Field Investigation Form
Appendix A

PHOTO BY DAN BURDEN

The selection tool within the PEDSAFE expert system requires a number of inputs describing the geometrics and operations of the location in question. The system uses these inputs to refine the selection of applicable countermeasures. Included on the following page is a form that may be used in the field to acquire these data elements.

Pedestrian Safety Guide and Countermeasure Selection System
Field Investigation Form

Location:	**Completed by:**
	Date:

Area Type	
Urban CBD	
Urban Other	
Suburban	
Rural	

Location	
Intersection	
Mid-Block	

Roadway Functional Class	
Local	
Collector	
Minor Arterial	
Major Arterial	

Number of Through Lanes	
≤ 2 lanes	
3 - 4 lanes	
≥ 5 lanes	

Motor Vehicle Speed[A]
≤ 45 mph
> 45 mph

Traffic Volume (Average Daily Traffic)	
< 10,000	
10,000 to 25,000	
> 25,000	

Signalization	
Traffic signal present (removal is NOT an option)	
Traffic signal present (removal IS an option)	
No signal present (installation is NOT an option)	
No signal present (installation IS an option)	

Comments

Notes

[A] Use 85th percentile speed if available. If not available, add 9 mi/h to the posted speed limit as a surrogate measure for the 85th percentile speed. Prior research has shown that 85th percentile speeds for vehicle traveling on many urban and suburban streets (including arterial, collector, and local classifications) generally exceed the posted limit by 6 to 14 mi/h. (D.L. Harkey, H.D. Robertson, and S.E. Davis, "Assessment of Current Speed Zoning Criteria," Transportation Research Record 1281, Transportation Research Board, Washington, DC 1990.)

Case Study Matrix
Appendix B

PHOTO BY MICHAEL KING

Included on the following pages is a matrix that shows the specific countermeasures addressed by each of the 71 case studies included in Chapter 6.

Case Study		Countermeasures																																																		
Case Study #	Case Study Title	Total Applicable Countermeasures	1 Sidewalks and Walkways	2 Curb Ramps	3 Marked Crosswalks and Enhancements	4 Transit Stop Treatments	5 Roadway Lighting Improvements	6 Pedestrian Overpass/Underpass	7 Street Furniture	8 Adding Bicycle Lanes	9 Roadway Narrowing	10 Reducing Number of Lanes	11 Driveway Improvements	12 Raised Medians	13 One-way/Two-way Street Conversions	14 Curb Radius Reduction	15 Well Designed Right Turn Slip Lanes	16 Roundabouts	17 Modified T-Intersection	18 Intersection Median Barriers	19 Curb Extensions	20 Choker	21 Crossing Islands	22 Chicanes	23 Mini-Circles	24 Speed Hump	25 Speed Table	26 Raised Intersection	27 Raised Pedestrian Crossing	28 Gateways	29 Landscaping	30 Specific Paving Treatments	31 Serpentine Designs	32 Woonerf	33 Diverters	34 Full Street Closure	35 Partial Street Closure	36 Pedestrian Streets/Malls	37 Traffic Signals	38 Pedestrian Signals	39 Upgrade/Modify Pedestrian Signal Timing	40 Traffic Signal Enhancements	41 Right Turn on Red	42 Recessed Stop Lines	43 Add/Modify Signing	44 School Zone Improvements	45 Identify Neighborhood	46 Speed Monitoring Trailer	47 On-Street Parking	48 Pedestrian/Driver Education	49 Police Enforcement
1	Serpentine Street Design	8	•	•																	•					•					•	•	•												•						
2	55th Street Corridor Improvements	7	•					•		•													•				•	•	•																						
3	Park Road Restriping	5	•							•	•				•																														•						
4	Downtown Revitalization Partnership	9	•	•	•				•																							•										•			•				•		•
5	Accessibility During Construction	3	•	•																																									•						
6	Old Town Improvements	11	•		•		•		•												•		•	•							•	•	•																•		
7	Solutions from Citizen Input	10	•	•	•		•			•	•		•	•													•		•																						
8	Curb Extensions in Rural Village	6	•	•	•		•														•											•																			
9	Safe Routes to School Program	3	•																																											•				•	
10	High-Volume Pedestrian Crossings	5	•					•	•					•																	•																				
11	Small Town Traffic Calming	7	•				•					•									•	•										•																	•		
12	Park Trail Bridges	2	•					•																																											
13	Fifth Street Traffic Calming	13	•				•		•	•	•										•	•	•	•			•		•		•																		•		
14	Roundabout for Downtown Revitalization	6	•															•			•		•								•	•																			
15	Redesign for Streetcar Access	3	•		•						•																																								
16	Street Redesign for Revitalization	2																																								•									•
17	Bridgeport Way Corridor Improvement	5	•				•			•				•																	•																				
18	ADA Curb Ramps	1		•																																															
19	Large Intersection Solutions	5		•							•						•						•																			•									
20	Granite Street Traffic Calming	8		•	•																•						•	•	•			•							•												
21	Pedestrian-Friendly Redesign	3												•																	•																		•		
22	Berkshire Street Traffic Calming	8			•										•						•			•			•	•	•			•																			
23	Exclusive Pedestrian Phasing	4			•																																				•	•			•						
24	Main Street Redesign	9			•				•			•			•						•			•							•		•																•		
25	Illuminated Crosswalk	1			•																																														
26	Traffic Calming and Emergency Vehicles	4			•																	•	•			•																									
27	School Zone Improvements	5			•																																								•	•				•	•
28	Pedestrian Crossing Devices	2			•																																								•						
29	Gateway Treatments	6			•						•												•						•	•		•																			
30	Raised Crosswalk at School	8			•																•						•		•																•	•			•	•	
31	Speed Tables at BWI Airport	5			•																						•		•			•													•						
32	Trail Intersection Improvements	7			•					•			•								•		•																	•					•						
33	Safe School Route Mapping	4			•																																								•	•				•	
34	Staggered Median	1																								•																									
35	Curb Extensions for Transit Access	5			•							•	•								•																								•						
36	Double-Ladder Crosswalks	1			•																																														
37	Zebra Crosswalk Markings	3			•																																							•		•					
38	School Zone Traffic Calming	6			•																		•			•									•											•			•		
39	Third Street Promenade	5					•		•																						•	•						•													
40	Vermont Street Footbridge	1						•																																											

Case Study		Case Study	Countermeasures																								
Case Study #	Case Study Title	Total Applicable Countermeasures	1 Sidewalks and Walkways	2 Curb Ramps	3 Marked Crosswalks and Enhancements	4 Transit Stop Treatments	5 Roadway Lighting Improvements	6 Pedestrian Overpass/Underpass	7 Street Furniture	8 Adding Bicycle Lanes	9 Roadway Narrowing	10 Reducing Number of Lanes	11 Driveway Improvements	12 Raised Medians	13 One-way/Two-way Street Conversions	14 Curb Radius Reduction	15 Well Designed Right Turn Slip Lanes	16 Roundabouts	17 Modified T-Intersection	18 Intersection Median Barriers	19 Curb Extensions	20 Choker	21 Crossing Islands	22 Chicanes	23 Mini-Circles	24 Speed Hump	25 Speed Table
41	Greenway Pedestrian Bridge	2						•																			
42	Pfluger Pedestrian-Bicycle Bridge	1						•																			
43	Grade-Separated Trail Crossing	1						•																			
44	State Street Pedestrian Mall	4							•																		
45	Elm Street Traffic Calming	6												•										•			•
46	Leland Street Redesign	6														•					•		•	•			
47	Seventh Avenue Traffic Calming	8												•				•									•
48	Main Street Roundabout	2																•					•				
49	School Zone Roundabout	2																•									
50	Harold Street Traffic Calming	3																			•		•			•	
51	Curb Bulbouts with Bicycle Parking	1																			•						
52	Traffic Calming Program	6																			•		•			•	•
53	Chicanes for Traffic Control	2																			•			•			
54	Mid-Block Speed Table	5																				•					•
55	Emergency Vehicles and Traffic Calming	3																					•			•	
56	Neighborhood Traffic Circles	2																							•		
57	Speed Humps for Cut-Through Traffic	2			•															•							
58	Raised Intersection	3																									•
59	Woonerf-Style Developments	3																									
60	Wall Street Revitalization	2																									
61	Church Street Marketplace	2																									
62	Pedestrian Countdown Signals (1 of 2)	2																									
63	Pedestrian Countdown Signals (2 of 2)	2																									
64	Antimated Eyes Signal	1																									
65	Leading Pedestrian Interval (1 of 2)	3																									
66	Leading Pedestrian Interval (2 of 2)	2																									
67	Red Light Camera Enforcement	3																									
68	Red Light Photo Enforcement	11	•						•		•	•									•	•					
69	Advance Yield Markings	2																									
70	Radar Trailers in Neighborhoods	3																									
71	Neighborhood Speed Watch Programs	1																									

Case Study #	Case Study Title	26 Raised Intersection	27 Raised Pedestrian Crossing	28 Gateways	29 Landscaping	30 Specific Paving Treatments	31 Serpentine Designs	32 Woonerf	33 Diverters	34 Full Street Closure	35 Partial Street Closure	36 Pedestrian Streets/Malls	37 Traffic Signals	38 Pedestrian Signals	39 Upgrade/Modify Pedestrian Signal Timing	40 Traffic Signal Enhancements	41 Right Turn on Red	42 Recessed Stop Lines	43 Add/Modify Signing	44 School Zone Improvements	45 Identify Neighborhood	46 Speed Monitoring Trailer	47 On-Street Parking	48 Pedestrian/Driver Education	49 Police Enforcement
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44	State Street Pedestrian Mall									•	•	•													
45	Elm Street Traffic Calming		•		•	•																			
46	Leland Street Redesign			•			•																		
47	Seventh Avenue Traffic Calming	•	•	•	•	•																			
48	Main Street Roundabout																								
49	School Zone Roundabout																			•					
50	Harold Street Traffic Calming																								
51	Curb Bulbouts with Bicycle Parking																								
52	Traffic Calming Program		•								•														
53	Chicanes for Traffic Control																								
54	Mid-Block Speed Table		•																•				•		
55	Emergency Vehicles and Traffic Calming								•																
56	Neighborhood Traffic Circles				•																				
57	Speed Humps for Cut-Through Traffic																								
58	Raised Intersection	•	•																						
59	Woonerf-Style Developments						•	•			•														
60	Wall Street Revitalization							•				•													
61	Church Street Marketplace									•		•													
62	Pedestrian Countdown Signals (1 of 2)													•	•										
63	Pedestrian Countdown Signals (2 of 2)													•	•										
64	Antimated Eyes Signal													•											
65	Leading Pedestrian Interval (1 of 2)														•		•		•						
66	Leading Pedestrian Interval (2 of 2)														•	•									
67	Red Light Camera Enforcement															•						•			•
68	Red Light Photo Enforcement	•			•	•	•						•												
69	Advance Yield Markings																	•		•					
70	Radar Trailers in Neighborhoods																			•		•			•
71	Neighborhood Speed Watch Programs																								•

Recommended Guidelines / Priorities for Sidewalks and Walkways ○○ Appendix C

PHOTO BY DAN BURDEN

INTRODUCTION

According to the American Association of State Highway and Transportation Officials' (AASHTO) A Policy on Geometric Design of Highways and Streets (also known as "the Green Book"): "Providing safe places for people to walk is an essential responsibility of all government entities involved in constructing or regulating the construction of public rights-of-way."

It is a basic principle that there be well-designed, safe places for people to walk along all public rights-of-way. How this will be accomplished will depend upon the type of road, whether it is new construction or a retrofitted area, and funding availability.

On February 24, 1999, Federal Highway Administration (FHWA) Administrator Kenneth R. Wykle, in a memorandum to FHWA field offices, stated, "We expect every transportation agency to make accommodations for bicycling and walking a routine part of their planning, design, construction, operations, and maintenance activities." Again, in February 28, 2000, Administrator Wykle sent a memorandum to the field offices in transmitting the new Design Guidance Language called for in the Transportation Equity Act for the 21st Century (TEA-21). The guidance, entitled "Accommodating Bicycle and Pedestrian Travel: A Recommended Approach—A U.S. DOT Policy Statement on Integrating Bicycling and Walking Into Transportation Infrastructure," states that bicycling and walking facilities will be incorporated into all transportation projects unless "exceptional circumstances" exist. The exceptional circumstances are spelled out, and he asked the division offices to work with State departments of transportation (DOTs) in the implementation of the guidance.

Government agencies at the State, regional, and local level are developing regulations for funding, installing, and retrofitting sidewalks. Because there is a great need to improve sidewalk facilities, it is important for these transportation agencies to direct funding to sidewalk improvement and installation projects that will be most beneficial to the safety and mobility of all citizens.

This document is intended to provide agencies at the State, regional, and local levels with tools they can use to develop guidelines for creating places for people to walk.

This document is limited to creating guidelines for sidewalks, which addresses only one major pedestrian need; other needs that merit further consideration include the ability to cross a street and intersection design.

BASIC PRINCIPLES

Many communities may wish to revisit their roadway planning and rehabilitation criteria. Policies, standard plans, subdivision regulations, and right-of-way requirements should be considered to make sure that sidewalks are included in new construction and rehabilitation projects.

A. GOALS AND OBJECTIVES

Typically, communities should focus on: (1) improving conditions for people who are currently walking (including improved accessibility to sidewalk facilities for pedestrians with disabilities), (2) increasing levels of walking, and (3) reducing the number of crashes involving pedestrians. Setting targets will help in the development of criteria for installing and retrofitting sidewalks.

B. PEDESTRIAN FACILITIES

There are several ways in which pedestrians can be accommodated in the public right-of-way:

1. **Sidewalks**— Sidewalks, provided on both sides of a street, are generally the preferred pedestrian facility. They provide the greatest degree of comfort for pedestrians and the presence of sidewalks has been associated with increased safety for pedestrians. The Uniform Vehicle Code defines a sidewalk as that portion of a street between the curb lines, or the lateral lines of a roadway, and the adjacent property lines, intended for use by pedestrians. In most cases, sidewalks are paved, usually in concrete. To comply with Federal Americans with Disabilities Act (ADA) guidelines, newly constructed sidewalks must be accessible to people with disabilities.

2. **Off-Road Paths**— An off-road path—paved or unpaved—can be an appropriate facility in rural or low-density suburban areas. Paths are generally set back from the roads and separated by a green area or trees. Paths can be flexible in that they can deviate from the exact route of a road in order to provide more direct access for key destinations. Paths that generally follow the roadway alignment are sometimes known as "side paths."

3. **Shoulders**— Wide shoulders on both sides of a road are the minimum requirement for providing at least a possible place for people to walk. They are not as safe as paths or sidewalks, but they are better than nothing. Shoulders are also beneficial for motorists and bicyclists, and future sidewalks or paths should be created in addition to, not to replace the shoulders.

4. **Shared Streets**— In very limited unusual circumstances, it may be possible to allow shared use of a street for people walking and driving. These are usually specially designed spaces such as pedestrian streets or "woonerfs," and guidelines for developing these kinds of places can be found elsewhere in the FHWA's Pedestrian Facilities Users Guide: Providing Safety and Mobility.

C. NEW CONSTRUCTION AND RETROFITTING

Places for people to walk should be provided in all new construction. Retrofitting will require priorities to be set, and these guidelines are intended to help identify where the need is greatest for adding sidewalks and other facilities.

NEW CONSTRUCTION

A. NEW SIDEWALK INSTALLATION

All new construction must include places for people to walk, on both sides of a street or roadway. New construction in urban and suburban areas should provide sidewalks. Recommended guidelines for new sidewalk and walkway installation are given in Table 1 on the following page.

B. PHASED DEVELOPMENT OF SIDEWALKS

In developing areas and rural areas, it may be acceptable—although less desirable—to start with shoulders and unpaved paths and then phase in sidewalks as development accelerates. Criteria for installing sidewalks along with new development should be implemented with the following in mind:

1. **Space for Future Sidewalks**— Space for future sidewalks must always be secured and/or reserved when a new right-of-way is being created or an existing one is being developed. If roadways are to be widened, additional right-of-way must be acquired; existing sidewalks should not be narrowed to accommodate a wider roadway.
2. **"Triggers" for Future Sidewalks**— In rural settings, if sidewalks are not installed at the time of development, guidelines are needed to determine when sidewalks will be required and how they will be funded. For example, sidewalks might be required on residential streets once an area has a density of more than four dwelling units per acre and on arterial streets once they are within a school walking zone or have transit service.
3. **Funding for Future Sidewalks**— If sidewalks are not installed at the time of development, there need to be clear regulations as to who (developer, property owners, or governmental agency) will pay for the sidewalks. Whoever is paying for the road must pay for the sidewalk. If there is money for a road, there is money for a sidewalk. Developer contributions to sidewalks must be set aside in an account at the time of development.

C. RETAINING RURAL CHARACTER

There is a desire in some residential developments to retain a rural atmosphere. Very often this occurs in places that are not truly rural, but rather suburban or exurban (they may have been rural before being developed). Frequently, it is in such places that pedestrian crashes occur that are directly attributable to pedestrians not having places to walk. To address both the goal of having safe places to walk and that of the community to retain a certain atmosphere, path systems can be developed that do not look like traditional sidewalks, but do meet walking needs. Even in rural areas, people do want to walk and such facilities should be provided.

Developers in outlying areas may argue that the land use will never fully develop into a pedestrian area. Given that people walk despite not having facilities—for exercise, going to friends' houses, accessing transit, etc.—it is neither rational nor acceptable to build places that do not have places for people to walk. Residential developments that were added in suburban areas, until recently, typically had sidewalks and functioned very well.

Sidewalks may not be needed on short residential cul-de-sacs (61 m [200 ft] or less), if there is a system of trails behind the houses and driveway aprons are properly constructed for pedestrians with disabilities. However, it is not a good practice to have an entire neighborhood without sidewalks.

D. SIDEWALK CONTINUITY

Sidewalks should be continuous; interruptions may require pedestrians to cross a busy arterial street midblock or at an unsignalized location to continue walking. Sidewalks should also be fully accessible to side streets and adjacent sidewalks and buildings.

RETROFITTING SIDEWALKS

Many of the streets built in recent decades do not have sidewalks, and these streets need to be retrofitted. In other cases, existing sidewalks need to be replaced.

Table 1. Recommended Guidelines for New Sidewalk/Walkway Installation.

Roadway Classification and Land Use	Sidewalk/Walkway	Future Phasing Requirements
Rural Highways (< 400 ADT)	Shoulders preferred, with minimum of 0.9 m (3 ft).	Secure/preserve right-of-way (ROW) for future sidewalks.
Rural Highways (400 to 2,000 ADT)	1.5-m (5-ft) shoulders preferred, minimum of 1.2 m (4 ft) required.	Secure/preserve ROW for future sidewalks.
Rural/Suburban Highway (ADT > 2,000 and less than 1 dwelling unit (d.u.) / .4 hectares (ha) [1 d.u. / acre])	Sidewalks or side paths preferred. Minimum of 1.8-m (6-ft) shoulders required.	Secure/preserve ROW for future sidewalks.
Suburban Highway (1 to 4 d.u. / .4 ha [1 to 4 d.u. / acre])	Sidewalks on both sides required.	
Major Arterial (residential)	Sidewalks on both sides required.	
Urban Collector and Minor Arterial (residential)	Sidewalks on both sides required.	
Urban Local Street (residential — less than 1 d.u. / .4 ha [1 d.u. / acre])	Sidewalks on both sides preferred. Minimum of 1.5-m (5-ft) shoulders required.	Secure/preserve ROW for future sidewalks.
Urban Local Street (residential — 1 to 4 d.u. / .4 ha [1 to 4 d.u. / acre])	Both sides preferred.	Second side required if density becomes greater than 4 d.u. / .4 ha (4 d.u. / acre) or if schools, bus stops, etc. are added.
Local Street (residential — more than 4 d.u. / .4 ha [4 d.u. / acre])	Sidewalks on both sides required.	
All Commercial Urban Streets	Sidewalks on both sides required.	
All Streets in Industrial Areas	Sidewalks on both sides preferred. Minimum of 1.5-m (5-ft) shoulders required.	

1 acre = 0.4 hectares (ha)

Establishing priorities for installing sidewalks involves three steps: (1) develop a prioritized list of criteria, (2) develop a methodology for using the criteria to evaluate potential sites, and (3) create a prioritized list of sites for sidewalk improvements.

A. CRITERIA

The following are suggested criteria for establishing priorities. Select three or more of them when developing your own set of criteria. The key is to select criteria that produce the outcomes desired for your community:

1. **Speed**— There is a direct relationship between speed and the number and severity of crashes; high-speed facilities may rank higher if speed is a criterion.

2. **Street Classification**— Arterial streets should take precedence because they generally have higher pedestrian use (due to more commercial uses), have a greater need to separate pedestrians from motor vehicles (due to higher traffic volumes and speeds), and are the main links in a community.

3. **Crash Data**— Pedestrian crashes seldom occur with high frequency at one location, but there are clearly locations where crashes occur due to a lack of sidewalks. Usually, there is a pattern of pedestrian crashes up and down a corridor, indicating a need to provide sidewalks throughout, not just at crash locations.

4. **School Walking Zones**— School walking zones typically extend from residential areas to an elementary school. Children are especially vulnerable, making streets (especially arterials) in these zones prime candidates for sidewalk retrofitting.

5. **Transit Routes**— Transit riders need sidewalks to access transit stops. Arterials used by transit are prime candidates for sidewalk retrofitting.

6. **Neighborhoods With Low Vehicle Ownership**— Twenty percent of the U.S. population has a disability and 30 percent of our population does not drive. Walking is the primary mode of transportation for many of the people in this country. People with disabilities live throughout the community. If they are not seen in the community, it may be due to the fact that adequate facilities are not provided. In addition, car ownership is lower and crash rates are often higher in low- and moderate-income neighborhoods with lots of children. Therefore, some locations with high pedestrian use (neighborhoods with more children and elderly persons and where vehicle ownership is low) should be given special consideration for sidewalks.

7. **Urban Centers/Neighborhood Commercial Areas**— Areas of high commercial activity generate high pedestrian use, even if they are primarily motorists who have parked their car. Sidewalks are needed to improve safety and enhance the economic viability of these areas.

8. **Other Pedestrian Generators**— Hospitals, community centers, libraries, sports arenas, and other public places are natural pedestrian generators where sidewalks should be given priority.

9. **Missing Links**— Installing sidewalks to connect pedestrian areas to each other creates continuous walking systems.

10. **Neighborhood Priorities**— Local residents may have a sense of where the most desirable walking routes exist. Neighborhood groups or homeowners associations can provide a prioritized list of locations where they see a need for sidewalks. Agencies should be cautious about using this criterion, as it is not desirable to let neighborhood pressure override addressing a key safety concern. However, it may be useful to monitor requests from pedestrians with disabilities.

B. METHODOLOGY

The two recommended methodologies for selecting locations for improvements are: (1) the overlapping priorities method, and (2) the points method. Establishing priorities should consume only a small percentage of a program budget—the level of effort put into prioritization should be proportionate to the size of the capital budget.

There is no single right way to select which criteria to use when developing priorities. The criteria and methodology should balance safety measures, such as vehicle speeds and pedestrian crash data; pedestrian usage measures, such as proximity to schools or commercial areas; continuity between origins and destinations; and accessibility for pedestrians with disabilities.

1. **Overlapping Priorities Method**— The easiest and cheapest way to identify overlapping priorities is through graphical representation; the intent is to identify locations that meet multiple criteria. This methodology is especially useful in cases where there is not a lot of staff time and funding for detailed analysis. It can be accomplished using a GIS system or it can be done by hand.

   The best way to describe this methodology is by example. Assume that priorities are going to be

developed based on transit routes, proximity to schools, people with disabilities, and neighborhood commercial areas. Start with a map of your jurisdiction. Using a color pen, identify those arterials that have high transit use; draw a half-mile circle around every elementary school and around locations that attract people with disabilities; and color in the neighborhood commercial areas. This visual approach will make areas of overlapping priorities become immediately clear. The streets without sidewalks within the overlapping areas are the highest priority for retrofitting sidewalks.

2. **Points Method**— A weighted points system can be used where staff time and funding are available for more detailed analysis, or if there is a large amount of capital available for sidewalk construction. If there are a lot of competing projects, a more sophisticated point system can be used to explain to the public why certain projects were funded and others were not.

   A point system can be developed in many ways; the system should be simple and produce desired outcomes. Any and all of the criteria listed above can be assigned a range of numbers and then be used to analyze the need for improvement at given locations. For example, a corridor could be assigned points based on the number of "walking along roadway" crashes over a 5-year period, the number of buses that travel the corridor during peak times, and the proximity to elementary schools. This method is time-consuming because it will be necessary to analyze multiple locations with sidewalk needs to create a list of priority projects.

3. **Prioritized List**— Both the overlapping priorities and the points methods will produce an initial list of prioritized projects. The next step is to refine the list so that it works, using common sense. One important consideration is that when roadways are resurfaced, rehabilitated, or replaced, curb ramps must be added if there are pedestrian walkways. In addition, the U.S. Department of Justice considers bus stops to be pedestrian walkways requiring access for people with disabilities, so areas near

Seattle Example

Seattle recently completed an inventory of all sidewalks in the city using a three-step process:

1. An intern was hired to review aerial photographs to determine whether a sidewalk existed. This information was then recorded as a new layer on the existing GIS street database.
2. The intern field-checked all locations where there was some uncertainty regarding the presence of a sidewalk (about 10 percent of the aerial photographs were not clear).
3. Each of 13 neighborhood groups that cover the city were given a draft copy of the inventory and were asked to check for errors.

The total effort took the equivalent of one full-time person working for 6 months in a city of 530,000 population, 218.3 km^2 (84.3 mi^2) of land use and 2,659 roadway kilometers (1,652 roadway miles) [1,934 residential street kilometers (1,202 residential street miles) and 724 arterial kilometers (450 arterial miles)]. Once the inventory was completed, the information was combined on a map with three other types of information:

1. School Walking Zones: A colored circle identified a half-mile area around each school.
2. Pedestrian Generators: A second color was used to identify a half-mile area around key pedestrian generators, such as hospitals, libraries, and community centers.
3. Neighborhood Commercial Areas: A third color was used to identify the dozen neighborhood commercial areas in Seattle (about one for each of the major neighborhood areas).

Once the map was printed, it was very easy to see where the three colors overlapped, two colors overlapped, etc. The final step was to have the computer calculate the sidewalk deficiencies in the overlapping areas. They found, for example, that there were less than 3 km (2 mi) of arterial streets that were within school walking zones, a pedestrian generator area, and a neighborhood commercial area that did not have sidewalks on either side of the street.

There were nearly 4.8 km (3 mi) of arterial streets that were within school walking areas, but outside of neighborhood commercial areas and pedestrian generators that did not have sidewalks on either side of the street. This was compared to a citywide deficiency of more than 32 km (20 mi) of arterial streets that lacked sidewalks on both sides of the street.

By developing these and other numbers, the pedestrian program was able to put together packages of information that demonstrated what could be accomplished with additional funding. What everyone thought to be an unsolvable multi-million-dollar problem was reduced to a series of smaller, fundable projects that decisionmakers could endorse. The result was increased funding and a new optimism that meaningful progress could be made on solving Seattle's sidewalk deficiencies.

transit should be given priority accordingly. Improving pedestrian crossings, particularly on arterial streets, may also be an important part of some projects. Other important questions include: Are priority locations ones that might be expected? Are there many surprises? Are priority locations in line with community priorities and expectations? Are some priorities at locations with very low pedestrian use? If the answer to these questions is "yes," then the criteria or the methodology should be evaluated and possibly revised to create outcomes that better reflect expectations and desires. The methodologies should be used to prioritize known needs, not to create a new set of priorities that don't make sense.

The final step is to create packages of fundable projects. The prioritization process should result in reasonable packages that decision-makers can embrace and support. For example, it may be possible to install sidewalks on both sides of every arterial within a half-mile of every elementary school for $5 million over a period of 5 years. Or, it may be possible to replace sidewalks in neighborhood commercial areas for $2 million over a period of 3 years. The objective is to take what may appear to be an unsolvable problem (endless need for more funds) and to package it in such a way that it begins to address some of the most critical pedestrian needs in a community.

SIDEWALK DESIGN GUIDELINES

SIDEWALK PLACEMENT IN LARGE AND SMALL CITIES

Continuous sidewalks should be placed along both sides of all fully improved arterial, collector, and local streets in urban and suburban areas. Sidewalks should connect to side streets and adjacent buildings. Accessible crossings should be provided across median islands, frontage road medians, and other raised islands.

SIDEWALKS, WALKWAYS, AND SHOULDERS IN RURAL AREAS

A safe walking area must be provided outside the motor vehicle traffic travelway. Sidewalks along rural roads should be well separated from the travelway. Isolated residential areas should have a pedestrian connection to the rest of the rural community for school access, shopping, and recreational trips.

An off-road path—also known as a "side path"—is a type of walkway used in some rural settings. This path may be paved or unpaved, and is separated from the roadway by a grass or landscaped strip without curbing. This maintains a rural look, but is safer and more comfortable than a shoulder.

A paved or unpaved shoulder should be provided as a minimum along the road. Paved shoulders are preferred to provide an all-weather walking surface, since they also serve bicyclists and improve the overall safety of the road. A 1.5-m- (5-ft-) wide shoulder is acceptable for pedestrians along low-volume rural highways. Greater width, up to 2.4 to 3.0 m (8 to 10 ft), is desirable along high-speed highways, particularly with a large number of trucks. An edgeline should be marked to separate the shoulder from the travelway.

SIDEWALK WIDTH

The width of a sidewalk depends primarily on the number of pedestrians who are expected to use the sidewalk at a given time — high-use sidewalks should be wider than low-use sidewalks. "Street furniture" and sidewalk cafes require extra width, too. A sidewalk width of 1.5 m (5 ft) is needed for two adult pedestrians to comfortably walk side-by-side, and all sidewalks should be constructed to be at least this width. The minimum sidewalk widths for cities large and small are:

Local or collector streets	1.5 m (5 ft)
Arterial or major streets	1.8 to 2.4 m (6 to 8 ft)
CBD areas	2.4 to 3.7 m (8 to 12 ft)*
Along parks, schools, and other major pedestrian generators	2.4 to 3.0 m (8 to 10 ft)

*2.4-m (8-ft) minimum in commercial areas with a planter strip, 3.7-m (12-ft) minimum in commercial areas with no planter strip.

These widths represent a clear or unobstructed width. Point obstructions may be acceptable as long as there is at least 914 mm (36 in) for wheelchair maneuvering (no less than 1,219 mm (48 in) wide as a whole); however, every attempt should be made to locate streetlights, utility poles, signposts, fire hydrants, mail boxes, parking meters, bus benches, and other street furniture out of the sidewalk. When that is not possible, sidewalk furnishings and other obstructions should be located consistently so that there is a clear travel zone for pedestrians with vision impairments and a wider sidewalk should be provided to accommodate this line of obstructions.

Similarly, when sidewalks abut storefronts, the sidewalk should be built 0.6 m (2 ft) wider to accommodate window-shoppers and to avoid conflicts with doors opening and pedestrians entering or leaving the buildings.

Many 1.2-m (4-ft) sidewalks were built in the past. This width does not provide adequate clearance room or mobility for pedestrians passing in opposite directions. All new and retrofitted sidewalks should be 1.5 m (5 ft) feet or wider.

SIDEWALK BUFFER WIDTH

Buffers between pedestrians and motor vehicle traffic are important to provide greater levels of comfort, security, and safety to pedestrians. Landscaped buffers provide a space for poles, signs, and other obstructions; they serve as a snow storage area; and they protect pedestrians from splash. The ideal width of a planting strip is 1.8 m (6 ft). Minimum allowable landscape buffer widths are:

Local or collector streets	0.6 to 1.2 m (2 to 4 ft)
Arterial or major streets	1.2 to 1.8 m (4 to 6 ft)

With a landscaped buffer between the sidewalk and the street, care must be taken to ensure that the bus stops are fully accessible to wheelchair users and have connections to the sidewalk. Irrigation may be needed in areas of low precipitation.

Buffers also provide the added space to make curb ramps and landings accessible. When the ramps and landings are designed properly, they are also better utilized by those pushing strollers or pulling carts and luggage.

If a planting strip is not provided between the sidewalk and roadway, then the sidewalk width should be a minimum of 1.8 m (6 ft).

Where landscaped sidewalk buffers cannot be provided due to constraints, on-street parking, a shoulder, or a bike lane can serve to buffer pedestrians from motor vehicle traffic lanes.

SIDEWALK SURFACE

Concrete is the preferred sidewalk surface, providing the longest service life and requiring the least amount of maintenance. Asphalt is an acceptable walkway surface in rural areas and in park settings, and crushed granite may also be an acceptable all-weather material in parks or rural areas, but they generally require higher levels of maintenance and are less desirable for wheelchair users.

Sidewalks may be constructed with bricks and pavers if they are constructed to avoid settling; bricks should be easy to reset or replace if they cause a tripping hazard. Also, bricks and/or pavers can cause vibrations that are painful for pedestrians who use mobility aids and, therefore, it may be appropriate to use bricks or pavers only for sidewalk borders in certain situations. There are stamping molds that create the visual appearance of bricks and pavers; these have the advantages of traditional concrete without some of the maintenance issues and roughness associated with bricks and pavers. There are commercially available products that produce a variety of aesthetically pleasing surfaces that are almost impossible to distinguish from real bricks and pavers. However, stamped materials can also have maintenance issues, since, for example, the sidewalk may never look the same again after repairs are made.

It is also possible to enhance sidewalks aesthetics while still providing a smooth walking surface by combining a concrete main walking area with brick edging where street furniture (lights, trees, poles, etc.) can be placed. For example, in a CBD, a 4.6-m (15-ft) total sidewalk width might include a 2.4-m (8-ft) clear concrete sidewalk with a 2.1-m (7-ft) edge.

SIDEWALK GRADE AND CROSS-SLOPES

Sidewalks should be built to accommodate all pedestrians and should be as flat as practical. Sidewalks should be held to a running grade of 5 percent or less, if possible. However, sidewalks that follow the grade of a street in hilly terrain cannot meet this requirement, for obvious reasons, and may follow the grade of the street. The maximum grade for a curb ramp is 1:12 (8.3 percent).

The maximum sidewalk cross-slope is 1:50 (2 percent) to minimize travel effort for wheelchair users and still provide drainage. At least 0.9 m (3 ft) of flat sidewalk area is required at the top of a sloped driveway to accommodate wheelchair use. In some cases, it may be necessary to bend the sidewalk around the back of the driveway to achieve a level surface of 0.9 m (3 ft).

CURB RAMPS

Curb ramps must be provided at all intersection crossings (marked or unmarked) and midblock crosswalks for wheelchair access. These ramps also accommodate strollers, carts, the elderly, and pedestrians with mobility limitations. Curb ramps should be as flat as possible, but must have a slope no greater than 1:12 (8.3 percent). Abrupt changes in elevation at the top or bottom should be avoided. The minimum curb ramp width is 914 mm (36 in); however, 1,219 mm (48 in) is the desirable minimum. If a curb ramp is located where pedestrians must walk across the ramp, the ramp must have flared sides of no more than 1:10 (10 percent) slope. These flares are not needed where ramps are placed in a landscaped area. Curb ramps also require a minimum of 914 mm (36 in)

of level and clear passage (1,219 mm (48 in) or more are desirable) at the top.

Two separate curb ramps, one for each crosswalk, should be provided at each corner of an intersection. Diagonal curb ramps provide no directional guidance to vision-impaired pedestrians, and force wheelchair users to maneuver in the crosswalk. Raised islands in a crossing must have at least a 1,219-mm (48-in) cut-through that is level with the street; this is generally preferable to curb ramps, which force wheelchair users to go up and down.

OBSTACLES ALONG THE SIDEWALK

The distance to the bottom of signs placed in or right next to a sidewalk should be at least 2 m (7 ft) above the sidewalk surface to avoid injury to pedestrians. Bushes, trees, and other landscaping should be maintained to prevent encroachment into the sidewalk. Jurisdictions should adopt ordinances requiring local property owners to trim the landscaping they place along their frontage to maintain clear and unobstructed sidewalks. The jurisdictions should provide an inspection procedure or a system of responding to sidewalk encroachment and maintenance complaints.

Guy wires and utility tie-downs should not be located in or across sidewalks at heights below 2 m (7 ft). When placed adjacent to sidewalks or pedestrian walkways, the guy wires should be covered with a bright yellow (or other high-visibility) plastic guard to make the wire more visible to pedestrians. Guy wires of any color will not be visible to blind pedestrians and must not be located within the pedestrian route. Other obstacles include signal controller boxes, awnings, temporary signs, newspaper racks, fire hydrants, and similar items.

ACCESSIBILITY

The easiest way to visualize accessibility requirements (grade, cross-slope, and clear width) is with the concept of a "continuous passage." Sidewalks must provide a continuous route at a 2 percent maximum cross-slope at a minimum width of 0.9 m (3 ft). This does not mean that 0.9 m (3 ft) is an acceptable sidewalk width, just that at no point shall the level area be less than 0.9 m (3 ft) wide; this applies mainly at obstructions, driveways, and curb ramps.

SNOW

Municipalities that do not remove snow on sidewalks should have an ordinance requiring property owners to clear the snow and keep the sidewalks accessible to pedestrians. When the latter is the case, municipalities should educate property owners as to why this is important and have enforcement efforts in place to ensure compliance.

BUS STOPS AND SHELTERS

It is generally preferable to place bus shelters between the sidewalk and the street, or between the sidewalk and adjacent property, so that waiting passengers do not obstruct the flow of pedestrians along the sidewalk. Benches and other street furniture should be placed outside the walking paths to maintain the accessibility of the walkway and to provide good pedestrian service. In addition, curb ramps should be provided at bus stops because it is not always possible for the bus to pull close enough to the curb to deploy a lift.

LIGHTING

Good street lighting improves the visibility, comfort, and security of pedestrians. In urban areas, it is important to light at least the intersections and other pedestrian crossing areas. Lighting is also recommended in areas where there is a high concentration of nighttime pedestrian activity, such as churches, schools, and community centers. Where continuous lighting is provided along wide arterial streets, it is desirable to place the lights along both sides of the street. Continuous streetlights should be spaced to provide a relatively uniform level of light. In shopping districts or in downtown areas with high concentrations of pedestrians, it is desirable to provide pedestrian-level lighting in addition to the street lighting to improve the comfort and security of pedestrians. The preferred pedestrian-level lights are mercury vapor or incandescent. Low-pressure sodium lights may be more energy-efficient; however, they are undesirable because they create considerable color distortion. Pedestrian-level lighting may also be installed in selected areas of pedestrian activity to create a sense of intimacy and place.

OTHER DESIGN CONSIDERATIONS

Sidewalks should be built within the public right-of-way or in a sidewalk easement along the right-of-way. This will provide access to the sidewalk for maintenance activities and will prevent the adjacent property owners from obstructing or removing the sidewalk in the future.

Care must be taken to avoid planting trees or large bushes in the landscape buffer area that will obscure the visibility between a pedestrian attempting to cross or enter a street and an approaching motorist. Trees with large canopies planted between the sidewalk and street should be generally trimmed up to at least 2.4 m (8 ft) high and bushes should be kept to about 762 to 914 mm (30 to 36 in) in height. Trees with large caliper trunks may not

be appropriate near intersections and in other situations where they may block visual sight triangles.

Meandering sidewalks are sometimes used where a wide right-of-way is available and there is a desire to provide a high level of landscaping, such as in a park or along a waterway or other natural feature. It is often believed that meandering sidewalks create a more pleasant walking environment. The reality is that they unnecessarily create a longer walking distance and are inappropriate for sidewalks along a street.

Sidewalks should be built along both sides of bridges. Pedestrian rails or guard rail are required along the outside of the bridge. On bridges with high speeds, concrete barriers between the travelway and the sidewalk may be considered to shield pedestrians from errant vehicles. However, this adds cost, weight, and width to the bridge, and the transition from barrier to guard rail or curb at each end often creates an awkward transition for pedestrians, who must detour around the barrier to access the bridge sidewalk.

Rollover curbs should not be used next to sidewalks as they encourage motorists to park on planting strips or sidewalks. They may be problematic for some visually impaired people, since they don't create a definitive edge between the street and adjacent uses.

Sidewalk Depth: Concrete sidewalks should be built to a minimum depth of 101.6 mm (4 in), and to a minimum depth of 152.4 mm (6 in) at driveways.

SIDEWALK COST CONSIDERATIONS

The actual cost of providing sidewalks will be different for each region of the country and varies with the season. Actual bid prices are also influenced by how busy contractors are at the time of construction.

The cost of constructing sidewalks alone is relatively low; typical bids run between $24 and $36 per meters squared ($20 to $30 a square yard), which roughly translates to $43 to $64 per lineal meter ($12 to $20 per lineal foot) for 1.8-m- (6-ft-) wide sidewalks. Therefore, sidewalks on both sides of the roadway can run roughly between $93,000 and $155,000 per kilometer ($150,000 and $250,000 per mile) (costs from Oregon DOT, 1999).

Factors to consider when calculating the cost of sidewalks:

1. Presence of curb and gutter: The costs of providing curb and gutter, which presumes the need to also provide a street drainage system, run much higher than the cost of sidewalk alone. A standard perpendicular curb ramp and top landing need a minimum border width of almost 3.7 m (12 ft) at intersections if there is a 152.4-mm (6-in) curb. A 152.4-mm (6-in) curb reduces the minimum border width to 3 m (10 ft). Yet, on many urban streets, this work must be performed prior to installing sidewalks. If this is the case, only the cost of sidewalks and curb ramps should be attributed to expenditures for pedestrians – catch basins are provided to drain the roadway surface used by motor vehicle traffic.
2. Number of driveways: To comply with ADA, many existing driveways must be replaced with ones that provide a level passage at least 0.9 (3 ft) wide. It can also be advantageous to inventory all existing driveways to see if any can be closed, resulting in a cost-savings.
3. Number of intersections: While intersections represent a reduction in the sidewalk, curb ramps are required where sidewalks cross intersections and the cost of providing additional traffic control at each intersection should be considered.
4. Obstacles to be removed: The cost for moving or removing obstacles such as utility poles, signposts, and fire hydrants vary too much to be itemized here; however, they are required to be moved if they obstruct access. These costs must be calculated individually for each project.
5. Structures: While minor sidewalk projects rarely involve new structures such as a bridge, many projects with significant cuts and fills may require retaining walls and/or culvert extensions. The costs of retaining walls must be calculated individually for each project.
6. Right-of-way: While most sidewalk projects can be built within existing rights-of-way (especially infill projects), some may require some right-of-way easement. An alternative to acquiring right-of-way is to narrow the roadway, which should consider the needs of bicyclists (e.g., through bike lanes or shoulders, at a minimum of 1.5 m (5 ft).
7. Miscellaneous factors: Planters, irrigation, benches, decorative lampposts, and other aesthetic improvements cost money, but they are usually well worth it if the impetus for the project is to create a more pleasant and inviting walking environment.

When project costs appear to be escalating due to one or more of the above-listed items, especially retaining walls

or acquiring right-of-way, consideration may be given to narrowing the sidewalk in constrained areas as a last resort. The full sidewalk width should be resumed in non-constrained areas—this is preferable to providing a narrow sidewalk throughout, or dropping the project because of one difficult section.

Tips to Reduce Total Costs:

1. Stand-alone vs. integrated within another project: Sidewalks should always be included in road construction projects. Stand-alone sidewalk projects cost more than the same work performed as part of a larger project. Sidewalks can be piggybacked to projects such as surface preservation, water or sewer lines, or placing utilities underground. Besides the monetary savings, the political fallout is reduced, since the public doesn't perceive an agency as being inefficient (it is very noticeable if an agency works on a road, then comes back to do more work later). The reduced impacts on traffic are a bonus to integration.

2. Combining Projects: A cost-savings can be achieved by combining several small sidewalk projects into one big one. This can occur even if the sidewalks are under different jurisdictions, or even in different localities, if they are close to each other. The basic principle is that bid prices drop as quantities increase.

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Recommended Guidelines for Crosswalk Installation

Appendix D

PHOTO BY CARA SEIDERMAN

Guidelines and Caveats

Other Treatments

References

These guidelines were developed in an FHWA report entitled Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations.(1) This report may be found at: www.walkinginfo.org/rd/devices.htm. In developing these proposed U.S. guidelines for marked crosswalks and other pedestrian measures, consideration was given not only to the research results in this study, but also to crosswalk guidelines and related pedestrian safety research in Australia, Canada, Germany, Great Britain, Hungary, The Netherlands, Norway, and Sweden (see references 2-8).

Marked crosswalks serve two purposes: (1) they tell the pedestrian the best place to cross, and (2) they clarify that a legal crosswalk exists at a particular location.

Marked crosswalks are one tool to get pedestrians safely across the street. When considering marked crosswalks at uncontrolled locations, the question should not simply be: "Should I provide a marked crosswalk or not?" Instead, the question should be: "Is this an appropriate tool for getting pedestrians across the street?" Regardless of whether marked crosswalks are used, there remains the fundamental objective of getting pedestrians safely across the street.

In most cases, marked crosswalks are best used in combination with other treatments (e.g., curb extensions, raised crossing islands, traffic signals, roadway narrowing, enhanced overhead lighting, traffic-calming measures, etc.). Think of marked crosswalks as one of a progression of design treatments. If one treatment does not adequately accomplish the task, then move on to the next one. The failure of one particular treatment is not a license to give up and do nothing. In all cases, the final design must address the goal of getting pedestrians across the road safely.

GUIDELINES AND CAVEATS

Marked pedestrian crosswalks may be used to delineate preferred pedestrian paths across roadways under the following conditions:

1. At locations with stop signs or traffic signals. Vehicular traffic might block pedestrian traffic when stopping for a stop sign or red light; marking crosswalks may help to reduce this occurrence.

2. At non-signalized street crossing locations in designated school zones. Use of adult crossing guards, school signs and markings, and/or traffic signals with pedestrian signals (when warranted) should be used in conjunction with the marked crosswalk, as needed.

3. At non-signalized locations where engineering judgment dictates that the number of motor vehicle lanes, pedestrian exposure, average daily traffic (ADT), posted speed limit, and geometry of the location would make the use of specially designated crosswalks desirable for traffic/pedestrian safety and mobility. This must consider the conditions listed below.

Marked crosswalks should be supplemented with other treatments (i.e., without traffic-calming treatments, traffic signals, and pedestrian signals when warranted, or other substantial crossing improvement) when any of the following conditions exist:

1. Where the speed limit exceeds 64.4 km/h (40 mi/h).

2. On a roadway with four or more lanes without a raised median or crossing island that has (or will soon have) an ADT of 12,000 or greater.

3. On a roadway with four or more lanes with a raised median or crossing island that has (or will soon have) an ADT of 15,000 or greater.

Street crossing locations should be routinely reviewed to consider the following available options:

- Option 1—No special provisions needed.
- Option 2—Provide a marked crosswalk alone.
- Option 3—Install other crossing improvements (with or without a marked crosswalk) to reduce vehicle speeds, shorten crossing distances, increase the likelihood of motorists stopping and yielding, and/or other outcome.

The spacing of marked crosswalks should also be considered so that they are not placed too close together. A more conservative use of crosswalks is generally preferred. Thus, it is recommended that in situations where marked crosswalks alone are acceptable that a higher priority be placed on their use at locations having a minimum of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians per peak hour). In all cases, good engineering judgment must be applied.

Marked crosswalks should not be installed in close proximity to traffic signals, since pedestrians should be encouraged to cross at the signal in most situations. The minimum distance from a signal for installing a marked crosswalk should be determined by local traffic engineers based on pedestrian crossing demand, type of roadway, traffic volume, and other factors. The objective of adding a marked crosswalk is to channel pedestrians to safer

crossing points. It should be understood, however, that pedestrian crossing behavior may be difficult to control merely by the addition of marked crosswalks. The new marked crosswalk should not unduly restrict platooned traffic, and should also be consistent with marked crosswalks at other unsignalized locations in the area.

OTHER TREATMENTS

In addition to installing marked crosswalks (or, in some cases, instead of installing marked crosswalks), there are other treatments that should be considered to provide safer and easier crossings for pedestrians at problem locations. Examples of these pedestrian improvements include:

- Providing raised medians (or raised crossing islands) on multi-lane roads.
- Installing traffic signals and pedestrian signals where warranted, and where serious pedestrian crossing problems exist.
- Reducing the exposure distance for pedestrians by:
  - —Providing curb extensions.
  - —Providing pedestrian islands.
  - —Reducing four-lane undivided road sections to two through lanes with a left-turn bay (or a two-way left-turn lane), sidewalks, and bicycle lanes.
- When marked crosswalks are used on uncontrolled multi-lane roads, consideration should be given to installing advance stop lines as much as 9.1 m (30 ft) prior to the crosswalk (with a STOP HERE FOR CROSSWALK sign) in each direction to reduce the likelihood of a multiple-threat pedestrian collision.
- Bus stops should be located on the far side of uncontrolled marked crosswalks.
- Installing traffic-calming measures to slow vehicle speeds and/or reduce cut-through traffic. Such measures may include:
  - —Raised crossings (raised crosswalks, raised intersections).
  - —Street-narrowing measures (chicanes, slow points, "kinny street" designs).
  - —Intersection designs (traffic mini-circles, diagonal diverters).
  - — Others (see ITE Traffic-Calming Guide for further details).(1)

Some of these traffic-calming measures are better suited to local or neighborhood streets than to arterial streets:

- Providing adequate nighttime street lighting for pedestrians in areas with nighttime pedestrian activity where illumination is inadequate.
- Designing safer intersections and driveways for pedestrians (e.g., crossing islands, tighter turn radii), which take into consideration the needs of pedestrians.

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