

Midblock Crossings

For most of this century — since pedestrians and motorists began competing for space — safety campaigns have directed pedestrians to walk to intersections to cross roadways, where the number of conflicts is the highest. This is helpful advice, especially in downtown locations where signalization is frequent, where cycle lengths are short, where blocks are long, and where intersections are small and compact. But with the advent of the modern suburb, blocks are much longer, signalization is even less frequent, some intersections are very wide, and vehicle speeds are much higher than downtown. Under these conditions, crossing at intersections becomes less practical and often more dangerous.

Today's designer is challenged to find workable crossing points to aid pedestrians across high-speed roadways. When convenient and manageable crossing points are not identified, most pedestrians cross at random, unpredictable locations. In making random crossings they create confusion and they add risk to themselves and drivers.

This chapter addresses two ways to facilitate non-intersection crossings, medians and midblock crossings. By placing medians along multilane roadways, the designer helps channel pedestrians to the best locations: where gaps are more

frequent, where lighting is improved, and where motorists have the best chance to search, detect, recognize, and respond to the presence of pedestrians. Where there are medians, the pedestrian still may cross at random locations, but due to the increased frequency of acceptable gaps and greatly reduced conflicts, the pedestrian is inclined to find a longer gap, then walk and not rush across the roadway.

Midblock crossings are an essential design tool. All designers must learn the best placement, geometrics, and operations of midblock crossings.

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Medians and Refuge Islands — Powerful Safety Tools

A median or refuge island is a raised longitudinal space separating the two main directions of traffic movement. Median islands by definition run one or many blocks. Refuge islands are much shorter than medians, and are a length of 31-76 m (100-250 ft). Medians and refuge islands can be designed to block side street or driveway crossings of the main road and block left

turning movements. Because medians reduce turning movements, they have the ability to increase the flow rate (capacity) and safety of a roadway.

Medians are now an essential tool to minimize the friction of turning and slowing vehicles. Medians maximize the safety of the motorist and pedestrian. Medians have been extensively studied by the Georgia and Florida Departments of Transportation. Based on more than 1,000 centerline miles (1,600 km) of conversion from two way left turn lanes (TWLTL's) to raised medians, motorist crashes were reduced dramatically. It has also been shown through FDOT research that pedestrians are at high risk while standing in TWLTL's.

Midblock crossings can be kept simple and are easily located on low volume, low speed roadways, such as short 40-48 km/h (25-30 mph) collectors through neighborhoods. When collectors are longer and handle more traffic and higher speeds, medians or refuge islands are helpful, and sometimes essential. On multilane minor and major arterials, refuge islands or raised medians are essential. However, when used, crosswalks must be placed with great care in these locations, especially once travel speeds exceed 64 km/h (40 mph).

Advantages of Medians

Medians separate conflicts in time and place. The pedestrian faced with one or more lanes of traffic in each direction must determine a safe gap in 2, 4 or even 6 lanes at a time. This is a complex task requiring accurate decisions. Young and older pedestrians have reduced gap acceptance skills compared to pedestrians in other age groups. Pedestrians typically have poor gap assessment skills at night. Many may predict that a car is 61 m (200 ft) off when in fact it is only 31 m (100 ft), far too close to attempt a crossing.

Medians Allow More Frequent Gaps

Medians not only separate conflicts, they also create the potential for acceptable gaps.

On a standard-width four lane plus TWLTL roadway of 20 m (64 ft) (five twelve foot lanes plus two 24 inch gutter pans), it takes an average pedestrian travelling 1.2 m (4 ft) per second nearly 16 seconds to cross. Finding a safe 16 second gap in 4 moving lanes of traffic may be difficult or impossible (Figure 12-1). In any event, this may require a wait of 3-5 minutes. Faced with a substantial time delay, many pedestrians select a less adequate gap, running across the roadway, or standing in the TWLTL hoping for a further gap. If a raised median is placed in the center, the pedestrian now crosses 7.9 m (26 ft). This requires two 8 second gaps (Figure 12-2). These shorter gaps come frequently. Based on traffic volume and platooning effects from downstream signalization, the pedestrian may be able to find an acceptable gap in a minute or less.

Medians are Cheaper to Build

The reduced construction cost of a median vs. a TWLTL comes as a surprise to many designers. Grass medians allow natural percolation of water, and thus reduce drainage and water treatment costs. Medians do not require either a base or asphalt. Curbing is essential in urban sections, but is cheaper than other associated construction costs. Medians average a 5-10% reduction in materials and labor costs compared to a TWLTL.

Medians are Cheaper to Maintain

While there is only a slight savings in cost to build a raised median versus a TWLTL, there is substantial savings in maintenance. A study for Florida DOT by Chris Warren of Lake City Maintenance compared 6.44 km (4.0 miles) of median versus TWLTL maintenance costs and found medians save an average of 40% of maintenance costs based on a 20 year roadway life.¹ More frequent resurfacing, such as every 7-9 years would show a much greater savings. This too surprises many designers. During the full life of the roadway asphalt, a raised median saves costs

Figure 12-1. Midblock crossing without median—the person must look in both directions.

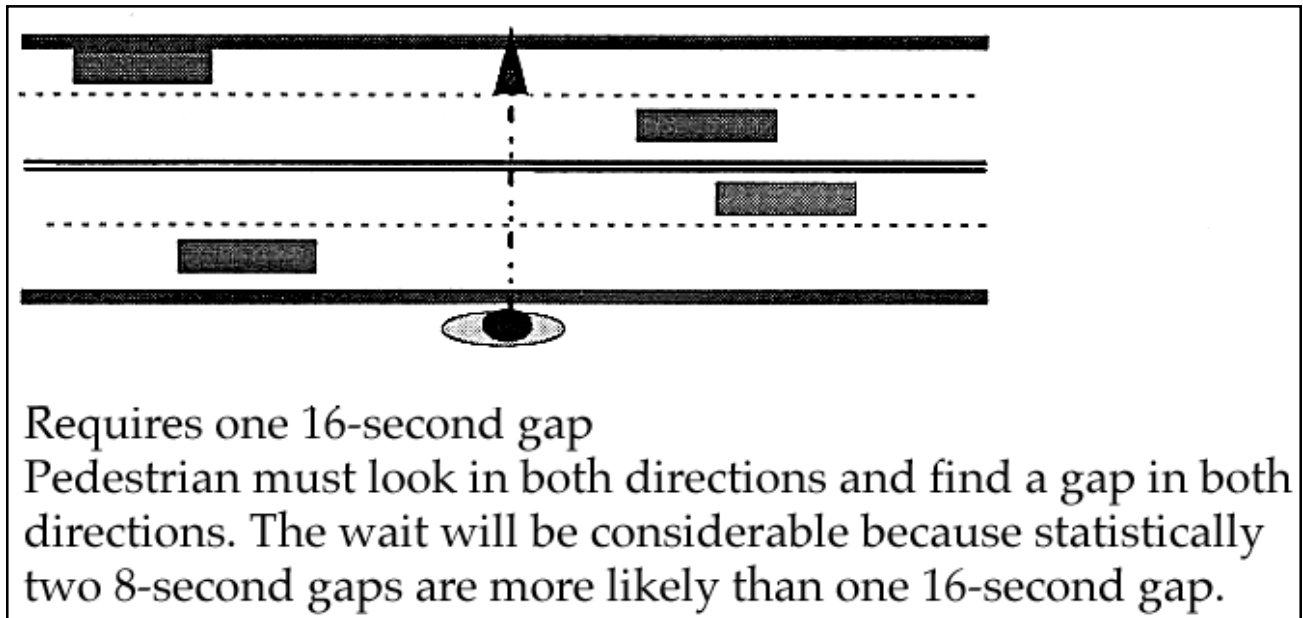
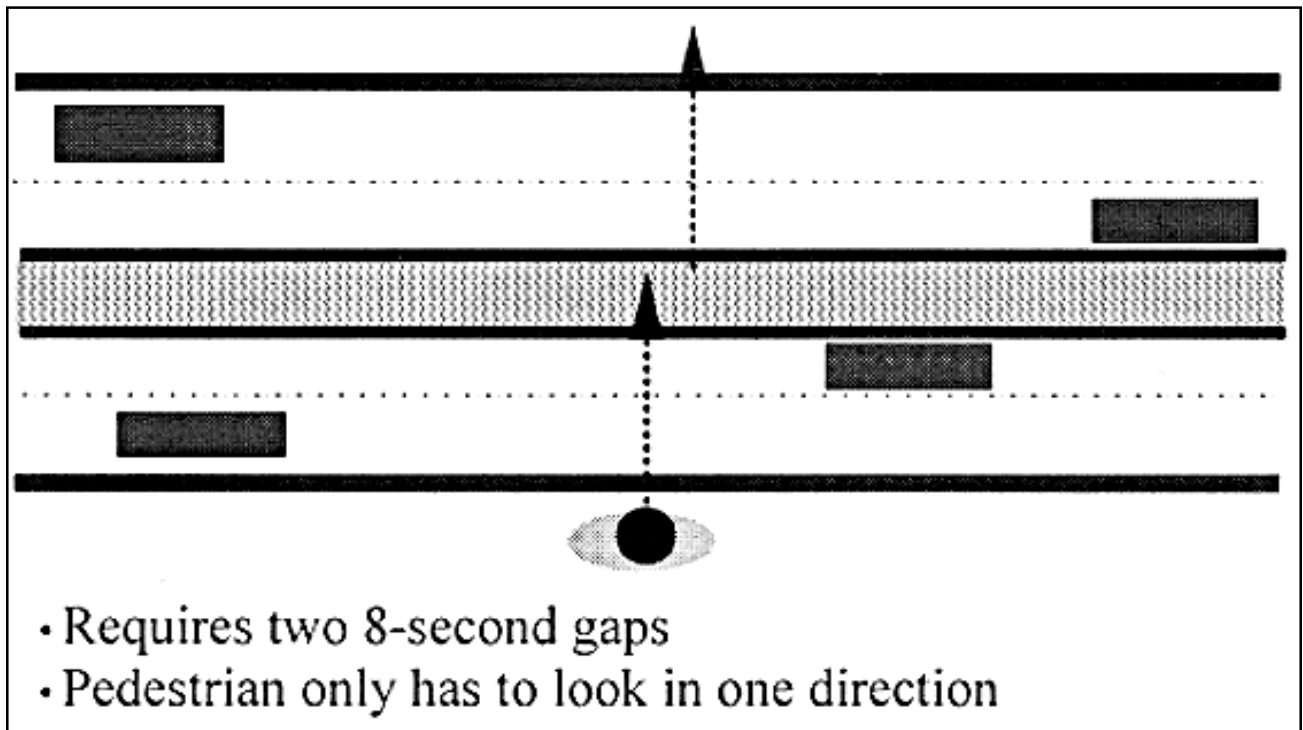


Figure 12-2. Midblock crossing with median — the pedestrian needs to look in only one direction at a time.



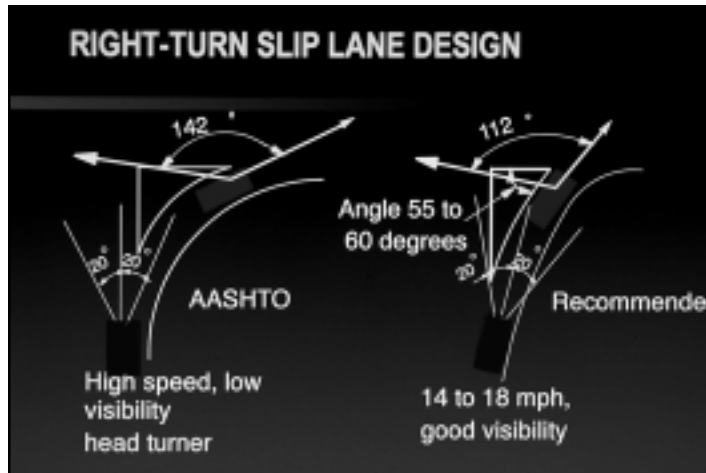


Figure 12-3. AASHTO's standards for right-turn slip lanes (left) encourage high motor vehicle speeds and provide low visibility. By comparison, FDOT's recommended standards encourage low motor vehicle speeds and provide good visibility.

associated with sweeping of accumulated debris, repainting of lines, replacement of raised pavement markers, and the resurfacing of the lane. The raised median requires infrequent cutting of grass, and occasional litter cleanup. If the median is dedicated by agreement or permit to the community for landscaping, then the costs to the state highway department drop to near zero. (See the FDOT Landscape Guide.)

Design Considerations

Ideally, a median should be at least 2.4 m (8.0 ft) wide to allow the pedestrian to wait comfortably in the center 1.2 m (4 ft) from moving traffic. If this cannot be achieved, a width of 1.8 m, 1.2 m, or even 0.6 m (6, 4 or even 2 ft) is better than nothing. To find needed width, especially in a downtown or other commercial environment, consider narrowing travel lanes to an appropriate width. In most locations this reduction in travel lanes can only be made to 3.4 m (11 ft), but in many other locations, where speeds are in the 32-48 km/h (20-30 mph) range the reduction to 3.1 m (10 ft) or even 2.7 m (9 ft) is possible, and may be desirable.

Medians typically have an open flat cut, and do not ramp up and down due to the

short width. If the island is sufficiently large, then ADA approved ramps (1:12 grade) should be used. It is best to provide a slight grade (2% or less) to permit water and silt to drain from the area.

Channelized Islands

When right-turning car or truck volumes are high, the designer often dedicates a special turning lane to this need. A special raised channelized island can benefit the motorist, adds to the capacity of the roadway, and benefits the pedestrian.

Although there is some controversy about the benefits to pedestrians, a properly designed slip lane clearly improves pedestrian crossings. It does so by separating conflicts in time and space. The pedestrian fully clears the right turning threat by picking a gap and going to the island. In most cases, it is safer to let the pedestrian pick a gap than it is to have him count on a right-turning motorist to stop at a red light. If there is another island on the far side of the leg, the pedestrian now only has the left-turning motorist and through motorist to contend with, and both are partially controlled by signalization.

To be useful to the pedestrian, the channelized island must be large enough to store the number of pedestrians that would normally be there during peak periods. This could be as little as 7.0 square meters (75 square feet), which is the minimum space permitted by AASHTO for a raised island. More typically, the channelized island would have 9.3 to 27.9 square meters (100 to 300 square feet).

The island must be designed to slow the motorist on approach, and to set up a proper viewing angle for gap selection at the intersection. This angle has been found to be 55-60 degrees. When properly designed at this angle, the tail of the channelized island (slip lane) will face the approaching motorist (see Figure 12-3).

Midblock Crossings by Roadway Classification

Midblock crossings are located and placed according to a number of factors including roadway width, traffic volume, traffic speed and type, desire lines for pedestrian movement, and adjacent land use. Guidance for median placement on various types of roadways appears below.

Local Roads

Due to their low traffic speed and volume, local roadways rarely have median treatments. Some exceptions may apply, especially around schools, hospitals, where traffic calming is desired and in other unique locations.

Collector Roads

Two-lane collector roads occasionally have medians or refuge islands. Rockville, Maryland, uses refuge islands to channel pedestrians to preferred crossing locations. Used in a series, these refuge islands have a strong visual presence, and act as significant devices to slow motorist travel through the corridor. A 16 km/h (10 mph) speed

reduction (from 64 km/h to 48 km/h [40 mph to 30 mph]) has been achieved. Pedestrians crossing at these midblock refuge islands with marked crosswalks (who also make their intent to cross known) achieve a nearly 100% favorable response from motorists.

When collector roads are widened to 4 lanes (not recommended), raised medians may be essential. A boulevard style street with tree canopies is recommended. This canopy effect helps reduce travel speeds.

Multilane Arterial Highways with Four Lanes

Suburban crossings of four-lane roadways are greatly improved when medians and midblock crossings are used (see Figure 12-4.) On lower volume roadways it is best to not use signalization.

Signalization may be helpful or even essential under the following conditions:

- ◆ On higher volume roadways,
- ◆ Where gaps are infrequent,
- ◆ In a school zone,
- ◆ Where elderly or disabled pedestrians cross,



Figure 12-4. A raised median provides pedestrians a place to wait safely and to cross one direction of traffic at a time.

Midblock Crossings

Figure 12-5. At times it may be necessary to block midblock access to pedestrians, such as on this busy section of U.S. Route 1 through Miami. These shrubs below the palm trees are dense enough to divert pedestrians to adjacent intersections.



- ◆ Where speeds are high, or
- ◆ When a number of other factors are present.

Daytona Shores, Florida, requested and had the Florida Department of Transportation install a half dozen refuge islands along the popular coastal U.S. Route 1. Pedestrian crossings before the installation were entirely random. These installed refuge island crossings were left unsignalized. During the first month there was very little movement of pedestrians to the island. However, starting in the second and subsequent months pedestrians began and continued to make their crossings at the islands, especially when traffic volumes were high and gaps were few. Most pedestrians learned that by using the refuge islands they did not have to run to make it across the street.

Multilane Arterial Highways with Six or More Lanes

Designers attempting to achieve high capacity with the creation of six-lane high speed urban roadways create nearly absolute barriers to pedestrians and bicyclists.

Crossing times of 15, 20, or more seconds may be very risky or impossible. When these conditions are reached, medians, signalization or grade separated crossings may be needed. With three or more lanes, merging is occurring, lane changing increases, and there is a greater tendency for motorists to speed and slow. This creates highly complex conditions for the pedestrian to predict.

At intersections where vehicle speeds are high, signalization may be the only practical means of helping pedestrians to cross unless it is part of a signal coordination scheme. At high speeds, and with infrequent signal calls, high numbers of rear end crashes can be anticipated. It is best not to allow urban area roadways to achieve high corridor speeds. This is especially true in areas where land use supports higher densities. The higher the speed the greater the engineering challenge to cross pedestrians safely.

If a pedestrian crossing is needed, the designer must increase the devices used to alert the motorist to the potential stopped condition. The standard pedestrian crossing and advanced crossing symbol with .9 by .9

m (36 x 36 inch signs) is an absolute minimum for speeds of 64 km/h (40 mph) or greater. Pavement word symbols can be used as further enhancement. An enhanced crosswalk marking such as a zebra or ladder style crossing should be considered. Large overhead signs, flashing beacons, bulbouts, and even flashing overhead signs have been successfully used in some locations.

Midblock Crossing Design

The design of midblock crossings makes use of similar warrants to standard intersections. Stopping sight distances, effects of grade, cross slope, need for lighting, and other factors all apply. The design considerations for medians are covered earlier in this chapter. However, there are a number of added handbook that must be followed.

Connect Desire Lines

All other factors considered, pedestrians and bicyclists have a strong desire to continue their intended path of travel. Look for natural patterns. A parking lot on one side connecting a large office complex on another virtually paints the desired crossing

location. Use of a high angle video time lapse camera to map pedestrian crossings quickly paints this location, if it is not already well known.

Vertical Height — Curbing and Landscaping

Curbing should be a non-mountable design. The planting of low shrubs and high canopy trees is highly desirable. A 2.4 m (8 ft) median is wide enough to allow the planting of non-frangible trees 1.2 m (4 ft) on either side. Make certain that landscaping allows adequate stopping sight distances, and allows the standing pedestrian to be easily detected from all approaches. Motorists often react favorably to the presence of a well landscaped area, often reducing their driving speed. Thus the use of trees, shrubs and colorful native plants and other landscaping is a positive feature.

Lighting

Motorists need to see pedestrians standing waiting to cross and those that are crossing. Either direct or backlit lighting is effective. Some overhead signs, such as in Portland, Oregon and Seattle, Washington, use overhead lights that identify the pedestrian crossing and also shine down on the actual crosswalk.



Figure 12-6. At this midblock crossing in Venice, Florida, the motorist and pedestrian can see one another.

Grade Separated Crossings Midblock or intersection grade separated crossings are effective in a few isolated locations. However, due to their cost and their potential for low use, engineering studies should be conducted by experienced designers. If given a choice, on most roadways, pedestrians generally prefer to cross at grade. Chapter 20 of this document covers grade-separated crossings.

Midblock Signals

The placement of midblock signals is called for in some locations. The warrants provided in the *Manual On Uniform Traffic Control Devices* (MUTCD) should be followed. But even more caution needs to be provided for signalized midblock locations. Pedestrians feel frustrated if a signal is holding them back from crossing when there is an ample gap. Many will choose to cross away from the crossing, while others will dutifully push the activator button, not get an immediate response, and cross when there is a sufficient gap. A few seconds later, the approaching motorists must stop at a red signal for no reason which can encourage motorist disrespect for the signal in the future.

Thus, the best signal setup for a midblock crossing is a hot (nearly immediate) response. As soon as the pedestrian call actuator button is pushed, the clearance interval should be activated. This minimal wait time is a strong inducement for pedestrians to walk out of their way to use the crossing. Hot responses can often be used if the nearby signals are not on progression, or if there are no other signals in the area. Even if the nearby signals are on progression, a hot response may be permitted in off-peak hours. Midblock signals should be part of a coordinated system to reduce the likelihood of rear-end crashes and double-cycled, i.e., pedestrian cycles per one vehicle cycle at intersections to reduce pedestrian delay.²

If a midblock signal system is used it is important to place a pedestrian push button in the median. There will be times when some pedestrians start too late, or when older pedestrians lack time, even at 0.9 m (3.0 ft) per second to cross. In these rare events the pedestrian needs to reactivate the signals.

The Placement and Design of Driveways

The frequency, design and placement of driveways have more impact on pedestrians than has been assumed. If the driveway crossing is overly wide, if driveways are frequent, or if the entry and exit speeds are high, the pedestrian faces substantial discomfort and risk. Every driveway creates potential conflicts. Reducing the number of driveways reduces the number of conflict points. As a general policy, suburban roadway driveways should not be permitted within 34 m (110 feet) on the approach to a signalized intersection, nor within 70 m (230 feet) on the departure side. This principle also applies to side streets. If there is a dedicated right turn lane, driveways should be outside of this lane as well. The ADA requires a 36 inch flat space on top of all driveways. Where sidewalks are built at the back of curb, this may require that a bulbed out section be added to the top of each driveway.

Driveway entry and departure radii are calculated by a combination of factors including the width of the receiving driveway, the design vehicle and desired turning speed. Motorists should have very low turning speeds across most driveways. A highly restrictive radius of 3.1 m (10 feet) may be necessary where pedestrian volumes are high and where the motorist is out of the main stream of traffic, or on lower class roads. There will be many rural section driveways where a 7.6 m (25 foot) radius applies.

At least four levels of driveway openings may be considered. Residential entries minimize pedestrian impact by using a 3.7 m (12 foot) driveway. For small commercial driveways, a 7.3 m (24 foot) opening is often the minimum needed. For large retailers and gas stations where large WB-15 trucks enter, it is necessary to apply a 9.2 m (30 foot) width. For malls and other large volume driveways, limit the opening that a pedestrian must cross to 11.0 m (36 feet). If more lanes are needed, use a median to separate directionality and break the pedestrian crossing distance back to 11.0 m (36 feet) or less.

Left turns into driveways can be dangerous to pedestrians. An important tool in access management on many multilane highways is a right-in, right-out driveway. This design requires a raised channelized island. To provide for the pedestrian, use a full cut allowing the pedestrian to cross and store in this space, separating conflicts in time and space.

Urban driveways are infrequent, especially where pedestrian-oriented design is used. However, in some downtown locations, parking garages, open parking lots, and other exceptions exist. In these cases, openings should be narrow and highly restricted for low-speed entry (8-13 km/h (5-8 mph) maximum). It is preferable to have garage driveway openings on side streets where these crossing conflicts affect fewer pedestrians. It is also best to have most parking on the perimeter of a downtown. In this way, traffic into the center of town is minimized, and priority is given to the pedestrian. Once again the strategies of using right-in right-out only driveways may be a “best” design.

Parking and Safe Access to Buildings and Schools

Standards are needed for separating pedestrians and vehicles to all common destinations. These include schools, public and commercial buildings, commerce in or near neighborhoods, tourist or entertainment districts, and other locations. This chapter is adapted from pages II-11 through II-16 of the *Florida Pedestrian Safety Plan*. It recommends policies, practices, and specific treatments to address pedestrian needs in parking lots, drop-off areas, tourist areas, and entertainment districts.

Discussion

Florida commerce is aided greatly by achieving a friendly environment for walking in tourist and entertainment districts. Every effort must be made to give the highest possible priority to walking, anticipating that tourists will prefer to park their cars and travel on foot to the many commercial eateries and attractions (Figure 13-1). Likewise, efforts should be taken to discourage vehicle use.

As with pedestrian access from off-site, parking lot design should address pedestrian needs equally with vehicular needs. Proper

facility design can, to some extent, control pedestrian movement and reduce conflict areas (Figure 13-2).

Pedestrians should be provided separate facilities and encouraged to use them. Directness is often a major influence in a pedestrian's choice of route. Therefore, separated walkways should provide as straight a route from a parked vehicle to the destination as does the roadway.

Not enough consideration has been given to providing for pedestrian needs in parking lots.

Not enough consideration has been given to providing for pedestrian needs in parking lots. Although the convenience of car drivers may be the site developer's primary concern, numerous conflicts are created for the guest/customer through the layout of parking and interior circulation.

In most cases, pedestrians must trek through lengthy parking lots. Many lots create such an unwalkable atmosphere that many drivers illegally park at front entrances or drive up and down aisles to get



Figure 13-1. Pedestrians need safe and attractive entrances with walkways that do not conflict with vehicle traffic.

to the nearest available space. Lots traditionally fail to take into consideration the vast expanse of inhospitable space created for those walking in from the street. Numerous landscaping obstacles are created, blocking reasonable access by pedestrians and creating sight restrictions. Many lots encourage high speeds and allow for two-way traffic circulation in unwarranted areas. In other lots, the spaces are arranged in a “herring bone” design, which inconveniences pedestrians (Figure 13-3).

Site Planning

Whenever practical, buildings should be sited near the roadway. The creation of unwalkable stretches of commercial parking lot strip development greatly increases the numbers of citizens finding trips outside of the car to be inconvenient and unsafe. Placing motor vehicle parking behind or alongside a building can reduce pedestrian/motor vehicle conflicts, and encourage walking. Unfortunately, many communities have zoning requirements that will not allow this type of development. If these zoning requirements cannot be changed, then separate pedestrian facilities should be constructed from off site to the building’s entrance. Pedestrians should not be forced to share road pavement with vehicles, except in crosswalks.

Site developers should always consider the walking task. Meandering walks may look good but are not an efficient way of getting people from one place to another. Points of origin and destination need to be established and a direct walkway built between them. If a walkway does not provide the most convenient route, it will not be used often (Figure 13-4).

Figure 13-2. Pedestrian oriented designs such as this one minimize pedestrian conflicts with autos, creating a safe area to shop and relax.



Planning also should consider future adjacent development and should provide for pedestrian traffic. Developers should set aside funds for future walkway construction as it may not be possible to predict accurately the route pedestrians will take between sites. When the adjacent site is completed, allow adequate time for paths to develop, then construct walks. See chapter 4 in TRB Report 294A for more details in this regard.¹

Recommendations

Parking Lots and Drop-Off Zones for School and Community Areas

1. To eliminate conflicts, provide traffic circulation that fully separates drop-off traffic from pedestrians. Traffic circulation should also minimize conflicts with pedestrians. Whenever practical, traffic circulation should provide a traffic-free pedestrian approach in the most common pedestrian arrival directions.

2. Far side bus stops have proven to reduce multiple-threat pedestrian crashes. However, near side bus stops are sometimes needed when a transit route turns, at crossings of some one-way streets, where it will prevent pedestrians from crossing a busy street, or when there is not a good far-side stopping location. Some transit agencies use a combination of near side and far-side stops at major intersections when there is heavy transfer traffic between two routes. However, a near side bus stop should be avoided in advance of an unsignalized marked crosswalk.

Midblock bus stops are sometimes located on long blocks when there is a midblock pedestrian generator such as a church, shopping center, or stadium. These types of bus stops may require a longer bus stop if the operator has to maneuver between parked vehicles.

All bus stops must be accessible to pedestrians in wheelchairs, and should be marked by a sign at or near where the door



Figure 13-3. This “herring bone” parking lot design is impractical for pedestrians to navigate.

of the bus is expected to stop. Bus stop signs, benches, or shelters and other street furniture should not obstruct access along the sidewalk or block access to the bus, and should be located far enough from the curb so they will not be hit by overhanging mirrors.

3. Control parking lot interior circulation, and provide sidewalk median access to parking.

4. Reduce pedestrian/automobile conflict points in all parking lot traffic circulation (Figure 13-5).

5. Reduce or eliminate driveway access on pedestrian emphasis streets, or minimize driveways by using a shared-use driveway (Figure 13-6).

6. Prohibit unsignalized left turns from roads into and out of all driveways at public schools, public buildings and large commercial buildings.

7. Plan parking garages with side or rear street entrances.

8. Provide separate access to garages for pedestrians.

9. Where pedestrian volumes are high, use raised pedestrian crossings, and illuminate the crossings.



Figure 13-4. If a walkway does not provide the most direct route, it will not be used often.



Figure 13-5. This effective treatment allows pedestrians safe, convenient access to this building from the sidewalk even while traversing a parking lot.

10. To the maximum extent practical, create one-way traffic flow to minimize pedestrian conflicts with vehicles.

11. Including the following treatments can promote the use of separated facilities:

- ◆ Walkway coverings (to protect walkers from the elements)
- ◆ Additional lighting of walkways (to increase individuals' sense of security)
- ◆ Landscaping which does not impede pedestrian mobility or create sight restrictions (may also provide shade and protection from the elements)
- ◆ Shopping cart storage locations
- ◆ Raised walkways (eliminates "puddle jumping" during wet weather)
- ◆ Drainage system design (channeling rain water into the roadway discourages the roadway's use by pedestrians during wet weather)

12. The desirable walkway width is 1.5 m (5 ft) of usable walking space. When walkways are constructed between rows of parking stalls, the facility should be at least 3.4 m (11.2 ft) in width to allow 0.8 m (2.6 ft) of automobile overhang with 1.5 m (5 ft) of walking space.

13. Bulbouts should be provided at all pedestrian/vehicle facility intersections to shorten the distance a walker must cross (Figure 13-7).

14. Crosswalks should be well marked to alert motorists and pedestrians (Figure 13-8). Heavily used crosswalks should be raised to slow vehicular traffic.

15. All facilities must be handicap accessible, not only to provide for the needs of handicapped people, but to allow shopping carts to be pushed easily on the walkways.

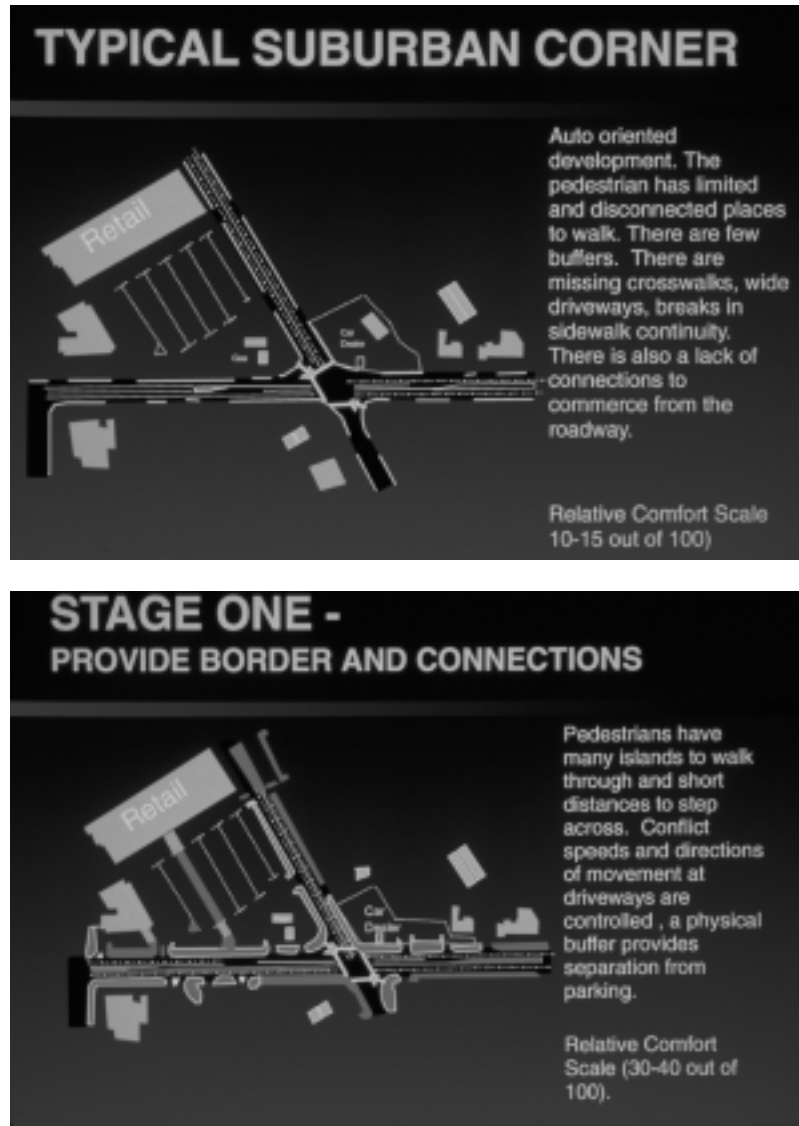


Figure 13-6. Unrestricted driveway access creates eight potential conflict points at every driveway (left). A raised median and consolidating driveways reduce conflict points (below left).

Simplify and Calm Motor Vehicle Movement to Promote Pedestrian Safety in Parking Lots

Motor vehicle facilities also should be designed to promote pedestrian safety. Traffic calming methods should be used throughout a lot's design. Vehicular circulation planning should:

- ◆ Encourage the use of perimeter roads by vehicles. All perimeter roads should promote pedestrian traffic from off-site by providing conspicuous crosswalks in convenient locations.
- ◆ Place roads away from buildings because

of the high concentration of pedestrian traffic. (Emergency vehicles must have access to the area adjacent to a building).

- ◆ Arrange parking aisles to work in pairs (one-way streets shaped to form a "U"), when near buildings, or other destinations.
- ◆ Create one-way parking aisles to allow for simpler crossing by pedestrians. One-way use of aisles may need to be encouraged with signage or other means.
- ◆ Place parking spaces at an angle. Angled parking provides a greater chance for motorists and pedestrians to see each other.



Figure 13-7. Bulbouts (or corner flares) shorten pedestrian crossings distances and slow traffic speeds.

In High Concentration Tourist Zones

Tourist or entertainment zones should be as free of motor vehicle traffic as practical. Planning and design incentives should favor a walking environment over a driving environment. Traffic should circulate around, not through, popular tourist or entertainment zones.

1. Consider auto-free zones. Otherwise, minimize commercial business vehicle access, use one-way pairs, and use strategies to prevent motorist “cruising.” Keep vehicle speeds to the absolute minimum. Provide sufficient garages to encourage parking and walking.

2. Fully illuminate all roadways and intersections. Provide frontal approach illumination of pedestrians at all crosswalks.

3. Provide illuminated overhead signs on all midblock crossings. Use traffic signal heads where warranted. Also provide minimum width crossings by using bulbouts and other strategies at all midblock crossings.

4. Provide appropriate width sidewalks. Eliminate driving lanes to favor pedestrian circulation and movements.

5. Allow for increased walking activity, standing, bus waiting zones and window shopping. Recess street furniture to create

obstacle free pedestrian zones.

6. Provide maps and information signing. Maximize the use of international symbols. Provide sidewalk imbedded maps or waist level maps. Provide color/symbol coded walking trails (Figure 13-9).

7. Provide traffic calming strategies such as side street closures for parking and pocket parks. Set the maximum speed to 40 km/h (25 mph) and highly enforce it. Provide special crossings such as raised crossings, zebra crossings, Barnes Dance, or bulbouts.

8. Eliminate or greatly reduce vehicle turning movements. If auto-free zones are not practical during work days, consider designing auto-free zones for evening and special event times.

9. Reduce turning speeds to 24 km/h (15 mph) or lower through design of intersections and driveways.

10. Eliminate left turns where practicable.

11. Evaluate Right-Turn-On-Red (RTOR).

In Entertainment Districts

Many people walking or driving in entertainment districts at night are under the influence of alcohol. These motorists and pedestrians commonly exhibit unpredictable behavior and may be unable to react in time to avoid collisions. As many as 47 percent of pedestrians killed in Florida were impaired by alcohol or drugs (Figure 4-13). To increase pedestrian safety:

1. Eliminate far-side parking for all taverns.

2. Encourage zoning that creates entertainment districts accessible by side streets. Consider auto free zones where “bar hopping” is frequent. Where taverns are permitted on both sides of a main roadway, consider reducing traffic speeds to 32 km/h (20 mph), and illuminate streets fully. Provide pedestrian refuges.



Figure 13-8. Enhanced pedestrian crossings assist the designer where pedestrian traffic and movements are dominant or preferred.

References

1. Planning and Implementing Pedestrian Facilities in Suburban and Developing Rural Areas. TRB Report 294A, Transportation Research Board, Washington, DC.

Figure 13-9. Informational signs and maps help tourists immensely in some situations.



School Access and School Zone Practices

Traffic control in school areas is a highly sensitive subject. If all the demands of parents and others were met, there would be many more police, adult crossing guards, traffic signals, flashers, signs, and crosswalks. However, past experience has shown that school crossing controls requested by parents, teachers and others are often unnecessary, costly, and tend to lessen the respect for traffic controls that are warranted. Safe and efficient traffic control can best be obtained through uniform application of realistic policies, practices and standards developed through engineering studies.

Pedestrian safety depends in large part on public education and an understanding of accepted methods for efficient traffic control. Nonuniform procedures and devices cause confusion among pedestrians and vehicle operators, and can contribute to crashes. In order to achieve uniformity of traffic control near schools, comparable traffic situations must be treated in the same manner. Each traffic control device and control method must fulfill a specific function related to specific traffic conditions. Pedestrians under the age of 15 experience a collision involvement rate twice that of all pedestrians. The youngest

students of five to eight years in age are particularly overinvolved in pedestrian accidents. They cannot be treated as short adults. Young children are not able to judge the speed of approaching vehicles, nor the adequacy of gaps in traffic, and their peripheral vision is not well developed. Young children are also often inattentive and careless in crossing streets. Despite this, the trip a child walks to and from school, in general, is a safer one in relation to other pedestrian activities of children.

Pedestrians under the age of 15 experience a risk of pedestrian collisions twice that of all pedestrians.

School Safety Program

School area traffic safety requires a partnership between traffic engineers, school officials, parents and students. The lack of commitment by any one of the partners will seriously diminish the safety program.

A school area traffic safety program consists of two parts: The physical facilities



Figure 14-1. Properly designed facilities in school zones are necessary to create a safe environment for children.

and the operation plan. Sidewalks and walkways separate school children from the flow of vehicular traffic, and along with fencing, driveway and school location, are a key part of the physical facilities for walking school children. The operation plan consists of the traffic control devices and the supervisory/control elements for the school walking trip.

The selection of the appropriate school zone traffic control is dependent upon the traffic characteristics, school location, the number of students crossing, and the ages of the students. In general, the most effective school zone traffic control includes well-trained adult crossing guards. On-site school

safety near bus loading areas, driveways, and parent loading zones often require adult supervision, generally by teachers or teacher aides.

School Location and On-Site Safety

Site selection and school layout are some of the most important factors in obtaining safe traffic conditions near schools. Donated land or land presently owned by the school district may not always be the best site for a school. Sites should be of sufficient size to accommodate the school buildings, playgrounds and athletic areas, bicycle and motor vehicle parking areas, bus loading areas and parent pickup zones.

The school site must be readily accessible from the street network to avoid traffic congestion that may put pedestrians at risk. In addition, schools must be accessible to students in wheelchairs. It may also be advisable to provide separate bikeways and sidewalks at schools or wider sidewalks to accommodate the many users adjacent to schools.

School sites should have separate parking areas for teachers, students and visitors. Bus loading areas should always be separated from all other vehicle traffic. Driveways should be located to minimize crossings by students, and students should never be required to cross parking areas.

Elementary schools and middle schools should be located inside residential neighborhoods, close to the students that the school is serving. The need to cross major streets on foot should be minimized. Elementary schools should not be located on high speed major streets. It may be best for school districts to change school boundaries or institute busing rather than exposing young children to crossings of wide arterial streets with high volumes or high speed traffic.

Sites for high schools are generally larger, require substantially more on-site parking areas, and are generally located on collector streets or major arterials. Driveway and school crossing locations should be coordinated with local traffic engineers to optimize existing traffic control and provide optimal spacing for future traffic signals.

Parking shall be restricted at driveways and in advance of all school crossing areas. Such parking restrictions protect school children by maximizing their visibility to motorists.

Fencing or other pedestrian barriers should be used to control student crossings and direct students to optimal crossing locations that can be better supervised. Crossing and student loading areas adjacent to the school should be reviewed for street lighting, particularly where student activity occurs during the hours of darkness. Street lighting also helps reduce the incidence of vandalism at the school site.

School Operating Plan

Each school should establish a program which includes a safe walking trip to school, utilizing existing traffic controls to the extent practical, and work with local officials to identify areas requiring improvements in accordance with the ITE Recommended Practice School Trip Safety Program Handbook.¹ In addition, a supervision and control plan should be adopted by each school.

The six steps in developing a school program based upon the “School Trip Safety Program Handbook” are:²

1. Set up the school trip safety process.
2. Identify deficiencies in routes.
3. Develop route maps for safe routes to school.
4. Select route improvements and control measures.

5. Implement route improvements.
6. Evaluate routines periodically.

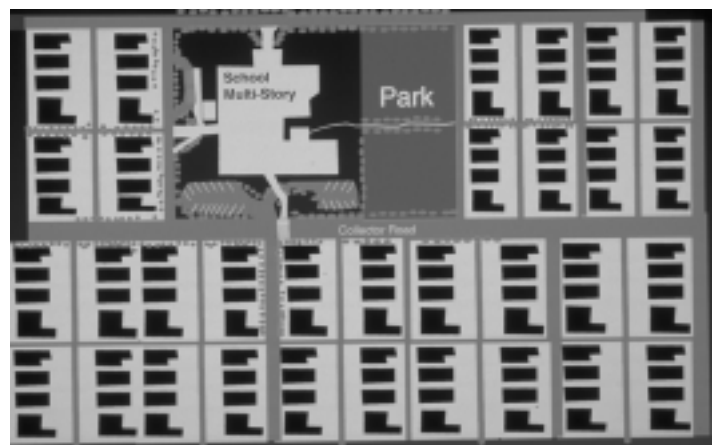
Traffic Controls in School Zones

Sidewalks and walkways should exist along all designated safe school routes. Crosswalk markings are helpful in designating and directing students along the safe school route. Traffic signals are sometimes needed to create adequate gaps in vehicular traffic at school crossings to allow children time to cross major streets safely. Speed tables with crossing markings on top can be placed at school crossings. Speed tables function much like speed humps (see Chapter 15) in that they slow down motorists. Signs should be placed ahead of the speed tables to alert drivers of their presence and that students may be crossing.

Factors such as sight distance, accident history, vehicle speeds, street width, age of students and other location and traffic characteristics should be considered in selecting the specific type of traffic control appropriate at each school crossing location.

According to the school crossing warrant, traffic signals are generally warranted at established school crossing locations when the number of gaps in the traffic stream during school crossing periods is less than the number of minutes

Figure 14-2. Example of school site layout.



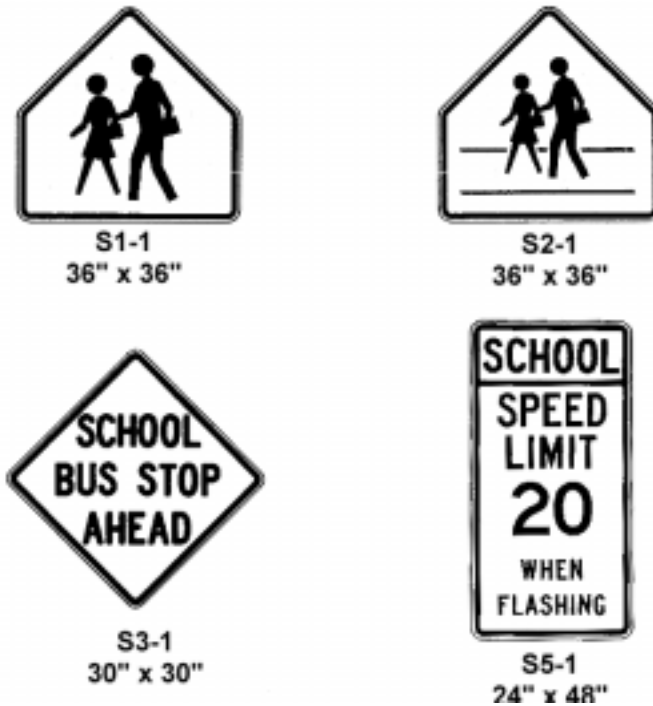


Figure 14-3. Warning signs used to alert motorists to schools and school crossings.

in that same period.³ Traffic signals should not be installed if there are only small numbers of students crossing; instead, an alternate crossing location or mode of transport should be considered. If installed under the School Crossing warrant, traffic signals should be coordinated with adjacent signals, and operate in an actuated mode to minimize traffic disruption. The signals should be equipped with pedestrian signal indications and pedestrian push buttons, and the designated crosswalks should be marked. School traffic signals may require adult crossing guards, particularly for younger students.

School Advance warning signs (S1-1) should be installed in advance of all school buildings and at major school crossings. The School Crossing sign (S2-1) is not well understood by motorists and is of limited value. When used, the S2-1 School Crossing sign shall be placed at the school crosswalk, and must be preceded by the S1-1 School Advance warning sign. The SCHOOL BUS STOP AHEAD sign (S3-1) is intended for use when a school bus that has stopped to

pick up or discharge riders is not visible for 150 m (500 feet) in advance because of limited sight distance. Reduced speed limits may be established in school zones. One type of school speed limit sign consists of a top panel with the legend SCHOOL, a speed limit sign, and a bottom panel with a legend such as WHEN CHILDREN ARE PRESENT. Alternatively, flashing beacons can be used in conjunction with the SCHOOL SPEED LIMIT XXX WHEN FLASHING sign (S5-1) to advise motorists to slow down in school zones when school children are expected. These signs are shown in Figure 14-3.

All decisions on the use of traffic control devices near schools should be coordinated with the school principal or district transportation director. The school principal should be contacted to coordinate any traffic control changes or construction activities near the school, even if not directly related to the school.

School Crossing Guards

Supervision of crossing school children should be carried out by adult crossing guards and may be supplemented by members of the school safety patrol (Figure 14-4). Control of vehicular traffic can only be exercised by police officers.

Adult guards should be considered when special problems exist which make it necessary to assist school children in crossing safely. The primary functions of crossing guards are:

- ◆ To instruct, direct and control students crossing the streets and highways at or near schools.
- ◆ To assist teachers and parents in the instruction of school children in safe crossing practices.

Crossing guards are appropriate for high school students under certain circumstances exist. However, many high school students resent being controlled by a crossing guard.

Most older students have driver's licenses and may be more likely to drive than to walk to school. Such student drivers may create a hazard for pedestrians.

Adult crossing guards should operate under the jurisdiction of the local school district, police department, or traffic engineering department. Crossing guards should normally be trained employees (instead of unpaid volunteers) for reliability and insurance purposes. The decision on where to place adult crossing guards should be made jointly by the school principal or transportation director and local traffic engineer.

In the absence of other handbook, the following criteria may be used to select appropriate locations for crossing guards:

- ◆ Uncontrolled marked crosswalks, where there is not a controlled crossing location within 180 m (600 ft), and
 - ◆ Urban Areas - 40 or more students cross a street where there are more than 350 vehicles per hour during each of two hour crossing periods, or Rural Areas - 30 or more students cross a street where there are more than 300 vehicles per hour during each of two hour crossing periods.
- ◆ When speed limit exceeds 60 km/h (40 mph), the rural criteria should be used.
 - ◆ Stop sign controlled intersections of collector or arterial streets where there are more than 500 vehicles per hour during any period when children are going to or from school, and there are high numbers of students crossing.
 - ◆ Traffic signals where there are high numbers of students crossing and high turning volumes or wide streets.

Above all else, engineering judgment should dictate when and where adult crossing guards are needed based on an engineering study.

It is recommended that crossing guards wear an easily recognized uniform. They are required to wear a fluorescent and reflective safety vest, use a stop paddle, and/or wear fluorescent gloves and use a whistle. In most parts of the U.S., school guards seldom wear uniforms identical to the police, and often a safety guard cap and reflective, bright orange vest worn over civilian clothes is all that is used as the uniform. Crossing guards should be provided with bright yellow or orange raincoats for use during wet weather conditions.



Figure 14-4. Crossing guards should not simply hold up a sign and let the children run across the street. Scenes such as this one prove the need for a crossing guard training program.

Crossing Guard Training

Florida has developed a standardized training course for crossing guards throughout the state to comply with section 234.302, Florida Statutes. The Statute requires all counties with 75,000 or more population to train and certify school crossing guards in accordance with handbook developed by the Florida Department of Transportation. The goal is for all school crossings to be conducted in the same manner and to eliminate confusion to motorists as well as students.

Two types of courses are available, trainers and guards. The 12-hour trainer's course covers the following:

- ◆ the Florida School Crossing Guard Training Guidelines;
- ◆ Florida/National Pedestrian/Bicycle Crash Statistics;
- ◆ crash causation;
- ◆ visibility and conspicuity;
- ◆ traffic control devices including the "WALK", flashing "DON'T WALK", and steady "DON'T WALK";
- ◆ purpose, goals and responsibilities of the school crossing guard;
- ◆ limitations of children in traffic;
- ◆ public image;
- ◆ uniforms;
- ◆ legal/risk management aspects of the job; and
- ◆ most importantly, the standardized procedures for conducting a school crossing

The standardized procedures address proper positioning of guards, alert signals to motorists and pedestrians, and proper entrance/exit into streets and highways. The procedure also includes reminding the children to look left-right-left and over their shoulder before entering the roadway even

when the guard says it is clear.

Once state certified as a trainer, the certified trainer will conduct school crossing guard training classes consisting of four hours of classroom training, two hours of in-the-field training, and two hours on-site observation at the guard's post. The guard will then be state certified. All guards must be retrained annually.

There is no fee for the course and training manual. However, there is a supplemental audiovisual kit containing a 15-minute training video, and a set of 80 slides.⁴ available for \$25. Kits can be obtained at the training sessions or by writing to the Florida Department of Transportation School Crossing Guard Program.

Crossing guards should also be provided with an identification card, a list of responsibilities, and a list of phone numbers in the event of an emergency or if other concerns arise with students or traffic conditions at their crossing.

School Safety Patrol

School safety patrols offer a way of extending traffic safety education beyond the classroom. Careful instruction and supervision of patrol members are essential if the patrol is to be efficient and helpful to other students.

If used, the school safety patrol should be organized and administered by each school, with the school principal responsible for determining the overall school safety patrol policy. Administrative responsibility for actual operation of the patrol may be delegated to an individual teacher. The school safety patrol members should be selected from the upper grade levels, preferably not below the fifth grade. Qualities such as leadership and reliability should be considered in selection, and patrol service should be voluntary and open to all who qualify. Patrol members should have written approval of parents or guardians.

References

1. School Trip Safety Program Handbook, Institute of Transportation Engineers, Washington, DC, 1981.
2. Manual on Uniform Traffic Control Devices for Streets and Highways, Report No. FHWA-SA-89-006, Federal Highway Administration, Washington, DC, 1988.
3. Florida School Crossing Guard Program: Training Manual, Florida DOT, State Safety Office, 605 Suwannee Street, MS 82, Tallahassee, FL, 32399-0450, September 1993.
4. Florida School Crossing Guard Training Handbook, Florida DOT Safety Office, August 1993.

Traffic Calming Strategies



15

Introduction

Local residential access streets are designed to carry low traffic volumes (less than 2,000 vehicles/day) at low speeds. As traffic volumes and speeds increase on a particular residential street, there is a significant decrease in the actual and perceived quality of life for the residents who live on that street because of safety, noise, and pollution. It has been found that volumes exceeding 2,000 vehicles/day are considered a problem by local residents.

Local efforts to improve the pedestrian environment on neighborhood streets should try to reduce the number of possible conflicts (and the potential for injury when the conflicts involve speeding traffic) between cars and other users (e.g., pedestrians and children on bikes). Neighborhood traffic control measures serve this purpose by reducing the speeds and/or volumes of motor vehicle traffic. An agency may find it necessary to rate the relative need of each location when allocating funds for popular traffic control measures. In cases where public funding is not available, neighborhoods may be willing to pay the cost of installing these measures themselves, as long as the proposed location is reasonable and otherwise fits the program criteria.

What Is Traffic Calming?

Traffic calming involves strategic physical changes to streets to reduce vehicle speeds and to decrease the cars' dominance. Traffic control devices are designed and located to keep through traffic on arterial roads. They do so by making the travel time on the residential streets and downtowns greater than the travel time on the adjacent arterial roads. Traffic calming also seeks to control the behavior of the remaining drivers. Many traffic calming devices can be retrofitted: speed humps, chicanes (devices that cause a driver to move left/right as they travel along the street), speed tables, and modern roundabouts. More extreme examples are street closures or restricted access.

Traffic control devices are designed and located to keep through traffic on arterial roads.

During the initial street design, other traffic calming treatments can be built into the street: narrower streets, street pavers instead of asphalt, and different street designs. Many traffic calming schemes have the following common aims:

Traffic Calming Strategies

Figure 15-1. These medians and bulbouts calm traffic on this revitalized main street.



- ◆ Improve safety for people, especially children, by controlling conflict points, reducing vehicle speeds and vehicle volumes.
- ◆ Improve the physical environment by lowering vehicle generated noise, pollution, and disruption.
- ◆ Create a green and inviting streetscape.
- ◆ Increase security by bringing back a higher number of pedestrians.

Most residents request traffic calming for a single street or block. However, traffic calming applied to one street usually affects a much larger area, either by restricting access to that area or by diverting traffic to nearby streets. It is best to treat an entire neighborhood with traffic calming strategies, and get the entire neighborhood involved in the decision-making process on the strategies to select. Other agencies, such as police, fire, sanitation and transit departments, need to be involved if access is affected, as well as the local school district if a diverter or street closure will affect school bus service.

In Europe and Australia, traffic calming techniques began in 1970. Their effectiveness has been proven and many now appear to be part of the original street

design rather than an afterthought. To reach this position, there was a strong desire to change the balance, to experiment, to learn from others, and to do the “right thing” for all people.

Traffic calming has not been extensively used in most part of the U.S. In Florida and other states, traffic calming offers promise as a means of managing motor vehicles. Traffic calming techniques need to be implemented and evaluated, and perhaps modified, to work in American settings.

Often, preliminary investigations will reveal if the problem is better treated by other programs. If there is poor sight distance at an intersection, clear the sight lines. A large number of crashes at a single intersection can be due to a wide range of items which would require a safety study.

Alternatively, residents unhappy with the streetscape identify trees and shrubs as part of a traffic calming scheme. Instead of landscaping, building a park so children do not have to play on the “unsafe” street may be more appropriate. Poor land zoning that creates traffic problems or truck traffic may be better treated by rezoning or by working with the company managers to reroute their trucks.

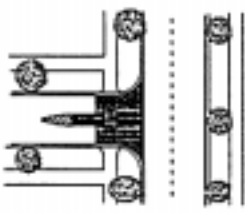
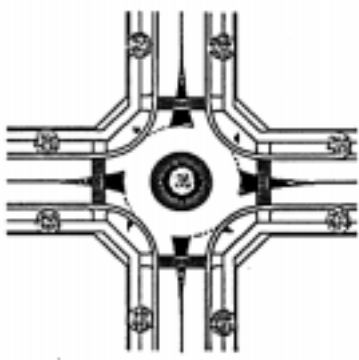
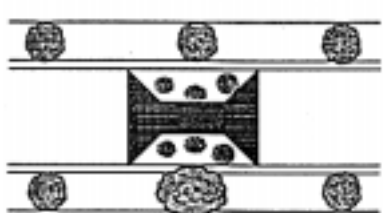
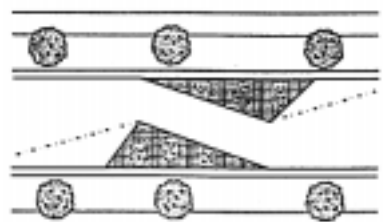
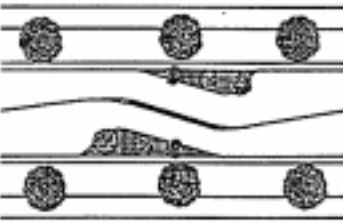
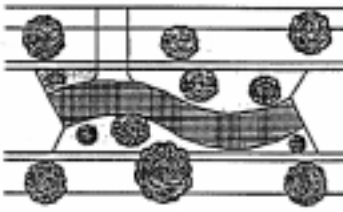
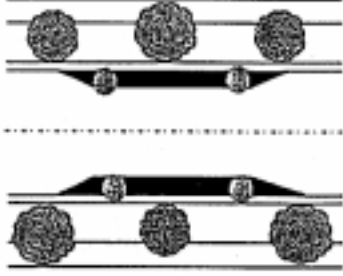
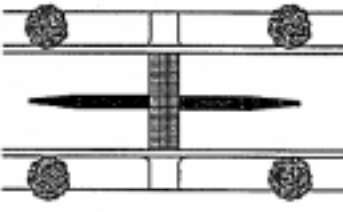
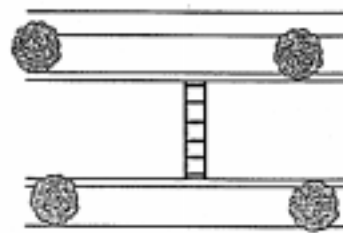
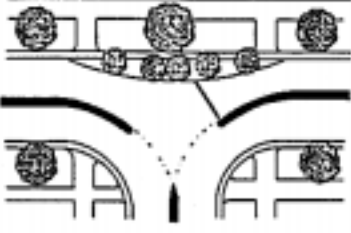
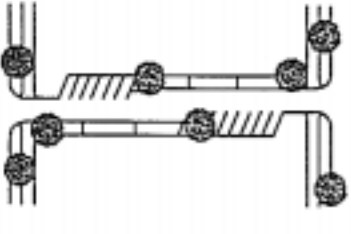
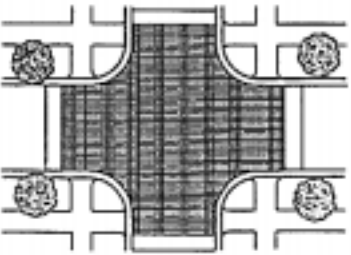
DEVICE	ADVANTAGES	DISADVANTAGES
 1. Gateway treatments	Positive indication of a change in environment from arterial road to a residential street. Reduces entry speeds. Reduces pedestrian crossing distance. On very wide streets provides space for landscaping in the median.	Low speed of turning vehicles may restrict arterial road flow.
 2. Roundabouts	Reduces crashes by 50 to 90 percent when compared to two-way, four-way stop signs and traffic signals by reducing the number of conflict points at intersections. Reduces vehicle speeds. Provides space for landscaping. Cheaper to maintain than traffic signals. Effective at multi-leg intersections. Provides equal access to intersections for all drivers. Provides a good environment for cyclists.	May be restrictive for larger vehicles if designed to too low a speed. Providing a mountable apron this limitation can be minimized. May require additional lighting. If left turns by large vehicles are to be accommodated then right-of-way may have to be purchased.
 3. Single-lane slow point	Reduces vehicle speed. More effective when used in a series. Imposes minimal inconvenience to local traffic. Pedestrians have a reduced crossing distance and so have a safer crossing. Provides space for landscaping. Provides a visual obstruction.	Landscaping needs to be controlled to ensure visibility is reduced. Contrary to driver expectation of unobstructed flow. Can be hazardous for drivers and cyclists if not designed and maintained properly. Confrontation between opposing drivers arriving simultaneously could create problems.
 4. Single-lane angled slow point	As for (3).	As for (3).

Figure 15-2. Traffic calming—advantages and disadvantages.

*Traffic Calming
Strategies*

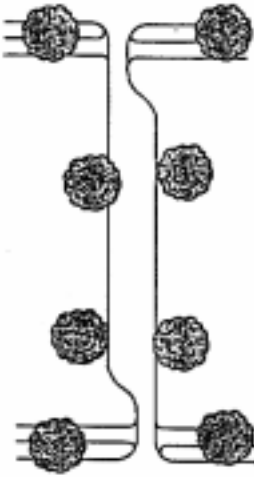
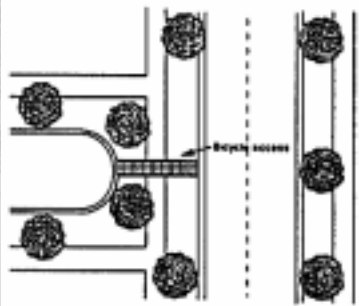
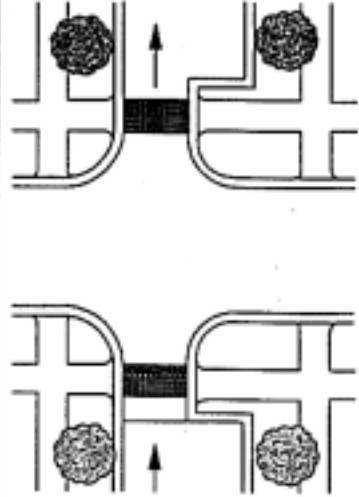
DEVICE	ADVANTAGES	DISADVANTAGES
 5. Two-lane angled slow point	As for (3), except that pedestrian safety is less than (3).	As for (3). It is less effective in controlling speeds because drivers can create a straighter through movement by driving over centerline.
 6. Driveway link	As for (3). Provides a greater visual obstruction. Provides a large area for landscaping. Length of device is limited by cost. A very effective method of changing the initial impression of the street. If done right drivers will not be able to see through. Appears as a road closure yet allows through movements.	Increases the area of landscaping to be maintained by residents. Cost is greater than many other devices. Therefore better to be installed in conjunction with street reconstruction.
 7. Two-lane slow point	Causes only minor inconvenience to drivers. Regulates parking and serves to protect parked vehicles as the bulb-outs can be installed in no-parking areas to stop illegal parking. Reduces pedestrian crossing areas. Provides space for landscaping.	Not very effective in slowing vehicles or diverting through traffic. Only partially effective as a visual obstruction.
 8. Mid-block median	Provides a refuge for pedestrians and cyclists. Can improve the streetscape if landscaped.	Will only create a limited reduction in vehicle speeds.
 9. Speed bump	Reduces vehicle speeds in the vicinity of the bump. Better if used in a series at 300 to 500 feet spacing.	Creates noise particularly if there are loose items in vehicles or trailers. If not well designed drivers will put two wheels in the gutter to reduce impact. A harsh cheap solution. There are more effective and nicer treatments.

Traffic calming — advantages and disadvantages.

DEVICE	ADVANTAGES	DISADVANTAGES
 10. Modified intersection	Reduces vehicle speeds. Reduces through traffic along the top of the Tee. Necessary to enforce changes in priority from one street to another.	Can be hazardous for vehicles and cause confusion regarding priority if incorrectly or inadequately designed.
 11. Diagonal road closure	Eliminates through traffic. Provides area for landscaping. Reduces conflicts. Increases pedestrian safety. Can include a bicycle pathway connection.	Will inconvenience residents in gaining access to their properties. May inhibit access by emergency vehicles unless the street names are changed. Will move through traffic to other streets if not back to the arterial.
 12. Shared zone	Provides a low speed shared environment that is safe for all users. Improves amenity without restricting access. Provides flexibility for on-street parking.	High cost unless part of original design.
 13. Intersection hump	Slows vehicles in the most critical area and so helps to make conflict avoidance easier. Highlights intersection.	Increases difficulty of making a turn.

Traffic calming — advantages and disadvantages.

*Traffic Calming
Strategies*

DEVICE	ADVANTAGES	DISADVANTAGES
 14. Modified street design	Reduces vehicle speeds without reducing access. Enhances amenity. Provides a large area for landscaping. Reduces the visual sight line.	High cost of retrofitting. Better as part of street reconstruction or initial construction.
 15. Street closure	Eliminates through traffic. Reduces the speed of the remaining vehicles. Improves safety for all other street users.	Reduces emergency vehicle access unless street is renamed. Reduces access to properties for residents.
 16. Partial street closure	Reduces through traffic in one direction and partially in the other. Allows two-way traffic in the remainder of the street.	Reduces access for residents. Emergency vehicles only partially affected as they have to drive around partial closure with some care.

Traffic calming — advantages and disadvantages.

Two basic approaches can be used to facilitate pedestrian movement, safety, and general livability in neighborhoods: 1) installing physical controls requiring vehicular diversion; and 2) managing traffic in place. The primary difference between the approaches is the extent to which conflicts between vehicles and pedestrians are separated.

Figure 15-2, which was prepared by Michael Wallwork of the Genesis Group in Jacksonville, lists the advantages and disadvantages of 16 traffic calming devices.¹ This chapter presents handbook for several, such as roundabouts, diagonal road closures or diverters, and modified street designs like chicanes.

Controls Involving Traffic Diversion

Neighborhood traffic control measures involving traffic diversion are geometric (physical) features that force or prohibit a specific action such as a turn or a through movement. Geometric features have the advantages of being largely self-enforcing and of creating a visual impression that a street is not intended for through traffic. Their disadvantages relative to other devices are their high cost, their negative impact on emergency and service vehicles, the loss of convenient access to some parts of a neighborhood, and a resulting increase in traffic on nearby streets. They are also static and must be appropriate at all hours of the day and night.

Street Closures

Street closures may be appropriate where large volumes of through traffic or turning vehicles create unsafe conditions in a residential area. They are generally installed with curbs forming street-ends or diagonals across intersections that eliminate through vehicular traffic. Bollards allow free access to pedestrians and bicyclists. They eliminate motor vehicle traffic, but can be removed for entry by emergency vehicles. Landscaping is often included with these

measures to serve as a visual cue to motorists, and as a visual enhancement for the neighborhood. Street closures may adversely affect access by emergency vehicles. They may turn out to be unpopular with residents where access is made more difficult. Thus, prior consultation with residents is necessary at early stages of planning and design to minimize opposition.

In a partial street closure, access to or from one end of a street is prohibited by a physical barrier and a no-entry sign. The street remains two-way but access from the closed end is permitted only for bicyclists and pedestrians.

Driveway links are narrowed roadway segments with textured or colored paving and ribbon curbs or landscaping to mark the edges. While not a true street closure, driveway links reduce through traffic because drivers cannot see through them and therefore perceive them as street closures. These cost more than many devices, though, and the landscaping must be maintained.

Cul-de-sacs

An intersection cul-de-sac is a complete closure of a street at an intersection, leaving the block open to local traffic at one end, but physically barring the other. Thus, a cul-de-sac represents the most extreme technique for deterring traffic short of barring all traffic from the street in question. A turnaround must be constructed at the closed end of the street of sufficient size to allow sanitation trucks and emergency vehicles to turn around. A cul-de-sac can be designed to allow emergency vehicles to pass through, by use of mountable curbs or removable barriers. These designs will generally allow other vehicles to pass through and constant enforcement may be required to prevent those other vehicles from passing through.

Since a cul-de-sac is completely effective at its task of preventing through traffic, the choice of where and whether or not to use it depends largely on other aspects of traffic movement. For example, a cul-de-sac is less desirable in the vicinity of fire, police, or

Traffic Calming Strategies

ambulance stations where emergency vehicle movements are frequent. It is also less desirable in areas where multi-alarm fires are more likely. The provision of other services that require large vehicles, such as school bus routing and sanitation pickup, needs to be considered when designing cul-de-sacs. A cul-de-sac is desirable adjacent to schools and parks, where the vacated street can be converted into additional play space.

Cul-de-sacs are extremely effective at limiting traffic volumes. They normally reduce traffic to that generated by the land uses that are adjacent to the street. Although a cul-de-sac is not a speed attenuating device, it may serve the purpose since the street comes to a dead end. However, cul-de-sacs will generally require additional right-of-way dedication on local streets and must be large enough to accommodate a sanitation truck or fire truck that needs to turn around. Cul-de-sacs limit access for residents as well as nonresidents and if overused, can have the effect of confining people in their neighborhoods.

A cul-de-sac placed within one block, rather than at one end, performs the same function as an intersection cul-de-sac.

Midblock cul-de-sacs are typically used when two different traffic-generating land-use types are adjacent to each other. An example of this is when a commercial area is backed by a residential area. The cul-de-sac is placed at the transition so that the commercial area is afforded the access, yet its traffic does not intrude into the residential area.

Diagonal Diverters

A diagonal diverter is a barrier placed diagonally across an intersection to convert the intersection into two unconnected streets, each making a sharp turn. The primary purpose of a diagonal diverter is the same as that of forced-turn channelization to break up the routes, making travel through a neighborhood more difficult, while not actually preventing it.

Studies of systems of diverters have shown that traffic on streets with diverters can be reduced from 20 to 70 percent depending on the system of devices in the area. In these studies, traffic on adjacent streets with no diverters increased by as much as 20 percent. These devices have little to no effect on speeding, other than in

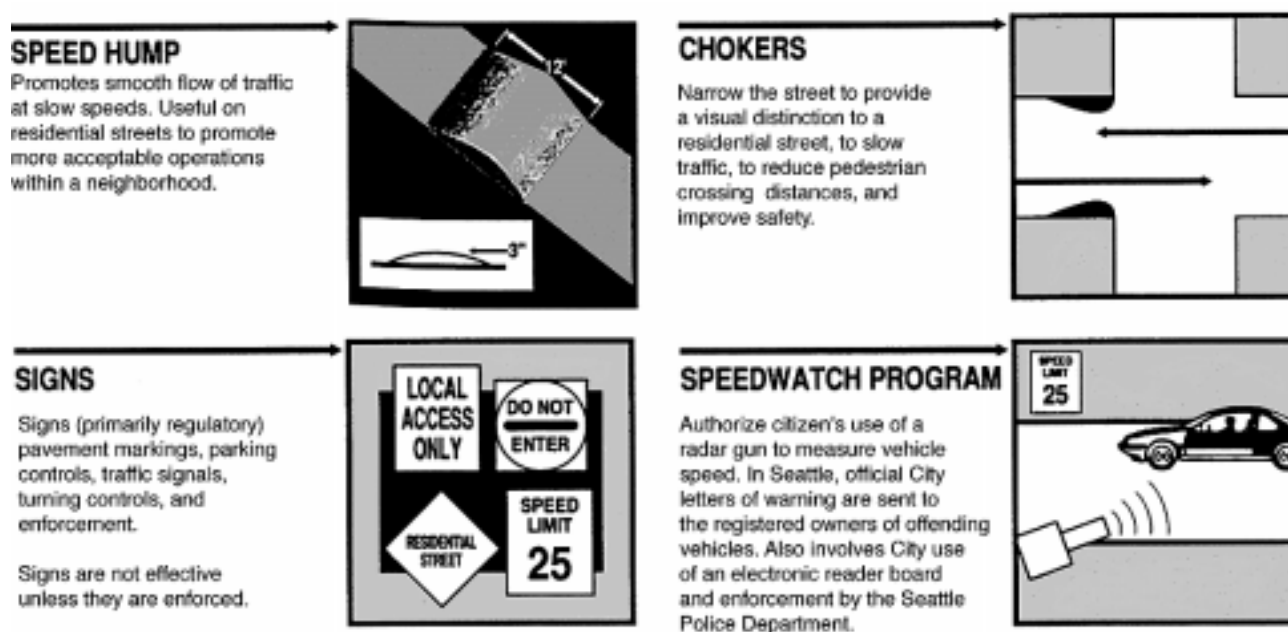


Figure 15-3 Traffic control measures used to manage traffic in place.

the immediate area of the diverter, and a minimal effect on traffic safety.

Diverter and cul-de-sacs should only be used in cases where a reasonable arterial or access street alternative is available and easily accessed. Otherwise, vehicular traffic will simply reroute to other residential streets and likely result in similar problems on those streets. Diverted traffic should be directed to the nearby arterial street, and signage should be used with diverters to discourage motorists from entering the neighborhood.

Public participation in determining use and location of diverters is essential to successfully address traffic concerns of a neighborhood. Residents should have a voice in the design and operation of the streets on which they live. Community, neighborhood, and political forces also need to be in favor of these controls before proceeding.

Careful thought needs to be given to circulation patterns resulting from diverters/closures. A trial installation is strongly recommended by use of barricades, barrels or guardrails. A trial period on the order of six to eighteen months gives ample time to collect data showing new traffic patterns and to evaluate community support again. In the event of permanent installation, small park features can be included in the diverter/closure area to further enhance pedestrian and neighborhood surroundings.

Managing Traffic in Place

When the nature of the street system, community sentiment, or the local political climate do not favor street closures or diverters, there are numerous effective measures to manage traffic in place and still provide improved pedestrian surroundings. Each of the measures to manage traffic in place can be used in areas where there is a desire to slow down traffic and reduce collisions or collision potential. While reducing speeds and collisions, these

measures normally have small effects on traffic volumes. Cost may be an important factor in finally deciding which measures to use; however, some can be installed inexpensively, using temporary installation schemes. Several of these measures are shown in Figure 15-4, and all of these measures have positive results for pedestrian use and activities on neighborhood streets.

Speed Limit Signs and Speed Zones

Speed limit signs are regulatory devices that are intended to inform the motorist of the speed limit of the roadway. Speed limit signs usually have no effect on traffic volumes and little if any effect on traffic speed, since drivers usually drive at what they perceive to be safe and reasonable under existing conditions. Studies in Europe have also shown that the use of speed limit signs without any physical barriers to traffic generally resulted in no change in driver speeds. Other traffic calming facilities generally must be installed in conjunction with reduced speed limit signing to obtain lower speeds.

Mini-Circles

Mini-circles are raised circular islands in the center of an intersection, which creates a one-way, circular flow of traffic within the intersection area. Mini-circles separate points of conflict and often slow speeds of vehicular traffic.² Mini-circles differ from roundabouts in that mini-circles are smaller (usually no more than 3.1 m (10 ft) in diameter) and are used in residential neighborhoods. They can easily be placed in existing intersections as part of a traffic calming scheme. The mini-circles narrow the available travel path, thereby forcing motorists to slow down. Roundabouts are larger and are used at the intersection of arterial roads. The roadway follows a circular path around the roundabout but the travel path is not narrowed. Mini-circles of an intermediate size, such as 3.1 m (10 ft) in diameter, have been used mainly as speed control devices within the intersection of two local streets, such as the one shown in

Figure 15-4. A secondary objective is to reduce traffic volumes by using them as a part of a group of mini-circles or other devices that slow or bar a driver's path. The following three handbook regarding mini-circles have been developed:

- ◆ If the objective is to reduce traffic speeds along a section of a residential street, two or more mini-circles at adjacent intersections should be used. A single mini-circle will slow traffic in the immediate vicinity of the intersection, but its impacts on traffic speed will generally be confined to within approximately 120 m (400 ft) of the mini-circle.
- ◆ A mini-circle should not be installed in an intersection with a high volume of left-turn movements. Many motorists will make left turns to the left of the mini-circle. This creates conflicts with traffic approaching from the left.
- ◆ Mini-circles should be designed with mountable curbing on the perimeter to accommodate unusually large service vehicles.

Chicanes

These are alternately placed curb extensions, parking bays, or other barriers into the street that force motorists to slow down and drive around them. The curb extensions narrow the road to one lane, with two-way operation. Chicanes are effective at reducing speeds and collisions. Installations result in loss of on-street parking, so if parking demand is high, this measure may not be appropriate. In such situations, parking controls should be used, as discussed below. Designers should be aware that the reduced roadway width can endanger bicyclists when motorists try to overtake bicyclists while passing through the chicane or when motorists view the chicane as an obstacle course.

Chokers or Bulbouts

A choker (also known as a bulbout curb bulb, nub, neckdown or gateway) is a narrowing of a street, either at an intersection or midblock, in order to reduce the width of the traveled way (see Figure 15-3). While the term usually is applied to a design which widens a sidewalk at the point of crossing, it also includes the use of islands which force traffic toward the curb while reducing the roadway width. Streets

Figure 15-4. A traffic mini-circle used at the intersection of residential streets.





Figure 15-5. A choker (curb bulb) used on a one-way residential street.

narrowed at the crosswalk reduce the distance over which pedestrians are exposed to vehicular traffic. Bulbs provide safe areas for people to walk or play, or may provide added area for landscape or gateway features, thereby improving the appearance of the neighborhood. An example of a choker on a one-way residential street is shown in Figure 15-5.

Studies to date have shown that bulbouts reduce traffic volume only when they either reduce the number of lanes of travel or add friction to a considerable length of street. Curb bulbs also appear to have a significant effect on speed and can improve the safety of an intersection by providing pedestrians and drivers with an improved view of one another.

Speed Watch and Enforcement Programs

Neighborhood residents often feel uneasy when they perceive that motorists are traveling too fast on their streets. This uneasiness can keep residents from enjoying their own surroundings as pedestrians.

Speed watch programs normally include: the use of radar to check speeds of passing motorists, the recording of license plate numbers of speeding motorists, and

notification of those speeding motorists as to the residential nature of the street on which they were caught speeding. Enforcement presence or follow-up is often effective. Many of the motorists speeding on residential streets live in the neighborhood themselves, so this is really a neighborhood awareness program, where neighbors participate in a process to help return their streets to a safer, more comfortable state. Speed watch programs are less successful when speeding motorists live outside the neighborhood and are “cutting through.”

Pedestrian Secure Streets (INSERTB)

FDOT has found that seniors and children make only half of their potential walking trips due to their fear of being victims of crime. The most significant way to increase walking levels is to get more people walking. If an environment appears harsh or unfriendly, few people walk, and the lack of pedestrians keeps others away.

Once a place appears safer and more friendly for walking, people will return to the streets. Street designers need to work as a team to create well-lit streets, to provide open landscaping, and to eliminate hiding places. The use of low shrubs to define street and sidewalk edges, to keep sitting

Traffic Calming Strategies

Figure 15-6. Speed humps are intended to reduce traffic speeds to 32 to 40 km (20 to 25 miles) per hour.



places open and inviting, and to undertrim trees for maximum viewing are important. Walls and fences should not be built around parks and other public lands.

There has been a tendency in recent years to gate streets in some neighborhoods to “keep crime out.” Traffic engineers are cautioned that such action may create more problems than it solves, by moving not only crime but also traffic to an adjacent neighborhood, and thus, may not be the best global solution. The solutions offered through traffic calming and other techniques appear to be more pedestrian friendly and should be explored more fully. Chapter 15 is devoted to traffic calming.

Speed Humps

Also known as road humps, undulations, or “sleeping policemen,” speed humps have undergone extensive demonstration and evaluation in Europe, Australia, and the United States. The purpose of speed humps is to promote the smooth flow of traffic at slow speeds around 32 to 40 km/h (20 to 25 mph). They are not meant to reduce vehicle speeds to 8 to 16 km/h (5 to 10 mph), as are speed bumps.

The speed hump is an elongated hump with a circular-arc cross-section rising to a maximum height of 75 mm (3 inches) above

the normal pavement surface and having a chord distance of 3.7 m (12 ft) in the direction of vehicular travel (see Figure 15-6). Speed humps have proven to be more effective, quieter, and safer than conventional speed bumps, and speed bumps are not recommended for street use.

Humps can be effective in reducing traffic speeds to reasonable levels on local residential streets. Substantial reductions in the speeds of the fastest cars can be expected along with an 85th percentile speed of about 40 km/h (25 mph). Typical average speeds on hump-equipped streets are under 32 km/h (20 mph). Although humps can be traversed safely at high speeds, most drivers will generally drive slower.

Although quieter than speed bumps, the primary disadvantage to speed humps remains noise to the adjacent homeowners. Some residents find speed humps (or the warning signs) unsightly and there are complaints of motorists driving with two wheels along the gutter (and sometimes onto the sidewalk) to avoid the hump. Residents along the street must be aware of the advantages and disadvantages of speed humps, and those living directly in front of the proposed hump location should provide written approval of the hump installation.

The ITE Technical Council Committee 5B-15 has stated that the individual municipal traffic engineer should be responsible for determining the safety of the design and the criteria used for installation of speed humps, including signs and/or markings. For guidance in the design and installation of speed humps, refer to the Handbook for the Design and Application of Speed Humps - A Proposed Recommended Practice.³ Representatives from the municipality should evaluate speed humps once they have been installed by collecting speed, volume, and accident data to determine their continuing effectiveness.

Stop and Yield Signs

The purpose of a two-way stop sign is to assign the right-of-way at an intersection. Two-way stop signs are suitable for use at minor street approaches to arterials and collector streets, and when there is poor sight distance. Stop signs do not reduce speeding on local streets, except for approximately 60 m (200 ft) prior to the intersection, and are expressly prohibited for this purpose by the MUTCD. Stop signs, however, do stop vehicles at intersections, where pedestrians typically cross the street. Two-way stop signs have little to no effect on reducing traffic volumes and the results on traffic safety are mixed.

Four-way stop signs are rare outside of the U.S. and Canada. They are usually intended for intersections where traffic volumes or other conditions do not warrant traffic signals (see Table 8-1) or as a stopgap measure when a signal is urgently needed, but is not yet constructed. Four-way stops are frequently requested as a speed control device, yet studies have shown that when stop signs are overused, only five to twenty percent of the motorists come to a complete stop, forty to sixty percent come to a rolling stop (below 8 km/h (5 mph)), and twenty to forty percent pass through the stop sign at speeds higher than 8 km/h (5 mph). Studies have also shown that violation rates are higher at stop signs that are placed as speed control devices.

Yield signs are used to assign right-of-way between two intersecting streets without requiring traffic on the other street to come to a complete stop. In the United States, this sign is used where sight distances at the intersection of two non-arterial streets permit traffic on the controlled street to approach safely at 25 km/h (15 mph) or higher. In many countries, the sign is the standard for assigning the right of way of vehicles on an arterial street. Yield signs offer little benefit to pedestrians, since motorists generally yield only to other motor vehicles, and pedestrians must choose gaps in traffic to cross.

Other Signage

Signs such as CHILDREN AT PLAY, RESIDENTIAL STREET, and LOCAL ACCESS ONLY, are not standard and not generally recommended or effective for use in neighborhoods. These signs by themselves have little, if any, effect in reducing vehicle speeds or volumes. A number of more helpful measures for managing traffic in place involve warning or regulatory signs such as DO NOT ENTER, NOT A THRU STREET, DEAD END, or turn restrictions. The MUTCD and engineering judgement will serve as a guide on what to use and when. As with diverters or street closures, residents should have input into any traffic signs that will restrict their access.

The Planning Process

To be successful, a traffic calming program needs a structured planning process, community participation, and consultation with all relevant authorities. The project is undertaken in response to the needs of residents of a street, area, or the community. Residents are the main initiator of traffic calming schemes, although elected representatives or city staff can also initiate schemes.

The planning process for a traffic calming scheme is complex and includes

significant resident participation. In the past, skipping or skimming over parts of this process has caused schemes to fail. It is more than simply providing a technical solution to a specific traffic problem. It is an interaction between land use, transportation, resident/community needs, and preferences. Traffic calming is not, and should not be seen as, traffic management solely for the safe and efficient movement of vehicles. It is a community project where the residents and other affected people must be active participants so they become owners of the project and increase its acceptance.

Three key groups should be included in the public participation process: the residents of the neighborhood, local traffic engineering and public works officials, and local elected officials. The residents of the area should have a voice in the design, function, and operation of the streets where they live, because they ultimately are the ones subjected to undesirable traffic conditions, and they must live with any restriction resulting from a traffic management program. The public works professionals of the community, including city planners, traffic engineers, transit officials, sanitation officials, police, firefighters, and emergency medical services, have a responsibility to identify these problems and to assist the residents in formulating alternative solutions. School officials must also be involved if a potential solution will affect their bus routing or limit teacher/parent access to their school.

The elected officials ultimately will make the decisions regarding the implementation of any proposed traffic management program. For this reason, they should be involved from the onset and should be made aware of the existing problems, alternative solutions, and the final implementation plan.

1. Identify Problems and Issues: Collect and analyze crash data, traffic volumes, streetscape, residential, neighborhood, and community problems.

2. Establish Objectives: Specify and get agreement on the scheme's aim with the residents. This step is essential in evaluating and comparing alternative schemes and their relative success.

3. Alternate Plans: Develop a set of alternate schemes meeting the above aims.

4. Plan Selection: Evaluate the impact of each plan, including achievement of the aims, and undesirable or unavoidable impacts. After consultation with the residents, refine the final plan, design individual traffic control measures, and develop a staged construction plan.

5. Implementation: Undertake any additional "before" studies, tell the community of the work program, and of traffic detours. Often people do not appreciate what a particular device is really like on-the-road. A useful technique is to install cheap, temporary treatments so the residents can try them before proceeding with the final construction.

6. Review: Never assume the scheme achieves the desired effect. Drivers can be very innovative and may find unexpected alternate routes. Conduct after studies to measure their effectiveness, impacts, and resident/community reaction. Change the scheme if necessary.

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