State of Georgia

Department of Transportation

Pedestrian and Streetscape Guide

Pedestrian and Streetscape Guide

September 2003

Atlanta, Georgia 30308

Georgia Department of Transportation

This document was developed as part of the continuing effort to provide guidance within the Georgia Department of Transportation in fulfilling its mission to provide a safe, efficient, and sustainable transportation system through dedicated teamwork and responsible leadership supporting economic development, environmental sensitivity and improved quality of life. This document is not intended to establish policy within the Department, but to provide guidance in adhering to the policies of the Department.

Your comments, suggestions, and ideas for improvements are welcomed.

Please send comments to:

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DISCLAIMER

The Georgia Department of Transportation maintains this printable document and is solely responsible for ensuring that it is equivalent to the approved Department guidelines.

Georgia Department of Transportation

Revision Summary

Revision Number	Revision Date	Revision Summary
	September 2003	Reformatted to new standard template

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Chapter 1. Introduction

Why a Pedestrian and Streetscape Guide

As Georgia's population continues to grow, we strive to create livable communities that offer a diversity of transportation alternatives including convenient, reliable, safe, efficient, and attractive pedestrian facilities.

Most of us are pedestrians at some point each day, and for some of us, especially children, walking is a primary mode of transportation. Whether we walk several miles a day, use a wheelchair to get from our office to the bus stop, ride a skateboard through the park, or simply walk across the parking lot from our car to the grocery store, all of us have a need for well-designed and properly functioning pedestrian facilities.

Increasing pedestrian travel and safety are objectives of Georgia's Transportation Plan.

Georgia State Department of Transportation's (GDOT) mission states that "(We) are committed to a safe, efficient, and sustainable transportation system for all users." Through this mission, GDOT created the *Bicycle and Pedestrian Plan* (*1995*) that defines several goals for increasing pedestrian travel throughout the state. These are shown in Table 1.

The Federal Highway Administration (FHWA) has a national policy addressing pedestrian facilities into the transportation infrastructure. This statement specifies "bicycling and walking facilities will be incorporated into all transportation projects unless exceptional circumstances exist." (*FHWA 2000*). This principle should be applied to federally funded state and local transportation projects. To ensure pedestrian facilities exist at the local level, they should be included in city capital improvement plans.

GDOT began the guide process by creating a Statewide Bicycle and Pedestrian Advisory Committee. This guide will help achieve many of the goals in GDOT's Bicycle and Pedestrian Plan created in 1995.

Users should be aware of some limitations when applying the recommendations in this document. Some recommendations are provided as "best practices" and don't necessarily conform to GDOT standards and policies. Use of features or elements that do not conform to GDOT policies

. **GDOT's Bicycle and Pedestrian Plan Goals**

- Promote bicycling and walking as mobility options in urban and rural areas of the state.
- Develop a transportation network of primary bicycle routes throughout the state to provide connectivity for intrastate and interstate bicycle travel.
- Promote establishment of U.S. numbered bicycle routes in Georgia as part of a national network of bicycle routes.
- Encourage economic development opportunities that enhance bicycle and pedestrian mobility.
- Promote non-motorized transportation as a means of congestion mitigation.
- Promote non-motorized transportation as an environmentally friendly means of mobility.
- Promote connectivity of non-motorized facilities with other modes of transportation.

Table 1

and/or standards should only be done after consultation with GDOT. For example, placement of trees in clear zone areas may be acceptable for locally funded improvements, but not acceptable per GDOT standards, which always apply when the project is funded through GDOT. If new accessibility standards are enacted by the Access Board, or any federal legislation, the application of these guidelines should not contradict or be inconsistent with those new federal or state standards.

Who Will Use This Guide?

The design guidelines provided in this guide will assist GDOT, cities, counties, private developers, design professionals, and others in designing, constructing, and maintaining pedestrian facilities in a variety of settings, including urban, suburban and rural communities throughout Georgia. The primary audience of the guide will be transportation design practitioners, including those listed in Table 2.

Georgia strives to provide a safe pedestrian environment for all its citizens, especially children.

Anticipated Guide Users

Primary Audience

- Traffic and transportation engineers
- Site development and building permit review staff
- Planners and designers, including architects, civil engineers, landscape architects, urban designers, and other design professionals
- Developers

Others Who Might Find the Guide Helpful

- School districts
- Neighborhood councils and planning committees
- Metropolitan planning organizations
- Central business district planning organizations/business people
- Small towns
- Officials and politicians
- Special campaigns and programs
- Citizen advocates

Table 2

What is the Focus?

The focus of this guide is on *design* of *pedestrian and streetscape facilities (*see Tables 3 and 4), but good design is only one component of a successful pedestrian facility. Conscientious planning, effective education programs, and consistent safety and law enforcement also contribute to improving our communities for pedestrians. Some basic principles related to planning for pedestrians are provided in this handbook, but the overall intent is to encourage good design practices.

"Design" Focus
The primary focus of this guide is to encourage good planning, design, and engineering practices related to pedestrian facilities. The guide also addresses a few important construction, ongoing maintenance, and operational aspects related to pedestrian facilities.

Table 3

Pedestrian Facilities
For the purposes of this guide, pedestrian and streetscape facilities include:
Sidewalks, trails, curb ramps, grade separated crossings, wide shoulders, traffic calming and control devices and other technology, design features, and strategies intended to encourage pedestrian travel.

Table 4

References and Other Resources

The technical information contained in this guide was compiled from numerous sources. The Resource Guide at the end of this document provides a comprehensive list of sources for information related to pedestrian planning and design, including sources referenced for this document. In addition to the Resource Guide, readers interested in finding additional information related to specific types of pedestrian facilities will find a list of relevant sources of information at the end of each section of the design toolkit. The Resource Guide also lists sources of information related to pedestrian planning, education, and enforcement.

When no specific source is referenced for graphics, figures, and tables in this document, drawings were created and/or other information was compiled especially for use in the Pedestrian and Streetscape Guide. In some cases, other documents or sources of information may have been researched and specifically adapted for this guide based on input from GDOT or the advisory group and other technical experts involved.

Acknowledgments

Funding for this report was provided to the Georgia Department of Transportation with federal funds from the U.S. Department of Transportation.

Sponsoring Agencies and Organizations

- Georgia Department of Transportation

- GDOT's Internal Bicycle and Pedestrian Taskforce
- State Bicycle and Pedestrian Advisory Committee
- Pedestrians Educating Drivers on Safety (PEDS)

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Chapter 2. How to Use this Guide

How Should the Information in This Guide Be Used?

The information presented in this guide should not be interpreted as standards, specifications, requirements, or regulations, but rather as guidelines.

The guidelines included in this guide apply to normal situations encountered during project development. Unique design problems sometimes require flexibility in design solutions. Other available design information and all applicable federal, state, and local requirements should be reviewed as part of the project design. Some elements of the guide may not be appropriate for major highways and arterial routes or may not be possible on existing right-of-way, but some parts of the guide should always be considered and implemented wherever feasible.

The information presented in this guide may not solve all problems associated with pedestrian

Georgia pedestrians live, work, and play in a wide variety of settings, and design of pedestrian facilities needs to be adaptable to these settings.

travel, but it provides a “first step” in establishing a consistent set of statewide guidelines for design of pedestrian facilities. The guide can also be used as a tool to build consensus on sometimes differing approaches to design.

The guidelines in this guide are often presented in terms of “desirable” and “minimum” dimensions or recommendations. These recommendations should be applied with professional judgement to achieve design solutions that are specifically tailored to the circumstances encountered. For example, if a sidewalk receives a high amount of use, the project designer or local design reviewer may elect to apply the “desirable” dimension over the “minimum” for the sidewalk width.

Relationship to Other Guidelines and Standards

Cities and counties may already have adopted standards related to design of pedestrian facilities. In that case, the guidelines can be referenced as a supplement to local standards. When no standards have been adopted by federal, state, or local agencies, these guidelines and other documents can provide useful direction to design practitioners. Eventually, local agencies may amend their current design standards to incorporate all or portions of these guidelines.

Pedestrian facilities should be designed and built in accordance with existing federal, state, and local standards as applicable. In some situations, the current standard may not be achievable due to geometric, environmental, or other constraints. In these circumstances, variances from the standard may be acceptable; however, a facility should not typically be built to less than the minimum standards described. Deviations from standards should be documented and justified through special studies. Table 5 lists several documents that include other design standards and guidelines related to pedestrians.

Other Documents to Review for Pedestrian and Streetscape Guide

- Local design standards, zoning codes and development codes
- *Americans with Disabilities Act (ADA)* Federal Requirements
- *Manual on Uniform Traffic Control Devices*, Federal Highway Administration, USDOT
- *A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials (AASHTO)
- *Uniform Building Code (UBC),* International Conference of Building Officials, and/or locally adopted building code
- *Design and Safety of Pedestrian Facilities*, ITE
- *Guide for Planning, Design, and Operation of Pedestrian Facilities*, AASHTO
- *Guide for the Development of Bicycle Facilities*, AASHTO

Note: This is only a partial list and does not include all available resources. See the Resource Guide for other relevant publications

Table 5

This guide provides recommendations for a variety of pedestrian facilities.

Permission to Reproduce and Copy

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Where Can You Find the Information You Need in This Guide?

Look for the Boxes Important and helpful information is highlighted in boxes like this one, throughout the guide.

About Pedestrians

Refer to the next section of this guide, About Pedestrians, for information about the needs and characteristics of pedestrians and factors that affect pedestrian travel.

Design Toolkit

The Design Toolkit provides recommendations under 11 topics. A directory of the toolkit topics is provided on the first page of the Design Toolkit for easy reference. Toolkit 1 — General Design Guidelines, provides a general overview of design considerations related to pedestrians and creating pedestrian friendly communities. Toolkit 2 — Accessibility, provides recommendations and guidelines related to accessible design and compliance with the Americans with Disabilities Act (ADA). The remaining toolkit sections focus on more specific areas of pedestrian facility design.

Resource Guide

Look in the Resource Guide near the end of this guide for a comprehensive list of sources related to planning and design of pedestrian facilities. Relevant sources of information related to pedestrian facilities addressed are also listed at the end of each toolkit section.

Sometimes, there's more than "one-way" to find the best solution for design of pedestrian and streetscape facilities.

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Chapter 3. About Pedestrians

Understanding the needs and characteristics of pedestrians and factors that affect pedestrian travel is important when designing pedestrian facilities. This part of the guide describes the many types of pedestrians and provides information about pedestrian safety and current research on levels of pedestrian travel.

Pedestrians Defined

Every trip begins and ends as a pedestrian trip — whether walking to a bus stop or across a parking lot to your car.

Georgia State law defines a Pedestrian as:

> *"Any person who is afoot"* (GLC 40-1-1),

By state definition, rollerskaters, in-line skaters, and skateboarders are also pedestrians. Wheelchair users are also considered pedestrians.

Every trip begins and ends as a pedestrian trip.

Pedestrian Safety

Analysis of pedestrian/motor vehicle collisions can help establish engineering, education, and enforcement solutions. Most reported pedestrian injuries are a result of collisions with motor vehicles. According to *Mean Streets*, a project conducted by the Surface Transportation Policy Group, there were 356 pedestrian fatalities caused by motor vehicles in the state of Georgia in 1997 and 1998. Pedestrians accounted for 11.5 percent of all persons killed in traffic-related collisions. The report also cited that Metro Atlanta is the second most dangerous metropolitan area for pedestrians in the US, only behind Tampa, Florida.

According to the National Highway Traffic Safety Administration (NHTSA), 4,906 pedestrians in the United States were killed in traffic crashes in 1999. 85,000 pedestrians were injured in traffic crashes. One-fourth of those fatalities where children between the ages of 5-9. Most fatalities occurred in urban areas, at non-intersection locations, at night. According to the Insurance Institute for Highway Safety "Pedestrians are the second largest category of motor vehicle deaths, after occupants." Overall, pedestrian fatality rates are declining. In 1975, pedestrian fatalities accounted for 17 percent of all motor vehicle accidents and in 2000, pedestrian fatalities accounted for 11 percent. This is likely due to several things, including the increased focus on improving pedestrian safety and good design for pedestrians and the decline in exposure, particularly by high risk groups. According to Mean Streets, American children now walk 37 percent less than they did twenty years ago. Even though fatality rates are declining, pedestrian safety is still an ongoing and important concern. Common characteristics of pedestrian collisions are listed in Table 6.

Common Characteristics of Pedestrian Collisions

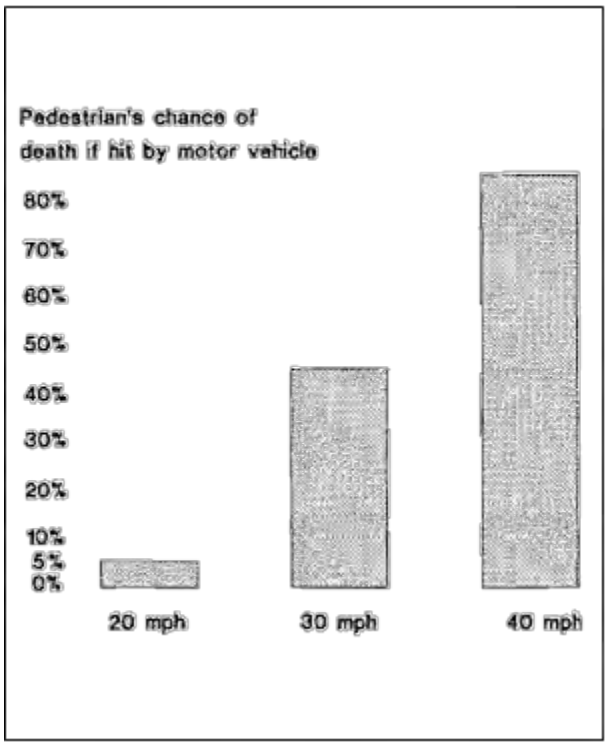
- Driver inattention
- Struck by vehicle while crossing at an intersection (50 percent of all collisions)
- Struck by vehicle while crossing mid-block (33 percent of all collisions)
- Struck from behind while walking along the roadway in the same direction as traffic (particularly in rural areas)
- Motorist exceeding safe speed (contributes to most pedestrian deaths)
- Darting out into the street at mid-block (most common type of pedestrian collision for children)
- Vehicles backing up (difficult to see children and others walking behind)
- Collisions in urban areas (80 percent of all collisions)

Source: Pedestrian and Bicycle Crash Types of the Early 1990s; (Snyder, Knoblauch, Moore, and Schmitz; Cross and Fisher)

Table 6

Vehicle speed is a significant factor in causing fatalities as a result of pedestrian collisions. The faster a motorist drives, the more likely injuries to a person on foot will result in death. The chart in Figure 1 illustrates the rate of death that occurs in correlation to the speed of a vehicle involved.

Fatalities Based on Speed of Vehicle



Source: Walk Tall: A Citizen's Guide to Walkable Communities

Figure 1

As the figure shows, when collisions occur with the vehicle travelling at a speed of 40 mph, 85 percent of pedestrians are killed, compared to a death rate of 45 percent at a vehicle speed of 30 mph, and only 5 percent at a vehicle speed of 20 mph. The ability to stop in time for crossing pedestrians also significantly decreases as vehicle speed increases, as shown in Figure 2.

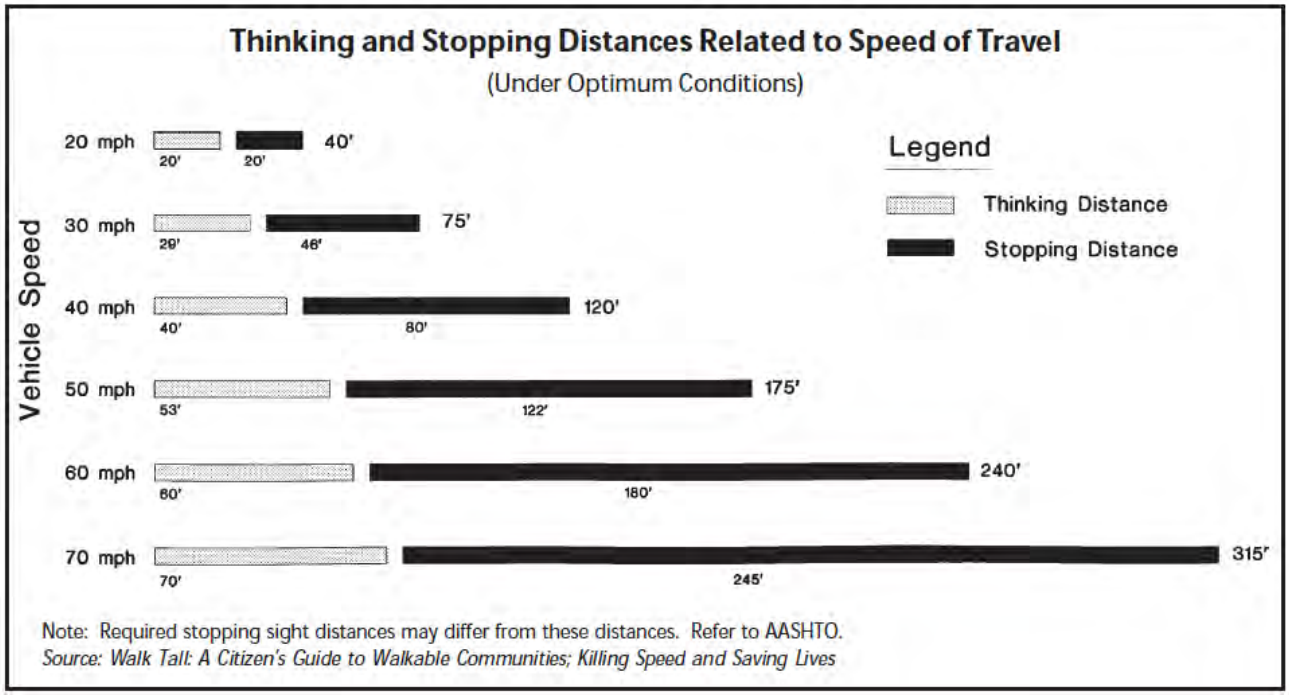


Figure 2

Identifying areas where most pedestrian injuries and fatalities occur, is a start to improving pedestrian safety. High risk areas can be mapped and analyzed using several different techniques, including Geographic Information Systems (GIS) software. Once risk areas are identified, improving the pedestrian environment in these areas should then be a high priority.

Children and Older Adults

The pedestrians most likely to be involved in collisions are also the ones who most rely on pedestrian travel for transportation — children and older adults. In Georgia, children and young adults age 5 to 19 constitute only 7.5 percent of the population; yet between 1997 and 1998, this group accounted for 13.20 percent of all pedestrian fatalities in Georgia (*Mean Streets 2000, Surface Transportation Policy Group*). According to NHTSA, 24 percent of all children between the ages of 5 and 9 who were killed in traffic crashes were pedestrians. 5 to 9 year-old males are most at risk for pedestrian injuries or fatalities. This group is the most likely to dart- out in front of traffic.

People over age 65 represented 11.9 percent of the national population; yet accounted for 18 percent of all pedestrian deaths during that same year (*Traffic Safety Facts 1999*, NHTSA). The death rate for people over 65 was higher than any other age group. People over 65 are two to four times more likely to die when involved in a pedestrian-motor vehicle collision. Older adults are particularly more vulnerable while crossing the street, since they need more time to cross.

Pedestrian Needs

In order to successfully design pedestrian facilities, we must recognize that pedestrian needs are wide-ranging, and our design approach must be flexible to meet the diversity of needs.

For some of Georgia's population, especially in metro Atlanta, pedestrian travel is the primary mode of transportation. Citizens in this segment of the population include those who do not use a motor vehicle including some older adults, children and young adults, people who walk to the bus or train, people with certain disabilities, and people who can't afford to own cars. There are also many others who choose pedestrian travel as their primary mode of transportation.

Recognizing why people do not walk in the first place is an important step in determining their needs. Certain circumstances such as insufficient infrastructure, physical barriers (rivers or freeways), lack of curb ramps, major road separation from commercial districts, and long block lengths, which prevent street crossings, are some reasons why people do not walk. According to the University of North Carolina Highway Safety Research Center, a high correlation exists between communities who meet the needs of the pedestrian and an increased level of pedestrian travel. In communities that do not provide adequate pedestrian facilities, fewer people walk and those who do are in far more danger of pedestrian injuries and fatalities.

Another common obstacle in designing pedestrian facilities is assuming that one standard can be applied to fit an "average" population. For example, the speed that pedestrians travel can vary greatly, yet pedestrian signals are often timed for average walking speeds of 3 to 4 mph. Children, older adults, and people with certain disabilities typically travel at a much lower walking speed of 2 mph.

Pedestrian needs are diverse, but one thing remains the same—pedestrians need a safe, interesting, and inviting environment. Some typical pedestrian needs are listed in Table 7.

Some Important Needs of Pedestrians

- Safe streets and walking areas
- Convenience
- Nearby places to walk
- Visibility
- Comfort and shelter
- Attractive and clean environment
- Access to transit
- Interesting things to look at while walking
- Social interaction

Table 7

Acceptable Walking Distances

Acceptable walking distances will vary depending on geography, climate conditions, and land use patterns. The distance pedestrians will travel is also influenced by the weather, the time of day, demographics, the purpose of their trip, and many other factors. Most people will walk longer distances for recreational purposes, but prefer to walk shorter distances when they are commuting

or in a hurry, such as from the bus stop or transit station to their office. The following guidelines provide information on acceptable walking distances:

- Traditionally, planners strive to locate community facilities, neighborhood parks, and other popular pedestrian origins and destinations no more than one-quarter mile from the origin of most pedestrian travel.
- Site designers typically use 300 feet as the maximum distance from parking and site pedestrian circulation to building entrances. Street crossings are typically most effective when located approximately 300 to 600 feet apart in areas heavily used by pedestrians.
- Pedestrians can be expected to travel about 1,000 to 2,000 feet to a major transit station — about 750 feet for mobility impaired. Most pedestrians will walk farther if the transit station serves higher frequency transportation options, such as light rail.

Spatial Needs

Figure 3 illustrates approximate human dimensions when walking and sitting. For two people walking side-by-side or passing each other while travelling in opposite directions, the average space taken up is 4 feet 8 inches with adequate buffer areas on either side. The desirable width that best serves two pedestrians walking together or passing each other is six feet. Figure 4 illustrates passing difficulty for three pedestrians on a sidewalk less than 6 feet. Walking rates slow when pedestrian volumes increase and square footage per person decreases. Figure 5 illustrates how average flow volumes decrease on walkways with increasing degrees of pedestrian density.

A spatial bubble is the preferred distance of unobstructed forward vision while walking under various circumstances. Figure 6 illustrates the spatial bubbles that are comfortable for the average pedestrian while attending a public event, shopping, walking under normal conditions, and walking for pleasure. This information is helpful to the designer for use in calculating how much forward clear space is necessary to maintain a reasonable degree of comfort for pedestrians.

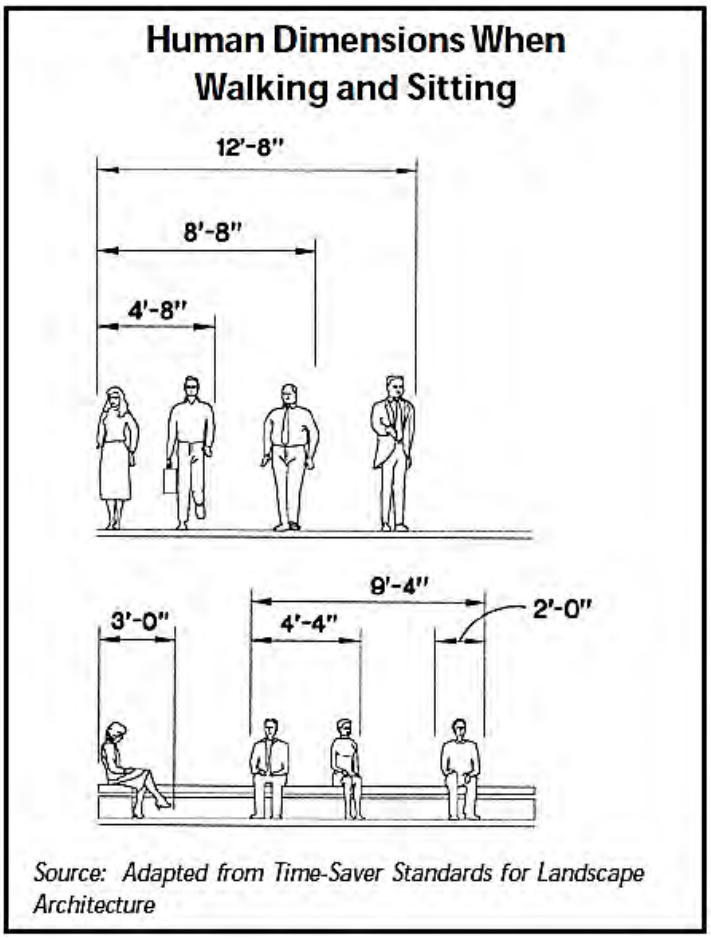


Figure 3

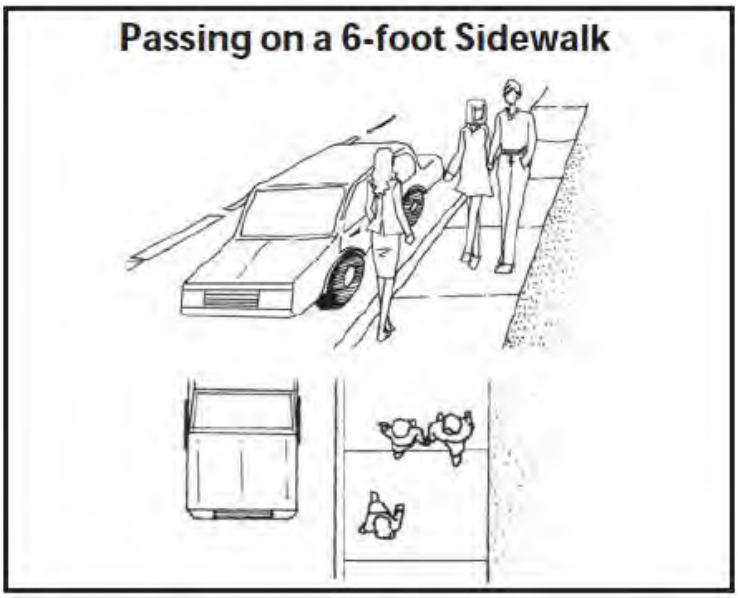


Figure 4

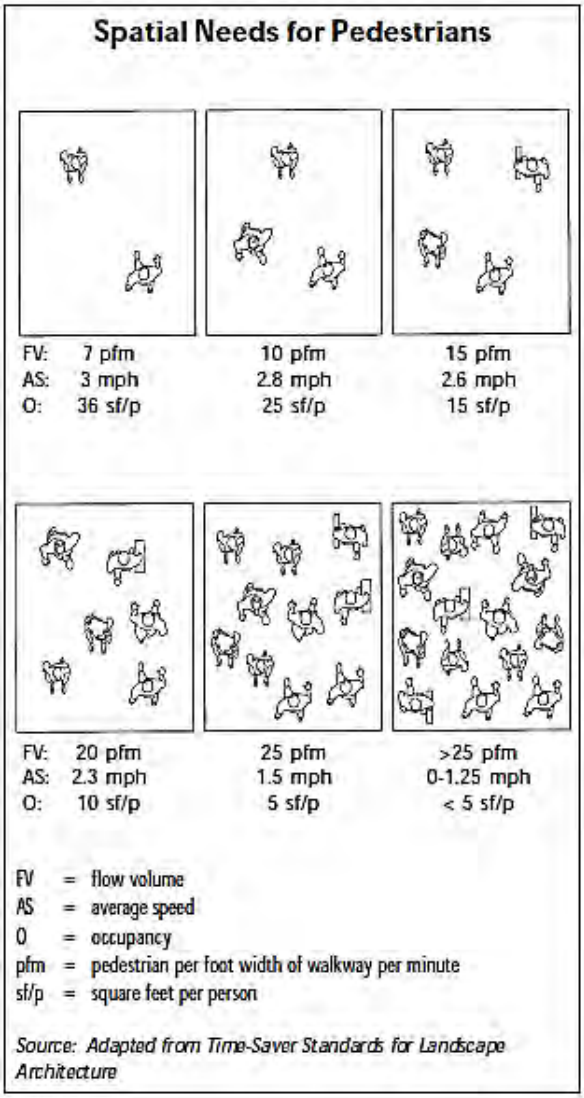


Figure 5

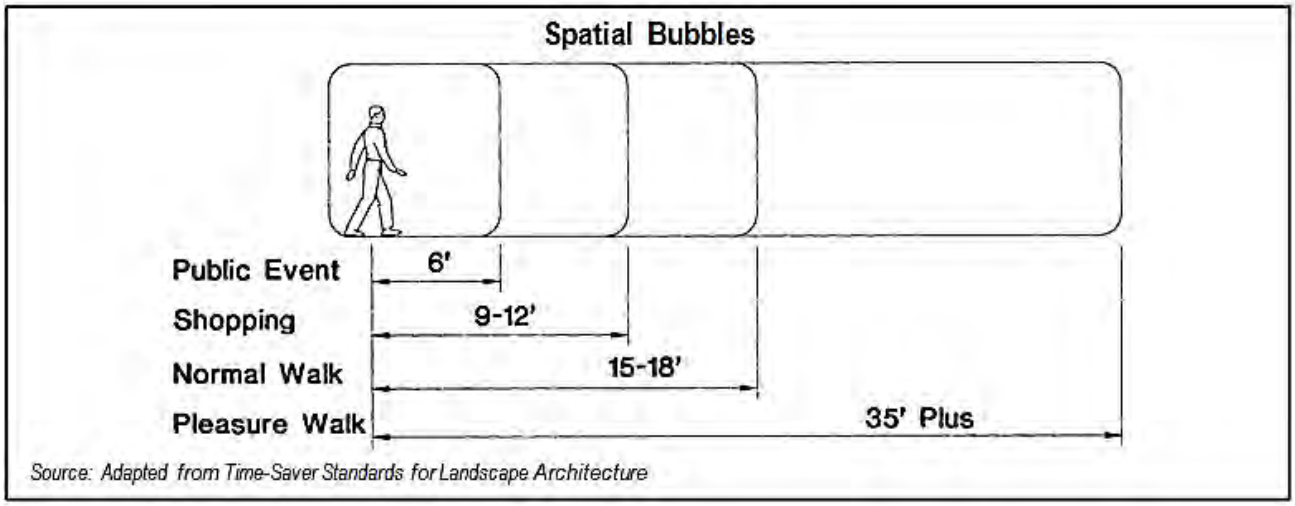


Figure 6

Children and Older Adults

Different pedestrian age groups have different needs. Table 8 summarizes common pedestrian characteristics related to age groups.

Common Pedestrian Characteristics by Age Group	
Age 0 to 4	• Learning to walk • Requiring constant parental supervision • Developing peripheral vision, depth perception
Age 5 to 12	• Increasing independence, but still requiring supervision • Poor depth perception • Susceptible to "dart out"/ intersection dash
Age 13 to 18	• **S**ense of invulnerability • Intersection dash
Age 19 to 40	• Active, fully aware of traffic environment
Age 41 to 65	• Slowing of reflexes
Age 65+	• Street crossing difficulty • Poor vision • Difficulty hearing vehicles approaching from behind • High fatality rate
Source: Washington State Bicycle Transportation and Pedestrian Walkways Plan, 1994	

Table 8

The primary need of young pedestrians is adult supervision. Even design with the best of intentions cannot fully protect children from the dangers of streets. Educational programs geared toward increasing a child's awareness of traffic and safety measures are an important tool to increasing their safety as pedestrians. In addition to adult supervision and effective education programs, good design of the places children walk most, such as school zones and school walking routes, neighborhood streets, and parks, can significantly help to improve their safety.

See Toolkit 3, Children and School Zones, for more information.

There are several educational programs and advocacy organizations in Georgia that promote a safer walking environment for children and aim to educate them on the importance of walking.

These include:

- PEDS – a nonprofit organization dedicated to making metro Atlanta safe and accessible for all pedestrians, has been a catalyst for various policy changes adopted by GDOT and other agencies.
- DeKalb County Board of Health – assesses infrastructure such as sidewalks around schools in DeKalb

- Metro Atlanta Safe Routes to School Coalition – an organization working to secure funding for policy change regarding pedestrians including education, encouragement, and infrastructure.

Older adults have a variety of needs as pedestrians. Research shows that people over 60 walk more, yet in some cases may have impaired mobility. Table 9 lists some examples of elements that aid older adults in their travel as pedestrians.

People with Disabilities

People with disabilities, including those using special walking aids or wheelchairs, need carefully designed facilities that eliminate barriers.

The needs of pedestrians with disabilities can vary widely depending on the type of disability and level of impairment. Elements that are helpful to people with disabilities are listed in Table 10.

Research shows that older adults walk more than other age groups.

Aids to Older Pedestrians
• Reduced roadway crossing distances (bulb- outs and curb extensions)
• Signal timing at lower than average walking speed
• Signals within 60 feet of viewing distance; easy-to-read signs
• Refuge areas in roadway crossings
• Traffic calming
• Shelter and shade
• Handrails
• Smooth surfaces and unobstructed travel ways

Table 9

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

Table 10

Space requirements for pedestrians with disabilities vary considerably depending upon their physical abilities and the assistive devices they use. Spaces designed to accommodate wheelchair users are generally considered to be functional and advantageous for most people. Figure 7 illustrates the spatial dimensions of a wheelchair user, a person on crutches, and a sight-impaired person.

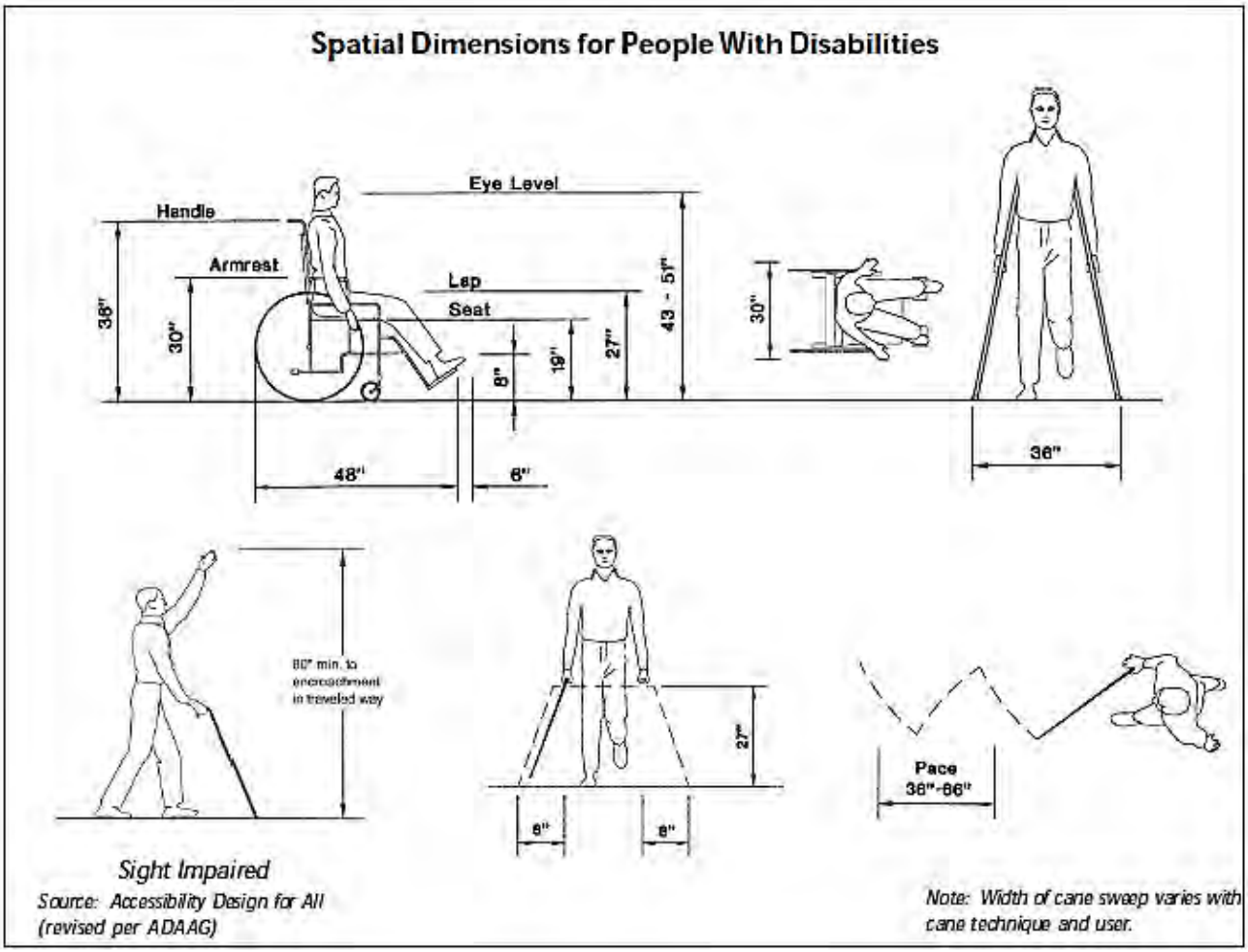


Figure 7

Levels of Use and Travel Characteristics

Various Settings

Different areas in Georgia experience different levels of pedestrian travel. In certain urban areas, the level of walking is higher. Table 11 lists some reasons why urban areas receive high pedestrian use.

Why Urban Areas Receive High Pedestrian Use

- Higher densities of residences, businesses, and other origins and destinations
- Traffic congestion
- High concentrations of origin and destination points
- Shopping and services are more accessible to pedestrians
- Average trip distances are shorter
- Parking is too costly or unavailable

- Transit service is more readily available
- More available pedestrian facilities

Table 11

Pedestrian travel is higher in urban areas, but pedestrians can also be found in suburban and rural areas. There is a common misconception that people who live in the suburbs do not walk, but research indicates that this is not the case, particularly in suburban areas that provide an interconnected and continuous system of well- designed pedestrian facilities. Anne Vernez-Moudon's research paper, Effects of Site Design on Pedestrian Travel in Mixed-Use, Medium Density Environments, December 1996, found that relatively high numbers of people walk in suburban centers, where adequate pedestrian facilities are provided.

It is also important to recognize that people living in suburban and rural areas travel as pedestrians for different purposes than those living in urban areas. Suburban and rural pedestrian trips are often associated with walking to schools or school bus stops, transit bus stops, or for recreation and leisure purposes, and fewer people walk for the purpose of running errands, shopping, and travelling to community services.

Even though pedestrian trips account for 39 percent of all trips less than one mile overall, walking typically still only comprises between one and four percent of all commute trips in the United States overall. This low pedestrian commute percentage could lead to the conclusion that there is an enormous amount of untapped potential to increase walking as a mode of commuting in Georgia.

Trip Characteristics

There are approximately 56 million walk trips per day in the United States. Pedestrians travel for a wide variety of reasons. Throughout the United States, pedestrian travel is gaining renewed attention as a form of transportation. Pedestrian travel and other modes of transportation are being encouraged as alternatives to single occupant vehicle travel for energy conservation, reduced traffic congestion, and better air quality. Table 12 lists various types of trips that more people are choosing to make as pedestrians. Table 13 lists facts related to pedestrian trips.

Typical Types of Pedestrian Trips (Why People Walk)

- To and from work and school
- Social visits and events
- Appointments
- Health and exercise
- Errands and deliveries
- Recreation
- Extra-curricular activities
- Combined (recreational walking while shopping)
- Multimodal trips (walking to a bus stop)

Table 12

Pedestrian Trip Facts

- Pedestrian trips account for 39 percent of all trips less than one mile, ranking second only to private motor vehicle trips
- 73 percent of all pedestrian trips are less than one-half mile
- One out of five trips is work related

Sources: Washington State Bicycle Transportation and Pedestrian Walkways Plan; Best Foot Forward Pedestrian News

Table 13

Research on Pedestrian Use

National Biking and Walking Study The National Biking and Walking Study, conducted in 1993, included 24 case studies that provided in-depth information on specific topics related to bicycling and walking. Case Study No. 4, Measures to Overcome Impediments to Bicycling and Walking, cited three primary categories of reasons for not walking:

- Facility deficiencies
- Information or knowledge deficiencies
- Motivational deficiencies

Facility deficiencies include lack of adequate facilities and connectivity. Information or knowledge deficiencies are a result of people not knowing about the level of walking opportunities available to them. Motivational deficiencies have to do with attitudes and behaviors — people not walking because distances between origins and destinations are too long, walking is not convenient, the weather is poor, or they feel uncomfortable or unprotected as pedestrians. In many cases, information/knowledge and motivational deficiencies would decrease as a result of improvements to pedestrian facilities and expanding the pedestrian network.

Desire for Improved Pedestrian Facilities

Public opinion surveys have shown that people have a desire to walk and would increase the amount of pedestrian travel they do if better facilities were available. A Lou Harris Poll (1995) found that 5 percent of those polled walked as a mode of transportation, but 13 percent would be willing to walk outdoors or walk more often if there were safe designated paths or walkways (*Pathways for People*, Emmaus PA, 1995). In addition, 72 percent polled wanted more planning for pedestrian facilities and 59 percent would favor increased government funding for pedestrian facilities.

Table 14 lists some common reasons for low levels of pedestrian travel.

Pedestrian Project Prioritization

As transportation agencies have sought to improve conditions for pedestrians as quickly as possible, various project prioritization methods have been developed. This insures that the community realizes a maximum return on their investments in individual pedestrian projects.

As the most thorough method, a complete transportation demand model can be created to project or simulate pedestrian travel within a specific area. This follows the standard four-step modeling process used for traffic modeling – trip generation, trip distribution, mode split, and network assignment. However, this method can be very data-intensive and time consuming without the promise of high accuracy in the final estimation of pedestrian trips.

Common Reasons for Low Levels of Pedestrian Travel

- Poor facilities; lack of sidewalks or walkways
- Failure to provide a contiguous system of pedestrian facilities
- Concerns for personal safety
- Failure to provide facilities to and from popular origins and destinations
- Inclement weather
- Poor lighting
- Lack of separated facilities

Sources: Washington State Bicycle Transportation and Pedestrian Walkways Plan; National Biking and Walking Study Case Study #4

Table 14

Another method that is very thorough in its consideration is the Latent Demand Model developed by Sprinkle Consulting, Inc. This method examines individual roadway segments and develops supply and demand scores. This is done with the goal of selecting projects that provide high quality pedestrian facilities (supply) where there is high potential for pedestrian activity (demand). A complete scoring scale has been developed such that only minimal project investment is recommended for roadway segments with low potential for pedestrian activity. The formulas for the demand score take into consideration several socioeconomic and spatial variables (e.g., employment and population distribution) and, therefore, require significant data compilation and a geographic information system (GIS) for all but the smallest of analyses. The Latent Demand Model's classification system for pedestrian facility quality is entirely based on the notion that pedestrians desire a sense of being buffered from vehicle traffic. Different lateral separation values are matched to each level of demand with equivalency formulas that account for different traffic levels and landscaped buffers. One shortcoming of this method is it does not account for the nature of adjacent development in ranking the quality of the pedestrian facility.

The City of Portland Oregon Pedestrian Master Plan established another pedestrian project prioritization method. This method also utilizes a scoring system for the supply and demand of a roadway segment. Rather than developing a quality-based classification of pedestrian facilities, this system ranks general pedestrian projects based on the combined score of pedestrian potential (demand) and pedestrian deficiency (the inverse of supply quality). This method does not consider

demographic variables but does generally require GIS because it considers job and population distribution and other spatial variables.

There are also some very simple methods that have been used for pedestrian project prioritization. One example is corridor planning. With this method, a coarse-grained network (usually grid-based) of corridors is designated across an entire community. Priority is then given to those pedestrian projects that fall within these corridors with extra priority given to projects that increase the continuity of pedestrian facilities within the corridors.

As another example of a simple prioritization method, Table 15, contains some common-sense questions that one can ask to consider the merits of a given proposed pedestrian project.

Local jurisdictions in Georgia could implement a project prioritization method to determine the need for pedestrian facilities.

Ask the Following Questions

- Are there origins and destinations within acceptable pedestrian travel distances that will generate trips?
    - schools and parks
    - shopping areas
    - medical facilities
    - social services
    - housing
    - community and recreational centers
    - transit/park-and-ride
- Does the existing street or roadway provide pedestrian facilities or should it?
- What is the setting (urban center, residential, rural)?
- Are there high traffic volumes and speeds that could affect pedestrian use?
- Can pedestrians cross without travelling more than 400 to 600 feet to an intersection or another crossing point?

• Are transit or school bus stops located along the roadway with safe access and crossing? • Is there an opportunity to complete a contiguous system by filling in existing gaps? • Are there barriers to pedestrian travel that can be removed or opened (dead-end routes, blocked passages)?

Table 15

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Chapter 4. Toolkit 1 – General Design Guidelines

This Toolkit Section Addresses:

- *Pedestrian Facilities Defined*
- *The Importance of Good Design for Pedestrians*
- *The "Bigger Picture" — Creating Pedestrian- Friendly Communities*
- *Creating a Continuous Pedestrian System*
- *Special Pedestrian-Oriented Districts and Areas*
- *Creating an Effective Pedestrian System*
- *Pedestrian-Friendly Streets*
- *Other Sources of Information*

This section provides an introduction to the design toolkit by first defining "pedestrian facilities" according to Georgia's Statewide Transportation Plan. Next, a brief overview of the importance of good design for pedestrians is provided, followed by a discussion related to some general pedestrian planning and design guidelines that can be applied on a community or region wide basis. The design information presented in this section provides important basic guidance for improving overall conditions for pedestrians in Georgia communities, thereby encouraging pedestrian travel as an alternative to single occupant vehicles and enhancing our quality of life.

Pedestrian "facilities" include more than just sidewalks, as described in Table 16.

Pedestrian Facilities Defined

The 2000 *Statewide Transportation Plan* created by the Georgia Department of Transportation (GDOT) recognizes that "pedestrian facilities" are far more extensive than just sidewalks. Table 16 lists different types of pedestrian facilities.

Pedestrian Facilities

Pedestrian facilities include:

- Sidewalks and on-street facilities
- Walkways and trails
- Curb ramps
- Crosswalks
- Grade separations (such as underpasses and overpasses)
- Wide shoulders in rural areas
- Traffic control devices
- Furnishings that create a pedestrian-friendly atmosphere (such as benches and landscaping)
- Other technology, design features, and strategies intended to encourage pedestrian travel (such as traffic calming devices including traffic circles, roundabouts), planting strips, shelters, public art, and lighting

Definition of sidewalk:

"Sidewalk" means that portion of a street between the curb lines, or the lateral lines of a railway, and the adjacent property lines, intended for use by pedestrians

Georgia Code and Rules 40-1-1

Table 16

The Importance of Good Design for Pedestrians

Pedestrians are an integral part of Georgia's transportation system. The importance of good design not only applies to development of new facilities, but also to improvement and retrofit of existing facilities for pedestrian use. When pedestrian access is expanded and existing conditions for pedestrians are improved, higher numbers of pedestrians can be expected to use the system. Research has shown that well designed and maintained pedestrian facilities encourage walking and promote higher levels of pedestrian travel.

Pedestrians want facilities that are safe, attractive, convenient, and easy to use. Good pedestrian details attract more pedestrians, thus making neighborhoods feel safer and helping commercial areas succeed. If designed properly, the best public pedestrian facilities can also be the most durable and the easiest to maintain. Poor design of pedestrian facilities can lead to perpetual problems and can actually discourage use if pedestrians are made to feel unsafe, unprotected, or uncomfortable. Unattractive, inadequate, and poorly designed and maintained facilities can be an unfortunate waste of money and resources and a hindrance to community vitality.

Consider Pedestrians at the Start of Projects

Consider pedestrian facilities at the inception of all public and private projects, and address pedestrian needs as part of the total design solution. Examples of considering pedestrian facilities at the onset would be creating a pedestrian circulation master plan as part of an overall community plan or project specific design such as an intermodal transportation facility.

This allows for potential conflicts between transportation modes related to safety and level of service to be resolved early on and avoids the problems of pedestrians being an afterthought in the design process.

Pedestrian facilities include furnishings that create a pedestrian-friendly atmosphere.

Consider the character and setting of the area, nearby land use densities, origins and destinations, and the level of pedestrian use, including the increase in use that may occur when pedestrian improvements are installed. Often, decisions not to install pedestrian facilities are short sighted, based on the perception that an area with low pedestrian use doesn't need improvement. In reality, pedestrians are probably not using the system because it is not adequately meeting their needs under existing conditions. Sometimes land use changes and facilities need to be upgraded to serve more intensive pedestrian travel. After conditions are improved, pedestrian use can almost always be expected to increase, based on recent research findings.

Design is Only Part of the Solution

Good design is an important factor in incorporating pedestrians into Georgia's transportation system, but it can't be expected to solve all pedestrian related problems. Education and enforcement are other important tools that heighten awareness of pedestrians. Proactive statewide, regional, and local policy development typically sets the stage for establishing a stronger focus on pedestrian issues and encouraging communities to better meet pedestrian needs. Table 17 lists typical policies for achieving a multimodal transportation system that encourages pedestrian travel. These policies can help local communities get started on developing their own pedestrian plans and programs.

Typical Policies for Encouraging Pedestrian Travel

- Local, regional, and state jurisdictions should address pedestrian issues through comprehensive planning as required by Federal transportation legislation.
- Consider pedestrian needs in all transportation facilities.
- Reinforce a sense of neighborhood and community with transportation designs that accommodate pedestrian use.
- Ensure a connected system of pedestrian routes in urban areas.
- Enhance pedestrian mobility and safety in rural areas.
- Define jurisdictional roles in providing pedestrian facilities.
- Encourage land use and transportation development that accommodates pedestrians.
- Provide pedestrian facilities that complement local business activity and provide access for employees.
- Enhance intermodal access for persons with impaired mobility.
- Maintain the existing transportation system adequately so pedestrian use is maximized.

Table 17

Georgia's Commitment

Georgia recognizes the need to provide adequate and safe pedestrian facilities. In 2001, the State Transportation Board resolved to "direct more financial and staff resources towards programs that will increase the use of non-motorized modes of transportation to and from schools; make routes to school safer for those modes; reduce motor vehicle congestion; improve student health and fitness; and work with local government entities to foster transportation-related improvements and programs for the safety of the students." By helping to foster a safe environment around schools, the Board can promote a better walking environment in many communities in Georgia.

The "Bigger Picture" — Creating Pedestrian-Friendly Communities through Land Use Planning

When developing a community of any size, pedestrians need to be thought about from the very beginning stages. One assumption about pedestrians that should always be made is that people want to walk. With this thought in mind, planning for pedestrians becomes an integral part of the design process. Destinations, whether the grocery store, park, or bus stop, should be close in proximity to neighborhoods. In established communities, strategies can be used to encourage pedestrian scale design and increased pedestrian travel. Techniques such as in-fill development, zoning changes, and pedestrian connections to transit help create pedestrian-friendly communities.

There are many good sources of information about how to plan and design pedestrian-friendly communities, as listed at the end of this toolkit section. Some common characteristics of pedestrian-friendly communities are listed in Table 18.

Common Characteristics of Pedestrian Friendly Communities
Coordination Between Jurisdictions Putting pedestrian facilities in place to meet current and future needs requires close coordination between jurisdictions and other modes of transportation.
Linkages to a Variety of Land Uses/Regional Connectivity Pedestrian circulation and access is provided to shopping malls, transit, downtown, schools, parks, offices, mixed-use developments, and other community origins and destinations, as well as other communities within the region, as illustrated in Figure 7.
Continuous Systems/Connectivity A complete system of interconnected streets, pedestrian walkways, and other pedestrian facilities will increase pedestrian travel.
Shortened-Trips and Convenient Access Connections are provided between popular origins and destinations, between dead-end streets or cul-de- sacs, or as shortcuts through open spaces, as illustrated in Figure 8.
Continuous Separation from Traffic Minimized or eliminated street and driveway crossings are provided and well defined. Buffers from motor vehicles and separation of uses are provided.
Pedestrian Supportive Land Use Patterns Land use patterns, such as a grid layout or short blocks in business districts and downtowns enhance pedestrian mobility.
Well-Functioning Facilities Adequate width and sight distance, accessible grades, and alignment to avoid blind corners are provided. Common problems, such as poor drainage, are avoided.
Designated Space Pedestrian facilities should be well delineated, signed, and marked.
Security and Visibility It is important to design a safe and secure environment for pedestrians. Lighting, increased visibility, open sight-lines, access to police and emergency vehicles, and locating pedestrian facilities adjacent to neighborhoods and businesses can increase safety.
Automobile is not the Only Consideration Streets are designed for all modes of transportation. Parking supply is reduced or managed using methods that encourage walking.
Neighborhood Traffic Calming Narrowed streets lined with trees, traffic circles, curb bulbs, neck-downs, and other techniques can lower vehicle speeds and create safer conditions for pedestrians.

Common Characteristics of Pedestrian Friendly Communities
Accessible and Appropriately Located Transit Siting of transit facilities adjacent to work, residential areas, shopping, and recreational facilities encourages pedestrian trips. Transit stops and centers should typically be located in areas of supporting densities (4 to 7 units per acre minimum). Development of adequate pedestrian facilities to access transit is essential to the success of pedestrian travel as an alternative mode. **Lively Public Spaces** Secure, attractive, and active spaces provide focal points in the community where people can gather and interact. Pedestrian pocket parks and plazas are examples. **Character** Preservation of important cultural, historic, and architectural resources strengthens community heritage and character. **Scenic Opportunities** Attractive environments and scenic views encourage pedestrian use, particularly when facilities are oriented toward them. **Pedestrian Furnishings** Providing amenities, such as benches, restrooms, drinking fountains, artwork and other elements, creates a more attractive and functional environment for pedestrians. **Street Trees and Landscaping** Street trees bring human scale to the street environment. Landscaping and flowers in planting strips, containers, and other areas soften surrounding hard edges of buildings and parking lots and add life, color, and texture to the pedestrian's field of vision. **Design Requirements** Guidelines and adopted standards are followed and, if deviated from, justified and documented. **Proper Maintenance** Frequent cleanup and repair on a regular basis ensures ongoing, consistent use.

Table 18

Street trees enhance the pedestrian environment.

Creating a Continuous Pedestrian System

The pedestrian transportation system in Georgia should be consistent across jurisdictional boundaries and public and private developments. Regional and local pedestrian systems need to be planned, designed, and constructed to provide a comprehensive network of travel options for pedestrians.

The design guidelines in this guide encourage more consistent design of pedestrian facilities throughout the state, but the responsibility to develop and support a seamless pedestrian transportation network lies with everyone. In most cases, local jurisdictions have the authority to require property owners and developers to provide sidewalks. Targeting public funding so that strategically located projects can be designed and built to fill in the gaps between private development is one way to help improve the overall system. Retrofit of existing areas where pedestrian facilities are inadequate is another important step. The development of a seamless pedestrian system will be the result of both public and private investment throughout neighborhoods and communities.

Coordination between agencies, governments, and private entities is critical to the success of regional pedestrian systems. School districts, utility companies, private corporations, and local agencies all need to work together at the onset of transportation and development plans and projects to reach the best solutions for all interests involved. Consider the needs of pedestrians throughout project planning, design, and development processes at all levels, with particular interest toward increasing pedestrian safety, mobility and access, and improving the pedestrian network overall.

Special Pedestrian-Oriented Districts and Areas

In some instances, either concerning new development or preservation of older development, the creation of a pedestrian-oriented district may be appropriate. Pedestrian districts can be developed through revision of a city zoning code to pertain to a certain area of the city. To preserve an older area where the pedestrian environment is likely to already exist, officials can create a pedestrian-overlay district that aims to keep the pedestrian-friendly design, such as the requirement of street trees, reduced parking requirements, and building facades oriented towards the pedestrian. New development that occurs in pedestrian districts would follow specific criteria, which makes the environment conducive to pedestrian travel. Transit-oriented districts also promote a pedestrian environment. See Toolkit 9 – Pedestrian Access to Transit for more information.

Creating an Effective Pedestrian System

Pedestrian systems and facilities need to be functional to be effectively used by pedestrians. *The National Bicycle* and *Walking Study* conducted by the US Department of Transportation in 1992 provides guidance for making a pedestrian system effective. The study states:

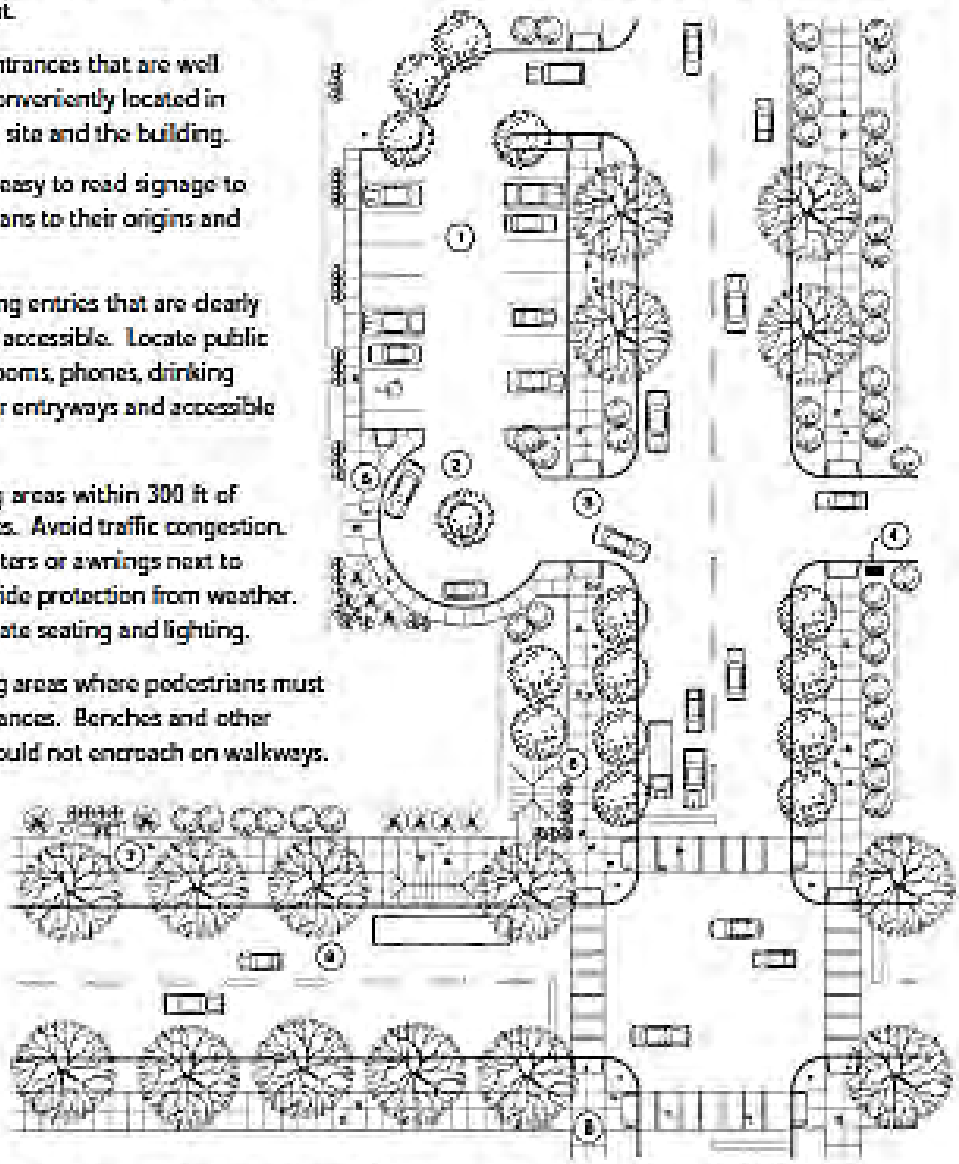
> *"Pedestrian facilities both encourage people to walk and improve pedestrian safety along certain routes. The facilities must be well- designed and maintained to be effective, and must include the following features:*

- Sidewalks, paths or walkways which are wide, relatively clear of obstructions and separated from traffic lanes;
- Grade separated pedestrian crossings - only when clearly justified, since such facilities go unused or create illegal street crossing behavior by pedestrians if not properly planned, designed and located;
- Proper design and operation of traffic and pedestrian signals, including pedestrian push buttons, where appropriate;
- Barriers that physically separate pedestrians from motor vehicle traffic at selected locations to discourage jaywalking;
- Facilities for people with mobility and visual impairments, including curb ramps, audible pedestrian signals, and longer intervals for slower pedestrian walking speeds;
- Signing and marking, including pavement edgelines and pedestrian warning signs where needed; and
- Pedestrian malls which are well-planned with respect to commercial development, traffic circulation and visual appeal.

Figure 8 illustrates an example of how to design effective pedestrian facilities within an area, including some of the features recommended by the National Bicycling and Walking Study. Toolkit 10 — Site Design for Pedestrians contains more specific design guidelines related to site development.

Creating an Effective Pedestrian System

1. Locate parking near the buildings they serve.
2. Drop-off zones are most convenient when located as close to the primary entrance to the building as possible. Provide curb cuts for pedestrian accessibility. Walkways should be unobstructed. Access to drop-off areas, parking, and building entries should be direct and convenient.
3. Provide site entrances that are well defined and conveniently located in relation to the site and the building.
4. Use clear and easy to read signage to direct pedestrians to their origins and destinations.
5. Provide building entries that are clearly identified and accessible. Locate public facilities (restrooms, phones, drinking fountains) near entryways and accessible routes.
6. Locate waiting areas within 300 ft of building entries. Avoid traffic congestion. Overhead shelters or awnings next to buildings provide protection from weather. Provide adequate seating and lighting.
7. Provide resting areas where pedestrians must walk long distances. Benches and other furnishings should not encroach on walkways.
8. Provide walkways along clear and direct routes throughout the site. Surfaces should be firm and level. Curb cuts and ramps should be provided where necessary. Accessible walkways should be continuous (not dead-ends).
9. Locate transit stops in highly visible and convenient areas. Provide pedestrian shelters.



Note: For tree planting and landscape requirements within state highway rights-of-way, refer to GDOT Standards (MDG 5150)
Source: Time-Saver Standards for Landscape Architecture, adapted with revisions for this guide

Figure 8

Pedestrian-Friendly Streets

Current planning and design directives at the local and regional level often encourage design of pedestrian friendly streets. The meaning of "pedestrian-friendly" can be interpreted in many ways, but generally, the intent is for street design to incorporate elements that enhance the safety, security, comfort, and mobility of pedestrians. Table 19, lists several elements typically included on pedestrian-friendly streets.

Typical Elements of Pedestrian-Friendly Streets

- Streets that are interconnected and have small block patterns provide good opportunities for pedestrian access, mobility, and safety.
- Narrower streets, scaled down for pedestrians and less conducive to high vehicle speeds (note: street trees at the sides of streets create the perception of a narrower roadway).
- Traffic calming devices to slow traffic (See Toolkit 8) or if appropriate, reduced speed limits
- Median refuge islands to provide a refuge area for crossing pedestrians
- Public spaces and pedestrian "pockets" adjacent to the main pedestrian travel way, that provide a place to rest and interact (sidewalk cafes, benches, etc.)
- Awnings/covered building entrances that shelter pedestrians from weather
- Planting buffers, with landscaping and street trees that provide shelter and shade without obstructing sight distances and help to soften the surrounding buildings and hard surfaces
- Street lighting designed to pedestrian scale (shorter light poles with attractive fixtures that are effective in illuminating the pedestrian travel way but not obtrusive or harsh)
- Wide and continuous sidewalks or separated walkways that are fully accessible
- Clear delineation and direction for the pedestrian (special paving on sidewalk or at edge of pedestrian travel area, easy-to-reach signal actuators, etc.)

Table 19

Other Sources of Information

The following sources of information are recommended for general design of pedestrian facilities. Please see the Resource Guide included at the end of this guide for complete bibliography information.

Accommodating the Pedestrian, Adapting Towns and Neighborhoods for Walking and Bicycling, Richard K. Untermann

Guide for Planning, Design, and Operation of Pedestrian Facilities - Draft, AASHTO

Pedestrian-friendly street

City Comforts, How to Build an Urban Village, David Sucher

City, Rediscovering the Center, William H. Whyte

Creating Bicycle-Friendly and Walkable Communities, Pro Bike Pro Walk 96 Resource Book, Bicycle Federation of America, Pedestrian Federation of America

Creating Transportation Choices Through Zoning, A Guide for Snohomish County Communities, The Snohomish County Transportation Authority

Design and Safety of Pedestrian Facilities, A Proposed Recommended Practice of the Institute of Transportation Engineers, ITE Technical Council Committee 5A-5

Handbook for Walkable Communities, Dan Burden and Michael Wallwork, PE

Handbook of Landscape Architectural Construction, Volume Two, Site Works, Maurice Nelischer

Municipal Strategies to Increase Pedestrian Travel, Washington State Energy Office

National Bicycling and Walking Study, Case Study No. 4, Measures to Overcome Impediments to Bicycling and Walking, US Department of Transportation

Pedestrian Malls, Streetscapes, and Urban Spaces, Harvey M. Rubenstein

Pedestrian Planning and Design, John J. Fruin, PhD

Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas Research Report 294A, Transportation Research Board

Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas State-of-the- Art Report 294B, Transportation Research Board

Planning Design and Maintenance of Pedestrian Facilities, Goodell-Grivas, Inc.

Site Planning and Community Design for Great Neighborhoods, Frederick D. Jarvis

The Car and the City, 24 Steps to Safe Streets and Healthy Communities, Alan Thein Durning

Time-Saver Standards for Landscape Architecture, Design and Construction Data, Charles W. Harris, Nicholas T. Dines

Walk Tall, A Citizen's Guide to Walkable Communities, Version 1.0, Pedestrian Federation of America

Handbook for Walkable Communities, Washington State Pedestrian Facilities Planning and Design Courses, Dan Burden and Michael Wallwork, PE

Pedestrian Facilities Users Guide, UNC Highway Safety Research Center for FHWA

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Chapter 5. Toolkit 2 – Accessibility

This Toolkit Section Addresses:

- *Understanding the American with Disabilities Act (ADA)*
- *Designing for People With Disabilities*
- *Designing for Older Adults*
- *Pedestrian Access Routes*
- *Eliminating Barriers and Obstacles*
- *Widths and Clearances*
- *Passing and Resting Areas*
- *Difference Between Site Development Requirements and Street Development Requirements*
- *Sidewalk Curb Ramps*
- *Accessibility Across Driveways*
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- *Textural and Visual Cues*
- *Accessible Pedestrian Signals*
- *Crosswalks*
- *Median and Pedestrian Refuge Islands*
- *Signing and Other Communication Aids*
- *Other Sources of Information*

Everyone has an inherent right to access. The overall intent of this toolkit section is to encourage design that provides accessibility to all pedestrians, including people with disabilities and older adults. People with physical impairments and older adults have a wide range of abilities and needs, and often rely on pedestrian travel as their only mode of transportation. Just as we design roadways for use by a wide range of vehicles, so should we design sidewalks, walkways, crossings, signals and other types of facilities for use by a wide range of pedestrians. For a description of the spatial requirements and general needs of pedestrians with disabilities and older adults, refer to the section of this guide called About Pedestrians.

Everyone has an inherent right to accessibility

Understanding the Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal law that was enacted in 1990 for the purpose of ensuring that all Americans have the same basic rights of access to services and facilities. The ADA prohibits discrimination on the basis of disability. To effect this prohibition, the statute required certain designated federal agencies to develop implementing regulations. The ADA Accessibility Guidelines (ADAAG) prepared by the Architectural and Transportation Barriers Compliance Board (also called the Access Board) are a result of this rulemaking process. The ADAAG contains a wide range of administrative and procedural requirements, including compliance with design and construction standards.

The ADA requires pedestrian facilities used by the general public to be planned, designed, constructed and maintained so that a wide range of people can use them and rely on them for their daily travel, including people with disabilities. Providing pedestrian facilities that are fully accessible enables people with various degrees of mobility and disability to exercise their rights to become as self-sufficient and independent as possible.

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

In recent years, much information has been developed to respond to the perceptions planners and designers have about what the ADAAG requires. Some of this information can be confusing and conflicting. The design guidelines in this toolkit section help to clarify the regulations of the ADA as described in the ADAAG and the FHWA's *Part 2*, *Designing Sidewalks and Trails for Access*.

In 1999, the US Access Board formed the Public Rights of Way Access Advisory Committee (PROWAAC) to develop guidelines for accessibility in the public right-of-way. PROWAAC published a report in January, 2001 called *Building a True Community* that set forth the committee's

recommendations. The report and committee recommendations are currently in the Federal rulemaking process; thus the committee recommendations cannot be considered law at this point. Undoubtedly, some of the recommendations will be modified as the rulemaking process follows and public comment is taken. Recommendations in this Guide should be considered as best practices. It should be noted that the guidelines being considered in this rule-making process are requirements for new construction. While it is desirable to apply the same guidelines to alterations of existing facilities, it is recognized that existing streets present topographic challenges that don't always lend themselves to the application of the new construction guidelines. As a result, alteration requirements are subject to an interpretation of the "maximum extent feasible".

Designing for People with Disabilities

Disabilities include a wide range of conditions (hearing and sight impairments, mobility limitations, heart disease, etc.) Approximately 70 percent of all Americans will have a disability at some point in their lifetime, either temporarily or permanently (Accessibility Design for All, An Illustrated Handbook). Disabilities can affect people differently and limit abilities to greater or lesser degrees. For this reason, some design approaches may accommodate one person but be a barrier to others. At this writing, accessibility requirements within the public right-of-way are under update. Check with the United States Department of Justice for the latest requirements.

Working closely with people who have disabilities in the project design process can be an effective way to ensure that their needs are fully accommodated. In addition to appropriate agency internal review, the Easter Seal Society (1-800-678-5708) provides design review and comment services upon request. (There may be a fee associated with reviews by the Easter Seal Society or other groups.)

Persons with disabilities often rely on transit service for daily errands.

The best guidance design professionals have for accommodating the needs of people with disabilities are the regulations and standards issued under the ADA.

Designing for Older Adults

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

Pedestrian Access Routes

The "Pedestrian Access Route (PAR)" is the key element of accessibility and is defined in Table 20.

Pedestrian Access Route

A pedestrian access route is a continuous corridor of accessible travel, threading its way along sidewalks and across driveways and roadways, free of abrupt changes in level, with a clear width of at least sixty inches and a clear height of at least eighty inches, and assures access for all sidewalk travelers, from those who use wheelchairs or push strollers to those who find their way with a cane.

Source: PROWAAC

The ADA is divided into five sections or 'Titles'. Designers need to understand the provisions of Title II and Title III and their application to various sites. Title III applies to sites and buildings that owned and operated by private businesses, but open to the public. Title II applies to federal, state, and local government facilities. Public rights-of- way are covered under Title II.

Recreational facilities, including trails, should provide accessible experiences.

Building a True Community, which provided recommendations for Title II facilities, has suggested wider routes and different ramp and clearance measurements due to the different and larger types of mobility devices often used in outdoor travel. The term used in that report is Pedestrian Access Route (PAR). The term used in the Title III regulations is 'accessible route' which has specific meaning in application to routes of travel between locations on a site. Designers need to be aware of the possible differences in design minimums in different types of facilities.

The following discussion sets forth the minimum recommended dimensions of the PAR.

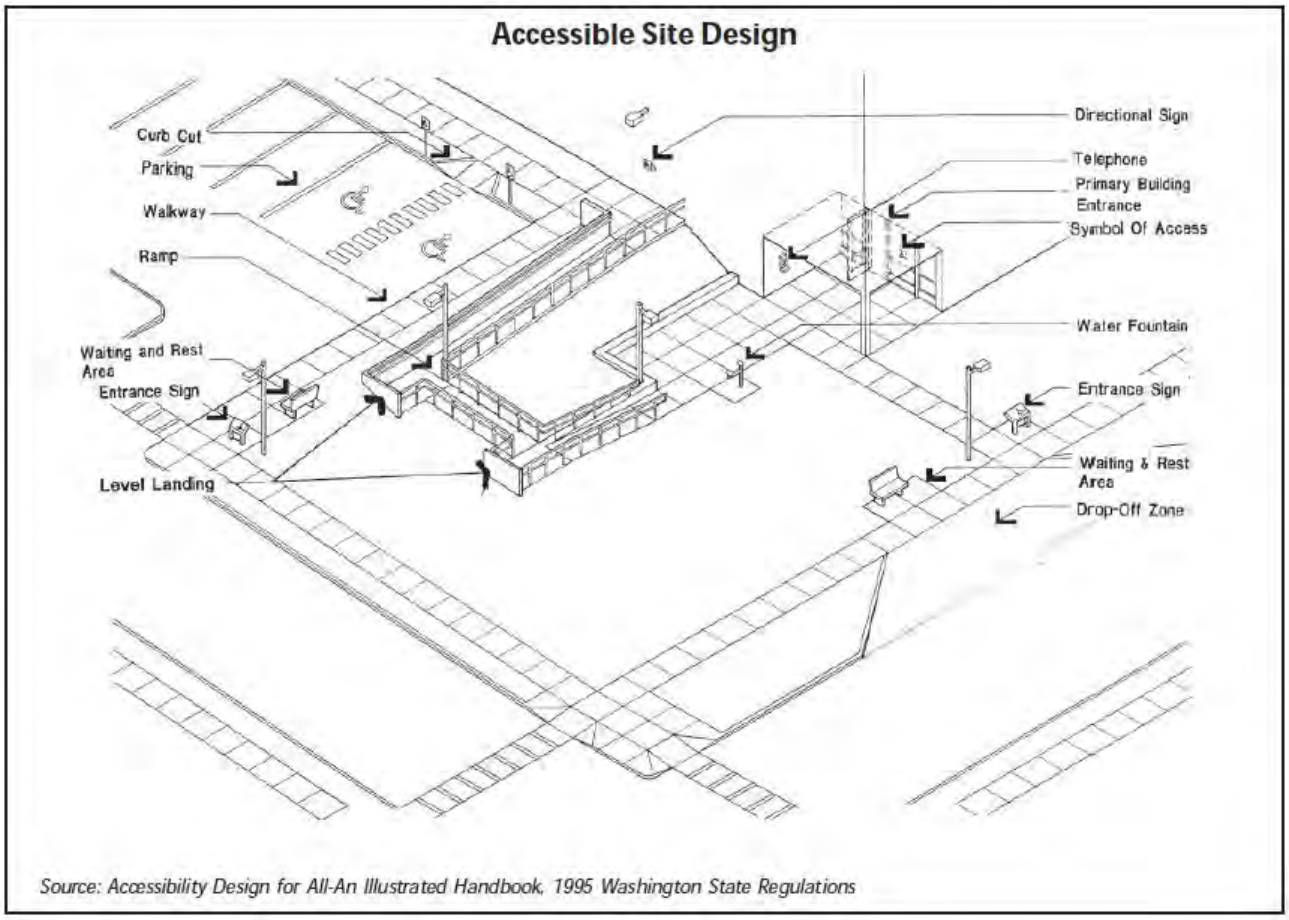

Figure 9

In addition, ADAAG requires every site to have at least one accessible route of travel that provides a connection between exterior accessible site elements (parking, waiting and drop-off zones, sidewalks and walkways, bus stops, etc.) and an accessible building entrance. In a park or similar setting, pedestrians should be able to access all major features of the site, including parking, drinking fountains, restrooms, interpretive signs and other constructed facilities and points of interest. Figure 9 (on the previous page) illustrates a site with alternative routes of travel connecting the building entrance.

Recreational facilities, such as trails, should provide accessible experiences as well. If terrain or other unusual conditions do not allow for the trail to serve persons with disabilities, other accessible connections or facilities that provide a similar recreation experience can be created.

Eliminating Barriers and Obstacles

The Pedestrian Access Route needs to be continuous and unobstructed. Obstacles and abrupt changes in elevations create barriers for pedestrians, especially for those with disabilities. Curbs, steps, and stairways create barriers for wheelchair users and other people with disabilities, as well as people pushing strollers or carts. Curb ramps allow access for wheeled devices up onto and down from areas raised and separated by curbs. Where it is not possible or practical to avoid the installation of steps and stairways, ramps or elevators should be provided to facilitate full access. Design guidelines for ramps and curb ramps are presented later in this section. Design guidelines for steps and stairways are provided in Toolkit Section 10 — Site Design for Pedestrians.

Building a True Community recommends that the pedestrian access route include a "reduced vibration zone" that provides a smooth, stable and slip resistant surface within the route of travel.

This "path within a path" is described in more detail later in this section.

Often, coordination between local jurisdictions, private vendors, utility companies and others is necessary to avoid placement of obstacles within the pedestrian travel way after a project is designed and built. Another solution to reducing obstacles within the pedestrian travel way is consolidation of elements, such as placing multiple signs on one post, placing signs on light standard posts and providing a "corral" for trash receptacles, newspaper stands, and other street furniture.

Sidewalk cafes or other displays can become hazards for sight impaired pedestrians or obstructions for wheelchair and stroller users. Enclose these areas with covered railing or fencing that is at least 27 inches in height and detectable by a person using a long white cane. Provide a clear path of travel around the outside of these areas.

Widths and Clearances

A clear width of passage, without obstacles such as signs, newspaper stands, and trash receptacles should be free of utility covers when practical.

Title III requires that pedestrian travel ways have a minimum of 3-foot wide path of travel to accommodate wheelchairs. PROWAAC recommended a minimum 5-foot wide pedestrian access route, and a "reduced vibration zone" of 4- foot width maintained within the 5-foot path of travel. The purpose of the reduced vibration zone is to provide a smooth surface for wheelchairs to reduce pain and discomfort for those using them. This surface should be free of utility covers, decorative pavers with joints, and other surface features that create a rough or bumpy surface when practical. It is best to provide direct routes of travel as well, so that pedestrians don't have to change their course of travel to avoid such obstacles.

While the "Building a True Community" report recommends a reduced vibration zone concept, a proposed draft rule by the Access Board does not include this concept due to difficulties in defining the "reduced vibration zone" legally. Designers are still encouraged to conform to the PROWAAC concept wherever possible.

The minimum width for sidewalks is 5 feet on local streets (6 feet desirable), which meets the ADAAG minimum clear width of 3 feet. When a walkway of less than 5 feet must be installed, passing areas should be provided as described below and shown in Figure 10.

GDOT sidewalk standard plan provides for a 5- foot wide sidewalk separated from the back of curb by a 2-foot planter that is paved with contrasting color concrete.

Vertical clearance is also important to accommodate tall people and to allow an area free of obstructions that might be hazardous to people with visual impairments. Pedestrian access routes are required to have a clear height of no less than 80 inches. Local requirements may vary. Where the vertical clearance of an area adjacent to a sidewalk is impacted by lateral obstructions, a continuous permanent barrier around or at the base of the obstruction is required.

Passing and Resting Areas

Adequate width for wheelchair users is important. It is necessary to provide passing areas for two wheelchairs as well. When an accessible route of travel is less than 5 feet wide, passing areas measuring 5 feet by 5 feet every 200 feet are necessary, as illustrated in Figure 10. Passing areas may already be available at building entrances, plazas, and sidewalk intersections. It may be more cost effective, practical and desirable to create a continuous 5-foot wide (minimum) path than to create special passage areas.

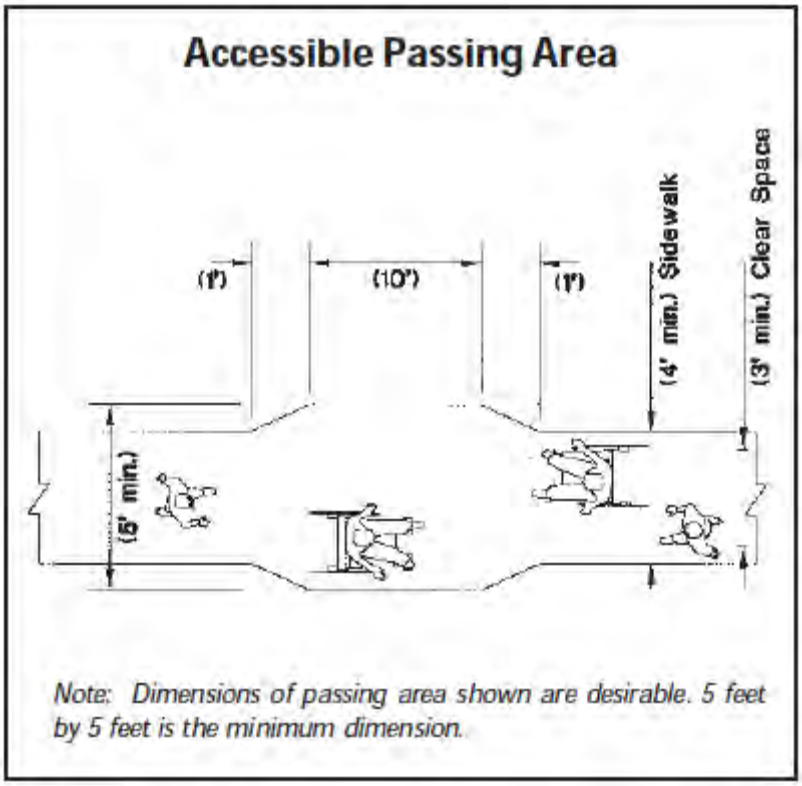

Figure 10

Avoid long distances between resting areas for people with lower stamina or health impairments. Strategically and frequently located benches, seating walls, resting posts, railings, restrooms and drinking fountains are examples of elements that can make pedestrian travel more convenient and enjoyable, particularly for those with mobility impairments.

Difference between Site Development Requirements and Street Development Requirements Grades

Because sidewalk grades adjacent to streets are most often controlled by street grades, the grade limitations applied to pedestrian access route sidewalks within the public right-of-way are not limited by the provisions of ADAAG for walkways within a site. Even if sidewalk grades within the public right-of-way exceed 5 percent, they are not considered to be ramps, and thus the landing requirements in ADAAG do not apply.

For site development, accessible routes of travel should not exceed a maximum longitudinal grade of 1:20 or 5 percent. If the grade must exceed this maximum, a ramp can be constructed (see design guidelines for ramps later in this section). Any accessible route of travel is required to not exceed a maximum grade of 1:12 or 8.33 percent.

It is important to note, however, that sidewalks and walkways located along roadways within the right-of-way may follow the grade of the roadway and are not considered ramps even when grades exceed ADAAG limits.

When an accessible route is greater than 1:20 (5 percent), it is considered a ramp and must have handrails and landings. Landings are required with a grade exceeding 1:20 (5 percent), if the ramp has a 1:12 (8.33 percent) grade at every 2.5 vertical feet of elevation change, or where there is a change in direction. Landings are required to be level (i.e., not exceeding 2 percent slope in any direction) and a minimum of 5 feet in length and width, and should be consistent lengths along the route of travel. Again, these requirements do not apply to pedestrian facilities within public rights-of-way that follow the street grade, although the sidewalk grade may not exceed the grade of the adjacent street.

In some cases it may be more practical to design a pathway at a lower gradient to minimize the number of landings required (see Figure 11). On multi-use pathways that follow the natural terrain, landings are typically not required by the ADA. Where possible, multi-use pathways should be accessible, but this is not always practical due to topographic conditions and other physical constraints. Landings on these steeper multi-use trails create a choppy effect, are difficult to construct, and are a hindrance to bicycle travel. However, if a pathway is designated as an accessible route of travel, landings and handrails on both sides must be provided where grades dictate the need for these.

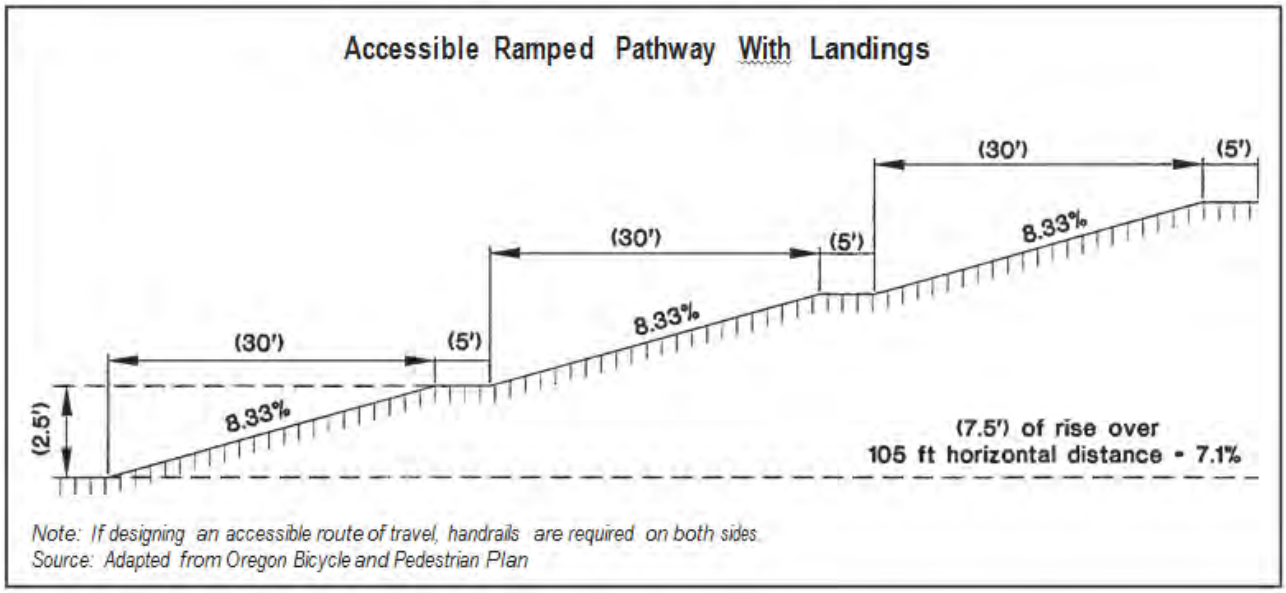

Figure 11

Cross Slopes

Cross slopes on sidewalks and walkways should not exceed 2 percent, but should be of sufficient grade to facilitate positive drainage and avoid water accumulating on the surface. It is difficult to operate a wheelchair along a walkway with a cross slope greater than 2 percent, because the wheelchair tends to turn toward the direction of the cross slope. As the cross slope of the sidewalk increases, the user is essentially required to steer with one arm and push the wheel with the other arm. This exponentially increases the amount of work required to move the wheelchair on a given grade.

In new construction, slopes across intersections and other street crossings should not exceed 2 percent, where possible, to facilitate crossing by wheelchair users and others. Thus, it is recommended that new street profiles should be “benched” at intersections and mid-block crossings to maintain a crosswalk cross slope (or profile grade on the street) of 2 percent or less. In addition, crown slopes on streets should be kept as close to 2 percent or less as possible to also reduce the effort for wheelchair users. Wheelchair users should not be forced to travel uphill at steeper grades across the street.

If the paved surface is relatively narrow (12 feet or less) designers should consider specifying even lower cross slopes, particularly when the paving material is portland cement concrete. Over these narrower distances, contractors can normally achieve relatively good grade control, and specifying grades of 1 percent can be effective in achieving acceptable drainage. Reduction of the cross slope from 2 percent to 1 percent provides a significant benefit to pedestrians in manual wheelchairs.

Sidewalk Curb Ramps

Design of Sidewalk Curb Ramps

Sidewalk curb ramps provide accessibility at intersections, building entrances and other areas where elevated walkways are edged with curbing.

Sidewalk curb ramps are required to be a minimum of 4 feet wide, with a maximum grade of 1:12 (8.33 percent) in the direction of travel, and 1:10 (10 percent) on the side aprons, as long as landing space is provided behind the curb ramp. A minimum 4-foot wide (5 feet by 5 feet is recommended) landing with a maximum 2 percent slope in any direction is required behind curb ramps (See Figure 12, Type A curb ramp). When a landing cannot be provided, use the Figure 13, Type B or C design.

Curb cuts at street crossings for multi-use pathways should be the full width of the pathway.

A well designed curb ramp.

Locations of Sidewalk Curb Ramps at Intersections

Curb ramps are important devices at intersections, not only because they facilitate crossing for wheelchair users, people pushing strollers, bicyclists, and others, but also because they help pedestrians with vision impairments to identify the street crossing location. Two curb ramps per corner at intersections are recommended for new construction, one in the direction of each crosswalk (see Figure 14). Providing only one curb ramp at the apex may direct pedestrians into the center of the intersection and into an opposing traffic lane, rather than toward the crosswalk. It could also introduce a pedestrian at a point where drivers are not anticipating a pedestrian, such as when turning. Table 21 lists important things to remember when designing curb ramps at intersections.

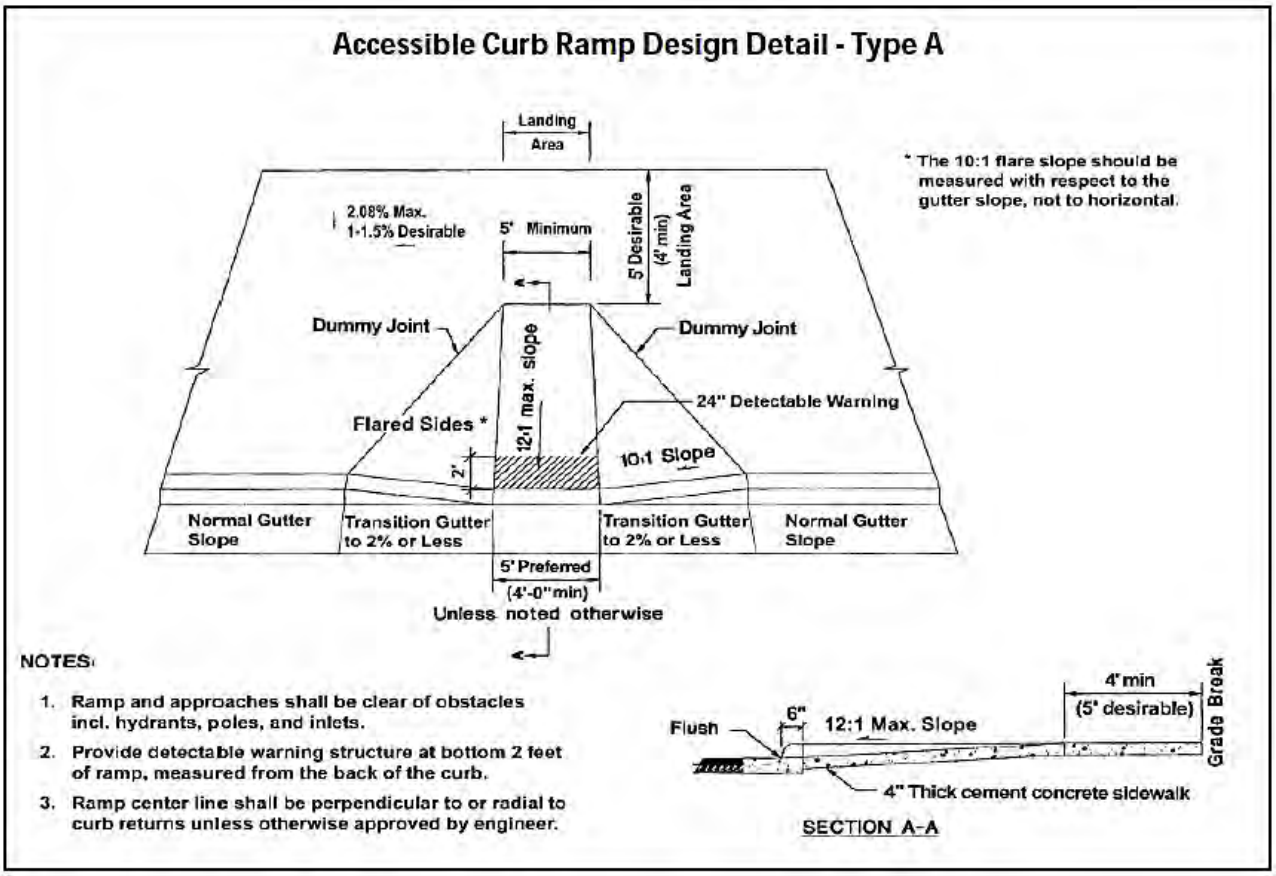

Figure 12

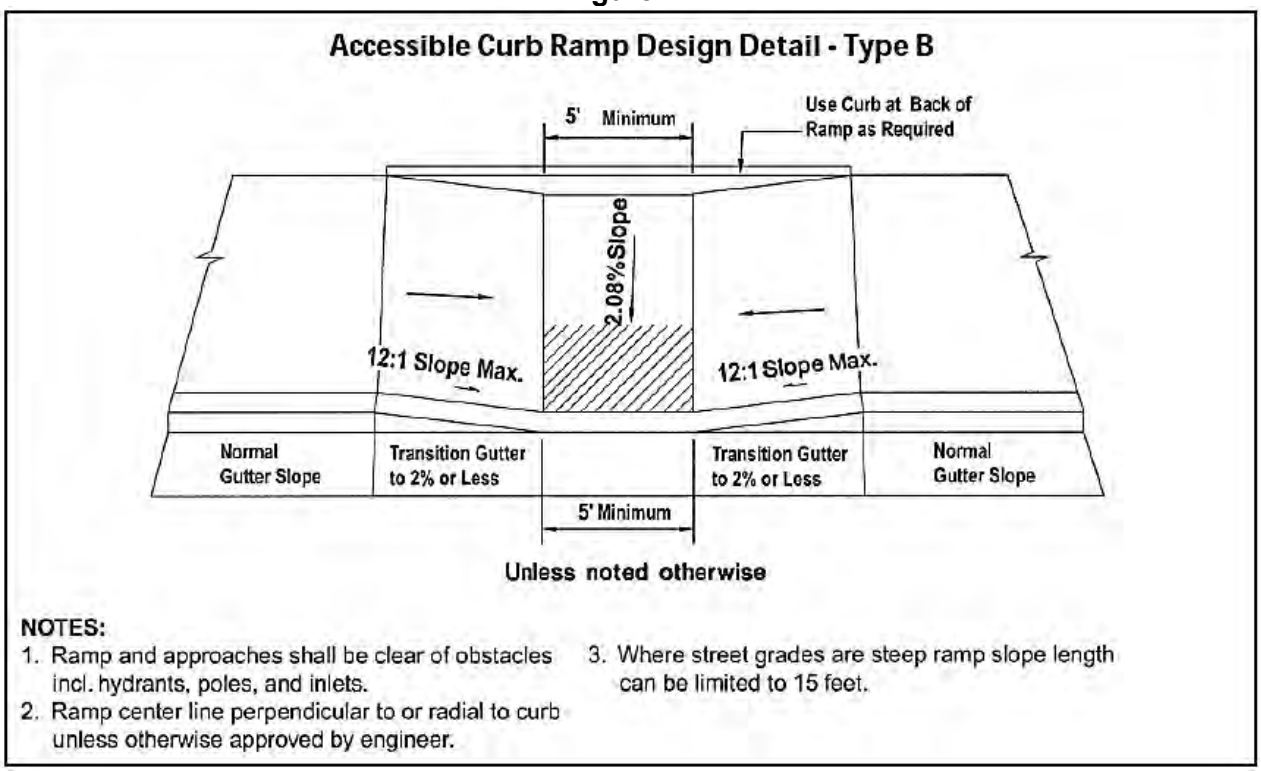

Figure 13

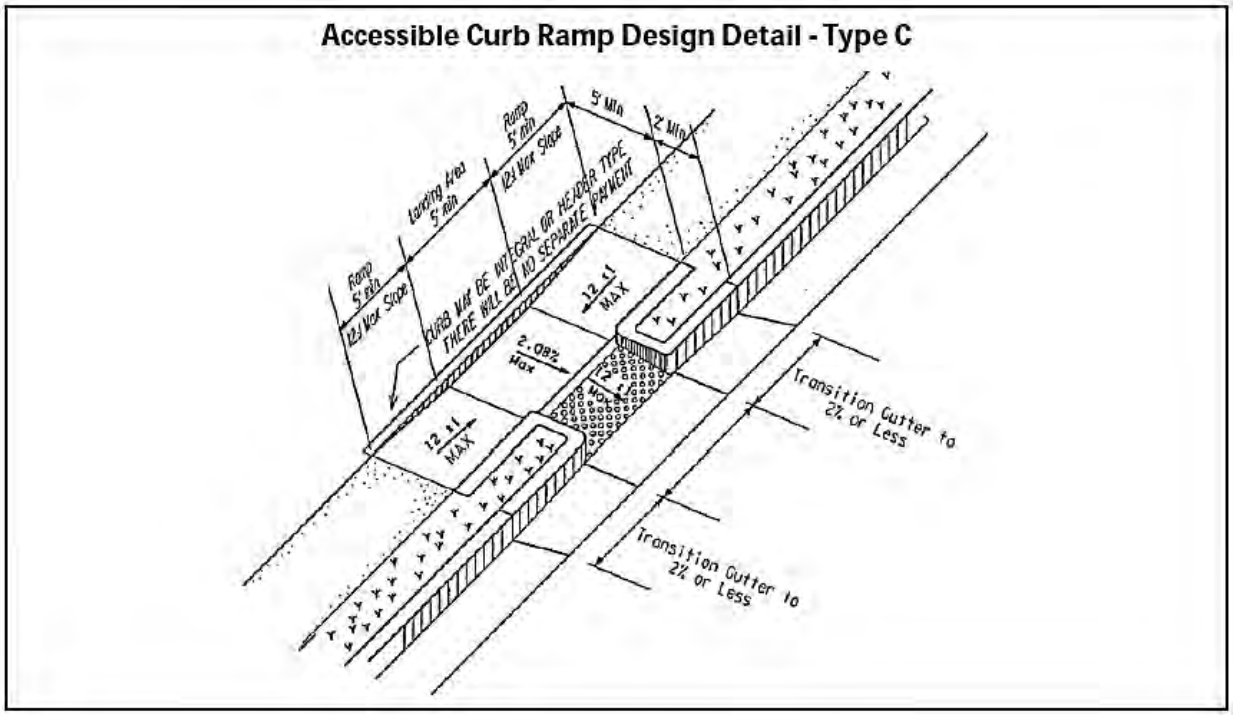

Figure 13 (cont.)

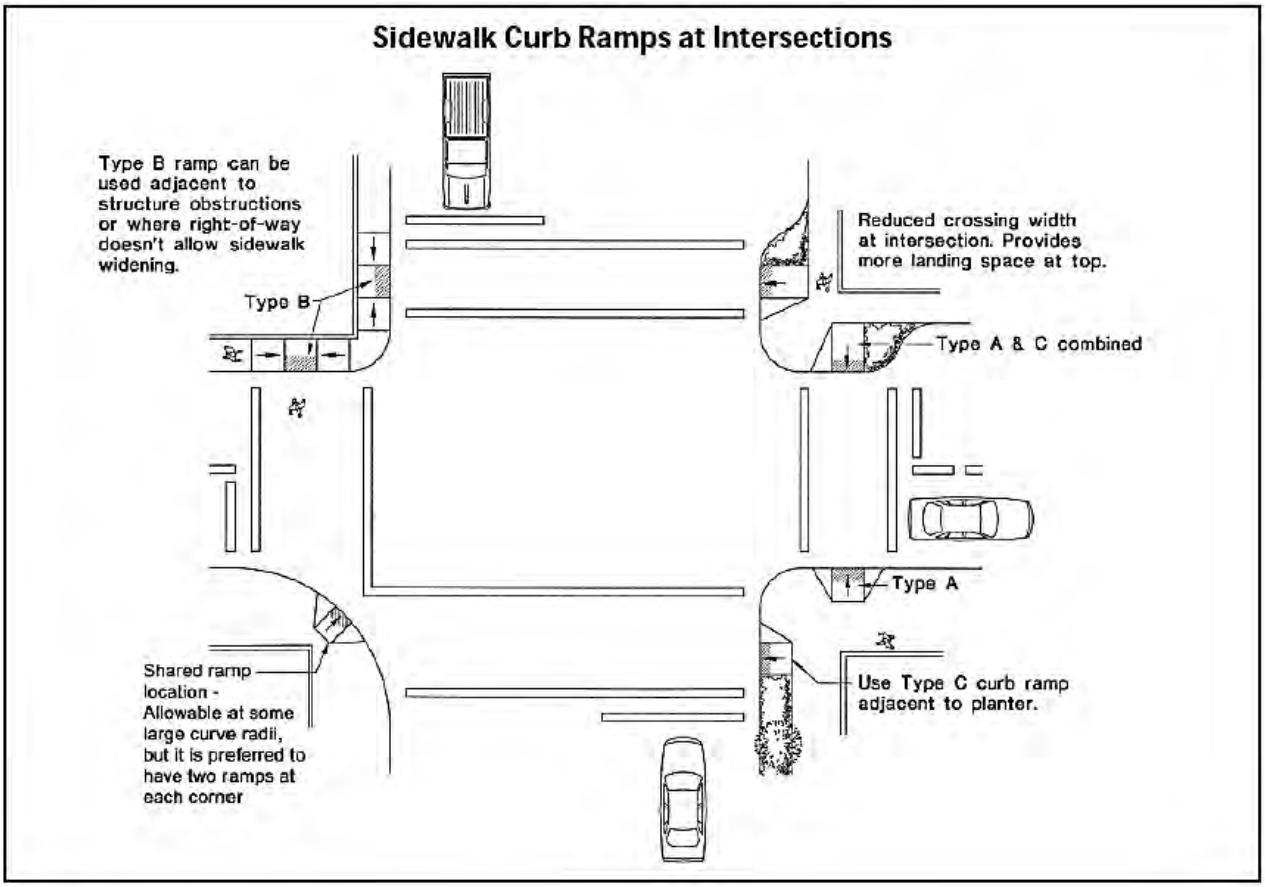

Figure 14

Important Things to Remember About Curb Ramps at Intersections
• Curb ramps should align in the direction of crosswalks, with two per corner at each intersection • Curb ramps function best when located in the center of the crosswalk; or as an alternative, can be constructed to be as wide as the approaching walkway • The low end of the curb cut should meet the grade of the street with a smooth transition, without a lip • Curb cuts should also be provided at channelization islands in an intersection and median refuge islands, unless full cut- through openings are provided at grade with the street • Truncated dome detectable warnings should be installed to provide information to pedestrians who are blind or visually impaired about the location of the street • Good drainage at intersection corners is important so that standing water does not accumulate within the crossing area. Storm drainage inlets should be placed on the uphill side of crosswalks and outside of the crosswalk area

Table 21

Accessibility across Driveways

As a general rule, it is best to minimize the number of driveway crossings across a pedestrian access route. When the sidewalk across the driveway crossing is an accessible route, special design requirements need to be applied.

The traditional approach to accommodating driveway cuts in sidewalks has changed due to accessibility requirements. The past method of driveway installation across sidewalks resulted in a 10 percent cross slope for a 5-foot wide sidewalk (see Figure 15). This created difficult-to-maneuver driveway aprons in the path of travel, creating a major impediment to sidewalk usability, and violating the requirement for maximum cross slope of 2 percent.

There are four basic approaches to designing driveway cuts that fulfill accessibility needs. These are illustrated in Figures 16, 17, 18, and 19. The most important element of these solutions is that they provide a continuous accessible route that is a minimum 4 feet in width (5 feet desirable) with a cross slope not exceeding 2 percent.

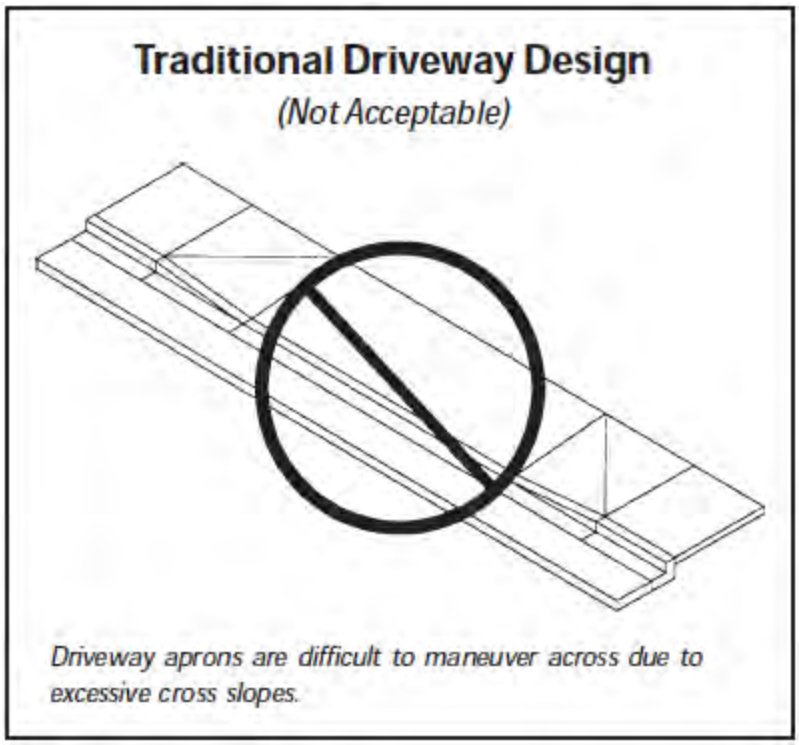

Figure 15

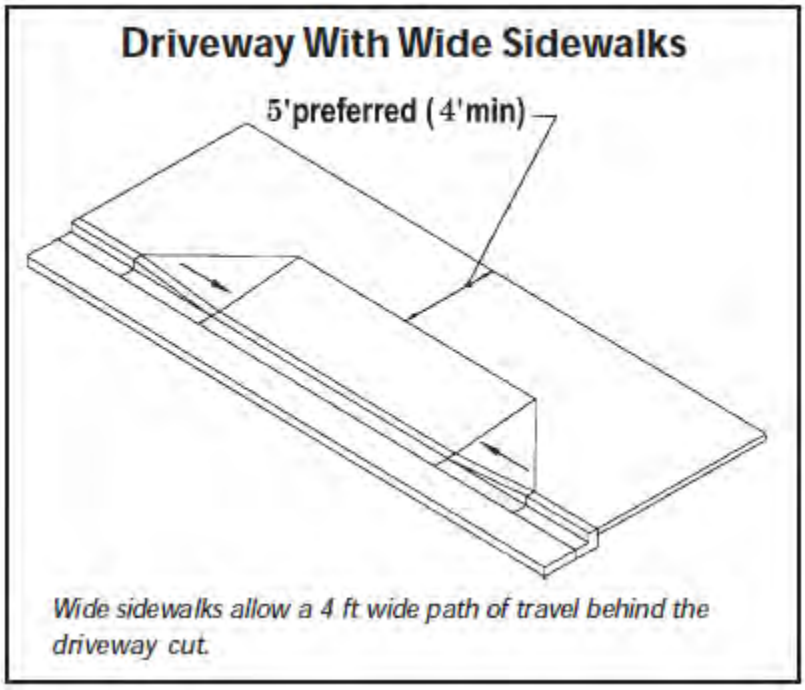

Figure 16

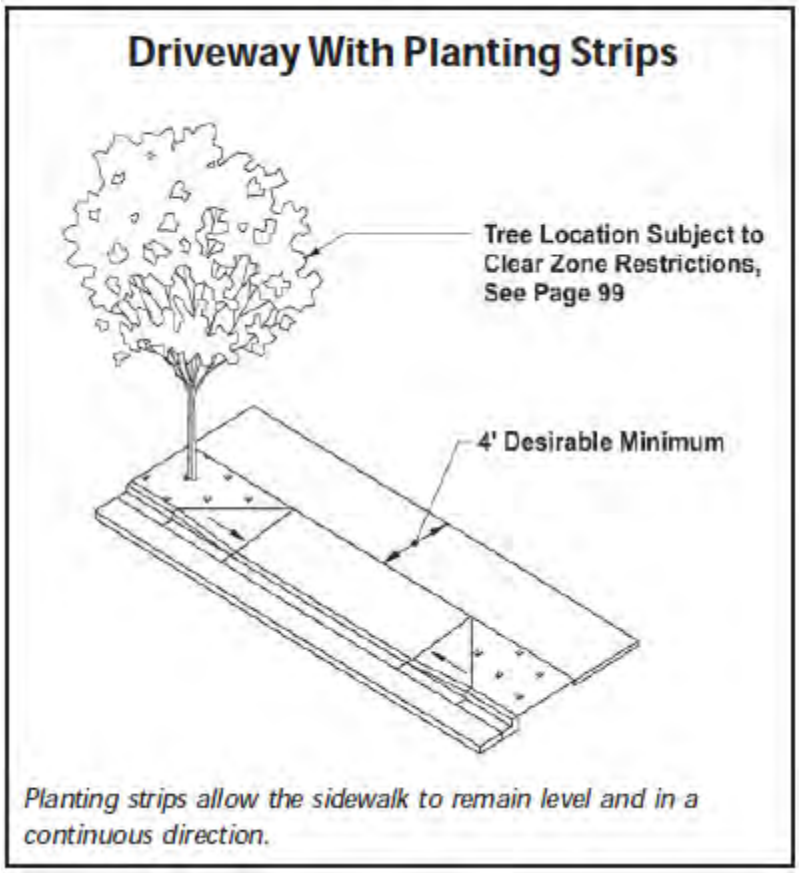

Figure 17

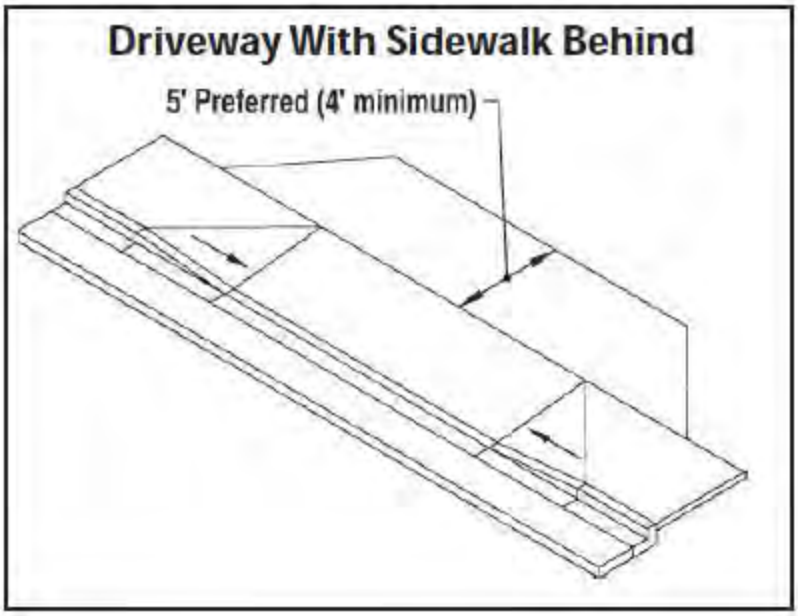

Figure 18

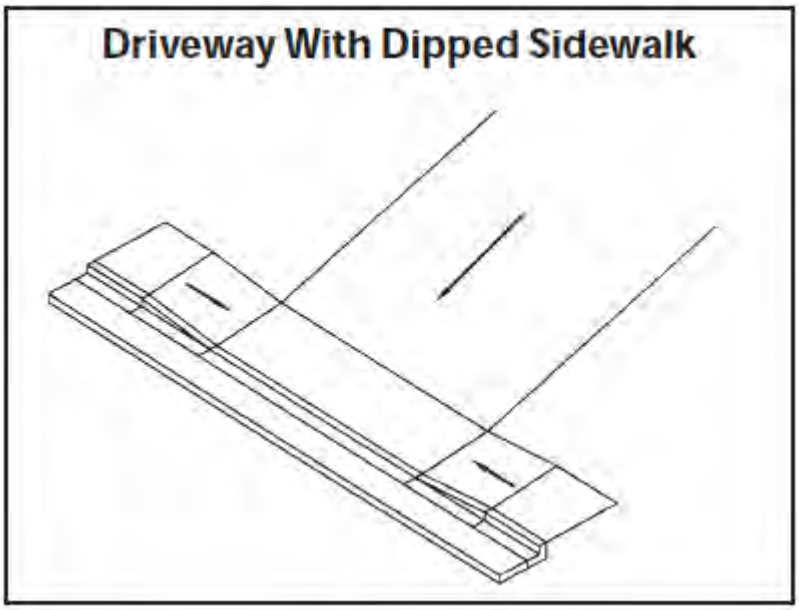

Figure 19

Where constraints don't allow a planting strip or wider sidewalks, the sidewalk can be wrapped around the upper end of the driveway cut. As shown in Figure 18.

The approach shown in Figure 19 dips the sidewalk in the direction of travel, keeping the cross slope at a constant grade. The problems with this approach are that pedestrians must maneuver up and down the sidewalk grade change and drainage may accumulate in the sidewalk area.

Surfacing

The surface of a walkway must be firm and stable enough to support the higher point loads of wheelchair wheels, crutch tips and other mobility aids. Pavement is typically the most practical means of meeting this requirement. Smooth pavement surfaces are the most desirable, such as portland cement concrete or asphaltic concrete. Unit pavers can also provide a stable surface, particularly if the pavers are joined end to end without joints and are smooth and level. Note that unit pavers are not allowed by some agency standards. Also, the supporting surface should be designed to provide permanent support that eliminates the possibility of settling and joint offsets.

Sometimes, scoring patterns and unit paving patterns can create irregular surfaces that compromise wheelchair stability and control, or that create barriers for ambulatory pedestrians who have gait impairments. Architectural style and appearance should always be balanced with the importance of accessibility. Keep in mind that the requirement for a smooth, stable and slip resistant surface does not limit the entire paved walkway to unjointed, plain pavement.

Reduced Vibration Zone

The Draft Rule proposed by the Access Board eliminates the requirement for a reduced vibration zone because a good definition for reduced vibration elements has not been developed.

Where a hard surface is provided that results in a more rough texture (like unit pavers, stamped concrete, or similar) best practice would include a 4-foot wide smooth paved surface within the

textured surface to provide a smoother area for wheelchair users, walker users and others with mobility impairments. It is clear that the more bumpy surface resulting from these design features can create painful conditions for those using a wheelchair for passage.

The recommendations in *Building a True Community* apply only to the pedestrian access route. Other portions of the paved area can have very creative urban design treatments that add interest and visual aesthetics.

Surface Materials

Surface materials should be chosen to avoid creating slippery conditions for pedestrians. Exposed aggregate concrete surfaces accumulate moisture which can freeze and create icy conditions on sidewalks if not maintained properly. They are also slippery when wet and undesirable for both persons with disabilities and ambulatory pedestrians.

Compacted crushed rock surfaces and consolidated soils are less desirable and may not be acceptable for PAR without extensive maintenance to ensure rollability and maneuverability. However, in some cases this type of surfacing may be a suitable solution in outdoor recreation areas to make walkways and trails more accessible to all (see Toolkit 4 - Trails and Pathways, which addresses accessibility considerations for recreational trails). Compact crushed rock surfaces into a smooth condition without loose rocks, bumps or grooves. The use of a binding agent with the crushed rock can improve surface stability and longevity. Loose gravel, such as pea gravel and most types of wood chip surfacing are generally not acceptable as accessible surfaces.

Textural and Visual Cues People who are blind or visually impaired need cues as they travel through a pedestrian system. A variety of cues may be used to maintain orientation, such as the sound of traffic, the line of buildings along the sidewalk, entrances to businesses, or traveling along the edge of a sidewalk when there is a landscape strip. Delineating the sidewalk path with a color contrasting surface along the edges of the path can be helpful to pedestrians with low vision, many of whom are elderly. Decorative changes in color across the sidewalk, however, can be very confusing. Many individuals who are visually impaired may have difficulty determining if a color change is a shadow, step, hole or just a decorative color.

The detectable warning is a unique and standardized surface intended to function much like a stop sign to alert pedestrians who are blind or visually impaired to the presence of hazards in the line of travel and should only be used for this purpose. The truncated dome surface should not be used for wayfinding or directional information. Detectable warnings are not required at unsignalized driveways because installation at driveways would make it harder to accurately identify the streets.

The following locations above were identified by the committee as being appropriate for the installation of detectable warnings:

A. Where a sidewalk crosses a vehicular way, excluding unsignalized driveway crossings.

B. Where a rail system crosses pedestrian facilities that are not shared with vehicular ways.

C. At reflecting pools within the public right-of- way, which have no curb or rim protruding above the walking surface.

D. At islands and medians that are cut through level with the roadway.

E. Where required by proposed ADAAG Chapter 11. (This will be the outcome of the Building a True Community report.)

Where islands or medians are less than 4 feet wide, the detectable warning should extend across the full length of the cut through the island or median.

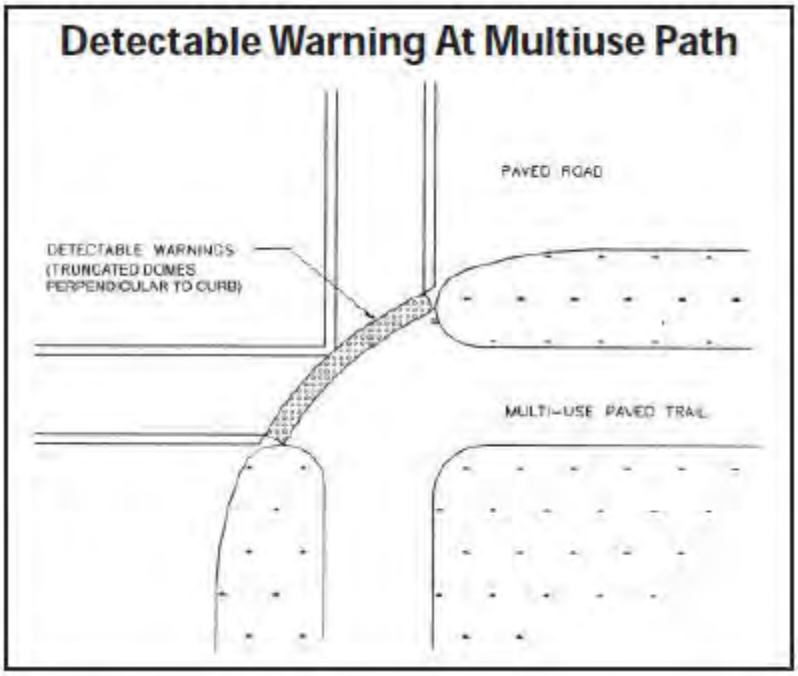

Figure 20

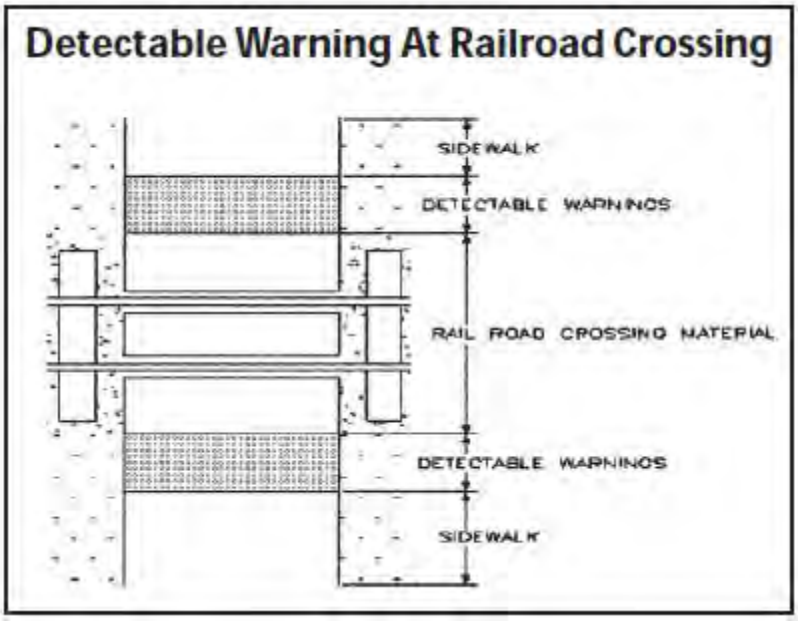

Figure 21

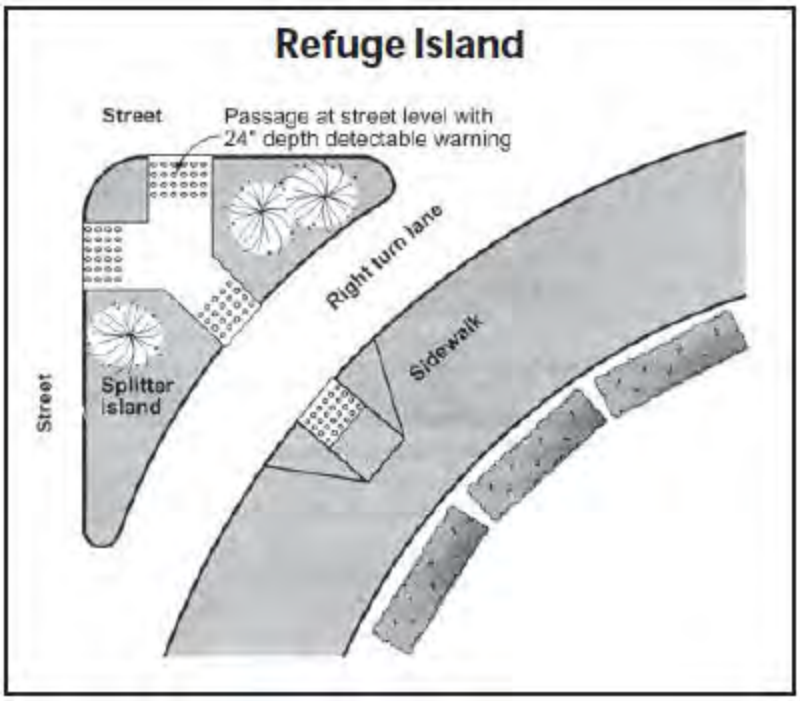

Figure 22

Detectable Warning Surface Specifications:

A. Size: Detectable warnings should be placed for a width of 24 inches in the direction of travel and extend the full width of the curb ramp or flush surface.

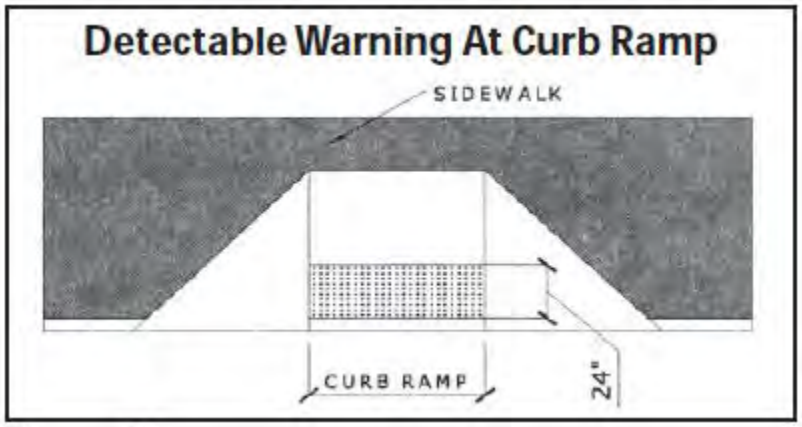

Figure 23

B. Location: The detectable warning should be located so that the edge nearest the curb line or other potential hazard is 6 to 8 inches from the curb line or other potential hazard, such as a reflecting pool edge or the dynamic envelope of rail operations. Placement of the detectable warnings at a maximum of 6 to 8 inches back from the curb line gives some latitude in placement of the detectable warning. Where curbing is embedded at the sidewalk/street junction, this will not need to be replaced. In addition, allowing 6 to 8 inches of ramp (or curb) surface beyond the detectable warning will give pedestrians who are blind an

additional stopping distance before they step into the street. It will also enable some persons having mobility impairments to make a smoother transition between the street and the curb ramp.

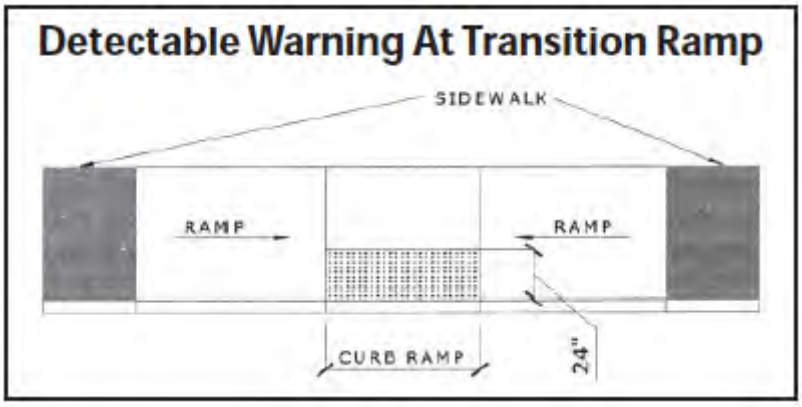

Figure 24

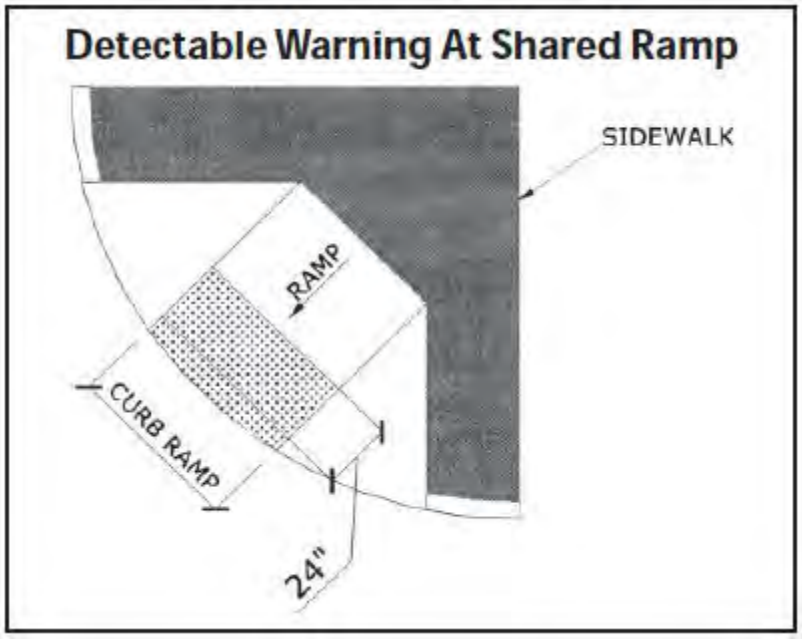

Figure 25

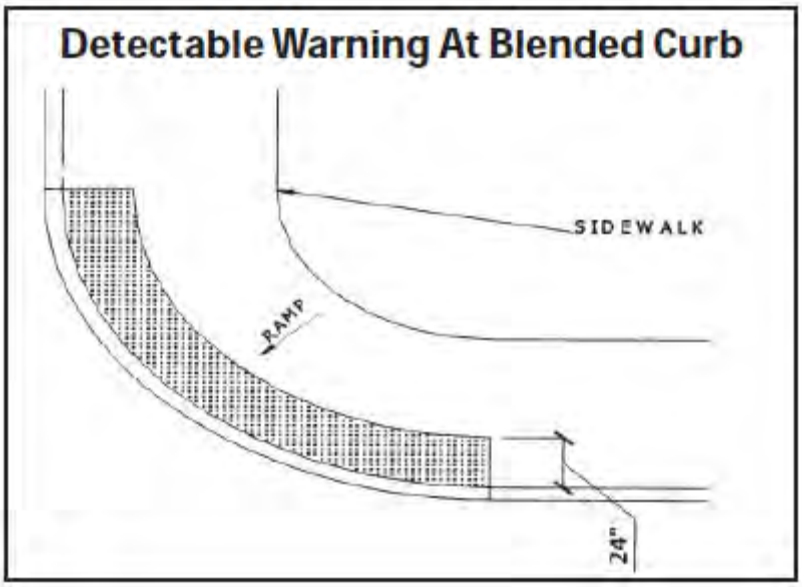

Figure 26

C. Dome Size and Spacing: Truncated domes should have a diameter of 0.9 inch at the bottom, a diameter of 0.4 inch at the top, a height of 0.2 inch and a center-to-center spacing of 2.0 inches to 2.35 inches measured along one side of a square arrangement. The size and spacing of the domes affect detectability by pedestrians who are blind. This specification is much more detailed than that in the current ADAAG, and offers much less latitude in dimensions and spacing. It ensures that the dome spacing is the maximum currently known to be consistent with high detectability. The diameter measurement in the present ADAAG is ambiguous if the user of these guidelines is not told whether the diameter is to be measured at the bottom or the top of the truncated domes. As currently implemented by most US manufacturers, it is the bottom diameter that measures 0.9 inch, and the top diameter varies widely. The diameter of the dome where it touches the sole of the shoe affects detectability, and the top diameter of 0.4 inch is based on current research.

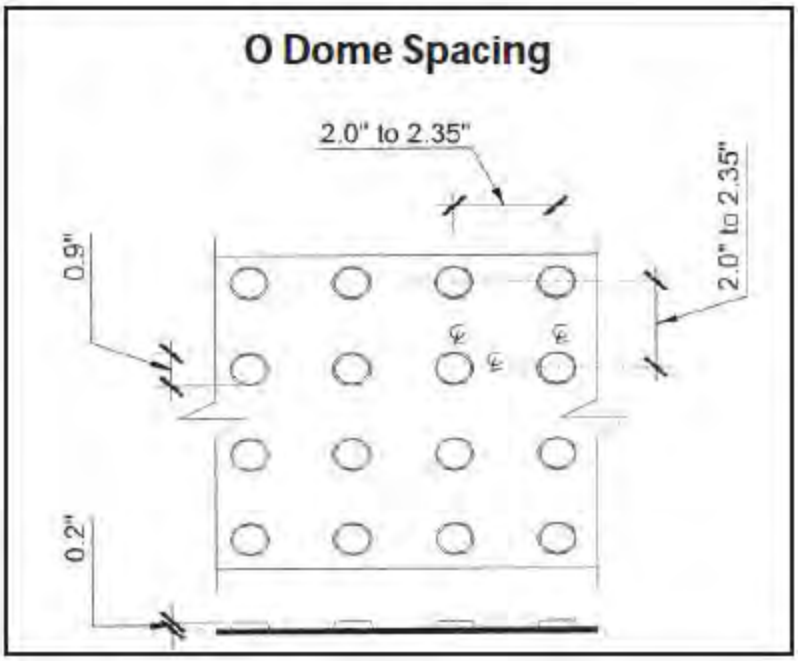

Figure 27

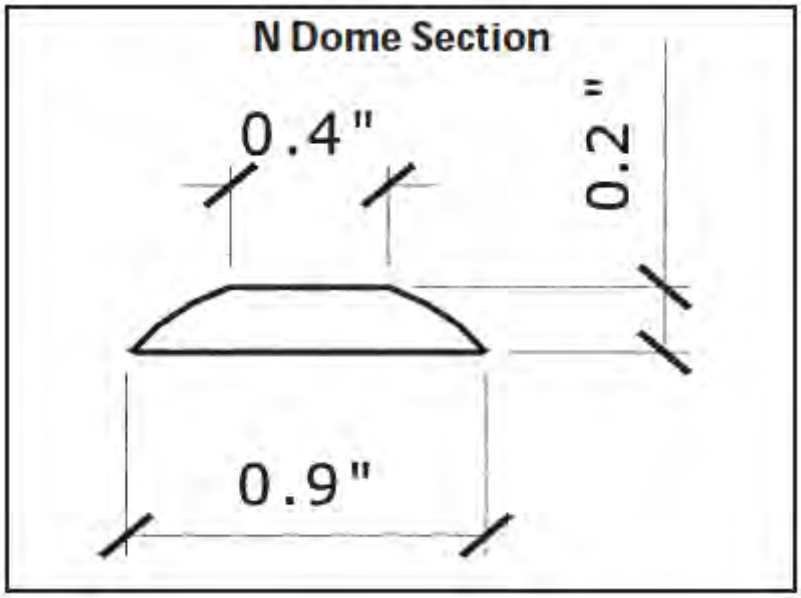

Figure 28

D. Dome Alignment: Domes should be aligned on a square grid in the predominant direction of travel to permit wheels to roll between domes. This specification ensures the greatest degree of safety and negotiability for persons with mobility impairments. It requires square alignment; to give persons using wheeled mobility aids the greatest chance of being able to avoid the truncated domes. PROWAAC recommends 2.35-inch dome spacing but it may be difficult to acquire prefabricated elements or templates at greater than 2-inch spacing. Availability over time should improve and 2.35-inch spacing is strongly preferred.

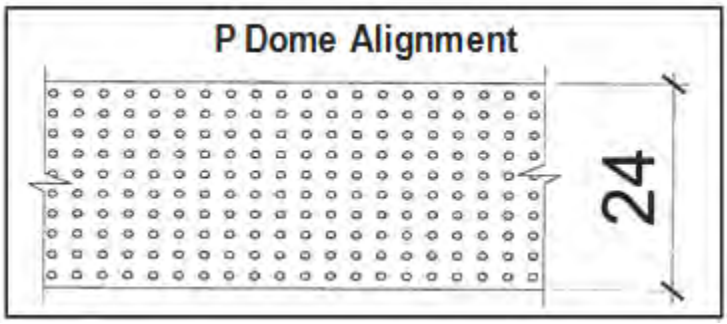

Figure 29

E. Visual Contrast: There should be a minimum of 70 percent contrast in light reflectance between the detectable warning and an adjoining surface, or the detectable warning should be "safety yellow". The material used to provide visual contrast should be an integral part of the detectable warning surface. Both domes and the underlying surface should meet the contrast recommendation. Visual contrast can be measured in accordance with existing ADAAG, A.2.9.2, and appendix.

F. Other elements can be strategically placed along accessible routes to identify ramps, building entrances, pathway intersections, etc. Such elements include lighting, change in landscaping, signs, and changes in pavement patterns or colors.

Curbs are also important detection devices for sight impaired people and should be kept along street edges and intersections. Curbs help cane users clearly detect the location of curb ramps and driveways because they follow the curb line and note where it recesses. The removal of curbs, such as at a recessed intersection, has caused difficulty for those who are blind or visually impaired because they then have trouble detecting the edge of the street.

Accessible Pedestrian Signals (APS)

The primary technique that people who are blind or visually impaired have used to cross streets at signalized locations is to initiate their crossing when they hear the traffic alongside them begin to move, corresponding to the onset of the green interval. The effectiveness of this technique has been reduced by several factors including: increasingly quiet cars, right turn on red (which marks the beginning of the through phase), complex signal operations, and wide streets. Further, low traffic volumes make it difficult for pedestrians who are blind or visually impaired to discern signal phase changes.

The increasing use of actuated signals, at which the pedestrian must push a button and cross during the pedestrian phase, requires blind pedestrians to locate the pedestrian push button and to cross only at the proper time during that phase. These changes in signalization make it necessary to provide the pedestrian signal information in an accessible format. In responding to a request for an accessible pedestrian signal at an existing intersection, the jurisdiction may find it useful to work closely with the blind pedestrian(s) who will be using the intersection and with an orientation and mobility specialist.

Accessible pedestrian signals are not required by current accessibility rules and law. Best practices suggest that existing technology can provide very meaningful accessible signals, but there is no standard approach to providing them. Several technologies have been developed that provide clear

audible messaging to blind pedestrians, and thus the approach varies from signal to signal. It is recommended that accessible pedestrian signals be provided where possible, and that special signals be made to provide them where crossings are known to serve pedestrians with visual impairment. The following discussion describes appropriate features that should be included in an accessible pedestrian signal system.

The technology of Accessible Pedestrian Signals has developed in recent years. There are now four types of APS available in the United States. Overhead signals mounted on the pedestrian signal indication have been most commonly used, but problems noted include: difficulties identifying which signal are associated with which crosswalk, which signal is associated with which intersection, noise complaints from neighbors, and difficulty by blind pedestrians in hearing traffic above the loud sound of the APS.

Signals in which the sound comes from the pedestrian push button and that include a locator tone and vibrotactile information, are used extensively in Europe and Australia and are now available in the US. There are also signals which are vibrotactile only. Sound transmitted to a receiver carried by the blind pedestrian, using Remote Infrared Audible Signs (RIAS) or LED technology, has also been used to provide information about the status of the walk signal and to provide additional information about the location and the nature of the intersection. RIAS systems provide a beaconing effect by means of the directional sensitivity of the receiver units.

Accessible pedestrian signals vary greatly in their current technology and use. PROWAAC in their Building a True Community recommended a number of measures to provide consistency and predictability to the use of APS. Essentially, they recommend that where signals provide any pedestrian information, it is good practice to provide that information in an accessible format. Currently, a standardized format for this information has not been developed, and application of this practice can be formidable in determining the accessible format.

Accessible Pedestrian Signal.

Specific direction is provided in the report for location of push buttons, push button size, push button force requirements, locator tones, visual contrast, acknowledgment indications and signage. Generally, APS should comply with the following requirements:

A. Push buttons should be a minimum of 2 inches in at least one dimension.

B. A locator tone should be provided for each push button. If two buttons are on one pole where the existing facility is being altered, only one locator tone source is required.

C. The force required to activate push buttons should be no greater than 3.5 lbf.

D. Push buttons should be operable with a closed fist.

E. Push button(s) should have a visual contrast with the body background of at least 70 percent.

F. There should be a visible and audible indicator that the button press has occurred (acknowledgment indications).

Note: A long button press (e.g., 3 seconds) may bring up the accessible features or additional accessibility features of the individual device. An additional button should not be used to bring up additional accessibility features. All accessible features available should be actuated in the same way. Thus, for a given signal, a long button press could request more than one additional feature. Possible additional features include: 1) sound beaconing by increasing the volume of the WALK tone and the associated locator tone for one signal cycle, so a blind pedestrian might be able to use the sound from the opposite side of the street to provide alignment information; 2) sound beaconing by alternating the audible WALK signal back and forth from one end of the crosswalk to the other; 3) providing extended crossing time, and 4) providing a voice message with the street names at the intersection.

G. Signage accompanying push buttons should comply with the Street Identifications and Other Pedestrian Signage section that follows.

PROWAAC set forth specific requirements for each of the above elements. A more detailed discussion follows.

Push Button Location

The recommendations of PROWAAC are intended to standardize some elements of the pedestrian push button location to make the push button accessible. Locating the pedestrian push buttons a distance from the crosswalk (which is common now) makes it difficult for a pedestrian, particularly a blind pedestrian, to push the button and return to the crosswalk location in time for the walk phase. A wheelchair user needs to be able to push the button from a level surface. The control face of the push button or the push button housing will include a tactile arrow to inform the pedestrian who is blind about the button and return to the crosswalk location in time for the walk phase. A wheelchair user needs to be able to push the button from a level surface. The control face of the push button or the push button housing will include a tactile arrow to inform the pedestrian who is blind about the direction of the crosswalk, so the location and direction of the control must be aligned with the crosswalk.

Since the APS will provide an audible indication of the WALK interval from the pedestrian push button, the blind pedestrian must be able to discern which signal is sounding at each phase. This is not possible if both APS are on the same pole. Use of different tones is not an acceptable method to identify different crossings. The separation is intended to allow the blind pedestrian to determine which APS is sounding through sound localization while standing at the curb preparing to cross the street. While the separation is not required for call buttons that are not associated with an APS or locator tone, routinely separating the call buttons will result in a more uniform and predictable location, and will facilitate consistent future APS and/or locator tone installation.

The location of the push button should be in accordance with the following minimum requirements:

A. It should be placed adjacent to a clear level landing on the pedestrian access route leading to the crosswalk. A clear, level (no greater than 1:48 cross slope in any direction) ground space should be provided with a stable, firm, and slip resistant surface to operate controls. The minimum clear ground space area should be 32 inches x 54 inches.

B. Where a parallel approach is provided, controls should be within 10 inches of the clear ground space, measured horizontally, and centered on the approach. Where a forward approach is provided, controls should abut and be centered on the clear ground space.

C. The control face of the button should be parallel to the direction of the marked crosswalk controlled by the push button, and no closer than 30 inches to the curb.

D. Mounting height should be 42 inches to the centerline of the push button above the clear approach area.

E. The push button should be no further than 5 feet from the crosswalk lines extended and within 10 feet of the curb, unless the curb ramp is longer than 10 feet.

F. When at a curb ramp, the push button should be within 24 inches of the top corner of the ramp, on the side furthest from the center of the intersection of the roadway. At a transition ramp, the push button should be adjacent to the lower landing.

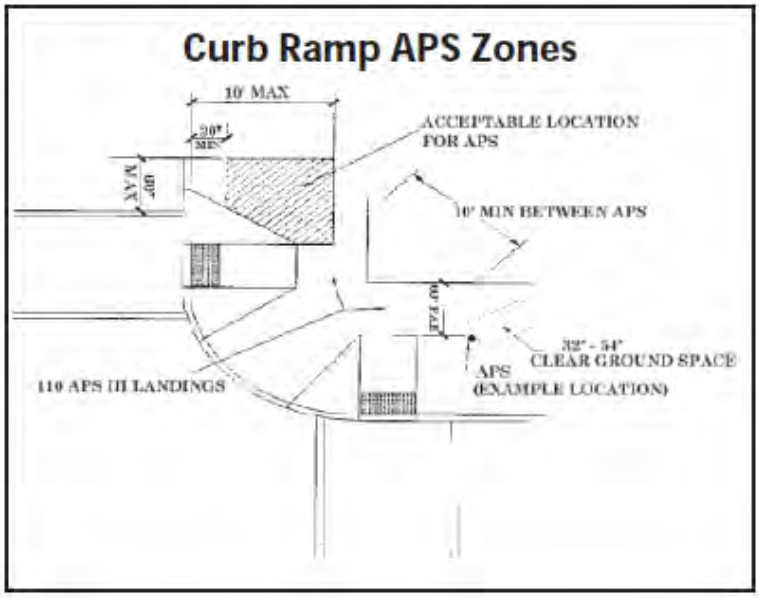

Figure 30

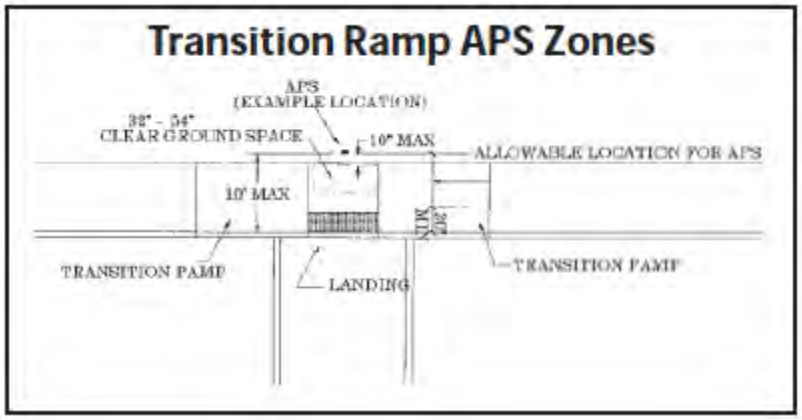

Figure 31

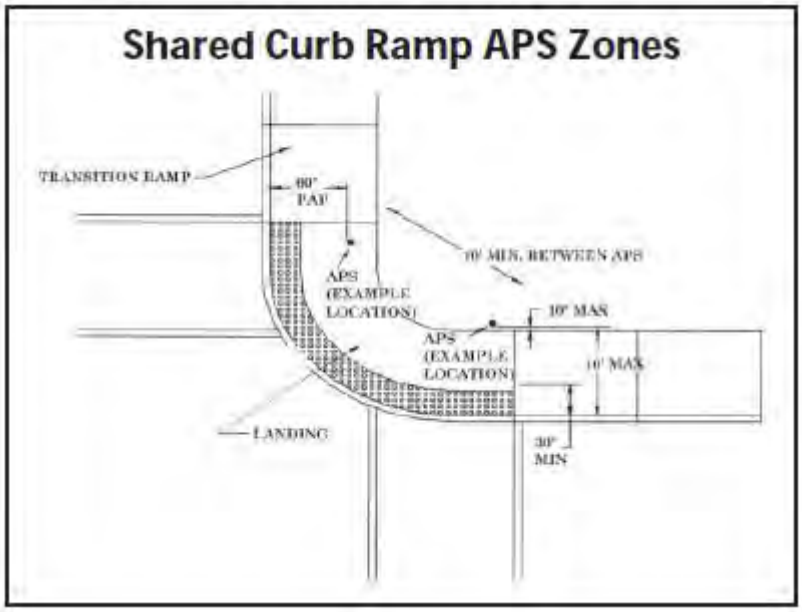

Figure 32

G. Where there are two APSs, in pedestrian push button housings, on the same corner, the push buttons should be mounted on poles separated by at least 10 feet.

If the requirement for separation cannot be met due to location requirements A-F above, two APS-related push buttons may be installed on a single pole. If installed on the same pole, the APS should be equipped to provide speech transmitted data or other technology that delivers an unambiguous message about which crosswalk has the walk signal indication.

Signals providing information only in vibrotactile format are not recommended. It should be noted that for information in vibrotactile format to be usable, the pole must be located so the user is able to keep a hand on the button while positioned at the top of the curb ramp or at the crosswalk.

Push Button Signage

A. Tactile Arrow. Where there is a push button, there should be a tactile arrow pointing in the direction of pedestrian travel controlled by the button.

The arrow shall be raised at least 1/32 inch, 1.5 inches in length. Stroke width should be between 10 percent minimum and 15 percent maximum the length of the arrow. The arrowhead should be open and at 45 degrees to the shaft. The arrowhead should be no more than 33 percent of the length of the arrow shaft.

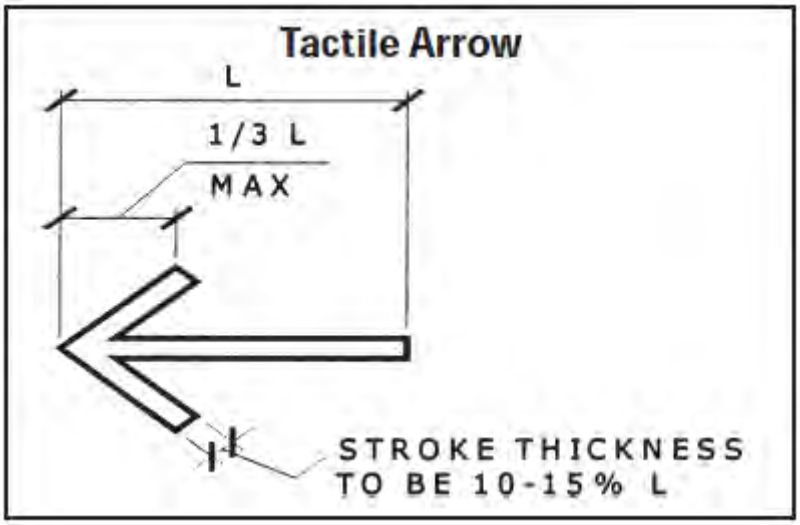

Figure 33

B. Universal Symbol. Controls are to include a universal tactile and visual symbol (if established by the U.S. Access Board) that will go on or at the push button indicating the presence or absence of an Accessible Pedestrian Signal at a crossing.

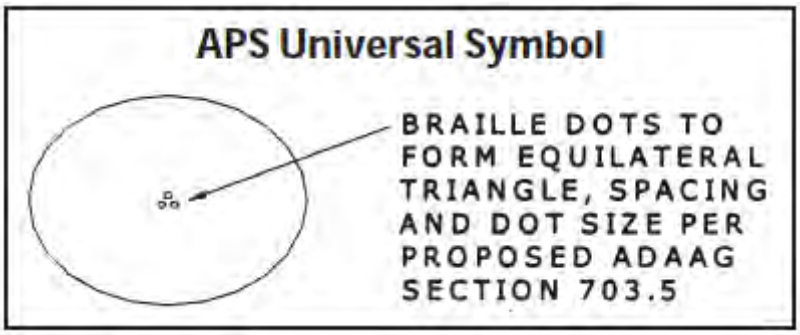

Figure 34

C. Street Name. Street name information should be provided at pedestrian push buttons, where the push button is equipped with an APS and a locator tone. The accessible street name information provided at a pedestrian push button should include the street name (or a reasonable abbreviation) in grade 2 Braille and in tactile raised letters complying with “Street Identification and Other Pedestrian Signage”. The sign should be located immediately above the push button mechanism and parallel to the crosswalk controlled by the button. The street name should be the name of the street whose crossing is controlled by the push button.

Please note that street name information for individuals with visual impairments should be provided at pedestrian push buttons where the push button is equipped with an APS and a locator tone. Therefore, the push button (or its housing) would also be equipped with a

tactile arrow indicating which street is controlled by the pedestrian crossing. Traditional street signs should continue to be used in addition to these supplemental signs.

Push button at signal

Audible signage may be provided in addition to Braille and tactile signage. Audible signage can provide auxiliary information about the intersection which can be of great value to persons with visual and cognitive impairments.

The arrow and street name information at the push button will provide information accessible to blind pedestrians, now typically provided to sighted pedestrians by signage, to clearly indicate which crossing is controlled by the push button. The arrow must be oriented parallel to the crosswalk to give this information clearly; the specifications of the arrow are to make it more easily distinguishable by touch.

D. Crosswalk Mapping. Where a map of a crosswalk is associated with a push button, the map should be visual and tactile. Maps shall have at least 70 percent visual contrast, light on dark or dark on light. The characters and/or symbols should be raised 1/32" minimum. The crosswalk should be represented by a vertical line, with the departure end of the crosswalk at the bottom of the map. The map should be on the side of the push button housing that is furthest from the street to be crossed.

For the universal tactile and visual symbol, PROWAAC suggested application of three dots in a triangle on the button as close to the center as practicable.

Locator Tone

Where new traffic signals with a locator tone are installed, and in alterations where any locator tone is installed, the locator tone should meet the following requirements.

At locations with audible beaconing, in response to a long button press, the locator tone loudness may increase during the pedestrian clearance interval to allow the user to hear the tone on the opposite side of the intersection.

Locator tone should be deactivated during periods in which the pedestrian signal system is inactive.

A locator tone notifies pedestrians who are blind or visually impaired of the need to push a button to request a WALK signal. It also indicates the location of the push button. These specifications are the same as the specifications in the MUTCD for the locator tone.

Where new traffic signals are installed, Accessible Pedestrian Signals (APS) may be provided when the following conditions are present:

A. Pedestrian timing is affected by push button activation,

B. timing includes a lead pedestrian interval, or

C. where there is a fixed time signal with pedestrian signal indication information presented. In this instance, a push button shall be provided that delivers the same information in an accessible format.

Required Features

Where APS are provided, they should comply with the following requirements:

A. **Crosswalk Indication.** Accessible pedestrian signals should clearly indicate which crosswalk has the walk interval. The use of two different tones as sole indication of which crosswalk has the walk interval should not occur.

   Note that separation of the push buttons with the vibrotactile information and arrow provided on the push button is a good means to provide crosswalk-specific information. A speech message may also be used to provide this information. MUTCD specifies the wording of such a speech message. Remote infrared audible signals, which are inherently directional, are another good way to clearly indicate which crosswalk has the walk interval. Additional strategies that may provide unambiguous information are an alternating audible signal or an audible signal from the far end of the crosswalk.

B. **Walk Indication.** When indicating the walk interval, the accessible pedestrian signal should deliver the indication in audible and in vibrotactile format.

Remember, signals should not solely provide accessible information in vibrotactile format.

C. **Locator Tone.** Where there is an accessible pedestrian signal controlled by a pedestrian push button, there should be a locator.

An audible tone shall be available whenever people are in the vicinity, not just an infrared sign. Infrared signs are discussed in the section titled "Signing and Other Communication Aids", subsection "Audible Signs". The tone may be initiated by a passive detector such as an infrared detector, and therefore sound only when pedestrian presence triggers the device.

D. **Walk Interval Tone.** When APS use audible tones, they should have a specific tone for the walk interval. If the same tone is used for the locator tone, the walk interval tone shall have a faster repetition rate than the associated push button locator tone. The two signals shall be distinguishable either by tone and/or by repetition rate. A voice message may be used for the WALK indication.

Where the APS provides signal information using tones, the tone should consist of multiple frequencies with a large component at 880 Hz. The walk tone shall have a repetition rate of 5 Hz minimum and a duration of 0.15 seconds maximum.

Note that frequencies above 1 kHz are difficult for persons with an age-related hearing loss to detect. Multiple frequencies will assist a larger population group of vision and hearing impaired persons.

E. **Operating Period.** Under stop-and-go operations, APS should not be limited in operation by time of day or day of week.

Information access cannot be abridged by day or time. Rather than disconnect a device for periods of time, volume should modulate in response to ambient levels.

F. **Activation.** Actuating a single APS on an intersection is not intended to activate all other devices at all other crosswalks

G. **Volume.** Tones should be at least 3dB and no more than 5dB greater than the ambient noise level and should be sensitive to level changes. The walk tone should be no louder than the locator tone. At installation, the signal system should be adjusted to be audible at no more than 5 to 12 feet from the system or at building line whichever is closer. If an audible tone is provided, the audible tone(s) should be audible from the beginning of the associated crosswalk.

Where audible beaconing is provided, opposite beacon may be audible at departure curb. A louder walk interval audible tone and subsequent clearance interval tone may be provided after a long button press at intersections where audible beaconing is needed.

The APS specifications and sound levels recommended here are intended to provide precise information about the onset of the walk interval. Using special actuation as specified below, they may also function as audible beacons, giving assistance in alignment and crossing within the crosswalk.

H. **Audible Beaconing.** Where provided, beaconing signals should be provided during the walk interval and clearance interval. No conflicting protected traffic movements are to be permitted.

Beaconing is usually not needed, although it may be needed at intersections that are wide, have low parallel traffic volume, or have skewed crosswalks. Where beaconing is desired as an additional accessibility feature, it should be actuated by depressing the push button for a longer period of time.

Where beaconing is actuated, it will be most effective if it functions only for that crosswalk whose push button was actuated. The area of definite audibility in the direction of travel should be detectable within 1/3 of the width of the crossing from the entrance to the crossing.

While sound beaconing is an alternative that may assist a blind pedestrian in aligning at a difficult crossing, the use of beaconing at all intersections is not necessary. There are concerns that loud overhead APS may mask traffic sounds that are useful to the blind pedestrian, and subject residents who live near the APS to unacceptable noise levels. Nearby residents have objected to audible signals in the past where they used two different sounds in a beaconing manner to alert users. By providing tones with volume that modulates to ambient noise levels, noise intrusion beyond the intended hearing range is minimized and termination of the tone during night hours is unnecessary

Other Pedestrian Signals and Timing Controls

Other pedestrian signals and timing controls not specifically described elsewhere should comply with the following recommendations:

Lead Pedestrian Intervals

Lead Pedestrian Intervals (LPI) are signal controlled pedestrian locators where the pedestrian signal releases the pedestrian before the similar vehicular movement is released, or where a pedestrian “scramble” exists where pedestrians have an “all way walk” phase.

Where LPIs are used, APS should be required.

Note that without APS, a blind pedestrian listening for a parallel traffic surge at a crosswalk with LPI may miss the walk interval and enter the crosswalk without enough time to complete the crossing before the signal changes.

Mid-block Crossings

When conditions indicate mid-block crossings are acceptable, a locator tone should also be considered to communicate the crossing presence to blind and sight impaired users.

Accessible mid-block crossing.

Providing pedestrian signal indication on the near side of the crossing is of direct benefit to persons with low vision and to persons benefited by redundancies. Use of larger devices and signage which is visible at near side curbs is encouraged.

Crosswalks

Where provided, crosswalks should comply with the following requirements. Where possible, the cross slope of pedestrian street crossings, at either marked or unmarked crosswalks, should be not more than 1:48 measured perpendicular to the direction of pedestrian travel. Also, where possible, the running grade of pedestrian street crossings, at either marked or unmarked crosswalks should be not more than 1:20 (5 percent) in the direction of pedestrian travel in the crosswalk. Crosswalks at signalized intersections should be marked on the roadway with pavement markings. Crosswalks must be at least 8 feet wide and preferably at least 10 feet wide.

According to MUTCD, pedestrian crossing intervals should be calculated at the walking speed of 4 feet per second. MUTCD also includes a recommendation that if appropriate conditions exist, designers should consider a slower walking speed for the clearance interval. PROWAAC recommends using a walking speed of 3.5 feet per second, and further extending the time if the following factors are present: running grade of the crosswalk greater than 1:20; cross slope of the crosswalk greater than 1:48; or crosswalk length greater than 50 feet with no intermediate pedestrian refuges. Table 50 in Toolkit 6 - Intersections compares different walking speeds.

Extended time for pedestrian crossing may be initiated by passive detection of pedestrian movement in the crosswalk, provided that the detection system is designed to include detection of people using wheelchairs. Extended time may also be initiated by a long (e.g., greater than 3 seconds) button press.

MUTCD recommends calculating the clearance interval based on the pedestrian reaching the farthest edge of the traffic lane on the opposite side of the street. According to the PROWAAC report, total crossing distance as defined by MUTCD should include the entire length of the crossing plus the length of one curb ramp.

Medians and Pedestrian Refuge Islands

General

Raised medians and pedestrian refuge islands in crossings should be cut through level with the street or have curb ramps at both sides. Curb ramps should have a level area (landing) 60 inches long by 60 inches wide minimum at the top in the part of the island intersected by the crossings. Cut-throughs should be aligned perpendicular to the street being crossed and should be parallel to the direction of the pedestrian access route if the pedestrian access route is not perpendicular to the street. Detectable warning should be installed in all locations as described in "Textural and Visual Cues"

Signing and Other Communication Aids

Signing is an essential aid to negotiation for all pedestrians, including older adults and people with disabilities. Signing identifies nearby services, warns of possible hazards, and directs people to their destinations. Signs should be readily observable, with clear and precise information. Place directional signage at decision points where access provisions are not obvious to indicate the location of accessible parking spaces, building entrances, and restrooms. Redundancy is desirable for significant safety and directional information.

To provide accessibility in signing, planners and designers need to understand which signing components are important for those requiring accessibility. Street identification, bus route identification, and informational and warning signs provide basic information that pedestrians with sight impairments rely on to guide them in traveling.

Street Identification Signing

Generally, street identification signing is provided for motorists primarily, with usability by pedestrians almost an afterthought. As a result, the placement location for many street signs is not conducive to the addition of accessible signage. Also, the lack of consistent locations for sign posts and other elements that could be used for placement of tactile signing makes installation of tactile signing less effective because users with sight impairments would not necessarily know where (or even if) those elements are present.

Where an APS is provided, visual and tactile street identification that complies with ADAAG should be provided above the push button as described previously.

Bus Route Identification

Where bus route identification signs are provided in the public right-of-way on or adjacent to a public sidewalk, visual characters, tactile characters and Braille signs providing the route number and route name should be provided. Raised print is necessary for route number identification only. If a variable message sign is used at a bus stop or shelter, an audible equivalent should be provided.

Bus stops and shelters are covered as transportation facilities in accessibility guidelines adopted by USDOT as part of the Title II regulation (49CFR Parts 27, 37 and 38). Bus route identification signs must comply with specifications for visual characters. DOT's ADA regulations do not require tactile

signs at bus stops and shelters. DOT's ADA regulations do require, however, that bus stop locations be audibly and visibly announced on the vehicle.

Informational and Warning Signing

It is important to provide informational and warning signs in the public right-of-way in an accessible format. However, there are few recognized standards for making that information readily accessible to individuals who are blind or visually impaired. Signs at construction barriers are of particular concern. It is recommended that as much as possible, the construction barriers be provided in a manner that provides direction and access to all pedestrians.

Sign Mounting Locations

Mounting height for all signs which include tactile characters should be 60 inches above the walkway surface to the centerline of the sign.

Bus shelter signage should be mounted on the shelter wall closest to the front of the bus, as close to the street as possible, at 60 inches above the adjacent clear landing. Bus stop signage where no shelter is present shall be mounted on the pole at 60 inches above adjacent grade.

Variable Message Signs

Variable message signs presented using Light Emitting Diodes (LED), Liquid Crystal Displays (LCD), flip-dot, or other means should be legible from the same distance as conventional print signs. Character height for variable message signs should be about 35% greater than character height for conventional print signs in order to have equal legibility at the same distance.

Audible Signs

Building a True Community extensively discusses standards for frequency, power, range, and other technical requirements for Remote Infrared Audible Sign Receivers (RIAS). Transit stations and platforms are routinely used by persons who are blind. Tactile signs do not necessarily help persons who are blind to locate station entrances and exits, fare gates, fare machines, stairs and escalators, platforms, and other amenities, because tactile signs cannot be located consistently enough for persons who are blind to find them efficiently. RIAS are suggested as a wayfinding system because, like vision, they enable users to scan the environment (using a personal receiver) and "read messages" from a distance. They are able to provide directional and informational messages in a way that enables persons who are blind to travel as independently as persons who can read print signs.

RIAS have been found to be a particularly effective means to make wayfinding information accessible to persons who are blind or who have print disabilities.

Other Sources of Information

The following sources of information are recommended for design of accessible pedestrian facilities. Please see the Resource Guide included at the end of this guide for complete bibliography information.

Accessibility Design for All, An Illustrated Handbook, 1995 Washington State Regulations, Barbara L. Allan and Frank C. Moffett, AIA, PE

Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; State and Local Government Facilities; Interim Final Rule, Federal Register, Part II, Architectural and Transportation Barriers Compliance Board

Designing Sidewalks and Trails for Access: Part Two—Best Practices Design Guide, Beneficial Designs Inc. for the US Department of Transportation

Recommendations for Accessibility Guidelines: Recreational Facilities and Outdoor Developed Areas, Recreation Access Advisory Committee

Uniform Building Code (and state and local building codes)

Universal Access to Outdoor Recreation: A Design Guide, PLAI, Inc.

Building a True Community, report by the PROWAAC, a committee of the US Access Board

Contact

Thibault, Lois E., US Architectural and Transportation Barriers Compliance Board (Access Board), 1331 F Street NE, Suite 1000, Washington, DC, 20004-1111, (202) 272-5434 ext 32, e-mail thibault@access-board.gov.

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Chapter 6. Toolkit 3 – Children and Work Zones

This Toolkit Section Addresses:

- *Special Considerations Related to Children*
- *Improving Student Pedestrian Safety— A Cooperative Process*
- *School Related Pedestrian Improvements*
- *The School as a Community Focal Point*
- *Pedestrian-Friendly Schools and School Zones*
- *Traffic Control and Crossings Near Schools*
- *School Walk Routes and Safety Programs*
- *Education Tools and Programs for Child Safety*
- *Ongoing Maintenance*
- *Other Sources of Information*

Children have the right to travel safely as pedestrians, just as we all do.

The potentially severe, and often fatal, consequences of a collision between a moving vehicle and a child raise high emotions whenever the topic is discussed. Children are more vulnerable than adults to collisions with motor vehicles, because their movements are often unpredictable. Traffic engineering approaches must fully address concerns about the safety of young children walking along or crossing busy streets and highways to schools, parks, neighbors' houses, or between other origins and destinations in our communities. Table 22 lists common types of pedestrian/motor vehicle collisions involving young children.

Most Common Types of Pedestrian/Motor Vehicle Collisions for Children Aged K-6

- Darting out
- Dashing across an intersection
- Crossing in front of a turning vehicle
- Crossing a multi-lane street
- Entering or crossing an intersection
- Playing in a roadway
- Going to or from a school bus
- Crossing behind a vehicle that is backing up

Source: A Guidebook for Student Pedestrian Safety; as adapted and expanded for this guide.

Table 22

Special Considerations Related to Children

Collision statistics and other information related to children are provided in the section of this guide called About Pedestrians. As pedestrians, children are exposed to more collisions for several reasons. One of the most problematic characteristics of child pedestrians is that their movements are less predictable than adults. Young children tend to dart-out into traffic or cross the street without looking for oncoming traffic more often than adults. Young children also lack the visual acuity and peripheral vision to judge speeds of oncoming traffic and adequacy of gaps in the flow of traffic (Knoblauch, et al). Since children do not drive, they lack the understanding of what a driver's intentions might be at an intersection or crossing point. Table 23 lists the special limitations of children aged five to nine.

Many pedestrian collisions occur on all types of streets, and unfortunately, child pedestrian injuries occur on local, residential, and neighborhood streets that are straight, paved, and dry. According to the *National Safe Kids Campaign*, in 1999, almost half of all child pedestrian deaths occurred after school in the late afternoon and early evening. Most of these occurred at non-intersection locations. Driveways also present a danger to young children. Nearly half of all toddler accidents occur when drivers are backing out of a driveway and do not see young children.

It is important to remember the special limitations of young children when designing for them.

Some Special Limitations of Children Aged 5 to 9
• Children are shorter than adults; typical eye height is 3 feet above ground; their field of vision is different.
• Children have one-third narrower peripheral vision than adults and are less able to determine the direction of sounds.
• Children have trouble judging speeds and distances of moving cars.
• Children are sometimes too small to be seen by fast moving or inattentive drivers.
• The movements of children are less predictable than adults.
• Children have shorter attention spans and may grow impatient at crossings.
• Children have less experience as pedestrians and may not be fully aware of dangerous conditions.
Source: A Guidebook for Student Pedestrian Safety; revised and expanded for this guide.

Table 23

It is important to remember the special limitations of this age group when designing for them. Research has shown that adults uniformly tend to overestimate a child's capabilities to deal with traffic, particularly when crossing the street. Adults sometimes fail to realize that many children under age nine lack the developmental skills to safely and consistently cope with moving traffic.

Improving Student Pedestrian Safety—A Cooperative Process

The safety of students walking to and from school is a major concern of parents, teachers, schools, public works, law enforcement, and the general community. One of the most important tools for communities to develop is a safe walking route plan for children. It is also important to develop a plan to determine which students walk to schools and which ride the school bus. The basics about developing school walk routes are described later in this toolkit section. The responsibility for student pedestrian safety goes beyond development of "safe walk routes" by school districts. Preparing walk route plans is only part of the overall process (see Table 24).

Process for Improving Student Pedestrian Safety
• Prepare school walk route plans
• Provide school walk route maps and information to parents and students
• Identify pedestrian safety deficiencies
• Implement remedial actions and improvements to address pedestrian safety concerns

Table 24

Identifying problems and implementing improvements to address these problems in school zones and along school walk routes require a cooperative effort among public agencies (capital investments and public works funding programs), school districts, private developers, and others in the community to ensure maximum success. All of these entities must work together and coordinate with each other to develop pedestrian improvement programs that provide better opportunities for

children to walk to school. Additional traffic and pedestrian studies may be needed to identify deficiencies in walking routes. These are identified later in this section.

Georgia school districts should work with public works agencies and traffic engineers to mitigate walk route deficiencies. If hazardous walking conditions are improved, more students will walk to school, reducing ever-escalating transportation costs and at the same time making walkways safer for the community at large.

School Related Pedestrian Improvements

There are two key components of a pedestrian improvement program that ensure safer conditions for school children:

- A sufficient level of physical facilities provided along the school walking route and adjacent to the school (responsibility: local jurisdiction, school district, and private development)
- Effective operation plans and safety programs, consisting of supervisory control elements and student/adult education for school trip safety (responsibility: school district, parents, and general community)

This toolkit section focuses on design recommendations for physical facilities surrounding and at the school site and along school walk routes. Some information related to school walk route and safety programs is provided at the end of this section.

On roadways without sidewalks, but with adequate shoulders, children should be encouraged to walk on the left shoulder, facing oncoming traffic.

The School as a Community Focal Point

A broader consideration related to the design of pedestrian access to schools is how the school is oriented within the community and connected to surrounding neighborhoods. Schools are often a focal point of the community, serving as much more than a place of education by providing outdoor fields and facilities for play, recreation, meeting, voting, and other community services. Siting a school so it can be easily reached from all directions and providing a sufficient level of pedestrian facilities in the vicinity of the school further help to establish it as a strong component of the community.

School sites should be centered in the community and accessible to pedestrians from all sides.

Schools can function both as neighborhood parks and school playgrounds. Streets leading to the school site should be designed to include full sidewalk or walkway improvements and other elements that contribute to pedestrian safety and comfort (traffic calming to slow traffic, good lighting, clear visibility, and trees for shelter and shade). Intersections and crossings within the vicinity of the school need to be well designed, with a focus on the needs of student pedestrians. Schools should be located where major street crossings are minimized. When possible, older schools should be refurbished instead of building new ones. Older schools are typically located in established residential neighborhoods and can serve as an important community focal point. Table 25 lists important elements of a school as a focal point within the community.

Pedestrian-Friendly Schools and School Zones

School sites and surrounding areas should be designed to invite pedestrian travel while also improving pedestrian safety.

The School as a Community Focal Point

- The school site is centrally located in the community; most children live within 1 mile.
- Pedestrian and bicycle access is available from all directions.
- Sidewalks, bike lanes, and trails on adjacent streets or through neighborhoods connect to the school property.
- Linkages between surrounding neighborhoods, such as access between cul- de-sacs, provide enhanced pedestrian connections to the school.
- Effective traffic control devices are provided within the surrounding vicinity.
- A school walk route and safety program exists and safety patrols are provided within the vicinity.
- School facilities, including the playground, fields, and meeting rooms, are available for community use.
- Because of the level of pedestrian improvements in the area and the design of the school site, children and adults feel comfortable walking to the school rather than riding the school bus or driving cars.

Table 25

School Site Design

Design and retrofit of schools and school grounds requires consideration of many factors, too numerous to list in this guide, but some of the basic principles of good school site design related to pedestrian travel are provided below. Specific sites may have unique conditions that require special design treatments. Good design solutions are typically based on the adopted standards and practices of the local jurisdiction, but design solutions can also exceed established standards where desired or necessary to provide a more effective pedestrian system.

Elements of Good School Site Design

- Surrounding streets are equipped with sidewalks and bike lanes.
- The building is accessible to pedestrians from all sides (or at least, from all sides with entries/exits).
- Trails and pathways provide direct links between the school site and the surrounding neighborhoods.
- Bus drop-off zones are separated from auto drop- off zones to minimize confusion and conflicts.
- Buses, cars, bicycles and pedestrians are separated and provided with their own designated areas for traveling.
- Pedestrian travel zones (sidewalks, etc.) are clearly delineated from other modes of traffic (through the use of striping, colored and/or textured pavement, signing and other methods).
- Parking is minimized; people are encouraged to walk to school.
- Pedestrians are clearly directed to crossing points and pedestrian access ways by directional signing, fencing, bollards or other elements.
- Strategically located, well-delineated crossing opportunities are provided, including marked crosswalks at controlled intersections and mid- block crossings (signalized if warranted).
- Traffic calming devices (raised crossings, refuge islands, bulb-outs at crossings, on-street parking, traffic circles, landscaping, etc.) are installed in the vicinity to slow vehicles.
- View obstructions are avoided so there is clear visibility of pedestrians throughout the area.
- Parking restrictions are required in areas close to children walk routes.
- Bus unloading zones should be separated from vehicular traffic.
- Student crossings and bus loading zones should provide adequate light, if needed.

Table 26

Table 26 lists a few of the typical elements on and adjacent to school sites that function well for pedestrians and encourage pedestrian travel.

Figure 35 illustrates a typical school site design that includes many of these features.

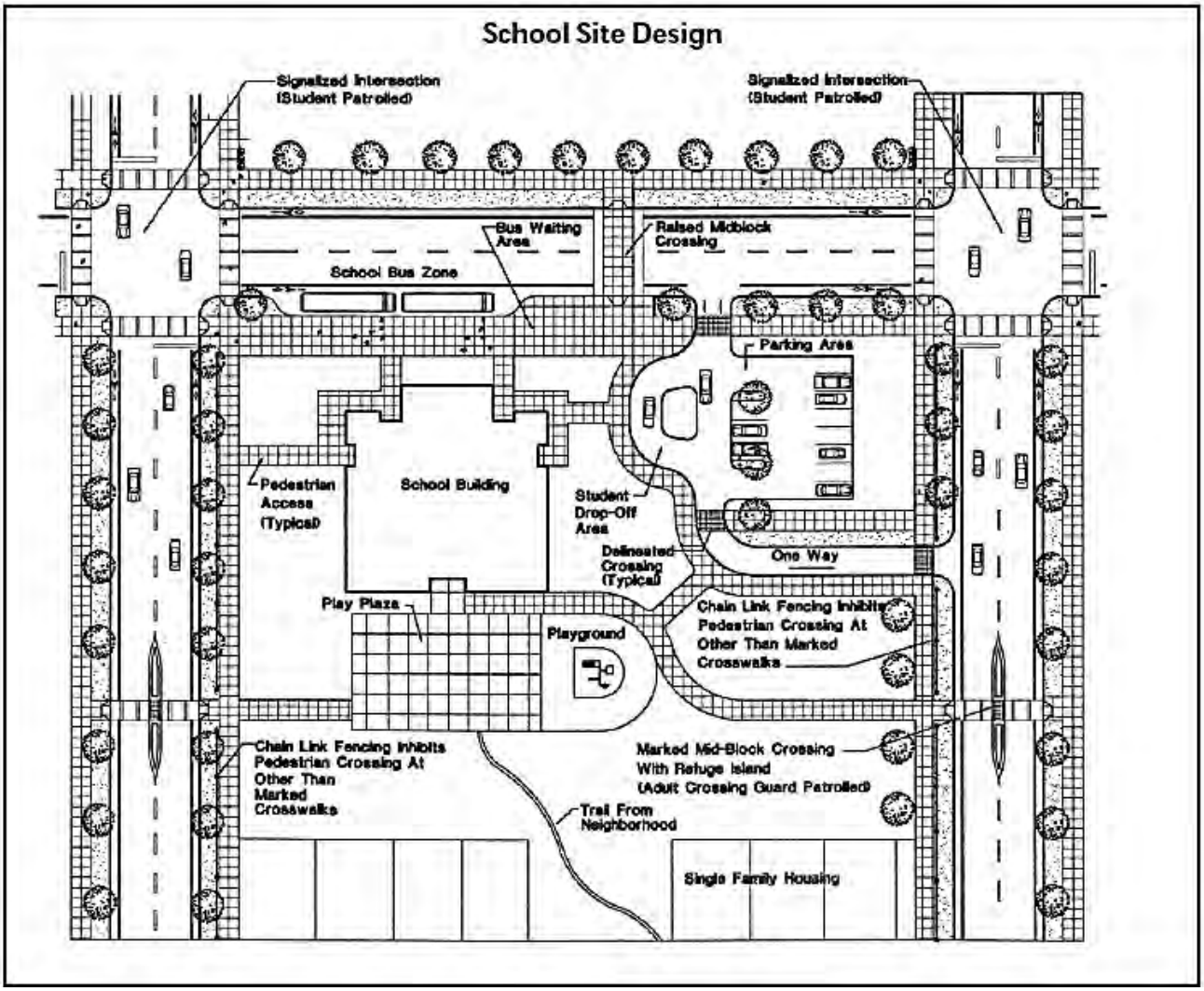

Figure 35

Pedestrian Access Routes to the School

Sidewalks and walkways that clearly define the routes of access to and from schools should be provided in all areas surrounding the school and on the school site. Vertical separation (with curbs) and horizontal separation (planting buffers, ditches, or swales) from motor vehicle traffic are strongly encouraged to improve the safety of pedestrians walking along streets. Typical roadside improvements that may be suitable for pedestrian travel under varying circumstances are listed in Table 27. Sidewalks are the preferred facility for school walk routes (see Figure 36).

Roadside Pedestrian Improvements Along School Walk Routes

- Well compacted and grassed stable surface is recommended for shoulders
- Paved shoulder (recommended as an interim solution only; if an accessible route of travel, edge treatment is necessary)
- Paved walkway or sidewalk separated from roadway by ditches, swales, or planting buffer (good long-term solution; often used in rural and residential areas; 5-ft. minimum separation

required by AASHTO) • Adjacent sidewalk with curb and gutter or vertical curb (good long-term solution; often used in urban areas) *Source: A Guidebook for Student Pedestrian Safety; revised and expanded for this Guide*

Table 27

On roads without sidewalks (often the case in rural areas surrounding schools), widened roadway shoulders accommodate pedestrians. Shoulders may be paved or unpaved, but if unpaved, a well compacted and grassed stable surface is highly recommended. At a minimum, *A Guidebook for Student Pedestrian Safety* recommends that shoulders that are part of a designated school walk route be minimum 5 feet wide (8 feet preferred) and be provided on both sides. If a shoulder can only be provided on one side, provide a minimum of 8 feet in width to allow students to walk off the roadway in either direction. Although this is not the most desirable solution (shoulder on only one side), it is better than a scenario where there are no pedestrian travel areas at the roadside. This guide recommends that shoulder use for pedestrian travel be considered as only an interim solution until separated walkways or sidewalks can be developed along roadways leading to the school. Refer to Figure 37.

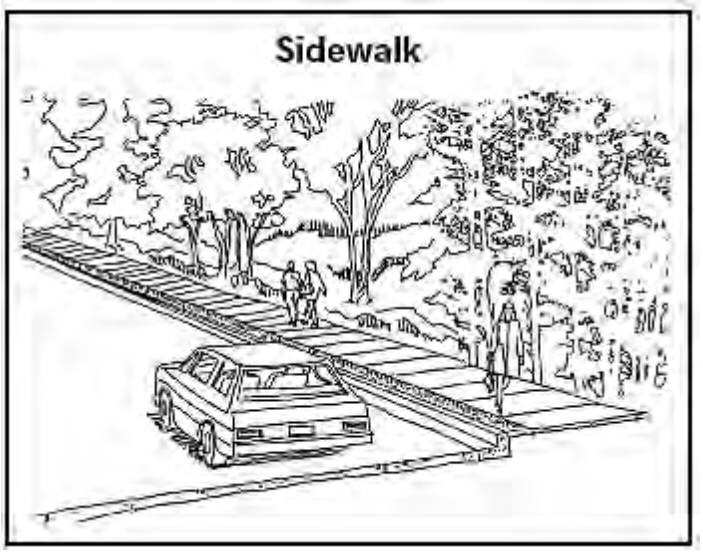

Figure 36

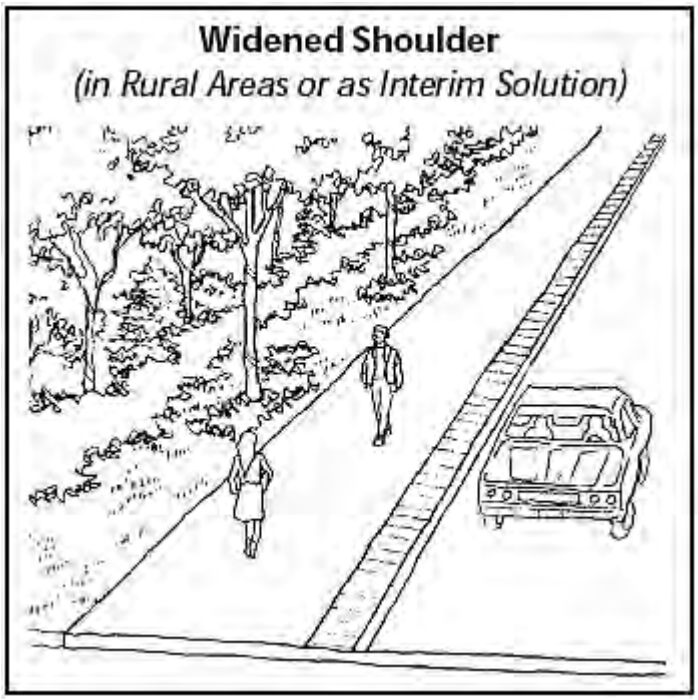

Figure 37

Design standards for shoulders vary among jurisdictions. Consider using contrasting materials, e.g. asphalt roadway with concrete or crushed rock shoulders, for better visibility. In rural areas, rumble strips should be milled between the traveled way and the outside edge of the shoulder as long as an FHWA-recommended minimum of 48" contiguous space remains after milling the rumbles. (Note that under operations, debris will accumulate starting approximately 12" from the edge of the traveled way, and increasing farther from the traveled way. Regular sweeping may be required by the local jurisdiction to keep such a shoulder usable, particularly by bicycles.) Check with your local agency for specific standards that may be applicable to your project. For more information related to the design of sidewalks, walkways, and shoulders, refer to Toolkit Section 5.

Along roads with adequate shoulders, children should be generally directed to walk on the left shoulder facing oncoming traffic. However, children may walk on the shoulder on the side with the flow of traffic for a short distance to or from school if such action reduces the number of road crossings they must make.

School Bus Stop Design

Bus stops need to be adequately designed to provide sufficient waiting area away from the roadway for the number children using the stop. In urban areas, bus stops are often designed and constructed as part of private development projects. In rural areas, bus stop locations often consist of a widened shoulder area adjacent to the roadway. Figures 38 and 39 illustrate two typical designs for school bus stops – one for areas where sidewalk either exists or can be constructed, and one for areas where widened shoulders function as the pedestrian travel zone. Check with your local agency and school district for specific design practices that may be applicable in your area.

Students need to be able to travel safely to and from the bus stop.

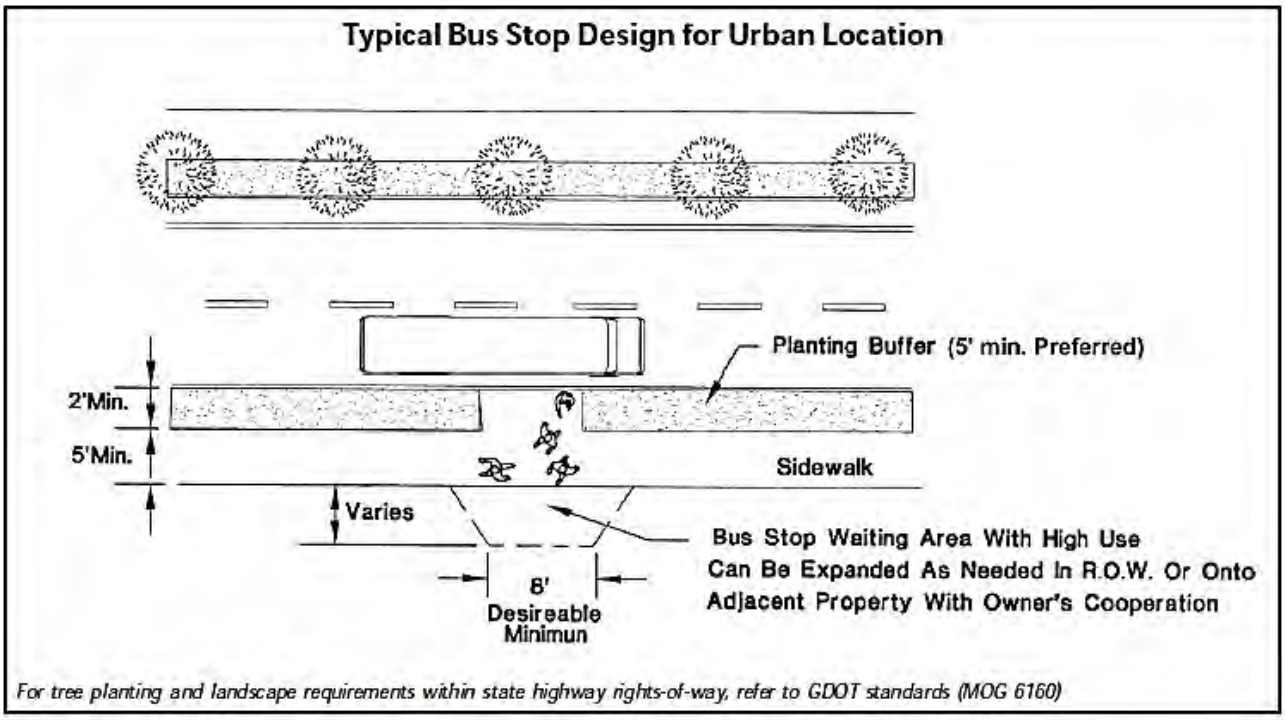

Figure 38

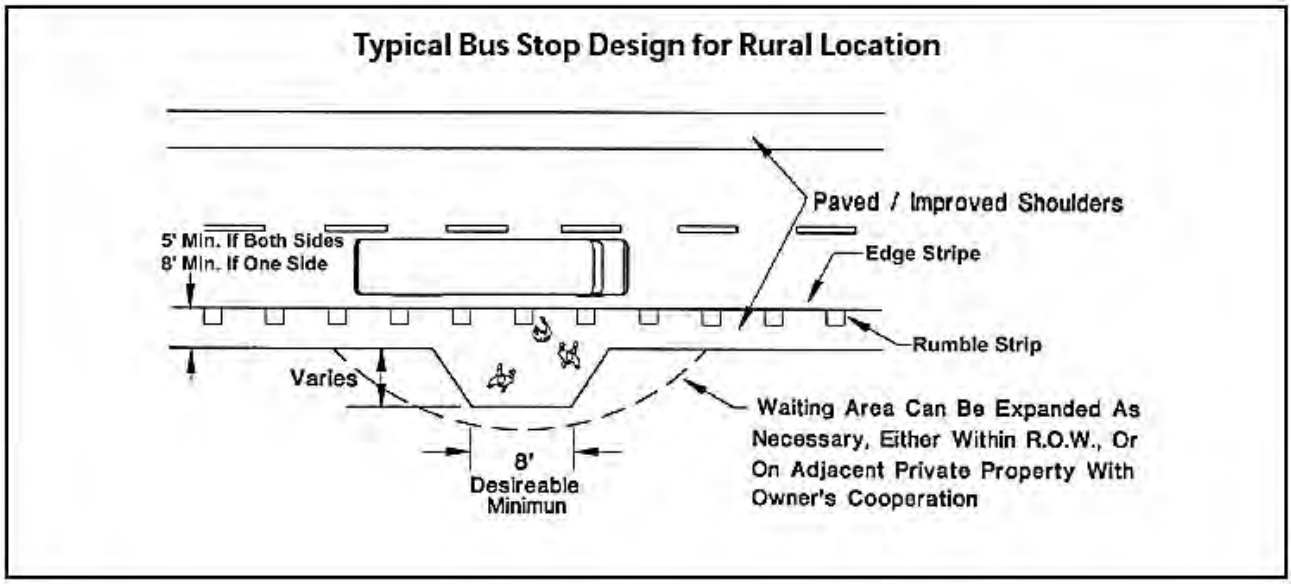

Figure 39

Visibility at Crossings and Along School Walk Routes

Children are smaller than adults and more difficult for motorists to see at crossings. To function safely, crossings should provide an unobstructed visual field between motorists and pedestrians. Certain obstructions such as street lights, mailboxes, and telephone booths should not hide the pedestrian from view. Landscaping can enhance the pedestrian environment and trees can provide shade and shelter from wind and weather. However, care must be taken to select lower growing shrubs that won't block views of pedestrian. A maximum shrub height of 2 feet is suggested for school zones. Trees along streets should be upward branching, with lower branches located at least 6 feet above ground.

Parked vehicles (even momentarily) are also visual obstructions, especially for children, wheelchair users, and people of small stature. For recommended setbacks for parked vehicles near pedestrian crossing points, refer to Toolkit 6 - Intersections.

Traffic Control and Crossings Near Schools

Special considerations related to various types of crossings and traffic control methods used near schools are described in the next part of this section of the guide. More specific design information related to traffic control and crossing treatments can be found in Toolkits 6, 7, and 8.

General Considerations

Traffic control related to schools is a sensitive and controversial subject. The methods used to protect children as they walk to school need to be carefully considered and analyzed by traffic engineering professionals on a case-by-case basis before solutions are implemented.

According to the Institute of Transportation Engineers (ITE) manual, *Design and Safety of Pedestrian Facilities*, the majority of drivers do not typically reduce their speeds in school zones unless they perceive a potential risk, such as the presence of police or crossing guards, or clearly

visible children. Overuse of signs and other devices can cause drivers to be less responsive and attentive. Unnecessary installation of traffic controls lessens the respect for warranted traffic controls. Placement of signs, crossing treatments, and traffic control devices need careful consideration.

According to the ITE's *School Trip Safety Program Guidelines*, a number of elements should be studied to determine the appropriate types of crossing treatments and traffic control in school zones or along school walk routes, including, but not limited to:

- existing and potential traffic volumes and speeds,
- inventory of existing traffic control devices and roadway facilities,
- adequacy of gaps in the stream of traffic,
- numbers and ages of children crossing (pedestrian volumes and characteristics),
- adequacy of sight distance,
- collision statistics, and
- location of the school and relationship to surrounding land uses (both existing and planned).

These elements should be considered under the direction of a professional traffic engineer and the results reviewed with the local public works agency, as well as a safety advisory committee established by the school district. There are many variables related to these elements and how they might influence design treatments.

Types of Traffic Control and Crossing Treatments

There are several types of crossing treatments and traffic control devices that may be appropriate in school zones and along school walk routes under varying conditions. Crossing treatments are usually necessary at locations where adequate gaps are not currently available in vehicular flow to allow school children to cross safely. Table 28 lists potential types of traffic control and crossing treatments that may be implemented near schools. Each of these treatments is summarized below. More detailed design information for most of these can be found in other sections of this guide. Check with your local agency to determine the accepted practices for your specific project.

Potential Traffic Control and Crossing Treatments Near Schools
• Reduced speed zones (see discussion below) • Traffic calming techniques • Marked crosswalks at intersections and mid-block • Stop controlled crosswalks • Signalized crossings (with pedestrian actuators) • Flashing beacons (check with your local agency) • Grade separated crossings • Crossing guard or school patrolled crossings • Signing and marking

Table 28

Reduced Speed Zones

The school zone speed limit is typically a minimum of 10 m.p.h. less than the immediately adjacent posted speed limit, and a maximum of 20 m.p.h. less than the immediately adjacent posted speed limit. This speed limit is usually required to extend 300 feet in either direction from the school and from marked crosswalks near the school. A lower maximum speed limit may be established within a school zone or other area whenever the local jurisdiction determines that on the basis of an engineering and traffic investigation, the maximum speed permitted is more than is reasonable and safe under existing conditions. Consider reducing the speed limit in school zones where special hazards exist and a traffic engineering study determines that such a speed reduction is warranted. Georgia law says speed limits in school zones cannot be reduced by more than 20 m.p.h. and cannot be less than 25 m.p.h. on state routes.

Traffic Calming

Traffic calming techniques are used to slow vehicles and to reduce non-local through-traffic. Various techniques can be used on all classifications of roadways, but traffic calming is generally very effective on local access streets in residential areas.

On street systems surrounding schools and in school zones, traffic calming can be an effective means to create a safer and more comfortable environment for children walking to school. Some examples of traffic calming techniques that may be appropriate include raised crossings, refuge islands at crossings, traffic circles, chicanes, bulb-outs, narrower streets, on-street parking, trees and landscaping along the right-of-way, and gateways. Speed enforcement and speed watch programs are also good methods for calming neighborhood traffic in school zones, although their effectiveness may only last for a limited time, unless consistently implemented. Refer to Toolkit Section 8 for more specific design recommendations related to traffic calming.

Marked Crosswalks

The issue of providing marked versus unmarked crosswalks at intersections is often debated. For a discussion on studies related to the effectiveness of marked and unmarked crosswalks, refer to Toolkit Section 6 — Intersections.

All crossing points within school zones and along school walk routes, typically within 1 mile of a school site (but may include intersections and crossings outside of this distance), should be evaluated to determine where to mark crosswalks. *The Manual on Uniform Traffic Control Devices* (MUTCD), requires crosswalks to be marked at all intersections on established routes to schools:

- where there is measurable conflict between vehicles and kindergarten or elementary students (while crossing),
- where students are permitted to cross between intersections, or
- where students could not otherwise recognize the proper place to cross.

Marked crosswalks are often located at signalized and stop controlled intersections or mid-block crossings. They may also be located at intersections or locations where traffic volumes warrant the need for pedestrian signals using the MUTCD guidelines, but none are provided. Marked crosswalks may be provided at other locations when a traffic engineering analysis determines the need.

School patrolled crossings (with either student patrollers or adult crossing guards) should not be operated unless proper traffic control devices are in place. At a minimum, these devices shall consist of school crossing warning signs (S1-1), marked crosswalks, and school speed limit signs (R2-1). GDOT discourages mid-block crossings on state routes. For design considerations related to the various types of crosswalk markings, refer to Toolkit Section 6 - Intersections.

A school patrolled marked crosswalk

Stop Controlled Crosswalks

Stop controlled crosswalks, consisting of stop signs and stop bars, with or without actual crosswalk markings, provide the added protection of having all vehicles stop at the crossing. Since vehicles must stop at the stop signs in these locations, there is typically less need for paid adult crossing

guards or student patrols. Additional protection with crossing guards and/or student patrols may be necessary at intersections where pedestrian volumes are high and traffic volumes are moderate or higher.

Signalized Crossings (With Pedestrian Actuators)

New traffic signals should provide marked pedestrian actuation buttons and symbolic "walk/ don't walk" indicators. It is appropriate to install signals at locations other than signalized intersections for pedestrian crossings. Examples include frequently used mid-block crossings and crossings to school sites.

The MUTCD defines warrants for installation of traffic signals at school crossings. The MUTCD recommends that a traffic engineering study be conducted to determine the frequency of gaps in the vehicular traffic stream that allow pedestrians to cross. When crossing gaps are less than one per minute and of insufficient duration to allow a given size of group to cross, a signalized crossing may be needed.

Provide pedestrian signal indications and push buttons at signalized school crossings and mark the designated crosswalks. For a complete discussion on signal placement and design, refer to the MUTCD.

The services of a school patrol program (adult crossing guard or student patroller) may not be necessary at all signalized intersections near the school unless special problems exist. School patrol services can provide additional protection at intersections where pedestrian volumes are high and traffic volumes are moderate to high. See the discussion under School Patrolled Crossings for appropriate locations for adult crossing guards versus student safety patrollers.

More information related to intersections, crossings and signalization can be found in Toolkits 6 and 7.

Flashing Beacons

Flashing beacons are common devices used in school zones, and they come in varying styles (mounted to school speed limit signs, and overhead crosswalk signs). The effectiveness of flashing beacons is an often debated issue. The flashing light alerts drivers in advance to the potential of pedestrians without forcing them to stop. Some studies indicate that after drivers have become accustomed to seeing the beacons in advance of conditions that do not appear to be truly unusual, they stop paying attention to the flashing light. This can result in a disregard for all beacons, even those that are truly needed (Flashing Beacons, Association of Washington Cities and County Road Administration Board).

Flashing Beacon

Flashing beacons are most effective when used as a warning of truly unusual or hazardous conditions not readily visible to the driver, such as a stop sign located just beyond a curve that is hidden from view of the driver. It is a common practice for flashing beacons to be attached to school speed limit signs. These beacons are only activated during hours that students are present in the school zone. Flashing beacons are discussed under section 4E of the MUTCD relating to hazard identification beacons, and a mid-block crosswalk is one of the specific applications noted for this device. Please refer to the MUTCD for more specific guidance related to the use of flashing beacons.

Grade Separated Crossings

Grade separated crossings may be necessary to physically separate the crossing of a very heavy volume of school pedestrian traffic and a heavy vehicular flow, or where the roadway's cross section is exceptionally wide, such as freeways and principal arterials. Typical types of grade separated crossings include overpasses and underpasses. Because these facilities are costly in comparison to other crossing solutions, they should be considered only in areas where large numbers of pedestrians will benefit. Grade separated crossings need to be easily accessible and convenient to use or they may lose their effectiveness. Pedestrians may be tempted to try crossing at grade instead of using the overpass or underpass. For additional design guidelines related to grade separated crossings, refer to Toolkit Section 7 - Crossings.

Crossing Guard and Student Patrol Controlled Crosswalks

Some specific design considerations related to school patrolled crosswalks (adult crossing guard or student patrolled) have already been discussed under the various traffic control and crossing treatments in this section. Traffic engineering studies can determine the need for and placement of school patrols at crosswalks on a case by case basis. It is important to coordinate with local jurisdictions on the use of school patrollers.

Adult crossing guard at busy intersection near an elementary school.

The use of well-trained adult crossing guards is considered to be one of the most effective methods of school zone traffic control. Student safety patrollers, who are most often students at the school, can also provide supervision and direction at crosswalks near schools. Adult crossing guards can be appointed as members of the school patrol under certain conditions (see Table 29).

When to Utilize Adult Crossing Guards

- Lack of adequate gaps due to high volume of traffic
- When 85 percent of the traffic exceeds the speed limit by 5 mph
- When there is restricted sight distance
- When the location or distance from the school building is such that poor supervision of students would otherwise result
- When there is a high volume of traffic in a crosswalk
- When the location has been determined by either school or law enforcement authorities to be beyond the capacity of a student to make rational decisions concerning safety
- When there is an excessive volume of pedestrian traffic over a highway
- When any of the above criteria exists and there is a lack of an alternative school route plan

Table 29

Crossing guards should be hired employees, trained to work with children. Untrained or volunteer crossing guards may not be adequately prepared to assist children in emergency situations. Training for crossing guards includes making sure guards are in the proper location for maximum supervision of children and making sure guards interact with children to teach them the right techniques for crossing streets. Crossing guards should wear an easily identified uniform and carry identification and phone numbers for authority in case of emergencies.

Sometimes vehicular traffic is such that control by a police officer, adult school patrol member or a traffic signal is required. In this case, student school patrol members can assist by directing students to cross in conformance with the direction given by the police officer or adult patrol member, or in conformance with the time cycle of the signal. Student safety patrol members should typically be selected from upper grade levels, preferably not below the fifth grade. Student safety patrollers should not be directed or authorized to halt or direct vehicular traffic.

Their purpose is to supervise and assist children, not to control vehicular traffic. Table 30 describes the primary functions of student safety patrollers.

Primary Functions of Student Safety Patrollers
• Instruct, direct, and control students in crossing streets at or near schools • Assist teachers and parents in instructing school children in safe pedestrian practices
Source: A Guidebook for Student Pedestrian Safety

Table 30

Signing and Marking

Figure 40 shows typical signing for school area traffic control. Descriptions of the types of school signs authorized by the MUTCD and used by GDOT are discussed below and shown in Figure 41.

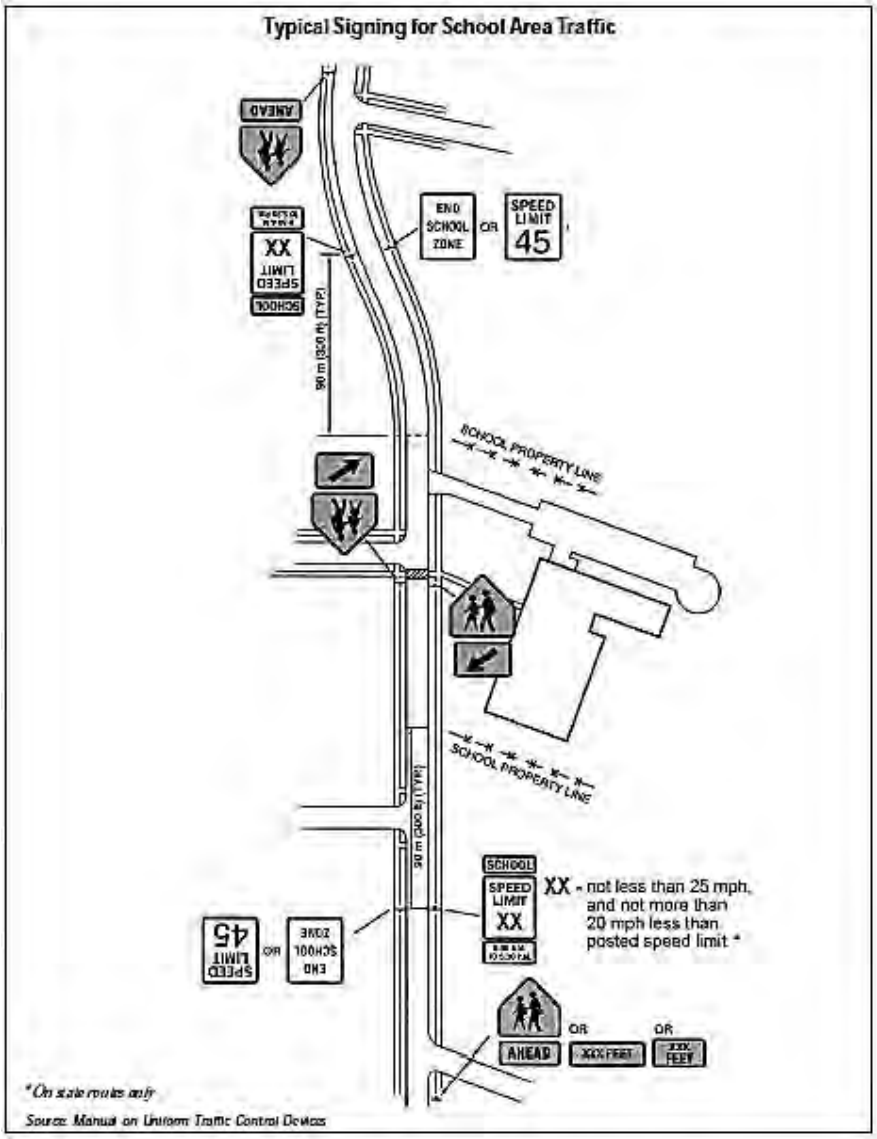

Figure 40

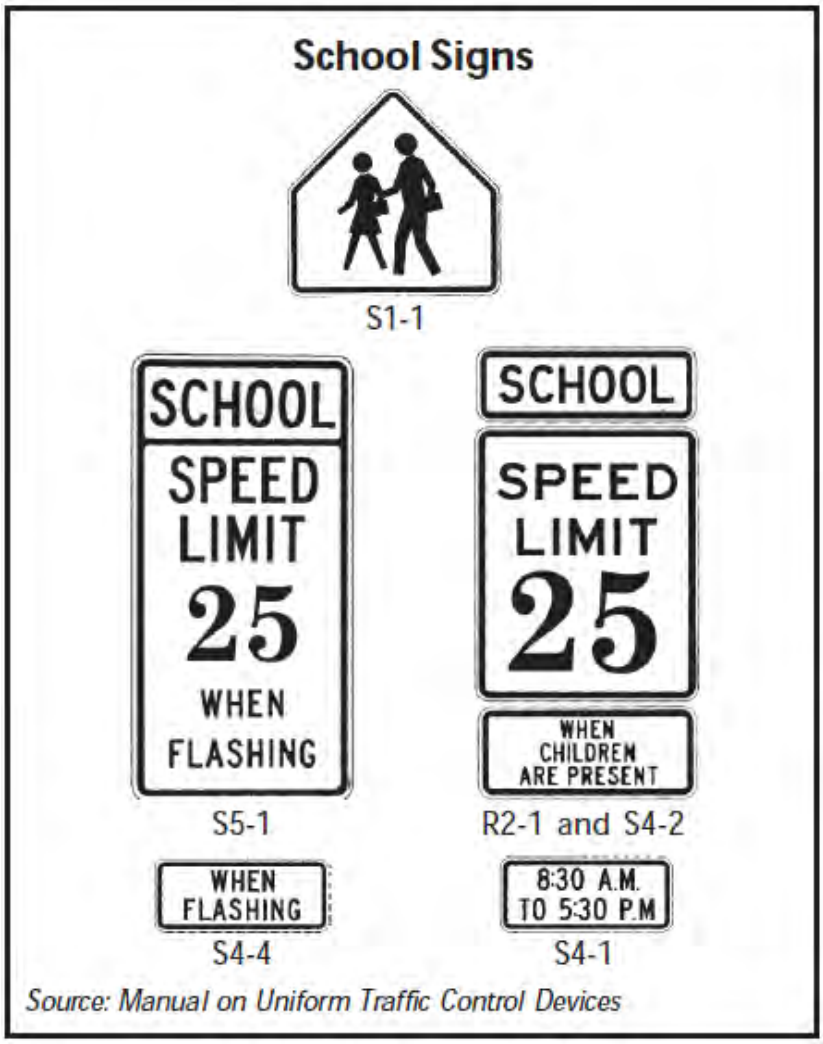

Figure 41

School Advance Sign (S1-1)

The School Advance sign is intended for use in advance of locations where school buildings or grounds are adjacent to the roadway. This sign can be supplemented with a diagonal downward pointing arrow (W16-7) to show the location of the crossing. The School Advance sign is placed not less than 150 feet in advance and not more than 700 feet in advance of the school grounds or school crossing.

School Bus Stop Ahead (S3-1)

School Bus Stop Ahead signs are intended for use in advance of locations where a school bus stop is not visible from 500 feet in advance. It is not intended for these signs to be placed everywhere a school bus stops, but only in locations where terrain or other features limit sight distance and there is no opportunity to relocate the stop to a more visible location.

School Speed Limit Signs (R2-1, S4-2, S4-1, S5-1)

School Speed Limit signs are used to indicate the speed limit within the school zone. School Speed Limit signs may be accompanied by signs that indicate applicable hours or conditions of speed limit reduction ("when children present"). A flashing beacon along with a sign "when flashing" may also be used to identify the periods when the school speed limit is in force. In Georgia, an advanced warning sign must be placed 700 feet in advance of the point at which the speed reduction is required, if the speed limit reduces by 20 mph (Code Section 40-6-183).

Overhead Crossing Signs

Overhead School Crossing signs are sometimes used at school crossings, but are not contained within the MUTCD and are considered to be extraordinary traffic control devices. These devices are only installed at locations where school authorities request supplemental traffic control for marked school crosswalks and only after a traffic engineering analysis considers other traffic control measures. When such signs are installed, they should include flashing lights that are on only at the time school children use the crosswalk. The school district should be responsible for ensuring that the flashing lights are on at the appropriate times. Flashing lights may be similarly used on School Speed Limit signs if installed in accordance with the MUTCD requirements.

School Zone Colors

GDOT has restricted the use of fluorescent yellow-green signage. This color of sign is to be used only in school zones, and when supplementing W11-1 and W11-2 signs (bicycle and pedestrian presence) with the AHEAD placard (W16-9p). It heightens driver awareness by placing an unexpected element (sign color) in their environment. Drivers who see the different colored signs then come to know that the different color represents a school zone, prompting them to look carefully for children as they are driving through. The mixing of standard yellow and fluorescent yellow-green backgrounds within one zone or area should be avoided.

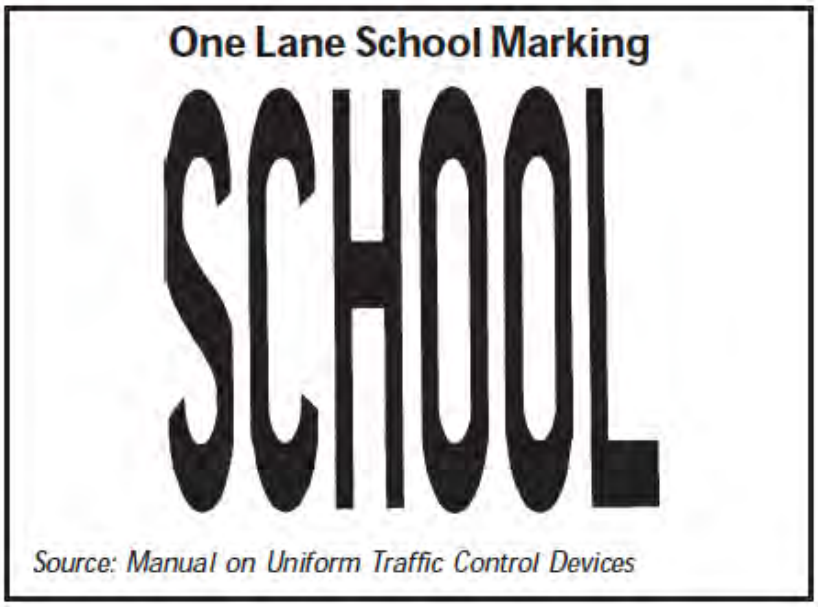

Figure 42

"School" Markings

The MUTCD allows word and symbol markings on the pavement for the purpose of guiding, warning, or regulating traffic. They are typically limited to not more than a total of three lines of words or symbols and are white in color. These types of markings are not used for mandatory messages except in support of standard signs. Figure 42 illustrates the school pavement marking design standard.

Other types of street crossing marking devices are discussed in Toolkit sections 6 and 7.

School Walk Routes and Safety Programs

School walk route plans are required by some states and local jurisdictions. It is recommended that the state, local jurisdictions, or school districts develop a plan for safe walk routes to school. Procedures for developing school walk routes are listed in Table 31. School walk route plans can be an important tool for communities. It can give parents and teachers assurance that these routes will be made safe for children's travel.

Once the school walk route has been established, pedestrian safety deficiencies along the walk route need to be identified, then remedial actions can be considered and implemented as funding becomes available.

Procedures for Developing School Walk Routes

1. Form Safety Advisory Committee (SAC)
2. Prepare base maps
3. Inventory existing walking conditions
4. Inventory traffic characteristics
5. Design the walk routes
6. Prepare the draft walk route maps
7. Review the route maps with the SAC
8. Have route maps approved by the school board
9. Distribute and explain the maps
10. Evaluate the program

Source: A Guidebook for Student Pedestrian Safety

Table 31

Educational Tools and Programs for Child Safety

Many tools currently exist that can help parents, teachers, and school officials assist in providing safe travel for children. These tools demonstrate that child pedestrian travel is a national issue. Below are some of the tools available.

- Kids Walk-to-School, A Guide to Promote Walking to School – a document to promote walking to school produced by the Center for Disease Control and Prevention
- Walk to School Day – an event devoted to encouraging walking to school and recognizing the need to create safe walking communities for children, initiated by the Partnership for a Walkable America. www.walktoschool-usa.org/
- National Kids Safety Campaign – a resource available to the community to help prevent child injuries, including pedestrian collisions. Brochures such as "Safe Kids are No Accident" are available to teach children how to become responsible pedestrians. www.safekids.org
- Way to Go School Program – a Canadian program committed to providing resources to school communities to develop traffic safety awareness programs and to increase the opportunities for children to walk, bike, or rideshare to school. www.waytogo.icbc.bc.ca

Ongoing Maintenance

The school district and school site officials are responsible for providing ongoing maintenance of pedestrian facilities and traffic control elements on the school site. This includes sidewalks within the right-of-way adjacent to the school site. Public and private property owners are typically responsible for repairs and reconstruction of the sidewalk within the street right-of-way adjacent to their property. Local jurisdictions are responsible for maintaining facilities and traffic control elements at intersections and mid-block crossings. On an annual basis, before the opening of school each year, elements that affect pedestrian travel in the area of the school should be inspected. Some of the things to look for include:

- Signs that are clearly visible and easy to read (paint has not worn off; tree branches are not in the way)
- Traffic control devices, signals, and actuators that function properly
- Sidewalks and walkways that are clear of obstruction; bikeable and walkable shoulders that are reasonably free of debris; pavement that is smooth
- Crosswalks and pavement markings that are clearly visible
- Pedestrian visibility that is not compromised by overgrown landscaping, parking, signs, fencing, or other obstacles at intersections, crossings, and along walkways

Other Sources of Information

For more specific design guidelines for various pedestrian facilities that may be developed within the vicinity of schools, refer to the other toolkit sections of this guide, including Toolkit 2 - Accessibility, Toolkit 4 - Trails and Pathways, Toolkit 5 - Sidewalks and Walkways, Toolkit 6 - Inter sections, Toolkit 7 - Crossings, and Toolkit 8 - Traffic Calming.

The following sources are recommended for design recommendations and other information related to pedestrian facilities for children and school zones. Please see the Resource Guide included at the end of this guide for complete bibliography information.

A Guidebook for Student Pedestrian Safety, Final Report, KJS Associates Inc., MacLeod Reckord, and Educational Management Consultants

Childhood Injury Prevention, A Directory of Resources and Program in Washington State, Washington State Department of Health

Design and Safety of Pedestrian Facilities, A Proposed Recommended Practice of the Institute of Transportation Engineers, ITE Technical Council Committee 5A-5

Elementary School Catalog, AAA Foundation for Traffic Safety

Florida Pedestrian Planning and Design Guidelines, University of North Carolina

Guidelines for the Installation of Crosswalk Markings, Steven A. Smith and Richard L. Knoblauch

Handbook for Walkable Communities, Washington State Pedestrian Facilities Planning and Design Courses, Dan Burden and Michael Wallwork, PE

"*Make Their First Steps Safe Ones*," Robert B. Overend

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Chapter 7. Toolkit 4 – Trails and Paths

This Toolkit Section Addresses:

- *Trails and Paths Across Multiple Jurisdictions*
- *Regional Connectivity*
- *Accessibility of Trails and Paths*
- *Special Considerations for Shared Use Paths*
- *Recommended Dimensions*
- *Paving and Surfacing*
- *Grades, Cross Slopes, and Drainage*
- *Shoulders, Side Slopes, and Railings*
- *Connections and Crossings*
- *Managing Motor Vehicle Access*
- *Vegetation and Landscaping*
- *Seasonal and Nighttime Use*
- *Maintenance*
- *Other Sources of Information*

Trails and paths provide recreational opportunities as well as increased transportation choices.

This section provides design recommendations related to various types of trails and paths that are independently aligned and not typically located parallel to streets or within road rights-of-way. These types of facilities are generally found within areas such as open spaces of planned residential communities and subdivisions, abandoned railroad rights-of-way, utility easements, parks and greenways, campuses, private developments, along waterfronts, and in other settings.

Trails and paths commonly serve a variety of pedestrians, including commuters, school- children, neighborhood residents, and recreational users such as joggers and skaters. Some trails are designed to also serve bicyclists. Trails that are designed primarily for a recreation experience and

for walking speeds are called “recreation trails.” Paths that are designed for transportation purposes and can comfortably accommodate bicycle speeds are called “shared use paths.”

Trails and Paths Across Multiple Jurisdictions

When a trail or path crosses over boundaries of multiple jurisdictions (state, county, and city rights-of-way, parks, and railroads), cooperative coordination between jurisdictions for the planning, design, operation, and maintenance of the facility is essential. Communities can benefit from working together to coordinate improvements and linkages for region-wide nonmotorized systems.

Regional Connectivity

Trails and paths can enhance pedestrian mobility and regional connectivity. When well planned, designed, and maintained, trails can provide convenient routes of travel within communities, linking popular origins and destinations such as parks, schools, and community centers. Trails are not typically an adequate substitute for a full system of on-street nonmotorized improvements. Rather, they serve as important linkages in the overall nonmotorized system.

Silver Comet Trail is a regional trail spanning 57 miles in Polk, Paulding, and Cobb counties.

Accessibility of Trails and Paths

Trails and paths provide important outdoor recreational opportunities and transportation alternatives for everyone. It is always the best design practice to provide pedestrian facilities that are accessible, including trails. At least one travel route, located entirely within the site boundary, must connect public transportation stops, accessible parking spaces, passenger drop-off and loading areas, and public streets or sidewalks with the accessible entrance to the site and primary developed activities and elements (buildings, shelters, restrooms, and programs). To the maximum extent feasible, the accessible route must coincide with the route for the general public.

If the recreational trail or path is not functioning as an accessible route of travel between buildings and facilities and cannot be designed to be fully accessible due to topography or other physical site constraints, it may be exempt from some of the design requirements related to the Americans with Disabilities Act (ADA). Check with your local agency, GDOT, and federal agencies such as the US Architectural and Transportation Barriers Compliance Board (Access Board) and FHWA to determine if your project is eligible for certain exemptions from the ADA design provisions.

Even though full compliance with the ADA design provisions may not be required, trails should be designed to provide accessible recreation experiences for everyone to the maximum extent possible. An accessible spur trail that extends off the main trail to a special point of interest, or sections of trail that serve varying levels of ability are examples of accessible recreation experiences that can be provided when it is not feasible to develop the entire trail as an accessible route. Figure 43 illustrates an accessible trail.

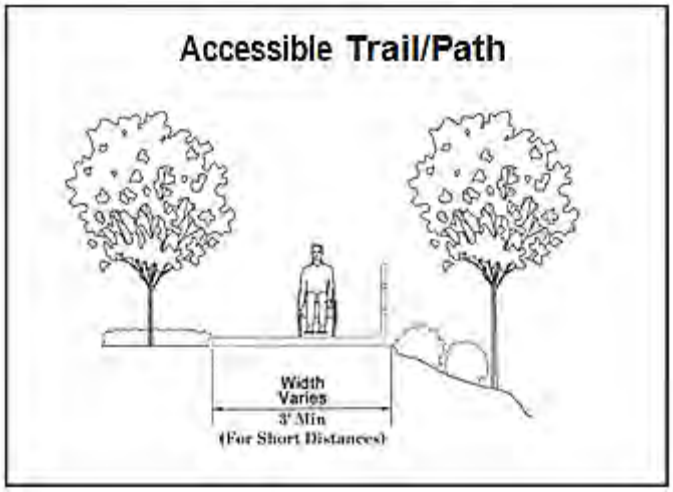

Figure 43

For more accessibility design guidelines and information related to the ADA, refer to Toolkit 2 - Accessibility.

Multiple Levels of Accessibility

Recreation trails (and in some cases shared use paths) are commonly designed to provide experiences for differing levels of accessibility. The levels of accessibility served may depend on the setting. In urban parks and open spaces, a full range of accessible recreation opportunities, including trails that provide easy access, are typically expected by the general public. In rural and primitive areas, full accessibility is not generally expected, and trails that serve varying levels of accessibility are commonly provided. Some trails may serve as accessible, while others may have steeper gradients and unpaved surfaces. Individuals are then free to choose a trail that provides the recreation experience and degree of challenge that they desire.

A recent publication of the FHWA, Designing Sidewalks and Trails for Access: Part II, Best Practices Design Guide, provides excellent information on trail design to accommodate a variety of users with disabilities. Universal Access to Outdoor Recreation: A Design Guide, developed by the PLAE and the USDA Forest Service, provides extensive design guidance related to outdoor recreation trails. It includes a recreation trail rating system and suggests that trails be signed to indicate the level of accessibility: easy, moderate, and difficult (see Figure 44).

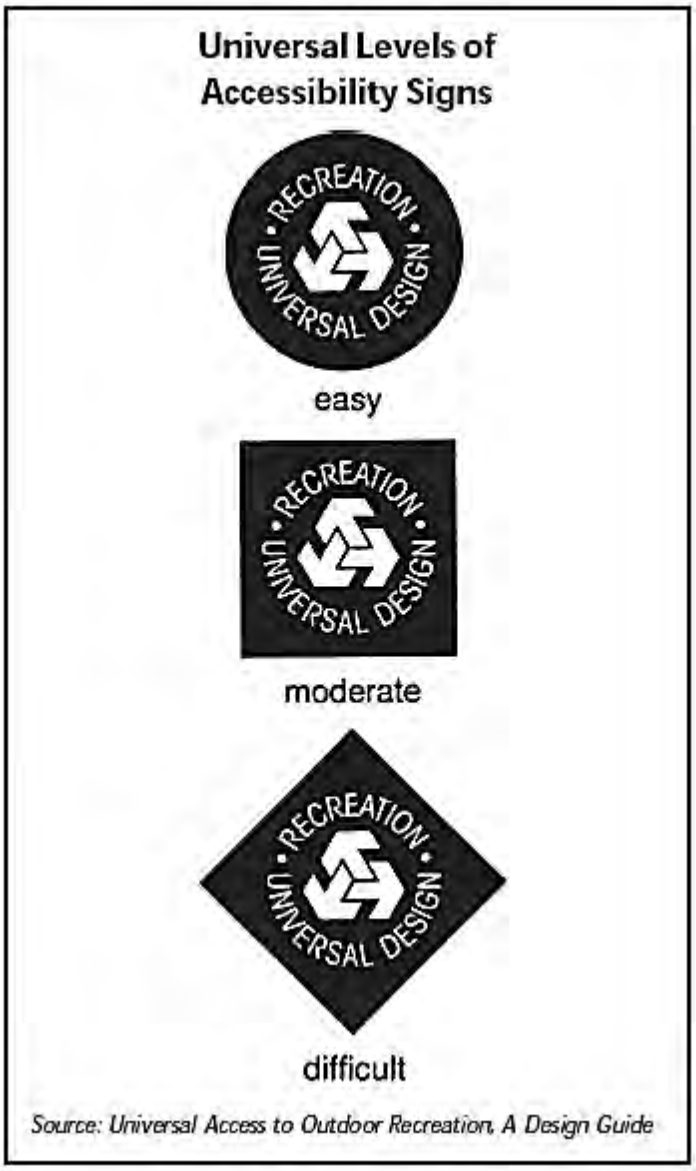

Figure 44

The design guide contains design guidelines for trails classified as easy, moderate and difficult. There are several other sources of information available for trail design. See the list at the end of this Toolkit section for other good sources.

Trails and paths serve a wide variety of users.

Special Considerations for Shared Use Paths

There are a few special considerations for the planning and design of shared use paths – multi-use trails that are designed primarily for a transportation function serving pedestrians and bicyclists. Design of shared use paths needs to carefully consider the various skill levels, experience, and characteristics of the different users.

Minimizing Conflicts Between Trail Users

The mix of pedestrians and bicycles on a shared use path is not always a desirable situation due to the high potential for conflict. Paths heavily used by commuting bicyclists present problems for families on recreational strolls. Children are particularly at risk on shared use paths because they tend to travel at slower speeds than the average bicyclist and their movements are unpredictable. They may change direction unexpectedly in front of an approaching bicyclist. Conflicts between bicyclists and pedestrians can be avoided by designing the path to separate them.

When paths must be shared by pedestrians and bicyclists, they need to be designed in accordance with applicable standards (refer to GDOT and AASHTO design requirements).Adequate visibility and sight distance is crucial. Design treatments that help to improve shared use paths so that they are safer for use by everyone include:

- Horizontal and vertical alignment to ensure clear lines of sight for pedestrians and bicyclists
- Wide shoulders, 2 feet minimum on each side, to provide stopping and resting areas and allow for passing, and widening at curves
- Avoidance of view obstructions at edges of the trail by placing signs, poles, utility boxes, garbage cans, benches, and other elements away from the edge of the path and using low-growing landscaping or high-branching trees
- Use of bicycle speed limits

- Use of delineation and separation treatments (see Table 32)
- Use of directional signing
- Signing and marking (refer to the *Manual on Uniform Traffic Control Devices*); a 4-inch wide centerline stripe may be considered for shared use paths with heavy volumes of pedestrians and bicyclists, on curves with restricted sight distance, and on paths where nighttime use is expected (see Figure 45); edge lines can also be beneficial on paths experiencing nighttime use

If a shared use path must accommodate a higher number of users, it needs to be as wide as possible with a desirable paved width of 12 feet or 10 feet minimum, and 2-foot wide shoulders on both sides (see Table 34, Recommended Dimensions). Figure 46 illustrates a typical shared use path shared by pedestrians and bicyclists.

A separate, soft-surface jogging or equestrian path may be constructed using wood chips, compacted crushed gravel, or other suitable material, parallel to but separated from the paved path (see Figure 47).

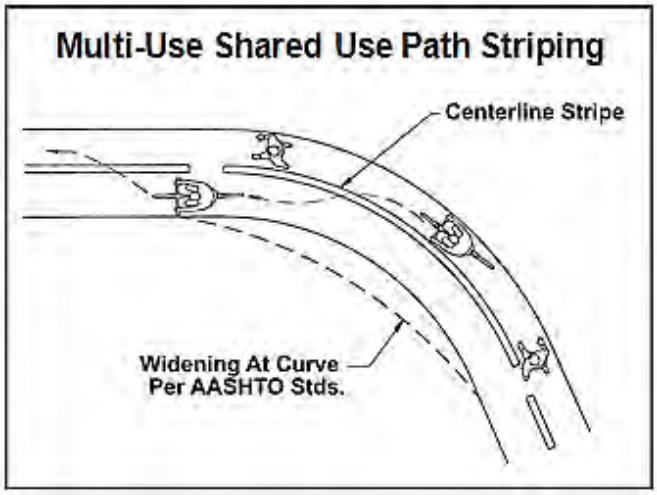

Figure 45

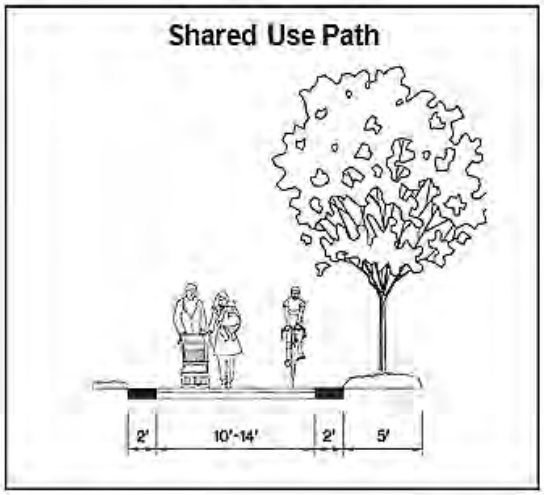

Figure 46

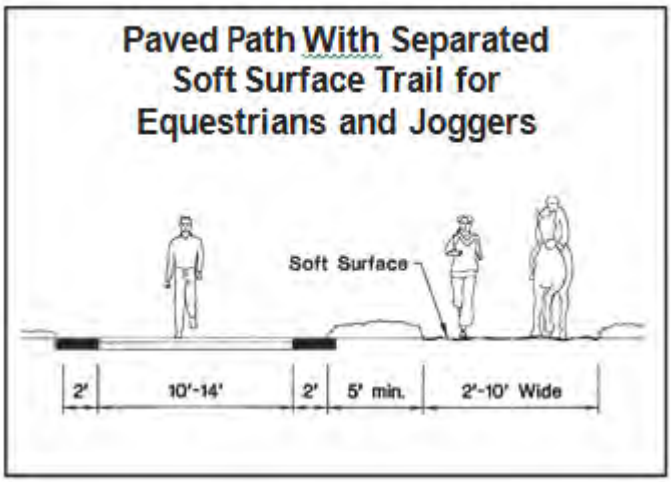

Figure 47

Some special delineation treatments that can be implemented to help minimize conflicts between pedestrians and other trail users are listed in Table 32.

Shared Use Paths Next to Roadways

Shared use two-way paths aligned along a street often do not function well due to problems related to bicycle use. For example, on a shared use two-way path, some of the bicyclists will be travelling against the normal flow of motor vehicle traffic, which is contrary to the rules of the road.

Conflicts at intersections and driveways are a major concern on paths adjacent to roadways. Motorists will often not notice bicyclists coming toward them on the right, since they do not expect to see them travelling against the flow of traffic. Additional problems are listed in the AASHTO *Guide for the Development of Bicycle Facilities*.

Shared use paths placed next to roadways can lead to hazardous conditions.

Delineation/Separation Treatments for Shared Use Paths
• Colored paving • Signing • Textured paving or paving patterns* • Pavement markings — symbols or words (slip resistant finish) • Striping with education program about trail use and other measures** • Combinations of two or more of the above • Raised pavement markers are not an acceptable method of delineation for trails shared with bicyclists, but some textured surfaces are acceptable; check with your local agency. *** Striping is most helpful on curves and other areas where sight distances are decreased, but when used, it should include a public education program to help trail users understand what the striping means and remind them of trail use etiquette (see Figure 30).*

Table 32

The feasibility of developing a shared use pedestrian and bicycle path within the right-of- way and adjacent to a roadway should be carefully considered. The following conditions should exist before determining that a shared use path within the right-of-way is necessary:

- The path can be separated from motor vehicle traffic. AASHTO standards require a minimum horizontal separation of 5 feet or a physical barrier, as illustrated in Figure 48.
- Development of bike lanes and sidewalks as an alternative to the shared use path would not be a feasible alternative. (Bike lanes and sidewalks typically take up less space than shared use paths within the right-of-way and allow bicyclists to travel with the normal flow of traffic.)
- There are no reasonable alternative alignments for bikeways and sidewalks on nearby parallel routes.

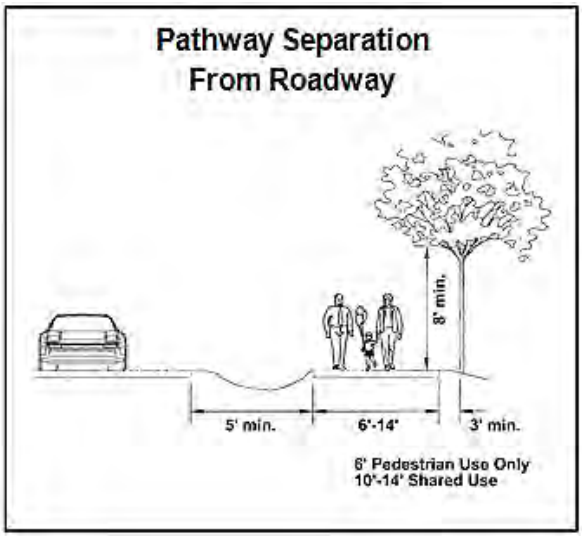

Figure 48

- There is a commitment to provide a continuous nonmotorized system throughout the corridor.
- Bicycle and pedestrian use is anticipated to be high.
- The path can be terminated onto streets with good bicycle and pedestrian facilities, or onto another safe, well designed path at each end.
- Potential driveway and intersection conflicts can be minimized or mitigated.
- There are popular origins and destinations throughout the corridor (schools, parks, and neighborhoods).
- The path can be constructed wide enough to accommodate all types of users, with delineation and separation techniques to minimize conflicts between users - 12 feet desirable, 14 feet optimum.

When there is no feasible alternative to locating a two-way shared use path within the roadway right-of-way, adequate separation is required. The wider the separation dimension, the better. Recommendations for separation treatments are provided in Table 33.

Separation Treatments for Shared Use Path Next to Roadway
• 5 feet minimum width of separation, should include path shoulders
• If less than 5 feet, a concrete barrier divider, wall and/or railing a minimum of 3.5 feet high is required by AASHTO.
• Landscaped or natural vegetation to provide buffer from noise and splash of vehicles and/or
• Drainage ditch or swale with maximum 1:3 side slopes at edge of 2-feet wide shoulder

Table 33

Recommended Dimensions

Design dimensions for trails can vary depending on the type of facility, levels of use they receive, and the setting in which they are located. Table 34 lists recommended dimensions for various types of trails. “Recreation trails” refers to trails that are designed primarily for a recreation experience and for walking speeds. “Shared use paths” refers to trails that are designed for transportation purposes and can comfortably accommodate bicycle speeds.

Paved pedestrian-only trails can provide access through parks and neighborhoods.

Recommended Dimensions for Trails and Paths

Trail/Pathway Element	*Recommended Dimensions*	*Comments*
Recreation Trails		
Paved Pedestrian-Only Trail Width	5 ft minimum 6 ft desirable	These trails are for exclusive use by pedestrians (see Figure 34).
Unpaved Pedestrian-Only Trail Width	2 ft minimum 4-6 ft desirable	Best as limited purpose facility in rural or semi-primitive areas; can provide interim solution (see Figure 35); minimum width should only be used in constrained areas.
Unpaved Shared Use Trail Width	6 ft minimum 8-10 ft desirable	Only suggested as an interim solution and not appropriate for high use trails; best in rural or semi-primitive areas (see Figure 36).
Pedestrian Mall/Corridor (Urban) Width	10 ft minimum 12 ft desirable 15 ft optimum	Pathways in urban areas or those that receive heavy use should be wide enough to accommodate several people walking side-by-side or groups of people walking in opposite directions.
Vertical Clearance	8 ft minimum 10 ft desirable	Additional clearance improves visibility. Ten feet is minimum when equestrian use is expected.
SHARED USE PATHS		
Shared Use Path Width	10 ft minimum 12 ft desirable 14 ft optimum	Minimum width should only be used where volumes are low and sight distances are good; width should be based on relative speed of users; higher speed users bicyclists and skaters) require greater widths.
Roadway Separation	5 ft minimum	Minimum separation for parallel, adjacent path; a physical barrier should be installed where minimum separation cannot be met.
Shoulders	1 ft minimum (peds. only) 2 ft minimum (shared use)	Shoulders provide pull-off/ resting and passing space; should be graded to the same slope as the path; minimum shoulder width of 1 ft should only be used in constrained areas.

Clear Zones	1 ft minimum* 2 ft desirable*	Clear zones are additional lateral clearance on each side of the path beyond the shoulders. All obstructions (e.g. trees, signs, etc.) should lie outside of the clear zones.
Vertical Clearance	8 ft minimum 10 ft desirable	Additional clearance improves visibility.

* If less than 1.2 m (4 ft) total lateral clearance is provided (including shoulder) between the edge of trail, and there is a vertical grade drop greater than 0.8 m (30 in), steeper than 2:1, railing may be required. See discussion later in this toolkit section.

Table 34

Pedestrian-only paved paths are typically found in parks or in neighborhood open spaces (see Figure 49). Unpaved pedestrian-only and multi-use paths are also found in parks and open spaces, as well as in undeveloped and natural areas. Unpaved trails are best used for areas with low use and limited purposes or as interim solutions until they can be fully improved (see Figures 50 and 51).

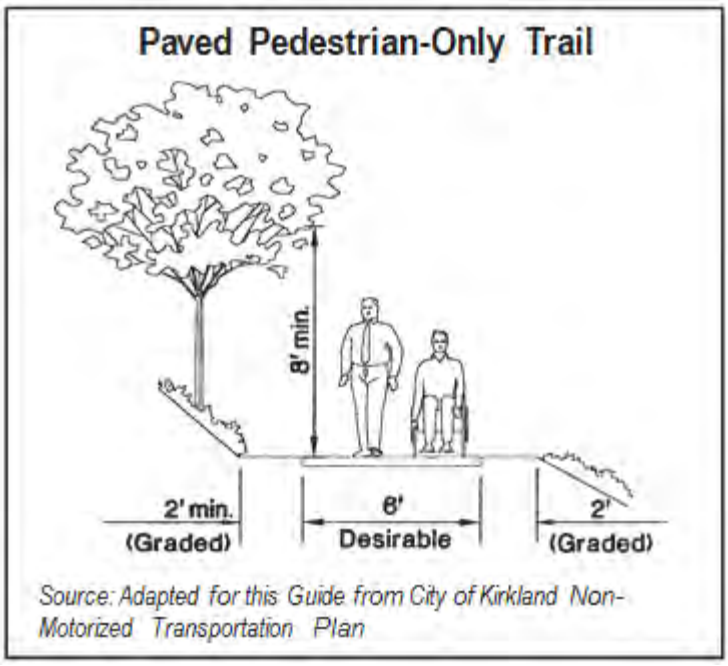

Figure 49

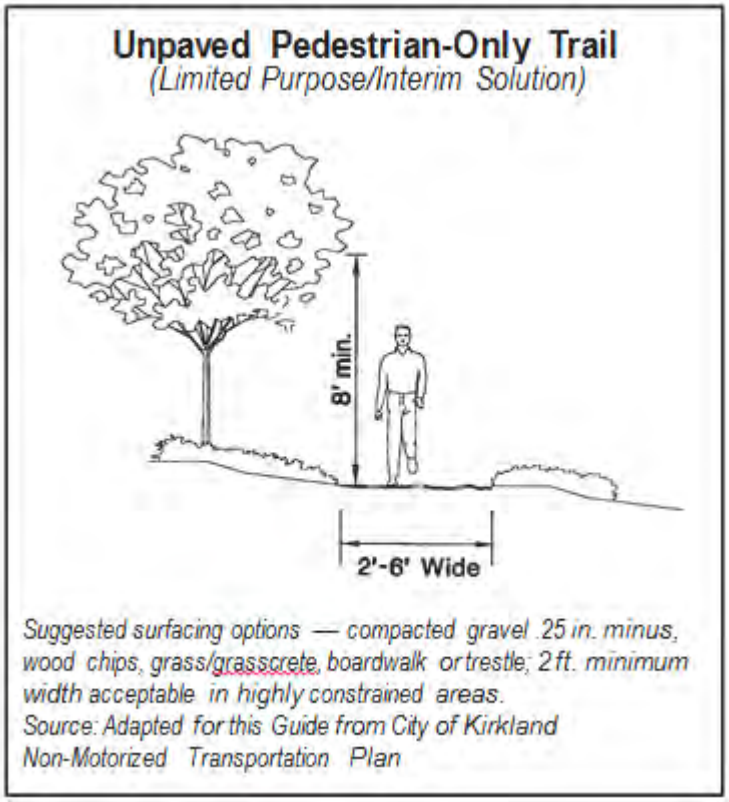

Figure 50

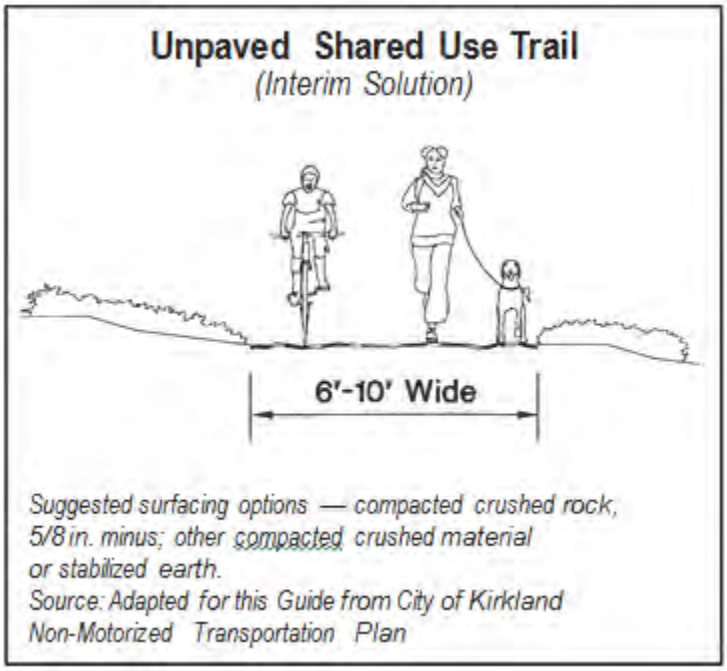

Figure 51

The recommended dimensions in Table 34 for shared use paths are based on AASHTO's *Guide for the Development of Bicycle Facilities*. Refer to this document for further details and background on the standards.

Paving and Surfacing

When selecting paving and surfacing materials, long-term durability, safety, accessibility, cost, and maintenance are usually the most important criteria.

In general, surfacing materials for trails in urban areas should be paved or consist of other hard-surfaced materials. Recreational trails in rural semi-primitive settings can be constructed of materials that blend with the natural setting.

Shared use paths shared by pedestrians and bicyclists function best when constructed of a smooth, paved, all-weather surface such as asphalt or concrete, regardless of the setting.

All paths and trail materials need to provide a firm, stable, and slip-resistant surface throughout the primary seasons of use. A good sub-base, such as compacted aggregate material or fully compacted native soil (if structurally suitable), is also important for structural support of multi-use trails.

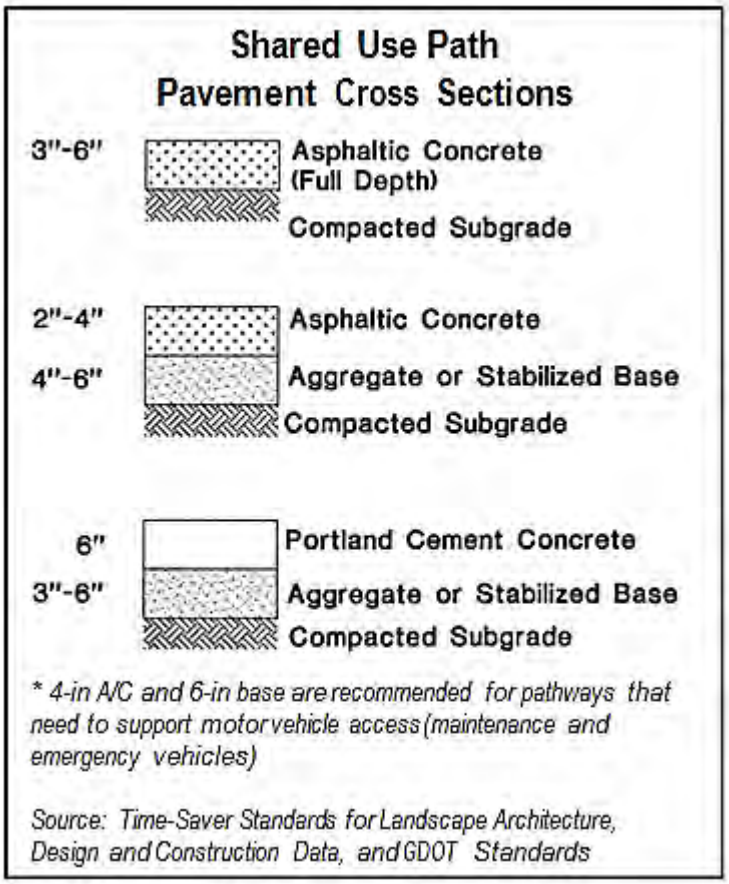

Figure 52

Recommended pavement cross sections are illustrated in Figure 52. Check with local standards to determine specific pavement design requirements for your project. Pavement conditions should be checked periodically for potholes or cracks, with repairs when necessary to maintain a smooth surface.

Grades, Cross Slopes, and Drainage

Trails and paths can be designed and constructed with various grades, depending on the level of accessibility being served, as discussed previously in this Toolkit section. Longitudinal grades on paths and trails should be kept to a minimum, especially on long inclines. Grades greater than 5 percent are typically undesirable. Where steep terrain exists, grades of 5 to 10 percent can be tolerated for short segments less than 500 feet. The design speed should also be increased and additional trail width of 3 feet should be provided for maneuverability on grades exceeding 5 percent. Providing signs alerting users to the maximum slope and advising on a maximum speed are also good measures.

It is important to keep trails and paths free of puddles and water accumulations that could become slippery. Drainage systems must be designed in accordance with all applicable standards and regulations. Check with your local agency to determine drainage design requirements.

A 1:50 (2 percent) cross slope will facilitate adequate drainage on trails and paths. Sloping in one direction instead of crowning the trail is preferred and usually simplifies the drainage and surface construction. Ditches or swales should be provided where necessary to control runoff and provide water quality. Ditches function best on the uphill side of the trail to intercept drainage.

Drainage grates and inlets are best located at the outside edge of the trail or off the path entirely. Grid style grates are recommended over grates with parallel bars spaced at 0.5 inches maximum. Grates should be set flush, less than 0.5 inches below the surface of the surrounding pavement, with no raised edges.

Drainage systems should be maintained in good working order year-round, particularly in areas of heavy rainfall.

Shoulders, Side Slopes, and Railings

Recommended widths for shoulders at the sides of trails are provided in Table 34. In areas where there are side slopes or ditches, a minimum of 4 feet of clear, level area (including shoulder) is needed before the up slope or down slope (or ditch) begins. Ditches function best on the uphill side of the trail to intercept drainage.

Maximum side slopes of 1:3 are recommended. When the grade drops severely from the shoulder of a pedestrian or bike travel way, railings are required by most jurisdictions. When a vertical drop is more than 30 inches, exceeds a down slope grade of 1:2, and is located less than 4 feet from the edge of the trail, walkway, or sidewalk, railing needs to be installed along the extent of the grade drop. Figure 53 illustrates conditions where railing is required.

Railings are required by AASHTO to be a minimum of 3.5 feet in height adjacent to shared use paths. On paths, walkways, and sidewalks used exclusively by pedestrians, the railing can be a minimum of 3.5 feet high. If railings are adjacent to a vertical drop, consult the Uniform Building Code for requirements.

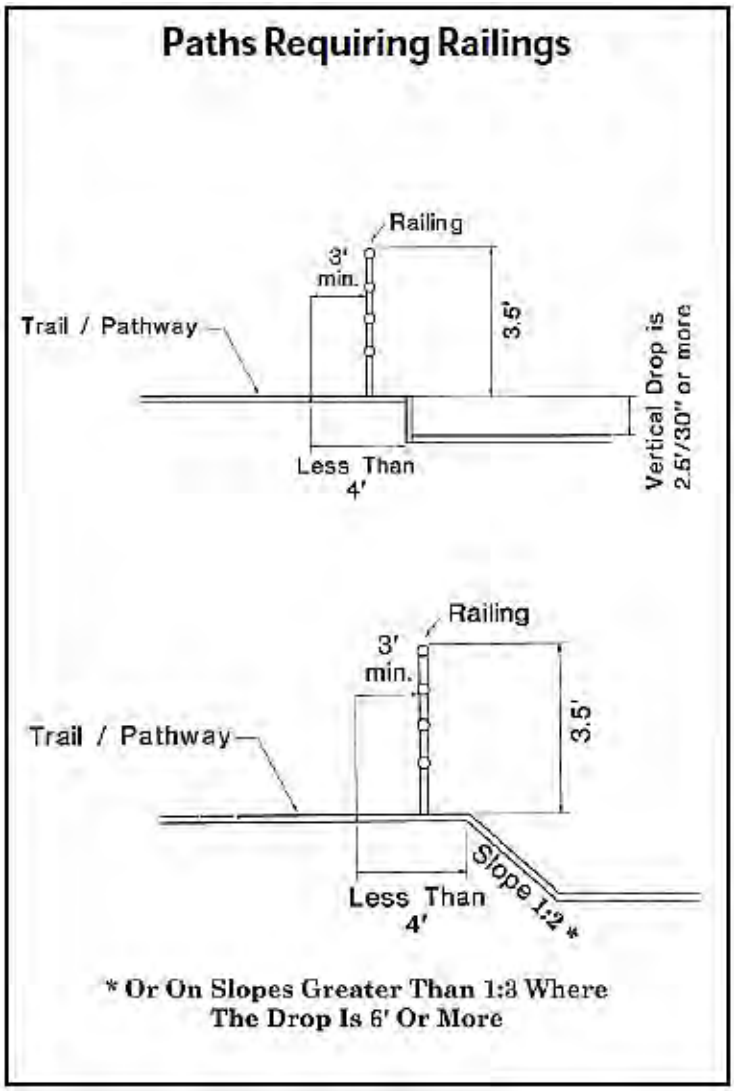

Figure 53

A maximum 1:3 slope is also recommended for steep side slopes on the uphill side of trails. It's best to avoid high retaining walls immediately adjacent to trails since they may be out of scale with creating a pedestrian-friendly environment. High walls should be terraced back from the edge of the trail shoulder. Blank walls should be screened with landscaping or designed with an attractive face or artwork.

Connections and Crossings

Initial planning of trail and path routes should minimize crossing points with roads and driveways as much as possible. Trails and paths should connect to street systems and destination sites in a safe and convenient manner. Connections should be clearly identified with destination and directional signing. Where a path that follows a given street encounters a cross street, the path crossing should utilize the normal pedestrian crosswalk and truncated dome, detectable warnings to delineate the street edge at the intersection of the streets. Where an intersecting path and street have orientations that are skewed, a realignment should be made that brings the angle at the

intersection as close to 90 degrees as possible. Crossings should be well- designed (see Toolkit 7 - Crossings).

Managing Motor Vehicle Access

As a general rule, separated trails and paths function best when motor vehicle access is prohibited or limited to maintenance vehicles for periodic inspection, sweeping, and repairs, utility vehicles, and emergency vehicles. The following design treatments are suggested for managing motor vehicle access on trails:

- Pavement cross-sections with sufficient base and thickness are necessary to support maintenance vehicles while minimizing deterioration. A 4- inch asphalt thickness over a 6-inch aggregate base is recommended.

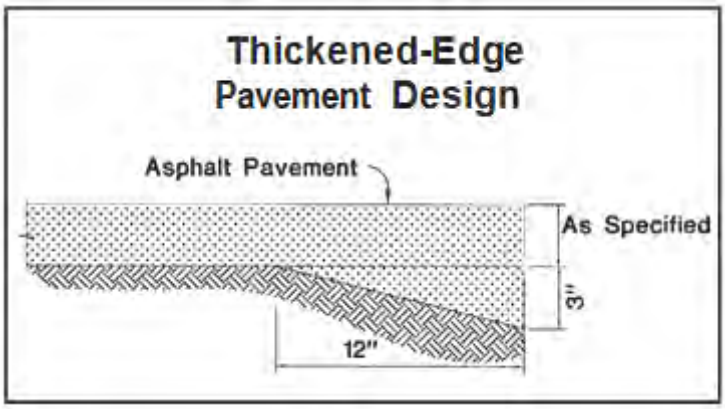

Figure 54

- Trail and path edges need to be designed with added thickness to support vehicle loads. See Figure 54 for thickened-edge pavement design.
- Access points can be provided from roadways for use by maintenance and emergency vehicles, but blocked from use by other motor vehicles with removable bollards or special gates (see Bollard Design and Placement).
- Gates or fencing at side entrances to the trail and path, can be specially designed to allow passage for pedestrians, wheelchairs, and bicyclists without providing an access point for motor vehicles.
- Signing can be installed to notify trail and path users that maintenance vehicles may be entering the system at the identified locations; temporary signs and markers need to be carried and placed at appropriate locations as warning devices during maintenance activities.

Bollard Design and Placement

When bollards are placed at trail and path entrances, marking them with bright colored reflective paint or emblems increases their visibility to pedestrians and bicyclists. The recommended minimum height for bollards is 30 inches.

Entrance Design to Restrict Motor Vehicles

Motor vehicles can be restricted from entering trails through the use of special design techniques, such as short curb radii or a split path configuration (see Figure 56). These techniques are most appropriate at locations where maintenance and emergency vehicles do not require access to the trail.

Bollards need to be adequately spaced to allow easy passage by bicyclists, bicycle trailers, and wheelchair users with one bollard in the center of the trail dividing the two-way traffic flow. If more than the center bollard is needed, other bollards should be placed outside the paved area at trail edges. Figure 55 illustrates suggested bollard placement for various trail widths.

Entrance Design to Restrict Motor Vehicles

Motor vehicles can be restricted from entering trails through the use of special design techniques, such as short curb radii or a split path configuration (see Figure 56). These techniques are most appropriate at locations where maintenance and emergency vehicles do not require access to the trail.

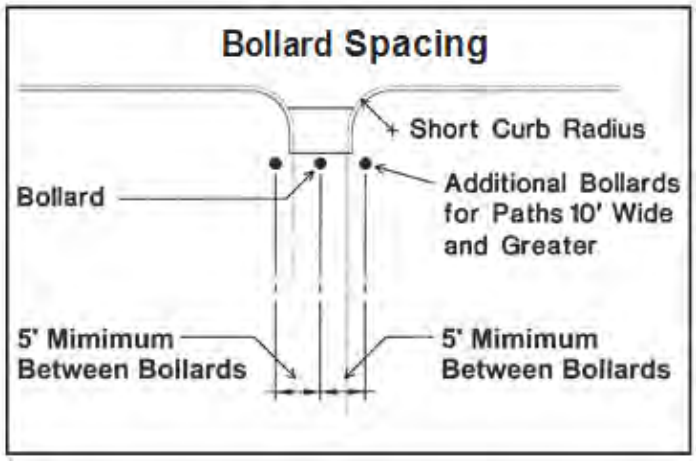

Figure 55

Bollards provide access control at points where pathways join or cross roads.

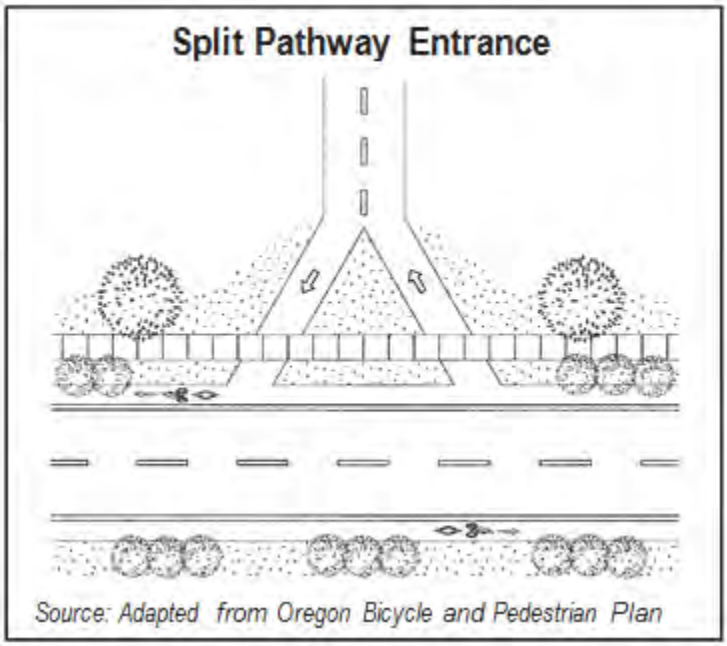

Figure 56

Vegetation and Landscaping

The primary objective of landscaping a trail or path area should be identified initially. If the objective is to provide screening, coniferous trees will provide year-round foliage. If the objective is trail user amenity, lining a trail with deciduous trees is a good measure because they will shade the trail during the summer and allow sun penetration during the winter.

Landscaping and trees placed along trails and paths need to be carefully selected to avoid the need for excessive pruning, cleanup of fallen fruit and debris, and watering, unless a fully automatic underground irrigation system can be installed. (Where irrigation cannot be installed, drought-tolerant and native species can be planted. Most landscaping, even drought-tolerant, needs some watering during the dry season of the first one or two years to become established.)

Some trees and shrubs (such as red maple or other shallow-rooted species) have a tendency to raise and buckle surrounding pavement areas. These types of trees and shrubs should be avoided near trails, or root barriers between trees and adjacent trails should be installed (see Figure 57).

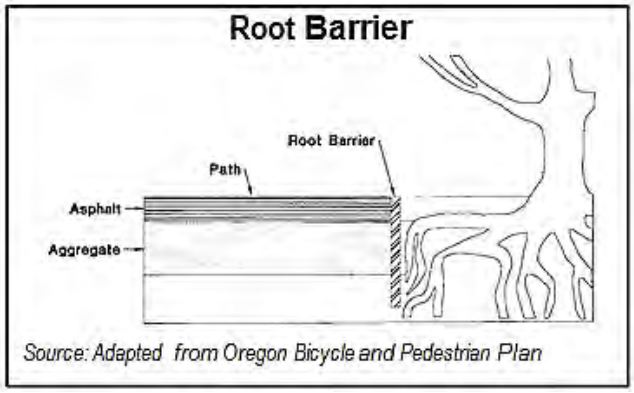

Figure 57

Seasonal and Nighttime Use

Trails and paths used regularly by pedestrians and bicyclists to move to and from origins and destinations within their communities year-round should be well maintained, with snow removal in areas of heavy snowfall, cleanup of fallen leaves and debris, and consistently functioning drainage facilities in areas of frequent rainfall.

When trails and paths are frequently used during nighttime hours, or during the late fall and winter when darkness occurs in late afternoon and early evening, lighting is an important consideration. Lighting should be designed according to applicable local standards, with consideration toward maximizing pedestrian safety and security while minimizing glare and obtrusiveness to surrounding neighborhoods.

Maintenance

Several suggestions have been provided throughout this section related to maintenance. It is important to establish a maintenance program at the time a project is developed to ensure that the trail will function properly over the long term. Maintenance activities should be scheduled during times of typically low trail use, if possible. Proper work zone signing is required by state and local governing laws and regulations whenever maintenance occurs on or adjacent to pedestrian travel ways.

Other Sources of Information

The following sources of information are recommended for design of trails. Please see the Resource Guide included at the end of this guide for complete bibliography information.

Designing Sidewalks and Trails for Access: Part Two— Best Practices Design Guide, Beneficial Designs, Inc. for U.S. Department of Transportation

Development Manual, Transportation Department, Parks & Community Services Department, City of Bellevue

Guide for the Development of Bicycle Facilities, American Association of State Highway and Transportation Officials

Handbook of Landscape Architectural Construction, Volume Two, Site Works, Maurice Nelischer

Oregon Bicycle and Pedestrian Plan, An Element of the Oregon Transportation Plan, Oregon Department of Transportation Bicycle and Pedestrian Program

Recommendations for Accessibility Guidelines: Recreational Facilities and Outdoor Developed Areas, Recreation Access Advisory Committee

Time-Saver Standards for Landscape Architecture, Design and Construction Data, Charles W. Harris, Nicholas T. Dines

Universal Access to Outdoor Recreation: A Design Guide, PLAE, Inc.

Trails for the Twenty-First Century, Rails-to-Trails Conservancy

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Chapter 8. Toolkit 5 – Sidewalks and Walkways

This Toolkit Section Addresses:

- *Determining When and Where Sidewalks and Walkways are Needed*
- *Sidewalks and Walkways in Various Settings*
- *Descriptions and Comparisons of Sidewalks and Walkways*
- *Location — Both Sides Versus One Side*
- *Accessibility*
- *Recommended Dimensions*
- *Passing, Waiting, and Resting Areas*
- *Grades, Cross Slope, and Drainage*
- *Side Slopes, Railings, and Walls*
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- *Sidewalks in Business Districts and Downtowns*
- *Shoulders as Walkways in Rural Areas*
- *Bicycles on Sidewalks*
- *Street Design Considerations*
- *Maintenance*
- *Other Sources of Information*

Pedestrian facilities addressed in this toolkit section include those located within street rights- of-way that are adjacent to or parallel with the roadway, such as sidewalks, walkways, and roadside shoulders used for pedestrian travel.

Sidewalks and walkways function as integral components of pedestrian-friendly street systems where pedestrians can experience safety, comfort, accessibility, and efficient mobility. Sidewalks and walkways increase pedestrian safety by separating pedestrians from vehicle traffic. Wide shoulders may be installed in some locations as an interim solution when it is not feasible to build a full sidewalk improvement. Table 35 lists priorities for pedestrians traveling along streets.

Priorities for Pedestrians Traveling Along Streets
• Safety and security • Efficient mobility • Defined space • Visibility • Accessibility • Comfortable/attractive environment

Table 35

Urban center with wide sidewalks.

Determining When and Where Sidewalks and Walkways are Needed

Research has documented that pedestrian travel increases in areas where more pedestrian facilities are available.

State and federal mandates to increase pedestrian travel and research findings that indicate pedestrian travel does increase when more pedestrian facilities are available, provide an important confirmation: There is a need to increase the general level of pedestrian facilities in our communities, including the available network of sidewalks and walkways. Even if there does not appear to be a current demand for pedestrian facilities, pedestrian travel can almost always be expected to increase when facilities are provided.

In recognition of this need, some accommodation for pedestrians should be provided along streets and roadways. It should normally be assumed that pedestrians will be present.

Some type of pedestrian travelway is recommended along all streets and roadways.

It is recognized that development of pedestrian facilities on all street systems will take time (particularly when retrofitting them into existing transportation systems). Realistically, cities, towns, and counties will gradually look for ways to add pedestrian facilities on a project-by-project basis, as funding and opportunities become available. To reach the overall goal of a more complete pedestrian travel network, local agencies often require pedestrian facilities to be constructed as part of private development projects as they occur. The community can then fill in missing links in the network through public funding and capital investment projects.

Table 36 lists criteria that can be analyzed to identify pedestrian safety deficiencies, as recommended by the Institute of Transportation Engineers (ITE).

ITE Criteria for Determining Pedestrian Safety Deficiencies

- Roadway and traffic control device inventory
- Sight distance studies
- The adequacy of gaps in the stream of traffic for pedestrian crossings
- Collision summaries and diagrams
- Conflict analysis
- Pedestrian volumes and characteristics
- Traffic volumes and speeds

Source: Design and Safety of Pedestrian Facilities, A Proposed Recommended Practice of the Institute of Transportation Engineers, ITE Technical Council Committee 5A-5

Table 36

Determining when and where sidewalks and walkways are needed is typically left up to the local jurisdiction. *A Policy on Geometric Design of Highways and Streets* (Design Book), by the American Association of State Highway and Transportation Officials (AASHTO) provides the following guidance:

- Develop sidewalks as integral parts of all city streets.
- If pedestrian activity is anticipated, construct sidewalks as part of street development.

- Give consideration to connecting nearby neighbor- hoods and urban communities with sidewalks, even though pedestrian traffic may be light.
- Sidewalks in rural and suburban areas are needed at schools, parks, local businesses, residential areas, offices, industrial plants, and other areas where pedestrians are present or anticipated.
- Traffic volume-pedestrian warrants for sidewalks along highways have not been established. In general, whenever the roadside and land development conditions are such that pedestrians regularly move along a main or high-speed highway, they should be furnished with a sidewalk or path area, as suitable to the conditions for safety.
- The higher speeds of traffic and general absence of lighting in rural areas reinforce the need for sidewalks. Available data suggests that sidewalks in rural areas reduce pedestrian/motor vehicle collisions.
- As a general practice, sidewalks should be constructed along any street or highway not provided with shoulders, even though pedestrian traffic may be light. Sidewalks built along rural highways should be completely separated from the traveled way by a ditch or as much space as available within the right-of-way. (Paraphrased from Chapter 4 of the Design Book, discussion on sidewalks.)

The AASHTO Design Book also contains pedestrian level of service criteria for measuring the capacity of existing pedestrian facilities to determine the need for improvements or expansions. If adequate capacity is not provided, pedestrian mobility may be seriously impeded. Refer to Chapter 2 of the Design Book for a description of this criteria, as well as other guidance for design of pedestrian facilities.

Sidewalks and Walkways in Various Settings

The design of sidewalks and walkways varies depending on the setting and the standards and requirements for those settings imposed by local agencies. Local and state agency criteria for sidewalks and walkways are typically included in street and roadway design standards.

Local agencies in Georgia can adopt varying design standards for urban and rural areas, as well as more specific requirements that are applicable to residential settings, downtowns, special districts, and other areas. (Check with your local agency to confirm the design requirements that may be applicable to your pedestrian project.)

The design guidelines throughout this guide, including the recommendations in this Toolkit, address solutions that are appropriate in various locations and settings (such as urban centers, neighborhoods, or rural areas). This information is provided to assist designers in determining the best type of sidewalk or walkway for the setting, which in some cases may require a variance from local and state agency standards currently in place.

An example of how the information in this guide might be helpful in justifying a variance from design standards:

> *The current adopted local agency design standard requires only a 5-foot wide shoulder along a rural roadway. Because there are schools, parks, and other pedestrian origins and destinations along this roadway route, traffic engineering staff or others (community groups,*

or private developers of a nearby subdivision) feel there is a need to develop a 6-foot wide sidewalk improvement along both sides of the roadway in this area. The information in this guide helps to explain why a full sidewalk improvement in this area is needed, and provides design guidance.

Local ordinances can also change to encourage more pedestrian-friendly sidewalk design. This could be done on a citywide level or through pedestrian-oriented districts. See Toolkit 1– General Design Guidelines for more information.

Descriptions and Comparisons of Sidewalks and Walkways

Sidewalks Defined

Sidewalks are typically constructed of concrete and are raised and located adjacent to curbs or separated from the curb by a linear planting strip. Sidewalk widths can vary, but typically they are a minimum of 5 feet wide (clear width) on local residential streets, and can be 6 to 15 feet, or sometimes wider, on collector and arterial streets, or in special districts.

Walkways Defined

In contrast to sidewalks, which are typically raised, walkways are usually built over the existing ground surface without being raised. Instead of vertical separation by curb and gutter, walkways are usually separated horizontally by a planting buffer or ditch. In some cases, extruded curbs or barriers are used to separate a walkway from adjacent street traffic (see Street Separation and Edge Treatments). Walkways are often constructed of materials other than concrete, such as asphalt or compacted granular stone or crushed rock. Some local agencies consider asphalt walkways as interim facilities in urban areas until full Portland cement concrete sidewalk improvements can be built. Check with your local agency.

Walkway separated from roadway.

An informal path created along a roadway may need more formal pedestrian improvements, especially in areas with bus stops.

Walkway width can vary, but the minimum recommended width in this guide is 5 feet, and the desirable minimum is 6 feet. When horizontally separated, the minimum separation distance between the edge of the street and a walkway is 2 feet, but 5 feet is recommended. The walkway appearance and alignment may be less formal in areas of low use or rural character with compacted crushed rock surfacing or other type of surface. These walkways need to meet ADA recommendations for firmness and slip resistance. Sometimes, natural paths are created as a result of frequent travel at the side of the roadway. These paths may suggest the need for more formal pedestrian improvements.

Roadside shoulders can serve as suitable walkways in rural areas if designed properly, especially if the alternative is no pedestrian travel area at all. Refer to the discussion later in this section for shoulder walkway design recommendations.

Location — Both Sides Versus One Side

In most cases, it is desirable to provide sidewalks on both sides of streets used by pedestrians. Pedestrians should always walk on sidewalks when they are provided in the right-of-way. Pedestrians are also encouraged to walk on the side of the roadway facing traffic. Providing sidewalks on both sides enables pedestrians to travel facing traffic in either direction, and minimizes the need for pedestrian crossing points.

A sidewalk on one side may be adequate for some local streets, especially when this improves a condition where there were no sidewalks previously.

Raised sidewalk in small town center.

Guidelines for New Sidewalk Installation

Roadway Classification and Land Use	Recommended Sidewalk/ Walkway Locations	Future Phasing
Highway (rural)	Min. 5-foot shoulder	Secure/preserve ROW for future sidewalks
Highway (rural/suburban) less than 1 dwelling unit (d.u.)/acre	One side preferred Min. 5-foot shoulder	Secure/preserve ROW for future sidewalks
Suburban Highway 1 to 4 d.u./acre	Both sides preferred. One side strongly recommended.	Second side strongly recommended if density becomes greater than 4 d.u./acre
Major Arterial (residential)	Both sides	
Collector and Minor Arterial (residential)	Both sides	
Local Street (residential) less than 1 d.u./acre	One side minimum Min. 5-foot shoulder	Secure/preserve ROW for future sidewalks
Local Street (residential) 1 to 4 d.u./acre	Both sides	
All Streets (commercial areas)	Both sides	
All Streets (industrial areas)	Both sides preferred	

Source: Designing Sidewalks and Trails for Access – Best Practices Design Guide, FHWA

Table 37

Several factors influence the decision of whether to place sidewalks, walkways, and widened shoulders on both sides or one side (and which side). These factors include the available space within the right-of-way, the existing physical limitations at the roadside, and which side of the street

origins and destinations (such as schools and bus stops) are located. Table 37, on the previous page, shows guidelines for new sidewalk installation according to the Federal Highway Administration (FHWA).

Accessibility

All sidewalks and walkways should be accessible and should comply with the ADA to the maximum extent feasible. Specific design recommendations for accessibility of sidewalks and walkways are provided throughout this Toolkit section. Also refer to Toolkit Section 2 - Accessibility for more information about the ADA requirements and their relationship to design of pedestrian facilities.

The Access Board recognizes that sidewalks are typically constructed to match the grade of the adjacent street, which often exceeds that allowed by the ADA. The Access Board recommends that every attempt be made to meet accessibility requirements within the public rights-of-way, particularly in new construction, but allows the sidewalk to follow the grade of the adjacent roadway.

Recommended Dimensions

In general, the width of a sidewalk or walkway needs to comfortably accommodate the volume of pedestrians normally using it. In high use areas, such as central business districts, sidewalks are generally 10 to 15 feet or wider to accommodate high pedestrian flows and to accommodate groups of people traveling in opposite directions. Conversely, when excessively wide sidewalks are located in areas where there are low pedestrian volumes, the expansive pavement and empty- looking sidewalks may seem uninviting to pedestrians. The area exclusively used by pedestrians on the sidewalk should be at least 5 feet, the amount of space for two people to pass one another. The desirable minimum width is 6 feet, since this creates a more comfortable width for two wheelchairs passing each other. Sidewalks should NEVER be less than 3 feet, the required amount for an accessible route (ADAAG 4.3.3, US Access Board, 1991). In 2001, the Public Rights of Way Access Advisory Committee recommended 5 feet as the minimum width for the pedestrian access route, with allowance for reduction to 4 feet for short distances. Signs and trees branches should not protrude into the vertical clearance area (below 80 inches) of the entire public sidewalk.

The spatial dimensions of people provided in the section of the guide called About Pedestrians can provide some insight into how wide a pedestrian walking area needs to be for a given number of people. The width of sidewalks and walkways provided may vary depending on pedestrian volumes, the roadside environment and land use setting, available space within the right-of-way, traffic characteristics, adjacent development, the characteristics of pedestrians using the facility, available funding levels, and local preferences.

Recommended dimensions for sidewalks and walkways along various types of streets are illustrated in Table 38. The table references common street system classifications and outlines the desirable and minimum dimensions recommended for sidewalks and walkways along each classification.

The dimensions listed in the table are guidelines. Dimensional requirements may vary within each local jurisdiction. It is necessary to consider each project on an individual basis to determine the best possible design solutions for pedestrians. For example, on a neighborhood collector that

provides a high volume of pedestrian access to a school, park, or other popular destinations, it may be desirable to provide wider sidewalks than recommended in the table.

Recommended Dimensions for Sidewalks and Walkways

Road Type	*Principal Arterial*	*Minor Arterial*	*Collector Arterial*	*Neighb. Collector*	*Local Residential*	*Commercial Access*
Right-of-Way	100 ft.	84 ft.	60 ft.	60 ft.	50-60 ft.	60 ft.
Width of Roadway	4 Lanes	4 Lanes	2 Lanes	2 Lanes	28 ft.+	44 ft.+
Sidewalk Widths						
No buffer						
Desirable	8 ft.	8 ft.	6 ft.	6 ft.	6 ft.*	6 ft.
Minimum	6 ft.	6 ft.	6 ft.	6 ft.	5 ft.*	6 ft.
With planting strip/buffer	6 ft.	6 ft.	6 ft.	5 ft.	5 ft.*	5 ft.
With street trees, no buffer	10 ft.	10 ft.	8 ft.	8 ft.	5 ft.*	5 ft.
Urban Center/Business District	10-15 ft.+	10-15 ft.+	Varies	5 ft.	5 ft.*	5 ft.
Planting Buffer Width When Used						
Desirable	5 ft.	5 ft.	5 ft.	5 ft.	5 ft.	5 ft.
Minimum	4 ft.	4 ft.	4 ft.	4 ft.	4 ft.	4 ft.

* Provide 6.5 ft. minimum if mailboxes or other obstructions are located within sidewalk, so that a minimum clear width of 5 ft. is provided.

Refer to local agency for specific design standards and requirements.

Source: This table was compiled from information in several documents (see Resource Guide)

Table 38

Passing, Waiting, and Resting Areas

Passing areas are required on all routes that are less than 5 feet wide. For more information, see Toolkit 2 - Accessibility.

Waiting and resting areas along walkways provide welcome relief to pedestrians, particularly those who have mobility impairments, or lack stamina. Figure 58 illustrates typical dimensions of waiting and resting areas adjacent to a walkway or sidewalk.

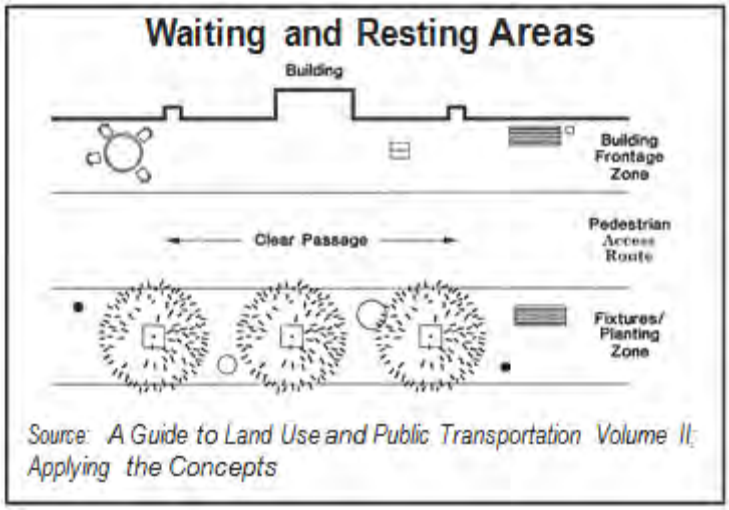

Figure 58

Grades, Cross Slope, and Drainage

Sidewalks and walkways should be designed with maximum grades of 5 percent (1:20) where possible. The ADA encourages all pedestrian travel ways to be designed to not exceed this maximum grade unless the adjacent road grade is steeper and there is no other alternative alignment for the walkway. Since sidewalk grades are generally designed to match the adjacent street system, it is recognized that in some cases it may be necessary to exceed this gradient where topographic conditions and other physical constraints are severe.

Sidewalks are typically constructed with a cross slope of 2 percent (1:50) maximum, which is also the maximum allowed for accessible routes of travel. The cross slope facilitates positive drainage toward the street or adjacent planting buffer.

Drainage grates are best located outside the route of pedestrian travel. If this is not possible, the grate (as well as manhole covers, hatches, vaults and other utility coverings) should not have openings greater than 0.5 inches in width and should be mounted flush with the level of the surrounding sidewalk surface.

Side Slopes, Railings, and Walls

The design of elements adjacent to sidewalks and walkways can affect pedestrian comfort and safety as much as the design of the sidewalks and walkways themselves.

Side slopes next to sidewalks and walkways should generally not be steeper than 1:3. A level area approximately 4 feet wide minimum is recommended for the sides of a sidewalk or walkway. When a vertical drop is more than 30 inches/2.5 feet, exceeds a down slope grade of 1:2, and is located less than 4 feet from the edge of the walkway, railing needs to be installed along the extent of the grade drop.

The recommended height for railings adjacent to sidewalks and walkways to provide protection from vertical drops is 3.5 feet. Railings adjacent to multi-use pathways are also recommended to be a minimum of 3.5 feet tall. For additional design recommendations related to railings, refer to Toolkit Section 4 — Trails and Pathways.

Vertical walls or retaining walls adjacent to sidewalks and walkways can be an imposing force on passing pedestrians. Avoid high retaining walls by terracing back on the slope with lower walls (when space is available in the right-of-way or can be obtained). Minimize blank wall faces and design wall with an attractive finish and texture or screened with trellises and climbing plants. Figure 59 illustrates suggested wall design treatments.

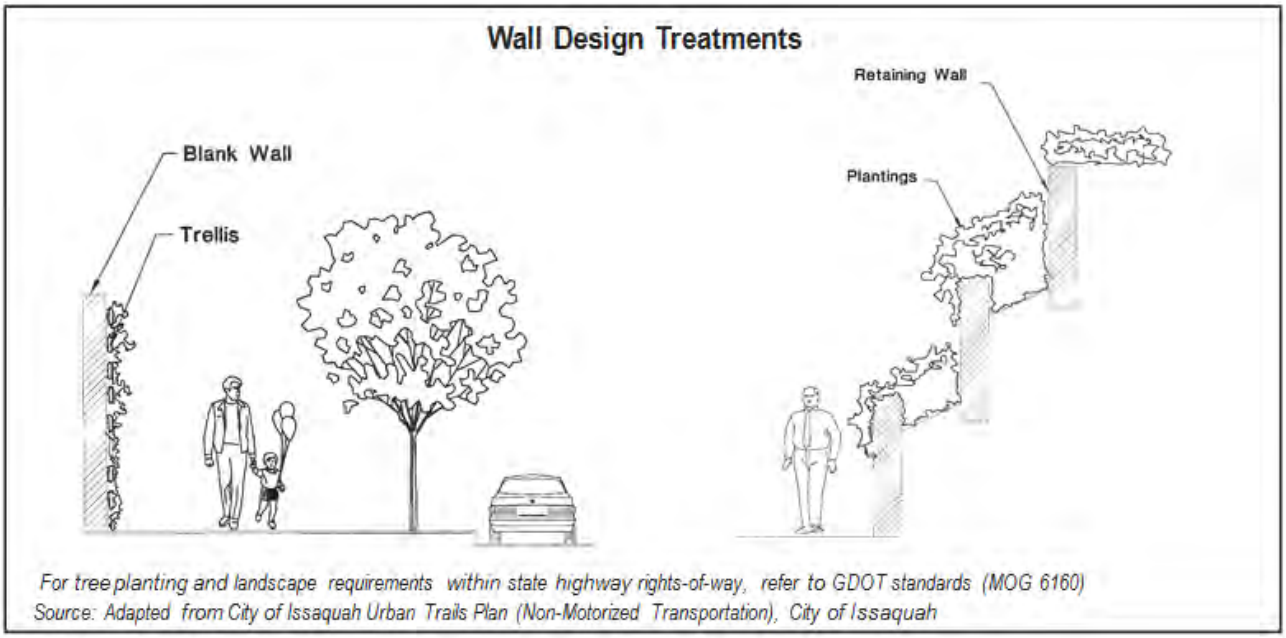

Figure 59

Surfacing

Any material used for sidewalks and walkways needs to be slip-resistant and easy to maintain (smooth for snow removal and able to resist buckling and cracking). Surfaces must be accessible, which is accomplished by meeting the “stable, firm, and slip-resistant” criteria of the ADAAG design guidelines.

Sidewalks and walkways in urban areas are typically constructed of Portland cement concrete (PCC), which provides a smooth, long-lasting and durable finish that is easy to grade and repair. Scoring patterns may be designed to match historic patterns within a neighborhood or district where appropriate.

Asphaltic concrete pavement (ACP) can be used as an alternative to PCC, but it generally has a shorter life expectancy (15 to 20 years versus 40 years for PCC). ACP is often used in low density residential areas or in less developed urban areas. Depending on the quality of design, construction, and drainage conditions, ACP sidewalks behind curbs sometimes tend to settle and wear down faster than PCC sidewalks. ACP is also more susceptible to deterioration by vegetation and requires more frequent maintenance. In areas, where walkways are aligned adjacent to shallow- rooted shrubs and trees, root damage to the pavement can result. Root barriers can provide an effective solution to this problem (see Toolkit Section 4 - Trails and Pathways).

Special paving should be smooth to accommodate all pedestrians.

Special districts and downtown streets often incorporate special paving into the design of sidewalks and pedestrian areas, such as stamped or colored concrete, brick, or other unit pavers.

Brick and unit pavers need to be installed to provide a smooth level surface. Special paving bands that contrast with the sidewalk surfacing can also be installed to alert pedestrians of upcoming driveway crossings or as accents along the sidewalk. Refer to local governing agency for current allowable material for sidewalks and walkways.

The PROWAAC *Building a True Community* report includes guidance for creating "reduced vibration zones" along accessible routes, including sidewalks and walkways. Refer to Toolkit 2 - Accessibility for more discussion.

In rural areas, alternative surfacing, such as compacted crushed rock or unpaved compacted earth, may also be acceptable for certain walkways. These surfaces are typically not accessible to people using strollers or wheelchairs unless very smooth and well-compacted or stabilized. Recycled pavement grindings can also provide an inexpensive surfacing material and are easy to grade (especially during the summer when the heat helps pack and bind the material).

Sometimes sidewalks and walkways within the right-of-way are constructed as boardwalks with wood decking, as structures over elevation drops or wet areas. Design considerations related to boardwalks and trestles are provided in Toolkit Section 7.

Street Separation and Edge Treatments

Planting Buffers

Sidewalks alongside roadways are often separated by planting strips consisting of natural vegetation or landscaping. Planting buffers (also referred to as planting strips, landscape strips or buffers, and nature strips) are generally considered to be a very effective separation treatment between walkways and streets in all types of settings. The added separation of a planting buffer helps a pedestrian feel more comfortable when walking along the street. Planting buffers can be landscaped in a variety of ways to aesthetically enhance the streetside environment. (Refer to Landscaping and Street Trees.)

Planting buffers can be raised and bordered by curbing, bermed, or developed at the same grade level as the roadway. It is recommended that planting buffers be a minimum of 5 feet in width where street trees are proposed. (Check with local or state agency.) In areas where there is limited space or right-of-way, the width of the planting buffer can be reduced to a minimum of 2 feet in width, or eliminated and provided again where there is more space or right-of-way available. Figure 60 illustrates a planting buffer between a sidewalk and street and Figure 61 illustrates a planting strip as an area for signs, utilities, and furnishings. Advantages and disadvantages related to the use of planting strips as a separation treatment next to walkways are listed in Table 39.

Walkway along suburban street with planting buffer.

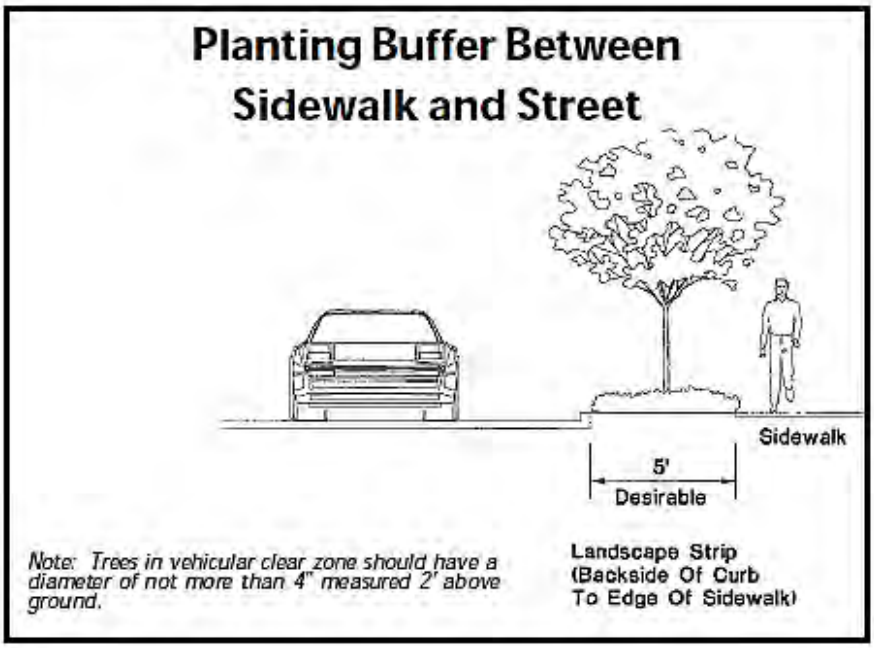

Figure 60

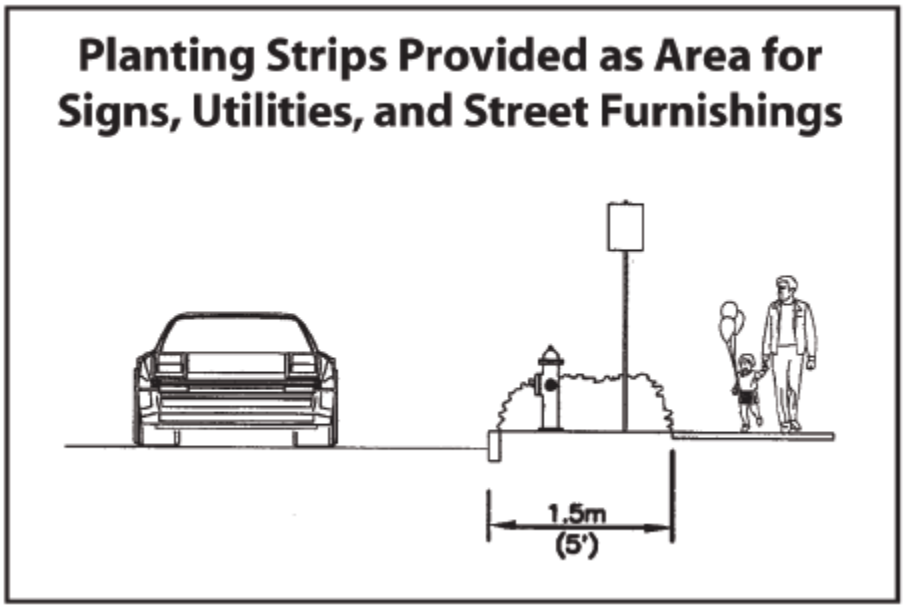

Figure 61

Advantages and Disadvantages of Planting Buffers
Advantages
• Separation between pedestrians and street traffic
• Sidewalk can be at a more constant grade across driveways, avoiding dipping at every driveway cut
• Area for drainage runoff and water quality treatment
• Space to locate street furniture, signs, mailboxes, parking meters and other elements outside the clear space of the walkway (see Figure 61)
• Aesthetic enhancement, increasing the appeal of the walkway and improving the pedestrian environment
• If wide enough, can be planted with larger trees that will provide shade and wind protection; 5 ft. minimum width recommended for tree planting
• Typically a lower cost solution for separation, if space is available
Disadvantages
• Maintenance is required, and varies depending on the type of landscaping selected
• If not designed and maintained properly, landscaping may hinder visibility and cause security problems
• Root growth can sometimes damage adjacent paved surfaces if not protected

Table 61

Clear Zone Considerations

AASHTO and GDOT (as well as most other state DOTs) have specific requirements limiting lateral obstructions that can be potentially dangerous to motorists who unintentionally leave the roadway. While planting buffers, poles etc. provide a level of perceived security to pedestrians, they need to be designed so that they do not create lateral hazards adjacent to the roadway. The relationship of speed and lateral separation between a tree and the edge of pavement or face of curb are critical considerations.

GDOT has issued specific guidance for placement of street trees behind curb and gutter within the right of way for speeds up to 45 mph. Where posted/design speeds are 35 mph or less, street trees, poles, and other street furniture should be located no closer than 4 feet from the face of curb. For posted/design speeds greater than 35 mph but less than or equal to 45 mph, street trees, poles and other street furniture should be located no closer than 8 feet from the face of curb. Refer to Figure 62 for specific dimensional requirements for street tree placement. Where the design speed or posted speed is over 45 mph, the clear zone should be determined from AASHTO guidelines in the AASHTO Roadside Design Guide, 2002. Keep in mind that some factors may require additional offset from the edge of roadway/face of curb. These factors which include additional analysis include accident experience (type, locations etc.) , number and location of driveways, type of adjacent development, on street parking, bike lanes, and available right of way widths. Also the necessary sight triangles for motorists and pedestrians at side streets and driveways should be examined and provided in the design.

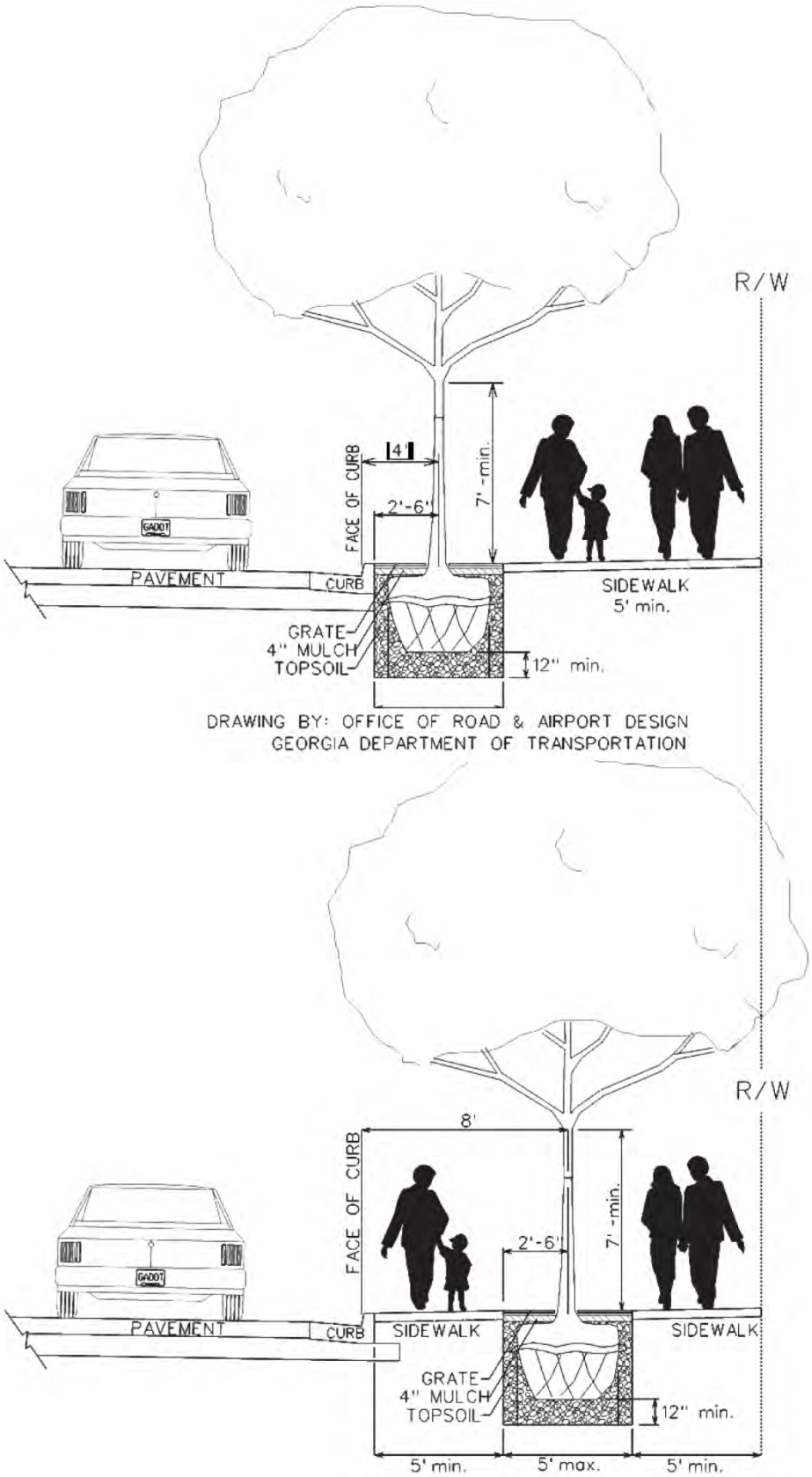
R/W
4'
2'-6'
FACE OF CURB
7' -min.
PAVEMENT
CURB
SIDEWALK
5' min.
GRATE
4" MULCH
TOPSOIL
12" min.
DRAWING BY: OFFICE OF ROAD & AIRPORT DESIGN
GEORGIA DEPARTMENT OF TRANSPORTATION
R/W
8'
FACE OF CURB
2'-6'
7' -min.
PAVEMENT
CURB
SIDEWALK
SIDEWALK
GRATE
4" MULCH
TOPSOIL
12" min.
5' min.
5' max.
5' min.

Figure 62

In their Roadside Design Guide, AASHTO also states that trees cannot be located closer than 18 inches from the face of curb, which is confusing to some designers. It is referred to as the clear offset. This requirement is not a function of clear zone considerations relating vehicle speed to offset requirements for safety purposes; it is simply an operational offset for clearance for truck and bus mirrors, bumpers, overhangs, and other accessories that project beyond the wheelbase of the vehicle.

Meandering Walkways

Sometimes, a meandering walkway is constructed, creating a planting strip with an informal, curving appearance. Although meandering walkways may look nice, they are not the most efficient way of getting people from one place to another. They may also be misguiding to pedestrians with sight impairments who need better predictability.

If a meandering walkway is desired, minimize the number of curves to avoid creating a route that is too awkward and indirect. Meandering walkways can provide the advantage of design to avoid obstacles such as telephone poles, utility features, signs, etc. Figures 63 and 64 illustrate a straight walkway and a walkway with a slight meander.

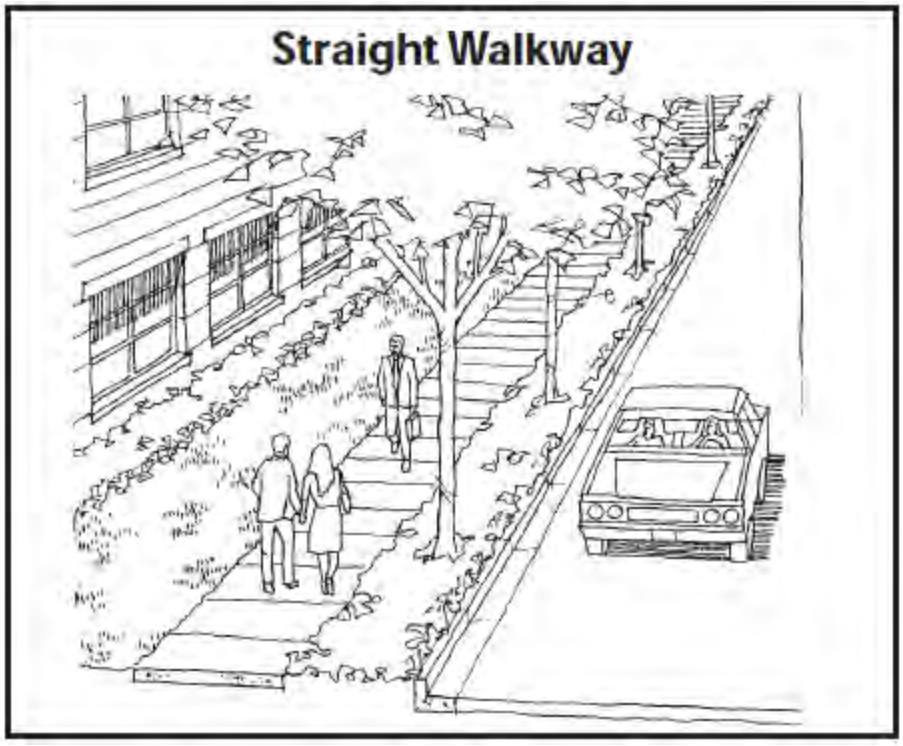

Figure 63

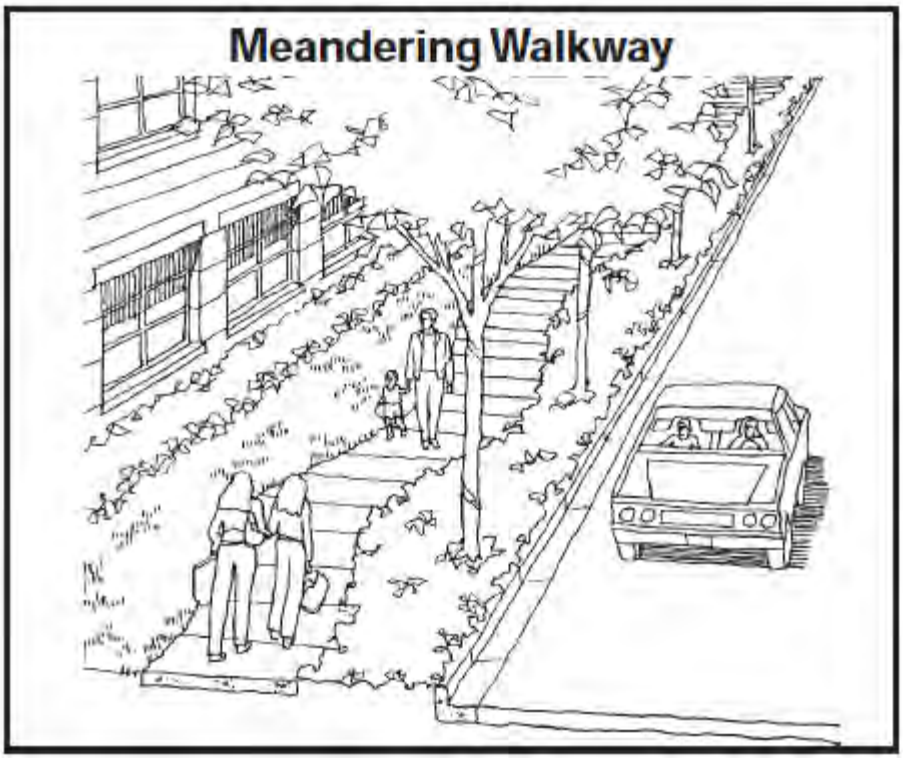

Figure 64

Ditches or Swales as Separation

On many rural roadways, an open ditch is located along the edge to provide conveyance and treatment of stormwater runoff. Where there is sufficient space within the right-of-way, the sidewalk or walkway can be located behind the ditch, providing a buffer area between motor vehicle traffic and pedestrians. In situations where a ditch or swale is used to separate a sidewalk, the separation area needs to be a minimum of 5 feet wide. A sidewalk separated from the roadway by a swale is illustrated in Figure 65.

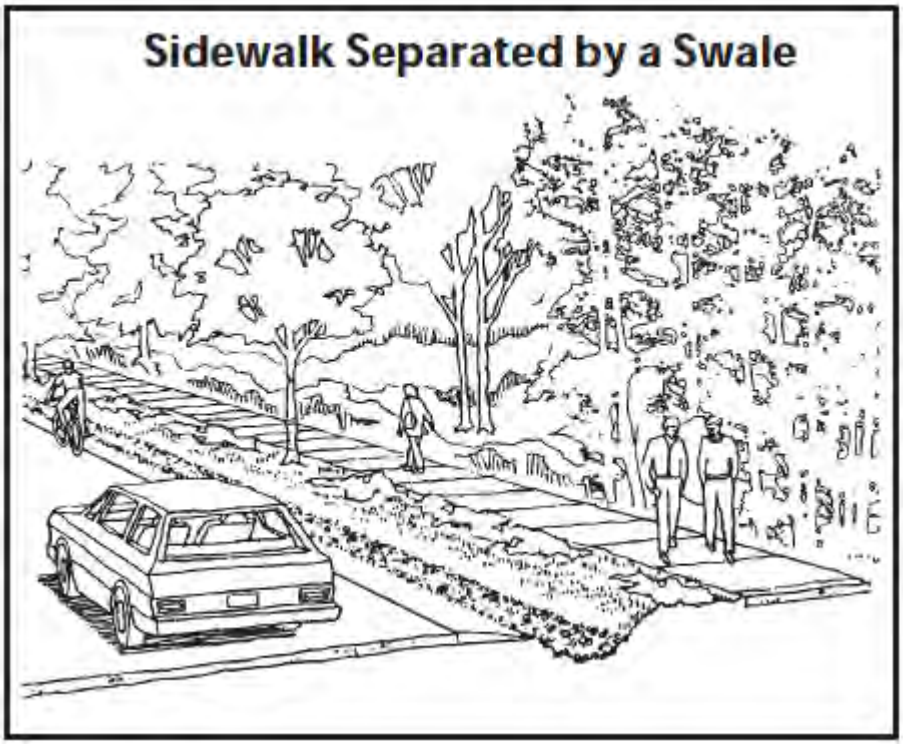

Figure 65

Curb and Gutter / Vertical Curb

Curb and gutter provides two primary functions: control of stormwater drainage, and vertical separation between motor vehicles and pedestrians. Curbs are often required on streets with higher volumes and speeds and where efficiently controlled drainage is a necessity. Curb and gutter or vertical curb are commonly required for urban streets.

Curb and gutter and vertical curb provide a non- mountable barrier adjacent to street parking that keeps cars from parking on adjacent sidewalks. Curbs provide a perceptive separation between moving vehicles and pedestrians. Curbs can be costly to construct, so they may not be practical to build in all areas. Curbs also have an urban-looking appearance, which may not be desirable in some areas, where a more natural-looking roadside appearance is desired. Figure 66 illustrates a sidewalk adjacent to curb and gutter, and Figure 67 illustrates a vertical curb adjacent to a planting.

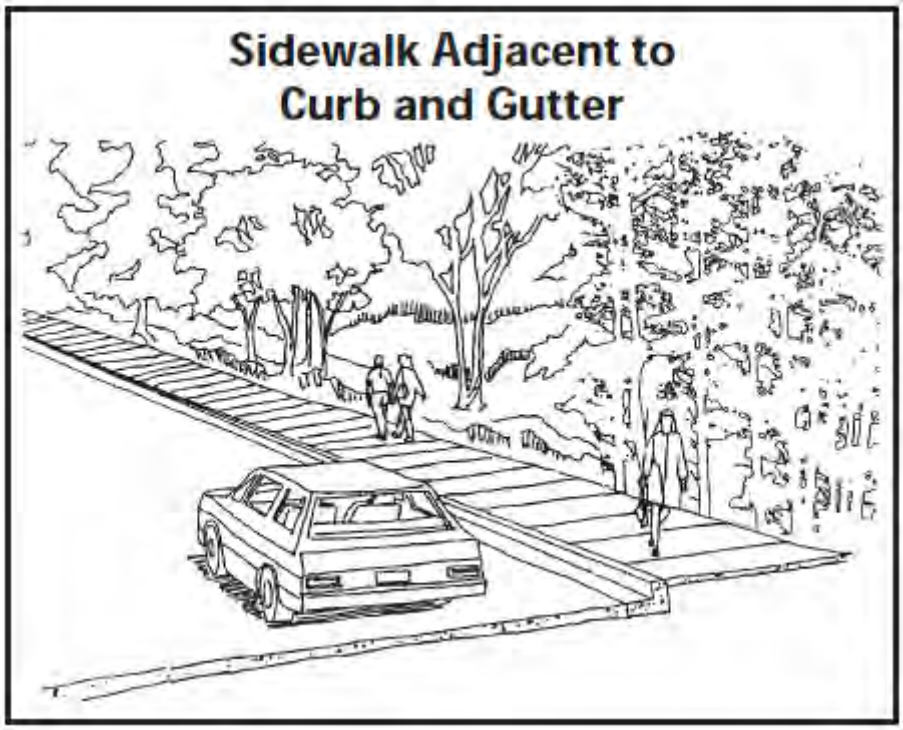

Figure 66

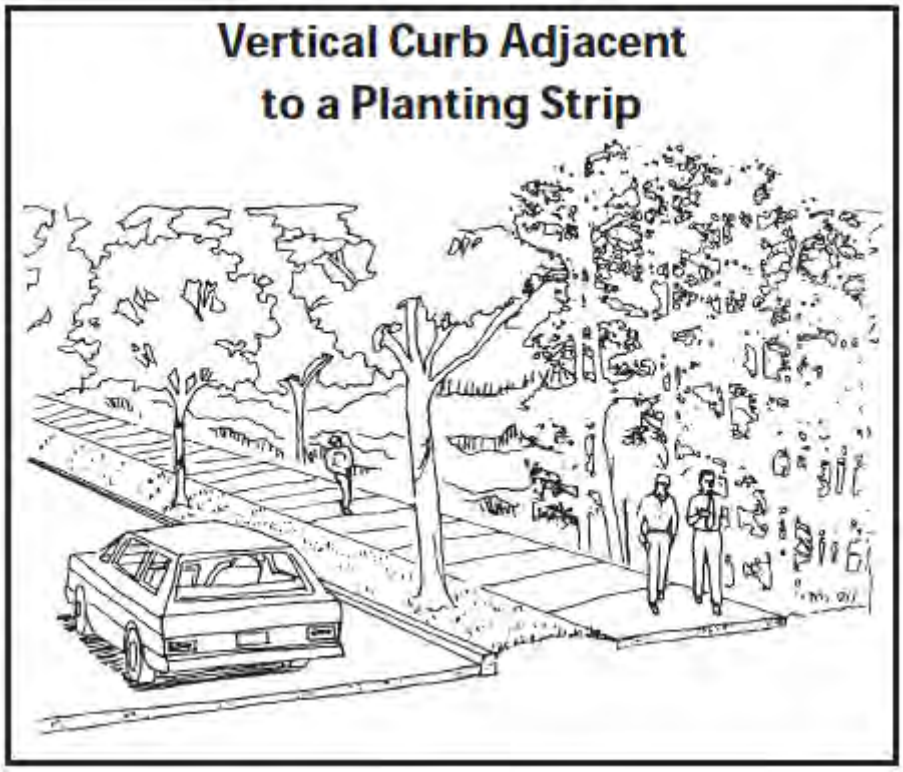

Figure 67

Rolled Curb (Strongly Discouraged)

Rolled curb is a mountable type of curb design often used in suburban neighborhoods. Rolled curb provides an advantage in that it eliminates the need for individual driveway cuts; however, it often presents a problem when used along sidewalks. Since rolled curbs are easily mountable by motor vehicles, drivers often park up on top of the curb and block the sidewalk. Additionally, the effectiveness of rolled curbs as a barrier is less than vertical curb between pedestrians and vehicles. Figure 68 illustrates a sidewalk with rolled curb. Rolled curb also needs to be converted to a vertical curb at the curb ramp to provide a message to blind pedestrians.

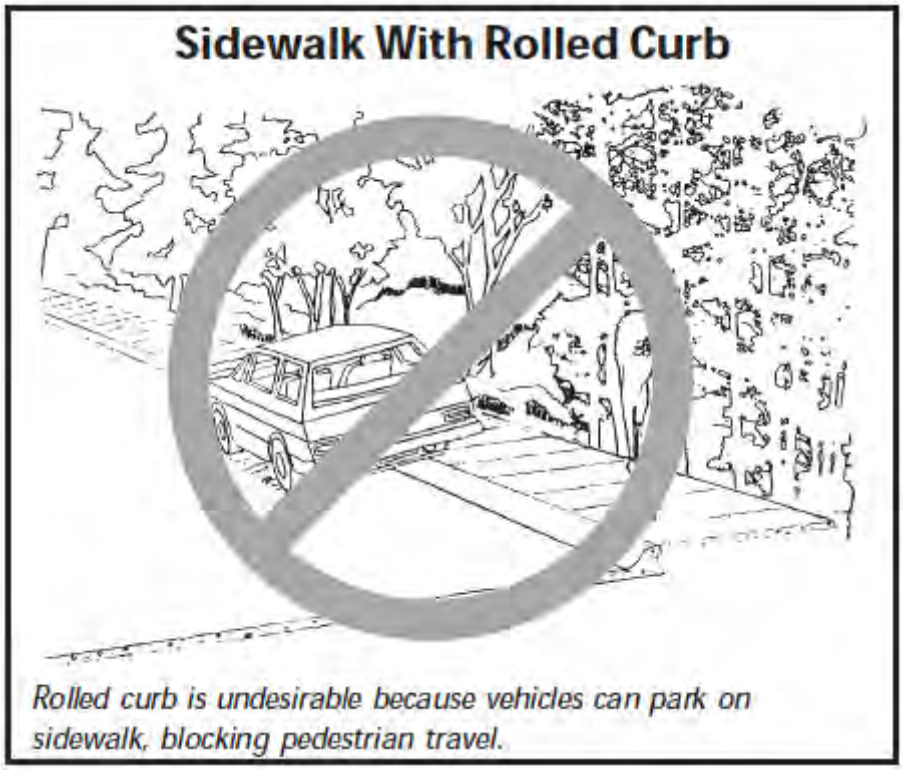

Figure 68

Vertical curb or curb and gutter constructed using standard designs provide a barrier adjacent to sidewalks that is more desirable than rolled curb adjacent to pedestrian travel ways.

Raised Pavement Markers (Strongly Discouraged)

Raised pavement markers are small plastic devices that are glued to the pavement surface as a delineation technique at the edge of roadways.

Raised pavement markers used adjacent to bicycle lanes are strongly discouraged, particularly as a delineation device between vehicle lanes and bicycle lanes. They create potential bicycle wheel deflectors and are particularly hazardous when they are wet, which makes small width bicycle tires slip and can cause loss of control of the bicycle. If they are used, they should be placed as far apart as practical, thus reducing their exposure to bicycle tires.

They should only be used as delineators at locations where an engineering study has determined that markers are essential to preserving pedestrian, bicycle, and motor vehicle safety. At the

initiation of the engineering study, local bicycling organizations and the state bicycle coordinator should be notified for review and comment. Existing raised pavement markers that interfere with bicycle travel should be removed at the time roadways are being resurfaced.

Use of raised pavement markers for conventional motor vehicle lane delineation should be done in accordance with MUTCD and state and local standards.

Bike Lanes as Separation

When bike lanes are located between the street and the pedestrian travel way, they provide a buffer between pedestrians and motor vehicles. It is recommended that the width of the bike lane comply with GDOT guidelines. The adjacent pedestrian travel way should be raised and separated by curb (in urban areas), or at a minimum, a white edge stripe should be used at the outside edge, between the bike lane and the shoulder area to be used by pedestrians (in rural areas). Figure 69 illustrates how a bike lane provides an additional buffer between pedestrians and motor vehicles.

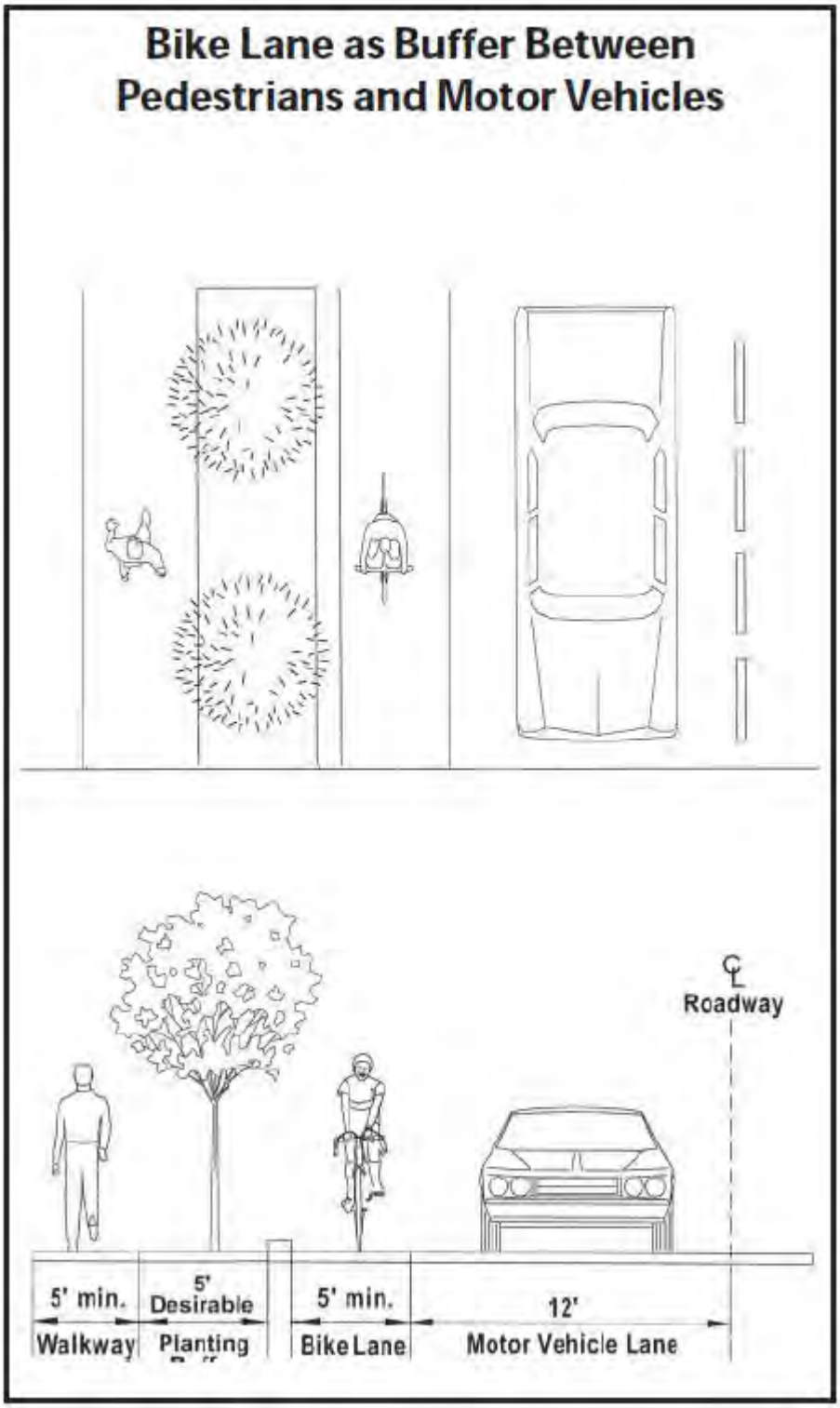

Figure 69

Concrete Barriers

Concrete barriers (also called New Jersey barriers) are occasionally used as a protective separation device between roadways and pedestrian travel ways, although their primary purpose is

to shield and direct vehicles away from potential hazards. According to AASHTO, concrete barrier height should be a minimum of 32".

Concrete barriers cost significantly more than curbing, and may not be the most visually appealing solution. They also are less attractive than other buffering/separation treatments when concrete barriers are used for separation between roadways and pathways. Check with local and state design requirements for end treatments. The ITE manual, *Design and Safety of Pedestrian Facilities*, provides some guidance about when it is necessary to provide pedestrian barriers.

Vertical concrete surfaces adjacent to pedestrian facilities should be smooth to avoid snagging of clothing or abrasive injuries from contact with the surface. Bolts or other protrusions from walls, railings, or barriers need to be cut off flush to the surface or recessed.

Street Furnishings, Utilities, and Related Clearances

Urban streetscapes should be carefully designed in order to provide adequate space for furnishings and utility facilities, outside the main travel way used by pedestrians. A clear travel way of 5 feet minimum is recommended for all sidewalks and walkways in the public right-of-way and 3 feet minimum is required by ADAAG for all accessible routes of travel within Title III sites. This clearance is only suitable where pedestrian volumes are low. Where pedestrian volumes are moderate to high, this clearance should be increased to the maximum obtainable or the full width of the sidewalk. Obstacles, such as signs, street furniture, and newspaper stands, should be placed off to the side of the travel way, in the "fixtures/planting zone," as discussed later in this toolkit.

The vertical clearance needed for sidewalks and walkways is typically 7 feet, as illustrated in Figure 70. The ADAAG requires that "*objects protruding from walls (e.g., signs, fixtures, telephones, canopies) with their leading edge between 27 and 80 inches above the finished sidewalk shall protrude no more than 4 inches into any portion of the public sidewalk*." Traffic signs located directly adjacent to or within the sidewalk need to be mounted and tree branches need to be pruned high enough so that there is a minimum of 7 feet of clearance from ground level. Informational and directional signs for pedestrians can be lower, if located a minimum of 3 feet from the sidewalk. A typical pedestrian travel way, designed to be clear of obstructions, is illustrated in Figure 71, on the next page.

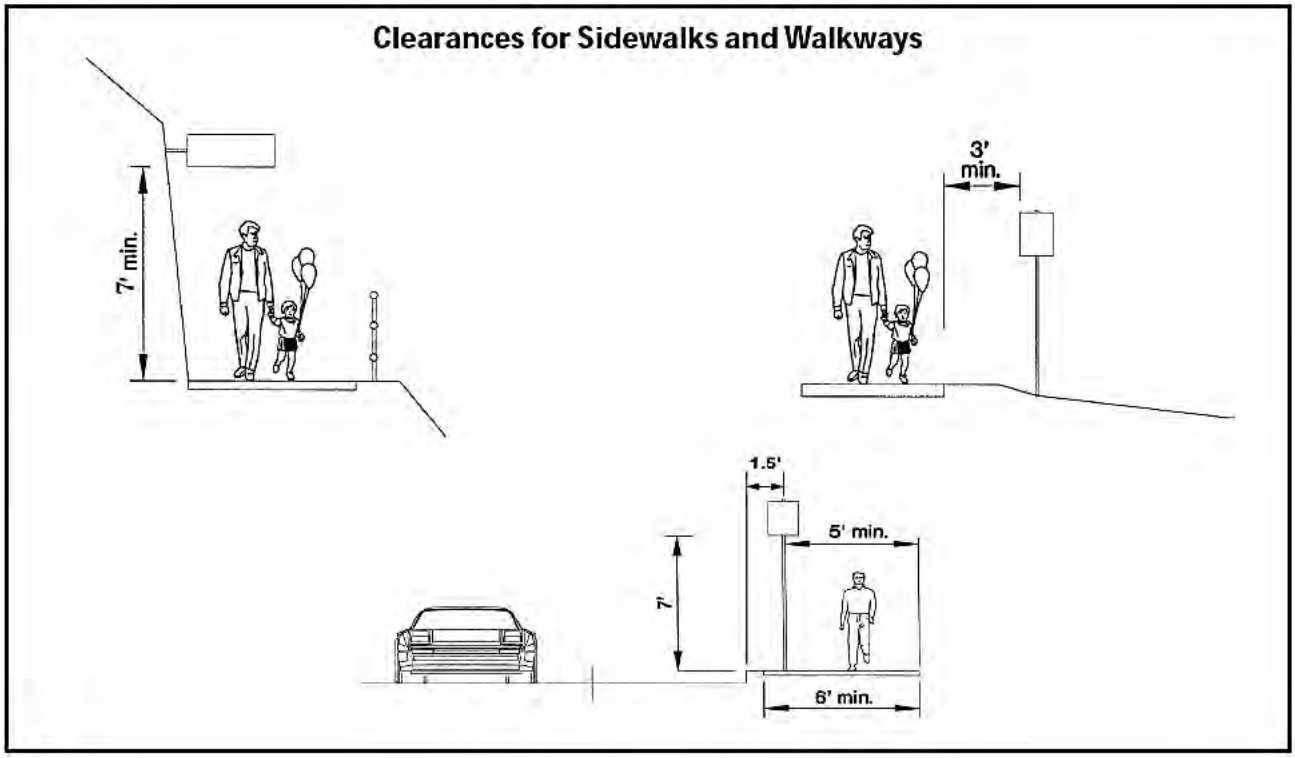

Figure 70

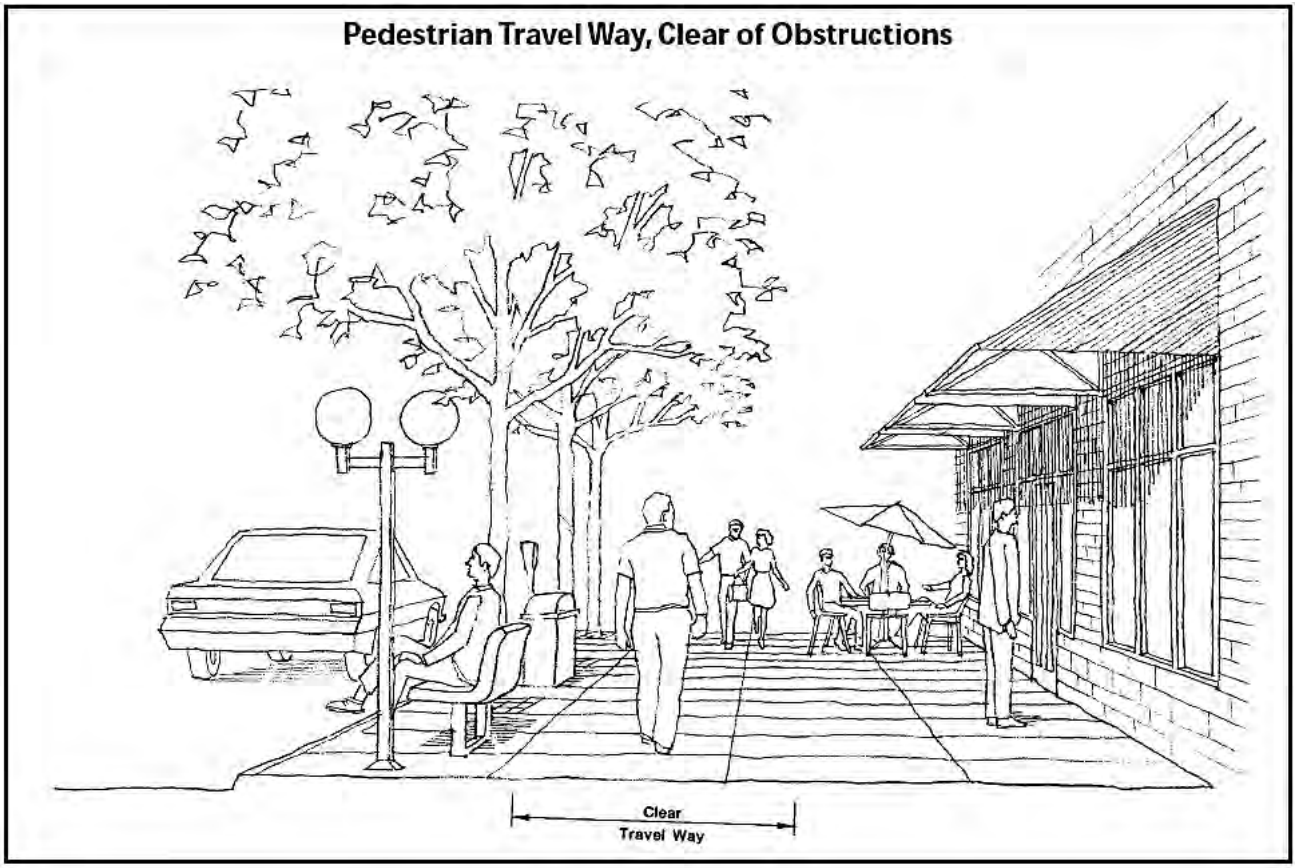

Figure 71

Landscaping and Street Trees

The use of planting buffers for separation between walkways and streets was discussed previously in this Toolkit. Landscaping and street trees in planting buffers and along streets can greatly enhance the pedestrian environment and provide shade and shelter, but careful thought needs to be given to the selection of trees and shrubs to be installed.

Street trees enhance pedestrian environments.

Using low height shrubs and upward branching trees will maintain visibility and sight distance at intersections, driveways, crossings, and other critical areas along the street system. It is also important to consider how high and wide the shrubs and trees will be at maturity.

Street trees are typically spaced evenly along the street, ranging from 25 to 50 feet apart, depending on the size of the tree at maturity. Trees can also be placed informally and clustered in areas. Do not locate trees where they will be an obvious obstruction to visibility. Utilities, whether above or below ground, are important to consider when determining if a tree is appropriate, the type of tree to plant, and its location along a street. Provisions on street trees need to comply with the discussion in “Clear Zone Considerations” section.

Selection of plant material also needs to consider the availability of irrigation water, ways to minimize maintenance, and community preferences for landscape materials (such as the use of native species and informal plantings versus ornamental or formal landscapes).

When tree wells are installed on urban sidewalks, they should be placed out of the pedestrian travel way. Tree wells can vary in size depending on the width of the sidewalk (refer to Figure 62). Tree grates adjacent to or within sidewalks need to meet the accessibility requirements of the ADA - top mounted flush with grade and no openings larger than 0.5 inches in diameter.

For all tree plantings and landscape requirements within state highway rights-of-way, refer to GDOT standards (MOG 6160) and the “Clear Zone Considerations” section. For all other rights-of-way, refer to local jurisdiction standards. Additional design guidelines related to landscaping adjacent to pedestrian facilities, including recommendations to minimize root damage to adjacent paved areas, are provided in Toolkit Section 4 - Trails and Pathways.

Lighting

Lighting of the street system, including adjacent sidewalks, walkways, and bike lanes, increases security and pedestrian safety and comfort. Typically, the street lighting system in urban areas sufficiently serves pedestrian sidewalks and walkways along the street. It's important to consider the security and comfort of pedestrians, when designing a street lighting system.

Where a new lighting system is being introduced either to replace or supplement the existing street lighting system, it may be possible to incorporate light posts and fixtures that are more pedestrian friendly (shorter and more in scale with pedestrians and with less obtrusive and harsh light sources). Additional lighting may be necessary at pedestrian crossing points, intersections, entrances to buildings, and other areas to supplement existing street system lighting.

Pedestrian scale lighting

It is generally recommended that a level of lighting between 0.5 and 2.0 footcandles be provided along pedestrian travel ways, depending on conditions. Check with your local agency for applicable design standards. Also, refer to the standards and design guidelines of the Illuminating Engineering Society of North America and GDOT's policies.

Signing

Pedestrian facilities generally require minimal signing. Most regulatory and warning signs are directed at motor vehicle traffic along streets and prior to crossings. Directional and informational signing installed for motor vehicle use may not adequately serve pedestrians, so care should be taken to identify key origins and destinations, such as schools, parks, libraries, museums, entertainment centers, and shopping districts.

Distances to these origins and destinations can be given in blocks, average walking time, or other measurements meaningful to pedestrians. The provision of walking maps, including information about transit routes, makes it easier for pedestrians to find their way around a new urban environment. Some cities and towns have provided maps inscribed in the sidewalk or on manhole covers. Information for pedestrians can also be displayed on kiosks or other designated areas.

Signs should be easy to read and understand with simple phrases and graphics. Letters and symbols need to be bold with high contrast to the background. Generally, light letters and symbols against dark backgrounds are easiest to read.

Signing needs to be understood by the vast majority of the population, including non- English speaking people and children. The use of internationally recognized symbols can be an effective way to identify features to all pedestrians.

Historic Districts

Many times sidewalks in historic districts include brick or cobblestone that makes it difficult and unsafe for pedestrians with mobility impairments to travel. It is difficult and painful for wheelchair riders to travel over these pavement types. There are several alternatives to cobbles and brick that can be used without compromising the design of the sidewalk.

- Brick or cobbles can be used as an edge to a concrete sidewalk. This preserves some historic design without compromising the travel experience for ALL pedestrians.
- The use of colored and/or stamped concrete (in various patterns) also creates a better environment, although, if used, the design needs to be provide a “reduced vibration zone” (refer to Toolkit 2 - Accessibility.)
- To maintain the character of historic districts, existing surface material can remain if additional paths of smoother material are added.
- Flat pavers or bricks that are butted directly together without joints can create a smooth surface, but the base design and construction must be of the highest quality to ensure that a consistent surface results.

Sidewalks in Business Districts and Downtowns

Sidewalks in central business districts and downtown areas need to be designed to efficiently accommodate heavy volumes of pedestrian traffic. Streetscapes in these areas often function for multiple purposes, and the streetside generally consists of three zones: the building frontage zone; the pedestrian travel zone; and the fixtures/planting zone. These three zones and their typical approximate widths are illustrated in Figure 72. Please note that these widths may vary and may be wider, depending on specific circumstances within the right-of-way.

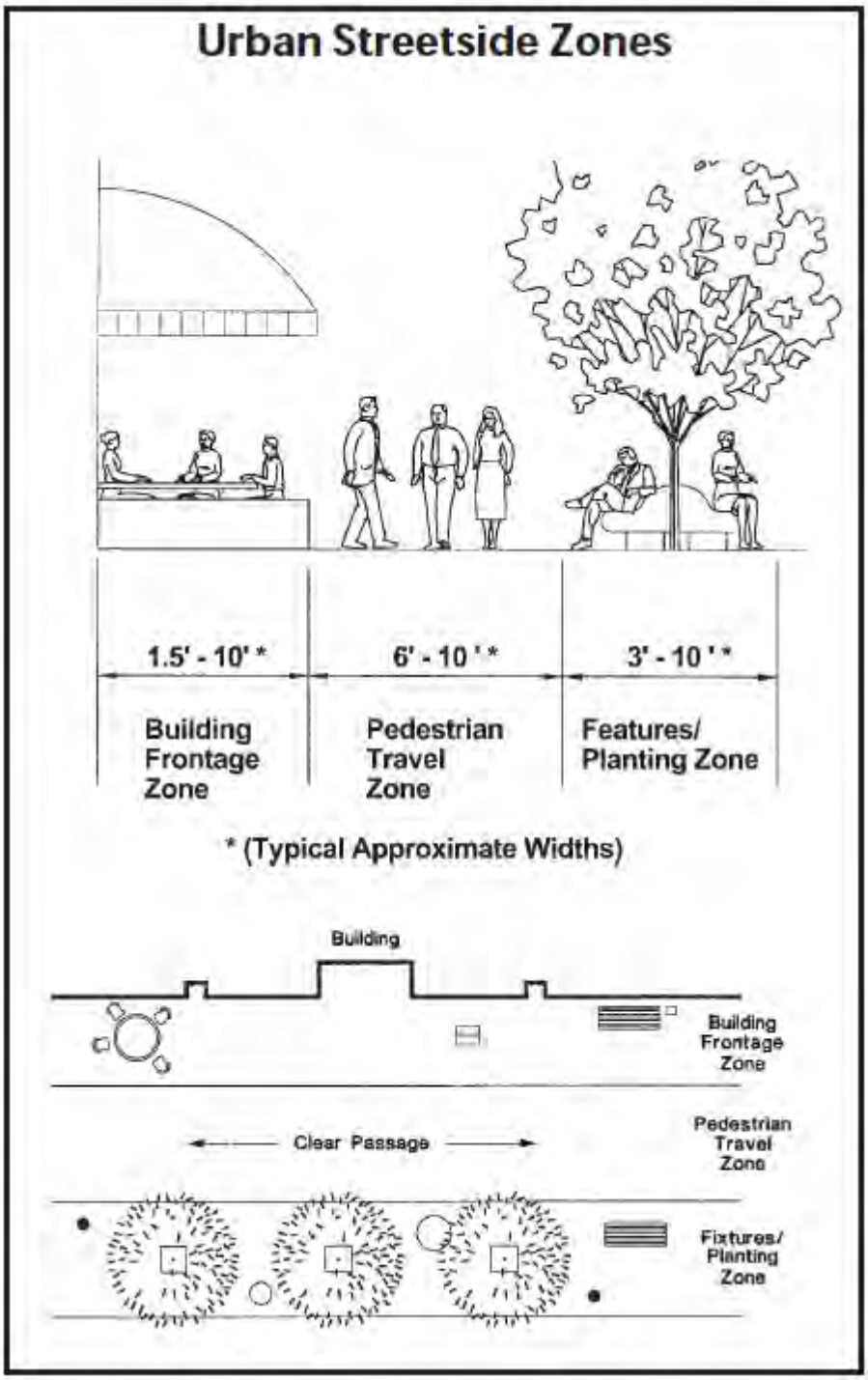

Figure 72

Building Frontage Zone

The building frontage zone is the area where people enter and exit buildings adjacent to the street right-of-way. People don't feel comfortable moving at full pace directly adjacent to the building wall, so this area is to the side of the primary travel area. It is also an area where pedestrians may window shop or move more slowly, restricting other pedestrians. On some streets, the building

frontage zone may become a pedestrian plaza, outdoor cafe, or gathering area in front of some buildings, depending on available space within the right-of-way. For this reason, the building frontage zone can vary in width from approximately 2 to 10 feet or more. At a minimum, people prefer about 2 feet of "shy" distance when walking adjacent to buildings, as illustrated in Figure 73.

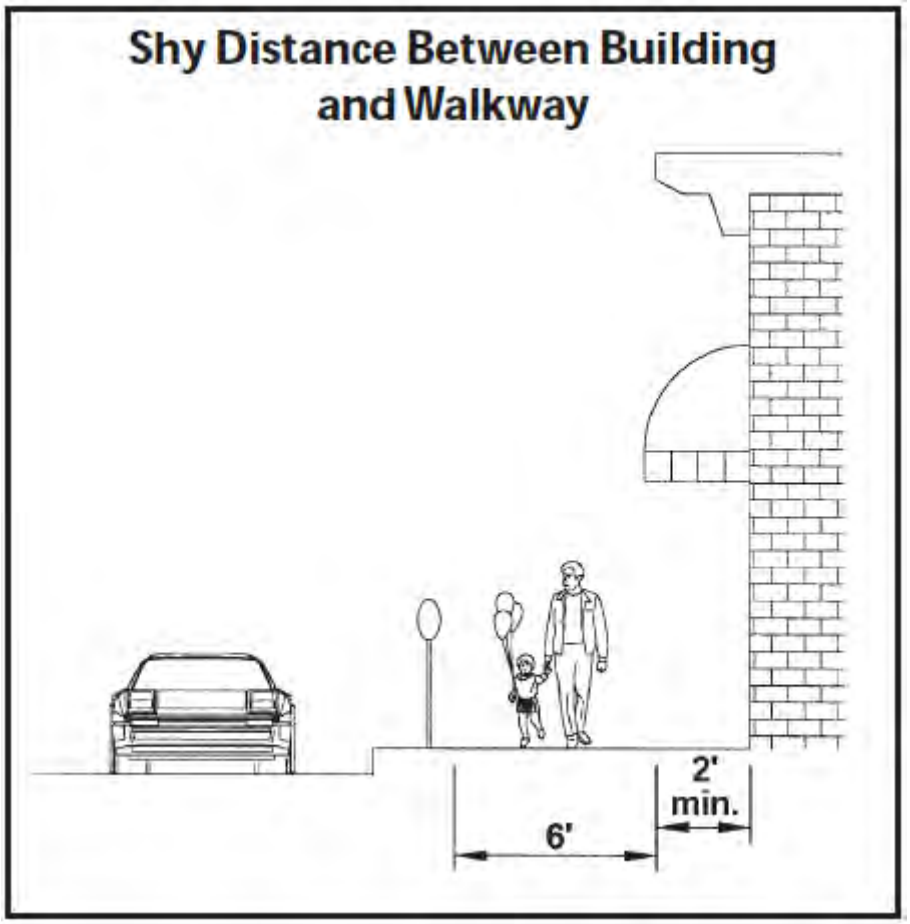

Figure 73

Pedestrian Travel Zone

The pedestrian travel zone is the central area where most pedestrians travel on the downtown sidewalk. It is desirable to provide the widest possible clear space for pedestrian travel, particularly in urban areas where there are higher volumes of pedestrians. The pedestrian travel zone on downtown streets should typically be 6 to 10 feet wide or greater in areas where high volumes of pedestrians are anticipated. Within this area, a minimum 5-foot wide accessible route must be provided.

Streetscapes in downtowns need to be designed to accommodate heavy volumes of pedestrians.

Fixtures/Planting Zone

The fixtures/planting zone is located directly adjacent to the street and provides a buffer between the street traffic zone and the pedestrian travel zone. Consolidate or congregate, where possible, utilities, street furniture, and other elements within the fixture/planting zone to minimize obstacles in the pedestrian travel way and improve the visual appearance of an area. Examples of consolidating include putting more than one utility on a pole system or more than one sign on a post, and clustering furnishings within the planting strip or to one side of the primary walking area. The approximate dimension for the fixtures/planting zone is typically 3 to 10 feet (minimum 4 feet, if trees are installed) depending on the dimensions of the right-of-way and the street traffic and the pedestrian travel zone. Curb extensions provide opportunities to place benches and furnishings.

On some urban streets with limited right-of-way, it may be necessary to reduce the widths of the building frontage and fixtures/planting zones, or eliminate them altogether. Providing a pedestrian travel zone with a minimum width of 6 feet is recommended in this case. Trees and fixtures that could conflict with vehicle entry and exit should be located between parallel parking spaces.

Shoulders as Walkways in Rural Areas

Wide shoulders along roadways can also function as walkways, particularly in rural areas. Local agencies sometimes consider paved or unpaved walkways and roadside shoulders used for pedestrian travel in urban areas to be interim solutions until funding permits construction of full sidewalk improvements. In rural areas, where funding for pedestrian improvements can be limited, walkways and shoulders may be acceptable as a longer-term solution, particularly if the alternative is no pedestrian facilities at all. In any case, local agencies should consider construction of sidewalks or pathways along sections of roadway where shoulders are being regularly used by pedestrians.

Shoulder walkway in rural area.

Recommended Shoulder Dimensions

A 3 to 5-foot wide shoulder adjacent to a bike lane and on local roads with lower traffic volumes (less than 400 ADT) may provide a sufficient walking space for a single pedestrian. But shoulders that accommodate groups of pedestrians, such as school children walking to and from school, and that are located on major collectors and arterials (with more than 2,000 ADT) should to be wider or should include a sidewalk behind a curb and gutter. Given the stipulated ADT and use by large groups of children, suitable wider sidewalks and/or planting buffers may be desirable.

At a minimum, shoulders at least 5 feet wide on both sides of the road for school walk routes or at least 8 feet wide if constructed on only one side are recommended. Shoulder areas located at school bus stops need to be widened to accommodate children waiting at the roadside for the bus (refer to Toolkit Section 3 - Children and School Zones).

In rural areas with heavy pedestrian use, an additional pavement width should be considered to obtain wider shoulders. Local standards for shoulder widths may vary. A typical walking shoulder is illustrated in Figure 74.

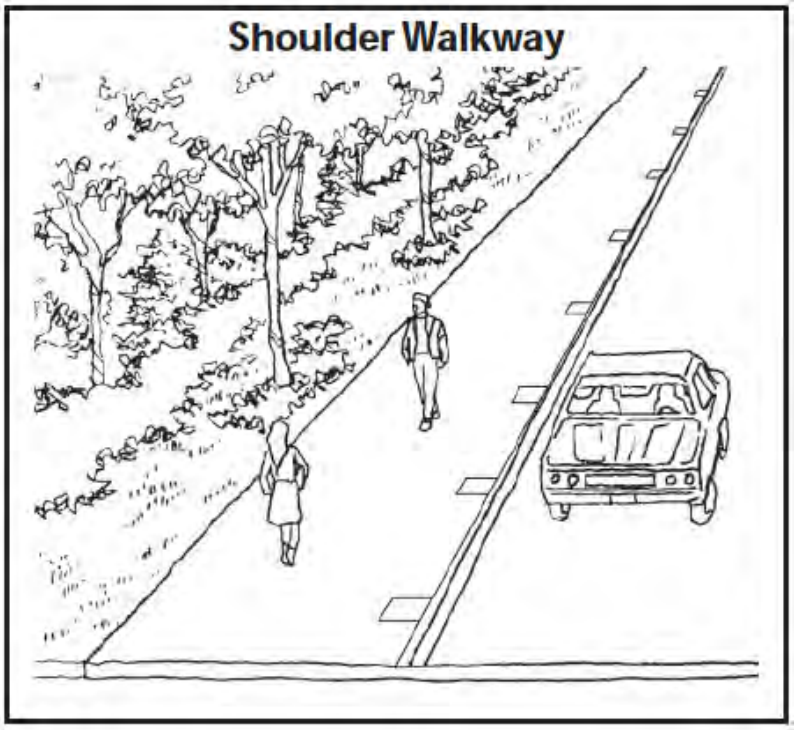

Figure 74

Shoulder Surfacing and Delineation

Shoulders may be paved or unpaved. A high visual and tactile contrast is desirable in order to clearly define the pedestrian area and discourage drivers from straying onto the shoulder. If paved shoulders are to be used by pedestrians, they should be well-marked. One design solution that helps delineate the shoulder walking area is the use of a contrasting paving material or color for the paved shoulder, or a contrasting strip separating the shoulder from the street.

Shoulders for walking may also be delineated by a 5-inch wide white strip at the edge of the vehicular travel lane or bike lane. Alternative striping solutions may also be acceptable, such as wider than standard white fog lines or edge stripes, dashed stripes, angled stripes, and other techniques.

Raised pavement markers are generally not recommended as an edge line delineation treatment because they create an obstacle to bicycle travel (see discussion earlier in this toolkit). Pavement texturing techniques, such as chip seal markers, can be used to delineate shoulders and provide both a tactile and audible warning to pedestrians and motorists.

Unpaved shoulders consisting of a compacted, stable surface can also be installed and offer a contrasting material adjacent to asphalt or concrete roadway paving. Compacted earth or low-growing grass shoulders can also provide a walking area for pedestrians, but they function poorly during wet weather. Unpaved shoulders can be less costly to install, but are usually more costly to maintain.

Operational Considerations Related to Shoulders

Shoulders are not an ideal travel route (see Toolkit 2 - Accessibility). In areas where an accessible travel route is needed along the roadside to provide access between public buildings or facilities, a full sidewalk or walkway improvement, raised and separated from the street, should be constructed.

Shoulders that are intended to be used by pedestrians should not be used as roadside parking lanes, not even for short-term or temporary periods (except during emergencies).

Shoulders that are heavily relied upon by pedestrians for a regular walking route will not function adequately if they double as bike lanes. Separate bike lanes are recommended. If a multi-use pathway is to be provided within the right-of-way, it should be designed to meet or exceed AASHTO standards (see Toolkit 4 - Tails and Paths).

Table 40 summarizes a few of the important concerns related to roadside shoulder design for pedestrian use.

Recommendations for Walking Shoulders

- Best used in rural areas with lower pedestrian volumes (to be used infrequently)
- 3 to 5 feet wide for roadways with less than 400 ADT
- 5 feet minimum, both sides for school walking routes
- 8 feet minimum, at least one side for school walking routes and roadways with over 2,000 ADT
- Can be paved or unpaved, but high visual and tactile contrast from adjacent roadway is best
- Sign to prohibit parking
- Double use as bike lanes not recommended (unless designed as a multi-use facility in accordance with local, state, and federal standards)

Table 40

Bicycles on Sidewalks

Generally, designating sidewalks for bicycle travel is not recommended even if the sidewalks are wider, for the following reasons:

- Motorists do not expect to see bicyclists traveling on sidewalks and may pull out of intersections or driveways and unexpectedly collide with a bicycle.
- The potential for conflicts between bicyclists and pedestrians greatly increases with shared use.
- Pedestrian movements are often unpredictable for an approaching bicyclist from behind (especially those of small children), and pedestrians cannot always predict the direction an oncoming bicyclist will take.
- Sidewalks are usually two-way facilities and bicyclists are encouraged to travel one-way, with the flow of traffic.

- Sight distances are more limited at driveway crossings.
- There also may be limited sight distance and clearances due to signs, utilities, landscaping, fencing, or other obstacles beside or protruding into the sidewalk.

Bicycling on sidewalks is discouraged, but not prohibited by state law. Local requirements may prohibit bicycling on sidewalks.

Street Design Considerations

Since sidewalks and walkways are developed as integral components of street and roadway systems, there are several important aspects related to street design that affect pedestrians.

Parking Along Streets

On-street parking provides a buffer zone between the roadway and the sidewalk. It also narrows the appearance of streets, reducing vehicle speeds. On-street parking provides opportunities for people to access the sidewalk directly from their vehicles and increases street activity. For these reasons, on-street parking is often supported in business and shopping districts, neighborhoods, and other urban areas. Figure 75 illustrates how on-street parking provides a buffer between street traffic and pedestrians.

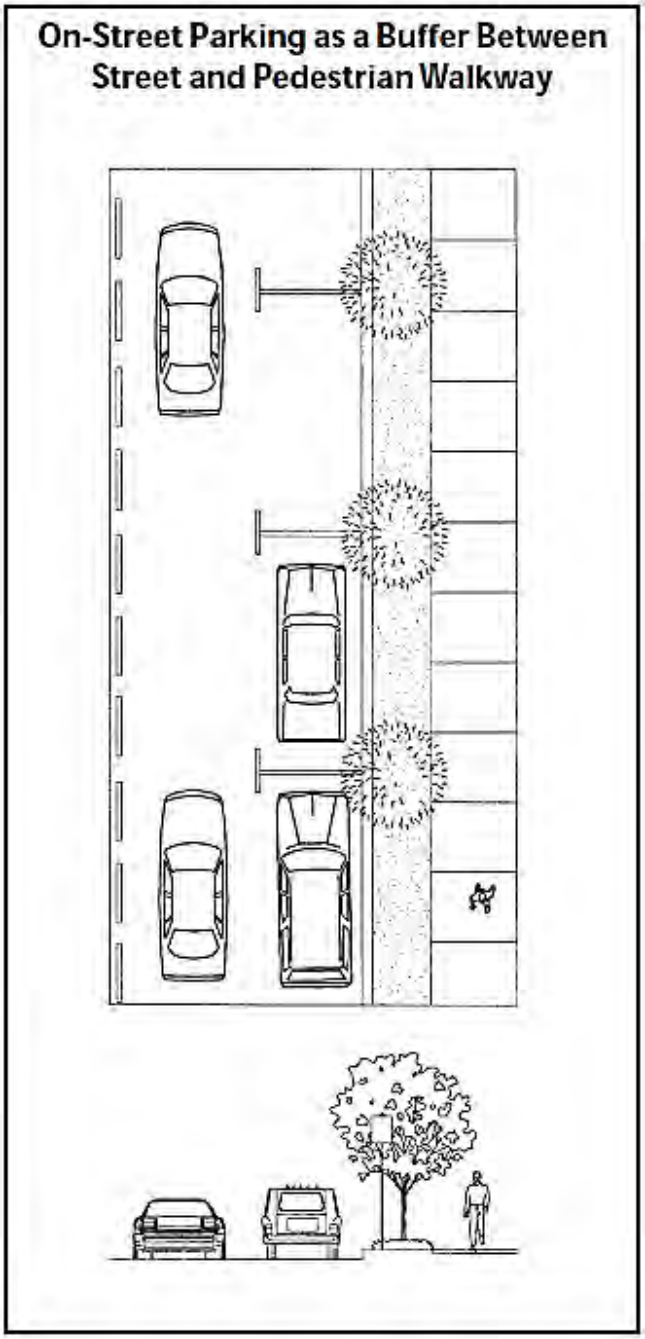

Figure 75

In some cases, on-street parking may present problems when there is not enough space for people to safely get out of their cars or walk between cars. On-street parking on roadways where there are no adjacent pedestrian facilities or undelineated crossings is not desirable because pedestrians may be forced to walk in the roadway to get to their destination or may cross at several points along the roadway rather than at a single point. A common cause of collisions is the lack of visibility of pedestrians entering the roadway from between parked cars. An example of this is when on-street parking is provided informally adjacent to a park or ball field where there are high numbers of children prone to darting out into streets and not aware of traffic conditions.

Parallel parking stalls need to provide adequate space for pedestrian movement around the parked car without forcing pedestrians out into the stream of traffic and to prevent car doors from opening into bike lanes. Typical dimensions of 9 feet wide by 24 feet in length (provides space in between cars) are recommended for on-street parallel parking stalls (although practice allows as narrow as 7 feet and as short as 22 feet, check local standards). In cases where a bike lane is located adjacent to parallel parking, the bike lane width should be at least 5 feet to provide additional maneuvering space.

When on-street parking is provided, adjacent pedestrian walkways and clearly identified street crossing points are also necessary. On-street parking or loading zones that are too close to intersections and mid-block crossings can block views of pedestrians. Parking areas should be set back from intersections and crossings to allow pedestrians to see oncoming traffic. Refer to Toolkit Section 6 - Intersections, for recommended set back distances for on-street parking near pedestrian crossing points. Fencing can be installed to channelize pedestrians to crossing points at specific entrances, but it should be designed and placed carefully so as not to become an obstacle to pedestrian travel. Bulb- outs and curb extensions also help to define pedestrian crossing points.

Angled on-street parking

When perpendicular parking stalls are located adjacent to sidewalks, wheel stops or curbing should be constructed to eliminate vehicle overhang that reduces usable sidewalk area. Figure 76 illustrates this treatment.

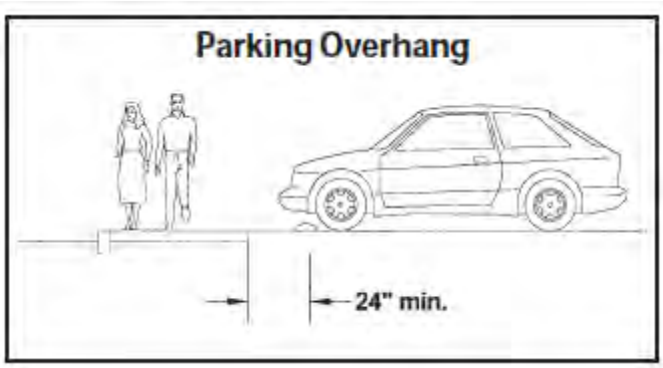

Figure 76

Access Management and Driveways

Most pedestrian/motor vehicle collisions on busy streets occur at points of intersecting movements, such as intersections, driveways, and alleys. Unlimited vehicle access on roads increases the level of conflicts between pedestrians walking along the roadway and cars entering or leaving the roadway. Pedestrians crossing the roadway need gaps in the traffic stream, but with unlimited access, vehicles entering the roadway quickly fill the available gaps. Pedestrian access to transit may also be complicated by excessive driveway access points creating obstacles on their way to the bus stop.

Table 41 lists access management techniques as well as several benefits for pedestrians that result from access management. Figure 77 illustrates how controlled access and limited driveways reduce conflict points between pedestrians and motorists. The level of access management and its relationship to providing pedestrian facilities along state highways is described later in this section.

Access Management

Techniques

- Reducing the number of existing driveways or consolidating driveways to parking areas and businesses
- Providing raised or landscaped medians or concrete barriers to control turning movements from the street (with these treatments, it is important to provide accessible pedestrian crossing opportunities with breaks in the medians or barriers at suitable crossing points)

Benefits

- The number of conflict points is reduced (particularly with the use of center medians to reduce the number of conflicts between left-turning vehicles and pedestrians.)
- Pedestrian crossing opportunities are enhanced with an accessible raised median and fewer conflicts with turning cars.
- Accommodating people with disabilities becomes easier with the reduced need for special treatments at driveway cuts.
- Traffic volumes may decrease if local traffic can use other available routes (but also note that volumes may increase if the route becomes more efficient for vehicles to use.)
- Improved traffic flow may reduce the need for road-widening, allowing more space within the right-of-way for use by pedestrians, bicyclists, and enhancements and maintaining fewer travel lanes to cross at intersections.

Source: Adapted from Oregon Bicycle and Pedestrian Plan

Table 41

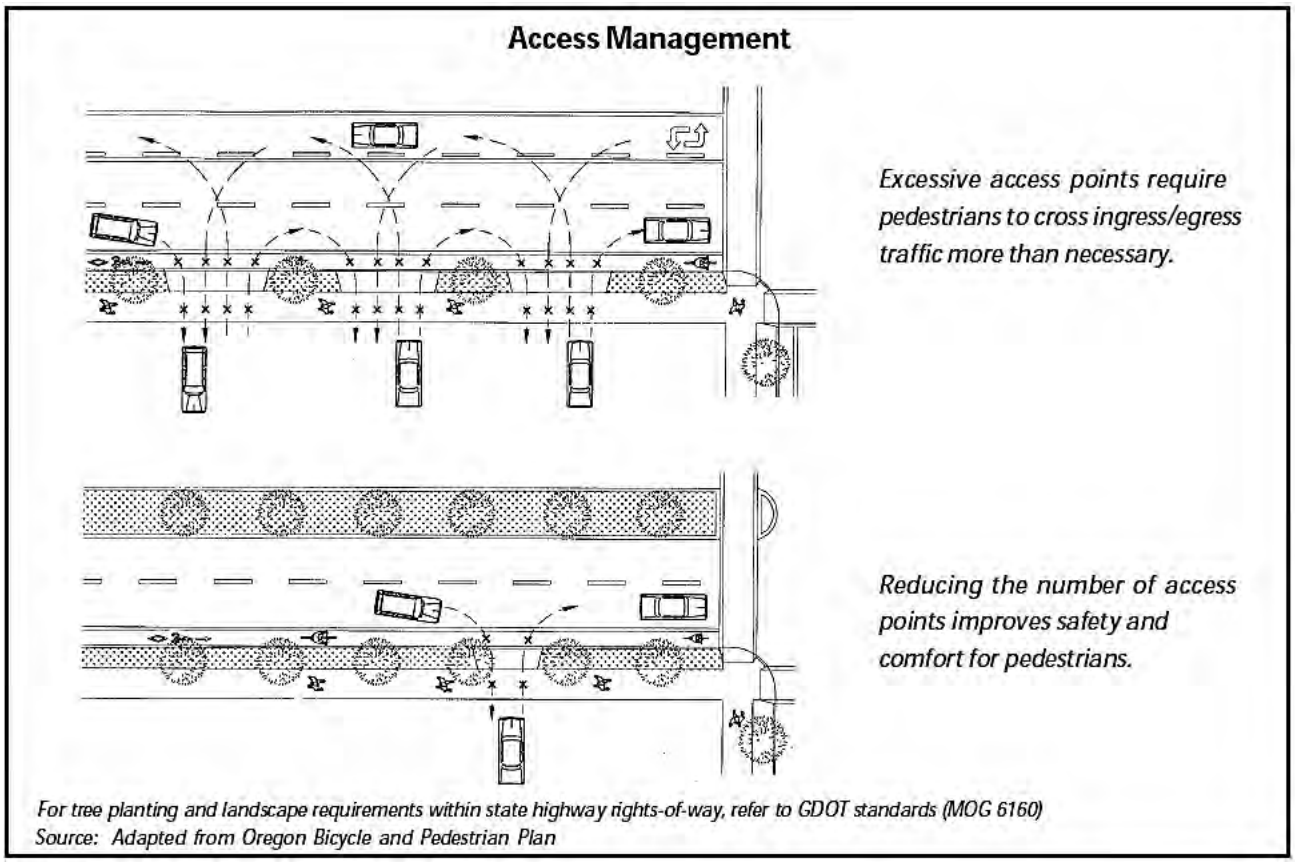

Figure 77

Driveways that cross sidewalks and walkways need to be carefully designed to minimize conflicts between pedestrians and vehicles. For design recommendations related to driveway design (for both commercial and residential sites), refer to Toolkit 10 - Site Design for Pedestrians.

Access to Transit

The level of transit use often depends on the extent of improvements provided for pedestrians. Transit stops are provided in both urban and rural areas, and often pedestrians rely heavily on transit as their primary mode of transportation. Sidewalks, walkways, crossings, and other pedestrian facilities adjacent to and near transit stops need to be carefully planned and well designed as a collaborative effort between the transit agency and the public works and traffic engineering departments of the local jurisdiction. Design recommendations related to transit stops and facilities are provided in Toolkit Section 9 - Pedestrian Access to Transit.

Benefits and Disadvantages of One-Way Streets for Pedestrians

One-way streets can provide certain benefits to pedestrian travel if appropriately implemented. However, when they are designed to increase traffic speeds, they can create an unfriendly and uninviting environment for pedestrians. Some of the benefits and disadvantages related to the use of one-way streets are described in Table 42.

When considering conversion to a one-way street system, communities need to consider all the potential implications. Additional information that may be helpful to communities in considering whether or not to convert to a one-way street system is available in the *Florida Pedestrian Planning* and *Design Guidelines* and the ITE *Traffic Engineering Handbook*.

Benefits and Disadvantages of One- Way Streets

Benefits for Pedestrians

- One-way streets in downtown areas or elsewhere, where practical, may be helpful to pedestrian travel because pedestrians have to watch traffic from only one direction when crossing.
- May also allow more space within the right- of-way in certain cases, creating more areas for pedestrians, parking, and other purposes.
- Can create smaller block patterns and allows reduced curve radii on corners where vehicular turning traffic doesn't occur, which equates to shorter crossing distances for pedestrians.
- Improved signal timing because one-way streets can create consistent signal spacing (so pedestrians may walk at a continuous pace between intersections; but this can be a disadvantage in that it may speed traffic).

Disadvantages for Pedestrians

- Vehicles are likely to travel faster if the travel lanes are wide or there are multiple lanes.
- May adversely affect transit operations and transfer opportunities.
- May change character of downtowns

Table 42

Pedestrian Facilities Along State Highways

State Highways as Main Streets

In many small towns and cities, state highways serve as the main street and primary arterial through the center of town. They function as the major route into which local arterials and collectors feed. In some smaller cities and towns, the state highway is often the only arterial connecting virtually all major destination points.

The provision of adequate pedestrian facilities along the state highways in these settings is a critical component to incorporating pedestrians into the overall transportation network. Sidewalks for these main streets need to be designed the same as they would be for the urban centers of larger cities — able to support heavy pedestrian use. (Refer to specific design recommendations earlier in this toolkit section, including the discussion on Sidewalks in Business Districts and Downtowns.) It is important to remember that there are differences between the small town main street environment and the larger city street environment, and applied design treatments should consider community preferences such as enhancements that reflect historic character or landscape themes.

Main street through small town

State Highways as Connectors between Towns and Cities

Providing sidewalks and walkways along sections of state highways that connect urban or suburban center should be considered. Along their length, they have potential trip generators, such as schools, parks, scenic stops, and residential and commercial areas within proximity to one another.

Maintenance

Clear, smooth, level surfaces are essential for pedestrians and particularly for people in wheelchairs, older adults, and young children. Vertical movement and cracking are common problems that could create hazards. Drainage systems should be kept in good working order to avoid accumulation of water over pedestrian walking areas. Table 43 outlines sidewalk concerns and maintenance measures to ensure that sidewalks adequately serve pedestrians over the long term.

Construction and installation of utilities should be coordinated between the utility company and the governing authority with jurisdiction over the street system. Interruptions to pedestrian travel need to be minimized and construction should avoid damage to pedestrian facilities. In some cases, it may be possible to improve conditions for pedestrians as part of an overall utility project.

Maintenance Recommendations for Sidewalks	
Concern	**Maintenance Activity**
Tree roots cracking heaving sidewalk	**Remove failed sidewalk, cut roots and install new sidewalk. A local arborist should be contacted prior to removing large roots**
Section pop-up of vertical height greater than ½ inch	**Replace defective sections or provide temporary asphalt shim.**
Cracked or spalling surface and poorly placed temporary patching	**Replace defective sections**
Separation of expansion and construction joints so that space between adjoining sections are greater than 1/4 inch	**Fill joint with hardening expansion compound**
Trash, loose sand, oil and grease on walkways and sidewalks	**Serve notice to abutting landowners to clean and maintain sidewalks.**
Materials, signs, vending machines, etc. restricting effective sidewalk width	**Require responsible parties to remove obstructions**
Low hanging tree limbs, bushes, weeds, and other foliage growing into the sidewalk and/or posing obstructions	**Enact and enforce local regulations requiring abutting land users to perform timely clearance activity. Hire private contractor to clear sidewalk and assess cost to abutting land users.**
Source: New Jersey Department of Transportation - Pedestrian and Design Guidelines	

Table 43

Such a project may create the opportunity to relocate a utility pole or box outside the pedestrian travel way. Also, refer to Toolkit 11- Safety in Work Zones, for more information.

Other Sources of Information

The following sources of information are recommended for design of sidewalks and walkways. Please see the Resource Guide included at the end of this guide for complete bibliography information.

A Guide to Land Use and Public Transportation, Volume II: Applying the Concepts, The Snohomish County Transportation Authority

A Guidebook for Student Pedestrian Safety, Final Report, KJS Associates Inc.

A Policy on Geometric Design of Highways and Streets, 2001, American Association of State Highway and Transportation Officials

A Working Approach to Accessibility in Public Rights of Way, Montana Department of Transportation

Accessible Sidewalks: A Design Manual, US Architectural and Transportation Barriers Compliance Board (The Access Board)

Accessibility Design for All, An Illustrated Handbook, 1995 Washington State Regulations, Barbara L. Allan and Frank C. Moffett, AIA, PE

Accommodating the Pedestrian, Adapting Towns and Neighborhoods for Walking and Bicycling, Richard K. Untermann

Americans With Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; State and Local Government Facilities; Interim Final Rule, Federal Register, Part II, Architectural and Transportation Barriers Compliance Board

"Boulder Brings Back the Neighborhood Street," John Fernandez, Planning

City Comforts, How to Build An Urban Village, David Sucher

City of Issaquah Urban Trails Plan (Non-Motorized Transportation), City of Issaquah

City, Rediscovering the Center, William H. Whyte

Design and Safety of Pedestrian Facilities, A Proposed Recommended Practice of the Institute of Transportation Engineers, ITE Technical Council Committee 5A-5

Design Guidelines, Building/Sidewalk Relationships, Central Business District, City of Bellevue

Design Manual, 1020 Facilities for Nonmotorized Transportation, Washington State Department of Transportation

Effects of Site Design on Pedestrian Travel in Mixed- Use Medium Density Environments, Anne Vernez- Moudon, PhD

Engineering Design and Development Standards, Snohomish County Public Works

Florida Pedestrian Planning and Design Guidelines, University of North Carolina

Great Streets, Allan B. Jacobs

Handbook of Landscape Architectural Construction, Volume Two, Site Works, Maurice Nelischer

Handbook for Walkable Communities, Washington State Pedestrian Facilities Planning and Design Courses, Dan Burden and Michael Wallwork, PE

Livable Neighborhoods: Rethinking Residential Streets, American Public Works Association and the University of Wisconsin-Madison

Livable Streets, Donald Appleyard

Manual on Uniform Traffic Control Devices from Streets and Highways, 2003 Edition, US Department of Transportation

Pedestrian Malls, Streetscapes, and Urban Spaces, Harvey M. Rubenstein

Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas Research Report, S.A. Smith, K.S. Opiela, and L.L. Impett

Planning Design and Maintenance of Pedestrian Facilities, Goodell-Grivas, Inc.

Public Streets for Public Use, Anne Vernez Moudon

Reclaiming Our Streets, Traffic Solutions, Safer Streets, More Livable Neighborhoods, Community Action Plan To Calm Neighborhood Traffic, Reclaiming Our Streets Task Force

Redevelopment for Livable Communities, Washington State Energy Office, the Washington State Department of Transportation, the Department of Ecology, and the Energy Outreach Center

Residential Streets, American Society of Civil Engineers

Safe Walkways for Clark County, 1993-98 Walkway Construction Program, A Report to the Clark County Board of Commissioners

Sharing Our Sidewalks, Ensuring Access in Portland's Shopping and Commercial Districts, Metropolitan Human Rights Commission

Sidewalk and Curb Ramp Design, Governor's Committee on Concerns of the Handicapped

Streets for People, A Primer for Americans, Bernard Rudofsky

The Car and the City, 24 Steps to Safe Streets and Healthy Communities, Alan Thein Durning

Time-Saver Standards for Landscape Architecture, Design and Construction Data, Charles W. Harris

Washington's Transportation Plan, State Bicycle Transportation and Pedestrian Walkways Plan, Washington State Department of Transportation

Designing Sidewalks and Trails for Access – Best Practices Design Guide

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Chapter 9. Toolkit 6 – Intersections

This Toolkit Section Addresses:

- *Effects of Pedestrian Improvements on Vehicle Capacity*
- *Common Design Practices for Pedestrian Crossings at Intersections*
- *Crosswalk Use*
- *Minimizing the Crossing Distances at Intersections*
- *Minimizing Pedestrian/Motor Vehicle Conflicts*
- *Other Sources of Information*

This toolkit section addresses pedestrian facilities at intersections, as well as traffic regulating practices that can improve conditions for pedestrians at intersections.

Intersections are commonly designed with a focus more towards motor vehicles than pedestrians. Even the best network of streets with well developed pedestrian facilities can suffer from low pedestrian use if there are inadequate facilities and obstacles at intersections.

Intersections can be made more pedestrian friendly by implementing designs that improve crossing conditions, reduce crossing distances and minimize conflicts between pedestrians and other intersection users.

Intersections are the most common location for pedestrian and motor vehicle collisions.

Effects of Pedestrian Improvements on Vehicle Capacity

The needs of pedestrians deserve equal consideration with the needs of motorists and other intersection users. Historically, pedestrian facilities have been overshadowed by the needs of motor

vehicles, but current practices encourage design approaches that improve conditions for pedestrians and fully integrate them into the transportation system.

When determining the type and extent of improvements needed at intersections, the needs of all user groups should be considered and balanced. In some cases, installation of improvements that reduce crossing distances (such as curb extensions or reduced curve radii) can affect vehicle capacity at intersections. Increased pedestrian use and relocation of bus stops may also affect vehicle capacity. To improve pedestrian safety and mobility, it may be necessary to reduce vehicle capacity. Capacity loss may be a compromise that improves the function of an intersection for all users and creates the best overall solution.

A traffic engineering analysis should be conducted as part of the design process to clearly determine needs and provide recommendations for channelization, turn lanes, acceleration and deceleration lanes, intersection configurations, illumination, and traffic control devices. Solutions should seek to provide maximum protection to pedestrians in balance with accommodating the operational needs of motor vehicles and other intersection users.

Common Design Practices for Pedestrian Crossings at Intersections

Intersection design requires consideration of all potential users of the facility, including pedestrians. Design approaches need to find ways to protect the access and safety of pedestrians (the most vulnerable user group at intersections) while still adequately meeting the needs of motor vehicles.

Sometimes meeting the needs of pedestrians may require a compromise in providing full service and capacity to motor vehicles at intersections, but more often, designers can balance these competing needs, resulting in adequate levels of operation for all users. Table 44 lists some basic principles of intersection design related to the needs of pedestrians.

Crosswalk Use

Whether marked or unmarked, crosswalks function as extensions of the approaching sidewalks, and when pedestrians are crossing in these areas, they have the right of way.

Georgia law states “the driver of a vehicle shall stop and remain stopped to allow a pedestrian to cross the roadway within a crosswalk when the pedestrian is upon the half of the roadway upon which the vehicle is traveling, or when the pedestrian is approaching and is within one lane of the half of the roadway on which the vehicle is traveling or onto which it is turning.”

Crosswalks are important for pedestrian safety

Basic Principles of Intersection Design to Accommodate Pedestrians

- Intersections that function well for pedestrians are typically compact.
- Free-flowing motor vehicle movements are either eliminated or vehicles are forced to a significantly slower speed through the intersection.
- All legs of an intersection should be available for pedestrian use; closing a crosswalk doesn't necessarily prevent pedestrians from crossing in that direction. (Note that on some tee intersections, it may not be desirable for pedestrians to cross in front of left turning vehicles.)
- Pedestrians need to be able to travel in a direct line across the intersection leg and the direction of travel needs to be clearly identified for all pedestrians, including those with sight impairments.
- Avoid increasing potential conflicts or the level of pedestrian exposure to motor vehicles (as would occur at multiple and skewed intersections).

Table 44

Given that state law gives pedestrians the right of way in marked and unmarked crosswalks, designing them to adequately meet the needs of all pedestrians is important. But design isn't the only consideration. If crossing improvements are not functioning properly, there may be other problems, such as inadequate enforcement, poor visibility and obstructed sight lines, or level of service deficiencies.

Determining the Need for Crossing Improvements at Intersections

Crossing improvements at intersections, such as crosswalk markings, signs, signals, refuge islands, and other elements, help to clearly delineate the pedestrian right-of-way to all users, including motorists, bicyclists, and pedestrians. An important question often asked is, "How should the need for crossing improvements at intersections be determined?" The *Manual on Uniform Traffic Control Devices (MUTCD)* provides warrants for traffic signals. The MUTCD also states that intersection improvements are necessary for traffic control devices to function properly. In addition to reviewing the MUTCD and other guidelines, good professional judgement and specific traffic engineering

analyses on a case by case basis are recommended (see Figure 78). The PROWAAC committee recommended that marked crosswalks be provided at all signalized intersections.

Guidelines for the Installation of Marked Crosswalks at Uncontrolled Intersections and Mid-Block Crossings

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT >9000 to 12,000			Vehicle ADT >12,000 - 15,000			Vehicle ADT > 15,000		
	Speed Limit**											
	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/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
Multi-Lane (4 or More Lanes) With Raised Median***	C	C	P	C	P	N	P	P	N	N	N	N
Multi-Lane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

C = **Candidate sites for marked crosswalks.** Marked crosswalks must be installed carefully and selectively. 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, 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 elderly and/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 other pedestrian facility enhancements.** 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, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.**

Source: Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations , FHWA 2002

Figure 78

This toolkit generally describes current established processes for determining the need for improvements at intersections, such as marked crosswalks and signals.

Marked versus Unmarked Crosswalks

In recent years, there has been much debate surrounding the safety implications of marking crosswalks at uncontrolled intersections. Previous research results were contradictory in terms of whether pedestrian and vehicle crashes were occurring with more, less, or the same frequency at marked and unmarked crosswalks. The contradictory findings can be attributed to limitations of the research project designs, which contained many confounding variables and small, potentially biased sample sizes and sites (see Figure 79).

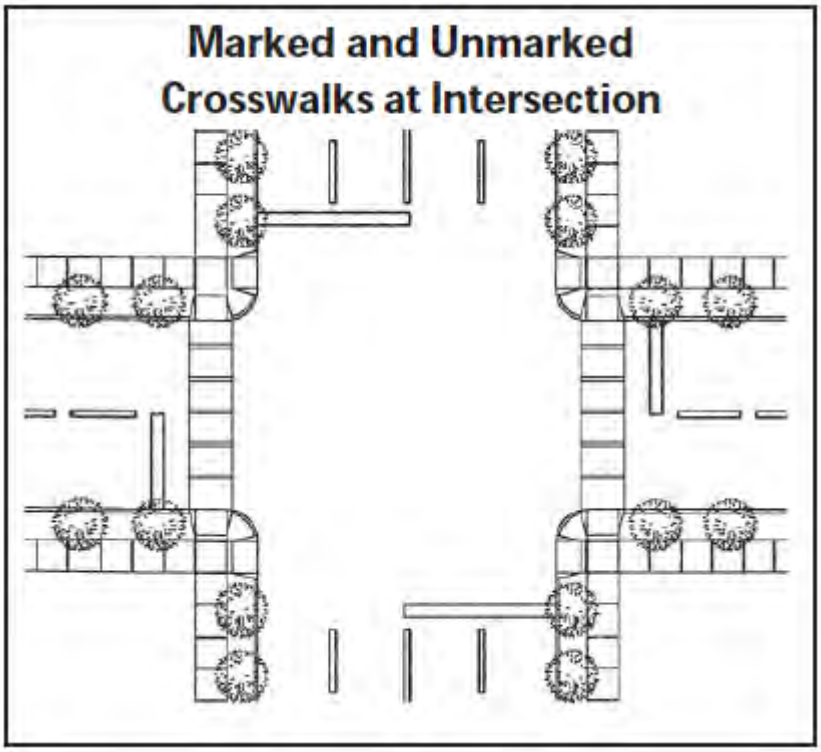


Figure 79

A study entitled *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations* was completed by the Federal Highway Administration to address crosswalk safety (Zeeger, Stewart, Huang, & Lagerway 2002). The study examined the safety of marked and unmarked crosswalks and the impact of additional pedestrian treatments, such as signal indications, lights, and traffic calming measures. The study evaluated 1,000 marked crosswalks at uncontrolled locations or locations with no traffic control devices and 1,000 matched but unmarked sites in 30 geographically dispersed cities in the United States. Detailed information collected for each site included pedestrian crash history, pedestrian and traffic volumes, number of lanes, speed limit, type of median, type and condition of crosswalk markings, and crosswalk location. Results of the study indicated that:

- Higher pedestrian volumes, higher average daily traffic (ADT) rates, and a greater number of roadway lanes are related to a higher incidence of pedestrian crashes;
- Crosswalk location, speed limit, direction of traffic flow, crosswalk condition, and crosswalk marking pattern were not related to the incidence of pedestrian crashes;
- Marked crossings had a higher incidence of pedestrian crashes on multi-lane (4 or more lanes) roads with high ADTs;
- Marked and unmarked crossings had similar incidences of pedestrian crashes on all 2-, 3-, and multi-lane roads with lower ADTs;
- Pedestrians ages 65 and above were more likely to be involved in crashes; and
- The installation of marked crossings did not alter motorist behavior (e.g., stop or yield to pedestrians) or pedestrian behavior (e.g., crossing without looking).

Typical marked crosswalk at intersection

According to the research, on smaller roadways with lighter traffic volumes, markings do not decrease the pedestrian crash risk; conversely, on large, high-volume roadways, the risk actually increase. However, Zeeger, Stuart and Huang (1999) indicated that the higher risk observed on multi-lane roadways with high ADT rates results from:

- An overall higher risk as the number of lanes or ADT rate increases regardless of markings.
- Recognition that multi-lane roadways with high ADT rates represent the most difficult scenarios for pedestrian crossings, and
- The fact that marked crossings draw pedestrians to cross in that location, particularly in areas where the crossing is perceived to be difficult.

Zeeger, Stuart, and Huang emphasized that the needs of pedestrians to safely cross streets cannot be ignored and that engineering and roadway treatments should be used to minimize the pedestrian crash risk. Based on these recommendations, it is rarely appropriate to remove crosswalk markings from multi-lane roadways with high average daily traffic. Instead, the markings should be enhanced with appropriate additional pedestrian treatments such as signing, traffic calming, signalization, or other countermeasures.

Crosswalk Dimensions

The MUTCD outlines requirements for minimum crosswalk widths and markings. The MUTCD requires a minimum crosswalk width of 6 feet. GDOT requires (and PROWACC recommends) a minimum crosswalk width of 8 feet. Wider crosswalks are often installed, particularly at crossings that receive high use. A width of 10 feet is commonly used for crosswalks. Crosswalks need to be at least the width of the approaching sidewalk. (ITE Design and Safety of Pedestrian Facilities). The approaching sidewalk or walkway and corner area at the intersection needs to be free of obstructions so that pedestrians can freely travel in either direction to cross the street (see Figure 80).

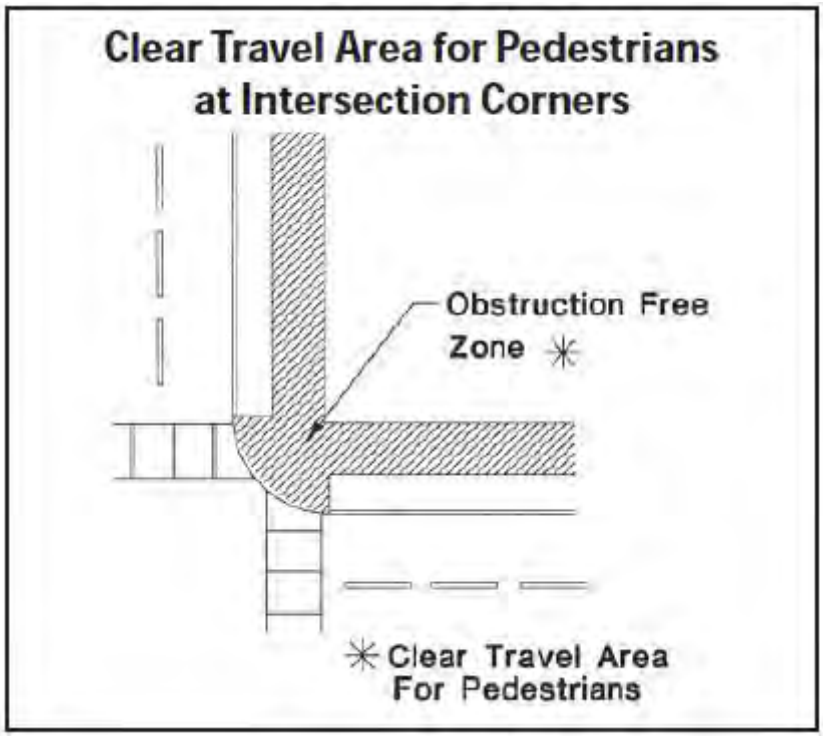


Figure 80

Crosswalk Markings

Crosswalks can be marked using various methods. Crosswalk marking patterns vary and limited information is available about the effectiveness of different designs. There is no evidence to support that one design is better than another, but some designs provide better visibility than others. Pedestrian visibility and safety can also be enhanced with advance stop or yield bars. Table 45 lists guidelines for determining the need for marked crosswalks.

Generally, high visibility markings are suggested for locations where greater motorist warning is considered beneficial and where pedestrians may not be expected to cross (such as mid-block locations), or where there are substantially higher pedestrian crossing volumes. Horizontal bars (two stripes perpendicular to vehicle traffic) are most often used at stop controlled intersections.

Guidelines for Determining the Need for Marked Crosswalks

- Pedestrian demand
- Sight distance
- Traffic volumes (daily and peak hour)
- Vehicle gaps/vehicle speeds
- Characteristics of pedestrians (school children, disabled people using crosswalk)
- Existing and desirable lighting levels
- Channelization refuge (island) opportunity
- Destinations/origins in proximity
- Special concerns—school walking routes, elderly needs, bus stops
- Collision history
- Distance to nearest crosswalk/intersection
- Number of lanes to be crossed
- Opportunity to concentrate pedestrian crossings at one location
- Citizen support
- Mid-block versus intersection
- Compliance with adopted standards (MUTCD) and other guidelines
- Traffic Patterns and Characteristics
- Driveway locations/number
- Other site specific or area-wide considerations

How the above elements apply to crosswalk decisions varies depending on location.

Site specific engineering judgement/study should be conducted before implementation.

Table 45

GDOT recommended ladder crosswalk

GDOT has adopted the ladder crosswalk design. Figure 81 shows GDOT's crosswalk design and crosswalk location detail. The GDOT crosswalk combines the transverse striping of a basic crosswalk with the higher-contrast piano key markings parallel to traffic flow. Properly sited between the tire paths, the piano key markings remain to mark the crosswalk even after the transverse bars are badly worn. Piano key markings are also being used more frequently because they provide the benefit of good visibility and easier maintenance. With the piano key pattern (and the ladder bar), the wheels of motor vehicles typically pass on either side of the markings, maximizing friction and minimizing deterioration. Table 46 illustrates several styles of crosswalk markings and lists advantages and disadvantages of each.

The minimum width of the horizontal bars recommended by the MUTCD is 6 inches. GDOT's minimum width for horizontal bars is 8 inches. Wider bars, 10 to 12 inches, are recommended by the ITE, particularly at crosswalks that receive high use or deserve special attention.

Stop bars are typically placed at intersections where motorists are required to stop to prevent overhang into crosswalk areas. GDOT uses 24-inch stop bars, parallel to the crosswalk that extends across all approach lanes. Stop bars need to be located at least 4 feet in advance of the crosswalk, and can either be parallel to the crosswalk or angled or staggered in each lane to increase visibility. Strategically locating and skewing stop bars improves visibility of pedestrians, as well as operations for right-turn- on-red vehicles and for vehicles turning left from the cross street.

GDOT Crosswalk and Location Details

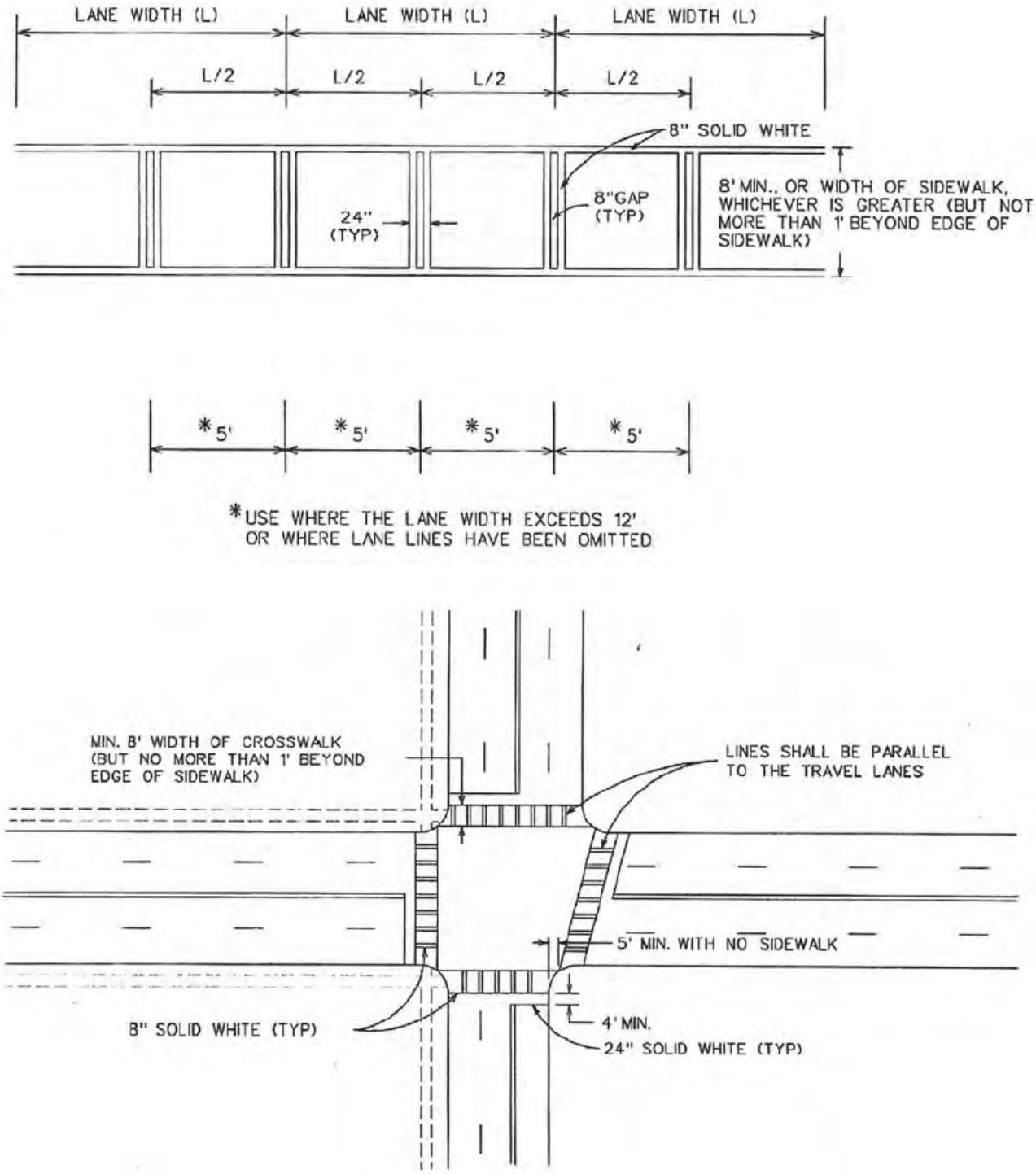


Figure 81

Advantages and Disadvantages of Crosswalk Marking Patterns

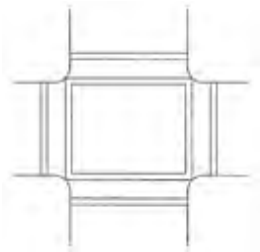
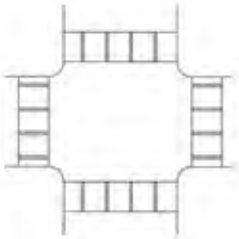
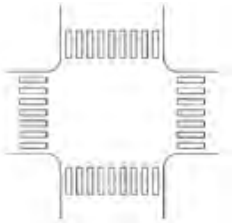
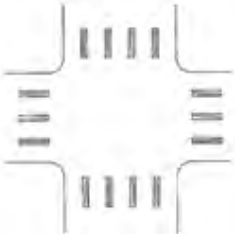
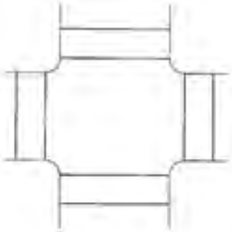
	Marking Pattern	*Advantages*	*Disadvantages*
	Horizontal Bars	Common practice at stop controlled intersections; less expensive, easy to install and maintain	Not as visible as some other marking types; bars tend to wear faster than other types; not appropriate for mid-block locations
	Georgia Department of Transportation Standard	Highly visible, horizontal bar increases contrast for pedestrians with visual impairments; easy to maintain	Wider stripes rub off with wheel friction, but can be placed to minimize this effect; surface can be slippery
	Ladder Bar	Highly visible	Wider stripes rub off with wheel friction, but can be placed to minimize this effect; surface can be slippery
	Piano Key	Highly visible and becoming more commonly used; easy to maintain since stripes can be placed outside the wheel friction areas	
	Dashed (European)	Captures attention because it is not a commonly used pattern	May not define space as well as some of the other choices
	Solid	Visible (but may not be as eye catching as other patterns); not commonly used	Expensive; more difficult to install and maintain; surface can be slippery

Table 46

Advance stop and yield markings have been shown to increase the visibility of pedestrians to motorists by providing a wider range of visibility on multiple lane roadways. When vehicles stop only four feet from the crosswalk (the typical standard,) they tend to screen the view of pedestrians from vehicles approaching in the other lane(s). Buses and trucks in particular cause this problem, as do today's larger sport utility vehicles. As the potential for larger vehicles to approach a crossing increases, the potential for pedestrians to be screened and blocked from the view of other vehicles increases. The underlying principle behind advance stop lines is that they increase the safety of pedestrians by reducing the screening effect of vehicles yielding to pedestrians.

One of the problems that can limit the application of advance stop lines is the reluctance to use stop lines in what is a "yield" rather than a "stop" situation. Advance yield bars are a relatively new technology that are in the research stage, and have the potential to mitigate the concern about stop lines in yield situations. Also, because they are unusual and not frequently used, they are much more noticeable by motorists.

Advanced Yield Marking

Since they are currently in the experimental stage, permission for their use must be requested from FHWA, and the proponent must agree to restoration of the location to comply with MUTCD if they prove to be ineffective.

However, current research indicates that they are effective in gaining compliance by motorists.

Advance yield markings should be located a minimum of 30 feet in advance of the marked pedestrian crossing, and should be used with complementary signing as shown in Figure 82. There is currently no standard for the "yield here for pedestrians" sign.

Advanced stop markings should be monitored regularly and maintained in good condition. They should also be removed when no longer needed. Painted markings are less expensive than plastic markings, but the plastic markers have a longer life. Check with your local agency for crosswalk and pavement marking requirements.

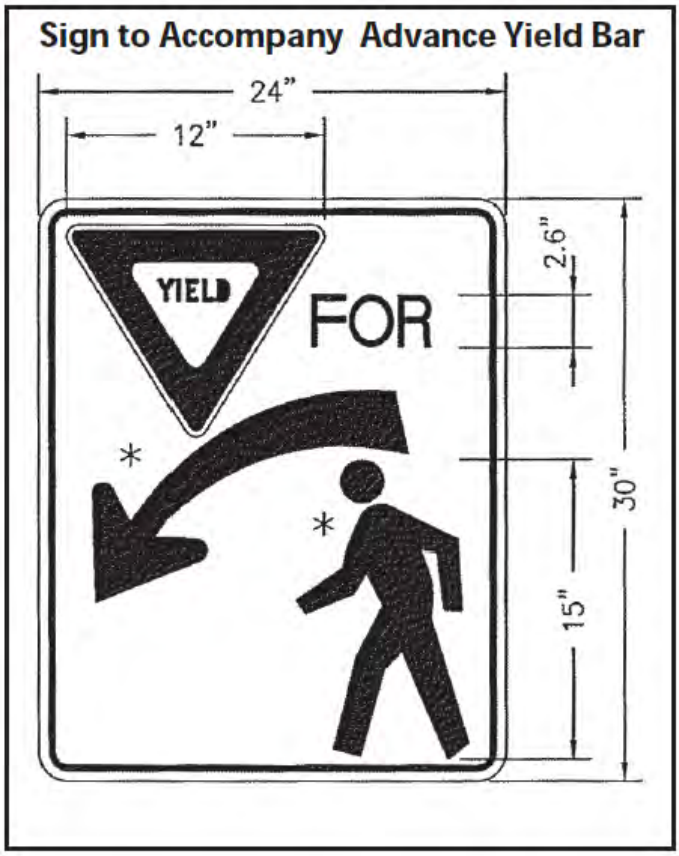


Figure 82

Also, for more specific design details related to pavement striping and marking techniques, refer to other sources, such as the MUTCD.

Rumble strips with raised pavement markers or buttons are sometimes placed in advance of crosswalks in rows, which create a “rumbling” effect, alerting approaching drivers to the upcoming crosswalk. Use of these types of markers is not generally recommended unless they can be placed far enough in advance of the crosswalk to be an effective warning device (at the same location as the crosswalk advance warning sign). Raised pavement markers should not be placed near the right edge line because they are an obstacle to bicycle travel (see discussion in Toolkit 5 — Sidewalks and Walkways). If raised pavement markers are used, they should be placed outside the required clearance area of bike lanes. The use of raised pavement markers should be analyzed on a case-by-case basis. They should only be installed after a traffic engineering study determines they are needed.

Curb Ramps

Curb ramps are often considered to be the most important elements of an accessible pedestrian environment. Curb ramps provide accessibility at the grade transition between intersection corners and lower street grades. They facilitate crossing for wheelchair users, people pushing strollers, bicyclists and others. If properly located, they can also help to direct pedestrians, including sight-impaired people, in the direction of the crosswalk if they are properly located. Toolkit 2 — Accessibility, discusses placement and design of curb ramps.

Lighting

The street lighting level provided at intersections may need to be supplemented with additional lighting in areas of heavy pedestrian traffic during early morning, late evening, or nighttime hours. Refer to the standards and design guidelines of the Illuminating Engineering Society of North America.

Location of Drainage Inlets and Grates

Drainage grates should be located away from crosswalks and curb ramps and outside the route of pedestrian travel. It is preferable to locate drainage inlets on the upstream side of the crosswalk to avoid excessive drainage flows across the crossing area. Roads and gutters should be graded to direct drainage away from intersection corners and walking areas.

Pedestrian Related Signs

It may be necessary to provide signs in advance of, at, or near an intersection. Regulatory signs are generally rectangular shaped signs that identify special conditions and regulate motorists and pedestrians. Warning signs are diamond shaped with black and yellow colors, and are used to identify upcoming conditions that may not be expected. Florescent yellow-green should be used for warning signs in school zones.

Pedestrian related warning signs include the standard pedestrian crossing signs used at locations to identify upcoming crossings (refer to Figure 83). The pedestrian warning sign with the pedestrian symbol should be used in advance of crossings in areas of high pedestrian use and at crosswalk locations. Refer to MUTCD for distance requirements for advance signing.

Figure 83

Minimizing the Crossing Distances at Intersections

Minimizing the crossing distance at intersections enables pedestrians to cross the street more safely, efficiently and comfortably. Techniques that reduce pedestrian crossing distance and time also provide the added benefit of improved timing at signalized intersections (without sacrificing the need for an adequate protection phase for the pedestrian). Several design techniques for reducing crossing distances at intersections are described in the following text.

Reduced Curb Return Radius

Historically, design of curb return radii at intersections has not typically considered the needs of pedestrians. With new design and retrofit design of intersections, it is important to consider the needs of all users of the intersection and to balance these needs to provide the safest operating conditions for all.

The use of shorter curb return radii at intersections is beneficial for pedestrians because it reduces the crossing distance of the intersection. Reduced radii also help to slow vehicles as they travel through the intersection, enabling drivers to respond more quickly to signal changes and crossing pedestrians.

The need for shorter pedestrian crossing distances and reduced vehicle speeds should be balanced with the need to provide adequate curb radius lengths to accommodate the types of vehicles that commonly turn at the intersection. A radius that is too small can cause large vehicles and buses to jump the curb, causing deterioration of the curb and intrusion into the waiting and standing space for pedestrians.

It may not always be practical to reduce the curb return radii at all intersections used by pedestrians, particularly at existing intersections. However, at intersections where there is heavy pedestrian crossing activity and limited truck and bus turning movements it may be desirable to shorten the radius by adding curb extensions or bulb-outs. It may also be desirable to analyze transportation routes in the area and to reroute trucks onto streets that receive less pedestrian use. This would enable streets more heavily used by pedestrians to be retrofitted with shortened curb radii without significantly affecting the overall operational needs of large trucks and buses in the area.

If truck and bus turning activity occurs at a minimal level, AASHTO standards permit 15 to 25 feet curb radii on minor streets, although shorter radii are allowed in certain situations. On major streets, AASHTO allows a minimum turning radius of 30 feet if the occasional truck can turn with some minimal encroachment. These standards may vary at the local level. In some cases local jurisdictions may encourage the use of shorter than standard curb radii at intersections where there is likely to be frequent pedestrian crossing activity, particularly in urban areas. GDOT typically uses a radius of 30 feet in its designs.

Curb return radii larger than 30 feet generally are not desirable where there are high numbers of pedestrians crossing.

Figure 84 illustrates how reduced curb radius at an intersection shortens the pedestrian crossing distance by comparing the crossing distance between two 15-foot radius corners with the crossing distance between two 30-foot radius corners at an intersection.

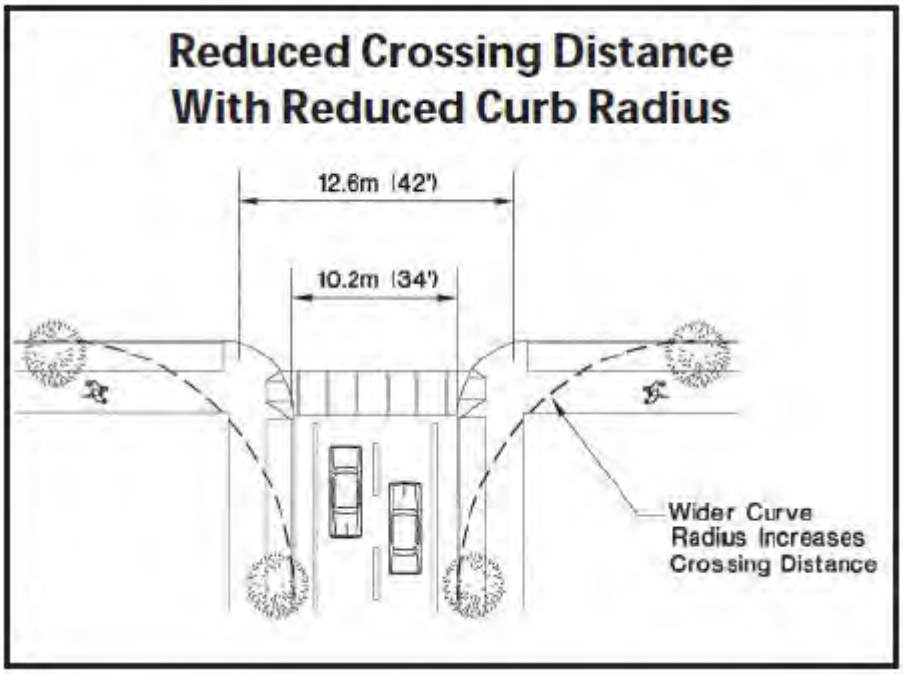


Figure 84

In certain situations, very short curb radii of 5 feet can be used on one-way streets at the corner where no turning movements are possible. Figure 85 illustrates how the use of one-way street patterns can enable reduced curb radii at the non- turning corners of the intersection. For more discussion on one-way streets, refer to Toolkit 5 — Sidewalks and Walkways.

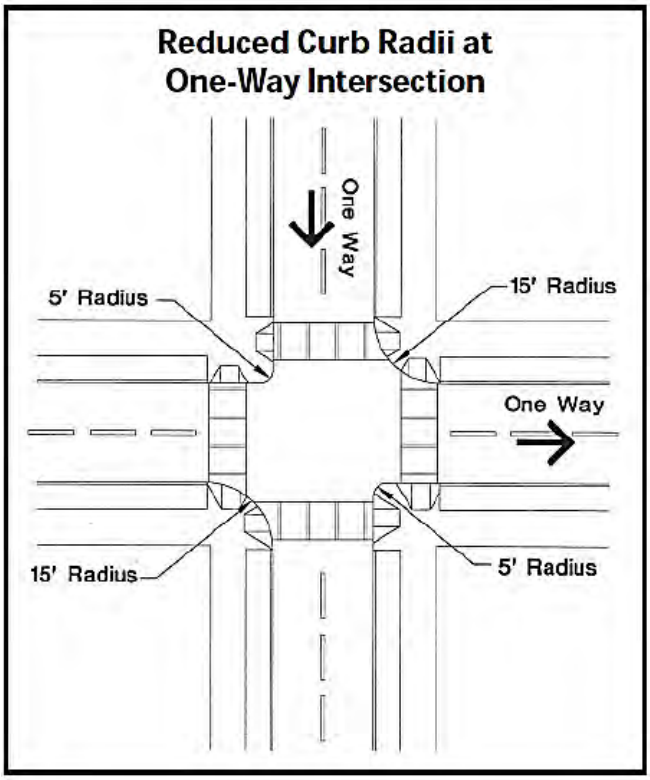


Figure 85

Table 47 summarizes the benefits and disadvantages related to shortening curb radii at intersections.

Right-Turn Channelization (Slip) Lane with Refuge Island

At wide intersections, there is often a triangular space between the through-lane and the right- turn lane (also called a "slip" lane) unused by motor vehicles. Placing a raised island in this area provides pedestrians a refuge area when crossing.

Benefits and Disadvantages of Shortening Curb Radii

Benefits

- Reduces crossing distances for pedestrians
- Slows vehicular movement through intersection
- Heightens awareness of pedestrians
- Improves signal timing because the time for the pedestrian crossing phase can be reduced
- Easier to install directional curb ramps

Disadvantages

- May not be feasible at intersections where buses and large trucks turn frequently
- If radii are too small, larger vehicles may either have to swing into opposing traffic or drive over the curbing at the corner, causing deterioration and intruding into pedestrian waiting space
- May decrease vehicular capacity at intersection

Table 47

This may be an appropriate solution where curb return radii of larger than 30 feet are unavoidable. This type of design is only appropriate for use when it fully addresses the needs of pedestrians. If designed properly, these devices can help to balance the needs of large vehicles and pedestrians at busy intersections.

At locations with extremely high numbers of right turning movements, slip lanes should be protected with a signal to provide pedestrians opportunities to cross.

Also, refuge islands should be designed with an elongated tail (see Figure 86), which stretches out the turning movement and provides vehicles more space to slow and observe pedestrians crossing the lane. (This elongated design is recommended by the Handbook for Walkable Communities as a method to make right-turn slip lanes safer for pedestrians. It has not yet been incorporated into the AASHTO Green Book.)

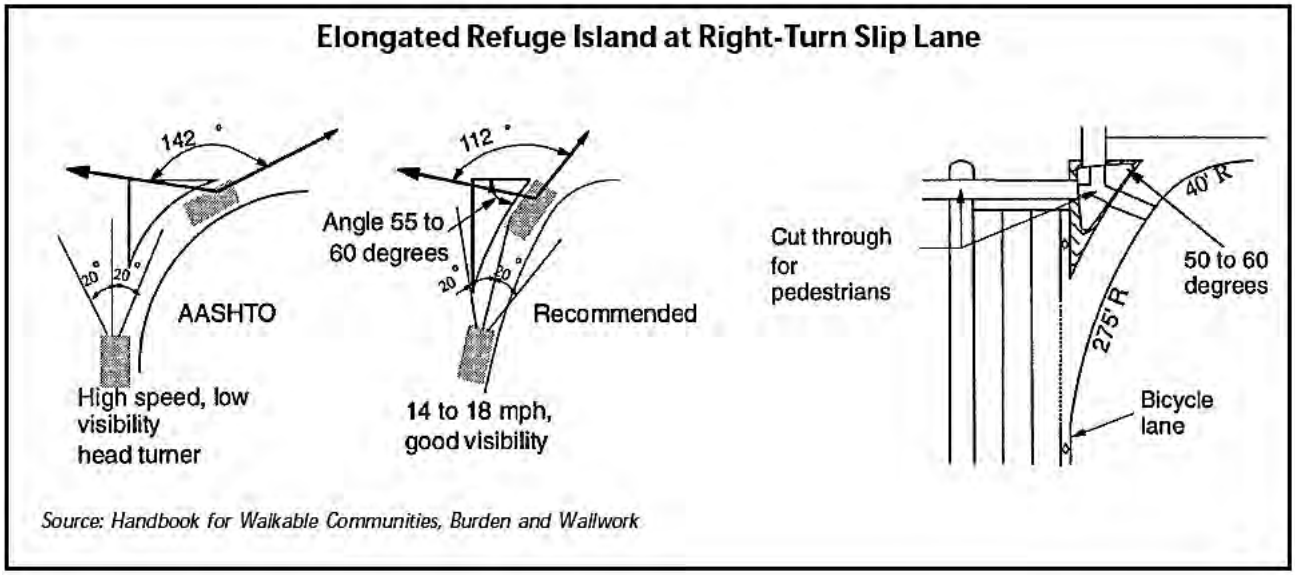


Figure 86

The refuge islands should be raised to provide a vertical barrier and added protection between vehicles and pedestrians. Refuge islands need to provide curb cuts or cut-throughs if space is limited, for accessible passage. AASHTO requires that curbed islands generally be no smaller than 54 square feet, but preferably a minimum of 100 square feet. Triangular refuge islands should be a minimum of 20 to 25 feet long and not less than 6 feet wide in the crossing region and 1.6 feet wide in the tail region. A wider area is needed to provide curb ramps and a level area between the curb ramps in the crossing region.

Pedestrian push buttons may be needed when the signal timing doesn't allow all pedestrians to cross the street on one crossing phase. These areas should be clear of obstacles such as utility facilities and landscaping above 2 feet. The crossing point may be marked with a highly visible crosswalk design and a stop bar. Signing with the message "STATE LAW - STOP FOR PEDESTRIANS IN CROSSWALKS" is also useful to advise motorists that state law requires them to stop for pedestrians in crosswalks. The sign should be placed near but in advance of the crosswalk location. Directional barriers or devices (such as bollards, signs, landscaped strip, or other elements) may be necessary to keep pedestrians from stepping off the curb in areas other than the crosswalk.

"Stop for Pedestrians" sign

Refer to Figure 87 for an example of a right-turn channelization lane and refuge island at a larger curb radius intersection.

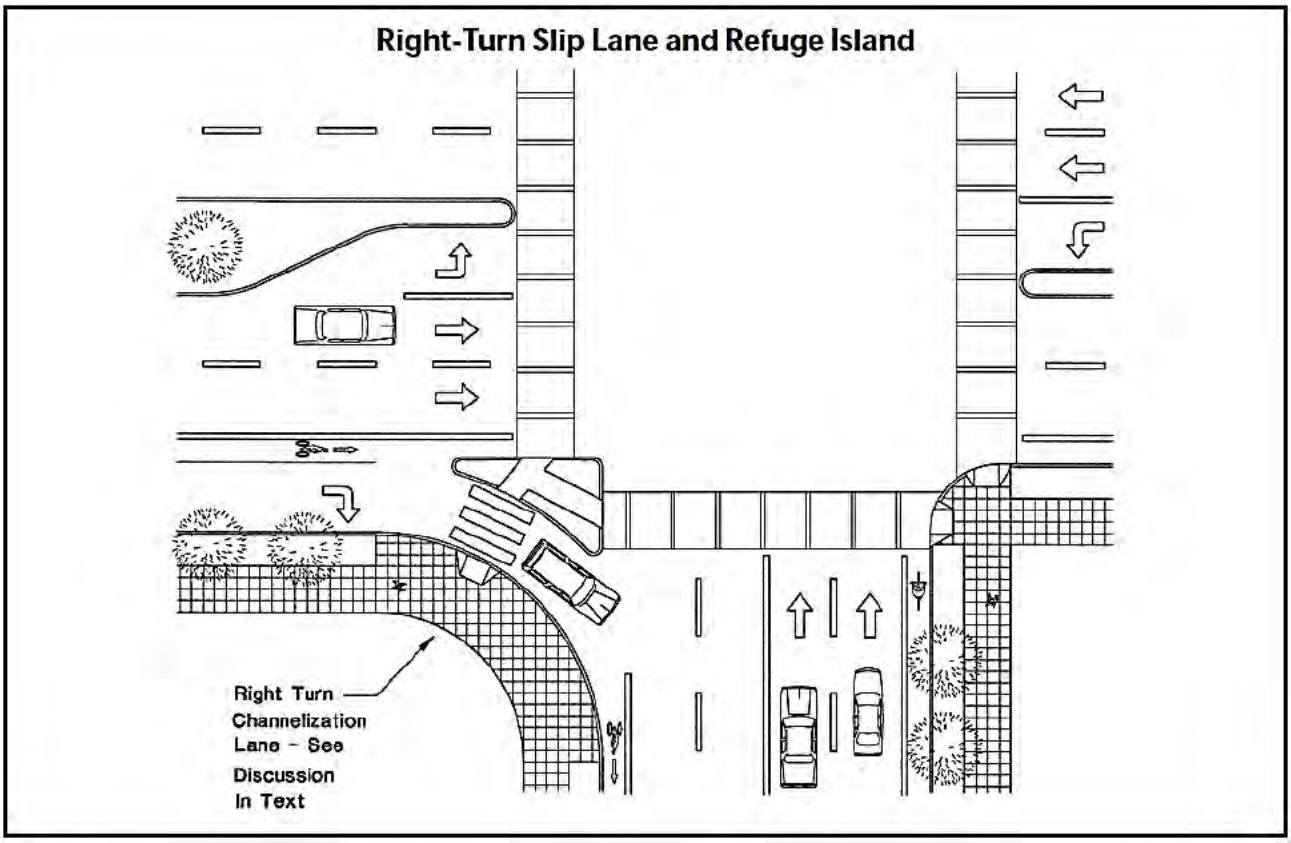


Figure 87

Medians and Center Refuge Islands

Medians and center refuge islands at intersections provide waiting areas for pedestrians and eliminate the need for pedestrians to cross both directions of traffic all at once. Medians and center refuge islands can be created at intersections or mid-block to help define the pedestrian walking space and provide protection and refuge from motor vehicles.

Refuge islands are typically shorter than medians, but either can be used at intersections. Medians and center refuge islands provide the benefit of turning one two-way street into two one-way streets from the perspective of the pedestrian. Pedestrians only have to cross one direction of traffic at a time and can wait and rest in between if necessary. Medians and refuge islands are generally most necessary where the length of crossing exceeds 60 feet, depending on the signal timing, but can be used at intersections with shorter crossing distances where a need has been determined. Table 48 lists typical conditions where refuge islands can provide the greatest benefit.

Locations Where Refuge Islands are Most Beneficial
• Wide, two-way streets (four lanes or more with high traffic volumes, high travel speeds, and large pedestrian volumes
• Wide streets where children, people with disabilities, or elderly people cross regularly
• Wide two-way intersections with high traffic volumes and significant numbers of crossing pedestrians
• Lower volume or streets where there is insufficient time to cross
• Minor access/local residential streets where islands function both as traffic calming devices and street crossing aids

Table 48

Medians and center refuge islands need to be large enough to provide refuge for several pedestrians waiting at once. They generally should be a minimum of 6 feet wide and preferably 8 feet wide or more where possible, face of curb to face of curb. These areas also need to be accessible, with either curb ramps or at-grade cuts. Cut-throughs are generally easier to construct and easier for pedestrians to negotiate than curb ramps, particularly on smaller islands.

Refuge islands should be raised to provide a vertical barrier between pedestrians and motor vehicles. Sometimes a small nose can be placed in front of the crosswalk to provide additional protection to pedestrians waiting at the median and refuge island. The use of medians and refuge islands at intersections also help to provide added protection during left-turning movements. Pedestrian push buttons should be mounted in the islands to provide pedestrians control over the signal phases from their refuge position. Push button posts and other poles need to be located out of the pedestrian travel way, but not inconveniently far from reach.

Figure 88 illustrates a median/refuge island at an intersection. For more discussion on medians and refuge islands, refer to Toolkit 7 — Crossings.

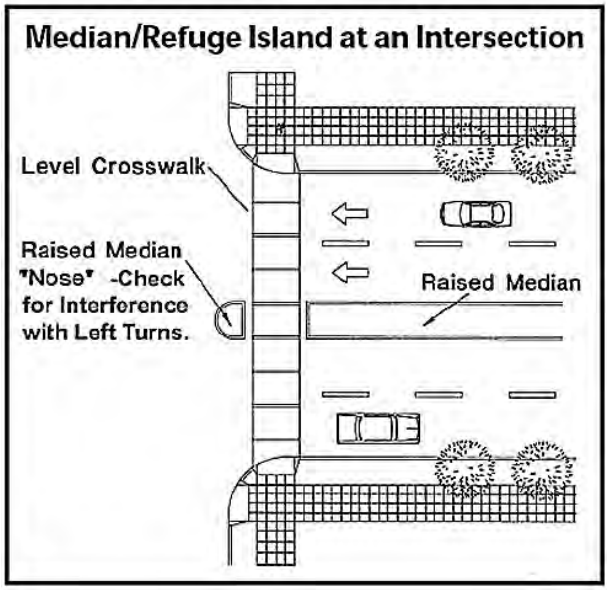


Figure 88

Curb Bulb-Outs and Extensions

In addition to reducing crossing distances, curb bulb-outs and extensions make pedestrians more visible to motorists at intersections. Curb bulb- outs and extensions at intersections and mid- block crossings may help to slow traffic by narrowing the street. They should be considered where on-street parking exists.

Curb extensions and bulb-outs work particularly well on urban streets where there is limited turning traffic by buses and large vehicles or that accommodate one-way traffic, and on minor streets in residential areas. They are also effective in delineating on-street parking zones. Other types of traffic calming techniques are described in Toolkit 8 — Traffic Calming. Figure 89 illustrates a typical curb extension design, and Figure 90 illustrates curb bulb-outs. Figure 91 illustrates how crossing distance is reduced through the use of curb extensions.

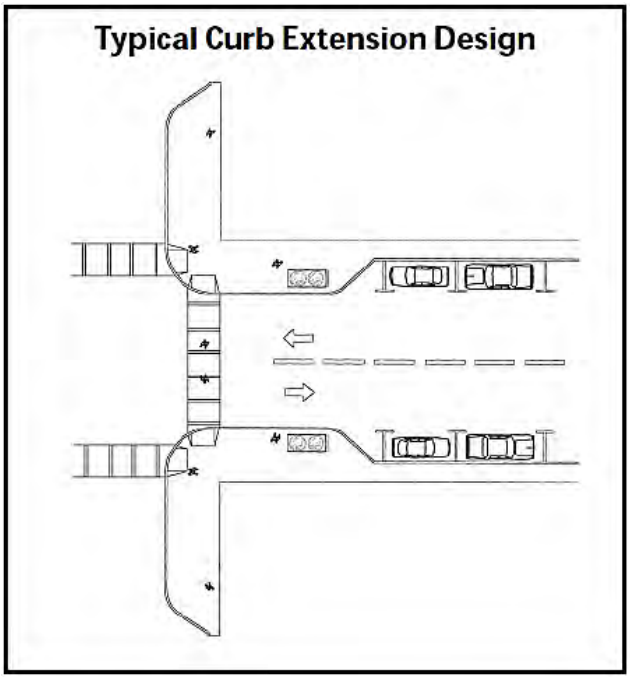


Figure 89

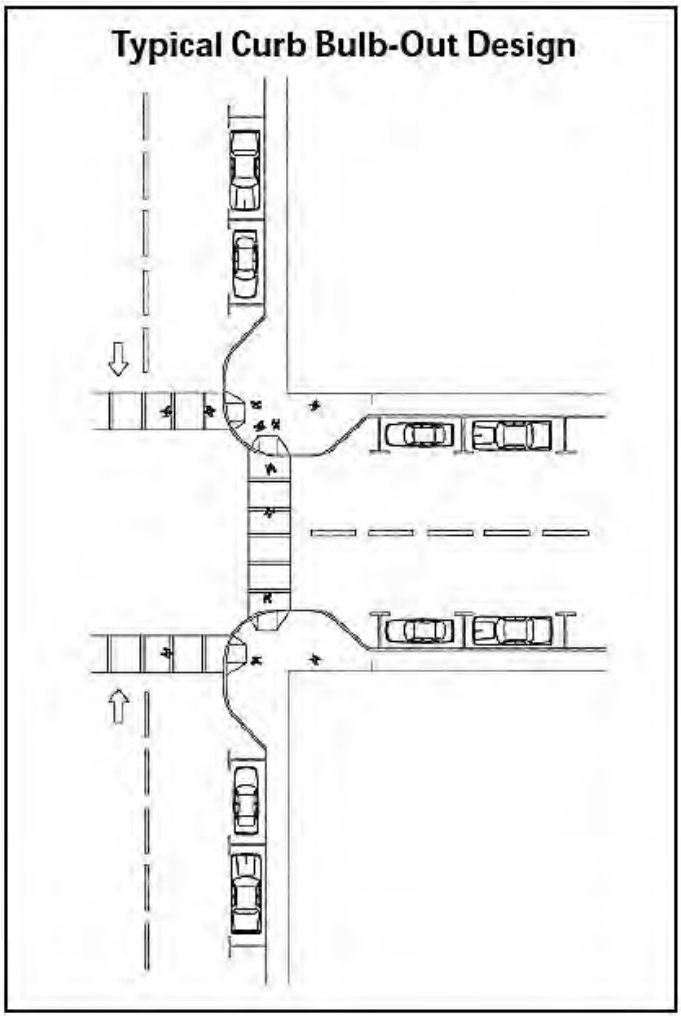


Figure 90

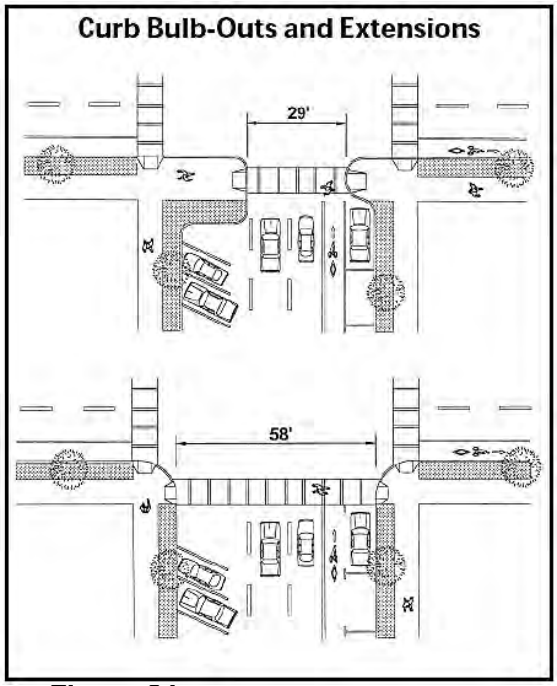


Figure 91

Avoiding or Reconfiguring Multiple and Skewed Intersections

Multiple intersections are intersections with more than four legs or vehicle approaches. Skewed intersections are created when intersections join at awkward angles, other than 90 degrees. When designing new intersections or improving existing intersections, avoid creating situations where more than four legs come together or where any of the intersection legs are skewed. Transportation agencies should consider reconfiguring skewed intersections. In *Designing Sidewalks and Trails for Access*, there are recommendations for designing skewed intersections. Recommendations include:

- Install curb ramps perpendicular to the curb
- Provide longer crossing times and accessible pedestrian signals if the intersection is signalized
- Provide marked crosswalks
- Add medians to reduce crossing distances
- Consider installing intersection guidestrips which provide directional information for pedestrians with vision impairments

Minimizing Pedestrian/Motor Vehicle Conflicts

Corner Visibility

Providing good corner visibility at intersections is commonly overlooked. Facilities such as signs, utility poles, bus stops, benches, and other elements are often added after design and construction of an intersection, inhibiting driver and pedestrian visibility. These elements should not be located in areas that interfere with sight distances. Figure 92 illustrates the area at an intersection that typically should be kept clear of obstructions. Refer to GDOT or local agency design standards for the adopted method to calculate sight distance triangles at intersections and driveways.

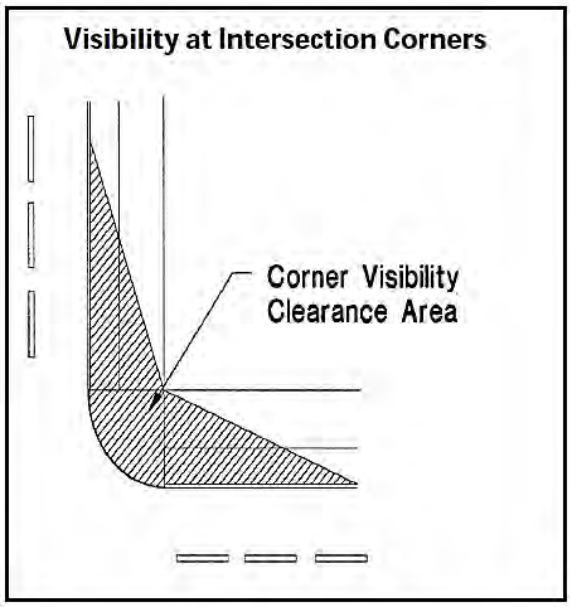


Figure 92

Elements that obstruct the downward views of high-seat position drivers (such as bus and truck drivers) should also be avoided at intersections (within the corner visibility triangle area), including low branching trees, signs, hanging banners, or other elements.

On-Street Parking Restrictions

On-street parking near pedestrian crossing points can interfere with visibility. When cars are parked too close to crossing points, they may block the line of sight between the driver and the pedestrian stepping off the curb to cross. This is a common cause of pedestrian/vehicle collisions.

GDOT prefers parking spaces to be at least 20 feet from crosswalks and 30 feet from stop signs. This is to assure that vehicles do not backup into a crosswalk when leaving a parking space (either parallel or angled parking). The *ITE Design and Safety of Pedestrian Facilities* recommends that parking be restricted within 50 feet of all intersection crossings where the speed of travel on the street is 35 to 45 mph, and be restricted within 100 feet at intersections on streets where the speed of travel is above 45 mph and at mid- block crossings (see Figure 93).

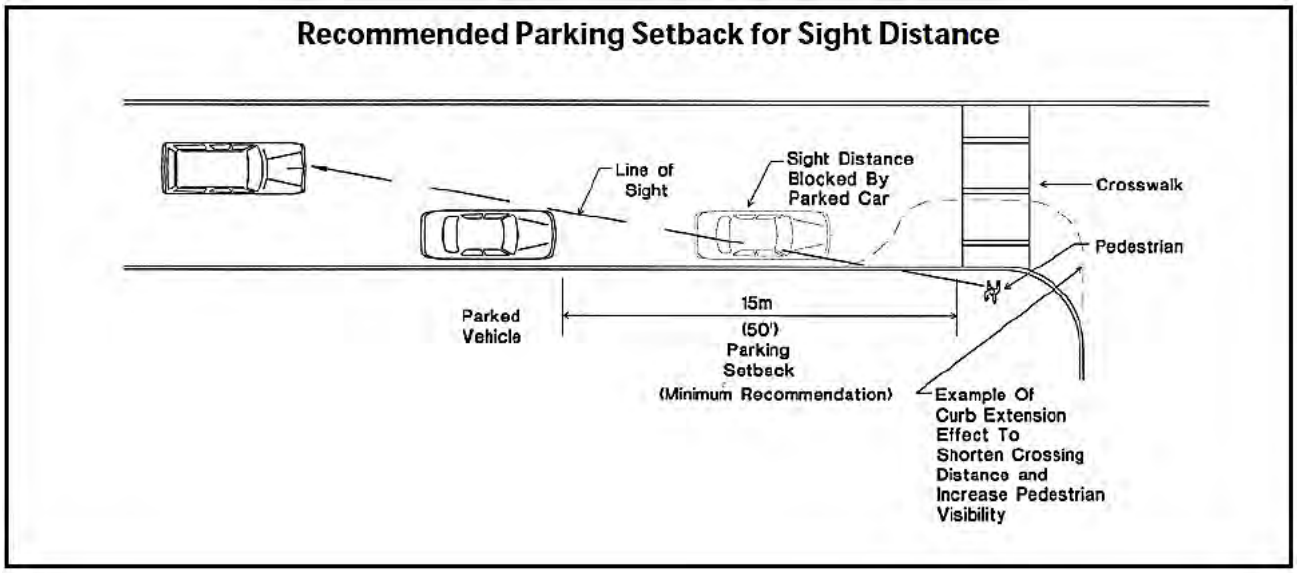


Figure 93

Designers should use professional judgement when considering the appropriate distance for parking setbacks from specific pedestrian crossing points.

In certain situations, it may be appropriate to require a greater setback distance (50 to 100 feet) from crossing points, such as:

- near schools where many children are crossing;
- at intersections or crossings that are not signalized;
- on roadways where travel speeds exceed 35 mph; and
- on roadways with elements that affect sight and stopping distance (curves, bridges, vegetation, etc.)

In some situations, a setback less than 50 feet may be appropriate, such as in central business districts, downtowns, or other areas where travel speeds are typically slower (between 20 and 30 mph), and at signalized intersections or crossings. Curb extensions (bulb-outs) at intersections and crossing points provide space for pedestrians to stand in better view of approaching vehicles, and on-street parking can be placed closer to the crossing point without affecting visibility of pedestrians.

Uncontrolled intersections and mid-block crossings are of particular concern where inadequate sight distance exists, because there is no control (stop sign or signal) over the movements of vehicles and pedestrians.

Additional considerations related to on-street parking are discussed in Toolkit 5 — Sidewalks and Walkways.

Traffic Regulation and Access Management

Traffic regulation and access management practices can help reduce potential conflicts between pedestrians and motor vehicles at intersections. For more information about access management, refer to Toolkit 5 — Sidewalks and Walkways and Toolkit 10 — Site Design. Traffic control and regulation devices are discussed in more detail in the following text.

Signalization

The needs of pedestrians should be considered at all traffic signal installations where pedestrian activity might be expected.

Pedestrian Indications (Signal Heads and Symbols) and Exclusive Pedestrian Phase Pedestrian signal indications include “WALK/ DON’T WALK” or the symbolic man/hand symbol used in conjunction with traffic signals. The MUTCD provides a list of warrants for pedestrian indications. Traffic signal symbols used to direct motorists may not provide the correct message to pedestrians. For this reason, it is strongly suggested that traffic engineers fully consider the need for pedestrian indications at all signalized crossings that have the potential to be used by pedestrians.

Pedestrian indications are typically provided when vehicular movement is controlled by actuated equipment and when pedestrian actuators have been installed.

Pedestrian indications and signal heads need to be installed in clearly visible locations from the crosswalk approaches. Audible devices are being used in some areas. This type of indication is particularly helpful to sight impaired pedestrians. For more information about audible devices, refer to Toolkit 2 - Accessibility.

Research has documented that many pedestrians do not understand the meaning of pedestrian signal indications, particularly the flashing “DON’T WALK” symbol.

Figure 94 illustrates the pedestrian indication symbols commonly used throughout the United States, as well as the action to be taken during each phase of the signal indication.

Figure 94

Where there is heavy pedestrian crossing activity (near a transit center or college campus, for example), an exclusive pedestrian signal phase should be provided to allow pedestrians to cross in one or more directions. A "pedestrian scramble," where pedestrians are allowed to cross at all directions (including diagonal) within a well-defined intersection area is an example of an exclusive phase application. During this exclusive pedestrian phase, no vehicular movement typically takes place.

Pedestrian Actuated Signals

Pedestrian actuated signals may be warranted at intersections (and mid-block locations) where gaps in the stream of traffic provide inadequate opportunities for pedestrians to cross. Install pedestrian actuated signals only where warranted by the MUTCD, ADA guidelines, or engineering judgment. Adequate sight distance is necessary at these locations, and warning signs should be installed in advance of the signal.

Some examples of locations where pedestrian actuated signals may be appropriate include:

- Intersection crossings where the level of pedestrian activity may be relatively low, but the traffic volume and speed of vehicles is high, or gaps in traffic are not adequate to allow pedestrians to cross
- Mid-block crossings on streets where pedestrian activity is high and the volumes and speeds of vehicular traffic are also high
- Heavily used crossings at mid-block bus stops (provide increased responsiveness of the actuation during times of peak hour pedestrian access to the bus stop)

The MUTCD provides signal warrant guidelines related to pedestrian actuated signals. Local jurisdictions may use other criteria to determine the need for these signals. Toolkit 3 - Children and

School Zones and Toolkit 7 - Crossings also discuss the use of pedestrian actuated signals. Also, refer to Toolkit 2 - Accessibility for considerations related to placement and design of pedestrian actuation devices for maximum accessibility.

Push Buttons (Actuators/Detectors)

Pedestrian push buttons and detection devices should be conveniently located near the end of crosswalks and in easy to reach positions. They should be located no more than 5 feet from the pedestrian travel way and face toward pedestrians. It is recommended that signs be mounted on the push-button poles to identify which button to cross for each crossing direction. The purpose and use of push buttons should be clearly identified, and they should clarify which crosswalk they are linked to.

In addition to being located at intersections, pedestrian actuators may also be located in intersection or mid-block refuge areas, where pedestrians may be caught crossing during the end of the walk cycle. In some areas with heavy pedestrian volumes, or where signal cycles are particularly long, it may help to place additional actuators in advance of the intersection to decrease pedestrian waiting time. Research shows that when pedestrians have to wait on average over 30 seconds, they have a tendency to not wait. Pedestrian use should be considered when selecting cycle lengths. Table 49 lists recommended measures to improve the effectiveness of push buttons.

Measures to Improve the Effectiveness of Push Buttons
• Maintain push buttons as necessary to ensure they are functioning
• Make push buttons responsive to pedestrians
• Provide signing to show which street crossing the push button controls
• Sign operating times for push buttons designed to operate only during certain times

Table 49

The use of motion detectors, infrared, or video devices to automatically change the signal phase when pedestrians approach the crossing is being experimented with around the country. Also, special signals are being tested that allow vehicles to proceed in an intersection during the pedestrian cycle when there are no pedestrians present.

Signal Timing

Signals are often timed with a focus toward accommodating smooth motor vehicle flows rather than accommodating the needs of pedestrians. Traffic signals are usually timed for vehicle speeds, causing pedestrians to have to stop at nearly every intersection.

Signals with excessively long waits may cause pedestrians to cross against the signal, increasing the potential for pedestrian/motor vehicle conflicts. Research indicates that many pedestrians stop watching for the light to change, and instead start looking for gaps to cross streets when their delay exceeds 30 seconds. Installation of pedestrian actuation devices can help with this problem.

Signals that do not provide enough time for pedestrians to cross are also a major concern. The walking speed normally used by GDOT for calculating pedestrian walking time is 4 feet per second, but this may not provide adequate crossing time for all pedestrians. GDOT will consider varying

from the standards under certain circumstances. Pedestrians sometimes travel at slower speeds and thus may need more crossing time.

Studies have indicated that up to 30 percent of the population does not normally walk as quickly as 4 feet per second. Recent research by Knoblauch, Pietrucha, and Nitzburg determined that for design purposes, values of 3 feet per second are appropriate for older pedestrians. Other studies have indicated that some pedestrians with mobility impairments travel at 2.5 feet per second or slower. Table 50 depicts the length of time necessary to cross various distances at these speeds. This table is provided to compare the differences in crossing time that can occur with different pedestrian groups. Set or adjust signal timing to accommodate a greater cross-section of the population. Several sources, including the ITE manual Design and Safety of Pedestrian Facilities, are recommending the use of the 3 feet per second travel speed for signal timing. PROWAAC recommends a walking speed of 3.5 feet per second be used for calculation of crossing time.

Crossing Distances, Speeds, and Time

Crossing Distance	***Average Pedestrian Crossing Time at 4 ft./second***	***Older Adult Crossing Time at 3 ft./second***	***Mobility Impaired Pedestrian Crossing Time at 2.5 ft./second***
24 ft.—2 lanes	6 seconds	8 seconds	9.6 seconds
34 ft.—2 lanes* with bike lanes	8.5 seconds	11.3 seconds	13.6 seconds
46 ft.—3 lanes with bike lanes	11.5 seconds	15.3 seconds	18.4 seconds
58 ft.—4 lanes with bike lanes	14.4 seconds	19.3 seconds	23.2 seconds
70 ft.—5 lanes" with bike lanes	17.5 seconds	23.3 seconds	28 seconds

** Assumes 12-foot vehicular lane width and 5-foot bike lane width.*

Source: Adapted from walking speed estimates

Table 50

MUTCD recommends using a walking speed of 4 feet per second, but GDOT recommends using 3.5 feet per second when there is a known presence of slower pedestrians (including elderly and people with mobility impairments) who regularly use a crossing (near a retirement home or hospital). The possibility of extending signal crossing time in these areas should be considered.

WALK Signal Timing

At some intersections, the 4 to 7 second “start-up” time walk interval recommended by the MUTCD may present a dilemma to pedestrians who see the “DON’T WALK” display before they are more than one or two lanes across the street, especially since as discussed earlier, many pedestrians do not always understand that the flashing “DON’T WALK” symbol doesn’t mean to stop walking. It may be desirable to provide a longer “WALK” interval at some locations, like at particularly wide intersections, or in areas where there is clearly confusion among crossing pedestrians.

A device currently being used in several cities around the country, the Countdown Signal, displays the number of seconds left for the pedestrian to cross the intersection.

Turning Movements

Regulating turning movements at intersections can improve conditions for pedestrians. According to the ITE, 37 percent of all pedestrian/motor vehicle collisions at signalized intersections involve left- or right-turning vehicles. Table 51 lists potential solutions to minimize pedestrian/motor vehicle conflicts involving left- or right-turning vehicles.

Suggestions for Reducing Turning Conflicts

- Design compact intersections with small turning radii that force slower speeds
- Prohibit right-turn-on-red
- When right-turn slip-lanes are used, place crosswalks as far upstream (with respect to traffic flow) as possible and provide highly visible markings
- Restrict left turns at downtown intersections and on commercial streets, during certain hours when there are higher concentrations of pedestrians at intersections, or provide left turn arrows for motorists before allowing pedestrians to use crosswalk
- Shorten crossing distance and exposure time with curb extensions or bulb-outs
- Provide medians and refuge islands
- Place signs to remind motorists of their duty to yield to pedestrians while turning left or right
- Provide well-illuminated crossings
- Improve marking and visibility of crosswalks

Sources: ITE Design and Safety of Pedestrian Facilities,

Table 51

Right turn channelization should not be used without consideration of pedestrians. The addition of a right-turn lane increases crossing distances for pedestrians and allows vehicles to travel more freely when turning right through the intersection. This may cause inattentive drivers to not notice pedestrians on the right. Elimination of free-right- turn-on-red movements may be an appropriate solution at certain intersections where there is a high level of anticipated conflict with motor vehicles.

Dual Right Turning Movements

It is strongly recommended that dual right turning movements be avoided at intersections used by pedestrians. Criteria for dual turn lanes should be developed and used to ensure that they are provided only when necessary. If dual turn lanes are installed, a separate pedestrian crossing phase in a signal should be provided.

Dual right turning movement lanes are particularly difficult for pedestrians. Dual right turn lanes increase the level of unpredictable movements at intersections. Visibility is impaired when multiple vehicles are turning at the same time. In addition, dual turning lanes may not be well utilized by

motor vehicles. One lane may be favored and as a result, motor vehicle speeds may be different in each lane. Drivers are often not able to see beyond the car in front or to the side of them to determine if there is a pedestrian crossing the street, a common cause of pedestrians being hit at intersections.

For right-turn channelization lanes, consider the possibility of adding a controlled slip lane with a refuge island, which provides added protection for crossing pedestrians if designed properly (see discussion earlier in this section). This solution should only be used where right turn channelization is necessary or already exists.

Interchanges and Expressway Ramps Expressways and freeways often present barriers to pedestrian circulation. Pedestrians crossing exit and entrance ramps often conflict with drivers accustomed to traveling at high speeds. Drivers' attention is often focused on other traffic and not on pedestrians.

Several design treatments can be applied to improve pedestrian crossing at interchanges.

- Provide as short a crossing distance as possible and at a right angle to the ramp.
- The crossing point should be located at either the terminus or the beginning of the ramp, where the vehicle is just entering or has slowed from its exit.
- Entrance and exit ramps that encourage free- flowing motor vehicle movements are a challenging area for pedestrian crossings (such as cloverleaf ramps and single point urban interchanges). Special elements should be considered to warn both drivers and pedestrians of potential conflicts, such as in-pavement flashers, more extensive signing, and flashing beacons when pedestrians are present.
- Interchanges and access ramps connecting to local streets at right angles are easiest for pedestrians to cross, because crossing distances are reduced and visibility is enhanced. These intersections should be designed in accordance with accepted practices. Controls such as stop signs and signals provide pedestrians opportunities to cross.
- With ramps that merge into the local street system at expressway access points, channelization islands can be installed to provide refuge area for crossing pedestrians. This reduces crossing distance for pedestrians, which helps to improve signal timing. The shorter the ramp crossing distance, the better.
- Pedestrian crossings at controlled access ramps need to be clearly marked and identifiable to approaching motorists.
- Good sight distance and visibility at ramp terminals is an important necessity.
- Grade separation may be necessary (see discussion later in this section).

Grade Separation

Grade separation may be necessary at crossings where extreme conditions dictate the need for pedestrians to be completely separated from the roadway (or from railroad tracks or waterways). If designed properly, overpasses and tunnels can provide safe pedestrian crossing opportunities. However, they can also be extremely costly and may make it difficult to provide accessibility, unless there is sufficient space for ramping (if not, elevators are necessary). In some cases, if the added

travel distances are excessive, pedestrians who want the most direct route may be discouraged from using the grade separated crossing. The use and placement of grade separated crossings should be carefully considered.

Criteria for determining the need for grade separation and additional design information is provided in Toolkit 7 — Crossings.

Traffic Circles — Roundabouts versus Traffic Calming Circles

Various types of traffic circle designs exist around the world. Traffic circles provide different solutions for different traffic needs and some designs are more beneficial for pedestrians than others. There are two types of traffic circles commonly used — roundabouts and traffic calming circles. Roundabouts typically increase the volume of traffic traveling through intersections. Traffic calming circles decrease traffic speeds and are most appropriate on low volume streets.

Roundabouts are used at intersections in place of signals and carry significant traffic volumes. Their primary purpose is to provide motor vehicles free flowing mobility at a lower speed. Figure 95 illustrates an example of a modern roundabout design.

Traffic calming circles are used at low volume neighborhood intersections for speed control and to discourage through trips. Figure 96 illustrates an example of a traffic calming circle.

For these reasons, roundabouts typically create less favorable conditions for pedestrians than traffic calming circles. Characteristics related to roundabouts and traffic calming circles and their effect on pedestrian travel are summarized below. Additional information about traffic calming circles and other traffic calming devices is provided in Toolkit 8 — Traffic Calming.

Roundabouts

Modern roundabouts are designed to slow traffic, reduce delays, and handle higher traffic volumes. Research has shown fewer pedestrian collisions occur at modern roundabouts than at signalized or unsignalized intersections. If properly designed, modern roundabouts can create a positive environment for pedestrians.

Roundabouts allow pedestrians to cross frequently, without waiting for traffic to stop (when vehicular volumes are low to moderate). However, pedestrians crossing are not protected since vehicles are free flowing. Pedestrians identify and accept gaps in traffic and cross when it is safe.

Splitter islands are used to deflect the path of motor vehicles and to slow them as they approach the roundabout. This deflection reduces vehicle speeds, making it easier for pedestrians to cross the path of a vehicle entering the roundabout. Splitter islands also provide crossing refuge for pedestrians. Locate pedestrian crossings about 20 feet from the yield line. This allows pedestrians

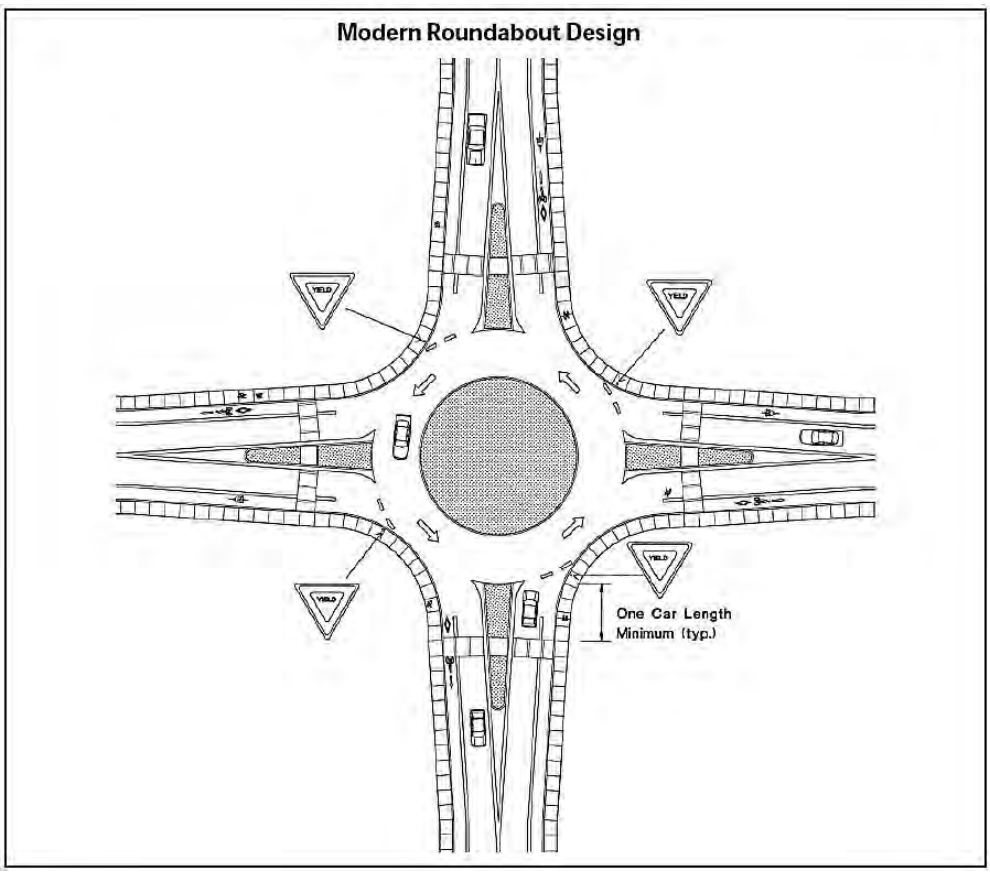


Figure 95

Traffic Calming Circles

Traffic calming circles are very effective in reducing vehicle speeds and discouraging non- local trips through neighborhoods, which benefits pedestrians. Traffic calming circles also create a condition where vehicles are forced to stop or significantly reduce their speed at the intersection, which allows better opportunities for pedestrians to cross.

A drawback of some traffic calming circle designs is that vehicles need to swing wide at the intersection to avoid the center barrier and vehicles may intrude into the pedestrian crossing area if insufficient space is provided for the turning movement. A minimum of 13 feet of clearance between the circle edge and the crossing location is recommended when designing traffic circles. Another drawback is that some drivers try to take the shortest path through the traffic calming circle and turn toward the left, rather than going all the way around the circle. This creates an unexpected movement for crossing pedestrians.

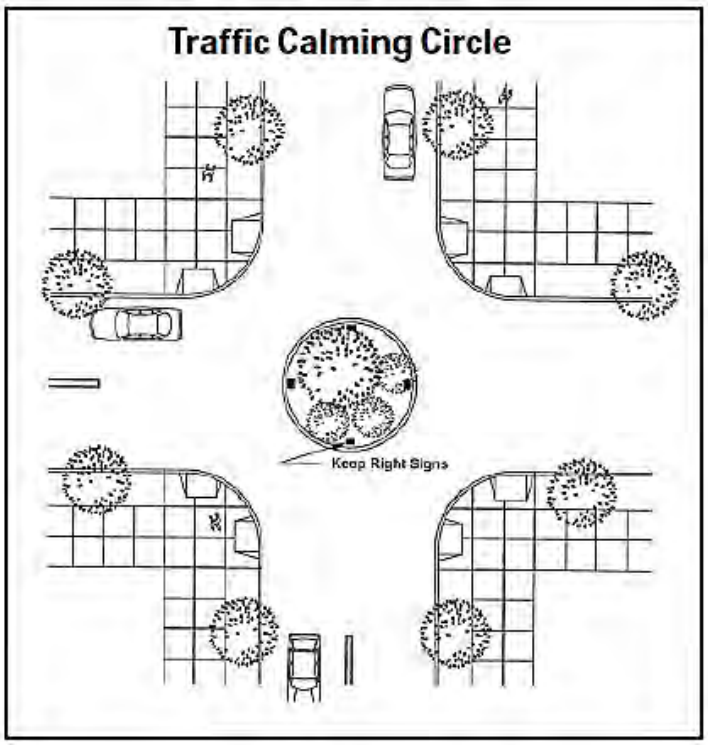


Figure 96

Raised Intersections

In some cases, raised intersections may be a suitable solution, but this practice is still considered experimental in most areas. Raised intersections create an area that clearly functions for primary use by pedestrians. Approaching motorists can see that the intersection is not a location designed for rapid, through-movement, which causes them to slow down and yield the right-of-way to pedestrians. Raised intersections are not appropriate for high-speed thoroughfares and major arterials and collectors. Local requirements may prohibit their use under a variety of circumstances. Raised intersections may be most appropriate in urban centers and downtowns where traffic is already moving slowly through intersections.

Raised intersections make it easier to meet the ADA requirements because the crosswalk is a natural extension of the sidewalk, with no change in grade. Raised intersections require special treatment, such as tactile warning strips or audible signals, to make them detectable to the visually-impaired.

Placement of drainage inlets is simplified at raised intersections, because surface water will drain away from the center of the intersection.

Special Paving

Special paving techniques are sometimes used to mark crossings at intersections in urban areas, particularly in special districts. Changes in pavement color and texture raise a motorist's awareness through increased visibility, noise, and vibration (see Figure 97).

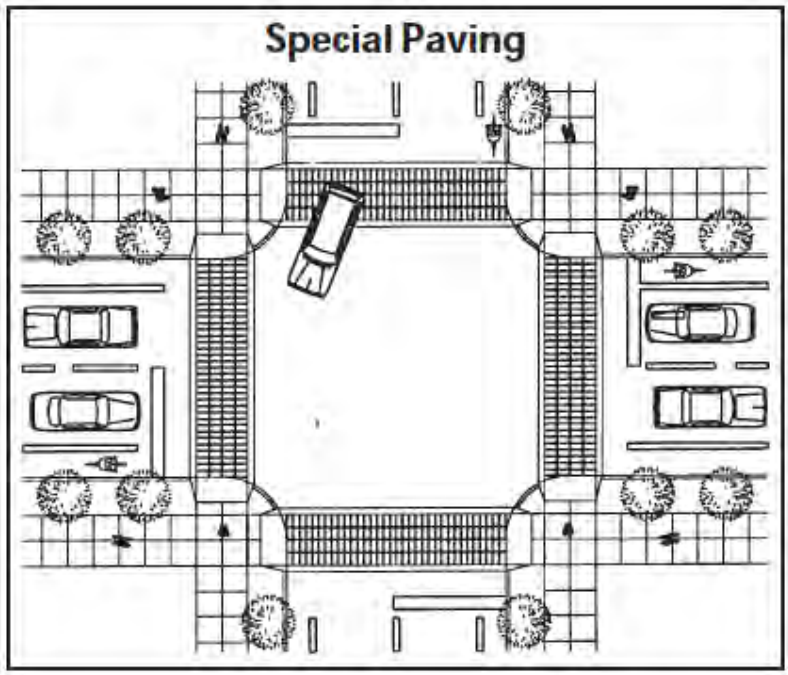


Figure 97

Crossings constructed with special paving should use nonslip bricks or unit pavers. Scored or stamped colored concrete surfaces can also be used, and are generally more durable over the long term than unit pavers, with more uniform joints and less chance of displacement. However, creation of a reduced vibration zone within the crossing area is recommended (PROWAAC X02.1.1). Refer to Toolkit 2 - Accessibility. Special paving surfaces should be installed and maintained in a smooth, level, and clean condition. Care should be taken to ensure that grooves and joints do not impact accessibility.

Because the color contrast between special paving features in crosswalk and adjacent pavement diminishes over time, horizontal crosswalk markings should be used.

Colored and textured paving in a crosswalk

For state routes and GDOT and TE funded projects, the use of brick pavers is not allowed. The use of stamped concrete and/or stamped asphalt is acceptable when the following conditions are met:

- The crossing is at a 90 degree angle with no curves to the roadway;

- The width of the treatment is less than 10 feet;
- Current ADT is 5,000 or less and truck volume is 10% or less; and
- When asphalt treatment is used; the maintenance agreements include the statement that when DOT resurfaces the roadway, the resurfaced treatment will be asphalt only, unless the sponsor funds architectural treatment.

GDOT's Chief Engineer reserves the right to waive any of the above requirements if needed and warranted.

Research is ongoing and design professionals and traffic engineers should investigate the benefits and disadvantages of the latest techniques and approaches when seeking to implement innovative treatments at intersections.

Other Sources of Information

The following sources of information are recommended for design of intersections. Please see the Resource Guide included at the end of this guide for complete bibliography information.

A Policy on Geometric Design of Highways and Streets, 2001, American Association of State Highway and Transportation Officials

An Analysis of Pedestrian Conflicts with Left-Turning Traffic, Dominique Lord

Flashing Beacons, Association of Washington Cities and the County Road Administration Board

Curb Ramps for Accessible Pathways, Bureau of Transportation Engineering and Development, Office of Transportation, City of Portland

Design and Safety of Pedestrian Facilities, A Proposed Recommended Practice of the Institute of Transportation Engineers, ITE Technical Council Committee 5A-5

Design Manual, Washington State Department of Transportation

Field Studies of Pedestrian Walking Speed and Start- Up Time, Richard L. Knoblauch, Martin T. Pietrucha, and Marsha Nitzburg

Florida Pedestrian Planning and Design Guidelines, University of North Carolina

Guidelines for the Installation of Crosswalk Markings, Steven A. Smith and Richard L. Knoblauch

Handbook for Walkable Communities, Washington State Pedestrian Facilities Planning and Design Courses, Dan Burden and Michael Wallwork, PE

Manual on Uniform Traffic Control Devices for Streets and Highways, 2003 Edition, US Department of Transportation

Oregon Bicycle and Pedestrian Plan, An Element of the Oregon Transportation Plan, Oregon Department of Transportation Bicycle and Pedestrian Program

"Pedestrian Actuated Crosswalk Flashing Beacons," John W. VanWinkle

Pedestrian Crossing Study, Final Submittal, Pedestrian Traffic Control Measures, Arctic Slope Consulting Group, Inc.

Pedestrian Improvements Demonstration Project, Kirkland Avenue at Main Street, Kirkland Avenue at Third Street, Lake Street South, Specifications and Contract Documents, KPG, Inc.

Pedestrian Signal Installation Policy, David I. Hamlin and Associates

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Chapter 10. Toolkit 7 – Crossings

This Toolkit Section Addresses:

- *Determining the Need for Mid-Block Crossings*
- *Mid-Block Crossing Design*
- *Railroad Crossings*
- *Grade Separated Crossings*
- *Multi-Use Trail Intersections and Crossings*
- *Boardwalks and Trestles*
- *Other Sources of Information*

This section discusses the need for and describes different types of mid-block crossing treatments, including marked crosswalks, mid-block actuated signals, median refuge islands, overhead signs, and flashing beacons. Standard practices, as well as some new techniques being tried around the country and in Canada, are discussed. Other types of non-street intersection crossings, such as railroad crossings, grade-separated crossings, multi-use trail and pathway crossings, and bridges are also addressed. Crossing design treatments for street intersections are covered in Toolkit 6 - Intersections.

In all cases, the crossing treatment design applied to a specific location should be guided by a traffic engineering study of the existing conditions and intended function of the crossing.

Mid-block crossing with median refuge island.

Determining the Need for Mid-Block Crossings

In some urban areas where distances between intersections are long, mid-block crossing points provide pedestrians opportunities to cross safely. Mid-block crossings can also provide convenience and safety in less developed areas, where pedestrian activity is high (such as between an apartment site and a grocery store; a school and a park; or a transit stop and a residential neighborhood). Figure 98 illustrates a typical mid-block crossing.

Locations being considered for a mid-block crossing need to be carefully studied. The following guidance for determining locations for mid-block crossing installation is provided by the ITE manual, *Design and Safety of Pedestrian Facilities*:

- Where significant pedestrian crossings and substantial pedestrian/vehicle conflicts exist; (should not be used indiscriminately)
- Where the crossing can serve to concentrate or channelize multiple pedestrian crossings to a single location;
- At approved school crossings or crossings on recommended safe school walk routes;
- Where land uses create high concentrations of pedestrians needing to cross (such as residential areas across from retail or recreation, and transit stops across from residential or employment);
- Where pedestrians could not otherwise recognize the proper place to cross or there is a need to delineate the optimal location to cross;
- Where there is adequate sight distance for the motorist and pedestrian. (Any obstacles that would interfere with visibility at the crossing location such as mailboxes, utility poles, street furniture, and landscaping should be removed or relocated. On-street parking should be set back from the crossing point for improved visibility. Refer to Toolkit 6 - Intersections for recommended parking set back distances); and
- Installed on the basis of an engineering study if located at other than an existing stop sign or traffic signal.

Smith and Knoblauch developed criteria relating to pedestrian and vehicle volumes for determining where marked crossings should be located. Refer to Toolkit 6 - Intersections, which provides a chart illustrating this criteria. This chart also takes into account street widths and other factors (such as concentrations of children, older adults, and pedestrians with mobility impairments).

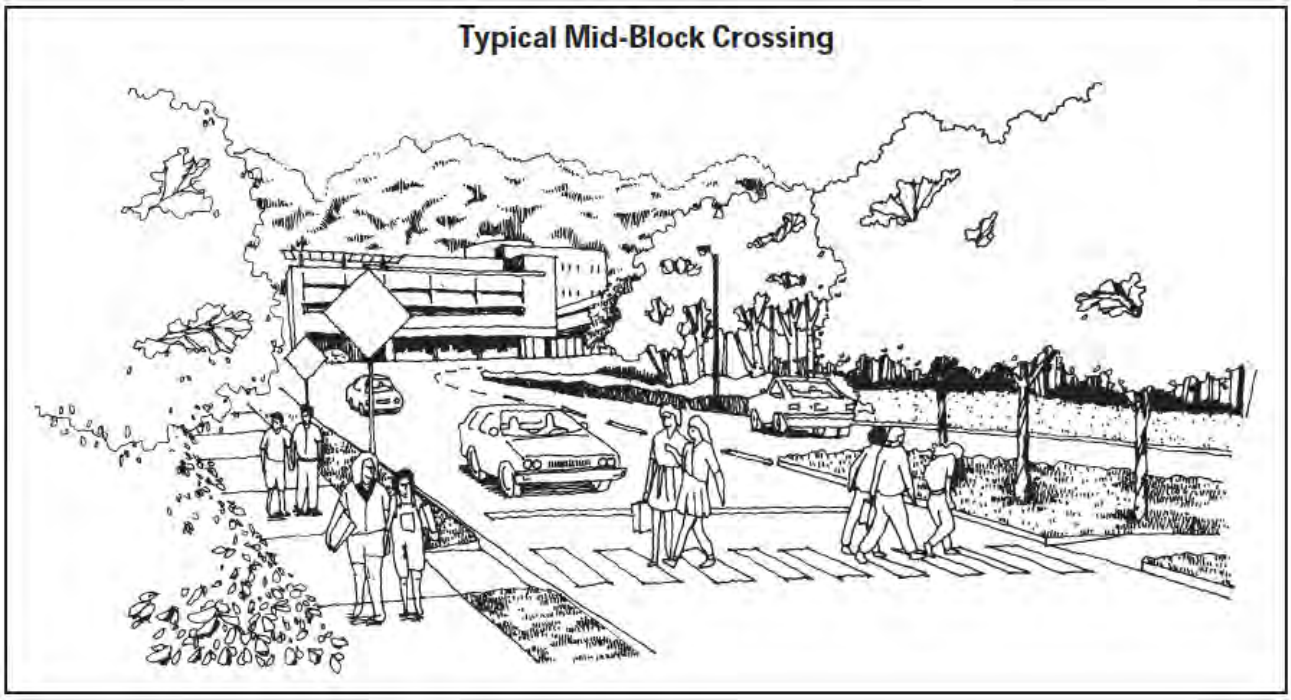

Figure 98

Midblock crossing in Helen, Ga

Mid-block crosswalks should generally be avoided under the following circumstances (unless they are stop controlled):

- Immediately downstream (less than 300 feet) from a traffic signal or bus stop where motorists are not expecting pedestrians to cross;
- Within 600 feet of another crossing point (Knoblauch et. al.), except in central business districts or other locations where there is a well-defined need. The recommended minimum separation in most cases is 300 feet; and
- On high speed streets with speed limits above 45 mph.

Refer to Toolkit 6 - Intersections for design guidelines related to crosswalks, including some local agency approaches to crosswalk installation.

Mid-Block Crossing Design

Crossing design treatments are often used in combination with one another at mid-block crossings. Standard practices, as well as some more innovative techniques being tested around the country, are described. Determining methods of crossing design treatments and related traffic control requires careful consideration and traffic engineering analysis of existing conditions on a project by project basis.

Marked Crosswalks

It is strongly recommended that all mid-block crossings be marked with highly visible crosswalks; otherwise pedestrians and motorists may have trouble recognizing the designated crossing point. Mid-block crossings should always include marked crosswalks, but mid-block crossings should only be located where a specific need has been determined.

It should be noted that marked crosswalks are meant to clarify the right-of-way and guide pedestrians to cross at the safest location. They are not safety devices to protect pedestrians from vehicles. There have been studies that have shown that marked crosswalks may instill a false sense of security in pedestrians (see discussion in Toolkit 6 - Intersections). There are also concerns that when crosswalks are installed indiscriminately or too frequently, they may eventually become less obvious to motorists. For these reasons, it is important to fully consider the need for mid-block crossings before installation.

Various crosswalk designs are discussed in Toolkit 6 - Intersections. The use of ladder or piano bar markings is highly recommended over the use of other types of crosswalk markings because of their high visibility. Horizontal bars are not typically used at locations other than controlled intersections. Crosswalk markings should be at 90 degrees to the street to identify the shortest path for crossing and minimize pedestrian exposure. In refuge islands, angling the crossing provides an opportunity for pedestrians to view oncoming traffic.

Stop lines or bars should be placed in advance of crosswalks. These are usually 12 to 24 inches wide solid white lines that extend across all approaching lanes. They are usually installed at a minimum of 4 feet in advance of the crosswalk to prevent motorists from encroaching into the pedestrian crossing space. Some jurisdictions install stop lines further in advance of crosswalks at mid-block locations to provide improved visibility and buffer distance between the motor vehicle and the crosswalk.

Raised pavement markers placed in rows are often used in advance of mid-block crosswalks. If used, they need to be placed far enough in advance of the crosswalk for the rumble effect to provide adequate warning to the motorist. They should be placed in combination with and at the same distance as pedestrian advance warning signs to enhance motorist awareness. Because raised buttons and pavement markers can be a hindrance to bicycle travel, they should not be placed adjacent to the right edge line or within bike lanes. A minimum clearance of 2 feet is

recommended between such markers and any bicycle travel area. Raised pavement markers are difficult to maintain in areas of snow removal.

A mid-block crossing of a two-lane arterial is illustrated in Figure 99. Various types of devices that can be used in conjunction with crosswalks at mid-block locations are discussed below.

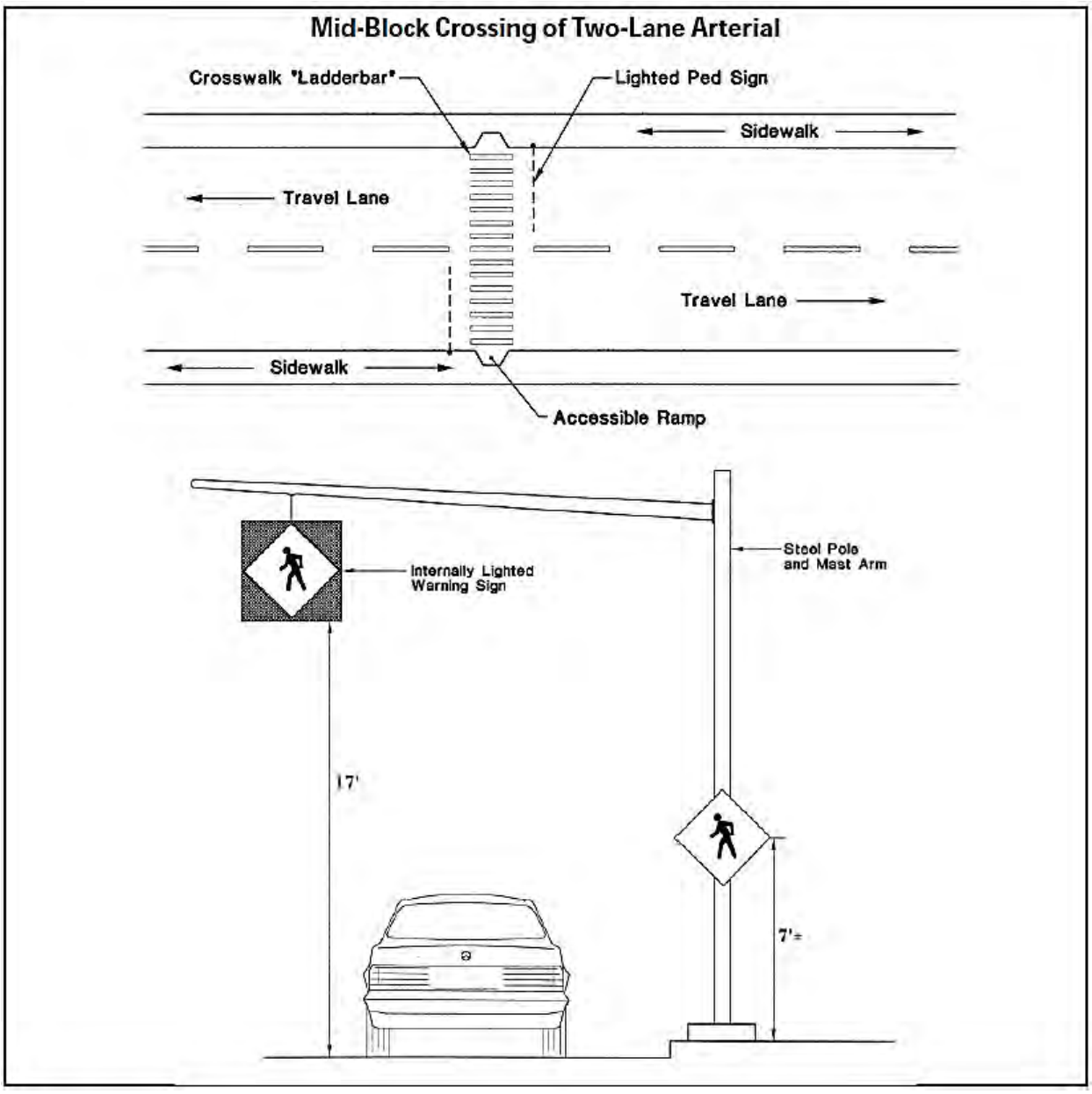

Figure 99

Mid-Block Pedestrian Actuated Signals

The MUTCD bases the need for pedestrian crossing traffic control on the number of adequate gaps or space between the vehicles in the roadway's traffic stream. It states that pedestrians must wait for a gap in traffic that is of sufficient duration to permit street crossings without interference from

vehicular traffic. When the delay between adequate gaps or spaces becomes excessive, pedestrians may become impatient and endanger themselves by attempting to cross the street during inadequate gaps.

When adequate gaps occur less frequently than an average of once per minute, some form of traffic control is necessary. Pedestrian actuated signals or grade separated facilities should be considered as possible solutions for roadways with these characteristics.

Mid-block crossing. Notice how median path directs pedestrians to look at oncoming traffic.

Pedestrian actuated signals are often appropriate for roadways that have high traffic volumes or speeds, or four or more lanes. Since these signals only operate in the presence of foot traffic, they do not cause undue delay to vehicles during periods of low pedestrian volumes.

Pedestrian actuated signals should be considered in locations where pedestrian walk routes cross major arterials or other high volume or high speed facilities. A signal warrant analysis should be performed to study specific conditions and determine if a pedestrian actuated signal should be installed.

Medians and Refuge Islands

Medians and refuge islands are raised longitudinal spaces separating the two main directions of traffic movement in the street. Refuge islands are shorter than medians, typically up to 20 feet long, compared to over 100 feet long. Refuge islands are more commonly used at mid-block crossings than medians, but either provides major benefits for pedestrians and motorists.

Medians and refuge islands reduce crossing distances for pedestrians and effectively turn one two-way street into two one-way streets for pedestrians. Pedestrians only have to cross one direction of traffic at a time and can wait or rest in between. This creates a better opportunity for pedestrians to find gaps in the flow of traffic before crossing the street. Medians and refuge islands are a benefit to drivers when located at mid-block crossings, because they help to better identify the upcoming crossing point. They also provide a location for a pedestrian crossing sign in the middle of the street, providing another opportunity to warn drivers of the crossing.

Medians or refuge islands are recommended whenever crossing distances exceed 60 feet to provide a waiting and resting area for slower pedestrians. Medians and refuge islands also can be designed to block side street or driveway crossings of the main road and block left-turning movements. Because medians reduce turning movements, they have the ability to increase the flow rate and safety of the roadway.

Refuge Island

Refuge islands can be installed with more flexibility in a variety of locations because they are shorter. Refuge islands are easily located on low volume, low speed roadways, such as 25 to 30 mph collectors or subcollectors through neighborhoods. When collectors are longer and handle more traffic and higher speeds, medians or refuge islands are helpful. On multi-lane minor and major arterials, raised medians or refuge islands are essential.

Figure 100 illustrates a mid-block crossing design. Table 52 lists several design guidelines for medians and refuge islands.

Raised Mid-Block Crossings

Raised mid-block crossings are sometimes constructed to provide a well-defined pedestrian crossing as well as traffic calming. This type of crossing is only suitable for low speed, low volume local streets, since the raised crossing is essentially functioning as a speed table or hump.

Raised crossings enhance pedestrian safety by creating a vertical pavement undulation that forces motorists to slow down when approaching. Raised crossings function as an extension of the sidewalk and allow pedestrians to cross at a constant grade, without the need for curb ramps or median cut-throughs. For detection by pedestrians who are blind, truncated dome detectable warnings should be installed at the edge of the street and the median.

Raised crossings should have a 6-foot parabolic approach transition, raising the vehicle 3 to 4 inches above the nominal pavement grade. The flat section of the crossing table should be 10 to 12 feet wide. The need for additional catch basins to handle interrupted gutter flow should be considered.

Raised crossings need to be highly visible, either striped as a mid-block crossing or constructed of a contrasting pavement design (such as unit pavers and stamped or colored concrete). The

pavement surface must be smooth and stable, without deep grooves or joints to provide maximum accessibility. A detectable surface should be used to distinguish the end of the sidewalk and the beginning of the roadway to assist visually impaired persons.

Raised crossings should be signed with advance warning signs and pedestrian crossing signs in the same manner as other mid-block crossings. Refer to Toolkit 8 — Traffic Calming for more discussion on traffic calming techniques.

Raised mid-block crossing — note high visible pavement surface

Mid-Block Crossing of Five-Lane Arterial with Existing Median

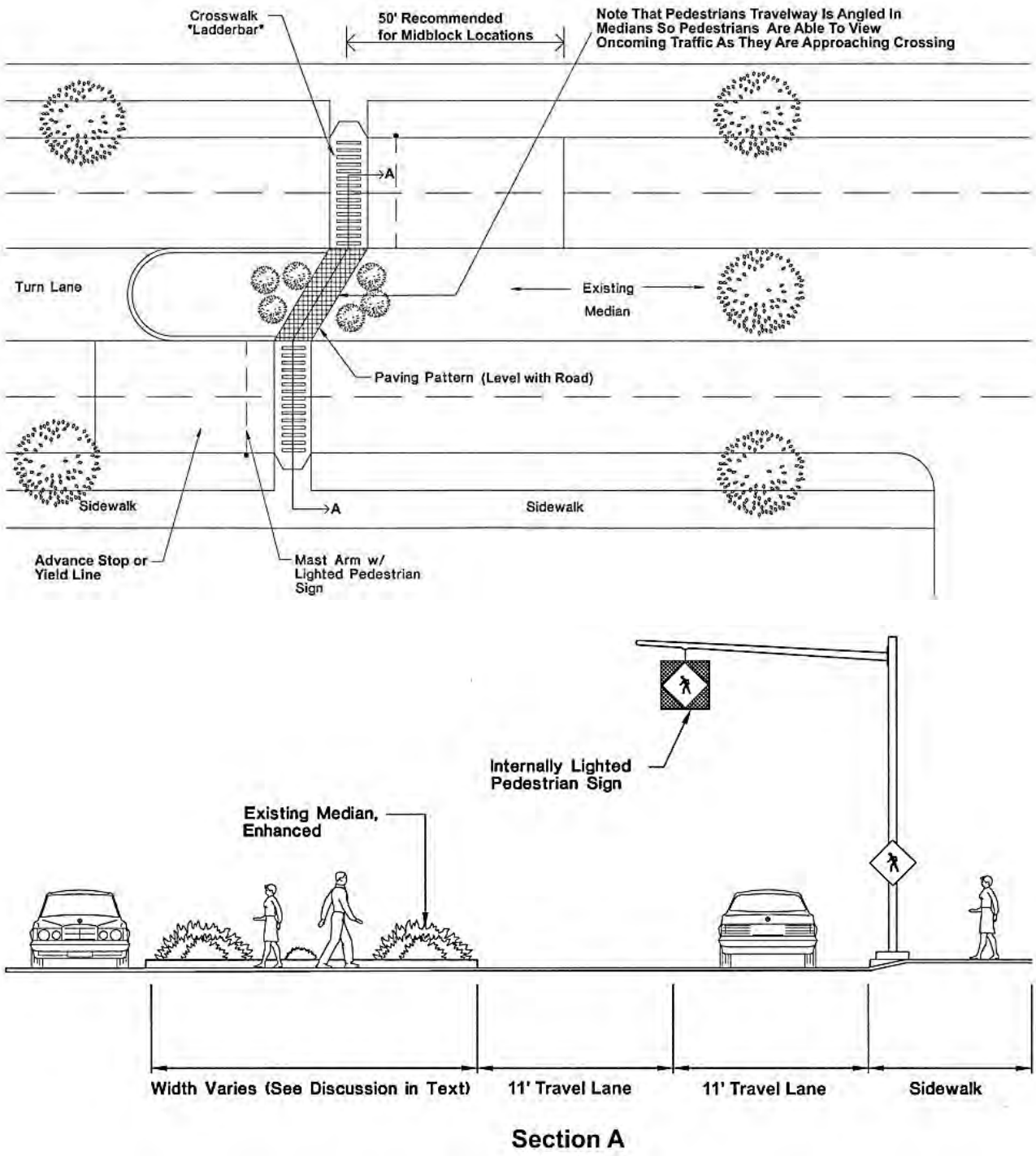

Figure 100

Design Guidelines for Medians and Refuge Islands

- Medians and refuge islands should be a desirable width of 8 to 10 feet wide and a minimum width of 6 feet wide to prevent wheelchair users, bicyclists, and people with strollers from projecting out into the stream of motor vehicle traffic. In some cases, smaller width medians and refuge islands may be acceptable, particularly when there is limited space in the right-of-way, depending on local requirements and existing conditions (check with your local agency).
- In order to obtain appropriate median width, travel lanes can be narrowed to 11 feet, if allowed by local standards. In locations where vehicle speeds range from 20 to 30 mph, the travel lanes can be reduced further to 10 feet, if allowed by local standards.
- Trees in medians and at the sides of streets can help to narrow the long range field of vision for approaching drivers, causing them to slow down as they near the crossing point. Landscaping in median refuge islands must be handled carefully. It is essential that landscaping not block the sight lines of pedestrians and motorists at the crossing area. Placement of trees must comply with applicable clear zone requirements.
- Curb ramps or full cut-throughs should be installed in all median refuge islands. Cut- throughs are more common because the median width is sometimes not large enough to accommodate ramps that meet the ADA requirements. Cut-throughs should be designed with a maximum 2 percent cross slope to allow water, silt, and debris to drain from the area.
- A pedestrian push button should be placed in the median of signalized mid-block crossings where the crossing distance exceeds 60 feet.
- The use of angled (45 degrees+) refuge areas in the island should be considered (see figures later in this section). These provide the benefit of directing and encouraging pedestrians to look in the direction of oncoming traffic, helping them to be more aware of approaching vehicles. Pedestrians are also prevented from darting directly out into traffic. See Figure 83.
- Medians and refuge islands should be illuminated

Table 52

Flashing Beacons

The use of flashing beacons is controversial, because if they are used indiscriminately, they eventually become “invisible” to motorists (see more discussion in Toolkit 3 - Children and School Zones). A crosswalk with a flashing beacon provides a relatively low cost treatment for mid-block pedestrian crossings. These devices are authorized by the MUTCD, under the sections related to hazard identification beacons. The flashing light alerts drivers in advance of potential pedestrians without forcing them to stop, unless there is actually a pedestrian in the crosswalk. This sort of device can be used on roadways with higher vehicular volumes without causing any undue delay to drivers.

Flashing beacons are most effective if they are operating only during times when there is a clear need to alert the motorist, like when pedestrians are actually present (rather than constantly flashing all the time). Some communities around the country are experimenting with different types of pedestrian actuated flashing beacons.

A pedestrian-actuated flashing beacon has been used successfully for a number of years in Chattanooga, Tennessee (*ITE Journal*, January 1997). The typical design consists of overhead signs with the message "Yield to Pedestrians — 25 MPH When Flashing" with dual 8-inch beacons mounted approximately 300 feet in advance of the crosswalk in both directions. Push buttons are mounted on pedestal poles on both sides of the crosswalk, along with auxiliary flashers that confirm to the pedestrian that the overhead beacons have been activated. Signs are also posted instructing the pedestrian in the use of the flashers. Once activated, the beacons are controlled by a timer housed in the flasher cabinet.

Overhead flashing beacon

Soft Sandwich

This technique is being used at the Georgia State Capitol campus, in New Jersey and other areas and involves the use of heavy plastic "sandwich board" signs cautioning motorists to yield to pedestrians. These signs are typically placed in the center of the roadway (see Figure 101).

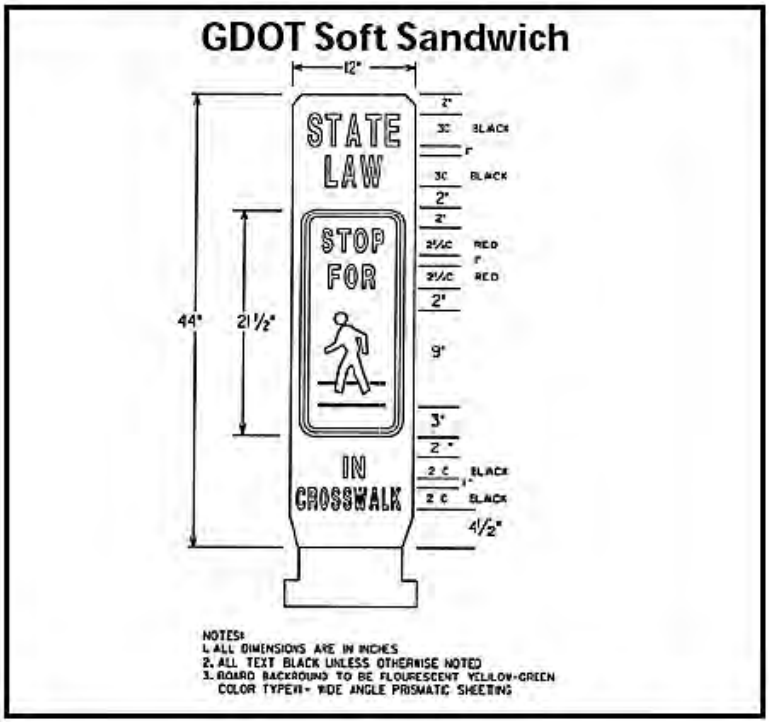

Figure 101

Earlier “hard” versions of these signs were banned by the New Jersey DOT because they could become projectile objects when hit by a vehicle. Some towns are now testing flexible or “soft” versions of these signs that will not injure pedestrians or cars when hit.

In–Roadway Warning Lights

An effective warning system that alerts motorists that a pedestrian is crossing or waiting to cross the street are at grade or in-roadway flashing warning lights. Originally developed from airport pavement warning lights for airplanes, they have been applied in a number of locations around the country. They are now manufactured by several abricators, and installations are becoming more competitively priced. They are included in the 2000 version of MUTCD.

The flashing warning lights are in housings that are slightly larger than reflectorized lane markers and placed directly on the pavement surface 1 foot outside the crosswalk lines. When activated, they flash toward oncoming traffic and are very noticeable by motorists on all but the sunniest, brightest days. Fortunately, when the in- pavement flasher visibility is lowest during sunny days, pedestrian visibility is better because of the weather. On overcast days or at night, in- pavement flashers are very noticeable and provide good warning to drivers. Flashes are extremely visible at night time, when pedestrians are least visible. The lights are installed at a level so that they can be effective warning without impairing night time vision with glare.

Activation of the flashers can be accomplished by several means. Traditional pedestrian push buttons can be installed on posts at the crossings. Pedestrians simply push the button to activate the flashers. They flash for a preset period, enough for the typical pedestrian to cross the street.

There has been some skepticism about the use of pedestrian push buttons. While they have been used in many installations, some traffic engineers are concerned that the act of pushing a pedestrian signal push button can make the pedestrian feel that he/she has the same security as if they were crossing at a signalized intersection. In actuality, the presence of the in-pavement flashers only serves as a warning to motorists about a pedestrian crossing the street. It doesn't, by itself, require the motorist to stop. Pedestrians should be advised by signing that they should not cross until it is safe to do so.

Use of passive detection methods helps to mitigate concern about pushing a button. There are several types of detection systems that can detect a pedestrian waiting to cross the street. One type is infra-red detection through infra-red beams placed near the curb. Another is microwave detection. Each is more expensive than push buttons, but each detects the presence of pedestrian crossers without them being aware of it.

In–roadway warning lights

It is important for the detection device to be able to detect the direction of travel of the pedestrian, so the crossing warning lights are not activated by a pedestrian leaving the street and passing through detection. With infra-red, the use of two beams at each entry to the crosswalk can establish directionality. Microwave detection is capable of determining pedestrian direction of travel.

Since direction of pedestrian travel is important with these types of devices, entry to the crosswalk should be channelized in a way that requires pedestrians to pass through the detection, and not be able to go around it. This can be done with landscaping, railing, street furniture, or other channelization tools.

Animated Eyes

Another effective method that provides a higher level of warning to motorists that a pedestrian is crossing is "animated eyes" signing. They were developed by the Center for Education and Research in Nova Scotia, Canada, and have been installed in several states.

Animated eyes can be used both to alert the motorist of an impending pedestrian crossing and they can also be used to remind the pedestrian to look both ways for approaching traffic before crossing.

Animated eyes

Actuation for these devices requires the same considerations as for in-pavement flashers and other warning devices for pedestrians.

Use of advance stop or yield lines with in-roadway lights are generally appropriate and provide an added element of safety.

Portable Pedestrian Flags

Local communities around the country have been experimenting with portable orange flags at intersections and mid-block crossings. This is a program that could be maintained at the local, community-level. The flags are being used by some people and have been viewed as an effective measure to increase driver awareness of upcoming crossing activity. People who are using them say they feel more comfortable crossing while holding the flags. Cities have experienced some loss of flags to vandals, but overall report that the program has been successful (see Figure 102).

Portable Pedestrian Flags increase driver awareness

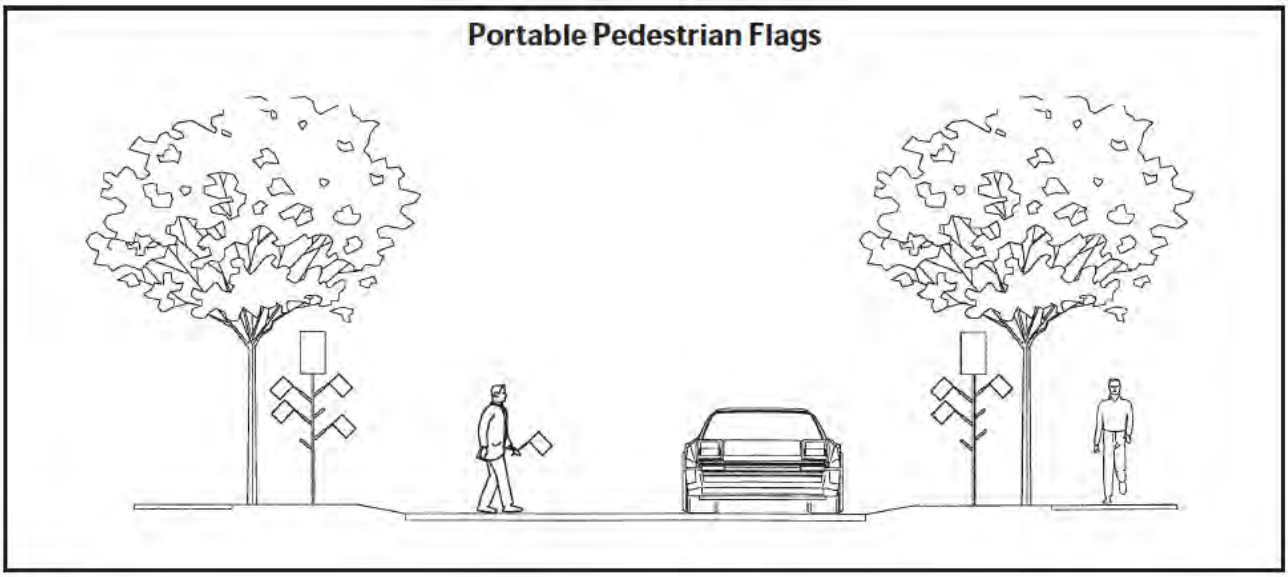

Figure 102

Advance Warning Signs and Pedestrian Crossing Signs (Side or Overhead)

Advance Pedestrian Crossing Signs should always be installed in advance of mid-block crossings (MUTCD Sign W11-2). Placement of advance warning signs depends on the speed of motor vehicle travel and other conditions, such as available sight distance. Refer to the MUTCD for sign placement criteria.

Advance Pedestrian Crossing Signs should not be mounted with another warning sign (except for a supplemental distance sign or advisory speed plate) or regulatory sign (except for NO PARKING signs) to avoid information overload and allow for an improved driver response.

Other Design Considerations

It is usually necessary to supplement the existing street lighting system with additional lighting at new mid-block crossing locations. It is extremely important that these crossing locations be well-illuminated, so they are clearly visible to motorists driving at night.

Fences, barriers, signs, or sidewalk ramps can be used at mid-block crossings and refuge islands to channelize pedestrians to the crossing. Trees and landscaping can also be used to enhance and identify the crossing area, but care must be taken to ensure that these do not obstruct visibility at the crossing in any way.

See Toolkit 6 - Intersections for recommended setback distances for on-street parking.

Railroad Crossings Crossing Design Options

At-grade railroad crossings can be difficult for pedestrians to negotiate. They differ from roadway crossings in that when a train reaches a crossing it always has the right-of-way and cannot stop to avoid a pedestrian. There are three types of railroad crossing designs: those with crossbuck signs, those with crossbucks and flashing light signals, and those featuring automatic gates in addition to the crossbucks and flashing lights.

Pedestrian safety improvement options are limited at these locations, since stopping the train is not a viable option. The only recourse to improving conditions for pedestrians is to improve the method of stopping pedestrians or to provide grade separation for pedestrians from the tracks. If the crossing is heavily used by pedestrians on a daily basis (located on a school walk route, or near pedestrian origins and destinations), it is recommended that it be designed to include the crossbuck sign, flashing light signals, and automatic gates. An analysis should be completed to determine if grade separation is a suitable solution. Another lower cost solution for crossings located on school walk routes is to assign a crossing guard to that location.

Railing is used to channelize pedestrians so they can view oncoming traffic.

Railroad crossings are different than road crossings in that trains always have the right-of-way.

Surface Smoothness

The smoothness of the surface is an important consideration, especially when providing crossings that are part of the pedestrian travel route. Concrete used at the crossing area provides smoothness and performs best under wet conditions. Rubberized material can provide a durable, smooth crossing, but can become slippery when wet. If asphalt pavement is used, it must be regularly maintained to prevent ridge buildup next to the rail lines. Timber crossings wear down rapidly and are slippery when wet.

The ADA requires smooth surfaces and a maximum lift tolerance between surfaces or at pavement joints of 0.5 inches or the elevation difference must be treated as a ramp.

Signing and Marking

It is desirable for stencils and signs to be placed prior to railroad crossings to warn oncoming pedestrians, bicyclists, and motor vehicles, particularly at locations with heavy pedestrian activity.

Angle of Crossing

Since trains may be coming in either direction, the optimum condition is for pedestrians and bicyclists to cross at a 90 degree angle to the rail line. This also provides a straight on angle for wheels (on wheelchairs, strollers, bicycles, etc.) to cross the rail lines. When the crossing is angled wheels can have trouble going over the rail lines. Optimally, wheels should be able to cross rail lines at 90 degrees.

Grade Separated Crossings

Determining the Need for Grade Separated Crossings

Grade separated pedestrian crossings are installed when it is necessary to physically separate the crossing of a heavy volume of pedestrians from a roadway with heavy motor vehicle traffic (including freeways and expressways). Grade separation is also used at some railroad crossings and water crossings. Crossings must be designed to provide access for pedestrians with disabilities which may require long ramps or elevators. Long- term maintenance of such features in working order should be carefully considered in making a decision to install grade separated crossings.

The effectiveness of grade separated crossings depends on their perceived ease of accessibility by pedestrians. An overpass or underpass will not necessarily be used simply because it improves safety. Because of the high cost of grade-separated facilities, they should be incorporated into the early stages of new developments that are intended to generate substantial volumes of pedestrians. According to a study by Zegeer and Zegeer, state and local agencies consider grade- separated crossings to be most beneficial under the following conditions:

- Moderate to high pedestrian demand to cross a freeway or expressway
- Large number of young children (particularly near schools) who must regularly cross a high-speed or high-volume roadway
- Streets with high vehicle and pedestrian crossing volumes where there is an extreme hazard for pedestrians (for example, wide streets with high speed traffic and poor sight distance)
- Where one of the above conditions exists in conjunction with a well-defined pedestrian origin and destination (residential neighborhood across a busy street from a school, a parking structure affiliated with a university, or an apartment complex near a shopping mall)

Refer to the ITE manual *Design and Safety of Pedestrian Facilities* and the MUTCD for more specific information and warrants to determine the need for grade separated crossings.

Overpasses and Bridges

Overpasses and bridges should be easy and convenient for pedestrians to access. If a grade separated crossing would be less convenient than the at-grade condition, some pedestrians may try to cross at grade, which is not desirable when the purpose of the crossing is to increase safety. Pedestrian bridges can vary in their structure and may be constructed of cast-in-place concrete, prestressed concrete, steel, or wood. Choosing the appropriate type of structure requires knowledge of the conditions at the proposed location. Consideration should be given to cost, constructability, maintenance, aesthetics, and physical site constraints.

Pedestrian bridge over river

Aesthetics

The type of structure chosen should complement the site where it will be located. Different materials are more appropriate in different settings. For instance, a timber truss would fit a rural setting, whereas a steel truss would fit an industrial setting. When designing the structure, detail structural elements to blend with the environment. Taper girder haunches or arch superstructure to create structures that are aesthetically appealing.

Design Load

AASHTO requires a design live load of 85 pounds per square foot. Some local building codes require a design live load of 100 pounds per square foot. Other loads, such as seismic, stream flow, and wind loads should also be considered in accordance with applicable codes. If the structure is to provide access for emergency or maintenance vehicles, the appropriate design loads should be used.

Geometry

With accessibility requirements resulting in ramped accessible bridges, all bridges must be assumed to provide service to both pedestrians and bicyclists. As a result, a railing to railing width of 12 feet is preferable. If a bridge is to accommodate emergency or maintenance vehicles, a 12-foot width is mandatory.

Bridges built over roadways must maintain a minimum of 16.5 feet of clearance under the structure. Since pedestrian bridges are lighter than vehicular bridges and would sustain greater damages from vehicle impact, it is good practice to provide 18 to 22 feet of clearance to prevent damage. Clearance over railroad tracks is controlled by the railroad company but is generally at least 23 feet. Bridges built over waterways must maintain a minimum clearance above the 100-year flood level (check local guidelines for clearance). Bridges over navigable waters must satisfy requirements of the Coast Guard. Comply with all local, state, and Federal requirements when designing a bridge. Figure 103 illustrates typical geometry of overhead crossings.

Above grade pedestrian bridge in East Point

Approaches to bridges should consist of ramps that meet ramp accessibility standards discussed in Toolkit 2 — Accessibility. If ramps are not feasible or would provide a deterrent to using the bridge due to long length, elevators should be installed to provide users access to the bridge.

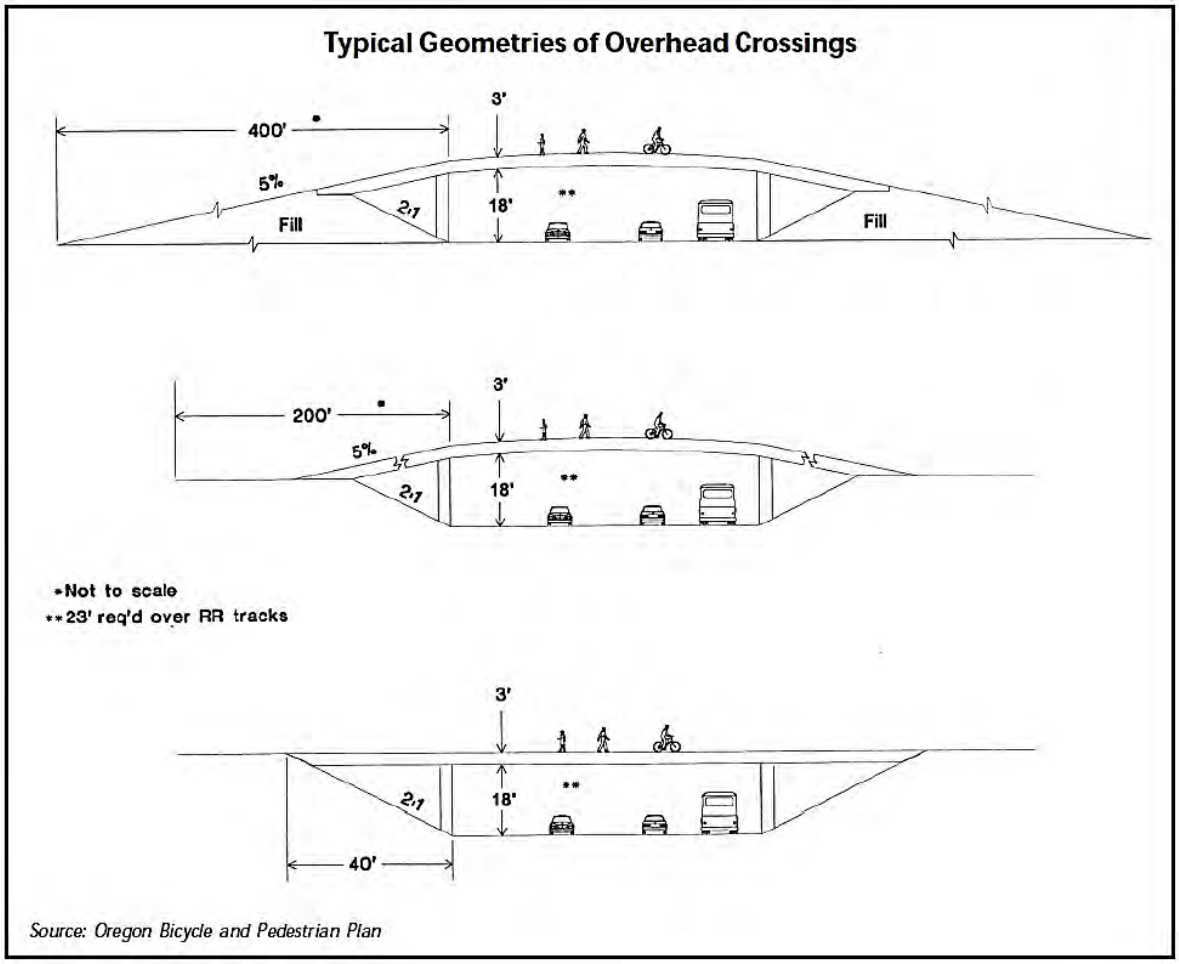

Figure 103

Safety

For information on protective screening refer to AASHTO. For bridges near schools, overhead fencing is recommended. Railings 3.5 feet in height are required on both sides of the bridge.

Skywalks and Skyways

Skywalks or skyways are fully enclosed walkways between buildings at mid-block. They allow pedestrians to pass between buildings without going to street level or being exposed to weather. Design of skywalks will largely be determined by the buildings into which they are built and thus are not discussed in detail in this guide.

Skywalks can function successfully, especially in areas where inclement weather is common. One note of caution related to the use of skywalks: some communities have experienced a loss of pedestrian activity at the street level, negatively impacting the retail businesses and economic vitality of the area. When skywalks are being considered, ways to ensure that street level retail will still be fully accessible and inviting to pedestrians need to be identified.

Skywalk example

Underpasses and Tunnels

Tunnels and underpasses provide a walkway for pedestrians underneath the roadway. Pedestrians are often more apt to use overpasses than underpasses or tunnels, and overpasses are easier to supervise and maintain. Tunnels are sometimes less desirable than bridges due to greater potential costs, the possibility of drainage problems causing increased maintenance, and issues related to security. Before choosing to install a tunnel, soil exploration is required to determine whether a tunnel is constructible and whether drainage will be a problem.

Tunnels should be designed to let more natural light in and with wide openings to be more inviting to pedestrians. To encourage maximum pedestrian use, tunnels should be easy to access and should be as short as possible.

Geometry

When designing tunnels for pedestrians, the alignment with approaching walkways needs to provide the pedestrians with a clear view of the end of the tunnel. One way to accomplish this is to raise the roadway about halfway to reduce the change in elevation for the tunnel. Tunnels and underpasses created by a vehicular overcrossing must have an overhead clearance of at least 10 feet and be at least 12 feet wide to accommodate bicycle travel. Figure 104 illustrates typical geometries of underpasses.

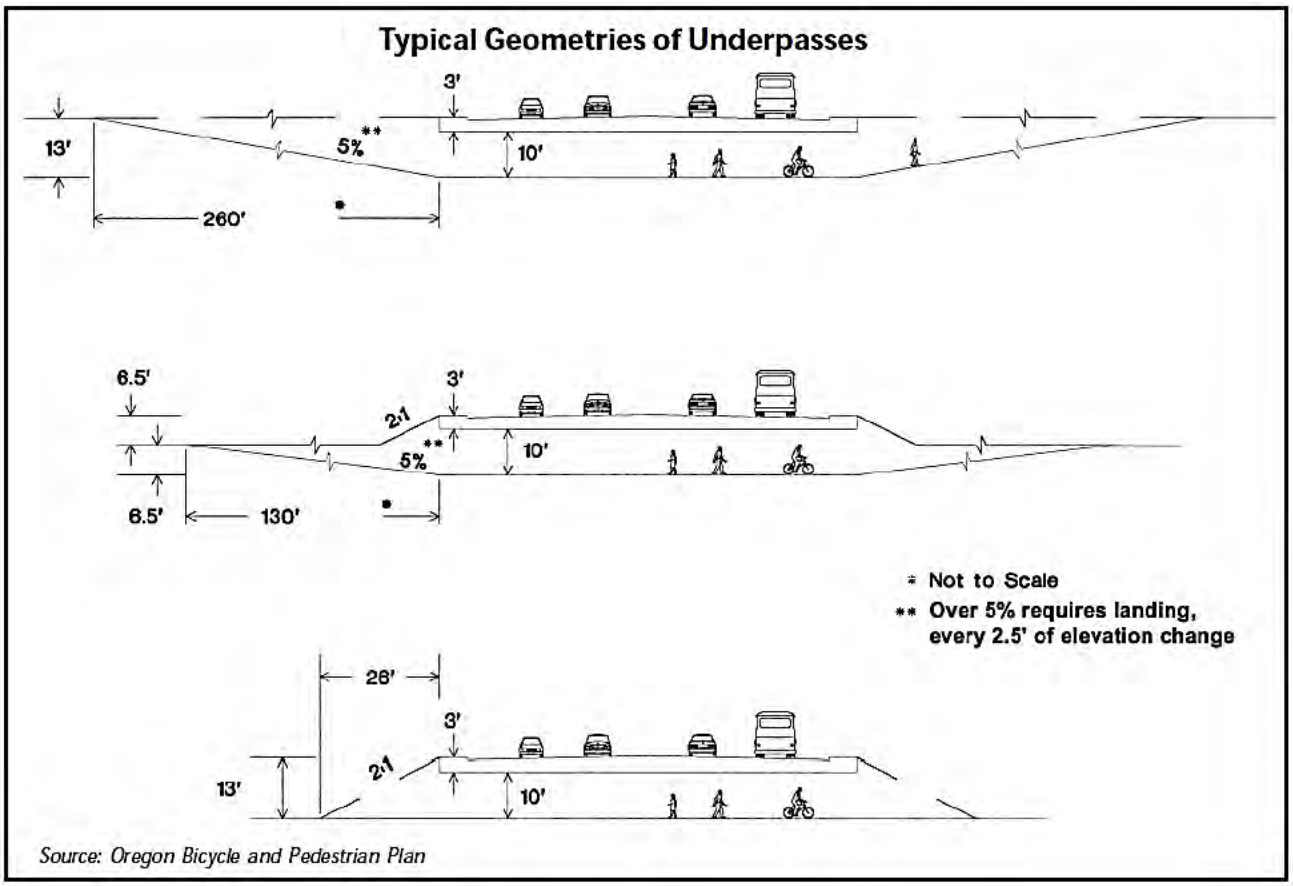

Figure 104

Safety

Tunnels must be well lit throughout. Poorly illuminated tunnels will discourage pedestrian use. The ITE manual, *Design and Safety of Pedestrian Facilities*, recommends placing tunnels near places of high activity such as entertainment complexes or other activity centers. This helps to discourage crime in and around the tunnel.

This tunnel is designed with wide openings on both ends that allows more light into the tunnel and makes it feel less imposing on pedestrians and bicyclists.

Multi-Use Trail Intersections and Crossings

Treat trail crossings the same as a roadway intersection. There should be adequate sight distance, traffic control (as warranted), medians or refuge islands, pavement markings, signing, lighting, access control, and other devices to ensure the safest possible condition for trail users and motorists. Curb cuts should be provided, as well as median cut-throughs if necessary, to facilitate bicycles, wheelchairs, and strollers.

Information related to multi-use pathway intersections with roads is provided in Toolkit 4 — Trails and Pathways. A very comprehensive source of information on trail intersection design is *Trail Intersection Design Guidelines*, by the North Carolina Highway Safety Research Center, prepared for the Florida Department of Transportation in June 1996.

Boardwalks and Trestles

Boardwalks and trestles are simply small bridges consisting of multiple small spans. Boardwalks are usually only a few feet above grade. They provide a walkway that is just above the ground to allow pedestrians access across sensitive and previously inaccessible areas, such as wetlands and streams in parks. Boardwalks and trestles are attractive in natural settings because they are typically constructed of wood.

Wood trestle with edge

The basic design, geometry, and safety criteria for boardwalks and trestles are the same as bridges. A few more specific considerations are summarized below.

Boardwalks and trestles are surfaced with wood decking, which can be an accessible surface, if the spaces between the decking do not exceed 0.25 to 0.5 inches and the deck boards are attached evenly, with no boards, screws, or nails protruding from the surface.

When there is a drop off the edge of the boardwalks of less than 2.5 feet, an edge (wood or other material) needs to be provided to keep wheelchairs and strollers directed onto the decking surface. For grade drops of more than 2.5 feet, a full railing needs to be provided (see Toolkit 4 — Trails and Pathways and Toolkit 5 — Sidewalks and Walkways for railing design recommendations).

A good resource for information about design of boardwalks and trestles is *Time-Saver Standards for Landscape Architecture*.

Other Sources of Information

The following sources of information are recommended for design of crossings. Please see the Resource Guide included at the end of this guide for complete bibliography information.

A Guidebook for Student Pedestrian Safety, Final Report, KJS Associates Inc.

A Policy on Geometric Design of Highways and Streets, 1994, American Association of State Highway and Transportation Officials

An Analysis of Pedestrian Conflicts with Left- Turning Traffic, Dominique Lord

Flashing Beacons, Association of Washington Cities and the County Road Administration Board

"*A Toolbox Approach to Residential Traffic Management*," Joseph Savage and R. David MacDonald

Bellevue Transit Neighborhood Links Project, Otak, Inc.

"*Boulder Brings Back the Neighborhood Street*," John Fernandez

Chattanooga, Tennessee City Traffic Engineer, (423) 757-5005

Design and Safety of Pedestrian Facilities, A Proposed Recommended Practice of the Institute of Transportation Engineers, ITE Technical Council Committee 5A-5

Flashing Beacons, Association of Washington Cities and the County Road Administration Board

Guidelines for the Installation of Crosswalk Markings, Steven A. Smith and Richard L. Knoblauch

Handbook for Walkable Communities, Washington State Pedestrian Facilities Planning and Design Courses, Dan Burden and Michael Wallwork, PE

Manual on Uniform Traffic Control Devices for Streets and Highways, 2004 Edition, US Department of Transportation

NE 124th Street Sidewalk, 100th Avenue NE and 108th Avenue NE Median Islands, Specifications and Contract Documents, KPG, Inc.

Oregon Bicycle and Pedestrian Plan, An Element of the Oregon Transportation Plan, Oregon Department of Transportation Bicycle and Pedestrian Program

"*Pedestrian Actuated Crosswalk Flashing Beacons*," John W. VanWinkle

Pedestrian Crossing Study, Final Submittal, Pedestrian Traffic Control Measures, Arctic Slope Consulting Group, Inc.

"*Pedestrian Signs at Crosswalks Spark Controversy in New Jersey*," The Urban Transportation Monitor

Proposed Warrants for South African Mid-Block Pedestrian Crossings, H. Ribbens, G. Brafman Bahar

Streetscape Manual, City of Toronto

Unsignalized Pedestrian Crossings, New Zealand's Technical Recommendation, Roger C.M. Dunn

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Chapter 11. Toolkit 8 – Traffic Calming

This Toolkit Section Addresses:

- *Why Is Traffic Calming Used?*
- *The Traffic Management Approach*
- *Traffic Calming Techniques*
- *Traffic Calming on Arterial Streets*
- *Administration of a Traffic Calming Program*
- *Other Sources of Information*

Traffic calming is concerned with reducing vehicle speeds, vehicle noise, visual impacts, and sometimes through traffic volumes. Traffic calming does not generally mean that roadway capacity is reduced. Traffic calming techniques use various means to influence the behavior of motorists: physical, psychological, visual, social, and legal (regulatory and enforcement).

Even though traffic calming is not specifically a "pedestrian facility," it relates to pedestrians by improving their environment. This section provides an overview of different traffic calming techniques. There are many good resources listed at the end of this section that provide information about the effectiveness and design approaches related to traffic calming methods. They provide much more detail than that contained in this section and contain guidelines on selecting the most appropriate traffic calming solution for a specific situation.

Traffic circle in residential neighborhood

Why is Traffic Calming Used?

The first traffic calming programs were developed in the 1960's in European countries such as The Netherlands and Germany. These were a direct response to community demands to reclaim residential streets as safe areas for pedestrians. The techniques consisted of installation of devices such as speed humps and chicanes. While a few cities in North America had programs dating back to the 1970's, the widespread development of these programs is a relatively recent trend. As these programs have emerged, several jurisdictions adopted their own terms for traffic calming – "traffic mitigation," "neighborhood traffic management," etc. The recent Institute of Traffic Engineers (ITE)

publication Traffic Calming: State of the Practice has provided the following definition for traffic calming.

> *Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non- motorized street users.*

According to the National Highway Traffic Safety Administration, in 2000, 4,739 pedestrians were killed in crashes in the United States. Almost one-fourth of the children between 5 and 9 years old killed in traffic crashes were pedestrians (this proportion is much lower for other age groups). In the state of Georgia, 9% of all traffic fatalities were pedestrian fatalities.

Most pedestrian collisions occur from 3:00 to 6:00 p.m., when children are most likely to be walking home from school or out in the neighborhood, and also the time when most vehicles are on the road.

In the United States, the need for reduced speeds in residential areas is echoed in ITE's Handbook on Residential Street Design, published in 1989:

> *"...research has shown that pedestrians are not usually seriously injured when hit by a car moving at a speed of less than 20 miles per hour at the time of impact. If impact speeds are between 20 and 35 mph, injuries are usually serious, while at speeds above 35 mph they usually endanger life and are fatal."*

Statistics provide important insight into the need to improve traffic conditions to increase pedestrian safety. Along with this increasing need, a trend for more livable and sustainable communities has been gaining momentum over the past several years. People are demanding that their neighborhoods become less oriented toward automobiles and more oriented toward walking, bicycling, and access to transit.

The Traffic Management Approach

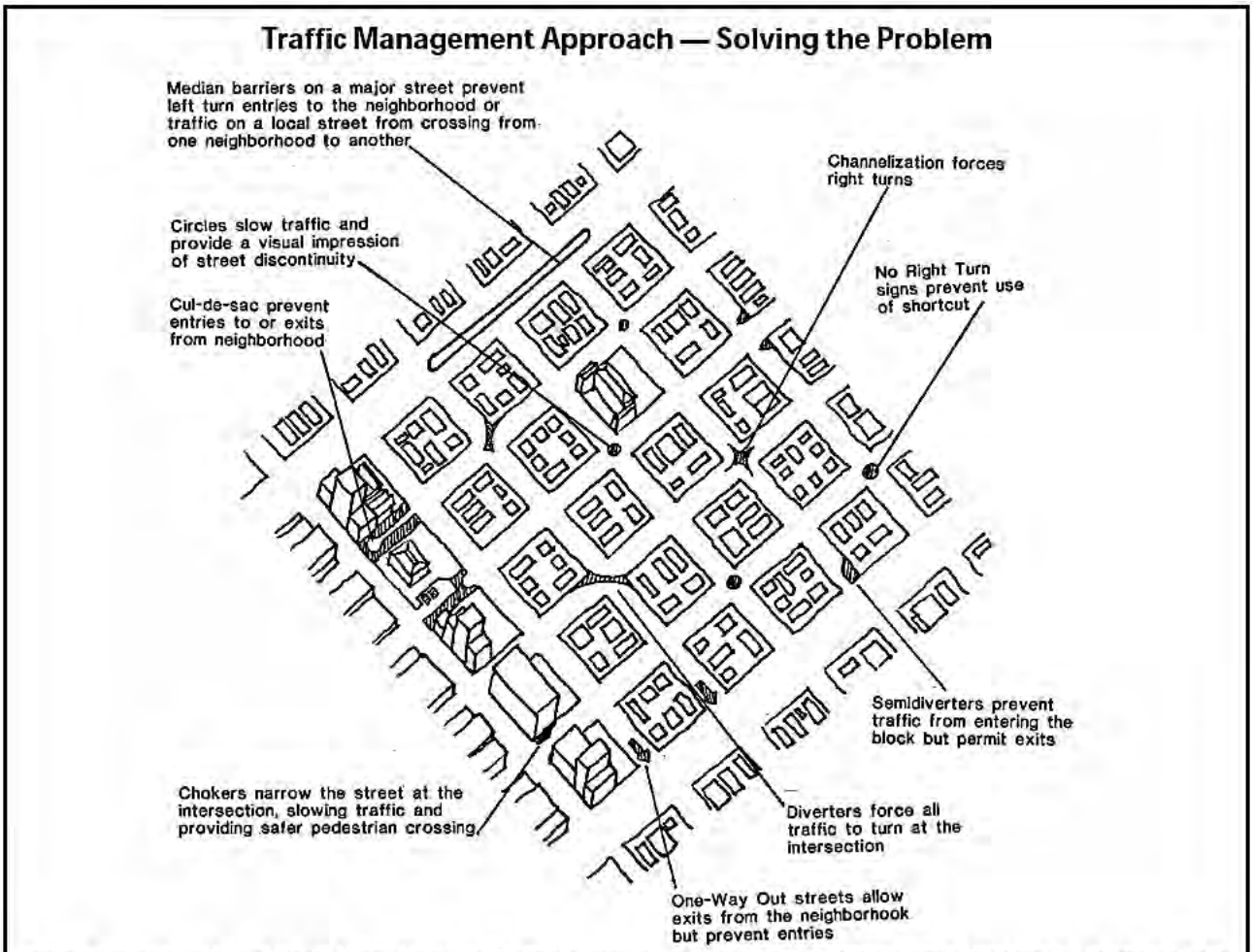
Traffic calming programs seek to reduce traffic speeds and volumes on neighborhood streets (i.e. local roads, and possibly low volume collector roads) to make them safer for pedestrians, bicyclists, and residents, with special regard for children.

Although traffic management and calming techniques are often used in areas other than residential neighborhoods, most programs are focused in residential areas, where traffic problems are more prevalent and have the most influence on the day to day livability of the community. A wider range of techniques is generally more acceptable in residential areas where streets provide local access and do not function as major conveyors of commuting traffic or as primary emergency routes.

When traffic calming techniques are applied to identified target neighborhoods and districts, rather than in isolated locations, the behavior of motorists tends to be more significantly influenced and the traffic problems of the area are more noticeably improved. Isolated applications can be problematic because they may divert traffic to other areas in the neighborhood rather than managing it on an area-wide basis. To address this issue, the traffic calming program of the City of Portland, Oregon includes a "diversion tolerance" policy – a traffic calming feature will not be added to a street if the resulting diversion is estimated to add more than 150 vehicles per day to a parallel street.

Establishment of such an objective standard can be particularly helpful when implementation of a traffic calming program becomes controversial (see Administration of a Traffic Calming Program).

Traffic calming programs seek to make residential streets safer and reduce traffic intrusion by reducing traffic speeds and to a lesser extent, traffic volumes. Figure 105 illustrates a typical urban neighborhood and its traffic related problems, and how these can be resolved through the use of various traffic management tools.



Source: Adapted from State of the Art Report: Residential Traffic Management, Federal Highway Administration; A Guidebook for Residential Traffic Management, WSDOT; and Traffic Calming, Hoyle

Figure 105

Traffic Calming Techniques

Table 53 is a quick reference relating typical traffic calming goals to the means of achieving the goal. Table 54 is a schematic diagram that categorizes various traffic calming techniques. The table shows how several distinctions can be made amongst the various techniques. All techniques can be divided into volume control and speed control techniques. Speed control techniques can, in turn, be divided into active and passive techniques. Active techniques are street design treatments that affect motorists in a tangible way such as speed humps and traffic circles. Passive techniques, on the other hand, affect motorist behavior through changing the psychological “feel” of a street.

Examples include narrowed roadways and colored/textured pavement. Finally, active speed control techniques can be divided into the three groups of vertical deflection techniques, horizontal deflection techniques, and constrictions.

Common Residential Traffic Management Program Actions

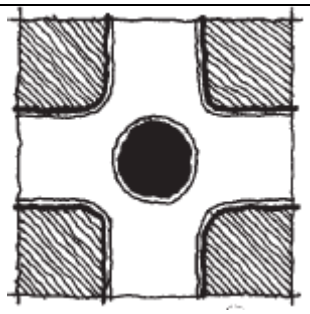
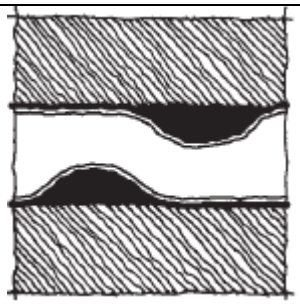
Reducing	***By What Means***	***Examples***
Traffic volumes	Physical	Traffic circles, traffic diverters
Vehicle noise	Psychological	Variable-space paint stripes
Visual impacts	Visual	Landscaping to block through views
Traffic speeds	Social; physical	Neighborhood "Speed Watch" program, speed humps/tables
Collisions/speeding	Legal; physical	Strict speed enforcement; spot safety improvements

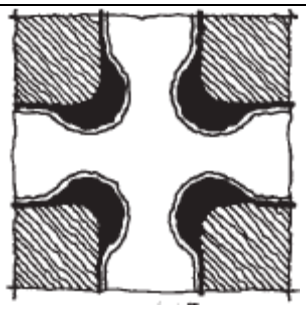
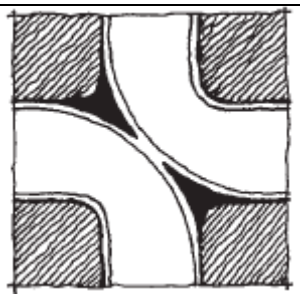
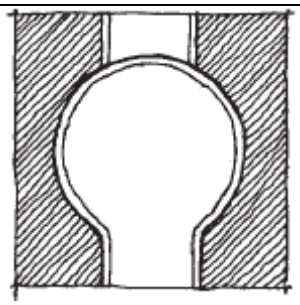
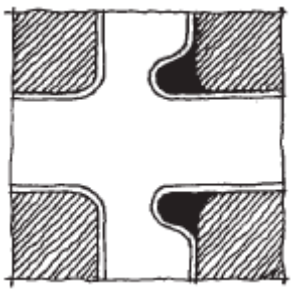
Source: Adapted from A Guidebook for Residence Traffic Management

Table 53

Table 54 illustrates some of the more common types of traffic calming methods currently used. Each of the techniques illustrated and described can be effective in managing traffic and creating improved conditions for pedestrians. These techniques have shown successful results in slowing traffic and reducing collisions on residential streets. For further information, refer to Traffic Calming State-of-the-Art, published by the Institute of Transportation Engineers and the Federal Highway Administration (FHWA).

Common Types of Traffic Calming Methods

	Technique	***Description***
	**Traffic Circles**	Circular raised islands centered within intersections. Circles can be landscaped or surfaced with special paving. Landscaping can be maintained by the local jurisdiction or by neighborhood volunteers.
	**Chicanes**	Alternately placed curb extensions into the street that force motorists to drive in a serpentine pattern. Chicanes are offset from each other in mid-block locations and can be used to keep through-trucks versus local delivery off residential streets.

Common Types of Traffic Calming Methods		
	**Curb Bulb-Outs, Chokers/Neckdowns**	Curb extensions placed at mid-block locations or intersections which narrow the street to provide visual distinction and reduce pedestrian crossing distances. Bulb-outs help to provide a clear visual signal to drivers that a crossing is approaching and makes waiting pedestrians more visible. Neckdowns are often longer than bulb-outs and often line up with and help to define parallel street parking areas. They narrow the appearance of the street and can be attractive, especially when landscaped.
	**Diagonal Diverters**	Eliminates through traffic while providing partial access in opposite directions; island can become amenity and provide refuge for pedestrians.
	Forced Turns and Partial Diverters	Truncated diagonal diverters (one end remains open) and other types of partial diverters discourage commuter traffic by forcing turns, but provides local access opportunities.
	**Cul-de-sac/Street Closures**	Street is closed and turned into a cul-de-sac; end of street becomes a neighborhood amenity and focal point (landscaped mini park); the ongoing provision of pedestrian and bicycle access is important.
	**One-Way Entry and Exit**	Curb bulbs/extensions are used to close one lane of traffic at intersections; stops through traffic but allows ingress or egress depending on the direction and location of the closure.

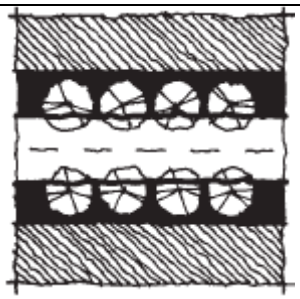
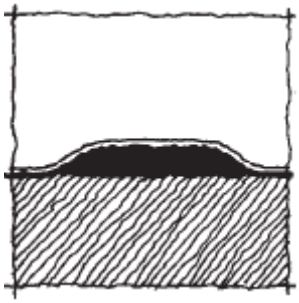
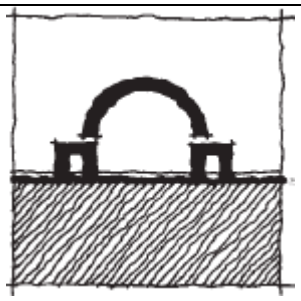
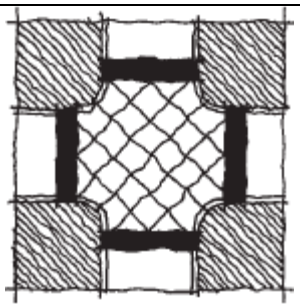
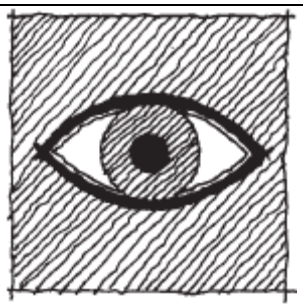
Common Types of Traffic Calming Methods		
	**Narrower Streets**	Narrower streets limit the expanse of pavement visible to the driver and can be effective in slowing traffic, especially when lined with trees or on-street parking.
	**Speed Humps/Tables**	A speed hump is wider and smoother than a speed bump, and effective in slowing cars as they approach pedestrian zones. These are most appropriately used on neighborhood streets.
	**Signs and Neighborhood Gateways**	Signs such as “Residential Street,” “Local Access Only”, or monuments that identify neighborhood districts can be effective, especially when used in conjunction with other techniques, including those listed above and others, such as pavement markings and textured warning strips.
	**Special Paving**	Alternative road surfaces, such as brick, colored concrete or special pavers, can be used at crossings, intersections, or along the sides of the street to break up the visual expanse of pavement and define areas of pedestrian travel.
	**Speed Watch Programs**	Citizens and organizations can utilize a radar device and electronic sign board to measure speeds of passing vehicles in their neighborhoods. Letters of warning can be sent to the registered owners of offending vehicles. These programs promote neighborhood awareness of speeding.

Table 54

Traffic Calming Circles

As discussed in Toolkit 6 — Intersections, there are many types of traffic circles. Larger traffic circles, such as rotaries and roundabouts, function primarily to improve traffic flow through the intersection. Smaller to intermediate circles, 10 to 20 feet, are used to control speeds at the intersection of two local streets. These smaller to intermediate circles are commonly used for neighborhood traffic calming on local streets.

Traffic calming circles are very effective in reducing vehicle speeds and discouraging non- local trips through neighborhoods, which benefits pedestrians. Traffic calming circles create a condition where vehicles are forced to stop or significantly reduce their speed at the intersection, which allows better opportunities for pedestrians to cross.

A drawback of some traffic calming circle designs is that vehicles need to swing wide at the intersection to avoid the center barrier and vehicles may intrude into the pedestrian crossing area if insufficient space is provided for the turning movement. A minimum of 13 feet of clearance between the circle edge and the crossing location is recommended when designing traffic circles.

Another drawback is that some drivers try to take the shortest path through the traffic calming circle and turn toward the left, rather than going all the way around the circle. This creates an unexpected movement to crossing pedestrians.

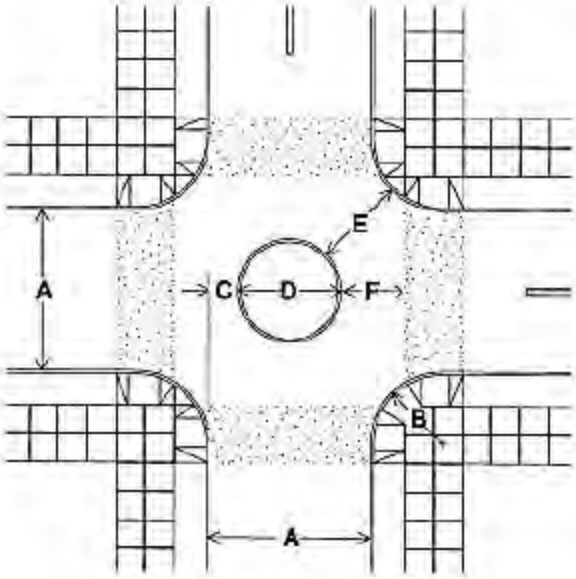
For this reason it is best not to locate traffic circles at intersections where there is a high volume of left-turning movements.

Traffic circles are often landscaped and provide a nice amenity to the neighborhood. Sometimes local residents take on the responsibility of maintaining the circle and it becomes a neighborhood “p-patch.” Care must be taken to select landscaping that will not block views between motorists and pedestrians crossing on opposite legs of the intersection. Upward high branching trees are suggested, along with shrubs (as well as annuals and perennials) that do not exceed a height of 2 to 3 feet.

Mountable curbs at the perimeter of the traffic circle are recommended to provide the ability for large vehicles, including emergency vehicles, to drive over the edge of the circle if they are having trouble making the turn around the island.

Figure 106 illustrates a variation of traffic circles and it is based on the traffic circle design successfully used throughout neighborhoods. For more information on traffic circle and roundabout design, refer to the list of resources at the end of this toolkit section.

Recommended Traffic Calming Circle Design



LEGEND

A Street Width
B Curb Return Radius
C Off-Set Distance
D Circle Diameter
E Opening Width
F Turning Area 13' min.

OPTIMUM CRITERIA

Off- set Distance (C)	Opening Width (E)
5.5' max.	16' min.
5.0'	17' +/-
4.5'	18' +/-
4.0'	19' +/-
3.5' or less	20'

NOTE:

Crosswalks Optional, Depending On Setting (Check With Your Local Agency)

Source: Adapted from the City of Seattle standard design for traffic circles.

Figure 106

Narrowed Streets

Narrowed streets that are either physically narrower or that create the perception that they are narrower are effective methods for calming traffic. Reduced street widths in residential and suburban areas are more commonly allowed by local jurisdictions. Narrow streets not only provide the benefit of traffic calming, but also help to create a more attractive and pedestrian- friendly character along the street. Narrow streets also reduce construction and maintenance costs.

Street trees lined on either side of the street narrow the driver's field of vision. When the driver's field of vision is narrowed, their automatic reaction is to slow down. On-street parking, separated walkways with planting strips, and bike lanes also narrow the look of a street. The use of contrasting pavement or texture in the bike lane or as a dividing strip at the edge of the road can further help to make the roadway appear narrower. Figure 107 illustrates how a street lined with trees and bike lanes looks narrower than one identical in width without these elements.

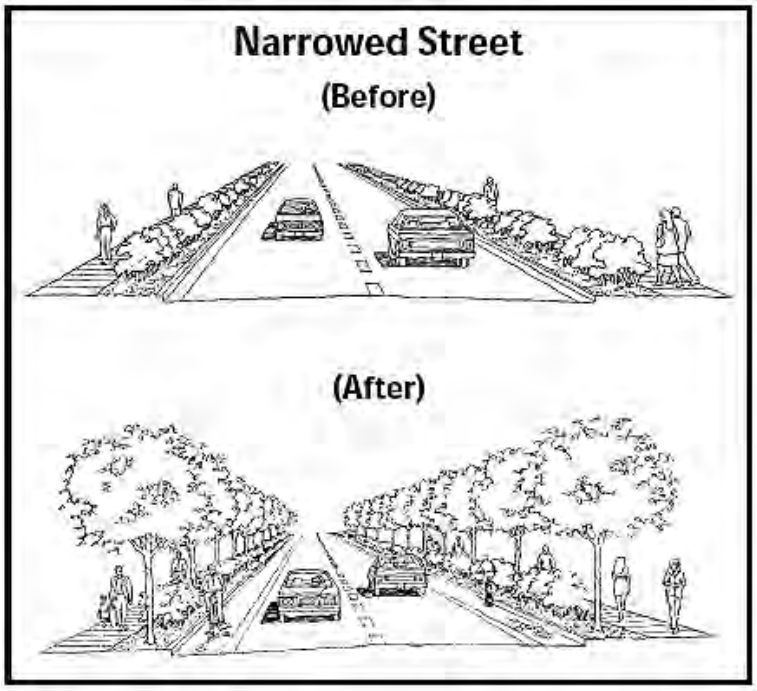


Figure 107

Medians and Refuge Islands

Refuge islands benefit pedestrians by reducing crossing distances and by reducing the amount of jaywalking. Further discussion can be found in Toolkit 6 - Intersections and Toolkit 7 - Crossings. Medians and refuge islands calm traffic because they help to narrow the field of vision of the approaching motorist, especially when they contain trees and landscaping (low growing shrubs or groundcover).

Chicanes

Chicanes are curb extensions or other features (such as landscape islands and on-street parking) that alternate from one side of the street to the other, where either one lane of traffic is fully closed

at “pinch points” causing one car to wait for another to pass before proceeding, or partially closed with enough roadway width remaining for two cars to pass. A study of the use of chicanes in Seattle showed varying decreases in traffic volumes ranging from 6 percent to 48 percent on higher volume streets (Seattle Transportation Division, *Traffic Calming*, Hoyle). The study also found a significant reduction in vehicle speeds and concluded that speeds on neighboring streets continued to increase without chicanes.

Chicanes provide the advantage of not blocking emergency vehicle access and allowing local access opportunities. Drivers are more likely to violate chicanes, especially at intersections with low traffic volumes. Chicanes should be made visible with signs, painted curbs, landscaping, reflectors, and street lights. Figure 108 illustrates an example of chicanes used along a neighborhood street. On-street parking is not permitted at the ends of the street.

Chicanes

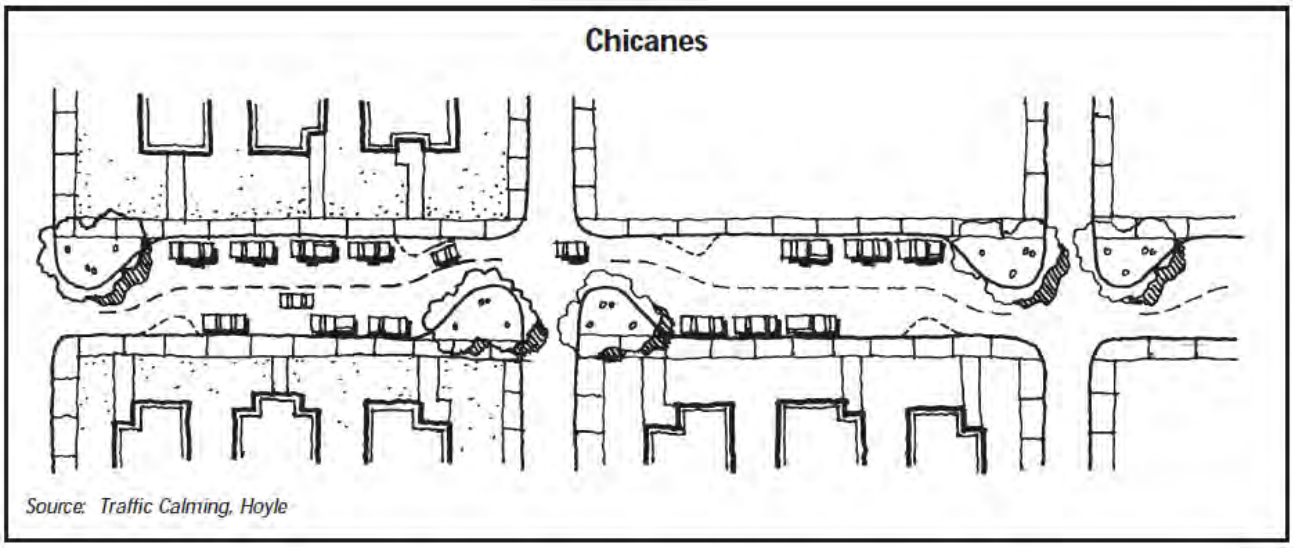


Figure 108

Curb Extensions and Bulb-Outs

Curb extensions and bulb-outs can be designed in a variety of ways. When placed at intersections and mid-block crossings, they provide the advantage of reducing the crossing width for pedestrians. Curb extensions are often used in conjunction with landscape treatments to enhance the street and buffer adjacent parking.

They also help to more clearly identify mid-block crossing locations to both pedestrians and motorists. The recent FHWA report, T*he Effects of Traffic Calming Measures on Pedestrian and Motorist Behavior*, summarizes research on curb extension installations and concludes that their installation can directly reduce motorist speeds.

In some cases, a curb extension or “choker” is used at intersections to create a one-way entry or exit point for that specific street segment. Autos are allowed to exit the street, but entrance occurs at side streets. Pedestrians and bicyclists are allowed to travel in both directions. Figure 109 illustrates typical curb extension and bulb-out designs.

Curb extension

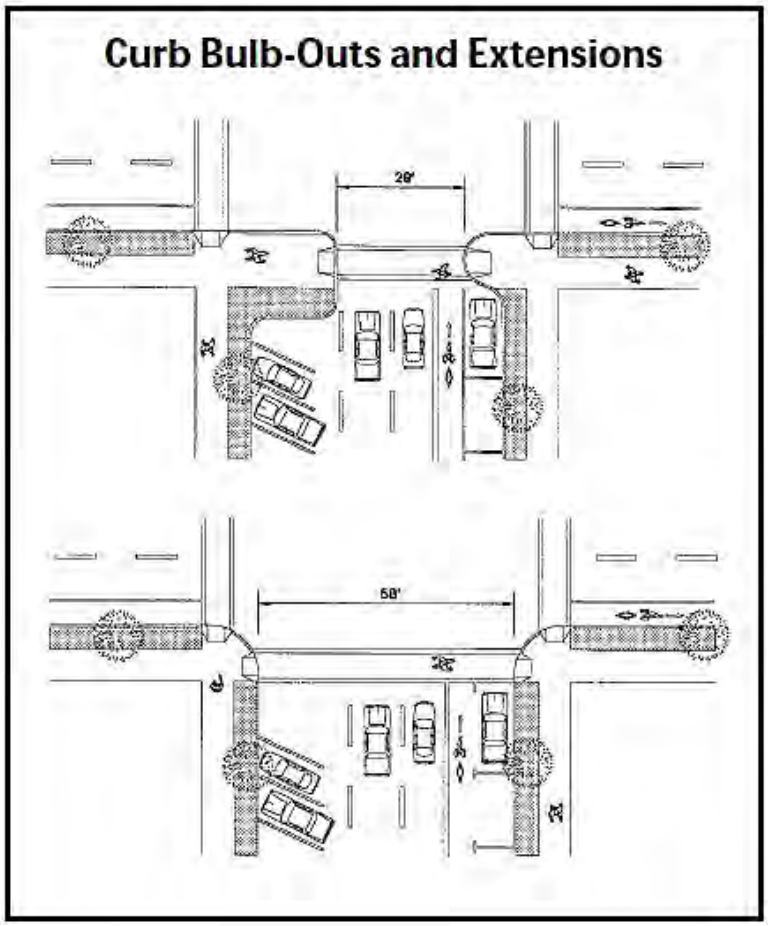


Figure 109

Diverters and Street Closures

Diagonal diverters close roads and eliminate through traffic, while providing access to the surrounding neighborhood. The diverter island provides an area for landscaping and aesthetic enhancement. The island also provides a crossing refuge area for pedestrians.

Full street closures eliminate through traffic, improving the safety of the street by significantly reducing traffic volumes and speeds near the closure.

A disadvantage of full street closures and diagonal diverters is that they cut off emergency vehicle access unless another route can be provided. They also limit access opportunities for the affected residents. Through-traffic may transfer to other local streets in the area if not managed.

Diagonal diverter

Another concern is that the closure of streets may contradict other transportation and land use planning goals that encourage an open grid system of streets.

Partial street closures reduce through-traffic in one direction and partially in the other. Traffic is diverted, while allowing for emergency vehicle and local resident access.

When streets are either fully or partially closed, it is always important to continue to provide pedestrian and bicycle access through the closed area.

Raised Intersections

Raised (or tabled) intersections provide the advantage of slowing vehicles at one of the most critical locations for pedestrian crossing activity. Raised intersections are often paved with contrasting material (stamped, scored, or colored concrete or unit pavers) to the roadway and stand out visually to approaching motorists. The use of special paving also helps to delineate the pedestrian crossing area.

Raised intersections create an area clearly designated for pedestrians. Approaching motorists can see that the intersection is not a location designed for rapid, through-movement, which causes them to slow down and yield the right-of-way to pedestrians. Raised intersections are not appropriate for

high speed thoroughfares and major arterials and collectors. Local requirements may prohibit their use under a variety of circumstances.

Raised intersections make it easier to meet the ADA requirements because the crosswalk is a natural extension of the sidewalk, with no change in grade. However, since the curb line is harder for sight-impaired pedestrians to detect at intersections, special treatment such as tactile warning strips or audible signals are needed to make them detectable.

Placement of drainage inlets is simplified at raised intersections, because surface water will drain away from the center of the intersection.

Changes in pavement color and texture at the intersection raise a motorist's awareness through increased visibility, noise, and vibration. Crossings constructed with special paving should use nonslip bricks or unit pavers. Scored or stamped and colored concrete surfaces can also be used, and are generally more durable over the long term than unit pavers, with more uniform joints and less chance of displacement. Special paving surfaces should be installed and maintained in a smooth, level, and clean condition. Care should be taken to ensure that grooves and joints are not so deep as to impact accessibility.

Raised Crosswalks/Speed Tables

Raised crosswalks are speed humps that are marked as designated crossings. They may be wider than typical speed hump designs. Raised crosswalks or speed tables are appropriate at mid- block locations on local streets, some local and collector roads, and in other locations like at airport drop-off and pickup zones, shopping centers, and campuses. Raised crosswalks are typically marked with high visibility crosswalk designs or may be surfaced with special paving (see Raised Intersections). The recent FHWA report, The Effects of Traffic Calming Measures on Pedestrian and Motorist Behavior, summarizes research on raised crosswalks. It concludes that they can directly reduce motorists' speeds and increase the occurrence of motorists yielding to the crossing pedestrian. Figure 110 illustrates a typical raised crosswalk.

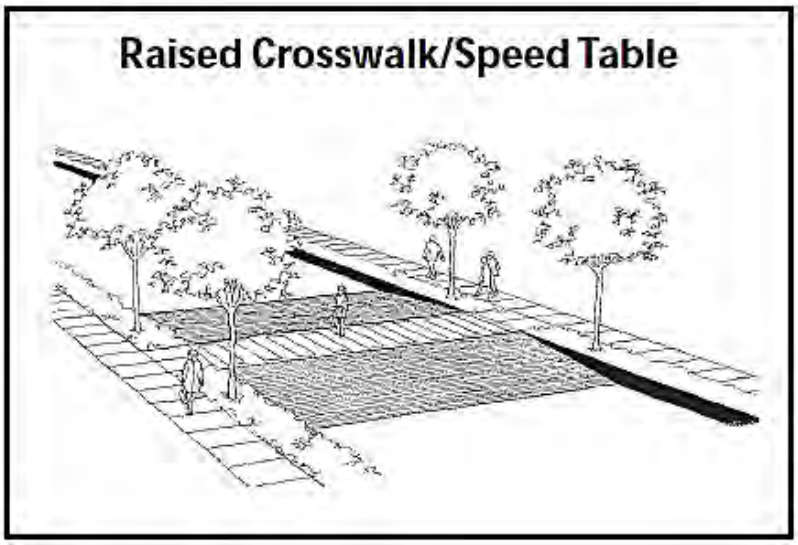


Figure 110

Gateways

Gateway treatments generally encompass a wide variety of techniques that provide neighborhood identification, such as signs, monuments, landscaping, special paving, narrowed entrances, and other elements. These enhancements help to provide an indication to motorists that they are entering a neighborhood area from an arterial road or other type of street where traffic was moving at higher speeds.

Gateway to the City of Douglas

Traffic Calming on Arterial Streets

In many communities there are instances where residential streets have an arterial designation. Sometimes this is part of the original development scheme while other times it is a more recent designation as a consequence of community growth. In any event, there can be compelling reasons to limit speeds and introduce traffic calming on arterial streets. With some street networks, a neighborhood's pedestrian accessibility can be "cut-off" if all traffic is channeled onto high-speed arterial to leave the neighborhood. This renders any efforts to calm the residential streets futile.

European countries offer the many examples of arterial street traffic calming. Programs have been developed in these countries that prescribe traffic calming treatments for any design speed up to approximately 40 mph. Standards have been developed, for example, for speed humps with a drawn-out profile that allows for much higher speeds than typical humps in the United States. At the upper-limit of 40 mph, the techniques are limited to gateways and mild horizontal shifts in roadway alignment.

Another European measure for calming arterial streets is reallocation of right-of-way. This can take the form of narrowed roadways and even narrowed travel lanes. Where adjacent buildings form a street wall, roadway narrowing can change the psychological feel for motorists by having the

remaining space take the form of a dramatic-sized sidewalk. Local jurisdictions should coordinate with fire departments and transit authorities before narrowing travel lanes.

Advance warning of traffic-calming measures on arterials is important, particularly after a transition from a highway. Since arterials do serve commuters and emergency response routes, there is a higher chance for controversy when applying traffic calming to arterial streets (further discussion can be found in the following section).

Administration of a Traffic Calming Program

There are different approaches that can be taken in implementation of a traffic calming program. One approach is to emulate the procedures by which traditional traffic control devises are installed (stop signs, traffic signals, etc.) This includes the establishment of objective standards for the conditions under which different treatments should apply. For a traffic calming program, these would probably take the form of minimum traffic volumes and minimum average speeds that a street must have to warrant installation of a traffic calming device. This approach has the advantage of consistency and objectivity.

Another approach to program implementation is to be responsive to citizen requests for installation of traffic calming in a specific area. There are also merits to this approach since traffic officials can gain a good understanding of the specific problems of a street through listening to direct stakeholders. Also, it may be very difficult to justify applying traffic calming on a street that meets the warrants yet all of the citizen requests are for different areas.

As a result of these dilemmas, many cities have developed elaborate procedures for traffic calming project prioritization that borrow from both approaches. Often a neighborhood petition requirement is part of the procedure.

Traffic calming in the Netherlands

Some traffic calming programs have generated a tremendous amount of controversy in their communities. Occasionally a neighborhood will be divided – in support and opposition – to installation of traffic calming techniques. Other times all neighbors will support traffic calming while the dissent comes from groups such as business owners and commuters. All traffic calming programs should be designed to keep open lines of communication between traffic managers and other impacted agencies. Fire departments should be a key player since emergency response could be affected by a traffic calming proposal.

Table 55 shows good approaches to administrating a traffic calming program.

Approaches for Administrating a Traffic Calming Program

- Programs that rely on citizen identification of potential sites can generate significant support for a project before agency development of particular traffic interventions. Such programs can generate a large number of candidate sites, allowing the agency to apply a prioritization procedure to select candidate sites with the best potential for success and community acceptance.
- Involvement of agencies who operate heavy equipment is important in the selection of particular calming devices. School transportation services, transit agencies, and fire departments are particularly important participants in the design process.
- Many effective local programs stress documentation of the problem that needs to be solved, including speeding, cut-through traffic volumes, pedestrian safety and access. Many elements of the data collection process can be done by members of the community, using radar guns to document travel speed, conducting traffic counts and surveys, and disseminating traffic awareness brochures.
- The installation of devices should be seen as the last element of a progressive program that begins with documentation of observed problems, and includes education and enforcement components before committing to the construction of devices.
- Before and after documentation of conditions is a critical and on-going component of traffic calming programs.
- Many traffic calming programs have introduced a phased process to facility development – citizens must demonstrate popular support for a device through petitions of adjacent residents and property owners. After installation of a temporary device, these same people would have the opportunity after a period of time (often 90 days) to petition for device removal. If a petition is not submitted, the device is then “finalized”, including landscaping, construction of permanent curbing, etc.

Table 55

Other Sources of Information

The following sources of information are recommended for traffic calming. Please see the Resource Guide included at the end of this guide for complete bibliography information.

A Guidebook for Residential Traffic Management, Final Report, Washington State Department of Transportation

A Sampler of Neighborhood Traffic Calming Efforts, Chris Leman

“*A Toolbox Approach to Residential Traffic Management*,” Joseph Savage and R. David MacDonald

Accommodating the Pedestrian, Adapting Towns and Neighborhoods for Walking and Bicycling, Richard K. Untermann

"Boulder Brings Back the Neighborhood Street," John Fernandez

City Comforts, How to Build An Urban Village, David Sucher

Design and Safety of Pedestrian Facilities, A Proposed Recommended Practice of the Institute of Transportation Engineers, ITE Technical Council Committee 5A-5

Florida Pedestrian Planning and Design Guidelines, University of North Carolina

Great Streets, Allan B. Jacobs

Handbook for Walkable Communities, Washington State Pedestrian Facilities Planning and Design Courses, Dan Burden and Michael Wallwork, PE

Livable Neighborhoods: Rethinking Residential Streets, American Public Works Association and the University of Wisconsin-Madison

Livable Streets, Donald Appleyard

Portland Pedestrian Crossing Toolbox for Pedestrian Program Bureau of Transportation Engineering and Development, Charles V. Zegeer

Preparing Your Own Design Guidelines, A Handbook for Seattle' Neighborhoods, City of Seattle Department of Construction and Land Use and Planning Department

Reclaiming Our Streets, Traffic Solutions, Safer Streets, More Livable Neighborhoods, Community Action Plan To Calm Neighborhood Traffic, Reclaiming Our Streets Task Force, City of Portland Bureau of Traffic Management

Residential Streets, American Society of Civil Engineers

Traditional Neighborhood Development: Will the Traffic Work? Walter Kulash

Traffic Calming, Cynthia L. Hoyle

Traffic Calming, A Guide to Street Sharing, Michael J. Wallwork, PE

"Traffic Calming — An Overview," Walter Kulash

Traffic Calming — The Solution to Urban Traffic and a New Vision for Neighborhood Livability, Citizens Advocating Responsible Transportation, Ashgrove, Queensland, Australia

Traffic Calming State-of-the-Practice, Institute of Transportation Engineers and Federal Highway Administration, 1999.

The Effects of Traffic Calming Measures on Pedestrian and Motorist Behavior, Federal Highway Administration, 2001

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Chapter 12. Toolkit 9 – Pedestrian Access to Transit

This Toolkit Section Addresses:

- *Transit Compatible Design*
- *Improving Transit Facilities for Pedestrians*
- *Transit Stops and Bus Pullouts*
- *High Capacity Right-of-Way Transit*
- *Transit Centers*
- *Park-and-Ride Facilities*
- *Transit Malls*
- *Transit-Oriented Development*
- *Coordination Between Agencies*
- *Other Sources of Information*

Transit and walking are alternative modes of transportation that are complementary and supportive to each other.

Transit includes several types of transportation modes, including public bus services, commuter and light rail lines, van pools, subways, and monorails. Expanding access to transit and improving transit facilities are complementary to promoting pedestrian travel as an alternative transportation mode. Transit compatible planning and design and efficient transit service are supportive of one another in thriving communities.

Pedestrian and transit travel work well with each other. Every transit trip begins and ends with pedestrian travel. Good pedestrian facilities often make the trip to transit stations or stops more enjoyable, thus making it easier for people to choose both modes of transportation to go to work, shopping, or other activities. All transit facilities and the transportation routes that lead to them need to be safe, convenient, and accessible to create an active walking city. If people do not feel safe or comfortable walking to transit stations or stops, then they are likely to choose other modes of travel, such as a car. The more people that drive, the less pedestrian-friendly a community can feel.

This section discusses design practices that promote and enhance transit access for pedestrians and improve conditions at transit facilities, encouraging both transit use and higher levels of walking. The focus of this section is not on overall design of transit facilities, but rather on specific design of features and facilities for enhancing pedestrian access to transit facilities. Several other useful documents related to transit facility design are available for reference. Refer to the list at the end of this toolkit.

Many of the design guidelines suggested in this section are a summary of varying practices. Consult with local transit agencies to verify specific local requirements for boarding pads, bus stop locations, and other important design criteria that may be unique to individual transit authorities.

Enhancing pedestrian access to transit increases transit use.

Transit Compatible Design

Planning and design for areas where transit service is available, or may become available in the future, should provide transit compatible features, as illustrated in Figure 111. These features include some pedestrian-scale design for better access to transit services. Figure 111 is an example of how a suburban office park was converted to mixed use and improved for better access to transit.

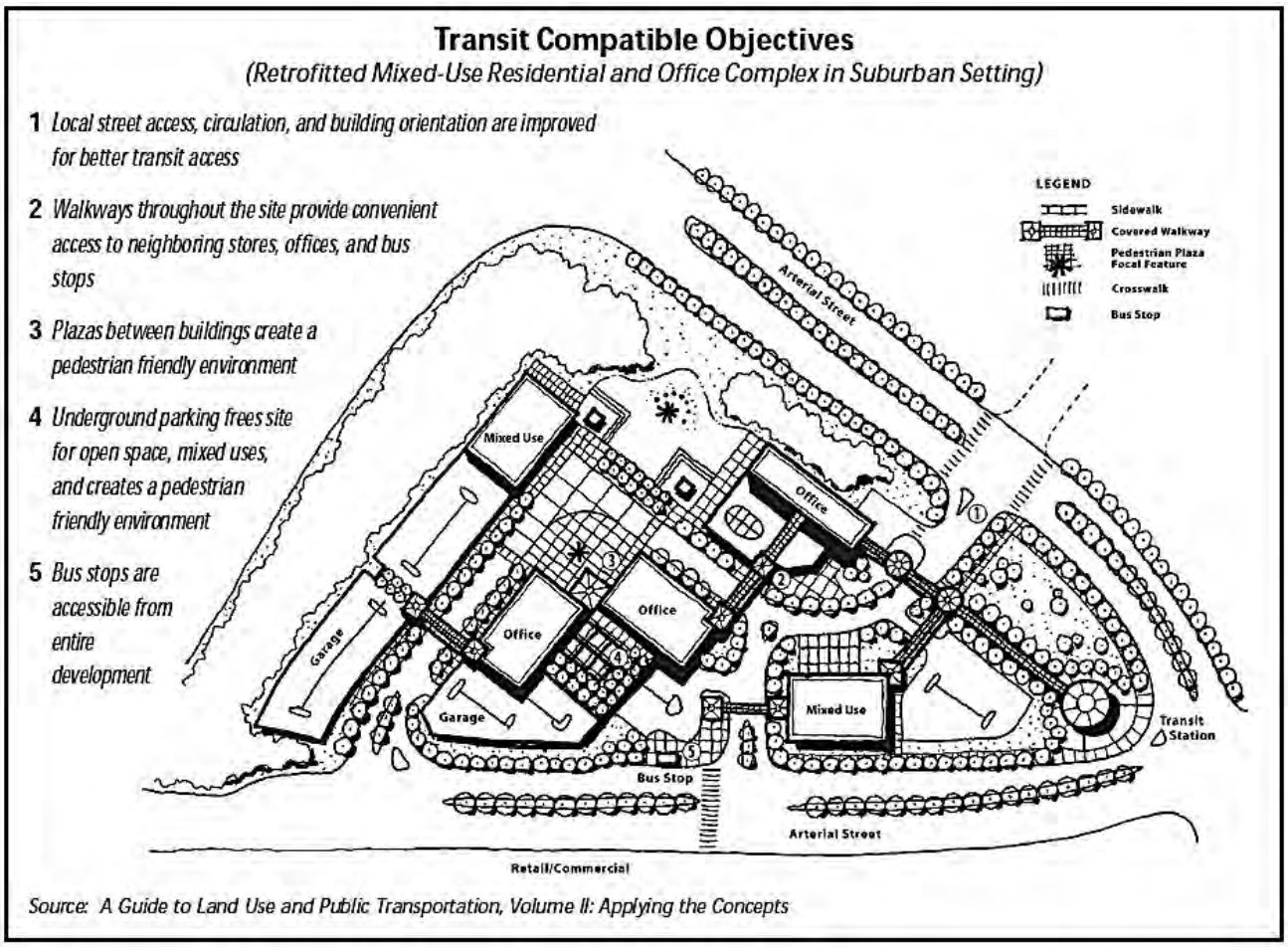

Figure 111

Improving Transit Facilities for Pedestrians

The success of transit as a mode of transportation is highly dependent on pedestrian access. People with disabilities (including people who use wheelchairs or are sight impaired) often rely on transit as their primary source of transportation, and transit facilities need to be designed to meet their needs. (Refer to the section called About Pedestrians for a discussion on the spatial needs for pedestrians, and Toolkit 2 — Accessibility.) Some important design guidelines can be followed to encourage and improve access to transit facilities for pedestrian riders:

- Provide adequate sidewalks and walkways on streets with bus routes that lead to transit stops
- Design sidewalks that access transit with a minimum of 6 feet in width, enabling two adults to walk comfortably side-by-side. In urban areas, where street furnishings, parking meters, sign posts, and other elements clutter the sidewalk, the desirable minimum width is 10 feet.
- Provide a minimum 9-foot long by 5-foot wide landing pad at bus entrances and exits (measured from the direction of getting on or off the bus), as required by the ADA for some bus stop locations. It may be desirable to build a continuous strip of 8-foot sidewalk or shoulder along the entire length of the bus stop, rather than to try and predict where in the

sidewalk the landings should be. The buses may not stop in the exact location each time. Refer to Figure 112 for an illustration of a widened bus loading area. Figure 113 illustrates a typical bus stop cross-section.

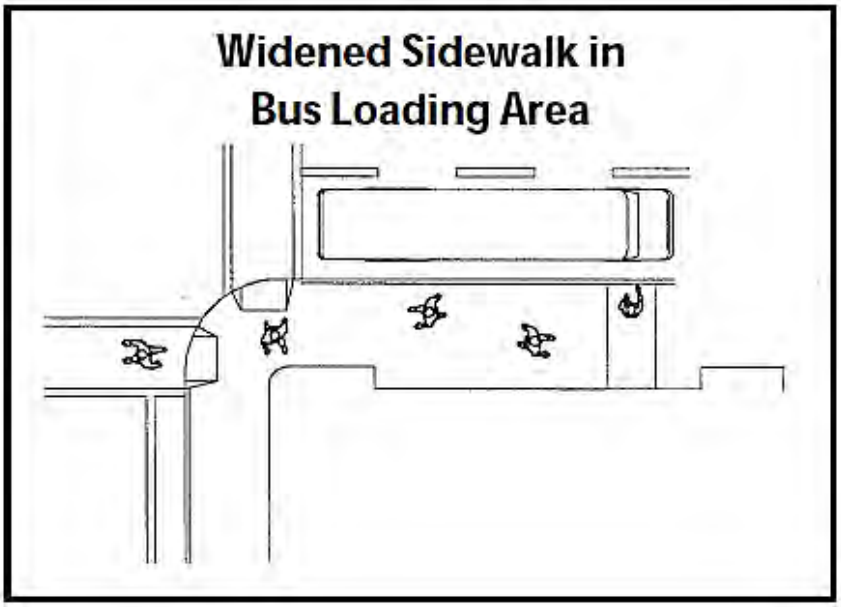

Figure 112

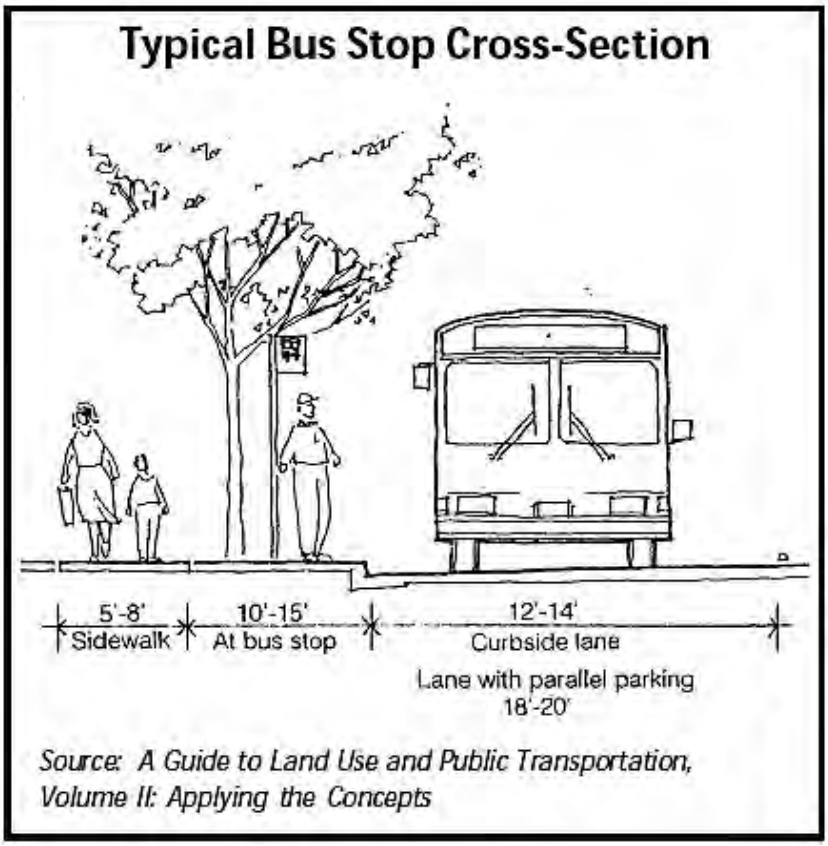

Figure 113

- At light rail and other transit stations and stops, make sure the waiting areas are secure, open, inviting, well-lit, and easily accessible to everyone.
- Encourage transit use by providing shortcuts that reduce the distance a pedestrian must walk. Bridges over streams, paths through parks and neighborhoods, and walkways that connect to dead-end streets can provide expanded access opportunities for pedestrians.
- Provide well-lit access ways to transit facilities, since transit riders often commute to work or school in early morning and late afternoon and evening hours.
- Keep pedestrian signals and other traffic control devices operational and set with timings that allow pedestrians to comfortably cross streets to reach transit stations and bus stops.
- Provide separate spaces for those waiting, passing through, transferring between buses, and queuing to board and deboard to improve pedestrian mobility and transit function.
- Locate bus stops to discourage crossing of streets at undesirable locations.
- Pedestrian crossings near at-grade light rail and commuter stops need to have clear lines of sight and good visibility so pedestrians can see the trains approaching.

Installing street furnishings set back from the curb increases pedestrian mobility and visibility.

- Create space directly adjacent to bus loading areas that are free of all street level obstacles. Street furnishings (except for bus stop signs) such as benches, pay phones, light posts, shelters, kiosks, and garbage receptacles should be set back a minimum of 8 feet from the curb where adequate space is available. Where space is not available, the lateral clearance required by the ADA is 3 feet.
- Maintain open sight lines between the bus operator's view and the passenger waiting and loading areas. Shelters should be constructed with windows and clear materials to provide a view of the waiting passengers inside. The recommended minimum for height clearance for all signs in the bus stop zone is 7 feet from the bottom of the sign to ground level.
- Overhanging tree branches need to be at least 8 feet from the ground to avoid signing obstruction or interference with mirrors on the buses.

- Provide open zones that promote visibility of users and visibility for users to increase their perception of personal security.

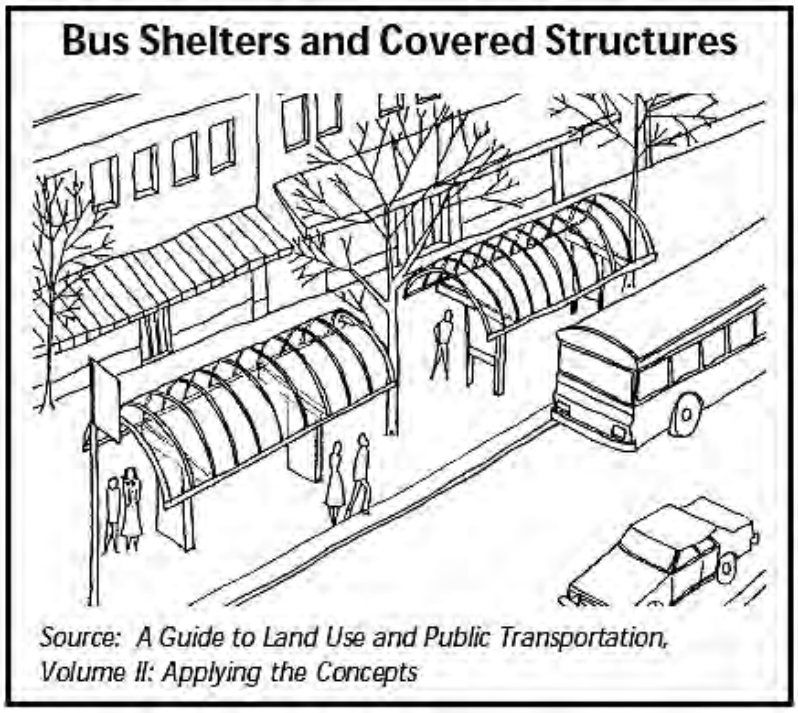

Figure 114

- Provide shelters and covered structures where feasible to protect passenger waiting areas from wind and precipitation (see Figure 114).
- Provide accessibility to people with disabilities with curb cuts, ramps, detectable warning features, and clearly defined and delineated pedestrian space.
- Reduce risks of slipping and falling by providing paving surfaces with good traction. Pavement texture and color can also be used to communicate function and spatial relationships for the visually impaired.
- Install street furniture that is durable and vandal resistant.
- Consider aesthetics and maintenance requirements in the initial design phase, rather than as an afterthought.

Some relatively low-cost improvements that can increase pedestrian access to transit are listed in Table 56.

Low Cost Improvements to Increase Pedestrian Access to Transit
• Pavement markings where sidewalks or other pedestrian facilities do not exist
• Marked crosswalks
• Removal of sidewalk obstructions
• Changes in signal phasing at intersections and crossings near stations and bus stops

Table 56

Transit Stops and Bus Pullouts

Transit stops and bus pullouts or zones provide designated space for loading or unloading passengers. A zone accommodating one bus is normally from 80 to 160 feet in length, and longer in business districts with high levels of use. Bus stops can be as simple as a sign and a pullout area, designated space at the curb, or shoulder for the bus to stop. Or, they may include other facilities, such as shelters, benches, and other furnishings.

There are three choices for location of bus stops - near-side, far-side, and mid-block. Near-side stops are located on the approaching side of an intersection in relation to the direction of travel. Far-side stops are located on the departing side. Mid-block stops are not close enough to an intersection to be affected by the intersection.

Far-side stops are generally more desirable than near-side stops from the perspective of the pedestrian, but near-side stops can be successfully designed to adequately accommodate pedestrians.

The following considerations for pedestrians should be made when designing bus stops and pullouts:

- Provide a minimum 4-foot wide clearance zone from the curb so that opening bus doors are not blocked by street furnishings, sign posts, landscaping, or other obstructions.
- Provide 9 feet of clearance from the curb for wheelchair lift operation; 4 feet for the lift to extend and 5 feet for the wheelchair to maneuver beyond the lift. The ADA requires a minimum width of 3 feet for accessible paths of travel but generally, path widths adjacent to transit should be wider to accommodate groups of pedestrians as well as wheelchair users. 6' minimum sidewalk width is suggested for paths next to transit. In high use urban areas, 10 feet minimum is recommended. Design bus stops to accommodate wheelchair lifts. Only as a last resort should a zone or stop be inaccessible.
- Provide open sight lines and avoid placing shelters, furnishings, and vegetation that may obstruct driver and waiting passenger views, as discussed previously.
- Shelters should be well-lit and constructed of materials that do not obstruct views out of or into the shelter.
- Sidewalks should be provided within designated bus zones with a landing area for wheelchair access to transit services.

- Transit riders need to be able to cross the road safely at transit stops. On a typical two-way street, with residences and development on both sides, half the riders will need to cross the road when boarding or exiting the bus. Mid-block crossing facilities should be provided at mid- block bus stop locations. See Toolkit 7 - Crossings for discussion on mid-block crossings.
- Curb heights should never be higher than the height of the bus step to prevent falls during passenger boarding and departing. Older buses tend to have a bottom step that is 14 to 18 inches above the roadway. Newer buses can have bottom steps as low as 11 inches above the roadway.
- On streets with parallel parking, near-side bus stops can benefit from elongated curb bulb-outs (or neck-downs) that provide passengers adequate area to board or exit the bus without having to step into the street or the stream of pedestrian travel on the adjacent sidewalk. With this facility, buses are able to pull up directly adjacent to the curb.
- Bus stop design should avoid conflicts with other types of uses. For example, bus stops should not interrupt bike lanes, and waiting areas and shelters should be provided to the side of the walkway so that pedestrians can pass passengers waiting to board.
- When there is a planting strip directly adjacent to the curb, provide a sidewalk slab that extends from the existing sidewalk to the curb so that passengers do not have to cross wet grass or mud during inclement weather.
- Avoid locating bus stops where there are curbs of varying heights.
- Strategically locate bus stops to minimize crosswalk movements of transferring passengers if transfer movements between bus routes are heavy. For example, locate bus stops on the same corner of an intersection so users are not required to cross the street (see Figure 115).

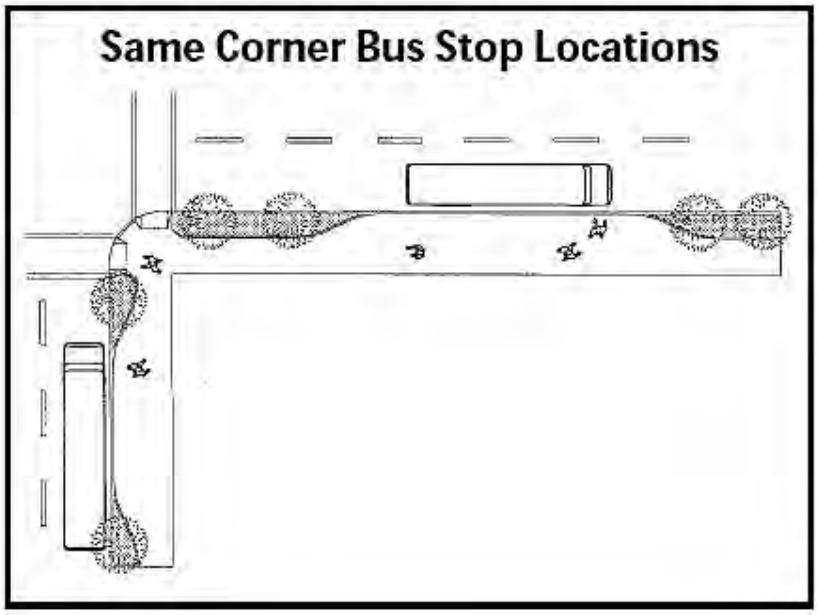

Figure 115

- All transit stops should be easy to reach by walkways.
- Transit stops should include sheltered, visible, and comfortable seating areas and waiting spaces, set back from the walkway.
- Bus stops should provide shelters for protection from weather and a secure waiting place for transit riders.
- Bus pullout locations are often warranted where there are heavy traffic conditions. When pullouts are to be located near intersections, a far-side location is preferred. The needs of the passengers boarding and exiting the bus should not conflict with the needs of pedestrians and bicyclists moving through the area. Curb bulb- outs at the nearby intersection help pedestrian crossing movements, prevent motorists from entering the bus pullout area, and reduce conflicts with bicyclists traveling through. Pullouts should be designed to meet roadway conditions and bus characteristics. Configurations of pullouts should allow buses to pull up directly adjacent to the curb.

High Capacity Right-of-Way Transit

The types of high capacity transit facilities usually found in their own exclusive rights-of-way include light rail vehicles, subway trains, and commuter rail trains. While these types of systems are designed and built by transportation agencies, there are still certain pedestrian elements that should be considered during the design process. These include:

- Ensure that pedestrians feel safe and there are no “hiding places” at transit waiting areas.
- Avoid drastic level changes. If stairs and escalators are provided, make sure they are wide enough to allow faster pedestrians to go around.
- Provide well-lit areas around transit stations for pedestrians entering and leaving during dark periods.
- Provide adequate and safe crossings for pedestrians accessing at-grade transit vehicles.
- Use landscaping, fences, or shrubbery to delineate where the best crossing is for pedestrians, but use care not to install landscape that creates hiding places or visual intrusions.
- Provide pedestrian-only crossing gates or other warning devices, if needed.

Pedestrian Elements for High Capacity Transit

The use of urban design elements will help create a more pedestrian-friendly atmosphere around high-capacity transit stations. Below is a list of elements that can enhance the surrounding neighborhoods and provide safety for pedestrian near or at high-capacity transit stations.

Landscape

Landscaping around transit stations provides a visual, pleasing environment and shade relief from heat and glare. Distinctive plants can be used to identify the stations as landmarks. Plants that represent the local, natural environment should also be encouraged. Trees that will provide maximum shade should be planted around the station. Transit authorities should seek partnerships

with surrounding businesses and/or neighborhoods to create small gardens, plazas, or parks to enhance the pedestrian environment around stations.

Adjacent Activity Areas

The adjacent activity area is defined as the transition space for transit riders who are arriving at both center (median) and side (curbside) locations by foot or by drop-off from buses or private vehicles. These areas can be designed as "park-like" spaces that provide decorative plants, fountains, art opportunities, drinking fountains, information kiosks, LRT arrival and departure information and "sociability" opportunities such as shaded seating areas. The activity areas should also accommodate linkages to existing community amenities, provide sufficient bicycle parking and storage facilities, and provide space for outdoor food vendors. The design of these areas enhances the pedestrian environment and encourages use of the transit system.

Bus Connections

Highly efficient, comfortable, and convenient intermodal transfer connections between buses and high capacity transit are vital to the success of the entire integrated system. High capacity transit agencies should work with bus agencies to relocate bus stops if necessary to decrease walking time for pedestrians using both modes of transportation. Bus stops should also be positioned to minimize street and driveway crossings to increase pedestrian safety. Pedestrian flow between high capacity transit and bus stops should be estimated and projected to help determine walkway widths.

Signage

Wayfinding, directional, and identification signage will help direct pedestrians to stations from bus connections, park and ride lots, adjacent pedestrian areas, major neighborhood intersections, and key cultural, educational, and recreational facilities. Regulatory and safety signs will encourage safe pedestrian activity in and around transit stations.

Lighting

Lighting should provide a safe and secure experience for pedestrians. Lighting should be designed to cast adequate light to the pedestrian-level and scaled appropriately to canopies and the pedestrian level of activity. Shadows and low light should be minimized to decrease the potential for hiding places.

Marta Station in East Point

Refer to local transit agencies, such Metropolitan Area Rapid Transit Authority (MARTA), for more details on the design of rights-of-way transit.

Transit Centers

Transit centers provide an area for transit line buses on two or more routes to come together at the same time for transferring riders, or as points of origin and destination. Transit centers can be sited to optimize pedestrian access to major activity centers, such as shopping centers and college campuses. Transit centers can also promote transfer connections between different transportation systems. Because they are highly visible facilities within the community, transit centers help increase public awareness of the availability of transit service. Both off-street and on-street transit centers can be developed, depending on the space requirements, street traffic volumes, passengers within walking distance, and other factors.

Transit centers function best when designed to meet the demands of peak user levels. Platform space needs to be adequate to accommodate all pedestrians, including those who are waiting, queuing, or simply walking up and down the sidewalk or platform. A common rule of thumb for determining space requirements for platform areas is 10 square feet per person, using the peak pedestrian volume anticipated.

Transit centers help increase public awareness of the availability of transit service.

The most important element of design for transit centers is minimizing circulation conflicts between buses, pedestrians, and autos. Pavement delineation with texture, color, striping, or other means can help identify spaces that are for exclusive use by pedestrians. Buffering techniques with planter boxes, street trees, furnishings, or other circulation design elements can be used to provide separation between pedestrians and automobiles wherever possible.

Park-and-Ride Facilities

In addition to the general conditions recommended for all transit facilities described previously, park-and-ride lots that function well for pedestrians generally include:

- At least one accessible route of travel, minimum 3 feet wide (but six feet for two-way travel) safely delineated over the entire site
- Sidewalks next to curb-side parking lanes and to all loading zones
- Minimum 6-foot wide sidewalks for two-way pedestrian travel, and greater width if feasible; the recommended minimum width of sidewalks adjacent to a bus or taxi loading zone is 12 feet, with 8 feet of unobstructed space next to the curb

- A maximum walking distance of 800 feet from the car to the bus loading zone
- Security lighting
- Public pay phones

In addition, other desirable features can include drinking fountains and restrooms where feasible and justified.

Transit Malls

Transit malls are created by removing automobile and truck traffic on sections of existing street systems, usually on principal streets within the urban network. Only buses, taxis, and light rail are allowed to access the transit mall area. Parking is prohibited and walks are widened to accommodate higher volumes of pedestrians. Streetscape improvements, including special pavement, public art and sculpture pieces, benches, and other furnishings are typically found at a successful transit mall. Transit malls function well as social gathering spaces and can become good locations for art exhibits and a variety of downtown activities, as long as these activities do not interfere with the principal purpose of the facility — convenient access to transit.

Transit malls can accommodate higher volumes of pedestrians.

A transit mall serves as a linear linkage system between activities along its route, including housing, retail, office, hotels, and entertainment. A transit mall may also be an area of concentrated transit facilities with high volumes of transferring or transit riders being picked up and dropped off. Transit malls typically function best in places where there is a diversity of uses (for example, in retail districts or downtown cores) and with a significant ridership source nearby, such as employment centers, college campuses, and sports stadiums. Several elements can encourage use of transit malls by pedestrians and keep them looking attractive:

- Shaded, sheltered areas to sit and read or walk around
- A well-planned layout with adequate clearances for accessibility and sufficient space for high volumes of pedestrians
- Security through adequate lighting, clear sight lines, visibility, and regular patrols
- Aesthetically pleasing and interesting things to look at, such as artwork, colorful planters, and fountains

- Quality paving materials and street furnishings
- Litter receptacles and cigarette ash cans

Restrooms and drinking fountains improve user comfort but are often too costly to include.

Transit-Oriented Development

Transit-oriented development (TOD) can mean different things to different people. From a transportation standpoint its goal is to "increase the percentage of trips taken by riders to station areas and increase the number of internal trips by foot and bicycle within the station's vicinity." From a planning perspective TOD includes physical characteristics such as "a compact mix of lands uses, including residential, commercial, recreational, and service activities, in close proximity to one another" and "a site layout and design that encourages walking with pleasant, safe, and interesting places and an effective network of pedestrian and bicycle routes." (*Creating Transit Station Communities, Puget Sound Regional Council, 1999*).

The concept of TOD aims to design pedestrian- friendly communities that have good access to public transit. These communities are centered around a transit station. The mixes of uses that should be included around a transit station to make it effective as a pedestrian and transit destination include residential development that is higher in density, public facilities such as parks and service centers, employment centers, and commercial and retail centers.

Transit-oriented development must include pedestrian-friendly facilities and amenities

Transit-oriented developments are already being implemented in some areas throughout Georgia. Two MARTA stations in Atlanta, Lindberg and Medical Center Station will include a mix of uses and pedestrian-oriented amenities around them. For more information on TOD, refer to other sources of information included at the end of this section.

Coordination Between Agencies

Coordination between transit agencies, local jurisdictions, and transportation system planners and designers is essential when planning and designing pedestrian facilities for access to transit. Often, transit stations and stops are located without the benefit of crosswalks or sidewalks nearby. Land

use planning efforts sometimes do not consider ways to support transit use in communities. Communication and coordinated reviews between transit agency staff and local planners and engineers should occur during the beginning stages of new projects.

Other Sources of Information

The following sources of information are recommended for pedestrian access to transit. Please see the Resource Guide included at the end of this guide for complete bibliography information.

Accommodating the Pedestrian, Adapting Towns and Neighborhoods for Walking and Bicycling, Richard K. Untermann

Design and Safety of Pedestrian Facilities, A Proposed Recommended Practice of the Institute of Transportation Engineers, ITE Technical Council Committee 5A-5

Creating Transit Station Communities – A Transit- Oriented Development Workbook, Puget Sound Regional Council

Linking Bicycle/Pedestrian Facilities With Transit, M. Replogle and H. Parcells

Metro Transportation Facility Design Guidelines, Municipality of Metropolitan Seattle

Non-Motorized Access to Transit, Final Report, Wilbur Smith Associates

Non-Motorized Access to Transit, Technical Appendices, Wilbur Smith Associates

Urban Design Elements, Central Phoenix/East Valley Light Rail Transit Project

Pedestrian Malls, Streetscapes, and Urban Spaces, Harvey M. Rubenstein

Planning and Design for Transit, Tri-County Metropolitan Transportation District of Oregon

Using GIS for Transit Pedestrian Access Analysis, Orange County Transportation Authority Transit Programs Department

The Role of Transit in Creating Livable Metropolitan Communities, Project for Public Spaces, Inc.

The Transit Metropolis: A Global Inquiry, Robert Cervero

Planning, Developing, and Implementing Community Sensitive Transit, Livable Communities Initiative

How to Promote and Enhance Urban Development Around Light Rail Transit Stations, SE Wisconsin Regional Light Rail Transit Study

Building Livable Communities: A Policymaker's Guide to Transit-Oriented Development, Center for Livable Communities

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Chapter 13. Toolkit 10 – Site Design for Pedestrians

This Toolkit Section Addresses:

- *Thinking About Pedestrians as Part of Site Development*
- *Pedestrian-Friendly Site Design*
- *Building Location and Design*
- *On-Site Circulation and Parking*
- *Walkways and Accessible Routes*
- *Site Access and Driveway Design*
- *Landscaping and Furnishings*
- *Ramps, Handrails, Stairways, and Steps*
- *Sites Used Exclusively by Pedestrians*
- *Play Streets*
- *Strategy for Increasing Pedestrian Travel — Mixed-Use Site Development*
- *Other Sources of Information*

Good site design accomplishes many important objectives related to pedestrians, including safer conditions, more convenient access, and increased pedestrian travel. When sites are designed with the pedestrian in mind at the onset, rather than as an afterthought, a more pedestrian-friendly environment can be created. Pedestrians can easily tell whether or not their needs are being adequately considered at the businesses, shopping centers, community buildings, and other sites they frequent. Pedestrians need to be an integral part of the beginning stages of site design.

Sites should be designed to be accessible, safe, and pedestrian friendly.

This toolkit section provides site design and development recommendations intended to make designers of private and public sites more aware of the needs of pedestrians. When pedestrian conditions are improved, pedestrian travel and activity in the area increases. Well designed sites

that invite pedestrians and provide convenient facilities for them are also often successful businesses and vital areas within the community.

Thinking About Pedestrians as Part of Site Development

Integrating pedestrians into site development is important. Increased pedestrian activity can be beneficial to business and can improve the safety and character of the community. Often, site development is oriented more toward creating convenient and efficient access and circulation for motor vehicles, rather than pedestrians. In order to fully integrate pedestrians into the overall transportation system, all places used by pedestrians need to be designed for their safety, convenience, and comfort, not just public rights- of-way.

What can be done to ensure that pedestrians are considered and planned for as part of all site development in our communities? To begin with, all development, public and private, should be required to include pedestrian facilities. Cities and counties should adopt ordinances and zoning code requirements that encourage pedestrian- friendly site design and development. Ordinance changes should reflect elements important in pedestrian design. Setbacks, for instance, could be capped to provide a more pedestrian-friendly environment in neighborhoods and commercial districts. Also, parking requirements could be decreased to allow more flexibility in parking options such as shared-parking or the use of on- street parking in some areas. Zoning changes, such as allowing mixed-use development and higher densities, promote pedestrian-friendly areas from the beginning of the design process.

Perhaps one of the most important things that can be done to consider pedestrians in site design and development is for design professionals and developers to be more conscious of pedestrian needs at the onset of the planning and design process, rather than as an afterthought. Information provided in this toolkit addresses how to design several site elements with pedestrians in mind. This design guidance can be applied as appropriate to all types of sites, including office buildings, shopping centers, and multifamily developments, and other areas. (Refer to the discussion at the end of this toolkit for information related to sites used exclusively by pedestrians and mixed-use development as a strategy to increase pedestrian travel.)

Pedestrian-Friendly Site Design

Designing sites to meet the needs of pedestrians doesn't have to be complicated. A simple approach can help designers envision a good pedestrian environment.

When reviewing a site for the first time, designers and developers should consider the point of view of a pedestrian walking through the site. There are several helpful questions designers can ask themselves at the beginning of the site design process.

By considering these questions, the needs of pedestrians will be addressed as a basic premise of the overall site design process. Site planners and designers can begin to consider how various site elements can be specifically designed to improve conditions for pedestrians. To create a better walking environment, buildings, architectural elements, and landscape should be used to maximize shade and cooling during the hot season. There are many ways to make sites more friendly and accessible to pedestrians.

Table 57 provides an overview of some basic site design solutions that improve conditions for pedestrians. These solutions and other design recommendations related to various site elements are described in more detail over the next several pages. Often, existing shopping centers, office parks, and public and private developments can be upgraded and improved for better pedestrian access. Figure 116 illustrates a good example of a retro-fitted design of an existing shopping center to enhance pedestrian access.

Pedestrian-Friendly Site Design Checklist

- Delineated walkways through parking lots
- Connections to neighborhoods and surrounding areas
- Easy to identify building entrances and building frontages located along streets rather than across parking lots
- Convenient and safe access to transit and adjacent sidewalks
- Alignment of walkways for convenience and reduced travel distances
- Accessible routes of travel to and from the site, as well as throughout the site
- No barriers (walls, ditches, landscaping, or roads without safe crossings) to pedestrian travel

Table 57

Neighborhoods are an integral part of travel. Most children are pedestrians in neighborhoods, as well as people who walk to work, to connect to transportation, or for pleasure. Many of today's suburban developments are not conducive to pedestrians. Low-density single family development and cul-de-sacs often make it difficult to get around neighborhoods or to link to transportation. Traditional and Neo-traditional neighborhood designs offer an alternative to suburban street patterns. These designs are characterized by a mix of housing options and land uses, a connected street network, using a grid system, narrower streets, and a connection to transit options. If pedestrian connections are not present in existing housing development, pedestrian cut-throughs and linkages should be provided.

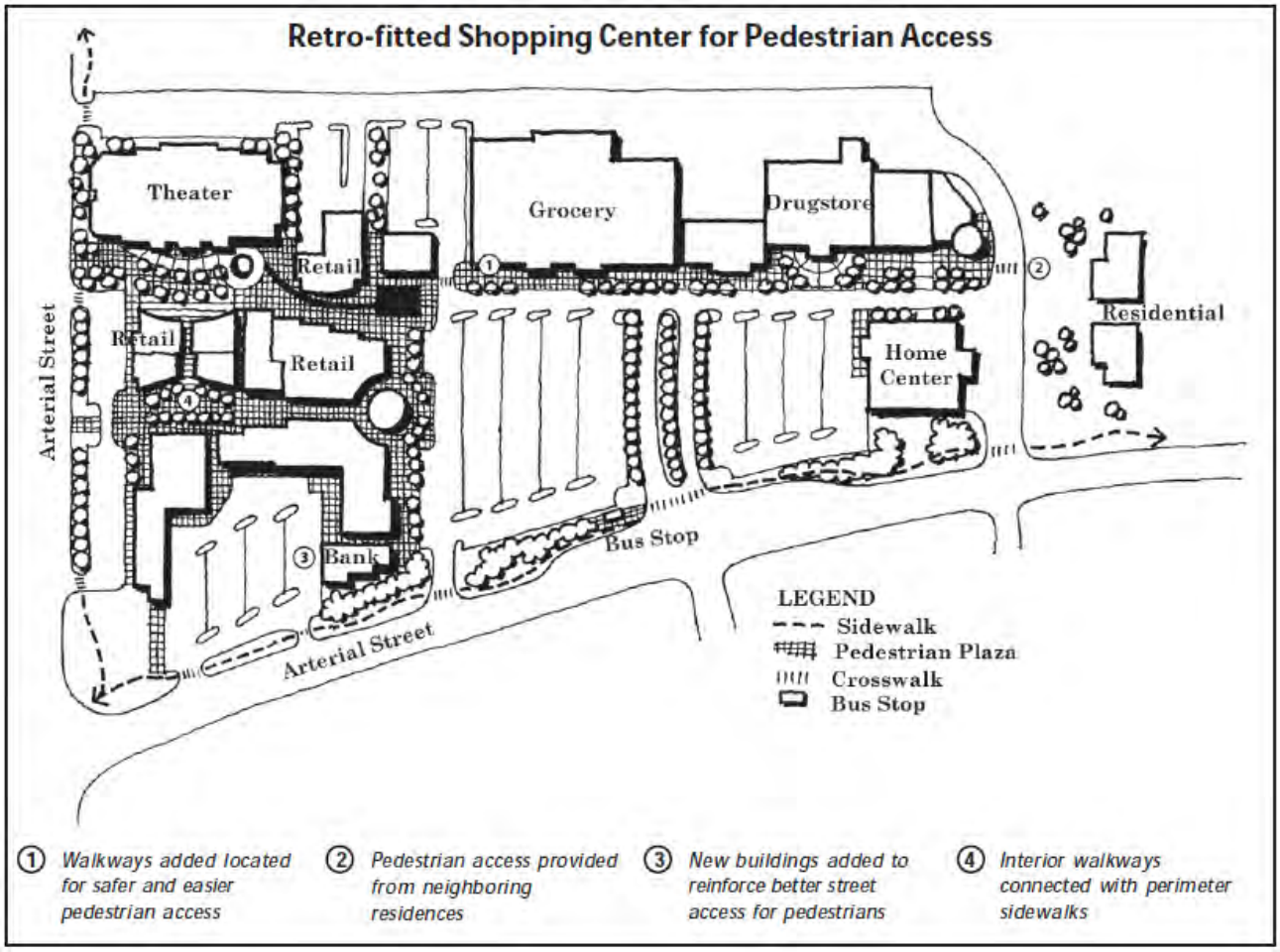

Figure 116

Building Location and Design

There are several design guidelines related to building location and architecture that encourage pedestrian access by providing an attractive and welcoming environment.

Pedestrian scale architecture along pedestrian access ways invites pedestrians into businesses.

Pavement texture or scoring can be used to delineate the pedestrian travel area in a parking lot.

- Locate buildings directly adjacent to the sidewalk and street environment, avoiding placement of parking between the street and buildings. This allows pedestrians to access the buildings directly from the street, encouraging a friendly street atmosphere, and avoids forcing pedestrians to cross parking lots to get to building entrances.
- Create a pedestrian-friendly atmosphere by laying out buildings and other site elements in configurations that define spaces for people to walk and gather around the site.
- Create plazas, seating areas, displays and exhibits that draw pedestrians to the building.
- Building design should reflect the character of the surrounding neighborhood or district and respond to the preferences of the community.
- Building wall design and finishes that relate to pedestrian scale should be provided on sides of the building that face towards streets and pedestrian access ways. Architectural elements such as windows, balconies, and entries should be encouraged.
- Color, texture, landscaping (climbing vines) and other techniques can soften hard surfaces and bring human scale to building frontages. Blank walls are not desirable.
- On sites where there is a high volume of pedestrians entering the building and traveling across vehicle circulation (at shopping centers and grocery stores), the area in front of the building(s) can be striped or delineated with special paving to direct pedestrians to the building entrances.
- Pedestrian-friendly buildings and businesses should include displays, signs, retail features and outdoor seating areas combined with wide storefront walkways to welcome the pedestrian.

On-Site Circulation

One of the biggest concerns for pedestrians in site design is conflict with motor vehicles. The following design strategies can minimize conflicts and help clarify pedestrian circulation.

- Clearly define pedestrian access ways. Striping, delineation of walking zones with curbs and landscaping, centralized walkway medians and islands, and textured paving are all good examples of ways to provide defined walking spaces within parking areas and adjacent to vehicular circulation.
- Provide direct access to the building entrance from the street and sidewalk where pedestrians, bicyclists, and transit riders are traveling.
- Locate transit stops adjacent to or on the site, and provide direct access to a variety of origins and destinations on the site. Figure 117 illustrates two site designs that provide good transit access.

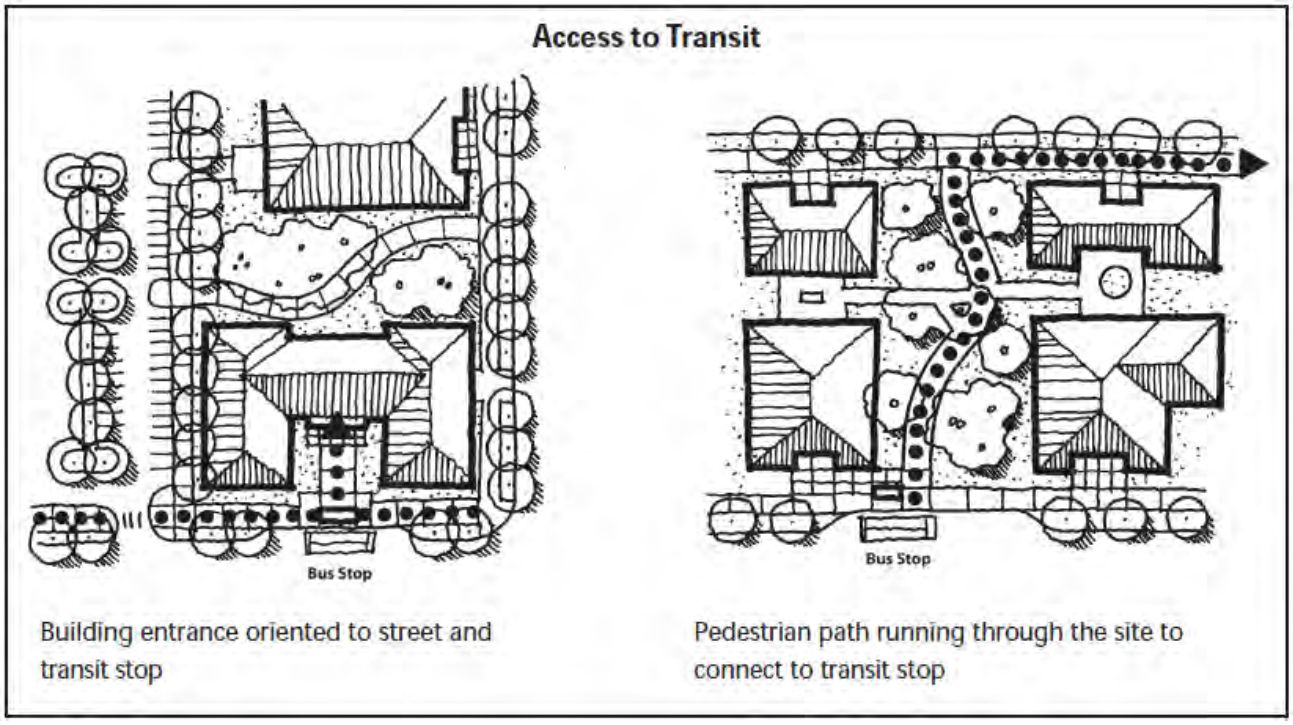

Figure 117

- Provide well delineated and marked drop-off and pick-up zones for pedestrians that are separated from the flow of vehicle traffic. These areas, as well as all areas in front of building entrances, should be designated as no parking zones.
- Avoid conflict between pedestrians and motor vehicles by minimizing pedestrian crossings in vehicle circulation zones and designing motor vehicle circulation aisles so that crossing pedestrian travel ways is minimized.
- Consider the use of raised crossings, speed humps, and speed tables to discourage high traffic speeds in parking lots where pedestrian volumes are high.
- Design parking lots so they can be shared by more than one building on the site or by buildings on neighboring sites; also limit parking in certain areas to help increase pedestrian trips and transit use, and decrease motor vehicle use. Figure 118 illustrates an example of a site design where three buildings share a single parking area.

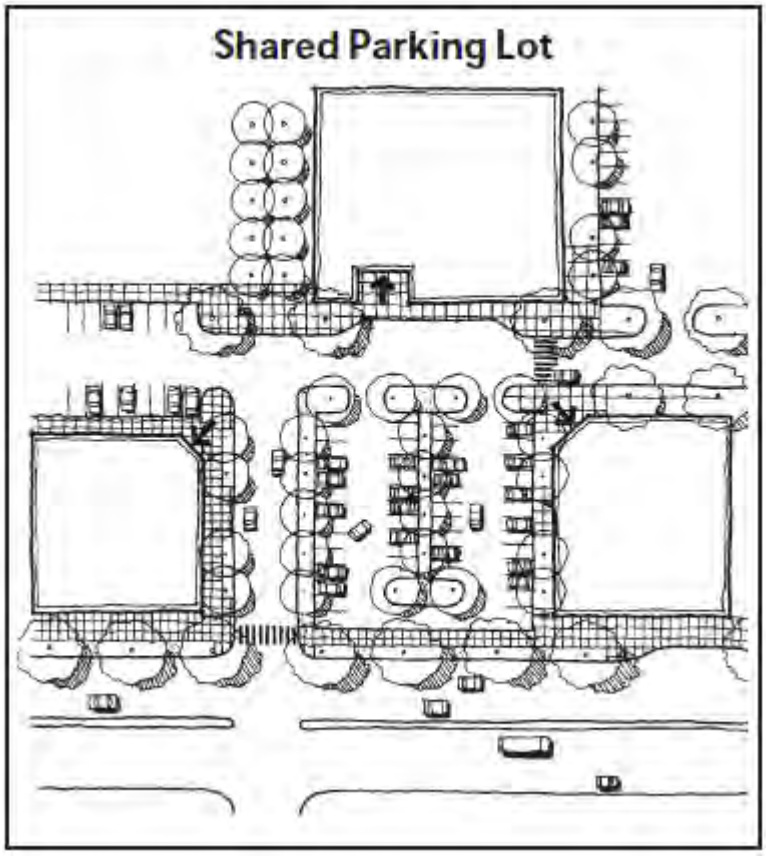

Figure 118

- Locate parking areas behind buildings or underneath buildings, rather than between the building and the street, where possible.
- Provide one-way traffic flow through parking lots, where appropriate, to minimize pedestrian confusion and conflicts with automobiles.
- Fully illuminate pedestrian walking areas through parking lots.
- Provide good drainage to avoid puddles and concentrated runoff areas across pedestrian walking routes.
- Provide separate access to parking garages and structures for pedestrians.
- Avoid locating pedestrian walking areas near truck and freight delivery zones. Trucks backing up without being able to see pedestrians are a common cause of collisions.

Walkways and Accessible Routes

Layout of walkways as part of site design is a key ingredient in making the site efficient for pedestrian travel. The directions pedestrians will travel on sites are sometimes difficult to predict. Pedestrians will walk along routes that are the most convenient and direct to their destinations.

In urban areas and on sites where the priority for pedestrians is efficient access to and from buildings, parking, bus stops, and other site elements, walkways should be aligned along the most direct routes. Meandering walkways may look nice in certain settings, but are not the most efficient

way of getting people from one place to another. People may not use a walkway if it does not provide the most direct route, especially during times of inclement weather or when they are in a hurry (on the way to work or class).

The Americans with Disabilities Act (ADA) Access Guidelines require all sites to provide an accessible route of travel between accessible site stops, perimeter sidewalks, and other facilities. An accessible route is a clear level walkway that provides access for all pedestrians, including people with disabilities. Specific design requirements related to accessible routes of travel are provided in Toolkit Section 2 — Accessibility.

Figure 119 illustrates a building entrance directly accessible from the street.

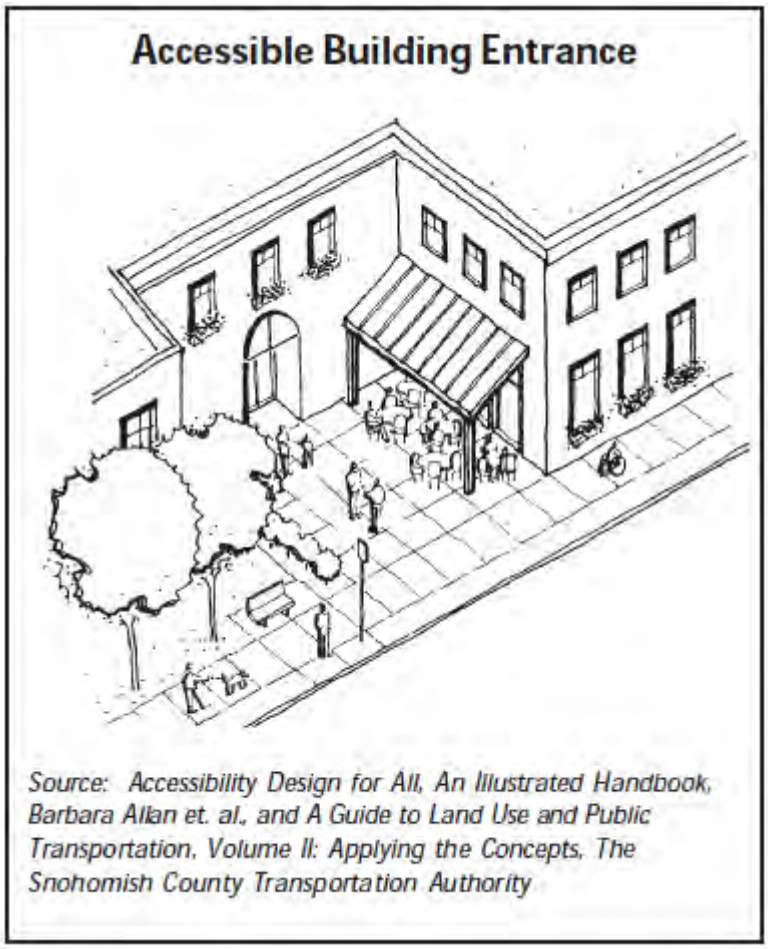

Figure 119

Other walkway design treatments that can help to improve conditions for pedestrians include:

- Covered walkways and shelters increase pedestrian comfort and provide protection from weather
- Well illuminated walkways and corridors increase pedestrian security
- Raised walkways through parking areas (with curb cuts to provide accessibility) to avoid the need for “puddle jumping” during wet weather, and to more clearly define the pedestrian travel way (see Figure 120).

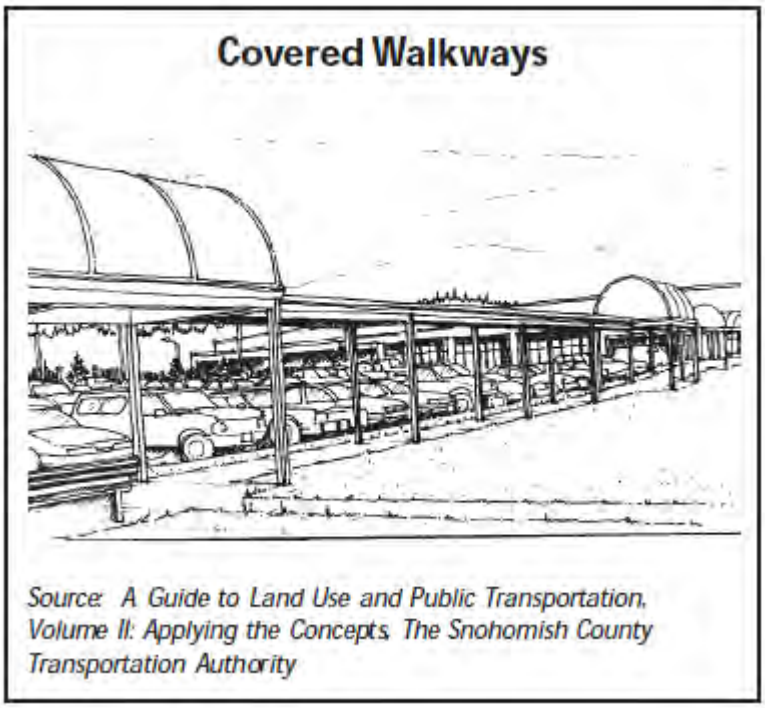

Figure 120

For more information related to walkway and pathway design, including dimensional guidelines, suggested surfacing materials, and other treatments, refer to Toolkit 4 - Trails and Pathways and Toolkit 5 – Sidewalks and Walkways.

Site Access and Driveway Design

Much can be done through access management and driveway design to improve pedestrian mobility and safety. Access management suggestions include:

- Limit the quantity and frequency of driveway access points and entrances to sites from streets to minimize interruption of pedestrian travel on adjacent sidewalks and walkways.
- Design sites so that adjacent properties can share access points where possible.
- Separate pedestrian and vehicle access to the site to minimize conflicts.
- Design emergency vehicle access to allow quick access and minimum conflict with pedestrians.

For more discussion related to access management techniques and benefits, refer to Toolkit 5 - Sidewalks and Walkways.

Driveways can be designed or retrofit so that they are easier for pedestrians to cross. Generally, the narrower the driveway width, the better for pedestrians. The shorter the crossing distance, the less likelihood of a conflict with a motor vehicle. The provision of clear sight lines between the pedestrian and the motorist pulling out of or into the driveway is very important.

Driveways that provide access to businesses, offices, or other commercial buildings can be built as conventional driveways or with designs that resemble street intersections (with right-in/right- out

access control). For pedestrian safety and comfort, the conventional driveway design is more desirable, because motorists are forced to slow down when turning into the driveway and the pedestrian right-of-way is more clearly established. Most residential driveways are designed in the conventional style.

Figure 121 illustrates three different driveway designs commonly being constructed. The least desirable of the three is the first design, which shows a very wide driveway with no refuge for pedestrians and undelineated crossing area. The driveway is designed to resemble a street intersection, which may encourage higher speed turns and discourage stopping for pedestrians since their right-of-way is not clearly delineated. In this design, the movement of the vehicle clearly takes priority over crossing pedestrians.

The second design (center drawing) is more desirable and is suggested for commercial driveways when it is not feasible to provide a conventional driveway apron design. The second design still treats the driveway like a street intersection, but it limits the driveway width to two lanes and provides a refuge island in the middle for crossing pedestrians. One additional element that would make this design better would be if the pedestrian travel way across the lanes were striped.

The third drawing (on the right) is the most desirable design for residential driveways. This design provides a delineated walkway across the driveway neck. In this conventional driveway design the pedestrian travel way is clear to the driver, the crossing distance is narrower, and the walkway stays at a constant grade.

Sidewalks that cross driveways and alleys can be problematic if sight distance is limited by adjacent buildings, landscaping, or other elements. Often drivers pulling into or out of the driveways are concentrating on the flow of vehicular traffic and may not notice oncoming pedestrians. Several measures can be applied to improve pedestrian visibility and make these crossings easier for pedestrians:

- Unit pavers or colored pavement bands in the sidewalks prior to driveway entrances to provide a visual and tactile forewarning of the upcoming driveway crossing, or an alternative texture or pavement color across the entire pedestrian travel way at the driveway or alley access point to help motorists identify a pedestrian crossing zone.
- Signs located to the side of the pedestrian travel way to identify upcoming driveways and alleys.
- Stop signs at an access point used by multiple drivers.
- Curb stops at the access point to keep the front of the vehicle from protruding onto the sidewalk.

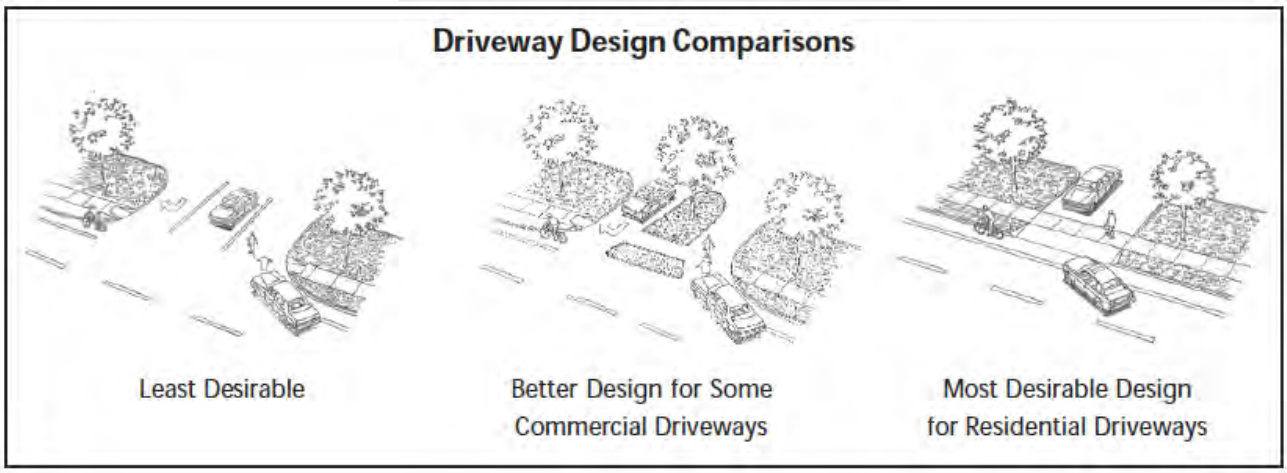

Figure 121

- Auditory warnings can be provided when vehicles are entering and exiting (often used in downtown areas where vehicles are exiting from parking garages).
- Mirrors placed in strategic locations so exiting drivers can see approaching pedestrians. (Mirrors need to be placed carefully to avoid glare and obstruction to pedestrian travel.)
- Planting buffers that separate the walkway from the street allow some extra space between pedestrians crossing the driveway and vehicles pulling into the driveway; they also provide room for the driveway apron to ramp up before the walkway, creating a more constant grade on the walkway (rather than dipping up and down at each driveway cut).

Wider planting areas at the perimeter of sites provide space for vehicles pulling out of driveways, eliminating the problem of blocking the sidewalk used by pedestrians (see Figure 122). Note that when trees are planted in planting buffers near driveways, they should be placed to avoid affecting sight distance and upward branching species should be selected. Typically, tree trunks don't create a sight obstruction because drivers can pull up or back a few inches to see around them. It is important to ensure that any landscaping placed within proximity to driveways does not block visibility. (See Toolkit 5 - Sidewalks and Walkways for more information on trees and landscaping near walkways.)

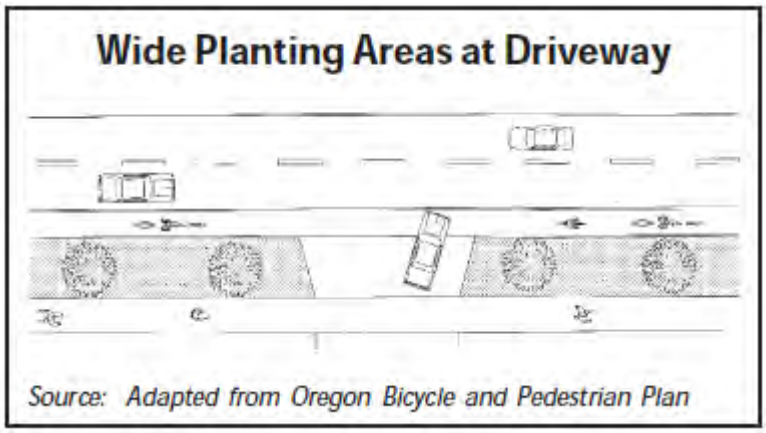

Figure 122

Landscaping and Furnishings

Successful pedestrian environments provide furnishings and create attractive settings for pedestrians to gather, rest, socialize, and orient themselves. While these furnishings are good for pedestrian environments, they should not protrude into the pathway of pedestrians. Examples of complementary elements on pedestrian oriented sites include:

- Trees of heights and patterns complementary to human scale, with high branches and upward branching habits along walking areas, and with the capability to provide shade and shelter; trees should be installed to avoid buckling of adjacent pavement by root systems;
- Perimeter landscaping with defined edges that reduce the impact of parked vehicles and enhance the streetscape;
- Shrubs and ground covers that don't block walkways or interfere with visibility and security;
- Shopping cart storage in several convenient and easy to find locations;
- Wind screens to protect pedestrians from cold winds, particularly in downtown areas where wind tunnels are often created;
- Benches or seating areas outdoors or in building alcoves that allow pedestrians to stop and rest;
- Access to restrooms;

Landscaping and furnishings provide an attractive pedestrian environment.

- Strategically located garbage receptacles and cigarette ash cans that help keep an area clean and attractive, and fully screened garbage bins with self-closing doors and landscaping; and
- Public artwork that creates interest in a place as a destination.

Ramps, Handrails, Stairways, and Steps

Pedestrian routes with stairways and steps should be avoided where possible, and ramps and handrails should be provided to allow easy access for everyone. More information about ramp design is provided in Toolkit Section 2 - Accessibility.

Ramps

Providing accessibility along walkways and across sites with significant changes in elevation is sometimes challenging, governed by Title III regulations. Ramps allow accessibility where grades exceed 1:20 or 5 percent. Table 58 summarizes the ADA requirements for ramps.

In general, ramp design should incorporate the following:

- Maximum longitudinal grade of 1:12 or 8.33 percent;
- Minimum width of 44 inches (60 inches desirable) for exterior ramps, with a minimum clear space of 36 inches between handrails;

ADA Requirements for Ramps

- The maximum rise for any run shall be 30 inches
- Ramps shall have level landings at the bottom and top of each ramp and each ramp run

Note: See the ADA Accessibility Guidelines for additional information.

Table 58

- Level landings at the top and bottom of the ramp and at changes in direction;
- Intermediate landings for every 30 inches of vertical elevation change; every 30 feet of 8.33 percent run;
- Handrails for walkways and pathways steeper than 1:20 (see design guidelines later in this section);
- Maximum cross slope of 2 percent and sufficient to provide positive drainage; and
- Edge protection for ramps steeper than 1:20 or landings more than ½-inch above the adjacent grade. Edge protection may include low walls or curbs not less than 2 inches high, and handrails when necessary.

Landings on Ramps

Where a ramp changes direction, landings need to be 5 feet wide by 5 feet long minimum. Landings always need to be at least as wide as the width of the ramp.

Exceptions to Maximum Grades of Ramps

Curb ramps and other short ramps constructed on existing developed sites may have slopes and rises greater than those allowed by the ADA where space limitations preclude the retrofit of 1:12 slopes or less, provided that:

- A slope not greater than 1:10 (10 percent) is allowed for a maximum rise of 6 inches;
- A slope not greater than 1:8 (12.5 percent) is allowed for a maximum rise of 3 inches; and
- Keep in mind that grades steeper than 1:8 (12.5 percent) cannot be used by most users with disabilities.

Handrails

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

If handrails extend into a pedestrian access route in a street right-of-way more than four inches (4”), they must include an equal extension at a cane detectable height less than 27”.

Accessible routes having grades steeper than 1:20 (5 percent) shall have handrails on both sides. Handrails shall extend at least 12 inches beyond the top and bottom of any ramp run (see Figure 123). The top of the handrail is required to be 34 to 38 inches above the grade of the walkway or ramp. An intermediate handrail may be mounted at a height of 17 to 19 inches or a handrail with vertical rail members spaced not more than four inches apart to aid those in wheelchairs.

Handrails are required to be continuous unless there is a point of access along the ramp that requires a break in the handrail. Handrails should be continuous through the landings for the entire length of the ramp system.

Handrails are not required for sidewalk curb ramps, and are generally not recommended alongside multi-use pathways since they could become a hazard to bicyclists.

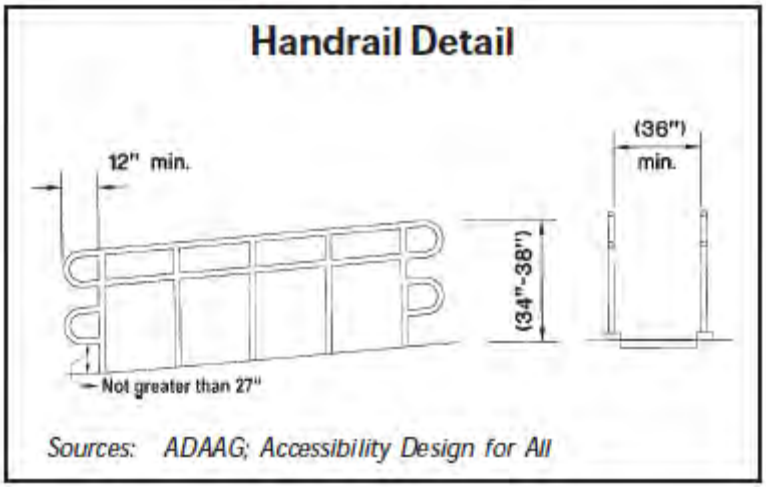

Figure 123

Stairways and Steps

Sometimes steps and stairways are unavoidable in areas where there are significant grade changes. When stairways and steps must be installed in pedestrian environments, several design guidelines should be followed. Some of the most important guidelines are described in the following text. Please check other sources for more detailed information.

Stairway Width

The minimum width of public stairways should be 5 feet, and the minimum width for private stairways should be 4.5 feet.

Step Dimensions

Treads and risers should be uniform in height and depth, with treads no less than 11 inches wide and risers no deeper than 7-7.5 inches. It is generally preferred that risers for outdoor stairways be a minimum of 4.5 inches and a maximum of 7-7.5 inches in depth.

Tread to Riser Ratio

The tread to riser ratio should be consistent. A typical formula for tread to riser ratio is:

$2R + T = 26$ to 27 inches

where R = riser and T = tread

Stairs are often necessary in areas of significant grade changes.

Height between Landings

Typical height between landings can vary. The Uniform Building Code allows up to a maximum height of 12 feet. Lesser heights are generally recommended to provide more frequent resting opportunities for pedestrians and to break up the visual expanse of the stairway.

Landing Dimensions

Landings should be long enough to allow a minimum of three strides on the landing before proceeding onto the next set of steps. A 5-foot landing is a typical minimum length. Longer landings are typically in lengths of multiples of 5 feet. The width of the landing should be at least the width of the stairway. Landing placement for stairways is illustrated in Figure 124.

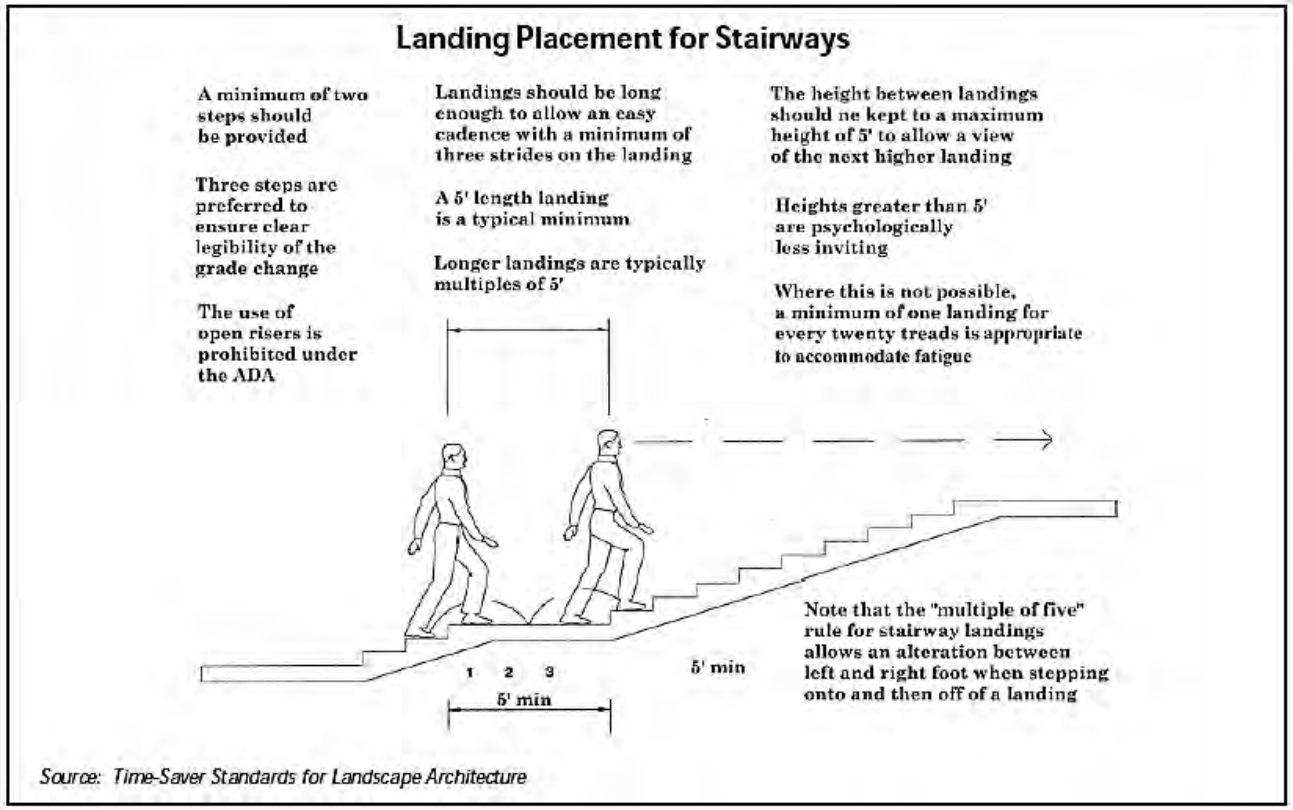

Figure 124

Tread Design

Nosings, the outer exposed corners of steps or stairs, should not be abrupt. Designs that create a potential tripping hazard should be avoided. Nosings should be easy to see and not obscured by confusing surface patterns. Nosing edges should be chamfered or have rounded corners. Beveled shadow lines help to create a visual distinction between steps. The heights of the bevels should be kept to a minimum to avoid tripping, with nosing undersides not exceeding 0.5 inches. Closed, beveled risers are preferred over 90-degree square risers, risers with recesses, or open steps. Figure 125 illustrates recommended nosing configurations. Treads should be pitched downgrade at a 2 percent slope for proper drainage.

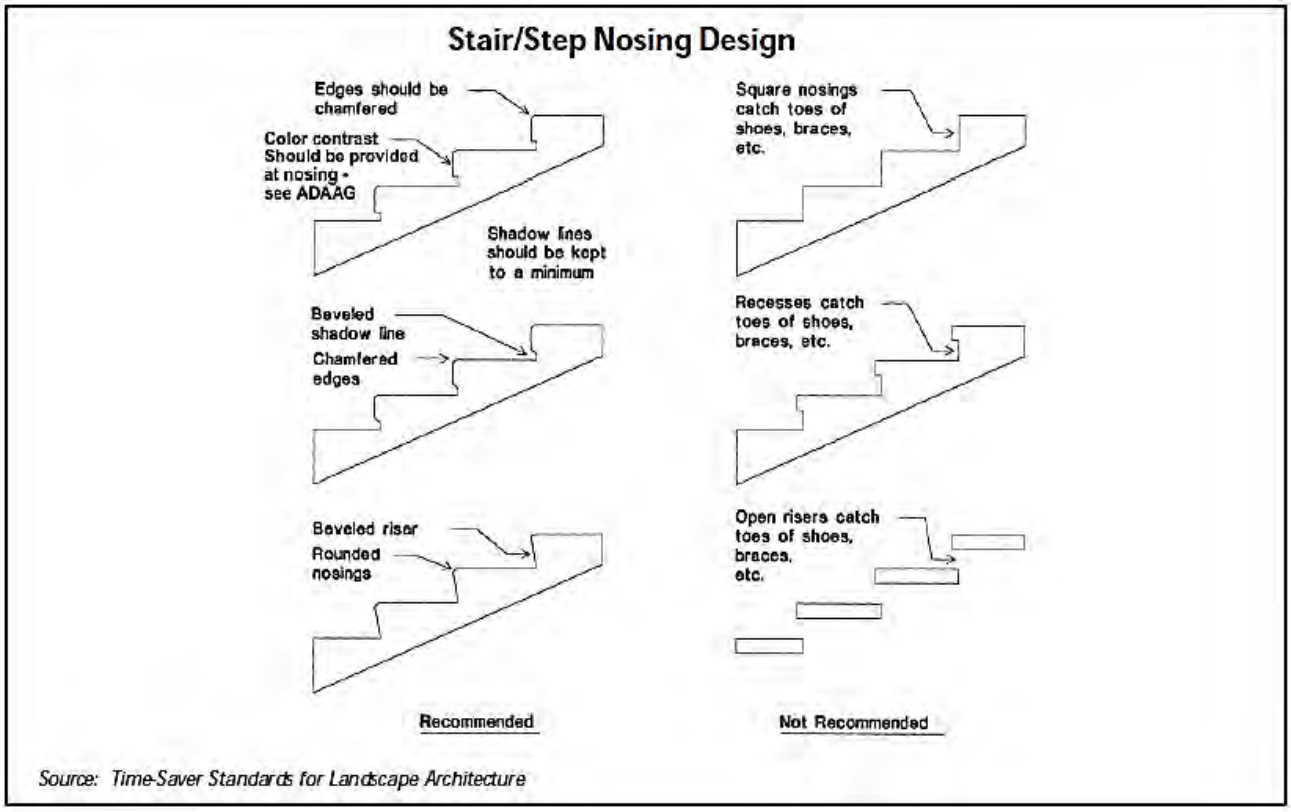

Figure 125

Sites Used Exclusively by Pedestrians

Pedestrian malls, plazas, and special districts, including tourist and recreation sites, are often developed for either exclusive use by pedestrians or with the focus that pedestrians are the primary user group. These spaces provide important opportunities to increase pedestrian travel in our communities and the enjoyment of Georgia's unique features. Since these sites serve high numbers of pedestrians, they are usually designed with the specific needs of pedestrians in mind. Figure 126 illustrates an example of a pedestrian plaza design.

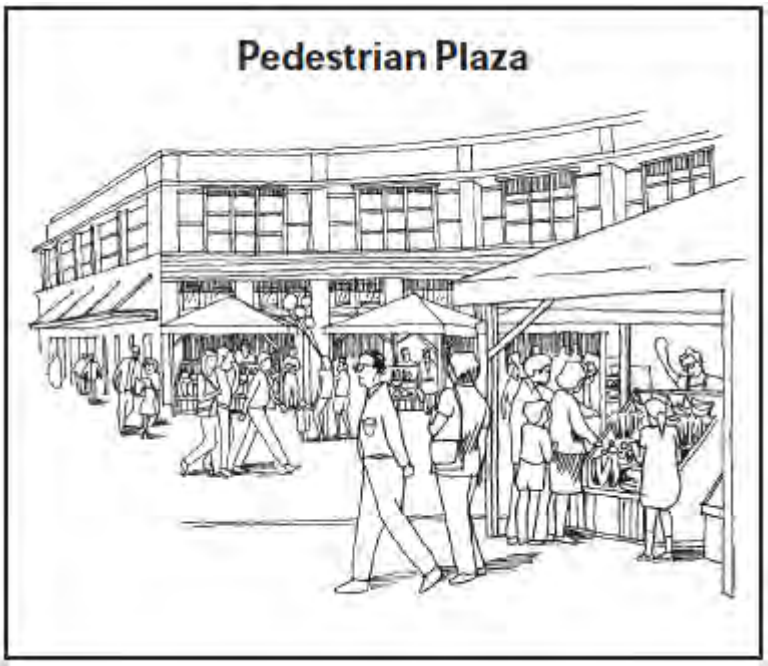

Figure 126

Sometimes turning over a street for use entirely by pedestrians is a failure for downtown businesses, because they rely on visibility from passing vehicles. Conversely, the use of underground walkways, skywalks, and other systems that take pedestrian activity away from the street can also sometimes reduce the vitality of downtown street level retail. In some cases, exclusive pedestrian facilities are successful, mostly where there is a diverse mix of uses concentrated around the mall or plaza with office workers or college students nearby.

Many urban planning experts agree that the vitality of downtown areas is strengthened when streets serve a mix of transportation modes (pedestrians, bicyclists, transit, and motor vehicles) with the needs of all user groups being carefully considered and balanced in the planning and design process.

Design guidelines that can help to establish pedestrian malls, plazas and special districts as vibrant public gathering spaces are listed below.

- Special paving and accents can enhance plazas and special districts and provide a clear message to tourists as to where they should walk.
- With many tourist attractions and recreation areas located adjacent to busy highways, pedestrian access is sometimes a major concern, especially with the high visitation some of these sites receive. Consider grade separated crossings in these areas, but only if their use will be convenient for pedestrians.
- Drop-off and pick-up zones for buses, trolleys, and other touring vehicles should be clearly delineated and located to avoid interrupting pedestrian travel along sidewalks and impeding views of pedestrians and motorists.
- Signing is an important tool in these areas, and can be used both to identify elements within the district and to clearly orient pedestrians.

- Maps engraved in sidewalks or on manhole covers provide a unique opportunity to direct pedestrians.
- Eliminate left-turns and free-right turns at intersections where high volumes of pedestrians cross.
- Create places where pedestrian activity thrives by introducing special entertainment, music, concessions, seating, and outdoor cafes.

Play Streets

Play streets are another form of pedestrian-only areas. Play streets have been implemented in inner-city neighborhoods in places like New York and Philadelphia. Designated play residential streets are closed to vehicular traffic during certain hours of the day, typically late afternoon after school. These streets provide safe areas for children to play without compromising safety to traffic. Children can develop games and multiple group activities in the street. With the assistance of adult volunteers and local police to be in charge of blockading the street with barricades, signs, or cables, play streets can be beneficial in urban communities.

Strategy for Increasing Pedestrian Travel — Mixed Use Site Development

Over the past 50 years, arrangement and design of land uses has been scaled to driving rather than walking. Momentum in many communities is mixed-use site development, where compatible land uses are developed on a single site. Mixed- use development was an integral component of traditional towns built before the automobile became the focus. Local governments can encourage mixed-use development through local zoning ordinances.Mixed-use development should be allowed within or near single-family residential districts. Figure 127, on the previous page, illustrate a mixed-use site development concept.

Examples of mixed use include apartments located over retail shops or housing, services, and shopping opportunities all sited within a convenient walking distance, usually 0.25 miles or less. Below are three basic criteria of successful mixed-use developments:

A pedestrian-friendly mixed-use development.

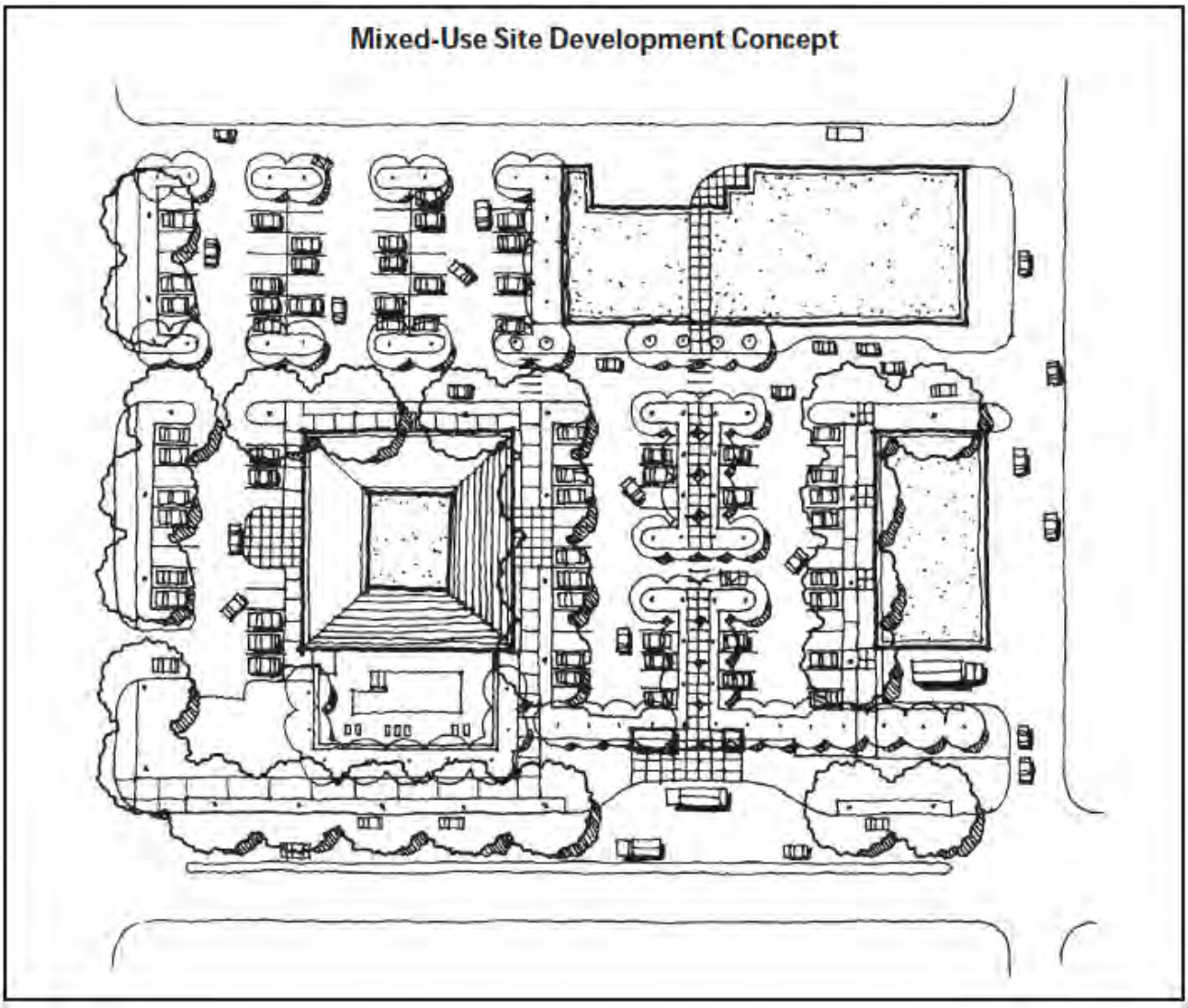

Figure 127

- Complementary land uses
- Located within convenient walking distance of each other
- Connected by safe, direct walkways

Table 59 provides a checklist for successful mixed- use site developments.

Checklist for Successful Mixed Use Site Developments
• Are the uses complementary?
• Are the uses located within convenient walking distance of each other?
• Are the uses linked by sidewalks or paved paths?
• Are the walking routes short and direct?
• Do the buildings fit with and complement each other?

- Do the uses create activity at different times of the day?
- Is parking kept out of the pedestrian's path of travel?
- Do the uses support one another economically?

Source: A Guide to Land Use and Public Transportation, Volume II: Applying the Concepts, The Snohomish County Transportation Authority

Table 59

Other Sources of Information

The following sources of information are recommended for site design for pedestrians. Please see the Resource Guide included at the end of this guide for complete bibliography information.

A Guide to Land Use and Public Transportation, Volume II: Applying the Concepts, The Snohomish County Transportation Authority

Accessibility Design for All, An Illustrated Handbook, 1995 Washington State Regulations, Barbara L. Allan and Frank C. Moffett, AIA, PE

Accommodating the Pedestrian, Adapting Towns and Neighborhoods for Walking and Bicycling, Richard K. Untermann

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Chapter 14. Toolkit 11 – Safety in Work Zones

This Toolkit Section Addresses:

- *Protective Barriers*
- *Covered Walkways*
- *Sidewalk Closure During Construction*
- *Intersections and Crossings Near Work Zones*
- *Accessibility in the Work Zone*
- *Maintenance*
- *Other Sources of Information*

Fencing used to secure a work area supported by blocks needs to be positioned to avoid creating obstacles or tripping hazards for pedestrians.

Pedestrian safety is an important issue in and around work zones. Pedestrians travel at slower speeds than other modes of transportation and are more susceptible to the impacts of access, dirt, noise, and fumes from construction areas. Work zones should be monitored at all times for pedestrian safety needs. Temporary access and detours should be provided to ensure safe, convenient, and accessible unimpeded pedestrian travel in and around work zones. Access to pedestrian facilities such as bus stops, crosswalks, and links between origins and destinations should be provided. Extra travel distance to these locations should be minimized or avoided. Traffic control by police or construction workers through flagging and signs may be needed in certain areas when work vehicles and equipment are traveling across pedestrian paths or when pedestrian traffic is heavy. At a minimum, the pedestrian travelway should be clearly marked and signed through the construction zone. When possible, the travelway should parallel the disrupted right-of-way, on the same side of the street. Construction sites should keep all objects out of the pedestrian path including equipment, vehicles, construction signs, and cones. Pedestrians should feel safe and secure when traveling near work zones.

Urban and suburban settings have the highest volume of pedestrian traffic, and construction projects are most likely to impact pedestrians in these areas. Safe and convenient passage through or around a work zone should be provided. Pedestrians may ignore a detour that is out of the direction of their travel.

Local jurisdictions responsible for traffic safety in work areas should train construction inspection staff to recognize improper and unsafe pedestrian facilities during construction.

Protective Barriers

Near work zones where higher volumes of pedestrian traffic or school children exist, pedestrian fences or other protective barriers may be needed to prevent pedestrian access into a construction area. Barriers should be made of sturdy, non-bendable material such as wood. Pedestrian fences should be at least 8 feet high to discourage pedestrians from climbing over the fence. Any devices that are placed in the "clear zone" should be designed to be crashworthy. Table 60 lists other considerations for encouraging safety in work zones.

Considerations for Pedestrian Safety in Work Zones

- Separate pedestrians from conflicts with construction vehicles, equipment, and operations.
- Separate pedestrians from conflicts with traffic traveling around or through the construction area.
- Provide a safe, convenient, and accessible route that maintains the direction and character of the original route.
- In urban areas, avoid work vehicle traffic during high pedestrian travel times which include mornings between 8:00am-9:00am, lunch times between 11:30am-1:30pm, and in the evenings between 4:30pm-5:30pm.
- Provide police patrol or guards for pedestrian safety when needed, especially during times of high construction and/or high pedestrian traffic.
- Communicate construction activity and pedestrian impacts through local media and pedestrian interest groups. Contact community and school officials in the area.
- Avoid using delineating materials that are difficult to recognize by people with impaired sight.
- Walkways through construction zones should be a minimum width of 5 feet.

Source: Based on ITE' Design and Safety of Pedestrian Facilities; and MUTCD 2000

Table 60

Covered Walkways

For construction of structures adjacent to sidewalks, a covered walkway may be required to protect pedestrians from falling debris. Covered walkways should be designed to provide:

- sturdiness
- adequate light and visibility for nighttime use and safety

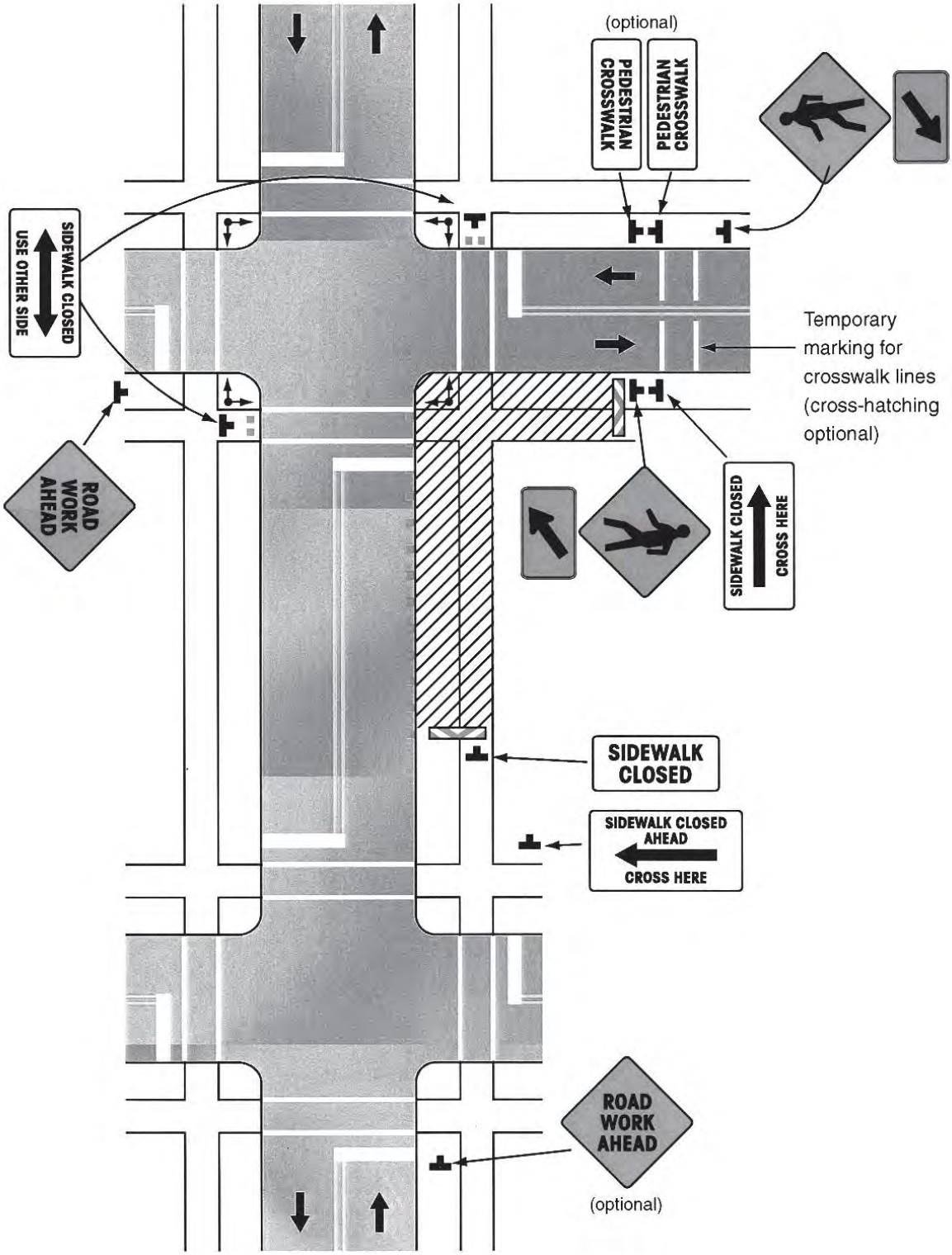
- proper sight distance at intersections and crosswalks
- adequate and impact-resistant longitudinal separation from vehicles on higher speed streets; for work zones adjacent to high speed traffic, wooden railings, chain link fencing, and other similar systems are not acceptable

Sidewalk Closure during Construction

It is undesirable to close sidewalks or pathways during construction. This should be the last option. If sidewalks have to be closed, construction sites should provide alternative pedestrian routes, safe crossings to the other side of the street, and easy-to-read and distinguishable signs and placement markings. Temporary walkways must also be safe and clear of obstructions such as debris, potholes, grade changes, and mud.

If a temporary route is created in the roadway adjacent to the closed sidewalk, the parking lane or one travel lane in a multi-lane street may be used for pedestrian travel, with appropriate barricades, cones, and signing, as illustrated in Figures 128 and 129. When using a barricade, good practice would provide a continuous route, detectable by a cane. When a parking lane or travel lane is not available for closure, pedestrians must be detoured with advance signing in accordance with the Manual on Uniform Traffic Control Devices. For mid-block construction, signs should be placed at the nearest intersection to forewarn pedestrians of a sidewalk closure. Signs should also be placed to avoid blocking the path of pedestrians.

Crosswalk Closures and Pedestrian Detours



Source: Manual on Uniform Traffic Control Devices

Figure 128

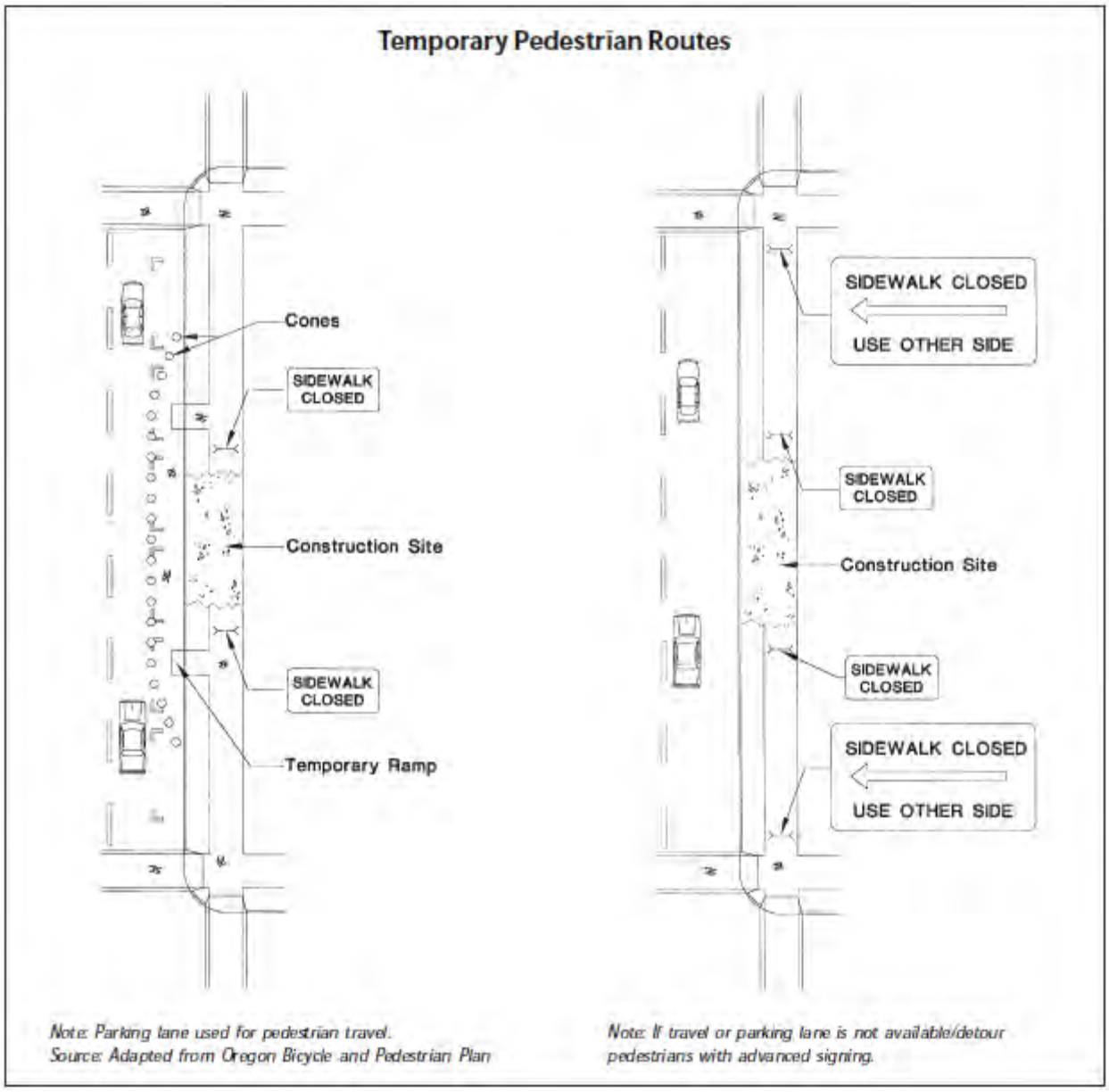


Figure 129

Intersections and Crossings Near Work Zones

- At intersections, avoid closing crosswalks.
- At signalized intersections, mark temporary crosswalks if they are relocated from their previous location. Maintain access to pedestrian push buttons.
- Include pedestrian phases in temporary signals.
- Place advanced signing at intersections to alert pedestrians of mid-block work sites and direct them to alternate routes.

Accessibility in the Work Zone

The removal of a pedestrian travel way in the right-of-way may severely limit or preclude a person with a disability from navigating. The temporary travel way should be convenient and accessible for all users and should minimize or avoid extra travel distance. The temporary travel way should have no vertical protrusions up to 80 inches. The travelway should be well protected with a barricade. Barricades should be continuous, stable, and non-flexible. It should be constructed with a toe rail no higher than 1-1/2 inches above the adjacent surface and a continuous railing mounted on top. The barricade height should not exceed 42 inches and the top rail shall be situated to allow pedestrians to use the rail as a guide for their hands. The top railing of the barricade should have diagonal stripes with 70 percent contrast. This will assure the barricade is highly visible to pedestrians.

Warnings should be provided at both the near side and the far side of the intersection preceding the disrupted right-of-way. Warning signage should accessible to pedestrians who are visually impaired. Broadcast signage and flashing beacons with an audible tone are examples of signage that could be used.

Maintenance

Pedestrian facilities in and adjacent to work zones should be maintained to provide safety and functionality. Proper maintenance will maximize the effectiveness and life of work zone pedestrian facilities. Poor maintenance can result in increased work zone accidents. Table 61 summarizes recommended maintenance activity for pedestrian facilities in and adjacent to work zones.

Work Zone Maintenance

Issue	*Recommended Maintenance*
Temporary pathways constructed of inexpensive, short-life materials	Pathway surfaces should be inspected regularly. Surface materials should be treated with nonslip materials. Surface materials with holes, cracks, or vertical separation should be replaced.
Detour pedestrian paths increase volumes on detour roadway	Detour pathway should be inspected regularly for adequacy of signal timing, signing, and pedestrian traffic hazards.
Construction material debris on pathway	Require contractor to maintain clear pathways.
Changing pedestrian route during construction	Inspect pedestrian signing regularly to ensure a clearly understood pathway.
Damaged traffic barriers	Replace and reevaluate adequacy for pedestrian safety.

Source: Adapted from Bicycle and Pedestrian Facilities Planning and Design Guidelines, North Central Texas Council of Governments

Table 61

Other Sources of Information

- *Bicycle and Pedestrian Facilities Planning and Design Guidelines*, North Central Texas Council of Governments
- *Florida Pedestrian Planning and Design Guidelines*
- Oregon Bicycle and Pedestrian Plan
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- *Building a True Community*
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