

HIGHWAY DESIGN MANUAL

Chapter 18 Pedestrian Facility Design

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**CHAPTER 18
PEDESTRIAN FACILITY DESIGN**

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18.1 INTRODUCTION

Pedestrian facilities, which are facilities specifically intended to accommodate people walking, generally include crossings, refuge islands, pedestrian signs and signals, information technology systems (ITS), sidewalks, other walkways, curb ramps, public transit loading zones, grade-separation structures, call boxes, and street furniture.

According to the 2000 Census, 30% of New York State residents do not own an automobile and 20% have a disability. Estimated pedestrian AADT was nearly 20 million trips (not including transit and car-linked walk trips) in New York State which supports a multibillion dollar sidewalk-based economy. As the population ages, an increasingly larger proportion of the State's population will rely on pedestrian accommodation and public transit as their primary means of transportation. Accessible design is the foundation for all pedestrian design, and facilities need to be planned, designed, operated, and maintained for use by all people.

Pedestrians should be afforded the ability to safely travel between pedestrian traffic generators such as homes, places of work, stores, schools, post offices, libraries, parks, etc. Safe and accessible pedestrian infrastructure provides the means for making this mode of transportation feasible. Pedestrian connections are also the critical transitions between different modes of transportation.

Federal Highway Administration (FHWA) policy (23 CFR 652.5), the AASHTO *Policy on Geometric Design of Highways and Streets* and the AASHTO *Guide for the Planning, Design, and Operation of Pedestrian Facilities* encourage designers to provide for pedestrians during project planning, design, and construction of transportation facilities.

18.2 CHAPTER OBJECTIVES

The first objective of this chapter is to provide the procedural requirements for determining if pedestrian facilities are warranted and should be incorporated into Department projects. The second objective is to provide the guidance necessary to design, construct, and maintain these facilities in accordance with current guidelines and standards.

18.3 POLICY

Current Department policy is consistent with federal policy and design guidance and states that: "NYS DOT must make...pedestrians integrated elements of our intermodal transportation system." It is Department policy to consider the accommodation of pedestrians, including persons with disabilities, during the earliest scoping stage of Department projects. "Considerations" of pedestrian needs should include, at a minimum, a presumption that pedestrians will be accommodated, unless pedestrian access is prohibited by law, deemed unfeasible based on anticipated use, and/or an absence of need is determined. This aligns with FHWA policy (23 CFR 652.5) which requires that the safe accommodation of pedestrians and persons with disabilities should be given full consideration during the planning, design, and construction phases of federal-aid highway projects. The Department has determined that this policy also applies to all projects, regardless of the fund source, including 100% state-funded projects.

18.4 DEFINITIONS

For consistency in all Department projects, the following definitions will be used. **The definitions marked with an asterisk are consistent with definitions established in the Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).** The ADAAG contains the standards that are used for the design of accessible pedestrian facilities on all Department projects.

*** Alteration** - A change to a building or facility that affects or could affect the usability of the building or facility or part thereof. Alterations include, but are not limited to: remodeling, renovation, rehabilitation, reconstruction, historic restoration, resurfacing or changes or rearrangement of the structural parts or elements. Normal maintenance activities or changes to mechanical or electrical systems are not alterations unless they affect the usability of the building or facility by pedestrians. *Note:* Most Department projects involving pedestrian facilities are alterations for the purpose of ADAAG interpretation. Resurfacing is an alteration. As described in ADAAG, "new construction" would include a new street or highway on a new location.

***Blended Transition** – Connections between the pedestrian access route and the street that have a running slope of 5% or less.

Central Business/Walking District – Central Business/Walking Districts are characterized by high development densities, usually have a high transit mode share, large peak-period surges in pedestrian traffic volumes, limited street capacity, and up to 90% or more of all "on-street" mode share consists of pedestrian traffic movement.

Detectable warnings - A walkway surface treatment that is detectable by visually impaired persons or persons with low vision. Detectable warnings consist of a standard pattern of small truncated domes located at closely spaced intervals. The detectable warnings provide a tactile cue that is noticeable by cane or underfoot at the boundaries between pedestrian walkways and vehicular ways.

Intelligent Transportation System (ITS) – The application of modern technology and management systems to address multi-modal transportation needs, in particular to enable the more efficient operation and management of the transportation system.

Logical Termini – Logical termini are rational end points for a transportation improvement. Most common termini are points of traffic generation, especially intersecting roadways. According to FHWA regulations, logical termini shall have "independent utility or independent significance, i.e., be useable and be a reasonable expenditure even if no additional transportation improvements in the area are made."

Multiple-Threat Crash – A situation that may occur in multilane road configurations where there is a pedestrian crossing. The driver in the first travel lane stops for a pedestrian, but blocks the visibility of the pedestrian to a driver in the second travel lane.

Pedestrian Accommodations – Pedestrian accommodations are facilities specifically intended for pedestrian use. (See pedestrian facilities definition.)

Pedestrian Access Route (PAR) – The portion of the public right of way that serves as an accessible route. (* Accessible route is a continuous, unobstructed path connecting all accessible elements and spaces of a building or facility.)

The PAR refers to elements such as sidewalks, plazas, crosswalks, ramps, curb ramps, blended transitions, median islands, elevators, etc. It does not, necessarily, encompass the full width of sidewalks or other pedestrian ways but refers to that part, compliant with the most current best practices and/or standards adopted by the U.S. Department of Transportation, which in effect, provides a continuous accessible means of passage. Standards for pedestrian access routes address clear width, cross slope, grade, surface, changes in level, and other characteristics.

Pedestrian Generators – Pedestrian generators in this document refer to places where pedestrians originate (residences, nursing homes, etc.) and places where pedestrians travel to (stores, schools, etc).

* **Pedestrian Facilities** - Any features or elements used by disabled or able-bodied pedestrians to move from one point to another including sidewalks, crossings, refuge islands, pedestrian signs and signals, curb ramps, stairs, and general pedestrian areas such as plazas, public transit loading zones, and grade- separation structures. Pedestrian facilities also include call boxes, street furniture, etc.

Pedestrian Path – Pedestrian facility designed to facilitate pedestrian movement along a corridor where pedestrian facilities are warranted, but where sidewalks adjacent to the road are not feasible.

Sidewalk – A smooth, paved, stable and slip-resistant, exterior pathway intended for pedestrian use along a vehicular way separated with a curb offset.

Structural Impracticability – Structural impracticability may apply in new construction, when the unique characteristics of the existing terrain prevent the incorporation of certain accessibility features.

Technical Infeasibility – Technical infeasibility may occur during an alteration of a building or a facility, when existing conditions prevent the incorporation of certain accessibility features. For example, if the structural conditions would require removing or altering a load-bearing member that is an essential part of the structural frame; or because other existing physical or site constraints prohibit modification or addition of elements, spaces, or features that are in full compliance with the minimum requirements for accessibility.

18.5 PROCEDURAL REQUIREMENTS

FHWA regulations require that whenever a State highway is to be constructed, reconstructed, or rehabilitated or when the Department engages in any other public improvement project, the Project Developer should determine whether the existing pedestrian accommodations:

- Are adequate.
- Are readily accessible to persons with disabilities.
- Require reconstruction.
- Require rehabilitation.
- Warrant the construction of new facilities.

The Americans with Disabilities Act (ADA) requires that new and altered facilities be accessible to and usable by persons with disabilities.

The following procedures for pedestrian accommodation apply to all projects that are classified as new construction, reconstruction, bridge replacement, bridge rehabilitation, signal requirement contracts, safety, 3R, or 2R, as well as locally administered projects and work undertaken by Department Maintenance forces that are similar to the preceding project types.

18.5.1 Pedestrian Generator Checklist

The Pedestrian Generator Checklist (see Exhibit 18-1) is a tool to be used by the Project Developer in coordination with the Regional Bicycle and Pedestrian Coordinator during project scoping. The checklist highlights the importance of evaluating the potential for pedestrian activity at the project location and observing adjacent land use. The Pedestrian Generator Checklist focuses on the existence of pedestrian generators/destinations rather than on existing pedestrian activity since the lack of facilities may be the root cause of the lack of pedestrian activity. When generators of pedestrian activity are present and there is a probable use, Department policy is to accommodate pedestrians. Probable use has been defined as a mix of pedestrian generators and destinations within 800 m.

A Pedestrian Generator Checklist is required for all projects listed under Section 18.5. A Pedestrian Generator Checklist is also required for Highway Work Permit projects having highway mitigation such as lane widening or intersection improvements. This checklist should be completed during project scoping. All completed Pedestrian Generator Checklists should be submitted to the Regional Bicycle and Pedestrian Coordinator for review. Projects with one or more “Yes” answers on the checklist indicate a potential need for pedestrian accommodation, and the Project Developer should meet with the Regional Bicycle and Pedestrian Coordinator to determine if there is a need to accommodate pedestrians. The completed Pedestrian Generator Checklist should be included as an appendix to the Project Scoping Report and Design Report.

Information for the checklist may be obtained through use of methods such as:

- Observation.
- Discussions with local governments and planning organizations.
- Public informational meetings.
- Accident reports.
- Questionnaires.
- Community organizations addressing pedestrian needs, including persons with disabilities.

Professional judgment must be exercised to assure that potentially conflicting information is satisfactorily reconciled. The Regional Bicycle and Pedestrian Coordinator and/or regional landscape architectural staff should also be consulted for additional information and assistance.

18.5.2 Pedestrian Data Acquisition

The following factors should be considered during project scoping and discussed in the Project Scoping Reports and Design Reports.

3. Existing and expected land-use patterns and generators of pedestrian traffic:
 - Land use – residential, business/commercial, mixed commercial/residential, industrial, recreational, educational, agricultural, and open space.
 - Specific pedestrian traffic generators – residences, major employment centers, schools, parks, shopping plazas, malls, neighborhoods, health care facilities, colleges/universities, recreation areas, etc.
 - Transportation options that may require pedestrian linkage- bus stop locations, transit corridors and terminals, park-and-ride lots, parking garages, etc.
3. Existing and anticipated pedestrian characteristics:
 - User groups – i.e., commuters, students, shoppers, tourists, children, adolescents, elderly persons, and persons with disabilities.
 - Trip purpose – utilitarian (shopping/errands; commuting to work, school or place of recreation) or recreational (visiting friends, neighborhood riding, or touring.)
 - Frequency of use – daily, weekends, seasonal (as in tourist areas), peak time.
 - Slower walking speeds – due to aging population, increasing distractions (e.g., cell phone use, headphones, etc.), general decline in fitness, etc.
3. Existing site accommodations and characteristics such as:
 - Locations of walkways/worn paths and their relation to pedestrian generators/ destinations.
 - The location of incomplete walkways that adjoin or are located within the right of way, and their relation to pedestrian generators and destinations.
 - Locations where pedestrian facilities do not exist and their relation to pedestrian generators and destinations.
 - Existing pedestrian facility signs.
 - The physical condition of the existing pedestrian facilities (including existing conditions that limit access for people with disabilities, such as sidewalk lifts or other deteriorated situations).
 - Any site constraints or structural features that reduce feasibility of constructing pedestrian facilities (including facilities providing access for people with disabilities).
 - Existing right of way and availability of right of way.
 - Existing surface conditions, drainage, pavement markings, crosswalks, pedestrian signals, street lighting, signage, kiosks, and channelization.
4. Local or regional transportation plans which identify existing or proposed pedestrian facilities.
5. Pedestrian accident history, including causes and site context (roadway description and surrounding land use). Pedestrian accident history should include actual recorded incidents and local feedback on perceived safety. The absence of an accident history does not necessarily indicate a safe and accessible condition exists for pedestrians. Information may be gathered from local highway supervisors, local police, residents, or business owners.

For more information on pedestrian data acquisition, see Reference 27, listed in Section 18.15.

18.5.3 Pedestrian Traffic Forecasting

In most projects, careful application of the Pedestrian Generator Checklist, as described in Section 18.5.1, will be sufficient for determining the need for pedestrian facilities to accommodate existing, latent, seasonal, and projected future pedestrian traffic. However, pedestrian traffic forecasting may be necessary in areas of high pedestrian volumes and/or special-use areas, e.g., central business/walking districts, colleges, amusement parks, etc., to provide the necessary information to determine the appropriate treatment(s) and design of pedestrian facilities. For more information on pedestrian traffic forecasting, refer to HDM Chapter 5, Section 5.2.1.1 or consult with the Regional Bicycle and Pedestrian Coordinator or Main Office Pedestrian and Bicycle Program.

18.5.4 Pedestrian Level-of-Service

For high-density main streets, and central business/walking districts with very high pedestrian traffic volumes, it may be necessary to determine the Pedestrian Level-of-Service (LOS) for sidewalk, crosswalk, transit-related stairwells and ramps. Due to the high likelihood of noncompliance of pedestrian facilities, and very constrained access, a pedestrian LOS of E or less is not acceptable for pedestrian facilities at either existing or build-out development scenarios.

Refer to Exhibits 18-2 and 18-3 and HDM Chapter 5, Section 5.2.2.1 for more information on Level-of-Service.

Exhibit 18-2 Relationship between Walkway Width and Pedestrian Volume

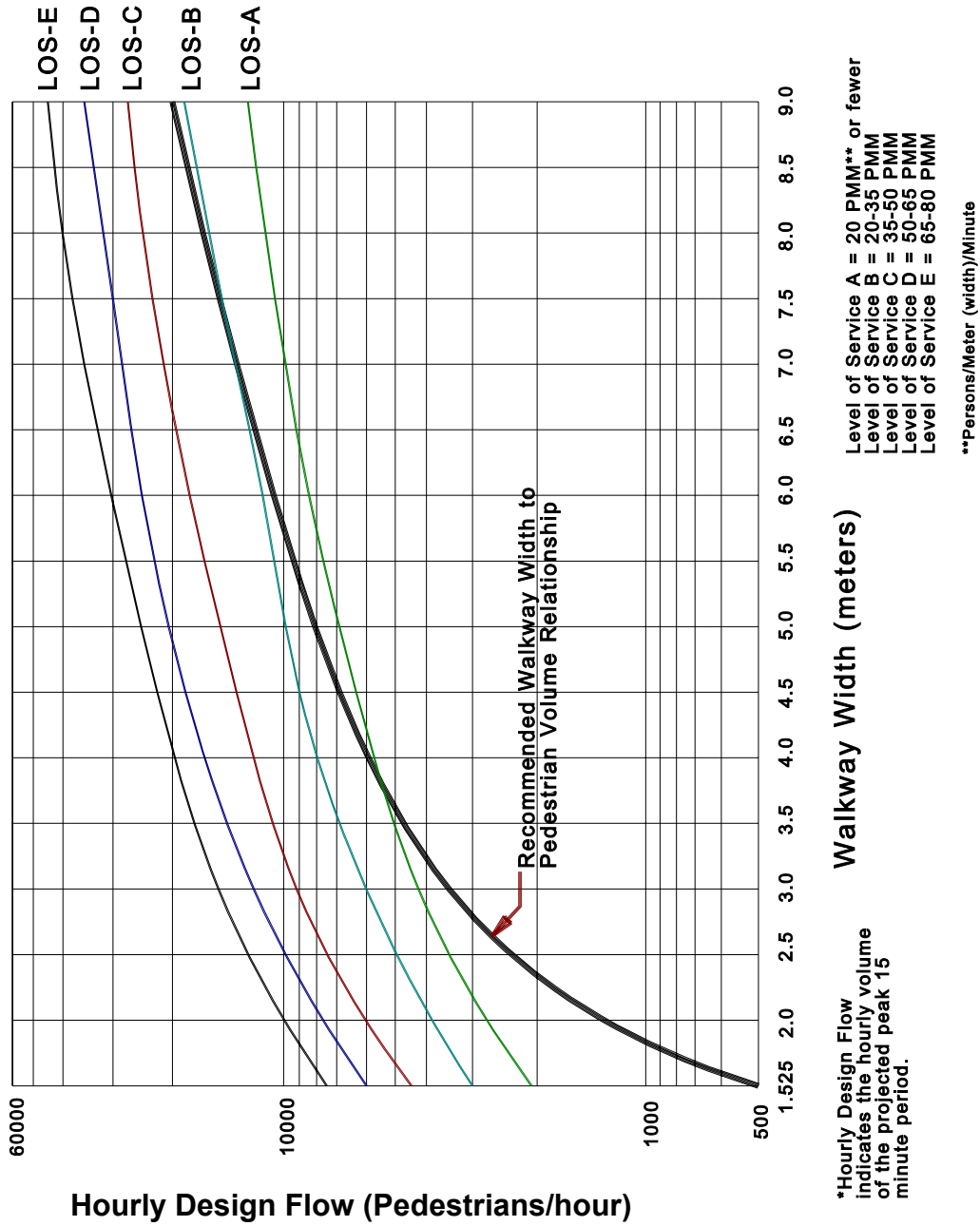


Exhibit 18-3 Pedestrian Level-of-Service**LOS A**

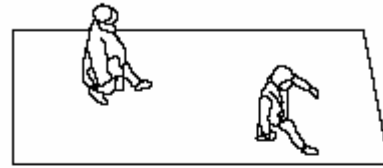
Pedestrian Space $>5.6 \text{ m}^2/\text{p}$ *Flow Rate* $\leq 16 \text{ p}/\text{min}/\text{m}$

At a walkway LOS A, pedestrians move in desired paths without altering their movements in response to other pedestrians. Walking speeds are freely selected, and conflicts between pedestrians are unlikely.

**LOS B**

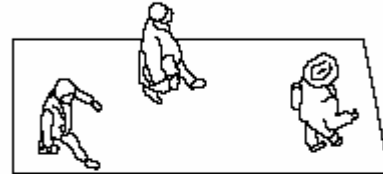
Pedestrian Space $>3.7\text{-}5.6 \text{ m}^2/\text{p}$ *Flow Rate* $>16\text{-}23 \text{ p}/\text{min}/\text{m}$

At LOS B, there is sufficient area for pedestrians to select walking speeds freely, to bypass other pedestrians, and to avoid crossing conflicts. At this level, pedestrians begin to be aware of other pedestrians, and to respond to their presence when selecting a walking path.

**LOS C**

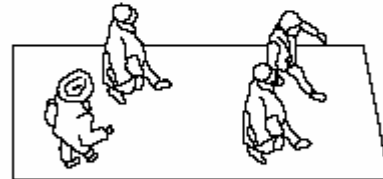
Pedestrian Space $>2.2\text{-}3.7 \text{ m}^2/\text{p}$ *Flow Rate* $>23\text{-}33 \text{ p}/\text{min}/\text{m}$

At LOS C, space is sufficient for normal walking speeds, and for bypassing other pedestrians in primarily unidirectional streams. Reverse-direction or crossing movements can cause minor conflicts, and speeds and flow rate are somewhat lower.

**LOS D**

Pedestrian Space $>1.1\text{-}2.2 \text{ m}^2/\text{p}$ *Flow Rate* $>33\text{-}49 \text{ p}/\text{min}/\text{m}$

At LOS D, freedom to select individual walking speed and to bypass other pedestrians is restricted. Crossing or reverse-flow movements face a high probability of conflict, requiring frequent changes in speed and positions. The LOS provides reasonably fluid flow, but friction and interaction between pedestrians is likely.

**LOS E**

Pedestrian Space $>0.75\text{-}1.4 \text{ m}^2/\text{p}$ *Flow Rate* $>49\text{-}75 \text{ p}/\text{min}/\text{m}$

At LOS E, virtually all pedestrians restrict their normal walking speed, frequently adjusting their gait. At the lower range, forward movement is possible only by shuffling. Space is not sufficient for passing slower pedestrians. Cross- or reverse-flow movements are possible only with extreme difficulties. Design volumes approach the limit of walkway capacity, with stoppages and interruptions to flow.

**LOS F**

Pedestrian Space $\leq 0.75 \text{ m}^2/\text{p}$ *Flow Rate* varies $\text{p}/\text{min}/\text{m}$

At LOS F, all walking speeds are severely restricted, and forward progress is made only by shuffling. There is frequent, unavoidable contact with other pedestrians. Cross- and reverse-flow movements are virtually impossible. Flow is sporadic and unstable. Space is more characteristic of queued pedestrians than of moving pedestrian streams.



18.5.5 Pedestrian Facility Documentation

18.5.5.1 Projects that do not Warrant Pedestrian Accommodation

During project scoping, it may be determined that pedestrian facilities are not needed for a particular project. When such a determination is made, it should be documented in the Project Scoping Report/Design Report. One of the three exceptional circumstances listed below should be stated in this documentation:

1. The project exists on a road where pedestrians are prohibited by law. It has been determined that there is no need to provide a pedestrian crossing from adjacent pedestrian facilities.
2. The cost of establishing pedestrian facilities would be excessively disproportionate to the need or probable use.
3. The project exists in an area where sparsity of population or other factors indicate the absence of a need for pedestrian facilities.

Note 1: Typically, excessively disproportionate is defined as exceeding 20% of the cost of the larger transportation project, but it should be determined on a project-by-project basis. Consensus should be reached between the project designer and the Regional Bicycle and Pedestrian Coordinator as to the reasonableness of providing pedestrian facilities within that particular project.

Note 2: Project designers shall consider pedestrian movement during construction activities, even when a permanent facility is not warranted. If permanent facilities are warranted, then a temporary sidewalk should be provided. If permanent facilities are not warranted, occasional pedestrian traffic must still be safely maintained during construction. In no case shall pedestrian conditions during construction be less safe than the pre-construction condition. This may require the inclusion of a fully accessible temporary sidewalk. See the Work Zone Traffic Control Diagrams for pedestrian accommodation at: <http://www.dot.state.ny.us/traffic/workzone/pedaccdiaq.html> .

18.5.5.2 Projects That Warrant Pedestrian Accommodation

If pedestrian accommodation is warranted, the manner in which this will be accomplished should be discussed in the Design Approval Document. Specific features that address the project's needs, objectives, and design criteria are discussed for each alternative included in the feasible alternative(s) section of the Design Approval Document. Pedestrian facilities should be commensurate with the project type. For example, within a signal requirement contract, the pedestrian accommodation may be as simple as a leading pedestrian interval or all-red phase.

Project limits should be established to carry pedestrian facilities to logical termini. Sidewalks should not usually end midblock. If there is evidence of travel to/from a pedestrian generator that is located within close proximity, the project designer should determine if it is feasible to extend pedestrian facilities to that generator.

When accommodation of pedestrians is warranted, but there are extenuating circumstances that prevent doing so, then a nonconforming feature explanation is required and should be documented

as described in the Highway Design Manual, Chapter 5, Section 5.1. The Regional Bicycle and Pedestrian Coordinator should agree with the nonconforming feature explanation that documents the reason(s) for the omission of pedestrian facilities.

The existence of districts or properties that are on or eligible for the National Register of Historic Places in the project area is not a justified reason to preclude new accessible pedestrian facilities in an area where such facilities are warranted. Pedestrian safety and accessibility are legitimate transportation concerns. Instead, project designers should work with the State Historic Preservation Office as outlined in ADAAG to determine the most appropriate placement and material for the warranted pedestrian facility.

When it is decided that existing pedestrian facilities require reconstruction or substantial rehabilitation but the work cannot reasonably be accomplished as part of a project under consideration, the Region should identify the need for the work on its existing facilities transition plan. (See 28 CFR Part 35 Nondiscrimination on the Basis of Disability in State and Local Government Services, Section 35.150). If the pedestrian facility is owned by a municipality or other government entity, the municipality or other entity should be advised in writing that they are responsible for the accessibility of the facility and that they should consider adding the necessary improvements to their facility transition plan.

18.5.5.3 Meeting Minimum Standards and Guidelines

When the need to accommodate pedestrians is determined to exist, facilities intended for them should be designed, constructed, and maintained in accordance with current regulations, guidelines, and standards.

The Department's minimum standards and guidelines for pedestrian facilities are included or referenced in this chapter. Departure from pedestrian accommodation standards should be described as nonstandard features per Highway Design Manual Chapter 2, Section 2.6.16. Nonstandard pedestrian facilities need approval as nonstandard features in accordance with Highway Design Manual Chapter 2, Sections 2.6.16 and 2.8.

The following references provide nationally accepted standards for pedestrian facilities.

- *The Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities* (ADAAG) (www.access-board.gov) are the primary regulatory standards that govern the design and construction of all pedestrian facilities in all Department projects. It is important to note that whenever facilities for persons with disabilities cannot fully meet the standards outlined in the ADAAG, a determination of each structural impracticability or technical infeasibility must be thoroughly documented in the permanent project record. See Section 18.6.1.2 for further information. This information will support the brief explanation that should be included in the Project Scoping and Design Reports as noted above.
- *AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities.*

- AASHTO, *A Policy on Geometric Design of Highways and Streets (Green Book)*.
- *Manual on Uniform Traffic Control Devices* <http://mutcd.fhwa.dot.gov>.
- *Official Compilation of Codes, Rules and Regulations of the State of New York, 17 NYCRR Transportation, Volume B (New York State Manual of Uniform Traffic Control Devices)*.

The Regional landscape architectural staff should be consulted for current ADAAG requirements. Also refer to Section 18.6.1.2 for additional guidance about structural impracticability and technical infeasibilities.

18.6 PEDESTRIAN FACILITY DESIGN

This section will provide project designers with information on how to design for pedestrian accommodation. It is not intended to cover all topics of pedestrian facility design. Rather, there are lists of references which will provide more in-depth information.

Attributes of good highway design that should be thoughtfully and seriously considered when accommodating pedestrians are summarized below.

- Circulation – The roadway should serve the needs of all users, including pedestrians.
- Balance – Roadway features should work in concert balancing the needs of all users.
- Connectivity – The roadway should provide connectivity/reasonable trip distances.
- Safety – Pedestrians using sidewalks and street crossings should not feel threatened by vehicle traffic.
- Accessibility – Sidewalks and crossings should be fully accessible to all users.
- Traffic Engineering Elements – Physical/operational elements account for all users.
- Landscape Development – Street furniture, vegetation, and aesthetic treatments should contribute to user safety, comfort and security.

For additional information see Reference 12 listed in Section 18.15 References.

18.6.1 Pedestrian Facility Design under the Americans with Disabilities Act (ADA)

The Department has a duty to construct, maintain, monitor, and update, any facility it owns or maintains to meet the most current ADA standards.

The Rehabilitation Act of 1973 (Section 504) requires nondiscrimination in all federally assisted programs, services, and activities. This means the programs, services, and facilities must be available to and usable by persons with disabilities.

The Americans with Disabilities Act (ADA) requirements for federal, state, and local governments extend and **increase** the requirements in Section 504 of the Rehabilitation Act. The ADA requirements are more stringent and require public facilities to be accessible regardless of the funding source.

The ADA is a civil rights law that requires nondiscrimination in the provision of public programs and facilities. Title II of the ADA requires state and local governments to make their “programs” accessible. The provision of opportunities for pedestrian travel is considered a program. Therefore, where pedestrian facilities are provided, access must be provided for persons with all kinds of disabilities, including access to intersections, regardless of their configuration. To accomplish this, **the ADA requires effective communication with persons with disabilities, and in order to meet this requirement, state and local governments must respond to requests from disabled persons.**

The U.S. Department of Justice's ADA implementation regulations barring discrimination in state and local government services (28 CFR Part 35) require that "a public entity shall furnish appropriate auxiliary aids and services where necessary to afford an individual with a disability an equal opportunity to participate in, and enjoy the benefits of, a service, program, or activity conducted by a public entity. In determining what type of auxiliary aid and service is necessary, **a public entity shall give primary consideration to the requests of the individual with disabilities**" (28 CFR 35.149 and 35.150).

All pedestrian facilities designed, constructed, or altered, must meet or exceed the minimum requirements for design, construction, and alteration established in ADAAG. However, if full compliance is technically infeasible on alterations, the alteration must provide accessibility to the maximum extent possible. Refer to Section 18.4 for the definition of an alteration.

ADA regulations require that sidewalk curb ramps must be constructed or reconstructed to meet current standards when any work, including roadway resurfacing or similar activities, involves work at intersections where sidewalks lead to street crossings. The connecting lengths of sidewalk between intersections must also be carefully examined for condition, accessibility, and continuity to determine the need for reconstruction, maintenance, or rehabilitation. These sections of sidewalks may not be required to be included in the scope of the resurfacing project, but should be included in the Regional Transition Plans which should have a reasonable estimated date for completion. Routine maintenance is the responsibility of the town, village, or city where the sidewalk is located. Refer to Section 18.14 for additional information about municipal maintenance responsibilities.

When traffic signal installation or similar work involves demolition and reconstruction of a sidewalk, curb, curb ramp, or any other pedestrian facility that will be retained, the pedestrian facility must be replaced, reconstructed, or constructed to conform to the current accessibility standards.

When a project involves the reconstruction of one side of an intersection, the Department is required to ensure that all pedestrian facilities within the intersection meet current ADA standards.

ADA regulations also require that when private entities construct pedestrian facilities on the public right of way, the permit process should ensure that within the right of way, all elements and features of the pedestrian facility meet the accessibility requirements.

18.6.1.1 Additional Design Considerations for Persons with Special Needs

In addition to mandated design requirements for persons with disabilities, the following are design considerations for areas where there are significant numbers of persons with special needs.

A. Older Persons

For projects that occur in areas where there are nursing homes, senior citizen housing, medical facilities, etc.:

- Minimize pedestrian crossing distances.
- Utilize a slower walking speed for signal timing at pedestrian crossings.
- Provide refuge islands.
- Provide pedestrian lighting to improve pedestrian visibility.
- Provide high visibility marking/delineation of crosswalks.
- Minimize complex vehicular turning movements.
- Increase sign retroreflectivity and letter size.
- Enhance traffic control devices with large indications.
- Use repetition and redundancy in signing.

For further information see Reference 3 in Section 18.15.

B. Visually Impaired Persons

The use of detectable warnings is the current practices for accommodating blind and vision-impaired pedestrians at intersections such as roundabouts and channelized turn lanes. Accessible pedestrian signals (APS) and other traffic control devices are typically installed at conventional intersections upon request of an individual or groups of individuals who would benefit by their existence.

Federal regulations direct that pedestrian safety considerations, "including installation of APS at street crossings" be included, where appropriate. However, an interim product from NCHRP Project 3-62 recognizes that the types of APS used in the United States are not entirely adequate. The results of the project, when completed, are expected to form the basis for better guidance regarding the use of APS.

The National MUTCD Section 4E.06 states, "The installation of accessible pedestrian signals ... should be based on an engineering study, which should consider the following factors:

- Potential demand for accessible pedestrian signals.
- A request for accessible pedestrian signals.
- Traffic volumes during times when pedestrians might be present.
- The complexity of intersection geometry (from the pedestrian point of view).

The following is the recommended practice:

- The ADA requires “effective communication” with persons with disabilities and it requires state and local governments to respond to requests for accessible pedestrian crossings from pedestrians who are blind or vision-impaired. These ADA requirements are acknowledged in the National MUTCD Section 4E.06.
- Proactively assure there is outreach and dialogue with blind and vision-impaired persons and organizations that represent them during the Department’s public involvement process for projects that may include roundabouts and/or channelized turn lanes. 28 CFR 35.160(a) requires that “(a) public entity shall take appropriate steps to ensure that communications with ... members of the public with disabilities are as effective as with others.”

Decisions to employ pedestrian crossing features (e.g., beneficial geometric designs, traffic control devices (i.e., APS, flashing beacons, etc.), and way-finding techniques) to assist blind and vision-impaired pedestrians should result from “effective communications” with individuals, groups, or organizations and should be based on the following:

- A request or requests from blind or otherwise vision-impaired individuals and/or organizations that represent them.
- The frequency or likelihood of use by blind or vision-impaired pedestrians.
- The proximities to transit stops, government offices, medical facilities, places of employment, shopping, places that provide services to blind and/or other vision-impaired persons.
- Motor vehicle traffic conditions (e.g., volumes, speeds, vehicle mix, peaks, lulls, etc.), proximity to other accessible crossings, “need” for an individual requestor to cross.
- Special, unique, or unusual conditions such as motorists’ inability to clearly see pedestrians who are waiting to cross at intersections (e.g., obstructions, curved approaches, parking lanes)

It is beneficial to involve an orientation and mobility specialist who teaches blind and other vision-impaired pedestrians how to find and use more difficult crossings such as roundabouts and channelized turn lanes. These people are usually familiar with traffic control devices, auxiliary aids, and other related services that benefit blind and vision-impaired persons. (Orientation and mobility specialists can be located by contacting organizations representing the blind and vision-impaired community or by contacting local centers for disabled persons.)

Pedestrian facility features that benefit pedestrians who are blind or are visually impaired include:

- Accessible text messages (larger print and raised text).
- Accessible audible pedestrian signals.
- Guide strips for way-finding.
- Physical barriers to prevent hazards in work zones.
- Provide pedestrian lighting.
- Utilize visual contrast in a consistent manner.

For further information see Reference 12 listed in Section 18.15 References.

18.6.1.2 Technical Infeasibility/Structural Impracticability

Regional landscape architectural staff can provide current advice regarding site-related situations that may be the basis for exceptions to the technical provisions of the ADAAG standards. A finding of structural impracticability (new construction) or technical infeasibility (alterations) must be made relative to each feature or element the designer believes can not be constructed in full compliance with the current accessibility standards. As an example, if the minimum width of a walkway cannot be attained and a finding of site structural impracticability or technical infeasibility is made, the walkway cross slope and surface requirements must still comply with the appropriate ADAAG provisions. No blanket provisions for structural impracticability or technical infeasibility exist.

Structural impracticability and/or technical infeasibilities should be identified as soon as possible. All structural impracticabilities and technical infeasibilities must be identified and documented in the design approval documents as discussed in HDM Chapter 2, Section 2.8.3. The designer must document that a pedestrian facility or element cannot meet the minimum requirements of the accessibility guidelines due to a specific structural impracticability or technical infeasibility. However, the design must ensure that each affected element is made accessible to the maximum extent feasible. See ADAAG Section 4.1.6 (1)(j).

18.6.1.3 Commercial or Public Buildings

When projects affect pedestrian access from the public highway or from walkways along the public highway to adjacent commercial or public buildings or facilities, the Department's obligations are as follows:

1. If a walkway, ramp, or stairway to a principal entrance of an existing commercial or public building or facility has to be removed in its entirety or requires structural alterations due to the necessary completion of the Department's project and no other accessible route exists to that principal entrance, then the removed or altered walkway, ramp, or stairway must be replaced by an accessible route, meeting the ADAAG requirements for new construction, to the extent that it is technically feasible. If another accessible route to a principal entrance does exist, the walkway, ramp, or stairway may be replaced in kind or may be eliminated if the property owner agrees and if this alternative is consistent with the Building Code. In-kind replacements must otherwise meet

applicable Department and Building Code requirements.

2. If grade changes require the addition of one or two steps to an existing stairway, the steps can be added without significantly affecting the accessibility of the entrance but the added steps must have riser and tread dimensions that match the existing stairway (note that this only applies if steps can be added without altering the structure of the existing stairway). Designers are cautioned that if work on a stairway is done off the right of way, a release must be obtained. Commercial property owners may be especially concerned about the potential of making their businesses less accessible.

3. If all, or portions of, a walkway or stairway to any nonprincipal entrance of a commercial or public building or facility are removed or structurally altered, the walkway or stairway may be replaced or altered in kind, consistent with applicable building code requirements. However, replacement stairways constructed by the Department must also meet the ADAAG requirements for stairs and the other requirements of Section 18.8.1.

18.6.1.4 National Register of Historic Places

The Department of Transportation must comply with the ADAAG accessibility requirements when dealing with districts or properties that are on or are eligible for the National Register of Historic Places. Full technical compliance with ADAAG is required unless such compliance would “threaten or destroy” the historic resource. In accordance with Section 106 of the National Historic Preservation Act, if the State Historic Preservation Officer (SHPO) or Advisory Council determines that compliance with the ADA will threaten or destroy the historic significance of the facility, “the alternative requirements in ADAAG Section 4.1.7(3) may be used.” These minimum requirements call for at least one accessible route or one accessible entrance. Access is still required. **It should be clear that the imperative is to provide accessible public facilities, including those that involve historic resources. Not providing access is not an easily justified option.**

Continued changes to cultural and historic landscapes are to be expected. Widening sidewalks to meet Department standards, providing curb ramps, extending sidewalk systems, and making slight elevation changes to make adjacent facilities accessible usually should not, in and of themselves, have an adverse effect on the historic setting. Removing and replacing deteriorated walkway materials should not threaten or destroy the historic significance of the resource.

18.6.1.5 Reestablishing Pedestrian Routes to Private Residences

ADA law does not apply to one- or two-family private residences, NYS Building Code does. The pedestrian route off of the public right of way and to a private residence may be replaced in kind, as long as it meets current building codes requirements and the Department’s applicable stairway and railing standards. Project designers should also analyze each site to determine the most accessible solution. If several solutions for a particular situation are comparable in cost and meet building code and Department requirements, the homeowner’s preferences should be considered.

Information about the Department’s stair and handrail standards can be found in Section 18.8.1.

18.6.2 Use of Shoulders as Pedestrian Facilities

When accommodation of pedestrian travel is warranted, then pedestrian facilities should be provided. The preferred facility for pedestrian travel along a road is a sidewalk. When the context of the project is such that sidewalks are not a feasible solution, the project designer must consider other pedestrian facility options. For example, if the project occurs on a high-speed, rural highway where the introduction of a curb is not acceptable, the pedestrian facility can be located along, but not immediately adjacent to the highway facility hence removing the need for a curb. See Section 18.6.3 for more information on Pedestrian Paths.

Shoulders are not substitutes for a well-designed pedestrian facility. However, there may occasionally be a need to design shoulders as walkways where roadside space is constrained. For example, this has occurred along sidewalks where relatively short segments of shoulders were designed as public walkways to bypass obstacles, such as existing retaining walls or slopes where sidewalks could not be constructed.

In such a situation, ADAAG requires that accessible design standards be used to design the segments of the shoulders that are intended to serve as walkways. This means that these segments of the shoulder must meet the ADAAG 2% maximum cross slope requirements. This conflicts with the normal 6% shoulder cross slope and may result in technical infeasibilities where the cross slope of the traveled way exceeds 2% (i.e., the insides of curves).

Designers are reminded that Section 1156 of the Vehicle and Traffic (V&T) Law states “When sidewalks are not provided any pedestrian walking along and upon a highway shall when practicable walk only on the left side of the roadway or its shoulder.” Therefore, when shoulders will be used as pedestrian facilities, the designer should decide whether it is practicable for pedestrians to walk facing traffic or if provisions should be made for them to walk in either direction along one side of the road. The decision should be based on safety, e.g., the ability to cross the road safely, and other considerations. If pedestrians are expected to walk facing traffic, 1.2 m wide accessible shoulders may be sufficient and appropriate pedestrian crossings should be provided to access the shoulder along the opposite side of the roadway. When pedestrians may walk in either direction, the accessible shoulder width should be 1.525 m.

Pedestrians are permitted to use the shoulders of most State highways, with the exception of interstates, parkways, and other similar controlled-access highways where they are specifically prohibited. Shoulders do not have to meet ADAAG standards when scoping and other studies indicate that sidewalks and/or other pedestrian facilities are not warranted.

18.6.3 Pedestrian Paths

Pedestrian paths are pedestrian facilities designed to facilitate pedestrian movement along a corridor where pedestrian facilities are warranted, but where sidewalks are not feasible or are inappropriate. Pedestrian paths differ from sidewalks in that they are not immediately adjacent to the roadway and do not require a curb. Pedestrian paths may also allow for the temporary completion of a pedestrian facility system until sidewalks can be constructed.

Pedestrian paths are generally set back from the road and separated by a ditch, green area, or street plantings. These paths can be constructed along, but not immediately adjacent to a roadway or in another logical location. The alignment of a pedestrian path is more flexible than a sidewalk system. However, where pedestrian paths cannot be separated from roadways by at least 1.525 m, a suitable barrier should be considered. Factors that should be considered in making judgments regarding barrier need or type include:

- Is a barrier necessary to protect path users from motor vehicle encroachments?
- Is a barrier necessary to prevent path users from encroaching on the roadway?

Pedestrian paths used to complete a pedestrian system follow the same design requirements as sidewalks. That is, they must conform to the same surface treatment, cross slope, grade, and width requirements of the ADAAG discussed in Sections 18.6.5. If designed as a shared-use path, there are additional design standards used in order to accommodate multiple-user types. Refer to HDM Chapter 17, Section 17.5.

18.6.4 Guidelines for Installing Sidewalks

The Department should design sidewalks as parts of projects whenever they are determined to be necessary and consistent with needs identified in the Project Scoping Report, Final Design Report, and the guidelines in this chapter. The Department shall ensure that sidewalks necessitated by highway work permit related projects are constructed under the terms of the work permits.

Designers should provide sidewalks when adjacent land use includes pedestrian generators and destinations within close vicinity to one another, and/or where municipal or Regional/Metropolitan Planning Organization (MPO) transportation studies indicate the need for pedestrian facilities. The need for sidewalks should be documented in all Project Scoping Reports and Design Reports (see Section 18.5).

In general, sidewalks are recommended along streets or highways (where pedestrians are permitted) in developed or developing areas, even where pedestrian activity may appear light. Specific pedestrian volume warrants for sidewalks along streets and highways are not established and actual counts may not reflect the demand for pedestrian facilities. Rather, the Project Developer should look for the potential of pedestrian traffic, using the Pedestrian Generator Checklist discussed in Section 18.5.1.

PEDESTRIAN FACILITY DESIGN

No absolute criteria exist that define exactly where a sidewalk should be located or where it should begin or end. Designers should use their professional judgment, the Pedestrian Generator Checklist, the logical terminus principle, and the guidance presented in Exhibit 18-4. It should be noted that pedestrian facilities constructed under the terms of highway work permits should have logical termini to the extent practicable. Land developers, however, should not be required to purchase additional property in order to terminate pedestrian facilities at commercial entrances, streets, other sidewalks, etc. Sidewalks should be terminated by an accessible route connecting the sidewalk to the roadway shoulder or an existing pedestrian facility.

Existing, deteriorated, or nonaccessible sidewalks (those not meeting the minimum requirements of current ADAAG standards) should be rehabilitated or replaced. Incomplete, but warranted, pedestrian facility systems should be made complete and should have logical termini. Existing but unnecessary sidewalks should be eliminated. However, if they are left in place, they must be accessible. The Design Report should document any decision to remove an existing sidewalk.

Exhibit 18-4 Guidelines for Locating Sidewalks in Developed Areas

Type of Area (land use, roadway functional classification, or density of dwelling units)	Providing Sidewalks on New Streets	Providing Sidewalks on Existing Streets
Commercial, Industrial, and public service (all streets)	Developed sides of these streets	Developed sides of these streets
Residential (along major and minor arterials)	Developed sides of these streets	Developed sides of these streets
Residential (along collectors)	Developed sides of these streets.	Developed sides of these streets.
Residential – neighborhood streets with detached residences less than 30 m apart	Developed sides of these streets	Preferred on both developed sides to prevent unnecessary crossings. If that is not feasible, sidewalks may be built only along one side of the roadway. The sidewalk should be built along the area with more pedestrian generators and destinations.
Residential – neighborhood streets with detached residences an average of 30 m to 60 m apart	Desirable on both developed sides to prevent unnecessary crossings, but needed on at least one side if vehicle traffic exceeds 400 vehicles/day. The sidewalk should be built along the area with more pedestrian generators and destinations.	Desirable on both developed sides to prevent unnecessary crossings, but needed on at least one side if vehicle traffic will exceed 400 vehicles/day. The sidewalk should be built along the area with more pedestrian generators and destinations.
Residential – local roadways with residences further than 60 m apart (see note 4.)	Needed on one side of these roadways when vehicle traffic will exceed 400 vehicles/day. The sidewalk should be built along the side with more pedestrian generators and destinations.	Needed on one side of these roadways if vehicle traffic exceeds 400 vehicles/day. The sidewalk should be built along the side with more pedestrian generators and destinations.

1. Sidewalks frequently extend from the building face to the curb in heavily developed urban areas where structures are continuous and attached. Where sidewalks will be replaced or reconstructed in such areas, designers should pay attention to doorway and basement entrances, stairs, roof drains, utilities, trees, street furniture, snow storage space, etc. Clearance next to the face of buildings is generally recommended to be 0.5 m. ADAAG and the regional landscape architectural staff should be consulted early in the project design. Detailed grading plans with spot elevations and slopes may be useful in areas with limited space and building entrances.
2. Identifying nearby land use, such as schools, parks, shopping centers, and other commercial properties and their associated pedestrian traffic, will help determine whether sidewalks are needed on both sides of the street. See discussion on Pedestrian Generator Checklist Section 18.5.1 and Pedestrian Traffic Forecasting Section 18.5.3.
3. Sidewalks should be provided along both sides of roads, streets, and arterials where pedestrian access is needed or desired to schools, universities, office complexes, commercial establishments, post offices, transportation terminals and transit stops. The designer should discuss this with the regional landscape architectural staff or the Regional Bicycle Pedestrian Coordinator to determine the best sidewalk placement.
4. Professional judgment must be used to determine appropriate locations to begin and/or end sidewalks as development becomes less dense. Sidewalks should have logical termini.

18.6.4.1 Sidewalks on One Side of Street

A sidewalk on one side of the street may be an adequate solution in certain situations, but is generally not recommended when both sides of the street are developed. This type of system causes pedestrians to cross streets more frequently, hence increasing their level of exposure to potential conflicts with vehicular traffic. Pedestrians may cross where drivers of vehicles do not expect them, but rather where it is more convenient for the pedestrian to access the sidewalk. For example, a pedestrian originating from a residence on the side of a road without pedestrian facilities may opt to cross midblock rather than travel along the roadway to reach an intersection in order to cross and access the sidewalk. The Vehicle and Traffic law requires pedestrians to walk facing traffic. This will create multiple crossings in residential areas to access the sidewalk when the pedestrian's intended destination is to the right of their origin.

18.6.4.2 Public Concerns about Sidewalk Construction

There will be occasions when pedestrian facilities are warranted, but to retain a certain atmosphere, they are not desired by residents, local officials, or other agencies. Two examples are along a rural or suburban highway where the community wants to retain a "rural" atmosphere regardless of local density and development patterns and in historic districts where the introduction of a curb and sidewalk may appear to affect the historic district. (See National Register of Historic Places, Section 18.6.1.4) Pedestrian safety and accessibility need to be considered under these circumstances. True contextual design will take into account all of these needs and work towards a solution that best meets the needs of stakeholders. Project designers should work with the community and/or the State Historic Preservation Office to determine how to best accommodate the needs of pedestrians while retaining the desired sense of place. Some solutions may be to provide pedestrian facilities along, but not immediately adjacent to the roadway (see Pedestrian Paths, Section 18.6.3), or may be to choose appropriate materials for the construction of the sidewalk, as long as it meets the standards established by ADAAG.

18.6.4.3 Municipality Concerns Regarding Sidewalk Maintenance

There will be occasions when a municipality opposes the establishment of sidewalks because of the cost associated with sidewalk maintenance. This is not an appropriate reason to omit the construction of sidewalks. When sidewalk construction is necessary to address identified needs for safe and accessible pedestrian travel they should be provided. Sidewalk maintenance resolutions and agreements are not prerequisites to the construction of necessary pedestrian facilities.

18.6.4.4 Phased Development of Sidewalks

In areas that are beginning to develop and sidewalks are not currently warranted, it is important to plan for future sidewalks. Items to consider are right of way acquisition for future sidewalks, deciding when to install sidewalks, and who will likely be responsible to fund and maintain the sidewalks. Municipalities may require private developers to provide pedestrian facilities with their site plan. In some cases, the sidewalks may not have termini at intersections or pedestrian generators. This should be considered staged construction that will temporarily leave incomplete

sidewalks along some routes. This is not inappropriate, if the municipality has documentation of an intention to add pedestrian facilities to this area, as in a master plan or some other planning document. For further discussion, refer to Reference 12 listed in Section 18.15 References. The sidewalk should transition to the shoulder with a curb ramp.

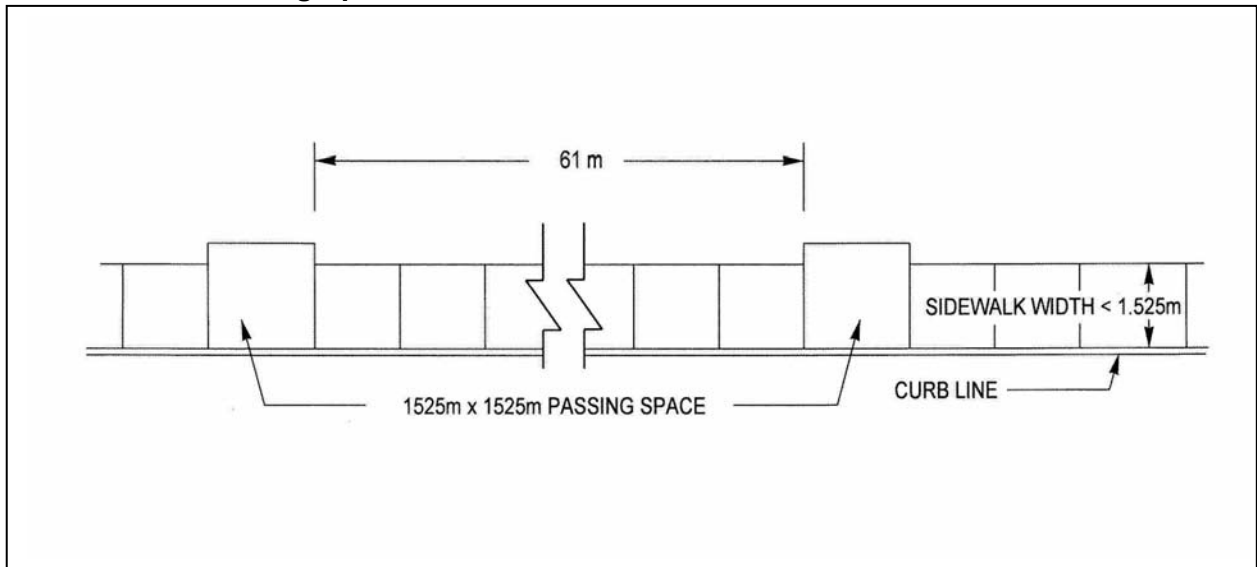
18.6.5 **Walkway Design**

Note: Channelization (access control) islands are not necessarily sidewalks, especially where they are isolated from sidewalk systems and are located in areas where sidewalks are not warranted. When these islands are used solely for access control, they do not need to conform to the minimum standards listed in this section.

18.6.5.1 Widths

The Department's standard minimum accessible width for pedestrian access routes is 1.525 m, exclusive of the curb. On structures, the minimum dimension from the face of the bridge rails or barriers to the face of the curb is 1.7 m. These widths accommodate continuous, two-way pedestrian traffic. **Designers should consider a minimum accessible 1.2 m clear width only in limited, extremely restricted circumstances where obstructions cannot be avoided**, such as around utility poles that cannot be relocated, immovable topographic features, structures, etc. Walkways should be designed consistent with the Department's standard minimum accessible width of 1.525 m, even if additional right of way has to be purchased or an easement obtained. Where obtaining additional widths is a not practicable, short segments of the accessible pedestrian access route as narrow as 1.2 m may be considered. However, ADAAG requires a 1.525 m x 1.525 m minimum passing space every 61 m when walkway widths are less than 1.525 m. See Exhibit 18-5.

Exhibit 18-5 Passing Space



Effective walkway width is not total walkway width, but rather that portion of the walkway section that is free of obstructions or impedances and actually available for pedestrian travel. Additional clearance space should be provided near doors at building entrances, street appurtenances, etc. Where parking is provided adjacent to sidewalks, space should be provided to accommodate opening car doors outside of the pedestrian access route. This can be accomplished either through a minimum walkway width of 2 m, or the use of a buffer strip along the curb.

Walkways in central business/walking districts and similar locations should be designed to provide for adequate capacity to accommodate the projected and/or build-out peak pedestrian volume. Care must be taken to avoid under-designing facilities that would lead to excessive congestion or over-designing facilities that will not have enough traffic to warrant the increased width and appear uninviting to pedestrians. Additional space along a pedestrian access route, however, provides lateral clearance along building faces, basement entrances, and similar locations and accommodates shy distance, window shopping, and deliveries to businesses, building maintenance activities, and snow storage.

To see the relationship between walkway widths and pedestrian volumes for a desired level of service see Exhibit 18-2. For more information refer to Reference 16 listed in Section 18.15. Regional landscape architectural staff can provide advice regarding the practical sidewalk widths that take pedestrian volumes, desired levels of service, and spatial and cost requirements into consideration.

18.6.5.2 Cross Slope

The cross slopes on sidewalks or other walkways are governed by two somewhat opposing criteria. The flatter the cross slope the more easily it can be traversed by persons in wheelchairs, those using walkers as a mobility aid, as well as other members of the community. Conversely, the slope needs to be steep enough to provide adequate drainage. Generally, a 2% cross slope will satisfy both concerns. There will be cases where design constraints such as the slope of intersecting perpendicular driveway entrances or lack of right of way make it difficult to meet the desired cross slope and still achieve a 1.525 m, or greater, accessible width. However, the cross slope on the Pedestrian Access Route within a walkway shall not exceed 2%, even after application of construction tolerances. The only exception to this is at midblock crossings where an abrupt change in the roadway slope would cause an unnecessary hazard.

When a 2% cross slope cannot be met for the entire sidewalk width, a 1.2 m wide minimum continuous pedestrian access route (with the required 2% cross slope) is required. The continuous pedestrian access route should not be placed directly adjacent to buildings or curbs. The remaining sidewalk width that is traversable by able-bodied persons may vary in cross slope up to a maximum 5%. Stepped curbs, paving blocks, grassed slopes, or other appropriate surfaces that are clearly different than the sidewalk's surface, may be placed adjacent to the sidewalk in order to accommodate the necessary changes in grade. Refer to Section 18.4 for the definition of Pedestrian Access Route.

18.6.5.3 Walking Surface

Walkways constructed on Department projects must meet the ADAAG requirements for a stable, firm, and slip-resistant surface. They should be hard-surfaced, smooth, and durable and provide for all-weather use.

A. Reduced Vibration Zone

The Pedestrian Access Route (PAR) should include a minimum 1.2 m Reduced Vibration Zone, particularly within crosswalks. This is a narrower route within the boundaries of the PAR that is relatively smooth and free of irregular surface features, e.g., exposed aggregate, pavers with rounded edges or chamfered edges greater than 6 mm, cobblestones, stamped concrete, and other types of rough or jointed surfaces. A reduced vibration zone minimizes the sometimes painful vibration persons using wheeled mobility aids may experience traversing rough and uneven surfaces. Examples of reduced vibration surfaces include squared edge pavers and pavers with edges chamfered 6mm or less. As a general guide, surface imprints wider and deeper than 6 mm would not be considered vibration-free. At crosswalks the Reduced Vibration Zone can be bordered with other more aesthetic surface treatments inside or outside the standard crosswalk markings. (See Exhibit 18-6.) Refer to Section 18.4.1 for discussion of Alternate Crosswalk Treatments.

Exhibit 18-6 Crosswalk Surface Treatment

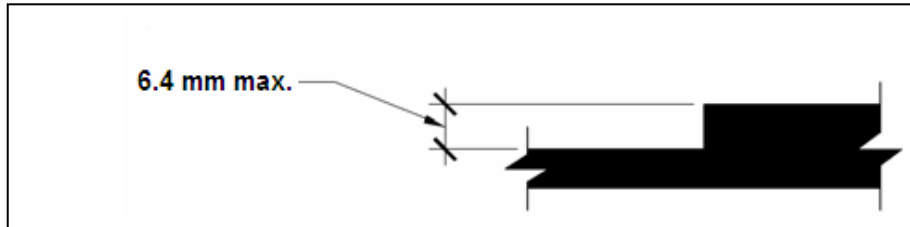


Photo courtesy of Pattern Paving Company

B. Vertical Alignment

Walking surfaces are permitted to have vertical changes in level up to 6.4 mm high (see Exhibit 18-7). Changes in level between 6.4 mm and 13 mm high maximum shall be beveled with a slope not steeper than 1:2. Changes in level exceeding 13 mm shall be treated as a ramp (slope requirements, cross slope requirements, etc).

Exhibit 18-7 Walking Surface Permitted Change in Level (Source ADAAG)

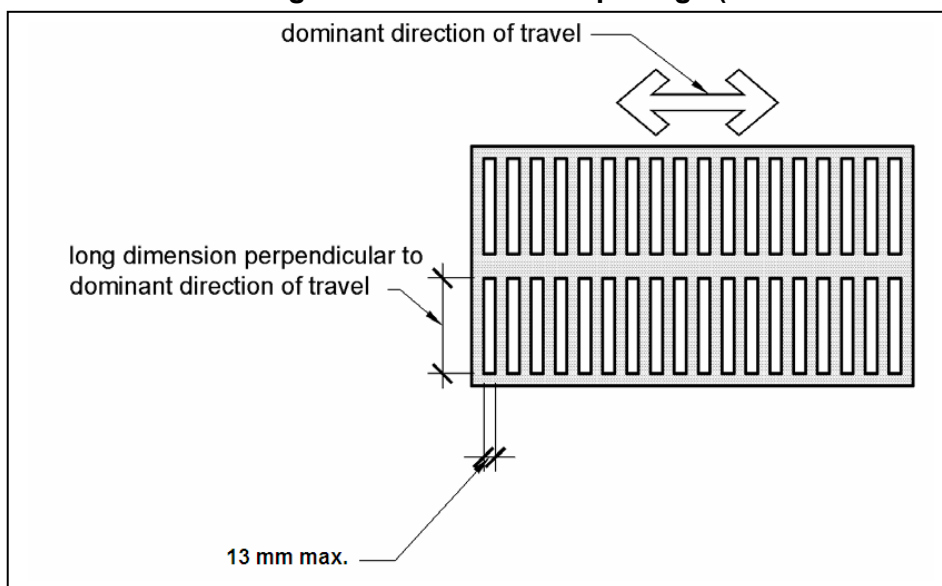


C. Permitted Openings

In general, grates, access covers and similar surfaces should not be placed within the PAR. If it is technically infeasible to avoid placing them in the PAR, then the following conditions **must** be met, as shown in Exhibit 18-8:

- Openings shall not allow passage of a sphere more than 13 mm diameter.
- Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel.
- Grates, access covers and similar surfaces **shall not** be located on curb ramps, blended transitions or landings.
- Grates, access covers and similar surfaces shall be slip resistant.

Exhibit 18-8 Walking Surface Permitted Openings (Source ADAAG)



18.6.6 Placement within the Right of Way

Sidewalks should be located as far as practicable from the travel lanes. The desirable width of the space between the edge of sidewalk and the back of curb or shoulder is 2.5 m or more on all but low-traffic-volume streets and roads. Wider setbacks enhance the real and perceived levels of safety associated with walking close to high-speed, high-volume roadways and improve pedestrian comfort and convenience by moving them away from wind blast, dust, noise, and water splashing. When 2.5 m is not feasible, the desirable minimum setback widths are depicted in Exhibit 18-9.

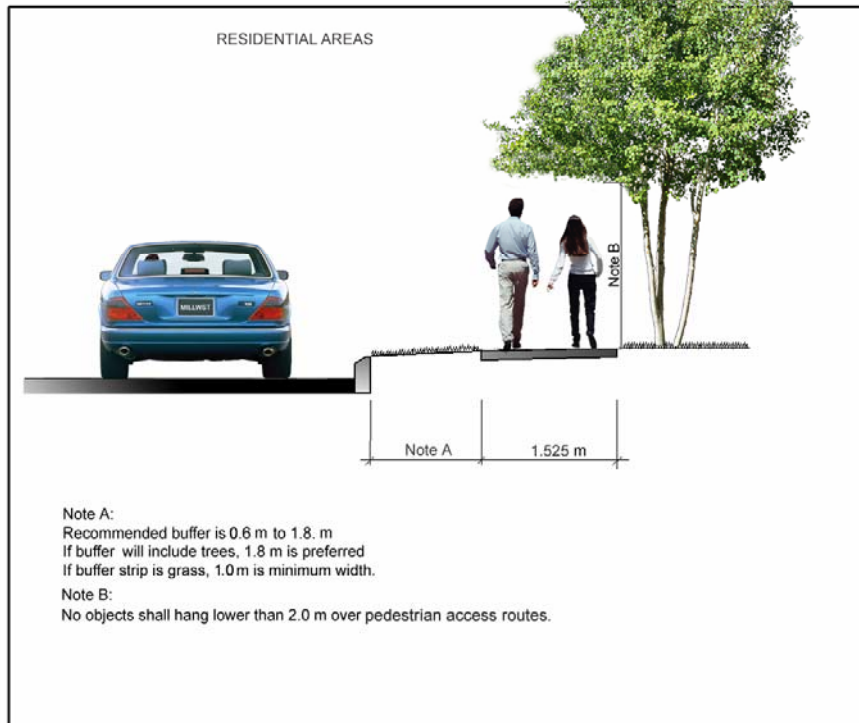
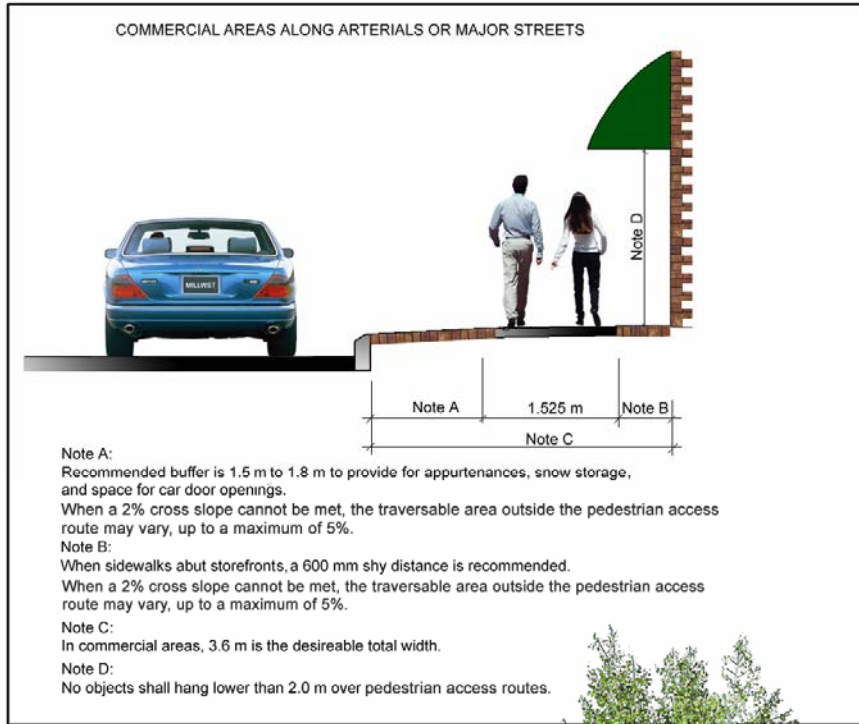
The area between curbs or shoulders and sidewalks also provides:

- Storage space for snow.
- Storage space for trash and leaf collection.
- Areas for street trees.
- Areas for utilities, street furnishings and traffic signs.
- Space for changes in grade so that sidewalk grade variations at driveways are minimized.
- Space to accommodate grade differences between street and buildings while providing 2% sidewalk cross slope.

Refer to HDM Chapter 3, Section 3.2.11.1 for a detailed discussion of sidewalk setbacks and snow storage widths. HDM Chapter 10, Section 10.2.1, 10.2.2.4.B, and 10.2.2.4.C also give guidance on additional clear zone requirements which may affect sidewalk location and providing curbing with sidewalks.

PEDESTRIAN FACILITY DESIGN

Exhibit 18-9 Sidewalk Placement within the Right of Way



18.6.7 Pedestrian Facility Design Elements

Pedestrian facility design elements contribute to function and comfort of the pedestrian facility system. The need for pedestrian design elements should be discussed with the locality and should be designed or selected to fit within the context of the project area.

Pedestrian facility design elements should be placed logically in association with their intended use. These elements should not obstruct the visibility of pedestrians or motorists approaching an intersection. These elements must be located to avoid creating obstacles for pedestrians with vision impairments and should not be located within the effective width of the pedestrian facility, nor may they extend into the pedestrian access route. In addition, the following are clearances as required by the ADAAG:

- No objects shall hang lower than 2.0 m over the normal path of travel. (See Exhibit 18-9.)
- No object mounted on a wall or post or free standing shall have a clear, open area under it higher than 0.685 m above the ground.
(<http://www.access-board.gov/ada-aba/final.htm#pgfid-1006249>)
- No object higher than 0.685 m attached to a wall shall protrude more than 100 mm.
- No protruding element shall reduce the clear width of the circulation path to less than 1.2 m.

18.6.7.1 Pedestrian Lighting

Pedestrian lighting can improve the safety of pedestrians and increase their comfort and sense of security. Pedestrian lighting is recommended in areas of high concentration of pedestrian travel at intersections or other pedestrian crossings and in areas where there is significant dusk or nighttime pedestrian activity. The Department's *Policy on Highway Lighting*, and the AASHTO *Informational Guide for Roadway Lighting* guides the selection of locations at which fixed-source lighting should be provided and presents design guidance for their illumination. The AASHTO guide also contains a section on the lighting of tunnels and underpasses. For additional information on lighting see References 19 and 25 in Section 18.15.

18.6.7.2 Benches

The availability of places to rest and congregate adds to the overall pedestrian environment. As the population is aging, an increasing number of pedestrians will be elderly persons who cannot walk long distances without stopping to rest. Project designers should consider providing benches at appropriate intervals, especially in areas near civic centers, nursing homes, and hospitals where there will likely be a relatively high concentration of elderly persons. Another option is to provide space for benches, which will be supplied by the municipality. It is appropriate to work out a maintenance agreement with the municipality for the repair or replacement of any damaged benches.

Refer to the US Forest Service Recreation Area Guidelines for the scoping requirements of bench placement. Bench design should comply with the technical requirements of Section 903 of the revised ADAAG.

18.6.7.3 Street Trees and Other Plantings

Street trees create an aesthetically pleasing buffer between the roadway and the pedestrian facility and may contribute to traffic calming when designed appropriately. Trees and shrubs should not be placed where they will obstruct the visibility of pedestrians, bicyclists, or motorists approaching an intersection. If tree grates are necessary, they should be placed outside of the PAR. If that is not possible, the tree grates should be flush with the pedestrian facility and meet the other requirements discussed in Section 18.6.5.3 B.

18.6.8 **Pedestrian Facility Appurtenances**

Pedestrian facility appurtenances generally refer to stationary outdoor objects such as signs, signal poles, lighting, telephones, litter containers, parking meters, fire hydrants, mailboxes, newspaper vending machines, utility poles, planters, etc., that may be located adjacent to the pedestrian access route.

The functional and aesthetic quality of the street environment depends on the design, selection, and location of the appurtenances. When possible, appurtenances should be chosen for their appropriateness, size and scale, locations, and the needs and requirements of users. The designer should consider the impact that the total number of individual appurtenances used will have on the visual appearance and function of the street environment. To the extent practicable, appurtenances should be compatible with each other as well as the surrounding visual and cultural environment. **Pedestrian facility appurtenances follow the same clearance restrictions as pedestrian facility elements listed under Section 18.6.7.**

To ensure that the street and sidewalk environments are safe, functional, and pleasant to use, designers should:

- Coordinate the design, selection, and location of all appurtenances with the agencies responsible for their operation and maintenance.
- Refer to ADAAG and the NYS MUTCD for information regarding sign heights and placement in walkways, distances that objects may protrude into accessible routes, etc.
- Ensure the project roadside clear area and sight distance requirements are met when selecting and locating pedestrian facility appurtenances.
- Develop appropriately scaled drawings (i.e., 1:250) of the work to accurately locate and coordinate the various appurtenances associated with pedestrian facilities. All walkway-related drainage structures, crosswalks, and curb ramps should be shown. All of these elements should be drawn to scale and carefully labeled. The drawings should be part of, or incorporated into, the contract documents.

The benefits of being specific in the contract plans are:

- It relieves the Engineer-in-Charge of having to make specific location decisions during construction.
- It helps ensure that pedestrian-facility-related appurtenances will not be located in the pedestrian access route or in the curb ramps and their landings.
- It allows the designer to anticipate potential conflicts between all of the elements in the design.
- It allows consolidation of signs onto a minimum number of posts, thereby reducing visual clutter.
- It enhances the safety of pedestrians with disabilities by ensuring that signs, poles, and grates are not placed in, or encroach upon, the sidewalks or curb ramps and that appurtenances will not block motorists' views of pedestrians at crosswalks.

18.7 PEDESTRIAN CROSSINGS

Intersections should be designed with the premise that pedestrians will be present (see Section 18.5.5.1 for exceptions), and will be able to cross the street safely. This requires that project limits be established so entire intersections are included. Some attributes associated with good intersection-crossing design are listed in Exhibit 18-10.

Since vehicular speed is a critical aspect of pedestrian safety, traffic calming measures should be considered in areas of significant pedestrian crossings. For more information on traffic calming, see HDM Chapter 25 and References 4, 8, 12, and 28 listed in Section 18.15.

Where public streets with sidewalks include opportunities for street crossings at intersections, ADA regulations require curb ramps with detectable warnings. In addition, designers should take into consideration specific pedestrian groups who may use the project site, including a predominance of children, elderly persons, or persons with disabilities. Child behavior may be unpredictable, and they may be prone to taking risks. Some elderly persons and persons with disabilities may have problems with diminished vision, reflexes, decision-making skills, and may have other physical impairments that reduce their walking speed.

Exhibit 18-10 Best Practices for Pedestrian Crossing Design at Intersections

Attributes	Explanation
Clarity, Directional, and Instructional Information (e.g., signing and audio/tactile cues as needed)	It should be obvious to motorists that there will be pedestrians present; it should be obvious to pedestrians where best to cross.
Convenient	Pedestrians will cross where it is most convenient.
Predictability	The placement of crossings should be predictable. Additionally, the frequency of crossings should increase where pedestrian volumes are greater.
Visibility	The location and illumination of intersection crossings allows pedestrians to see and be seen by approaching traffic while crossing.
Reasonable delays	The pedestrian does not have to wait unreasonably long for an opportunity to cross.
Adequate Crossing Time	The time available for pedestrians to cross accommodates users of all abilities.
Reduced Vibration Zone	Provide a 1220 mm minimum path within the crossing which eliminates or minimizes rough or jointed surfaces.
Limited Exposure	Conflict points with vehicular traffic are few, and the distance to cross is short or is divided into shorter segments by refuge islands or medians.
Clear and Accessible Crossing	The crossing is free of barriers, obstacles, and hazards, and is accessible to all users.

18.7.1 Pedestrian Street Crossing Dynamics

18.7.1.1 Crossing Opportunities and Path Diversion Distance

Based on FHWA research and AASHTO guidance, 1.6 km is recognized as the maximum walking distance that most healthy/able-bodied people would be willing to undertake. However, the research also states that the majority of pedestrian trips are 0.4 km in length. Subject to good engineering judgment, 0.4 km is an appropriate average distance for accommodating “most” pedestrians of all abilities, outside of high-pedestrian traffic zones. In high-pedestrian traffic zones, or central business/walking districts, pedestrian crossings spaced between 100 m and 150 m apart would be reasonable and may correspond with the typical block lengths in high-pedestrian traffic zones.

Suggested spacing of crossings are as follows:

- Central business/walking districts – from 100 m to 150 m apart and based on density.
- Urban or suburban residential/retail areas – based upon density/ land use and not to exceed 0.4 km.
- Low-density rural centers/seasonal use areas – as needed. It is easier to find crossable gaps.

The maximum distance that people with disabilities should reasonably be expected to divert from their intended path would be between 50 m and 75 m.

For more information, see Reference 12 in Section 18.15 References.

18.7.1.2 Pedestrian Crossing Speed

The typical walking speed used in design for pedestrians is 1.2 m/s. However, there may be contextual situations that require the consideration of a longer crossing time (See Exhibit 18-11). Examples include pedestrian facilities serving nursing homes, elementary schools, or medical facilities. When determining the proper walking speed for crossing an intersection, project designers should consider pedestrians who may be disabled, or are age 65 years or older, and 14 years and younger. This information is available by county, from the NYS Statistical Year Book. For more information, see Reference 1 in Section 18.15.

The AASHTO *Policy on Geometric Design of Highways and Streets*, and *Guide for the Planning, Design and Operation of Pedestrian Facilities*, along with the NYS and national MUTCD guidance gives designers the option of using a slower walking speed such as 0.8 to 1.1 m/s.

Exhibit 18-11 provides some examples of the length of time necessary to cross various distances by different pedestrian populations.

Exhibit 18-11 Crossing Distances, Speeds, and Time

Crossing Distance	MUTCD Normal Crossing Time at 1.2 m/s	Older Adult Crossing Time at 0.9 m/s	Mobility-Impaired Crossing Time at 0.8 m/s
7.2 m (2 lanes*)	6 seconds	8 seconds	9 seconds
10.2 m (2 lanes w/bike lanes**)	8.5 seconds	11.3 seconds	12.75 seconds
13.8 m (3 lanes w/bike lanes**)	11.5 seconds	15.3 seconds	17.25 seconds
17.4 m (4 lanes w/bike lanes**)	14.5 seconds	19.3 seconds	21.75 seconds
21.0 m (5 lanes w/bike lanes**)	17.5 seconds	23.3 seconds	26.25 seconds

* Assumes a 3.6 m vehicular lane width.

** Assumes a 3.6 m vehicular lane width, and a 1.5 meter bicycle lane width.

Adapted from: *Pedestrian Facilities Guidebook*, Washington State Dept. of Transportation, 1997.

18.7.2 Intersection Types**18.7.2.1 Continuous Right Turns**

Continuous right turns are utilized to maximize vehicular efficiency through signalized intersections, including single-point urban interchanges. Continuous right turns are sometimes used in roundabouts.

While this type of movement benefits vehicular level-of-service, continuous right turns are generally not recommended in areas where high pedestrian activity may occur.

If continuous right turns are deemed necessary because of capacity, designers should ensure that visibility of the presence of pedestrians is maximized. Additionally, designers should consider the use of yield to pedestrian signs or pedestrian activated signals.

18.7.2.2 Single-Point Urban Interchange (SPUI)

Single-point urban interchanges are desirable choices for select locations due to their efficiency. This type of intersection has the potential to be the most dangerous for pedestrians because:

- The configuration of the intersections is such that pedestrian crossings are longer.
- Vehicles approach pedestrians from behind.
- Vehicles travel at a greater speed.
- The cycle time for signals is longer, which may cause the pedestrian to cross on red.

SPUIs are not recommended for areas where high pedestrian activity may occur or in situations where higher percentages of children or the elderly may need to navigate through the interchange.

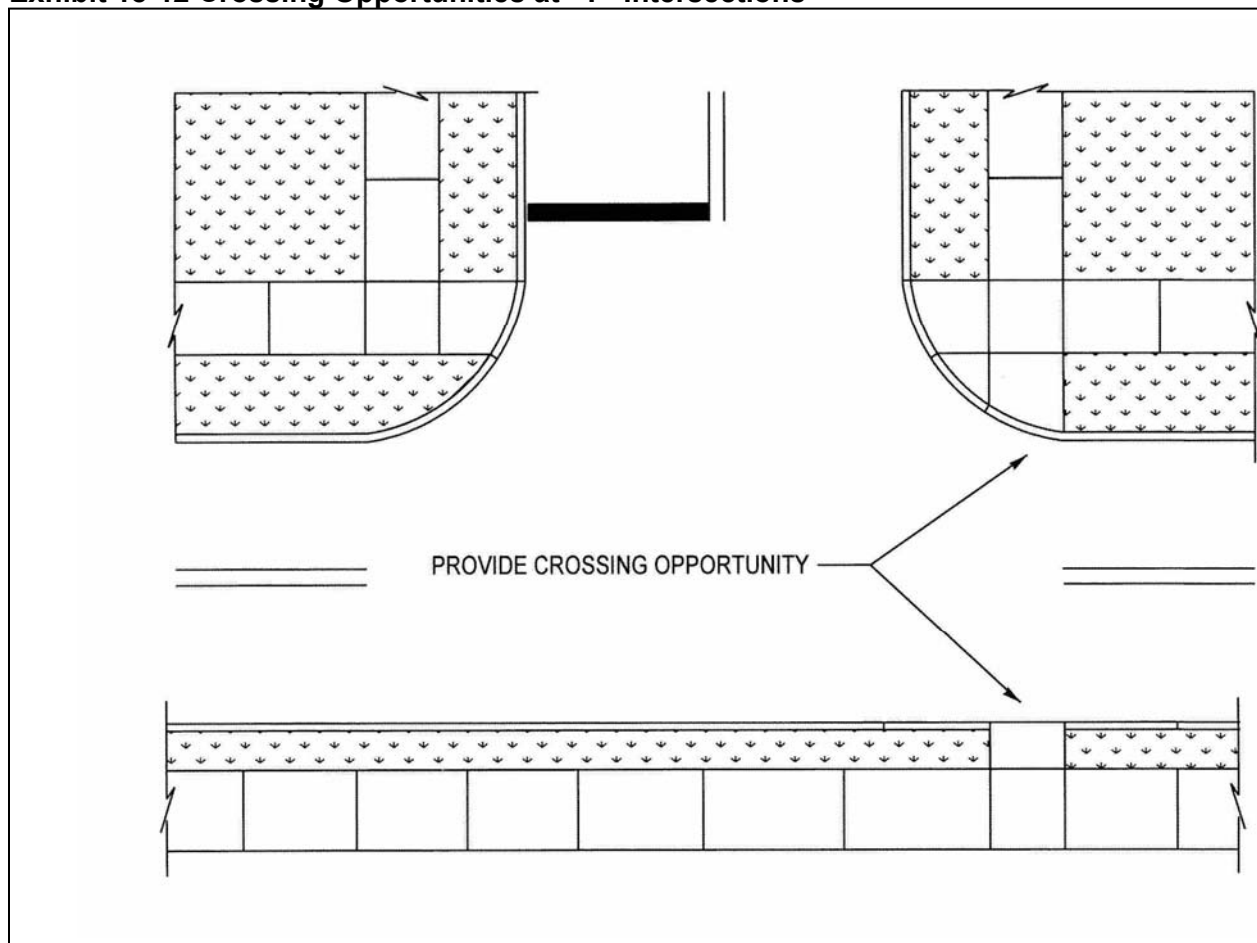
18.7.2.3 "T" Intersections

Designers need to determine where it is appropriate or necessary to provide opportunities for pedestrians to cross through streets at "T" intersections and the need for signs where pedestrians may not cross the through street or road. Consideration should be given to the comfort, convenience, and safety of pedestrians, particularly persons with disabilities.

Crosswalks (marked or unmarked) across through-streets cannot always be located immediately at every "T" intersection. However, designers should consider the spacing between intersections, location of pedestrian-traffic generators, common pedestrian travel routes, location of bus stops, postal drop boxes, etc., to determine appropriate crosswalk locations.

For further information see References 3 and 28 listed in Section 18.15 References.

Exhibit 18-12 Crossing Opportunities at "T" Intersections



18.7.2.4 Roundabouts

Design and operational characteristics of roundabouts have the following generic characteristics that make them more conducive to pedestrian traffic activity than conventional signalized intersections.

- Splitter islands provide refuge for pedestrians and break up the crossing length into smaller distances.
- Collisions at roundabouts involve low speeds and low angles of impact, and therefore, are less likely to result in serious injury.
- The reduced speed minimizes speed differential and creates a more balanced operating environment for pedestrians.

A. When Pedestrian Facilities are Warranted

Accessible pedestrian facilities should be provided through roundabouts when such facilities are warranted, including, but not limited to cut-through splitter islands with detectable warnings, sidewalks and curb ramps with detectable warnings.

Depending upon vehicular and pedestrian characteristics and volumes, the creation of crossable gaps may require additional design and/or signal actuation measures.

In multilane roundabouts, geometric design should avoid speed differentials that may contribute to multiple-threat crashes.

Design considerations for pedestrian crossings at roundabouts may include the following:

- Location/alignment of the splitter island.
- Location/alignment of the approach crosswalk.
- Determining the need for midblock or off-set crosswalk design.
- Restricting pedestrians from crossing to the central island.
- Type of warning or regulatory signing
- Design lighting to adequately illuminate the crossing and minimize back lighting of pedestrians.
- Optimal vehicular entry/exit deflection for maximizing safety for both pedestrians and vehicles.

B. When Pedestrian Facilities are not Warranted

According to the Vehicle and Traffic Law, pedestrians are permitted to walk facing traffic along the left side of the roadway or its shoulder. Therefore, when it is determined during project scoping that pedestrian facilities are not warranted, the occasional pedestrian may use the shoulder and walk in the direction facing traffic.

Cut-through splitter islands should not be included in roundabouts where pedestrian facilities are not necessary. Cut-through splitter islands should only be provided at roundabouts where a complete pedestrian system is included.

C. Blind Persons and Vision-Impaired Pedestrians

There are no specific current practices for accommodating blind and vision-impaired pedestrians at roundabouts and channelized turn lanes. However, accessible pedestrian signals (APS), other traffic control devices, and geometric designs are typically installed at conventional intersections upon request of an individual or groups of individuals who would benefit by their existence.

Too little traffic, too much traffic, and traffic that doesn't alternately stop and go can cause problems for pedestrians who are blind or have other vision impairments. Most blind pedestrians are trained to listen for surges of traffic parallel to their direction of travel (such as occurs at stop signs and signals at traditional intersections) in order to know when they have an opportunity to cross a street. These necessary acoustic cues do not occur at roundabouts and may be absent or confusing at channelized turn lanes.

To date, most guidelines related to installation of APS are related to traditional intersections. These guidelines are not generally applicable to roundabouts or channelized turn lanes. However, it may be impossible for blind and otherwise vision-impaired pedestrians to obtain usable orientation and directional information about the crossings by using acoustic and other traditional cues and way-finding techniques. In short, **it can be difficult or impossible for blind and otherwise vision-impaired persons to find pedestrian crossings at roundabouts and channelized turn lanes. It can also be difficult or impossible for them to successfully determine opportunities to safely cross these roadways unless geometric designs and/or traffic controls that provide crossing location information and safe crossing opportunities are implemented.**

Current research is now being conducted. NCHRP Project 3-78 will identify, test, and recommend a range of geometric design and/or traffic control device treatments with a potential to improve the ability of blind and other vision impaired pedestrians to safely cross at roundabouts and channelized turn lanes. This research is not likely to be completed until sometime in 2008. See Section 18.6.1.1 for design recommendations to accommodate pedestrians who are blind or visually impaired.

18.7.2.5 Grade-Separated Pedestrian Crossings

Grade-separated pedestrian crossings allow for the uninterrupted flow of pedestrian movement separate from vehicle traffic and can improve crossing safety when appropriately located and designed. Some options for grade-separated crossings include overpasses (bridges, elevated walkways) and underpasses (tunnels, below grade networks).

There are issues of concern regarding grade-separated crossings. These crossings are quite expensive and may be visually obtrusive. Other concerns are the personal security of the users and the possibility of vandalism. There are also concerns regarding the ability to safely traverse these facilities during a mass evacuation.

For more information, see References 8, 12, and 28 listed in Section 18.15.

18.7.2.6 Midblock Crossings

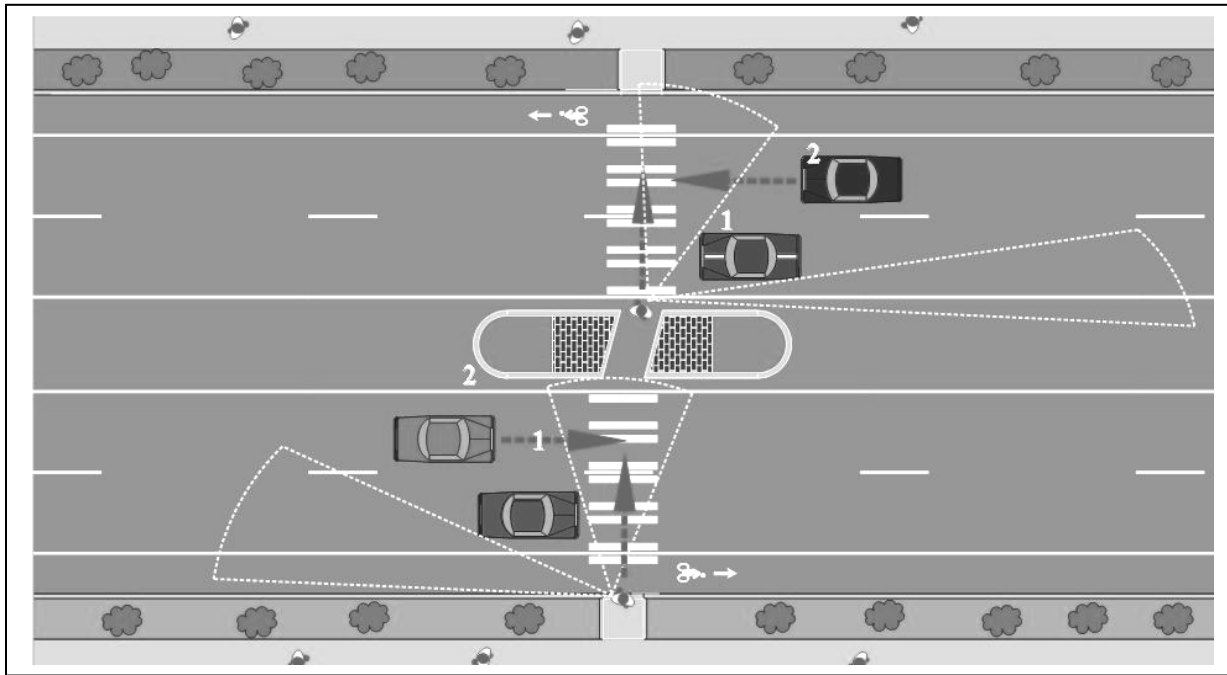
Midblock crossings should be designed taking pedestrian, bicyclist, and motorist safety into consideration. Location and design details will depend upon the distance between signalized crossings, vehicle operating speeds, frequency and duration of crossable gaps at adjacent intersections with concurrent phasing, availability of pedestrian refuge islands, the locations of pedestrian trip generators (including transit stops), and the percentage of pedestrians who are elderly, disabled, and/or children. The project scoping reports and design reports should discuss the factors leading to a decision to install midblock crossings.

NY State Vehicle and Traffic Law states that “When traffic control signals are not in place or not in operation, the driver of a vehicle shall yield the right of way, slowing down or stopping if need be to so yield, to a pedestrian crossing the roadway within a crosswalk on a roadway upon which the vehicle is traveling...”. Where midblock crossings are used, advance pedestrian crossing signs and pedestrian crossing location signs should be provided to warn motorists of pedestrian crossing activity. In-street signing, traffic calming, or signals may also be considered. (Note: See Traffic Engineering Directive OS 05-002 for information on in-street signing). All signs, crosswalk markings, signals, or traffic calming measures shall be provided in accordance with the NYS MUTCD, and Chapter 25 of the *Highway Design Manual*. Designers should consult with the Regional Transportation Systems Engineer for additional guidance.

In order to prevent a multiple-threat crash, it is recommended to use an advance stop bar/yield line at midblock crossings in multilane roads. A multiple-threat crash is a situation that may occur when a driver in the first travel lane stops for a pedestrian, but blocks the line of sight between a pedestrian and a driver in the second travel lane. (See Exhibit 18-13.) Use of an advanced stop bar/yield line can open up the line of sight for the driver and the pedestrian. (See Exhibit 18-14.) Information on advanced stop bar/yield line can be found in Section 3B.16 of the National MUTCD.

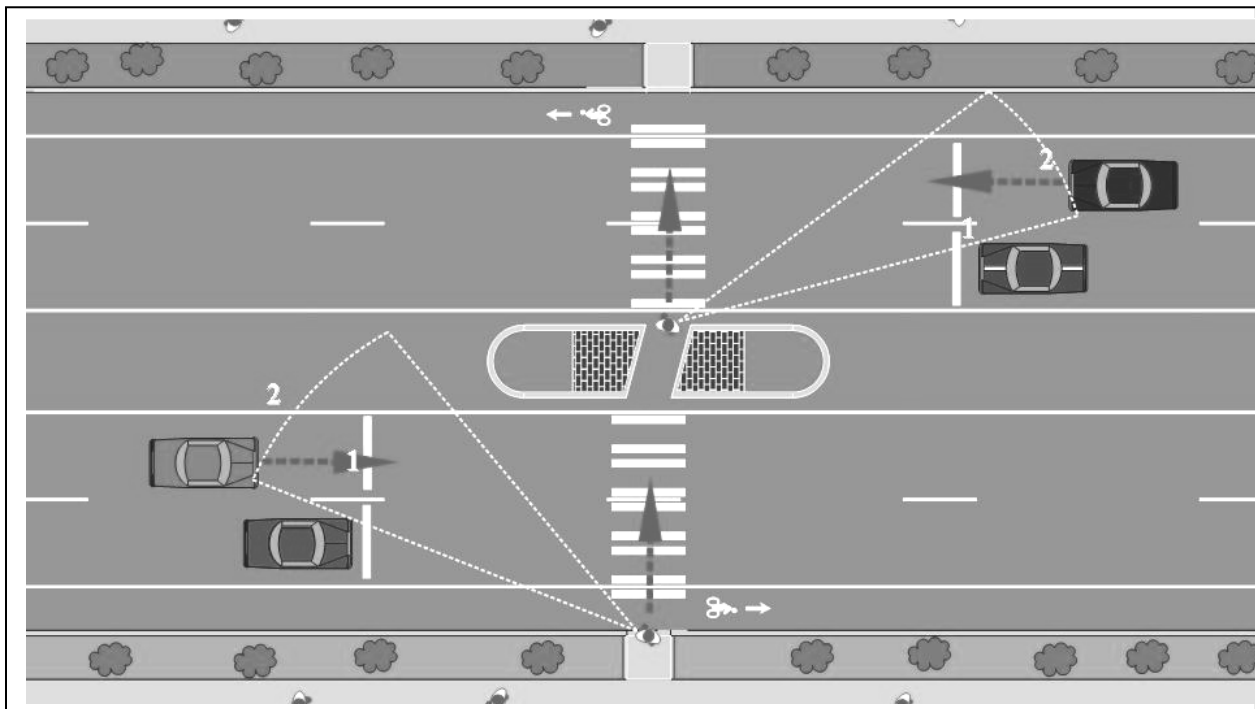
For more information on midblock crossing see References 4, 8, 12, 22, and 28 listed in Section 18.15.

Exhibit 18-13 Multiple-Threat Crash



Designing Pedestrian Facilities for Accessibilities Training, APBP and FHWA, 2005

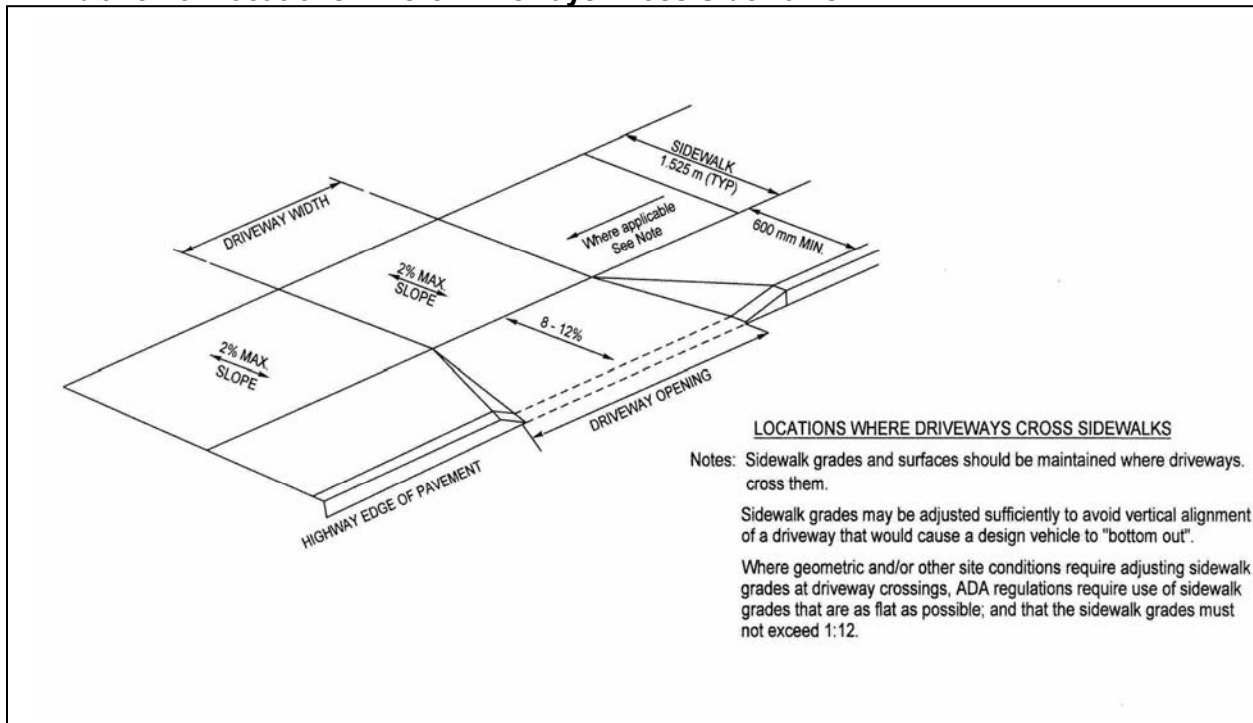
Exhibit 18-14 Advance Stop Bar (note: an advanced yield marking can also be used)



18.7.2.7 Walkway/Driveway Intersections

Where a driveway crosses a pedestrian access route, the intersection surface, slope, etc., shall conform with the accessible walkway requirements established by ADAAG (see Exhibit 18-15). At these intersections, it is recommended that the driveway conform to the sidewalk elevation. When that is not feasible, the walkway's downward slope to accommodate the driveway crossing should be as flat as possible, not to exceed 8.33%. The walkway surface material should continue across the driveway to indicate that the area is still the pedestrian access route and that the driveway is crossing the walkway, not the other way around. In general these intersections do not require detectable warnings. However, major driveway entrances, (i.e., those that function like streets and utilize traffic control devices) do require detectable warnings. See Section 18.7.4.

For more details on walkway crossings and access design for pedestrians, see References 8, 12, and 28 listed in Section 18.15.

Exhibit 18-15 Locations Where Driveways Cross Sidewalks

18.7.2.8 Pedestrian/Rail Crossings

Detectable warnings are required where railroad tracks cross a pedestrian access route (PAR).

Ordinarily, ADAAG prohibits surface openings greater than 13 mm in the direction of travel along PARs. However, surface gaps at rail crossings are exceptions. These gaps must be at least 64 mm to safely accommodate rail car wheel flanges and, due to variations in load and wheel play, the gaps must be 75 mm or more to accommodate heavy freight trains. Research is ongoing to determine the best practice of accommodating both the railroad car wheel flanges and the pedestrian utilizing a wheel chair at Pedestrian/Rail Crossings.

18.7.3 Curb Ramps/Blended Transitions

Note: Blended Transitions may be used singularly or in combination with curb ramps to connect the PAR to each pedestrian street crossing. The standards for curb ramps apply to blended transitions with the exception being the running slope of a blended transition should be 5% maximum.

Guidance for the design of sidewalk curb ramps is found in the ADAAG and the 608 Series Standard Sheet "Sidewalk Curb Ramp Details." In addition to the Department's standard sheets on curb ramp design, the Department of Public Service of Akron, Ohio, has developed an extensive collection of curb ramp standard construction drawings. They can be viewed at <http://ci.akron.oh.us/asp/drawings/standard.asp>.

For more information on curb ramp design, see Exhibit 18-16 and References 8 and 12 listed in Section 18.15.

The Department's standards for curb ramps are as follows:

- The minimum width for sidewalk curb ramps is 1.525 m.
- Curb ramps should be constructed with the running slope no flatter than 5% and the maximum traversable slope in the direction of pedestrian travel not to exceed 8.33%. However, in situations where the roadway itself exceeds 8.33%, the length of a parallel curb ramp does not have to exceed 4.5 m. The project designer may choose to continue the ramp at an 8.33% slope beyond the 4.5 m, or opt for a slope greater than 8.33% after the 4.5 m.
- Curb ramps must be provided wherever accessible routes cross curbs.
- Curb ramps must be installed at all corners of intersections containing sidewalks.
- Perpendicular curb ramps (i.e., perpendicular to the flow of pedestrian traffic) must have a level landing at the top.
- Grates, access covers and similar surfaces **shall not** be located on curb ramps, blended transitions or landings.
- Curb ramps require the use of detectable warnings, see Section 18.7.4.
- Utilities, signs, and other fixed objects may not be placed in a curb ramp, or in a manner that interferes with the use of the curb ramp.
- Single diagonal or depressed corner curb ramps serving two street crossing directions should be avoided in new construction and should only be considered where conditions specifically require their use.

18.7.3.1 Directionality versus Perpendicular

Curb ramp design and placement should be determined by the design constraints of the sidewalk, street and intersection. The ideal design incorporates a separate curb ramp for each direction of pedestrian traffic, oriented perpendicular to the curb, and aligned with the direction of pedestrian flow. Recognizing that the ideal is not always possible, curb ramp design has some flexibility, but not at the expense of wheelchair or scooter usability. In order to design the best possible curb ramp, designers should recognize the issues behind directionality and alignment perpendicular to the curb. Directionality is important for blind persons and persons with vision impairments. When the curb ramp is aligned with both the sidewalk and the crosswalk, visually impaired pedestrians have a straight line of travel

A curb ramp that is designed to be perpendicular to the curb minimizes surface warping. Surface warping is an issue as it may cause wheels on a wheelchair or scooter to lift off the surface. With one or two wheels in the air, the chair or scooter user experiences some loss of control until all four wheels make contact with the surface. This instability problem can be minimized by having the curb ramp placed at a right angle to the curb.

Often, the issues of directionality and ramp alignment perpendicular to the curb are directly at odds with one another. Currently the recommendation from the Access Board encourages directionality, provided that it is not provided at the expense of wheelchair or scooter usability, that surface warping at the street/curb ramp interface is minimized, and the cross slope of the ramp does not exceed 1:50.

Exhibit 18-16 Curb Ramp Design

Design	Required or Best Practices	Rationale
Provide a level maneuvering area or landing at the top of the curb ramp.	Required	Level landings are critical to allow wheelchair users space to maneuver on or off of 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 sidewalk 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 shall be 5% maximum.	Required	Severe or sudden grade changes may not provide sufficient clearance for the frame of the wheelchair, 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 that can be visually distinguished from the surrounding terrain.	Required	Gradual slopes make it difficult for people with vision impairments to detect the presence of a curb ramp.
Design the ramp and the gutter with a cross slope of 2.0 percent. (required)	Required	Ramps should have minimal cross slope so users do not have to negotiate a steep grade and cross slope simultaneously.
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.
Transitions from ramps to gutter and streets should be flush and free of vertical changes of level. (required)	Required	Maneuvering over any vertical rise such as lips and defects can cause wheelchair users to propel forward when wheels hit this barrier.
Align the curb ramp 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 wheelchair users approach a curb ramp, they often build up momentum in the crosswalk in order to get up the curb ramp grade. This alignment may be useful for the vision impaired.

Adapted from: FHWA's *Designing Sidewalks and Trails for Access, Part 2*, September 2001.

18.7.4 Detectable Warnings

A detectable warning is a walkway surface treatment, detectable by blind persons and persons with low vision. Americans with Disabilities Act regulations require detectable warnings to be constructed on **permanent and temporary** sidewalk curb ramps at street intersections, curb ramps or cut-throughs in median/refuge islands, and in-street or cross-sidewalk rail crossings and blended transitions.

Detectable warnings are not limited to public streets, but are also required at stop- or yield-controlled entrances to commercial or public facilities where the entrances function like public streets. Detectable warnings should not be installed at relatively minor entrances such as driveways at gasoline stations or similar facilities, unless they are controlled by an official signal or sign, as the intent is to provide a warning to pedestrians that they are crossing a significant (street or street-like) vehicular passageway.

The need to install detectable warnings is triggered by any of the following conditions:

- When curb ramps or blended transitions are constructed or altered as a part of projects undertaken by the Department.
- When curb ramps or blended transitions are constructed or altered as a part of projects requiring highway work permits.
- When curb ramps fall within project limits of resurfacing projects, or other alterations, regardless of whether done by capital construction contract, vendor-placed paving contract, NYSDOT Maintenance forces, or work performed under highway work permits.

Note: When a curb ramp is constructed or altered in a project, the curb ramp on the opposite side of the vehicular passageway needs to be upgraded with detectable warnings. When the altered or constructed curb ramp is located within an intersection, all the curb ramps within that intersection are to be upgraded with detectable warnings. Project limits need to be determined accordingly to ensure the inclusion of detectable warnings at all appropriate locations. These incidental curb ramps are not required to be reconstructed in the same fashion as the ramp which triggered the additional work, as long as they otherwise meet ADAAG requirements. The associated curb ramps can be retrofitted with detectable warnings.

Detectable warnings come in a wide variety of types, materials, and installation methods. Current specifications provide for three installation methods, i.e., embedded preformed units, stamping, and surface-applied. Since, generally, the Department does not maintain sidewalks, snow removal will vary from community to community. The method of snow removal that the detectable warnings will be subject to, should be considered when specifying the methods and materials.

Detectable warnings are required to contrast with the adjacent curb ramp or other applicable walkway surface (light-on-dark or dark-on-light). Dark Gray is the default color, as it provides good contrast with □ortland cement concrete sidewalks and is available with most products. White or Safety Yellow are recommended colors for use on asphalt concrete or other similarly dark surfaces.

When detectable warnings are installed, on or adjacent to standard concrete surfaces, other dark colors, such as black, are acceptable but must be specified in the Contract Documents. The

following colors satisfy the Materials Bureau visual contrast requirements when placed adjacent to the Department's standard ortland cement concrete sidewalks:

- Dark Gray, Munsell Book Notation 10BG 3/1, Federal Standard Number 36081.
- Dark Brown, Munsell Book Notation 10YR 3/2, Federal Standard Number 30097.
- Dark Red, Munsell Book Notation 10R 3/6, Federal Standard Number 10076.
- Dark Green, Munsell Book Notation 2.5G 3/6, Federal Standard Number 14110.

Contact the Main Office Materials Bureau or Design Quality Assurance Bureau, Landscape Architecture Section, for further material guidance. For further information see Reference 9 in Section 18.15.

18.7.5 Curb Radii/Intersection Extension

A wide curb radius typically results in relatively high-speed vehicle turning movements and longer pedestrian crossing distances. Use of tighter curb radii will reduce turning speeds, shorten the crossing distance for pedestrians, and also improve sight distance between pedestrians and motorists. Nearby land uses and types of road users should be considered when designing an intersection so the curb radii are selected appropriately. However, if a curb radius is too small, large trucks or buses may intrude into opposing travel lanes or may ride over the curb, thereby placing pedestrians in danger.

Intersection curb extensions, also known as bulb-outs, flares, neck-downs, neck-outs, pinch points, or chokers are extensions of the sidewalk at intersections or midblock crossings of roadways with on-street parking (see Exhibit 18-17). Intersection curb extensions should only be used on low-speed streets with parking lanes. In addition, curb extensions should be designed to assure curbs do not abruptly jut out to the edge of the travel lane. For this reason, intersection curb extensions should be avoided where parking is sporadic or where alternate-side parking rules are in effect. Curb extensions should generally be at least 6 m long and as wide as the parking lane minus an appropriate curb offset for bicycle access. Designs should also reflect the turning radii of snow plows and other design vehicles.

For more information on intersection curb extensions, see HDM Chapter 25 Traffic Calming. For discussion of curb radii see References 3, 12, and 28 listed in Section 18.15 References.

Exhibit 18-17 Curb Radii/Intersection Extension



Photo: I 2003 Project for Public Spaces, Inc. www.pps.org All rights reserved.

18.7.6 Pedestrian Refuge Islands and Medians

A pedestrian refuge island is located in or near a pedestrian crossing to aid and protect pedestrians crossing a roadway. On wide streets, a median refuge can provide a safe location for those who begin crossing too late or are only capable of walking exceptionally slow. Depending on the signal timing, pedestrian refuge islands or medians should be considered where the pedestrian crossing distance exceeds 18.3 m or 5 lanes of vehicular traffic. Pedestrian refuge islands or medians can also be used at intersections or midblock locations with shorter crossing distances, where a need has been recognized.

Medians that are intended as pedestrian refuge islands must be accessible to all pedestrians, including those with disabilities. The dimensions of a pedestrian refuge island should be determined by the expected pedestrian storage and crosswalk level of service criteria. The minimum dimension in the direction of pedestrian travel of the refuge island is 1.8 m for new construction. For alterations where it is not practical to widen the median, the crossing or cut-through width may be increased to provide additional pedestrian storage space.

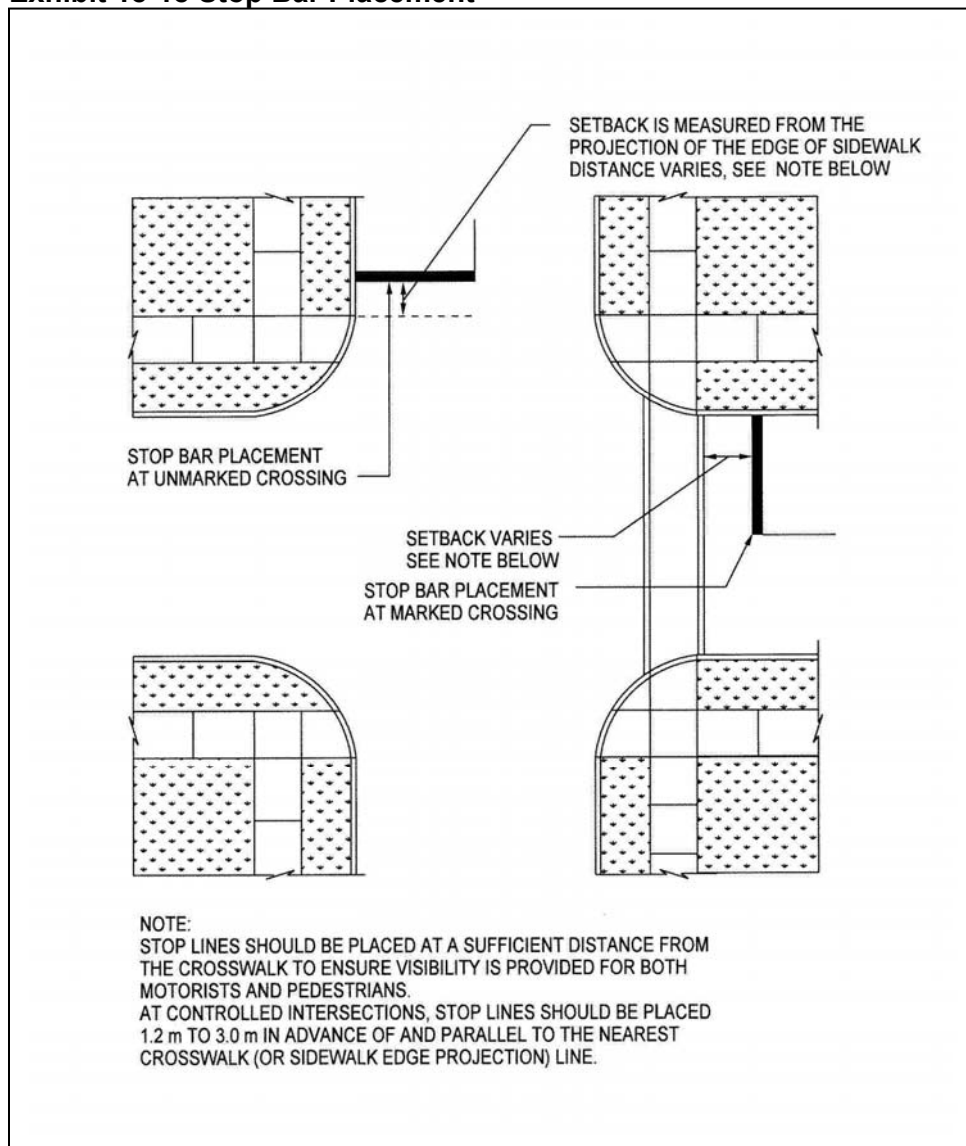
A median refuge should not be used to justify a signal timing that does not allow pedestrians to complete their crossing in one signal cycle. See Reference 12 in Section 18.15.

18.7.7 Stop Line Placement

Stop lines should be placed at a sufficient distance from the crosswalk to ensure visibility is provided for both motorists and pedestrians. At controlled intersections, stop lines should be placed 1.2 m to 3.0 m in advance of and parallel to the nearest crosswalk or, if unmarked, the projection of the near edge of sidewalk. See Exhibit 18-18. On multilane roads, greater setbacks can help ensure that the motorist's view of the pedestrian in the crosswalk is not screened by vehicles in adjacent lanes.

Recommended practices for stop lines are discussed in references 7 and 28 listed in Section 18.15.

Exhibit 18-18 Stop Bar Placement



18.7.8 Marked Crosswalks

The criteria for determining how to control and/or mark street crossings at intersections are dependent on pedestrian and vehicular volumes, vehicular speed, intersection configuration, school zones, facilities and services for the elderly, and other area developments.

In general, marked crosswalks have the following advantages. They may:

- Serve to warn and remind motorists of locations where pedestrians can be expected.
- Channel and limit pedestrian traffic to specific locations with appropriate sight distance.
- Orient pedestrians in finding their way across complex intersections.
- Improve pedestrian access and safety at night.

Some studies have shown that the absence of marked crosswalks may cause some pedestrians, particularly the elderly, to be more hesitant to cross the street. This hesitancy is attributed to the misunderstanding that marked crosswalks are the only legal places to cross.

Marked crossings also have some disadvantages. They may:

- Give pedestrians a false sense of security by leading them to think that the motorist can and will stop. This is especially true on multilane highways (i.e., multiple threat).
- Cause disrespect for other pedestrian regulations and traffic controls when the crosswalk is perceived as unjustified, in a worn condition, is unsigned, or is poorly located.

Each crosswalk location should be individually analyzed and designed. Marked crosswalks should be considered at:

- Midblock crossings.
- Locations with pedestrian-activated signals.
- Established school crossings.
- Intersections with vehicular signals in main streets, central business/walking districts, and in other areas where significant volumes of pedestrians cross the highway.
- Locations in either urban or nonurban areas where there is development along both sides of a highway and where concentrated numbers of pedestrians cross the highway "midblock" (e.g., where a large parking lot is on the opposite side of the road from a campus, rural recreational area, or manufacturing plant).
- Signal-controlled entrances to commercial properties.

Note: Crosswalks are not limited to public streets, but are also recommended at stop- or yield-controlled entrances to commercial or public facilities. Crosswalks should not be installed at relatively minor entrances such as driveways at gasoline stations or similar facilities, unless controlled by an official signal or sign, as the intent is to provide a warning to motorists that they are crossing a pedestrian access route.

PEDESTRIAN FACILITY DESIGN

Crosswalks should not be installed at locations, such as those with poor sight distance, which could present an increased safety risk to pedestrians without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. In most cases, marked crosswalks are best used in combination with other treatments, such as warning/regulatory or in-road signing, curb extensions, refuge islands and medians, signals, enhanced lighting, and traffic calming techniques.

A variety of alternative surface treatments for crosswalks are currently available including:

- Surface-applied products.
- Inlaid thermoplastic products.
- Traditional concrete pavers.

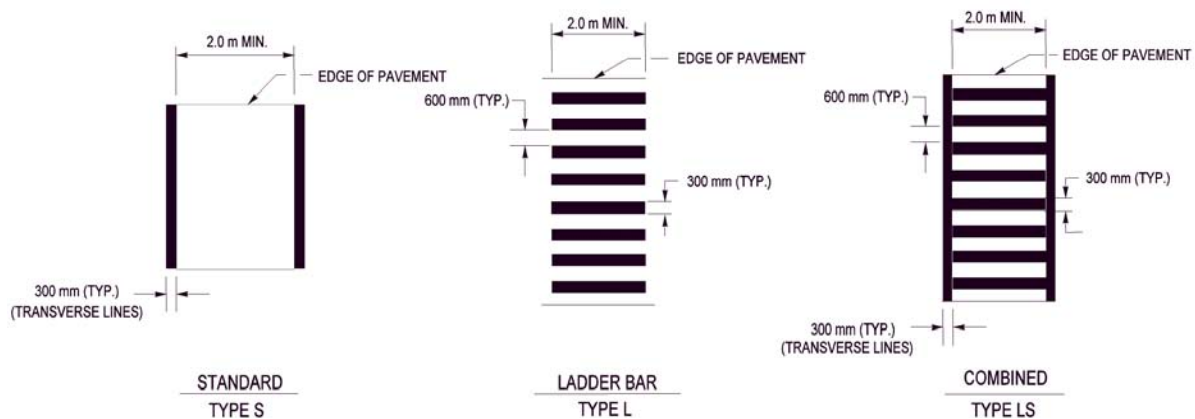
All surface treatments used within vehicular ways must be approved by Main Office Materials Bureau to ensure skid resistance, durability, etc.

Pavers are currently prohibited by the FHWA in roads with traffic volumes greater than 8,000 AADT. Research is being conducted to develop design details to accommodate greater load capacity.

If an alternative surface treatment is used within the crosswalk, it is recommended that a minimum 1.2 m Reduced Vibration Zone be incorporated. (See Section 18.6.5.3 Walking Surface.) A more textured surface can be placed bordering the Reduced Vibration Zone within the standard crosswalk markings or outside. See Exhibit 18-6.

For more information on marked crosswalks, see Exhibit 18-19 and 18-20 and References 8, 12, 26, 28, and 33 listed in Section 18.15.

Exhibit 18-19 Typical Crosswalk Markings



TYPICAL CROSSWALK DETAILS
 NOTE: ALL CROSSWALK MARKINGS SHALL BE WHITE
 SEE STANDARD SHEET M685-2R1

Exhibit 18-20 Recommendations for Installing Marked Crosswalks and Other Needed Pedestrian Improvements at Uncontrolled Locations *

No. of Lanes and Median Type	Vehicle AADT < 9,000			Vehicle AADT > 9,000 to 12,000			Vehicle AADT > 12,000 to 15,000			Vehicle AADT > 15,000		
	Speed Limit**											
	<50 km/h	57 km/h	65 km/h	<50 km/h	57 km/h	65 km/h	<50 km/h	57 km/h	65 km/h	<50 km/h	57 km/h	65 km/h
2 Lanes	C	C	P	C	C	P	C	C	N	C	P	N
3 Lanes	C	C	P	C	P	P	P	P	N	P	N	N
4 or more Lanes With Raised Median	C	C	P	C	P	N	P	P	N	N	N	N
4 or More Lanes Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

Source: *Safety Effects of Marked Vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines*, Federal Highway Administration.

C = Candidate sites for marked crosswalks. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, walking speed, vehicle speed, sight distance, vehicle mix, etc., may be needed at other sites. It is recommended that a minimum of 20 pedestrian crossings per peak hour (or 15 or more disabled, elderly, or child pedestrians) exist at a location before placing a high priority on the installation of a marked crosswalk alone.

P = Possible increase in pedestrian crash risk may occur if crosswalks are added without adequate design features and/or traffic control devices. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased due to providing marked crosswalks alone. Consider using other treatments where warranted, such as traffic calming treatments, pedestrian signals, various signal phasing and progressions to improve pedestrian safety, ITS and accessible signals, and other substantial improvements to provide safe pedestrian crossing.

- These guidelines include intersection and midblock locations with no traffic signals, stop signs or any warning/regulatory signing on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median

** Where the speed limit exceeds 65 km/h, marked crosswalks alone should not be used at unsignalized locations.

18.7.9 Pedestrian and Vehicular Traffic Signals

Signal timing will be determined by the Regional Traffic Engineer and should be calculated to allow a pedestrian sufficient time to cross an intersection. Altering the timing of signal cycle length, phasing, progressions, and coordination to accommodate pedestrians can decrease delay for vehicle and pedestrian traffic movements. When necessary, a minimal increase in vehicular delay may be required to facilitate pedestrian crossings.

Pedestrian signals are designed to direct and protect the pedestrian at street crossings. The NYS MUTCD provides both mandatory and permissive warrants. When applying the warrants, consideration should be given to any significant concentrations of young, elderly, or persons with disabilities using the project site. Pedestrian-activated signals should be considered when vehicular signal timing is not sufficient to properly accommodate pedestrians.

Pushbuttons that activate pedestrian signals must be reachable from sidewalk and be located as close as practicable to the sidewalk curb ramp (see Exhibit 18-21). The pushbutton mounting height, approach dimensions, and approach surface must meet the applicable ADAAG Section 4.2 requirements regarding space allowances and reach ranges. According to ADAAG Section 4.27.4, the force required to activate controls shall be no greater than 5 lbf (22.2 N).

Whenever pedestrian signals are installed, marked crossings should also be considered. See Section 18.7.8.

Pushbuttons for accessible pedestrian signals should be located adjacent to, or within 255 mm of a level, all-weather surface to provide access from a wheelchair. Where there is an all-weather surface, wheelchair accessible route to the ramp, the pushbutton should be located in accordance with all the requirements as follows:

- Within 1.5 m of the crosswalk extended.
- Within 3 m of the edge of curb, shoulder, or pavement.
- Parallel to the crosswalk to be used.
- Mounted on a post or signal pole between 915 mm and 1120 mm above an accessible surface.

Exhibit 18-21 Recommended Locations for Accessible Pedestrian Signals

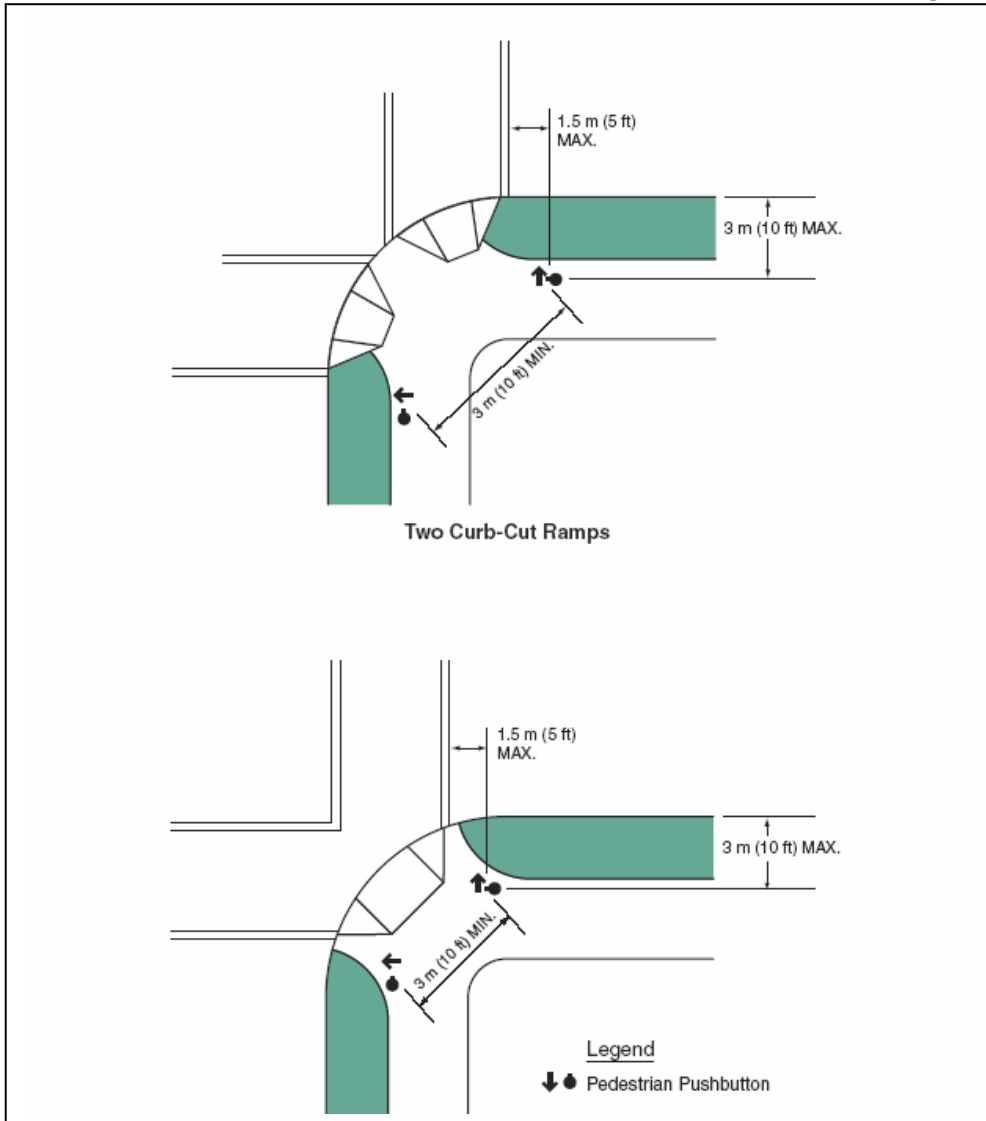


Figure from National MUTCD, 2003, page 4E-2

18.7.10 Pedestrian Intelligent Transportation Systems (ITS)

Pedestrian ITS technologies facilitate access, safety, mobility, and way-finding during street crossings. The following measures are being applied by NYSDOT and NYCDOT:

- **Accessible/Audible Pedestrian Signals** - are signal devices that supplement the visual signals/cues used by sighted pedestrians to safely and independently negotiate crossings for the visually disabled (see National and NYS MUTCD).
- **Calming Green Wave** - when signal coordination, cycle duration, and green wave bandwidth are tuned to improve safety, rather than maximizing vehicular speeds and capacity (permitted under Department guidelines).
- **Count-Down Signal** - are pedestrian signals that provide information to pedestrians regarding the amount of time remaining to cross a street (see National and NYS MUTCD).
- **Illuminated Pushbutton** - provides feedback to the pedestrian that the pedestrian-actuated signal button is working, and that the signal will change (permitted under Department guidelines).
- **In-Roadway Lighting System (IRLS) at Crossings** - signals that are installed in the roadway surface to warn road users that conditions may require them to slow down or come to a stop (see the National MUTCD, and ITE In-Roadway Lighting System Manual).
- **Leading Pedestrian Interval Signal Phasing** - provides a brief (usually 3 to 5 second) exclusive signal phase that allows pedestrians to establish a presence in the intersection, before vehicular turn movements begin, and reduces vehicle-pedestrian conflicts (permitted under Department guidelines).
- **Exclusive (all red) Pedestrian Phasing** - is effective at high-pedestrian-volume locations for avoiding turn-merge, multiple threats, and trapped pedestrian conflicts. Vehicle traffic delays tend to be higher than for concurrent phasing.
- **Scramble Pedestrian Phasing** - is an exclusive pedestrian phase that permits conventional and diagonal pedestrian crossings. Scramble phasing operates well only in very special situations, since overall signal delay is significant.
- **Split Phasing** - provides a phase without turning conflicts by dividing the cycle into three (3) phases: (1) cross street is stopped, avenue goes; (2) cross street through traffic goes, turning vehicles and avenue are stopped; (3) cross street through and turning vehicles go, and avenue is stopped.

For more information on pedestrian ITS crossings, see References 4, 12, 23, 24, and 28 listed in 18.15.

18.7.11 Unauthorized/Unsafe Pedestrian Crossings

When the analysis of traffic accident data and consultations with the Regional Traffic Engineer have indicated the need to discourage unauthorized or unsafe pedestrian crossings, signs, fences, bollards, or railings should be considered. The design of these devices should be consistent with the area's aesthetic quality, roadside safety, and community characteristics. Designers should consider maintenance and the potential to significantly obstruct emergency mass evacuations on foot. For more information see Section 18.12.4 and Reference 4 listed in Section 18.15 References.

18.8 ELEVATION CHANGES

18.8.1 Stairs

As with all other features of a pedestrian circulation system, stairs that are constructed or reconstructed by the Department must meet all the applicable portions of accessibility requirements found in the ADAAG in addition to other related codes, standards, and best practices.

Grading within the right of way frequently necessitates construction of stairs as well as the removal, reconstruction, or alteration of a portion of existing stairs. These are normally stairs that connect primary sidewalks along the roadway to secondary sidewalks leading to residences, public buildings or businesses. When public or commercial stairs must be reconstructed or altered, the affected stairways must be reconstructed or altered according to ADAAG. Refer to the requirements of ADAAG Sections 4.1-4.35, especially Section 4.9. The Department's practice is to construct, reconstruct, or alter residential stairways using the same standards.

Homeowners and businesses occasionally request the Department to omit specific elements that must be constructed or reconstructed to comply with various related requirements. The Department cannot waive these requirements simply because property owners object. For example, handrails are occasionally a source of annoyance to some homeowners, but the Department must install them. The Department has an obligation to assure that the current or next owner of the property, or any visitor to the property, has a safe route that meets all of the applicable standards. While the designer should be sensitive to the homeowners' or business owners' concerns, the Department must satisfy all of the applicable requirements, including the Department's requirements pertaining to the design and construction of stairs.

The Department's minimum standard width for stairs is 1.22 m clear area between stairway railings. (see NYS Building Code 1003.2.13.7.2). Many one- and two-family homes, however, have narrower stairs and sidewalks as their primary access from the highway right of way. These sidewalks and stairs may be replaced with ones at least a 915 mm wide clear distance between the stairway railings. The designer should encourage the affected property owners to consider allowing the Department to construct a wider facility (where the entire route connecting a building to the street will be reconstructed). Some codes for other than one- and two-family dwellings, including the NYS Building Code, generally require a 1.1 m minimum width between stairway railings to accommodate rescue assistance apparatus.

The Department should not construct stairs with fewer than three risers. Data indicates that stairs with fewer than three risers are associated with a disproportionate percentage of stairway related injuries. Where existing stairs with fewer than three risers are to be replaced as part of a Department project, the designer should consider one of the following:

- Adjusting the profiles of the roadway and/or the sidewalk to eliminate the need for stairs.
- Constructing a ramp instead of stairs.
- Designing the riser heights and tread widths of replacement stairs to provide at least three risers per stairway.

Exterior stairs are normally not as steep as interior stairs that are constructed where space is limited, lighting is controlled, and weather is not a factor. Exterior stairs are used in a wider variety of weather and lighting conditions than interior stairs. Unfortunately, most references concerning riser/tread ratios are for interior stairs. While there are no absolute formulae for determining the appropriate relationships between risers and treads for exterior stairs, the most commonly accepted formula recommends that the sum of the dimensions of two risers and one tread should equal 660 mm. In addition, ADAAG and the NYS Building Code require uniform riser heights on a flight of stairs in order to minimize the potential for tripping. See Exhibit 18-22.

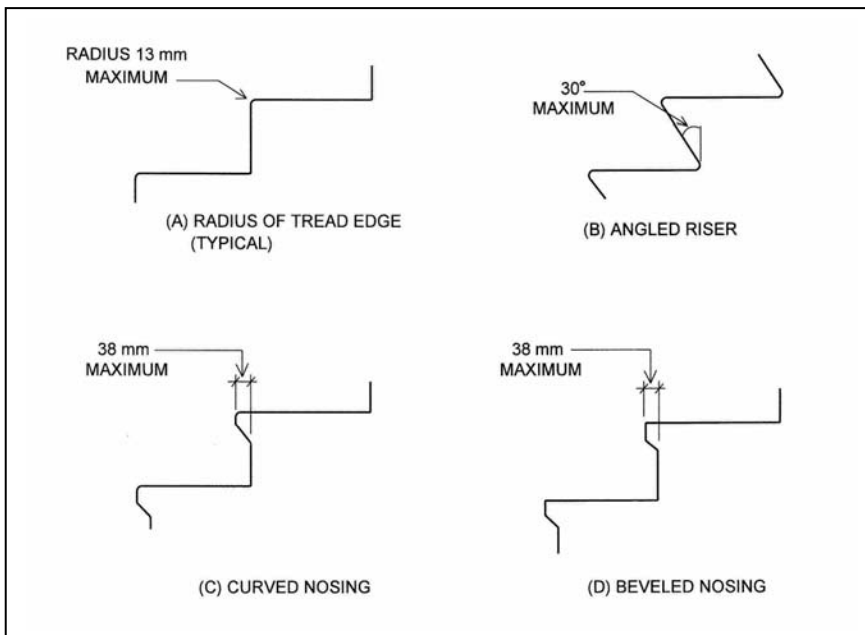
Exhibit 18-22 Recommended Riser Height/Tread Width Ratios

$2R + T = 660 \text{ mm}$	
Riser Height	Tread Width
175 mm	310 mm
155 mm	350 mm
135 mm	390 mm
115 mm	430 mm

Some references, including ADAAG, establish the minimum width of a tread (measured from riser to riser) on public, institutional, and commercial stairways as 280 mm. However, this dimension represents those found in interior conditions. The minimum tread width, measured riser to riser, for exterior stairs on Department projects is 310 mm. This additional width provides a safer and more comfortable footing on stairways with closed risers, especially where uneven lighting, accumulated snow and other exterior conditions may be less than ideal.

Stairways with open risers may be difficult for some persons with vision related disabilities to see and/or use, especially in adverse weather and where lighting is uneven. **Therefore, ADAAG does not permit stairways with open risers to be constructed on pedestrian access routes.** Refer to ADAAG Section 4.9.2.

Similarly, some current building codes and reference standards allow maximum riser heights in excess of 180 mm to 209 mm in residential structures. These heights are commonplace for interior spaces. While outdoors, most people will typically walk faster than they do indoors and have a longer stride. This makes high risers more difficult to maneuver. Adverse weather conditions and uneven lighting can also make exterior stairway risers higher than 175 mm difficult to maneuver. Therefore, the maximum riser height for exterior stairs on Department projects should not exceed 175 mm. Similarly, the minimum riser height on Department projects should not be less than 115 mm.

Exhibit 18-23 Stair Nosings (source ADAAG)

- According to ADA regulations, the radius of curvature at the leading edge of the tread shall be 13 mm maximum.
- Nosings that project beyond risers shall have the underside of the leading edge curved or beveled.
- Risers shall be permitted to slope under the tread at an angle of 30 degrees maximum from vertical.
- The permitted projection of the nosing shall extend 38 mm maximum over the tread.

18.8.2 Ramps

All pedestrian ramps must comply with all the applicable portions of the current ADAAG. All ramps, except curb ramps, must have handrails on both sides. Any part of an accessible pedestrian route with a grade steeper than 5% is usually considered a ramp. However, a sidewalk along a vehicular way that exceeds a 5% grade, is not considered a ramp and does not have to meet the ADAAG standards for ramps.

The ability of a disabled person to manage an incline is related to the incline's slope and length. Wheelchair users with disabilities affecting their arms or with limited stamina have serious difficulty using inclines. Most ambulatory disabled people and most disabled people who use wheelchairs can manage a slope of 1:16. Therefore, ADAAG requires that the least possible slope should be used for any ramp. However, the steepest slope must not exceed 8.33% (1:12). Also, the maximum rise for any run must not exceed 760 mm. In addition, level landings must be provided at the top and bottom of ramps and each ramp run and at all ramp turns.

Designers should refer to ADAAG Section 4.8 for additional guidance regarding requirements for pedestrian ramps.

18.8.3 Landings

Landings on stairs and ramps must meet all of the applicable requirements of the most recent ADAAG. In addition, the Department standard for the maximum vertical rise of any set of stairs

between intermediate landings within a flight of stairs should fall within the range of 2.4 m to 3.6 m and should be evenly spaced along straight runs of stairways. Landings should be provided on ramps as discussed in 18.8.2.

18.8.4 Handrails

Handrails help people steady themselves while moving along stairs and ramps. They are meant to be held onto and they act as a guide for elderly, disabled, and visually impaired persons. They can also significantly reduce the occurrence of falls and the severity of injuries associated with falls.

While the current ADAAG establishes an acceptable handrail height of between 865 mm and 965 mm above the stair nosings, the Department standard is 915 mm. This height is consistent with ADAAG and other regulatory codes, including the NYS Building Code.

Handrails must be constructed on both sides of every stairway and ramp that the Department builds.

Handrails must meet all of the appropriate requirements of the current ADAAG accessibility guidelines, especially the requirements of Sections 405.8 and 504.6. The designer should be aware of all of the specific design features of a handrail before designing the adjacent pedestrian facilities. For example, handrail extensions at the top and bottom of stairs and ramps may not protrude into the usable, accessible width of an adjoining sidewalk. Therefore, designers should attempt to locate the stairway/walkway intersections to accommodate handrail extensions. Refer to ADAAG Sections 505.10 and 504.6.

The ADAAG standards also state that the diameter or width of the gripping surfaces of a handrail or grab bar shall be 32 mm - 38 mm, **or the shape shall provide an equivalent gripping surface.** Flatter shapes are sometimes desired instead of the round handrails normally installed by the Department. Handrails and grab bars with a circumference or perimeter between 100 mm and 120 mm provide the appropriate "equivalent gripping surface." Alternative handrail designs should have rounded corners (see Exhibit 18-24).

On stairs and ramps where vertical balusters are used in lieu of horizontal intermediate rails, the spacing must not allow the passage of a 100 mm sphere between the balusters. The spaces below the bottom rail of a handrail on a ramp must also be sized to prevent a 100 mm sphere from passing through. The space below the bottom rail of a handrail on a stairway must be sized to prevent a 150 mm sphere from passing through at any point (see Exhibit 18-25).

The designer should be familiar with the needs and character of the community. The materials, sizes, and shapes of handrails should be appropriate not only for the user, but for the community in which the railing is located. It is important to understand, however, that the Department cannot waive its responsibility for providing a facility designed and constructed in full compliance with all applicable standards, including the Department's, regardless of the wishes of adjoining property owners.

Exhibit 18-24 Acceptable Handrail Shapes

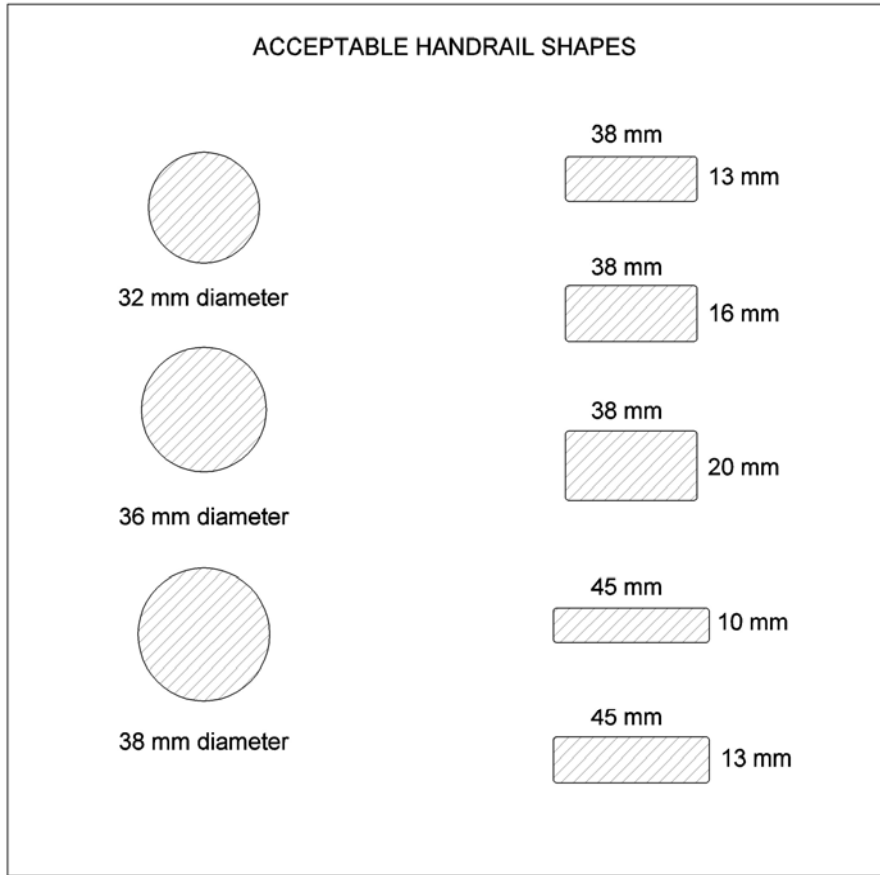
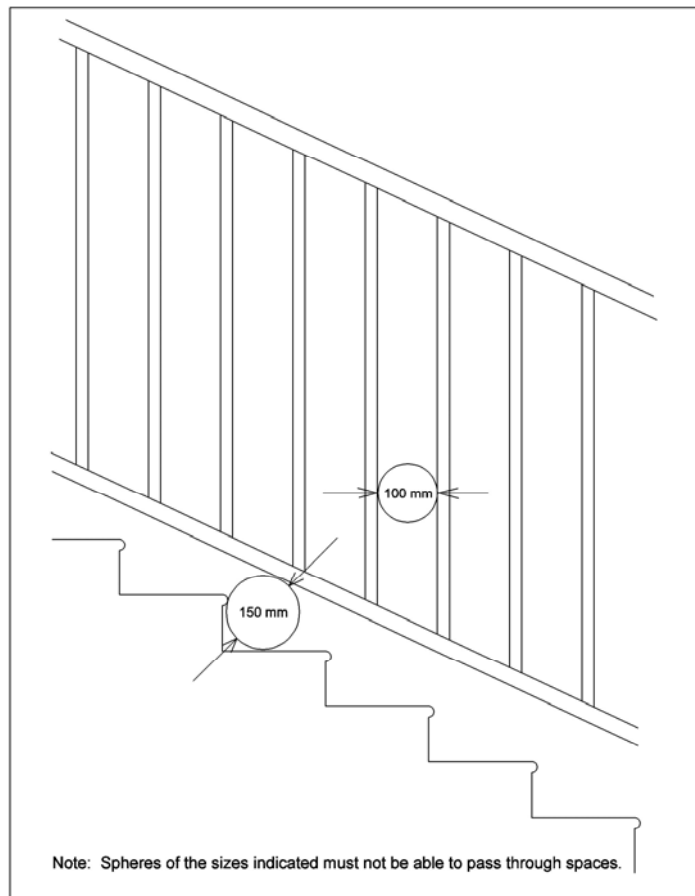


Exhibit 18-25 Maximum Bottom Rail and Baluster Spacing for Handrails**18.8.5 Protective Rails**

Protective rails (referred to as “guards” in the NYS Building Code) are used to keep people from falling or going where they should not. Protective railings are used along drop-offs, on structures, balconies, etc.

For the purpose of this chapter, railings on bridges are not included. Specific guidance and information on bridge rails should be obtained from the NYSDOT *Bridge Manual* and *Standard Specifications for Highway Bridges* by the Structures Design and Construction Division.

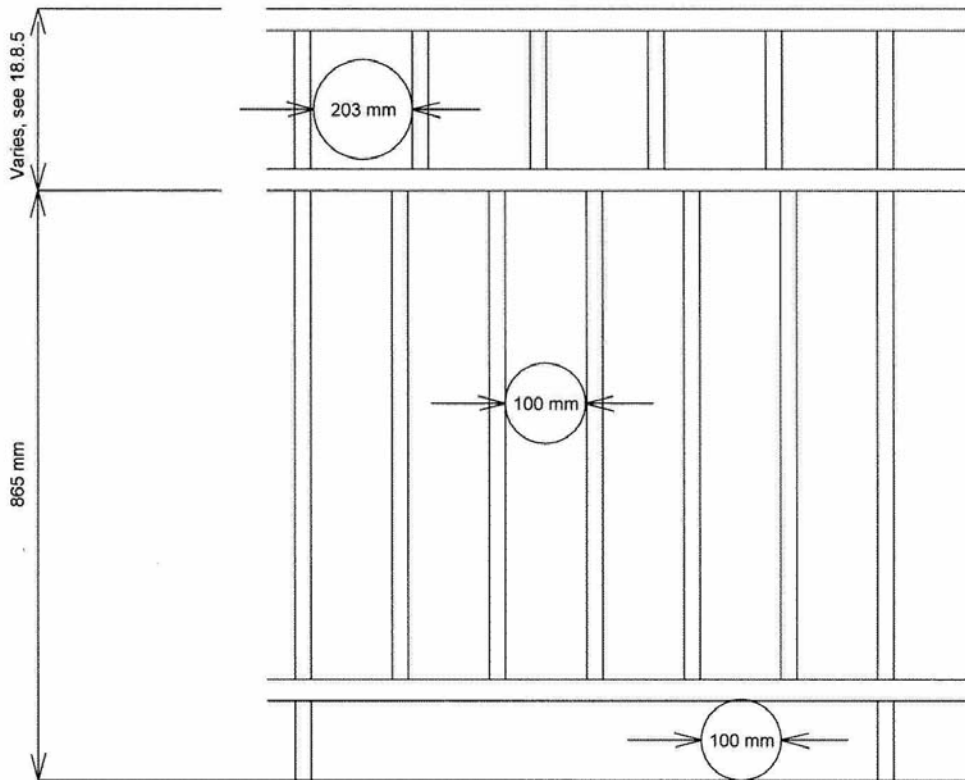
The minimum height for protective rails is 1.07 m on any pedestrian facilities that are more than 760 mm above an adjacent surface. The height of the protective rail is measured vertically from the adjacent surface.

There is no specific guidance on the use of horizontal rails versus vertical balusters on protective rail systems. However, where concentrations of small children are anticipated (e.g., playgrounds, parks, schools, and daycare centers) the designer should consider the use of balusters in place of a horizontal rail system. The Department’s standard spacing between balusters on protective rails is:

- On the portion of any protective railing up to a height of 865 mm (measured from the adjacent walkway surface), the baluster spacing must not permit the passage of a 100 mm sphere.
- On the portion of any protective railing that extends above a height of 865 mm (measured from the walkway surface), the baluster spacing must not permit the passage of a 203 mm sphere.
- A 100 mm sphere must not be able to pass through the space between the walkway surface and the bottom rail.

See NYS Building Codes 1003.2.12 and 1003.2.12.2.

Exhibit 18-26 Spacing of Balusters on Protective Rails



Note: Spheres of the sizes indicated must not be able to pass through spaces.

18.8.6 Elevators

There are instances where elevators must be considered as an option for moving pedestrians vertical distances. Elevators may have to be used where combinations of stairs and ramps meeting the accessibility standards cannot be constructed or would require the use of space needed for other purposes. Elevators are typically installed only in urban areas because of the volume of people needed to justify the cost of constructing them and the necessary security and maintenance associated with them. Normally elevators would be built at transit stops or where space is limited at bridges or overpasses in densely developed areas.

Security and maintenance are usually the deciding factors in determining whether or not a municipality, transit operator, or other maintaining entity will accept responsibility for an elevator.

Elevators must meet all of the minimum accessibility standards outlined in ADAAG Section 4.10.

Designers should consider elevators as a last option to combinations of stairs and ramps and may have to seek design assistance outside of the Department if elevators are used.

18.9 RECREATIONAL WALKWAYS, SHARED USE PATHS, TRAILS, AND OUTDOOR RECREATION ACCESS ROUTES

This section does not provide guidance regarding the design of recreational walkways, shared-use paths, and trails. It is intended only to provide guidance regarding access for pedestrians and to assure access for disabled people.

The most common recreational walkways, shared-use paths, and trails encountered and altered as part of Department projects are pedestrian/bicycle paths, facilities associated with trail head parking, segments of hiking trails, fishing access sites, and similar facilities.

18.9.1 Access for Persons with Disabilities

Specific national accessibility standards for recreational facilities, including outdoor recreation access routes, recreational walkways, and trails have not been adopted. However, it is established that the ADA affects these kinds of facilities. In general, outdoor recreation access routes, recreational walkways, shared-use paths and trails must be made as accessible as feasible. The current ADAAG requirements should be considered as minimum requirements for design.

Departures from ADAAG's minimum requirements should only be made where it is infeasible or inappropriate to strictly apply them. There are situations where it is difficult to make the shared-use paths, etc., accessible. They include:

- Locations where compliance to the ADAAG would cause considerable harm to cultural, historic, or significant natural features.
- Locations where compliance would significantly alter the nature of the setting or the purpose of the facility.
- Locations where compliance would require construction methods or materials that are prohibited by federal, state, or local regulations or statutes.
- Locations where compliance would not be feasible due to terrain.

Refer to the US Forest Service guidelines for consideration and rationale where departures from ADAAG are necessary www.fs.fed.us/recreation/programs/accessibility.

18.9.2 Use of Existing Sidewalks as Shared-Use Paths

Adapting an existing sidewalk for use as a shared-use path to accommodate bicyclists in addition to pedestrians or other users is usually undesirable. Existing sidewalks typically are not appropriate for higher speed bicycle use for the following reasons:

- They are normally designed for pedestrian speeds and maneuverability. Therefore, conflicts may be common between bicyclists and pedestrians walking at lower speeds, especially as they exit stores, parked cars, etc.
- Walkers, joggers, skate boarders, and in-line skaters can change their speed and direction almost instantaneously, leaving bicyclists insufficient time to react to avoid collisions.

PEDESTRIAN FACILITY DESIGN

- Disabled persons who may not be able to move easily or quickly, or who may have sight and/or hearing disabilities may not perceive rapidly moving bicyclists, skate boarders, in-line skaters, etc.
- Fixed objects such as parking meters, utility poles, sign posts, bus passenger shelters, benches, trees, fire hydrants, mail boxes, vending machines, etc., are potentially hazardous if they are struck by bicyclists or other walkway users.
- At intersections, motorists often are not looking for and do not expect bicyclists (who are traveling on the sidewalk at higher speeds than pedestrians) to be entering the crosswalk area. This may cause serious conflicts when motorists attempt to make a turn. Additionally, motorists exiting a driveway that intersects with a sidewalk may be unable to avoid conflicts with bicyclists, especially where sight distance is impaired by buildings, walls, fences, and/or shrubs.
- Significant sidewalk bicycle traffic may discourage pedestrian use of the sidewalk. This will be especially true for older or disabled people.

It is important to recognize that in areas where adequate facilities are not available to accommodate such uses as bicycling, in-line skating, etc., sidewalks are likely to be used for these purposes. However, simply providing wider sidewalks as a means of accommodating walkway users other than pedestrians will not normally contribute to their safety. Providing wider sidewalks may be reasonable where the variety of users is great but the total number of users is small. As stated above, wider sidewalks tend to encourage higher speed bicycle, in-line skater, and skate boarder use and can increase the potential for conflicts between bicyclists and motor vehicles at intersections, as well as between bicyclists, in-line skaters, skate boarders, and pedestrians or fixed objects.

When other design alternatives are not feasible, e.g., at multilane roundabouts, and an existing sidewalk must be used by cyclists or designated as a shared-use path (with additional width provided), the designer should consider the following:

- Use of signs requiring cyclists to dismount and walk along the sidewalk
- The provision of additional pavement striping and signing to alert motorists and pedestrians to the presence of bicyclists, as well as to warn bicyclists they must exercise caution.
- The removal or relocation of fixed objects along the shared use path so that they are less likely to be struck by bicyclists or other path users.
- Where possible, areas of inadequate sight distance for either motorists or pedestrians and bicyclists should be corrected.

It is inappropriate to sign a sidewalk as a bicycle path, bicycle route or shared-use path in order to discourage bicyclists from using a roadway that may otherwise be legally used by bicyclists. However, young children riding bicycles on sidewalks can be expected in residential areas. This relatively low-speed type of sidewalk bicycle use by young children is generally accepted.

18.10 BUS STOPS AND TRANSIT STATIONS

This section does not provide guidance regarding the location of bus stops. It is intended only to provide guidance regarding bus stop access for pedestrians and to assure access for disabled people. Designers should refer to Chapter 5, Sections 5.7.19.1 and Chapter 24, Sections 24.3.5 and 24.3.6 of this manual for information concerning bus stops and bus turnouts and should consult with the Regional Traffic Engineer.

Bus stops are frequently constructed or reconstructed and/or improved as part of Department projects. Existing bus stops that must be removed or relocated as part of a project are usually reconstructed at Department expense. However, this depends on the specifics of any existing agreement with the transit operator.

In general, when a bus stop on one side of a road is improved as a part of a project, a corresponding bus stop on the opposite side of the road should also be added, improved, or relocated to a more desirable location. If paved bus stop pads do not exist along a bus route on a project, and sidewalks are not otherwise warranted, project scoping documents should indicate coordination with the transit operator. When transit operators desire the Department to include paved bus stop pads in a project, appropriate funding arrangements must be made.

Design guidance for the accessibility of bus stops and other similar facilities can be found in Section 10 of ADAAG. Coordination with transit system operators is necessary to assure that bus stop pad configurations are also compatible with the system operators' buses and operations. Specific bus routes are chosen according to criteria selected by the system operators. Therefore, coordination with transit system operators is essential to assure that bus stop pads constructed or altered as part of a Department project are located to meet the system's needs and to ensure that they comply with Section 10 of ADAAG.

Bus passenger shelters at bus stops should not be located where they would reduce the effective width (1.525 m min.) of adjacent sidewalks, interfere with roadside clear area requirements, or reduce sight distance at intersections or driveways. Space should be provided for the bus system operator to install shelters of their choice after the Department's construction is completed, or the Department will install shelters meeting the system's specifications and the accessibility guidelines. The system operator should assure that their specifications are consistent with the accessibility guidelines before they are accepted for inclusion into Department projects. Appropriate funding and maintenance arrangements should be made in either case.

Where bus stop pads exist or are constructed or altered, sidewalks should be constructed to connect with nearby side streets, sidewalks, street crossings, shopping center entrances, etc. Where sidewalks do not exist, or are infeasible to construct, accessible connections from bus stops shall be provided consistent with the requirements of Section 10 of ADAAG.

Transit patrons need sidewalks, walkways, and street crossings to access bus stops and may need additional facilities (e.g., stairways, elevators, indoor corridors, and ramps) to access transit stations. Arterials and collectors served by transit are prime candidates for sidewalk and street crossing improvements. Safe and accessible pedestrian street crossings are essential to support the viability and utility of public transit.

PEDESTRIAN FACILITY DESIGN

Bus stops and transit stations are pedestrian traffic generators, because all transit riders are pedestrians at one end of their trip and frequently at both ends. When designing projects in areas surrounding or abutting bus stops or transit stations, designers should make every effort to ensure that:

- Accessible sidewalks/walkways to the bus stop or transit station are provided.
- Accessible street crossings and signing are provided to facility entries and exits.
- Projects do not sever existing or the planned right of way of pedestrian facilities.
- Pedestrian facilities are not replaced with lower quality or more circuitous facilities.

Designers should contact the regional landscape architectural staff regarding accessibility requirements for bus stops, transit stations, and other facilities covered by the provisions of Section 10 of ADAAG.

18.11 PARKING

It has been determined that providing opportunities for parking consists of a “program” under Program Access requirements of the ADA. Therefore, when off-street or on-street passenger-vehicle parking is provided as part of a Department project, the total number of accessible parking spaces provided within the project area must be consistent with the requirements of ADAAG Section 4.1.2, and the accessible parking spaces should be appropriately located and distributed. All off-street accessible parking spaces must also comply with the provisions of Section 1101.1(d)(4) of the NYS Uniform Fire Protection and Building Code as required by the NYS Vehicle and Traffic Law. For further information on parking, refer to HDM Chapter 5.

18.12 SPECIAL SITUATIONS

18.12.1 Main Streets

More than 180 communities have main streets or central business districts located on the state highway system in New York State. Frequent pedestrian crossing opportunities and sidewalk connections to surrounding neighborhoods are factors essential to the economic viability of a main street. When the pedestrian circulation is incomplete or does not adequately connect between land uses, overall circulation opportunities are constrained.

Beneficial main street design includes pedestrian infrastructure, signalization, and traffic calming to promote vehicular traffic speeds which do not pose real or perceived threats to pedestrian safe access. Additionally, the number of drivers passing a retail storefront is critical to their profitability. However, if drivers are moving too rapidly, they do not benefit the retailer.

Best practice outcomes for main street projects include meeting the following goals:

- Encourage drivers to drive at the desired or posted speed.
- Minimize conflicts between all legitimate traffic modes.
- Enhance “curb appeal” for pedestrians and drivers.
- Improve the aesthetic appearance of the street.

For more information see References 17 and 21 in Section 18.15.

18.12.2 Central Business/Walking Districts

While far fewer in number than main streets, central business/walking districts are very important to the economy and tourism. Design and operational strategies for central business/walking districts should be to control vehicle speeds, minimize vehicular impedence to the pedestrian, minimize pedestrian-vehicle conflicts, ensure adequate sidewalk and crosswalk capacities for accommodating peak period pedestrian traffic surges, and provide aesthetic designs that improves the human-scaled pedestrian and tourism experience (e.g., safety, comfort, and security) of the walking district.

Specific measures to achieve the above mentioned strategies may include the following:

- Sidewalk and crosswalk capacity expansion based upon increased development densities.
- Establish streetscape proposals that provide design features which maximize access and safety for all pedestrians.
- Provide operational improvements (i.e., leading pedestrian interval, all-red or split phasing, and a 32 km speed limit – where permitted) that give pedestrians priority.
- Establish and/or restore the local street grid system to improve pedestrian access.

For more information, see References 7 and 20 in Section 18.15.

18.12.3 School Walking Zones

School walking zones typically extend 0.8 km to 1.6 km from an elementary school. Children are especially vulnerable, making streets in these zones prime candidates for sidewalk and pedestrian crossing improvements. For more information, see References 12, 26 and 28 in Section 18.15.

Best Practices for Safe and Accessible School Walking Zones Accommodations include:

- Appropriate school zone signing, marking, and flashing beacons. (Note: Flashing beacons are installed by the school districts)
- Local sidewalk or walkway networks that permit access to school entries or exits.
- Optimally sited street crossings, including marked crosswalks at controlled intersections, midblock crossings and signalization if warranted.
- Traffic calming.
- Roundabouts.

18.12.4 Designing for Disaster Preparedness

Mass evacuation on-foot is often the only available means for people to quickly escape crime scenes, terrorist attacks, sudden natural disasters, or to cope with other actions or incidents that may cause highway, transit and/or commuter rail systems to shut-down for an undetermined period. Successful mass movement of pedestrians photographed during the September 11, 2001, attacks on the World Trade Center, the August 2003 northeast power outage, and transit strikes show that “walking” is the most reliable and sustainable mode of traffic for overcoming these kinds of circumstances. From a design and operational perspective, at-grade/street-level pedestrian access has been found to be the safest design feature for expediting pedestrian traffic movements when mass evacuations occur. Practices to be avoided that may inhibit mass evacuations include:

- Restricting at-grade pedestrian access through larger blocks, fencing and barriers.
- Pedestrian structures susceptible to movement and partial or total collapse.
- Pedestrian tunnels susceptible to flooding and exit and/or entry obstructions.
- Building site and frontage design configurations that impede pedestrian traffic.
- Use of stairways along major pedestrian routes.

While vehicular travel lanes in urban main streets, central business and walking districts may experience surges of pedestrian traffic; the availability of adequate pedestrian facilities are still more suitable for use during more localized mass evacuations for the following reasons:

- Travel lanes may be clogged or obstructed with abandoned vehicles and/or debris.
- On-street and highway vehicular traffic may still be active during the evacuation.
- Driver panic and general confusion may make pedestrian use hazardous.
- Travel lanes may be used by or restricted to emergency, military or government uses.

When a major subregional or regional catastrophic emergency occurs, then pedestrian use of travel lanes must be included in transportation, law enforcement, emergency management, military evacuation and recovery planning for the following reasons:

- Major emergencies will involve pedestrian traffic surges at critical regional transportation bottlenecks.
- Travel lanes anticipated to carry the highest pedestrian traffic volumes should be mapped and predesignated for the quickest removal of any obstructions that might hinder rapid at-grade mass pedestrian evacuations.

18.13 PEDESTRIAN FACILITY CONSTRUCTION

FHWA regulations ((23 CFR 652.5) require that provision for safe accommodation of pedestrians be given full consideration during construction. HDM Chapter 16, Section 16.4.4.2 contains a discussion on the maintenance and protection of pedestrian traffic during construction. Work zone traffic control diagrams for pedestrian accommodation can be found at:

<http://www.dot.state.ny.us/traffic/workzone/pedaccdiag.html>.

18.14 PEDESTRIAN FACILITY MAINTENANCE

The Department usually constructs sidewalks on State highways in towns, villages, and cities wherever professional judgment indicates they are necessary (see Section 18.5).

The Highway Law requires that villages, towns, and cities maintain sidewalks on State highways in their respective municipalities. The Highway Law also requires that villages, towns, and cities remove accumulated snow and ice as a part of their maintenance activities.

1. Section 46 of the Highway Law, requires villages to maintain sidewalks along State highways, including removing snow and ice.
2. Section 140 of the Highway Law requires towns to maintain sidewalks along State highways, including removing snow and ice.
3. Section 349-c of the Highway Law requires that cities maintain sidewalks along State highways, including removing snow and ice.

Whenever the Department determines that sidewalks are necessary, the decision should be discussed with the appropriate municipal officials. The Department is to also advise the municipality that they are obligated to ensure the sidewalks are maintained and that the obligation includes removal of snow and ice. The municipality is to be formally notified about the decision to construct sidewalks and the municipality's maintenance obligations subsequent to any discussions with them.

It must be recognized that Americans with Disabilities Act (ADA) regulations require accessible pedestrian routes to be maintained. Only temporary interruptions in service or access are permitted. A sidewalk with accumulated snow and/or ice that is left in place beyond a reasonable period of time would clearly not qualify as a temporary interruption in access.

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