Streets and Sidewalks, People and Cars

THE CITIZENS' GUIDE TO TRAFFIC CALMING

by Dan Burden

Local Government Commission
Center for Livable Communities

Acknowledgements

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Produced by
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The Local Government Commission is a nonprofit, non-partisan membership organization established in 1979 that helps local governments and community leaders establish and maintain the key elements of livable, resource-efficient communities:

— a safe and healthy human and natural environment,

— a sustainable economy, and

— an actively engaged and equitable society.

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A summary chart of "How The Tools Measure Up" is included on the back cover (with a description provided on the inside of the back cover).

Please Note — The contents of this guide represent the knowledge, experience, and expertise of the authors in providing ideas and concepts to improve safety, accessibility, mobility, and livability through traffic calming. It does not constitute a standard specification or regulation. This guide is not a substitute for sound engineering judgement. The decision to use a particular device or treatment at a particular location should be made on the basis of an engineering study of the location.

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A resource bibliography is available at www.lgc.org/center.

The Guide Is...

Introduction

The Citizens' Guide to Traffic Calming **is a workbook that can help you better understand the dynamics of vehicle and pedestrian movement, identify traffic calming opportunities, and recommend improvements to streets throughout your community. Streets play an important role in the livability, vitality, and character of our neighborhoods, towns and cities. They link neighborhoods and contribute to the quality of life in every community. Every street is part of a network of roadways that connects people and goods. From the street in front of your home or business to the regional highway, the design of our streets will shape the growth and development of our neighborhoods, and the way we live.**

As communities grow, it is important that residents and government leaders take steps to preserve their assets for future generations to enjoy. How we do this demonstrates our core values of protecting our environment, strengthening our sense of community, building a healthy economy, and including everyone in the process.

Walking is such a basic human activity that it has frequently been overlooked in the quest to build sophisticated transportation systems. Now people are looking to change that. They want to live in places that are welcoming, safe and enjoyable; they want livable communities in which they can walk, bicycle, chat and visit with their neighbors.

This guide contains information about calming traffic and maintaining livable communities. It is a tool to help make our neighborhoods the best and most desirable places to live.

Kids are comfortable in this short median island which helps reduce speeds in Petaluma, California.

What's Inside

Each of the guide's four chapters has been organized to help you understand traffic calming and apply it to your neighborhood streets. You will find a wide array of information to help you plan street improvements.

Chapter 1. Street Wise describes how streets are part of a region-wide transportation system, discusses the relationship between transportation and land use, and defines the parts of a street. Chapter 1 ends with a description of the relationship between street design and speeding.

Chapter 2. The Traffic Calming Process explains the background on traffic calming and demonstrates the link between well designed streets and high quality neighborhoods. The process of developing a traffic calming program in your neighborhood is explained in detail including how to evaluate streets, define the problems you are experiencing (e.g. , lack of places to walk, high traffic speeds), select tools or treatments to help solve the problems, get the treatments built, and evaluate your success.

Chapter 3. The Toolbox describes 20 traffic calming tools that can help address the problems you and your city have defined. Each tool is described and illustrated with sketches and photographs. Also included in this chapter are other design elements that can improve the overall safety, walkability and vitality of streets in your neighborhood.

Chapter 4. Resources includes the inventory forms and tools you need to survey and evaluate your streets.

Chapter 1. Street Wise

From the narrowest alley to the largest interstate highway, streets help us get around our towns and cities. From trucks, to cars, to bicycles, to feet, a community's street system accommodates many modes of transportation. Each street within the system has many functions and is designed to carry out these functions as effectively as possible.

Bulbouts at an intersection in Venice, Florida, shorten the crossing distance for pedestrians and make drivers travel more slowly around corners.

Every Street is Part of a Transportation System

Streets in business districts are designed to accommodate pedestrians, cars, transit, and bicycles, serving a mix of activities. Streets in residential areas are designed to carry people to and from their homes. Interstate highways and many principal arterials are designed to carry large volumes of people and freight over long distances at higher speeds.

Designing streets is complex because each transportation mode may place different demands on the street system. Sometimes these demands conflict. For example, bulbouts or curb extensions shorten the crossing distance for pedestrians at an intersection. They also reduce the speed at which vehicles can turn at an intersection. For these reasons, bulbouts make intersections safer for pedestrians. However, on major streets, we need to be careful not to eliminate the space needed for bike lanes.

Street Classifications

Street classifications define the function of each street and the standard to which it should be designed and used. Many factors determine a street's classification, including: travel demand, street right-of-way width, maintenance costs, needs for access to adjacent property, safety, preservation of neighborhood character, distance between major streets known as arterials, adjacent land uses, and connections to the regional transportation system and to major destinations.

Street classifications can limit the types of design or operational changes that can be made to a street. Many of the treatments presented in this guide are appropriate for use only on certain streets.

"Arterial streets" and "residential streets" are designated, in part, by the use of nearby properties. The arterial street system is designed to carry the majority of traffic – generally 1,500 to over 40,000 vehicles per day through and around a community. Residential streets provide access to and from individual homes and generally carry fewer than 1,500 vehicles a day, usually with no trucks or transit vehicles.

Typical Street Classifications

CLASSIFICATION	LOCAL ACCESS	NUMBER OF LANES	AVERAGE DAILY TRAFFIC	TYPICAL SPEED LIMIT	SIGNAL OR BLOCK LENGTH
Regional Freeway	restricted	4-12	30,000+	55 mph	no standard
Principal Arterial	limited	2-6	5,000-40,000	30-45 mph	1 mile
Minor Arterial	somewhat limited	2-4	3,000-15,000	30 mph	1/2 mile intervals
Collector	unlimited	2	1,000-5,000	30 mph	1/4 mile intervals
Commercial Street	unlimited	2-4	low	25 mph	1 block intervals
Residential Street	unlimited	2	under 1,500	25 mph *(20 mph in school zones)*	500 feet intervals

The Anatomy of a Street

Streets are used for many activities such as walking, bicycling, parking and driving. Most are designed to balance the demands of different uses and create an atmosphere that is safe, accessible, economically viable and lively.

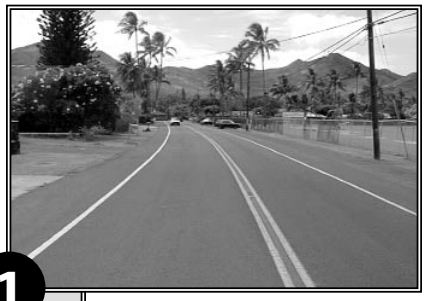
Like people, each street has an anatomy, and each part has one or more functions. For example, curbs define the edge of the roadway, improve safety by separating pedestrians from vehicles, and channel excess water to storm drains. Street lights increase our ability to see and be seen after dark. Signs orient us to locations, warn us about upcoming obstacles or changing conditions and regulate vehicle movements. Utilities and sewers, though often underground, are important to the smooth functioning of streets.

The street often includes vehicle travel lanes, paved shoulders, parking, bicycle lanes, walking areas, street furniture, bus stops, utility poles, planting areas for landscaping and trees, and signs. The street right-of-way is the publicly owned area adjacent to private property.

The intersection of two streets is one area where pedestrians, bicyclists and drivers meet and must navigate shared space. Crosswalks and curb ramps are used at intersections to define the pedestrian crossing area. Roundabouts control traffic at intersections while maintaining a smooth and steady traffic flow. Sensors known as signal detector loops can be set to change the signal when they detect a car or bicycle waiting for the light.

Sidewalks, walkways, and paved and unpaved shoulders within the street right-of-way are the pedestrian domain. Effective sidewalk width is the area of the walkway clear of obstructions. A sidewalk that is 10' wide may have an effective width that is significantly narrower due to the placement of bus stop shelters, utility poles, newspaper racks, signs and trees. It is important to retain as much effective sidewalk width as possible so that wheelchair users and others have room to navigate. All street furniture or landscaping should be arranged so that pedestrians have adequate space to travel. Neighborhood sidewalks need to be a minimum of five feet wide to accommodate two people walking abreast. When sidewalks are next to the street they must be at least six feet wide.

Kalakaua Avenue in Waikiki, Hawaii, accommodates a mixture of activities. Note the old drain line showing how much this sidewalk has been widened.



1

◗ Setbacks, Street Walls and Speeds

When buildings are set back far from the street edge as shown in ❶, the roadway appears to be very wide. This may result in excessive vehicle speeds. Buildings and trees that are adjacent to the sidewalk, like those shown in ❷, create a "street wall" that frames the street and narrows the driver's field of vision. Taller buildings placed close together create a solid street wall and give the street a sense of enclosure. People tend to feel more comfortable walking and driving on streets with a sense of enclosure.

2

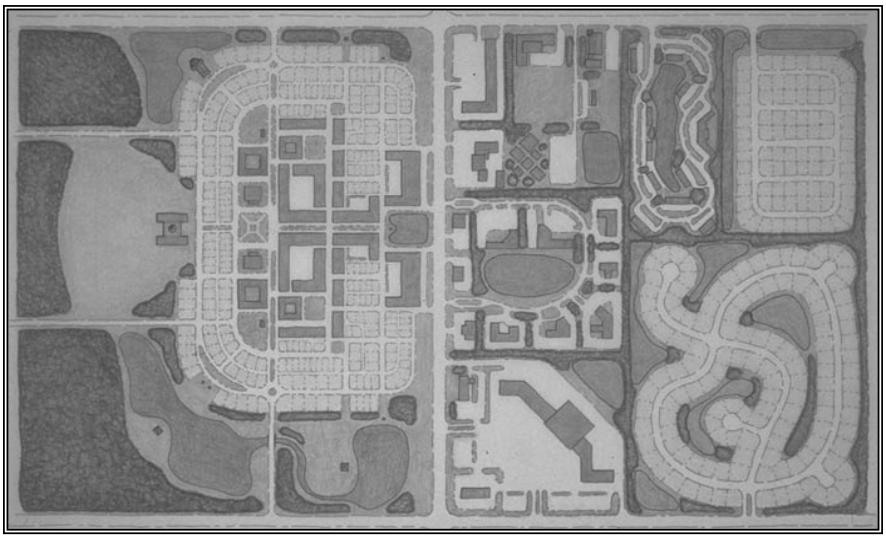
3

Street Wise

This Olympia, Washington, street is pedestrian friendly. Street trees, wide sidewalks, awnings and landscaping are some of the elements that make this street inviting to pedestrians.

Transportation and Land Use

Transportation and land use are closely linked. Higher density land uses make it more efficient, easier and cheaper to provide transit service, and encourage people to walk and ride a bike. Mixing land uses provides opportunities for living, shopping, and working in the same area, reducing the need for vehicular travel. In lower density areas, the automobile is the most practical and often only means of transportation.



Traditional Neighborhood (TND) vs. Conventional development.

The right side of the diagram shows conventional development. Homes are isolated from everything else, generating an average of 10-14 daily car trips per household. The neighborhood area to the left has the same number of homes and lots. Everything is connected. Fire responders have multiple access points due to the grid layout. Transit is more workable in this compact, mixed-use layout.

(drawing: Ramon Trias)

The street environment is shaped by the location and design of adjacent buildings. These are controlled by land use ordinances, including zoning codes and design guidelines for the neighborhood. Buildings with blank faces on the street are unpleasant to walk by, while those that are built to the sidewalk and have windows and entrances are inviting to pedestrians. Buildings that have signs readable at driving speeds, or buildings that are separated from the sidewalk by driveways or parking lots are designed for drive-by traffic and create an automobile-oriented environment.

Some land uses lend themselves to certain kinds of street activity and transportation choices. For example, a coffee shop with outdoor seating is a magnet for pedestrians. Customers will come by foot, bus and bicycle to enjoy the ambience of the street while they drink their coffee. On the other hand, a car wash or gas station creates an entirely different type of environment: one that is convenient for automobile access, but difficult for pedestrians.

Some types of land uses can be designed to give priority to one type of user over all others. For example, a bank can be designed with a front door and a walk up cash machine that faces directly onto the sidewalk. The same bank can be designed to favor the automobile by locating its front door facing a parking lot. In these examples, the activities are closely tied to the patterns of transportation choice and affect the character of the streets on which they are located. These various types of land uses have important effects on the street. Consider the impacts of a drive-through restaurant on a neighborhood commercial street. In addition to the noise and smells, there may be cars crossing the sidewalk creating safety concerns for pedestrians, or the cars might line up on the street and block the flow of traffic or reduce access to on-street parking.

Streets Influence A Driver's Behavior

The speed at which most cars travel down a roadway is dictated by several dozen environmental and human factors. When 60-85% of the motorists are driving faster than the posted speed, there are serious problems with the design of that street space. Speed limit signs and the threat of enforcement do little to set the speed of most vehicles.

Physical design influences a driver's behavior more than any other factor. Often we post a local street for the maximum speed the law permits (25 mph in most areas). Roadway designers will try to provide for an additional margin of safety on the road by designing the street to accommodate cars traveling an additional 10 mph over the posted speed limit, or 35 mph. Auto designers have made sure that cars can comfortably be driven at higher end speeds. Thus, many drivers travel as fast as 40-45 mph on streets where we live, walk and bicycle that are posted for 25 mph.

Ideally, streets and neighborhoods should be designed so that after-the-fact retrofits to calm the traffic are not necessary. One key element to designing streets that keeps cars from speeding is to keep streets physically or visually narrow. Well-designed streets should also be part of a network that disperses traffic evenly and accommodates bikes and pedestrians, and where the number and width of travel lanes is not excessive for the traffic volume.

Older, traditional narrow streets built in a grid pattern better distribute and naturally calm traffic. As shown in the diagram on the previous page, the traditional design of short blocks set in a grid provides a human-scale environment where there are often stores and offices not far from homes, and multiple routes of travel for vehicles. The conventional design on the right, in contrast, separates stores, homes and schools, requiring us to use a motor vehicle to reach most destinations. In addition, long, spaghetti-like street patterns with few connections require wider travel ways to accommodate higher traffic volumes.

The Design Matrix for Healthy Streets (next page) is taken from *Street Design Guidelines for Healthy Neighborhoods* and details ideal speeds, road widths, and other specifications for livable neo-traditional streets. *Street Design Guidelines* also provides other practical information about residential street design.

Faster Speeds, Smaller Fields of Vision

Maintaining slower speeds allow drivers to be more aware of their surroundings.

These pictures show how a driver's field of vision is reduced as travel speed increases.

At 15 miles per hour (mph), the driver can see that he or she must share the road with pedestrians and bicyclists. At 25 mph, a driver's field of vision is greatly reduced. At 30 mph, all the driver sees clearly is the roadway in the distance.

Design Matrix for Healthy Streets

This matrix, taken from *Street Design Guidelines for Healthy Neighborhoods*, describes the characteristics of streets designed to keep traffic speed and volume at a level that is comfortable for residents, pedestrians, and bicyclists. These guidelines are designed for streets in neo-traditional neighborhoods (see page 4). They are not recommended for conventional neighbor-hood development. Most streets built in the last 50-60 years in conventional subdivisions are wider and lack many of the features that help calm traffic.

Street Type	Max. Width	Max. Design Speed	Maximum Corner Radius	Max. Ctrline Radius	Curb	Median	Maximum St. Length	Vehicle Volume	Walk Way	Bike Lanes	Trees	2-Way Traffic	Parking
Trail	8-14′	20 mph	n/a	95′	no	n/a	n/a	n/a	n/a	n/a	yes	yes	no
Alley	10-12′	10 mph	15′	50′	no	n/a	400′	200	no	no	no	yes	no
Lane	16-18′	20 mph	15′	90′	option	no	600′	200	both	no	yes	option	1 side
Street	26′	20 mph	15′	90′-120′	option	no	1,320′	600	both	no	yes	yes	2 sides
Avenue	varies	30 mph	15-25′	250′	yes	option	n/a	3-20K	both	yes	yes	yes	option
Main Street	varies	15-25 mph	15-25′	600′	yes	option	2,600′	3-10K	both	option	yes	yes	option
Boulevard	varies	30-35 mph	25′	500′	yes	yes	n/a	20-40K	both	yes	yes	yes	option
Parkway	varies	45+ mph	25′	1,000′+	no	yes	n/a	20-60K	no	trails	yes	yes	no

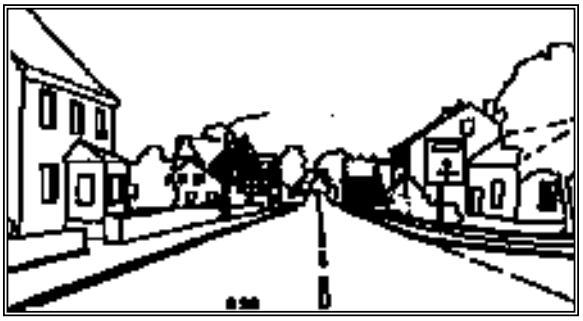
developed by Walkable Communities, Inc.

Why People Speed

There are many reasons why people speed through neighborhoods. Trees, medians, sidewalks, on-street parking and other neighborhood design elements influence the behavior of most motorists.

The following sets of photos show how different design elements shape streets and influence driver behavior in comparable situations. The left-hand photos represent an underlying principle responsible for the behavior; the right-hand photos show traffic calming treatments that can be used to modify driver behavior. The results of these treatments will vary slightly from situation to situation.

Before



After

These before and after drawings of a major road in Borgentreich, a small village in Germany, demonstrate how a roadway can be visually narrowed to encourage slower speeds.

Before

After

Grandview Avenue in University Place, Washington. Grandview was experiencing speeds in the low 40s before traffic calming treatments were implemented. With the addition of curbs, sidewalks, bike lanes, trees, medians, and a roundabout, speeds were reduced to the low 30s.

Before

After

In a relatively inexpensive retrofit, this Greenville, North Carolina, roadway (left) was visually narrowed by adding pavement markings seven feet in from each side. The center line was purposefully left out to create driver uncertainty. The resulting 20-foot wide lane slowed motorists by 7 mph.

Trees, pavement markings and sidewalks visually tighten the road. Excessive lanes should be dropped to help reduce speeds. Lanes that are too wide should be narrowed.

Problem

Solution

1◗ **People speed when roads are stark.** On the left, modern subdivision codes often call for designs like this which result in speeds of 30-40 mph. There is a natural desire to make use of the overly abundant space. These speeds can be reduced by changing municipal codes to support 24-28 foot wide streets (curb face to curb face).

Traffic calming elements such as parking on both sides of the street, planter strips between the street and sidewalk (so the sidewalk is buffered from the street by at least 6 feet), tree canopies, and houses brought closer to the street create an intimate, friendly feeling. Most motorists travel the tree-lined street (at the right) at 20 mph.

Problem

Solution

2◗ People speed when roads are long and seem to never end. The design of the street on the left results in speeds of 30-40 mph.

The Suisun City, California, street (on the right) terminates the vista of a long road with a round-about. Curb extensions are used on the corners to narrow the physical width. Parking is inset. This design also supports fire and rescue efforts by leaving well-identified spaces where no one parks. A minimum 20-foot street opening is maintained through this design.

Problem

Solution

3◗ People speed when roads are stripped of trees. Trees offer height to the street, which allows motorists a way to gauge speed. They create a sense of enclosure and provide a feeling of safety and comfort.

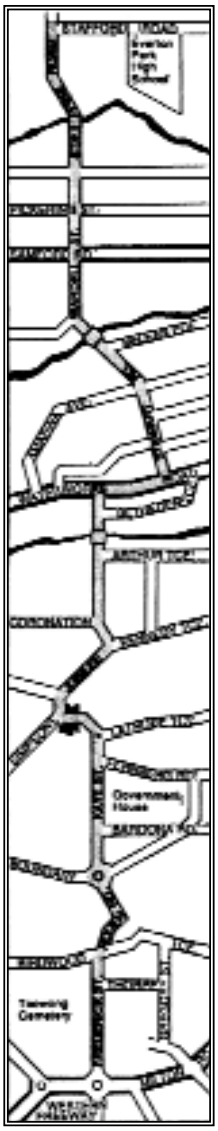
These two photos show different locations on the same street. Cars travel in the low 20s on the eight-block-long section with trees.

Street Wise

Rat Running: Neighborhood Cut-Through Traffic

"...to my father, one of the great rat runners of all time, who in 30 years of commuting worked out a route through London that avoided every stop light."

—tribute by Donald Appleyard, *Livable Streets*



Rat-running route chosen by motorists through a neighborhood in Brisbane, Australia. (from CART, Traffic Calming)

All people – pedestrians, bicyclists and motorists – have a natural desire to stay in motion. Congestion on arterial streets creates delays that frustrate roadway users, sending them looking for other options. Because motorists have the means to travel quickly over longer distances, they can avoid traffic lights or congestion by cutting through neighborhoods. Some motorists, particularly older drivers, may be drawn to residential streets to avoid troublesome intersections and fast-moving traffic.

"Rat Running" is the second greatest traffic management problem described by neighbors. Motorists cutting through the neighborhood are usually in a hurry, and drive at speeds unacceptable to residents.

The Preferred Route

Moving the traffic back to the arterial system requires making the arterial street a more desirable option than the residential street.

On neighborhood streets, solutions include eliminating route continuity and slowing motorists with traffic calming features such as bicycle boulevards, partial closures, intersection chokers, intersection medians, and one-way out streets.

On principal roads, solutions include improving intersections and reducing delays through the use of roundabouts, turn pockets, or improved signal timing. Engineers have a choice of which mode of travel and which behaviors they wish to reward.

This Danish commercial district provides one-way motorized traffic support, and gives higher two-way priority to pedestrians and bicyclists. Neighborhoods have a choice in determining how many motor vehicles they wish to support through their area. By making one-direction travel inconvenient, significant reductions can be seen in the number of motor trips. Traffic management here has resulted in a doubling and tripling of walking and bicycling. Retail trade and safety in the area increased significantly.

Chapter 2.
The Traffic Calming Process

What Is Traffic Calming?

Traffic calming slows vehicles on streets where drivers travel at higher speeds than is desirable. It is a way to reduce the negative effects of automobile use, alter driver behavior and improve conditions for the property owner, retailer, walker and bicyclist. To accomplish this, a combination of physical treatments are used such as bulbouts, medians, and roundabouts. These treatments affect the driver's perception of the street, and cause a change in his or her behavior.

Often traffic calming measures are taken to correct conditions on an existing street where the original design was inappropriate for, or no longer matches, the existing use. In some cases changes in land use and transportation patterns have changed traffic speeds and volumes.

adapted from the Institute of Transportation Engineers,
Guidebook for Residential Subdivision Street Design, 1993

Traffic Calming and Livable Communities

Traffic calming helps create livable communities where it is easy to travel by bicycle, car, transit or on foot, and to transfer from one mode of transportation to another. In a livable community you have many opportunities to interact with your neighbors because the streets are pleasant places to walk and socialize and there are a variety of nearby daily destinations.

There is often more than one element featured in a traffic calming measure. In Huntington, NY, this median and speed table help pedestrians cross safely.

Measures of Livable Communities

As part of the neighborhood workshops conducted by the author in cities across the nation, people were asked to describe what was important about their community now and what needed improvement over the next 20 years. The responses generally fell into three categories – safety, access and mobility, and quality of life. These are three indicators used in this guide to determine if traffic calming is appropriate in neighborhoods, what traffic calming treatments are best suited to a particular area, and methods of evaluating the effectiveness of the treatments installed.

Traffic calming addresses the three indicators:

Safety. Traffic travels slowly on traffic-calmed streets, resulting in fewer and less severe accidents. The number of fatalities due to motor vehicle crashes are also reduced on streets with slower-moving traffic. Traffic-calmed streets also encourage more people to walk and ride bicycles. More eyes on the street help reduce crime and discourage antisocial behavior, making it safer for everyone.

Access and Mobility. Safer streets balance mobility and access for all users, particularly pedestrians and bicyclists. This is especially important for children, seniors, and persons with disabilities.

Quality of Life. Traffic calming improves "livability" by reducing the number of automobile trips taken – thereby decreasing levels of pollution, congestion, and traffic-related noise. Traffic calming devices can provide additional space within the street right-of-way for landscaping, sidewalk amenities such as street furniture and outdoor eating areas, and transit shelters. These amenities create pleasing streets, attract pedestrians, encourage people to walk more frequently for short trips, and increase the likelihood of interactions among residents.

Overview

Traffic calming interventions are neighborhood-based solutions to local problems identified by residents. But because streets, sidewalks, intersections and crosswalks are part of a public transportation network, changes to them must meet the safety and design standards of the local jurisdiction. For traffic calming measures to be installed in a neighborhood, plans for them must be reviewed and approved by city staff and often by elected leaders. The traffic calming project must compete with many other roadway needs for limited funding. Sometimes the work can be incorporated into future maintenance or construction schedules that city or county staff will be aware of.

The approval process for a traffic calming project often involves a survey of residents and an analysis of the project's impact on nearby areas. The impetus for traffic calming can begin at the grassroots level with neighborhood residents, or at the staff level when officials identify problems on their own. Citizens pushing for

traffic calming solutions can seek assistance from city or county staff, and from elected officials, who might have a particular interest in the neighborhood or in creating more livable environments. The entire process can take between 12 months and three years on average.

Will Traffic Calming Work in My Neighborhood?

Traffic calming and other transportation strategies can work in any neighborhood. Communities that are organized, active and motivated are most likely to design and carry out effective traffic calming programs. Communities with a capacity to develop a plan for their future and work together to carry it out are likely to find and solve traffic problems. Strong communities where people look out for each other and place a high value on the quality of their neighborhoods have what it takes to set up and carry out a traffic calming program.

Traffic calming is a process as much as a product. Because traffic calming is a relatively new idea in many communities, most people do not understand its benefits. Many people will resist any change, often because they don't fully understand how traffic calming can improve the situation. Because people who live in a neighborhood can often generate widespread support among neighbors, they are in a prime position to call for changes to their streets.

For traffic calming to be accepted, a majority of local residents must be in favor of the program. Typically, cities seek 60 to 70% approval from the community – depending on the type of traffic calming treatment proposed – before building the street improvement.

The process works best if many people are involved: neighbors, students and staff from the local schools, local business owners and employees, city and county staff, representatives from the emergency response system (including fire and police departments), and anyone else who uses the streets in the neighborhood on a regular basis.

The Process

The process of gaining support for and implementing a traffic calming intervention often follows a course similar to this:

❶ A neighborhood sector is defined by staff and residents. It is essential to limit a traffic calming project to an area that shares roads and boundaries. This is often defined as a space – often one square mile or less – between geographic and major road boundaries.

❷ The problem is identified, often by neighbors, sometimes by local officials monitoring traffic flow and accident data.

❸ The problem is analyzed to verify and define it, using tools such as walking audits, traffic counts, speed checks, and crash statistics. Residents can participate in and facilitate this investigation. City planning and public works staff can often assist by providing data, participating in or conducting the surveys, and even leading the process.

❹ In an intensive, fast-paced, highly interactive and engaging workshop (called a "charrette"), community members envision how they want their community to look and feel. Appropriate traffic calming solutions can be identified. Other issues may come up in this exercise, such as a need for better lighting, a tree canopy, or streetscape changes if it involves a business district. If the charrette is held early on, it can be used to bring people together to identify and prioritize problems, and rally volunteers to gather data. Later in the process, a charrette can help citizens collaborate on solutions.

❺ Local government officials who have been involved in the process move to implement proposed solutions by integrating them into a city planning and funding process.

❻ Neighborhood leaders must gain needed consensus and support of a majority of

Traffic calming is an investment in the community. Streets should balance the community needs of motorists, pedestrians, bicyclists, mopeds, strollers, wheel chair users, and public transportation users.

Neighbors gathered in a charrette to select and vote for their traffic-calming priorities in the Waimanalo neighborhood in Honolulu.

Identifying the Problem

Collecting data on the streets in your neighborhood helps define problems. There are many ways to identify the problem areas in your neighborhood. You could begin by identifying high crash locations. Police departments might maintain computerized geographic information systems (GIS) that can identify such locations.

Crash data can tell you when an accident happened (time of day and time of year), information about the driver behavior that may have contributed to the crash – such as speed, alcohol impairment, inattention or misjudgment – and whether the crash resulted in injuries or fatalities. Crash data may identify a pattern among a number of crashes that may lead to a solution. For example, if most of the crashes at a specific location are occurring at night, additional lighting may help make the area safer.

Traffic collisions are shaped by many different factors. Perhaps one of the most important is traffic volume – the number of cars. Generally, the more motor vehicles, the greater the likelihood of collisions. Increased speeds may also produce more collisions particularly if the speed increase results in shorter following distances or gaps between moving vehicles.

Higher speeds, in turn, are associated with a higher risk of injuries resulting from crashes, whether it's two vehicles colliding or a vehicle and a pedestrian or bicyclist.

For these reasons, it is important to look for places in your community where volume, speeds, and crashes have increased. Crash data may be available from local or state police, transportation departments, or from local health departments. If data is not available from these sources, you may have to seek out other sources or collect and analyze it yourself. Collecting your own data will help you learn more about the streets in your neighborhood. (See section on conducting neighborhood traffic audits in the Resources chapter).

Another source of data on traffic conditions comes from residents themselves. Often, concerned citizens call local elected officials or government offices with concerns and complaints about speeding, dangerous roadway conditions, and other traffic safety issues. You can conduct your own survey by asking people to identify what they think are the major problems and potential solutions.

The charrette process provides another opportunity for citizens to help identify and pinpoint problems.

Getting Started

The best way to proceed is to collect preliminary data on the streets in your neighborhood. Where are crashes occurring? How fast are the cars typically traveling? How many cars use a street in one day? How wide are the streets? What are the designated land uses and zoning that govern new development? All of this information should be available for your review through your city or county planning and transportation departments.

The data you review is just one important piece of the entire traffic calming process. Data is not a substitute for a charrette, or an engineering field inspection, which a local government will perform if it is likely the project will be approved and funded. Data helps residents and staff separate perceived problems from real ones. This is important. Attacking perceived problems can worsen traffic effects and waste limited funds on low or unproductive solutions.

How Do I Know What Data to Collect?

Data collection includes three basic components. First, you need a sampling plan. Decide which streets and areas you will examine. If your neighborhood is small, you can examine all streets. If it is large, you may examine a smaller sample of streets, choosing them at random to ensure that they represent the project area.

Second, you need a survey form or other data collection instrument. By creating a paper form to fill out, you can make sure that you have captured all the necessary information in a useful format. The Neighborhood Traffic Audit Form and the Street Inventory Form (see the Resources chapter) will help you collect the data you need or will serve as examples for other survey forms you may want to create.

Third, you need to train and coordinate the individuals who will collect, manage, and analyze the data. It helps to involve professionals in your community who have experience with these tasks. Contact transportation department staff for assistance in collecting and analyzing data.

Where Do I Find the Data I Need?

Many of the elements contributing to neighborhood safety, access, and mobility are measured and recorded by governments, universities or other data collection bureaus. A municipal public works or transportation department, for instance, has data on traffic volumes, speeds, and levels of service (LOS) for most major streets and roads in its jurisdiction. There are also construction standards set by federal and state transportation agencies, national associations of civil engineers and local public works officials, which specify speed limits, travel lane dimensions, and other roadway features.

The planning department almost always has maps that show the locations of parcels, roads, streets, street widths, block lengths, schools and shopping areas and other land uses. They may also have aerial photographs of many neighborhoods.

Crash data are collected by the police department. Keep in mind that not all crashes are reported to the police and not all of the data on the police reports is complete or 100% accurate. The crash reports and their summaries provide a snapshot of traffic safety in your community. Accident reports can help to identify the nature and extent of safety problems.

There are also computerized databases and geographic information systems (GIS) for mapping and analyzing crash data. Check with the planners, engineers, police and injury prevention staff in the health department who serve your community to get access to data.

The police may be able to provide data about speeding and other traffic violations. It is important to remember, however, that traffic tickets can only be written when an officer is in the area. Just because police haven't been giving citations in your neighborhood doesn't mean there aren't problems with speeding, running stop signs, and other violations. It also doesn't mean that more enforcement is the answer. Design and engineering solutions are often more efficient means to calm traffic.

Tools of the trade.

All Data Is Not Created Equal.

Some of the data you need may not be available or could be out of date. You might need to update or add to the existing data. If your neighborhood is small, then you may be able to conduct a street-by-street walking inventory of the traffic problems, using a traffic audit form like the one provided in the Resources chapter.

If your neighborhood is geographically very large, you might need to conduct a windshield survey – driving around to various parts of your community, stopping at key locations, and observing the conditions. You will need to divide your community into a number of smaller sectors and assign individuals from each of these areas to conduct the assessments.

Invite kids of all ages to the neighborhood charrette. Children have an important perspective to share.

The Past Should Not Govern the Future.

Data is a picture of how things were in the past. Observation is how things are today. Vision is how you want things to be in the future.

Many planners and engineers assume auto traffic on a given street will continually increase. A neighborhood, however, might decide that it wants to reclaim a historic center business roadway for a vital pedestrian district. In this case, future social and retail uses could demonstrate a need to calm traffic, even though accident or volume data were insufficient to support it. Because of the focus on pedestrians, the historic retail district after traffic calming might exhibit slow traffic speeds and congestion levels that would not be appropriate on streets where traffic circulation is more of a priority.

Public Participation and Data Collection Tools

Three of the primary tools that citizens can use to promote traffic calming solutions for their neighborhood include the neighborhood charrette, the neighborhood traffic audit, and the street inventory.

1◗ Neighborhood Charrette

The best way to get people involved is to hold a neighborhood charrette. A charrette is an intensive, fast-paced, highly interactive and engaging workshop. The key elements for planning a charrette in your neighborhood are described in the sidebar on the next page.

Charrettes work best when they involve residents, neighborhood business owners and representatives from schools, places of worship, and local government. Charrette activities should draw out issues and problems and help people identify practical solutions. The priorities and projects derived from a charrette form the framework of your traffic calming program.

Measuring block lengths or crossing distances may be completed as part of a street inventory.

Your city's transportation department needs to play a major role. Contact department staff or your elected representative to find out how to best work with them. Staff should work with you to organize and lead a neighborhood charrette.

2◗ Neighborhood Audit

You are ready to conduct an inventory of the conditions on your streets. Begin by distributing the Neighborhood Traffic Audit form (in the Resources chapter) to neighborhood residents, business owners, shoppers, and school children. Ask them to identify conditions in your neighborhood: how traffic behaves, conditions for pedestrians and bicyclists, noise, and parking availability.

The form asks stakeholders to describe the problem locations such as those streets that are not able to handle the demands placed on them, either by vehicles, pedestrians or bicyclists. Are there places in your neighborhood that are used frequently by children and seniors, such as school zones or the path between a retirement community and a grocery store? Conducting the audit will help you assess how well the streets in your neighborhood work.

3◗ Street Inventory

The next step is to use the Street Inventory form (in the Resources chapter) to record data about your neighborhood streets. The form asks you to describe the physical elements on your street, including parking, sidewalks, and block length. Other data to collect include traffic speeds and volumes. Data on traffic volume is easy to collect by counting the vehicles and/or pedestrians that pass a particular point of the roadway. Peak volumes usually occur at rush hours and school drop off and pickup times. Traffic volume counts are used to estimate Average Annual Daily Traffic (AADT), Average Daily Traffic (ADT), and Peak Hour Volume (PHV) measurements. Each measurement plays a role in determining whether your street is designed properly, given the levels of vehicle and pedestrian traffic.

The Nuts and Bolts of A Charrette

Location, Location, Location. Set a time, and choose a place for the charrette that is easy to reach. A good rule of thumb is to select a place that can be easily accessed by someone in a wheelchair. Make sure the room is large enough, has plenty of tables and chairs, and can be darkened to show slides.

Invite People. Work with planning and transportation department staff to advertise the charrette. Invite your neighbors. Phone calls, flyers, banners, temporary road signs, and announcements at meetings are good ways to spread the word. On the day of the charrette, post signs to direct people to the right room. Have name tags and food or refreshments. Encourage people to sign in so you can compile a mailing list to inform them of the project as it progresses.

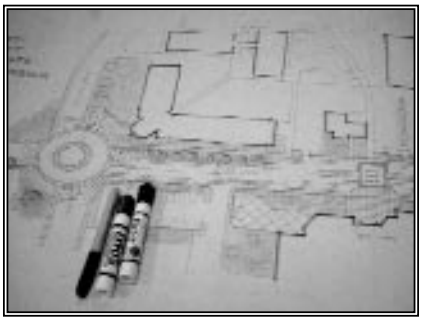
The Slide Show. Begin the program with a slide show of traffic calming treatments that explain how traffic calming can make communities more livable. Walkable Communities, Inc., has a slide show and video that can be purchased to present at your charrette.

Problem Identification. Following the slide show, ask people to describe their street-related problems. Have someone from the group record the observations on a flip chart. Post the lists on the wall. Record specific locations, too.

Voting. After everyone has had a chance to speak, give each participant up to seven colored dot stickers and ask them to place the dots on the statements that describe their highest priorities. Tell participants there's no "double-dotting!"

Work Tables. Following the voting, ask the participants to assemble in small groups of 6-8 people. Each group gets a large scale map of the study area. Each group should take 30-60 minutes to suggest solutions to the problems identified by the entire group during the voting exercise and draw them on the large scale map. A scribe takes notes and a group leader is appointed to help keep people focused. The group leader summarizes the results of the small group session.

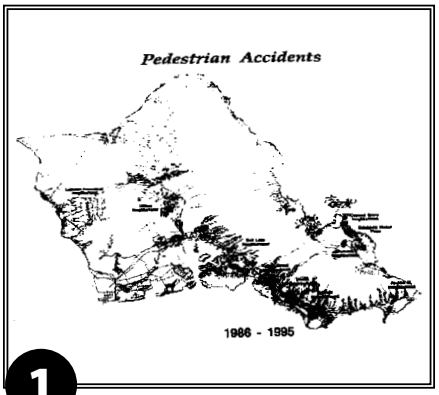
Presentations. Each table sends a presenter or presentation team to describe the team's issues and solutions. Often, as this is done, the audience begins to realize that each of the groups agree on key issues. Elements described that are not practical or agreeable to the larger group should be recorded so that, if a professional design team works on the problem, they can address the elements in the proposed solution. Many of these elements get worked out in the field inspection or in further discussions with the city and the community.



Get It Done: Implement Your Program

Here's how you begin to implement your neighborhood traffic calming program:

- **Present proposals to transportation department staff.** They are responsible for building the traffic calming tools recommended in your plan. Present your proposals clearly and concisely. Pictures and diagrams help.
- **Estimate costs.** Use the cost estimates in the tool kit to figure out how much your proposals might cost.
- **Investigate other related plans.** Find out what other departments may have plans for your street – such as the state transportation department, utilities and water departments, parks and recreation departments, and others.
- **Prioritize your recommendations.** Sometimes an opportunity, such as a major utility project, comes up to redesign a street all at once. More frequently improvements are made one at a time over a number of years. Setting priorities allows you to focus on the key improvements first. Use the priorities that were set during the neighborhood charrette as a basis.
- **Document community support.** Many of the traffic calming tools are new, costly, or controversial enough to require a show of support from citizens before public officials will commit the resources to plan and fund them. Sign-in sheets and summaries of neighborhood charrettes are good documentation of interest. Neighborhood surveys or petitions also demonstrate community support for your plan.
- **Develop recommendations.** Work with transportation department staff, preferably as you are formulating your recommendations. There is often more than one way to achieve a neigh-



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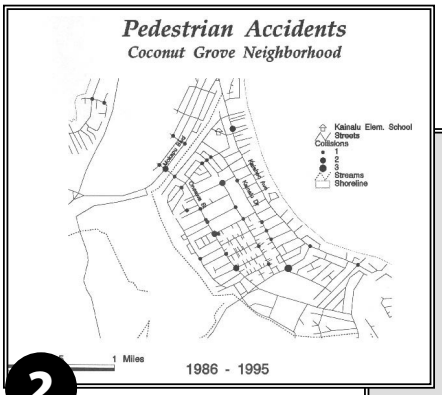

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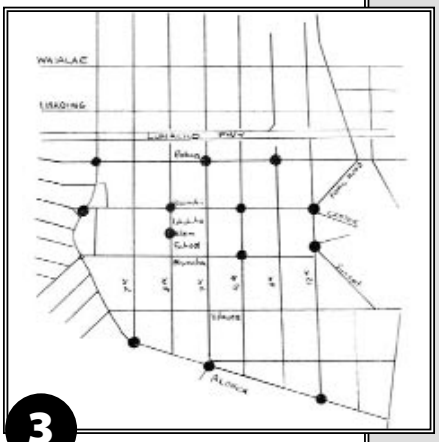


3

Maps Can Help

Maps are useful tools to display and analyze information. These three examples provide information about neighborhood streets. Map ❶ is a regional map that shows the locations of reported pedestrian crashes in Honolulu from 1986-95.

Map ❷ is created from the same data used to create the first map, but is shown at a larger scale to focus on one neighborhood.

Map ❸ is an example of a map you might draw when doing a street inventory to describe crash locations, main walking routes or other data you may need.

borhood goal. City staff can help you determine the effect of an idea on the street's safety and functioning and the likelihood of obtaining grant funding from outside sources.

➢ **Follow up on implementation.** Be patient and persistent. Carrying out a traffic calming plan can often take many years.

Did it Work?: Evaluate Your Program

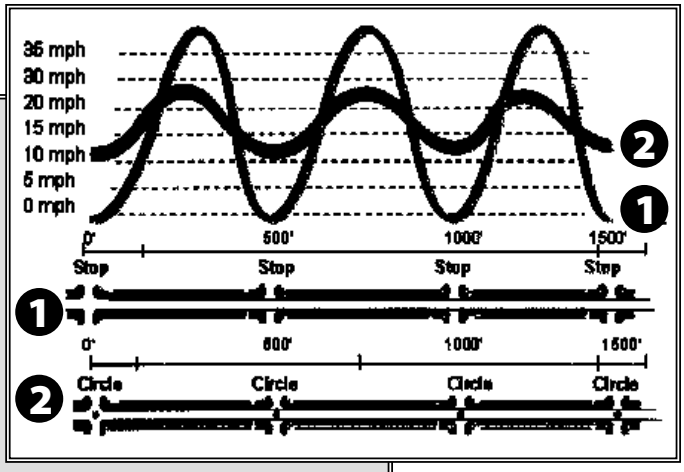
It is important to evaluate the strategies and treatments which have been implemented. Have they been effective in reducing speed, volume, and collisions? Has the environment become more conducive to walking and other non-motorized forms of travel? Did the quality of life in the community improve as a result of traffic calming? Did the treatments have all the intended effects?

The before-and-after evaluation process is the simplest way of evaluating your program. You need to collect data on the conditions and problems prior to and after implementation of strategies and treatments.

Did the traffic volume change? Did it go up or down? What about travel speeds? How about the number of pedestrian crashes or injuries? How did the physical environment change as a result of the implemented treatments and actions? Has the number of complaints about speeding or parking violations decreased? What about the mood of the community? Do residents feel safer and better about their neighborhoods? Has the pedestrian activity increased? Has the level of social interaction between people in-creased?

It is useful to prepare diagrams of traffic calming proposals to show transportation department staff, elected officials and other key decision-makers.

Make sure to share your evaluation with transportation or public works department staff. Program evaluations are useful for cities and counties to review as they look at doing traffic calming projects in other neighborhoods.



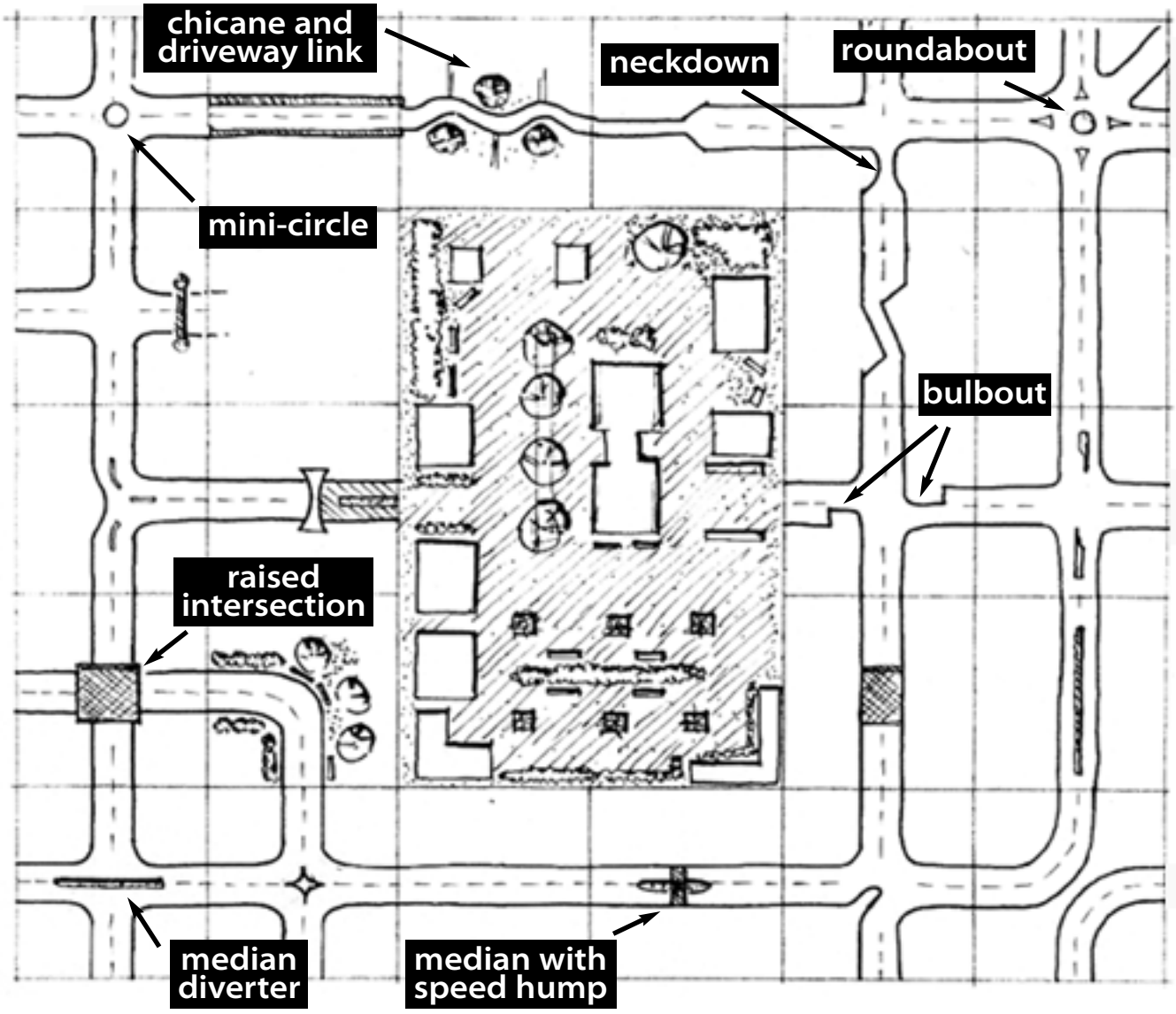
Stop Signs Mean Go, Traffic Calming Means Slow

Stop signs tell motorists to stop. However, as cars move out of the intersection, drivers tend to accelerate faster – and slow down more quickly as they approach the next stop sign (❶). Engineers call this phenomena of erratic speeds "speed spiking."

Traffic calming devices, such as mini-circles or other slow points, keep speeds within a narrower range (❷). They smooth out the speed, reduce noise and pollution, and create more civil behavior among drivers.

Chapter 3. The Toolbox

This chapter consists of a toolbox of resources that help you understand different traffic calming tools and techniques. Each toolbox page describes a tool and provides guidance on how to use it properly to improve safety, access and mobility – and the quality of life for the whole neighborhood.



HOW TO USE THE TOOLBOX

Before you select a tool, you need to know how it works. You also need to know what you're trying to fix. Remember that streets accommodate a variety of activities. Improvements are not really improvements if they shift a problem to the next block.

Test your ideas – if your proposed improvement solves a problem in your immediate area but creates a problem somewhere else, it's time to rethink your solution. Mistakes can be avoided early on by first learning all that you can about the traffic calming tools that may be appropriate for your street and consulting with city traffic engineers and others to ensure proper application of the tools.

Keep in mind that this toolbox is neither a substitute for a detailed engineering study nor does it replace sound engineering judgement. Following your conceptual work, your city engineer or consultant will prepare a formal engineering study and prepare final plans.

Four Steps

This chapter is designed to take you through the following four critical steps:

1) Identify what needs fixing;
2) Determine the type or types of locations you are dealing with;
3) Select the tools that might work in these cases; and
4) Review the tools in more detail to understand how they work.

Step 1: What Needs Fixing?

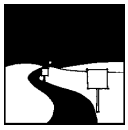
Use the space below to briefly describe the situation in your neighborhood that could benefit from traffic calming. Perhaps it is a difficult mid-block crossing. Maybe your community is considering installing a traffic signal at a busy intersection. Perhaps you need to address concerns such as high volumes of through traffic, trucks cutting through on residential streets, or poor pedestrian access to a school or shopping area.

It's a good idea to get a small notebook to compile your data and record thoughts and ideas as you develop your traffic calming program.

Step 2: Determine the Type of Locations

Spot Location 

Intersection 

Roadway 

District 

Not all traffic calming tools will work for the problems you are experiencing. The toolbox describes four types of locations – spot locations, intersections, roadways, and district-wide – and identifies the traffic calming tools that work best for each. You will find that some traffic calming tools are appropriate for more than one type of location.

Throughout this chapter, look for the symbols shown here. You will find one or more of them in the margin for each traffic calming tool. They will help you determine if that particular tool is appropriate for the problem you are trying to fix.

A **Spot Location** is a specific location on a roadway that is not an intersection. One example of a spot location is a mid-block bus stop.

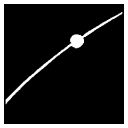
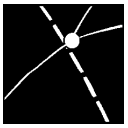
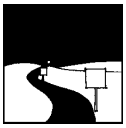
The **Intersection** of two or more streets is an area where pedestrians, bicyclists and drivers meet and must navigate the same space.

Roadway refers to improvements that would be applied along a stretch of road (such as bicycle lanes) or at multiple locations along a road (such as adjusting traffic signal timing).

A **District** encompasses many streets within a defined area. All of the tools are appropriate for districts.

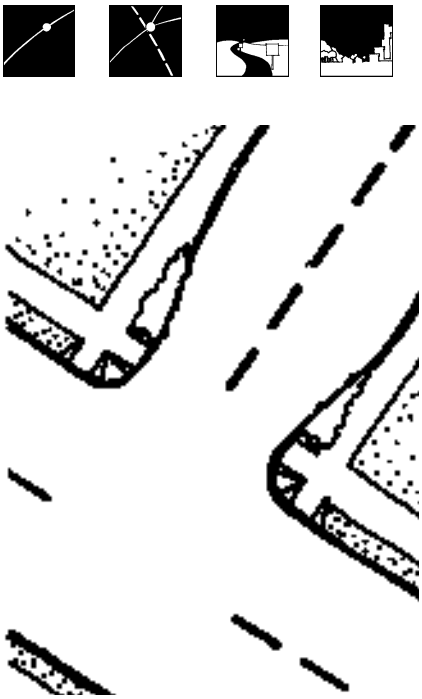
Step 3: Select the Right Tools

The table below will help you determine the best tool or set of traffic calming tools to use: in a spot location, at an intersection, along a roadway, or within a district. Some tools are effective in more than one type of location.

					
Tool	**Page**	**Spot Location**	**Intersection**	**Roadway**	**District**
Bulbout (curb extension)	24	✓	✓	✓	✓
Chicanes	25	–	–	✓	✓
Choker (neckdown)	26	✓	✓	✓	✓
Diverter	27	–	✓	–	✓
Driveway Link	28	–	–	✓	✓
Full Street Closure	29	–	–	✓	✓
Gateway	30	✓	✓	✓	✓
Intermediate Median Barrier	31	–	✓	✓	✓
Landscaping Treatments	32	✓	✓	✓	✓
Median	33	–	–	✓	✓
Modified T-Intersection	34	–	✓	–	✓
Partial Street Closure	35	–	✓	✓	✓
Pedestrian Refuge Islands	36	✓	✓	✓	✓
Speed Humps and Tables	37	✓	✓	–	✓
Raised Intersection	38	–	✓	–	✓
Reducing Number of Lanes	39	–	–	✓	✓
Roadway Narrowing	40	–	–	✓	✓
Mini Circles	41	–	✓	–	✓
Roundabout/Mini-Roundabout	42	–	✓	–	✓
Woonerf	43	–	–	✓	✓

Step 4: Review the Tools

Bulbout or Curb Extension



from Making Streets That Work, Seattle 1995

Bulbouts or curb extensions extend the sidewalk or curb line into the street, reducing the street pavement width. Bulbouts calm traffic speeds and improve pedestrian crossings. They shorten crossing distances and reduce the time pedestrians are exposed to traffic. Bulbouts improve visibility for pedestrians and motorists.

Bulbouts placed at an intersection discourage motorists from parking in a crosswalk or from blocking a curb ramp. Motorists may travel more slowly at intersections or mid-block locations with bulbouts depending upon how narrow the roadway becomes. Used in sequence, especially with landscaping, bulbouts tighten overly wide streets. The more restricted the street width becomes, the slower motorists tend to travel. Bulbouts also reduce turning speeds at intersections.

■ **Used for**

- ➢ Improving safety for pedestrians and motorists at intersections and midblock locations.
- ➢ Increasing visibility and reducing speed of turning motor vehicles at intersections (if designed correctly).
- ➢ Improving midblock visibility of pedestrians by bringing them to the edge of parked vehicles.
- ➢ Encouraging pedestrians to cross at designated locations.
- ➢ Preventing motorists from parking at corners.
- ➢ Improving access for emergency responders and large vehicles to narrow streets that might be blocked by on-street parking.
- ➢ Providing opportunity for high quality ramps for people with disabilities.
- ➢ Providing location for landscaping and public amenities.

■ **Considerations**

- ➢ Best used where on-street parking exists.
- ➢ When bike lanes are included, principal street curb extensions are adapted to permit a 5-foot lane.
- ➢ Mid-block curb extensions provide an opportunity to enhance midblock crossings and create a place to plant trees or add landscaping.

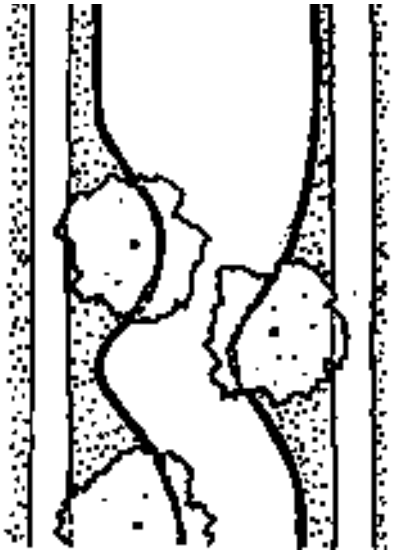
■ **Cost**

- ➢ $5,000-$20,000 each. Can be built for little or no additional cost during a street reconstruction.

This bulbout in Venice, Florida, reduced motorists turning speeds by 6-8 mph. The bulbout also reduced pedestrian crossing distance and time exposed to traffic.

Chicanes

Chicanes usually consist of a series of bulbouts or curb extensions that narrow the street to one lane at selected points and force motorists to slow down to maneuver between them. Such treatments are intended for use only on residential streets or quiet portions of a downtown with low traffic volumes (under 1,500 cars per day), where it is desirable to greatly restrict vehicle speeds and movements.



from Making Streets That Work, Seattle 1995

■ **Used for**

- ➢ Reducing vehicle speeds on long blocks (over 500 feet).
- ➢ Adding greenery and visually narrowing appearance of street.
- ➢ Creating a park-like environment.
- ➢ Assuring 20-foot opening for fire truck operations.

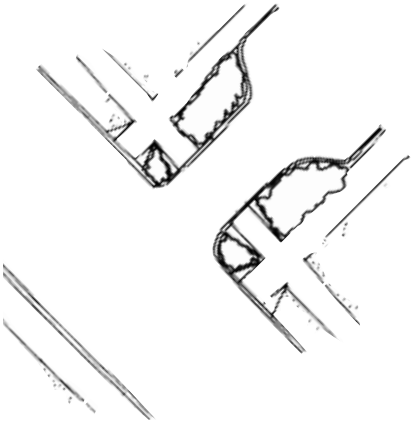
■ **Considerations**

- ➢ Chicanes minimize problems at driveway openings, but eliminate four on-street parking spaces.
- ➢ Properly designed and planted, chicanes create appearance that street ends mid-block. This further reduces speeding, and can reduce volumes on some streets.
- ➢ Can be used with or without existing curbing. In many cases drainage can flow along existing curb line, but can create new maintenance problems.

■ **Cost**

- ➢ For a set of three, $10,000 to $20,000.

Chicanes can be used on streets with or without sidewalks. These chicanes narrow this Main Street to two lanes and require traffic to move slowly. This style of chicane can easily handle 5,000 to 10,000 vehicles per day.



from Making Streets That Work, Seattle 1995

Choker or Neckdown

Like a partial street closure (p. 35), a choker narrows the mouth of an intersection. However, a choker does not just block one movement (either entering or exiting the intersection), but instead consists of a set of curb bulbouts which narrows the intersection to one lane, causing motorists to slow when entering or exiting.

■ Used for

- ➢ Slowing vehicles at entry-point and mid-point along the street.
- ➢ Improving safety for pedestrians and motorists at intersections; increases visibility and reduces speed of turning motor vehicles if designed correctly.
- ➢ Encouraging pedestrians to cross at designated locations.
- ➢ Preventing motorists from parking at corners.
- ➢ Improving access for emergency responders and large vehicles to narrow streets that might be blocked by on-street parking.
- ➢ Improving compliance with the Americans with Disabilities Act (ADA).
- ➢ Improving public space.

■ Considerations

- ➢ Narrowing street opening or mid-block point to 14 feet is essential. If narrowing is not restrictive enough two vehicles will pass one another and speed reductions are minimal.
- ➢ Works best when street volumes are above 600 and under 2,000 ADT.
- ➢ Midblock chokers provide an opportunity to enhance midblock crossings, create a community pocket park and places to plant trees.
- ➢ To assist large-vehicle entry, such as fire trucks, design to enhance right-turn movements (place curb extension on right-side of entry).

■ Cost

- ➢ $5,000-$20,000 each depending on site conditions and desired landscaping.

This choker, in South Miami, Florida, "chokes" the entrance of the street to a nine-foot travel lane.

Diverter

- **Forced Turn**
- **Diagonal**
- **Star**
- **Truncated**

A diverter consists of an island or curbed closure which prevents certain through and/or turning movements at intersections of residential streets.

A diagonal diverter breaks up cut through movements and forces right or left turns in certain directions. A star diverter consists of a star-shaped island placed at the intersection which forces right turns from each approach. A truncated diagonal diverter is a diverter with one end open to allow additional turning movements. Other types of island diverters can be placed on one or more approach legs to prevent through and left turn movements and force vehicles to turn right. (See figures at right)

As with other traffic calming measures, diagonal diverters must be used in conjunction with other traffic calming devices within the neighborhood street network. Any of these diverters should be designed to allow pedestrian, bicycle and emergency access.

■ Used for

- ➢ Traffic volume control.
- ➢ Discouraging commuter or other inappropriate traffic from entering or cutting through a neighborhood.
- ➢ Creating part of a bicycle boulevard system.
- ➢ Creating a small pocket park.

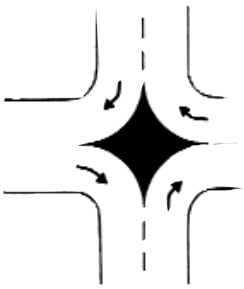
■ Considerations

- ➢ Diverters are a very strong measure and will have negative impacts on residents who use the streets daily.
- ➢ Consider less restrictive measures first.
- ➢ Try to solve main corridor problem first. Will an intersection improvement curtail cut-through traffic?
- ➢ Diverters should have strong neighborhood support before they are installed.
- ➢ Used most effectively on grid streets, or other patterns where many linkages exist.
- ➢ Evaluate neighborhood traffic patterns to determine whether other streets and emergency operations, sanitation, school bus and transit routes would be adversely affected.
- ➢ It is often possible to build a diverter to permit emergency response and bus access.
- ➢ Design diverters with ramps to allow bicycle and ADA access.

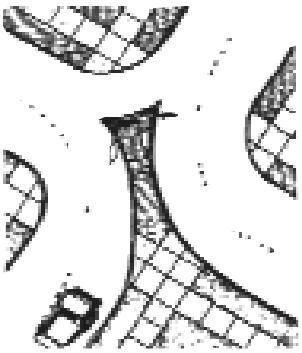
■ Cost

- ➢ $10,000-$20,000 per treatment.

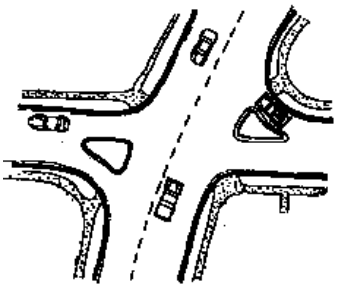
Diagonal Diverter



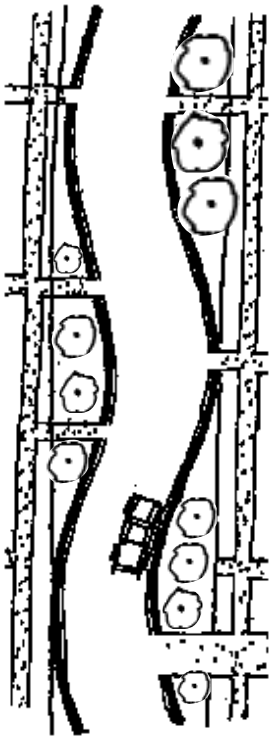
Star



Truncated Diverter



Forced Turn Diverter

Driveway Link

Driveway links refer to the use of a winding street pattern which allows for two-way through movements while forcing vehicles to pass through one at a time. Driveways create a link to the street for residents. The serpentine pattern provides areas which can be planted with trees and bushes to create visual obstructions.

Such designs are usually implemented with construction of a new neighborhood street or during reconstruction of an existing street. This type of design can be more expensive than other traffic calming options and needs to be coordinated with driveway access.

■ **Used for**

➢ Changing the entire look of a street. Sends a significant message to drivers that the nature of the road is not for fast driving.

➢ Creating slow streets in new neighborhood construction.

➢ Slowing traffic on overly long blocks that were poorly designed.

➢ Creating a network of pocket parks that can significantly improve property values in an area.

■ **Considerations**

➢ Expensive. Where cost is a concern, other lower cost traffic calming strategies might be equally effective.

➢ Most cost-effective where a street will soon undergo major reconstruction for utilities or other purposes.

■ **Cost**

➢ High cost ($60,000-$90,000 if retrofit), but less expensive if street is being rebuilt or with new construction.

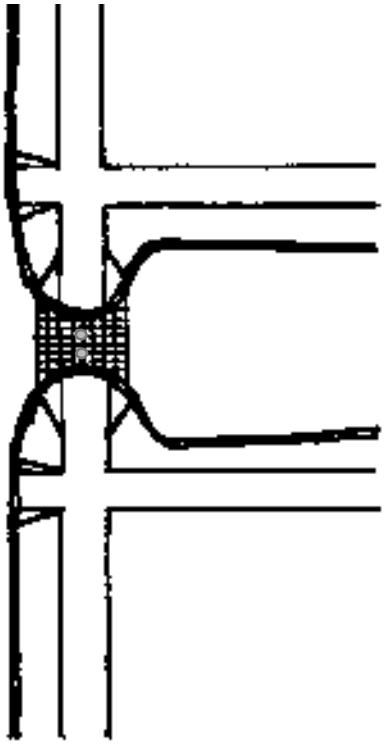
The driveway link is a curving roadway that helps slow traffic through the use of landscaping and colored pavement.

Full Street Closure


A full street closure is accomplished by installing a physical barrier that blocks a street to motor vehicle traffic either in initial design (e.g., new cul-de-sac) or by closure of an existing street. A street closure is done on a local street to prevent through traffic, but allows access for pedestrians (including wheelchair users), bicyclists and emergency responders.

Street closures typically shift traffic to other neighborhood streets and should only be considered if no other treatment will work. It is important to approach traffic calming from a neighborhood-wide perspective.

Don't use street closures to solve crime or other social problems. Often other tools, such as an intersection median barrier, will address the cut-through problem without such severe ripple effects.



■ Used for

- ➢ Limiting motor vehicle traffic to certain areas.
- ➢ Creating a short pedestrian mall.
- ➢ Creating a park, public plaza or other public space.
- ➢ Establishing an overall traffic management strategy.

■ Considerations

- ➢ Has highest negative impact on local residents.
- ➢ Highly restrictive. Analyze if new traffic patterns will adversely affect other streets in a negative manner. May generate new auto trips. Always use with caution.
- ➢ Do not use to address social or crime problems.
- ➢ Requires attention to turning movements of vehicles at street end.
- ➢ Not effective as a speed reduction measure.
- ➢ Design should allow walking, bicycling, and access for people with disabilities, emergency responders, transit and school buses. Use only if non-motorized access is improved to key locations.

■ Cost

- ➢ $30,000-$100,000 for a landscaped closure, depending on the design.

A full street closure, like this one in Cambridge, Massachusetts, changes traffic patterns and is thus rarely used.

Gateway

A gateway is a physical or geometric landmark on an arterial street which indicates a change in environment from a major road to a lower speed residential or commercial district. Gateways may be a combination of street narrowing, medians, signs, arches over the roadway, roundabouts, or other identifiable features. Gateways send a clear message to motorists that they have reached a specific place and must reduce speeds.

■ **Used for**

➢ Transitioning to a new area, such as a commercial district or neighborhood.

➢ Creating a unique image for an area.

➢ Sending a message to motorists that they are traveling from a principal roadway to a commercial or neighborhood district, and that they are expected to slow to an appropriate speed.

■ **Considerations**

➢ Most effective in speed reduction if gateway treatment initiates a new visual image, such as a consistent new streetscape.

➢ Effect is increased if opening slows turning speed.

➢ Often used in conjunction with other pedestrian enhancements, such as medians, bulbouts and paver treatments.

➢ Strong visual effects are essential.

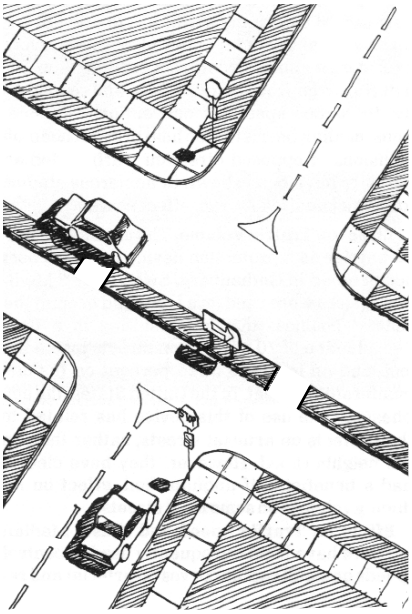
■ **Cost**

➢ Will vary depending on design.

The combination of street lamps, landscaping, street trees and intricately paved media can create a gateway welcoming residents and visitors to the center of town.

Intersection Median Barrier

This shortened version of a raised curb median extends through the intersection a distance adequate to prevent cross-street through movements and left-turning movements to cross streets from the main street. This treatment benefits pedestrians who need to cross any leg of the intersection and restricts vehicle entry into and out of neighborhoods, and can therefore greatly reduce cut-through traffic. As with a pedestrian refuge island (p. 36), the intersection median barrier can be as narrow as 4 feet, but 8 feet is preferred.



■ Used for

- ➢ Reducing cut-through traffic on a neighborhood street.
- ➢ Creating bicycle boulevard streets.
- ➢ Improving pedestrian access across busy collector and arterial streets.

■ Considerations

- ➢ Works best with grid pattern or other tightly laced neighborhoods where there are many points of entry.
- ➢ Local residents need to be provided access and should not be required to drive excessive distances to reach their homes.
- ➢ Analyze traffic patterns to see how much, if any, traffic will be diverted to other streets.
- ➢ Design must include safe and convenient emergency vehicle, bicycle and pedestrian access.
- ➢ Can be used internally in a neighborhood, but is more frequently used on edges and entries.
- ➢ May improve capacity of principal roadway, thus keeping road to minimal number of lanes.

■ Cost

- ➢ $10,000-$20,000

Intersection median barriers should be designed to allow walking and bicycling trips through the neighborhood.

Landscaping Treatments

The careful use of landscaping along a street provides separation between motorists and pedestrians, reduces the roadway's effective width (which in turn can reduce vehicle speeds), and provides a more pleasant street environment for both pedestrians and motorists. If an entire block of residents approves a landscaping plan, more landscaping options are available than would be available to a single individual. This can include a variety of trees, bushes, and large flower pots, which can be planted in the area between the sidewalk or walkway and the street. All proposed landscaping options should conform to parks and recreation department standards, and local government maintenance capabilities.

Placed in the median and along the sidewalk, these palm trees in Ft. Meyers, Florida, slow traffic, keep the pavement cooler, and enhance the appeal of the retail streetscape.

These curb extensions in Olympia, Washington, have been landscaped with native plants.

■ Used for

- ➢ Enhancing the street environment and improving property values.
- ➢ Projecting an image that the street is part of a place rather than a through route.
- ➢ Creating energy-saving green environment, cooling and preserving asphalt life, and tempering motorist behavior. Tree canopies can reduce energy costs to residential and commercial properties by up to 10%.
- ➢ Enhancing all other types of traffic calming measures.
- ➢ Increasing neighborhood pride, ownership and commitment to work together.
- ➢ Reducing water runoff.

■ Considerations

- ➢ Requires close coordination and teamwork within neighborhood
- ➢ May require additional funding by neighborhood for maintenance. This funding is often handled through neighborhood association fees, a volunteer effort, or other cooperation.
- ➢ Use low-growth shrubs where ability to see cars or pedestrians (sight distances) – such as at corners – is critical. Trees should be under-trimmed to eight feet.
- ➢ Xeriscaping helps hold down water use and reduce other maintenance costs.
- ➢ In snow country, consider designs that minimize negative impacts on snow removal and storage.
- ➢ Consult with arborist as to best street tree species for the region.
- ➢ In commercial districts trees should not block signs or building façades.

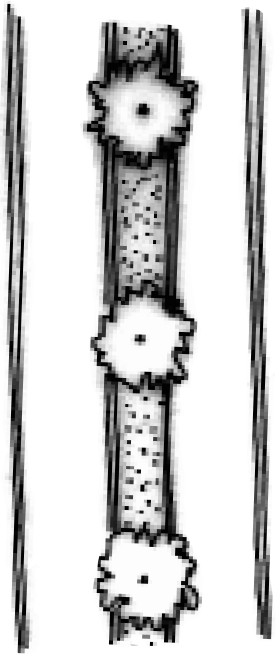
■ Cost

- ➢ Varies. From $1,000-$10,000 is typical. Often city or county will pay for initial installation and tree maintenance while the neighborhood will agree to maintain smaller plants. Some cities maintain greenhouses to assist neighborhoods with free plantings.

Median

A median may be considered to be a long pedestrian refuge island which is raised and located near the center portion of the street. Medians provide a refuge for pedestrians and bicyclists who cross a street mid-block or at intersections. Adding medians to existing streets may require reducing lane widths, the number of lanes, and/or removing on-street parking. Medians can be designed with turning pockets at intersections or at restricted locations. Typically, safety is enhanced due to a reduction in vehicle speed and an increase in separation between opposing directions of traffic and a reduction in points of conflict where turns are allowed.

Medians provide a signature landscape opportunity and can increase community pride and sense of place.



from Making Streets That Work, Seattle 1995

■ Used for

- ➢ Managing motor vehicle traffic and providing comfortable left-hand turning pockets with fewer lanes or more narrow lanes.
- ➢ Improving access across streets in commercial, park and transit districts or corridors.
- ➢ Providing a refuge for pedestrians and bicyclists crossing the street.
- ➢ Increasing roadway efficiency by up to 30 percent.
- ➢ Providing space for street trees and other landscaping while reducing water runoff.
- ➢ Improving access to some properties, especially when used in conjunction with roundabouts or other means to create U-turn opportunities.

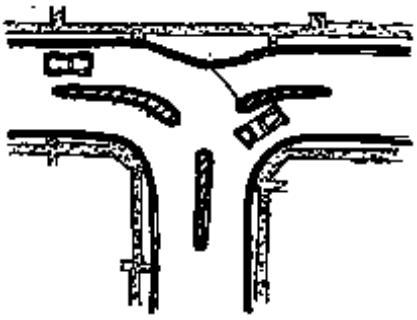
■ Considerations

- ➢ Most critical on high-volume, high-speed collectors and arterials.
- ➢ Will often increase property values.
- ➢ Can double the safety of roadway by reducing conflicts.
- ➢ Use small medians or pedestrian refuge islands if cost or driveway access is an issue.
- ➢ Conversion of former wide streets may allow for bike lanes, wider sidewalks, green planter strips and other measures that temper inappropriate driving speed on main roads.
- ➢ If full medians are used, some driveways can only be accessed with U-turn or other turn option. Most business and residential property owners must understand the benefits and disadvantages. Often the benefits outweigh the disadvantages, but these issues must be explained and well-understood.

Used in combination with bike lanes, this landscaped median in Seattle, Washington, converted this fast street to one lane in each direction that is pleasant for walking, bicycling and driving. The prudent driver sets the speed for all.

■ Cost

- ➢ $15,000-$30,000 or more per 100 feet (priced on lineal foot).



Modified T-Intersection

This design treatment is intended for certain T-intersections in residential areas where the speeds of through traffic need to be reduced. It involves a gradual curb extension or bulb at the top of the T so that vehicles are deflected slightly as they pass straight through the intersection (see diagram at left). This type of design helps to discourage cut-through traffic in a neighborhood. Careful design for each site is required to ensure that the deflection slows drivers but does not cause confusion about permitted movements.

■ **Used for**

➢ Reducing vehicle speeds through a T-intersection on a residential street.

➢ Narrowing field of vision (with well-landscaped median islands and curb extension).

➢ Simplifying street crossings for pedestrians and bicyclists.

■ **Considerations**

➢ Used when vehicle volumes are low to moderate and intended to provide primarily for local traffic.

➢ Works best for low to moderate traffic volumes (up to 1,200 ADT).

➢ Consider a mini-traffic circle, semi-diverter, or intersection slow-point as a less expensive treatment.

➢ Does not provide as many safety benefits as a mini-circle.

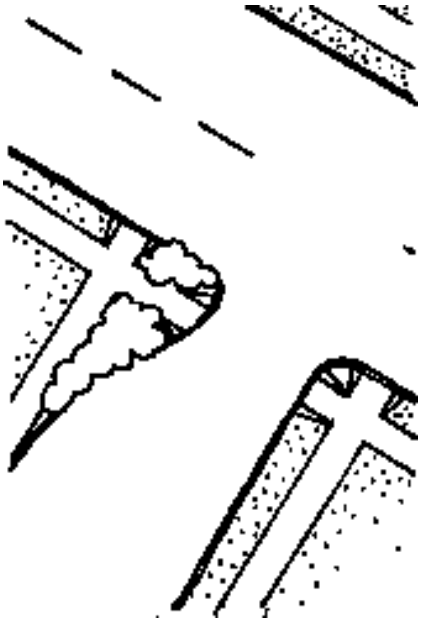
■ **Cost**

➢ $30,000-$60,000

A modified T-intersection in Portland, Oregon.

Partial Street Closure

A partial street closure blocks one direction of motor vehicle travel into or out of an intersection. It can also block one direction of travel on a two-way street. Partial street closures can be one-way, but are often two-way. If one way, then they should be marked with signs such as DO NOT ENTER, NO LEFT TURN or NO RIGHT TURN. A partial closure impacts adjacent streets; therefore, it is important to include neighbors in the planning process. They should be designed to allow easy access by bicyclists and pedestrians.



from Making Streets That Work, Seattle 1995

■ **Used for**

- ➢ Preventing turns from an arterial street onto a residential street.
- ➢ Reducing the use of the street as a cut-through route.
- ➢ Restricting access to a street without creating one-way streets.
- ➢ Creating a pocket park and enhancing the neighborhood.

■ **Considerations**

- ➢ Analyze whether less restrictive measures would adequately solve the problem.
- ➢ Analyze whether other adjacent local streets will be adversely affected.
- ➢ May be an option to a full street closure.
- ➢ Can increase distance that residents may need to travel and put additional traffic on other streets.
- ➢ Should be designed to allow emergency, bicycle and pedestrian access.

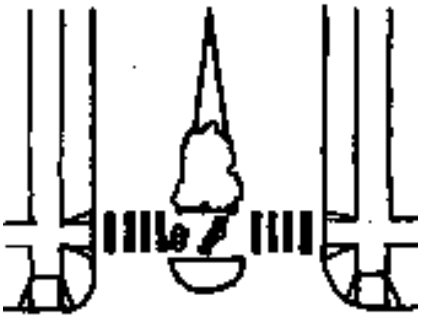
■ **Cost**

- ➢ $12,000-$20,000

The partial street closure here permits a low speed exit only. Emergency fire and medical responders can still enter. Pedestrians and bicyclists have full access.

Pedestrian Refuge Island

A pedestrian refuge island is a raised island placed in the center of the street at intersection or mid-block locations to help protect pedestrians from motor vehicles. As with medians, refuge islands allow pedestrians to be concerned with only one direction of traffic at a time. For example, a pedestrian can cross to the refuge island and wait for an adequate gap in traffic before crossing the second half of the street. Where mid-block or intersection crosswalks are to be installed at uncontrolled locations (i.e., where there are no traffic signals or stop signs), raised medians should be strongly considered as a supplement to the crosswalk. Pedestrian refuge islands can be as narrow as 4 feet, but 8 feet is preferred.



from Making Streets That Work, Seattle 1995

A refuge island with pavement markings in midtown Sacramento, California.

■ **Used for**

- ➢ Enhancing pedestrian and bicyclist crossings, particularly at un-signalized crossing points.
- ➢ Establishing "Safe Routes To School" crossings.
- ➢ Reducing left turn crashes.
- ➢ Simplifying pedestrian decision-making to one or two threats at a time.

■ **Considerations**

- ➢ Most critical on roadways with high speeds and high traffic volumes.
- ➢ Continue to provide for bicycle lane access on principal roadway.
- ➢ Can be used effectively with a lane width reduction strategy (narrowed to 10 feet).
- ➢ Important to create a 4 foot minimum standing area, with 8 feet preferred.
- ➢ Keep street opening as wide as the crosswalk (typically 10 feet or more on a principal street).
- ➢ Illuminate island and highlight with landscaping, trees, and reflectors to ensure motorist can see it.
- ➢ Can be used in snow country as long as the islands are clearly marked for plows.

■ **Cost**

- ➢ $6,000-$10,000 for basic island, more for significant landscaping.

Speed Humps and Speed Tables

Speed humps are typically paved with asphalt, approximately 3-6 inches high at their center, and extend the full width of the street. The higher the vertical rise, the better the humps work to reduce vehicle speed. This popular traffic calming device has some negative aspects, however. They may delay emergency vehicle response times by 5-10 seconds each, create noise and often shift the speed problem to a parallel adjacent street. Often they have minimal impact on the worst drivers, while punishing the most responsible motorists.

If no other options are available, speed humps should be spaced 400 to 500 feet apart for maximum effect. They should also be part of a neighborhood-wide traffic calming program.

A speed table is essentially a flat-topped speed hump. Speed tables can be a good solution at school crossings, trail crossings and in parking lots. Speed tables are often striped as crosswalks or constructed out of brick pavers. Speed humps and tables must be well-marked and well-lit so that they can be detected from 200-300 feet.

■ Used for

- ➢ Traffic calming narrow streets where few other measures can be applied.
- ➢ Reducing speeds where crosswalks and trails cross local and low-volume collector roadways.

■ Considerations

- ➢ Has minimal effect on trucks and sport utility vehicles and may worsen speeding with problem drivers.
- ➢ Can be used as a series of two humps (undulation) to impact all vehicle types.
- ➢ May make a neighborhood appear to be a "problem area."
- ➢ Should not be used in a series on emergency response routes or bus routes.
- ➢ Use when problems are very localized and can be controlled with a single measure.
- ➢ Often found by adjacent neighbors to be noisy. Noise problems can be reduced with careful design.
- ➢ Lowest priced traffic calming feature.
- ➢ The aesthetics of speed humps and speed tables can be improved through the use of color and specialized paving materials.
- ➢ Can be used in conjunction with other measures, such as short medians, medians and gateways.
- ➢ Speed tables are especially useful around schools, libraries and parks where high pedestrian flow is anticipated.

■ Cost

- ➢ $2,000 for humps, and $5,000-$15,000 for tables. Prices will vary depending on drainage treatment and materials selection.

Speed humps are frequently used on residential streets to reduce speeds. However, they can create unwanted noise and shift the speeding problem to other streets in the neighborhood. Often the same residents asking for their installation are the ones asking for their removal one year later.

Raised Intersection

A raised intersection involves providing ramps on each of the intersection approaches and elevating the entire intersection by approximately 6 inches. The crosswalks on each approach are also elevated as a part of this treatment. Bollards are sometimes added to reduce the likelihood of drivers cutting through the intersection on the sidewalk. The intersection ramps are usually made of concrete, but may be constructed of paving stones, bricks, or other materials. As with other vertical treatments such as speed humps or speed tables, these devices are uncomfortable for bus and emergency vehicle passengers.

■ **Used for**

- ➢ Reducing conflict speed at most critical location.
- ➢ Improving pedestrian and bicycle access and safety at most critical location
- ➢ Creating a prime corner ("100% corner") and increasing public amenities.

■ **Considerations**

- ➢ Requires good sight distances, and cannot be used effectively on steep grades.
- ➢ Must coordinate design with transit, emergency responders and other major operators.
- ➢ If cost is prohibitive, consider speed tables as an alternative.
- ➢ May increase values of adjacent residential and commercial properties.

■ **Cost**

- ➢ $25,000 to $70,000 for compact intersections. Costs are less if drainage interruption is minimized.

This Eureka, California, street has a raised intersection, which uses colored, textured pavers to make the street more attractive.

Reducing the Number of Lanes

Reducing the number of lanes on an existing multi-lane roadway reduces crossing distances for pedestrians and can slow vehicles to appropriate speeds. For example, a four-lane, undivided road can be converted to one through lane in each direction with a center left-turn lane and bicycle lanes on both sides of the roadway (pictured below).

Another option would be to reduce a four-lane, undivided road to one through lane in each direction with a center turn lane with short medians, left turn pockets, and bicycle lanes. This configuration eliminates the possibility of drivers using the center left-turn lane as a through lane, while providing a pedestrian refuge and a dedicated bicycle lane. If the roadway has no sidewalks, these may also be added.

If there are sidewalks with adequate room, a landscaped buffer may be installed to separate pedestrians from the travel lane. Roadway capacity is often unaffected, or improved, for volumes up to 15,000-20,000 ADT.

■ Used for

- ➢ Converting four-lane roadways to two, plus medians and bike lanes.
- ➢ Improving motorist compliance with the law, by allowing the prudent driver (not the imprudent driver) to set the speed.
- ➢ Reducing top end speeders most hours of the day. May have less effect in off-peak hours.

■ Considerations

- ➢ Can handle volumes up to 20,000 ADT in most locations, and 25,000 ADT in some.
- ➢ Generally benefits neighborhood with quieter, safer operations, and may contribute to increase in property values.
- ➢ Often increases safety by up to 30 percent.
- ➢ Best used with medians and bike lanes which provide space for motorists to pull over to permit emergency responders to get by.
- ➢ Can use with center turn lanes, using refuge islands in places to assist pedestrian crossing of high volume roadways
- ➢ When traffic counts are above 20,000 ADT may increase difficulty getting into and out of driveways. Most residents are satisfied with the tradeoff.

■ Cost

- ➢ Minimal. Often only requires re-striping the lanes. When medians or refuge islands are used, costs of $15-$25 per lineal foot are common.

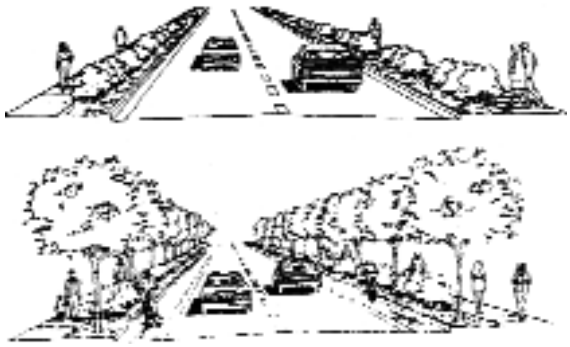
This section of Lake Washington Boulevard in Kirkland, Washington, was narrowed from four lanes to three. The conversion has created a smoother flow rate, addressed capacity issues, improved safety, and made way for a bike lane – which also provided a buffer for pedestrians.


Roadway Narrowing

Roadway narrowing can be achieved in two different ways. The lane width can be reduced, with excess asphalt then striped with a bicycle lane or paved shoulders. These treatments make the driving area appear to be narrow without adding curbing to physically narrow the roadway.

The street can also be physically narrowed by extending sidewalks, providing landscaped areas, or adding on-street parking within the former curb lines. This often reduces vehicle speeds along a roadway section and enhances movement and safety for pedestrians.

Adding bicycle lanes on higher-volume streets with speeds in excess of 20 mph enhances bicycle travel by increasing the predictability of both car and bicycle movements. Such treatments are particularly desirable for a neighborhood when several streets are treated in this way to create a connected system of bike lanes.



from Pedestrian Facilities Guidebook, Washington State

■ **Used for**

➢ Reducing speeds, increasing safety and redistributing space to other users and uses.

■ **Considerations**

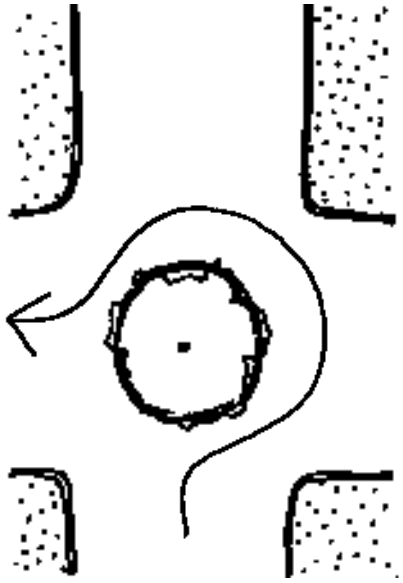
➢ Bicyclists must be safely accommodated. Bike lanes are needed if motor vehicle speeds exceed 20-25 mph. If speeds are less than 20-25 mph, bikes and motor vehicles can share the same space on the roadway. The extra width, in such settings, is often beneficial to pedestrians or dedicated for other Main Street or neighborhood needs.

➢ Use of bike lanes helps with truck turning movements (larger effective turning radius) and creates a space to allow motorists to pull over for emergencies and emergency responders.

Colored asphalt has been used to identify bike lanes on this street in Holland. The bike lanes visually narrow the street. Although the curb to curb width is more than 30 feet, the motorist only sees 11 feet of driving space. This visual tunneling reduces speeds by 9-14 mph.

Mini-Circle

Mini-circles are raised circular islands constructed in the center of residential street intersections to reduce vehicle speeds. They force motorists to maneuver around them and have been found to reduce motor vehicle crashes by 90-93%. Drivers making left turns are directed to maneuver in a counter-clockwise direction, exiting the traffic circle by turning right onto the desired street. Signs are often installed within the circle to direct motorists to proceed to the right of the circle before passing through or making a left turn. They are commonly constructed with landscaping (bushes, flowers, or grass) at locations where the neighborhood has agreed to maintain the plants. Stop signs are removed. Mini-circles often improve emergency response times up to 30% when four-way stop controls are removed. Use yield control on all four approaches.



adapted from Making Streets That Work, Seattle 1995

■ Used for

- ➢ Managing traffic at an intersection where volumes do not warrant a signal.
- ➢ Reducing crashes at intersections of two local streets.
- ➢ Reducing vehicle speeding at the intersection.
- ➢ Treating a series of intersections along a local street as part of a neighborhood traffic improvement program.

■ Considerations

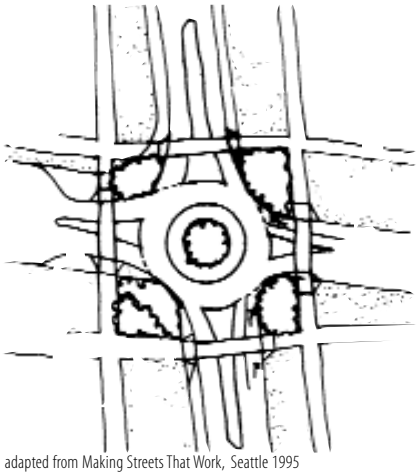
- ➢ Do not make generous allowances for motor vehicles by increasing the turning radii – this compromises motorist, pedestrian and bicyclist safety. Deflection curves must hold motorist speeds to 15-18 mph maximum.
- ➢ Do not use with stop signs. Yield controls are safer and more appropriate.
- ➢ Improves bicycling and walking conditions.
- ➢ Can be used effectively with Bicycle Boulevards.
- ➢ Larger vehicles (e.g., school buses, fire apparatus) may need to make left hand turns in front of circle.
- ➢ Landscaping that provides contrast, and especially trees, increase the effect of these intersection islands for distances up to 200 feet.
- ➢ Often reduces crashes by 90-95 percent.
- ➢ Keeps motorists in motion, thus creating quieter, cleaner-air conditions.
- ➢ Do not use if corner parking cannot be effectively controlled. In such settings fire responders may be denied access to a street.

■ Cost

- ➢ $8,000-$15,000. Asphalt mini-circles are installed for as little as $6,000. Most residents prefer the quality and durability of concrete.

In this traffic mini-circle in Vancouver, BC, buses and other large vehicles travel through on a straight or right-turning approach with no difficulty.


Roundabout and Mini-Roundabout



adapted from Making Streets That Work, Seattle 1995

A roundabout is a circular, raised island with deflector islands that form a hub for the traffic that flows around it and the streets that shoot off it. Roundabouts are located at the intersection of a collector or arterial street with one or more crossing roadways.

As with mini-circles on collector or residential streets, traffic circulates within roundabouts in a counter-clockwise direction and exits the roundabout by turning right onto the desired street. Therefore, no left-turning movements are needed. Unlike a signalized intersection, drivers select gaps in the traffic to enter the roundabout from each approaching street without having to stop.

Roundabouts are usually less expensive to install and maintain than traffic signals. They reduce crashes 50-90% at intersections previously controlled with traffic signals or stop signs. They can also handle 30% more traffic than intersections with signals and eliminate the need to widen roads to increase intersection capacity.

Roundabouts need to be constructed to accommodate pedestrians and bicyclists with crossing points and medians. Crosswalks should be placed about one car length beyond the yield line so that drivers exiting the roundabout have a full view of pedestrians. The design should not permit a motorist to travel faster than 15-20 mph.

■ Used for

- ➢ Managing vehicle movements where the existing intersection is unusually large, complex and/or has more than four approach legs.
- ➢ Improving an existing signalized or four-cross intersection which is experiencing heavy traffic backup and congestion.
- ➢ Improving safety of motorists, pedestrians and bicyclists.
- ➢ Creating a gateway into a downtown, neighborhood, waterfront or other area.
- ➢ Increasing pedestrian access across complex roadways.

This Fort Pierce, Florida, roundabout was constructed to reduce speeding, improve safety, and enhance the aesthetics of the community.

■ Considerations

- ➢ Street widths and/or available right-of-way need to be sufficient for a properly designed roundabout. Generally, all size vehicles and turning movements are supported with 110' from two diagonal corners. Smaller spaces can accommodate a roundabout, especially if the design vehicle or certain turns are restricted.
- ➢ Vehicle deflection must be set to reduce speed to 15-18 mph.
- ➢ Larger deflections create safety problems for all users.
- ➢ Use splitter islands entering and exiting roundabout to control deflection and turning movements.

■ Cost

- ➢ A landscaped roundabout ranges from $45,000 to more than $150,000. Can often be built for less than the cost of installing conventional signal system.

Woonerf

Woonerf (Dutch word which means "street for living") is common space shared by pedestrians, bicyclists, and low-speed motor vehicles. They are usually streets raised to the same grade as curbs and sidewalks. Vehicles are slowed by placing trees, planters, parking areas, and other obstacles in the street. Motorists are treated as the intruders and must travel at walking speed. This makes a street available for public use that is essentially only intended for local residents. A woonerf identification sign is placed at each street entrance.

■ Used for

➢ Residential or other local streets where volumes are low (under 1,000 ADT), limited use, and primarily local access streets.

➢ Streets where there is a neighborhood desire to create a public space for social activities and play by local residents.

■ Considerations

➢ A woonerf is generally not appropriate where there is a need to provide for non-resident motorists to access services or through streets.

➢ The design needs to keep vehicle speeds very low to make the streets safe for children, seniors and others.

■ Cost

➢ The cost to retrofit and create a woonerf may be quite high, but there would be no extra cost if part of original construction.

This Asheville, North Carolina, woonerf has been a popular and successful street since its construction over 20 years ago.

Additional Tools for Great Streets

ADA-compliant design

Bicycle lanes

Striped crosswalks

What about bike lanes? What about crosswalks? Beyond the traffic calming tools reviewed in the Toolbox, another set of great street tools can be used to improve streets. The next few pages describe other techniques that can be used to make your community more walkable and more livable. These tools can be used with the traffic calming toolbox – or on their own.

ADA-Compliant Design

People with disabilities who experience higher than normal levels of risk include the visually impaired, wheelchair users, developmentally restricted persons, and people who walk with special aids. Under the federal Americans with Disabilities Act, improvements were mandated to ensure access and mobility for people with physical limitations. Most of these improvements – including adequate time to cross streets, well-designed curb ramps, limited number of driveways, and wide sidewalks that are clear of obstructions – benefit all walkers.

Bicycle Lanes

Bicycle lanes indicate a preferential or exclusive space for bicycle travel on a street, and are typically striped – although colored pavement is sometimes used. They create more consistent separation between bicyclists and passing motorists, and can also provide a buffer zone between motor vehicles and pedestrians on a sidewalk.

Marked/Striped Crosswalks

To make pedestrians' actions more predictable for motorists, marked crosswalks indicate the proper locations to cross. In many cities, crosswalks are commonly installed at all legs of all signalized intersections and also at other selected locations.

Using crosswalks is a shared responsibility between drivers and pedestrians. Drivers must yield to pedestrians and pedestrians must not assume that all motorists see them in a crosswalk. Care on behalf of both parties can prevent pedestrian injuries.

While marked crosswalks are generally desirable at signalized locations, they may also be appropriate for selected, low speed, two- or three-lane, narrow streets, particularly in conjunction with speed tables, medians, refuge islands, bulbouts, and other traffic calming measures. Various striping patterns and textures can be used. It may be useful to supplement crosswalk markings with pedestrian warning signs.

Curb Radius Reduction

One common type of crash involving pedestrians occurs when a pedestrian is struck by a vehicle turning right at an intersection. A curb radius of 25 feet or more typically results in high-speed turns by motorists.

Shortening the radius – making the turn "tighter" for the driver – by extending the curb reduces the vehicle's speed, shortens the crossing distance for pedestrians, and improves visibility between pedestrians and motorists. Tighter turning radii are especially important in areas with heavy foot traffic.

Curb Ramps

Curb ramps provide access between the sidewalk and roadway for people using wheelchairs, strollers, walkers, and hand carts as well as for pedestrians who have trouble stepping up and down high curbs. Appropriate for use on all types of streets, curb ramps may be installed at intersections and mid-block locations with pedestrian crossings.

Driveway Improvements

Driveways may cause safety problems for pedestrians if the sloped pavement ramp extends through the sidewalk area. This will require the pedestrian to navigate the sloped pavement at each driveway crossing.

Other driveway features to be avoided are wide-turning radii, multiple adjacent driveways, or poorly defined driveways. Driveways that are wider than needed to enter and exit expose pedestrians to unnecessary risk by keeping them in the path of vehicles.

Driveway improvements can include narrowing or closing driveways, tightening turning radii, converting driveways to right-in/out only, and adding median dividers on wide driveways.

Pedestrian-scale lighting

Lighting Improvements: Pedestrian-Scale Lighting

Pedestrians – especially if they are wearing light colors – often assume that motorists can see them at night. They are deceived by their own ability to see the oncoming headlights. Without sufficient overhead lighting, however, motorists may not be able to see pedestrians in time to stop.

In commercial areas with night-time pedestrian activity, special lighting placed over the sidewalks can enhance both the ambiance of the area and the visibility of pedestrians to motorists.

Neighborhood Speed Watch/ Speed Monitoring Trailer

On some streets where traffic calming treatments have not yet been installed, temporary compliance with speed limit signs may be achieved by using a sign board which displays the speed of passing vehicles. Used in conjunction with intermittent police enforcement, this is an effective short-term strategy.

Pedestrian Signals

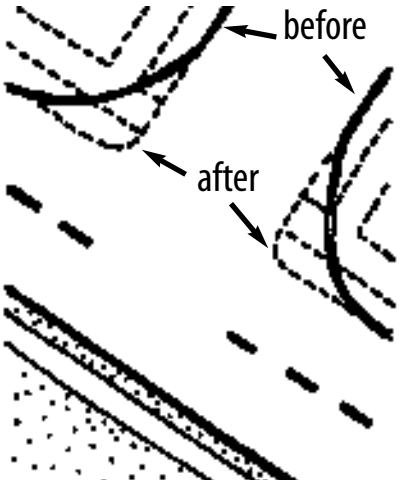
The use of walk/don't walk signals at signal locations is often valuable. Pedestrian signals are necessary when: (1) vehicle signals are not visible to pedestrians; (2) signal timing is complex – such as a left turn signal for motorists; (3) there is an established school zone crossing; and (4) an exclusive pedestrian interval is provided. Pedestrian signal heads may either be symbols of a walking person, an upheld hand, or they may be the words "walk" and "don't walk."

Pedestrian Signal Timing: Upgrade/Modify

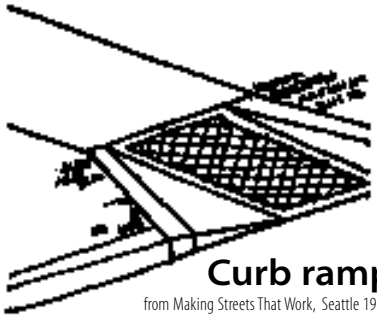
Pedestrian push buttons (with timing based on a walking speed of 3-3 1/2 feet per second) may be installed at locations where pedestrians are expected at intermittent intervals. Push buttons should not be used in downtowns or where pedestrians are routinely present. Quick response to the button should be programmed into the system.

Since push-button devices are activated by only one-half of pedestrians, new "intelligent" microwave or infrared pedestrian detectors – which automatically activate the red light and walk signal when pedestrians approach – are now being installed in some cities.

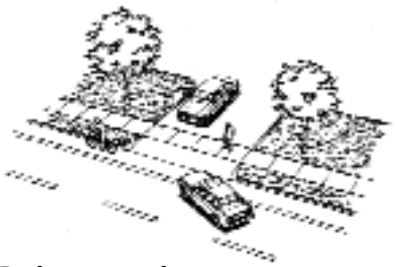
Other detectors can extend the crossing time for slower moving pedestrians in the crosswalk. In addition to "standard" pedestrian signal timing (where motorists may turn left or right across a pedestrian's path), exclusive pedestrian intervals stop traffic in all direc-



Curb radius reduction
from Making Streets That Work, Seattle 1995

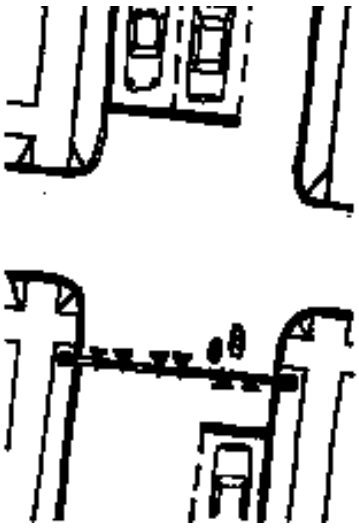


Curb ramp
from Making Streets That Work, Seattle 1995



Driveway improvements
from Making Streets That Work, Seattle 1995

Neighborhood speed watch
from Making Streets That Work, Seattle 1995



Pedestrian signal timing

from Making Streets That Work, Seattle 1995

Signage at pedestrian crossings

Street furniture in a shopping district

tions. This timing has been shown to reduce pedestrian crashes by 50%. Use of larger pedestrian signal heads and/or audible pedestrian messages (such as chirps for the blind) can be used to enhance crossings for some pedestrians.

Right-Turn Slip Lanes

At many arterial street intersections, pedestrians have difficulty crossing due to right-turn movements and wide crossing distances. Well-designed right turn slip lanes place right-turning vehicles at a 60° angle from through traffic. This angle limits vehicle turning speeds and increases the visibility of pedestrians. Right-turn slip lanes should be accompanied by pedestrian refuge islands within the intersection. Pedestrians can cross the right-turn lane and wait on the island for their walk signal.

School Zone Improvements

A variety of roadway improvements may be used to enhance safety or mobility for children in school zones. The use of well-trained adult crossing guards has been found to be one of the most effective measures for assisting children to cross streets safely, while sidewalks or separated walkways and paths are essential for a safe trip from home to school – on foot or by bicycle.

Police enforcement in school zones may be needed in situations where drivers are speeding or not yielding to children in crosswalks or when making turns.

Other helpful measures include parking prohibitions at intersections near schools, increased child supervision, and the use of signs, such a SLOW SPEED LIMIT 25 MPH WHEN FLASHING. Pedestrian safety education programs are also an essential part of child pedestrian safety, and can encourage a lifetime of pedestrian safety practices.

Add or Modify Signage

At some crossing locations and complex intersections, signs can effectively alert drivers or pedestrians to use extra caution, and thus improve pedestrian safety. Signs can, however, be used too frequently, which fosters noncompliance and disrespect for signs in general.

Speed limit signs, pedestrian warning signs, and no-turn-on-red signs, for example, can affect pedestrians. A new, strong yellow-green color is now approved by *The Manual on Uniform Traffic Control Devices*, an industry standard for use on signs which warn motorists that pedestrians and bicyclists may be in the vicinity. Because of its unique bright color, drivers pay more attention to the sign.

Street Furniture / Walking Environment

Tripping and falling are primary causes of pedestrian injuries, particularly for older walkers. Carefully planned and designed sidewalks and pedestrian areas are important, as is providing safety and mobility for users.

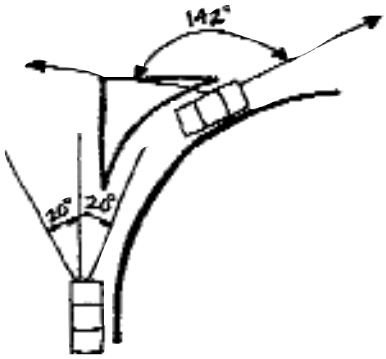
Sidewalks should be continuous and be part of a system which provides access to goods, services, and homes. Sidewalks and walkways should be kept clear of poles, sign posts, newspaper racks, and other obstacles which could block or trip people.

Benches, water fountains, and other street furniture should be carefully placed to allow for unobstructed paths for pedestrians. Paths must be properly maintained and kept clear of debris and puddles which can cause problems for pedestrians. Places to sit, chat, and people-watch enhance pedestrian livability.

Sidewalks, Walkways and Buffer Zones

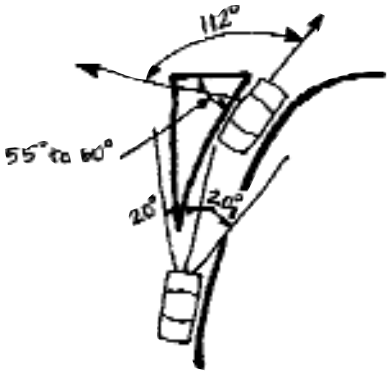
Sidewalks and walkways separate pedestrians from the roadway and provide off-street places for children to play. Sidewalks have

Recommended by the American Association of State Highway and Transportation Officials



High speed, low visibility head turner

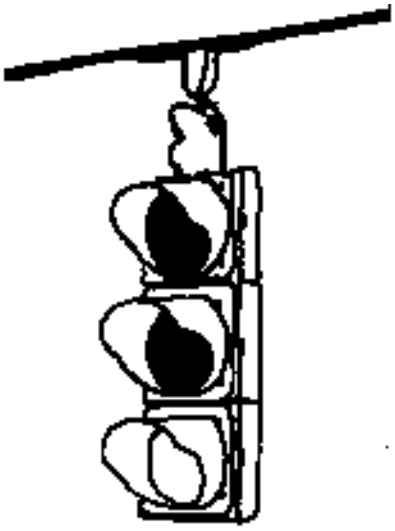
Recommended Design in Australia



14 to 18 mph, good visibility

Right-turn slip lane

from Walkable Communities, Inc.



Traffic signal

from Making Streets That Work, Seattle 1995

been associated with significant reductions in pedestrian-vehicle collisions. Such facilities also improve pedestrian mobility and should be provided for walking from residential areas to parks, schools, stores, and transit stops.

While sidewalks are typically made of concrete with curb and gutter, less expensive walkways for low-density residential areas may be constructed of asphalt, crushed stone, or other materials if they are properly maintained.

A minimum width that allows two people to pass safely is 5 feet of sidewalk or walkway, free of obstructions. An additional buffer zone (grass, trees, or other vegetation) of 4 to 6 feet is desirable as a separation from the street. Careful planning of sidewalks and walkways is important for a neighborhood or area to provide adequate safety and mobility.

Traffic Signals

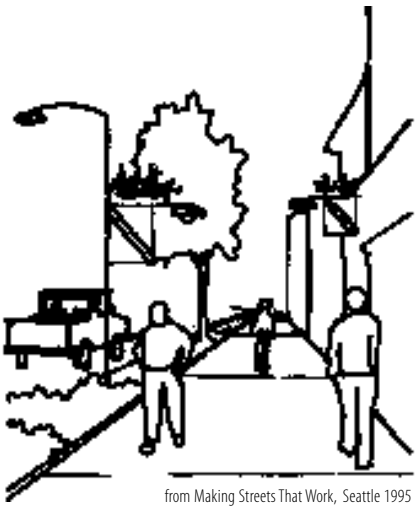
Traffic signals can create gaps in traffic flow to allow pedestrians to cross the street while motorists are stopped. Such signals should allow adequate crossing time for pedestrians (a walking speed of 3-3 1/2 feet per second). Signals are especially important for pedestrians crossing at mid-block crossing points on high-speed roads, high-speed or congested intersections, and in areas where seniors and young children want to cross streets. National standards based on the numbers of pedestrians and vehicles should be used in selecting these sites.

Traffic Signal Enhancements

A variety of traffic signal enhancements can benefit pedestrians, bicyclists and motorists. They include: providing left-turn phasing separate from pedestrian walk intervals; timing signals in sequence to encourage desired vehicle speeds; installing larger, more visible traffic signals (including back plates for bright background faces); and giving transit vehicles priority over other vehicles.

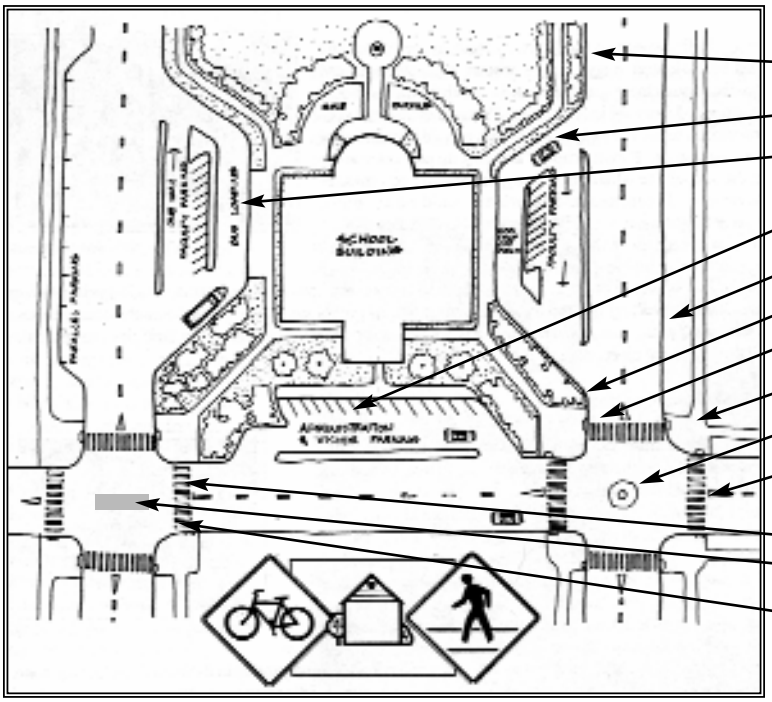
Signs commonly seen in school zones

from Making Streets That Work, Seattle 1995



from Making Streets That Work, Seattle 1995

Wide sidewalk with plantings and pedestrian-scale lighting



Basic Traffic Management Features

- Queuing space for student dropoff
- Passenger dropoff zone (left-turn out only)
- School bus loading/unloading only
- Staff and volunteer parking (no dropoffs)
- Sidewalks
- Curb extensions
- Tight corner radii
- Painted stop bar
- Roundabout or mini-circle
- Enhanced crosswalks

Options

- Median diverter
- Median refuge islands at intersection
- Intersection with median and flat top table
- Cones on center line to slow traffic
- Trees and other landscaping along streets
- Bike lanes
- Flashing beacon lights

A refuge island with speed table can be an excellent traffic calming and safety element near schools.

Traffic Calming Tools for Schools

School children need every break they can get. Traffic management elements should be incorporated in the design in and around schools to provide a comfortable and friendly environment for walking and to tightly control the behavior of parents in cars. If the school is not on a principal roadway carrying more than 4,000 vehicles per day, appropriate traffic calming features should be used to hold down speeds to 20-25 mph – even when children are not in school (i.e., 24 hours a day).

■ Traffic Management Principles for School Areas

- ➢ Separate modes (i.e., cars, buses, pedestrians).
- ➢ Keep all turning movements low-speed.
- ➢ Provide 24-hour 20 mph speed through design.
- ➢ Provide well-identified pedestrian crossings.
- ➢ Give priority to pedestrians and bicyclists.
- ➢ Locate drop-off zone before pickup zone.
- ➢ Do not permit queuing in undesirable locations.
- ➢ Do not permit motorists to cross main pedestrian routes.
- ➢ Use school crossing guards at elementary schools.
- ➢ Do not allow right turns on red, if intersection is signalized.
- ➢ Avoid multiple-lane highways.

Chapter 4. Resources

The following resources will help you to embark on your traffic calming program.

The forms in this chapter were designed to help evaluate the conditions of streets in your neighborhood. Please use them to record data (see Chapter 2 for more details) and photocopy as many forms as you need.

A list of books and publications on traffic calming, street design and urban design can also be found at the LGC Center for Livable Communities web page (www.lgc.org/center).

Neighborhood Traffic Audit

Name of Observer _____

Neighborhood _____

Date / Time of Audit _____

Where Do You Live? _____
(indicate street and cross street)

Age: 1-10 11-15 16-20 21-40 41-65 65+

Are you a : Pedestrian Bicyclist Motorist Resident Business Owner/ Employee
(Circle all that apply)

For the list below, circle the number that best describes the conditions in your neighborhood:

	Not a Problem ➜➜➜➜ Serious Problem				
Motorist courtesy toward pedestrians	1	2	3	4	5
Traffic safety for children and elderly	1	2	3	4	5
Number of cars	1	2	3	4	5
Speeding	1	2	3	4	5
Motorists obey stop signs	1	2	3	4	5
On-street parking available	1	2	3	4	5
Pedestrians can cross streets easily	1	2	3	4	5
Traffic noise	1	2	3	4	5
Visibility of pedestrians	1	2	3	4	5
Quality of pedestrian experience	1	2	3	4	5
Other (list):					
1. _____	1	2	3	4	5
2. _____	1	2	3	4	5

Please use the space here or on a separate sheet to describe specific problems in your neighborhood and the locations where they occur:

Street Inventory Form

Name of Observer _____

Neighborhood _____

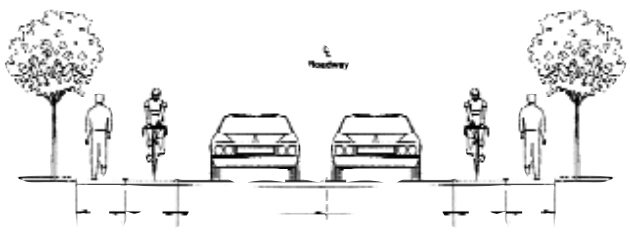
Date / Time of Audit _____

Street / Cross Sreet _____

Please circle or write in your responses:

Roadway Type	Commercial		Residential					
Number of Lanes	One	Two	Three	Four	Five+			
Block Length (feet)	200-300	301-400	401-500	501-800	Over 800			
On-Street Parking	None	Light	Moderate	Heavy	Saturated			
Walkway / Sidewalk	None	One Side	Both	Intermittent				
Walkway Width (feet)	_____	_____	_____	_____				
Type of Walkway	Grass	Asphalt	Concrete					
Traffic Volume *(vehicles per hour)*	0-30 _____	30-60 _____	61-120 _____	120-240 _____	240-480 _____	480+ _____		
Average Speed *(miles per hour)*	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50+

Please draw a typical street section below. Indicate dimensions in feet for each element that you draw.



SAMPLE SECTION

Speed Evaluation From

Follow the directions below to measure the speed of vehicles without using a radar gun:

Items Needed:

- ☐ Stop watch
- ☐ Measuring tape
- ☐ Street chalk or wide tape
- ☐ Note pad and pencil

Procedure

1. Determine where you want to measure vehicle speed. This location should be away from STOP signs or curves that would tend to slow vehicles.
2. Measure and mark a distance of 300 feet (100 yards) on the edge of the road. As always, be safe when in the road. Marks must be temporary (tape or chalk works well).
3. Find a comfortable spot off the road near the middle of the marked area where you can see both end marks.
4. Use the stop watch to measure how long it takes a vehicle to travel the 300-foot distance.
5. Refer to the table on the left to convert the travel time to vehicle speed.
6. Record the results and repeat steps 4 and 5 until a reasonable sample is obtained (usually at least 25 vehicles in each direction). The larger the numbers of vehicles sampled, the greater the accuracy of your results.
7. If it appears (based on your study), that a large percentage of the vehicles are traveling well over the posted speed limit, contact your transportation department.

Time it takes to travel 300 feet

Time Seconds	Speed (mph)
3.5	58.4
4.0	51.1
4.5	45.4
5.0	40.9
5.5	37.2
6.0	34.1
6.5	31.5
7.0	29.2
7.5	27.3
8.0	25.6
8.5	24.1
9.0	22.7

Adapted from the City of Salem, Oregon's Traffic Information Booklet, Public Works Department, Transportation Services Division, September 1996.

How The Tools Measure Up

The chart on the back cover summarizes the traffic calming tools described in this guide. The table indicates the tool and how it affects traffic volume, speed, noise, vehicle conflicts (accidents between two vehicles), the amount of traffic diverted to residential streets, pedestrian safety, bicycle safety, and emergency/service vehicle access.

The ▲ symbol indicates that use of the tool will generally increase the condition.

The ▼ symbol indicates that use of the tool will generally decrease the condition.

The dash (**–**) indicates that use of the tool will generally not affect the condition.

These indicators are included to give you a general idea of how the tools work. Depending on a street's location and traffic conditions, the tool may work differently.

Relative costs (low or high) are listed in the Estimated Costs column. Low-cost projects can usually be accomplished for $10,000 or less, while high-cost projects require over $10,000.

Estimates of the time it takes to complete each project (short-term or long-term) are included in the Timeline column. Short-term projects can typically be completed in one year or less, and long-term projects will typically take longer than that.

In addition to performance, the table also includes information on whether the tool can be used on an "arterial" or "residential" street or "both."

Tool	Page	Vehicle Volume	Vehicle Speed	Noise	Vehicle Conflicts	Traffic Diverted	Pedestrian Safety	Bicycle Safety	Emergency Vehicle Access	Estimated Costs	Timeline	Appropriate for Use on
Bulbout (Curb Extension)	24	–	▼	–	–	–	▲	–	–	high	long	both
Chicanes	25	▼	▼	▼	▼	▲	–	▼	▼	high	short	residential
Choker (Neckdown)	26	▼	▼	▼	–	▼	▲	–	–	low	short	residential
Diverter	27	▼	▼	▼	▼	▼	▲	▲	▼	low	long	residential
Driveway Link	28	▼	▼	▼	–	–	▲	–	▼	high	long	residential
Full Street Closure	29	▼	▼	▼	▼	▲	maintain access for these uses			high	long	residential
Gateway	30	▼	▼	▼	▼	–	▲	–	▼	low	short	both
Intermediate Median Barrier	31	▼	–	–	▼	▲	▲	▲	–	low	short	arterial
Landscaping Treatments	32	–	▼	▼	▼	–	▲	–	–	low	short	residential
Median	33	–	▼	▼	▼	▲	▲	–	▼	high	long	arterial
Modified T-Intersection	34	–	▼	–	▼	▼	–	–	–	low	short	arterial
Partial Street Closure	35	▼	–	▼	▼	▲	▲	▲	–	low	long	residential
Pedestrian Refuge Islands	36	–	▼	▼	▼	▲	▲	▲	–	high	long	arterial
Speed Humps and Tables	37	▼	▼	▲	–	–	▲	–	▼	low	long	residential
Raised Intersection	38	–	▼	▲	▼	–	▲	▲	▼	high	long	both
Reducing Number of Lanes	39	–	▼	▼	▼	–	▲	▲	–	low	short	both
Roadway Narrowing	40	–	▼	▼	–	–	▲	▲	–	low	short	both
Mini Circles	41	–	▼	▼	▼	–	▲	▲	–	low	short	residential
Roundabout / Mini-Roundabout	42	–	▼	▼	▼	–	▲	▲	–	high	long	arterial
Woonerf	43	▼	▼	▼	▼	▲	▲	▲	▲	high	long	both

▲ use of tool will generally increase the condition. ▼ use of tool will generally decrease the condition. (–) use of tool will generally not affect the condition. Complete table notes on inside of the back cover.

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