CHAPTER 11
SPECIAL DESIGNS

CHAPTER 11
SPECIAL DESIGNS

11-1 INTRODUCTION

Design elements which have special significance in the design process, but may not be applicable to every project, are presented in this chapter of the Road Design Manual. The importance of these design elements should be integrated into the design process so that they become an automatic part of the project development.

Measurements are presented in this chapter in both U.S. customary units and metric and were developed independently within each system. The relationship between the U.S. customary and metric values is neither an exact (soft) conversion nor a completely rationalized (hard) conversion. The U.S. customary values are those that would have been used had the requirements been presented exclusively in U.S. customary units. The metric values are those that would have been used had the requirements been presented exclusively in metric units; Therefore, the user is advised to work entirely in one system and not attempt to convert directly between the two.

THIS PAGE LEFT INTENTIONALLY BLANK

11-3.0 PEDESTRIAN FACILITIES

11-3.01 General

Pedestrian travel includes walking with or without a mobility device. While there are many common characteristics of pedestrian travel, there is not a typical pedestrian. Designers must develop pedestrian facilities for people who use walkers, wheelchairs, or push strollers and must address pedestrian needs and safety as part of a total design solution. Pedestrians include people of all types and abilities: they are children, the elderly, those using mobility devices, and people pushing strollers, and each may travel at different speeds.

11-3.02 Accessibility Requirements

MnDOT's guidance on pedestrian transportation is to develop a system that serves and contributes to a multimodal network, including pedestrian travel. Designers must identify pedestrian accommodations during the earliest scoping phase of projects unless pedestrian access is prohibited by law, excessively and disproportionately costly, or there is a documented absence of need.

Pedestrian facilities on public rights-of-way are required to be accessible to people with disabilities through the following federal statutes:

- Section 504 of the Rehabilitation Act of 1973 (Section 504) (29 U.S.C. §794), and
- Title II of the Americans with Disabilities Act of 1990 (ADA) (42 U.S.C. 59 12131-12164)

Title II of the ADA governs all state and local governments and their agencies and facilities, regardless of the funding source. All pedestrian facilities within the public right-of-way, designed, constructed, and/or altered on behalf of or for the use of a public entity must be readily accessible to and usable by persons with disabilities.

New Construction or Reconstruction Project Scope

All accessible features are required to meet the design requirements in *Public Rights-of-Way Accessibility Guidance* (PROWAG), as modified and adapted by MnDOT.

Preservation Project Scope

All preservation projects must include curb ramps where they are required and do not currently exist and must bring existing curb ramps within the radius into compliance for detectable warnings, cross slope, landings, and running slope to the maximum extent feasible without regard to cost.

If the project includes signal replacement and the location is eligible for Accessible Pedestrian Signals (APS), the signals must be included at that time.

Alterations must not decrease or have the effect of decreasing the accessibility of a facility or an accessible connection to an adjacent building or site below the requirements for new construction in effect at the time of the alteration.

Designers must use PROWAG, as modified and adapted by MnDOT, to meet accessibility requirements in the pedestrian environment within public rights-of-way. PROWAG identifies minimum design and operational requirements for accessibility; however, project context often calls for higher levels of pedestrian accommodation to serve safety and mobility needs and provide facilities with a cost-effective lifecycle.

11-3.03 Thresholds for Pedestrian Facilities

Use the following list, based on the AASHTO *Guide for the Planning, Design, and Operation of Pedestrian Facilities*, to identify the purpose and need for pedestrian facilities. The type of facility depends on the project context and location.

1. There is evidence of pedestrian activity, such as visibly worn paths or pedestrian volume counts;
2. The highway is a main street;
3. There is a history of pedestrian-related crashes;
4. Roadway improvements will create a safety impediment to existing or anticipated pedestrian travel (e.g. adding lanes so that the improvement itself acts as a deterrent to pedestrian traffic);
5. Local or regional transportation plans identify proposed pedestrian facilities;
6. A regional/Metropolitan Planning Organization transportation study indicates the need for pedestrian facilities;
7. There is existing development that may attract pedestrian travel along a route;
8. There is proposed development that may attract pedestrian travel along a route within five years of project completion, either as documented in a local plan or anticipated based on similar development history;
9. The roadway provides primary or connecting access to areas and facilities such as schools, parks, recreation areas and sports arenas, shopping areas, medical facilities or nursing homes, elderly housing and senior centers, day care centers, residential development, local businesses and industry that result in pedestrian concentrations, all public buildings, transit stations/park and rides, along transit routes and at major bus stops, churches, social services, or another significant destination, wide or complex intersections, or across a natural or constructed barrier;
10. There are gaps in the pedestrian network;
11. There is one or more points where pedestrians must travel more than 400-600 ft (120-180 m) to an intersection or crossing point;
12. Increased pedestrian use may occur when pedestrian improvements are installed; and/or
13. The neighborhood has identified priorities or documented citizen requests for walkways.

Check MnDOT's ADA Transition Plan and identify improvements listed in the Transition Plan that should be incorporated into the project. Include any identified improvements in the project. Improvements identified in the Transition Plan are required under Title II of the Americans with Disabilities Act (ADA) and where there is an ADA complaint.

11-3.04 Pedestrian Facility Definitions

ABA. An acronym for the Architectural Barriers Act.

ADA. An acronym for the Americans with Disabilities Act.

ADA Transition Plan. MnDOT's transportation system plan that identifies accessibility needs, the process to fully integrate accessibility improvements into the Statewide Transportation Improvement Program (STIP), and ensures all transportation facilities, services, programs, and activities are accessible to all individuals.

APS. See Accessible Pedestrian Signal.

Accessible Pedestrian Signal. A device that communicates information about the WALK phase in audible and vibrotactile formats. Also known as APS.

Alteration. A change to a facility in the public right-of-way that affects or could affect access, circulation, or use. An alteration must not decrease or have the effect of decreasing the accessibility of a facility or an accessible connection to an adjacent building or site.

Americans with Disabilities Act. Also known as ADA.

Architectural Barriers Act. Also known as ABA.

Blended Transition. A type of curb ramp with a running grade of 5% or less between the level of the pedestrian walkway and the level of the crosswalk.

Buffer Zone. The distance between the pedestrian access route and the curb zone at the adjacent roadway. The zone buffers pedestrians from traffic and provides space for snow storage; utilities; street furniture; trees and grass; and other walkway amenities. The buffer zone may be paved or planted.

Cross Slope. The grade that is perpendicular to the direction of accessible pedestrian travel. On a walkway, shoulder, or blended transition, it is measured perpendicular to the curb line or edge of the street or highway; on a curb ramp, it is measured perpendicular to the running grade.

Crosswalk. The portion of a roadway ordinarily included with the prolongation or connection of the lateral lines of walkways at intersections; any portion of a roadway distinctly indicated for pedestrian crossing by lines or other markings on the surface (Mn Statute 169.011, Subd. 20). Assume crosswalks exist at all corners and intersections, whether marked or unmarked, unless expressly prohibited.

Curb Extension. An extension of the walkway or curb line into the roadway, which reduces the effective street width; are used at intersections and midblock crossings, improve pedestrian crossings by reducing the pedestrian crossing distance, visually and physically narrow the roadway, improve the ability of pedestrians and motorists to see each other, and reduce the time that pedestrians are in the street. Also known as curb bulb-outs or neckdowns.

Curb Ramp. A ramp that cuts through or is built up to the curb and provides access between the walkway and roadway for people using wheelchairs, strollers, walkers, crutches, bicycles, and for pedestrians with mobility impairments who have trouble stepping up and down high curbs.

Curb Zone. An integral part of the drainage system adjacent to the roadway that prevents excess water from collecting in the walkway corridor; discourages motor vehicles from driving onto a walkway; and cues vision-impaired people to identify the border between the pedestrian access route or pedestrian circulation route and the roadway. Typically 6 in. (150 mm) wide.

Cut-Through. A design treatment that aids pedestrian passage through a traffic barrier such as a median, crossing island, or channelized turn lane island.

Detectable Warning. A surface feature of truncated domes, built in or applied to the walking surface to indicate an upcoming change from pedestrian to vehicular way.

Frontage Zone. The walkway area between the pedestrian access route and the property line that allows pedestrians to avoid walking close to barriers at the property line, such as buildings, storefronts, walls, or fences.

Grade Break. The meeting line of two adjacent surface planes of different grades.

Landing. A level area of walkway at the top or bottom of a ramp that allows wheelchair users space to orient their direction before and after using a ramp.

Maximum Extent Feasible. A public agency is exempt from fully meeting the Americans with Disabilities Act (ADA) standard only in the rare instance where physical terrain or site conditions restrict construction or altering the facility to the required standard. In such circumstances, an alteration must provide pedestrian facilities and features to the maximum physical accessibility feasible. Any altered features of the facility that can be made accessible shall be made accessible. Designers must document any instances of non-ADA compliance.

Median. The area between two divided roadways measured from edge of traveled way to edge of traveled way. The median excludes turn lanes. The median width might be different between intersections, interchanges, and at opposite approaches of the same intersection. If used as a refuge space for pedestrian crossing it must include a pedestrian signal. Also see Chapter 4-5.

MUTCD. An acronym for the Manual on Uniform Traffic Control Devices.

Pedestrian. Any person afoot or in a wheelchair (Minnesota Statutes 169.01 Subd. 24). A person afoot, in a wheelchair, on skates, or on a skateboard (MUTCD).

Pedestrian Access Route. Also known as PAR. A continuous and unobstructed walkway within a pedestrian circulation route that is specifically designed for ADA-accessible pedestrian travel.

Pedestrian Circulation Route. A way of passage provided for pedestrian travel; includes the pedestrian access route and frontage zone width.

Pedestrian Facility. Any form of built structure or surface improvement located on the public right-of-way. These include, but are not limited to signals, walkway surfacing, lighting fixtures, and bus stops. All pedestrian facilities must meet accessibility requirements.

Pedestrian Refuge. A raised or leveled space separating the two main directions of traffic movement where pedestrians can wait in the middle, crossing just one direction of traffic at a time. Refuges may include medians, crossing islands, and channelized turn lane islands and must be accessible to people using wheelchairs and those who are vision-impaired.

Planting Strip. An area located within the buffer zone, and if wide enough can include vegetation, such as grass, shrubs, trees, etc.

PROWAG. An acronym for the *Guidelines for Accessible Public Rights-of-Way* issued in 2005 by the U. S. Access Board. This guidance addresses roadway design practices, slope, and terrain related to pedestrian access to walkways and streets, including crosswalks, curb ramps, street furnishings, pedestrian signals, parking, and other components of public rights-of-way.

Running Grade. The grade that is parallel to the primary direction of travel, expressed as a ratio of rise to run or as a percent. Also known as the running slope.

Vibrotactile. A vibrating surface used in APS to communicate information by touch about pedestrian signal timing.

11-3.05 Walkways

Walkways include sidewalks and/or shared-use paths.

11-3.05.01 Sidewalks

Sidewalks are that portion of a street between the curb lines, or the lateral lines of a roadway, and the adjacent property lines that are intended for pedestrian use. Sidewalks are located along roadways and are most comfortable to users when separated by a buffer such as a planting strip, parking lane, bike lane, or vertically separated with an elevated curb. Sidewalks are typically a hard, smooth surface of concrete, though they can be of other materials. Minnesota Statute bans bicycle riding on sidewalks in business districts. Sidewalks must be accessible.

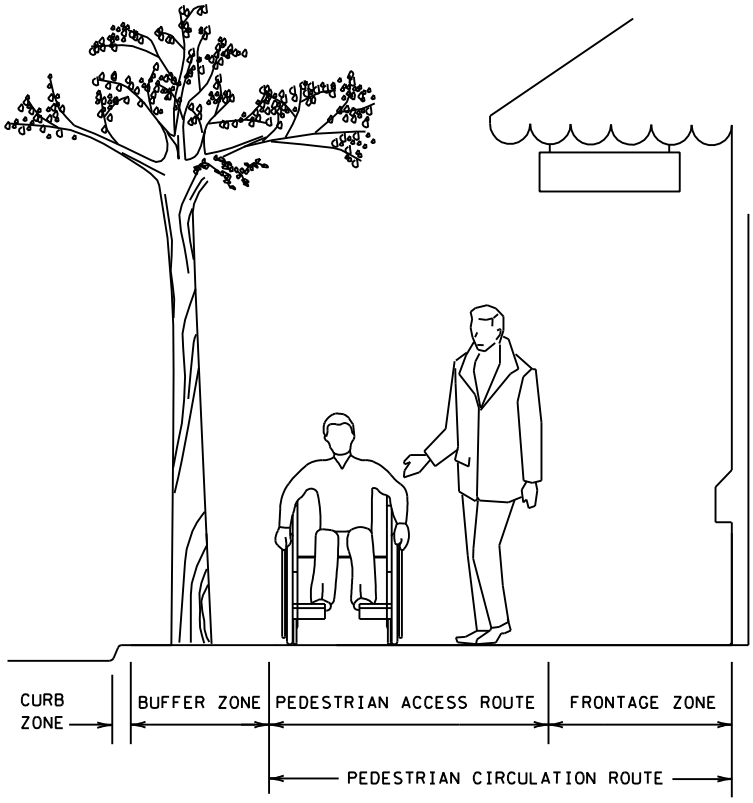
11-3.05.02 Shared-Use Paths

Shared-use paths are off-road facilities typically used by commuter and recreational pedestrians, cyclists, skaters, joggers, wheelchairs, and people pushing strollers. Paths may be paved with concrete or bituminous. Path use must be evaluated carefully to avoid and minimize mode conflicts and ensure safety for all users. For shared-use path design information, refer to the MnDOT Bikeway Facility Design Manual.

11-3.05.03 Pedestrian Access Route

A pedestrian access route is an accessible, continuous, and unobstructed portion of a walkway and must be integrated in all walkways, street crossings and crosswalks, overpasses and underpasses, courtyards, elevators, platform lifts, stairs, ramps, and landings. The pedestrian access route provides an accessible through route of passage and does not include the full width of the pedestrian circulation route. See Figure 11-3.05 (Walkway Zones).

Where a pedestrian access route turns, jogs, or changes direction, it must accommodate the continuous passage of a wheelchair. Additional maneuvering width or length may be needed at recesses and alcoves, doorways and entrances, and along curved or angled routes, particularly where running slopes exceed 5%.



WALKWAY ZONES
Figure 11-3.05

Street furniture, including, but not limited to, fixed or movable elements such as newspaper and sales racks, cafe seating and tables, bus shelters, vender carts, walkway sculptures, bicycle racks, telephones, call boxes, and toilets must not reduce the required width of the pedestrian access route. Vertical and overhanging restrictions apply to any protruding object across the entire width of the pedestrian circulation route. See 11-3.05.07 (Vertical and Horizontal Alignment), 11-3.06.01 (Protruding Objects), and Figure 11-3.05 (Walkway Zones) for additional information.

11-3.05.04 Buffer Zone

Pedestrians feel more comfortable with a separation from the roadway and from parked cars and other objects. Provide a buffer zone between the pedestrian circulation route and the curb zone where applicable. The buffer zone may be paved or planted and allows room for snow storage, plant root growth, and separates the pedestrian access route from vehicle access (i.e. car door swing). The desired clearance between the curb and a pedestrian is at least 3 ft (0.9 m), depending on any vegetation planted. Allow for this clearance when determining total walkway widths. See Figure 11-3.05 (Walkway Zones). Where there is limited room for the buffer zone, additional planning and coordination may be necessary to ensure the pedestrian access route remains accessible, continuous and unobstructed year round. For example, if inadequate snow storage space exists, snow may need to be hauled to an off-site storage location.

11-3.05.05 Frontage Zone

Note that attractive windows in shopping districts create momentary stopping for curious pedestrians. This is a desired element of a successful retail district street. Window shoppers take approximately 19-24 in. (480-610 mm) of space. The remaining walkway width will be constrained. This is often desirable on walkways not at capacity. However, if this stoppage forces pedestrians into the roadway, the walkway is too narrow. The recommended clearance in front of building faces with window front displays or for doors opening into the pedestrian circulation route is 3 ft (0.9 m). The clearance from a wall or fence is 1.5 ft (0.5 m); the clearance from a building face requires an additional 6 in. (150 mm) space.

11-3.05.06 Street Furniture

Street furniture intended for use by pedestrians and installed on or adjacent to a pedestrian circulation path must comply with the requirements for protruding objects in 11-3.06.01. This includes, but is not limited to drinking fountains, public telephones, public toilets, call boxes, tables, counters, newspaper racks, mailboxes, and benches. Each of these obstacles takes up a different amount of space in the walkway. Either place these items in the buffer zone, or create a separate storage area behind the walkway, in a corner, or a curb extension. Requirements include, but are not limited to vertical clearance, leading edge, clear floor space, approaches, knee and toe clearance, and slope. For street furniture requirements, refer to the ADA and ABA Accessibility Guidelines as well as the Minnesota State Building Code.

11-3.05.07 Vertical and Horizontal Alignment

Vertical alignment must be planar within curb ramp runs, blended transitions, landings, and gutter areas within the pedestrian access route, and within clear spaces required for accessible pedestrian signals, street furniture, and operable parts. Grade breaks must be flush.

Surface discontinuities increase rolling resistance and may subject wheelchair users and those using mobility devices to difficult and painful vibrations. Therefore, surface discontinuities must not exceed 0.5 in. (13 mm). Vertical discontinuities between 0.25 in. (6 mm) and 0.5 in. (13 mm) maximum must be beveled at 1:2 minimum across the entire level change. Discontinuities greater than 0.5 in. (13 mm) are not accessible.

Where the pedestrian access route crosses bridge seams or if any horizontal discontinuity is 0.5 in. (13 mm) or greater, provide a plate to cover the gap to achieve accessibility compliance.

11-3.05.08 Surfaces

Pavement surfaces must be firm, stable, and slip resistant. Surfaces with individual units laid out of plane and those that are heavily textured, rough, or chamfered, will greatly increase rolling resistance and will subject pedestrians who use wheelchairs, and rolling walkers to stressful and/or painful vibration. Therefore, when designing a decorative or textured pavement pattern, place the pavement pattern outside the pedestrian access route. Minimize surface discontinuities; when discontinuities on the pedestrian access route are unavoidable, they should be widely separated.

11-3.05.09 Side Slopes

Side slopes next to walkways should generally not be steeper than 1:3. If steeper than 1:3, provide a level area approximately 4 ft (1.2 m) wide minimum along the sides of a walkway. If a level area cannot be provided, install a physical barrier such as a safety railing, fence, or dense shrubbery. If installing a railing, place it a minimum of 10 in. (250 mm) from the edge of the walkway on a bridge and 20 in. (500 mm) on a shoulder from the walkway. The minimum safety railing height is 3.5 ft (1.1 m).

11-3.05.10 Walkway Placement

Project context and location determine the need for walkway placement. Placing walkways on both sides of a roadway is highly recommended to provide safe and convenient access to destinations, enhance overall pedestrian network connections, safety, and accessibility. Walkways placed on only one side of a roadway network weaken cohesion and requires pedestrians to make additional street crossings, exposing them to unnecessary conflicts with vehicular traffic.

When evaluating the need for a walkway, consider land uses and trip generators that the proposed facility will serve. Do not use volumes alone to determine the need for a walkway because lack of facilities, inaccessibility, or concern for personal safety may be the cause of low pedestrian activity. Avoid creating gaps in the pedestrian network. Abrupt breaks in the pedestrian network can create a potentially hazardous transportation environment.

When providing walkways, situate them separate from vehicular traffic. Provide walkways along streets within at least four blocks of schools, parks, shopping areas, and transit stops and along all streets in commercial areas or medium-to-high density residential zones. Coordinate walkway placement with local agencies (municipalities, cities, towns, etc.). See 11-3.03 for additional guidance.

11-3.06 Walkway Widths

The total width of a walkway is equal to the combined widths of the pedestrian access route, the buffer zone, and the frontage zone (see Figure 11-3.06A). The pedestrian circulation route includes the pedestrian access route and the frontage zone (see Figure 11-3.05); it does not include the buffer zone because obstructions in this area make it generally unusable to pedestrians.

The recommended minimum continuous and unobstructed pedestrian access route width is 5 ft (1.5 m). This is the width needed for two wheelchairs to pass or for a wheelchair to turn around, and allows two people to move continuously side by side and/or pass one another without conflict. In areas where space is extremely limited, a 4 ft (1.2 m) wide continuous and unobstructed pedestrian access route is acceptable for short distances only, and must include a 5 ft (1.5 m) wide section every 200 ft (61 m), for a minimum length of 5 ft (1.5 m).

Width calculations for buffer zones must consider adjacent roadway speeds and elements such as snow storage, trees and tree branches, and space for curb ramps and street fixtures. These elements must not obstruct the pedestrian access route. Objects or obstructions within the buffer zone and frontage zone create an avoidance distance where pedestrians shy away. Designers must add an avoidance distance to walkway width calculations.

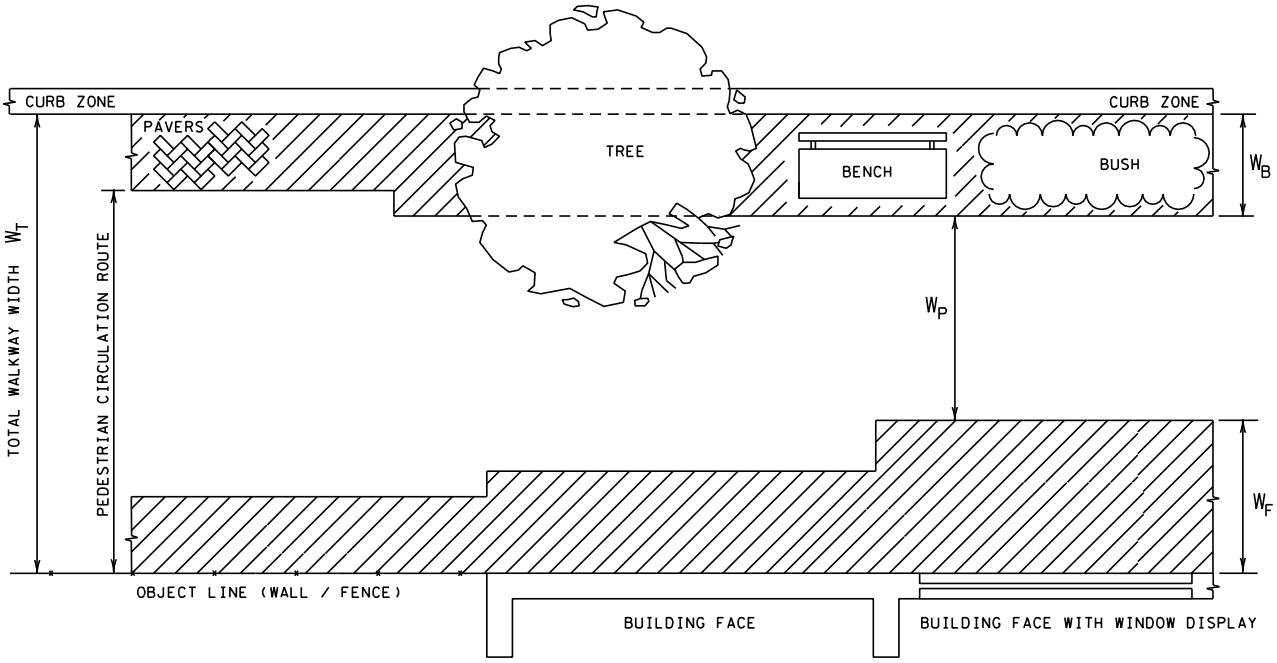
To compute walkway widths, use the following equation and Figure 11-3.06A:

$$W_P = W_T - (W_B + W_F)$$

where

W_P = Pedestrian Access Route
W_T = total walkway width
W_B = buffer zone obstructions and avoidance distances
W_F = frontage zone obstructions and avoidance distances

Elements adjacent to walkways can affect pedestrian safety and comfort as much as the design of the walkway itself. See 11-3.05.06 (Street Furniture) and 11-3.06.01 (Protruding Objects) for additional information.



TOTAL WALKWAY WIDTH

Figure 11-3.06A

Table 11-3.06 summarizes recommended walkway and buffer widths. Surrounding land uses affect pedestrian volumes and may require increases in pedestrian circulation route widths. In central business districts and around pedestrian generators such as schools and parks, consider a pedestrian circulation route of 8-12 ft (2.4-3.6 m). A buffer zone of 3 ft (0.9 m) will typically provide adequate space for snow storage and support a small ornamental size tree; mature shade trees require a buffer zone of at least 7 ft (2.1 m). In all cases, pedestrian circulation route widths described in the table must contain a continuous and unobstructed pedestrian access route regardless of frontage zone obstructions, street furniture, utilities, etc. Final walkway widths should be coordinated with local agencies (municipalities, cities, towns, etc.).

Functional Classification	Recommended Pedestrian Circulation Route Width	Recommended Buffer Width	Recommended Total Walkway Width (pedestrian circulation route + buffer width)
Principal arterials	6-8 ft (1.8-2.4 m)	3-6 ft (0.9- 1.8 m)	9-14 ft (2.7-4.3 m)
Minor arterials	6-8 ft (1.8- 2.4 m)	3-6 ft (0.9-1.8 m)	9-14 ft (2.7-4.3 m)
Collectors	5 ft (1.5 m)	3 ft (0.9 m)	8 ft (2.4 m)
Local roads and streets	5 ft (1.5 m)	3 ft (0.9 m)	8 ft (2.4 m)
Bridge crossing (any roadway)	Same width, or wider than clear width of approach walkway; 6 ft (1.8 m) min; wider if bicycles (also see LRFD)	3 ft (0.9 m) (also see LRFD)	Same width, or wider than clear width of approach walkway; 9 ft min. (2.7 m); wider if bicycles
Shared use path	5-14 ft (1.5-4.3 m) See MnDOT Bikeway Facility Design Manual	See MnDOT Bikeway Facility Design Manual and Chapter 12-3.05	

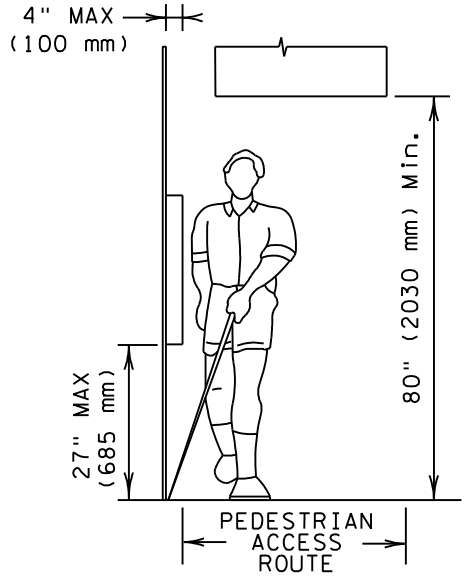
Note: When determining walkway widths, always consider the project context, not just available right-of-way.

RECOMMENDED UNOBSTRUCTED WALKWAY WIDTHS
Table 11-3.06

11-3.06.01 Protruding Objects

A person using a cane sweeps with the cane in a detectable range of 0-27 in. (0-685 mm) above the finished surface or ground. The detectable range allows the person sufficient time to detect elements or obstructions in the walkway before making body contact. Protruding objects must never reduce the minimum clear width of the pedestrian access route at any height. See Figures 11-03.06B, 11-03.06C, and 11-03.06D for protruding objects limits. For additional guidance, see the MN MUTCD and Minnesota State Building Code.

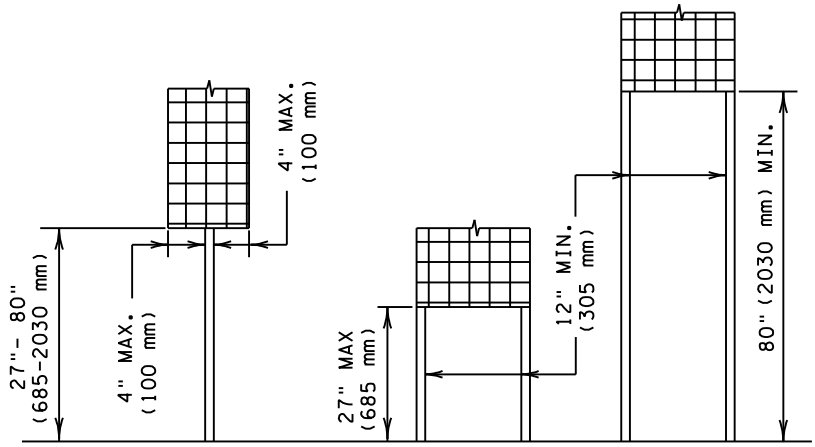
Note: For wall or post mounted objects, add an avoidance distance of 1.0-1.5 ft (0.3-0.5 m) to the pedestrian circulation route width.



LIMITS OF PROTRUDING OBJECTS
Figure 11-3.06B

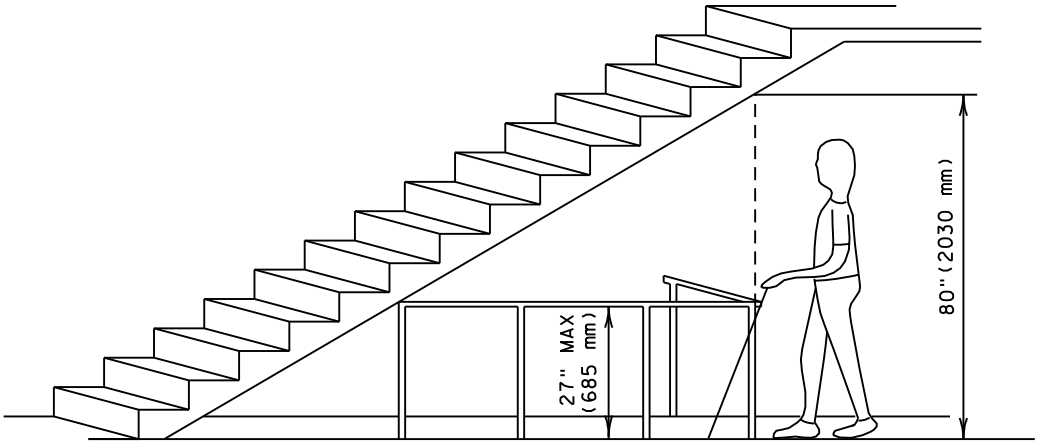
Objects with a leading edge located between 27 in. (685 mm) and 80 in. (2030 mm) above the finish surface or ground, such as banners, awnings, operable objects, and tree branches, can protrude up to 4 in. (100 mm) horizontally into the pedestrian circulation route. For example, awnings and their supporting structures must hang or project above the minimum required vertical clearance of 80 in. (2030 mm). Similarly, casement windows, when open, cannot encroach more than 4 in. (100 mm) into pedestrian circulation routes when they are at heights above 27 in. (685 mm).

Objects mounted on free-standing posts or pylons must never reduce the minimum clear width of the pedestrian access route at any height. Objects mounted on free-standing posts or pylons and mounted between 27 in. (685 mm) and 80 in. (2030 mm) above the finish surface or ground can protrude into the pedestrian circulation route up to 4 in. (100 mm) horizontally beyond the post or pylon base, when measured at 6 in. (150 mm) above the finish surface or ground. Where a sign or other obstruction is mounted between multiple posts or pylons and the clear distance between the posts or pylons is greater than 12 in. (305 mm), the lowest edge of the sign or obstruction must be no higher than 27 in. (685 mm) and no lower than 80 in. (2030 mm) above the finish surface. See Figure 11-3.06C for post-mounted protruding objects information. This excludes door closers, which are permitted to be 78 inches (1980 mm) minimum above the finish floor or ground.



POST- OR PYLON-MOUNTED PROTRUDING OBJECTS
Figure 11-3.06C

Provide railings or other barriers where the vertical clearance is less than 80 in. (2030 mm) high. The leading edge of the railing or barrier must be located no more than 27 in. (685 mm) above the finish surface or ground, see Figure 11-3.06D**.**



REDUCED VERTICAL CLEARANCE
Figure 11-3.06D

11-3.07 Grades and Cross Slopes

Steep walkway grades create problems for most pedestrians, especially under adverse weather conditions. To be accessible, walkways must be designed so that built tolerances do not exceed the maximum grades shown in Table 11-3.07. Where shared use paths and pedestrian trails cross highways or streets, the crossing must also meet the same requirements as street crossings, including detectable warnings. Where a pedestrian circulation path is in the shoulder, it must contain a pedestrian access route and must meet the same requirements as walkways.

Walkway Location and Function	Desirable Grade		Maximum Running Grade *	
	Running	Cross	Running*	Cross*
Walkway parallel with roadway (where roadway grade controls walkway grade)	≤ 5%	1.5%	May exceed 5%, but must be less than or equal to roadway grade	2%
Recreational trail that functions as a sidewalk	≤ 5%	1.5%	5% max.	2%
Crosswalk with stop control for a car	≤ 5% or max. extent feasible	1.5% or max. extent feasible	5% max.	2%
Crosswalk without stop control for a car	≤ 5% or max. extent feasible	1.5% or max. extent feasible	5% max.	5%
Shoulder serves as pedestrian access route	≤ 5%	1.5% unless on super elevation	Equal to roadway grade	2%
Walkway crossing a driveway	≤ 5%	1.5%	Equal to roadway grade	2%
Midblock crossing	NA	NA	5% for any distance	Warped to meet roadway grade

*****Note: The grades listed in these columns are maximum constructed grades. Designers must take construction tolerances into account to ensure finish surfaces do not exceed the maximum grade allowed. In cases where designs must exceed the maximum grade due to safety, topography or operations concerns, always design to the maximum extent feasible and document decisions in the project files.

WALKWAY RUNNING GRADES AND CROSS SLOPES
Table 11-3.07

11-3.08 Crossings

Pedestrians and vehicles use two types of intersections. They are: at grade and grade separated intersections.

11-3.08.01 At Grade Intersections

Most vehicular/pedestrian conflicts occur within at-grade intersections. Pedestrians are the most vulnerable user group at these intersections and their needs must be integrated equally with motorists. Intersections are usually the best and most direct place for pedestrians to cross a street yet, if intersection crossings are intimidating, few pedestrians will cross them. Proper intersection design reduces the potential for conflicts between motorized and non-motorized modes while providing adequate through movements and turning movements for vehicles. To limit pedestrian exposure to vehicles in intersections, design intersections as compactly as possible. Designers must accommodate traffic volumes and large turning vehicles while maintaining pedestrian safety and comfort. Designers should always consider tools to create the safest and shortest crossing for pedestrians, such as shared or continuous turn lanes, narrowed lanes, reduced curb radii, refuge islands, medians, curb extensions, pavement markings that reinforce the preferred pedestrian path, signal type and timing, as well as the frequency of large turning vehicles.

11-3.08.02 Types of At Grade Intersections

Pedestrians use three types of at grade pedestrian crossings. They are: controlled, uncontrolled, and mid-block.

Controlled intersections utilize traffic signals and/or stop or yield signs. A basic requirement for all controlled intersections with traffic signals is that pedestrians must be able to reach push buttons and perceive the control device soon enough to perform the action it indicates. Information on traffic signal warrants and traffic controls such as APS are found in the MN MUTCD, MnDOT Signal Design Manual, and MnDOT Traffic Signal Timing and Coordination Manual.

Uncontrolled intersections have no traffic signals or signs to control the flow of traffic. When one or more legs of an intersection is uncontrolled, pedestrian crossing movements become more complex. Uncontrolled intersection crossings may operate safely for all users when design considerations like street width, traffic volume, speed, and line-of-sight issues are taken into account.

Mid-block crossings provide pedestrians opportunities to cross safely where there is a long distance between intersections or where there is a generator that entices pedestrians to cross at a location other than a corner. Should a mid-block crosswalk be warranted, provide markings, signals, and/or warning devices to alert motorists.

11-3.08.03 Crossing Features

Crossing features include: crosswalks, curb ramps, and detectable warning surfaces.

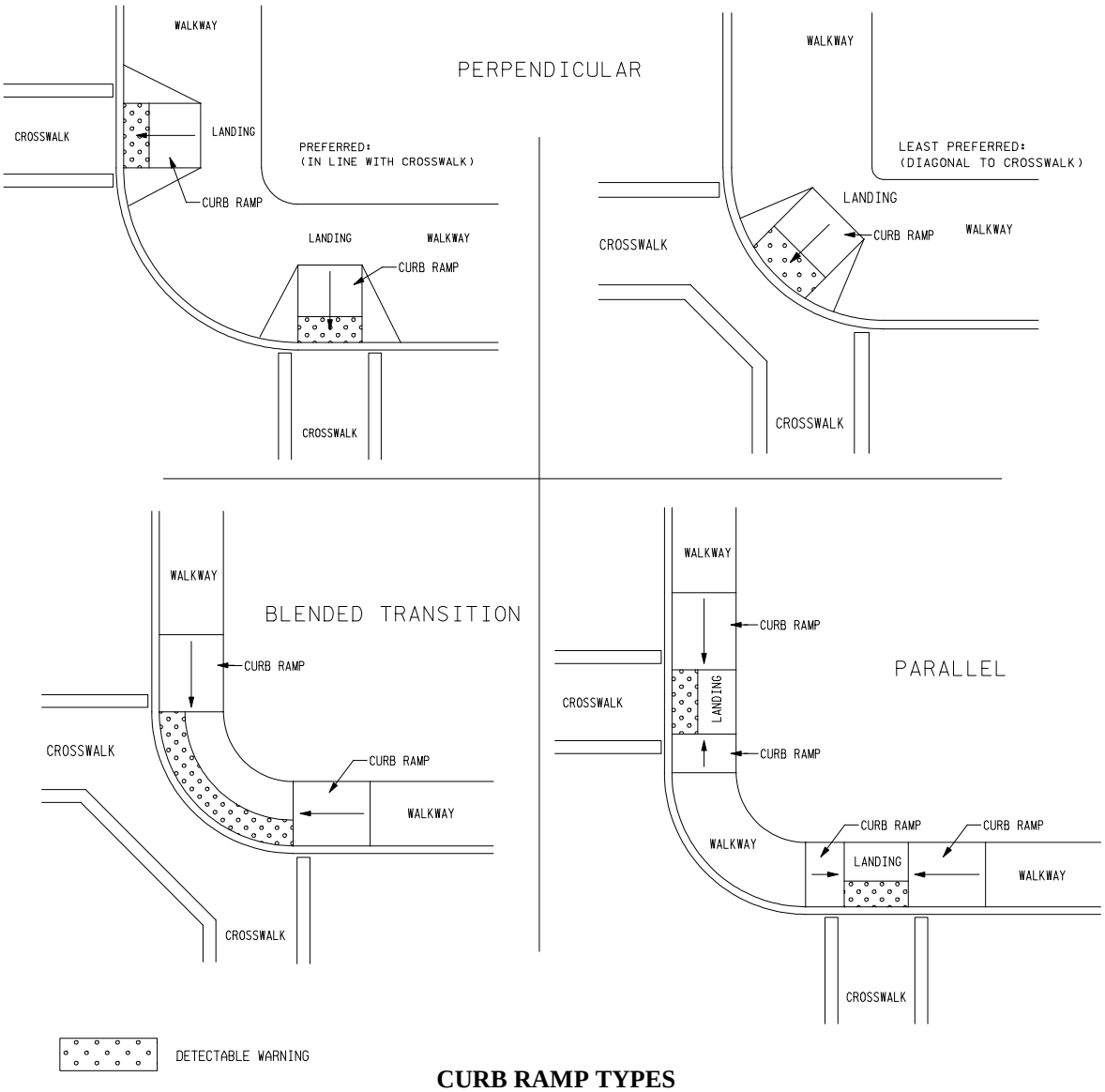
Crosswalks. Whether marked or unmarked, crosswalks exist at all corners and intersections. Crosswalks function as an extension of walkways and, unless restricted by signs for safety, must follow the most direct and convenient pedestrian path. Crosswalks may pass through a median or pedestrian refuge island. Marked crosswalks help direct pedestrians, including the sight-impaired, in the direction of crosswalks. Marked crosswalks must be 6 ft (1.8 m) wide minimum. For additional crosswalk design and cross slope information, consult the MN MUTCD and Table 11-3.07.

Curb Ramps. Curbs are barriers to pedestrians and impede or restrict mobility. Curb ramps permit people to cross streets without stepping up to or off curbs. Curb ramps provide accessibility between intersection corners and facilitate crossing for wheelchair users, people with vision impairments, people pushing strollers, bicyclists, and others. When properly located, perpendicular ramps can help direct pedestrians, including the sight-impaired, in the direction of crosswalks and pedestrian travel. Curb ramps installed at tangent points rather than on the corner radius provide more usable directional cues and create the shortest crossing point. All curb ramp surfaces must be smooth during the transition from the ramp to the gutter and roadway to prevent wheelchair users from becoming trapped, unbalanced, or unable to safely and efficiently maneuver through the pedestrian access route.

Curb Ramp Types. There are three curb ramp types: perpendicular; parallel; and blended transitions. Perpendicular ramps are generally preferred because they best guide pedestrians in the direction of travel. Parallel ramps are used where the available space between the curb and the property line is too tight to permit installing both a ramp and a landing. Blended transitions provide a connection where there is a narrow walkway at the back of curb. Blended transitions can be difficult for the vision-impaired to navigate into intersections and therefore function best when paired with APS. See Figure11-3.08A for curb ramp types.

Curb Ramp Orientation. Perpendicular ramps have a running grade that cuts through or is built up to the curb at right angles or meets the gutter grade break at right angles. The preferred perpendicular curb ramp orientation is two ramps placed in line with crosswalks (see Figure 11-3.08A). Perpendicular ramps are sometimes placed singly at the apex of the corner (referred to as diagonal curb ramps). Avoid diagonal orientation whenever possible. However, they may be appropriate in preservation projects at existing intersections where drainage inlets or other design considerations make separate perpendicular ramps for each crosswalk impractical.

Parallel ramps have a running grade that is in-line with the direction of sidewalk travel and parallel to the curb. Blended transitions are connections between the pedestrian access route and the street that have a running grade of 5% or less. Level landings, gently sloped transitions, and raised crosswalks fall into this category.



CURB RAMP TYPES
Figure 11-3.08A

Geometrics. The running grade for perpendicular and parallel curb ramps ranges from 5% to 8.3% maximum; the ramp length must not exceed 15 ft (4.5 m). The running grade for a blended transition ramp is 5% or less. For each ramp type, a less-steep grade is always desirable. The clear width of top and bottom landings should match the ramp width, excluding flares, but must be 4 ft (1.2 m) minimum. A landing of 4 ft (1.2 m) by 4 ft (1.2 m) minimum is required at the top of perpendicular curb ramps and at the bottom of a parallel ramp and at perpendicular curb ramps that are placed diagonally. These can overlap other landings and clear space. Ramp and landing cross slopes must not exceed 2%. See Table 11-3.07 for walkway running grades and cross slopes. The counter slope of the gutter or street at the foot of a curb ramp must not exceed 5%. If the difference in slope between the gutter and curb ramp exceeds 11%, provide a level strip for at least 2 ft (0.6 m) (see Figure 11-3.08B). Surface discontinuities between the curb ramp and the street must comply with measurements outlined in Section 11-3.05.07. Where pedestrians will cross a perpendicular ramp, the ramp must have flared sides with a maximum 10% slope. Curb ramps with curb returns are permitted where pedestrians would not normally walk across the ramp. A curb return, an option to flared sides, provides useful orientation cues, however, the curb return must be protected by a barrier, such as a grass buffer or fixed object large enough to impede cross travel. All curb ramps, including blended transitions, must include detectable warnings if they are located at street crossings.

GRADE BREAKS AND COUNTER SLOPE
Figure 11-3.08B

See Table 11-3.08A for curb ramp geometrics. The Standard Plate Manual provides curb ramps details. Also, consult the Curb Ramp Design Summary in Table 11-3.08B.

Location. Curb ramps at marked crossings must be fully contained within the crosswalk markings, excluding any flared sides; see Figure 11-3.08A. An unobstructed flat landing of 4 ft (1.2 m) by 4 ft (1.2 m) must be provided within the width of the crosswalk and wholly outside the parallel vehicle travel lane. Ramps at unmarked crossings must also be located wholly outside the parallel vehicle travel lane. Locate curb ramps so the ramp is protected to prevent visual obstruction by parked cars. Also, locate signal poles, hydrants, catch basins, etc., where they will not interfere with access to the ramp or landings. Access covers, and other appurtenances should not be located on curb ramps, landings, blended transitions, and gutters within the pedestrian access route. Grates must not be located within the gutter within the pedestrian access route.

Ramp Geometrics	Perpendicular	Parallel	Blended Transition
Running Slope			
Min	5%	5%	n/a
Max	8.3%	8.3%	less than 5%
Notes	Must form right angles with the curb or gutter grade break.		
Cross Slope			
Min	n/a	n/a	n/a
Max	2%	2%	2%
Counter Slope			
Min	n/a	n/a	n/a
Max	5%	5%	5%
Landing	4 ft (1.2 m) x 4 ft (1.2 m) minimum at top of ramp. When placed diagonally, 4 ft (1.2 m) x 4 ft (1.2 m) minimum at top and bottom of the ramp. Running and cross slope max 2%.	4 ft (1.2 m) x 4 ft (1.2 m) minimum at bottom of ramp. Running and cross slope max 2% at intersections. May be warped to meet street grade at mid-block crossings.	4 ft (1.2 m) minimum width. Cross slope max 2%.
Flares	10% max slope	n/a	n/a
Detectable Warning Surfaces	Where both ends of the bottom grade break are 5 ft (1.5 m) or less from the back of the curb, the detectable warning must be located on the ramp surface at the bottom grade break. Where either end of the bottom grade break is more than 5 ft (1.5 m) from the back of the curb, the detectable warning shall be located on the lower portion of the ramp.	Located on the landing surface at the back of curb.	Located radially at the back of the curb.

CURB RAMP GEOMETRICS
Table 11-3.08A

Design	Required or Best Practices	Rationale
Provide a level maneuvering area or landing at the top and bottom of the curb ramp.	Required	Level landings are critical to allow wheelchair users space to maneuver on or off the ramp.
Clearly identify the boundary between the bottom of the curb ramp and the street with a detectable warning.	Required	Without a detectable warning, people with vision impairments may not be able to identify the boundary between the walkway and the street.
Design ramp grades that are perpendicular to the curb.	Required	Assistive devices for mobility are unstable if one side of the device is not in contact with the surface.
Place the curb ramp within the marked or unmarked crosswalk area.	Required	Pedestrians outside of the crosswalk area are less likely to be seen by drivers because they are not in an expected location.
The counter slope of the gutter or street at the foot of a curb ramp, landing, or blended transition must be 5% maximum.	Required	Severe or sudden grade changes may not provide sufficient clearance for the frame of the wheel chair, causing it to tip forward or backward.
Design a ramp to eliminate the need to turn or maneuver on the ramp surface.	Required	Maneuvering on a steep grade is difficult and hazardous for people with mobility impairments.
Provide a curb ramp (and temporary curb ramps) with detectable warnings which can be physically and visually distinguished from the surrounding terrain.	Required	Without a detectable warning, vision-impaired people may not detect a curb ramp if it is on a gradual slope.
Design the ramp and the gutter with a cross slope of 2.0%.	Required	Ramps should have a minimal cross slope so users do not have to negotiate a steep grade and cross slope simultaneously.
Transitions from ramps to gutter and streets should be flush and free of vertical changes of level.	Required	Maneuvering over any vertical rise such as lips and defects can cause wheelchair users to propel forward when wheels hit this barrier.
Provide adequate drainage to prevent the build-up of water or debris on or at the bottom of the curb ramp.	Best Practice	Water, ice, or debris accumulation will decrease the slip resistance, and eventually degrade the physical condition of the curb ramp surface.
Align the curb with the crosswalk so there is a straight path of travel from the top of the ramp to the center of the roadway and to the curb ramp on the other side.	Best Practice	When wheel chair users approach a curb ramp, they often build up momentum in the crosswalk in order to get up the curb ramp slope grade. This alignment may be useful for the vision impaired.

CURB RAMP DESIGN SUMMARY
Table 11-3.08B

11-3.08.04 Detectable Warning Surfaces (Truncated Domes)

Detectable warning surfaces feature a distinctive pattern of raised domes that provide visually-impaired pedestrians a tactile cue at the boundary between pedestrian and vehicular routes. The primary purpose of detectable warnings is to alert pedestrians with vision impairments of their approach to streets and hazardous drop-offs. Detectable warnings are not intended to provide directional information. Provide detectable warnings at rail lines and pedestrian street crossings, including curb ramps and median and islands that are 6 ft (1.8 m) in length or greater in the direction of travel.

General. Detectable warnings must consist of a surface of truncated domes aligned in a square or radial grid pattern. They must extend 24 in. (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. See the Standard Plate Manual for additional detectable warning information.

Dome Alignment. The rows of domes in the detectable warning material must be aligned with the path of wheelchair travel to permit tracking between dome rows. The path of travel must be perpendicular to the grade break at the toe of the ramp. Where a ramp, landing, or blended transition provides access to the street continuously around a corner, the vertical rows of truncated domes in a detectable warning surface must be aligned to be perpendicular or radial to the grade break between the ramp, landing, or blended transition and the street. One corner of any detectable warning must be within 8 in. (205 mm) of the grade break; no point on the leading edge of the detectable warning may be more than 5 ft (1.5 m) from the grade break. To maintain a pattern perpendicular or radial to the grade break when using pre-fabricated detectable warning plates, install so any gaps between plates are strictly minimized.

Rail Crossings. Locate the detectable warning surface so the edge nearest the rail crossing is 6 ft (1.8 m) minimum and 15 ft (4.5 m) maximum from the centerline of the nearest rail. Align the detectable warning surface so the rows of truncated domes are parallel with the direction of wheelchair travel.

Rail Platform Edges. Detectable warning surfaces at platform boarding edges must be 24 in. (610 m m).

Pedestrian Refuges. When a median, crossing island or channelized turn lane island 6 ft (1.8 m) or greater in the direction of travel functions as a pedestrian refuge locate the detectable warning surface at curb ramps or at-grade cut-throughs at the curb line and in line with the face of the curb. Provide a minimum 2.0 ft (0.6 m) length of walkway with no detectable warning surface separating the detectable warning surfaces at the curb line. If turns are required on the refuge, provide a level landing at least 4 ft (1.2 m) square. Medians and islands less than 6 ft (1.8 m) length in the direction of travel or with no curb are not pedestrian refuges and, therefore, must be pulled back from the pedestrian path of travel at an intersection so as not to conflict with pedestrian travel. Where a median or island has no curb, the detectable warning must be located at the edge of the traveled way.

Driveways. Generally, provide detectable warnings only at commercial driveways controlled by traffic control devices or where the driveways operate like public streets.

11-3.09 Pedestrian Refuges

A pedestrian refuge is defined as the area within an intersection between lanes of traffic where pedestrians may wait until vehicle traffic clears, allowing them to cross a street. For the purposes of this section, pedestrian refuge is assumed to include medians, crossing islands, and channelized turn lane islands.

Typical locations that should be evaluated for pedestrian refuge design are wide two-way streets (more than 60 ft (18 m)) with high traffic volume, high travel speed, and large pedestrian volumes; wide streets where the elderly, people with disabilities, and younger children routinely cross, or streets with insufficient signal timing for pedestrians to cross the entire street.

Pedestrian Refuges in the pedestrian access route must be free of obstructions and large enough to provide refuge for several pedestrians waiting at once. A pedestrian refuge must include all pedestrian accommodations. If the intersection is designed as a two-phase crossing an accessible pedestrian signal must be provided in the refuge.

Pedestrian refuges can be constructed as raised or flush. If constructing a raised refuge, it must be designed with a curb ramp or at-grade cut-through and must have detectable warnings. Cut-throughs are easier for pedestrians to negotiate than curb ramps, particularly on small medians or crossing islands.

Medians. In many cases, raised medians that are provided under the warrants described in Section 4-5 have the potential to function as a pedestrian refuge if designed properly. When a median is provided, and it is determined that it will function as a pedestrian refuge, the median should be 6 ft (1.8 m) minimum in length in the direction of pedestrian travel and a minimum of 5 ft (1.5 m) wide to allow for wheelchairs and people walking side by side to pass. Medians that channelize traffic and are not intended to provide a pedestrian refuge can be narrower, but the nose must be pulled back so as not to conflict with pedestrians crossing in the walkway and signal timing must allow enough time for a pedestrian to safely cross the entire intersection. Do not use medians to justify signal timing that does not allow pedestrians to complete a crossing on one cycle. Medians with curb ramps require a level landing at least 4 ft (1.2 m) square. Medians with either curb ramps or at-grade cut-throughs must have detectable warnings placed at each curb line.

Crossing Islands. Crossing islands are similar to raised medians, but as a general rule, they do not provide traffic control for motor vehicle traffic. The primary function of a crossing island is to allow pedestrians to cross one direction of traffic movement at a time. Crossing islands typically have a length of 8 ft (2.4 m) or greater in the direction of pedestrian travel to allow for pedestrian standing room; if space is extremely limited consider narrowing travel lanes. Where narrowing the roadway is not practical, construct the island with a width of 6 ft (1.8 m) and increase the width of the cut-through or ramp to increase the available storage area. Islands with curb ramps require a level landing at least 4 ft (1.2 m) square, and must have detectable warnings.

Channelized Turn Lane Island. Channelized turn lanes, also called free right turn lanes, are used at signalized and unsignalized intersections with heavy right turn traffic volumes. They provide motorists with

smoother turning maneuvers, reduce non-pedestrian crashes, allow right-turning traffic to bypass a traffic signal, and increase intersection capacity.

Refuge islands separating channelized right turn lanes from the through traffic lanes can help accommodate pedestrians if properly sized by reducing the through street crossing distance by separating the crossing phase.

If the channelized turn lanes promote faster turning speeds, they can pose a safety problem for pedestrians, particularly those with vision impairments. Therefore, the turning roadway should be kept as narrow as the turning path of the design vehicle will allow, and should enter the receiving roadway at an angle as close to 90 degrees as the effective turning radius will allow. Turn lane islands with curb ramps require a level landing of at least 4 ft (1.2 m) square and must have detectable warnings. See Chapter 5 for additional channelized right turn lane information.

Pedestrian crossings to triangular crossing islands should be designed to meet the following criteria:

1. The pedestrian crossings should be at 90 degrees across the turn lane and placed where the motorist can easily see the pedestrian crossing ahead.
2. Pedestrians and motorists must be able to easily see each other.
3. The design should encourage low-vehicle-turning speeds.

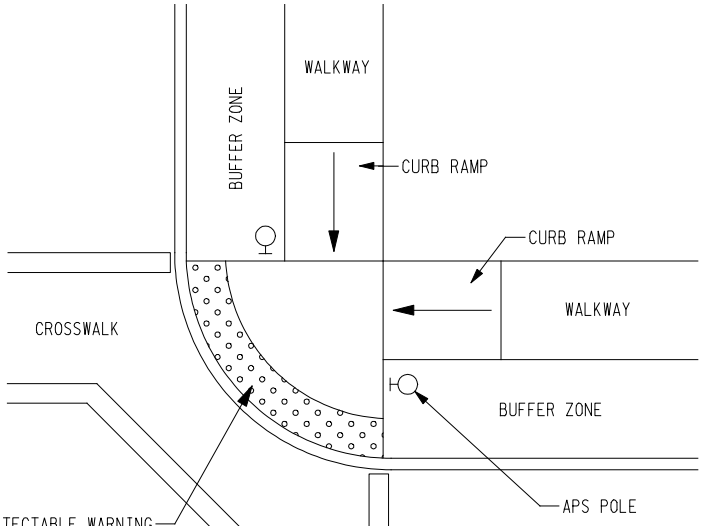
11-3.10 Curb Extensions and Turning Radii

Curb Extensions. Curb extensions reduce pedestrian crossing distances, improve sight distance and sight lines for both pedestrians and motorists, and create adequate space for curb ramps and landings where walkway space is narrow. Curb extensions work particularly well on urban roadways with limited large-vehicle turning traffic. They are also effective in delineating on-street parking areas and preventing parked cars from encroaching into crosswalks. In general, curb extensions should extend from the curb through the width of a parking lane. To provide alignment cues for pedestrians with vision impairments and conspicuity for approaching motorists, consider installing low-level landscaping or planting strips or boxes.

Turning Radii. Reducing curb radii is another means to shorten the length of pedestrian crosswalks. In general, but especially in urban areas, use the smallest practical curb radii when designing street intersections. Design curb radii to accommodate the largest vehicle type that will frequently turn the corner. In low-traffic areas, an occasional large vehicle can encroach into the opposing travel lane. Always consider a typical curb radius of 10-15 ft (3-4.5 m). Where there is a high potential for conflicts with pedestrians yet large vehicle turning movements necessitate curb radii exceeding 50 ft (15 m), evaluate installing a channelized right turn lane with a low-angle right turn and a pedestrian refuge island. See Chapter 5 for additional channelized right turn lane information.

11-3.11 Signals and Signal Timing

APS pole placement is critical for vision-impaired pedestrians. Locate the APS so the vibrotactile feature can be contacted from the level landing serving a curb ramp, or from a clear ground space that is in line with the crosswalk line adjacent to the vehicle stop line. To be effective push buttons must be installed as closely as possible to current PROWAG requirements. To fully meet PROWAG requirements, coordinate placing curb ramps, signal poles, and APS with the signal designer at the earliest phase of scoping. Coordinate to ensure scoping issues are addressed, such as obtaining adequate right-of-way and relocating utility pole where conflicts occur with signal pole placement. See Figure 11-3.11 for APS push button locations.



APS PUSH BUTTON LOCATIONS (conceptual only; no scale)
Figure 11-3.11

Reach and Clear Ground Space. Locate APS to achieve an unobstructed high forward and high side reach and an unobstructed low forward and low parallel side reach that is in compliance with the current PROWAG. See MnDOT Signal Design Manual for reach dimension.

Location at Channelized Turn Lanes at Intersections. Carefully locate and separate APS devices installed at splitter and 'pork chop' islands so signal spillover does not give conflicting information about which crossing has the WALK indication displayed.

In alteration projects, designers may find instances where physical terrain or site conditions restrict construction or altering the facility to the required APS standard. In such circumstances, an alteration must provide pedestrian facilities and features to the maximum physical accessibility feasible.

For additional signal or signal timing information, see the current MnDOT Signal Design Manual and the MnDOT Traffic Signal Timing and Coordination Manual.

11-3.12 Grade Separated Crossings

Grade Separated Crossings allow for the uninterrupted flow of pedestrian movement separate from the vehicle traffic and can improve crossing safety when appropriately located and designed. Such crossings may be necessary at freeways, high speed roadways, high-volume roadways, railroad tracks, or water. Grade separated crossings should be considered when warranted through the MN MUTCD, Section 4C.5: Pedestrian Volume, where a significant safety hazard exists, where there is high pedestrian volume, and after typical crossing measures such as traffic-calming or a pedestrian-activated signal have first been considered. Because pedestrians seek the most direct route, designers must carefully consider travel distances so as not to discourage pedestrians from using a grade separated crossing. Grade separated crossings must accommodate all people. When the grade-separated crossing is part of a pedestrian access route, the crossing and all crossing elements must be in compliance with current PROWAG guidance. Where the approach slope exceeds 5%, the approach is a ramp; ramps require landings and must be a minimum of 5 ft (1.5 m) long. See Figure 11-3.14 Ramp Landings for additional information. Extensive ramping will accommodate wheelchairs and bicyclists, but can result in long crossing distances that discourage use.

Because of the cost, potential right-of-way needs, and project complexity, consider grade separations early in project development. Coordinate with local agencies and municipalities to determine design criteria.

11-3.13 Types of Grade Separated Crossings

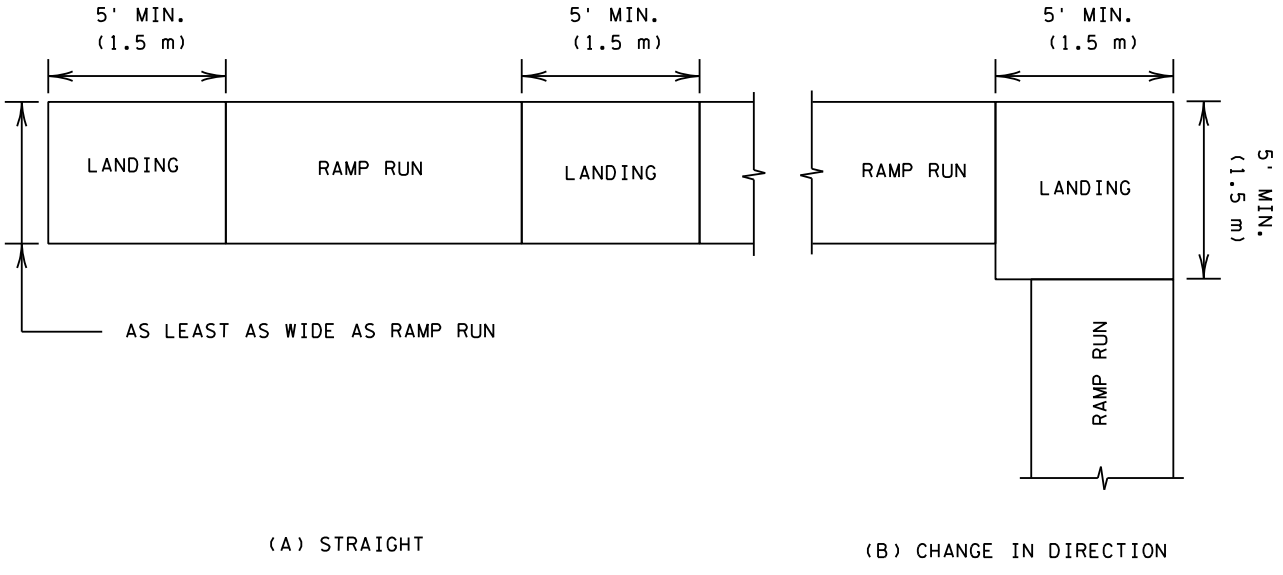
There are two types of grade-separated crossings: overpasses and underpasses.

Pedestrian Overpasses. Install pedestrian/bicycle overpasses based on pedestrian/bicycle volumes, safety hazards, efficient pedestrian/bicycle network connections and routing, land use patterns, and conflicts with high motor vehicle volumes and speeds, particularly with young children or the elderly. See specifications for pedestrian overpasses in the MnDOT Bridge Design Manual, Section .420, the MnDOT Road Design Manual, Chapter 9, and the MnDOT Bikeway Facility Design Manual. Overpasses work best when the topography allows for a structure without ramps (e.g., overpass over a sunken freeway).

Pedestrian Underpasses and Tunnels. Underpasses work best when designed to feel open and accessible because pedestrians may be reluctant to use underpasses with narrow, confined spaces, limited sight distance, and poor lighting. To minimize an uninviting underpass, locate the underpass in-line with the approaching walkway or bikeway, ramping gently to permit continuous vision through the underpass from the approach, and installing artificial lighting in coordination with the Office of Traffic Engineering, Lighting Section. The recommended minimum vertical clearance for pedestrian/bicycle access under-crossings is 12 ft (3.6 m). The crossing should have a vertical clearance of no less than 10 ft (3 m) to ensure emergency vehicle access, to contribute to individual pedestrian comfort and security, as well as reduce the potential for vandalism. The recommended width is 14 ft (4.3 m) and the minimum width is 12 ft (3.6 m). Underpasses are well suited for situations where a retrofit is needed, and, to minimize disruption, should be considered in association with major construction. See the MnDOT Road Design Manual, Chapter 9, and the MnDOT Bikeway Facility Design Manual for additional information.

11-3.14 Grade Separated Features

Ramps are used to connect public facilities, such as buildings, with a walkway at a different elevation. Ramp grades are between 5% and 8.33%. Ramp cross slopes must not exceed 2%. The maximum rise for any ramp is 30 in. (760 mm). A landing is required at the top and bottom of each ramp run for every 30 in. (760 mm) of rise. The landing must be level, with less than a 2% cross slope in both directions, have a minimum clear length of 5 ft (1.5 m), and be at least as wide as the widest ramp run leading to the landing. Ramps that change direction between runs require a minimum clear landing of 5 ft (1.5 m) by 5 ft (1.5 m). Provide handrails on both sides for all ramp runs with a rise of greater than 6 in. (150 mm). The surface of the ramp run or landing must extend 12 in. (305 mm) minimum beyond the inside face of a handrail. A barrier must be located within the lowest 4 in. (100 mm) of the ramp surface to prevent passage of a 4 in. (100 mm) diameter sphere. Design ramps and landings so water will not accumulate on the walking surface. Standing water at the base of the curb, or elsewhere, is a barrier to pedestrian travel. See Figure 11-3.14 for additional ramp and landing information.



RAMP LANDINGS
Figure 11-3.14

Elevators, limited-use/limited-application elevators, and platform lifts can be included in a pedestrian access route. Vertical access must remain unlocked during the operating hours of the facility served. Where provided, elevators, limited-use/limited-application elevators, and platform lifts must comply with the current applicable requirements in of Appendix D to 36 Code of Federal Regulations part 1191 and must allow pedestrians the ability to independently operate the elevator.

Escalators are not part of a pedestrian access route and must not be used in place of elevators. Escalators may be used in addition to elevators.

Stairs are not part of an accessible route; however, stairs may be incorporated into a design if designers provide an alternative pedestrian access route and any necessary elevators, walkways, ramps, or landings. Stairs must have uniform riser heights and tread depth. Risers must be 4 in. (100 mm) high minimum and 7 in. (180 mm) high maximum and at least 42 in. (1060 mm) wide. Treads should be 11 in. (280 mm) deep minimum, measured from riser to riser. Provide handrails on both sides for all stair runs with a rise of greater than 6 in. (150 mm). Design stairs so water will not accumulate on the walking surface.

Handrails are required on both sides of all ramp runs or stair flights with a rise of greater than 6 in. (150 mm). Handrails are not required on walking surfaces with running slopes less than 5%. Handrails must be continuous for the full length of each ramp or stair flight.

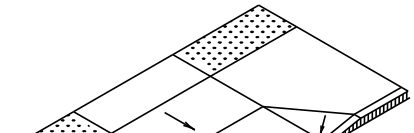
Handrail heights must be a minimum 34 in. (870 mm) and maximum 38 in. (970 mm) above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above walking surfaces, stair nosings, and ramp surfaces.

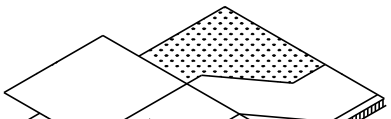
Handrails at ramps must extend horizontally above the landing for 12 in. (305 mm) minimum beyond the top and bottom of ramp runs. Extensions must return to a wall, guard, or the landing surface, or must be continuous to the handrail of an adjacent ramp run. Handrails at stairs must extend horizontally above the landing for 12 in. (305 mm) minimum beginning directly above the first riser nosing. Extensions must return to a wall, guard, or landing and must be continuous to the handrail of an adjacent stair flight. At the bottom of a stair flight, extend handrails at the slope of the stair flight for a horizontal distance at least equal to one tread depth beyond the last riser nosing. Extensions must return to a wall, guard, or the landing surface, or be continuous to the handrail of an adjacent stair flight. See the Minnesota State Building Code for additional handrail information.

11-3.15 Other Crossings

Accessible pedestrian crossings must include other types of crossings, such as driveways, rail roads, and free right turns.

Driveways. When a driveway crosses a walkway, the drive must be designed so the pedestrian access route remains fully continuous and unobstructed across the driveway. Therefore, driveway cross slopes in the pedestrian access route must not exceed 2%. There are four basic driveway designs that meet accessibility requirements. See Figure 11-3.15 for driveway design examples.





DRIVEWAY DESIGNS
Figure 11-3.15

Railroad Crossings. Railroad crossings are different from roadway crossings in that trains always have the right-of-way. Railroad crossings can be difficult to maneuver for people using wheelchairs or walking aids. A pedestrian access route crossing railroad tracks must be level and flush with the top of the rail at the outer edges and the surface between the rails must be aligned with the top of the rail. To enhance and accommodate pedestrian travel at the same elevation as the top of the rail, extend the concrete, bituminous, or rubber crossings required to permit vehicle travel 1 ft (0.3 m) beyond a paved shoulder. Flangeway gaps at all rail crossings must not exceed 3 in. (75 mm).

When a pedestrian rail crossing is not within the street or highway, provide a detectable warning device.

Free Right/Left Turns. Where there is a high potential for conflicts with pedestrians yet large vehicle turning movements necessitate curb radii exceeding 50 ft (15 m), evaluate installing a channelized right turn lane with a low-angle right turn and a pedestrian refuge island. See Chapter 5 for additional information.

11-3.16 Doors, Doorways, and Gates

Manual doors and doorways and manual gates that are intended for user passage must be accessible. There must be no projections into the required clear opening width lower than 34 in. (870 mm) above the finish floor or ground. Projections into the clear opening width between 34 in. (870 mm) and 6.7 ft (2 m) above the finish floor or ground must not exceed 4 in. (100 mm). See Section 404.2 of Appendix D to 36 Code of Federal Regulations Part 1191 for more information.

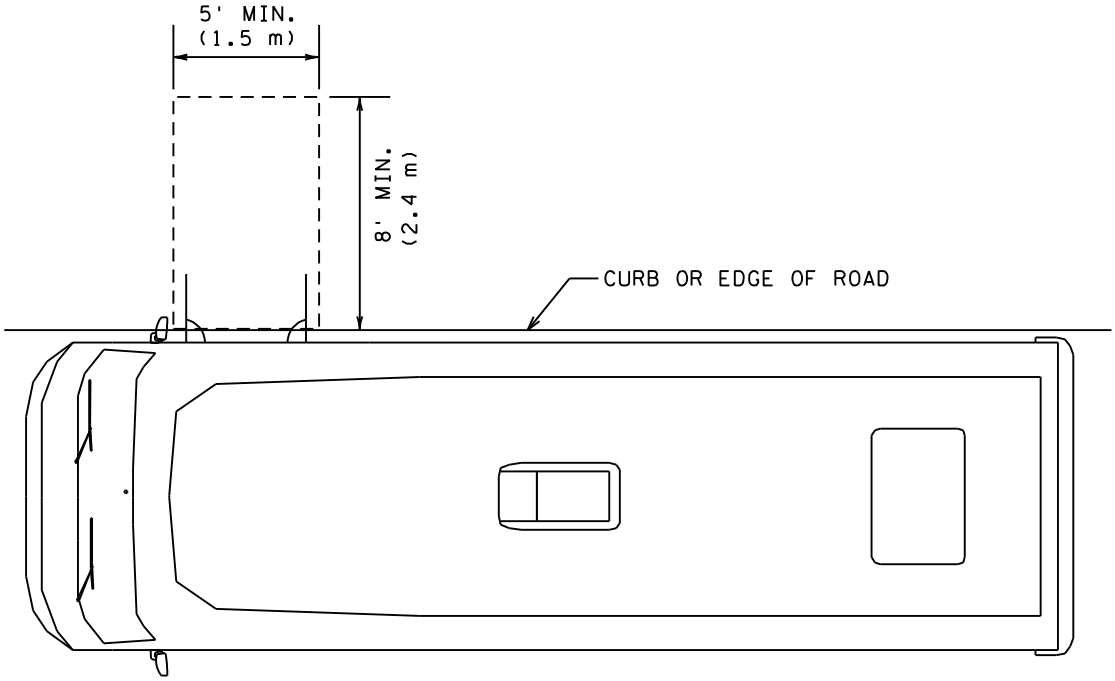
11-3.17 Transit Stops

Bus Stops. Where bus stops are marked along existing streets by signs, benches, or shelters, features such as surface improvements and curb ramps are subject to Title II ADA access requirements. Bus stops can vary from simply a sign and a designated stop at a curb, a pullout area, or a shoulder for the bus to stop. Bus stop benches and shelters must not intrude into an existing pedestrian access route.

Boarding and Alighting Areas. At bus stops where a shelter is provided, the bus stop pad can be located either within or outside of the shelter.

Surface. Bus stop boarding and alighting areas must have a firm, stable, and slip resistant surface.

Dimensions. A zone accommodating one bus is normally 80-160 ft (24-48 m) in length. A newly constructed transit stop must be accessible to all users and must be a minimum of 8 ft (2.4 m), measured perpendicular to the curb or street edge, by 5 ft (1.5 m), measured parallel to the street. The preferred size is a continuous 8 ft (2.4 m) pad or walkway the length of the bus or at least to the front and rear of the bus doors. See Figure 11-3.17.



DIMENSIONS OF BUS BOARDING AND ALIGHTING AREAS
Figure 11-3.17

Connection. Bus stop boarding and alighting areas must be connected to streets, walkways, or pedestrian paths by a pedestrian access route.

Grade. Parallel to the street or highway, the grade of the bus stop boarding and alighting area must be the same as the street or highway or less, to the maximum extent practicable. Perpendicular to the street or highway, the grade of the bus stop boarding and alighting area must not exceed 2%.

Bus Shelters. Bus shelters must provide a minimum clear space entirely within the shelter. Minimum clear space equals 30 in. (760 mm) by 48 in. (1220 mm) with a slope and cross slope of less than 2%. Bus shelters must be connected by pedestrian access route to a boarding and alighting area.

11-3.18 Rail Platforms

In light rail, commuter rail, and intercity rail systems, platforms must provide level-entry boarding access wherever practicable.

Slope. Rail platforms must not exceed 2% slope in all directions. Where platforms serve vehicles operating on existing track or track laid in existing street or highway, the slope of the platform parallel to the track shall be permitted to be equal to the slope of the street, highway, or existing track.

Detectable Warnings. Platform boarding edges not protected by screens or guards must have detectable warnings along the full length of the public use area of the platform.

Platform and Vehicle Floor Coordination. The preferred alignment is a high platform, level with the vehicle floor. For more details, see 36 CFR Part 1192 (ADA Accessibility Guidelines for Transportation Vehicles).

11-3.19 On-Street Parking

Where the width of an adjacent walkway exceeds 14 ft (4.3 m), an access aisle at least 5 ft (1.5 m) wide must be provided at street level the full length of the parallel parking space and must connect to a pedestrian access route serving the space. The access aisle must not encroach on the vehicular travel lane. An access aisle is not required where the width of the adjacent walkway is less than or equal to 14 ft (4.3 m). When no access aisle is provided, the parking space must be located at either end of the block face. Where perpendicular or angled parking is provided, an access aisle 8 ft (2.4 m) wide minimum must be provided at street level the full length of the parking space and must connect to a pedestrian access route serving the space. Access aisles must be marked to discourage parking in the aisles. A curb ramp or blended transition must connect the access aisle to the pedestrian access route.

11-3.20 Passenger Loading Zones

When passenger loading zones are provided, a minimum of one passenger loading zone shall be provided in every continuous 100 ft (30.5 m) of loading zone space or fraction thereof. See Figure 11-3.20.

Vehicle Pull-up Space. Passenger loading zones must provide a vehicular pull-up space 8 ft (2.4 m) wide minimum and 20 ft (6 m) long maximum.

Access Aisle. Passenger loading zones must provide access aisles adjacent to the vehicle pull-up space. Access aisles must adjoin a pedestrian access route and must not overlap the vehicular way.

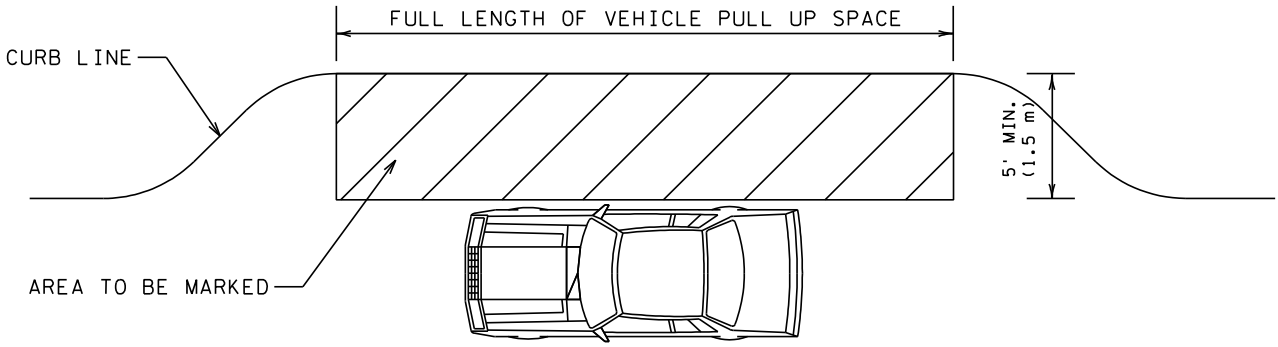
Width. Access aisles serving vehicle pull-up spaces must be 5 ft (1.5 m) minimum wide.

Length. Access aisles must extend the full length of the vehicle pull-up spaces they serve.

Marking. Access aisles must be marked to discourage parking in them.

Floor and Ground Surfaces. Access aisles must be at the same level as the vehicle pull-up space they serve.

Vertical Clearance. Vehicle pull-up spaces, access aisles serving them, and a vehicular route to and from the passenger loading zone must provide a vertical clearance of 10 ft (3 m) minimum.



PASSENGER LOADING ZONE ACCESS AISLE
Figure 11-3.20

11-3.21 School Zones

Walkways. Provide walkways on routes to and from schools, in all areas surrounding schools, as well as on school sites. Vertical separation (with curbs) and horizontal separation (planting buffers, ditches, and swales) from motor vehicle traffic is strongly encouraged to improve pedestrian safety while walking along streets.

On roads without walkways, which often occur in rural areas surrounding schools, shoulders may be used to accommodate pedestrians as an interim solution until it is feasible to install a separated pathway.

Visibility. Because children are smaller than adults, motorists may have difficulty seeing them at street crossings. Extra care is necessary in the vicinity of schools to ensure that utility poles, traffic control devices, mailboxes, landscaping, and other street furniture do not inhibit motorist ability to see children. Parked vehicles can also block visibility. Parking restrictions and sight line issues should be applied to both intersections and mid-block crossings near school. Constructing curb ramp extensions and crossing islands are additional enhancements that may be implemented.

School Speed Zones. Consult Chapter 13 of the Minnesota Traffic Engineering Manual and Part 7 of the MN MUTCD for guidance on identifying a school speed zone and additional traffic considerations in and around schools.

11-3.22 Work Zones

When an existing pedestrian access route is blocked by construction, alteration, maintenance, or other temporary conditions, provide an alternate pedestrian access route to the maximum extent feasible. Pedestrians must be protected from drop-offs, traffic, or other hazards within a work zone by a continuous, stable, and non-flexible channeling device such as a pedestrian barricade. Pedestrian barricades and channelizing devices must consist of a wall, fence, or enclosures. Any channeling device must have a continuous bottom edge at a maximum of 6 in. (150 mm) above the ground or walkway and a continuous upper rail at 3 ft (0.9 m) minimum above the ground or walkway. Support members must not protrude into the alternate circulation path.

Same-side travel is preferred because it does not increase pedestrian exposure and risk of accident from added street crossings. A route that uses vehicle lane width may be shorter, safer, and more usable than one that requires two street crossings, even if the roadway surface is imperfect. Alternate routes must provide the best elements of accessibility provided in the pedestrian circulation route before its disruption. Where it is not feasible to provide a same-side alternate pedestrian circulation route and pedestrians will be detoured, the alternate path provides a similar level of accessibility to that of the existing disrupted route. This may include incorporating accessible pedestrian signals (APS), curb ramps, or other accessibility features. When it is necessary to block travel at a departure curb and close a crosswalk that is disrupted by excavation, construction, or construction activity, take care to preserve curb ramp access to the perpendicular crosswalk. This may require additional pedestrian channelization.

11-3.23 Lighting

Pedestrian lighting can improve pedestrian safety and increase a pedestrian's comfort and sense of security. Install pedestrian lighting where there is a high concentration of pedestrian travel at intersections or other pedestrian crossings and in areas where there is significant pedestrian activity at dusk or nighttime. For information on selecting locations, illumination levels, as well as information to light underpasses and overpasses, see guidance in Chapter 10-6 of the Road Design Manual, the MnDOT Roadway Lighting Design Manual, and the AASHTO Informational Guide for Roadway Lighting.

11-3.24 Maintenance

Pavement surfaces must be maintained year–round and kept free of cracks, pooled water, debris, snow and ice in order to maintain an open pedestrian access route. Identify maintenance commitments and develop agreements with agencies and municipalities early as part of project development.

11-3.25 Roundabouts

Roundabouts are used at intersections in place of signals. The primary reasons for using roundabouts are to provide free-flowing mobility and reduced vehicle crash rates. Pedestrians identify gaps in traffic and cross when it is safe. Splitter islands, which can be flush or raised, separate and deflect entering and exiting traffic. This deflection slows vehicles making it easier for pedestrians to cross. Splitter islands provide refuge for pedestrians, break up the crossing into smaller distances, and allow pedestrians to cross one direction of traffic movement at a time. Where pedestrian facilities are provided at roundabout intersections, they must contain a pedestrian access route. Priority crossings or signals may be necessary where pedestrian volumes are high or where there are many young, elderly, or disabled pedestrians known to, or expected to, cross the roundabout. See Chapter 12 for specific roundabout information.

Noise from continuously circulating traffic may mask useful audible cues typically available to visually impaired pedestrians at crossings. Carefully delineate crosswalk approaches in roundabout with plantings, low enclosures, curbs, or other defined edges to identify crossing location(s). Crosswalk designs often remove cyclists from the circulating street or highway by means of a ramp that angles from the curb lane to the walkway with re-entry by a similar ramp beyond the pedestrian crossing. The bicycle route may provide false cues about the crossing location to pedestrians who are using the edge of the walkway for way finding. If walkways are curb-attached, there must be a continuous and detectable edge treatment along the street side of the walkway wherever pedestrian crossing is not intended. Where chains, fencing, or railings are used, they must have a bottom element 15 in. (380 mm) maximum above the pedestrian access route.

11-3.26 Pedestrian Safety

Pedestrian Safety is an important element of any design. While designing any project, review the available crash data to determine the location, extent and type of pedestrian accidents. Evaluate the data, then develop and incorporate design solutions.

11-3.27 Resources

A more complete discussion of pedestrian and ADA-accessible design can be found in the following:

- *AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities*; Washington D.C.: American Association of State Highway and Transportation Officials, 2004.
- *Guidelines for Accessible Public Rights-of-Way*. Washington, D.C. U. S. Access Board, November 23, 2005.
- *Designing Sidewalks and Trails for Access; Part II: Best Practices Design Guide*. U.S. Department of Transportation; Federal Highway Administration, 2001.
- Pedestrian and Bicycle Information Center. Web site is funded by the U.S. Department of Transportation Federal Highway Administration.
- *Design and Safety of Pedestrian Facilities, A Recommended Practice*, ITE Traffic Engineering Council Tech Committee 5A, 1998.
- *Special Report: Accessible Public Rights-of-Way Planning and Design for Alterations*. U.S. Access Board, August 2007.

THIS PAGE INTENTIONALLY LEFT BLANK

11-4.0 BICYCLE TRAFFIC

THE INFORMATION ON PAGES 11-4(1) TO 11-4(2) HAS BEEN INCLUDED IN THE MnDOT BIKEWAY FACILITY DESIGN MANUAL.

THE MnDOT BIKEWAY FACILITY DESIGN MANUAL CAN BE VIEWED ON THE MnDOT BICYCLE TRANSPORTATION WEBSITE AT http://www.dot.state.mn.us/bike/bikewaysdesignmanual.html.

THIS PAGE LEFT INTENTIONALLY BLANK

11-6.0 Railroad-Highway Crossings

THE INFORMATION FOR THIS SECTION HAS BEEN INCLUDED IN THE MnDOT FACILITY DESIGN GUIDE. REFER TO THE FOLLOWING WEBSITE:
https://roaddesign.dot.state.mn.us/facilitydesign.aspx

THIS PAGE LEFT INTENTIONALLY BLANK

11-7.0 UTILITIES

THE INFORMATION ON PAGES 11-7(1) TO 11-7(6) HAS BEEN INCLUDED IN THE UTILITIES MANUAL.

THE UTILITIES MANUAL CAN BE VIEWED ON THE MnDOT OFFICE OF TECHNICAL SUPPORT WEBSITE
http://www.dot.state.mn.us/utility/files/pdf/policy/utilities-manual-web.pdf

THIS PAGE LEFT INTENTIONALLY BLANK

11-11.0 ROADSIDE APPURTENANCES

11-11.01 Mailbox Supports

MnDOT has developed this policy regarding mailbox supports on the Trunk Highway System. Minnesota Rules Chapter 8818, "Mailbox Installation and Support Standards" is used as a reference to the MnDOT policy.

This policy provides guidance to location and installation of accepted mailbox supports on highways with speed limits of 40 mph (65 km/h**)** or greater.

11-11.01.01 Policy

1. Mailbox installations and supports that have been accepted by the FHWA as meeting the NCHRP Report 350 crash worthiness criteria, meet Minnesota Rules Chapter 8818, U.S. Post Office recommendations, and are in compliance with MnDOT Policy are acceptable. To obtain a drawing with an example of a crash tested mailbox support, which satisfies the above requirements, contact the Design Standards Unit, Office of Technical Support.
2. All mailbox supports should be a breakaway design and support a standard mailbox size T2 with a 10 lb (4.5 kg) load.
3. Mailbox supports should consist of corrosion resistance materials, which, in accordance with project/site specific conditions, may be required to include, but not limited to, the following:
   a) Post, pipes and other steel components galvanized per Spec. 3392.
   b) Pipes conforming to Spec. 3362, Schedule 40 of ASTM A53/A53M.
   c) All fasteners conforming to Spec. 3391.
4. The installation should include the following:
   a) Location of the face of mailbox should be 8 in. to 12 in. (200 mm to 300 mm) outside the edge of the shoulder or 6 in. to 12 in. (150 mm to 300 mm) behind the face of the curb.
   b) The height of the mailbox bottom should be 42 in. to 48 in. (1 m to 1.2 m) above the pavement in rural and urban areas. Postal Service regulations will determine the height. The local mail carrier post office should be consulted to determine if any changes need to be made to the installation regarding height and offset distances.
   c) Adequate embedment depths of the mailbox support should be provided so that the structure does not sag or fall over. The embedment depths will vary from each installation by the type of support, the location of the structure on inslope, the steepness of the inslope, and soil condition or type. The details for the supports should include the proper embedment depths in the plans or have provisions in the plans for the embedment depth to be decided in the field. Preferably, the embedment depth shall not be less than 48 in. (1.2 m).
   d) The spacing between mailboxes should be a minimum of 30 in. (760 mm) from center to center of the supports. A multiple mailbox support can be considered if two or more mailboxes are at one location.
5. Alternate support designs may be approved by the Design Standards Engineer or the Project Engineer in consultation with the Design Standards Engineer.

11-11.01.02 Unlawful Supports

The following mailbox installations and supports are considered a road hazard, and a danger to the safety of the traveling public.

1. An installation that contains more than one vertical support;
2. A single support containing more than two mailboxes;
3. A wooden support with a cross-sectional area greater than 16 $in.^2$ (100 cm^2) at any above-ground point along the support (for example, the maximum allowable square and round support dimensions are 4 in. x 4 in. (100 mm x 100 mm) and 4.5 in. (114 mm) in diameter, respectively), except that larger wooden supports are acceptable if, at a height 4 in. (100 mm) above the ground, the support cross-sectional area is altered in some fashion so as to reduce the cross-sectional area at that point to 16 $in.^2$ (100 cm^2) or less;

4. A metal support of a weight of 4 lb/ft (6 kg/m) or more for any 1 ft (300 mm) of vertical measurement above ground (for example, a standard steel pipe of up to 2 in. (50 mm) inner diameter would be acceptable), except that larger metal supports are acceptable if, within the first 3 in. (75 mm) above ground the metal support is less than 4 lb/ft (6 kg/m), or less than 1 lb (0.45 kg) for the 3 in. (75 mm) length;

5. Adjacent mailbox installations whose respective supports are spaced closer than 30 in. (760 mm), as measured from center of support to center of support;

6. Neighborhood delivery and collection box units, whether or not United States Postal Service approved;

7. A support comprised of material other than solely wood or metal posts that either exceeds 16 $in.^2$ (100 cm^2) in total cross-sectional area at a height of 4 in. (100 mm) above ground or a weight of 4 lb/ft (6 kg/m) or more for any 1 ft (300 mm) of vertical measurement above ground, unless within the first 3 in. (75 mm) above ground the support is less than 4 lb/ft (6 kg/m)**,** or less than 1 kb, (0.45 kg) over the 3 in. (75 mm) distance. Examples of such nonconforming supports could include supports such as filled milk cans, brick structures, plows, and concrete-filled pipe, etc.; and

8. An installation, whether a support or closed mailbox, that encroaches the usable roadway or its airspace.