vehicles. State and local laws based on the UVC require that motorists must yield to pedestrians when crossing the sidewalk (NCUTLO, 2000), but this often does not happen. As discussed in Section 2.9.3, access management can help reduce the number of driveways.

Geometrically, each driveway crossing must maintain its basic functionality as a pedestrian access route. Driveway entries often span the grade change from the street to the parcel, rising at least the height of the curb, or more for a site with considerable relief. Driveways that rise too steeply can damage vehicles with low clearance (and frequent scraping can damage the driveway and sidewalk surfaces). Abrupt grade changes result in a slower exit from the street, which also results in a longer gap in traffic being needed to execute the turn (see NCHRP Report 659, *Guide for the Geometric Design of Driveways* [Gattis et al., 2009], or local criteria for additional driveway grade and grade break information). Pedestrian access routes must meet accessibility criteria even where the route is crossed by a driveway. These requirements are discussed in detail in

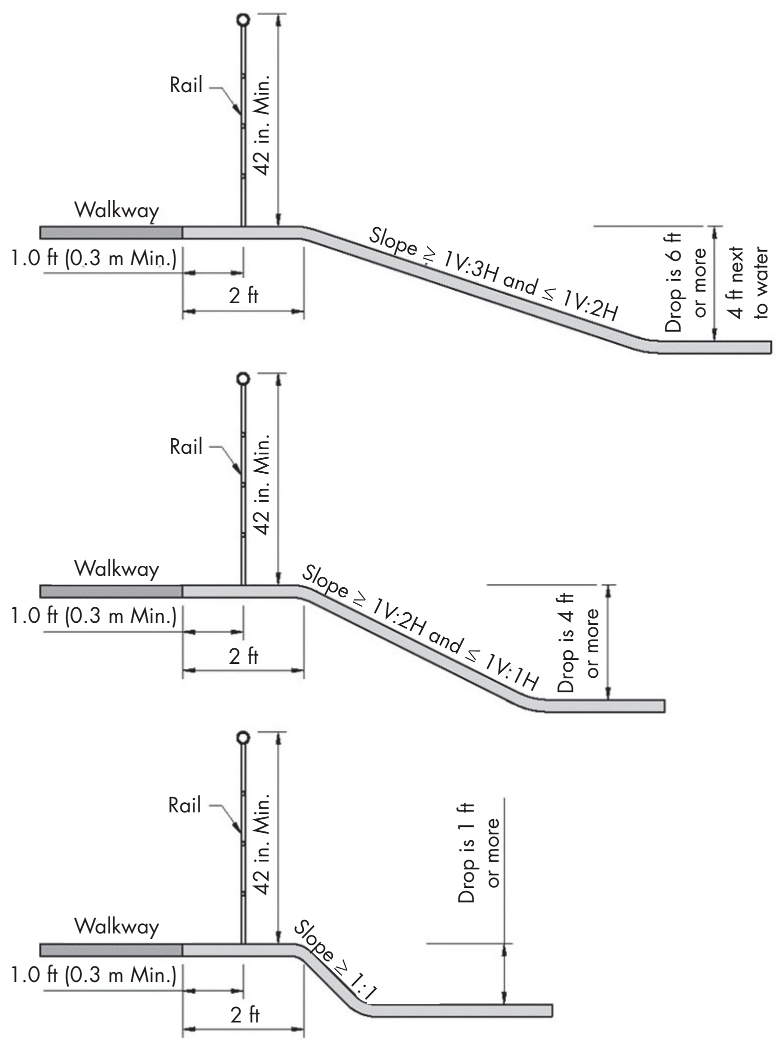


Figure 3-7. Pedestrian Rail between Walkway and Adjacent Slope (Florida DOT, 1999)

prior sections of this chapter, but the criteria most commonly applicable to driveway crossings include:

- a smooth planar surface with no surface discontinuities greater than 0.5 in. (1.3 cm),
- a continuous clear width of at least 4 ft (1.2 m), and
- a maximum cross slope of 2 percent.

Continuing the sidewalk design and material across the driveway is desirable to help to meet the expectations of pedestrians with vision disabilities, while also conveying to entering and exiting motorists that the area is also intended for pedestrians.

Driveways do not require detectable warnings where they intersect a sidewalk. PROWAG proposes the use of detectable warnings only where pedestrian access routes cross streets or railways, where pedestrian access routes traverse raised pedestrian refuge medians and corner islands, and at unprotected transit and rail boarding areas (U.S. Access Board, 2013). There are, however, limited driveway applications where their use may be appropriate, depending on the type of the driveway and its geometric design and traffic control. See the inset entitled "Detectable Warnings at Driveway Crossings" for further discussion.

3.3.8.1 Drop Curb Driveways

Most residential driveways and some low-volume commercial driveways have a simple drop curb or "dustpan" design. The curb is cut for the width of the driveway, and the driveway is constructed to span the rise to the elevation of the parcel. Various designs of this driveway type which can provide the required accessibility are discussed below, including benefits and challenges presented by each.

Sidewalks behind the Buffer Zone

The preferred design of a driveway crossing is to place the driveway's grade transition within a buffer or planting strip. Ample buffer space is necessary for designing driveways that do not compromise the pedestrian access route along the sidewalk (see Figure 3-8). Placement of sidewalks well away from the road, close to the right-of-way limit, helps to minimize the grades necessary for driveways and also to contain transitions to the buffer area so the sidewalk crossing can be kept at a 2 percent cross slope or flatter.

It can be challenging to meet the pedestrian accessibility requirements within a constrained right-of-way, and wide buffers may not be feasible to introduce to existing facilities. For these reasons, driveway transition and pedestrian access route needs should be addressed when determining the amount of right-of-way necessary for a given roadway. If vehicles are

Detectable Warnings at Driveway Crossings

Detectable warning surfaces are meant to communicate to pedestrians with vision disabilities that they are about to enter—or exit—a vehicular way. However, the application of detectable warnings to alert pedestrians with vision disabilities of driveway crossings is not clearly defined in the proposed PROWAG.

The proposed PROWAG does not require detectable warnings where pedestrian access routes cross driveways. Per PROWAG R208.1, detectable warning surfaces will only be required where:

- pedestrian access routes cross streets or at-grade railways,
- pedestrian access routes traverse pedestrian refuge islands,
- at unprotected rail and transit stops (either platforms or streetside).

PROWAG Advisory R208.1 states that detectable warning surfaces "should not be provided at crossings of residential driveways," but should be used "where commercial driveways are provided with yield or stop control" (U.S. Access Board, 2013). This latter guidance is appropriate where the geometric design or traffic control at a driveway makes the crossing comparable to a street. Conditions under which a driveway may function or be perceived as a street crossing generally exist where pedestrians are required to yield the right of way to vehicles, or where there is an increased probability of conflict with vehicular traffic such that pedestrians may need to proceed with caution before crossing. These conditions merit alerting visually impaired pedestrians through the application of detectable warnings.

Detectable warnings should not be indiscriminately applied at minor driveway locations. It may be confusing and a nuisance to pedestrians with vision disabilities when detectable warnings are provided at driveway crossings that appear and function more like a sidewalk than a street crossing.

curb ramps is parallel to vehicular traffic on the adjacent street and the pedestrian's path of travel on the sidewalk. Detectable warning surfaces are needed on the landing at the curb line between the two curb ramps (see Figure 3-28). A landing at the top of a parallel curb ramp is required only if turning is needed.

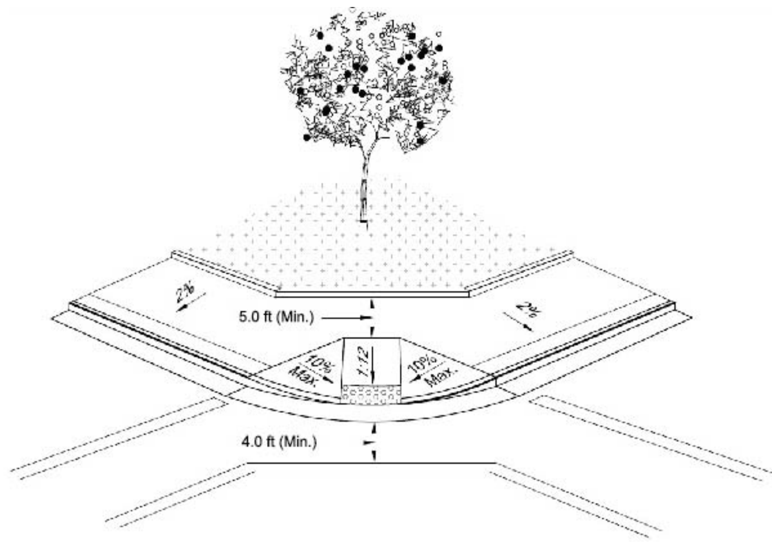


Figure 3-27. Single Perpendicular Curb Ramp (or Diagonal Ramp) Serving Two Crosswalks (Not a Preferred Design)

Parallel curb ramps result in pedestrians continuing along the sidewalk traveling down one curb ramp and up the other. For this reason, where practical, it is preferred that two perpendicular curb ramps be installed rather than parallel curb ramps.

Blended Transitions—With a blended transition, the sidewalk elevation is lowered to the street level with a gradual change in slope. The maximum grade in the direction of pedestrian travel is 5 percent, and

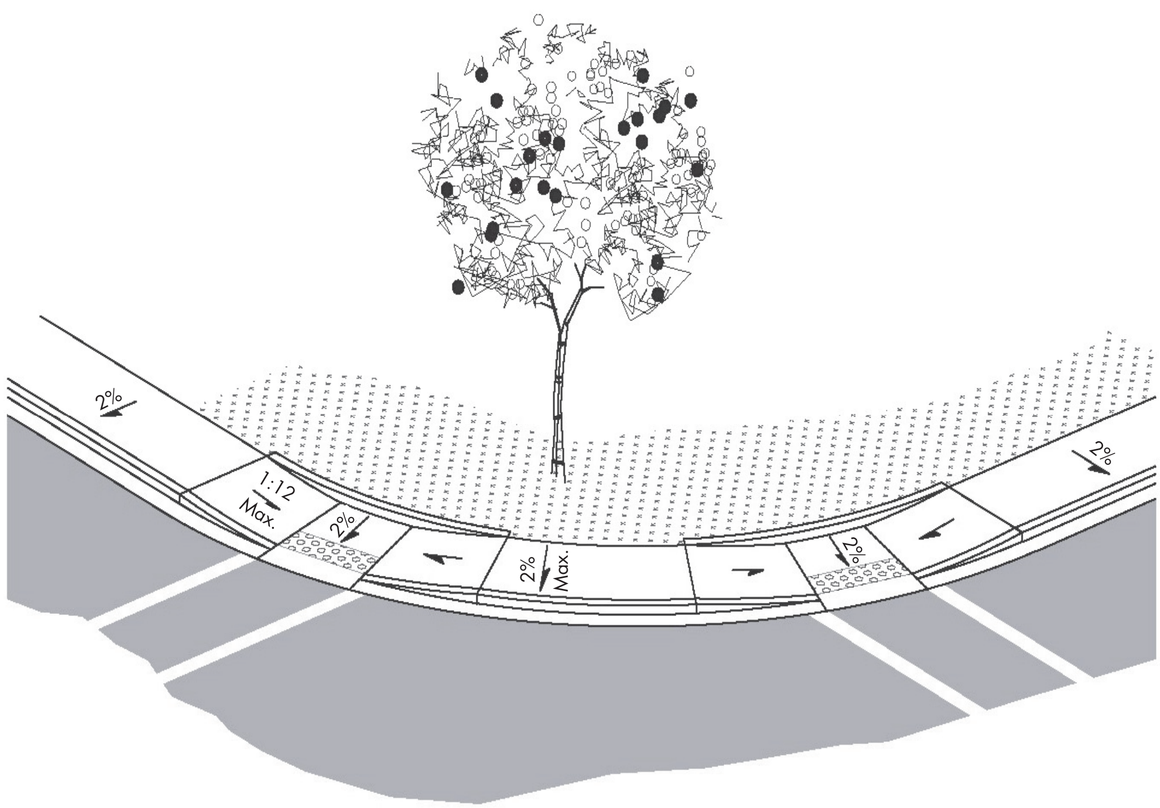


Figure 3-28. Parallel Curb Ramps

the maximum cross slope is 2 percent (except at pedestrian street crossings without yield or stop control where the cross slope is permitted to equal the street or highway grade). The maximum cross slope of the pedestrian access route around the blended transition is 2 percent. Blended transitions without accessible pedestrian signals (APSs) should be used sparingly since they provide limited directionality for pedestrians with vision disabilities.

Combinations—Curb ramps can also be designed using a combination of curb ramp types to take advantage of the characteristics of the different types of curb ramps. For example, a combined parallel and perpendicular curb ramp (see Figure 3-29) can use the concept of a parallel curb ramp to lower the elevation level of the landing and then use a perpendicular curb ramp to complete the remaining elevation gap between the landing and the street. This type of combined parallel and perpendicular curb ramp may be helpful where the sidewalk is narrow, has a steep grade, or has a high curb (FHWA, 2001). Where sedimentation is a problem for parallel ramps, combination ramps should be considered as an alternative.

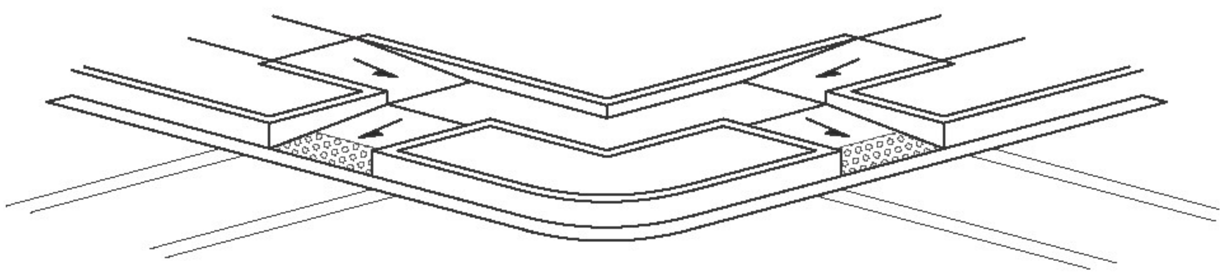


Figure 3-29. Combined Parallel and Perpendicular Curb Ramp [adapted from (FHWA, 2001)]

Curb Ramp Placement

Intersections may have unique characteristics that can make the proper placement of curb ramps difficult, particularly in retrofit situations. However, there are some fundamental guidelines that may be followed:

- Perpendicular curb ramps should be built at an angle perpendicular to the curb face; where the curb ramp meets the roadway, the full width of the curb ramp (exclusive of flares) must be within the crosswalk. Aligning the curb ramp with the crosswalk provides an additional cue for in-line travel across a street by pedestrians with vision disabilities. At large curb return radii, it may not be possible to provide a curb ramp that is both aligned with the crosswalk and exactly perpendicular to the curb face. Generally, alignment of the curb ramp with the crosswalk is preferable to providing a ramp that is exactly perpendicular to the curb face.
- One curb ramp should be placed for each direction of pedestrian travel. Where space is limited, a blended transition may be used to serve both directions of pedestrian travel.
- Curb ramps should not be located coincident with storm drain inlets, which can catch wheelchair casters or cane tips.
- Curb ramps should be designed for adequate drainage. The presence of a puddle of water at the base of a curb ramp can hide pavement discontinuities and can lead to icy conditions during cold weather.

If the median is at least 6 ft (1.8 m) wide so that it functions as a refuge, then detectable warning surfaces must be installed at the threshold of each roadway surface. The detectable warning surfaces will occupy the same 2 ft (0.6 m) needed for clearance (described above), leaving the center 2 ft (0.6 m) open for storage. The minimum width of a pedestrian refuge island should be 6 ft (1.8 m).

The proposed PROWAG indicates that if a cut-through island is less than 6 ft (1.8 m) wide (measured in the direction of pedestrian travel), detectable warnings should not be installed. An island less than 6 ft (1.8 m) wide is not considered a pedestrian refuge. Pedestrian signals on such crossings should be timed to allow for full crossing of the roadway in one cycle (U.S. Access Board, 2013).

It may be helpful to use 11-ft (3.3-m) lanes, or even 10-ft (3.1-m) lanes, to provide space for the median refuge. Traffic volume, vehicle mix, speed, and the presence of bicyclists should be taken into account prior to reducing lane widths. Where it is not practical to extend the width of the refuge, the cut-through width (measured perpendicular to the direction of pedestrian travel) may be increased to provide more storage space for pedestrians and bicycles within the median. It is recommended that the cut-through for a median refuge be the full width of the crosswalk. The minimum width of a cut-through for a median refuge is 5.0 ft (1.5 m) (U.S. Access Board, 2013). Crossings through a median can be angled so pedestrians can see and be more aware of traffic on the roadway they are about to cross (see Figure 3-35).

Figure 3-35. Angled Crossing Through a Median Island to Encourage Pedestrian Awareness of Traffic on the Roadway about to be Crossed

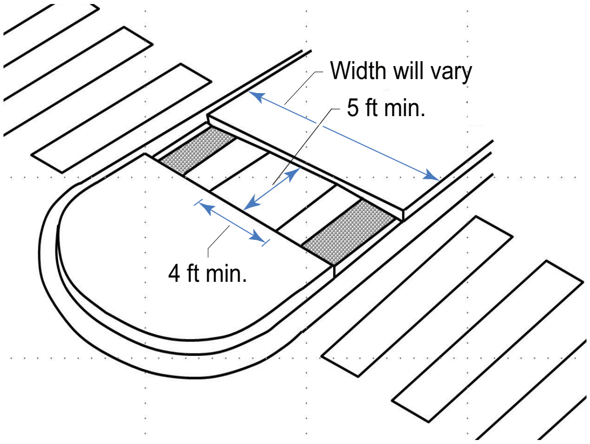
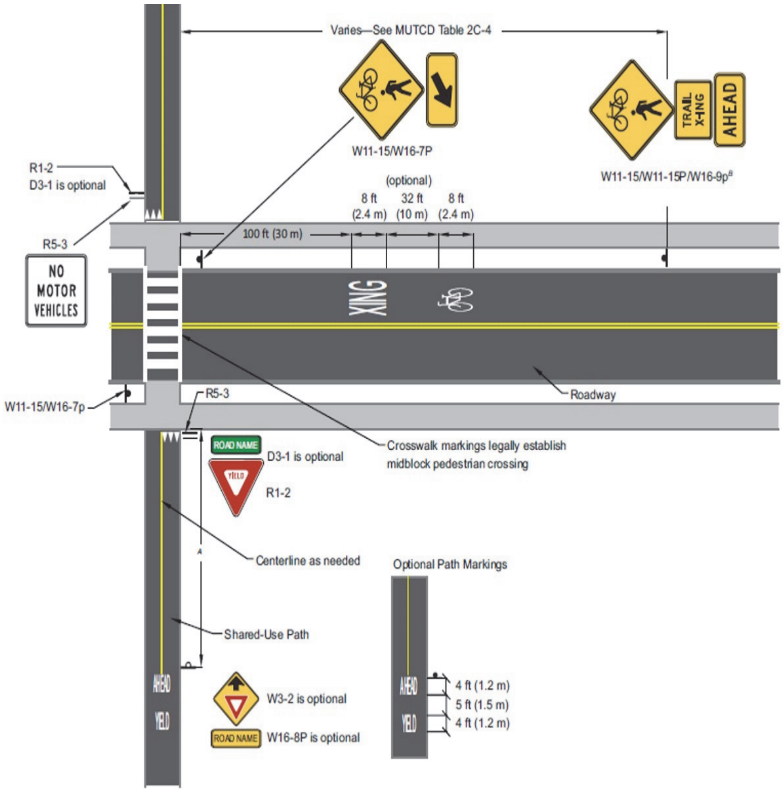


Figure 3-36. Landing between Curb Ramps for a Raised Pedestrian Refuge Area within a Median Island

Access to the median refuge should be functional and safe for all pedestrians. ADA-compliant curb ramps and landings are required if the crossing island functions as a refuge and has a pedestrian refuge area that is raised above the grade of the roadway surface. The accessible pedestrian route through a raised refuge island must have a minimum width of 5 ft (1.5 m), but should preferably be as wide as the crosswalk. A minimum 5-ft by 4-ft (1.5-m by 1.2-m) landing is required between curb ramps where the median refuge is raised (see Figure 3-36). Where it is difficult to provide a 5-ft by 4-ft (1.5-m by 1.2-m) landing because of space restrictions, consideration can be given to only raising the landing 3 in. (7.6 cm), which allows for shorter curb ramp lengths and a longer landing.

Median islands provide space for installation of supplemental traffic control devices. For example, although it is not desirable to design signal timings that do not allow pedestrians to complete their crossing in one cycle, if pedestrians are permitted to cross a portion of a street during a particular interval but are not permitted to cross the remainder of the street during any part of the same interval, then pedestrian signal heads must be installed within the median island along with pedestrian detectors if actuated operation is used. At the same time, designers should recognize that having two pedestrian signal heads—one in the median and one on the far side of the street—may create difficulties for pedestrians. Pedestrians may see conflicting signals and focus on the wrong signal when stepping into the street. Another example of a supplemental traffic control device that could be installed on median islands is the Rectangular Rapid Flashing Beacon (RRFB), which is designed to increase driver awareness of potential pedestrian conflicts (see Figure 3-37).

Figure 3-37. Rectangular Rapid Flashing Beacon Installation



Notes:

A Advance warning signs and solid centerline striping should be placed at the required stopping sight distance from the roadway edge, but not less than 50 ft (15 m).

B W11 series sign is required, supplemental plaques are optional.

Figure 3-44. Example of Midblock Crossing of Shared-Use Path (Where Path Is Controlled with a Yield Sign) (FHWA, 2009)

not establish a legal crosswalk. The MUTCD requires white crosswalk markings, as well (FHWA, 2009). Figures 3-43 and 3-44 provide examples of the additional signs and markings that may be used to promote awareness of the crossing and provide guidance as to yielding obligations.

At midblock crossings, PROWAG proposes that the cross slope of the crosswalk is permitted to equal the street or highway grade (U.S. Access Board, 2013). To the extent feasible, a cross slope of 2 percent or less is preferred for crosswalks at midblock crossings.

A significant proportion of vehicle–pedestrian crashes occur at nighttime at non-intersection locations. Lighting should be considered to improve driver awareness of pedestrians waiting to cross or already in the crosswalk. For roadways that have traffic traveling in both directions, particularly those without a center median, two luminaires should be used, located on either side of the road and placed prior to the crosswalk from the drivers' perspective (Figure 3-45) (FHWA, 2008b).

Supplemental crossing devices or features, in addition to marked crosswalks, should be considered based on characteristics of the roadway, driver population, pedestrian population, and vehicle and pedestrian traffic patterns. One or more enhanced crossing treatments are recommended for midblock crossings that cross multilane roadways with high traffic volumes (ADT greater than 12,000 vpd), where pedestrian crossing times are long and gaps in traffic are few. These treatments may also be appropriate on high-speed roadways, in areas where sight distance is limited, where pedestrian volumes are high (at least during certain time periods), and where the crash history indicates a number of vehicle–pedestrian crashes. The MUTCD

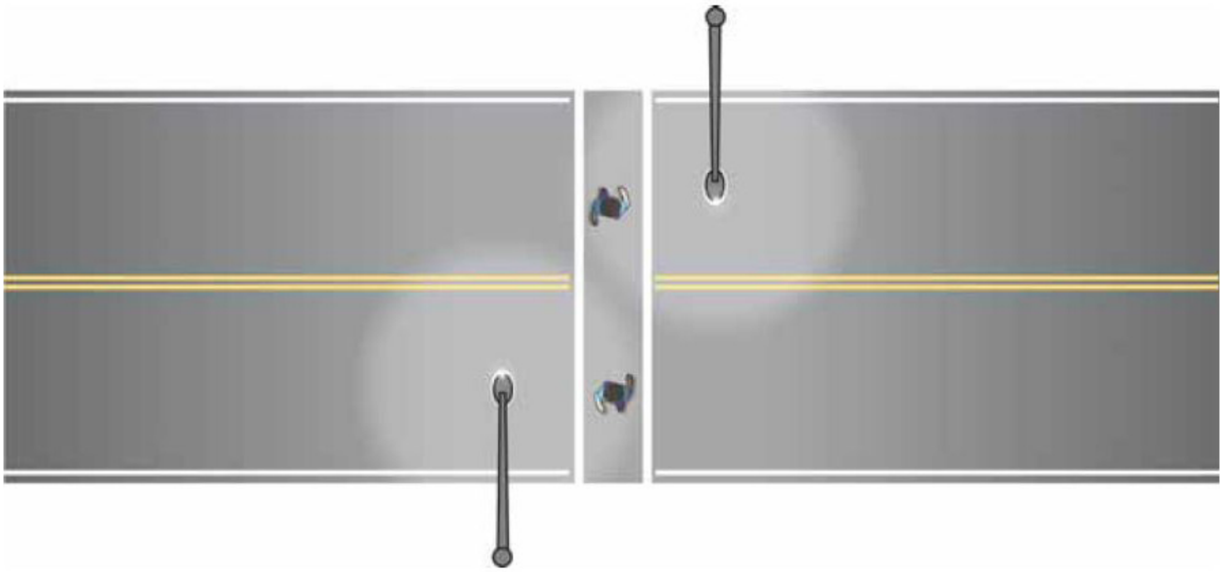


Figure 3-45. Recommended Luminaire Placement at Crosswalk (FHWA, 2008b)

(FHWA, 2009) and the *ITE Traffic Control Devices Handbook* (ITE, 2009) provide guidance on many of these treatments, including the following:

- in-street pedestrian crossing signs,
- overhead pedestrian crossing signs,
- raised crossings,
- flashers or beacons to supplement warning signs,
- illuminated pedestrian signals, and
- grade separation.

Each of these treatments is discussed below.

In-Street Pedestrian Crossing Signs (R1-6)—If used, these regulatory signs must be placed in the street on a lane line, on the centerline, or on a raised median island at the crosswalk to remind drivers of their legal obligation to pedestrians at unsignalized pedestrian crossings (see Figure 3-46). These signs are easily implemented and may be removed for snow removal and other maintenance purposes. Evidence suggests that in-street pedestrian crossing signs increase driver yielding compliance at unsignalized pedestrian crossings

Figure 3-46. Example of In-Street Pedestrian Crossing Sign