

Best Practices for Pedestrian Master Planning and Design

October 2005



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PEDESTRIAN MASTER PLAN BEST PRACTICES

This section presents best practices pedestrian master plans for consideration and possible adoption by the Collaborative. Unlike, the bicycle master plan, there are no required pedestrian master plan elements in the State of California. The contents of a pedestrian master plan presented here represent best practice content gleaned from pedestrian plans of cities like Oakland and Portland that are recognized as being exemplary. The first section presents best practice content in a sample plan outline format, elaborating on key elements of the plan.

I. CONTENTS/OUTLINE

Introduction

The introduction is an appropriate location to provide background on the pedestrian planning process in the community and the purpose of the pedestrian plan. A description of the community can be provided to give context for the pedestrian plan. Also, a description of the extent of citizen and community involvement in development of the plan may be appropriate here.

Existing Pedestrian Conditions

Purpose

The purpose of this section is to present a comprehensive picture of the existing pedestrian facilities such that successes and opportunities for improvement can be identified to help guide policymaking and the selection and prioritization of future pedestrian improvements. Typically the existing conditions data comes from three key sources: a survey of existing street conditions, pedestrian collision data, and community outreach.

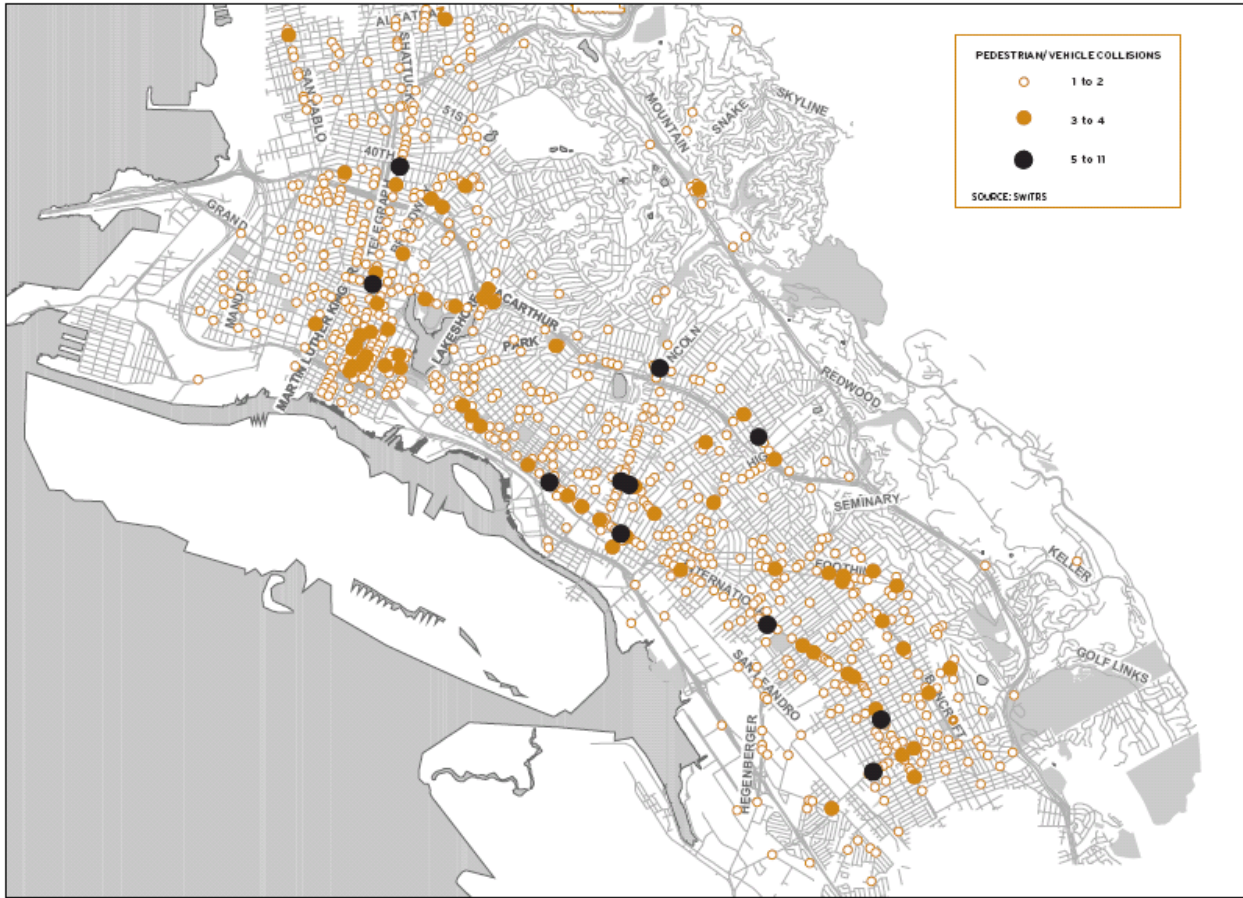
Contents

- Map and description of key pedestrian facilities and centers of pedestrian activity
- Data on walking rates if available
- Results from surveys of existing sidewalk and crossing conditions
- Analysis of pedestrian collision data
- Summary of input from community outreach activities

Details/Examples

Mapping collision data can help identify areas in need of pedestrian safety improvements. The example on the following page is a pedestrian collision map from the Oakland Pedestrian Master Plan.

Figure 1: Sample Pedestrian Collision Map



MAP 1 PEDESTRIAN/VEHICLE COLLISIONS—OAKLAND (1996-2000)

Policies and Objectives

Purpose

As with any planning document it is important to document existing and proposed policies and objectives. These help guide the creation of the remainder of the pedestrian plan, and other future pedestrian planning activities. The policies and objectives also clearly communicate to citizens, government agencies, and developers, the desired role of pedestrian transportation in the city and/or county.

Contents

- Description of how the pedestrian plan has been coordinated and is consistent with other local or regional transportation, air quality, or energy conservation plans.
- Existing and new pedestrian policies and objectives

Examples

The excerpt below from the City of Oakland Pedestrian Master Plan demonstrates the inclusion of policy statements in a pedestrian master plan:

Goal 2: Pedestrian Access

Develop an environment throughout the City – prioritizing routes to school and transit – that enables pedestrians to travel safely and freely.

General Plan Policies

→ **Policy T3.5, Including Bikeways and Pedestrian Walks.** “The City should include bikeways and pedestrian walks in the planning of new, reconstructed, or realized streets, wherever possible” (LUTE, p. 57).

→ **Policy T4.6, Making Transportation Accessible for Everyone.** “Alternative modes of transportation should be accessible for all of Oakland’s population. Including the elderly, disabled, and disadvantaged” (LUTE, p. 58).

→ **Policy T4.7, Reusing Abandoned Rail Lines.** “Where rail lines (including siding and spurs) are to be abandoned, first consideration should be given to acquiring the line for transportation and recreational uses, such as bikeways,

footpaths, or public transit” (LUTE, p. 59).

→ **Policy T4.10, Converting Underused Travel Lanes.** “Take advantage of existing transportation infrastructure and capacity that is underutilized. For example, where possible and desirable, convert underused travel lanes to bicycle or pedestrian paths or amenities” (LUTE, p. 59).

Policies and Action Items

PMP Policy 2.1. Route Network: Create and maintain a pedestrian route network that provides direct connections between activity centers.

Action 2.1.1. Improve existing connections across/under freeways to activity centers using lighting, acoustics, and other design features.

Action 2.1.2. Develop a system of signage for pedestrian facilities including walkways and trails.

Action 2.1.3. Create trails, identified in the Open Space, Conservation, and Recreation (OSCAR) Element

Pedestrian Design Guidelines

Purpose

This section of the pedestrian plan (sometimes created as a separate design guidelines document) is intended to identify and communicate the design elements important to improving pedestrian safety and walkability. Arming designers, engineers, developers, and others with these guidelines will help ensure that new and improved pedestrian facilities reflect the policies, goals and objectives of this plan, and consequently maximize safety and walkability. The subsequent sections of the pedestrian plan then identify where, to what degree and in what order these guidelines will be implemented throughout the planning area.

Contents

The following is a non-exhaustive list of pedestrian design elements commonly presented in pedestrian master plans or in separate pedestrian design guidelines documents:

- Sidewalk guidelines
 - Signage
 - Plantings
 - Lighting
 - Street Furniture
 - Building Edges
 - Wayfinding
 - Driveways
- Crossing Treatments
 - Striping
 - Paving
 - Curb Ramps
 - Texture and Contrast
 - Bulb-outs
 - Refuge Islands
 - Corner Radius
 - Safety Posts and Bollards
 - Flashers and Overhead Signs
 - Traffic Signals
 - Pedestrian Signals
 - Pedestrian Call Buttons
 - Flags
- Traffic Calming¹
 - Speed Humps
 - Rumble Strips
 - Raised Crosswalks
 - Slow points
 - Chicanes
 - Traffic Circles
 - Roundabouts
 - Medians
 - On-street parking
 - Pedestrian only streets

¹ Some agencies treat traffic calming devices in a separate, Neighborhood Traffic Calming document where the full menu of traffic calming devices is included. Others may desire to include a subset in Pedestrian Design Guidelines.

Recommended Pedestrian Facilities

Purpose

This section of the document should map the design guidelines established in the previous section of the plan to the planning area based on needs established in the existing conditions section of the document. Typically criteria for justifying the levels of pedestrian improvement are established in this section. In contrast to a bicycle plan, typically there are not established pedestrian routes. However, it should be possible to identify areas of the city or county where pedestrian activities are highest such as the central business district, transit stations, civic centers, commercial centers, schools, universities, etc.

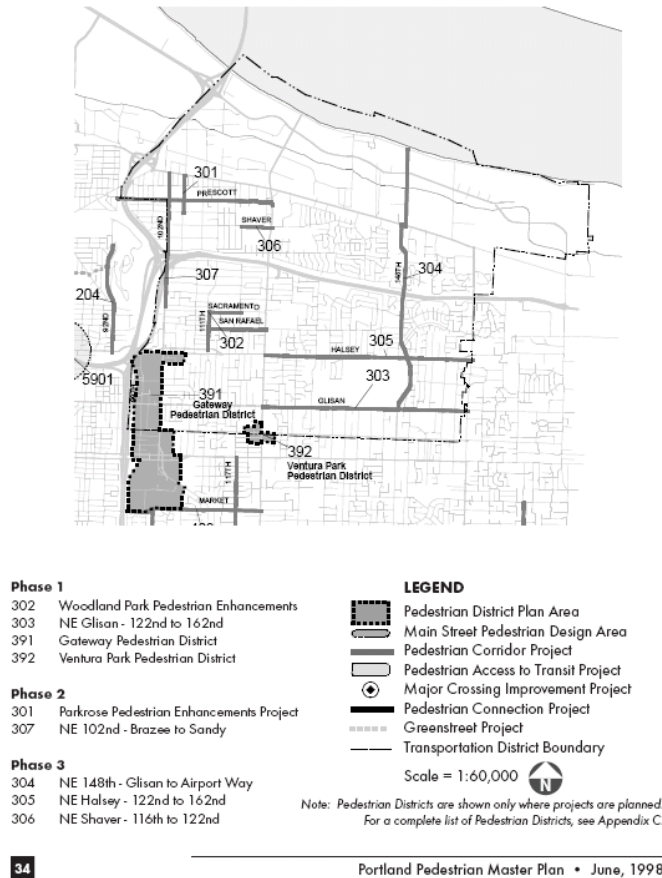
Contents

- Map and description of different locations and zones of pedestrian improvements
- Criteria for varying levels of pedestrian improvements.

Examples

The following is an example from the City of Portland Pedestrian Master Plan of a map depicting areas for recommended pedestrian improvements. Note how the legend highlights the different geographic scope of pedestrian improvement projects, ranging from crossing improvements to corridor improvements, to entire pedestrian district improvements.

Figure 2: Pedestrian Capital Improvement Program Map



In a large city or county with varying levels of pedestrian demand and walkability it would be difficult to provide a high level of pedestrian amenities in all parts of the city. One way to address this challenge is by grouping areas of the city into three categories of pedestrian investment based on pedestrian demand. Areas may qualify for basic, upgraded, or premium improvements

Most streets should be targeted to have “basic” facilities. In locations where pedestrian demand is higher, “upgraded” improvements should be implemented. This level of improvement includes everything in the basic level, plus added features, like wider sidewalks, more intense lighting and landscaping and higher quality street crossing treatments. These improvements are targeted for commercial streets with medium to high levels of automobile traffic.

Where pedestrian demand is at its highest, “premium” improvements should be used. These improvements include all of the basic and upgraded level improvements, plus additional elements that make the pedestrian setting an active urban place. Items like extra-wide sidewalks, special lighting, signage, and seating are some of the features included.

In the *Portland Pedestrian Master Plan*, priorities of pedestrian improvement projects were assigned by measuring walking potential against need. Geographic Information System (GIS) technology can be used to conduct an analysis of pedestrian demand and walkability, and create a map of pedestrian facility improvement priorities.

Implementation: Capital Improvement Program

Purpose

The capital improvement program is one of the most important elements of a pedestrian plan. It helps guide implementation of the pedestrian plan by organizing the desired improvements specified in the previous section of the plan into fundable discrete projects, identifying potential funding sources and costs.

Contents

- Consolidated list of all proposed pedestrian improvement projects
- Priority or phasing for the implementation of each improvement
- Cost of each project
- Anticipated source(s) of funding for each project

Each project listed in the CIP should be assigned an implementation phase or a priority. This enables those implementing the plan in the future, in the face of funding and/or labor constraints which may make it infeasible to implement the entire pedestrian plan, to select projects that will provide communities with maximum benefits in an equitable way. The CIP for the first five to ten years of the Plan should be specific, listing the total cost by year. However, since a CIP should be a flexible and dynamic document, it may be useful to estimate the total needs for later phases rather than costing them out by year.

When selecting a prioritization methodology, consideration should be given to the time and resources available for the process and the quantity of proposed pedestrian improvements. If time or resources are scarce and/or there are a small number of proposed improvements, a more simple qualitative methodology can prioritize the improvements. Larger cities with a more sizeable list of improvements and greater available planning resources may choose to utilize a more complex, quantitative methodology that prioritizes projects based on a scoring system.

Regardless of the type of methodology chosen, the prioritization should reflect which projects will best satisfy the goals and objectives set forth in the plan, and in other planning documents such as the circulation element of the general plan, and county or regional pedestrian planning documents. In addition, considerations of geographic equity are also important.

Examples

The example on the next page, from the *City of Portland Pedestrian Master Plan*, highlights key some key features of the CIP. The phase of implementation, type and description of each project is provided. Also note that the location of each project is designated by district to highlight equitable geographic distribution of the improvement projects.

Figure 3: Sample Pedestrian CIP

● = high ● = medium ○ = low

Phase One

District: North							
Type	Key No.	Proj Title	Cost Estimate	Pedestrian Potential	Deficiency	Community Support	Safety Conems
Corridor	104	N Columbia Blv - Swift Ct to Portland Rd <i>Construct a walkway and crossing improvements for pedestrian travel and access to schools; add pedestrian signal indications at existing traffic signals.</i>	\$1,300,000	●	●	○	●
Crossing	1002	N Lombard at Interstate	\$250,000	●	●	○	●
District: Northeast							
Type	Key No.	Proj Title	Cost Estimate	Pedestrian Potential	Deficiency	Community Support	Safety Conems
Corridor	201	NE Cully Blvd - Killingsworth to Prescott <i>Reconstruct the roadway and add separated sidewalks, bike lanes and crossing improvements.</i>	\$1,600,000 *	○	●	●	●
Corridor	206	NE 57th/Cully - Fremont to Prescott <i>Construct sidewalks and crossing improvements for pedestrian travel and access to transit and schools.</i>	\$1,000,000	○	●	●	●
Pedestrian District	292	Hollywood Pedestrian District <i>Plan and develop improvements to the pedestrian environment within this Pedestrian District, which is also a Region 2040 Town Center, to emphasize district identity and make walking the mode of choice for trips within the district. Seek regional funding and partnerships within the district for implementation.</i>	\$700,000	●	○	●	●
Main Street	289	NE Alberta - Martin Luther King to 33rd <i>Construct streetscape and transportation improvements as developed in the Alberta Street Plan.</i>	\$2,600,000	●	○	●	●
Crossing	2061	NE Prescott at Cully <i>Replace beacon with new traffic signal to increase pedestrian safety and convenience at this intersection.</i>	\$230,000	●	●	●	●

II. TRANSPORTATION IMPACT ANALYSES

Transportation impact studies, whether as stand-alone documents or chapters in an environmental document, are intended to disclose information to assist decision makers and the public in the project review process. The National Environmental Policy Act (NEPA), the Federal law governing environmental analysis, and the California Environmental Quality Act (CEQA)² have many differences, such as the level of specificity of alternatives analysis, but both require a full disclosure of transportation impacts, not just vehicular traffic impacts.

The term transportation captures a wide range of potential impacts and modes. To adequately assess impacts to the transportation system, transportation analyses should evaluate impacts to vehicles, transit, bicycle and pedestrian systems. Another suggested element of transportation analyses is a review of on-site circulation and access that also considers all modes. In jurisdictions that define neighborhood livability, land use compatibility, transportation demand management and/or quality of life objectives, analysis may be even broader.

² CEQA guidelines are presented in Appendix A.

Many locations lack policies related specifically to pedestrian, bicycle, and transit circulation. Some even lack policies related to vehicular level of service. Even where such policy guidance is lacking, it is important to provide a comprehensive evaluation of transportation impacts. The significance criteria below represent a minimum standard for assessing a broad set of transportation impacts. They are generally organized around the themes of identifying impacts that disrupt existing operations; interfere with plans for the future; conflict with adopted policies; and/or create new demand beyond that anticipated in existing planning documents.

Significance Criteria for Pedestrians

Pedestrian impacts are considered significant if:

1. A project disrupts existing pedestrian facilities. This can include adding new vehicular, pedestrian or bicycle traffic to an area experiencing pedestrian safety concerns such as an adjacent crosswalk or school, particularly if the added traffic reduces the number of pedestrian acceptable gaps at un-signalized crossings or cause queues to spillback through pedestrian crossings.
2. A project interferes with planned pedestrian facilities. In existing and/or planned urbanized areas, main streets or pedestrian districts, this can include impacts to the quality of the walking environment.
3. A project conflicts or creates inconsistencies with adopted pedestrian system plans, guidelines, policies or standards.
4. Agencies may also utilize the Pedestrian Level of Service tool to measure impacts to walkability. Pedestrian LOS is a tool used by the Florida Department of Transportation to measure pedestrian comfort. It takes into account the lateral separation of pedestrians from traffic (presence of sidewalk, buffers such as landscape strips, etc.) and the volume and speed of adjacent traffic.³

Site Access & Internal Circulation

Project site plans and proposed off-site improvements, including mitigation, should be reviewed for consistency with local design standards, parking codes, and other adopted guidelines. Where no local policies express alternative significance criteria, project impacts should be considered significant if a project fails to provide accessible and safe pedestrian connections between buildings and to adjacent streets and transit facilities.

³ The equation for measuring Pedestrian Level of Service can be found in FDOT's *Quality/Level of Service Handbook*, 2002

PEDESTRIAN FACILITY DESIGN BEST PRACTICES

This section presents best practice design guidelines for pedestrian facilities. Good pedestrian design is not just limited to sidewalks and crosswalks. This document will also highlight how street design and the design and orientation of adjoining land uses can improve safety, accessibility and comfort. In addition, design elements that improve access and safety for the disabled will be highlighted. The first sections present design guidelines for the three main components of a pedestrian network: sidewalks, street corners, and crossings. The remaining sections of the document present guidelines on how traffic calming techniques, supportive land uses, site layout, and building orientation can also serve to enhance the pedestrian network.

I. Source of Pedestrian Design Guidelines

Several documents govern the pedestrian facility design. State and federal law govern traffic control devices, and other facilities such as sidewalks and curb cuts. For certain types of facilities, the existing guidelines are used as recommended minimums, with the preferred alternative defined herein. Three basic realms where the design guidelines apply are sidewalks, crossings, and corners. These three realms are further broken down below.

A. Federal

All municipalities must follow the procedures and policies set out in the Manual on Uniform Traffic Control Devices (MUTCD). Traffic control devices include traffic signals, traffic signs, and street markings. The manual covers the placement, construction, and maintenance of devices. Under the guidelines, all devices must

- fulfill a need
- command attention
- convey a clear, simple meaning
- command the respect of all road users
- give adequate time for proper response

The MUTCD emphasizes uniformity of traffic control devices to protect the clarity of their message. A uniform device conforms to regulations for dimensions, color, wording, and graphics. Uniformity also means treating similar situations in the same way.

Municipalities must also adhere to the Americans with Disabilities Accessibility Guidelines (ADAAG). These guidelines are discussed in further detail later in this document.

B. State

Caltrans *Highway Design Manual*, Chapter 100-5 addresses pedestrian facility design and placement. It includes warrants for pedestrian signals and grade-separated pedestrian crossings. Section 10 of the *Traffic Manual* contains guidelines for the placement and marking of school crosswalks. Title 24 of the *State of California Code of Regulations* also addresses accessibility.

C. Local

Municipalities typically also have their own set of guidelines, standards, and policies governing the design of pedestrian facilities.

D. Other

Other important pedestrian design references include:

- AASHTO “Policy on Geometric Design of Highways and Streets”
- ITE Design and Safety of Pedestrian Facilities, A Recommended Practice
- California Vehicle Code

II. **Street Corner Facilities**

The street corner typically serves as the transition from the sidewalk to a crossing facility. Here, pedestrians perform many important tasks such as activating pedestrian crossing signals, waiting for vehicular traffic to clear, advertising their intent to cross to vehicles, gathering navigational information, and utilizing ramps to access crosswalks.

Good corners are:

- **Clear of obstructions** They have enough space to accommodate the typical number of pedestrians waiting to cross.
- **Visible** Pedestrians waiting to cross should have an unobstructed view of approaching vehicles and approaching motorists should be able to see waiting pedestrians easily.
- **Intuitive** Symbols, marks, and signs used at corners should be universal and clear so that both motorists and pedestrians know what actions or movements to make and expect.
- **Accessible** Everything at the corner, including ramps, landings, call buttons, signs, symbols, marks, and textures, must meet standards dictated by the Access Board, as required by the Americans with Disabilities Act and the *State of California Code of Regulations* Title 24.
- **Discreet** Corners should be separate from vehicle traffic. They should have design features that disallow vehicles from encroaching.

A. Americans with Disabilities Act Accessibility Guidelines: Corners

The primary guidelines governing corners are included in the Americans with Disabilities Act (ADA). The ADA is a civil rights act, signed into law in 1990, which prohibits public agencies from discriminating against individuals with disabilities. All new curb ramps must comply with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and the *State of California Code of Regulations* Title 24. The California Disabled Accessibility Guidebook (CalDAG) synthesizes the recommendations from both sources. A city’s or county’s standard plans should contain a detailed set of specifications for curb ramps, which are in compliance with the recommended minimums below. All other corner elements, including push buttons and tactile surfaces, must comply with ADAAG, which is currently under revision.

Curb Ramps

The ADA defines two types of curb ramp systems, “Perpendicular Ramps” and “Parallel Ramps.”

Every ramp must have:

- A landing at the top and at the bottom
- A maximum ramp slope in the right-of-way of 1:12
- A cross slope of no more than 1:50
- A minimum width of 915 mm (3'-0").
- A landing at the top least 1220 mm (4'-0") long and at least the same width as the ramp itself.
- A slope no more than 1:50 in any direction

If the ramp runs directly into a crosswalk, the landing at the bottom will be in the roadway. The landing, 1220 mm (4'-0") long, should be:

- Completely contained within the crosswalk
- Have a running slope no greater than 1:20

If the ramp lands on a dropped landing within the sidewalk or corner area where someone in a wheelchair may have to change direction, the landing must:

- Be a minimum of 1525 mm (5'-0") long
- Be at least as wide as the ramp, although a width of 1525 mm (5'-0") is preferred.
- Have a slope no greater than 1:50 in any direction.
- A single landing may serve as the top landing for one ramp and the bottom landing for another.

It is desirable to have two curb ramps per corner unless it is a minor residential street. For curb retrofits, this is not always feasible. It may be cost prohibitive due to utility relocation or curb reconstruction. However, **wherever possible, each crosswalk at a given corner should have a curb ramp**, similar to the figures on the following page, taken from the U.S. Department of Transportation's document, *Designing Sidewalks and Trails for Access*. Dual curb ramps are especially desirable at locations with narrow sidewalks and a wide corner radius. At locations with narrow sidewalks and a tight corner radius, a single curb ramp is appropriate.

Finally, ramps and dropped landings that end directly in the roadway should have a detectable warning surface.

Figure 4: Typical Single Curb Ramp

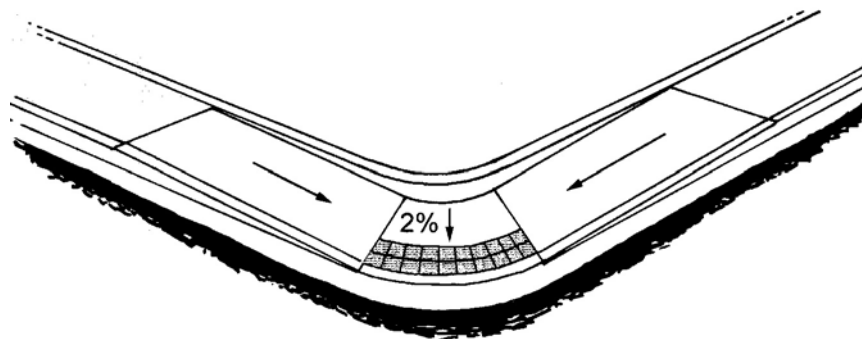
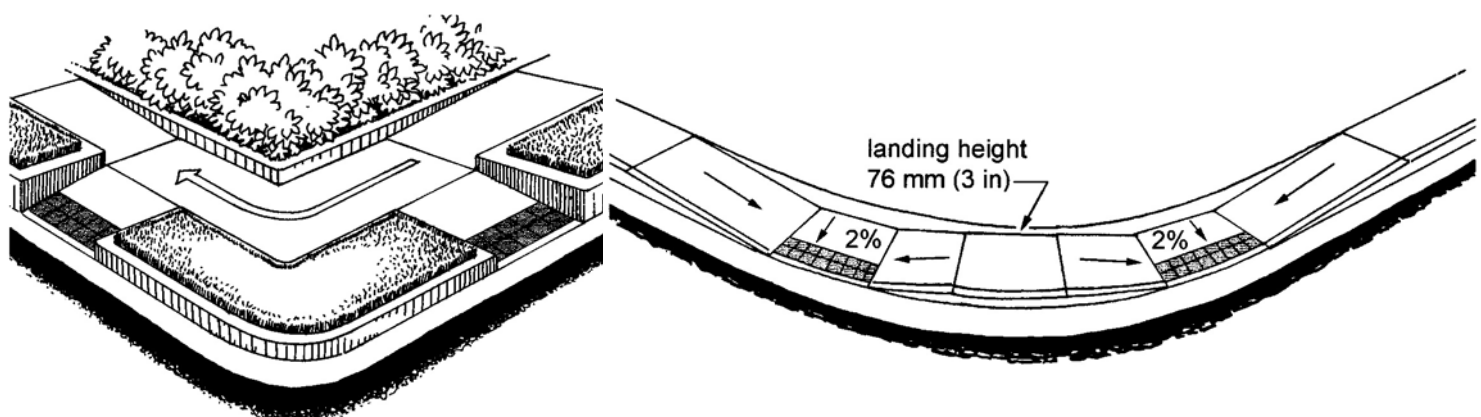


Figure 5: Typical Dual Curb Ramps



B. Pedestrian Area at Corners

The pedestrian area is defined as usable space for pedestrians. Corners must be functional and must accommodate those waiting to cross the street, those traveling along the sidewalk, and those who stop to congregate on the corner. The greater the number of expected pedestrians, the larger the pedestrian area should be. Other considerations sometimes erode the amount of usable space and hence the functionality of corners. Several strategies exist for expanding the pedestrian area at corners. Small corner radii generally provide the most usable space and the shortest crossing distances for pedestrians (see figure below). Designers may also consider curb extensions, right-of-way acquisition, or granting public easements across private property to expand the pedestrian area.

The pedestrian area should be clear of obstructions, especially immediately adjacent to the corner. This area is the triangle created by extending the property lines to the face of curb. Where existing obstructions such as utility poles or newspaper racks are removed, they should not be relocated such that they obstruct a pedestrian's line of travel.

C. Corner Radii

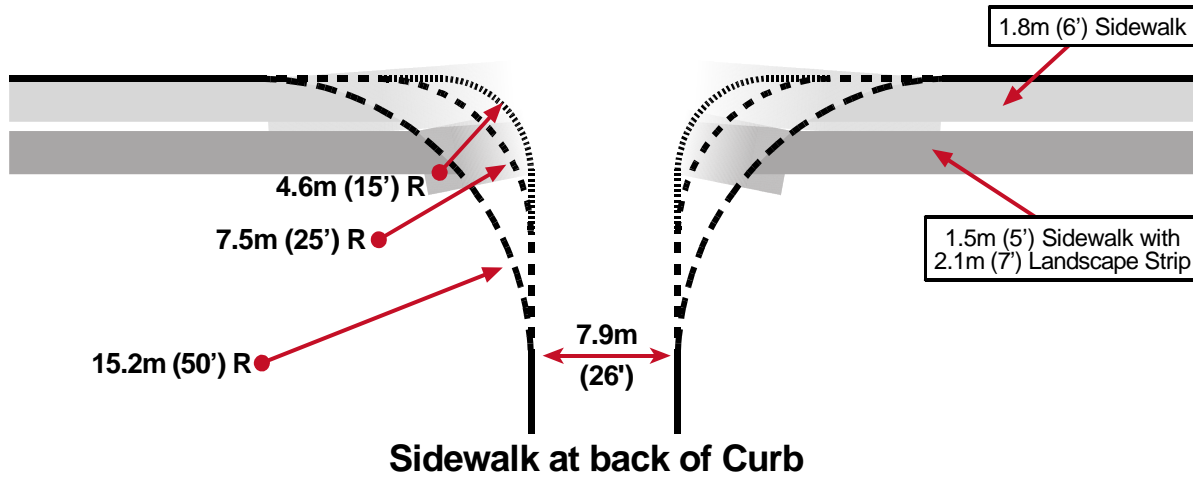
The general rule for choosing a corner radius should be to choose the smallest possible, acknowledging that each location has a unique set of factors that determine the appropriate radius. Small corner radii benefit both factors that affect the pedestrian realm. They improve comfort and a more enjoyable walking environment because they create more usable space for pedestrians at the corner. They improve safety because they slow vehicle speeds and shorten the crossing distance for pedestrians. Smaller corner radii are also beneficial for street sweeping operations.

While corner radii may be as small as 1'6", locations with any amount of turning traffic cannot accommodate a radius this tight. **In pedestrian districts, at locations with curbside parking, a 10' radius is recommended. At locations with no parking lane, a 20' maximum is recommended.** Locations with heavy truck traffic may also require a wider turning radius. Figure 16 displays corner radii appropriate at curb extensions. The corner radii is based on the width of the street.

Recommended ranges for curb radii regardless of whether or not a street is in the pedestrian district are as follows:

Street Type	Recommended Curb Radius
Residential	15
Local/Collector	20-30
Arterial	30
Industrial	Up to 50

Figure 6: Effect of Corner Radii on Pedestrian Crossing Distance



Radius	Average Vehicle Speed in Corner	Crossing Distance	Increased Crossing	Percent Increase
4.6m (15')	5 mph	7.9m (26')	+0m (0')	0%
7.5m (25')	10 mph	10.0m (36')	+3.0m (10')	38%
15.2m (50')	15mph	19.8m (65')	+11.4m (39')	150%

Sidewalk with Nature Strip

Radius	Average Vehicle Speed in Corner	Crossing Distance	Increased Crossing	Percent Increase
4.6m (15')	5 mph	11.3m (37')	+3.3m (11')	42%
7.5m (25')	10 mph	15.2m (50')	+7.3m (24')	92%
15.2m (50')	15mph	27.1m (89')	+16.2m (53')	203%

D. Curb Extensions

Consider curb extensions at intersections of three or more lanes, or at uncontrolled crossings where they may improve safety. Although there may be exceptions, curb extensions should be installed at locations with on-street parking. Generally, **curb extensions should extend a minimum of six feet into the street adjacent to parallel parking, or 12 feet adjacent to diagonal parking and no further than the edge of the travel lane or bicycle lane.** Designers should exercise special care not to create conflicts between bicyclists and pedestrians and not to design the curb extension such that cyclists are forced to “take the lane” at intersections where it is not appropriate. Curb extensions are a preferred treatment in a Pedestrian District. The figure below illustrates the effect of curb extensions on pedestrian crossing distance. It is demonstrative only and should not be used as a design standard.

Figure 7: Curb Extensions and Medians Shorten Pedestrian Crossing Distance

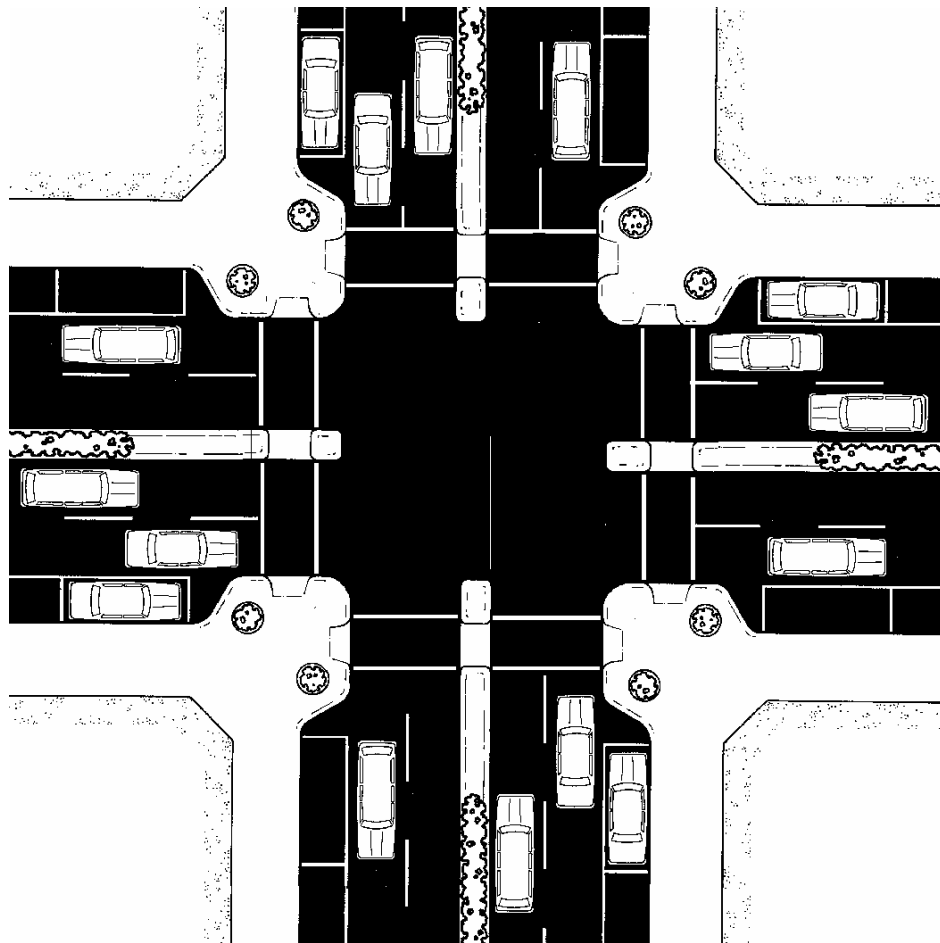
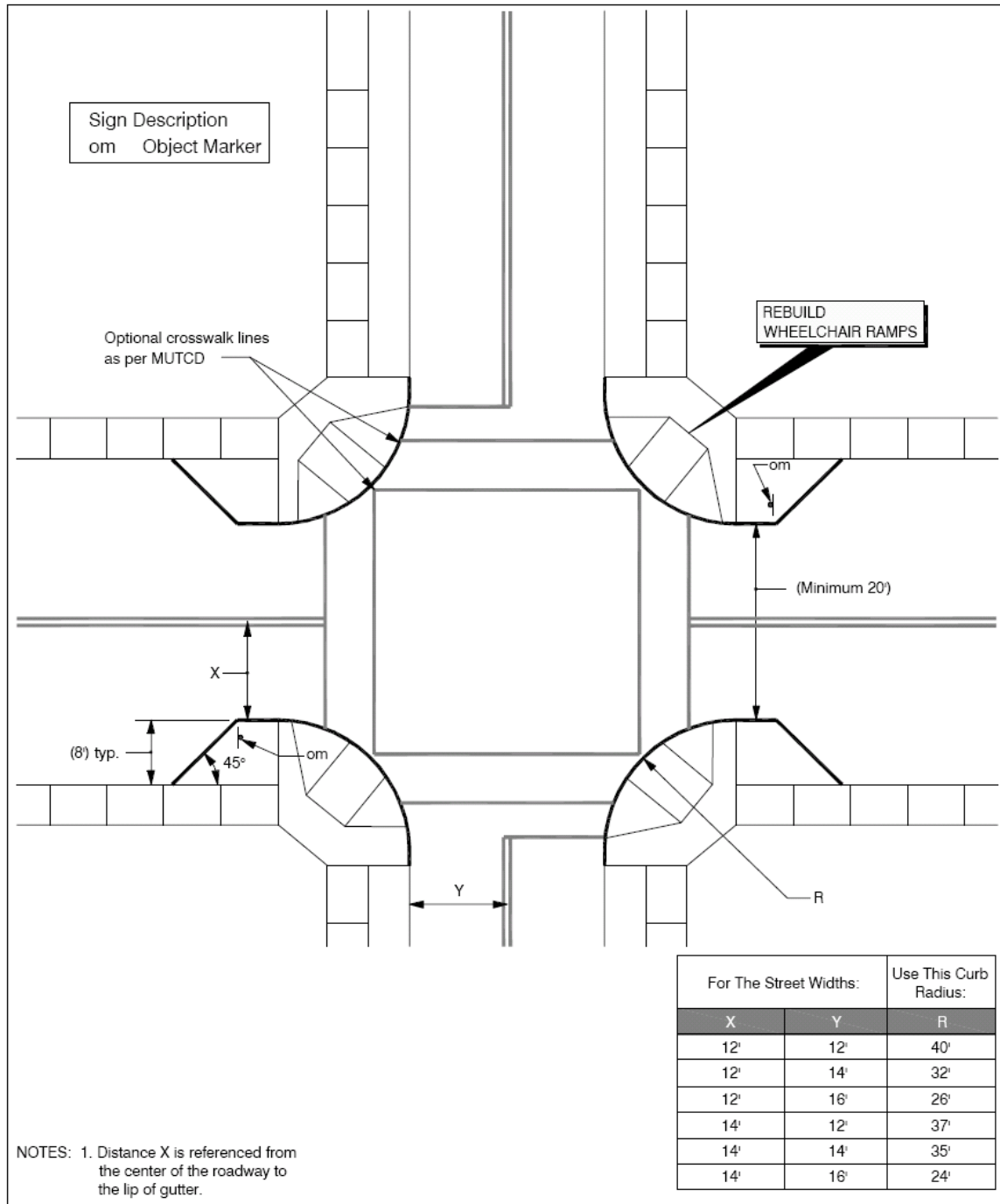


Figure 8: Curb Extension Design⁴



⁴ Although the curb extension in this figure is shown as eight feet, extensions may be as small as six feet, or as wide as 12 feet.

Figure 9: Effective Use of Space at Curb Extensions near Parallel Parking

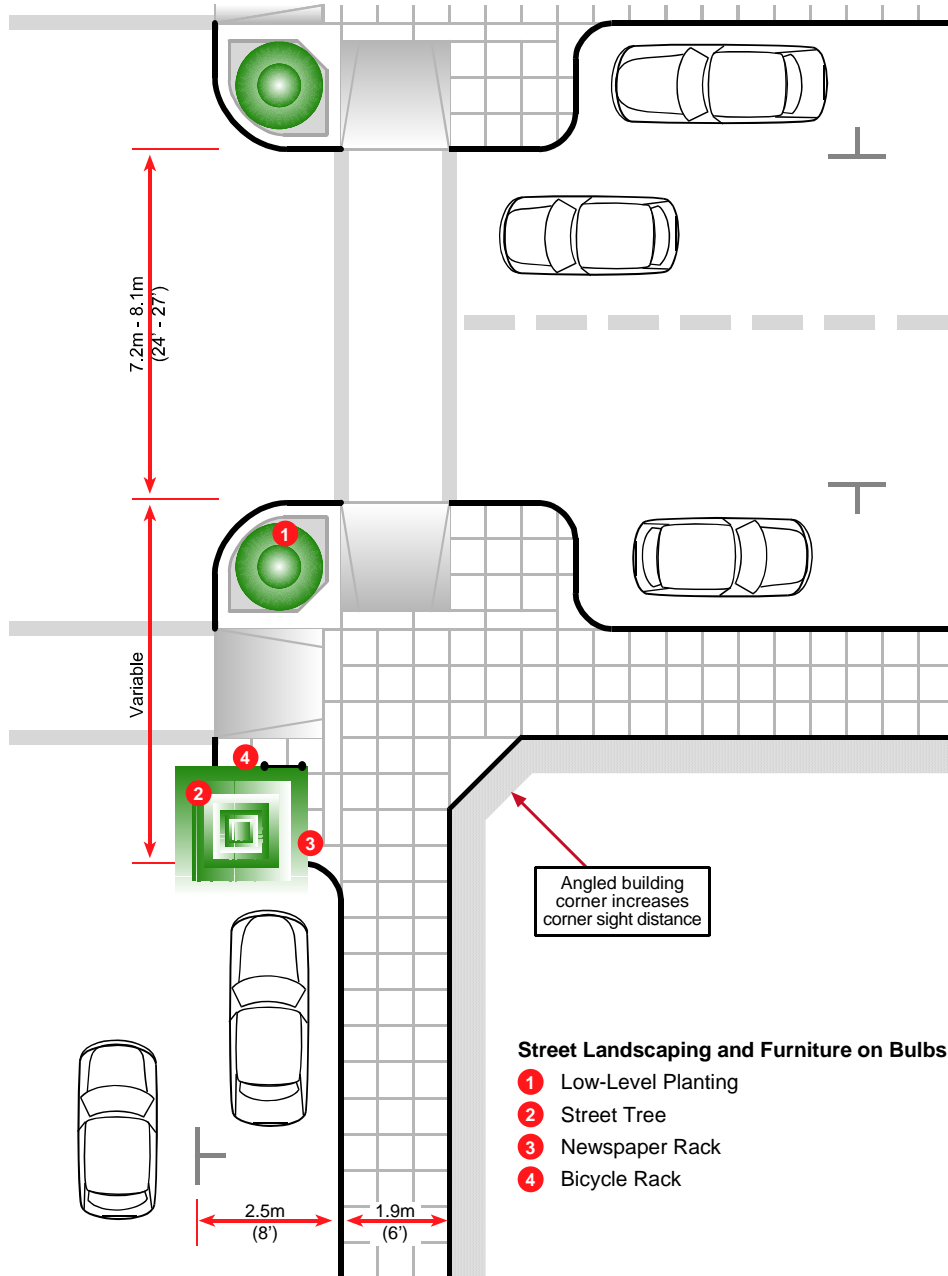
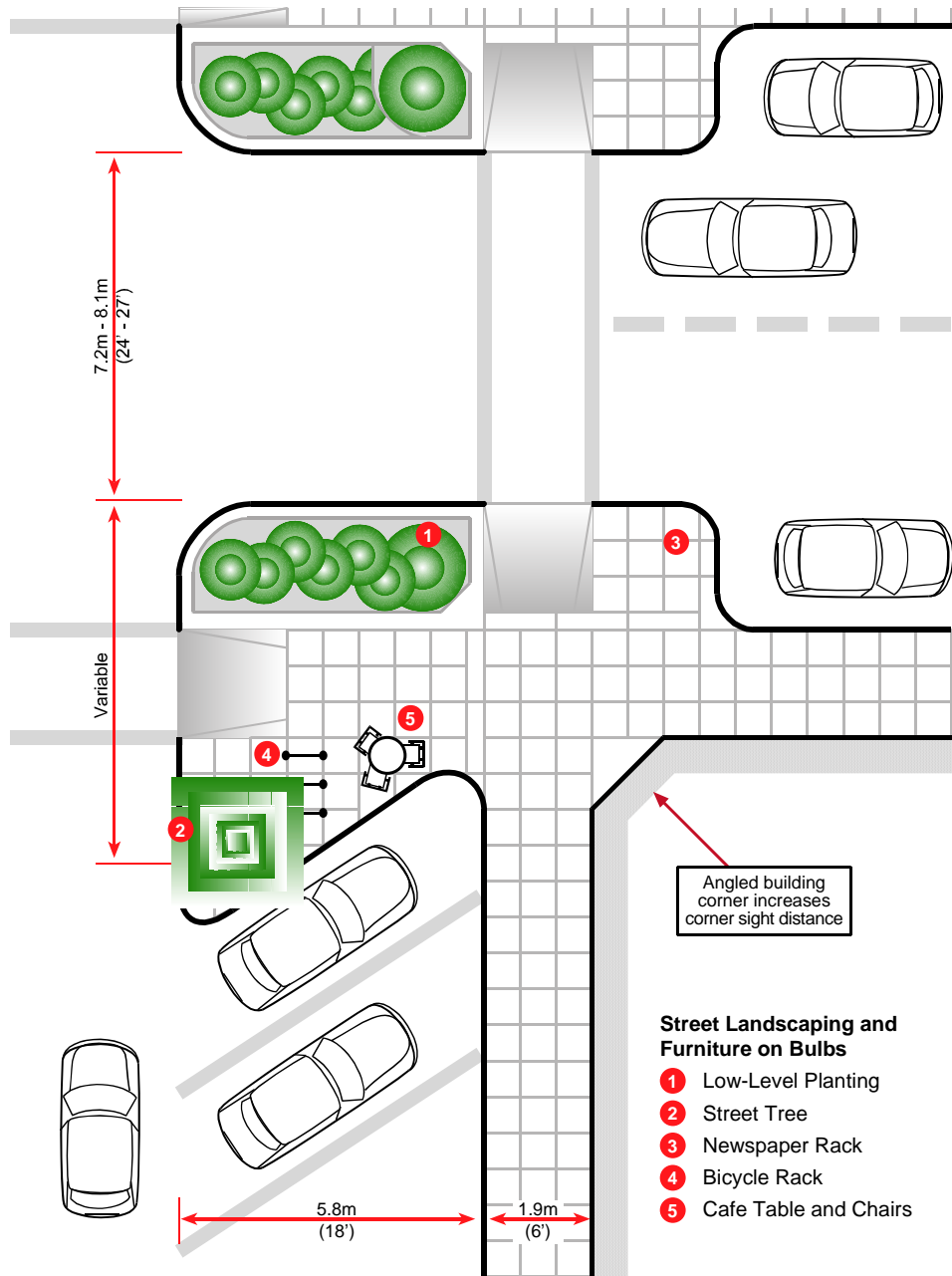


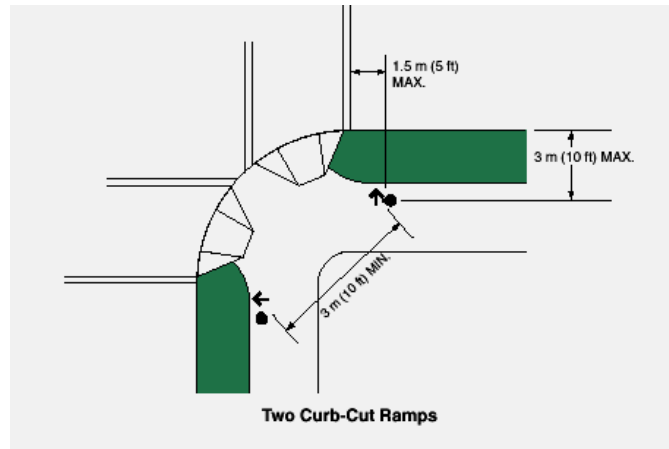
Figure 10: Effective Use of Space at Curb Extensions near Perpendicular Parking



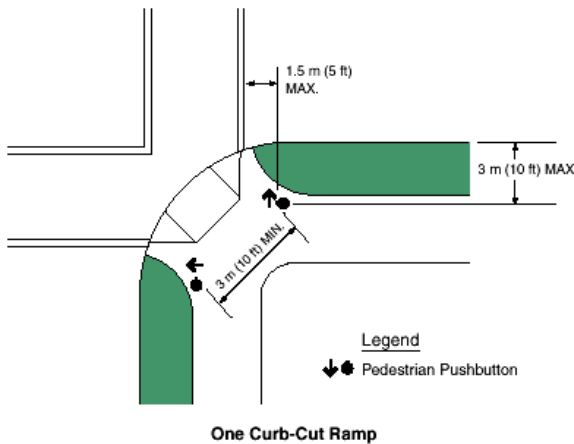
E. Push Buttons

When pedestrian push buttons are used, they should be well-marked, visible, and accessible to all pedestrians from a flat surface consistent with recommendations from the U.S. Department of Transportation's *Designing Sidewalks and Trails for Access*. **They should be located within ten feet of the crosswalk and not further than five feet from the curb.** The minimum standard is that pedestrian pushbuttons shall be located a maximum of five feet from the crosswalk line extended, and 10' maximum and 2.5' minimum from the curb line.

Figure 11: Pushbutton Locations for Accessible Pedestrian Signals at Dual Ramps and Single Ramps



Source: CalDAG 2003



Where needed, pedestrian call buttons should be located to meet the following criteria:



*ADA-Accessible
Pushbutton*

- The closest push button to a crosswalk should call the pedestrian signal for that crosswalk.
- An arrow indicator should show which crosswalk the button will affect.
- The push button should be visible to a pedestrian facing the crosswalk, unless space constraints dictate another button placement.
- The push button must be accessible from the level landing at the top of the curb ramp, or from the dropped landing of a parallel curb ramp.
- Where audible pedestrian signals are installed, audible push-buttons should also be used.
- Tactile symbols may also be installed for visually-impaired persons.
- At locations where pedestrian refuge islands or medians are located and the crossing is greater than 60 feet, pedestrian push buttons should be installed in the median.

F. Other Street Corner Facility Issues

Various elements may create obstructions at the street corner. There are several means of reducing the number and size of the obstructions. Items such as newspaper racks, trash bins, signal boxes, and street furniture may be consolidated and, where appropriate, regulated through local ordinances. Maintaining sight distance for both pedestrians and motorists is critical. When designing new intersections or driveway locations, it is important to measure the pedestrian's sight lines as well as those of the vehicle. Standard stopping distances from AASHTO are appropriate. Municipalities should establish guidelines governing the dimensions of plants and trees near intersections.

III. Sidewalk Facilities

The ADA mandates a minimum sidewalk width of four feet. Public sidewalks that are less than five feet wide require, as a minimum a five-by-five foot passing zone every 200 feet. For new sidewalks, as well as sidewalks in areas with high pedestrian demand, higher minimums are recommended. Sacramento County's guidelines call for a five foot minimum sidewalk adjacent to a planter strip and a seven foot minimum adjacent to curb and gutter.

On commercial streets, areas near hospitals, schools, and universities, especially in the areas of high pedestrian demand, eight feet is the minimum desired sidewalk width. This includes a two to three foot comfort zone on either side of the pedestrian walkway, as pedestrians generally keep about 1.5 feet clear of planters, street furniture and other obstructions near the curb. This should not prevent the local agency from installing wider sidewalks (up to 12 feet) in commercial districts and other locations with outdoor seating and amenities. **Sidewalks on local streets should be a minimum of five feet wide.** ADAAG contains minimum and maximum cross slopes and running slopes.

Wayfinding

Straightforward and predictable routing along sidewalks supports wayfinding by persons with visual impairments. Open areas that do not have detectable landmarks like curbs and building edges may not provide sufficient cues. Where a sidewalk borders a park, parking lot, or building setback, a raised edge should be provided as a shoreline for cane travelers. Tactile curb markings may also be used to indicate the location of street edges and pedestrian crossings. The sidewalk's through passage zone should not be obstructed or narrowed by street furniture, especially at turns and ramps. Additionally, items installed for pedestrian use on or along sidewalks should be accessible for persons with disabilities.

- *Pedestrian Master Plan*, City of Oakland, 2002

Elements such as street furniture, newspaper racks, bicycle parking racks, and trash bins should be kept in the buffer zone and should not impede a straight travel path along the sidewalk. Additionally, “meandering” sidewalks are discouraged. They prove challenging for disabled pedestrians and lengthen travel distance.

IV. Buffer Zone

Planting strips, parking lanes, and even bicycle lanes provide a buffer between pedestrians on the sidewalk and motor vehicle traffic. Planting strips require a minimum of five feet, although six feet is more desirable, especially for larger trees. **Sidewalks on commercial streets should provide a minimum five foot buffer zone in addition to an eight foot sidewalk.**

Buffer strips are recommended to eliminate driveway cross slopes in the sidewalk, improve pedestrian comfort, and offer landscape/shade opportunities.

There are several elements that can be located in the buffer zone, including lighting, plantings, wayfinding signage, and street furniture. Although this document does not address landscape architecture issues, special care should be taken when selecting and planting street trees. Street trees provide shade and shelter as well as a buffer, but if planted improperly, they can also damage sidewalks. The following discussions of lighting, signage, driveways, and building frontages are excerpted from the City of Oakland’s *Pedestrian Master Plan*, adopted in 2002.

A. Lighting

Pedestrian-scale lighting improves accessibility by illuminating sidewalks, crosswalks, curbs, curb lamps, and signs as well as barriers and potential hazards. From the pedestrian’s point of view, frequent lampposts of lower height and illumination are preferred over fewer lampposts that are very tall and bright. Pedestrian-scale lighting should be employed in areas of high pedestrian activity and where implementation is practical. Lampposts should be staggered on opposite sides of the street and be placed at crosswalks, bus stops, and corners. These lampposts provide vertical buffers between the sidewalk and street and help define pedestrian areas. Pedestrian-scale lighting and motor vehicle-scale lighting each should be provided as a complement to the other to ensure that both sidewalks and travel lanes are effectively illuminated. Pedestrian-scale lighting may be installed between existing lampposts to obtain the frequencies given in the table below. They must be located at least ten feet from the full growth canopy of adjacent trees. Poles and fixtures can be chosen from existing models identified by a local jurisdiction. Hoods on lampposts can reduce light pollution.

Street Type	Lamppost Height	Distance between Lampposts	Sidewalk Illumination	Crosswalk Illumination
ARTERIAL	14'	50'	0.9 FC (10 LUX)	2.0 FC (22 LUX)
COLLECTOR	12'	50'	0.6 FC (6 LUX)	1.0 FC (11 LUX)
LOCAL	12'	50'	0.2 FC (2 LUX)	0.5 FC (5 LUX)
WALKWAY	12'	30' (OR AT LANDINGS)	0.2 FC (2 LUX)	0.5 FC (5 LUX)
TRAIL	12'	30'	0.2 FC (2 LUX)	0.5 FC (5 LUX)

Proposed lighting guidelines (Fehr & Peers, 2001)

These hoods should also be designed to direct lighting onto the sidewalks. The installation of new lighting should take into account potential overflows that may adversely affect adjacent residents. The proposed lighting guidelines provide guidance in establishing adequate pedestrianscale lighting for a

range of rights-of-way. The implementation of pedestrian-scale lighting should occur as part of pedestrian-oriented street projects as they are completed.

B. Signage

An enhancement to the sidewalk network is signage for pedestrians to aid in wayfinding. The signs should consist of a distinctive logo and directional guidance to neighborhood destinations. They can be attached to lampposts and located at decision points along the route network. The City of Berkeley's bicycle boulevard program includes a successful signage component that may serve as an exemplar. Pedestrian signage should comply with the criteria for character proportion, height, and contrast specified by the MUTCD and ADAAG.

C. Driveways

Driveway entrances can be both dangerous and inconvenient for pedestrians. Driveway curbcuts that extend into the through passage zone may cause people on foot or in wheelchairs to fall. Driveways expose pedestrians on the sidewalk to motor vehicle cross traffic and cars parked in driveways often block sidewalks. Driveways also reduce the available space for street trees, lighting, street furniture, and parallel parking. As redevelopment or new development allows, minimum driveway widths and frequencies should be promoted as permitted by the planning code. Wherever possible, entrances should be consolidated such that multiple users share a common curbcut for motor vehicle access. The ramp portion of a drive entrance should be located within the utility zone where possible. Driveways should also be spaced at a minimum of 20' to reduce the amount of curbside parking eliminated.

D. Building Edges

Placement of street furniture along building edges is acceptable if the through passage zone is preserved. Buildings with lower floor windows, canopies for rain protection, tables, umbrellas, signs, planters, benches, and other street furniture contribute to street life and enhance the pedestrian environment.

V. **Crossing Facilities**

Pedestrian crossings generally fall into two categories: controlled and uncontrolled. Controlled crossings include signalized locations and stop-controlled crossings (both all-way stops and stop-controlled approaches on two- and three-way stops). Uncontrolled crossings include both intersection and mid-block locations.

Pedestrian-friendly crossings are:

- **Compact:** A generally good maxim to follow is "never design more than you need." Keep turning radii tight; discourage free-right turns; and include pedestrian refuge islands or other special devices at especially wide crossings.
- **Visible:** The pedestrian crossing should be clearly-marked. Maintaining a high-visibility crossing creates an intuitive and safe environment for all users. Visibility also applies to sight distance. **Pedestrians should be clearly visible by motorists up to 250 feet away.**
- **Useful:** One of the first steps in creating a marked, uncontrolled crossing, especially for mid-block locations, is to determine need and location. While identifying pedestrian "desire lines," or the places where the most pedestrians want to cross, can present special challenges, it is essential in order to ensure a cost-effective and well-used crossing.
- **Safe:** A common misperception about marked uncontrolled crossings is that they give pedestrians a "false sense of security." Recent research has concluded that not all marked uncontrolled crossings are less safe than marked crossings.

VI. Crosswalk Policy

Well-marked pedestrian crossings accomplish dual goals. They prepare drivers for the likelihood of encountering a pedestrian, and they create an atmosphere of walkability and accessibility for pedestrians. In California, it is legal for pedestrians to cross at any intersection or at any marked mid-block crossing. Marked crossings reinforce the location and legitimacy of a crossing.

Why Do Cities Mark Crosswalks?

Crosswalk Function:

- Creating reasonable expectations where pedestrians may cross a roadway
- Predictability of pedestrian actions and movement
- Channelization of pedestrians to designated crossing locations

Advantages of marked crosswalks:

- Help pedestrians find their way across complex intersections
- Designate the shortest path
- Direct pedestrians to locations of best sight distance

Critical issues for marked crosswalks:

- At uncontrolled locations on multi-lane streets with higher traffic volumes, may result in a greater number of pedestrian collisions if additional enhancements are not provided
- Maintenance for higher end physical or operational enhancements can be costly

In pedestrian-friendly cities, crossing locations are treated as essential links in the pedestrian network. At mid-block locations, pedestrians cannot cross legally without a marked crosswalk. When there are pedestrian generators in these locations, it may be appropriate to create safe, convenient crossing opportunities. Without mid-block crossing locations, pedestrians face the following three choices: detour to a controlled crossing location; detour to an intersection where it is legal to cross, even if not controlled; or jaywalk (cross illegally).

Steps in Identifying Candidate Locations for Marked Crosswalks

The first step in identifying candidate marked crosswalk locations is to identify the places people would like to walk (pedestrian desire lines) which are affected by local land uses (homes, schools, parks, commercial establishments, etc.) and the location of transit stops. This information forms a basis for identifying pedestrian crossing improvement areas and prioritizing such improvements, thereby creating a convenient, connective and continuous walking environment.

The second step is identifying where it is safest for people to cross. Of all road users, pedestrians have the highest risk because they are the least protected. National statistics indicate that pedestrians represent 14 percent of all traffic incident fatalities while walking accounts for only three percent of total travel trips. Pedestrian collisions occur most often when a pedestrian is attempting to cross the street at an intersection or mid-block location⁵.

Several major studies of pedestrian collision rates at marked and unmarked crosswalks have been conducted. In 2002, the Federal Highway Administration (FHWA) published a comprehensive report on the relative safety of marked and unmarked crossings. This document presents a variety of special treatment options to mitigate safety, visibility or operational concerns at specific locations. The flowchart on the following page outlines the steps in identifying candidate locations for crosswalks and appropriate crosswalk treatments based on the findings of the 2002 FHWA Study.

⁵ Pedestrian Crash Types, A 1990's Information Guide, FHWA; This paper analyzed 5,076 pedestrian crashes that occurred during the early 1990's. Crashes were evenly selected from small, medium, and large communities within six states: California, Florida, Maryland, Minnesota, North Carolina, and Utah.

A. Controlled Locations

The following is the recommended, or best practice, for pedestrian treatments in crosswalks at signalized intersections or stop-controlled approaches (i.e., vehicles stop at approach in question).

- **Mark Crosswalks on all approaches** (i.e., legs of the intersection) using standard crosswalk markings or high-visibility markings. Where the collision data or observations of conflicts identify a crosswalk of particular concern, consider special treatments.
- **Pedestrian signals should be timed per the 2004 Manual on Uniform Traffic Control Devices (MUTCD)**. The most recent update of the MUTCD calls for a minimum walk time⁶ of three feet per second from top of curb ramp to top of curb ramp, with the pedestrian clearance interval, timed for a walking speed of 3.5 feet per second. If there are special land uses such as senior centers or schools within 100 feet of the intersection, slower walking speeds (3.0 feet per second) may be considered.
- At actuated signals where pedestrian activation is registered for greater than 75 percent of the peak hour signal cycles, signals should accommodate pedestrian crossings in every peak period cycle.
- At locations that are not on a direct path to a generator with low side-street volumes, signals should be partially-actuated, meaning that pedestrians crossing the side streets get a WALK signal on every cycle, but pedestrians crossing the main street must use the pedestrian push button.

The following two situations are **exceptions** to the policy of marking crosswalks on all approaches:

- **Crossing locations with heavy right- or left-turn volumes** that occur during the same signal phase as the conflicting pedestrian movement where protected signal phasing for the heavy movement or other solutions are infeasible⁷
- **Intersections with inadequate sight distance⁸** of pedestrians. Elimination of crosswalks in these instances should only occur after other solutions have been deemed infeasible

Specific treatments at locations with the following characteristics are addressed in the design guidelines chapter. Treatments at these locations should be chosen using engineering judgment.

- Wide Intersections
- Intersections with High Numbers of Turning Vehicles
- Intersections with High Numbers of Pedestrians

⁶ The minimum walk time is the total time allocated including the WALK and the clearance interval, or FLASHING DON'T WALK (FDW)

⁷ Alternative pedestrian crossings should be identified and it may be necessary to install barrier treatments to reinforce that pedestrian should not cross at the location without a marked crosswalk.

⁸ Unrestricted sight distance of pedestrians by motorists should be at least ten times the speed limit (for example, 250 feet for a street with a speed limit of 25 miles per hour).

The table below summarizes the standard treatment for controlled crossings:

CONTROL TYPE	STANDARD TREATMENT	ENHANCEMENTS	DO NOT MARK
Signal	Advance 24" Limit Line seven feet before the crosswalk Dual white lines	High-visibility stencil Pedestrian refuge island Curb extensions Signal treatments: <ul style="list-style-type: none"> • Animated Eye • Countdown • Early Release • Scramble Right-turn on red restrictions	Inadequate sight distance
Stop sign	Dual white lines	High-visibility stencil Pedestrian refuge island Curb extensions	Inadequate sight distance

- **High numbers of turning vehicles**

There are a number of innovative treatments for pedestrians at signalized intersections, mostly related to pedestrian signals. Some of these treatments are not in state standards and should be applied with good engineering judgment. At locations with high pedestrian volumes and pedestrian-vehicle conflicts, the following measures are means to enhance the safety of pedestrian crossings:

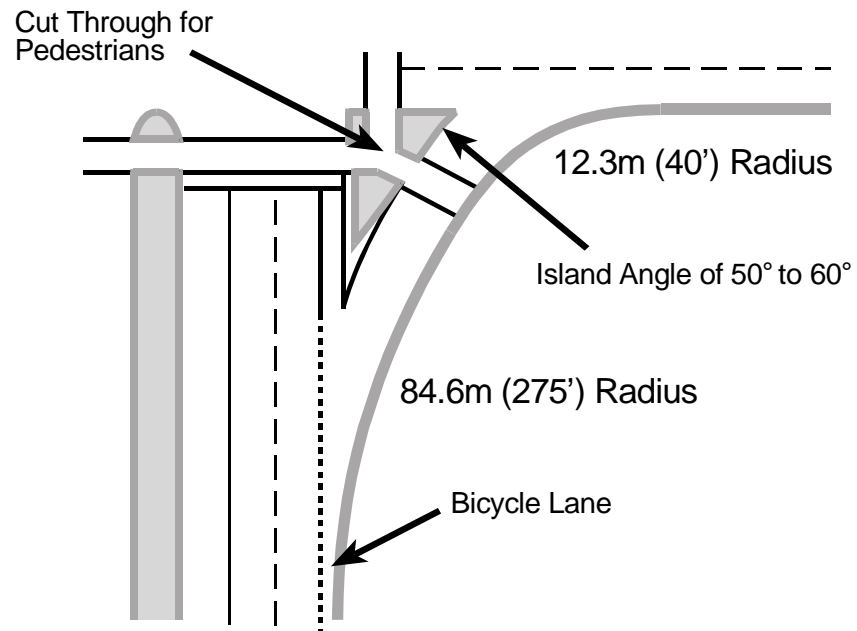
- The **Animated Eye Light Emitting Diode (LED) Signal** is a tool for reminding pedestrians to watch for turning vehicles. It would normally be used at intersections with large numbers of turning vehicles (vehicles turning left or right into the crosswalk)
- **Early Release** or pedestrian lead-time, allows pedestrians to establish themselves in the crosswalk, reducing conflicts between pedestrians and turning vehicles
- **Special Pavement stencils** such as “Pedestrians Look Left” or “Watch Turning Vehicles” stencil are used in Salt Lake City, Halifax, N.S., Canada, and the UK to remind pedestrians to be watchful. These stencils, used in conjunction with special signage, significantly reduced the number of pedestrians not looking for threats at intersections.⁹ Additionally, high-visibility crosswalks help channelize pedestrians
- Other special treatments include “**Yield to Pedestrians**” signs, and **reduced corner radii** to slow the speeds of right-turning vehicles. The curb radius should accommodate the expected amount and type of traffic for safe turning speeds. As the curb radius increases, incomplete stops become more frequent and drivers make turns at higher speeds.¹⁰
- Whenever possible, especially at locations adjacent to pedestrian generators, intersections should be designed **without “free rights”** for vehicles. When “free rights” are necessary, see the figure below for the recommended design.



⁹ Van Houten, Ron et al, “Special Signs and Pavement Markings Improve Pedestrian Safety,” *ITE Journal*, December 1996.

¹⁰ Kulash, William M., *Residential Streets*, Urban Land Institute, 2001.

Figure 12: Preferred Free Right Turn Design



- **High numbers of pedestrians**

These are appropriate in downtown locations, central business districts, or other areas with high pedestrian activity.

- **Pedestrian “scramble” phases**, so called because pedestrians have a walk signal in every direction while vehicles have a red light on all approaches. This treatment is appropriate in central business districts where pedestrian volumes are exceptionally high
- **“No Right Turn on Red” restrictions** for vehicles reduce pedestrian-vehicle conflicts at locations with high numbers of pedestrians, but makes vehicle circulation less convenient and may cause traffic diversions. This type of treatment needs to be considered on a case-by-case basis.
- **Advance stop lines or yield lines** are stop or yield bars placed seven feet in advance of the crosswalk. Advance stop lines or yield bars should be considered based on pedestrian volumes, generators and safety concerns relevant to a specific crossing

- **Wide intersections**

- **Countdown signals** are useful at signalized locations. At wide streets with long clearance intervals, the countdown signal effectively communicates the amount of time left to cross the street. At streets with medians, there should be adequate crossing time for the pedestrian to traverse the entire distance and countdown signals should be used as a default. Some jurisdictions, such as Sacramento County, install countdown signals as a standard at all signalized locations.



- **Pedestrian Refuge Islands** should extend through the crosswalk, with a curb cut for wheelchair accessibility. Sacramento County's ADA Transition Plan recommends a 60-foot wide opening with a minimum length of 72 feet and recommended of 120 feet. Refuge islands should be clear of obstructions and have adequate drainage. They should be at least 12 feet long or the width of the crosswalk (whichever is greater) and 60 feet square. At actuated pedestrian signals, an accessible pedestrian push button should also be located in the median. While refuge islands may be appropriate on streets of varying widths, they are especially desirable on streets 60 feet or wider.

Recommended refuge island widths are as follows:

Speed	Minimum Width ¹¹
25-30 mph	5 feet
30-35 mph	6 feet
35-45	8 feet

¹¹ Where bikes are expected to use the crosswalk, medians should be at least six feet wide, the length of an average bike.

B. Uncontrolled Crossings

This section describes best practices for considering the installation of crosswalks at uncontrolled intersections and mid-block locations.

▪ **When to Install Crosswalks at Uncontrolled Intersections**

The following is the recommended or best practice for pedestrian treatments at uncontrolled approaches to intersections that are not controlled by traffic signals or stop signs.¹²

Crossings should be marked where all of the following occur:

- Sufficient demand exists to justify the installation of a crosswalk (see Demand Considerations below)
- The location is 300 feet or more from a controlled crossing location
- The location has sufficient sight distance (sight distance in feet should be 250 feet), and/or sight distance will be improved prior to crosswalk marking
- Safety considerations do not preclude a crosswalk

Demand Consideration:

Uncontrolled crossings should be identified as a candidate for marking if there is a demonstrated need for a crosswalk. Need may be demonstrated by:

- 20 pedestrians per hour during the peak hour or 60 pedestrians total for the highest consecutive four-hour period



or:

- The crossing is on a direct route to or from a pedestrian generator, such as a school, library, senior center, shopping center, park, or employment center

▪ **When to Install Crosswalks at Mid-Block Locations**

Mid-block crossings should be marked where the following occur:

- Sufficient demand exists to justify the installation of a crosswalk (see Demand Considerations below)
- The mid-block location is approximately 300 feet or more from another crossing location
- The mid-block location has sufficient sight distance (sight distance in feet should be greater than 250 feet)

¹² The most common crosswalk of this type will be at intersections where a minor side street has a stop sign and a major street is uncontrolled.

- Provision of a crossing would channelize potential jaywalkers to a suitable crossing location
- Safety considerations do not preclude a crosswalk (see below, Safety Considerations at Uncontrolled Locations)

Where mid-block crosswalks are installed, the default design should be high-visibility pavement treatments.

Demand Considerations: Candidate locations for marked pedestrian crossings at mid-block locations should meet one of the following criteria:

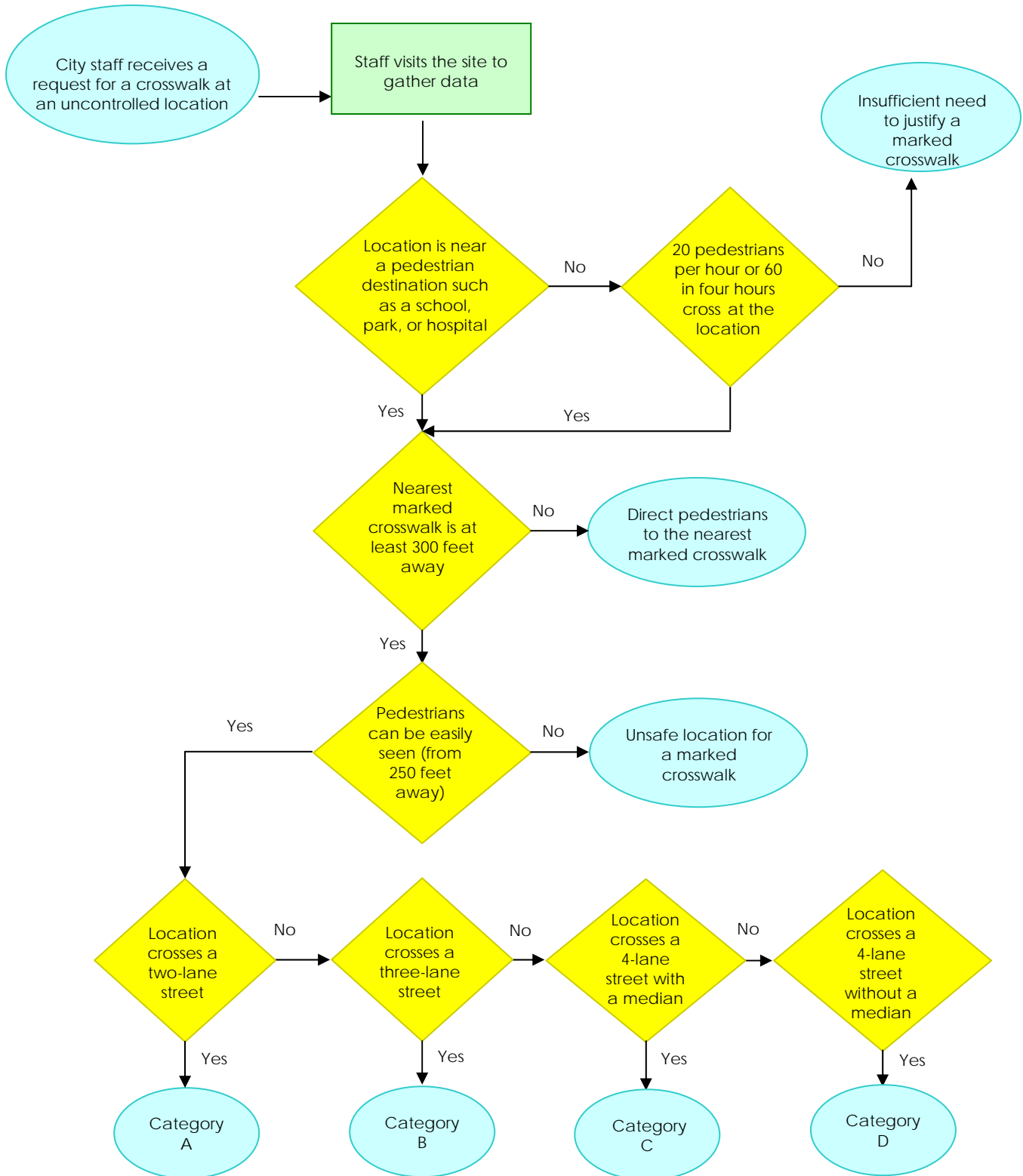
- 20 pedestrians per hour during the peak hour or 60 pedestrians total for the highest consecutive four-hour period
- A pedestrian generator is less than 300 feet away at a location mid-way between signal or stop-controlled intersections, or there are significant pedestrian trip generators on both sides of the street

▪ **Safety Considerations at Uncontrolled Locations**

The flowchart on the following page and corresponding tables should be used to determine if special treatments are needed to ensure safe crossing at uncontrolled locations (see *Pedestrian Design Guidelines* for examples of special treatments). Where safety concerns would continue even with special treatments, pedestrian signal warrants, established in Caltrans' Traffic Manual, should be tested to determine whether the crossing warrants a signal. In the event that a signal is determined to be inappropriate or the recommended device is infeasible in the short term due to financial considerations, the crosswalk should not be marked.

A marked crosswalk should *not* be installed if sight distance in feet is less than 250 feet.

Figure 13: CROSSWALK PLACEMENT FLOWCHART FOR UNCONTROLLED LOCATIONS



The following charts summarize the type of crossing treatments appropriate for uncontrolled crossing locations within each category.

CATEGORY A: TWO LANE STREETS

NUMBER OF CARS (average daily traffic)	POSTED SPEED		
	30 miles per hour or less	35 miles per hour	40 miles per hour or more
9,000 cars or fewer per day	Standard marked crosswalk	High visibility crosswalk	High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices
9,000-12,000 cars per day			
12,000-15,000 cars per day	High visibility crosswalk	High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices	Pedestrian signal or bridge
15,000 cars or more per day			

CATEGORY B: THREE-LANE STREETS¹³

NUMBER OF CARS (average daily traffic)	POSTED SPEED		
	30 miles per hour or less	35 miles per hour	40 miles per hour or more
9,000 cars or fewer per day	High visibility crosswalk	High visibility crosswalk	High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices
9,000-12,000 cars per day		High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices	
12,000-15,000 cars per day	High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices	Pedestrian signal or bridge	Pedestrian signal or bridge
15,000 cars or more per day			

¹³ Refers to streets with one lane in each direction and a center two-way left-turn lane.

CATEGORY C: FOUR OR MORE LANES WITH A RAISED MEDIAN

NUMBER OF CARS (average daily traffic)	POSTED SPEED		
	30 miles per hour or less	35 miles per hour	40 miles per hour or more
9,000 cars or fewer per day	High visibility crosswalk	High visibility crosswalk	High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices
9,000-12,000 cars per day		High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices	
12,000-15,000 cars per day	Pedestrian signal or bridge		Pedestrian signal or bridge
15,000 cars or more per day		Pedestrian signal or bridge	

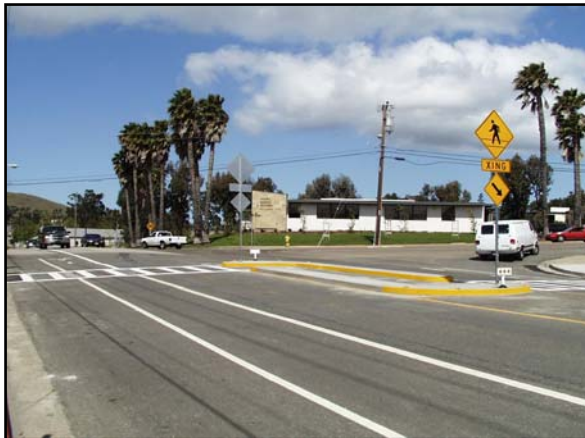
CATEGORY D: FOUR OR MORE LANES WITHOUT A RAISED MEDIAN

NUMBER OF CARS (average daily traffic)	POSTED SPEED		
	30 miles per hour or less	35 miles per hour	40 miles per hour or more
9,000 cars or fewer per day	High visibility crosswalk	High visibility crosswalk plus a pedestrian refuge or other Level 1 device	High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices
9,000-12,000 cars per day	High visibility crosswalk plus a pedestrian refuge or other Level 1 device	High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices	
12,000-15,000 cars per day	High visibility crosswalk plus a pedestrian refuge, overhead flashing beacons, or other Level 1 and 2 devices.		Pedestrian signal or pedestrian bridge
15,000 cars or more per day	Pedestrian signal or pedestrian bridge	Pedestrian signal or pedestrian bridge	

The following treatments are appropriate at uncontrolled locations that may need small adjustments to ensure that a marked crossing will be as safe as an unmarked crossing. These recommendations are all minimums, and they are specifically to improve safety. They should not preclude a jurisdiction from installing them in other locations to improve walkability. They are listed in order of intensity.

C. Level One

- Install **Pedestrian Refuge Islands** on multi-lane streets with ADT of less than 15,000 and 85th percentile speeds of less than 35 miles per hour where right-of-way permits.
- The **Split Pedestrian Crossover (SPXO)** is a pedestrian refuge that channels pedestrians, using curb railings, to cross one half of the street; enter the island at one end; walk towards the flow of traffic; and exit at the other end to cross the second half of the street. SPXOs can improve pedestrian safety on streets with ADTs below 45,000, with advance yield markings (triangles 16" wide by 24" long separated by 9" located 30-50 feet in advance of the crossing), "Yield to Pedestrians" signage, and good visibility, especially at night.
- **Curb Extensions** (see *Corner Zone*)



Level Two

- **Overhead signs and flashing beacons** showing the universal pedestrian symbol, including both standard yellow, fluorescent yellow, and LED displays, hang from a mast arm that extends over the street. Flashing red or yellow beacons enhance overhead signs.
- **Raised crosswalk** Using special pavers, concrete, or asphalt, create a raised crosswalk (similar to a speed table).
- **In-pavement flashers** (remotely activated) accompanied by a flashing sign at the crosswalk and advanced flashing sign increase the number of vehicles yielding to pedestrians.



Overhead flashers with beacons

Level Three

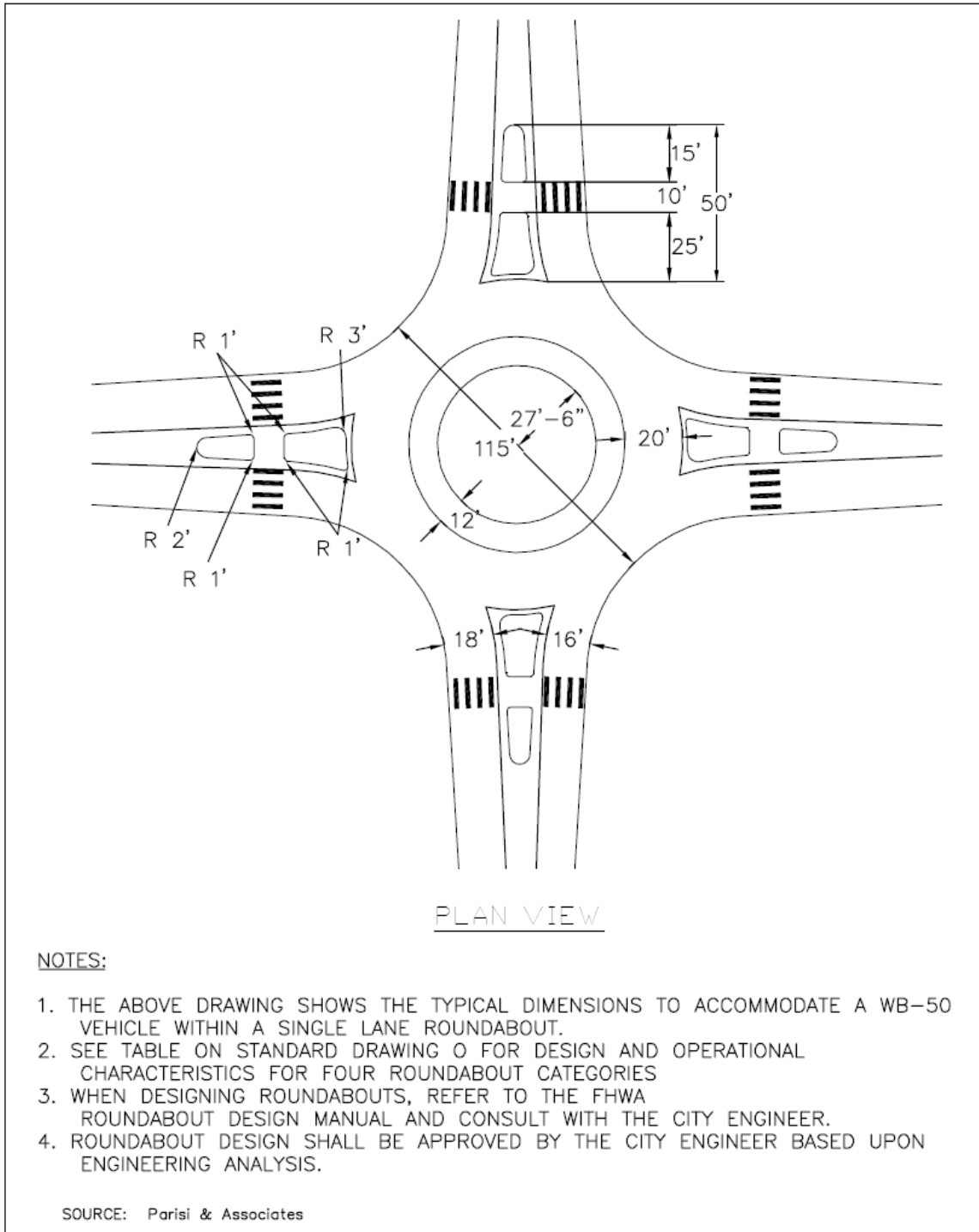
Pedestrian-actuated signals should be used where other methods are infeasible or ineffective.

At locations where none of the above solutions will mitigate safety concerns, or where pedestrian volumes warrant a pedestrian signal, but the signal would degrade vehicle LOS, consider the installation of a grade-separated crossing, if feasible.

Roundabouts

While roundabouts may improve traffic circulation and improve traffic safety, they do not necessarily provide optimum conditions for pedestrians. They create a difficult crossing situation for visually-impaired pedestrians because cars are usually not required to stop before entering the roundabout, and auditory cues may be confusing. On the other hand, roundabouts may reduce the number of conflict points between vehicles and pedestrians. The decision to install a roundabout should be made on a case-by-case basis, taking into consideration adjacent land uses and the volume and characteristics of pedestrians utilizing the crossings. The figure on the following page presents the recommended treatment for single lane roundabouts.

Figure 14: Accommodating Pedestrians at Roundabouts



Exceptions

The following situations are exceptions to the practice of marking crosswalks on all controlled approaches:

- **Crossing locations with heavy right- or left-turn volumes** that occur at the same time as pedestrians cross the path of the turning vehicle where protected signal phasing (such as left-turn arrows) or other solutions outlined above are infeasible.¹⁴
- **Intersections with inadequate sight distance¹⁵ of pedestrians.** Elimination of crosswalks in these instances should only occur after other solutions have been deemed infeasible.
- **Heavy or light rail crossings.** The California Public Utilities Commission (CPUC) is responsible for regulating at-grade crossings. The PUC no longer allows new at-grade crossings (pedestrians and cars crossing rail tracks) unless there are extraordinary circumstances.



Photo by Dave Campbell

Berkeley Bicycle and Pedestrian Bridge over I-80

¹⁴ Alternative pedestrian crossings should be identified and it may be necessary to install barrier treatments to reinforce that pedestrian should not cross at the location without a marked crosswalk

¹⁵ Unrestricted sight distance of pedestrians by motorists should be at least ten times the speed limit (for example, 250 feet for a street with a speed limit of 25 miles per hour.)

VII. Enhancing Walkability

This section includes recommendations for improving walkability, a more qualitative measurement of the pedestrian environment. Enhancing walkability should be a priority in pedestrian districts, or areas with multiple pedestrian trip generators, or destinations. Some examples of pedestrian trip generators include restaurants, parks, schools, transit centers, and employment centers. Factors affecting walkability include proximity of uses, the presence of buffers from traffic, and sidewalks that are wide enough to share comfortably with others.

Walkable communities have:

- Short block lengths – no longer than 500 feet with few exceptions.
- Frequent crossing opportunities – at least every 300 feet near pedestrian trip generators such as schools, parks, libraries, shopping centers, and hospitals.
- Different uses located within walking distance of one another – neighborhoods within ¼-½ mile of shopping centers and employment centers; all neighborhoods within ¼-½ mile of a transit stop.
- Frequent pedestrian amenities – benches, water fountains, newspaper racks with consistent design and placement in pedestrian districts.
- Wide sidewalks with buffer zones – sidewalks at least five-six feet wide with six-foot planting strips in pedestrian districts.
- Compact intersections – with short crossing distances and longer cycle lengths for pedestrians.
- Enhancements include street trees, pedestrian lighting, pedestrian-oriented building facades, and way-finding signage.

▪ Walkability Checklist

The checklist below is a summary of several items covered previously in this chapter. It could be used as a quick “pocket reference” for walkability.

- In areas with heavy pedestrian volumes that are designated “main streets”, provide sidewalks with 10’ walking area, 8’ planting strip, and 6’ frontage zone for street furniture (this exceeds the eight foot minimum mentioned previously and represents a recommendation).
- On arterials and major collectors, provide a minimum 5’ sidewalk with a minimum 6’ planter strip or buffer zone, especially in areas with no on-street parking. Five-foot sidewalk should be applied to all local/minor streets.
- In new development, keep block lengths 500 feet or shorter with frequent controlled intersections.
- In established neighborhoods and in school zones, consider speed humps, raised intersections at gateways, and other traffic calming devices to control speeds.
- In new developments, avoid cul-de-sacs or maintain passage for bicyclists and pedestrians to provide connections for non-motorized users.
- At actuated signals where pedestrian activation is registered for greater than 75% of the peak hour signal cycles, signals should accommodate pedestrian crossings in every peak period cycle.
- At locations that are not on a direct path to a generator with low side-street volumes, signals should be partially-actuated, meaning that pedestrians crossing the side streets get a WALK signal on every cycle, but pedestrians crossing the main street must use the pedestrian push button.

- At locations that do not satisfy the location warrants above, where peak hour vehicle congestion occurs and there are high vehicle volumes on all approaches, signals should be fully-actuated.
- Near special uses such as schools and senior centers where slower pedestrians are present, consider using remote pedestrian detection devices, such as video, infrared, or other detection technologies. The remote detection can be used to extend the pedestrian clearance interval allowing pedestrians still in the crosswalk additional time to finish their crossing.
- When pedestrian push buttons are used, they should be well-marked, visible, and accessible to all pedestrians from a flat surface consistent with recommendations from the U.S. Department of Transportation's Designing Sidewalks and Trails for Access.
- All new development should provide sidewalks that are at least 5 feet wide with planter strips that are at least 6 feet wide with vertical curbs along arterials and major collectors. In pedestrian districts where sidewalks are already established, developers could pay an in lieu fee for area-wide pedestrian improvements.
- Block lengths, especially in pedestrian districts, should be no longer than 500 feet.
- New intersections should minimize crossing distances for pedestrians, following the design guidelines for compact intersections.
- Free-right turn lanes should be minimized and used only when the demonstrated peak hour right-turning volume is 250 or greater.
- Turning radii for vehicles should be as tight as possible to minimize the speed of turning vehicles.
- New development should provide an internal pedestrian circulation plan that demonstrates a connection to the public sidewalk.
- New commercial development in pedestrian districts should have at least one major entrance on a public sidewalk.
- Front-on parking lots are discouraged, especially in pedestrian districts.
- Provide a high-visibility treatment at all uncontrolled crossing locations (uncontrolled crossing locations are mid-block sites and intersections without a signal or all-way stop) where a crosswalk is scheduled for installation. Choose a crossing treatment based on crosswalk guidelines that are a function of volume, speed, and number of lanes.

REFERENCES

Pedestrian Planning Resources

Design and Safety of Pedestrian Facilities, A Recommended Practice, 1998. Institute of Transportation Engineers, 525 School Street, S.W, Suite 410, Washington, DC 20024-2729, Phone: (202) 554-8050.

Pedestrian Compatible Roadways-Planning and Design Guidelines, 1995. Bicycle / Pedestrian Transportation Master Plan, Bicycle and Pedestrian Advocate, New Jersey Department of Transportation, 1035 Parkway Avenue, Trenton, NJ 08625, Phone: (609) 530-4578.

Improving Pedestrian Access to Transit: An Advocacy Handbook, 1998. Federal Transit Administration / WalkBoston. NTIS, 5285 Port Royal Road, Springfield, VA 22161.

Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas, Report No. 294A, Transportation Research Board, Box 289, Washington, DC 20055, Phone: (202) 334-3214.

Pedestrian Facilities Guidebook, 1997. Washington State Department of Transportation, Bicycle and Pedestrian Program, P.O. Box 47393, Olympia, WA 98504.

Portland Pedestrian Design Guide, 1998. Portland Pedestrian Program, 1120 SW Fifth Ave, Room 802; Portland, OR 97210. (503) 823-7004.

Implementing Pedestrian Improvements at the Local Level, 1999. FHWA, HSR 20, 6300 Georgetown Pike, McLean, VA.

Priorities and Guidelines for Providing Places for Pedestrians to Walk Along Streets and Highways, Federal Highway Administration, April 2000

Pedestrian Master Plan, City of Oakland 2002

Oregon Bicycle and Pedestrian Plan, 1995. Oregon Department of Transportation, Bicycle and Pedestrian Program, Room 210, Transportation Building, Salem, OR 97310, Phone: (503) 986-3555

Improving Conditions for Bicyclists and Pedestrians, A Best Practices Report, 1998. FHWA, HEPH 30, 400 Seventh Street SW, Washington, DC 20590.

Walkable and Bicycle-Friendly Communities, Burden, Dan, Florida Dept. of Transportation, 1996.

Improving Conditions for Bicycling and Walking: A Best Practices Report, U.S. Department of Transportation and Rails to Trails Conservancy, January 1998.

ADA-Related Design Resources

ADA Accessibility Guidelines for Buildings and Facilities, 1998 (ADAAG). U.S. Access Board, 1331 F Street NW, Suite 1000; Washington, DC 20004. (800) 872-2253.

Accessible Pedestrian Signals, 1998. U.S. Access Board 1331 F Street NW, Suite 1000; Washington, DC 20004. (800) 872-2253.

Accessible Rights of Way: A Design Manual, 1999. U.S. Access Board, 1331 F Street NW, Suite 1000; Washington, DC 20004. (800) 872-2253.

Designing Sidewalks and Trails for Access, Part One, 1999. FHWA, HEPH-30, 400 Seventh Street SW, Washington, DC 20590.

Uniform Federal Accessibility Standards, 1984 (UFAS), available from the U.S. Access Board, 1331 F Street NW, Suite 1000; Washington, DC 20004. (800) 872-2253

Universal Access to Outdoor Recreation: A Design Guide, 1993. PLAE, Inc, MIG Communications, 1802 Fifth Street, Berkeley, CA 94710. (510) 845-0953.

Recommended Street Design Guidelines for People Who Are Blind or Visually Impaired. American Council of the Blind, 1155 15th Street NW, Suite 720; Washington, DC 20005. (202) 467-5081.

Detectable Warnings: Synthesis of U.S. and International Practice, Bentzen, B.L., J.M. Barlow, and L.S. Tabor, U.S. Access Board, Washington, DC, 2000.

Trail Planning Resources

Trails for the 21st Century, 1993. Rails to Trails Conservancy, 1100 17th Street NW, 10th Floor, Washington DC 20036. (202) 331-9696.

Greenways: A Guide to Planning, Design, and Development, 1993. The Conservation Fund. Island Press, 1718 Connecticut Ave NW, Suite 300; Washington, DC 20009.

Trail Intersection Design Guidelines, 1996. Florida Department of Transportation, 605 Suwannee St., MS-82, Tallahassee, FL 32399--0450.

Pedestrian Design

Design and Safety of Pedestrian Facilities: A Recommended Best Practice, Institute of Transportation Engineers, 1998.

Pedestrian Safety Guidelines, City of Sacramento Public Works Department, 2003.

Caltrans Highway Design Manual, California Department of Transportation, 2001

Livable Streets, Appleyard, Donald, University of California Press, Berkeley, 1981.

Flexibility in Highway Design, Federal Highway Administration, Washington, DC, 1997.

The National Bicycling and Walking Study: Transportation Choices for a Changing America, Final Report and 24 Case Studies, Federal Highway Administration, Washington, DC, 1994. [Especially Case Study No. 19, "Traffic Calming, Auto-Restricted Zones and Other Traffic Management Techniques."]

Safety Effectiveness of Highway Design Features, Volume VI: Pedestrians and Bicyclists, Federal Highway Administration, Washington, DC, 1991.

Residential Street Design and Traffic Control, Wolfgang Hamburger et al., Institute of Transportation Engineers, Washington, DC, 1989.

The Traffic Safety ToolBox: A Primer on Traffic Safety, Institute of Transportation Engineers, Washington, DC, 1994.

Guidelines for the Design and Application of Speed Humps, ITE Traffic Engineering Council Speed Humps Task Force, Washington, DC, 1997.

Traffic Calming State of the Art, Institute of Transportation Engineers and the Federal Highway Administration, Washington, DC, August 1999.

Traditional Neighborhood Development: Street Design Guidelines, ITE Transportation Planning Council Committee, Washington, DC, 1997.

Great Streets, Jacobs, Allan, MIT Press, Cambridge, MA, 1994.

Pedestrian and Bicyclist Safety and Accommodation, National Highway Institute, U.S. Department of Transportation, Federal Highway Administration, and National Highway Traffic Safety Administration, Publication No. FHWA-HI-96-028, May 1996.

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