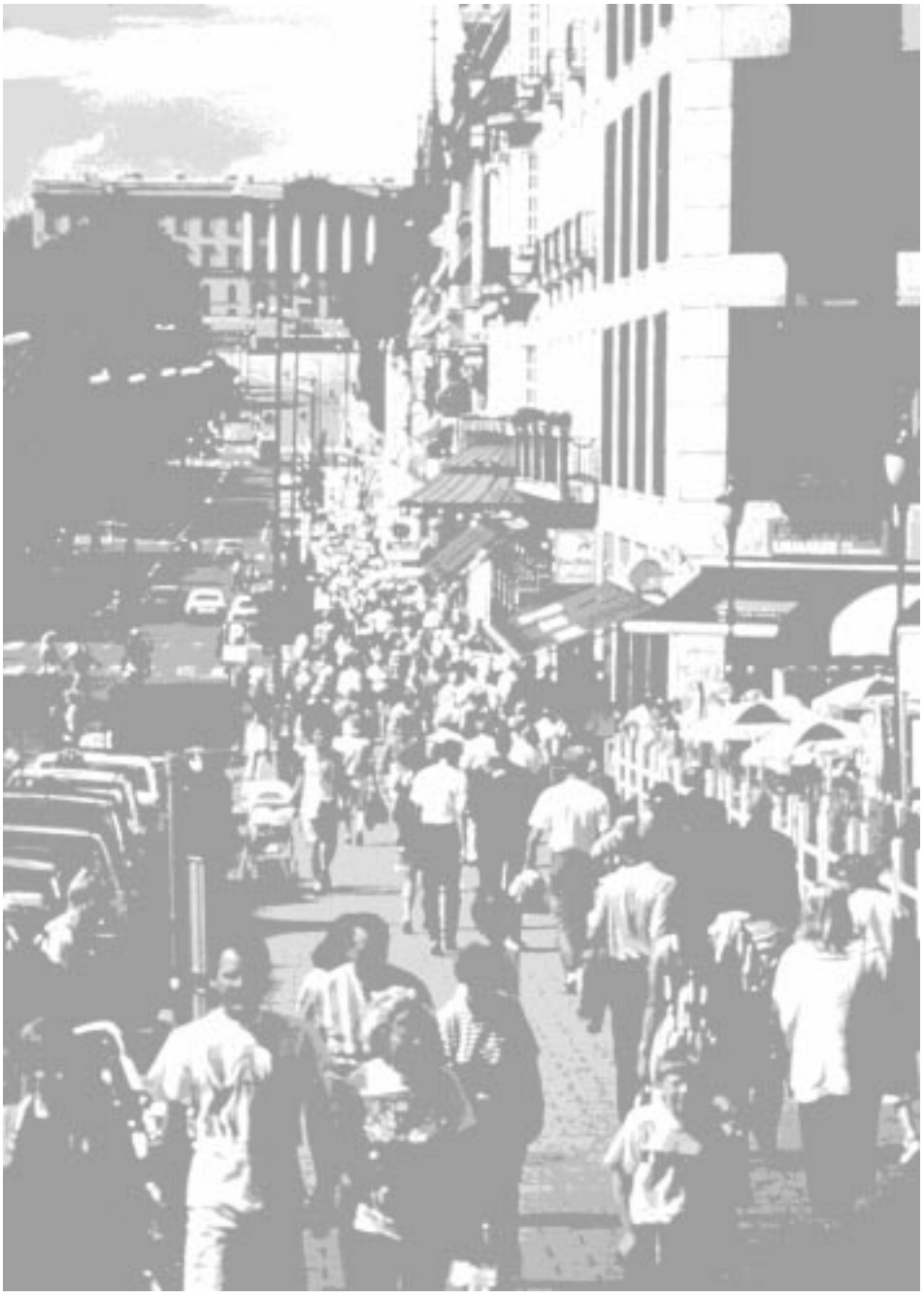
IMPLEMENTING PEDESTRIAN IMPROVEMENTS AT THE LOCAL LEVEL



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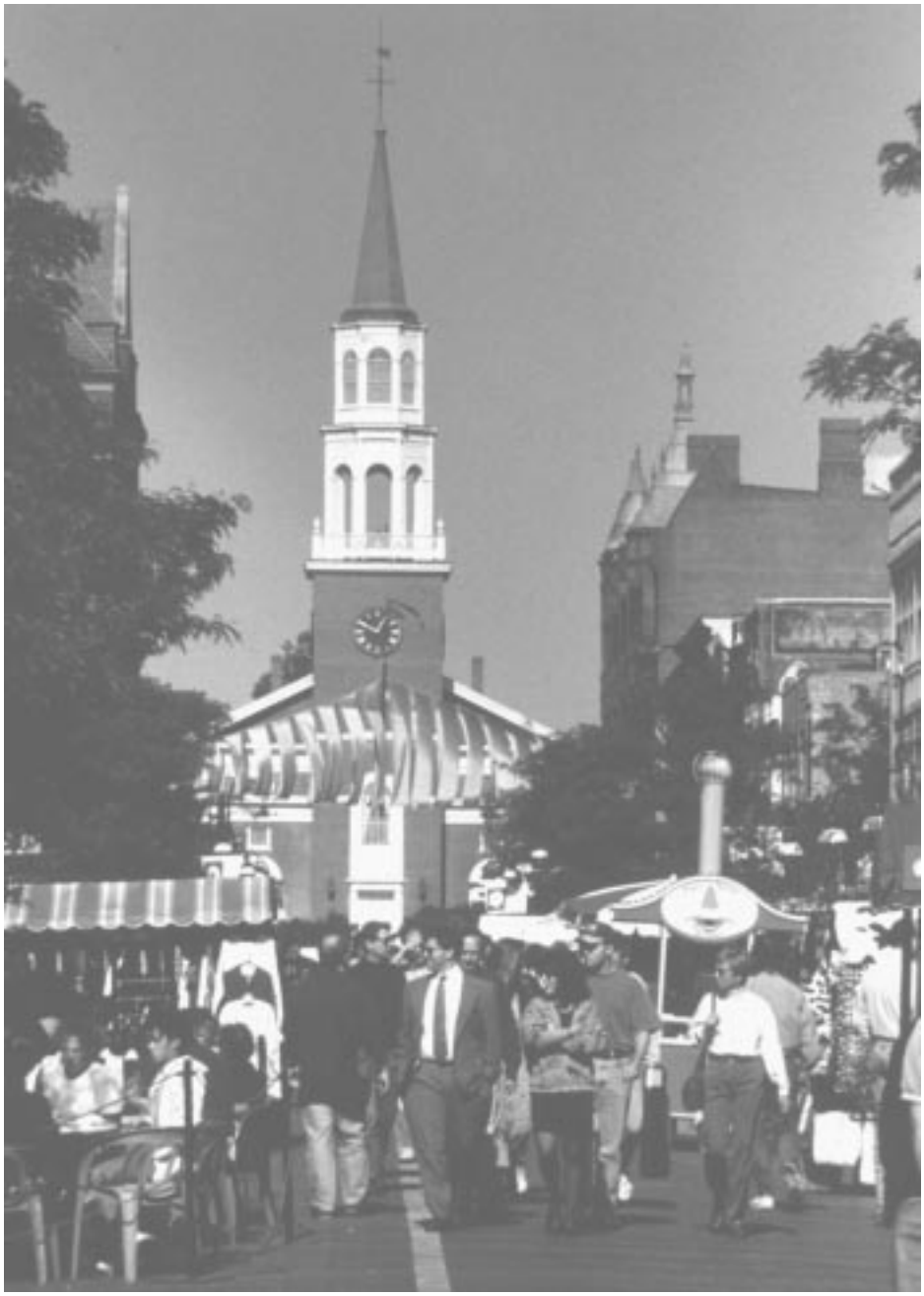
INTRODUCTION



The comfortable walking environment of the Church Street Marketplace in Burlington, Vermont, draws pedestrians to the city's downtown area in all seasons of the year.

The goal of implementing pedestrian improvements at the local level is to improve the walkability of a community. The purpose of doing so is to:

- Encourage more walking.
- Reduce the number of pedestrian/motor vehicle crashes and injuries.
- Better accommodate those who use walking as their primary mode of transportation.

Planning for pedestrians means, in many cases, focusing on small-scale improvements and local environments. Because the typical walking trip is

less than 1.6 km (1 mi) in length, regional scale plans tend to overlook those issues of most concern to pedestrians—the missing or broken section of sidewalk, the pedestrian walk signal that has never been installed, the construction zone that forces pedestrians to walk in a traffic lane, and the barrier between a particular neighborhood and nearby park.

Specifically, deterrents to walking and obstacles to pedestrians (including people with disabilities) include:

- Missing sections of sidewalks.
- Uneven walking surfaces.
- Misuse of pedestrian facilities (e.g. vehicles parked on sidewalks).
- Poor maintenance.
- Narrow walkway width.
- Missing curb cuts.
- Difficult street crossings.
- Lack of respect for walking as a travel mode (motorists not stopping for pedestrians in a crosswalk).
- Barriers on walking routes (rivers, railroads).
- High traffic levels or speeds (especially near schools, parks, or retirement centers).

Conversely, environmental factors that are known to encourage walking include:

- Continuous sidewalks.
- Safe street crossings.
- Pedestrian signs, signals, and markings.
- Compact land use.
- Sidewalk set-backs.
- Landscaping and lighting.

As a result, much of the most important pedestrian-related work in a community will happen at the micro-level and will involve paying attention to "nuts and bolts" issues. To deal with these micro problems, however, often requires looking at the problem from a more systemic point of view.

For example, instead of simply focusing on a particular missing curb cut, the best approach may be to create a program that routinely fixes such problems whenever a complaint is received or to schedule curb-cut retrofitting projects on an annual basis. Another approach is to ensure that standards for new roadway construction include a requirement for good sidewalks. In this fashion, it is possible to have a community-wide effect that can truly improve pedestrian conditions wherever people walk.

WHY ENCOURAGE WALKING?

The obvious and usually most overlooked reason why walking should be encouraged is that nearly everyone is a pedestrian. People walk somewhere everyday—from the house to the car or transit, from transit to the office, from the office to lunch, and so on. Walking trips may be for utilitarian or

recreational purposes. Strongly represented among those who walk are significant numbers of youth, elderly, people of low income, and those walking for exercise and health.

Encouraging and promoting walking will help:

- Reduce the incidence of chronic disease.
- Provide adults with an easy way to exercise, spend time with their families, and enjoy their surroundings.
- Benefit the workplace: people who are more fit are more productive, are absent less often, have fewer injuries, and are more satisfied with their jobs.
- Benefit local economies by attracting new jobs and increasing the share of retail sales in downtown commercial areas.
- Encourage a modal shift away from single occupant vehicles

A friendly walking environment especially benefits children and the elderly.

The 1995 Oregon Bicycle and Pedestrian Plan notes that increased walking will help reduce traffic congestion; air and noise pollution; wear and tear on roads; consumption of petroleum; crashes and property damage; and the need for additional roads, travel lanes and parking. The Plan also notes that the number of people who are walking (or riding bicycles) is a measure of the quality of life of a community. The sense of community is strong and people feel safer being out-of-doors, social interaction occurs openly, and children and older people have access to public and private facilities.

According to the Land Use, Transportation, Air Quality (LUTRAQ) studies conducted in Portland, Oregon, between 1991 and 1997, people who live in pedestrian-friendly neighborhoods:

- Make four times as many walking and biking trips.
- Make three times as many transit trips.
- Take fewer car trips.
- Drive fewer miles.

Clearly, attributes of increased walking can help planners and agency managers achieve important transportation goals.

- First, encouraging walking in communities nationwide can help reach a goal of the *National Bicycling and Walking Study*—to double the percentage of total trips made by walking in the United States, from 7.2 percent to 14.8 percent of all travel trips.
- Second, improving conditions for walking can provide additional travel options and enhance the livability of communities.
- Third, creating pedestrian-friendly environments can reduce pollution, oil import costs, and congestion costs.
- Fourth, encouraging walking helps reduce public health risks and health care costs and improves the overall quality of life in a community.

THE POTENTIAL FOR INCREASING WALKING

The 1995 Nationwide Personal Transportation Survey reveals that 7.2 percent of all transportation trips (via all modes) are made by walking. Of all trips, more than one-quarter (27.5 percent) are 1.6 km (1 mi) or less in distance. Because the average trip length of all walking trips is 1 km (0.6 mi), a significant number of trips could be made on foot if conditions were better.

There exists strong evidence that, if conditions were better, people would walk more often. In a Lou Harris poll commissioned by Rodale Press, it was found that 5 percent of those polled indicated that their transportation habits included walking or bicycling. The study also revealed, however, that if facilities existed 13 percent would walk or bike. Additionally, the study found that 72 percent of the people surveyed wanted planning for bicycle and pedestrian traffic and 59 percent of those surveyed would favor devoting more government funding for bicycle and pedestrian traffic (*Pathways for People*, 1992 and 1995).

SUCCESS STORIES

Many communities report a positive return on pedestrian investments. Such "walkable" communities provide examples and inspiration to people working to improve their own neighborhoods, towns and cities.

San Antonio, Texas is noted for its 4 km (2.5 mi) River Walk, or Paseo del Rio, that winds along the San Antonio River. Set below the noise and fast pace of the street, the Walk invites people to explore art galleries, gift shops, and cafes by day and lively nightclubs and restaurants by night.

Boulder, Colorado developed the popular Pearl Street pedestrian mall as one element in a revitalization plan for the city's downtown. What was once a street for cars is now a pedestrian facility that naturally draws people and has become the heart of Boulder's community life.

Burlington, Vermont completed its four-block-long Church Street Marketplace in 1981, and the pedestrian mall remains a popular destination for residents and tourists alike. The mixture of shops, restaurants, vendor carts, and offices serves as a draw for pedestrians in all seasons of the year. One of the most inviting aspects of the Marketplace is its human scale, enhanced by plantings, street furniture, and the narrow width of Church Street itself.

Portland, Oregon is often recognized as one of the most walkable places in the United States. One key element that contributes to this distinction is the size of Portland's downtown city blocks, which measure just 61 m (200 ft) on a side. Laid out in this manner by the city's founders to provide more corner locations for merchants, the unexpected result is the large amount of street space, much of which has been allocated for people on foot. Other initiatives have included: promoting public transportation, restricting parking, and emphasizing good land use planning. This emphasis has resulted in a lively walking environment that has attracted 30,000 new jobs, and helped increase retail sales by 300 percent since the 1970s.

Corning, New York designed its Centerway Square to be a friendly place for people to gather amidst a mix of offices, retail stores, housing, restaurants and open space that includes a bandstand, tables, and a clock tower. The design permits motorized traffic, but special brick pavers throughout

clearly define the whole area as a walker's domain.

A PLANNING STRATEGY

Planning for pedestrians should begin with a thorough understanding of existing local conditions, both what is there and what is needed. Therefore, it is advisable to start a pedestrian program by developing a checklist to help identify existing conditions, possible problems, existing environmental constraints, and program features. A list of topics that might appear on such a checklist appears on page vii and the following pages.

Next, implement improvements through the use of interactive and responsive programs. For the most part, such programs can be managed as part of an agency's routine function. For example, if the project checklist suggests installing accessible curb ramps at intersections, find out what curb cut standard the traffic department currently uses. If a poor or suboptimal design is being used, there are several steps that can be followed to improve conditions for pedestrians. These include:

- Changing the curb cut standard (or design guidelines) for new construction.
- Having the street department use the new standard whenever it replaces or modifies a current installation.
- Budgeting for annual curb cut installation, based on public requests and a quick prioritization of the street system (e.g., streets near schools, social service offices, popular transit stops, and senior centers).

PROJECT PRIORITIES

One approach to setting priorities for pedestrian improvements is to identify what would encourage people to walk more often and then orient efforts to improve conditions for pedestrians in this direction. During the development of the Louisiana Statewide Bicycle and Pedestrian Master Plan (1996), citizens of Louisiana were surveyed and asked what could be done to make it easier to get around on foot. The responses ranked as follows:

1. More sidewalks.	61.93%
2. More off-road trails.	57.80%
3. Destinations close to home and work.	33.94%
4. Education for motorists.	30.28%
5. Enforcement of bicyclist/motor vehicle laws.	28.44%
6. More benches, water fountains, etc.	28.44%
7. More crosswalks.	27.06%
8. Slower traffic on local roads.	21.56%
9. Better transit service.	15.14%

Another approach that can help decide where to start is to see what America's most progressive "pedestrian-friendly" communities are doing. Pedestrian-related activities in these communities typically include:

- Providing a community-wide walkway network that is continuous and safe.

- Providing curb ramps at intersections.
- Installing curb bulbs to shorten the pedestrian's crossing distance.
- Using "traffic calming" techniques to slow motor vehicle traffic on neighborhood streets.
- Rewriting work zone policies to always accommodate pedestrians safely.
- Reallocating space between pedestrians and motor vehicles.

Some projects are modest in scope while others are major undertakings.

While each of these projects and programs may be part of a larger comprehensive planning effort, each can be implemented singly. Also, implementation can be accomplished in phases or sequences that best reflect local realities.

For example, if it is relatively easy to install pedestrian signals but more difficult to retrofit sidewalks on a bridge across a major river, the former can be done immediately while the latter will require funding and political support to materialize.

Take advantage of opportunities as they occur. If the zoning ordinance is currently being revised, adding pedestrian considerations like mixed-use zoning or reduced commercial frontage requirements might be considered. Thus, it is both possible and desirable to pick and choose those projects and programs from the list that have local appeal and are doable. Such an approach makes it possible to get things going almost immediately and to start making a real difference in the community, often at minimal expense.

Some projects are expensive. For instance, if there is a need for a grade-separated pedestrian crossing of a freeway, such a project may cost upwards of $300,000 to $500,000. Planning for such an expenditure can take several years and may involve grant applications or implementation through the Transportation Improvement Program (TIP) process and the use of any one of several categories of Federal funds. Meanwhile, many small but important changes can be made as the community works its way toward pedestrian-friendliness.

Many local programs have found that small initial successes build momentum, allowing more ambitious work to follow. In one western community, for instance, installation of several "test" traffic circles on residential streets—a project that took several days of work and less than $5000 to accomplish—helped build support for an ongoing program installing such circles all over town.

ADA

In 1990, the Americans with Disabilities Act (ADA) was signed into law. This landmark civil rights legislation set new standards of access for public and private facilities, programs, and buildings.

Generally, ADA requires:

- All programs, buildings, and facilities constructed after January 26, 1993, or any project designed or permitted after January 26, 1992, to meet or exceed accessibility standards set down within the guidelines.
- An accessible route to services, programs, and activities offered by government.

- Curb ramps when a new street or walkway is built or when an existing street is reconstructed.
- A 0.9 m (3 ft) landing ramp at the top of a curb ramp.
- A 0.9 m (3 ft) passageway at all locations along a walkway.
- A 2 percent (1:50) or less cross-slope on walkways.
- A maximum run of 9.1 m (30 ft) for ramps with slopes between 8.33 percent (1:12) and 6.25 percent (1:16).
- A maximum run of 12.2 m (40 ft) for ramps with slopes between 6.25 percent (1:16) and 5 percent (1:20).
- A 1.5 m (5 ft) long flat landing at either end of a ramp and a 1.5 m (5 ft) wide landing if the alignment changes direction at the landing.
- A 0.9 m (3 ft) flat area at the top of driveways.
- Walkways a minimum of 1.5 m (5 ft) in width or, when this width cannot be maintained, passing areas located at intervals not exceeding 60 m (200 ft).
- Handrails 290 to 320 mm (34 to 36 in) along ramps that rise more than 0.15 m (6 in). Such handrails must extend 0.3 m (1 ft) into the landing areas at both ends of the ramp.
- Transit stops linked with walkways, or an alternative provided for the user.
- Safe waiting/standing areas at transit stops.

ADA does not necessarily require that each existing facility, such as a walkway, be accessible to and usable by individuals with disabilities. A curb that is inaccessible now can remain so if a change would:

- Result in undue financial or administrative burdens.
- Cause fundamental alterations in the nature of a program or activity.
- Threaten or destroy the historic significance of an historic property.

However, government agencies must still ensure that people with disabilities receive the benefits of services of an inaccessible facility.

For more detailed information, consult the *Americans with Disabilities Act Accessibility Guidelines (ADAAG,* 1991).

THE PROGRAM/PROJECT CHECKLIST

The following list briefly describes pedestrian programs or projects in categories that relate to the time honored Four Es—engineering, education, encouragement, and enforcement. Each program or project listed is more fully explored in this report . While not every conceivable pedestrian program or project is included, the following checklist contains the most important ones.

ENGINEERING

Walkways (pages 1-8)

Typical concerns: Sidewalks are often broken, missing, or not continuous.

Possible solutions: Require sidewalk installation or replacement as a condition of development, fix broken sidewalks, and add missing links.

Intersections (pages 9-12)

Typical concerns: 14 percent of fatal pedestrian crashes in urban areas occur in the central business district (CBD). Two-thirds of CBD pedestrian injuries occur at intersections.

Possible solutions: Create guidelines for intersection design to make pedestrians as visible as possible, to shorten crossing distances, and to slow motor vehicle speeds.

Crosswalks (pages 13-18)

Typical concerns: Pedestrians don't have easy, convenient places to cross and motorists fail to stop and yield.

Possible solutions: Create a program to install crosswalks, bulbouts (flared curbs) and refuge islands to encourage pedestrians to cross streets and roads at predictable as well as convenient locations. Bulbouts and refuge islands also reduce exposure time for pedestrians at crossings and increase green time for vehicles.

Curb ramps (pages 19-24)

Typical concerns: Wheelchair users can't cross the street or must use a nearby driveway.

Possible solutions: Create an annual program to install ramps where requested and needed.

Curb extensions and curb radii (pages 25-30)

Typical concerns: Wide streets are more difficult to cross than narrow ones and expose pedestrians to traffic dangers for a longer period of time.

Possible solutions: Use curb extensions to narrow streets at important crossings and include the specifications in standard designs.

Signal timing and push buttons (pages 31-34)

Typical concerns: Pedestrian crossing times are too short and most pedestrians don't know if the push buttons work.

Possible solutions: Follow a consistent policy of push button installation and signal timing whenever traffic signals are installed or modified.

Signing and marking (pages 35-38)

Typical concerns: When pedestrian signing and marking is used in the wrong location, in the wrong manner, or for the wrong purpose, it can lead to confusion for pedestrians.

Possible solutions: Evaluate high-risk locations and install consistent pedestrian crossing controls.

Pedestrian amenities (pages 39-42)

Typical concerns: Streetscape is devoid of amenities and street furniture that facilitate and encourage walking.

Possible solutions: Develop and install a system of amenities and street furniture, taking care not to limit sight distance or restrict width of normal pedestrian paths.

Reconfiguring arterial streets (pages 43-48)

Typical concerns: High arterial street speeds and wider roadways are often associated with high risk for pedestrians.

Possible solutions: Change the roadway design to provide median refuges and slow down traffic.

Bridges (pages 49-54)

Typical concerns: Without adequate sidewalks, pedestrians may have to walk in the roadway or avoid a walking trip all together.

Possible solutions: Make sure sidewalks are included in all new and major renovation bridge projects.

Traffic calming (pages 55-60)

Typical concerns: Too much through motor vehicle traffic is diverting to residential streets and speeding through neighborhoods.

Possible solutions: Install traffic-calming devices to discourage through traffic and reduce speed in response to neighborhood requests.

Maintenance (pages 61-66)

Typical concerns: Badly maintained sidewalks, or those cluttered with portable signs and newspaper stands, can lead to pedestrian injuries.

Possible solutions: Enact clear and fair laws governing use of the sidewalk for private purposes. Establish and implement an ongoing maintenance program. Remove all hazards. If a hazard cannot be removed, protect it with barriers or clear warning signs.

EDUCATION

Public awareness campaigns (pages 67-76)

Typical concerns: Safety and acceptance of walking as a legitimate travel mode are serious concerns for pedestrians.

Possible solutions: Create public awareness and education campaigns that target safety problems and change attitudes for the better.

ENCOURAGEMENT

Trip length reduction (pages 77-80)

Typical concerns: Even with adequate sidewalks and crosswalks, if destinations are too far away, few people will walk for utilitarian purposes.

Possible solutions: Encourage mixed-use developments through incentives like increased density or additional height allowances.

Walking route maps (pages 81-84)

Typical concerns: Knowing how to reach nearby destinations on foot is a major step to encouraging people to walk.

Possible solutions: Develop an interest in a series of neighborhood and regional walking maps.

Walking events (pages 85-88)

Typical concerns: Just getting started is often the biggest barrier to increased pedestrian activity.

Possible solutions: Facilitate the organization and promotion of special walking events to celebrate foot travel and encourage novices to give walking a try.

ENFORCEMENT

Construction zones (pages 89-92)

Typical concerns: Work sites often "take over" pedestrian space, forcing people to walk in the street or through construction debris.

Possible solutions: Require clear consistent work zone controls that protect pedestrians as part of the building permit process.

Land use development requirements (pages 93-96)

Typical concerns: Having to cross large parking lots to reach a nearby store negates the value of curbside sidewalks; it can be unsafe and discourage walking.

Possible solutions: Require safe pedestrian access to new and renovated buildings.

Law enforcement (pages 97-98)

Typical concerns: Motorists often ignore pedestrians, especially in crosswalks.

Possible solutions: Enforce pedestrian-related traffic laws, focusing first on key crash locations.

WALKWAYS

Where walkways are broken or where they have missing sections, people may be forced to walk in the roadway or may be discouraged from walking entirely.

Walkways are pedestrian linkages that include sidewalks, paths, and highway shoulders.

Sidewalks are walkways intended predominantly for use by pedestrians. When located within highway rights-of-way, sidewalks are usually separated from the traveled portion of the roadway by a curb and/or planting strip. Sidewalks are usually constructed with wearing surfaces that are smooth, hard and durable.

Paths or trails are walkways that, by design, may attract multiple user types, including bicyclists and skaters as well as pedestrians. Paths are usually separated from the traveled portion of the roadway and the highway right-of-way. Paths may be paved or unpaved; however, when unpaved, they should be smooth and firm enough to meet ADA requirements.

Highway shoulders, when designed according to American Association of State Highway and Transportation Officials (AASHTO) recommendations, are usually wide and smooth enough to accommodate pedestrians in rural areas where the provision of sidewalks or paths may not be practicable or feasible. Shared use of such shoulders by other users, including motor vehicles and bicyclists, should be expected.

TYPICAL CONCERNS

Where no walkways are provided , or where walkways are in poor repair or broken, or where they have missing sections, the following conditions will likely result:

- People may be forced to walk in the roadway, resulting in increased pedestrian/motor vehicle collisions. About 8 percent of all pedestrian crashes involve people walking along the road. Having a sidewalk, walkway, or other suitable place to walk reduces the chance of a crash.

- Without a safe and durable place to walk, people are discouraged, and in extreme cases prevented, from walking. Children have a difficult time walking to school, seniors can't get to nearby shops, and transit users must bushwhack their way to transit stops.
- The absence of sidewalks can eliminate access to all destinations for some people with disabilities. Even short gaps where sidewalks do not exist make sections of sidewalks that do exist completely inaccessible to these individuals.
- Not providing a durable and safe place to walk ignores the needs of people who rely on walking as a mode of travel.

There is likely no community in the United States that does not have at least some gaps within its walkway system. Worse, many new residential areas have few or no sidewalks or paths. Ensuring continuity throughout the pedestrian infrastructure can improve pedestrian safety and increase the likelihood that more people will want and choose to walk more often.

POSSIBLE SOLUTIONS

Obviously, the solution is to provide good facilities for people to walk. Establishing policies to ensure that safe places to walk will be developed is a good starting point in making a community more walkable. With these policies in effect, the development of pedestrian linkages becomes routine and a natural part of highway, road, and street planning; design; and construction processes. Such policies may be part of a local comprehensive plan, or they can be included in metropolitan or statewide long-range transportation plans.

For example, the New Jersey Bicycle/Pedestrian Master Plan includes this policy for sidewalk installation: All roadways should have some type of walking facility out of the traveled way. The Institute of Transportation Engineers (ITE) has issued a "Recommended Practice" on installing sidewalks (See Table 1.1).

IMPLEMENTATION STRATEGIES

Establishing walkable linkages requires a well-thought-out approach that may take several years to implement. Here are four strategies to consider.

1. Regulate new development and re-development. Official policies and related ordinances can go a long way towards making walkway installation "automatic." When policies and ordinances are changed, make sure these changes are implemented.

2. Capital projects. Look for opportunities to install sidewalks as part of capital projects. In urban and/or suburban situations, add sidewalks when widening a road or installing a sewer line in the right-of-way. Typically, sidewalks will add only a small amount to the overall project budget and extra savings can result when expenses such as excavation can be lumped together.

3. Adjacent property owners. Many communities give property owners the option of installing curbs, gutters, and sidewalks through a Limited Improvement District (LID). With a LID, property owners pay the cost (or a percentage) over time. This can be expensive and may generate opposition to sidewalks in general. However, if they are locally acceptable, LIDs can be an important part of the package.

4. Annual walkway installation program. To create a truly viable walking system, start an annual walkway installation program. Where the installation of concrete curbs, gutters, and drainage structures is planned, consider including the installation of concrete sidewalks as well. Asphalt walkways are usually cheaper to install; however, they will require more maintenance than concrete sidewalks. Since the amount of walkway that can be installed in a given year may be limited by available financial resources, projects should be selected with care. Here are several things to consider:

- Give highest priority to locations used by school children, the elderly, or the disabled. Transit connections may also provide a focus.
- Give preference to requests from neighborhood groups, especially those that meet other priorities such as providing a route for school children.
- Where a concrete curb and gutter section exists, concrete generally offers a longer lasting and therefore more permanent solution. Set the elevation in relation to the curb.
- Evaluate construction options. If asphalt surfaces are being considered, municipal crews may perform the work faster than outside contractors. Additionally, having municipal crews do the work could possibly provide a more expedient response to citizen requests. If a sidewalk or walkway construction project is large, outside contractors might be cheaper in the long run.

The City of Bloomington, Indiana developed a four-step approach to systematically fill in missing sidewalk segments that are most needed in the community. The steps include: 1) Initial identification of general areas needing improvements, 2) Data collection for the identified areas, 3) Data entry analysis and ranking of segments, and 4) Revision of segments and decision making process.

In step one, parents of area elementary school students were asked to identify areas around schools that needed improvements. Along with the parents' suggestions, proposed public works projects constituted the initial list of sidewalk segments to be studied further.

In step two, the type of data to be collected and analyzed for each street segment was determined based on draft criteria for project selection and prioritization as developed by the public works department. The sidewalk linkage criteria included: safety considerations, roadway classifications, pedestrian usage, proximity to destination points, and costs/feasibility.

Step three, data analysis, focused on roadway characteristics that made walking within a transportation corridor a pleasant or unpleasant experience. A scoring system developed for this analysis (see below) helped determine if a particular corridor could be made significantly safer for pedestrians by construction of a sidewalk. To determine segment rankings, each missing sidewalk segment was assigned points for each roadway characteristic. The more points a segment scored, the higher priority awarded that particular link.

Sidewalk Prioritization Criteria

Safety Characteristics		***12 pts. total***
Traffic speed	≥ 45 mi/h	+ 3 pts.
	40 mi/h	+ 2 pts.
	30 mi/h	+ 1 pt.
Lane width	≤ 11 feet	+ 3 pts.
	12 feet	+ 2 pts.
	13 feet	+ 1 pt.
Traffic volume	≥ 9000 ADT*	+ 3 pts.
	5000-9000 ADT	+ 2 pts.
	1000-5000 ADT	+ 1 pt.
Street classification	primary arterial	+ 3 pts.
	secondary arterial	+ 2 pts.
	collector	+ 1 pt.
Pedestrian Usage		***12 pts. max.***
Proximity	< 1/3 mile	+ 3 pts./attractor
	1/3 to 2/3 miles	+ 2 pts./attractor
	2/3 to 1 mile	+ 1 pt./attractor
Project feasibility		***12 pts. max***
Intuitive point assignment based on field observations and Public Works cost estimates		
Additional Factors		***4 pts. total***
Located along a bus route		+ 2 pts.
No sidewalk on either side of street		+ 2 pts.

Source: Pedestrian Plan, Bloomington, Indiana

*Average Daily Traffic

In step four, the results of the ranking and prioritization process was balanced with an intuitive look at overall community needs. Over time, the effectiveness of the prioritization system is re-evaluated to ensure that programming of missing sidewalk linkages meets the changing needs of the community.

COSTS AND SCHEDULING

Costs for installing walkways and sidewalks vary greatly. In general, asphalt walkways cost less than half of what it costs to install concrete curbs, gutters, and sidewalks, depending on the amount of drainage and grading work required. Normally, it is cheaper to build as much walkway or sidewalk as possible at one time because of economies of scale.

For some sample cost figures, see appendix B.

Consider purchasing a computer drawing program to design walkways and sidewalks on screen. This way, you can create many generic designs for different situations, and then modify them as needed.

SCHEDULING

Installing sidewalks, paths, and shoulders can generate public confidence and appreciation if such projects can be completed in a reasonable amount of time. If money has already been programmed for asphalt walkways, it is reasonable to expect they may be designed and installed within six to 12

months. Concrete installations, on the other hand, may take one to three years to complete. The key is to set goals, make them known to the public, and then meet the goals. By being prompt, public agencies responsible for the implementation of walkway projects will generate a reputation of delivering on promises.

EVALUATION

Evaluate sidewalks and paths regularly to determine if they are in good repair and are being used. Conduct a count of pedestrians to evaluate who is walking and when. The point is to determine whether walkways are being built at the right locations. In the long run, success depends on whether or not the needs of citizens are being met.

Boulder, Colorado, developed a sidewalk program which includes an inventory of existing sidewalks, locations without sidewalks, potential attractions, and other factors. The plan proposed approximately $11 million worth of pedestrian-related improvements over five to seven years (*City of Boulder Sidewalk Plan*; TransPlan Assoc., 1992).

Missoula, Montana, is integrating sidewalk condition information into its Pavement Management System database in order to more easily identify pedestrian-related problems.

PLANNING/DESIGN CONSIDERATIONS

The table below from the Institute of Transportation Engineers publication *Design and Safety of Pedestrian Facilities* suggests where walkways should be built.

Table 1.1 Guidelines for installing sidewalks

Guidelines for Installing Sidewalks

Land Use/(Roadway Functional Classification) and Dwelling Units	*New Urban and Suburban Streets*	*Existing Urban and Suburban Streets*
Commercial & Industrial/ (All streets)	Both sides.	Both sides. Every effort should be made to add sidewalks where they do not exist to complete missing links.
Residential/(Major Arterials)	Both sides.	Both sides.
Residential/(Collectors)	Both sides.	Multi-family—both sides. Single family —prefer both sides; require at least one side.
Residential/(Local Streets) More than 4 Units Per Acre	Both sides.	Prefer both sides; require at least one side.
1 to 4 Units Per Acre	Prefer both sides; require at least one side	One side preferred, at least 4-ft. shoulder on both sides required.
Less than 1 Unit Per Acre	One side preferred, shoulder on both sides required	At least 4-ft. shoulder on both sides required.

Notes:

1) Any local street within two blocks of a school site that would be on a walking route to school—sidewalk and curb and gutter required.

2) Sidewalks may be omitted on one side of a new street where that side clearly cannot be developed and where there are no existing or anticipated uses that would generate pedestrian trips on that side.

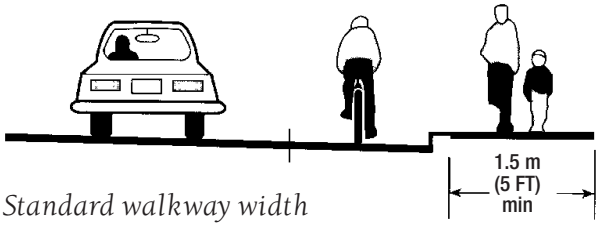
3) Where there are service roads, the sidewalk adjacent to the main road may be eliminated and replaced by a sidewalk adjacent to the service road on the side away from the main road.

4) For rural roads not likely to serve development, a shoulder of at least 4 ft. in width, preferably 8 ft. on primary highways, should be provided. Surface material should provide a stable, mud-free walking surface.

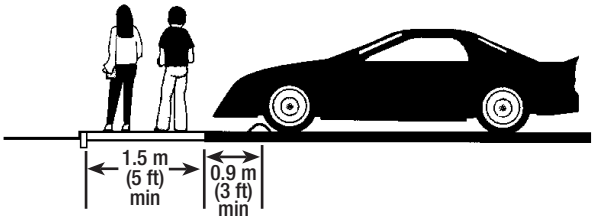
Source: *Design and Safety of Pedestrian Facilities*, Institute of Transportation Engineers

The following considerations are generally accepted as minimum guidelines for the planning and design of walkways.

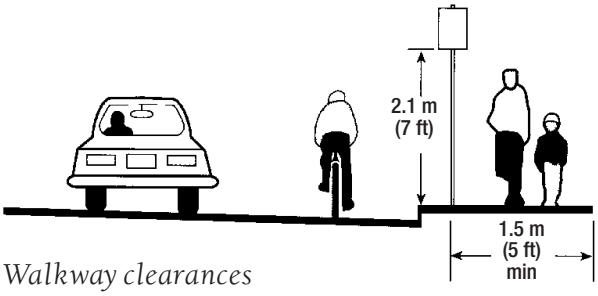
- Basic clear width for walkways should be 1.5 m (5 ft) exclusive of the curb. This width allows people to walk two abreast.
- The clear width for walkways should be free of all trees, signs, utility poles, hydrants, parking meters, planters, newspaper boxes, and other similar appurtenances.



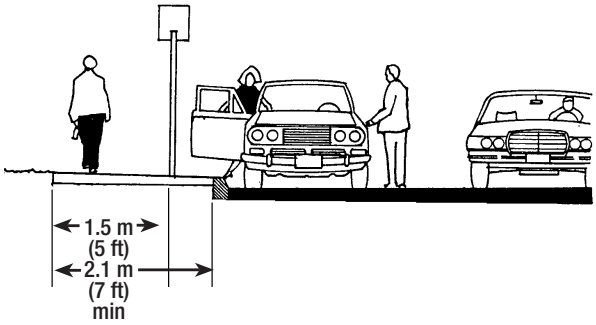
Standard walkway width



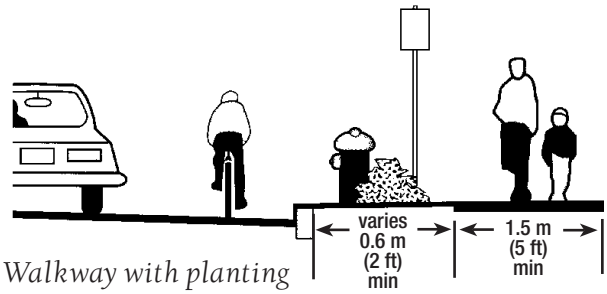
Reducing overhang from parked cars



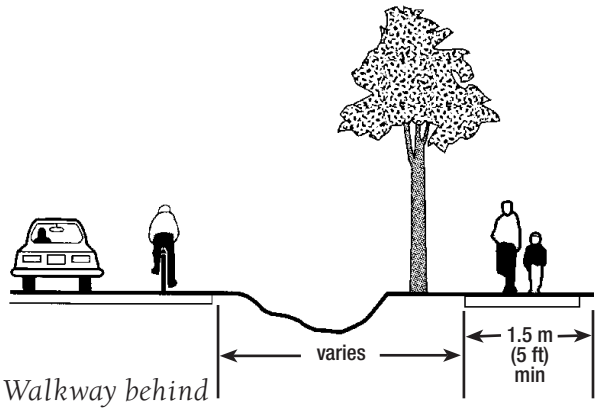
Walkway clearances



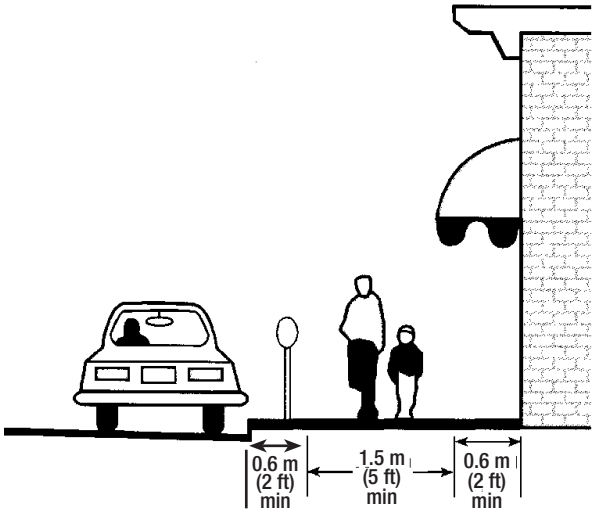
Walkways adjacent to parking lane



Walkway with planting strip



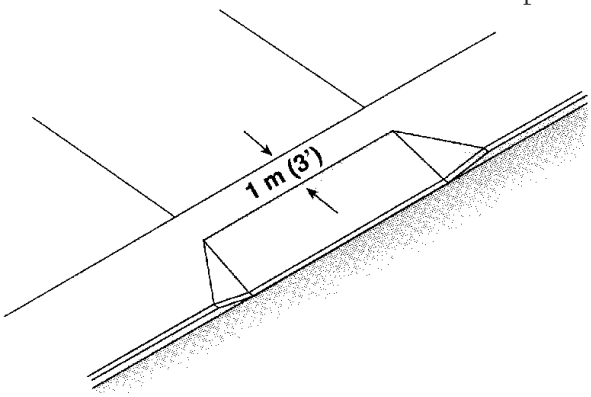
Walkway behind the ditch



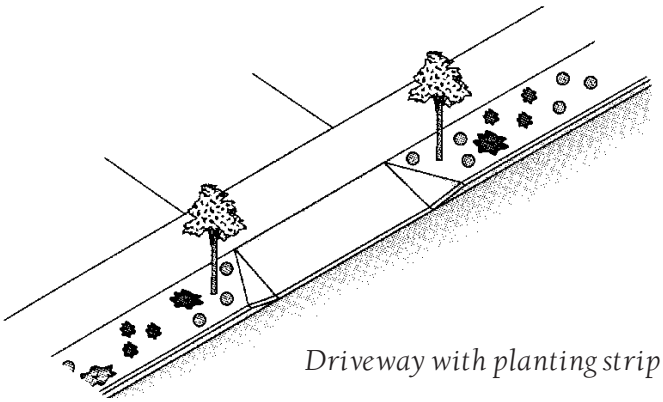
Walkway against wall

Adapted from 1995 Oregon Bicycle and Pedestrian Plan

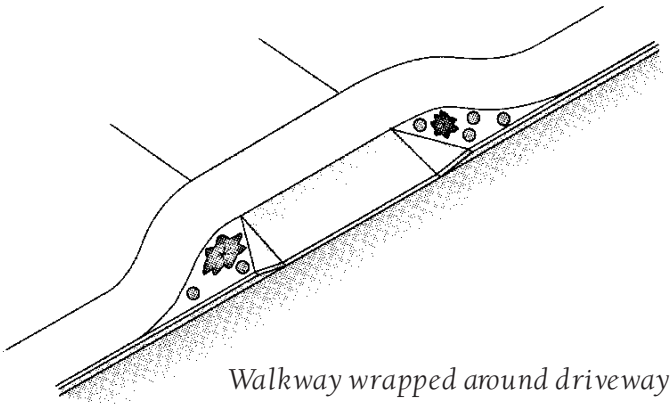
- Additional clear width may be needed where pedestrian volumes are higher as may be the case near transit stations, schools, or urban areas. Consult Chapter 13 of the 1994 *Highway Capacity Manual*, published by the Transportation Research Board, and/or the *Pedestrian Planning Procedures Manual*, FHWA, 1979, to evaluate widths of walkways that can accommodate high levels of pedestrian flow.
- When adjacent to parking, set walkways back an additional width of 0.6 m (2 ft) to compensate for the opening of parallel-parked car doors, or for bumpers of angled-parked cars to extend over the curb. The installation of sidewalks immediately adjacent to the curb is both uncomfortable and undesirable for pedestrians. Walkways should only be placed there when severe right-of-way constraints exist.
- Walkways should be located as far as practicable from travel lanes. A minimum of 1.2 m (4 ft) should be provided between the edge of the sidewalk and the curb. Where vehicle speeds exceed 56 km/h (35 mi/h) and/or the traffic mix is more than 5 percent heavy vehicles, and/or where there is high bicycle use, up to 3 m (10 ft) of clearance between the walkway and the roadway should be provided. Buffers created by such separation can be used as planting and/or snow storage areas.
- Where there is no curb and gutter, but there is a drainage ditch and sufficient right-of-way is available, walkways should be located on the opposite side of a ditch from the roadway for increased vehicle/pedestrian separation.



Wide walkway at driveway



Driveway with planting strip



Walkway wrapped around driveway

Adapted from 1995 Oregon Bicycle and Pedestrian Plan

ADA CONSIDERATIONS

- The desirable width of a sidewalk is 1.5 m (5 ft); the minimum passage width is 0.9 m (3 ft).
- If a 0.9 m (3 ft) wide walkway must be used, 1.5 m x 1.5 m (5 ft x 5 ft) passing areas are required at intervals not exceeding 60 m (200 ft).
- For walkways adjacent to a roadway, the walkway may follow the natural grade of the land.
- The grade of ramps and paths must not exceed 5 percent (1:20).
- A maximum grade of 8.33 percent (1:12) may be used for a rise of no more than 0.75 m (2.5 ft) and then level landings at least 1.5 m (5 ft) in length must be provided at each end of such grades.
- The maximum allowable cross-slope of a walkway is 2 percent (1:50).
- At driveways, curb cuts and crosswalks (marked or unmarked), a maximum allowable cross-slope of 2 percent must be maintained over a minimum allowable width of 1 m (3 ft).

INTERSECTIONS

Intersections should be designed and built to encourage pedestrian usage.

TYPICAL CONCERNS

Walkways provide mobility for pedestrians along a linear path. But eventually, pedestrians need to cross roads and streets at intersections. These intersections, where the paths of people and vehicles come together, can be the most challenging parts of negotiating a pedestrian network. If pedestrians cannot cross streets easily and safely, then mobility is severely limited, access is denied, and walking as a mode of travel is discouraged.

In urban areas, two-thirds of pedestrian injuries occur at central business district (CBD) intersections. Overall, the "intersection dash," where a pedestrian enters the street at an intersection and is seen too late by a driver of a motor vehicle, is the third most prevalent type of 61 crash types, and accounts for 7.2 percent of all pedestrian crashes (FHWA, 1996).

POSSIBLE SOLUTIONS

The solution is to design and build intersections that:

- Make pedestrians as visible as possible.
- Make pedestrian and motorist actions as predictable as possible.
- Minimize the width of roadway that pedestrians must cross.
- Slow vehicular traffic.

A good place to start is to develop design guidelines for intersections that are responsive to the needs of pedestrians that can be followed whenever new intersections are built or when existing intersections are being improved or reconstructed.

Important intersection issues include the following:

1. **Improved pedestrian conspicuity.** Ways to alert motorists to the possible presence of pedestrian activity at intersections include providing painted crosswalks in the roadway, moving pedestrians out from behind parked cars through the use of curb extensions (also known as bulbs, neckdowns, flares, or chokers), and improving both horizontal and vertical sight distances through the removal of extraneous curbside clutter such as newspaper boxes, redundant utility poles or overgrown vegetation.

2. **Distance and time that pedestrians have to cross a roadway.** Both the distance and time it takes pedestrians to cross a street can be shortened through the use of curb extensions, medians, and refuges.

3. **Slowing motor vehicles.** The use of traffic calming devices such as raised intersections tells drivers that the area is not designed for rapid through movement, but rather is an area where pedestrians can be expected. Drivers must exercise caution when approaching raised intersections and be ready to yield right-of-way to pedestrians. Another way to slow drivers is to design right turn slip lanes with exit angles between 50 and 60 degrees.

4. **Ease of movement from walkway to street levels and vice versa.** Curb ramps facilitate the transition from walkways to streets. Raised intersections can make it easier to meet ADA requirements as a crosswalk becomes a natural extension of a walkway and the need for curb ramps is eliminated. However, care must be taken to ensure that the visually-impaired realize they are entering the roadway.

IMPLEMENTATION STRATEGIES

1. **Develop pedestrian-friendly intersection policies and design guidelines.** Official policies and related ordinances can go a long way toward making pedestrian-friendly intersection installations routine. When policies and ordinances are changed, make sure they are implemented. Likewise, if designers use "standard" pedestrian-friendly intersection designs , the likelihood that such intersections will be built is greatly increased.

2. **Capital projects.** Look for opportunities to improve the pedestrian-friendliness of intersections as part of capital projects. In urban and/or suburban situations, improve intersections when roads are widened or otherwise improved.

3. **Connect isolated sidewalks at intersections.** Many communities require property owners to install walkways in conjunction with development and/or zoning approvals. Sometimes in these situations, the communities never connect the sidewalks at vehicular intersections. At other locations, an ADA-mandated curb ramp will be installed but no connection is made to adjacent walkways at intersections . Coordinate private sidewalk installations and isolated curb ramps with the public works department to ensure that a contiguous pedestrian network is ensured.

4. **Annual intersection improvement program.** Start an annual intersection improvement program. Where the installation of concrete curbs, gutters, and drainage structures is planned, consider including the installation of intersection improvements such as curb ramps, curb

extensions, median refuges, crosswalks, and pedestrian signals as well. As intersection improvements may be constrained by available financial resources, projects should be selected with care. Give highest priority to locations used by school children, the elderly, or the disabled. Transit connections may also provide a focus.

RESOURCES AND SCHEDULING

Improving an intersection may take years. That's why it's important to be sure to review and make suggestions to proposed intersection designs promptly on a case-by-case basis. Although it may not be possible to completely retrofit an intersection, do not overlook opportunities to upgrade intersections incrementally, adding pedestrian signalization, curb ramps, and curb extensions where possible. The point is to make sure that intersections are not a weak link in the pedestrian network.

EVALUATION

Evaluate intersections for possible deficiencies. Implement a program to count pedestrians. Evaluate who is using particular intersections and when. Where heavy pedestrian use is occurring, expedite improvements at these locations. Determine which crossing movements are heaviest and, if possible, identify conflicts with vehicles.

PLANNING/DESIGN CONSIDERATIONS

Improving intersections for pedestrians involves the coordination and integration of a number of design elements, including:

- Crosswalks (see pages 13-18).
- Curb ramps (see pages 19-24).
- Curb extensions and curb radii (see pages 25-30).
- Signal timing and push buttons (see pages 31-34).

When designing intersections:

- Take vertical as well as horizontal sight distances into account.
- Refer to AASHTO's *1994 Policy on Geometric Design of Highways and Streets* (also known as the "Green Book") for formulas relating to storage space needed for pedestrians.
- Prohibit parking near intersections.
- Use curb extensions, curb ramps, median refuges, and signalization.
- Limit right turn on red movements in areas of high pedestrian volumes.
- Keep crosswalks at right angles to turning roadway terminals and slip lanes.
- Keep right turns below 24 km/h (15 mi/h) and left turns below 32 km/h (20 mi/h).
- Locate marked crossing close to the parallel street; 0.6 m (2 ft) offset is standard.
- Use stop lines for motorists; keep stop lines behind crosswalks.

CROSSWALKS

Well-defined crosswalks encourage pedestrians to cross at reasonable locations and increase motorists' awareness of pedestrians.

TYPICAL CONCERNS

Most pedestrians hit by motor vehicles were trying to cross the street. While many of these crashes were at intersections, others occurred at mid-block locations where people often cross directly to some "attractor" (e.g., a bus stop or post office). Some studies have suggested that marked crosswalks give pedestrians a false sense of security; this is wrong. The real problem is that motor vehicle operators are not complying with the vehicle code which requires them to yield or stop for pedestrians in a crosswalk (marked or not). The key to a successful crosswalk marking program is to back it up with effective enforcement to ensure that motor vehicle operators comply with the vehicle code.

POSSIBLE SOLUTIONS

One solution is to create a program that will encourage retrofitting of roadway crossings to encourage pedestrians to cross at appropriate locations and increase motorists' awareness of pedestrians. Crosswalks are one tool that municipalities can use to accomplish both goals. Other tools include curb extensions and median refuges, which are discussed on pages 25-30 and 43-48, respectively.

Important crosswalk concepts and issues include:

1. Creating reasonable expectations of where pedestrians will cross a roadway. A marked crosswalk creates a visible indication for both motorists and pedestrians of where pedestrians may typically be expected to cross a roadway.

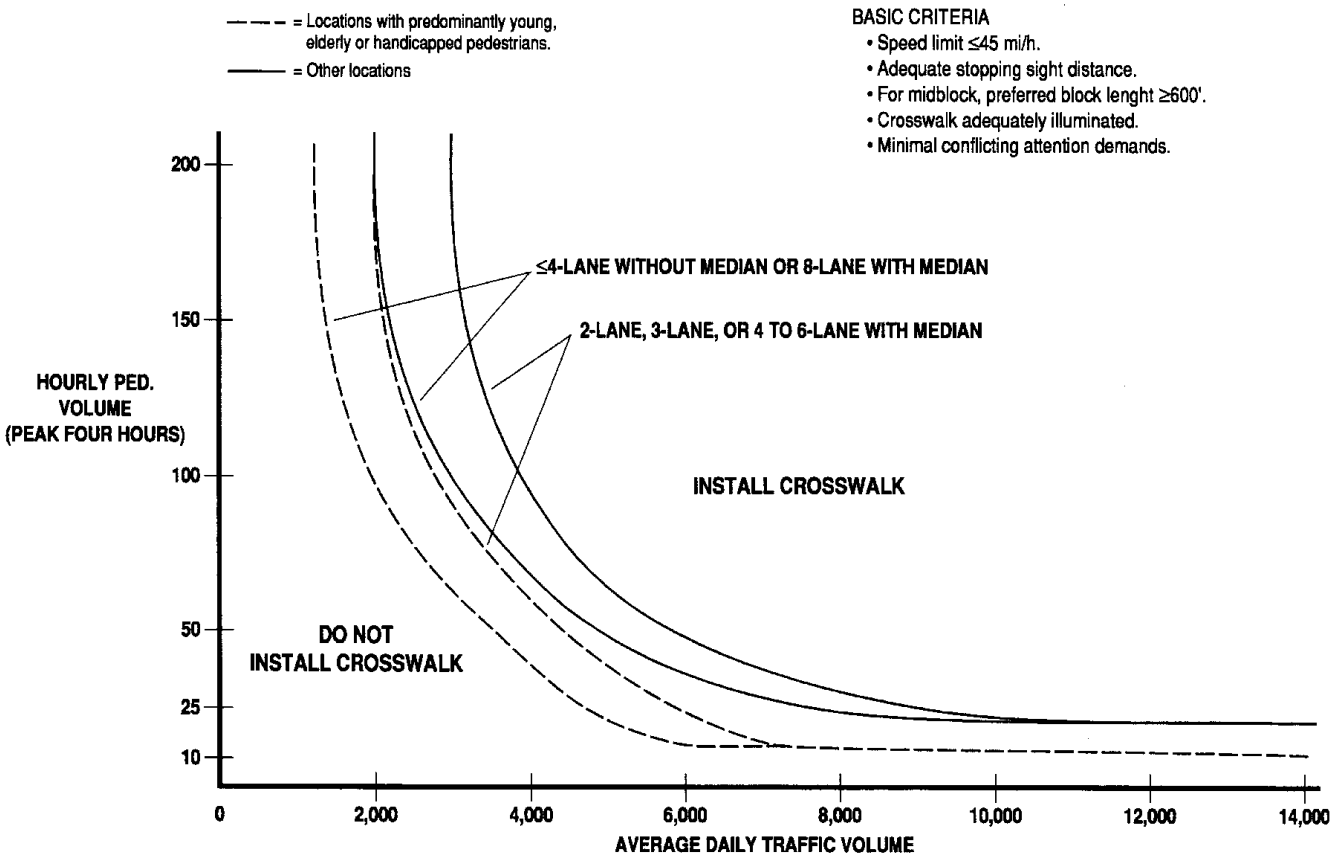
2. Predictability of pedestrian actions and movement. When combined with signalization (as well as curb extensions and median refuges where

appropriate), crosswalks can encourage pedestrians to cross at specific locations.

3. Where marked crosswalks might be located. Generally, marked crosswalks are located at all open legs of signalized intersections. When used with curb extensions, signs, and illumination, the visibility of pedestrian crossings can be enhanced.

Although expected at intersections, the installation of marked crosswalks at some mid-block locations is desirable when pedestrian crossings are likely.

The Institute of Transportation Engineers recommends that certain conditions may not warrant the installation of marked crosswalks, such as when the hourly peak pedestrian volume is very low (<25 pedestrians per peak four hours) or when traffic volume is very low (<2,000 ADT). At all other locations, or where predominantly young, elderly, or handicapped pedestrians may be found, marked crosswalks are recommended. (See figure below.)



1. If using only the peak **hour**, threshold must be increased by 1.5
2. For streets with median, use one-way (directional) ADT volume.

Other notes: Minimum striping is 6" parallel lines. Consider bolder markings and/or supplementary advance markings or signing at uncontrolled locations where speed limits exceed 35 mi/h.

Source: *Design and Safety of Pedestrian Facilities*, ITE (1997)

4. Work with existing guidelines. Part 3, Section 3B-18, of the *Manual on Uniform Traffic Control Devices* (MUTCD) provides guidance for marking crosswalks at signalized intersections and across intersection approaches on which traffic stops.

IMPLEMENTATION STRATEGIES

1. **Develop and adopt a crosswalk policy and design guidelines.** Decide where crosswalks will be used, and when policies and ordinances are changed or updated, make sure a crosswalk policy is implemented. Likewise, develop "standard" crosswalk designs for the public works department to follow.

2. **Piggy-back on capital and/or maintenance projects.** Look for opportunities to install crosswalks whenever intersections are changed or upgraded or when roadways are resurfaced or otherwise restriped.

3. **Use crosswalks to connect sidewalks and curb ramps at intersections.** Coordinate crosswalk painting with new or existing curb ramp locations.

4. **Establish an annual crosswalk improvement program.** Start an annual crosswalk improvement program. Schedule crosswalk replacement or repainting so that crosswalk markings do not deteriorate and become less visible to motorists.

5. **Implement a vigorous enforcement program.** Convince law enforcement authorities to actively enforce crosswalk laws and prosecute crosswalk violators. Create and implement a public relations program to increase public awareness about the responsibilities of motor vehicle operators. Emphasize crosswalk laws through the use of informational signage at crosswalk locations.

RESOURCES AND SCHEDULING

Crosswalks are relatively inexpensive to install. Determining where to install them, on the other hand, could take months or longer.

EVALUATION

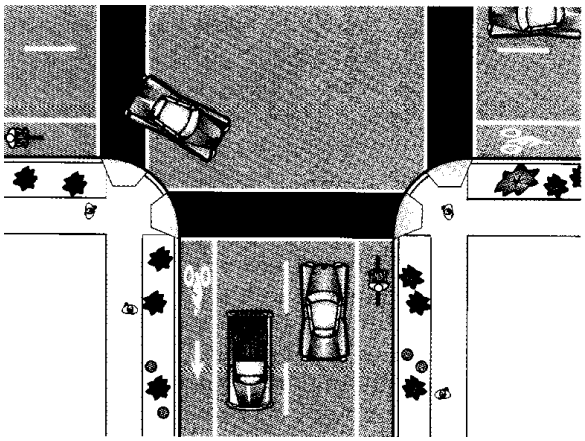
An informal traffic study can determine if the crosswalk program is enhancing pedestrian use and safety. Especially monitor locations of high potential pedestrian use. Review crash statistics on a regular basis.

PLANNING/DESIGN CONSIDERATIONS

When planning and designing marked crosswalks, consider these recommendations:

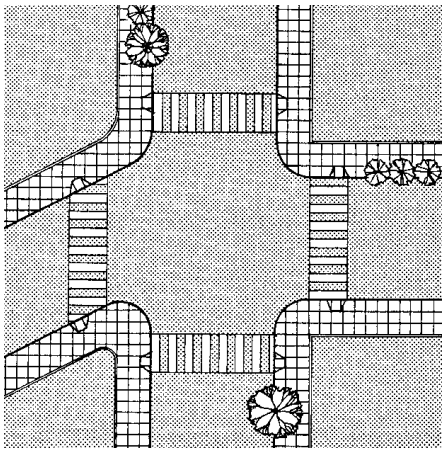
- Place crosswalks across full width of pavement.
- Use crosswalks at all signalized intersections.
- Use crosswalks at non-signalized intersections with discretion.
- Place crosswalks in locations where they are visible and where they are not obscured by parked cars or signs.
- Illuminate mid-block crosswalks and consider using median refuges.
- Use two white parallel lines 0.2 m to 0.6 m (0.5 ft to 2 ft) wide spaced at 1.8 m (6 ft) minimum, or the width of the approaching sidewalk if it is greater, to define a crosswalk area.
- Use special markings such as striped, or "zebra," longitudinal lines or diagonal cross-hatching for added visibility and to emphasize a crossing.
- Consider textured crossings, using non-slip bricks or colored pavers, to increase a driver's awareness through increased noise and vibration.
- Use crosswalks at the corners of skewed intersections.

Curb ramps should be directed in same direction as crosswalks



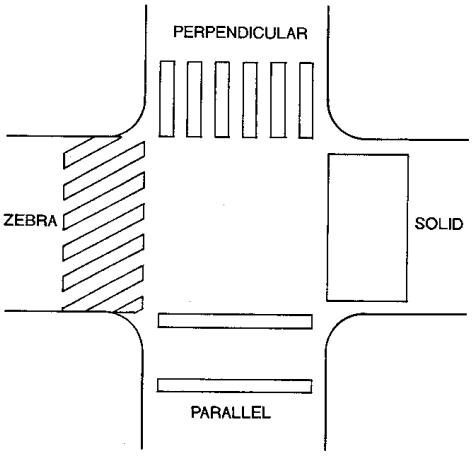
Adapted from 1995 Oregon Bicycle and Pedestrian Plan

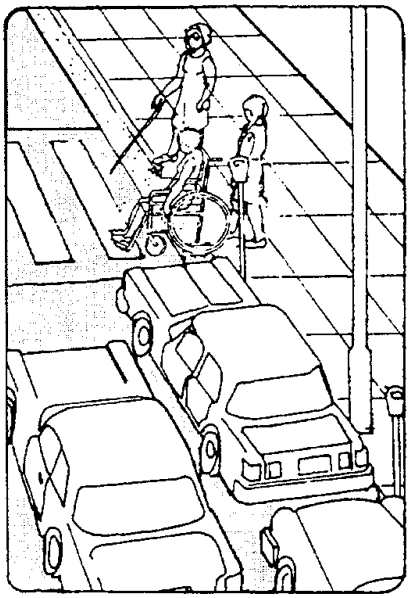
Colored and textured crosswalks increase drivers' awareness through increased noise and vibration



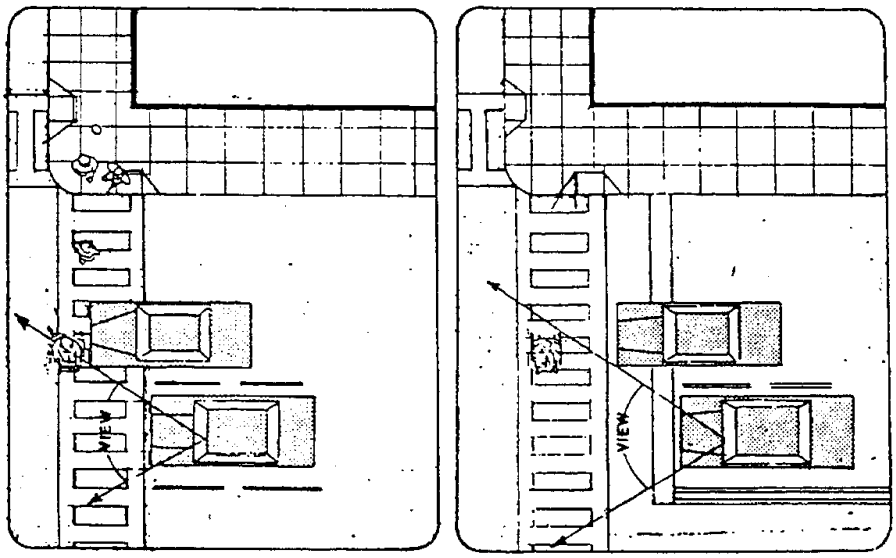
Adapted from 1995 Oregon Bicycle and Pedestrian Plan

Four types of crosswalk striping





Undesirable visual obstruction resulting from parked vehicles



(a) *(b)*

Typical vehicle encroachment and resultant sight restriction occurring without stop lines (a) and benefits of stop line installation (b)

Source:Planning, Design and Maintenance of Pedestrian Facilities, FHWA (1989)

Where warranted, the lighting levels in pedestrian areas should meet those recommended by the Illuminating Engineering Society (IES). See Table 6.

Table 6: Recommended Pedestrian Crosswalk Illumination.

Pedestrian Walkways	Commercial		Intermediate		Residential	
	Footcandle	Lux	Footcandle	Lux	Footcandle	Lux
Sidewalks	0.9	10	0.6	6	0.2	2
Pedestrian Walks*	2.0	22	1.0	11	0.5	5
Building Sites						
Entrances	5.0	55				
Grounds	1.0	11				
Parking Areas						
Self Parking	1.0	11				
Attendant Parking	2.0	22				

Values are given in minimum average maintained horizontal footcandles and lux.

* Crosswalks traversing roadways in the middle of land blocks at street intersections should be provided with additional illumination producing from 1.5 to 2 times the normal roadway lighting level.

Source: Illuminating Engineering Society (IES)

CURB RAMPS

Curb ramps ease the transition from walkways to roadway and open the entire pedestrian network to people with disabilities.

TYPICAL CONCERNS

The absence of curb ramps prevents many wheelchair users from crossing streets. Such a deficiency is common in many communities. Even if ramps are provided, they may be poorly designed.

Typical problems include:

- Steep slopes.
- Lack of a flat landing area.
- Obstructions in or near the ramp.
- Ramps that are too narrow to accommodate wheelchairs.

When new public walkways are built, the ADA requires a curb ramp at each curbed street crossing. Ramps must also be added when roadways are repaired. Recently, a Pennsylvania court interpreted this requirement very broadly to include annual street resurfacing programs.

ADA also requires that curb ramps be considered in regulations for new development, annual programs, and capital projects. Plans should show how communities will systematically install curb ramps, especially at key locations like social service agencies and transit stops.

POSSIBLE SOLUTIONS

The solution is to install curb ramps using ADA design guidelines. Curb ramps should be installed along with all new walkways. A program to retrofit existing walkways with curb ramps should be developed. Existing

curb ramps should be inspected and replaced if they do not meet ADA guidelines.

IMPLEMENTATION STRATEGIES

Having curb ramps installed at all intersections with sidewalks requires a clear, well-thought-out strategy that may require a period of several years to fully implement. Here are three keys to a successful approach.

1. Regulate new development and re-development. Make sure all permits involving walkways include curb ramps. This is required by ADA anyway so it shouldn't be a hard sell. Local ordinances may need changing or, where there is less formality, a simple directive might be issued. The same goes for bringing standard plans and specifications into compliance with ADA guidelines.

Simply changing the regulations to require curb ramps, however, may not be enough. People who review new plans and issue permits must know where ramps are appropriately located and what is an acceptable design. Here are several steps to consider:

a. Find out who reviews plans and issues permits. They may or may not be the same people.

b. Educate them on ADA and local curb ramp requirements (location and design). This could involve developing typical layouts and designs, a special training session, or a presentation at a staff meeting.

c. Follow up. Education is not a one-time effort—employees move on and new ones take their places. Periodic memos and presentations can keep everyone on track.

d. Inspectors are key players. Involve them in each of the steps above.

2. Capital projects and annual programs. ADA requires curb ramps to be installed whenever "alterations to the existing transportation infrastructure" are made. In other words, all capital projects and annual programs must be scrutinized for opportunities to install new ramps to ensure that all new or rebuilt intersections conform with ADA requirements. This can include construction projects ranging from annual resurfacing programs to major signalization upgrades and street widening.

Implementing a curb ramp requirement for all capital projects and annual programs requires an ongoing, concerted effort. There are several things that can be done.

a. Work with the managers of annual programs, such as asphalt resurfacing, to identify locations where curb ramps should be installed.

b. Make sure curb ramps are written into all the "scopes of work" and budgets for funding proposals (e.g., the Intermodal Surface Transportation Efficiency Act [ISTEA]) and locally funded capital projects.

c. As projects are funded and staff assigned, make sure the project manager knows where curb ramps must be included in the project. Have someone review designs to make sure well-designed curb ramps have been included.

3. Annual curb ramp installation program. To meet ADA requirements, an annual curb ramp installation program will likely need to be created. Here are some ways to get started.

a. Encourage staff and constituents to identify locations where ramps are needed. Try distributing "ramp request forms" to agencies and groups involved with the disabled community.

b. Develop a systematic way for identifying priority locations. Start by looking at sites that serve transit, social service agencies, schools, and neighborhood shopping areas.

Curb ramp projects may either be built by contractors or the public works department. Both ways can work and one is not necessarily cheaper than the other. However, here are two important points to consider.

- Curb ramps must be properly built. Even a quarter inch lip on a ramp can make it difficult, if not impossible, for some wheelchair users to negotiate.
- It helps public relations to respond to ramp requests within a reasonable amount of time—less than six months. When using private contractors, it may make sense to bid some of the ramps on a per unit basis as opposed to a site-specific basis to allow for quickest response to citizen requests.

CITIZEN WHEELCHAIR RAMP REQUEST
City of Seattle Wheelchair Ramp Program

Please provide a written description or sketch of the location(s) where wheelchair ramps would make your travel more safe and convenient.

LOCATION: NE NW SE SW All corner(s) of the
(please circle appropriate locations)

N

intersection between _____
(please list intersecting streets above)

(Street Name)

(Street Name)

PLEASE PROVIDE BELOW
Comments, Suggestions or Other Information that may assist us in providing a better service to you!

Please mark intersection corners needing wheelchair ramps with an "X".

REPORTED BY: Name _____ Day Phone _____
Address _____ Zip _____ Date _____

Please return to: Wheelchair Ramp Program, Rm 708 Municipal Building, Seattle, WA 98104

For more information, Contact Pam Hamlin at 684-5377

Source: City of Seattle (Washington) Engineering Department

RESOURCE REQUIREMENTS & SCHEDULING

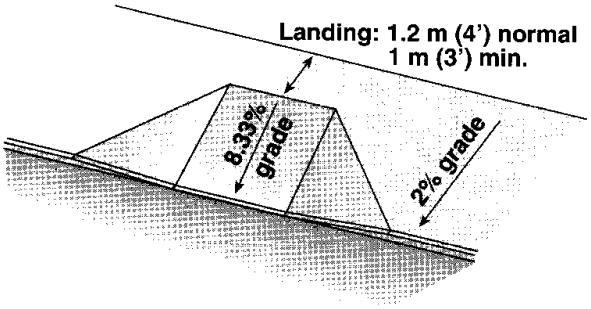
Curb ramps typically cost between $500 and $1,000 each. Usually it's cheaper to install a large number at the same time or as part of other concrete work. Timely ramp installation is a key part of an overall pedestrian program. Frequently, curb ramps can be installed easily and quickly, giving communities highly visible products that can improve locations all over town. With this in mind, it is preferable to design a curb ramp program to respond to citizen requests within six months. Where narrow sidewalks and limited rights of way exist, installation of curb ramps may take longer. In either case, consider using a citizen request card to bring curb ramp

requests to the attention of the street or public works department. The City of Seattle has developed an excellent program in this regard (see above).

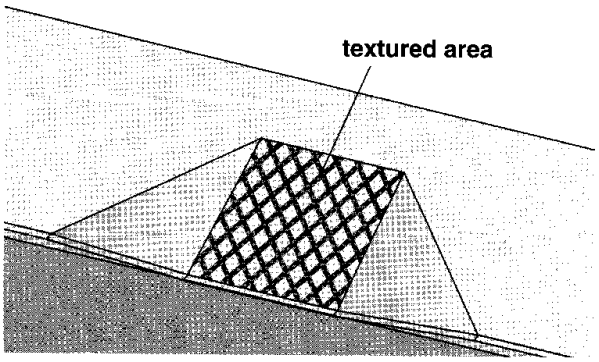
EVALUATION

Check to see if ramps are getting built as required and designed. In the case of new developments, do occasional check-ups to see if ramps are included in new plans. The same goes for annual programs. Seek out feedback on the location and design of ramps from local organizations that include wheelchair users.

PLANNING/DESIGN CONSIDERATIONS



1 m (3 ft) wide area at 2% cross-slope on walkways

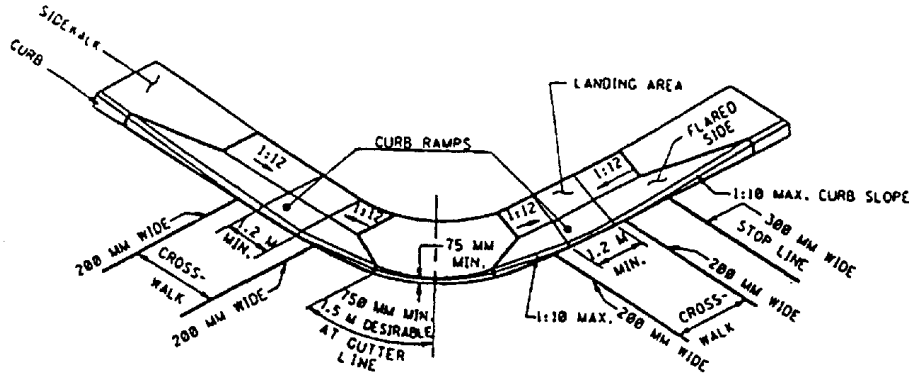


Textured ramp

Source: *Oregon Bicycle and Pedestrian Plan* (1995)

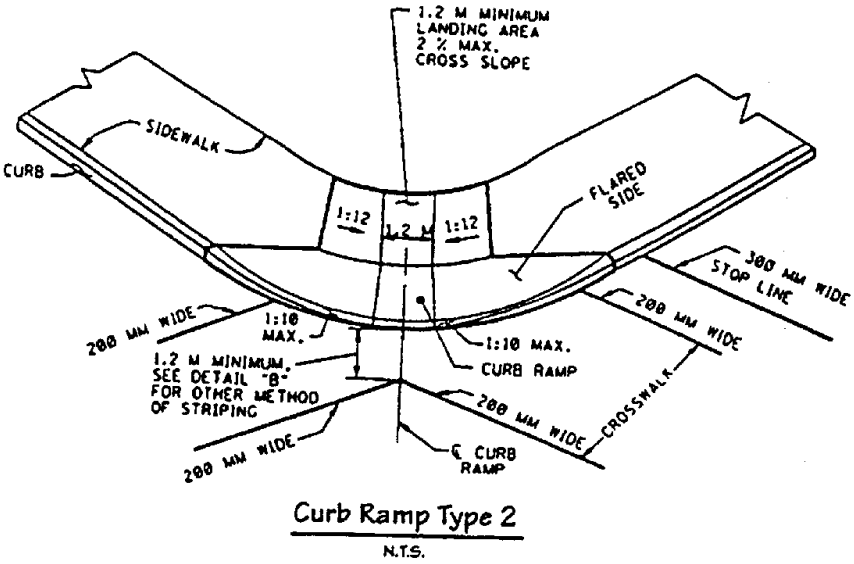
Important planning and design considerations for curb ramps include:

- A maximum slope not to exceed 8.33 percent (1:12) is required.
- A minimum width of 0.9 m (3 ft) or greater is required.
- A maximum allowable cross-slope of 2 percent (1:50) is required.
- Transition areas between a walkway and a ramp should be beveled not to exceed 8.33 percent (1:12).
- Textured surfaces at curb ramps help identify crosswalk locations for visually impaired pedestrians.

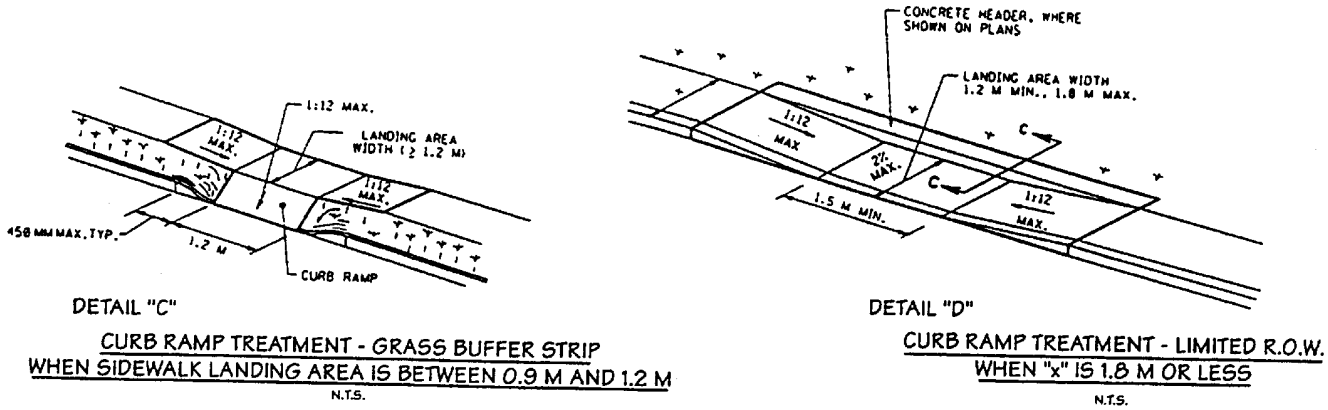


Perpendicular curb ramp

Source: *Standard Roadway Construction Details*, NJDOT



Diagonal curb ramp



Parallel curb ramp

Source: *Standard Roadway Construction Details*, NJDOT

ADA CONSIDERATIONS

- Two curb ramps are the preferred option at intersections for new construction.
- Alternatively, one oblique cut may be provided to direct users into the travelway.
- A continuous passageway behind curb ramps must be provided for wheelchair users who are not using the curb ramp. Such passageways must be at least 0.9 m (3 ft) in width and side slope must not exceed 1:50 (2 percent).

CURB EXTENSIONS & CURB RADII

Curb extensions shorten crossing distances and reduce pedestrians' exposure to motor vehicles.

TYPICAL CONCERNS

Pedestrians are exposed for a longer length of time to the threat of being hit by a vehicle when crossing a wide street. Another problem pedestrians face when trying to cross a street is visibility. Parked cars may make it difficult for them to see oncoming vehicles and vice versa.

Also, when streets intersect at an acute or obtuse angle or have a large curb radius, motorists can make turns at relatively high speeds. By contrast, 90-degree intersections and corners with tight curb radii tend to slow motorists down. The problem with obtuse angles is particularly bad when a vehicle on an arterial street turns onto a residential street. Pedestrians crossing the residential street adjacent to the arterial may not expect high-speed turning traffic or they may have their backs turned to the turning cars.

POSSIBLE SOLUTIONS

The solution is to shorten the crossing distance for pedestrians. One way to effectively shorten the pedestrian crossing distance on streets where parking is permitted is to install curb extensions, also known as bulbs, neckdowns, flares, and chokers. Curb extensions project into the street, usually for a distance equal to the depth of a typical parallel parking space, making it easier for pedestrians to see approaching traffic and giving motorists a better view of pedestrians. When motorists are better able to see pedestrians, they have a greater opportunity to stop.

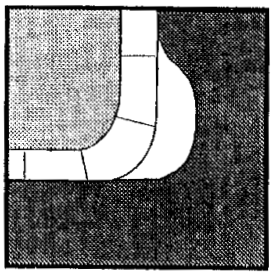
Decreasing crossing distances for pedestrians may also provide these motor vehicle capacity benefits:

- At signalized intersections, it decreases the length of the pedestrian phase.
- At unsignalized intersections, it reduces the time a right or left turning vehicle has to wait for a pedestrian to cross before exiting the roadway.

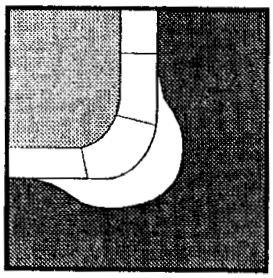
When designing curb extensions at intersections where there is low truck traffic, consider making the corner radius as small as possible. This will have the effect of slowing down right turning motor vehicles. However, where truck traffic is present, a tight corner radius may require these vehicles to use additional care in making such a turn.

Simultaneously installing curb extensions and changing curb radii is frequently possible since both involve moving the curb and gutter into the improved portion of the street right of way.

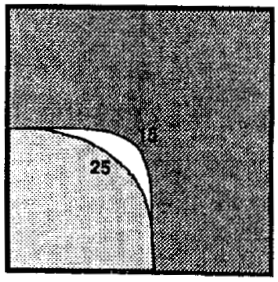
Where acute or obtuse intersections are encountered, such as where a residential street meets an arterial, creating an intersection that is closer to 90 degrees may also provide opportunities to reduce curb radii and create curb extensions.



Half extension



Full extension



Curb radius change

For a discussion of the advantages and disadvantages of each of these pedestrian improvements, see page 35 of the *Seattle Engineering Department Policy/Budget Considerations On Pedestrian-Related Design*, Seattle (Washington) Engineering Department, 1992.

IMPLEMENTATION STRATEGIES

Curb extensions and curb radius changes are appropriate for a limited number of intersections. As with other pedestrian improvements, the key is to develop an implementation strategy and stick to it for several years. Here's how to get started.

1. Arterial and residential street specifications. Include curb extensions and/or smaller curb radii in standard plans and specifications for public and private road projects. A change in one or more local ordinances may be required or specifications may sometimes be implemented by administrative rule.

2. Annual curb bulb installation program. Start an annual program to install curb extensions and adjust the curbs at obtuse-angle intersections. Develop project selection criteria to select the projects that will do the most to enhance safety. Consider including:

a. Locations where residential streets meet arterial streets at an obtuse angle.

b. Locations that are on routes used by school children or the elderly.

c. Downtown or neighborhood shopping areas with high pedestrian volumes.

d. Projects nominated by neighborhood associations.

RESOURCE REQUIREMENTS & SCHEDULING

The cost of installing curb extensions and changing the curb radii can vary considerably, depending on whether drain grates have to be moved and/or whether there are other issues that have to be addressed. For example, it may be necessary to move the conduit for a traffic signal or relocate utility poles and light and/or sign posts.

Decide if the work is to be done by the public works department or a private contractor. In general, if only a few bulbs are involved, it may be cheaper and faster to have town or city crews do the work. If there is a lot of work to do, it may be cheaper to use a private contractor. The key is to let the public know how long it will take to install a bulb and then deliver promptly.

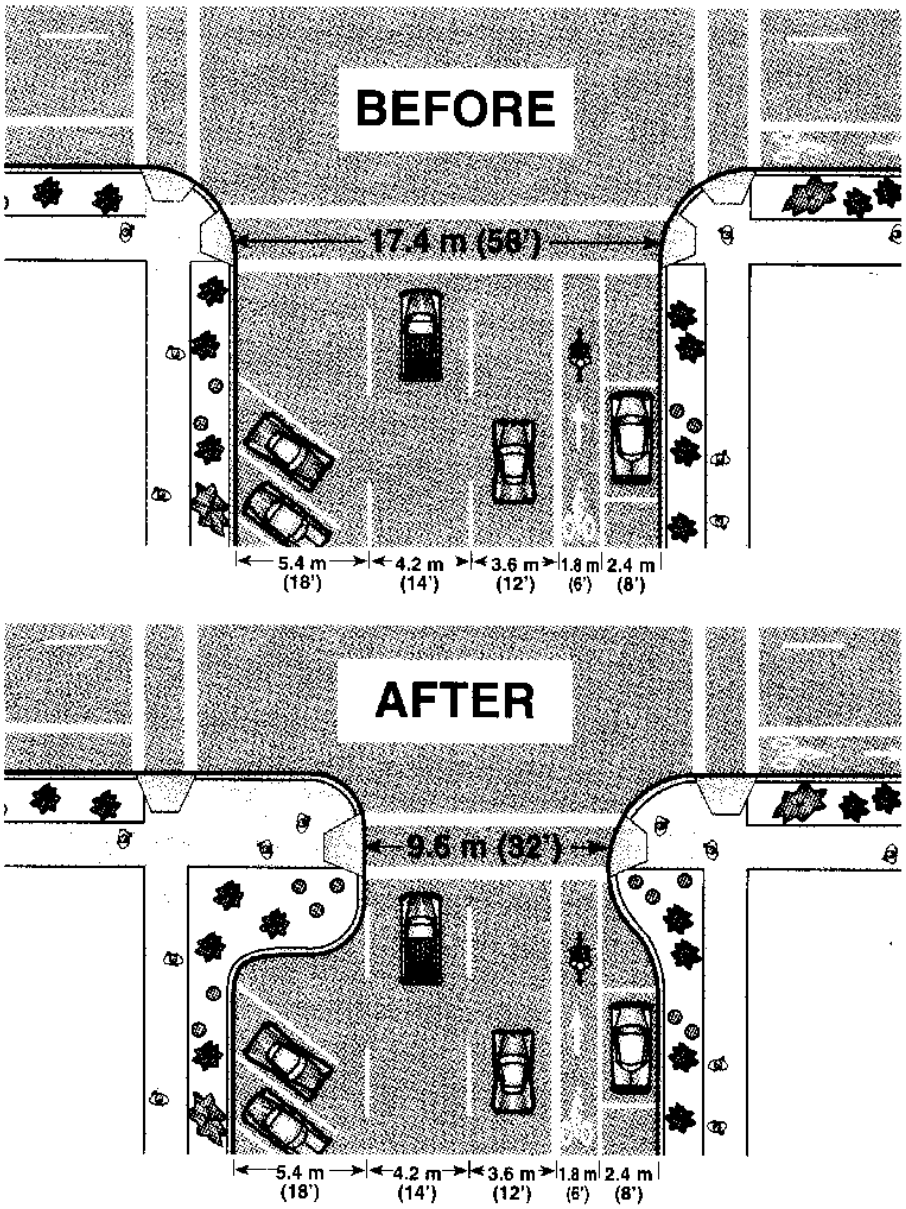
EVALUATION

Visit project sites to determine if good locations have been selected and the best design(s) are being used. Check crash records, do speed studies of cars making turns, look at the curbs to see if trucks or buses are driving over them, and ask pedestrians if they feel safer. Be a good listener and observer, and make modifications where needed.

PLANNING/DESIGN CONSIDERATIONS

Transportation engineers have been increasing curb radii over the years to keep trucks and buses from running over curbs and to increase capacity. Many intersections, however, have been designed with large curb radii where large truck traffic or buses are not anticipated (e.g., in residential neighborhoods). The following are guidelines for curb extensions and small curb radii:

- On arterial streets, install curb extensions only where permanent parallel parking is next to the curb. Curb extensions should protrude a minimum of 2 m (6 ft) into the roadway. Ideally, they should project the full depth of adjacent parking stalls, usually 5.5 m to 6 m (8 ft to 9 ft). Curb bulb projections prevent the parking area next to the curb from becoming a travel lane.
- A curb radii of 3 m to 4.5 m (10 ft to 15 ft) should be used where residential streets intersect other residential streets and arterial streets.
- A curb radii of 6 m (20 ft) or less should be used at the intersections of arterial streets that are not bus or truck routes.
- A curb radii of 7.5 m to 9 m (25 ft to 30 ft) or less should be used at the intersections of arterial streets that are bus and/or truck routes.
- Curb extensions should not extend too far into the street to present a bottle-neck for bicycle travel. At a minimum, a 4.3 m (14 ft) travel lane should be maintained on arterial and collector streets.



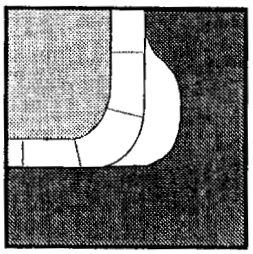
Curb extensions reduce crossing distance

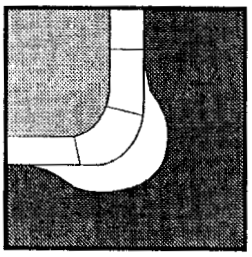
Source: *Oregon Bicycle and Pedestrian Plan* (1995)

SED Policy/Budget Considerations On Pedestrian-Related Design

(1992)

Curb Bulbs





Advantages:

- Shortens the crossing distance and reduces the exposure time pedestrians are in the roadway.
- May eliminate the multiple-threat accident potential.
- Provides the pedestrian with a better view of approaching traffic and allows the pedestrian to clearly indicate their crossing desire.
- Provides the motorist with a better view of pedestrian and thus a greater opportunity to stop.
- Enforcement of crosswalk legislation is more easily facilitated.
- If designed with new roadway construction, cost savings due to minimum pavement thickness for parking lane.

Disadvantages:

- Limits curb lane to parking only; i.e., cannot be used as temporary driving lane with temporary elimination of parking or cannot eliminate parking to accommodate an additional traffic lane or striped four-five foot bicycle lane.
- High cost: especially when retro-fitting; design should be aesthetically pleasing for pedestrian-friendly environment; and design may require drainage inlet relocation.

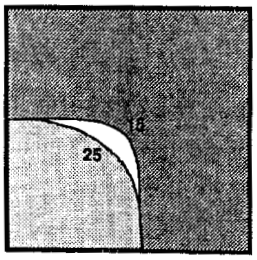
Issues:

- Curb bulbs are too often overlooked when opportunities are available for installation; e.g., condition developments.

Goals:

- Institutionalize curb bulbs so they will be considered for all projects by DCLU and Plan Review.
- Develop a curb bulb program and a budget to target problem crossing locations.

Curb Radius



- The current Seattle Street Improvement Manual design standard for an arterial to arterial curb radius is 25' - if large number of truck or bus turns the design standard is 30'.
- The Seattle CBD at one time had 9' curb radii and the arterial to arterial standard was 15'.

Rationale for increasing curb radii:

- Curb radii have been increased over the years to accomodate longer truck and bus lengths and thus reduce the likelihood of trucks/buses running over the curb and striking pedestrians standing on the corner; and to increase capacity by facilitating rapid right turn movements.

Issues:

- Increased curb radii facilitate rapid right turns: often motorists execute a "California Stop" looking to their left for a gap in traffic and do not look for pedestrians that may be stepping off the curb to their right.
- Increased curb radii increases the pedestrian's crossing distance and exposure time they are in the street.
- The additional vehicle space was previously pedestrian space on the corner - may create a pedestrian unfriendly area.

Goals:

- Incorporate curb bulbs at locations where curb radii are increased for pedestrian visibility and safety.
- Expand the current limit on large truck access to certain streets and hours and incorporate reduced street standards into design.
- Prevent further increases in truck lengths.

Source: Seattle (Washington) Engineering Department

SIGNAL TIMING AND PUSH BUTTONS

Pedestrian push buttons are effective only when the buttons are accessible to pedestrians.

TYPICAL CONCERNS

The public is often baffled by pedestrian signals and push buttons. These devices seem to vary not only from jurisdiction to jurisdiction but also from intersection to intersection. To many pedestrians, the Walk/Don't Walk signal timing lengths appear arbitrary. Also, the meaning of the flashing Walk/Don't Walk phases may not be understood. Part of the problem stems from the fact that many walkers do not know that the flashing Don't Walk is intentionally displayed before an average person can complete crossing the street. Another part of the problem may result from timing cycles that are simply too short for slow walkers such as older pedestrians and people who are disabled.

Another aspect of the problem may be the absence of pedestrian push buttons or a call button is that is obscured or difficult to reach. At many intersections that do have push buttons, the Don't Walk phase is so long that pedestrians think the push button request did not work. All of these problems lead to disrespect for pedestrian signals.

POSSIBLE SOLUTIONS

Develop policies governing pedestrian signal timing and push button actuation to ensure fair treatment for pedestrians. Make signal timing as consistent as possible, and adopt a clear pedestrian push button warrant. Develop a desired time period for pedestrian waiting and push button response times and evaluate signalized intersections. Ensure that the pedestrian level of service at signalized intersection falls within an acceptable range. Refer to Part 4, Section 4B-28, of the *Manual on Uniform Traffic Control Devices* (MUTCD) for guidelines on the design and operation of

traffic control signals that take into consideration the needs of pedestrian as well as vehicular traffic.

Major issues relating to pedestrians and signalized intersections include:

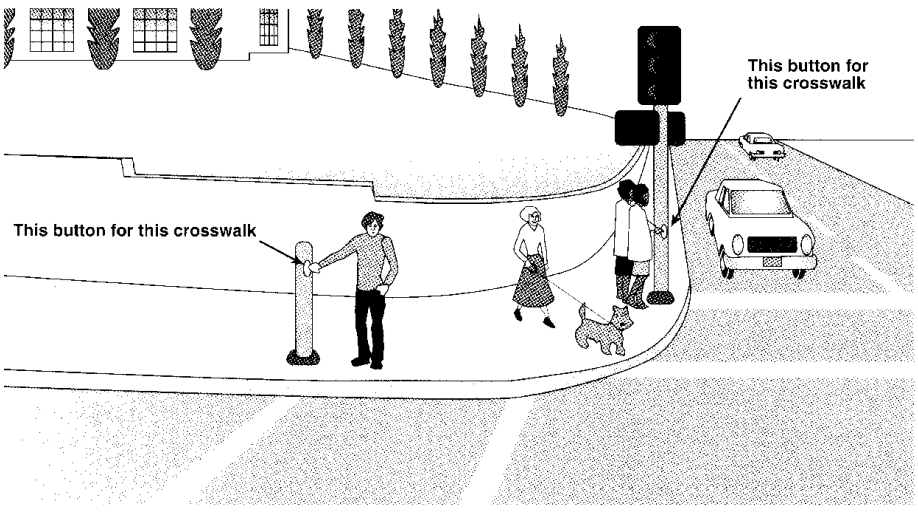
- Seemingly arbitrary length of Walk and flashing Don't Walk cycles.
- Pros and cons of lengthening the Walk or flashing Don't Walk to accommodate slower pedestrians.
- Safety trade-off of shortened pedestrian phases implemented to enhance vehicular right turns.
- Trade-off between motor traffic delays and pedestrian delays at actuated pedestrian crossings.
- Designing and exploring pedestrian actuation in a way pedestrians will understand.

IMPLEMENTATION STRATEGIES

Making signalized intersections consistent with stated policies won't happen overnight. Consider it part of a long term commitment to pedestrian safety. Whatever strategy is employed, use field observations to see how pedestrians react to signal timing and push buttons. Comparing a variety of configurations will help make it possible for workable and consistent policies to be developed.

Annual program: A comprehensive strategy involves evaluating and prioritizing problem locations. It should not be hard to locate those needing attention. In all likelihood, the public works department probably maintains a file filled with complaints from citizens.

New signal or signal timing projects: Review the pedestrian signal timing plan for any intersections undergoing signal modifications or adjustments. Be aware of signal work and provide appropriate suggestions. This will help transportation engineers and traffic signal technicians become more sensitive to pedestrian needs.



Conveniently placed push buttons

Source: *Oregon Bicycle and Pedestrian Plan* (1995)

RESOURCE REQUIREMENTS

Given the peculiarities of many intersections, a strictly policy-driven approach may not work. As a result, trained personnel will be needed to evaluate signal timing and actuation at specific locations. Most of the work will be done by staff of the local traffic engineering department.

EVALUATION

Monitor intersections with modified signal timing and push buttons, and compare them with unaltered intersections. Crash reductions and/or fewer pedestrian complaints will be good indicators if the new policies are working.

PLANNING/DESIGN CONSIDERATIONS

Consider these issues and features when providing signals that are responsive to pedestrians:

- Signals must fulfill a need, command attention, convey a clear and simple meaning, command respect of road users, and provide adequate time for response.
- The MUTCD assumes normal walking speed to be 1.2 m/s (4 ft/s). However, the use of 1.1 m/s (3.5 ft/s) as a walking speed in calculations is becoming more common. Consider using 0.9 m/s (3 ft/s) where there is a high frequency of older pedestrians. Some people with mobility impairments move as slow as 0.8 m/s (2.5 ft/s).
- When their delay exceeds 30 seconds, many pedestrians stop watching for a light or signal indication, and look for gaps to cross the street.
- Place pedestrian signal heads at each end of crosswalk.
- Place push button at top of and as near as possible to the curb ramp and clearly in line with the direction of travel. This will improve operations as many pedestrians push all buttons to ensure they hit the correct one.
- Use a push-button box that gives pedestrians a visible acknowledgment (indicator light comes on at push button box) that their crossing request has been received.
- Where medians exist, place additional push buttons in medians. If the signal head on opposite of street is more than 18.3 m (60 ft) away, place additional pedestrian signal heads in medians.
- Place pedestrian signals and buttons in channelized islands.
- Visually impaired people may need audio support at key signalized intersections.
- Audio signals are available in different sounds from pleasant (cuckoo or tinkling bell sounds are preferred) to obnoxious (avoid raspy-sounding buzzers).
- Symbolic signal face designs are preferred over signal faces that use the words WALK and DONT WALK.
- Pedestrian intervals and phases:

  Where pedestrian signals are provided, the sum of the WALK phase

(which allows time for pedestrians to search and start walking) and the flashing DONT WALK phase (also known as the pedestrian clearance interval) should equal the full GREEN phase for vehicles.

Avoid shortening the WALK phase to improve the flow of right-turning vehicles. Include the clearance interval as part of the total crossing time, which is calculated by dividing the total distance to be crossed by the average walking rate as determined by the customer base (i.e., 0.8 m/s to 1.2 m/s [2.5 ft/s to 4 ft/s]).

The steady DONT WALK phase, when pedestrians should be out of the street, should occur during the YELLOW and RED phases for vehicles.

The MUTCD has many guidelines regarding push button placement and pedestrian signal timing.

SIGNING AND MARKING

A wide variety of signs are used to alert motorists to pedestrian activity, caution pedestrians at dangerous crossings, and direct pedestrians to designated crossings.

TYPICAL CONCERNS

Traffic engineers use a wide variety of road signs and pavement markings. Some are used to alert motorists to pedestrian activity, caution pedestrians at dangerous crossings, and direct pedestrians to designated crossings.

The problem is one of perceptions and assumptions: Pedestrians often assume that motorists will obey signs and respect pavement markings. Yet, drivers often ignore pedestrian signs and markings.

POSSIBLE SOLUTIONS

Used judiciously and located with consistency, signs and markings can be effective. Jurisdictions should develop clear guidelines for their use and should avoid over-reliance on signs and paint to control motorist behavior. This may mean altering and/or relocating existing signs and markings. Studies are in progress to determine whether markings (especially text messages) improve pedestrian safety and whether signs contribute to visual overload for motorists and breed disrespect for messages.

IMPLEMENTATION STRATEGIES

Modifying and relocating pedestrian signs and markings for consistency can't be done overnight. Use a combination of long-term strategies to achieve success.

Sign and pavement marking review program: Although it is a significant undertaking, consider implementing an annual program to evaluate high-risk areas with significant pedestrian activity. Consider commercial districts, schools, hospitals, and social service centers. Make observations at mid-block crossings with and without warning signs and/or markings. Look at how pedestrians and motorists behave depending on the type and placement of signs and markings.

Observe dangerous crossings (i.e., ones with crashes). Consider the possible role of poorly placed signs, too many or too few signs, or a lack of signs and/or markings in exacerbating dangers. Survey drivers and pedestrians, asking how they react to various symbols in order to determine where and what signs and markings work best.

Major street rehabilitation: Revamping pedestrian signs and markings is relatively inexpensive. As a result, review existing signs and markings whenever widening a street, relocating curbs, upgrading signals, resurfacing roadways, or doing large-scale utility cuts.

Citizen participation/education: While developing sign and marking policies, meet with community groups, senior citizen organizations, chambers of commerce, school officials, and others. Such groups often request pedestrian signs and crosswalks but all too often their requests are turned down. Citizens may not agree with agency decisions to remove problem signs, crosswalks, or pavement markings. Too much signing may reduce their visual impact and lessen respect.

At the same time, take advantage of residents' knowledge in selecting sites for new signs and markings. And, if the jurisdiction has any citizen boards or committees that address traffic, pedestrian, or urban design issues, have them review proposed pedestrian signing and marking policies.

There is no better qualified resource than the public to help identify needs and problem locations. They may not be, however, the best resource to develop solutions for these needs and problems.

Sign/marking maintenance program: Assuming standards are already in place, review pedestrian signs and markings as a part of the repainting and sign maintenance schedule. Make sure crosswalks are well-painted. This, and making sure pedestrian signs are not obstructed by trees are often the main problems to be fixed.

RESOURCE REQUIREMENTS & SCHEDULING

Though it may take several years to review all the major crosswalks, focus on the high pedestrian volume areas first. Much of the cost will involve formulating policies, and up-front traffic engineering work. Costs of paint, signs, relocation, design, and construction vary from place to place, but are relatively inexpensive. The experience gained in creating an on-going program will lead to efficiencies and cost savings. However, keep in mind that agency budget priorities can change, leaving such a program unfunded sometime in the future. The least expensive, but admittedly slowest, approach would be to combine signing and marking changes with other essential street maintenance work.

EVALUATION

It may be possible to asses long-term program effectiveness by comparing before-and-after crash rates. At least three years of before and after data are required for statistically valid results. For a more immediate view, watch for changes in the number of complaints at troublesome crossings that have been modified. Citizens interested in a particular location should be happy to offer comments.

PLANNING/DESIGN CONSIDERATIONS

The *Manual on Uniform Traffic Control Devices* (MUTCD) governs signs, signals, and pavement markings to help ensure that such guidance and warnings are consistent. The MUTCD does not give specific criteria for crosswalk locations or striping options. Much is left to engineering judgment. As a result, there is leeway in adapting local guidelines to specific signing and marking policy needs.

Seattle is developing an experimental sign aimed at educating and reminding motorists of 1990 crosswalk legislation supported by citizens. The sign will be installed at locations where crosswalk or pedestrian signs are not appropriate. It is designed to be relocated after four to six weeks to another location. Coordination with the Seattle Police Department will ensure enforcement. Initially, Seattle will place four 760 mm x 900 mm (30 in x 36 in) black on yellow signs in different locations around the city.*

Colors for signs and markings should conform to the color scheme recommended by the MUTCD to promote uniformity and understanding from jurisdiction to jurisdiction. For the background color of signs, use:

- YELLOW—General warning.
- RED—Stop or prohibition.
- BLUE—Service guidance.
- GREEN—Indicates movements permitted, directional guidance.
- BROWN—Public recreation and scenic guidance.
- ORANGE—Construction and maintenance warning.
- BLACK—Regulation.
- WHITE—Regulation.

For pavement markings, use:

- YELLOW—Centerline stripes.
- WHITE—All other pavement stripes and markings, including edge stripes, lane markings, and crosswalks.

Warning signs that alert drivers of vehicles of the potential presence of pedestrians include the symbolic PEDESTRIAN CROSSING **without** crossing lines (W11A-2) to warn motorists of a crossing point ahead at a distance or areas of high pedestrian use, and the symbolic PEDESTRIAN CROSSING **with** crossing lines (W11-2) to indicate a specific crossing location, such as at a marked crosswalk.

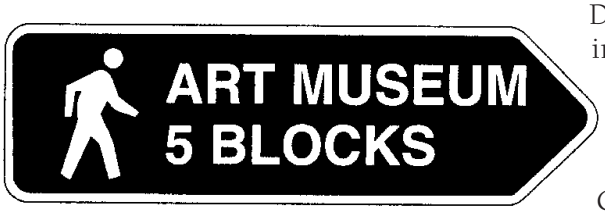
Signs W11A-2 and W11-2

*Inclusion in this report does not constitute FHWA endorsement. This device currently is not included in the Federal Manual on Uniform Traffic Control Devices (MUTCD). Before using any traffic control device that is not included in the MUTCD, the interested State or locality should submit a request for permission to experiment to FHWA's Office of Highway Safety (HHS-10), 400 Seventh Street S.W., Washington, DC 20590. Guidelines for conducting an experiment can be found in Part 1A-6 of the MUTCD.

Traffic signs directed at pedestrians include, but are not limited to, CROSS ON WALK SIGNAL ONLY (R10-2 and R10-2a) and CROSS ONLY AT CROSSWALKS (R9-2).

Where motorists seldom stop for pedestrians in crosswalks and where motorist behavior modification is needed, STOP FOR PEDESTRIANS IN CROSSWALK signs and standards placed in the roadway have proven effective.

Sign R9-2



Pedestrian directional sign

Directional signs for pedestrians are intended to assist people who are new to the area or to assist residents who may not know the most direct route to a destination by foot. Use distances meaningful to pedestrians such as number of blocks or average walking time.

Consult the *Manual on Uniform Traffic Control Devices* (MUTCD), the *Traffic Control Devices Handbook* or the FHWA publication *Planning, Design and Maintenance of Pedestrian Facilities* (1989) for specific guidance on pedestrian traffic control devices and procedures.

PEDESTRIAN AMENITIES

Pedestrian amenities such as landscaping, buffer areas, benches, walkway illumination, and attractive handrails and waste containers can create an environment that is pleasing and inviting to walkers.

TYPICAL CONCERNS

A streetscape that is devoid of pedestrian amenities and street furniture is inhospitable and uninviting. Such environments actually discourage walking. A survey conducted as part of the Louisiana Bicycle and Pedestrian Plan found that 30 percent of the people who might walk more often would do so if more benches and water fountains were available.

POSSIBLE SOLUTIONS

Unlike motorists, pedestrians must move using their own power and they are exposed to the weather. Providing opportunities for them to rest, to shield themselves from the weather or hot sun, or to refresh themselves with a cool drink greatly improves the walking environment. Amenities such as seating, shelters, water fountains, and landscaping are low-cost improvements that are always appreciated, as are informational and directional signs. Lighting should also be provided to increase visibility and safety at night.

Many people walk or jog for fitness. Social and recreational walking trips account for 12 percent of all pedestrian trips. Almost 90 percent of suburban area residents walk for recreation and exercise. For these trips, a hospitable environment is especially important if walking is to be sustained and encouraged.

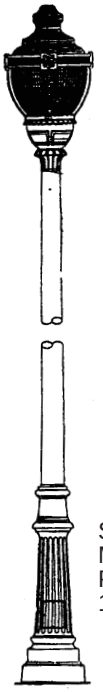
IMPLEMENTATION STRATEGIES

Pedestrian amenities may be considered enhancements to walking. Develop a program that systematically prompts consideration and inclusion of pedestrian amenities as a part of every comprehensive pedestrian project. If

necessary, set aside a certain percentage of project funding for the provision of items that contribute to making walking a more pleasant and enjoyable experience.

Consider these items when making improvements for pedestrians:

- Seats and benches.
- Transit shelters.
- Awnings.
- Drinking fountains.
- Rest rooms.
- Trash receptacles.
- Telephones.
- Information and directional signage.
- Information kiosks.
- Statuary.
- Ornamental fountains.
- Planters.
- Shade trees.
- Grassy areas and planting strips.
- Textured walkway surfaces.
- Walkway lighting.
- Up-lighting of trees, monuments and gazebos.
- Selective relocation of utility poles and/or burial of utility cables.



Source: Downtown Middlebury Master Plan (Landworks, 1995)

RESOURCE REQUIREMENTS & SCHEDULING

Compared with other improvements, pedestrian amenities are among the most economical treatments that be added to the pedestrian environment. Some representative costs (taken from several Vermont Transportation Enhancement Activity grant applications in 1996) are:

Benches	$600 each	
Shade trees		
5 cm to 6.4 cm (2 in to 2.5 in) caliper	$300 each	
7.6 cm to 8.9 cm (3 in to 3.5 in) caliper	$350 each	
Tree grates and tree guards	$650 each	
Install planting pit and soil	$645 per m^2	$60 per ft^2
Shrub planting beds/landscape islands	$54 per m^2	$5 per ft^2
Shrubs and perennial plantings	$54 per m^2	$5 per ft^2
Ornamental fountain, marble veneer	$4,500	
Interlocking pavers	$38 per m^2	$3.50 per ft^2
Brick pavers	$108 per m^2	$10 per ft^2
Marble walk	$162 per m^2	$15 per ft^2
Metal railings	$98 per m	$30 per ft
Granite posts and metal railings	$164 per m	$50 per ft

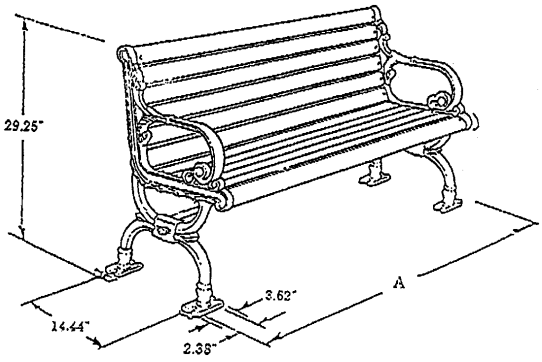
Historical reference trash barrels	$700 each	
Relocate power pole	$2,000	
Kiosk	$7,000	
Directional signs	$400 each	
Street signs	$70 per two	
Conduit/wire and trenching/backfill, sidewalk	$3.28 per m	$5.50 per ft
Conduit/wire and trenching/backfill, roadway	$22 per m	$6.50 per ft
Historical reference light fixture and 4.8 m (16 ft) pole	$1,600 each	
Light fixture pole installed on concrete base	$125 each	

EVALUATION

Conduct pedestrian counts before and after installation of amenities. Poll pedestrians regarding enjoyment and satisfaction of walking environment. Query retailers in shopping districts to see if an improved streetscape had a positive influence on sales.

PLANNING/DESIGN CONSIDERATIONS

Source: Downtown Middlebury Master Plan (Landworks, 1995)



Benches: In urban settings, locate benches in parks and shaded settings. Widen sidewalks and use curb extensions for placing benches out of the pedestrian traffic stream.

Transit shelters: Always erect transit shelters over a paved surface and always connect transit shelter to a paved walkway . Enclose three sides of shelter to provide weather protection. Use transparent material on sides of shelter for maximum visibility and security. Illuminate shelter and area around shelter for nighttime use. Consider access for the disabled, and ensure that the shelter does not block through pedestrian traffic.

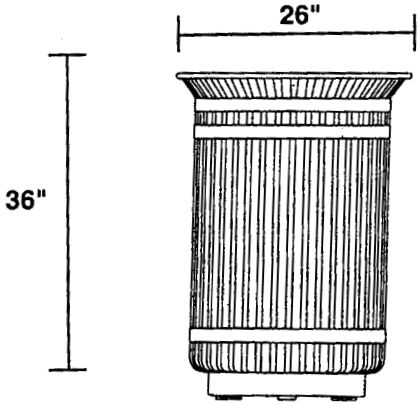
Awnings: Encourage awnings in shopping districts, modifying zoning ordinances if necessary, to protect pedestrians from the weather and to provide visual enhancement.

Landscaping: Trees, plants, shrubs, and grassy areas can greatly enhance the aesthetics of the pedestrian environment, making walking less stressful or tiring. The Oregon Bicycle and Pedestrian Plan suggests these considerations for plantings:

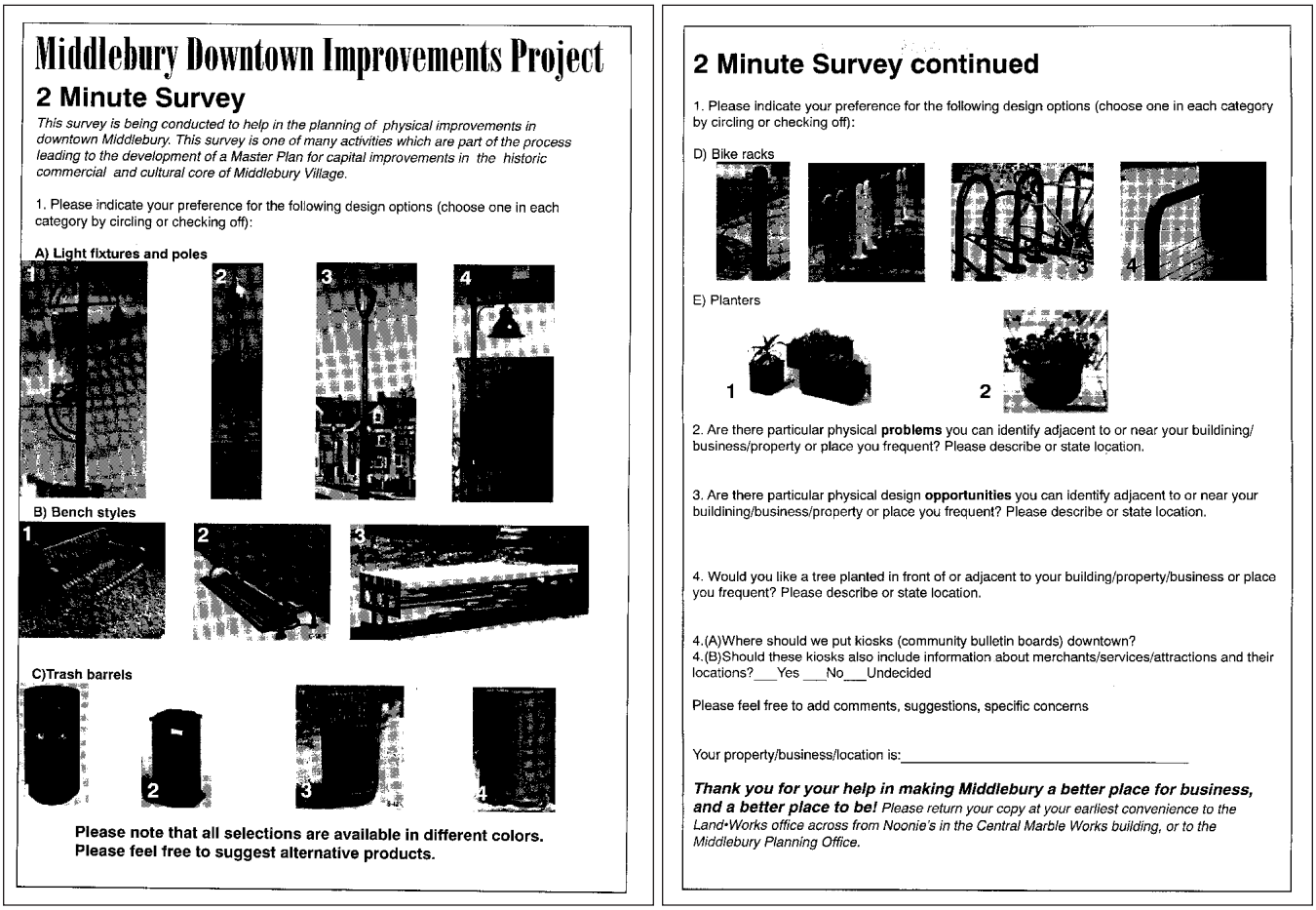
- Plants should be adapted to the local climate and fit the character of the surrounding area. They should be able to survive without protection or intensive irrigation and should require minimal maintenance to reduce long-term maintenance costs.
- Plants should have growth patterns that do not obscure pedestrians from motor vehicles, especially at crossing location. Plants should not obscure signs or signals.

- Plants and/or trees should not have roots that could buckle and break sidewalks or raise tree grates or tree guards.
- Planting strips should be wide enough to accommodate plants grown to full maturity.
- The soil in planting areas should be loosened and treated with mulching materials deep enough so plants spread their roots downward rather than sideways into the walk area.

Drinking fountains and public restrooms: Drinking fountains placed at strategic locations can increase walking distances and times among pedestrians. Conveniently located restrooms are welcomed by residents and tourists alike and take the pressure off business owners from having to provide sanitary facilities for the general public or from having to deny such requests when made.



Source: Downtown Middlebury Master Plan (Landworks, 1995)



Middlebury Downtown Improvements Project

2 Minute Survey

This survey is being conducted to help in the planning of physical improvements in downtown Middlebury. This survey is one of many activities which are part of the process leading to the development of a Master Plan for capital improvements in the historic commercial and cultural core of Middlebury Village.

1. Please indicate your preference for the following design options (choose one in each category by circling or checking off):

A) Light fixtures and poles

B) Bench styles

C)Trash barrels

Please note that all selections are available in different colors. Please feel free to suggest alternative products.

2 Minute Survey continued

1. Please indicate your preference for the following design options (choose one in each category by circling or checking off):

D) Bike racks

E) Planters

2. Are there particular physical **problems** you can identify adjacent to or near your buildining/ business/property or place you frequent? Please describe or state location.

3. Are there particular physical design **opportunities** you can identify adjacent to or near your buildining/business/property or place you frequent? Please describe or state location.

4. Would you like a tree planted in front of or adjacent to your building/property/business or place you frequent? Please describe or state location.

4.(A)Where should we put kiosks (community bulletin boards) downtown?
4.(B)Should these kiosks also include information about merchants/services/attractions and their locations?___Yes ___No___Undecided

Please feel free to add comments, suggestions, specific concerns

Your property/business/location is:_____

Thank you for your help in making Middlebury a better place for business, and a better place to be! *Please return your copy at your earliest convenience to the Land•Works office across from Noonie's in the Central Marble Works building, or to the Middlebury Planning Office.*

One New England village used this double-sided sheet to gain popular support for a streetscape project and to poll residents regarding their preferences in design for street furniture.

RECONFIGURING ARTERIAL STREETS

Excessively wide multi-lane arterials can leave pedestrians stranded and at risk.

TYPICAL CONCERNS

Arterials with four or more wide lanes encourage people to drive in excess of posted speed limits. High speeds increase the risk of fatal crashes, especially for pedestrians. In particular, high speeds increase crossing risks at non-signalized intersections and at mid-block locations. High speed arterials also amplify traffic noise, making it unpleasant to be near the street. The net result is that high arterial speeds compromise pedestrian safety and discourage walking.

POSSIBLE SOLUTIONS

Vehicle speed on arterial streets can be reduced in a number of ways. The simplest engineering approach is to reduce the number of through lanes in each direction. This could mean converting four lanes into three, with one lane in each direction and a two-way center turn, two way left turn lane (TWLTL), or "scramble" lane. This configuration also provides opportunities for installing bike lanes in each direction at the edge of the roadway. If the arterial has only one wide lane in each direction, narrowing the lanes and adding bicycle lanes can also help. Adding a center median can reduce lane width and provide a "refuge" for crossing pedestrians as well as a place for streetscape greenery.

IMPLEMENTATION STRATEGIES

Controlling Excessive Speeds on Arterials: Start a program to address the community's arterial traffic speed concerns. Encourage citizens to

identify roads in need of traffic calming. Evaluate and prioritize the candidates according to pre-established criteria. Handle projects as funding permits.

Tasks:

- Develop clear engineering principles to evaluate candidate arterials for reconfiguration, provide design templates, and devise generic configurations.
- Establish a system that allows citizens to recommend arterial street traffic calming projects. Establish clear rules defining the affected community, required levels of support, and acceptable traffic and road conditions. This will help prevent unreasonable requests.
- Develop a brochure or video explaining the program. Include diagrams of alternate schemes, and enough detail so that citizens will understand what to expect from such projects. Point out that not all requests can be fulfilled. The decision to undertake reconfiguration requires both popular support and engineering suitability.

Arterial Restriping and Resurfacing: Since jurisdictions usually restripe arterial streets on a regular schedule, use the opportunity to treat troublesome arterials. Linked to routine restriping, rechannelization work would add little additional cost. Do the same for arterial resurfacing or repaving projects. Since these require restriping once the work is complete, reconfiguring the street adds little to the cost. However, since streets are resurfaced infrequently, this strategy cannot be used alone. The best time to restripe roadways is in the spring, after the effects of winter weather have worn off much of the existing striping.

RESOURCE REQUIREMENTS AND SCHEDULE

Arterial reconfiguration is probably the least expensive approach to reduce arterial speeds and control motorists' behavior. It typically involves very little construction (unless a raised median is needed). The main costs involve:

- Traffic evaluation
- Design
- Layout and repainting

Costs vary widely from project-to-project, making it difficult to establish a range. In Seattle, lane reconfiguration costs from $3,048 to $1,5240 per kilometer ($10,000 to $50,000 per mile) of arterial. The actual costs of restriping could depend on the extent to which new stripes are added, old stripes must be removed or relocated and whether loop detectors are encountered and require relocation.

Traces of old stripes may still be visible at night or when wet, especially if the old stripes were removed by sandblasting. Grinding the old stripes away can be more effective and often cheaper. Never paint an old stripe with black paint. Combining a restriping project with a resurfacing project is usually the most effective way to reconfigure arterial lanes.

The greatest cost in lane configuration may come from having to relocate loop detectors especially when converting from a 4-lane to a 3-lane configuration. If lanes are being shifted or narrowed only slightly, loop detec-

tors may not have to be moved at all.

Median construction involves the same steps as above, with the important addition of a construction phase. Obviously, this adds significant costs to the project. The most desirable location for medians is between high-use pedestrian generators. Unfortunately, these locations are also where automobile access is highest. Installing medians for pedestrians in such locations will conflict with the desire to provide access in and out of the generator locations for left-turning vehicles. While improving safety for pedestrians, the installation of medians could prove to be politically unpopular for this reason.

EVALUATION

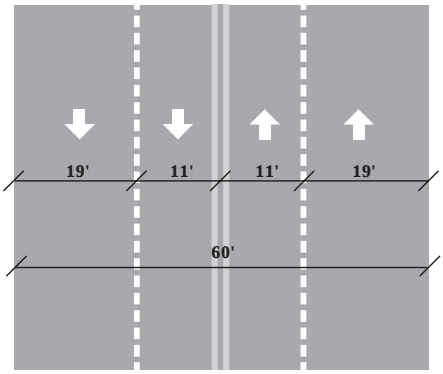
Pre- and post-re-channelization evaluation might consist of the following:

- Speed studies.
- Traffic counts on arterial and nearby residential streets.
- Community resident surveys.
- Time it takes to cross street: before and after modifications.

Possible measures of success include crash reductions, lower average travel speeds, and in the long run, higher levels of non-motorized transportation. One potential side effect to consider is whether motorists use nearby residential streets to avoid rechannelization. This phenomenon can undermine support if treated arterials mean more hectic traffic on neighborhood streets. Since it is important to evaluate traffic not only on the arterial itself, but on nearby residential streets, all surveys should reach out to those living near the project.

PLANNING AND DESIGN CONSIDERATIONS

Follow MUTCD guidelines on lane widths and striping techniques. The figures below show typical arterial configurations which encourage speeding (before), followed by drawings that effectively calm neighborhood arterials (after):



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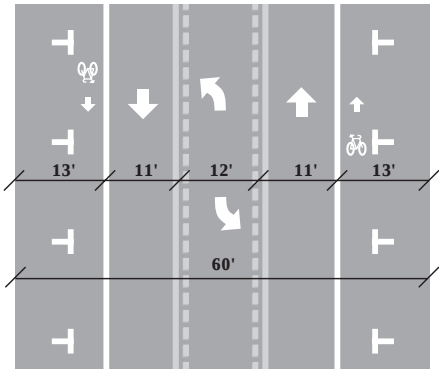
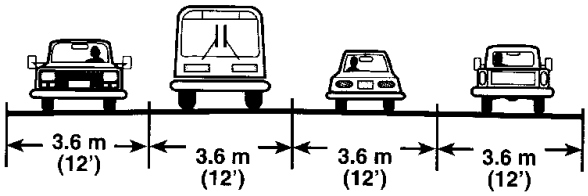


AFTER

Use curb bulbs at intersections with this configuration for maximum traffic calming effect.

Examples for reconfiguring arterial streets

BEFORE:



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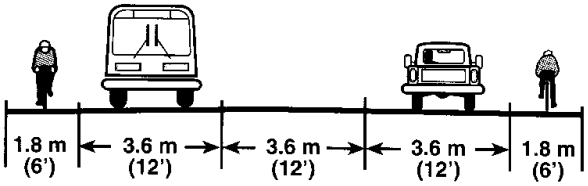

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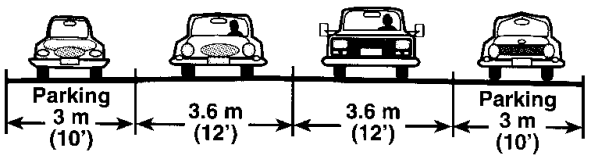

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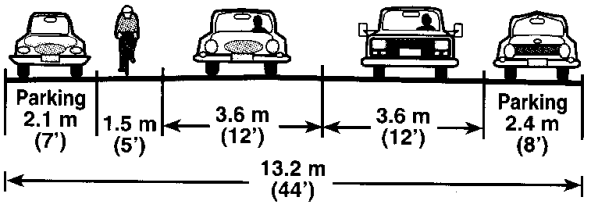

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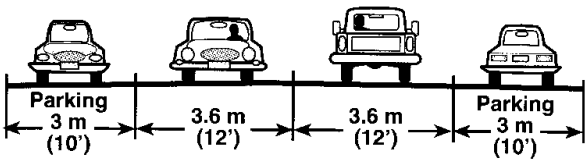

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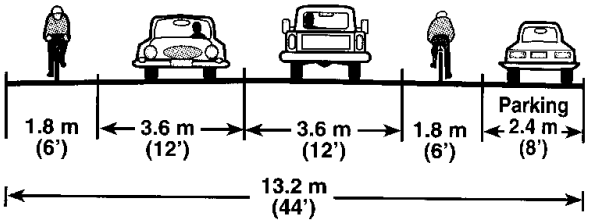

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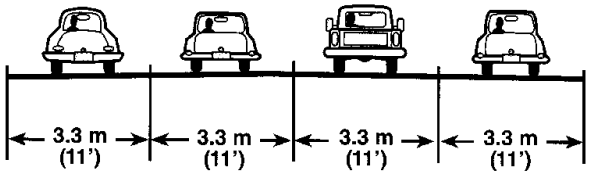

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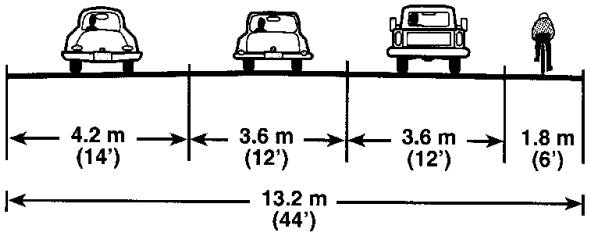

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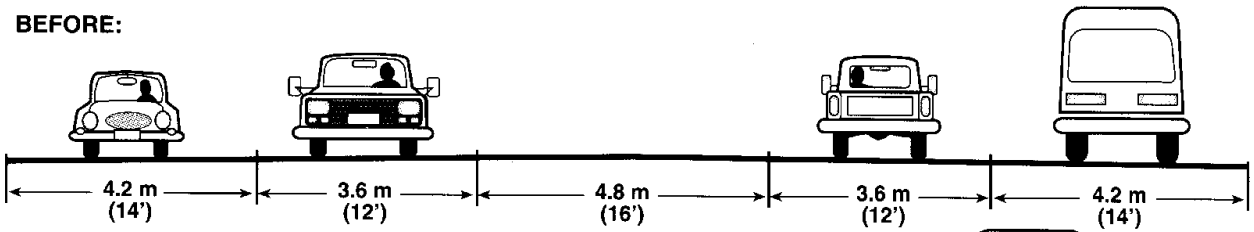

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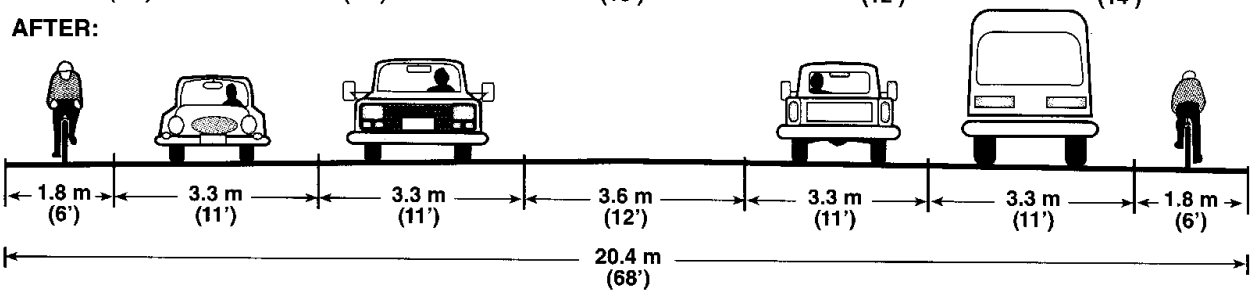


Source: *Oregon Bicycle and Pedestrian Plan* (1995)

BRIDGES

Although this bridge is the only land link between the mainland and a residential island off the coast of North Carolina, it has no pedestrian access.

TYPICAL CONCERNS

Bridges are the only way for pedestrians (and others) to cross barriers such as freeways, rivers, railroad tracks, and industrial areas. Freeway overpasses and underpasses built in the late '50s or early '60s frequently lack adequate walkways in situations where pedestrians are permitted. Where bridges may have adequate walkways, sometimes the approaches to these bridges don't. In many communities, such barriers prevent pedestrian access between neighborhoods, schools, and employment centers.

POSSIBLE SOLUTIONS

The solution is to construct safe, convenient walkways on bridges and bridge approaches. In most cases, this will only be possible when a new bridge is constructed or an old bridge undergoes major renovation. Since bridges are usually expected to have a life of 50 years or more, it is critical to "get them right" when an opportunity occurs. Because of this time factor, think of bridges as a separate program category that deserves special attention.

IMPLEMENTATION STRATEGIES

As a first step, determine which bridges need pedestrian improvements. List all bridges in the community and visit each one, noting what needs to be done. Once an inventory has been completed, there are several implementation strategies to consider.

1. **Major renovation:** Most communities have a prioritized list of bridges that need major renovation. Using this list, revise the narrative to include a

description of pedestrian deficiencies. This way, pedestrian improvements may be included when the project is scoped and funded. At the very least the opportunity to provide for pedestrian access will not be lost due to neglect or oversight.

2. New bridges: Find out what new bridges are planned for the future, and revise the project narratives to include pedestrian facilities.

3. Bridge approach projects: Installing walkways and curb ramps on bridge approaches can be done relatively cheaply, perhaps as part of an annual walkway program. This is appropriate for bridges that have walkways but lack good access.

4. Retrofitting existing bridges with new walkways: As mentioned, many existing bridges were originally designed without pedestrians in mind. As a result, space for walkways on these bridges is non-existent. At least one company has developed a walkway system designed to be cantilevered from the existing bridge structure, thereby providing suitable walkway widths on both sides of a bridge without reducing the width of existing traffic lanes.

Building or rehabilitating bridges as pedestrian projects will be difficult because of high costs and possible structural problems. For example, it may be impossible to cantilever a sidewalk off the side of an existing bridge. In such cases it will be necessary to add a sidewalk when renovating the entire bridge.

There are, however, many examples around the country of successful "pedestrian only" bridge projects. Several firms make prefabricated bridges. It may also be possible to find an existing bridge scheduled for replacement that you can "recycle" and move to a new location.

Pedestrian only bridges face the same problems and issues as paths in urban areas: location. Such bridges must serve a need and be accessible. If it is possible to situate a pedestrian only bridge next to a roadway bridge that cannot be renovated, roadway crossing problems must also be addressed.

RESOURCE REQUIREMENTS & SCHEDULING

Since rehabilitating and constructing bridges is expensive, it often takes several years to complete a project. But once completed, a bridge may serve a community for a generation or more. Stay with this issue for the long haul. If most or all bridges built or renovated over the next 20 years are improved, a more pedestrian-friendly community will have been created.

EVALUATION

Conduct pedestrian counts on improved bridges to make sure they are being used. If they aren't, find out why. Perhaps access is still difficult or the bridge feels unsafe. Don't let expensive improvements languish with little use, especially if simple changes can make a difference. Otherwise, the credibility of the agency responsibility for the bridge program may suffer when improvements are argued for other bridges. When conducting an evaluation, look at who is using the facility. Overall use may be low, but maybe it provides critical access for school children, seniors, and those with disabilities. That can make the project worthwhile.

PLANNING AND DESIGN CONSIDERATIONS

When designing walkways for bridges, investigate whether the walkways will encourage bicycle use. If bicycle use is likely, it may be necessary to provide for bicycle travel on the roadway while providing at the same time walkways are provided for pedestrians. Some states, such as Oregon, maintain that it is better to accommodate bicycles on the roadway. Further, AASHTO discourages shared use of sidewalks. Therefore, combining bicycle and pedestrian use on a walkway should be considered only where separation between the two modes is not feasible. It should be noted, however, that where walkways are designed to accommodate bicycle travel, the resulting geometrics required for bicycles will likely meet or exceed the geometric needs for pedestrians.

The Oregon DOT standard width for sidewalks on bridges is 2.1 m (7 ft) (min. 1.8 m [6 ft]), to account for a shy distance from the bridge rail — some pedestrians feel uncomfortable walking close to a high vertical drop. The bridge sidewalk must not be narrower than the approach sidewalk; in instances where the approach sidewalks are of differing widths, the lesser of the two widths may be used on the bridge. Sidewalks on bridges with design speeds greater than 65 km/h (40 mi/h) require a vehicle barrier at curb line.

For bridges designed exclusively for bicycle and pedestrian use, the following guidelines are recommended:

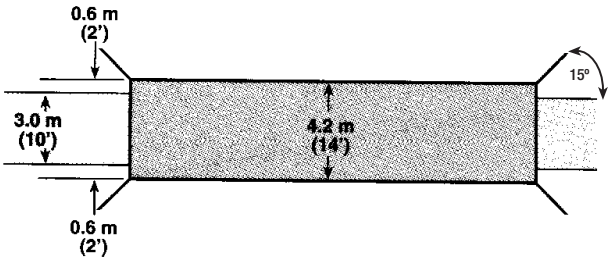
Widths and clearances: The minimum clear width of the bridge surface should be no narrower than the approach path. A preferred width of 4.3 m (14 ft) provides an additional clear width of 0.6 m (2 ft) on each side of a 3 m (10 ft) traveled portion of a bridge that is to be used by both cyclists and pedestrians. A vertical clearance of 3 m (10 ft) should be maintained.

Design loads: When a bridge is wide enough to permit access by emergency vehicles—one reason why a 4.3 m (14 ft) structure is preferred—the design live load of the bridge should accommodate such vehicles.

Railings: Railings on both sides of a multi-use path structure should be a minimum of 1.1 m (3.5 ft) high. Smooth 250 mm (10 in) wide horizontal rub rails should be attached to the inside of the railings at a handlebar height of 0.9 m (3 ft) above the bridge deck surface. Openings in the handrail should be no wider than 150 mm (6 in) to prevent young children from falling through the handrail.

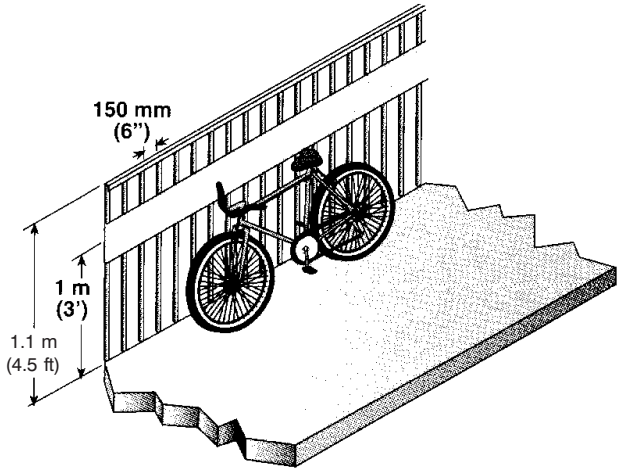
Bridge entrances: At each entrance to the bridge, the handrails as described above should extend a minimum of 2.4 m (8 ft) beyond the end of the bridge and they should be splayed outward at 15-degree angles to the pathway. Bollards (posts) should be provided at each end of the bridge to prohibit unauthorized motor vehicles from regularly using the bridge, but they should be designed in such a way so as to permit access to emergency vehicles. Such bollards should not be placed to obstruct or otherwise interfere with the path of travel of bicyclists or pedestrians proceeding in either direction.

Decking: If wood decking is to be used, it should be laid at no less than 45 degrees to the direction of travel along the bridge to prevent gaps that may develop in the decking from trapping bicycle wheels. Where possible, decking should be laid 90 degrees to the direction of travel.



Multi-use path bridge

Adapted from *Oregon Bicycle and Pedestrian Plan* (1995)



Railing with "rub-rail"

OVERPASSES AND UNDERPASSES

A pedestrian overpass or underpass is a type of bridge facility. Before building one, consider some of the design issues:

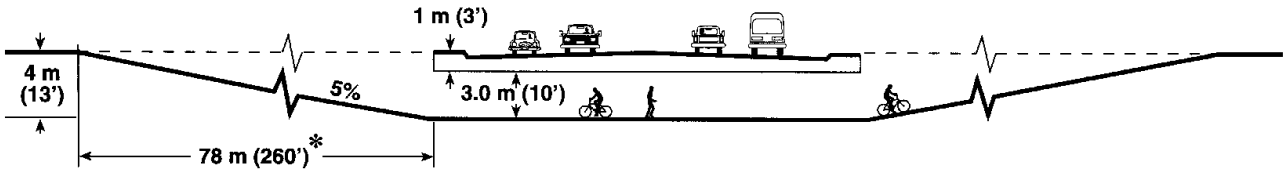
Overpasses: Because overpasses are usually open, they present fewer security problems than underpasses. However, there are also disadvantages associated with overpasses:

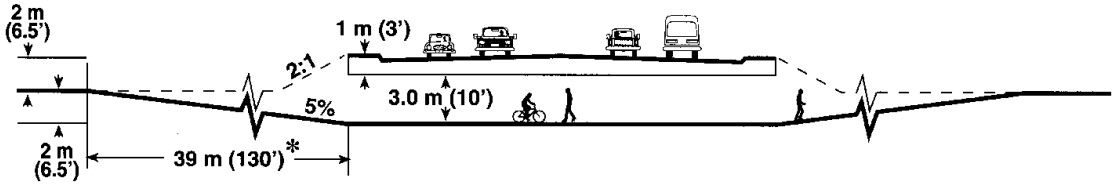
- May require long approach ramps to meet ADA requirements and achieve clearance over most roadways. Additional clearance is required over railroad tracks and waterways.
- Can block views and be unsightly.
- May not be used by pedestrians if they have to climb long ramps and or stairs.
- Ramps can invite skateboarders.

Underpasses: Underpasses provide opportunities to reduce approach grades because the minimum 2 m (10 ft) clearance for an underpass is less than that required for overpasses. Where topography permits or where roadways are elevated, an undercrossing may be constructed with little or no change in grade. Often, they are less expensive to build than overpasses. However, the following disadvantages are associated with underpasses:

- Can feel dangerous to users.
- Can be expensive.
- Require good drainage system to prevent flooding.
- May require skylights in medians of divided highways or artificial lighting at all times.

Access for the disabled: Because overpasses and underpasses usually involve a change in elevation for the users of such facilities, care must be exercised to ensure that ramps and walkways are designed to comply with ADA requirements. Generally, ADA requires:





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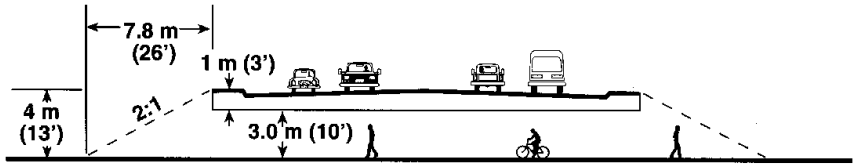
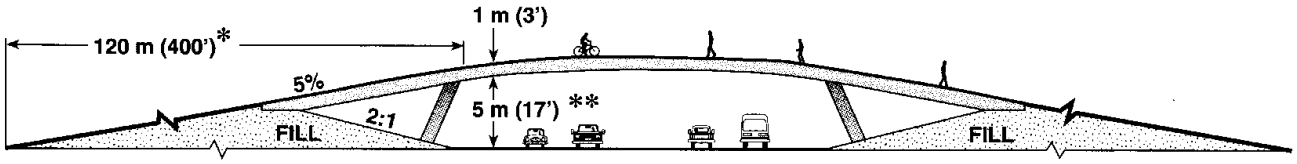
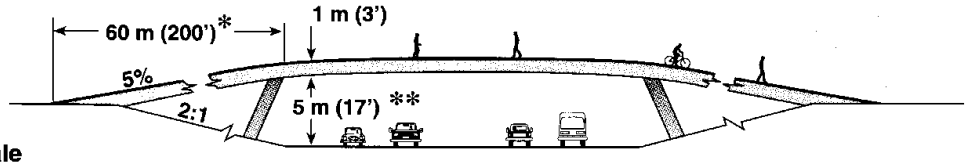


Undercrossing configurations





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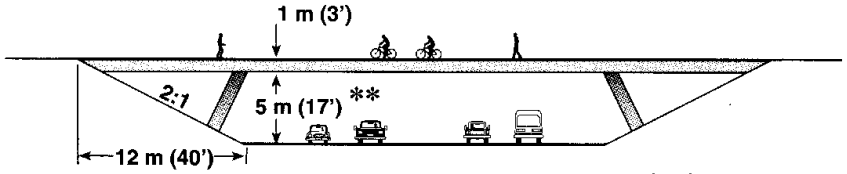
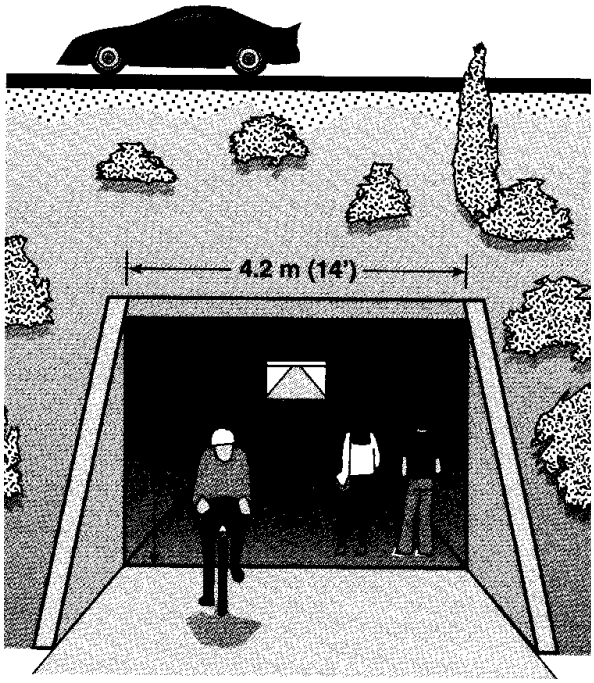


** 7 m (23') req'd over RR tracks

Overcrossing configurations

Source: *Oregon Bicycle and Pedestrian Plan* (1995)

- A maximum run of 9.1 m (30 ft) for ramps with slopes between 8.33 percent (1:12) and 6.25 percent (1:16).
- A maximum run of 12.2 m (40 ft) for ramps with slopes between 6.25 percent (1:16) and 5 percent (1:20).
- A 1.5 m (5 ft) long flat landing at either end of a ramp and a 1.5 m (5 ft) wide landing if the alignment changes direction at the landing.
- Walkways a minimum of 1.5 m (5 ft) in width, or when this width cannot be maintained, passing areas located at intervals not exceeding 60 m (200 ft).
- Handrails 290 to 320 mm (34 to 36 in) along ramps that rise more than 0.15 m (6 in). Such handrails must extend 0.3 m (1 ft) into the landing areas at both ends of the ramp.



Undercrossing dimensions

Adapted from *Oregon Bicycle and Pedestrian Plan* (1995)

TRAFFIC CALMING

Speed bumps are just one way to "calm" neighborhood traffic.

TYPICAL CONCERNS

Over the past several decades, automobile travel has increased dramatically. As arterial and collector streets become congested, motorists search for alternative routes on nearby neighborhood streets. In too many cases, increased vehicular traffic and speed on these residential alternatives leads to more car/pedestrian conflicts and a loss of identity and livability within the invaded neighborhood.

POSSIBLE SOLUTIONS

"Calm" traffic on residential streets. Most traffic calming techniques involve modifying intersections or roadway channelization to encourage motorists to (1) drive slower or (2) stop using residential streets as by-passes. By lowering speeds and/or discouraging through traffic, the number of crashes can be reduced and pedestrian safety can be enhanced.

An important factor in all pedestrian crashes is speed, and studies have shown a dramatic correlation between motor vehicle speeds and fatality rates. Implementing measures to reduce the speed of traffic produces a corresponding reduction of the severity and frequency of car/pedestrian crashes. Traffic calming not only discourages through traffic volume in residential settings, it also slows the speed of all traffic.

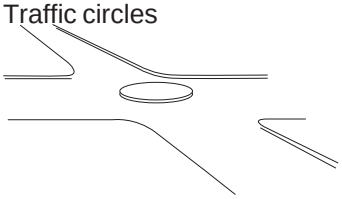
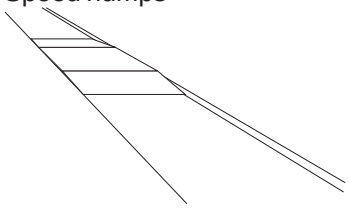
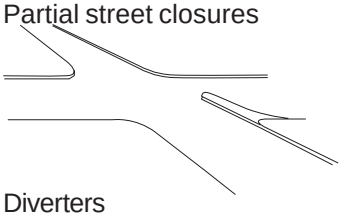
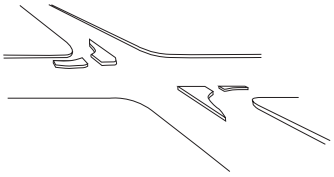
COMMON TRAFFIC CALMING TECHNIQUES

Slowing traffic speed is a good first step to take toward eliminating intersection conflicts as slower speeds decrease braking distances and allow for increased reaction times.

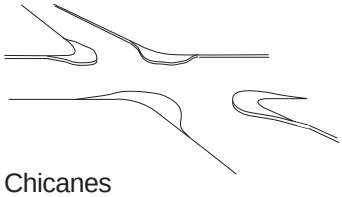
For example, one way to slow traffic speed is to install traffic circles. Circles produce immediate, readily observable improvements in traffic safety, reducing motor vehicle speeds and crashes in residential intersections.

A second but equally important purpose of traffic calming is to discourage through traffic. A list of traffic calming techniques that both slow and discourage traffic includes:

- Traffic circles (a.k.a. roundabouts).
- Speed humps and tables.
- Partial street closures.
- Diverters.
- Curb extensions or bulb-outs.
- Chicanes.
- Choke points.
- Gateway treatments.
- Woonerven.

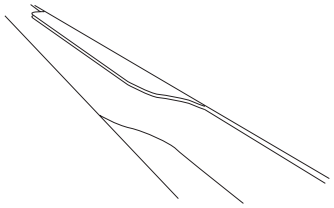
Technique	*Definition*
Traffic circles 	Raised islands located in the middle of an intersection to slow traffic
Speed humps 	Raised surfaces on the road over a short distance to force motorists to slow down to an intended speed with minimal discomfort
Partial street closures 	Access to a road barred in one direction, though the rest of the road remains two-way
Diverters 	Structures placed at intersections to prevent through traffic by forcing motorists onto another street

Curb extensions



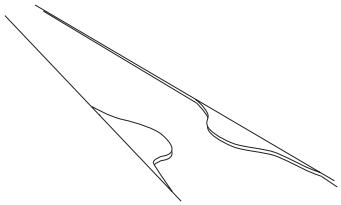
Sidewalk extensions at intersections that reduce crossing distances, and increase pedestrian visibility

Chicanes



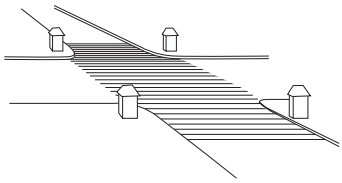
Obstacles or parking bays staggered on alternate sides to create an obstructed route for motorists

Choke points



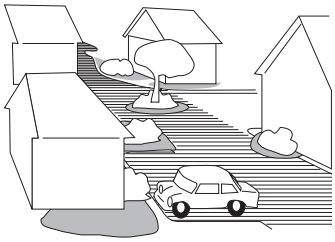
Narrowing a road over a short distance to a single lane in order to slow traffic

Gateway treatments



Raised intersections and surface alteration to show a change from arterial to residential streets

Woonerf



A Dutch term (meaning "living yard,") for the strategy in which motorized and non-motorized traffic are not segregated, and pedestrians are given priority

For more details, refer to the *National Bicycling and Walking Study, Case Study #19, Traffic Calming, Auto Restricted Zones, and Other Traffic Management Techniques: Their Effect on Bicyclists and Pedestrians,* FHWA-PD-93-028.

IMPLEMENTATION STRATEGIES

The following discussion shows various ways in which one traffic calming technique—traffic circles—can be implemented.

Traffic circles have a strong traffic calming impact, particularly on the way motorists negotiate intersections. But they should only be installed in a thoughtful step-by-step fashion. There are at least three general strategies to installing traffic circles.

Piggy-back on other projects: Traffic circle projects can be included in related capital projects such as street repaving, curb realignments, and sub-surface utility projects. It is, however, necessary to gauge community support and to evaluate the appropriateness of all proposed traffic circles. (See the 60 percent rule in paragraph A on the next page.)

Development regulation: Traffic circle installation can also be required as a condition of development. If, for instance, a development will generate additional automobile traffic on nearby residential streets, the

developer could be required to install circles to ameliorate the impact. The conditions triggering this requirement would depend on the nature of the development and existing traffic conditions within the community. The downside of this strategy is that it is usually difficult to require off-site improvements.

Annual program: A fixed amount of money for traffic circle installation could be appropriated annually. This strategy has been used in Seattle, Washington, since 1978.

SEATTLE'S TRAFFIC CIRCLE EXPERIENCE

Creating a traffic circle selection process is a crucial step in allocating scarce resources. Seattle uses a two-step procedure. Proponents must first show the idea is supported by a substantial majority of the neighborhood. The City will then do a technical assessment. This is necessary because the City gets several hundred requests but can afford to build only 20 to 25 circles each year. Here are the steps:

A. Citizens propose traffic circle locations: Rather than relying exclusively on engineering analysis, Seattle encourages residents to begin the process. When citizens ask for a traffic circle, they receive a petition form on which to gather signatures of residents living within one block of the proposed site. If 60 percent support the traffic circle, it next receives a formal review in order to compete for funding. In this way, the City need not worry about public support. Highly controversial locations are eliminated up front.

B. Department analyzes sites: Because of the many technical aspects involved, it is essential to closely scrutinize each proposed location. Strong neighborhood support alone does not guarantee that the proposed traffic circle will be installed. The City uses a formal system for comparing intersections to rank all citizen proposals.

This is a necessary step to ensure that there are technically sound reasons to install a traffic circle at one location rather than another. The analysis consists of the following:

- Evaluation of crash records in the 3.5 years prior to the request.
- Traffic volume counts.
- Speed checks.

Points are assigned for each category. A location must accumulate at least three points to compete for funds. Competing locations are then prioritized. If a location ranks high on the priority list, and if installation is feasible, a community meeting is scheduled.

C. Project implementation: Once an intersection is chosen, City representatives meet with residents to introduce the design and appearance of the traffic circle, explain the implementation process, and answer questions. This step reassures citizens that the City is working with the community to solve a local traffic problem.

Once the layout is established, a mock-up traffic circle is installed using traffic cones to judge the efficacy of the design, as well as fire truck and emergency vehicle clearance. If there is any doubt, the Fire Department brings a truck out to the location. When all tests are satisfactorily

completed, the final circle is installed. An important feature that should not be overlooked when designing traffic circles is a concrete apron around the circle. This apron permits trucks to drive over the edge of a circle should the turning radius be too tight.

In Europe, mock-up traffic circles are tested using devices like giant Lego blocks. The blocks are considered to be more effective than traffic cones as most drivers will slow excessively in the presence of cones assuming there might be construction in progress or there is a open hole or rough road ahead, thereby diminishing the effect of the test.

One benefit of traffic circles is the creation of new public space for landscaping. Once the circle is permanent, the City provides basic landscaping but only if local residents commit to maintaining it. In addition, neighborhoods are encouraged to plant additional greenery that will not impair visibility. This aspect promotes local "ownership" and helps reduce maintenance costs

EVALUATION

It's best to consider traffic circles temporary until a three- to six-month test period has passed. During this period, do traffic counts and speed studies. In addition, distribute survey cards to gauge citizen support and identify any problems. If the traffic circle is unpopular, citizens should be able to petition to have it removed. In Seattle, for instance, a 60 percent majority is required for removal; removals of traffic circles have occurred very rarely.

RESOURCE REQUIREMENTS & SCHEDULING

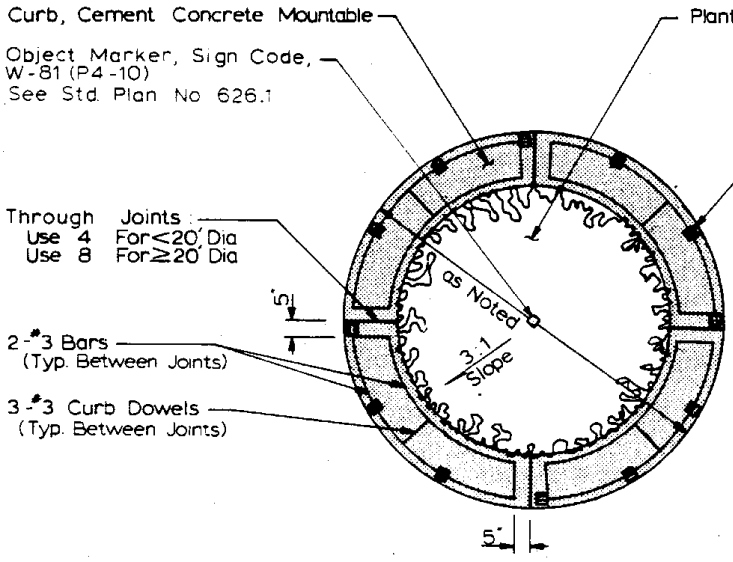
Traffic circles can cost between $5,000 and $15,000 to build. In Seattle, because of the popularity of the program and the technical requirements, it can take one to two years from the time a neighborhood requests a circle to when it gets built. In general, traffic circles are almost maintenance free and can last as long as the road itself. Neighborhood landscaping efforts can help keep city maintenance at a minimum.

SPECIFICATIONS

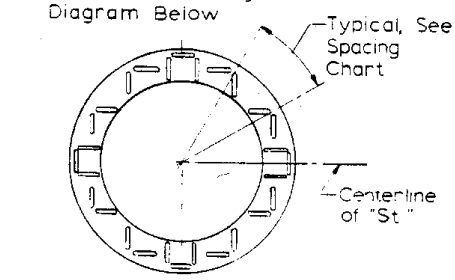
The exact location and shape of each traffic circle should be designed to the particulars of the intersection. Size is determined by the intersection's geometrics, using the largest circle that meets basic design considerations.

The diagram on the next page illustrates a typical traffic circle design being used in Seattle.

Standard Plan No. 415.1



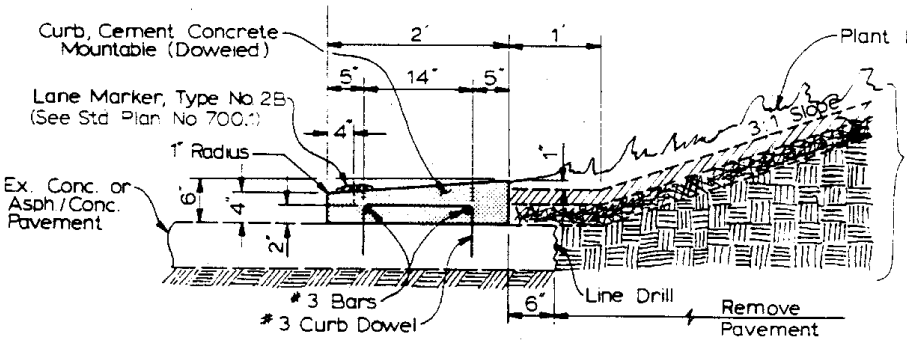
Typical Traffic Circle



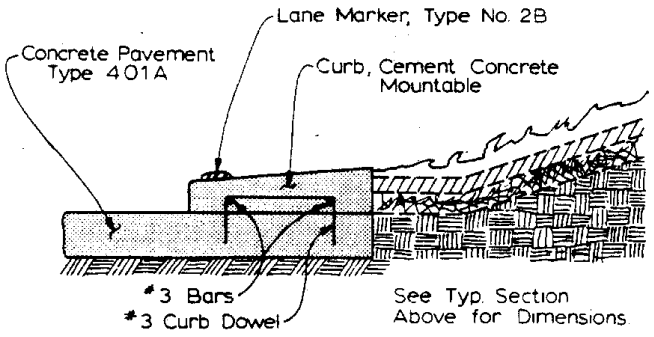
Diameter of Circle	Degree of Spacing
≤ 12'	Every 45°
≤ 20'	Every 30°
> 20'	Every 22½°

(Facing Vehicle Approaches)

Traffic Circle
Stimsonite Reflector Layout



Typical Section



Typical Section

Ref. Std. Spec. Sec. 8-02, 8-04

Do Not Scale

APPROVED BY THE BOARD OF PUBLIC WORKS 7/12 1991 CHAIRMAN ATTEST: EXEC SECRETARY	CITY OF SEATTLE DEPARTMENT OF ENGINEERING	Traffic Circle Details

Source: Seattle (Washington) Engineering Department

MAINTENANCE

Broken pavement creates safety and access problems for pedestrians.

TYPICAL CONCERNS

Inadequate maintenance can result in conditions that hamper pedestrian safety and access and limit use of pedestrian facilities . Typical problems include uneven pavement, standing water, overgrown shrubs and trees, sidewalk clutter (e.g., newspaper stands, vendors, portable signs, and construction activity), and snow-covered walkways that aren't cleared promptly in winter. Damaged street furniture, damaged or missing signs, improperly functioning signals, and worn pavement markings can create hazardous conditions for pedestrians.

POSSIBLE SOLUTIONS

Effective inspection and maintenance management policies that address specific problems should be developed and enforced. Some will be directed at the private sector and others written for government agencies.

IMPLEMENTATION STRATEGIES

Improving maintenance can require action on several fronts. The policies of all relevant agencies should be reviewed and changed, if necessary. Designers should be encouraged to consider maintenance from the beginning phases of a project. Outreach efforts should be initiated to involve the public in identifying and reporting areas in need of maintenance.

1. **Identify key implementors.** Implementation requires working closely with those agencies and personnel responsible for maintaining the current infrastructure, as well as those charged with designing and building new facilities. For walkway maintenance, this may mean the local public works

department. For trails, it may mean local and State park and recreation agencies.

Determine which activities are the responsibility of the private sector and which are best handled by public agencies. This will require researching existing policies and ordinances.

New facility design can involve local engineering and park planning agencies, as well as private developers. It may be that a new arterial street being built in the local community is actually designed by engineers working in the State capital.

2. Review existing policies and practices. In some cases, an agency's policies, standards, and guidelines are included in formal documents that have gone through an approval process or that have been issued by department supervisors. Examples of these may be standard sweeping schedules and snow removal priorities. Conducting a review of these may be relatively simple once copies have been obtained.

3. Review results in the field and solicit comments from users. In some cases, policies may seem reasonable in theory, but may break down in practice. For this reason, it is important to see how well the facilities work. Checking out the walkway system on foot can help uncover previously unknown problems.

In addition, soliciting comments from users can help identify problems that would otherwise be overlooked. Because of their first-hand knowledge of conditions, pedestrians can often pinpoint specific needs and problem locations. To get such information, send news releases to the local media asking for help. In all likelihood, users will welcome the opportunity to contribute.

Conducting on-site visits will determine if current policies work. If not, ask why not? Most likely the policies are not addressing the problems or they are not being properly implemented. Be careful not to impose unnecessary rules or act in a heavy-handed manner. For example, keep in mind that First Amendment rights allow newspapers to place their stands in public rights-of-way. The goal of maintenance programs and activities should be to promote reasonable public safety and access, not to completely eliminate sidewalk "amenities" or to enrage property owners.

4. Recommend appropriate changes in policies and practices. On the basis of the reviews and comments discussed above, develop modified versions of policies and practices where warranted. In addition, develop new guidance for adoption. Work with the appropriate agencies to make sure the changes are understood and implemented.

5. Create an ongoing spot improvement program. As mentioned earlier, soliciting comments from users can help an agency find specific problem locations. Institutionalizing this process, in the form of a user requested "spot improvement program," can provide ongoing input and, in many cases, help identify problems before an injury occurs. In addition, such a program can dramatically improve the relationship between an agency and the public. Spot improvement programs are good policy and good public relations.

To this end, set aside a modest annual budgetary allocation for user-requested spot improvements. Create mail-back postcards for distribution

to community centers, schools, shops, and user groups. As cards come in, check out the locations identified and take action as necessary.

6. Evaluate progress. As the work proceeds, keep track of successes and failures, as well as the schedule of routine maintenance activities. Identify changes that have or have not been made to policies and determine if additional effort is needed. On an annual basis, ask the public for comments on maintenance issues, in general, and the spot improvement program, in particular. In addition, keep track of the numbers and kinds of problems identified and how they were dealt with. Finally, determine if the program budget is appropriate to the task.

7. Develop an inspection and maintenance checklist. Periodic inspections that identify problem areas are an essential feature of any maintenance program. The frequency of inspections will vary from region to region and with the nature of the maintenance activity. The adoption of an inspection and maintenance checklist outlining possible problems and appropriate solutions will help ensure adequate maintenance and repair for pedestrian facilities.

Snow removal policies that favor vehicles and ignore pedestrians having to walk in the street and may leave municipalities open to legal action.

When sand is removed from gutters, care should be taken to remove it from walking surfaces also.

Poorly maintained crosswalks create unnecessary conflicts for users and can make a statement about the priority a municipality places on walking.

INSPECTION AND MAINTENANCE CHECKLIST

- ☐ **Uneven pavement and pavement with missing pieces:** Sections of walkway with a vertical pop-up of greater than 13 mm (1/2 in) should be replaced or repaired with a temporary asphalt shim. In locations with a high volume of pedestrian traffic, especially wheelchair users, the pop-up should not exceed 6 mm (1/4 in).
- ☐ **Snow and ice buildup on walkways:** Walkways should not be used as snow storage areas for snow removed from streets. Local policies should treat the clearance of snow from walkways as being of equal importance with clearing snow from streets. In areas where abutting land users are responsible for clearing walkways, local regulations should be enforced. Curb ramps should be kept clear of snow accumulation from plowing.
- ☐ **Expansion and construction joints have separated , creating a space between adjoining sections that is greater than 13 mm (1/2 in):** The gap can be filled with hardening expansion compound.
- ☐ **Loose sand and debris on the surface of the walkway:** Have the walkways swept and the debris removed. Where the abutting land user bears this responsibility, enforce local regulations to clean walkways.
- ☐ **Newspaper stands, portable signs, and other devices are creating barriers in a walkway:** The responsible parties should be required to remove the obstructions.
- ☐ **Tree roots that crack and heave walkways:** Have the failed sections removed, the roots cut and new sections of walkway installed. If the roots to be removed are large, contact an arborist to avoid injuring the tree.
- ☐ **Overgrown trees, shrubs, grass, or weeds are encroaching on walkways :** Local regulations that require abutting land users to perform timely clearance of vegetation that becomes an obstruction and/or limits sight distance should be enacted and enforced. As an alternative, private contractors can be hired to clear walkways and the costs assessed to abutting land users.
- ☐ **Transition problems resulting from previous repairs:** Where the pavement surface from a prior repair has deteriorated, become cracked, or is missing altogether, remove the transition section and have all defective sections of pavement replaced.
- ☐ **Worn or slippery steps or ramp surfaces:** Steps and ramp surfaces that have become worn and slippery should be overlaid, texturized, or replaced to create a slip-free and unbroken surface.
- ☐ **Worn paint on stop bars and crosswalks:** Develop a policy for regular inspection and refurbishment of paint on crosswalks and stop bars.
- ☐ **Missing or damaged signs:** Periodically check for missing or damaged signs and other traffic control devices.
- ☐ **Improperly functioning pedestrian signals:** Inspect pedestrian signals periodically for proper operation; clean lenses and replace bulbs as necessary.

The development of a ongoing maintenance management program will also greatly curtail the risk of liability. However, the primary goal of a maintenance management program should not be to avoid liability but to control the risk of injury to highway users. The most important step that any government entity can take to reduce potential liability is to reduce crashes, injuries and fatalities.

No doubt some liability will eventually be raised. However, having developed a competent risk management program, a government entity will not only be benefiting its residents and users, it will also be helping to assure the taxpayers it is doing all that it can to be responsible stewards of the public treasury. Additional suggestions for managing risk include:

- Develop written maintenance procedures and follow them. Remove all hazards. If a hazard cannot be removed, protect it with barriers or clear warning signs.
- Monitor pedestrian facilities. Inspect facilities regularly using trained and experienced maintenance personnel. Investigate all reports of hazards from all sources. Review crash reports to determine whether hazardous conditions exist.
- Keep a report of maintenance activities and inspections. Such records may become significant in liability actions that take place at a later date.

RESOURCE REQUIREMENTS & SCHEDULING

1. Private sector responsibilities: Many requirements can be enforced through a permitting process. Properly regulating construction use of the sidewalk area and requiring permits for placing signs or newspaper stands, for instance, can be effective ways to ensure safe passage for pedestrians. Administration costs may usually be recovered through permit fees.

Sidewalk maintenance laws are more difficult to enforce, requiring staff time for on-site evaluations, notification, and enforcement. Because of costs, consider only investigating complaints, or limiting evaluation to arterials and school walking routes.

2. Public sector responsibilities. Since maintenance costs vary, consider an annual program focusing on priority areas with high pedestrian volumes, like school walking routes and areas near transit stops.

EVALUATION

Conduct periodic walkway maintenance field checks. Check construction sites and the location of newspaper stands, portable signs, and street vendors. Evaluate the agency's effectiveness in responding to complaints. Make improvements in priority locations. If problems are discovered, find out why they keep reoccurring and make the appropriate adjustments.

EDUCATION AND PUBLIC AWARENESS CAMPAIGNS

*Some states and communities are experimenting with "Supplemental Pedestrian Crossing Devices" designed to further alert motorists of the obligation to yield to or stop for pedestrians.**

TYPICAL CONCERNS

Educating people about the hazards that may be encountered while walking, promoting safe walking conditions, and encouraging more people to walk are important parts of a community pedestrian program. The purpose of this section is to highlight the principal issues associated with pedestrians and walking that have a relationship to education and public awareness. These issues include:

- Safety.
- Acceptance of walking as a legitimate mode of travel.
- Promoting walking as a desirable activity.

To provide a safe environment for pedestrians, planning and engineering professionals, educators, and enforcement officials need to know the characteristics and needs of the pedestrian user group. To interact appropriately and safely with pedestrians, motorists need to understand and acknowledge that walking is an accepted and legitimate mode of travel, and that they have a duty to operate their vehicle so as to not endanger pedestrians. To be aware of hazards and to walk safely, all pedestrians, young and old, need to understand the danger spots and risks that are associated with walking in an environment that favors the automobile.

*Inclusion in this report does not constitute FHWA endorsement. This device currently is not included in the Federal Manual on Uniform Traffic Control Devices (MUTCD). Before using any traffic control device that is not included in the MUTCD, the interested State or locality should submit a request for permission to experiment to FHWA's Office of Highway Safety (HHS-10), 400 Seventh Street S.W., Washington, DC 20590. Guidelines for conducting an experiment can be found in Part 1A-6 of the MUTCD.

POSSIBLE SOLUTIONS

Education and awareness efforts are important ingredients in a successful transportation program that not only accommodates pedestrians, but also encourages this mode of travel. Frequently, however, a lack of information or, in some instances, misinformation perpetuates unsafe practices by pedestrians. Additionally, because development patterns of the past 50 years have catered to the automobile, children have become reliant on their parents to drive them to school, dance class, soccer practice, etc. Because children are not walking to these destinations, they gain little exposure to and practice with walking in various traffic situations.

Studies of pedestrian crashes have identified numerous crash types, of which a small number are by far the most common. Therefore, there is some potential to improve pedestrian safety by concentrating education efforts on messages and training that help reduce the most common of crash types.

Educating planning, engineering, and other design professionals about the needs of pedestrians is another key component to increasing pedestrian travel. Education in facility planning and design, as well as in education and enforcement programs, will begin the process of institutionalizing pedestrians and walking into the planning and design processes.

Education and awareness efforts can also help communities meet the twin goals of the National Bicycling and Walking Study, which are:

1. To double the current percentage (from 7.9 to 15.8 percent) of total trips made by bicycling and walking, and

2. To simultaneously reduce by 10 percent the number of bicyclists and pedestrians killed or injured in traffic crashes.

Safety issues. Pedestrian crashes are a serious problem. In 1996, about 5,400 pedestrians were killed in motor vehicle crashes. These fatalities accounted for approximately 14.5 percent of motor vehicle related deaths nationwide. In urban areas, pedestrians account for as much as 40 to 50 percent of all traffic fatalities. In 1996, an estimated 82,000 pedestrians were injured in motor vehicle collisions. Many more injuries are not reported to authorities.

In the 1970s, National Highway Traffic Safety Administration (NHTSA) and Federal Highway Administration (FHWA) research showed that pedestrian crash types could be classified into broad groups that have similar characteristics. Thirty-seven crash groups were identified and it was learned that just seven pedestrian crash types accounted for more than 50 percent of all crashes. Most crashes occurred among just three types: the Dart Out (33 percent) where a pedestrian unexpectedly enters the street — in two-thirds of these cases, the crash occurred in the curbside lane; the Intersection Dash (9 percent) where the pedestrian ran into street at an intersection and was seen too late by the driver; and the Vehicle Turn Merge (7 percent) where a vehicle driver was concentrating on turning or merging into traffic and failed to see the pedestrian.

In 1996, FHWA sponsored additional research to further refine and update crash type distributions.

This research resulted in a study, *Pedestrian and Bicycle Crash Types of the Early 1990s*, FHWA (1996) that identified 61 individual crash types. These types were grouped into 11 major subgroups that closely correspond to the original NHTSA crash typology. Among these 11 subgroups, just 2—Intersection-related and Midblock events—account for more than half (58.7 percent) of all pedestrian crashes. The types of crashes occurring in these subgroups include:

<u>Intersection-related (32.2 percent).</u> Consist of four subtypes, including:

- Vehicle turning or merging at intersection (9.8 percent). Driver of vehicle is concentrating on turning or merging into traffic and fails to see pedestrian.

  Typical pedestrian: Female, 45 years and older.

  Typical driver: 65 years and older.

  Typical location: Urban.

  Typical time: 2-6 p.m.

- Intersection dash (7.2 percent). Typically, a pedestrian runs into street at an intersection and is seen too late by driver.

  Typical pedestrian: Child age 14 and younger.

  Typical road class: Local road.

- Driver violation at intersection (5.1 percent). Driver of vehicle violates sign or signal or is driving carelessly.

- Other intersection (10.1 percent). Includes multiple threat (i.e., vehicle stops for pedestrian who is crossing and stopped vehicle screens pedestrian from view in an overtaking vehicle); trapped (signal changes from red to green trapping pedestrian in road); walking into a vehicle; walking, standing and stepping into road; misjudged crossing gap distance and other miscellaneous types.

  Typical pedestrian: 65 years and older, alcohol related.

  Typical light condition: Dark, lighted.

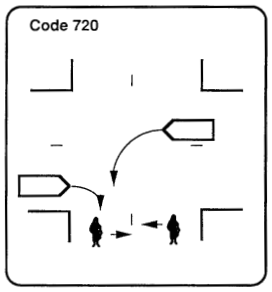
  Typical location: U.S. or state route.

<u>Mid block events (26.5 percent).</u> Consist of two subtypes, including:

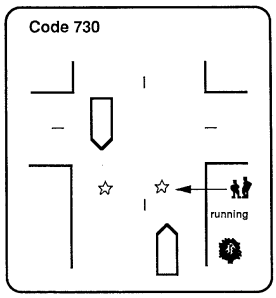
- Mid block dart and dash (13.3 percent). Pedestrian unexpectedly appears. Most common (9 percent) were midblock dashes defined to be situations where the pedestrian was running and the motorist's view was not obstructed. Midblock dart-outs, in which motorist's view was obstructed until just before impact occurred in just under 5 percent of the cases. In three out of four cases, the crash occurs in the curbside lane.

  Typical pedestrian: Child age 14 and younger.

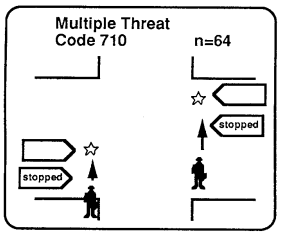
  Typical time: 2-6 p.m.



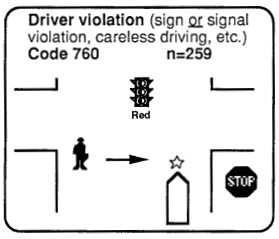
Vehicle turn/merge at intersection



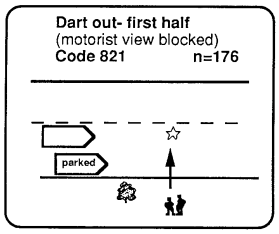
Intersection dash



Other intersection



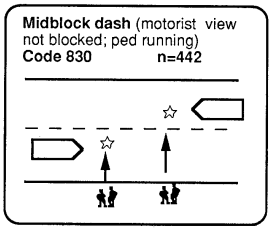
Other intersection



Midblock dart out/ dash—first half

I indicates crash location

Source: *Pedestrian and Bicycle Crash Types of the Early 1990s*, FHWA (1996)



Midblock dart out/dash—Second half

- Other midblock (13.2 percent). Includes walking, standing and stepping into road, misjudged crossing gap distance, speeding motorists, and other miscellaneous types.

  Typical pedestrian: Alcohol related.

  Typical light condition: Dark

  Typical location: State route.

Acceptance and legitimacy issues. Often, when asked, pedestrians will say they feel they get no respect from drivers of motor vehicles and that they feel threatened and vulnerable. In public involvement meetings in conjunction with the *Pennsylvania Bicycle and Master Plan,* pedestrians complained of feeling victimized by drivers who showed them no respect. Drivers said they perceived pedestrians as a hindrance to their progress.

Public outreach participants in the development of the *Louisiana Statewide Bicycle and Pedestrian Master Plan* expressed their perception that the pedestrian mode of travel was not viewed as a legitimate means of transportation, either by drivers or public officials.

Public awareness and education campaigns can help change attitudes of community leaders and drivers and gain respect for pedestrians. Such programs can also help elevate walking to the status of a legitimate and complementary mode of travel, deserving attention at all steps in the planning, design, and implementation process.

A good place for a community to start is to adopt, in its comprehensive plan, a vision statement that recognizes walking as a valuable, important, and desirable mode of travel for transportation, recreation, health, and wellness. As such, walking should be considered and integrated into all transportation, recreation, and tourism systems. Once made a part of the vision of a comprehensive plan, the consideration of pedestrian issues become more routine and legitimate.

Promotion. To create shifts from one mode of travel to another, the benefits of the second mode of travel must be promoted.

In some cases, the business community can be persuaded to, first, help improve conditions for walkers, and second, to promote the community as a pedestrian-friendly place to shop and visit. Increased walking in a shopping district will frequently contribute to the financial bottom line of retailers. Members of the Middlebury (Vermont) Downtown Business Bureau recently helped fund a study that identified what needed to be done to make their community more accessible and friendly to pedestrians. Then they voted to create a special tax district that would assess the downtown business community for the next seven years to help pay for the recommended pedestrian improvements. Meanwhile, they are promoting the community as a walkable place and the local economy seems to be improving.

IMPLEMENTATION STRATEGIES

There are five primary audiences that are generally accepted as the principal targets for education and awareness efforts.

1. Children.

The very youngest (elementary school ages, 5-11), are impulsive, have

limited peripheral vision, lack training and experience, have poor speed/gap assessment, think grownups will look out for them, think close calls are fun, are short in stature making it difficult for them to see and be seen, want to run to limit street crossing time, and like to copy behavior of older people.

Pre- and early teens (middle school ages, 12-15) are willing to take chances and cross more busy roadways.

Teens (high school ages, 16-18) are very active, go long distances, and feel invincible.

Primary messages and important skills for children should include:

- Stopping, looking ,and yielding before entering or crossing a roadway.
- Learning the concept of an edge when crossing a street.
- Scanning left-right-left to look for traffic before crossing a street.
- Understanding walk/don't walk signals.

Primary strategies should include:

- Classroom/school based programs.
- Printed materials distributed through schools and other outlets.
- Annual safety event - highlighting the most important safety messages.
- TV, radio, and print public service announcements.

2. Adults.

Adults (ages 19-64)

Senior adults (ages 60+) May exhibit reduced vision, agility, balance, speed, and strength. Some older adults have problems with hearing, vision, and concentration and may focus on only one object at a time. Senior adults may have greatly reduced abilities under low light/night conditions.

Crash rates for older adults (65 years of age or older) are lower than for most age groups, however, older adult pedestrians are much more vulnerable to serious injury or death when struck by a motor vehicle than younger people.

Primary messages and important skills should include:

- Knowledge of the most prevalent kinds of pedestrian crash types and ways to avoid them.
- Understanding that alcohol plays a role in many adult pedestrian crashes.

Primary strategies should include:

- Literature distributed through colleges, universities, major work centers, and senior centers.
- TV, radio, and print PSAs and feature stories.

3. Parents.

Parents of young children are also an important target audience, even

though they can also be targeted as adults. In many cases, parents often misunderstand basic traffic safety concepts and pass this along to their children. As a result, safety education programs directed at youngsters may be undermined by contradictory messages coming from those individuals that children trust the most.

Primary messages should include:

- Age and developmental factors in pedestrian safety.
- Common crash causes and how to prevent them.
- Walking facing traffic.

Primary strategies should include:

- Direct involvement in safety programs through PTAs and other youth-oriented groups.
- Literature sent home from schools and other youth-oriented outlets.
- Pediatrician office literature.
- Videos and literature at parent nights at schools.
- TV, radio, and print PSAs and feature stories.

4. Motorists.

Motorists contribute to the majority of the crashes involving walking and bicycling. Drivers frequently fail to pay attention and respond to the presence of pedestrians. Many assume, for instance, that it is the responsibility of even young children to stay out of the way of cars.

Primary messages and important skills should include:

- Motorists must stop for pedestrians in crosswalks.
- Many crashes involve motorists' failure to scan for and yield to pedestrians when turning or merging.
- Many children are killed by cars in their own driveway.
- Still more pedestrian crashes occur in parking lots and are associated with backing.
- Motorists are responsible for contributing to the safety of children.
- Drive slowly in neighborhoods and when children are present.

Primary strategies should include:

- Pedestrian content added to driver training programs.
- Driver license test to include pedestrian-related questions and situations.
- TV, radio, and print PSAs and feature stories; posters on buses.

5. Transportation Planning and Design Professionals. A growing number of planners and engineers are willing to provide better accommodations for pedestrians (and bicyclists) but don't know what to do. Design of facilities for these modes is typically not taught in civil engineering and planning schools. Further, basic roadway design often fails to address the needs of pedestrians.

Primary messages and important skills should include:

Walking will take place and needs to be accommodated in roadway design.

Primary strategies should include:

Development of a facilities design manual and improved roadway design standards.

Conducting professional training courses and workshops on all aspects of pedestrian planning and design.

Turning concepts into actions

Safety. Generally, the following actions are recommended to help improve safety for pedestrians:

- Target and eliminate key behaviors that lead to crashes, injuries, and deaths (e.g.., motorist failure-to-yield, pedestrian mid-block dart and dash), especially the way motor vehicles are operated.
- Encourage schools, safety organizations, and law enforcement agencies to deal with pedestrian safety issues and to focus on the most important crash problems.
- Support the development of public awareness campaigns keyed to the most important causes of crashes, injuries, and deaths.
- Encourage the use of safety equipment among pedestrians (retroreflective clothing).
- Educate walkers, bicyclists and motor vehicle users how to safely interact with each other.

One of the first things that should be done when developing public awareness campaigns to reduce crashes and improve safety is to identify what safety problems exist in the community.

Your police department should be able to provide a summary of pedestrian crashes by type and location over recent years. This will help to identify chronic safety problems (if they exist). Match up recurring safety problems with the national pedestrian crash types to identify target audiences. If crash reports are not available, targeting the national crash types and audiences listed above will likely produce the desired results.

After prior pedestrian crashes have been studied, future crashes should be tracked. *Pedestrian and Bicycle Crash Types of the Early 1990s* contains a manual and codes that can be used for typing pedestrian crashes. As a matter of regular practice, crash investigators at local levels should be urged to report completely on any pedestrian crashes, and particularly roadway related variables.

After pedestrian crash types have been identified, a variety of countermeasures — specific efforts intended to solve a problem, typically traffic crashes—should be implemented and tested for crash reduction effects. Several countermeasures have been shown to be effective in reducing specific kinds of pedestrian crashes.

Typical public awareness and education related countermeasures that may help improve pedestrian safety include education-oriented print materials, video tapes, PSAs and model safety regulations. Many of these

products target pre-school and school-age children. Today, there are many public awareness programs and educational materials to help communities target specific problems, effect changes in fatality and injury rates, and secure a long-term approach in addressing local problems. The following resources are representative of some programs that have been developed by others to help communities address pedestrian safety problems and effect changes in fatality and injury rates.

- *Planning Community Pedestrian Safety Programs: An Agenda for Action* (1990). A "how-to" booklet that describes the benefits of initiating a community safety program, suggests pedestrian safety target groups, and tells how to develop and evaluate a plan of action. Available from the National Highway Traffic Safety Administration (NHTSA), 400 7th Street, S.W., Washington, D.C. 20590, Phone: (202) 366-1739.
- *Pedestrian Accident Reduction Guide*. A manual that provides guide lines for a successful pedestrian safety program. Published by National Highway Traffic Safety Administration (NHTSA), Office of Alcohol and State Programs, 400 7th Street, S.W., Washington, D.C. 20590, Phone: (202) 366-1739.
- *Walk Alert Program Guide*. This guide provides detailed information on planning a community-based pedestrian safety program with emphasis on education, engineering, and enforcement. Available from National Safety Council, 444 North Michigan Avenue, Chicago, IL 60611, Phone: (312) 527-4800.
- *Model Pedestrian Safety Program: User's Guide* and *User's Supplement*. The Guide and Supplement outline a six-step process in planning and creating a safe traffic environment for pedestrians. Available from National Technical Information Service, Springfield, VA 22161, Phone: (703) 487-4650.
- *Older Adult Pedestrian Safety*. A booklet that offers guidelines for developing pedestrian programs to meet the needs of older adults. Available from local AAA clubs and AAA Headquarters, Traffic Safety Department, 10000 AAA Drive, Heathrow, FL 32746-5063.
- *Safe Street Crossing for Kids—A Program that Works* and *Planning Guide*. These publications provide planners with information on starting a children's pedestrian safety program. Includes background information, program components, step-by-step guidelines, and reference information. Available from National Highway Traffic Safety Administration (NHTSA), Office of Alcohol and State Programs, 400 7th Street, S.W., Washington, D.C. 20590, Phone: (202) 366-1739.

The table on the next page shows what educational countermeasures the State of Florida has deemed appropriate for addressing common crash types among specific populations.

Acceptance and legitimacy. Agencies can help promote walking as a legitimate mode of travel and recreation by promoting acceptance of the need for all pedestrians to be accommodated by the transportation system. For example, agencies can:

- Develop a means of ensuring public participation in the development and implementation of plans and policies that impact pedestrians. Often agencies can create citizen advisory groups to advocate policies,

Pedestrian Accident Types and Potential Engineering Countermeasures

Countermeasures / Accident Type	Pre-School					Elementary School							High School			General Public					Elderly		
	Parental Guidance	Traffic Safety Clubs	Television Programs	Walking in Traffic Safety	Watchful Willie	Officer Friendly	Demonstrations by Patrols	Education Within the Curriculum	Green Pennant Program	"Big Wheel" Spot	Willy Whistle Program	Child Intersection Dash Spot	"And Keep on Looking"	Assemblies	Drivers Education	Your Traffic Court	Talks to Groups	Community Action Program	Use of Mass Media	Multiple Threat Spot	Vehicle T/M Spot	Adult Intersection Dash Spot	Safety Courses	Talks to Groups	Community Contact Programs
Dart-out (First Half)					•						•														
Dart-Out (Second Half)					•						•														
Midblock Dash																									
Intersection Dash												•	•									•			
Turn-Merge Conflict													•								•				
Turning Vehicle													•												
Multiple Threat													•							•					
Bus Stop Related						•																			
School Bus Stop Related						•																			
Ice Cream Vendor																									
Trapped																									
Backup	•																								
Walking on Roadway																									
Result Vehicle-Vehicle Crash																									
Hitchhiking																									
Working in Roadway																									
Disabled Vehicle Related																									
Nighttime Situation																									
Handicapped Pedestrians																									
Pedestrian Safety in General	•	•	•	•	•	•	•	•	•	•				•	•	•	•	•	•				•	•	•

* Dots designate countermeasures believed to positively affect behavior/accident types.

Source: *Florida Pedestrian Safety Plan*, FDOT (1992)

programs and facility improvements that will enhance and promote walking.

- Develop or revise vision and policy statements to recognize the importance of walking and the need to integrate this mode into transportation and recreation systems.
- Identify and encourage other agencies to develop and implement policies, programs, and projects that maximize opportunities for walkers and that encourage walking.
- Call for including pedestrian related information in the State driver's manual along with questions relating to the interaction of motorists, bicyclists, and pedestrians on written examinations.
- Provide training on pedestrian facility planning, design, and maintenance for all practicing transportation and design professionals.
- Provide training for law enforcement officers in the conduct of safety education and enforcement programs for pedestrians.
- Educate planning and enforcement officials — as well as the general public — in the importance of traffic calming as a safety countermeasure.
- Develop and conduct public information and awareness campaigns targeted toward all roadway users, including bicyclists, pedestrians, and motorists, with the intent of modifying behavior and attitudes to provide cooperation among these users.
- Establish a public safety education program using TV, radio, signs, and information materials to teach motorists, bicyclists, and pedestrians

how to share the road.

- Develop and conduct public awareness campaigns promoting walking as a means of solving community problems, improving personal health and wellness, and enhancing the quality of life.

Promotion. Usually, it is a core of enthusiastic citizens who come to the forefront to espouse the benefits of walking and who lobby for improved pedestrian facilities. Local agencies can support responsible civic action through the establishment of citizen advisory committees. Such committees are particularly effective in the area of identifying critical issues and needs that affect pedestrians.

In addition to helping an advisory committee find its legs, local agencies can also initiate these actions to promote and encourage walking:

- Provide education programs to companies promoting walking to work.
- Encourage local chambers of commerce and business groups to develop appropriate literature to promote the community as a walkable tourist destination.
- Encourage local organizations to develop walking tours and maps.
- Encourage and support private sector companies and organizations to become involved in activities designed to facilitate walking.

EVALUATION

To evaluate the effectiveness of public awareness and education campaigns:

- Review crash statistics on an annual basis to track changes and, over time, trends. Adjust actions as needed.
- Keep a record of the number of pedestrian programs that advocate walking. Increase the number each year.
- Keep a tally of the total number of projects that are designed specifically to promote walking.
- Record on a periodic basis the percentage of employee commute options that contain elements that encourage walking.
- Keep a record of the law enforcement officials who have received training in bicycle and pedestrian safety education and enforcement training activities. Encourage more to receive this training each year.

Success will be on the way when:

- There is a supportive policy for walking in the community.
- People have access to pedestrian education programs.
- There is an active advocacy organization and a pedestrian advisory committee at the local level.
- There are funds being spent on programs devoted to pedestrian safety education and awareness.
- There are training programs available for planners, engineers, law enforcement officers, and safety program managers.
- More people are walking and are doing so safely.

TRIP LENGTH REDUCTION

Land use patterns can greatly affect a person's ability and desire to walk or not walk.

TYPICAL CONCERNS

Pedestrians are sensitive to distance. If distances are too long, people will not walk. In many suburban areas, this issue is of particular concern since low densities create longer trips. Additionally, zoning practices often separate land uses so that needed services, such as grocery stores, are beyond walking distance from the nearest homes.

POSSIBLE SOLUTIONS

Land use, density, and zoning are complex topics studied and debated by scholars and politicians. Nevertheless, actions can be taken to reduce trip length for some people and thereby encourage more walking trips.

The first suggestion is to promote higher residential density. The second is to mix certain types of land use. In particular, integrate small businesses that generate frequent trips into residential neighborhoods. Good examples are small grocery stores, video rentals, hair salons, and coffee shops. The third suggestion is to design and retrofit developments to better serve pedestrians.

IMPLEMENTATION

Since the tradition of building low-density, suburban-style homes, separated away from all business activity is well entrenched, don't mandate too much change too quickly. Provide incentives and do pilot projects in areas open to the idea. Chances are at least one neighborhood is already zoned for higher densities and residents are eager for new development to

revitalize their community. Try a pilot program there to encourage mixed-use development and higher densities.

Incentives can take many forms. In some cities, developers of multi-family housing on arterial streets are allowed to add units if they reserve the first floor for retail. Allowing additional building height is another way to get first floor retail space. Alternatively, developers of office buildings can be allowed more square footage if the building includes one floor of apartments. Not only does this add density, it helps brings people and life to areas that are otherwise deserted at night. Consider setting a goal to include some housing in every building constructed in certain areas of your community.

There are two keys to making incentives work. They must "make sense" for the developer; and high-density, mixed-use must be acceptable to the community. Build success by being a good listener, being flexible, and creating success where the opportunity presents itself.

In areas of fast growth, encourage higher density, mixed-use developments with a traditional type grid street system. This "neo-traditional" approach is gaining popularity around the country.

RESOURCE REQUIREMENTS & SCHEDULING

It is true that increasing densities and reducing trip distances can take years to implement. Visible results can be achieved within a few years by focusing on areas of rapid development or redevelopment. However, don't pursue this end at the expense of projects and programs with more immediate results. As with all strategies to change land use patterns, work within the context of a larger pedestrian program.

The literature on density, efficiency, and cost is extensive. In general, the arguments suggest that higher densities and shorter trip distances lead to resource conservation and greater efficiency.

EVALUATION

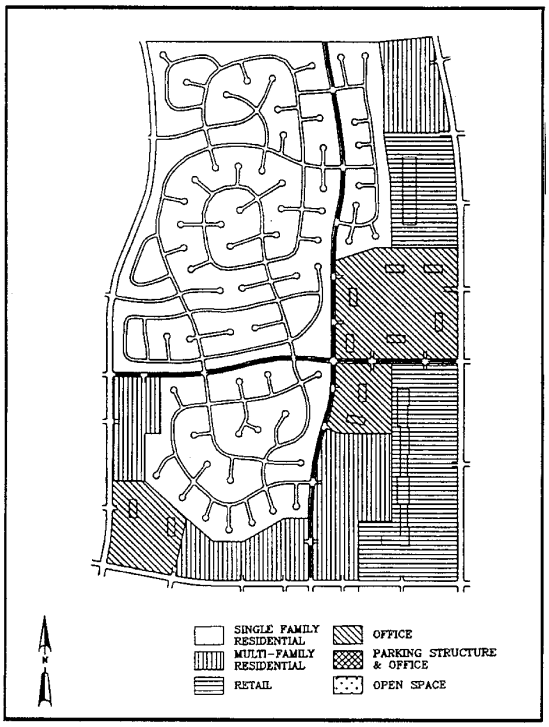
Check to see if developers are taking advantage of incentives that are offered. If not, find out why and make adjustments. If multi-family housing developments include neighborhood stores, determine whether they encourage pedestrian trips in place of motor vehicle trips. For new neo-traditional developments, determine what effect they have on modal splits, trip frequencies, and trip types. The key is to show whether land-use strategies increase pedestrian trips and create livable communities.

PLANNING/DESIGN CONSIDERATIONS

Recently, most development has been characterized by suburban sprawl, cul-de-sacs and low-density land-use development, all of which are oriented toward the automobile. Such designs encourage driving while discouraging walking.

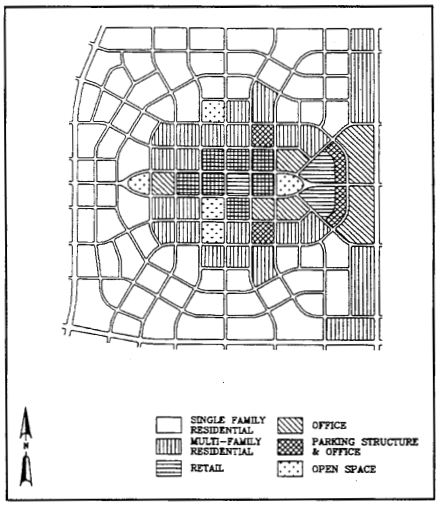
Traditional and neo-traditional neighborhood designs, on the other hand, are distinguished by neighborhood and civic centers within walking distance of each other. These traditional designs feature compact development patterns, mixed land use, and a variety of housing choices. Most

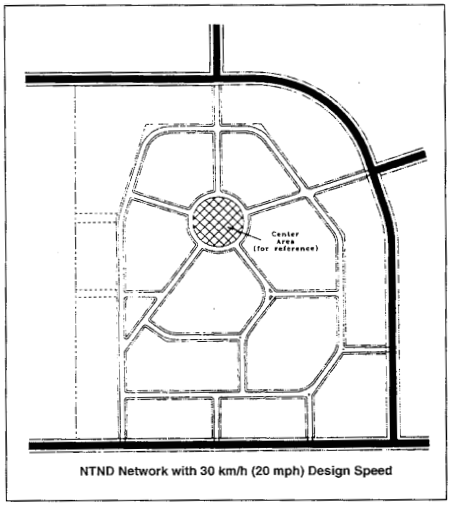
Suburban land-use development that features few arterials and many cul-de-sacs encourages driving while discouraging walking.



Source: *Traffic Engineering for Neo-Traditional Neighborhoods: An Informational Report,* ITE Technical Committee 5P-8, 1993

Traditional and neo-traditional land use patterns promote walking trips.





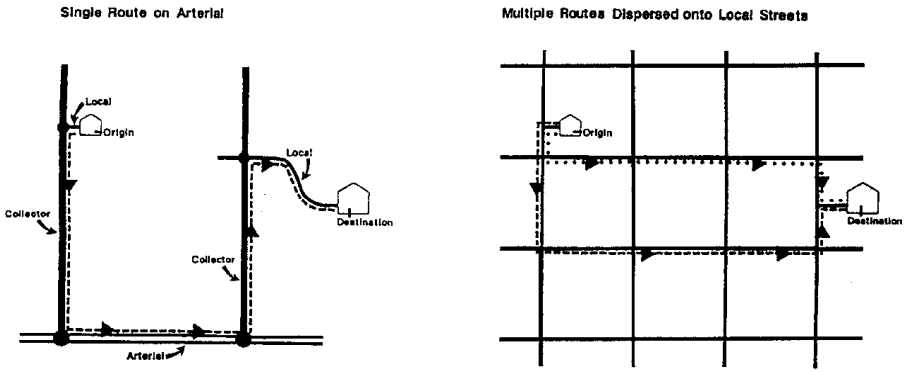
Source: *Traffic Engineering for Neo-Traditional Neighborhoods: An Informational Report,* ITE Technical Committee 5P-8, 1993

importantly they incorporate grid patterns that allow connected networks of narrow streets and pedestrian-scale improvements.

Traditional and neo-traditional developments also allow roadways to be narrower in width and permit radii of roadway curves and intersection curbs to be reduced. Curb radii on local streets can be as small as 3 to 4.6 m (10 to 15 ft). On sub-collectors, curb radii can be 4.6 to 6.1 m (15 to 20 ft). The compact network of streets also enhances the ability to locate buildings close to the street, shortening walking distances between destinations. This in turn provides opportunities for important community structures such as town halls, theaters, churches, and museums to face open areas,

parks or squares, thereby further increasing the aesthetics and livability of the neighborhood.

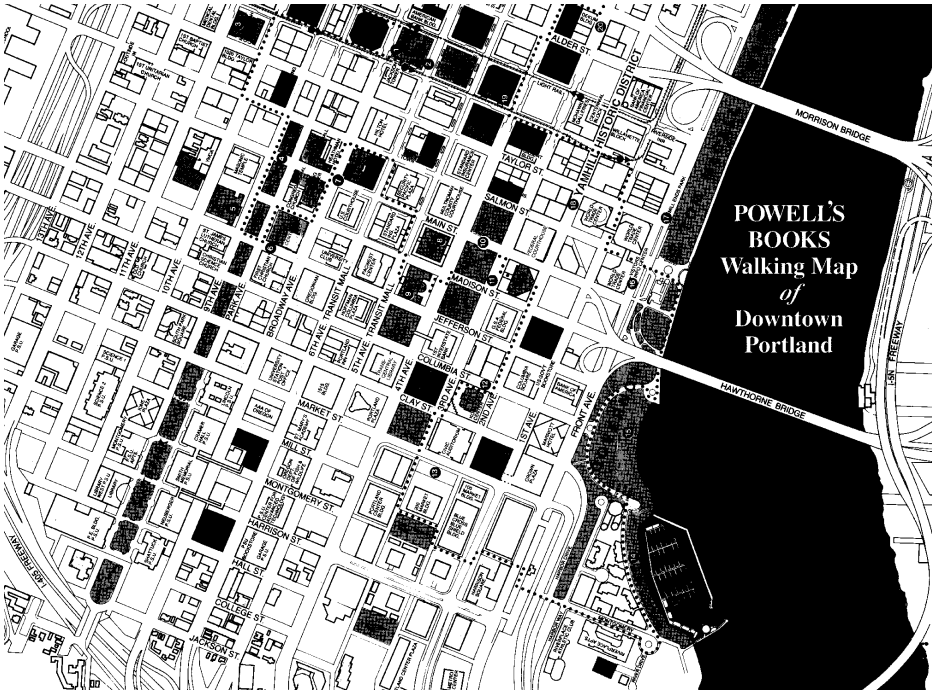
When a grid or other dense street network does not currently exist, look for ways to retrofit pedestrian linkages that promote and maintain walking continuity. Connect cul-de-sacs, loop roads, and other isolated neighborhood layouts using "cut-throughs" to adjoining developments. Such "cut-throughs" enable pedestrians to travel the most direct route, or in some cases via alternate routes, to their destinations. In addition, there will also be fewer vehicular conflicts because pedestrians won't have to use arterials to get from one local street to another.



Typical street hierarchy versus typical neighborhood network paths

Source: Traditional Neighborhood Development, Will the Traffic Work?, Kulash, 1990

WALKING ROUTE MAPS



A typical walking map of a city. In this case, the city is Portland, Ore.

TYPICAL CONCERNS

Walking is becoming increasingly popular, but few people know how to explore their own cities or neighborhoods. Searching out the best routes can be time consuming, and many feel uncomfortable walking through unfamiliar areas.

POSSIBLE SOLUTIONS

One solution is to encourage the production of guide maps that show walking routes through neighborhoods, historic districts, parks, greenways, and along bodies of water. Such maps can identify routes that start and end at the same place, or suggest good ways to reach popular destinations on foot; they can also include routes of different lengths and difficulty. Such maps can become navigational tools for both recreational and utilitarian walking trips.

IMPLEMENTATION STRATEGIES

Walking guide maps can be produced quickly and cheaply. They help increase the visibility for pedestrian programs. Consider creating two types of maps: local neighborhood maps and regional trail or route maps. Also, think through the map distribution process. A good approach is to have your pedestrian advisory committee develop a guide to good routes and then have a local cartographer utilize your research to produce and distribute walking maps commercially. The result will be a greater variety of maps; better maps produced according to state-of-the-art cartographic techniques; maps printed and distributed with private funds, not public

money; and the development of business opportunities for local entrepreneurs.

Neighborhood walking routes: Begin by developing neighborhood-based walking routes with the help and support of the neighborhood residents. They know the best routes for discovering the hidden and interesting places that make for great walking. These "gems" make walking fun and exciting.

Not everyone will want maps showing routes through their neighborhood. While some view a walking map as a benefit and safety enhancement (i.e., more eyes and ears in the neighborhood), others see them as invitations for strangers to wander into their backyards. Walkers are unlikely to cause problems but the fear is real and must be addressed. Start by developing routes for areas where they are most welcome.

There are numerous ways to work with a neighborhood, ranging from an approach where residents may wish to produce their own map, to an approach where residents review proposed routes. A good middle ground is to hold public meetings where citizens draw their favorite walking routes and destinations on a map. The next step is to draw up draft alternatives for review. Once you reach a consensus and routes have been developed, have the map(s) produced and distributed by the private sector as described above.

Regional walking maps: Regional routes through green belts and parks are easier to develop because they may require less neighborhood involvement. Select a variety of routes to meet the needs of different types of pedestrians. For example, select a short, flat route through a park; a circular route around a lake; and a strenuous route up a hillside. Include routes that are accessible to those with disabilities.

Distribution: Commercial cartography companies usually have well-developed distribution systems and networks. To broaden distribution, prepare press releases announcing the availability of any maps. Send notices of availability to community service centers, libraries, athletic supply stores, local clubs, and City Hall.

RESOURCE REQUIREMENTS & SCHEDULING

If maps are produced commercially, no costs will be incurred for production and distribution. The biggest cost, however, is the staff time required to bring the project to the point where it is possible to turn it over to a cartographic company. It can easily take one to two years to develop routes and check them out for an entire city. Because maps can be so time consuming to produce, find ways to involve other people and organizations. Preliminary groundwork can also be expedited if a G.I.S. (Geographic Information System) is available within the community. Once a map is in the G.I.S. system, it can be easily corrected for subsequent preliminary iterations that can be used to test routes in the community. If G.I.S. is not available, ask around for a CAD (computer-aided drafting) version of the city map. While not as powerful as a full-fledged G.I.S., such a map can do much of what is needed.

EVALUATION

How do you know if the map is good or having any effect? Encourage cartographic companies to include a comment card with map copies or to

print the agency's phone number on the map. The resulting cards and phone calls will at least provide anecdotal evidence of the level of walking created by the map.

SPECIFICATIONS

Specialty maps, such as a walking route map, are not guided by formal standards; however, maps should be readable and user-friendly. One of the best ways to develop ideas is to look at other maps. Visit the book store and check out maps and guidebooks. If they carry no pedestrian maps, check out the bike maps. Write to other cities and ask for copies of their maps.

One good commercially produced walking map is a walking map of Portland, Oregon, that has been developed and distributed by Powell's Bookstore, 1005 W. Burnside, Portland, OR 97209, Phone: (503) 228-4651. Newcomers to the Portland area say it's the best walking map of the city. Naturally, all of Powell's numerous bookstores are prominently located on the map, and the map is readily available at all Powell's bookstores.

WALKING EVENTS

Once introduced to walking through a special event, people are more likely to consider walking for other purposes.

TYPICAL CONCERNS

Walking is a great group activity. Many people will participate in a walking event before considering it for utilitarian and/or commuting trips. Events are important because they let people experience the joys of walking in a safe, positive environment. Once introduced to walking through a special event, people are more likely to consider walking for other purposes. Unfortunately, too few communities offer walking events that attract large numbers of people.

POSSIBLE SOLUTIONS

The solution is to organize and promote a variety of special pedestrian events to attract walkers of all ages and fitness levels. There should be something for everyone. For example, an organized walk with pre-registration and a map may attract the fit, adult walker. On the other hand, closing a roadway along a lake for a Sunday morning group stroll may attract the less fit walker as well as families with children.

IMPLEMENTATION STRATEGIES

Here are three ways to facilitate and encourage walking events.

Training: Sponsor a seminar on event organization. If your community has a successful event, ask the organizer to share experiences. Bring in an expert from out of town. Invite walking enthusiasts, service organizations, and potential sponsors from the business community. One expert in the field is the American Volkssport Association (AVA). This organization promotes Volksmarches, or planned walking events. Volksmarch comes from a German word meaning the people's walk. The activity of Volksmarching was brought into America by U.S. troops, stationed in Germany, who began

marching on military bases. Since being introduced, the activity has caught on with civilian Americans and spread across the United States. For more information, contact the American Volkssport Association National Events Hotline (800) 830-9255, 1001 Pat Booker Road, Suite 101, Universal City, TX 78148, Phone: (210) 659-2112, Fax: (210) 659-1212, Web site: www.ava.org.

Permits: If permits are required for walking events, obtaining such a permit can be a time-consuming process. To speed the process, put together a simple brochure explaining how to obtain needed permits. This can be very helpful for volunteers organizing a special event.

Funding: Running an event can be costly, especially if organizers have to pay for police and emergency personnel. Consider covering these costs with public funds for the first year or two to help get events off the ground. Help write grant proposals to secure private funding.

While walking events help promote pedestrian activity, direct staff involvement may be not advisable unless there is a tangible benefit to the agency. Ask these questions to make this determination:

- Will the event provide program funding?
- Will it help develop important contacts for key projects?

Events may be fun but they can also be time consuming, and are likely better done by non profit organizations or the private sector, as noted above. Also, ongoing staff involvement can be an inefficient use of time.

In some communities, local and national organizations make use of walking events to raise money for charitable causes. In exchange for the benefits of participating in a well-organized event, walkers obtain pledges from sponsors who may be friends, family members, or business associates. These "walkathons" are usually high-profile events that introduce many to the pleasures of walking.

RESOURCE REQUIREMENTS & SCHEDULING

Costs and time requirements vary, depending on the location, size and type of event. They can range from almost nothing for an informal neighborhood walk to thousands of dollars for a large event requiring street closure and traffic control. Planning a large event should begin at least a year in advance.

Develop a work plan with a timetable and budget. Make it realistic so that those involved have a positive, enjoyable experience. Don't burn out staff or volunteers.

Consider corporate sponsorship for events. While nice, it is certainly not needed. Some organizers don't want to associate with certain products (tobacco, alcohol, etc.).

Seriously consider having organizations or clubs skilled in running events conduct walking events. While they may get the glory, they also will shoulder the responsibility. After all, the point is to get more people walking more often.

EVALUATION

Evaluate an event immediately after completion. Talk to volunteers, spon-

sors, participants, and other involved parties. Look at what went well and what might be improved. Make a list of the things to do differently next year. If the event flopped, try a different approach. This requires being able to let go of old ideas and trying new ones. Avoid running an event year after year with only marginal success.

PLANNING /DESIGN CONSIDERATIONS

The best course of action is to consult experts in the field who run walking events. One expert is the American Volkssport Association (AVA). In addition to organizing group events, AVA has developed more than 1,100 so-called "permanent trails," or walking routes, nationwide. These routes, usually starting at a hotel, inn, or other public place, are designed for people who desire to enjoy a self-guided walk alone or with a small group of friends. Such "trails" could form the basis of a walking event in communities where these trails have been established. Call the AVA for a list or locations of their permanent trails.

While not designed for walking events, the *Bicycle Event Organizer's Handbook* published by the Texas Bicycle Coalition (1992) provides a complete and informative description of what should be considered when running a group event. Topics include organization, selecting routes and destinations, finding sponsors, developing local support, logistics, risk management, publicity, volunteers, participants, and post-event activities. Time lines and an extensive safety manual are also included. This 98-page book is available for $50 from the Texas Bicycle Coalition, P.O. Box 1121, Austin, TX 78767.

CONSTRUCTION ZONES

Pedestrian needs must be accommodated during construction projects.

TYPICAL CONCERNS

When construction zones encroach on sidewalks or crosswalks, pedestrians may suddenly find themselves having to make detours that may be unsafe, difficult to navigate or both. They may be forced to choose between picking their way through the construction site or walking in a busy street. This can be especially dangerous for the elderly and handicapped, who rely on well-maintained, well-marked sidewalks for safe mobility. Adding to the problem is when projects are built in phases and when construction zones change weekly or even daily.

POSSIBLE SOLUTIONS

The answer is to develop and implement construction zone policies to eliminate unexpected obstacles for pedestrians and make transitions as safe and smooth as possible. The following concerns should be addressed:

- Advance warning and guidance signs.
- Adequate illumination and reflectorization.
- Channelizing and barricading to separate pedestrians from traffic.
- Wheelchair accessibility.
- Preventing visually-impaired pedestrians from entering work zones.
- Circumstances requiring temporary walkways.
- Providing alternate routes for pedestrians with appropriate signing when necessary.

Contractors should be allowed flexibility as long as requirements are met. It's often difficult to plan ahead as many traffic control decisions are made daily in the field. All parties involved should be made aware of the

needs of pedestrians and be made responsible for ensuring safe and continuous passage.

IMPLEMENTATION STRATEGIES

Developing a workable policy for pedestrian access through construction zones requires the cooperation of traffic engineers, construction inspectors, crew chiefs, contractors, and pedestrian advocates. The policy should apply whenever construction or maintenance work affects pedestrian access, whether the work is done by private firms or city, county, or State crews.

Link to construction permits: Make sure that permits for construction that will encroach on sidewalks or crosswalks are contingent upon meeting pedestrian access policies. Give contractors copies of the standards when they apply for a permit. What is needed are standards or a policy that is readily available. These can be incorporated into contracts, agreements, or specifications.

Train in-house work crews: Many road, pavement, maintenance, or utility projects use permanent city crews to do the work. Educate crew chiefs and crews to ensure they understand and follow the policy.

RESOURCE REQUIREMENTS

Enacting pedestrian access policies for work zones is not expensive. The main costs involve developing the policy, training crews and construction inspectors, and imparting information to contractors. Ongoing costs involve work site inspection.

EVALUATION

The main burden ultimately falls on construction inspectors who will be responsible for monitoring compliance. After implementation, ask them to keep track of how the policies work and whether changes are needed. In addition, use citizen complaints and comments to help identify problems or successes.

PLANNING /DESIGN CONSIDERATIONS

While the MUTCD's pedestrian guidelines apply to pedestrian traffic around road construction work zones, the absence of specific guidance on pedestrian access around building construction zones leaves local agencies a great deal of flexibility.

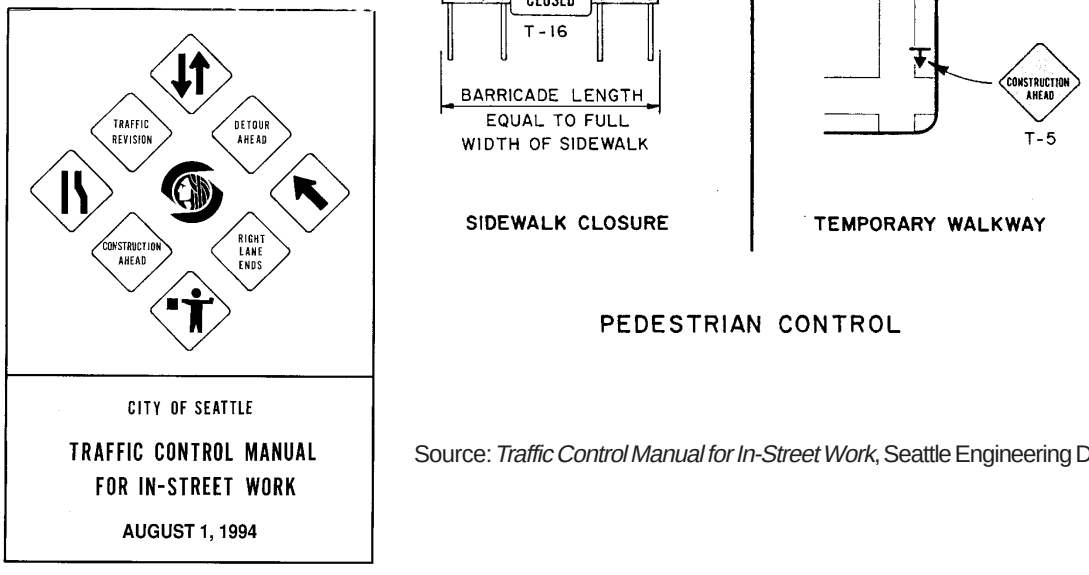
The Engineering Department of the City of Seattle has developed specific policies for pedestrian access, control, and protection in work zones. These policies are detailed in the city's *Traffic Control Manual for In-Street Work* (4th edition, 1994). The purpose of the manual is "to set forth the basic principles and standards to be observed by all those who perform work in a public street so as to provide safe and effective work areas and to warn, control, protect and expedite vehicular and pedestrian traffic."

Before any in-street work is commenced, all persons performing work within the street right-of-way must first obtain a permit by submitting and receiving approval of a traffic control plan.

To protect pedestrians, the manual describes procedures for erecting

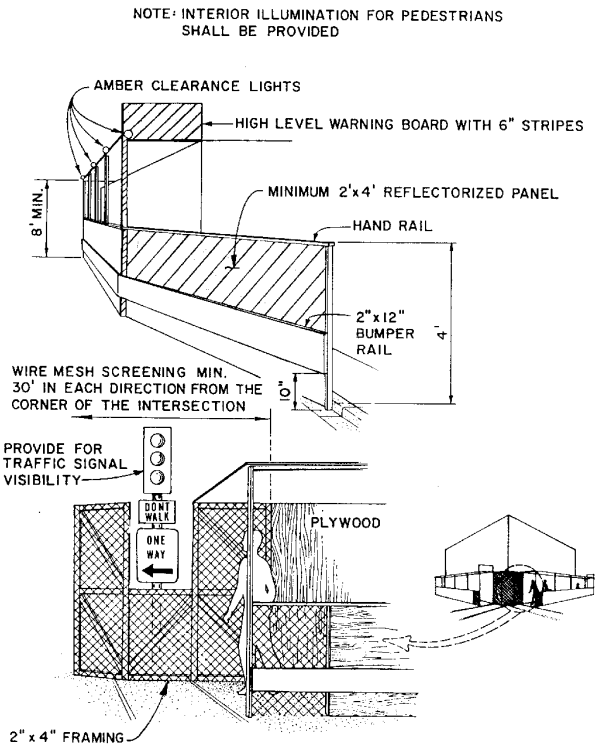
protective barricades, fencing, and bridges together with guidance devices and signs. Whenever passageways or walkways are affected by construction, access for pedestrians and disabled people is ensured. Access to recommended school crossings must be maintained at all times. Where walkways are necessarily closed by construction, alternate walkways, including temporary curb ramps, must be provided. Where alternate walkways are not feasible, signs are required at the limits of construction and in advance of the closure at the nearest crosswalk or intersection to divert pedestrians across the street. Pedestrians must never be diverted into a portion of the street concurrently used by moving vehicular traffic. Where required, fixed pedestrian ways using fences and canopies shall be considered. Adequate illumination and reflectorization is required during hours of darkness.

The diagrams below and on the next page are excerpted from Seattle's *Traffic Control Manual for In-Street Work*.

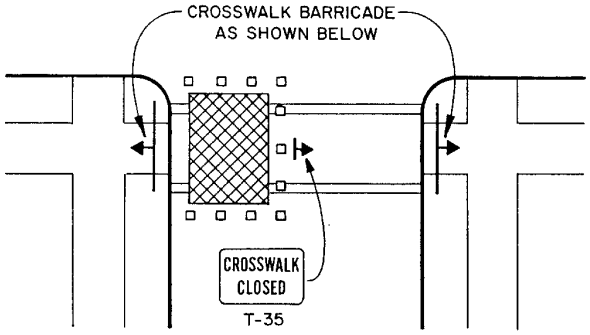


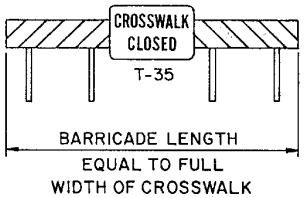
PEDESTRIAN CONTROL

Source: *Traffic Control Manual for In-Street Work*, Seattle Engineering Department



PEDESTRIAN PROTECTION





CROSSWALK CLOSURE

Source: *Traffic Control Manual for In-Street Work*, Seattle Engineering Department

PEDESTRIAN CONTROL

LAND USE DEVELOPMENT REQUIREMENTS

Planning and zoning practices that permit suburban sprawl effectively eliminate the potential for walking trips.

TYPICAL CONCERNS

Even where sidewalks are provided along arterial streets, pedestrians can sometimes have trouble getting to adjacent buildings. Often, large parking lots separate stores from the street and pedestrians going to the shops must walk between long rows of parked cars. This situation can be particularly hazardous for children, seniors, and those with disabilities.

More common yet is the convenience store set back from the street to allow drive-up parking in front. In such situations pedestrians must walk across parking lots, through the comings and goings of customer and delivery traffic. Because many convenience stores are frequented by young children living nearby, this age group can be at risk.

Finally, some public buildings may be inaccessible to pedestrians because the buildings are served by driveways with no sidewalks.

POSSIBLE SOLUTIONS

The solution is to write building requirements and zoning ordinances that ensure good access for pedestrians. People should be able to reach buildings without walking across large parking lots or across landscaping. The most obvious solution is to site buildings adjacent to the street right-of-way with parking at the side or back. If buildings must be set back, a protected, landscaped sidewalk from the street to the building should be provided.

IMPLEMENTATION STRATEGIES

There are two basic strategies for improving access to buildings. One is to change building permit requirements for new construction and major renovation projects. The other is to retrofit existing building sites. In gen-

eral, the first is a long-term approach while the second is a short term fix. It is generally not possible to require private developers to retrofit properties except to meet ADA requirements; consequently, retrofitting is often limited to public buildings or done at public expense.

1. Building permit requirements: Look for ways to include pedestrian requirements in codes for new development either by changing local ordinances or simply issuing an administrative rule. Also, review standard plans and/or specifications for model requirements.

Siting a building close to a sidewalk on a street can elevate the priority of walking within a community as well as improve access for pedestrians.

Consider providing incentives to encourage pedestrian access. Examples include allowing larger buildings if built adjacent to a street right-of-way or reducing off-street parking requirements. Find out what developers need and offer it as an incentive.

The New Jersey Department of Transportation publication *Pedestrian Compatible Roadways—Planning & Design Guidelines* incorporates a "Site Review Checklist for Pedestrian Facilities" worth considering:

Safety and Security:

- Are crossings of wide expanses of parking lot held to a minimum?
- Are pathways provided that are visible from buildings and free of dark, narrow passageways?
- Is adequate lighting provided for nighttime security?
- Are sight distances adequate at crossings?
- Do pathways lead to the safest crossing points?
- Are pedestrian/vehicle conflict points kept to a minimum?
- Are pedestrians clearly visible to traffic where they cross the street?

Walking Surfaces and Amenities:

- Are the walking areas pedestrian-scale?
- Are the walking surfaces skid-resistant with slopes less than 1:12?
- Are there curb ramps and are they properly designed and located?
- Are major changes in grade properly treated with stairways, ramps, and handrails?

2. Retrofitting existing buildings: Retrofitting a building site will probably be limited to public buildings sites since it is generally not possible to require retrofits of private buildings. However, public buildings should serve as an example and incentive to the private sector.

To get started, find out when major maintenance is scheduled for social service centers, libraries, schools, city and county administration buildings, and the like. Read project justifications, visit the sites, see what has been omitted, and add those elements. Do this early (i.e., before the project is funded).

Start an annual capital program to retrofit public building sites. At a minimum, retrofit a few key sites with high pedestrian use or that serve special populations.

The Transportation Research Board publication entitled *Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas, Report No. 294A* (pp 30 - 53) offers these suggestions for what to consider when developing new sites:

- Provide a reasonable path through surface parking lots.
- Channelize vehicular paths through parking lots with landscaped islands.
- Orient site layout to connect with nearby off-site pedestrian facilities.
- Orient uses and buildings along a street system with sidewalks.
- Identify potential links to other magnets nearby and provide a walkway from anticipated transit stops.
- Define pedestrian space between the developed property and the highway.
- Make the routes direct.
- Consolidate driveways.
- Channelize driveway entrances and exits.
- Soften the environment with landscaping, sign control, and so on.

RESOURCE REQUIREMENTS & SCHEDULING

Using building codes to improve pedestrian access to building sites is not a quick deliverable like aggressively installing curb ramps or sidewalks. Consequently, it should not be pursued at the expense of such projects and programs. It should be pursued within the context of the overall pedestrian program.

Cost is not easily measured. Locating a building to be directly adjacent to a street may cost very little or it may require moving utilities or changing standard plans. It is probably cost-neutral, with some sites costing more and others less. In the long run, social costs will be lowered through crash reductions and increased walking and transit use.

EVALUATION

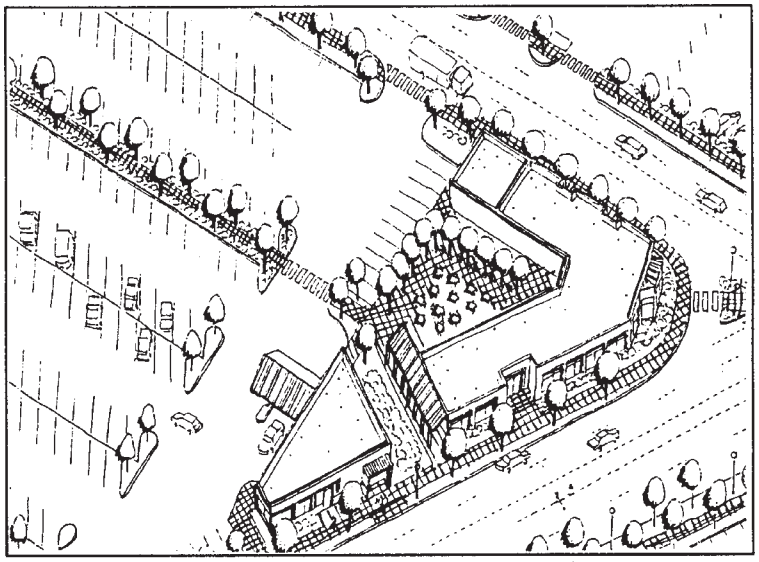
If developers are provided with incentives to encourage pedestrian access, check to see if they use them. If not, find out why and make adjustments. Do site visits to evaluate pedestrian features. Look for motorist/pedestrian conflict points, ask pedestrians if they feel safe, and do counts to gauge pedestrian activity.

PLANNING/DESIGN CONSIDERATIONS

Here are three types of design treatments to consider. Specific sites will require combinations and variations of these basic designs.

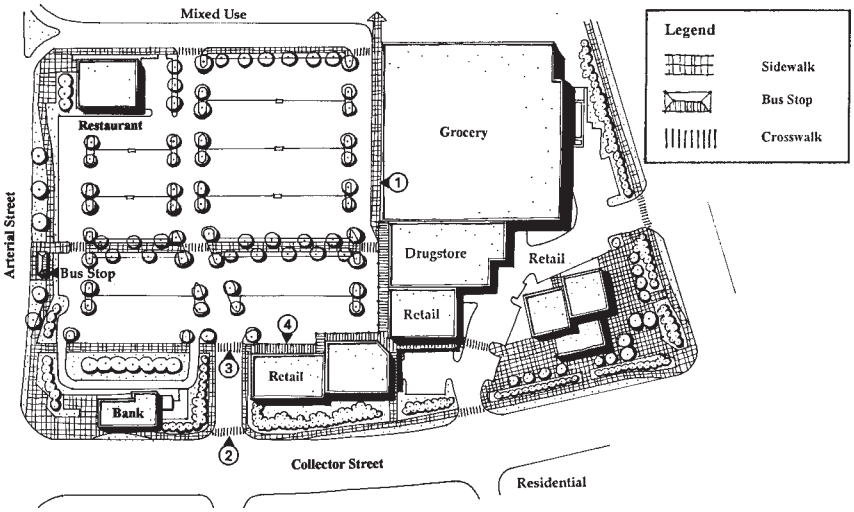
Consider the following design layouts to encourage walking in your community:

Buildings on corners create a safer, inviting environment for pedestrians.



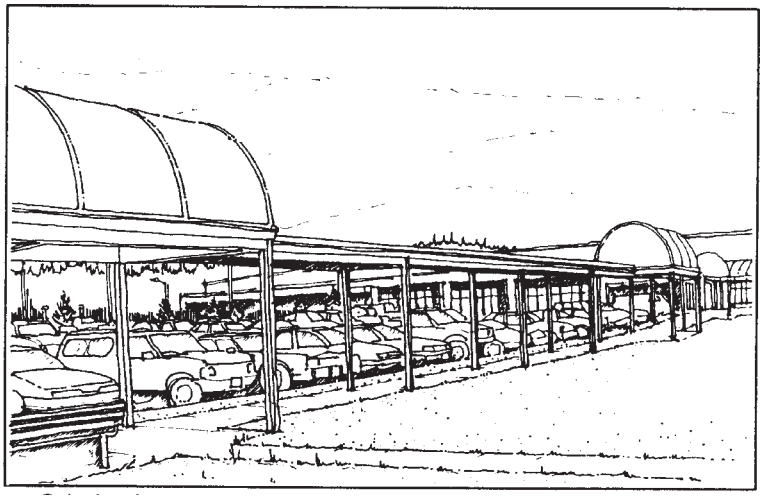
Source: *A Guide to Land Use and Public Transportation, Volume II: Applying the Concepts*, SNO-TRAN, 1993

Driveways located away from fronts of stores minimize conflicts between pedestrians and cars. Safe internal access and circulation provide connections to surrounding properties. Canopies in front of stores offer weather protection to the patrons



Source: *A Guide to Land Use and Public Transportation, Volume II: Applying the Concepts*, SNO-TRAN, 1993

Covered walkways make parking areas more safe for pedestrians.



Source: *A Guide to Land Use and Public Transportation, Volume II: Applying the Concepts*, SNO-TRAN, 1993

LAW ENFORCEMENT

When law enforcement agencies permit motor vehicles to park on sidewalks, a reduction in pedestrian access, comfort, safety, and activity may result.

TYPICAL CONCERNS

If local police don't enforce traffic laws related to pedestrians and vehicles, the result will be increased crashes, and injuries, and fewer people walking.

While many states require motorists to stop for pedestrians in crosswalks, all too often the law is ignored. As a result, crossing an intersection can be both difficult and dangerous. Rather than challenging motorists, many people may decide not to walk to nearby shops and parks. Also, it is critical that motor vehicle speeds be controlled.

POSSIBLE SOLUTIONS

The solution is to develop and implement a selective enforcement program. The purpose of such a program is to reduce the number of pedestrian/vehicle collisions and the threat of motor vehicles.

IMPLEMENTATION STRATEGIES

Implementation will not be easy. Police departments frequently face tremendous pressure to focus on "more serious" crimes. Pedestrian law enforcement is far down the list of many departments' priorities. Possibly the best strategy will be to initiate pilot projects in areas with school children, senior citizens and lots of community support.

There are probably at least two or three locations where speeding motorists occasionally hit pedestrians and where residents are asking for better enforcement. Such situations are excellent candidates for pilot enforcement

programs. If an enforcement initiative is successful here, expand the program. The key is to start small, pick good locations, and develop enforcement activities as public demand and support grows.

SEATTLE ENFORCEMENT PROGRAM

The City of Seattle's enforcement program targets key intersections. Each year, the Engineering Department and the Police Department identify problem locations on the basis of reported crashes, citizen complaints, and police observations. In doing so, they also select geographically dispersed intersections so that the effort has a community-wide effect. Most selected intersections have marked crosswalks but no signals.

Officers ticket motorists who fail to stop for pedestrians stepping off the curb within the marked crosswalk. An active publicity component, using local media, enhances program impact. While the number of tickets written is not high, the public gets the message: They risk a ticket if they don't stop for pedestrians.

RESOURCE REQUIREMENTS & SCHEDULING

Costs will vary depending on program size. However, if the police write enough tickets, it may pay for itself. The key is to minimize police staff time while getting maximum benefit. For example, four officers, each assigned to one of four sites for four hours a week for six weeks will require about 100 hours. It may be possible to use new photo radar technology for speed enforcement at much lower cost.

EVALUATION

A "step out" survey determines what percentage of motor vehicle drivers stop for pedestrians trying to cross at a particular location. Select a site with a marked crosswalk but no signal. To conduct the survey step off the curb and record whether motorists stop; test drivers coming from both directions. The key is to step off the curb when drivers are the same distance from the crosswalk each time. The distance is a function of the posted speed limit and driver reaction time.

Conduct periodic site evaluations. Do a "step out" survey before and after to see how the program influences driver behavior. If behavior improves, let the media know. If it does not, take a look at your program. Perhaps there was too little publicity or the enforcement effort did not last long enough or was not very thorough. Note: this activity is best done by or with law enforcement officers (though not while in uniform!).

RESOURCES

A Policy on Geometric Design of Highways and Streets (1994 edition), published by the American Association of State Highway and Transportation Officials (AASHTO), P.O. Box 96716, Washington, DC, 20090-6716, Phone: (888) 227-4860, Fax: (800) 525-5562.

Design and Safety of Pedestrian Facilities, A Recommended Practice, (1998 edition), published by the Institute of Transportation Engineers, 525 School Street, S.W., Suite 410, Washington, DC 20024-2729, Phone: (202) 554-8050, Fax: (202) 863-5486.

Florida Department of Transportation's Roundabout Guide, Florida Department of Transportation, 605 Suwannee St., MS-82, Tallahassee, FL 23299-0450.

Guide for the Development of Bicycle Facilities (1991), published by the American Association of State Highway and Transportation Officials (AASHTO), P.O. Box 96716, Washington, DC, 20090-6716, Phone: (888) 227-4860, Fax: (800) 525-5562.

Highway Capacity Manual, Special Report 209 (1994 edition), published by the Transportation Research Board, Box 289, Washington, DC 20055, Phone: (202) 334-3214, Fax: (202) 334-2519.

Louisiana Bicycle and Pedestrian Plan (1997), available from the Louisiana Department of Transportation and Development, P.O. Box 94245, Baton Rouge, LA 70804, Phone: (504) 358-9160.

Making Streets that Work, City of Seattle, 600 Fourth Ave., 12th Floor, Seattle, WA 98104-1873, Phone: (206) 684-4000, Fax: (206) 684-5360.

Manual on Uniform Traffic Control Devices, published by the Federal Highway Administration (FHWA), Superintendent of Documents. P.O. Box 371954, Pittsburgh, PA 15250-7954, Phone: (202) 512-1800.

Model Pedestrian Safety Program: User's Guide and *User's Supplement.* Available from National Technical Information Service, Springfield, VA 22161, Phone: (703) 487-4650.

National Bicycling and Walking Study: Transportation Choices for a Changing America (1994), published by the Federal Highway Administration (FHWA). Available from the National Bicycle and Pedestrian Clearinghouse, 1506 21st Street, N.W., Suite 210, Washington, DC 20036, Phone: (202) 463-6622, Fax: (202) 463-6625.

National Bicycling and Walking Study: Case Study # 19; Traffic Calming and Auto-Restricted Zones and other Traffic Management Techniques—Their

Effects on Bicycling and Pedestrians, published by the Federal Highway Administration (FHWA). Available from the National Bicycle and Pedestrian Clearinghouse, 1506 21st Street, N.W., Suite 210, Washington, DC 20036, Phone: (202) 463-6622, Fax: (202) 463-6625.

Nationwide Personal Transportation Survey, published by the Federal Highway Administration (FHWA), Office of Highway Information Management, Phone: (202) 366-0160, Fax: (202) 366-7742.

New Jersey Bicycle and Pedestrian Plan (1996), published by the New Jersey Department of Transportation, 1035 Parkway Avenue, Trenton, NJ 08625, Phone: (609) 530-8062, Fax: (609) 530-8044.

Older Adult Pedestrian Safety. Available from local AAA clubs and AAA Headquarters, Traffic Safety Department, 10000 AAA Drive, Heathrow, FL 32746-5063.

Oregon Bicycle and Pedestrian Plan (1995), published by the Oregon Department of Transportation, Bicycle and Pedestrian Program, Room 210, Transportation Building, Salem, OR 97310, Phone: (503) 986-3555, Fax: (503) 986-3896, E-mail: michael.p.ronkin@state.or.us.

Pathways for People (1992 and 1995), published by Rodale Press, 33 East Minor Street, Emmaus, PA 18098.

Pedestrian and Bicycle Crash Types of the Early 1990s (1996). Published by Federal Highway Administration (FHWA). Available from National Technical Information Service, Springfield, VA 22161, Phone: (703) 487-4600.

Pedestrian Accident Reduction Guide. Published by National Highway Traffic Safety Administration (NHTSA), Office of Alcohol and State Programs, 400 7th Street, S.W., Washington, DC 20590, Phone: (202) 366-1739.

Pedestrian Compatible Roadways—Planning and Design Guidelines, Bicycle/Pedestrian Transportation Master Plan (1993), c/o Bicycle and Pedestrian Advocate, New Jersey Department of Transportation, 1035 Parkway Avenue, Trenton, NJ 08625, Phone: (609) 530-4578, Fax: (609) 530-8044.

Pedestrian Planning Procedures Manual (1979), published by the Federal Highway Administration (FHWA).

Pedestrian Safety Program Resource Kit. Available from the National Highway Traffic Safety Administration (NHTSA), 400 7th Street, S.W., Washington, D.C. 20590, Phone: (202) 366-1739.

Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas, Report No. 294A, published by the Transportation Research Board, Box 289, Washington, DC 20055, Phone: (202) 334-3214, Fax: (202) 334-2519.

Planning Community Pedestrian Safety Programs: An Agenda for Action (1990). Available from the National Highway Traffic Safety Administration (NHTSA), 400 7th Street, S.W., Washington, D.C. 20590, Phone: (202) 366-1739.

Planning Design and Maintenance of Pedestrian Facilities (1989), published by the Federal Highway Administration (FHWA). Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, Phone: (703) 487-4600.

Safe Street Crossing for Kids—A Program that Works and *Planning Guide*. Available from National Highway Traffic Safety Administration (NHTSA), Office of Alcohol and State Programs, 400 7th Street, S.W., Washington, D.C. 20590, Phone: (202) 366-1739.

Traditional Neighborhood Development—Will the Traffic Work?, authored by Walter Kulash. Paper presented at ASCE Conference on Successful Land Development, 1990.

Traffic Calming (1995), published by the American Planning Association, 122 South Michigan Avenue, Chicago, IL 60603

Traffic Control Manual for In-Street Work (1994), published by the Seattle Engineering Department, City of Seattle, 600 4th Avenue, Seattle, WA 98104-6967, Phone: (206) 684-5108, Fax: (206) 470-6967.

Traffic Control Devices Handbook, published by the Federal Highway Administration (FHWA), Superintendent of Documents. P.O. Box 371954, Pittsburgh, PA 15250-7954, Phone: (202) 512-1800.

Walk Alert Program Guide. Available from National Safety Council, 444 North Michigan Avenue, Chicago, IL 60611, Phone: (312) 527-4800.

Walk Tall (1995), published by Rodale Press. Available from the Bicycle Federation of America, 1506 21st Street, N.W., Washington, DC 20036, Phone: (202) 463-6622, Fax: (202) 463-6625, E-mail: bikefed@aol.com.

SAMPLE COSTS

Cost estimates vary from locale to locale and, of course, over time. They also vary depending on whether construction is undertaken by public agencies or by private contractors. The best advice for obtaining estimates of current costs is to solicit cost estimates from a local public works department or construction firm.

For a quick idea of relative cost ranges, here are some cost figures for typical pedestrian improvements obtained from agencies and consultants.

These estimates are provided from a 1994 New York State DOT memorandum regarding cost estimates for constructing pedestrian and bicycle facilities:

- Sidewalk construction: $3.75 per s.f. not including MPT (maintenance and protection of traffic), surveys, mobilization, etc. Thus, a 5-ft-wide sidewalk would cost $99,000/mile. The addition of a curb would cost $74,624/curb lane mile. (NYSDOT, Region 8, 1994.)
- Four-way pedestrian signal: $15,000/unit based on providing a pedestrian crossing capability at a vehicle signalized intersection at all four approaches using buttons and pedestrian indications. (NYSDOT, Region 8, 1994.)
- Two-way pedestrian signal: $7,500/unit based on providing a pedestrian crossing capability at a vehicle signalized intersection using buttons and pedestrian indications. (NYSDOT, Region 8, 1994.)
- Striping: $1.80/lin ft for a 4-inch stripe. This translates into a cost of $9,504/mile. (NYSDOT, Region 8, 1994.)

The following estimates were taken from a number of Transportation Enhancement Activity grant applications submitted to the Vermont Agency of Transportation (VAOT) in 1996:

Item:	**Unit**	**Unit price**	**Metric equiv.**
Site work:			
• Stump removal	each	$300	
• Common excavation	m^3	$6.50	
• Excavation of surfaces and pavements	m^3	$20	
• Sub-base of dense graded crushed stone	m^3	$25	
• Hay bales for erosion control	each	$6	
Asphalt:			
• Asphalt paving	yd^2	$10	$12 m^2$
• Retop existing 4-ft-wide walk with asphalt	lin ft	$2	$6.50 m
	ft^2	$0.50	$5.40 m^2$
	yd^2	$4.50	$5.40 m^2$

• Install new 4-ft-wide asphalt walk, no curb	lin ft	$6	$19.70 m
	ft^2	$1.50	$16.15 m^2
	yd^2	$13.50	$16.15 m^2
Concrete:			
• Install new 6-ft-wide concrete walk	ft	$20	$64.60 m
	ft^2	$3.33	$38.85 m^2
	yd^2	$30	$35.85 m^2
• Replace and raise 4-ft-wide concrete sidewalk, add curb	ft	$25	$82 m
	ft^2	$6.25	$67.25 m^2
• Cast-in-place concrete curb	m	$45	
• Bituminous concrete pavement (driveways)	m ton	$94.00	
• Portland cement concrete sidewalks, 5"	m^2	$30	
Signs and stripes:			
• 12" white line	m	$1	
• Crosswalk marking with diagonal line	m	$1.15	
• Removing signs	each	$8.25	
• Erecting salvaged signs	each	$12.50	
• Setting salvaged posts	each	$30	
• Signage	each	$350	
Landscaping:			
• Topsoil	m^3	$20	
• Topsoil seeding	yd^2	$2.50	$3 m^2
• Geo-textile fabric for silt fence	m^2	$3.60	
• Street trees 3"-3.5" cal.	each	$475	
• Deciduous trees	each	$150	
• Wooden rail fence	ft	$25	$82 m
Street furniture:			
• Benches	each	$750	
Illumination:			
• Lighting	each	$3,000	

Source: Various Vermont Agency of Transportation (VAOT) Transportation Enhancement Activity grant applications (1996)