



TOOLBOX SECTION

3

Accessibility





Just as we design roadways for use by a wide range of vehicles, so should we design sidewalks, transit stops, crossings, signals and other types of facilities for use by a wide range of pedestrians. (www.pedbikeimages.org/DanBurden)

ACCESSIBILITY

Everyone has an inherent right to accessibility. The overall intent of this toolbox section is to encourage design that accommodates all pedestrians, including people with disabilities and older adults. People with physical impairments and older adults have a wide range of abilities and needs, and they often rely on pedestrian travel and transit as their primary modes of transportation. Just as we design roadways for use by a wide range of vehicles, so should we design sidewalks, transit stops, crossings, signals, and other types of facilities for use by a wide range of pedestrians.



Everyone has an inherent right to accessibility (CompleteStreets.org)

Since accessibility guidelines for public rights-of-way (presented in the *Public Rights-of-Way Accessibility Guidelines*, also called PROWAG) vary from site development guidelines (presented in the *ADA Accessibility Guidelines*, also called ADAAG), each set of guidelines will be discussed in separate subsections, beginning on page 3-7.

Considering Accessibility in the Scope of Each Project

As designers begin each project, they should consider its scope and relationship to the jurisdiction's transition plan, if one has been prepared. Transition plans are typically done at the local level. In Hawaii, the State Department of Transportation and all of the counties have transition plans, which were developed to fulfill the requirements of the Americans with Disabilities Act (ADA).

As projects move forward, the need for accessibility improvements should be evaluated on a case-by-case basis. It is generally more cost effective to correct a known barrier by including it in a planned alteration project, rather than waiting to fix the problem at a

IN THIS SECTION

- **CONSIDERING ACCESSIBILITY IN THE SCOPE OF EACH PROJECT**
- **UNDERSTANDING THE AMERICANS WITH DISABILITIES ACT (ADA)**
- **DESIGNING FOR PEOPLE WITH DISABILITIES**
- **SPATIAL NEEDS FOR PEOPLE WITH DISABILITIES**
- **DESIGNING FOR OLDER ADULTS**
- **PROGRAM REQUIREMENTS**
- **DESIGNING FOR ACCESSIBILITY IN PUBLIC RIGHTS-OF-WAY**
- **SITE PEDESTRIAN FACILITIES**
- **OTHER RESOURCES**

Select a solution that best balances the needs of all individuals. (www.pedbikeimages.org/DanBurden)



later date. The limitation of project scope or boundary to avoid a program access improvement could give rise to a complaint.

The scope of accessibility improvements should be related to and commensurate with the scope of the overall project, particularly with regard to roadway improvements. Each element that is altered as part of the project must be designed and constructed to be accessible to and usable by people with disabilities to the maximum extent feasible. Failure to provide accessible alteration project improvements may require a public entity, including responsible individuals, to defend their decision-making in court.

Planning, design, and development for accessibility should:

- Incorporate assistance from people with disabilities in the community. Consider their opinions and recommendations. Get input, advice, and support from local advisory committees, such as the Hawaii Disability and Communication Access Board (DCAB). In Hawaii, this is required per HRS 103-50.

- Recognize that the first solution to a problem may not always be the best. Look hard and wide for creative solutions.
- Be diligent in record-keeping. Document the analysis work, findings, and decisions. Save them in the permanent project record file.
- Select a solution that best balances the needs of all individuals: people who use wheelchairs, people who have vision impairments, and all pedestrians, young and old. Avoid solutions where roadway improvements are fully realized at the expense of pedestrian accessibility.
- Develop, adopt, and use a standard method of design review and approval.
- Provide defensible decisions, particularly in adversarial situations.

The recommendations above provide no guarantee that a project design will not be challenged. There will always be a second opinion or a different design solution. However, if the scope of the project is clearly defined, research is adequate, and the method of selecting the preferred alternative is clearly documented,

the solution can be adequately defended. It is the designer's responsibility to provide the expertise needed to evaluate alternatives before confirming an engineering solution. Note that cost cannot be the basis for eliminating workable alternatives in a planned alteration.

Understanding the Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal law enacted in 1990 for the purpose of ensuring that all Americans have the same basic rights of access to services and facilities. The ADA prohibits discrimination on the basis of disability. To affect this prohibition, the statute requires certain designated federal agencies to develop implementing regulations. Section 504 of The Rehabilitation Act of 1973, a precursor to the ADA, created and extended civil rights to people with disabilities. The ADA, enacted later, called for specific guidance pertaining to design of accessible facilities.

The ADA Accessibility Guidelines (ADAAG) prepared by the Architectural and Transportation Barriers Compliance Board

(also called the US Access Board) contain a wide range of administrative and procedural requirements, including compliance with design and construction guidelines.

The guidelines contained within the ADAAG are continually updated and current versions should be reviewed as part of the design process for every project. The ADAAG applies to new construction and alterations, but other legal requirements of the ADA cover improvements of existing facilities, including removal of barriers in places of public accommodation.

In recent years, much information has been developed to respond to the perceptions planners and designers have about what the ADAAG requires. Some of this information can be confusing and conflicting. ADAAG requirements are discussed at the end of this section.

In 1999, the US Access Board formed the Public Rights-of-Way Access Advisory Committee (PROWAAC) to develop guidelines for accessibility in public rights-of-way. Prior to the *Public Rights-of-Way Accessibility Guidelines* (PROWAG), applicable portions of

ACCESSIBILITY AND USABILITY ARE KEY CONSIDERATIONS

...for pedestrian facilities, which should accommodate pedestrians of all abilities.

- American Association of State Highway and Transportation Officials (AASHTO)

ADAAG were used to guide accessibility design within the public right-of-way, but ADAAG didn't discuss a number of significant issues related to pedestrian facility design within public rights-of-way. The PROWAAC published a report in January 2001 called *Building a True Community* that set forth the committee's recommendations. Hearings were held and the PROWAAC recommendations have been modified over time. The US Access Board released the proposed guidelines for public comment in summer 2012, and comments were gathered from the public through February 2, 2012. The guidelines are currently under review.



Older adults often rely on walking and transit services to complete their daily errands. (Dan Burden)

People who use walking aids need carefully designed facilities that eliminate barriers. (Dan Burden)



by the Office of Budget and Management. The US Access Board anticipates publishing the proposed rule (with revisions to the draft rule based on public comments) in the near future.

Standards for Accessible Design. The Hawaii DCAB reviews and provides recommendations on project plans prior to construction. More information on the DCAB can be found at: <http://hawaii.gov/health/dcab/home/index.htm> (May 2013).

Designing for People with Disabilities

Disabilities include a wide range of conditions (hearing and visual impairments, mobility limitations, etc.). Approximately 70 percent of all Americans will have a disability at some point in their lifetime, either temporarily or permanently (*Accessibility Design for All, An Illustrated Handbook*). Disabilities can affect people differently and limit abilities to greater or lesser degrees. For this reason, some design approaches that accommodate one person may be a barrier to others.

Working closely with people who have disabilities throughout a project's design process can be an effective way to ensure that their needs are recognized and accommodated. The best guidance design professionals have for accommodating the needs of people with disabilities are the regulations and standards issued under the ADA

Spatial Needs for People with Disabilities

People with disabilities, including those using special walking aids or wheelchairs, need carefully designed facilities that eliminate barriers. The needs of pedestrians with disabilities can vary widely depending on the type of disability and level of functional limitation. Elements that are helpful to people with disabilities are listed in Exhibit 3.1.

Space requirements for pedestrians with disabilities vary considerably depending on their physical abilities and the assistive devices they use. Spaces designed to accommodate individuals who use wheelchairs are generally considered to be functional and advantageous for most people, including able-bodied pedestrians. Refer to the introductory section "General Characteristics and Needs of Pedestrians," which illustrates the

EXHIBIT 3.1 Aids to Pedestrians with Disabilities

- Curb cuts and ramps
- Tactile warnings
- Easy-to-reach activation buttons
- Audible warnings and message systems
- Raised and Braille letters for communications
- Signal timing at lower than average walking speed
- Maximum grade of 1:20 and cross slope of 1:50 (ramps can be 1:12)
- Roadway crossing refuges
- Reduced roadway crossing distances (bulb-outs and curb extensions)
- Traffic calming
- Handrails
- Smooth surfaces and unobstructed travel ways

spatial dimensions of a wheelchair user, a person on crutches, a person with visual impairment, and other pedestrians.

Designing for Older Adults

Older adult populations (over 65 years of age) are an important consideration because of their increasingly limited ability to drive. As populations age, transit accessibility and safe walking routes become more important. According to the Statewide Pedestrian Master Plan, the average elderly population in Hawaii is 13.3 percent, and the following areas have elderly populations that are higher than the statewide average:

- **Oahu**—City of Honolulu and areas north and east (19 to 58 percent)
- **Kauai**—Central south area of Waimea (5 to 28 percent)
- **Maui**—Central valley (19 to 58 percent)
- **Hawaii**—Some pockets of elderly populations near Kailua-Kona and north of Hilo

Exhibit 3.2 lists some examples of elements that aid elderly adults in their travel as pedestrians.

EXHIBIT 3.2 Aids to Older Pedestrians

- Reduced roadway crossing distances (bulb-outs and curb extensions)
- Signal timing at lower than average walking speed
- Signals within 59 ft (18 m) of viewing distance; easy-to-read signs
- Refuge areas in roadway crossings
- Traffic calming
- Handrails
- Smooth surface and unobstructed travel ways
- Shelter and shade

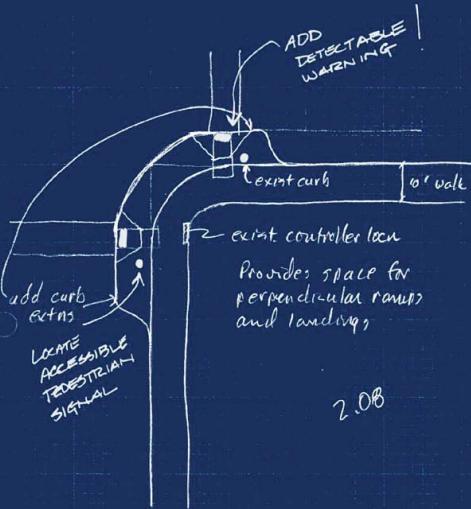


EXHIBIT 3.3 Special Report Accessible Public Rights-of-Way
(Accessible Public Rights-of-Way Advisory Committee)

Public Rights-of-Way Access Advisory Committee

Special Report:

ACCESSIBLE PUBLIC RIGHTS-OF-WAY
PLANNING and DESIGNING for ALTERATIONS



July
2007

Older adults are often avid pedestrians. If retired, senior citizens may have more time to enjoy walking for exercise and recreation. Older adults often walk and use transit to do their daily errands. They sometimes use wheelchairs or motorized carts to travel along pedestrian routes. When walking, they may travel at slower rates and have less mobility, or they may have disabilities such as visual impairment and may be hard of hearing. Many of the same design recommendations for people with disabilities can be applied to accommodate older adults with these special needs.

Program Requirements

Much of the following discussion on Program Requirements and Project Scope is taken from *Special Report Accessible Public Rights-of-Way Planning and Designing for Alterations*.

In assessing their responsibilities for existing facilities, many jurisdictions have relied heavily on two helpful tools—the self-evaluation and the transition plan. (A transition plan was developed by HDOT in 1999.) These tools were initially required under both Section 504 of

the Rehabilitation Act of 1973 and ADA Title II regulations. Many jurisdictions have continued to use these tools to plan for addressing accessibility issues, assessing progress, and managing changing circumstances. In addition, the Section 504 regulations require that jurisdictions establish a system for periodically reviewing and updating the self-evaluation that forms the basis for the Federal-aid transition plan.

A transition plan can provide decision-makers with an efficient tool for complying with Section 504 and ADA requirements and holds information that often is not available in other planning documents. An updated transition plan will identify and locate elements and features that need to be added or altered, processes for determining accessibility priorities, and information that can be used in assessing the ‘undue burden’ cost limitation. However, this only applies to existing facilities. Cost is not a determinant of infeasibility in new construction and alterations.

While many methods may be used to achieve program access in existing facilities, ensuring usability in an already-developed pedestrian circulation system (a program) is likely to require

remedial construction. In some cases, a new construction or alterations project will give rise to a program access obligation. For example, when a bus stop sign is placed in a hitherto-undeveloped environment. The presence of an existing bus stop that is not yet served by the pedestrian facilities needed to make it accessible—a pad for the deployment of a bus lift, a sidewalk for access to the stop—is a clear indicator of program access improvements that may need to be constructed for full use of the transportation system.

An alteration project may differ from a new construction project because existing development may limit available space, access points and elevations. Where existing constraints in an alteration project prevent the full implementation of accessibility objectives, the ADA and Section 504 regulations provide a degree of flexibility to designers and agencies.

Alterations under the ADA are required to meet new construction criteria to the maximum extent feasible, and extensive reconstruction work can and should approach the accessibility required of new construction. For example, a project that calls for the removal of pavement and sidewalks

to subgrade, followed by the installation of new sidewalks and pavement, is an alteration whose broad scope offers significant opportunity to incorporate the full range of accessible features. On the other hand, the installation of a single curb ramp at an existing intersection is an alteration with limited scope for correcting adjacent inaccessible conditions.

Designing for Accessibility in Public Rights-of-Way

As discussed above, PROWAG are the guidelines that should be used for pedestrian facilities within the public right-of-way. A number of technical elements are similar within both PROWAG and ADAAG, but the discussion below focuses on guiding design of pedestrian facilities within the public right-of-way. Guidance for the design of pedestrian facilities within sites beyond the public right-of-way is discussed at the end of this section under the "Site Pedestrian Facilities" heading.

Pedestrian Access Routes (PAR)

PROWAG refers to accessible paths as *Pedestrian Access Routes (PAR)* and ADAAG refers to them as *Accessible Routes (AR)*. The "pedestrian

access route" is the key element of accessibility. This term should not be confused with an "accessible route". AR is discussed under the "Site Pedestrian Facilities" heading at the end of this section. A PAR is the public right-of-way counterpart to the AR currently required in ADAAG. A PAR is a continuous, unobstructed path connecting all accessible elements of a pedestrian system. Where a pedestrian circulation path is provided in the street, along a highway, or within a shoulder, it shall contain a PAR.

The pedestrian access route can include walkways, sidewalks, street crossings, and crosswalks, and overpasses and underpasses, courtyards, elevators, platform lifts, stairs, ramps and landings. Where sidewalks are not provided, pedestrian circulation path may be provided in the street, highway, or shoulder unless pedestrian use is prohibited. (PROWAG Advisory R204)

Longitudinal Grades

Because of the constraints imposed by right-of-way width, the PAR is relieved of the slope limits that would apply to an accessible pedestrian route on a site provided it matches the general grade of the adjacent roadway. Where the

PAR is supported by a structure, such as an underpass, overpass, or bridge, it shall comply with ADAAG requirements.

Even though PARs are not required to have an accessible longitudinal gradient, the best practice is to design PARs at an accessible grade to the maximum extent feasible. Per ADAAG, an accessible grade is defined as a maximum of 1:20 or 5 percent. If the grade exceeds 5 percent, a ramp must be constructed. Longitudinal ramps along accessible routes of travel shall not exceed a maximum grade of 1:12 or 8.33 percent. When an accessible route is greater than 1:20, it is considered a longitudinal ramp (except for sidewalks along roadways) and must have handrails and landings. Longitudinal ramps are described in more detail under Site Pedestrian Facilities.

HANDRAILS

Walkways within public rights-of-way should not be considered to be ramps, and are not required to comply with the same criteria that ADAAG specifies for site and building conditions. Thus, handrails would not normally be required within public rights-of-way, although there may be situations where the designer would elect to include them.

If handrails project into a pedestrian circulation path in the street right-of-way more than 4 in (10.0 cm), they must include an extension to improve cane detectability for pedestrians with visual impairments.

SHARED USE PATHS

The US Access Board is currently seeking public comment on a new initiative to develop accessibility guidelines for shared use paths which provide a means of transportation and recreation for various users, including people with disabilities. The new guidelines will provide technical provisions for incorporating accessibility into the construction or alteration of shared use paths covered by ADA. This rulemaking will complement guidelines the board is developing for the Accessibility Guidelines for Outdoor Developed Areas (ODAAG) and PROWAG.

The draft technical revisions for shared use paths require a maximum longitudinal grade of 5 percent. However, a requirement for landings on shared use paths is not included. The entire draft guidelines are available at: <http://www.access-board.gov/sup/anprm.htm> (May 2013).

Landings on steep shared use paths create a choppy effect, are difficult to construct, and are a hindrance to bicycle travel. The best practice is to design shared use paths at a grade of 5 percent or less to avoid the need for landings and handrails. Although this may not be feasible with paths that follow the longitudinal grade of the roadway.

PAR Surfacing

PROWAG states “the surface of the pedestrian access route shall be firm, stable and slip resistant.” Hard surface paving (concrete, unit pavers, etc.) of the PAR is not required, but in order to achieve the requirements stated, hard surface paving is often the best surface solution that fulfills the requirement.

The surface within the PAR (a minimum width of 4 ft (1.2 m)) should include a “reduced vibration zone” that provides a smooth, stable, and slip resistant surface within the PAR. The purpose of the reduced vibration zone is to provide a smooth surface to reduce pain and discomfort for individuals who use wheelchairs. This surface should be free of utility covers, wide joints, and rough or bumpy surfaces, such as some rough surfaces resulting from unit pavers.



This walkway in Honolulu has a clear travel way and smooth surface.



Protrusions into the PAR are hazardous.



Per PROWAG, surface discontinuities along the PAR shall not exceed 0.5 in (13 mm) maximum. Vertical discontinuities between 0.25 in (6.4 mm) and 0.5 in (13 mm) shall be beveled at 1:2 minimum. The bevel shall be applied across the entire level of change.

Research has indicated that chamfers on unit pavers of less than 0.5 in (1.25 mm), if flush, are not distinguishable from cast-in-place concrete sidewalks with a broom finish, although as chamfer is reduced, the surface becomes even smoother. Unit pavers abutted without joints and with careful installation can also provide a smooth finish.

Spaces outside the PAR may be constructed of less smooth materials. This allows urban designers to be creative in the choice of paving materials over the full width of a sidewalk outside the reduced vibration zone.

Widths and Clearances

A clear width of passage, without obstacles such as signs, newspaper stands, and trash receptacles, needs to be provided for PARs. PROWAG requires a minimum 4 ft (1.2 m) wide path of travel, and it is recommended that this minimum width be a

"reduced vibration zone." If the PAR is less than 5 ft (1.5 m) in clear width, passing areas must be provided. See "Passing and Resting Areas."

It is best to provide direct routes of travel as well, so that pedestrians do not have to change their course of travel to avoid obstacles. Exhibit 3.4 illustrates directioness of route.

Vertical clearance is also important to accommodate people with visual impairments. A PAR shall have a minimum clear height of 6 ft-8 in (2.0 m). 7 ft (2.1 m) is recommended as a preferred vertical clearance. Where the vertical clearance of an area adjacent to an accessible route of travel is impacted by lateral obstructions, a continuous permanent barrier around or at the base of the obstruction shall be provided.

Eliminating Barriers and Obstacles

Pedestrian access routes shall be continuous and unobstructed. Obstacles and abrupt changes in elevations create barriers for all pedestrians. Curbs, steps, and stairways create barriers for individuals who use wheelchairs and people pushing strollers or carts. Curb ramps allow access for wheeled devices to areas raised and separated by curbs.

EXHIBIT 3.4 Direct and Indirect Route Examples

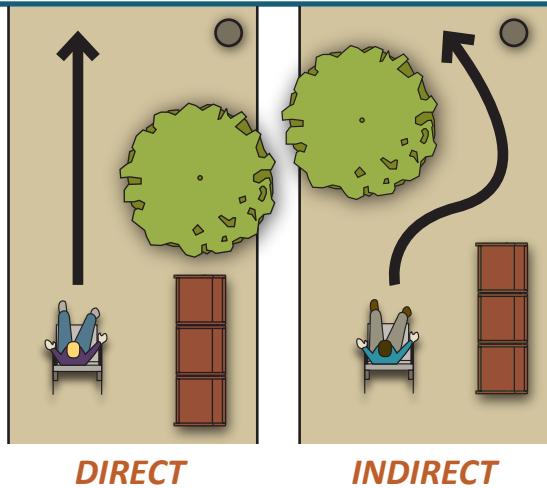
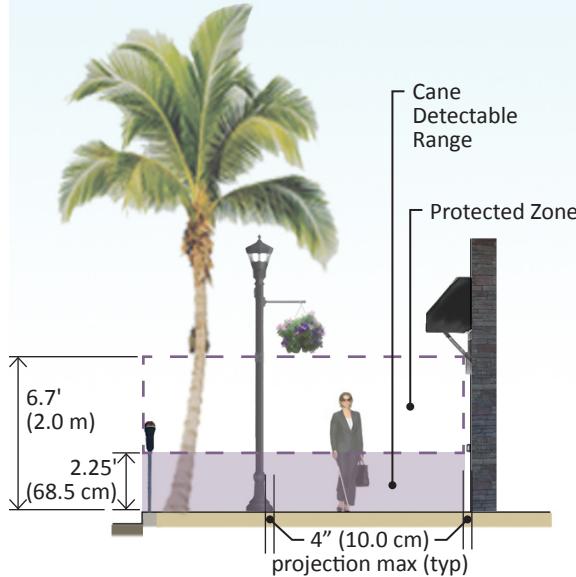


EXHIBIT 3.5 Obstructions need to be detectable within 2.25' (68.5 cm) of the PAR surface.



Section R402.2 of PROWAG addresses protrusion limits as follows: *"Objects with leading edges more than 2.25 ft (68.5 cm) and not more than 6.7 ft (2.0 m) above the finish surface or ground shall protrude 4 in (10.0 cm) maximum horizontally into the pedestrian circulation path."* See Exhibit 3.5.

Section 307.5 of ADAAG Required Clear Width: *"Protruding objects shall not reduce the clear width required for accessible routes."*

Coordination between the governing agency, state, city, county, private vendors, utility companies, and others is necessary to avoid placement of obstacles within the pedestrian travel way. Another solution to reducing obstacles is achieved by consolidating elements in a "corral" (such as trash receptacles, newspaper stands, and other street furniture).

SIDEWALK CAFES

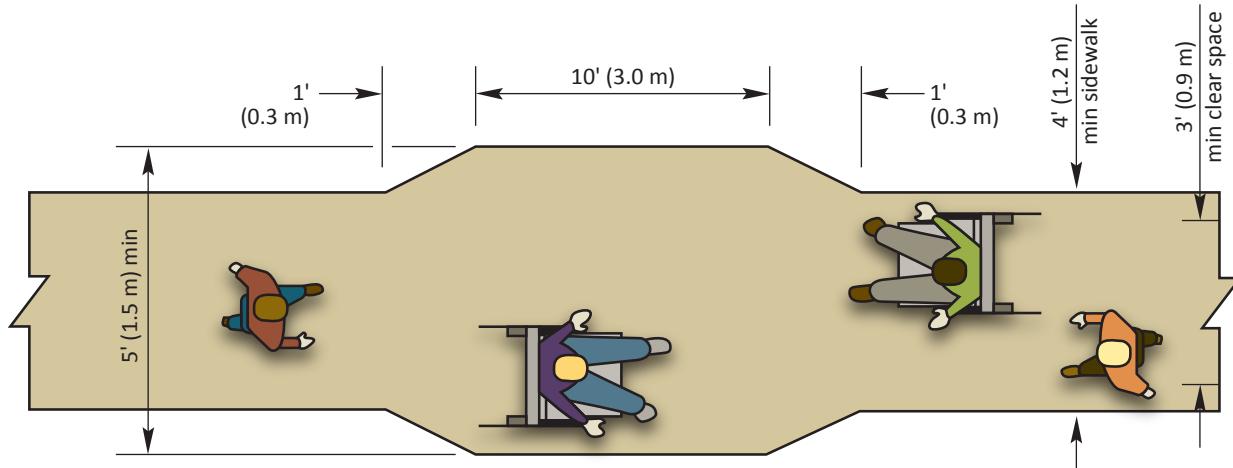
Sidewalk cafes, hanging signs, and displays along a PAR can be hazards for pedestrians with visual impairments and individuals who use wheelchairs or strollers. Enclose cafe areas with railing or fencing to delineate the space from the PAR. Railing/fencing must be detectable by cane

to warn visually impaired persons of potential hazards in the path of travel. A continuous uninterrupted railing, fence or barricade meets this requirement if it has a continuous, firm barrier located 27 in (68.5 cm) above ground or lower. If the railing, fence or barricade is not continuous, a detectable barrier must run continuously along the pedestrian side at a height of 27 in (68.5 cm) or less. Provide a clear path of travel around the outside of these areas. Hanging signs should either be placed above the vertical clearance zone or located on posts or light poles outside of the clear width of passage.

Passing Areas

It is necessary to provide sufficient passing areas for two wheelchairs. When an accessible route of travel is less than 5 ft (1.5 m) wide, passing areas that are minimum 5 ft by 5 ft (1.5 m) shall be provided at 200 ft (60.0 m) maximum intervals. A 10 ft (3.0 m) long passing area is preferred. Refer to Exhibit 3.6. Passing areas may already be available at building entrances, plazas, and sidewalk intersections. It is more cost effective, practical, and desirable to create a continuous clear width area wide enough for two wheelchairs to pass each other than to create special passing areas.

EXHIBIT 3.6 Accessible Passing Area



Note: Dimensions for passing areas shown are desirable. 5 ft (1.5 m) by 5 ft (1.5 m) is the minimum dimension.

Cross Slopes

Cross slopes on pedestrian surfaces shall not exceed 2 percent. The use of a cross slope less than 2 percent is acceptable, but surfaces should be designed to facilitate positive drainage, avoiding water accumulating on the surface. It is difficult to operate a wheelchair along a route with a cross slope greater than 2 percent because the wheelchair tends to turn toward the direction of the cross slope. As the cross slope of the sidewalk increases, the user is essentially required to steer with one arm and push the wheel with

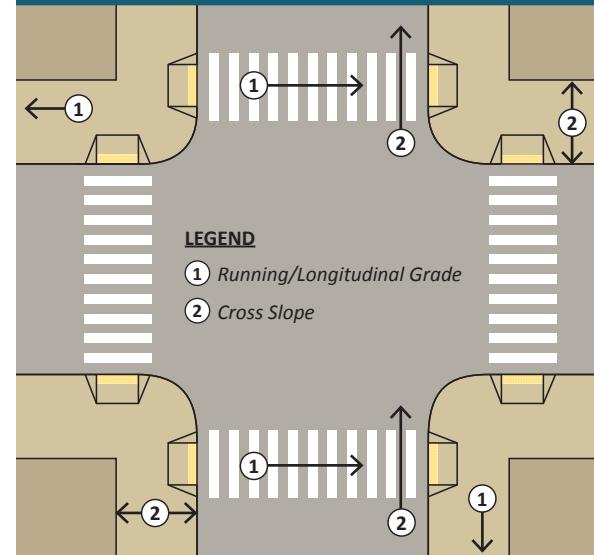
the other arm. This increases the amount of work required to move the wheelchair.

Cross slopes across intersections and crossings also shall not exceed 2 percent, to facilitate crossing by individuals who use wheelchairs and others. Keep in mind this is for the 4 ft wide PAR, and not for the full width of the crosswalk.

Crosswalks

Where provided, crosswalks should comply with the following requirements. Crosswalks should be

EXHIBIT 3.7 Running/Longitudinal Grade vs. Cross Slope



marked on the roadway with pavement markings. Per HDOT standards, marked crosswalks shall be a minimum of 10 ft (3.0 m) wide. This exceeds the minimum width of 6 ft (1.8 m) recommended by PROWAG, but the 10 ft width is best because it provides more space for pedestrians and greater visibility of the crosswalk. For new construction, the cross slope of pedestrian street crossings, at either marked or unmarked crosswalks, should not be more than 1:48 (2 percent) measured perpendicular to the direction of pedestrian travel. The running grade of pedestrian street

crossings, at marked and unmarked crosswalks, shall be no more than 1:20 (5 percent) in the direction of pedestrian travel in the crosswalk.

CROSSING TIME/SIGNAL TIME FOR PEDESTRIANS

Pedestrian crossing intervals shall be calculated as follows:

- A walking speed of up to 4 ft per second may be used to evaluate the sufficiency of the pedestrian clearance time at locations where an extended pushbutton press function has been installed to provide slower pedestrians an opportunity to request and receive a longer pedestrian clearance time.
- The additional time provided by an extended pushbutton press to satisfy pedestrian clearance time needs may be added to either the walk interval or the pedestrian change interval.
- Where pedestrians who walk slower or pedestrians who use wheelchairs routinely use the crosswalk, a walking speed of less than 3.5 feet per second should be considered in determining the pedestrian clearance time.

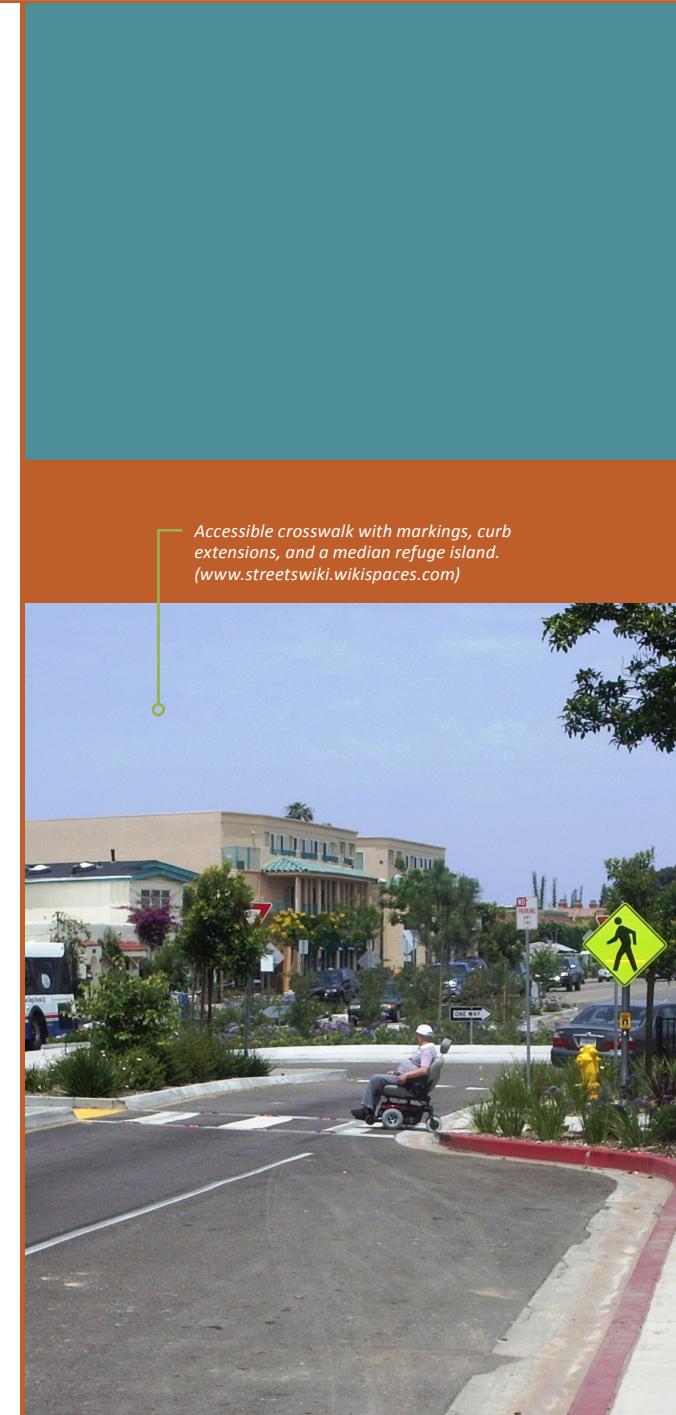
Designers should also consider extending the time for pedestrian crossings beyond the calculated requirement if any of the following factors exist:

- Running/longitudinal grade of the crosswalk greater than 5 percent
- Cross slope of the crosswalk greater than 2 percent
- Crosswalk length greater than 50 ft (15 m) with no intermediate pedestrian refuge (Keep in mind that retrofit and new designs should comply with maximum 2 percent cross slope and 5 percent running/longitudinal grade requirements.)

When calculating pedestrian signal phase timing, total crossing distance should include the entire length of the crosswalk plus the length of one curb ramp. Refer to Toolbox Section 5—Intersections and Crossings and the MUTCD for additional guidance.

Medians and Pedestrian Refuge Islands

Raised medians and pedestrian refuge islands in crossings should be cut through at street level or have curb ramps at both sides. Each





BEFORE

Expanding a sidewalk provides space for a curb ramp landing.



AFTER

curb ramp shall have a level area (landing) 4 ft (1.2 m) square, minimum at the top of the curb ramp in the part of the island intersected by the crossings. Cut-throughs should be aligned perpendicular to the street being crossed and should be parallel to the direction of the pedestrian access route if the pedestrian access route is not perpendicular to the street. Medians and pedestrian refuge islands shall be a minimum 6 ft (1.8 m) minimum in length in the direction of pedestrian travel.

Sidewalk Curb Ramps

Sidewalk curb ramps may also be known as accessible ramps or wheelchair ramps placed at intersection corners, crossings, parking access, and other locations to facilitate a seamless transition from the sidewalk level to the street level.

DESIGN OF SIDEWALK CURB RAMPS

Sidewalk curb ramps provide accessibility at intersections, building entrances, and other areas where elevated walkways are edged with curbing. They must be designed in a standard manner so they are detectable to people with sight impairments and so people in wheelchairs can use them with consistency.

Exhibits 3.8 and 3.9 show methods for curb ramp design in detail.

Even though some sidewalk curb ramp details suggest a minimum ramp length of 6 ft (1.8 m) [6 in (152 mm) curb height at 5 percent], most often the curb ramp uphill slope is running against a sidewalk cross slope of 1 to 2 percent, which makes the curb ramp longer to intersect the sidewalk grade. For example, a curb ramp placed perpendicular to a sidewalk that has 2 percent cross slope would require the curb ramp to be about 7.2 ft (2.2 m) long. In this case, designers may choose to reconstruct the entire sidewalk. HDOT uses an 8 ft (2.4 m) minimum length for Type A curb ramps.

A curb ramp may often be located along an existing sidewalk with a cross slope and running slope that exceed PROWAG guidelines. Rather than referencing a generic standard plan in the design documents, situations like this require detailed engineering design of the curb ramp with dimensions and spot elevations to control the constructed product. HDOT always requires site-specific design of curb ramps due to past problems with contractors referencing

EXHIBIT 3.8 Accessible Curb Ramp Design Details - Type A

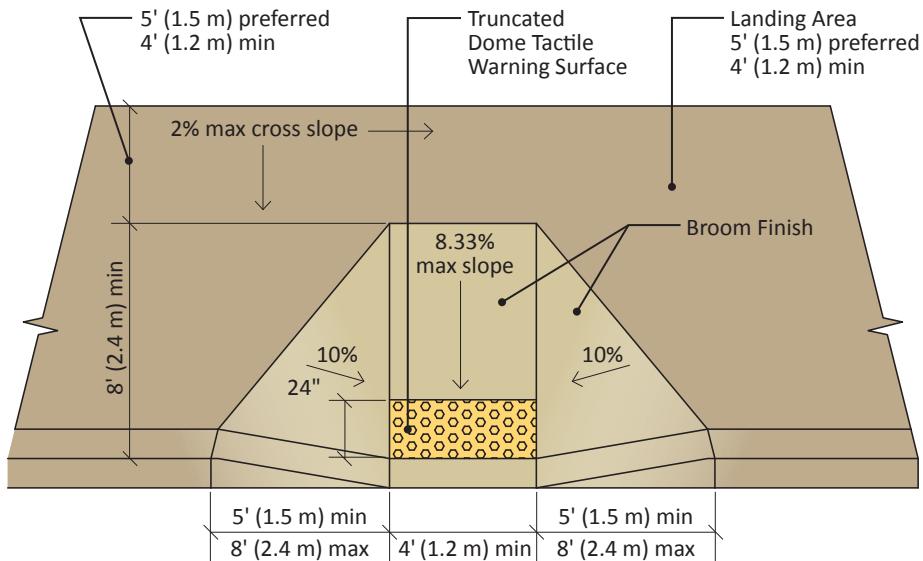
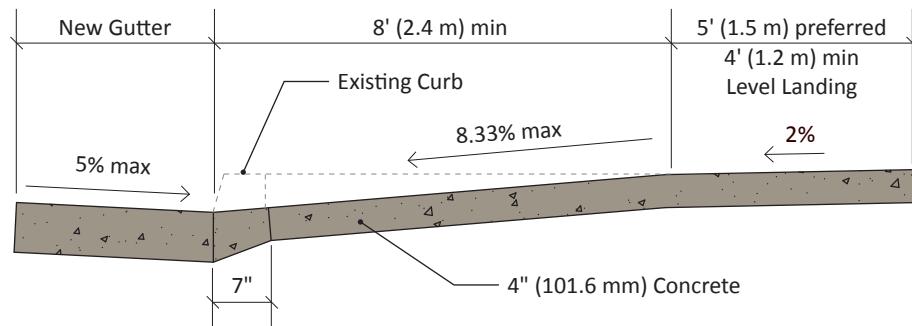
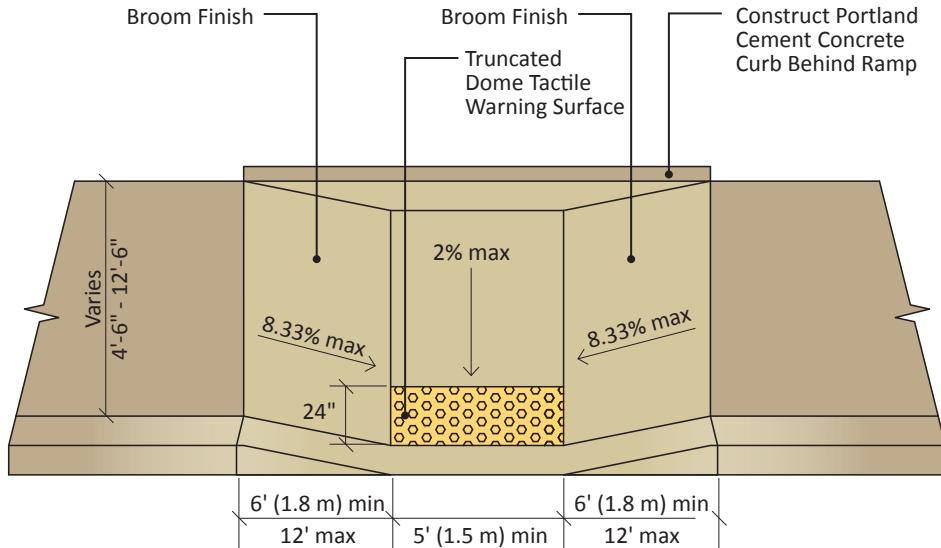


EXHIBIT 3.9 Accessible Curb Ramp Design Details - Type B



The diagram illustrates a curb transition between an 'Existing Curb' and a 'New HDOT Standard Curb'. The 'Existing Curb' is shown as a vertical line with a horizontal extension. The 'New Gutter' is indicated by a vertical line to the left of the transition. The distance between the end of the existing curb and the start of the new curb varies from 4' to 10' - 6". The new curb has a vertical drop-off. A dashed line indicates a 8% max slope from the curb to the ground. A solid line indicates a 2% max slope from the curb to the ground. The ground surface is labeled '4" Concrete'.

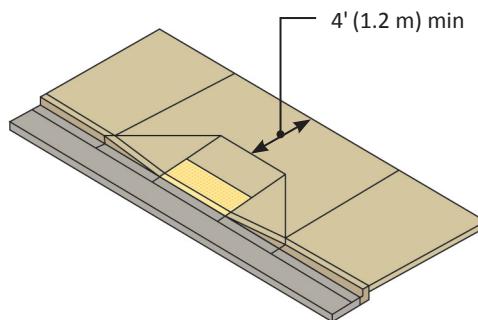
Notes:

1. Ramp and approaches shall be clear of obstacles including hydrants, poles, and inlets.
 2. Ramp center line shall be perpendicular to or radial to curb returns unless otherwise approved by engineer.
 3. If roadway slope is >2%, conform to roadway slope and file technical feasibility statement.

Notes:

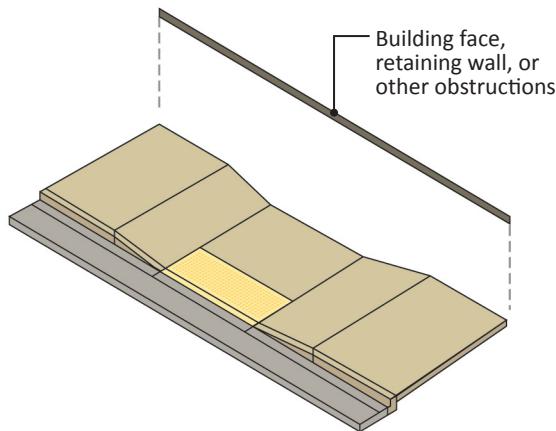
1. Ramp and approaches shall be clear of obstacles including hydrants, poles, and inlets.
 2. Ramp center line shall be perpendicular to or radial to curb returns unless otherwise approved by engineer.
 3. The slope of the ramp shall take precedence over the length of the ramp. If the maximum slope of a ramp cannot be met within a length of 12 ft, then the slope of the ramp shall be set when the length of the ramp is set at the maximum of 12 ft.

EXHIBIT 3.10 Curb Ramp Type A



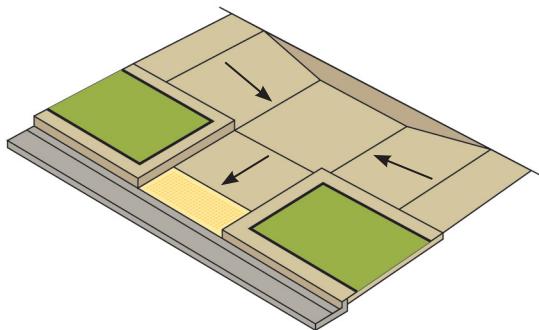
Provide minimum 4 ft landing at top of ramp for turning or bypassing the ramp.

EXHIBIT 3.11 Curb Ramp Type B



Use where inadequate top landing space exists.

EXHIBIT 3.12 Curb Ramp - Alternate Option



If planter width is 6' or greater the slope can be eliminated.

See HDOT standard plans for ramp construction details.

standard plans. Designers should not rely on field inspectors and contractors to lay out these special ramps based only on the standard plan.

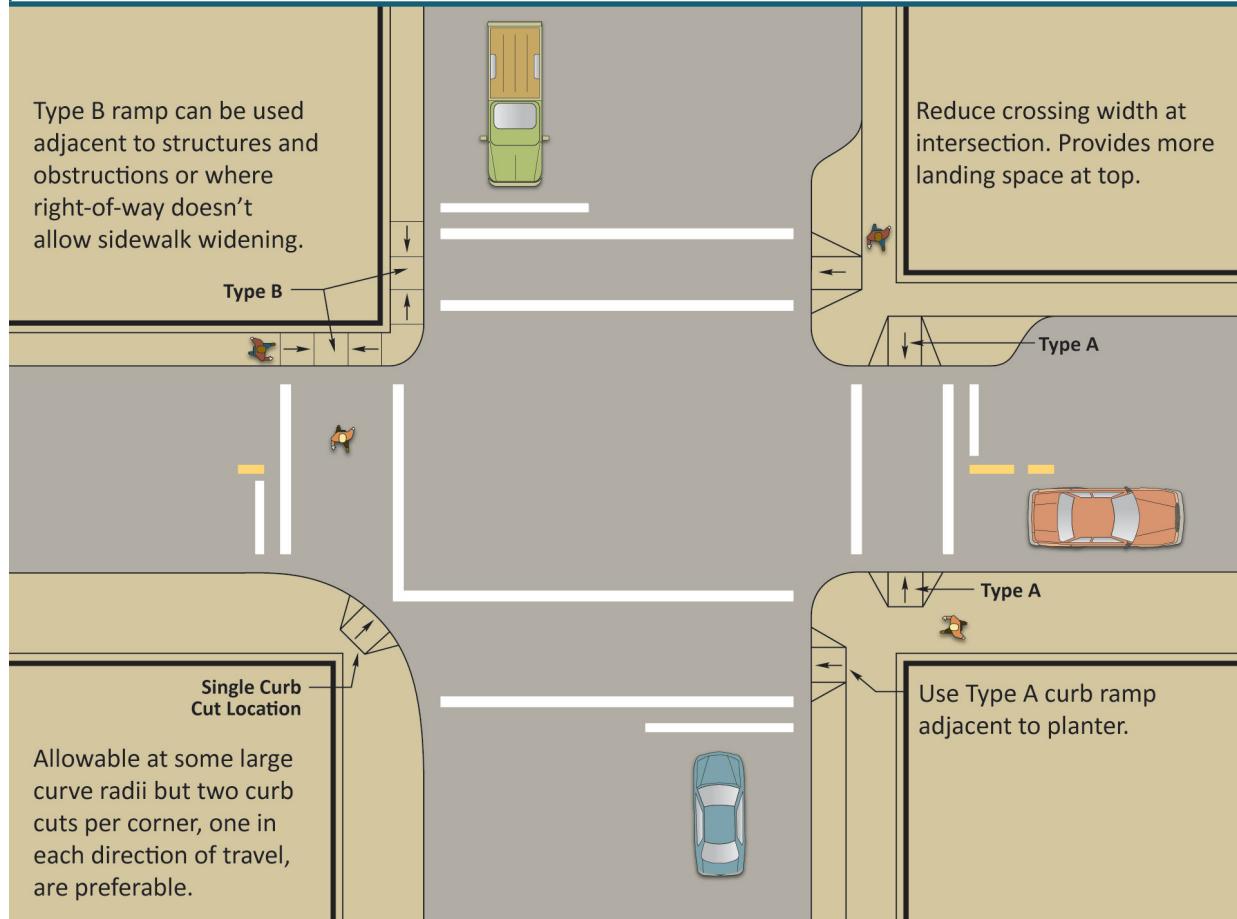
LOCATIONS OF SIDEWALK CURB RAMPS AT INTERSECTIONS

Curb ramps are important devices at intersections, not only because they facilitate crossing for individuals who use wheelchairs, people pushing strollers, bicyclists, and others, but also because they can help pedestrians with visual impairments identify the street crossing location and provide directional guidance.

Two curb ramps per corner are required for new intersections, one in the direction of each crosswalk (see Exhibit 3.14).

The use of only one curb ramp at each corner (diagonal ramp) may direct pedestrians out into the center of the intersection and into an opposing traffic lane, rather than toward the crosswalk. A single ramp placed on the diagonal of the corner may introduce a pedestrian at a point where drivers are not anticipating a pedestrian, especially when turning. Exhibit 3.13 lists important criteria for the design of curb ramps at intersections.

EXHIBIT 3.14 Sidewalk Curb Ramps at Intersections



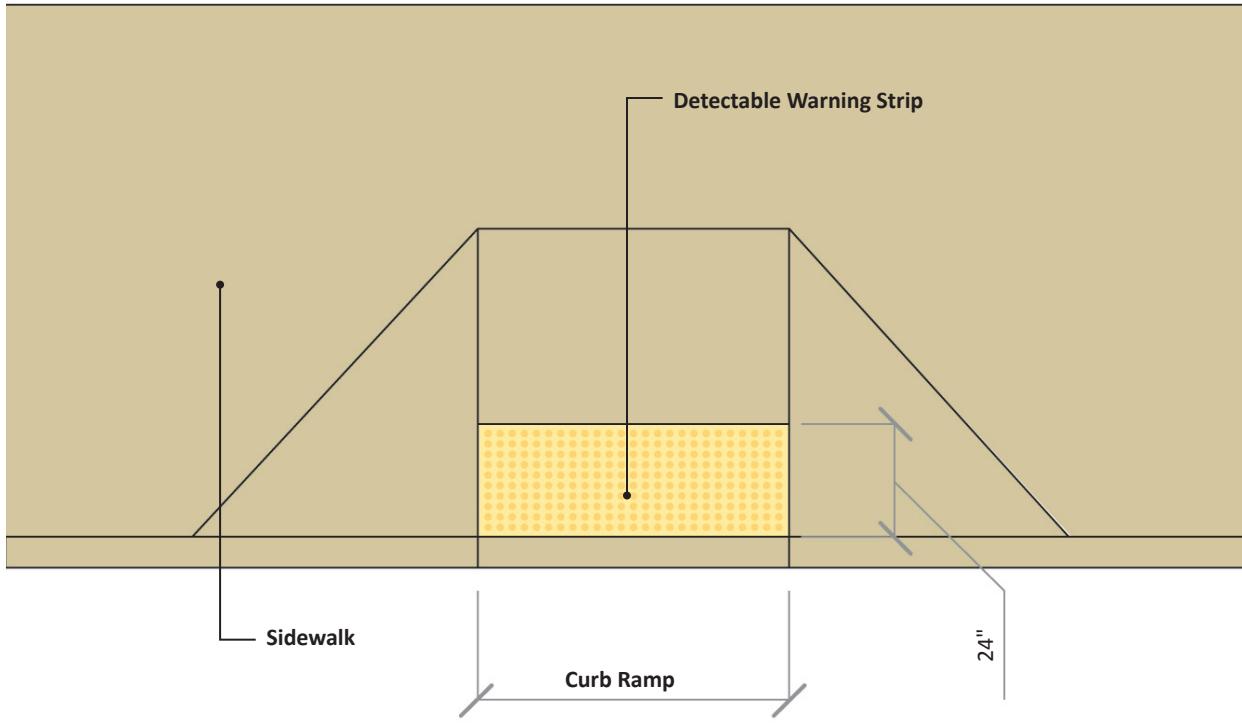
Detectable Warning Surfaces

People who are blind or have low vision need cues as they travel through a pedestrian system to identify the boundary between a pedestrian route and a vehicular route where there is a flush connection. Detectable warning surfaces can provide this cue. If their meaning is understood, textural changes in the surface of the pedestrian area can serve as a tactile cue for persons who have low vision or are blind. Details of the detectable warning strip and domes are shown in Exhibits 3.15 and 3.16 and PROWAG.

The detectable warning is a unique and standardized surface intended to alert pedestrians who are blind or have low vision to the presence of traffic and hazards in the line of travel and should only be used for this purpose. The truncated dome surface should not be used for wayfinding or directional information. They are strictly for detection of street edges and transit ways (any locations pedestrians may encounter moving traffic). However, detectable warnings are not desirable at driveways because installation at driveways would make it harder to identify the street.

Domes should be aligned on a square or radial grid in the direction of travel. The purpose of

EXHIBIT 3.15 Detectable Warning Strip Location



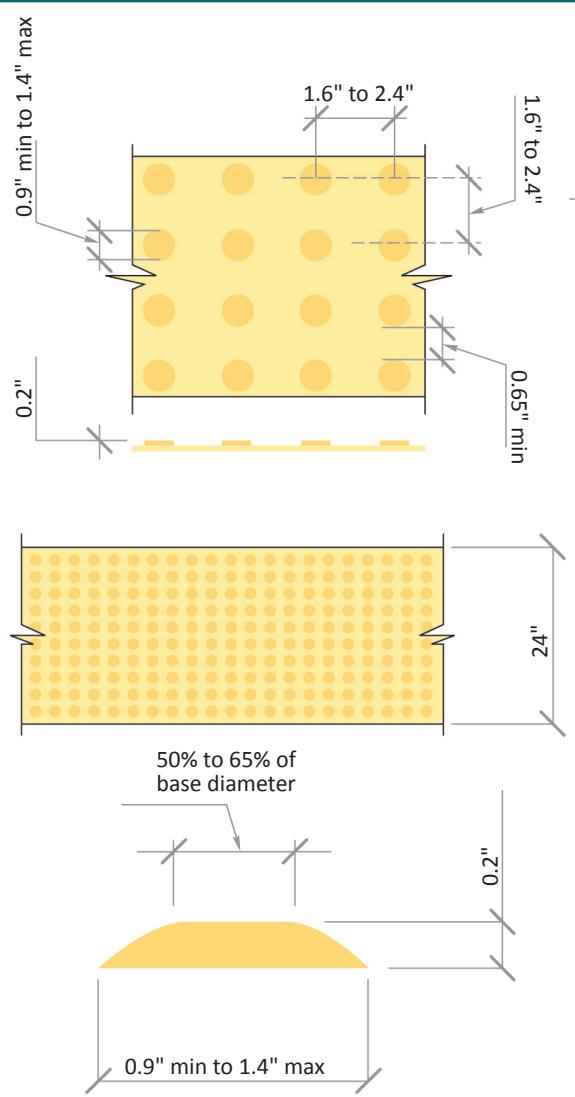
this alignment is to permit wheels to roll between domes, and provides the greatest chance for wheelchair wheels to avoid the truncated domes.

Per PROWAG R304.1.4, detectable warning surfaces shall extend 2 ft (610 mm) minimum in the direction of travel and the full width of the curb ramp (exclusive of flares), the landing,

or the blended transition. Domes function much like a stop sign for pedestrians who are blind or have low vision, and the 2 ft depth is appropriate to provide the message before stepping into the street.

When a ramp, landing, or blended transition provides access to the street continuously around a corner, the vertical rows (running

EXHIBIT 3.16 Detectable Warning Strip Dome Spacing and Dimensions



up from the back of curb) of truncated domes should be aligned to be perpendicular or radial to the grade break between the ramp and the street for a full width for each crosswalk served.

Detectable Warnings at Medians/Islands

Medians and refuge islands that are level with the street at crosswalks and curb ramps shall have detectable warnings provided at the following locations:

- At the base of curb ramps or the outside border of cut through spaces. Note that it is preferable for disabled pedestrians to use cut-throughs than curb ramps in islands.
- At cut-through islands located at the curbline in-line with the face of curb and shall be separated by a 2 ft (61.0 cm) minimum length of walkway without detectable warnings.

Visual Contrast

Per PROWAG, detectable warning surfaces shall contrast visually with adjacent gutter, street or highway, or walkway surface, either light-on-dark or dark-on-light. Contrast may be provided on the full ramp surface, but should not extend to the flared sides. Many pedestrians use the visual

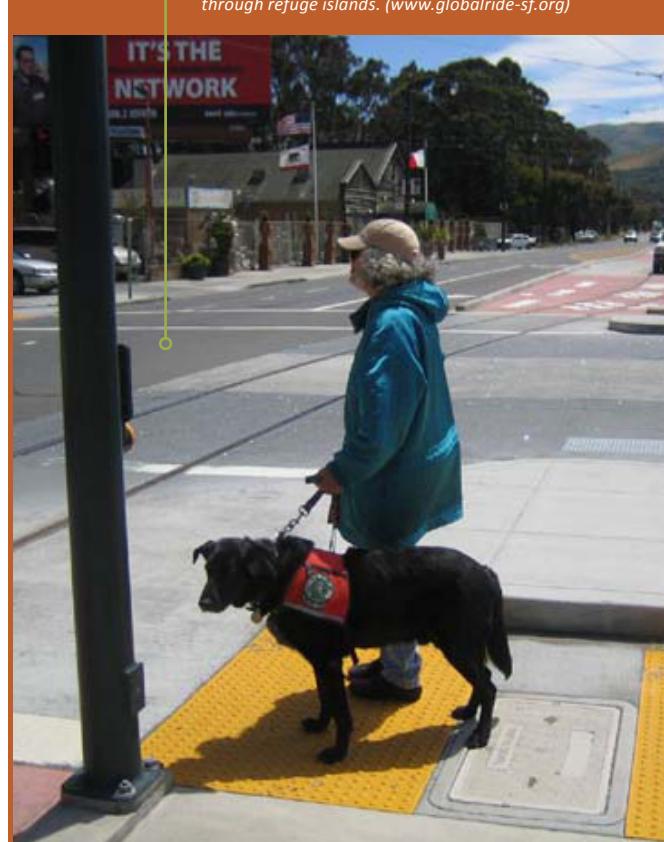
contrast at the toe of the ramp to locate the curb ramp from the other side of the street. The color yellow is often used, but other contrasting colors are acceptable. (See PROWAG.)

Curbs are also important detection devices for people with visual impairments along street edges and intersections. Curbs help individuals who use canes to clearly detect curb ramps and driveways because they can follow the curb line and note where it recesses. The removal of curbs, such as at an intersection where curbs are flush with the street surface, can cause difficulty for those who are blind or visually impaired because they may have trouble detecting the edge of the street. In those places and along the edges of shared streets, where the street level and sidewalk level is the same, detectable warning strips should be provided to delineate the edge of the primary vehicle traffic area.

Rolled curbs also can present detection problems for blind pedestrians. It is recommended that rolled curbs be transitioned to vertical curb or to vertical curb and gutter around intersection curb returns to provide better detection and information to blind pedestrians.



An example of a detectable warning strip located in Portland, Oregon. (Texas DOT)



Detectable warning strips shall be provided at cut-through refuge islands. (www.globalride-sf.org)

Accessible Pedestrian Signals (APS)

According to the MUTCD, an accessible pedestrian signal (APS) is a device that communicates pedestrian timing information in nonvisual formats through audible tones, verbal messages, and/or vibrating surfaces (Section 4E.09).

According to PROWAG, an APS is a device that communicates information about the "Walk" and "Don't Walk" phases in audible and vibrotactile formats (R209.1).

An APS provides audible and tactile cues to pedestrians who may have difficulty seeing the visual cues that typical traffic signal pedestrian features provide. An APS alerts individuals to the existence and location of pedestrian push buttons, tells them the beginning of the walk interval, and helps establish the direction of the crosswalk and location of the destination curb. An APS can also provide intersection street names in Braille or with a speech message, relay intersection signalization with a speech message, and intersection geometry through tactile maps, diagrams, or speech messages. (See Exhibit 3.17 and 3.18.)

A pedestrian waits to feel the vibrotactile walk signal at an intersection. (NCHRP)



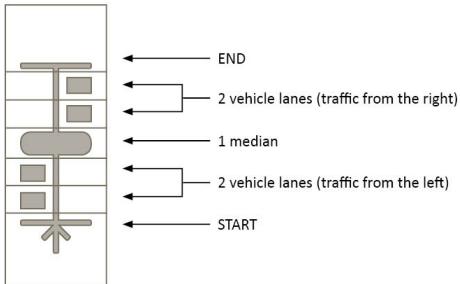
Several benefits occur with the use of an APS. Pedestrians who are blind or have low vision can make better judgments about when to cross, and typically complete their crossings before the signal changes. Another benefit is that sighted pedestrians often make a faster start when the walk indication occurs because of the audible information that comes from the APS.

GUIDELINE REQUIREMENTS

Two documents guide the requirements and installation of APS devices, the MUTCD (2009) and the PROWAG, which sets forth the guidelines per federal mandate. The MUTCD outlines the detailed technical requirements for installation.

PROWAG requires the installation of APS devices for new construction or alterations where pedestrian signals are provided, unless it is technically infeasible, whereby it should be done to the maximum extent feasible. While MUTCD suggests that studies should be performed to determine if APS is warranted, the PROWAG language that requires APS devices is still in the rulemaking stage and when adopted would revise the MUTCD. Because PROWAG is currently being finalized by the US Access Board,

EXHIBIT 3.17 Tactile Street Crossing Map on an APS-Integrated Push Button Housing



APS integrated push button unit with tactile street crossing map (NCHRP)

EXHIBIT 3.18 Speech Messaging (Dan Burden)



designers should plan to include APS wherever new signals are planned or existing signals are altered.

MUTCD Chapter 4E, Section 4E.09 (and beyond) discusses the design and construction requirements of APS elements, as well as technological features.

APS HISTORY

Early installations of APS devices in the US consisted of “cuckoo” and “chirp” or “cheep” sounds mounted on the pedestrian signal head. They were part of the overall installation and did not have a special call feature, so they sounded each time a pedestrian interval occurred. The sound provided some directional guidance to



Speaker mounted above a pedestrian signal (NCHRP)

Braille Street Sign at Pedestrian Signal.



blind pedestrians, but the duration was typically only during the walk interval, silenced during the clearance interval. This resulted in directionality benefits being lost during the clearance interval. They were also controversial because those living near them complained about noise. APS technology has advanced to better solutions.

APS FEATURES

Current technology for APS solves many of the problems created by the older APS installations. Push button-integrated APS features are much more complete, provide information in a more consistent format, and MUTCD now provides a relatively standard approach to designing and installing them. An overall discussion about the features follows.

Locator Tone

A push button locator tone is a repeating sound that informs approaching pedestrians that they are required to push a button to actuate pedestrian timing. This enables pedestrians who have visual disabilities to locate the push button.

Locator tones typically sound from the push button assembly during the DON'T WALK intervals.

A tone is also provided for the WALK interval. Current recommendations are that the tone used to indicate the WALK interval should be a ticking tone which repeats 8 to 10 times per second, otherwise known as the rapid tick. That tone is also provided from the pedestrian push button location. The WALK indication shall have a faster repetition rate (8 to 10 ticks per second) than the push button locator tone (1-second intervals). (MUTCD)

Accessible Pedestrian Signals: A Guide to Best Practices describes locator tone use by pedestrians who are blind or who have low vision as follows.

Pedestrians who are unfamiliar with an intersection will approach the intersection and take the following actions:

- Upon hearing the locator tone or two locator tones if there are two push buttons, they will realize that there is a push button for the crossing.
- They will probably continue to the curb or curb ramp location in order to become familiar with the corner and intersection layout and to determine proper alignment.



This accessible pedestrian signal has a high-contrast, raised tactile arrow on the push button and a high-contrast recessed tactile arrow on the sign above the button.

They will orient themselves to the sounds by listening to traffic.

- They will return to, if they are not already standing next to, the push button locator tone that is believed to be the correct push button for the crossing and check that the tactile arrow alignment is parallel to the desired crosswalk.
- They will push the button and return to the curb to realign themselves for crossing the intersection.
- They may repeat this process if the pedestrian phase begins before they are properly aligned to cross.
- If the push button locator tone for the APS device on the opposite side of the street is audible as they cross the street, they may focus on the sound for verification of alignment.

Automatic Volume Adjustment

Push button-integrated locator tones have the capability to measure the ambient noise levels and will generally self adjust to be 2 to 5 decibels (dB) above the background traffic noise. MUTCD suggests that volume of the slowly repeating

tone should be adjusted to be heard no more than 6 to 12 ft (1.8 to 3.6 m) from the push button or at the building line, whichever is less.

Speech Messages

Speech messages from the push button are most important when the push buttons for the two crossing locations at a signalized intersection are less than 10 ft (3 m) apart. (Location of push buttons is discussed later in this section.) Research has found that the locator tone and vibrotactile assemblies are more effective at providing crossing information when the two push buttons are adequately separated, but speech messages are best when the two push buttons are closer together. Drawbacks of speech messages are that pedestrians with hearing loss, who are not fluent in English, or who have cognitive disabilities may have difficulty hearing or understanding the message.

Tactile Arrow

Tactile arrows are used to help pedestrians who are blind or have low vision align with the crosswalk and determine which crosswalk the push button controls. Pedestrian signal devices shall provide tactile and visual signs complying

with PROWAG 306.4 on the face of the device or its housing or mounting to indicate crosswalk direction. Signs shall include a tactile arrow aligned parallel to the crosswalk directions. The arrow shall be raised .03 in (.8 mm) minimum and shall be 1.5 in (38 mm) minimum in length. The arrow shall contrast with the background.

Other Features

Often, APS units can include other features that provide useful information to the blind pedestrian. These could include:

- Braille signage – PROWAG requires street name information in Braille or in an audible format. If speech messaging is not used, then Braille signage is required.
- Tactile map – Tactile maps can be helpful to blind pedestrians in understanding the layout of the crossing they are about to make. The information can include curb location (if curb exists), the number and location of lanes (including bike lanes) to be crossed, presence of a median, and parking presence.

Another useful feature that can be provided is the extended button press. If an extended push

EXHIBIT 3.19 Example of Adequate Separation Between APS Integrated Push Buttons



button is used, a push button press of less than one second shall actuate only the pedestrian timing and any associated accessible walk indication. A push button press of one second or more shall actuate the pedestrian timing, any associated accessible walk indication, and any additional feature(s). This extended press can call up an extended crossing time, a push button information message (most often intersection street name information), and audible beaconing that helps blind pedestrians hone in on the push button at the opposite end of the crosswalk,

improving directional interpretation. If additional crossing time is provided by means of an extended push button press, a PUSH BUTTON FOR 2 SECONDS FOR EXTRA CROSSING TIME plaque shall be mounted adjacent to or integral with the pedestrian push button. (MUTCD Section 4E.13)

INSTALLATION LOCATION

Placement of the push button-integrated APS is critical for accurate understanding by pedestrians who are blind or have low vision.

Placement helps to indicate which street is being crossed, how to line up to cross, and separates audible messaging between the two push buttons controlling the two crossings at a typical intersection. (See Exhibits 3.19, 3.20 and 3.21.) MUTCD location guidance give some important guidance:

- Two push buttons should be used, one for each direction of travel on the same corner, separated by a minimum of 10 ft (3 m). This allows the blind pedestrian to more easily determine which direction of travel each push button serves.
- Having both APS-integrated push buttons on the same pole makes it extremely difficult for pedestrians who are blind or have low vision to determine which push button applies to which crossing. As a result, when two APS-integrated push buttons are closer than 10 ft (3 m), a speech message is required. Per MUTCD, the following features are required if placement separation is less than 10 ft (3 m).
 - A push button locator tone
 - A tactile arrow
 - A speech walk message for the

EXHIBIT 3.20 Ideal Location for APS Integrated Push Buttons (MUTCD)

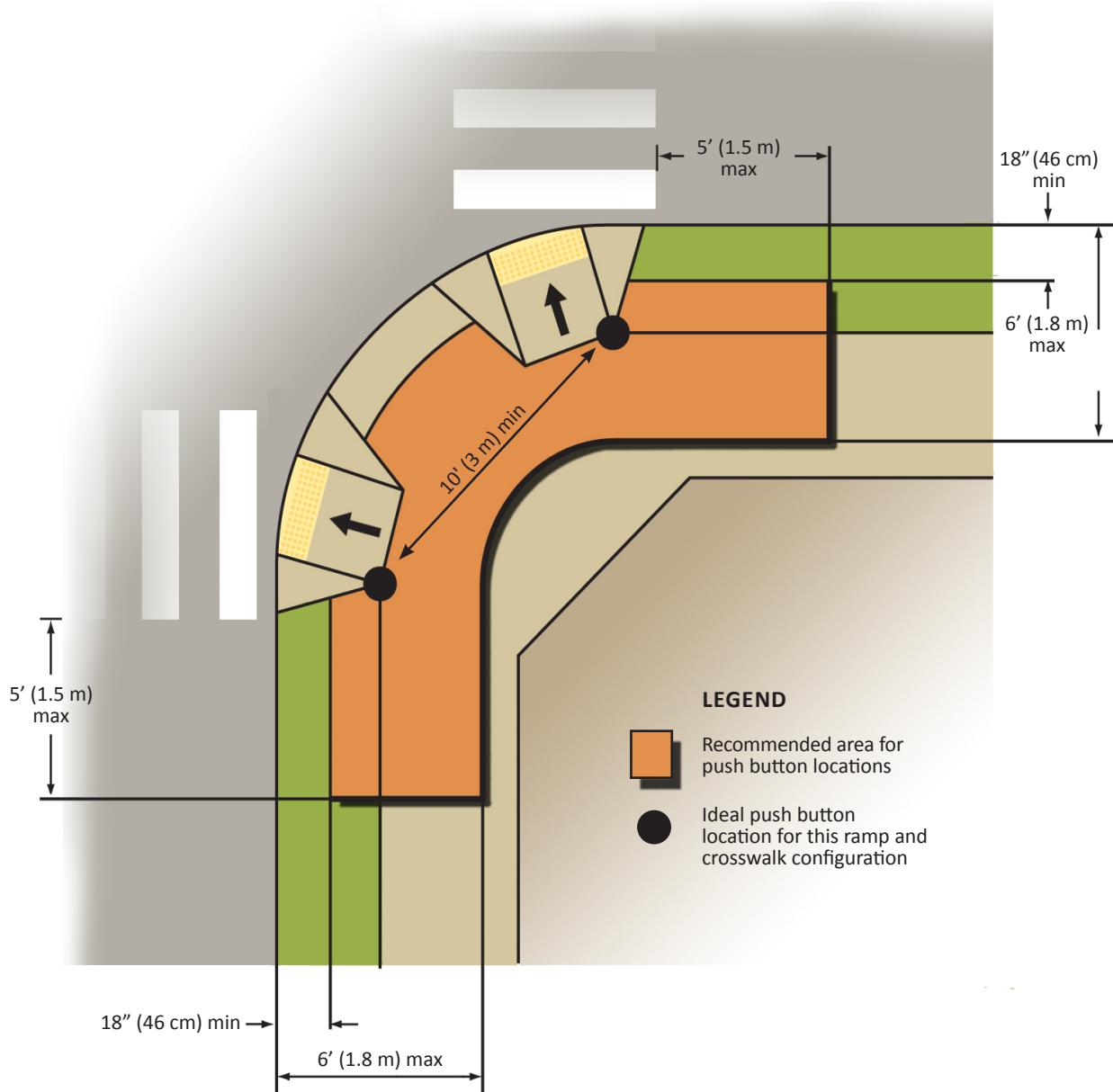


EXHIBIT 3.21 Locations for Push Buttons in Various Ramp Configurations

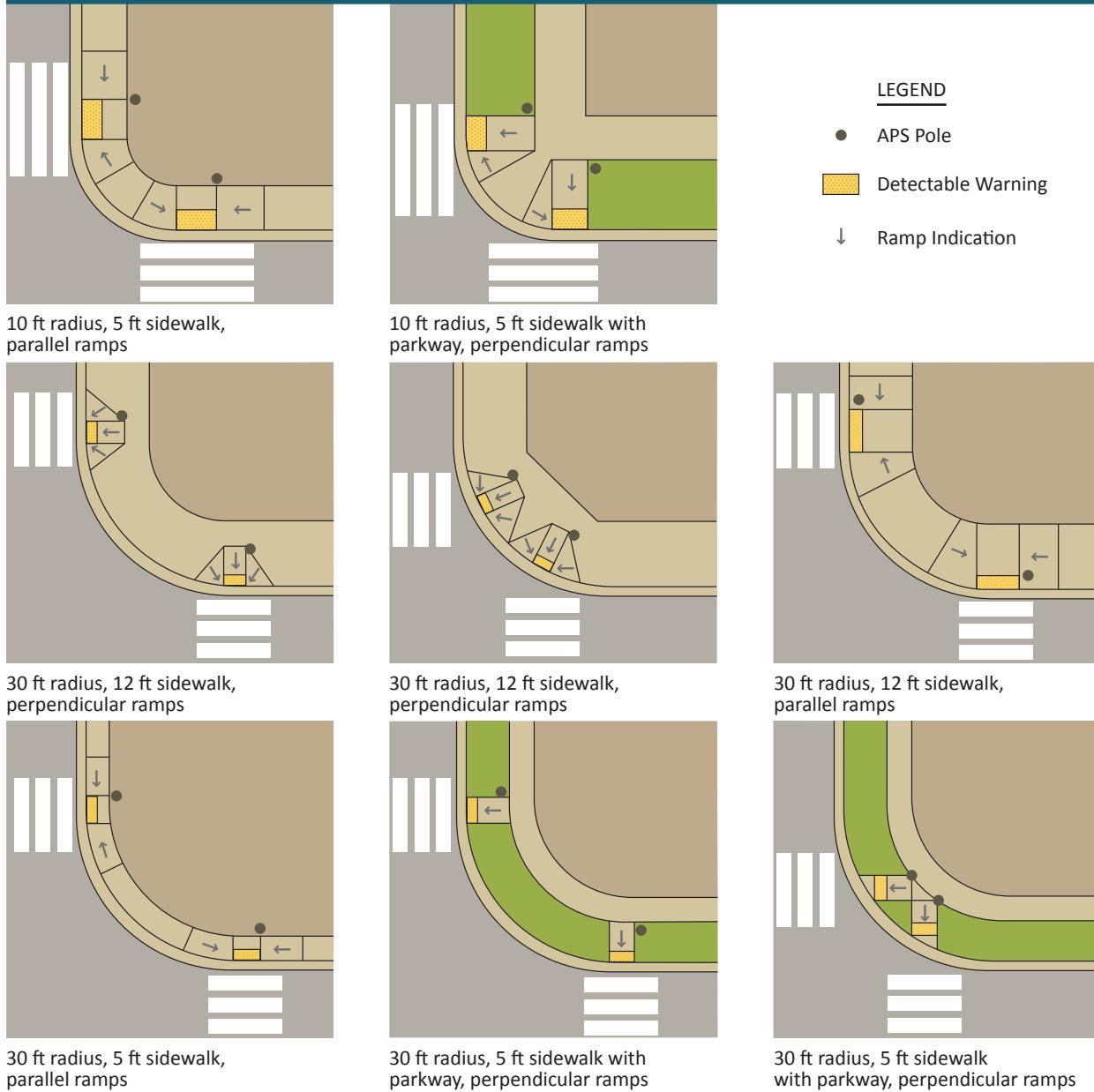


EXHIBIT 3.22 Push button must be within 5 feet of the extended crosswalk line.

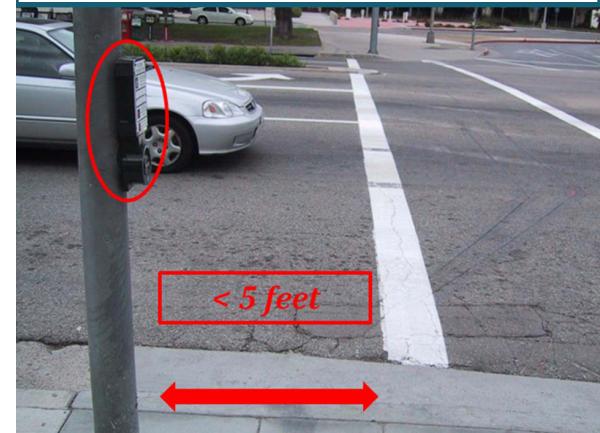


EXHIBIT 3.23 Push button must be within 10 feet of curb.



- WALKING PERSON (symbolizing WALK) indication, and
- A speech push button information message
 - Per PROWAG, accessible pedestrian signals shall be located so that the vibrotactile feature can be contacted from a clear floor or ground space. (See PROWAG 209.1.)
 - MUTCD provides the following guidance:
 - A. Unobstructed and adjacent to a level all-weather surface to provide access from a wheelchair
 - B. Where there is an all-weather surface, a wheelchair accessible route from the push button to the ramp
 - C. Between the edge of the crosswalk line (extended) farthest from the center of the intersection and the side of a curb ramp (if present), but not greater than 5 ft (1.5 m) from said crosswalk line
 - D. Between 1.5 and 6 ft (0.5-1.8 m) from the edge of the curb, shoulder, or pavement
 - E. With the face of the push button parallel to the crosswalk to be used

- F. At a mounting height of approximately 3.5 ft (1.1 m), but no more than 4 ft (1.2 m), above the sidewalk

Where there are physical constraints that make it impractical to place the pedestrian push button between 1.5 and 6 ft (0.5 and 1.8 m) from the edge of the curb, shoulder, or pavement, it should not be farther than 10 ft (3 m) from the edge of curb, shoulder, or pavement.

Exhibits 3.22 and 3.23 show location examples with notes from *Accessible Pedestrian Signals: a Guide to Best Practices*.

Signage and Other Communication Aids

Signage is an essential aid for all pedestrians, including older adults and people with disabilities. Signage identifies nearby services, warns of possible hazards, and directs people to their destinations. Signs should be readily observable, with clear and precise information.

To provide accessibility in signage, planners and designers need to understand which signage components are important for those requiring

accessibility. Street identification, bus route identification, and informational and warning signs provide basic information that pedestrians with visual impairments rely on to guide their mobility.

STREET IDENTIFICATION SIGNAGE

Street identification signage is primarily provided for motorists, and usability by pedestrians is often an afterthought. As a result, the location for many street signs precludes the addition of accessible signage. Also, the lack of consistent locations for sign posts and other elements makes the installation of tactile signage less effective because individuals with visual impairments would not necessarily know where (or even if) those elements are present.

Where an APS is provided, visual and tactile street identification shall be provided above the push button. For additional information, refer to PROWAG, MUTCD, and the Special Report: Accessible Public Rights-of-Way Planning and Design for Alterations. (Exhibit 3.24 shows a page from the Special Report.)

BUS ROUTE IDENTIFICATION

Where bus route identification signs are

provided in the public right-of-way on or adjacent to a public sidewalk, visual characters, tactile characters and Braille signs providing the route number and route name should be provided and are required when a bus route identification sign is located at the bus shelter. If a variable message sign is used at a bus stop or shelter, an audible equivalent should be provided. Spider maps in bus stations that show bus routes are very helpful and can be provided.

Bus stops and shelters are covered as transportation facilities in accessibility guidelines adopted by The United States Department of Transportation (USDOT) as part of the Title II regulation (49CFR Parts 27, 37 and 38). Bus route identification signs must comply with specifications for visual characters. The USDOT's ADA regulations do not require tactile signs at bus stops and shelters, but do require that bus stop locations be audibly and visibly announced on the vehicle.

INFORMATIONAL AND WARNING SIGNS

It is important to provide informational and warning signs in the public right-of-way in an accessible format. However, there are very few recognized standards that address providing

EXHIBIT 3.24 This excerpt from the Special Report: Accessible Public Rights-of-Way Planning and Design for Alterations, shows a design solution example of a ramp and pedestrian button locations. (Accessible Public Rights-of-Way Advisory Committee)

4

Special Report: Accessible Public Rights-of-Way—Planning and Designing for Alterations

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DESIGN SOLUTIONS

CONSTRAINT—LIMITED RIGHT-OF-WAY

Lower Sidewalk to Street Surface (Blended Transition)

Problem Statement

Not enough room for landing and curb ramp.

Problem and Design Solution Discussion

Existing street improvements, including vehicle lanes and sidewalks, consume the entire right-of-way. Often there is insufficient space for the installation of an accessible curb ramp and landing at a street intersection that will meet new construction standards. Another potential solution is to lower the sidewalk grade at the intersection to make the sidewalk elevation flush with the street elevation, thus eliminating the spatial needs for curb ramps. Detectable warning surfaces provide a critical message to blind travelers where the sidewalk is flush with the street.

Application Considerations

- Potentially increases construction costs.
- May require street drainage changes/additions.
- Continuous detectable warnings are required to delineate pedestrian area from the street area.
- Placement of APS close to buildings and other hard vertical surfaces creates directional sound interpretation issues for blind pedestrians and should be avoided.
- If provided, bollards should have high visual contrast to background (dark/light or light/dark).

Design Solution 1.05

Related Design Standards

- MUTCD
- Local Codes and Standards

Related Design Guidelines

- AASHTO
- PROWAG

information readily accessible to individuals who are blind or have low vision. Signs at construction barriers are of particular concern. Additional discussion about signage for construction activities is provided in Toolbox Section 11—Safety in Work Zones and Maintenance.

TACTILE INFORMATION AND SIGN MOUNTING LOCATIONS

Per PROWAG R409.4.1, tactile characters on signs shall be located 4 ft (1.2 m) above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 5 ft (1.5 m) maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.

Bus shelter signs should be mounted on the shelter wall closest to the front of the bus, as close to the street as possible, at 5 ft (1.5 m) above the adjacent clear landing. Bus stop signage where no shelter is present shall be mounted on the pole at 5 ft (1.5 m) above adjacent grade.

VARIABLE MESSAGE SIGNS

Variable message signs presented using LED, LCD, flip-dot or other means should be legible

from the same distance as conventional print signs. Character height for variable message signs should be about 35 percent greater than character height for conventional print signs in order to have equal legibility at the same distance.

AUDIBLE SIGNS

Audible signs are required when visual equivalent signs are provided at the same location. PROWAG extensively discusses standards for frequency, power, range, and other technical requirements for Remote Infrared Audible Sign (RIAS) receivers. Transit stations and platforms are routinely used by persons who are blind or have low vision. Tactile signs do not necessarily help blind people locate station entrances and exits, fare gates, fare machines, stairs and escalators, platforms, and other amenities, because they cannot be located consistently enough for persons who are blind or have low vision to find them efficiently. RIAS receivers are suggested as a wayfinding system because they enable individuals to scan the environment (using a personal receiver) and “read messages” from a distance. They provide directional and informational messages in a way that enables persons who are blind or have low

vision to travel as independently as persons who can read print signs.

Accessibility Across Driveways

As a general rule, it is best to minimize the number of driveways a pedestrian must cross. Where a driveway crosses a sidewalk, the driveway must conform in width, cross slope and grade to the design requirements for sidewalks in order to maintain accessibility for pedestrians with disabilities. Unramped curb returns are not permitted. Wheelchairs, strollers, and those who use walkers need a relatively flat surface to travel. Side flares and cross slopes at driveway aprons may cause a drive wheel, caster, or leg tip to lose contact with the surface.

The basic approaches to designing driveway cuts that fulfill accessibility needs are illustrated in Exhibits 3.27 through 3.30. Exhibit 3.26 shows the older type of driveway design that is not ADA-compliant. The important common element of these solutions is that they provide a continuous, level accessible route that is a minimum of 4 ft (1.2 m) in width [5 ft (1.5 m) is desirable] with a cross slope not exceeding 2 percent. Again, keep in mind that this is the

minimum width of the clear travel way and not the recommended width of the sidewalk. The full width of the sidewalk will generally be wider. Refer to Toolbox Section 4—Sidewalks and Walkways for sidewalk width recommendations.

Where a parking garage exit crosses a sidewalk, exiting drivers should be reminded that they

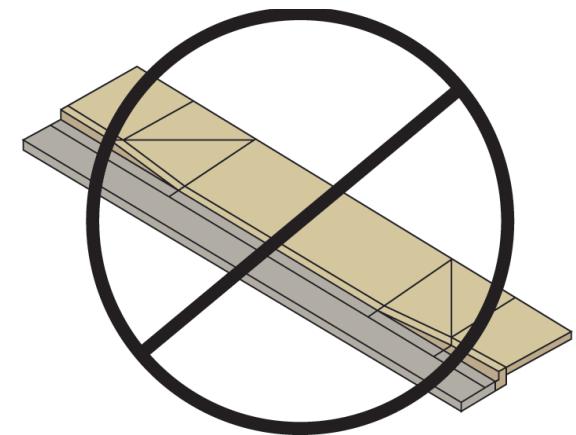
need to yield to pedestrians. This can be accomplished with Stop or Yield signs and can be supplemented with mirrors, displays, audible signals, and/or flashing lights. Such signs and signals should be directed to the drivers, not the pedestrians. Sufficient sight distance for drivers to see pedestrians at such locations is needed.

EXHIBIT 3.25 An existing driveway apron has been reconstructed to provide a level pedestrian route across it.



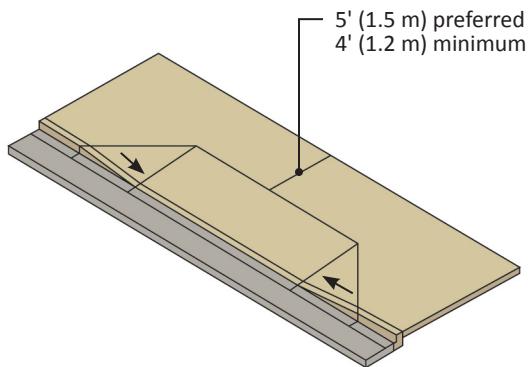
EXHIBIT 3.26 Past Driveway Design Example

NOT ACCEPTABLE



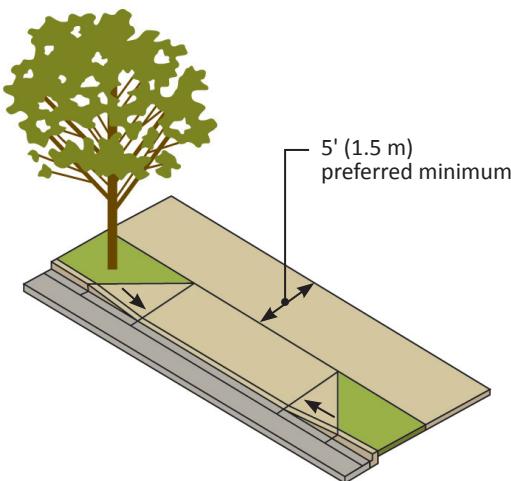
Driveway aprons, traditionally designed like the example above, are difficult to maneuver across due to excessive cross slopes.

EXHIBIT 3.27 Driveway with Wide Sidewalks



Wide sidewalks allow a 5-foot-wide preferred and 4-foot-wide minimum path of travel behind the driveway cut.

EXHIBIT 3.30 Driveway with Planting Strips



Planting strips allow the sidewalk to remain level and in a continuous direction.

EXHIBIT 3.28 Driveway with Sidewalk Behind

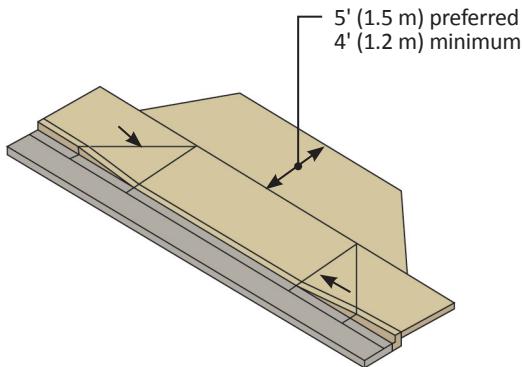
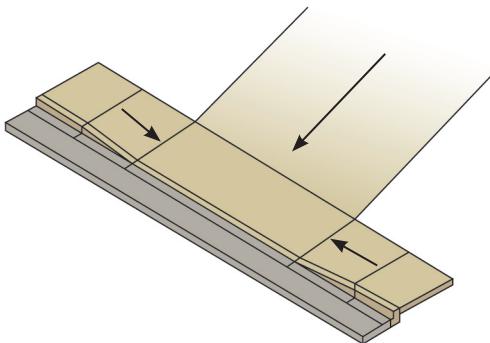


EXHIBIT 3.30 Driveway with Dipped Sidewalk

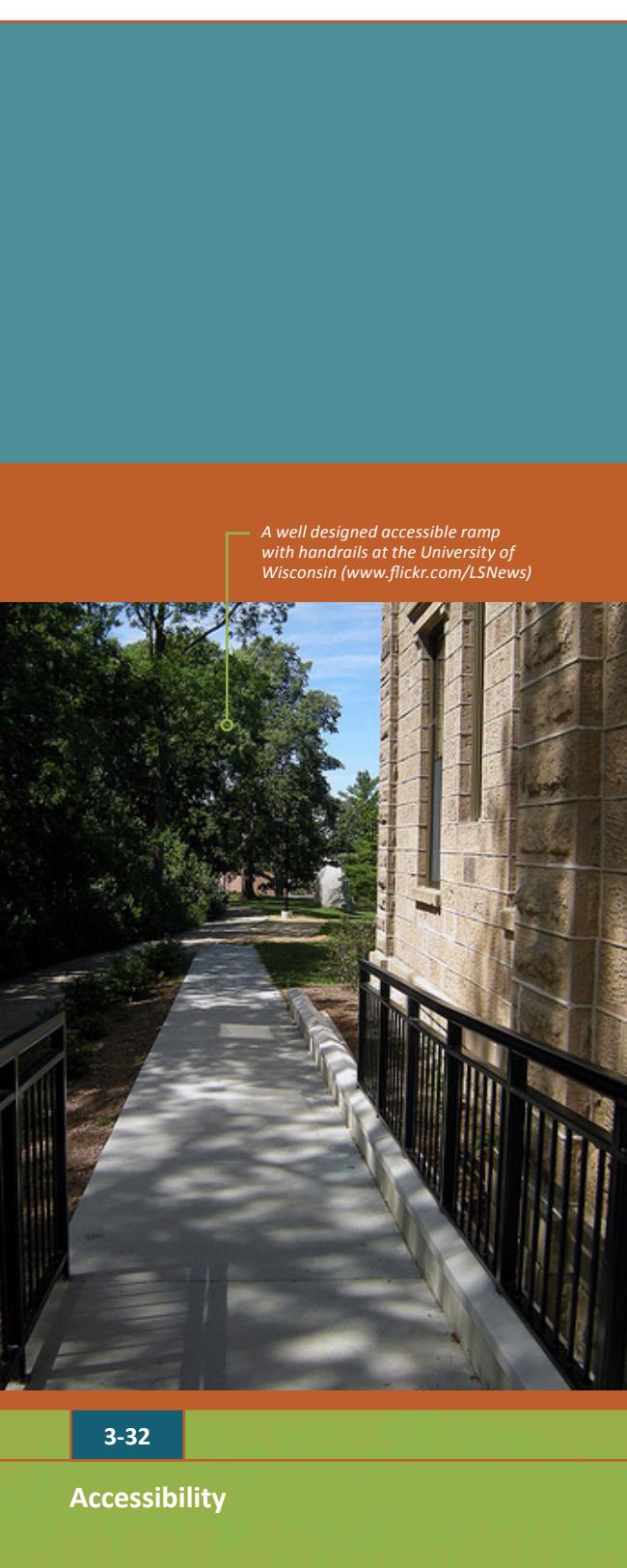


Site Pedestrian Facilities

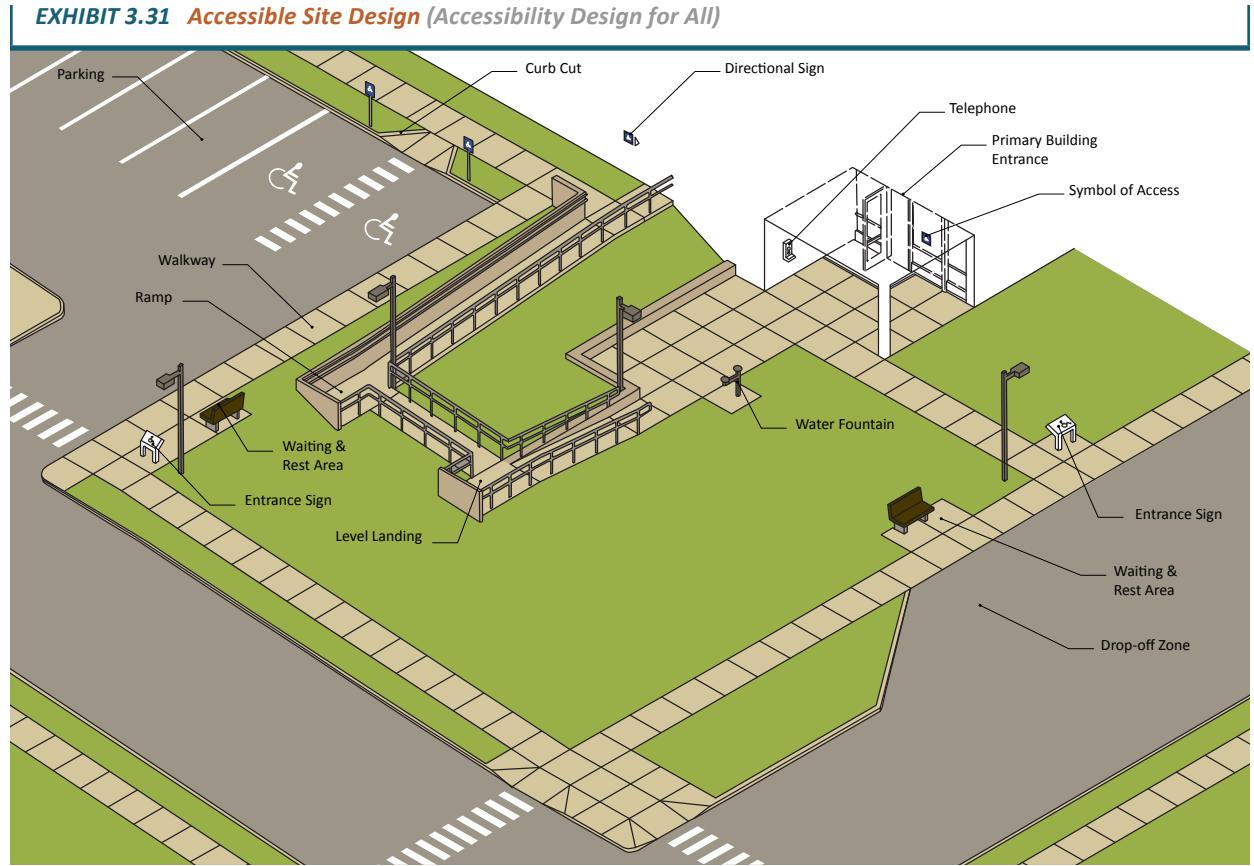
Following are some additional accessibility requirements and guidelines that apply to sites outside of public rights-of-way. This toolbox section highlights some important guidance, but site designers and architects also should refer to ADAAG and the International Building Code (IBC) for more detailed guidance, as well as other guidance related to site design.

Accessible Routes of Travel

Accessible routes of travel are called Accessible Routes (AR) for site development and are defined by ADAAG. ADAAG requires that every site have at least one AR that provides a connection between exterior accessible site elements (parking, waiting and drop-off zones, sidewalks and walkways, bus stops, etc.) and an accessible building entrance. In a park or open space, public facilities and points of interest should be connected by an accessible route. Refer to earlier discussion in this section pertaining to grade requirements for access routes. Exhibit 3.31 illustrates a site with alternative routes of travel connecting the building entrance.



A well designed accessible ramp with handrails at the University of Wisconsin (www.flickr.com/LSNews)



Site Connections

The route between accessible parking spaces and the building entrance must be carefully planned to minimize the travel distance for a disabled person and to avoid obstacles and hazards. The maximum distance should be no greater than 100 ft (30.5 m).

Ramps

Providing accessibility along walkways and across sites with significant changes in elevation is sometimes challenging. A ramp is defined as any part of the AR that exceeds a 1:20 grade. Ramps allow accessibility where grades exceed 1:20 or 5 percent.

In general, ramp design shall incorporate the following:

- Maximum running/longitudinal grade of 1:12 or 8.33 percent
- Minimum width of 3 ft (91.0 cm) [5 ft (1.5 m) desirable] for exterior ramps, with a minimum clear space of 3 ft (91.0 cm) between handrails (minimum width of 4 to 5 ft (1.2 to 1.5 m) is desirable where feasible)
- Level landings at the top and bottom of the ramp and at changes in direction
- Intermediate landings for every 30 in (76. cm) of vertical elevation change; every 30 ft (9.0 m) of an 8.33 percent run (see Exhibit 3.33)
- Handrails for walkways and pathways steeper than 1:20
- Maximum cross slope of 2 percent and sufficient to provide positive drainage
- Edge protection on each side of ramp runs and at each side of ramp landings

LANDINGS ON RAMPS

- Where a ramp changes direction, landings

shall be 5 ft (1.5 m) wide by 5 ft (1.5 m) long minimum. For this reason, a constant ramp width of minimum 5 ft (1.5 m) would be easier to construct.

- In some cases it may be more practical to design a pathway at a lower gradient to minimize the number of landings required.

EXCEPTIONS TO MAXIMUM GRADES OF RAMPS

- A slope not greater than 1:10 (10 percent) is allowed for a maximum rise of 6 in (150 mm).
- A slope not greater than 1:8 (12.5 percent) is allowed for a maximum rise of 3 in (80 mm).
- Keep in mind that grades steeper than 1:8 (12.5 percent) are difficult to maneuver.

Handrails

Accessible routes (AR) having grades steeper than 1:20 (5 percent) must have handrails on both sides. Handrails shall extend horizontally at least 12 in (305 mm) beyond the top and bottom of any ramp run (see Exhibit 3.34). The top of the handrail is required to be 34 to 38 in (860 to 970 mm) above the grade of the walkway or ramp. An intermediate handrail may be mounted at a height of 16 to 18 in (410 to

EXHIBIT 3.32 Summary of Requirements for Access Routes

Eliminate obstacles within the access route.

3 ft (91 cm) clear width absolute minimum

5 ft (1.5 m) wide passing areas every 200 ft (60 m) on accessible routes less than 5 ft (1.5 m) in width.

Maximum 1:20 (5%) grade is desirable, steeper grades up to 1:12 (8.33%) can be used for ramps.

Level landing areas, 5 ft (1.5 m) in length, for every 2.5 ft (760 mm) of elevation change along 1:12 (8.33%) grade (ramps).

EXHIBIT 3.33 Accessible Ramp Pathway with Landings (Oregon Bicycle and Pedestrian Plan)

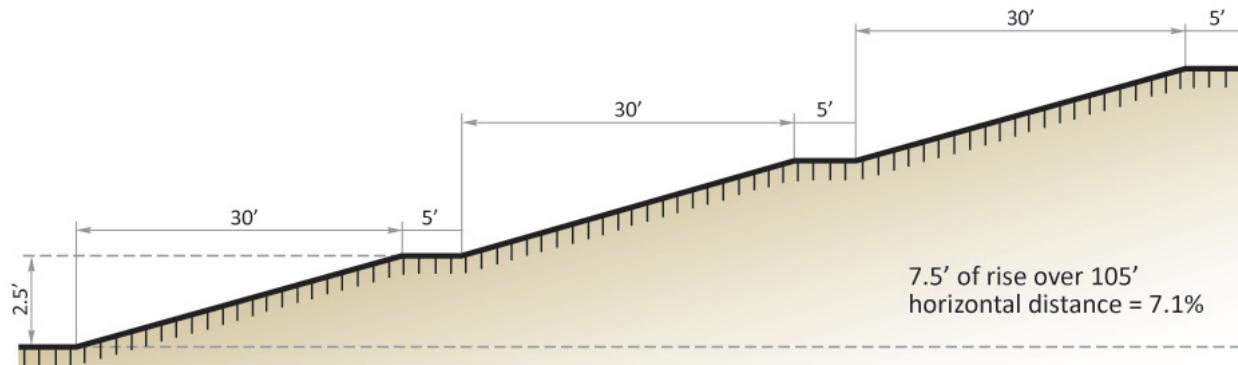
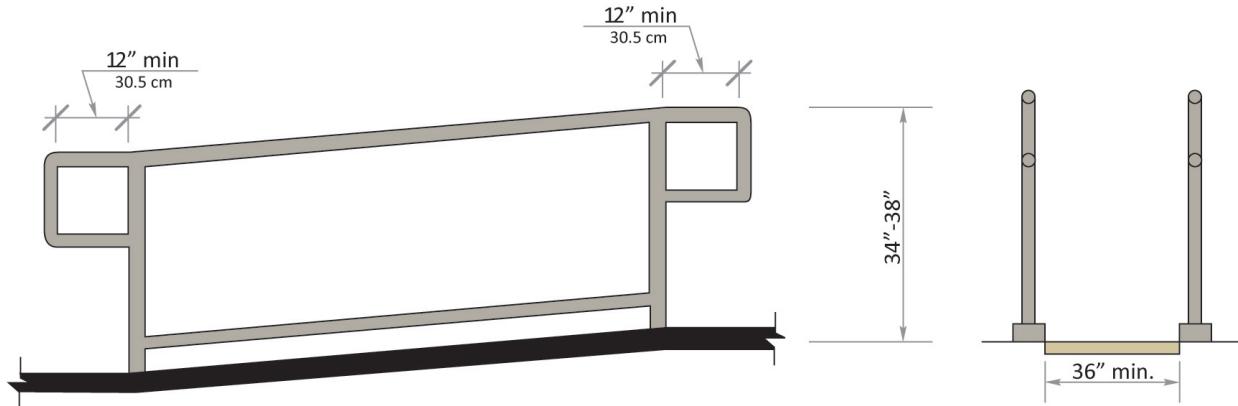


EXHIBIT 3.34 Handrail Detail (ADAAG)



460 mm) or a handrail with vertical rail members spaced not more than 4 in (100 mm) apart to aid those in wheelchairs.

Handrails are required to be continuous unless there is a point of access along the ramp that requires a break in the handrail.

Handrails should be continuous through the landings for the entire length of the ramp system.

Handrails are not required for sidewalk curb ramps, and are generally not recommended alongside multi-use pathways since they could become a hazard to bicyclists (unless pathway is specifically designated as an accessible route of travel).

Lighting

Lighting is required along exterior accessible routes of travel any time the buildings on site are occupied. A minimum intensity of 1 foot-candle is required on the surface of the route.

Recreational Facilities

Recreational facilities and trails should provide accessible experiences as well. The US Access

Board is developing the Accessibility Guidelines for Outdoor Developed Areas (ODAAG) that will clarify how, and to what extent, access can be achieved. The guidelines will cover new or altered trails, beaches, and picnic and camping areas. Under this rulemaking, the Board is first developing guidelines for outdoor developed areas managed by the Federal government.

Guidelines for non-Federal sites will be developed separately under a subsequent rulemaking. On June 20, 2007, the Board released proposed guidelines for recreation facilities managed by the Federal government. Proposed guidelines for non-Federal sites will be published for comment at a future date.

If exceptions outlined in ODAAG 1019 do not allow for the trail to serve as an accessible route of travel, alternate connections can be created that provide a similar recreation experience. If this is not technically feasible, alternate program access can provide a similar experience for disabled pedestrians. For example, an accessible location featuring interpretive descriptions of the trail experience, such as noting viewpoints, with panels that show the view and describe the significance of the trail features.

Other Resources

Refer to the following sources of information for additional guidance.

- American Association of State Highway and Transportation Officials (AASHTO). *Guide for the Planning, Design and Operation of Pedestrian Facilities*. 2004.
- Federal Highway Administration. Kirschbaum, J.B., Axelson, P.W., Longmuir, P.E., Mispagel, K.M., Stein, J.A., and Yamada, D.A. *Designing Sidewalks and Trails for Access, Parts I and II*. 1999. Chapter 7 covers curb ramps. <http://www.fhwa.dot.gov/environment/sidewalk2/index.htm> (May 2013).
- Federal Highway Administration. Resource Library. <http://www.fhwa.dot.gov/accessibility/index.cfm> (May 2013).
- Institute of Transportation Engineers. *Promoting Sustainable Transportation through Site Design: An ITE Recommended Practice*. 2010.
- Public Rights-of-Way Access Advisory Committee (PROWAAC) to the US Access Board. Special Report: Accessible Public
- US Access Board. *ADA Accessibility Guidelines for Buildings and Facilities (ADAAG)*. <http://www.access-board.gov/adaag/html/adaag.htm> (May 2013).
- US Access Board. Common Problems Arising in the Installation of Accessible Pedestrian Signals. <http://www.access-board.gov/research/pedestrian-signals/bulletin.htm> (May 2013).
- US Access Board *Public Rights-of-Way Accessibility Guidelines (PROWAG)*. Draft-rulemaking in process. <http://www.access-board.gov/prowac/> (May 2013).
- US Access Board. Sidewalk videos. <http://www.access-board.gov/news/sidewalk-videos.htm> (May 2013).
- US Architectural and Transportation Barriers Compliance Board: *Accessible Rights-of-Way: A Design Guide*. 1999.

Rights-of-Way Planning and Design for Alterations. <http://www.access-board.gov/prowac/alterations/guide.htm> (May 2013).



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