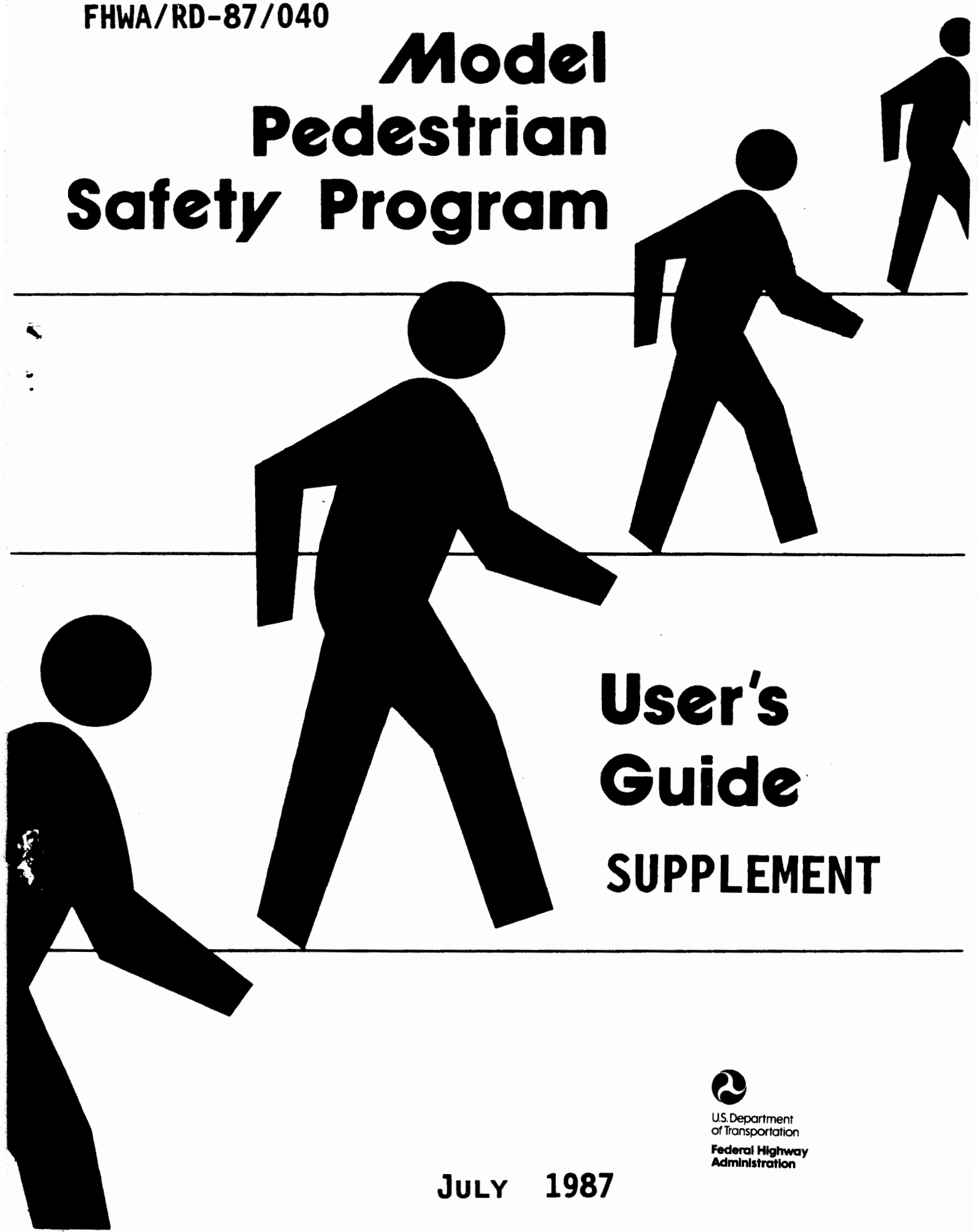
FHWA/RD-87/040

Model Pedestrian Safety Program



User's Guide

SUPPLEMENT

U.S. Department of Transportation
Federal Highway Administration

JULY 1987

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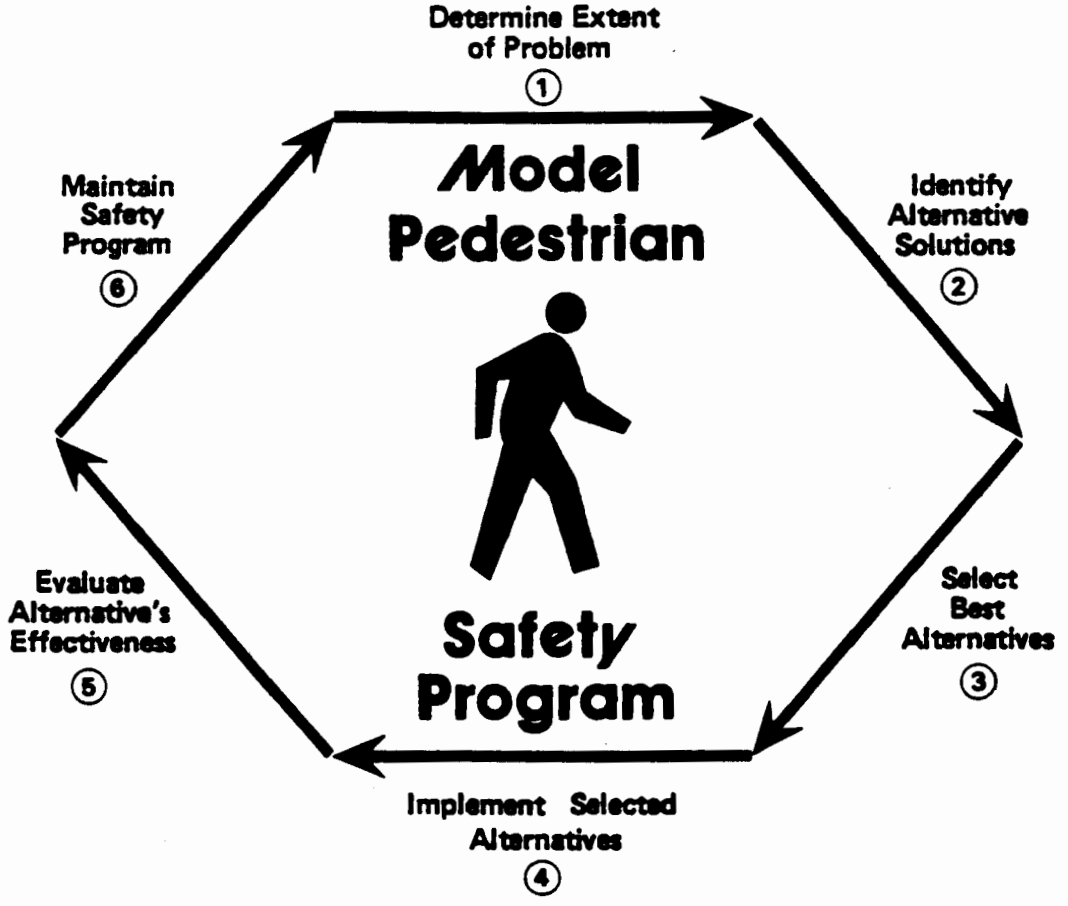

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This volume is a Supplement to the first volume, Model Pedestrian Safety Program User's Guide (FHWA/RD-87/039).

16. Abstract

This Supplement to the Model Pedestrian Safety Program User's Guide provides detailed information on specific pedestrian safety countermeasures.

The countermeasures are grouped into the three major areas of engineering countermeasures, education countermeasures, and enforcement countermeasures. The "enforcement" category includes enforcement of existing laws, suggested model ordinances designed to improve pedestrian safety when enacted on the state or local level, and various programs intended to increase the safety of children.

Within these groups, each countermeasure is discussed in terms of its advantages and disadvantages, implementation considerations, and the conditions when the countermeasure would be most beneficial.

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The comments and suggestions received from Charles Zegeer, North Carolina Highway Safety Research Center, Richard D. Blomberg and David F. Preusser, Dunlap and Associates, and Martin T. Pietrucha, Center for Applied Research, are greatly appreciated.

We wish to thank Brenda Hundley of the Center for Applied Research secretarial staff for her patience and support during the preparation of the manuscript.

Finally, we wish to thank the concerned individuals who take the time to read this document. The safety of pedestrians can be improved only if concerned individuals at the state and local level care enough to do something. We hope the User's Guide and Supplement will help them decide what to do and how to do it.

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INTRODUCTION

The Model Pedestrian Safety Program User's Guide was written to assist individuals or organizations interested in planning and creating a safer environment for pedestrians. The Guide was designed for local associations; civic groups; school groups; municipal, county, and state governments; highway departments; safety coordinators; and police and traffic engineering departments. The Guide presents ideas, resources, procedures, and implementation suggestions to help the pedestrian. A limited number of copies of the Guide are available at no cost from the Federal Highway Administration, Research, Development and Technology, Publications and Report Centr HRD-11, 6300 Georgetown Pike, McLean, Virginia 22101.

This Supplement to the Model Pedestrian Safety Program User's Guide provides detailed information on specific pedestrian safety countermeasures.

Traditionally there are three general types of safety countermeasures, called the three Es of safety: Engineering, Education, and Enforcement. Engineering countermeasures change the physical environment to produce a change in pedestrian or driver behavior. Education countermeasures attempt to produce changes in behavior by changing the way pedestrians and drivers search, detect, evaluate, and decide in situations where there is potential conflict. Enforcement countermeasures use laws and ordinances to produce "safer" behavior on the part of drivers and pedestrians.

A wide variety of countermeasures are applicable to the pedestrian safety problem. Tables 1, 2, and 3 match the specific accident types described in the User's Guide to the possible countermeasures detailed in this Supplement. Table 1 matches specific accident types to potential engineering treatments. Table 2 relates the accident types to education countermeasures. Table 3 relates the accident types to enforcement countermeasures. The "enforcement" category includes the enforcement of existing laws as well as suggested model ordinances designed to improve pedestrian safety when enacted on the state or local level. Also included are various programs intended to increase the safety of children.

Table 1. Pedestrian accident types and potential engineering countermeasures.

Accident Type \ Countermeasures	Engineering and Physical																						
	Barrier: Median	Barrier: Roadway/Sidewalk	Barrier: Street Closure	Bus Stop Relocation	Crosswalk: Intersection	Crosswalk: Midblock	Diagonal Parking-1 Way Street	Grade Separation	Facilities for Handicapped	Lighting: Crosswalk	Lighting: Street	One-Way Streets	Retroreflective Materials	Safety Islands	Sidewalk/Pathway	Signal: Ped. (Shared)	Signal: Ped. (Delayed)	Signal: Ped. (Separated)	Signal: Traffic	Signs and Markings	Urban Ped. Environment	Vehicular Traffic Diversion
Dart-out (First Half)	●	●				●	●														●	●
Dart-out (Second half)	●	●				●	●					●		●							●	●
Midblock Dash	●	●				●								●							●	●
Intersection Dash					●			●		●	●			●			●	●		●		
Turn-Merge Conflict								●									●	●				
Turning Vehicle								●									●	●				
Multiple Threat								●		●	●					●	●	●	●		●	
Bus Stop Related				●																	●	
School Bus Stop Related				●																		
Ice Cream Vendor																				●		
Trapped					●			●						●		●	●	●				
Backup																						
Walking on Roadway		●									●		●		●					●		
Result Vehicle-Vehicle Crash																				●		
Hitchhiking											●		●									
Working in Roadway																				●		
Disabled Vehicle Related																				●		
Nighttime Situation										●	●		●									
Handicapped Pedestrians									●													

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

Table 2. Pedestrian accident types and potential educational countermeasures.

Accident Type \ Countermeasures	Preschool					Elementary School								High Sch.			General Public						Older Adults		
	Parental Guidance	Safety Town/Safety Clubs	Television Programs	Walking In Traffic Safely	Watchful Willie	Officer Friendly	Education Within the Curriculum	Green Pennant Program	"Big Wheel" Spot	Willy Whistle Program	Safe Street Crossing	Child Intersection Dash TV Spot	"And Keep on Looking" Film	Assemblies	Drivers Education	Youth Traffic Court	Talks to Groups	Community Action Program	Use of the Mass Media	Multiple Threat Spot	Vehicle Turn-Merge Spot	Adult Intersection Dash Spot	Safety Courses	Talks to Groups	Community Contact Programs
Dart-out (First Half)					●					●															
Dart-out (Second Half)					●					●															
Midblock Dash																									
Intersection Dash												●	●									●			
Turn-Merge Conflict													●								●				
Turning Vehicle													●												
Multiple Threat													●							●					
Bus Stop Related						●																			
School Bus Stop Related						●																			
Ice Cream Vendor																									
Trapped																									
Backup	●																								
Walking on Roadway																									
Result Vehicle-Vehicle Crash																									
Hitchhiking																									
Working in Roadway																									
Disabled Vehicle Related																									
Nighttime Situation																									
Handicapped Pedestrians																									
Pedestrian Safety in General	●	●	●	●	●	●	●	●	●		●			●	●	●	●	●	●				●	●	●

Table 3. Pedestrian accident types and potential enforcement/regulations/ child protection countermeasures.

Countermeasures / Accident Type	Child Protection					Enforcement/Regulations									
	Safe Route to School Prog.	School Bus Routing Plan	School Bus Patrols	School Crossing Guards	Play Streets	Enforcement	Ice Cream Truck Ordinance	Bus Stop Ordinance	School Bus Regulations	Dismounted Motorist Regs.	Vehicle Hazard Lights Regs.	Freeway Walking Regs.	Regs. for Peds. on Highways	Vehicle Overtaking Law	Parking Near Intersections
Dart-out (First Half)					●										
Dart-out (Second Half)					●										
Midblock Dash					●										
Intersection Dash															●
Turn-Merge Conflict															
Turning Vehicle															
Multiple Threat														●	
Bus Stop Related								●							
School Bus Stop Related		●	●						●						
Ice Cream Vendor							●								
Trapped															
Backup															
Walking on Roadway													●		
Result Vehicle-Vehicle Crash															
Hitchhiking												●			
Working in Roadway															
Disabled Vehicle Related										●	●				
Nighttime Situation											●				
Handicapped Pedestrians															
Pedestrian Safety In General	●	●	●	●	●	●									

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

In using these tables, look over all the possible countermeasures and note any which may be helpful for a particular problem. There is usually no single cure for a specific safety problem. It is important to keep an open mind and consider all possible solutions before making a choice.

The countermeasures described in this Supplement are grouped into the three major areas of engineering countermeasures, education countermeasures and enforcement countermeasures. Within these groups, each countermeasure is discussed as thoroughly as possible in the following format:

- Definition of the countermeasure.
- Identification and definitions of specific design types c variations of the general countermeasure.
- Associated data about pedestrian accidents and behaviors as they relate to the countermeasure.
- Advantages of the countermeasure.
- Disadvantages of the countermeasure.
- Factors and/or problems that should be considered before and during countermeasure implementation.
- Conditions when implementation of the countermeasure would be most beneficial.

This Supplement does not attempt to describe all of the detailed procedures needed to implement each countermeasure. In some instances it is suggested that additional references, user's manuals or implementation guides be obtained. When references are listed with a "PB" number, they can be purchased from the National Technical Information Service (NTIS):

- National Technical Information Service (NTIS)
  5285 Port Royal Road
  Springfield, VA 22161
  Telephone Number (703) 487-4650

Other documents are available from the following sources:

- Federal Highway Administration (FHWA)
  Office of Safety and Traffic Operations
  Safety and Design Division
  6300 Georgetown Pike
  McLean, VA 22101
  Attention: John C. Fegan (HSR-20)

- National Highway Traffic Safety Administration (NHTSA)
  Office of Alcohol and State Programs
  400 Seventh Street, N.W.
  Washington, D.C. 20590
  Attention: Dr. Virginia Litres (NTS-23)

- American Automobile Association (AAA) - Information, pamphlets, posters, and many of the referenced materials are available from your local AAA office.

Many of the engineering countermeasures involve special applications of standard traffic control devices. All such signs, signals, markings, and devices should be installed in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and the Traffic Control Devices (TCD) Handbook. The Handbook offers guidelines for implementing the standards and applications contained in the MUTCD. The MUTCD and the TCD Handbook are available from:

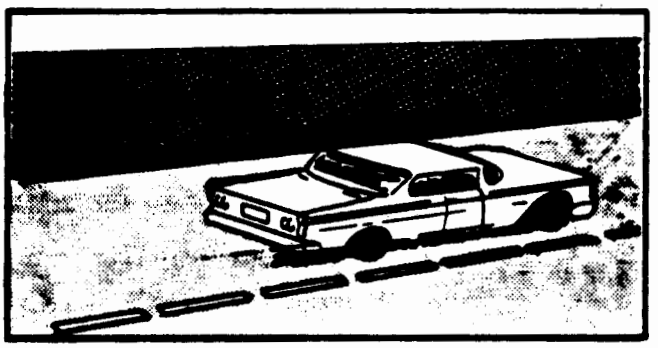
- Superintendent of Documents
  U.S. Government Printing Office
  Washington, D.C. 20402
  (202) 783-3238

BARRIERS

Chains, fences or similar devices separating pedestrian and vehicular traffic. They can be positive barriers channeling pedestrians to safe crossings or negative barriers preventing pedestrians from crossing at hazardous locations.

Types of Barriers

- Median Barriers. Generally chain link fences located along a median or area separating opposing traffic lanes that prevent pedestrians from crossing at nonintersection locations. They can be installed exclusively as pedestrian barriers or be incorporated with vehicle-separating median barriers (e.g., guardrails).



- Sidewalk Barriers. Located along or near the edge of a sidewalk to channel pedestrians to crosswalks or grade-separated facilities, or to impede their crossing at hazardous locations. Common construction materials include chain link fencing, pipe and chain/cable, planters or other sidewalk furniture, and hedges.

- Roadside Barriers. Generally high chain link fences located alongside a highway or freeway to prevent pedestrians from crossing the road.

Associated Behavioral and Accident Data

- More than half of pedestrian deaths and injuries occur while crossing between intersections.
- Median barriers can significantly reduce midblock crossings and running into the roadway.
- Median and meter-post barriers can reduce the incidence of pedestrians darting out into traffic from behind parked cars.
- About 15 percent of freeway pedestrian accidents involve pedestrians running or walking across the freeway. Barriers near freeway interchanges can discourage people from crossing freeways.

Advantages

- Channel pedestrians to safe crossing facilities (e.g., overpasses, underpasses, signalized intersections).
- Can prevent pedestrians from crossing at hazardous locations.
- Can reduce incidence of pedestrians running into the roadway.

Disadvantages

- Snow, leaf, etc. removal and maintenance problems.
- Many pedestrians don't like barriers, and many designs are aesthetically unpleasing.
- People often try to climb barriers or cut holes in them.
- Barriers are more expensive than some types of treatments (e.g., signs and markings).
- May interfere with on-street parking and vehicle loading and unloading.
- May put stranded motorists in danger, forcing them to walk along hazardous roads (e.g., freeways).

Implementation Considerations

- The community must be involved in any decision to install a barrier.
- Some types of barriers can be set up temporarily as an experiment to analyze their effectiveness and local acceptance.
- Careful studies of pedestrian movement should precede and follow the installation of barriers.
- Barriers are most effective when located where a hazard is apparent.
- Barriers should not toally block visibility between pedestrians and motorists.
- Barriers should be difficult for pedestrians to climb over or under.

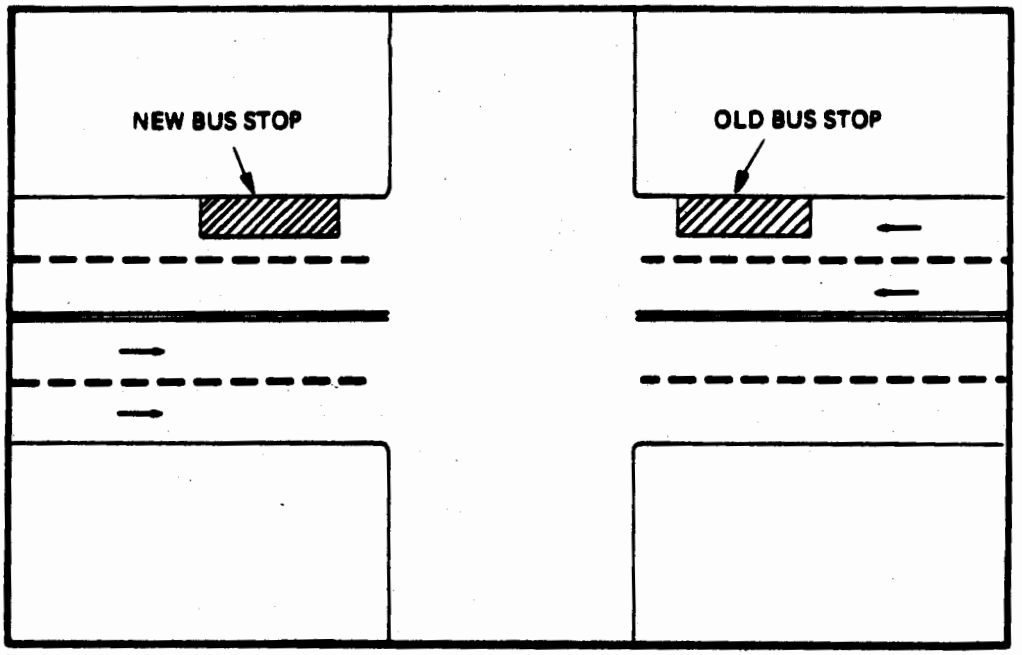
Conditions When Most Beneficial

- In conjunction with pedestrian overpasses.
- Where there are high vehicle speeds on uncontrolled access roads and young pedestrians.
- Where little or no separation exists between roadway and sidewalk on high-speed roadways, particularly where there are no curbs and on curves.
- Near schools, arenas or other pedestrian generators where pedestrians spread out in many directions.
- In downtown areas with high pedestrian volumes on high vehicle volume-high density roadways and where jaywalking is common.
- On bridges with both pedestrian and vehicle traffic.
- When pedestrian flows cannot otherwise be controlled.

BUS STOP RELOCATION

The location of bus stops on the near sides of intersections can be hazardous to pedestrians who cross the street in front of the stopped bus. Approaching motorists are often unable to see a pedestrian who steps out into the travel lane from behind the front end of a bus.

Relocating a transit or school bus stop from the near side to the far side of an intersection can improve pedestrian safety by increasing the sight distance between approaching motorists and pedestrians. (School bus stop relocation is discussed under "School Bus Routing and Patrols.")



Advantages

- Reduces the number of bus stop related accidents.
- Waiting passengers assemble at less-crowded sections of the sidewalk, reducing interference with crossing pedestrians.
- Buses at far-side bus stops are less likely to obscure traffic control devices or pedestrian movements in the intersection than at near-side bus stops.
- Reduces conflicts between buses and right-turning vehicles.
- Buses can rejoin moving lanes more easily, saving time and energy.
- Reduces the number of people entering the street in front of a bus.

Disadvantages

- May increase bus stop operation time because delays at signals will no longer be used for passenger pickup.
- Cars illegally parked in the bus stop may cause buses to overhang into the cross street.
- Stops on narrow streets or within a moving traffic lane may block traffic on both the street with the bus route and on the cross street.

Implementation Considerations

- Far-side bus stops are not universally applicable. Far-side stops should not be used at bus stop locations ch as intersections with heavy turning volumes.
- At transfer points, it may be better to use a combination of near side and far-side stops (to minimize the number of street crossings for pedestrians who transfer from one bus to another).
- When deciding whether to relocate a bus stop, the following should be considered:

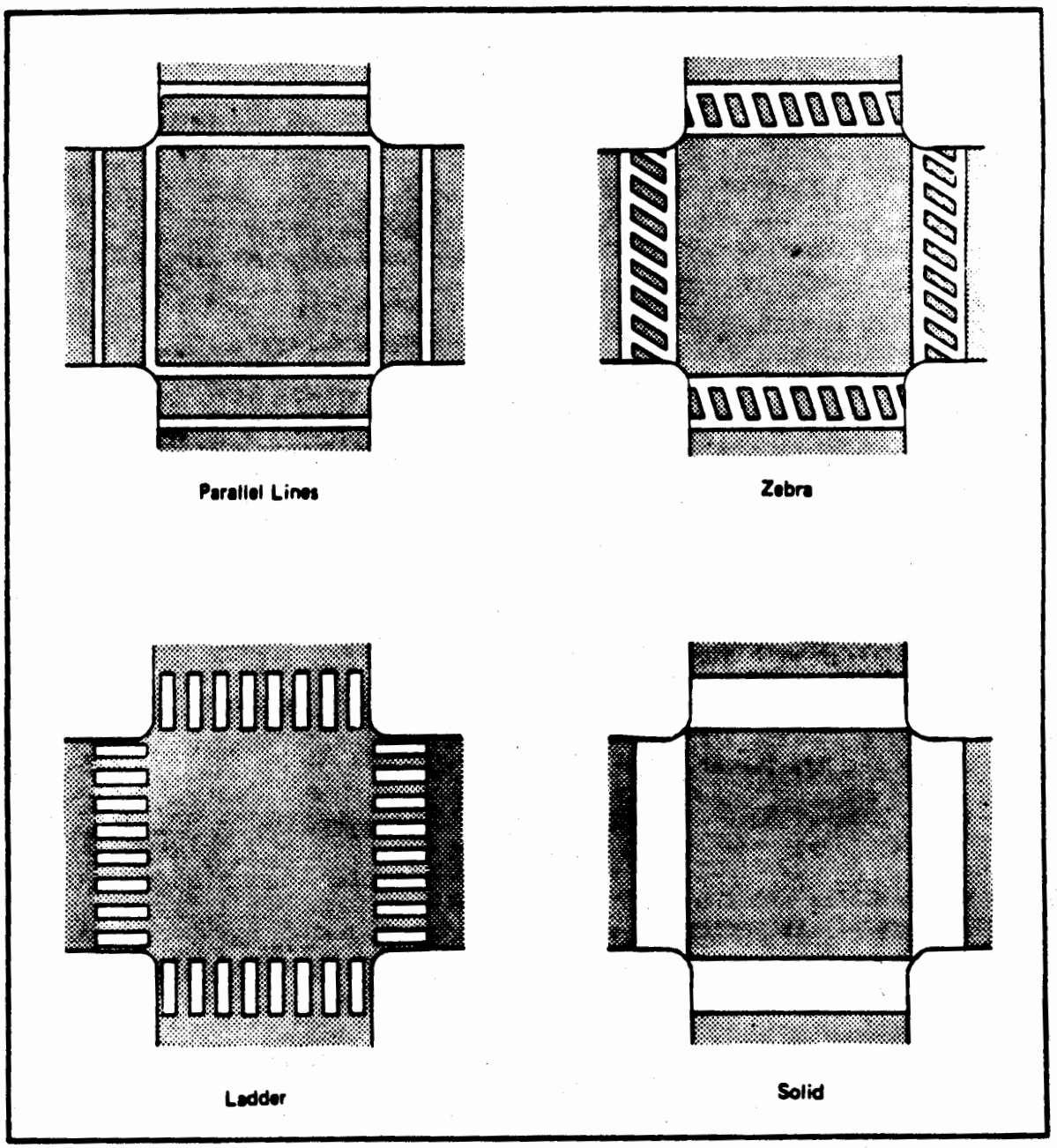
  - Number of buses using the stop.
  - Number of passengers per bus and time to load and unload.
  - Parking situation.
  - Vehicle movement and possible conflicts.
  - Sight distance for pedestrians and motorists.

Conditions When Most Beneficial

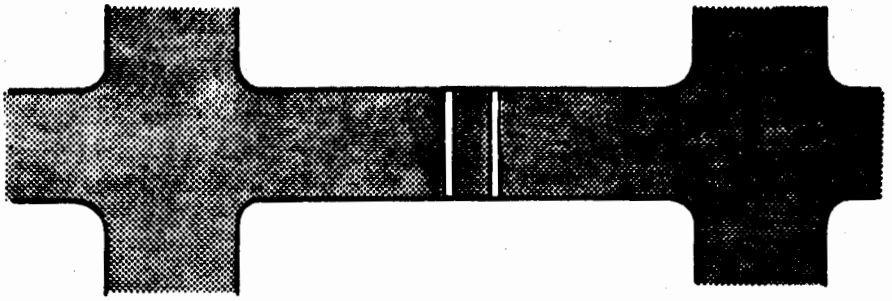
- In areas with high bus traffic, high bus ridership and/or with exclusive bus lanes.
- Along streets with a moderate or heavy volume of right-turn traffic on the bus street.
- In central business district (CBD) areas and/or other areas with heavy pedestrian volumes and high traffic volumes.
- At either signalized or nonsignalized intersections with one or more of the conditions mentioned above.

MARKED CROSSWALKS

Marked crosswalks are the part of the road distinctly indicated for pedestrians by lines or other markings on the road surface. Markings can be two solid parallel lines, stripes running parallel to the direction of vehicle flow (ladder), diagonally slanted stripes (zebra), or "solid" markings made by painting the entire crosswalk area or constructing it of material different than the roadway surface.



A midblock crosswalk is a marked crosswalk located between intersections, possibly with pedestrian-actuated signals.



Crosswalks can be signalized or nonsignalized. Behavioral and accident data for signalized crosswalks are discussed under the section "Signals." This section covers only nonsignalized crosswalks.

Associated Behavioral and Accident Data

- Unmarked crosswalks are more than twice as hazardous as marked crosswalks.
- Pedestrians tend to use the shortest and easiest routes in crossing and will not use crosswalks if they are inconvenient.
- Large numbers of crosswalks and crosswalk signs may increase motorist noncompliance.
- Many cities limit the use of midblock crosswalks because drivers often do not expect crosswalks in these locations and tend to be less attentive to pedestrians trying to cross.

Advantages

- Channel pedestrians across complicated or dangerous intersections.
- Can position pedestrians where they can be best seen.
- Midblock crosswalks tend to be used when they are available. They reduce crossing from behind parked vehicles and running in the road.

Disadvantages

- May present an illusion of safety; pedestrians may feel overly secure.
- Motorists don't see crosswalks as well as pedestrians may think.
- Overuse may cause disrespect for other pedestrian and traffic control devices.
- Midblock crosswalks reduce the number of parking spaces and may reduce traffic flow capacity.

Implementation Considerations

- A careful engineering study should be made before marking crosswalks at locations without signals or stop signs.
- Model guidelines for identifying locations that should have crosswalk markings have been developed. These general guidelines are based on a combination of vehicle volumes, pedestrian volumes, and roadway classification. Copies of the guidelines are available from NTIS ("Investigation of Exposure Based Pedestrian Accident Areas: Crosswalks, Sidewalks, Local Streets and Major Arterials," FHWA/RD-87/038).
- Factors to consider in designing a crosswalk include:
  - Advance warning signs.
  - Vehicle stop lines.
  - Overhead lighting.
  - Reflectorization.
  - Sight-distance.
  - The needs of the handicapped.
- Materials used for diagonal- and ladder-striped markings should not become slippery when wet.
- Warning signs should be posted to alert drivers to potential pedestrians at midblock crosswalks.
- Adequate sight distance must be provided at midblock crosswalks.

Conditions When Most Beneficial

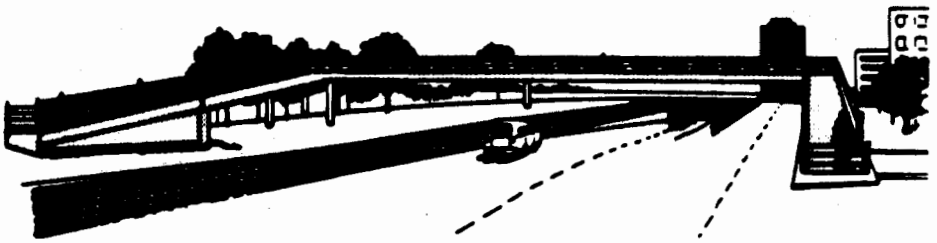
- Signalized intersections with heavy pedestrian volumes, particularly with complex intersection geometrics (e.g., five or more legs, skewed intersecting roadways, wide streets).
- Midblock crossing locations which are controlled by traffic signals and pedestrian signals.
- School crossing locations which are controlled by adult (or police) crossing guards during school crossing periods.

GRADE SEPARATION

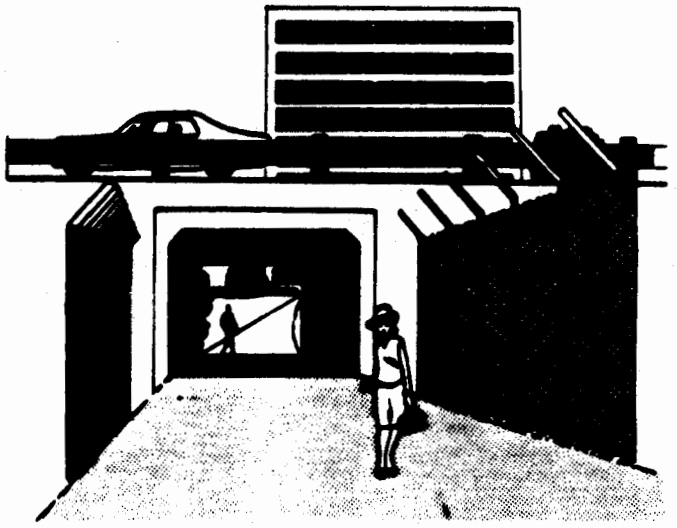
Grade-separated facilities allow for free, uninterrupted flow of pedestrians and motor vehicles, where pedestrians cross above or below roadways.

Types of Grade-Separated Facilities

- Pedestrian Overpass/Bridge. Above-ground passageway or bridge for pedestrians over a roadway. Usually both ends of the overpass are at grade level with stairs or ramps taking the pedestrian up over the roadway.

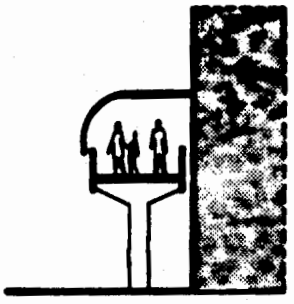


- Pedestrian Underpass/Tunnel. Has the same function as an overpass, except that the stairs or ramps lead the pedestrians down to an underground passage. Both ends are at grade level.

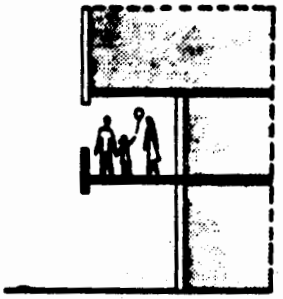


- Below-Grade Networks. Extensive underground walkways that carry pedestrians to the vehicles flowing above them. These networks are sometimes associated with rapid transit rail systems.

- Elevated Walkways. "Sidewalks" located above ground level. They may or may not run parallel to the vehicle direction of flow and can be free-standing or part of an adjacent building (e.g., as an arcade).

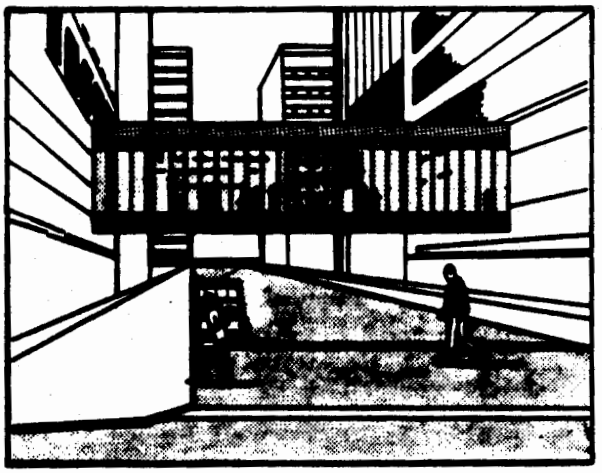


Free-Standing Walkway



Integral Walkway

- Skyways/Skywalks. Generally enclosed pedestrian crossing structures over roadways. Located in urban areas, they may connect opposing buildings at midblock.



Advantages and Disadvantages

	Advantages	Disadvantages
Grade Separation in General	Provide completely separate facilities for pedestrians and vehicles. Improve vehicle circulation. Can reduce pedestrian delay.	Pedestrians may not use grade separated facilities if they are not convenient. Can increase pedestrian travel time by forcing pedestrians to take an indirect route. Are often not used by most pedestrians and therefore may not be effective in reducing accidents at sites where they are installed.
Overpasses/ Bridges	Provide convenient safe crossings. Easier to maintain than underpasses. Typically less expensive to construct than underpasses.	Are expensive. Need high clearance for trucks. Unenclosed versions provide an opportunity for people to drop items onto passing vehicles. Can be aesthetically unpleasing.
Underpasses/ Tunnels	Do not create an eyesore. Protect pedestrians from inclement weather. Are shorter in length than underpasses. (They only have to be deep enough for a pedestrian to go under the road, whereas overpasses must be high enough to allow trucks to pass under.)	Generally higher construction costs than overpasses. Maintenance problems (drainage, litter, vandalism, lighting). Require proper lighting and design to discourage crime and encourage use.
Below-Grade Networks	Provide protection from sun and harsh weather. Do not disturb the urban landscape. Expansion is possible, linking other underground systems or major activity centers. Do not have to follow grid pattern of streets.	May require numerous entry points. Loss of visual contact with the city may cause loss of orientation. Emergency service problems. Pedestrians see them as unsafe and monotonous.
Elevated Walkways	Provide direct, convenient paths. Compact and efficient arrangement of retail space. Provide cover for at-grade pedestrian level. Can be enclosed to protect people from bad weather.	Potential danger of falling objects if not enclosed. May need numerous entry points. Possible decline in retail activity at-grade. Emergency service problems. Coordination with property owners may be difficult. Difficult to coordinate with at- and below-grade systems.

Implementation Considerations

- Grade separation is expensive. Less expensive alternatives should be considered before choosing grade separation (e.g., barriers, signalization, crossing guards near schools).

- Barriers may be required to channel pedestrians to the grade-separated crossing.

- Ramps for the handicapped, older adults, and bicyclists must be provided.

- Most pedestrians probably will not use grade-separated facilities if they:

  - Are not easily accessible.
  - Do not provide a relatively direct path to the desired destination.
  - Increase the time required to get to the desired destination.
  - Are not well lighted and don't provide a feeling of personal security.

- Tunnels should be as wide as possible, with no turns, to allow maximum daylight illumination.

- The planning process for underground networks, skyways, and elevated walkways is complex (see section on Urban Pedestrian Environment").

Conditions When Most Beneficial

- Where pedestrian demand is moderate to high to cross freeways or expressways.

- Where there is a large volume of young children (i.e., near schools) which regularly must cross a high speed and/or high volume road.

- Streets with high vehicle volumes and high pedestrian crossing volumes where extreme hazard exists for pedestrians (e.g., high speed traffic, wide street, poor sight distance).

Recommended Reading

An FHWA project examined the warrants or criteria currently used to determine when grade-separated pedestrian facilities should be installed. A series of new warrants was also developed. The report, Warrants for Pedestrian Over- and Underpasses, is available from NTIS (PB-86-104 239/AS).

FACILITIES FOR THE HANDICAPPED AND OLDER ADULTS

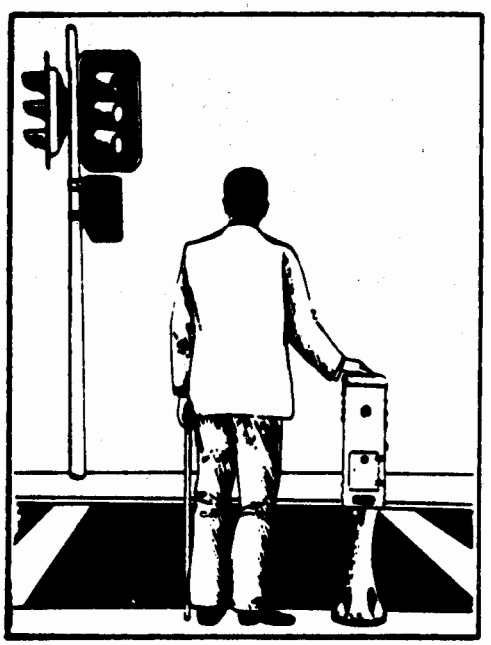
Facilities for the handicapped are traffic engineering devices that aid those with physical disabilities (e.g., blindness, deafness, loss of limb). Many older adults have physical limitations that also should be considered when selecting engineering treatments.

Types of Facilities for the Handicapped and Older Adults

- Signal-related

  - Audio. Pedestrian signals augmented with bells, horns, buzzers or clicking sounds to indicate when the WALK signal is on.

  - Tactile. Devices keyed to the signal that vibrate to let the blind touching the device know when they can cross. They may be located on signal pedestals or on hip-high posts, as in Japan.



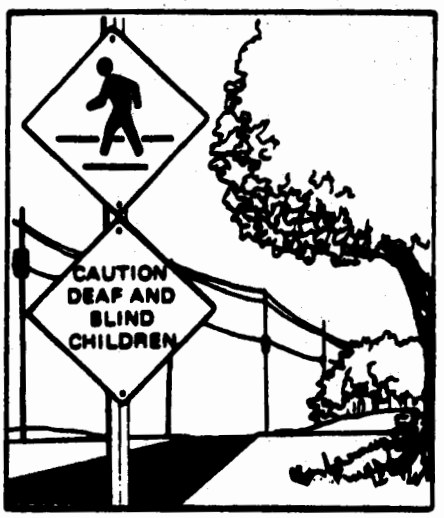
  - Combination audio and tactile ("Ticker" used in Sweden). Small vibrating boxes located on signal posts which give off a clicking sound so they can be easily located.

  - Special pedestrian-activated. Signals that when actuated by pedestrians, give a longer than usual WALK phase, which is particularly useful for pedestrians with slower walking speeds.

- Sign-related

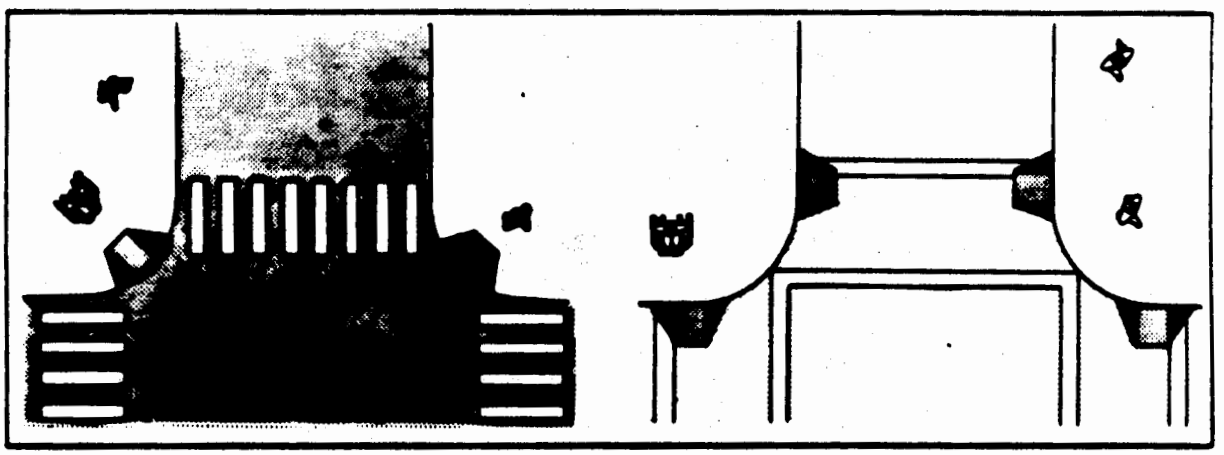
  - Braille maps and signs providing information to the blind.

  - Warning signs for motorists indicating the presence of handicapped people in the area.



- Sidewalk-related

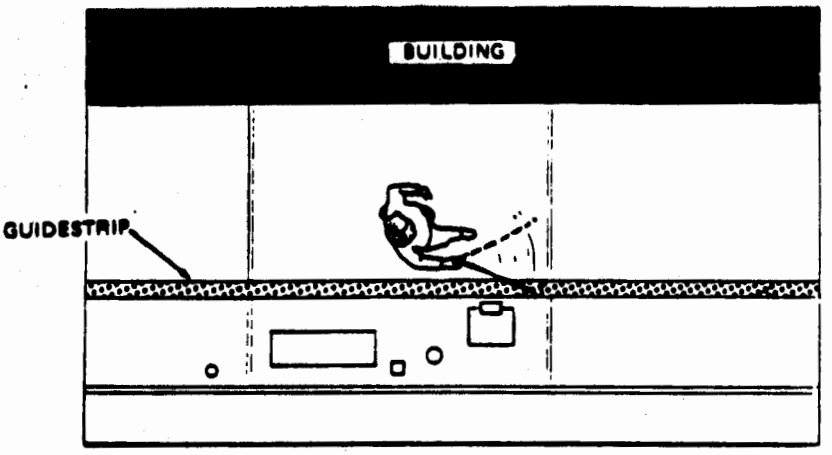
  - Curb ramp. Sloped structure for pedestrians which cuts through a curb or builds up to the curb from street level to help those in wheelchairs, on crutches, and the older adults negotiate curbs. There are many different design types, each with advantages and disadvantages.



Ramps Cutting Through Curb

Ramps Built Up to Curb

- Guidestrips. Tactile strips located along the edge of a walkway to guide blind pedestrians. They can be made of sand or glass beads set in thermoplastic.



- Handrails. Rails along ramps and sloping sidewalks for the deaf (who may have equilibrium problems due to ear injury), the blind (to orient themselves), and others with mobility problems.

- Careful location of street furniture away from the pedestrian traffic stream to give the blind and those in wheelchairs a clear space.

- Crosswalk-related

  - Guidestrips. Raised markings of epoxy and gravel that can be felt by a blind person with a cane and used as a guide to cross the street.

Associated Behavioral and Accident Data

- Over 25 percent of the population can be considered handicapped, including the blind, the deaf, those temporarily or permanently in wheelchairs or on crutches, and the chronically ill.
- The blind are generally cautious and are rarely involved in serious accidents.
- A majority of older adults and the handicapped enjoy walking or being outdoors and many depend on walking as a means of transportation.

Conditions When Most Beneficial

- When implementing any treatment, but especially those for the handicapped, it is important to make sure that the potential target group wants to have the treatment installed and will use/accept it.
- Numerous combinations of these special engineering treatments are appropriate in areas with a high percentage of older adults and/or handicapped people.
- Curb ramps are most beneficial along streets with abnormally high numbers of wheelchair users (e.g., particularly near treatment centers and hospitals).
- Use of special signing and signals for the visually impaired is controversial and their effectiveness is largely unknown.
- Use of pedestrian push buttons to extend the walk interval is particularly useful in areas of high use by older adults and/or handicapped pedestrians.

Recommended Reading

An FHWA report, Accessibility for Elderly and Handicapped Pedestrians - A Manual for Cities, describes numerous techniques that can be used to improve the safety, comfort, and convenience of handicapped pedestrians. A limited number of copies of this manual are available at no cost from the Federal Highway Administration, Research, Development and Technology, Publications and Report Center, HRD-11, 6300 Georgetown Pike, McLean, Virginia 22101.

LIGHTING

Lighting involves the nighttime illumination of roads, sidewalks, and crosswalks. While street lighting is often implemented primarily for vehicles or as a crime deterrent, pedestrian safety is a side benefit. Crosswalk lighting is special illumination of crosswalks to increase motorists' visibility of pedestrians.

Associated Behavioral and Accident Data

- Despite limited pedestrian night travel, 35 to 42 percent of pedestrian accidents occur during darkness.
- Improved lighting may reduce pedestrian accidents at night by almost one half.
- Pedestrians at well lit locations choose larger gaps for crossing.

Advantages

- Helps the deaf and those in wheelchairs use streets more safely.
- Increases clothing brightness.
- Causes some pedestrians to pay more attention to the crossing.
- Allows drivers to see farther ahead and may provide adequate stopping sight distance at night if sufficient illumination is used.

Disadvantages

- Pedestrians may develop a false sense of security.
- Crosswalk lighting systems are not proven to be effective.
- Some overhead lighting configurations may illuminate the crosswalk and the top of the pedestrian's head, which may not make the pedestrian more visible to the driver.

Implementation Considerations

- Luminaires should provide brightness without glare.
- Citizens may willingly pay additional taxes for lighting upgrading.
- Pedestrian and neighborhood attitudes toward crosswalk lighting are generally good.

Conditions When Most Beneficial

- Arterial streets and other roadways with high traffic volumes, particularly near intersections.
- Streets or areas with high nighttime pedestrian activity, particularly where other high-pedestrian areas in the city or area are also lighted.
- High-crime areas.
- Streets or intersections with a high incidence of nighttime accidents.
- Dark residential streets with high volumes of child and/or older adult pedestrians.

Recommended Reading

- Warrants for providing street lighting are described in the FHWA report, Fixed Illumination for Pedestrian Protection. It is available from NTIS (PB-256 672).

ONE-WAY STREETS

A one-way street is a street on which vehicles may travel in only one direction. One-way streets can be combined with diagonal parking to improve pedestrian safety.

Associated Behavioral and Accident Data

- Conversion to one-way streets can reduce pedestrian accidents 20 to 50 percent by improving the driver's field of vision and necessitating that pedestrians have to look only in one direction when crossing.

Advantages

- Driver does not have to deal with oppos traffic and can give more attention to pedestrians.
- Provide greater gaps in traffic.
- Increase street capacity.
- Reduce pedestrian and vehicle delay, may permit simpler signalization.
- Reduces certain types of turning accidents.

Disadvantages

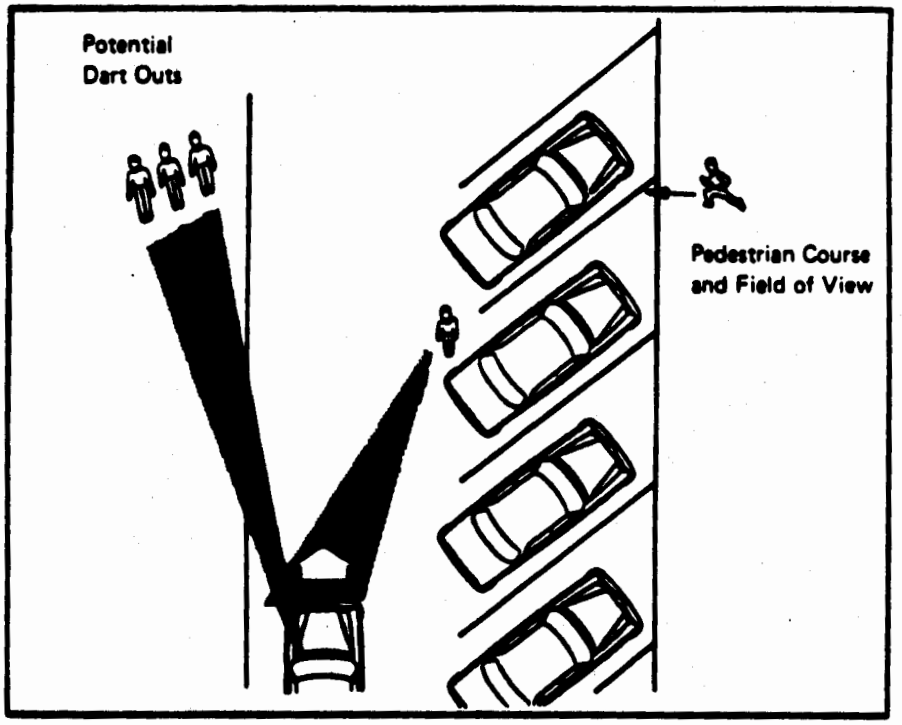
- At intersections pedestrians may not be able to see traffic signals because there is only one direction of traffic flow, while there are two directions of pedestrian flow. Pedestrian signals may be required.
- One-way streets can increase vehicle speed, vehicle volume, and trave time for some trips.
- Possible problems with neighborhood acceptance and possible negative effects on transit and emergency travel.

Implementation Considerations

- The change must be planned within the context of the entire street, transit, and traffic system. Changes must be made in signs, markings, signals, and other traffic control devices.
- Conversion to one-way streets has shown no negative effect on business or economic conditions.
- Plans must be made to combat increased vehicle speeds that may result from change to one-way streets.
- Transition areas between one-way and two-way streets require special treatment.

DIAGONAL PARKING

Diagonal parking is a situation in which vehicles may park only head-in at an angle. When used as a pedestrian safety treatment, parking is prohibited on the opposite side of the street. Diagonal parking can be combined with one-way streets to improve pedestrian safety.



Associated Behavioral and Accident Data

- Diagonal parking can reduce accidents involving pedestrians darting out from behind parked cars because pedestrian and motorist fields of view are improved, pedestrians act more cautiously, and vehicle speeds tend to decrease.

Advantages

- Can improve pedestrian sight lines and pedestrian scanning behavior.
- Can reduce vehicle speed; drivers use more caution.

Disadvantages

- Takes up space from travel lanes.
- Increases vehicle risk of being hit while pulling out of parking space.
- Can reduce vehicle parking capacity.
- Possible street sweeping problems if street is one-way with no provision for vehicle removal during cleaning operations.

Implementation Considerations

- The traffic safety problems associated with diagonal parking require extreme care when considering these treatments. The use of diagonal parking should be limited to local streets with low speeds and minimal through traffic.
- Objectives for changing the street should be clear.
- The public must be educated about the change.

RETROREFLECTIVE MATERIALS

Retroflective materials reflect light from vehicle headlights back to the driver, thus increasing the visibility of a person wearing the materials. Two types of retroreflective materials are currently in production. One is composed of millions of tiny glass beads bonded to cloth or to a material that can be transferred to cloth. The second design uses microscopic prismatic elements as the reflecting medium on a flexible vinyl material. Adhesive backing allows for transferring the material to cloth.

Associated Behavioral and Accident Data

- Despite reduced levels of pedestrian travel, more pedestrians are killed or injured at night than during daylight hours.
- Most pedestrians estimate their visibility in the dark to be much greater than it actually is.
- Reflectorization can make the visibility of a pedestrian five times greater than with no reflectorization.
- The added visibility of retroreflective materials gives drivers an increased stopping margin.

Advantages

- Inexpensive.
- Easy to implement.

Disadvantages

- Depends on voluntary use.
- Nonstandard reflective materials may confuse motorists.

Implementation Considerations

- The effectiveness of retroreflective materials on nighttime pedestrian safety depends on the proportion of pedestrians who wear them.
- Four major U.S. manufacturers and distributors of retroreflective materials are:

  Reflexite Corporation
  199 Whiting Street
  New Britain, CT 06051

  - Safety Premiums
    Raymond D. Strakosch, Inc.
    9 Cross Street
    Norwalk, CT 06851

  - Safety Trim Industries, Inc.
    26 Old Hollow Road
    Trumbull, CT 06611

  - 3M Company
    Safety Systems Department
    3M Center
    St. Paul, MN 55101

Conditions When Most Beneficial

- For any pedestrians who walk at night.
- Particularly useful for rural areas and areas with little or no nighttime lighting.
- Highly recommended for school children for use on their jackets, backpacks, and bicycles.

SAFETY ISLANDS

Safety islands are pedestrian refuge areas between opposing traffic lanes or within an intersection. They include islands originally installed to channel vehicle traffic but used by pedestrians.

Types of Safety Islands

- Roadway Level Islands. Islands marked on the road with paint, raised markers or other distinguishing material.
- Raised Islands/Medians. Islands raised above the level of the road and designated with a curb.
- Loading Islands. Raised islands serving as refuges for loading and unloading passengers from transit vehicles.

Associated Behavioral and Accident Data

- Some pedestrians are not able to completely cross wide intersections before the light changes.
- Running at intersections to make the light is a common accident cause.
- Safety islands can provide a refuge at confusing intersections on wide or busy roads.

Advantages

- Minimize pedestrian exposure to traffic, allowing pedestrians to cross in stages.
- Permit pedestrians to look for traffic in one direction at a time.
- Give pedestrians a resting place on wide roads or intersections.

Disadvantages

- Present an "illusion of safety."
- Potential street sweeping or plowing problems.
- May damage vehicles if drivers don't see them.
- May increase danger if impatient pedestrians step off them into the traffic flow.

Implementation Considerations

- Installation should be preceded by engineering studies to determine proper design and possible effects on traffic flow.
- Safety islands should be considered during the planning process for complex streets or intersections rather than after construction.
- Islands must be visible at all times and from a distance. This can be achieved through: illumination, reflectorization, size, marking, and/or signing.
- The needs of the handicapped must be considered, including guidestrips for the blind and curb ramps.
- Barriers may be necessary to keep pedestrians from stepping into traffic at improper locati ".
- Pedestrian signals may be oful in showing pedestrians the crossing interval for each crossing stage.

Conditions When Most Beneficial

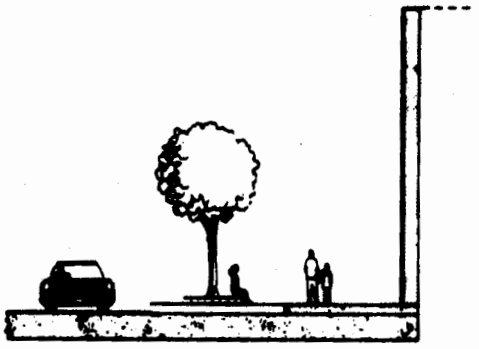
- Wide two-way streets with high vehicle volumes, high speeds, and large pedestrian volume.
- Wide streets where older adults, handicapped pedestrians, and/or children cross regularly.
- Streets where signal timing is not sufficient for pedestrians to cross safely.
- Wide, two-way intersections with heavy traffic volumes and cross'g pedestrians.

SIDEWALKS

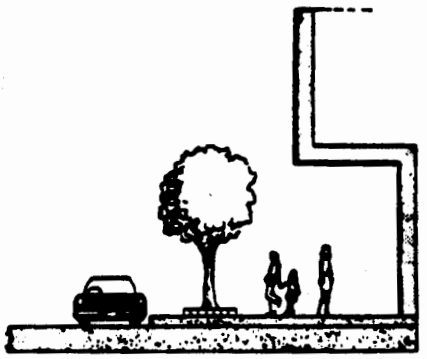
Sidewalks are at-grade areas for pedestrian travel. They include walkways between the curb lines or edge of a roadway and the adjacent property lines. Sidewalks can be either permanent or temporary walkways made of various types of materials.

Types of Sidewalks

- Shoulder Improvements. Areas adjacent to the roadway that have been cleared of physical obstructions for use by pedestrians.
- Pathway. Temporary gravel or asphalt walkway along the roadside.
- Permanent Sidewalk. Concrete walkway separated from the road by a curb or gutter.
- Widened Sidewalk. Walkway that has been widened by reducing the street area (generally the parking lane). Landscaping can provide a buffer zone.



- Arcade Setback. Walkway that has been widened by taking space from the first floor of a building.



Advantages

- Separate pedestrians from motor vehicles.
- Reduce number of pedestrian accidents in residential and business areas.
- Provide safer and more easily traveled areas for all pedestrians, particularly older adults and the handicapped.
- Provide paved places for children to play.
- Shoulder improvements are the least expensive of the alternatives.
- Suitable for areas with low pedestrian volumes.
- Pathways are less expensive than permanent sidewalks.
- Sidewalk widening can increase pedestrian space and relieve pedestrian congestion. Wider sidewalks provide an additional buffer zone between pedestrians and vehicles, and improve the pedestrian walking environment.
- Arcade setbacks provide shelter from weather and don't reduce vehicle space.

Disadvantages

- May require a complicated political process to get installed.
- Often local resistance is experienced because property owners may have to fund the construction.
- Snow removal problems.
- Cracking caused by severe weather requires maintenance.
- Sidewalk widening may reduce vehicle travel lanes and available parking space. More expensive than temporary walkways.
- Arcade setbacks require cooperation of builders, developers, and other private interests and may reduce at-grade store frontage and sales space.

Implementation Considerations

- An overall planning strategy is necessary to determine policies on location of sidewalks, funding, and design.
- Funding can come from assessment of property owners, city funds or both.

- If shoulders are the only walking areas for pedestrians, roadway edgelines should be painted to delineate the vehicle lanes from the shoulder.

- Pathways may be separated from the road by curb and drainage facilities.

- Sidewalks should not be placed too close to high-speed roadways.

Conditions When Most Beneficial

- Suburban streets, particularly with moderate to high pedestrian travel and/or streets with high volumes or speeds.

- Streets where there is no place for pedestrians to walk except in or near travel lane.

- Narrow streets with pedestrian traffic.

- High pedestrian accident areas or routes.

- On roads near schools, parks, or major pedestrian generators.

Recommended Reading

- A FHWA report, Investigation of Exposure Based Pedestrian Accident Areas: Crosswalks, Sidewalks, Local Streets and Major Arterials (FHWA/RD-87/038), examined existing guidance/warrants for the provision of pedestrian pathways and sidewalks. Revised guidance/warrants are also presented in the report which is available from NTIS.

SIGNALIZATION

Signals are electromechanical devices used for regulating, directing or warning motorists and pedestrians. Signals provide safer crossing areas for pedestrians by stopping those vehicles most likely to conflict with pedestrian flow and by telling pedestrians when it is safe to cross.

Types of Signals and Signal Systems

- Traffic Signal. Signal installed primarily for vehicular traffic control. Pedestrians use the same phase and signals as the vehicles at intersections where no pedestrian signals are provided.

- Pedestrian Signal. A word or symbolic supplement to traffic signals telling pedestrians when to start their crossing. Pedestrian signals (i.e., WALK/DONT WALK or the man/hand indications) are generally mounted on signal poles at the far end of the crosswalk. Pedestrian signals can cycle with the traffic signal or be activated by a pedestrian-actuated push button. Pedestrian signals at an intersection may have any one of the following four types of phasing:

  - Standard (Concurrent or Shared) Phase. Pedestrian signals are timed with the traffic signal. Pedestrians cross at the same time as vehicles moving parallel to them, and right-turning (and, in some cases, left-turning) vehicles may turn across the pedestrian crosswalk during the crossing, i.e., WALK, interval.

  - Early Release Phase. Allows pedestrians to leave the curb (and, in some cases, finish crossing) before vehicles are permitted to turn.

  - Late Release Phase. Pedestrians are released after a certain portion of the phase has been given to turning vehicles.

  - Separate Phase (Scramble or Barnes' Dance). All vehicles are stopped during one signal phase of each cycle to allow pedestrians to cross unimpeded on all approaches (and on the diagonals at some separate phase intersections where diagonal crosswalks and corresponding pedestrian signals are provided).

Advantages

- Traffic signals:

  - Create gaps in traffic flow so pedestrians may cross the street while traffic is stopped.
  - Can provide for the orderly movement of traffic.
  - Can increase the traffic handling capacity of intersections.

- Pedestrian signals:

  - Warn pedestrians of an impending light change sooner than the vehicle amber signal.
  - Can give pedestrians a longer crossing cycle.

- Separate phase signals completely separate pedestrians and vehicles in situations where pedestrians and motorists all obey their signals (e.g., pedestrians crossing during the DONT WALK interval and motorists running the red light present the risk of a pedestrian accident).

Disadvantages

- Traffic signals:

  - Signals are often not timed to provide adequate time for pedestrians to safely cross the street.
  - More expensive than most other countermeasures.
  - May cause pedestrian congestion on sidewalks and pedestrian delay at corners.
  - In rural and residential areas, many children do not wait for the light before crossing.
  - Suspension wire-mounted signals often cannot be seen by pedestrians standing on the corner. In such cases, pedestrian signals (i.e., WALK/DONT WALK) should be installed.
  - Pedestrians and drivers often disobey signals.

- Pedestrian signals:

  - Lack of understanding of meanings of steady and flashing signals (i.e., only about half of pedestrians understand the difference between the flashing and steady DONT WALK).
  - Typically, younger pedestrians either disregard the pedestrian signal, or overdepend on it.
  - Pedestrians may feel overly safe from turning vehicles when they see a WALK indication.
  - Many pedestrians do not use the push button.

- Separate phase signals can cause serious vehicle and pedestrian delay and backup.

- Pedestrians often obey traffic signals more frequently than pedestrian signals.

Implementation Considerations

- Warrants, design requirements, and guidelines are in the MUTCD and Traffic Control Devices Handbook.

- Signal timing should also consider pedestrians, with special cycles where needed (e.g., longer crossing times in areas with substantial volumes of older adults or handicapped pedestrians).

- The shortest possible cycles should be used to accommodate waiting pedestrians and minimize vehicle delay. After waiting 30 seconds, pedestrians become impatient.

- The signal system must be as simple as possible. Complicated signals confuse drivers and pedestrians.

- Prohibiting right and/or left turns at intersections may reduce pedestrian accidents.

- If pedestrians can see the traffic signal, they are more likely to ignore the pedestrian signal.

- Adults understand symbolic signals as well as word messages. Children do not understand symbolic messages as well as DONT WALK/ WALK.

- Push buttons must be located so children and people in wheelchairs can reach them.

- Several considerations relate to pedestrian push button signals, including:

  - The signal with pedestrian actuation devices should be timed to provide a reasonable waiting time (e.g., 30 seconds or less) to the pedestrian after the button is activated.

  - Supplemental signs designating the specific streets (e.g., PUSH BUTTON TO CROSS GRANGER STREET) can increase pedestrian use of push buttons. Use of a special device (e.g., a light which comes on when the button is pushed) can increase pedestrian use and respect for push buttons.

  - If a pedestrian device is designed to operate only for specific times of the day (e.g., off-peak traffic periods), a sign should accompany the actuation device (e.g., PUSH BUTTON NOT IN OPERATION FROM 2:00 TO 6:00 P.M. ON WEEKDAYS).

- Numerous types of signs and markings may be installed to supplement or explain the traffic and pedestrian signals (see section on Signs and Markings).

Conditions When Pedestrian Signals Are Most Beneficial

- As specified in the MUTCD, pedestrian signals shall be installed at intersections:

  - When a traffic signal meets the Minimum Pedestrian Volume or School Crossing Warrant.
  - When an exclusive pedestrian phase is provided.
  - When vehicular signal indications are not visible to the pedestrian.
  - At established school crossings.

- Pedestrian signals may be installed:

  - When pedestrian volumes are sufficient to require a pedestrian clearance interval.
  - When the vehicular indication may tend to confuse pedestrians (i.e., split phase timing).
  - At intersections with complex designs (e.g., five or more intersection legs, wide streets, refuge islands for pedestrians to cross only part of the street during a single signal phase).

- Pedestrian signals are most effective in cities where pedestrian compliance is high.

- At intersections or midblock locations where pedestrian push buttons are used. (In some cities, the push button actuation alters the cycle split to allow for more time for pedestrians to cross the street.)

- In areas with considerable volumes of young children and/or older adults.

Conditions When Traffic Signals Are Most Beneficial

- Refer to Traffic Signal Warrants, as specified in the MUTCD.

SIGNS AND MARKINGS

Signs are devices mounted on a fixed support, conveying a regulatory, warning or guiding message to pedestrians or motorists. Word or symbolic messages may be presented. Markings are regulatory, warning or guiding words, patterns, or lines painted on the pavement (for vehicles) or sidewalk curb (for pedestrians). Guidelines for the proper use and placement of signs, signals, and markings are provided in the MUTCD.

Types of Signs and Markings

- Regulatory Signs. Tell pedestrians and motorists what they may or may not do, based on the law.

  Examples: "Pedestrians Prohibited"
  "Cross Only at Crosswalks"
  "No Turn on Red"
  "No Left Turn"
  Speed limit signs

- Warning Signs. Call the driver's/pedestrian's attention to conditions on or near a roadway that are potentially hazardous to pedestrians.

  Examples: "Caution, School Crossing"
  "Watch for Vehicles"

- Guide Signs. Provide information to help the pedestrian cross the street or use a pedestrian facility.

  Example: "For Extra Walk Time Push Button"
  "Push Button to Cross Elm Street"

- Variable Message Signs. Electronic signs that light up various messages depending on the specific situation.

  Example: "Speed Limit 25 mph When Flashing"

- Crosswalk Markings. Painted lines delineating a pedestrian crosswalk.

- Stop Line. Painted stripe indicating the place where vehicles should stop at a stop sign, traffic light or crosswalk. Offset and angled stop lines are also in use on multilane roads to improve the sight distance of the driver in the right lane relative to pedestrians and cross street traffic.

Advantages

- Inexpensive.
- Signs can tell people of regulations applying only at specific locations or times.
- Signs give advance warning of schools.
- Signs make motorists more attentive in an area with children.
- Pavement markings can channelize pedestrians and vehicles.
- Pavement markings can supplement the regulations or warnings of other devices.
- Pavement markings do not divert the motorist's attention from the roadway.
- Stop lines can increase the distance vehicles stop from the crosswalk and improve the driver's view of any pedestrians in the crosswalk. Offset stop lines can increase motorist sight distance in the right lane so pedestrians can be seen before they step out into the motorist's path.

Disadvantages

- People have difficulty understanding signs.
- Installation of new or novel signs requires an education and publicity program.
- Signs can be ineffective in urban areas because they have to compete with other visual objects.
- Signs tend to be ignored in rural areas.
- Signs may be easily damaged.
- Regulations considered unnecessary or unwarranted will often be violated.
- Excessive use of warning signs may cause motorists to ignore them.
- Pedestrians tend not to believe warning signs and disregard them.
- Pavement markings have short durability and need continual maintenance.
- Pavement markings may be hard to see in the winter because of snow.
- Pavement markings may not be clearly visible when we

Implementation Considerations

- The MUTCD and Traffic Control Devices Handbook should be consulted and followed when installing signs and markings.

- Signs and markings should:

  - Be uniform and consistent in design and placement.
  - Present a clear, simple, and legible message.
  - Fulfill a need as demonstrated through field studies or observation.
  - Command attention and be conspicuous.
  - Give the motorist or pedestrian adequate time to respond.
  - Be visible at night through lighting or reflectorization.
  - Be constantly maintained and upgraded as warranted.

- The use of symbols versus words on signs is not universally preferrable. Different age and cultural groups assign different meanings to the same signs/symbols.

- Speed limit signs with flashing beacons are more effective than variable message or standard speed limit signs.

- "Walk On Left Facing Traffic" signs are effective in rural areas.

Conditions When Most Beneficial

- Regulatory and/or warning signs aimed at motorists are most useful in areas such as:

  - Where motorists do not expect pedestrians.
  - Visibility obstructions (e.g., crosswalks on hill crest or vertical curves).
  - School crossing locations.
  - Rural and high speed locations.
  - Midblock crossing locations.
  - Intersections with heavy turning movements.

- Regulatory and/or warning signs aimed at pedestrians are most useful in areas such as:

  - At complex intersection geometrics (five or more legs, offset approach legs, etc.).
  - Complex signal phasing.
  - At prohibited pedestrian crossings.
  - Where pedestrians must cross high-speed or other unsafe roadways.
  - Where unexpected conflicts to pedestrians and/or heavy turning volumes exist.

- In general, pavement markings have not been shown to be effective in improving pedestrian safety, although crosswalks are useful in some situations for channelizing pedestrian movements.

URBAN PEDESTRIAN ENVIRONMENT (UPE)

Urban pedestrian environments (UPEs) are at-grade environments partially or wholly separated from vehicular traffic. They include malls; auto-free zones; and transitways located in urban business, commercial, industrial, and residential areas. UPEs are usually initiated as part of an urban renewal or downtown economic revitalization process. Pedestrian safety is a definite side benefit.

Types of Urban Pedestrian Environments

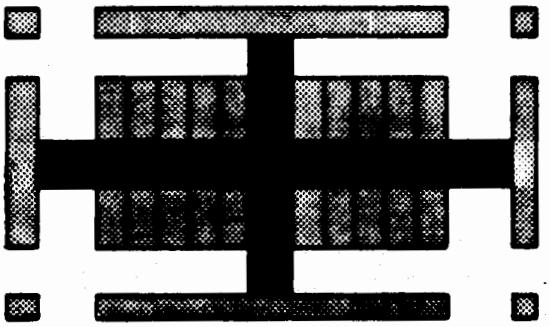
- Transitway. Street reserved for pedestrians and transit vehicles. All private vehicles are excluded except for emergency or temporary construction work vehicles. Transit lanes are set apart from pedestrian areas.

- Modified Street. Conventional street with one block closed to traffic for exclusive pedestrian movement.

- Plaza or Interrupted Mall. Blocks of a retail street given over to exclusive pedestrian use, with cross streets left open to vehicular traffic.

- Continuous Mall. Multiblock pedestrian street from which all but emergency vehicles are excluded and which extends the full length of the shopping area without interruption.

- Displaced Sidewalk Grid. Horizontally displaced pedestrian walkways through alleys, arcades or lobbies within buildings.



- Below-Grade or Above-Grade Networks. See section on Grade Separation.

Advantages

- Reduce pedestrian delays; relieve pedestrian congestion.
- May provide aesthetic, economic, and social enhancement of downtown area.
- Greater accessibility to retail merchants.
- Decrease noise and air pollution on affected street.
- Increase revenues, sales, and land values.
- Eliminate onstreet servicing of stores.
- Can be developed in stages.

- May provide shelter for pedestrians.
- Can unify commercial or recreation areas.
- Transitway increases efficiency and time savings of mass transit.
- Displaced sidewalk grid relieves vehicle congestion at intersections.

Disadvantages

- Generally high cost of installation, maintenance, and operation.
- Vehicle traffic must be diverted to other streets.
- Maintenance problems (e.g., snow removal).
- Reduce retail activity on nearby streets.
- Increase noise and air pollution on nearby streets.
- Disrupt utility and emergency services.
- Disrupt mail and goods delivery.
- May disrupt bus routes.
- Problems of street furniture placement for visually handicapped pedestrians.
- Parking problems.
- Security and policing problems.
- Transitway doesn't provide complete separation of pedestrians and vehicles.
- Pedestrian-vehicle conflict is possible at cross streets in a plaza or interrupted mall.
- Displaced sidewalk grid may cause midblock conflicts between pedestrians and vehicles.

Implementation Considerations

- Feasibility studies determining the political, business, and general public support are essential. Included in these evaluations should be potential effects on traffic, area economics, and social environment.

- Successful implementation requires a great deal of cooperation and organization:

  - A primary leadership group and working committees must coordinate and administer the process.
  - Public and private interest can be developed through the media, informational meetings, pamphlets, and displays.
  - Management, financial, and scheduling plans should be arranged and followed.

- Periodic review sessio nould be held to:

  - Consider and develop alternative concepts, if necessary.
  - Insure that all concerned parties have adequate opportunity to contribute as they see fit.

- Temporary UPEs can be set up as part of a feasibility study to determine a more permanent need.

- Crosswalks must be provided for pedestrians in transitways.

- Pedestrian-vehicle conflicts at plazas or interrupted malls can be minimized through:

  - One-way cross streets.
  - Signals and warnings to the motorists, such as signs, traffic bumps or contrasting pavement at the mall crossings.

Conditions When Most Beneficial

- In central business district (CBD) and high pedestrian volume areas.

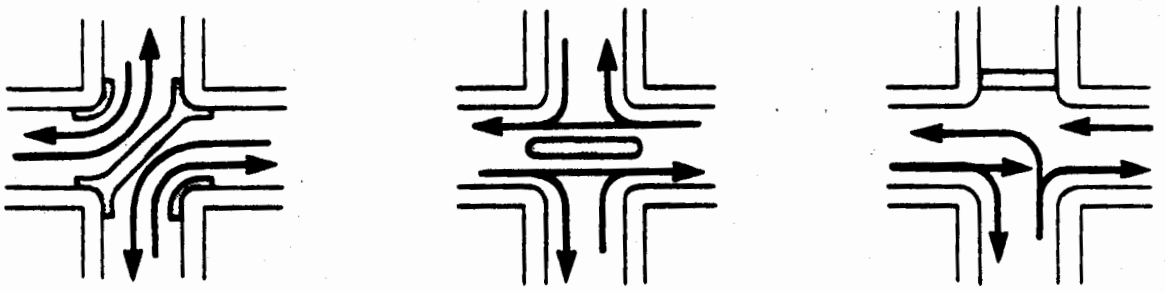
- Where sidewalks are overcrowded and vehicle volumes are low.

- In high-density downtown shopping areas with heavy pedestrian activity.

- Where traffic circulation would not be adversely affected.

VEHICULAR TRAFFIC DIVERSION STRATEGIES

Street closure barriers are concrete, wood, or live plant barriers used to prevent vehicles from entering particular streets or blocks. These barriers can completely close off a street to make an auto-free zone or play street, or more simply divert vehicles, thus reducing the amount of through traffic in a neighborhood. Street closure barriers can be either permanent or temporary.



Advantages

- May serve a dual purpose by channelizing or controlling pedestrians as well as vehicles.
- Prevent vehicles from entering certain streets (play streets, malls).
- Can reduce vehicle speeds and volumes in residential areas.
- Can be temporary or permanent.

Disadvantages

- Community members may be opposed to vehicle barriers.
- Limit easy access of emergency and sanitation vehicles.
- Possibility of auto accidents caused by barriers.
- Complicated planning process involving street rerouting and engineering studies.

Implementation Considerations

- Detailed standards for vehicle barriers can be found in the MUTCD.
- Closing of streets involves many political and engineering processes (see sections on Urban Pedestrian Environments and Play Streets).

Conditions When Most Beneficial

- In residential areas with high levels of pedestrian activity (particularly children) and problems from high-speed non-local traffic.
- In neighborhoods with a need for pedestrian play or w ing areas free of traffic.

EDUCATION COUNTERMEASURES

GENERAL CONSIDERATIONS FOR EDUCATION OF CHILDREN

ASSOCIATED ACCIDENT DATA

- 40-45 percent of all pedestrian casualties in the United States are children.
- Nearly 80 percent of all child pedestrian accidents are precipitated by unsafe or illegal actions by the child.
- Most child pedestrian accidents are of the dart-out type and occur at nonintersections.
- Almost 75 percent of the pedestrian accidents involving children occur in residential areas not at intersections.
- Few accidents involve children on their way to or from school -- the majority occur near the child's home between 2 p.m. and 6 p.m.
- Children in accidents come from homes with less parental supervision and fewer play facilities.

ASSOCIATED BEHAVIORAL DATA

- Dart-out behaviors are exhibited by children from preschool to age 13, although they are less frequent with the older age groups.
- Children can be expected to do the unexpected in a traffic situation.
- Young children show the following forms of intellectual or physical immaturity:
  - Limited ability to deal with more than one thing at a time, which is improvable through training.
  - Limited capability to judge vehicle velocity, distance, and safe gaps.
  - Inability to properly understand signs, many traffic terms, and signals (a large number of children would cross on a red light).
  - Problems with sound localization and direction judgment.
  - Limited peripheral vision.
  - Greater difficulty to see over cars, and to be seen, when behind cars, because of their smaller size.
- Drivers and children do not understand each other's behavior.
  - -- Drivers believe children will always stop and give cars the right of way.
  - -- Children think adults will always be kind to them and that vehicles are capable of stopping instantly.

- A majority of children, whether walking or running, do not come to a complete stop before entering a street.

- Children should not be "overprotected" through overuse of pedestrian facilities. They need to learn how to cross safely at areas where there are no special facilities.

- Parents should be encouraged to involve themselves in child safety through better supervision and by setting a good example.

- Warrants or guidelines should be established and used to determine the type of countermeasures to use along a school route (patrols, adult guards, signals, police).

PARENTAL GUIDANCE

Setting a good example through proper actions in traffic. Parents or day care/nursery school personnel can use the AAA booklets, "Preschool Children in Traffic."

Advantages

- May teach children not to dart-out into traffic or play in the street.
- Help children learn by doing.
- Help children develop safe habits.
- Booklets are individualized for different age groups.
- Provide parents with a guide and materials for teaching their small children to deal with traffic.

Disadvantages

- Takes up parent's time.
- Depends on the motivation of parents or day care/nursery school personnel.

Implementation Considerations

- Adults should be informed of the necessity for preschool child safety.
- Follow-up training is necessary.
- Parents and nursery school personnel must be aware of the booklets, which may be available through local AAA offices.

SAFETY TOWN

A miniaturized village with streets, sidewalks, buildings, and traffic control devices used for instructing small children in the basics of traffic operations. The town can either be fixed (in a shopping center or school area) or portable.

Advantages

- Teach children responsibility for their actions.
- Teach children how to use traffic systems in a realistic, but safe environment.
- Children learn by doing.
- Community tends to be enthusiastic.

Disadvantages

- A location must be found either for storage or for permanent location.
- May be costly to build and operate.
- Needs organization and continuing management.
- May take police from other duties.
- Children may not relate a safety town to traffic situations in the real world.

Implementation Considerations

- Should be carefully planned and coordinated with the police department and other affected community groups.
- A citizen's group may sponsor the program.

TRAFFIC SAFETY CLUBS

Clubs in which parents and children learn about safety hazards and basic traffic rules. Safety skills are developed through songs, games, group training, and instruction of the parents.

Advantages

- Directly educate small children.
- Indirectly benefit children by training parents.

Disadvantages

- Involve much planning and cooperation.
- Leaders must be trained.
- Clubs vary in quality of training.

Implementation Considerations

- Requires advance planning and preparation.
- Presently used in Japan and Great Britain.

TELEVISION PROGRAMS

Typical programs using safety films or combinations of films and explanations by safety personnel.

Advantages

- Young children are avid television watchers.
- Most homes have televisions.
- A time slot can be easily chosen to reach a majority of young children.
- Television stations are required to show a certain number of hours of public service shows and they are likely to be responsive to programs on child safety.
- Films are available through the local AAA clubs.

Disadvantages

- Require contacts and planning.
- May be costly to produce.
- Safety shows may not be aired on prime time.

Implementation Considerations

- A working relationship could be developed with local television stations or filmmakers.
- It might be useful to set up a special group concerned with safety messages on television.
- The local AAA office should be contacted about films.
- Some programs aimed at elementary school children (see following section) may have beneficial effects on older preschoolers or the siblings of preschoolers.

WALKING IN TRAFFIC SAFELY

The Walking in Traffic Safely (WITS) program is a parent-child program designed to teach preschool children about streets and cars. The program consists of nine storybooks delivered to parents at six-month intervals as their child matures. The basic lesson is learning to recognize roads and stay away from them unless accompanied by a parent or some other older person. The program is modeled after the European child safety clubs.

Advantages

- Based on extensive research.
- Involves parents in the safety process.
- Covers the appropriate issues for preschoolers.
- Can delay the time children are allowed in traffic unsupervised.
- Children learn words and concepts to help them understand the safe street crossing advice they will receive when they are older.

Disadvantages

- Requires scheduling either by parents or an outside agency.
- Not applicable to some non-nuclear family situations unless a teacher can be involved.
- Large number of separate items.

Implementation Considerations

- Parent booklet for each storybook.
- Parents work with children.
- Available from NHTSA.

WATCHFUL WILLIE

The Watchful Willie program consists of a series of four lessons for preschool chilren. The objective of the program is to teach these children to recognize streets and cars and to stay away from them. The "spokes-person" for the program is Watchful Willie, a hand-puppet provided for the teacher in the program materials.

Advantages

- Contains all needed teacher and student materials.
- Contains information for parents.
- Entertaining activities for children.
- Proved effective and well received through field research.

Disadvantage

- Requires teacher preparation.

Impelementation Considerations

- May be used in a day care center or other places where supervised activities are provided for preschool children.
- Available from the National Safety Council, 444 N. Michigan Avenue, Chicago, Illinois 60611 (1-800-621-7619).

PROGRAMS FOR ELEMENTARY SCHOOL CHILDREN

OFFICER FRIENDLY

Assembly or classroom programs given by the police or other safety officials. Such programs include talks, films, and demonstrations about pedestrian, bicycle, school bus, and other safety issues.

Advantages

- Improves child/police relations.
- Children learn from an authority figure with experience in the area.

Disadvantages

- Quality of these programs varies according to the dedication and facilities of individual police departments.
- Takes police officers from other duties.

Implementation Consideration

- Not effective individually. Must be part of a coordinated program.

EDUCATION WITHIN THE CURRICULUM

Safety taught as part of the classroom curriculum. Such programs present numerous and varied approaches:

- Rote learning of safety slogans or steps for crossing correctly.
- Classroom lectures and discussions.
- Use of activity cards or safety kits containing information sheets, quizzes, poster materials, and visual aids.
- Poster Contest (sponsored every year by the AAA) involving children in designing safety posters. Can be incorporated into art classes.
- Safe Route to School Program (see section on Child Protection).
- Films, slides, models, and simulators. Such materials could be provided through a centralized safety library.

- Demonstrations or simulations. The results of pedestrian accidents are illustrated through a simulated crash of a vehicle and a safety cone dressed up as a (child) pedestrian.

- On-site training or field trips to traffic facilities.

Advantages

- The subject can be covered more thoroughly.

- Can be woven into the regular curriculum.

- Permit discussion and questions.

- Children learn by doing.

Disadvantages

- Take time from other classroom subjects.

- Teachers must be specially trained in the subject matter.

- Classroom instruction is not as effective as instruction in a safety town situation for teaching children to cross properly at signals.

- May be expensive.

- Require audio-visual equipment.

- Need time and materials to prepare.

Implementation Considerations

- Not effective individually. Must be part of a coordinated program.

- Programs taking place away from the school (field trips and demonstrations) must provide for the safety of the students.

- Local AAA clubs should be contacted about the availability of AAA films and pamphlets.

GREEN PENNANT PROGRAM

Schools with an accident-free year are given a green pennant to put on their flagpoles. For each subsequent accident-free year, a gold star is added to the pennant. These awards are highly publicized in the media. Schools that have a child pedestrian accident may not fly their pennant for one month and must remove one gold star. This applies to <u>any</u> pedestrian accident involving a child that attends that school.

<u>Advantages</u>

- Involves the whole school and the community through the media.
- Publicizes pedestrian safety.
- Reminds students to act safely at all times, not just on the way to school.
- Provides motivation for students to act safely.
- Requires children to think about safety problems and express them.

<u>Disadvantages</u>

- Requires paperwork.
- Pennants and stars must be provided.

"BIG WHEEL"/CHILD RIDING TOYS

The "Big Wheel" 60-second spot is intended for in-classroom use, although it may be used on television. It deals with young children on riding toys. The message in the spot is:

> When you are on a Big Wheel, you move quickly and low to the ground. Drivers can't see you and you can't see oncoming vehicles. Therefore, never ride into the street. Get your mom or dad to put a line near the end of your driveway. Never cross the line and ride into the street -- no matter what.

Advantages

- Very inexpensive.
- Addresses known accident type.
- Provides specific behavioral advice.

Disadvantage

- Limited availability.

Implementation Considerations

- May require assistance from television stations.
- Available from NHTSA.

WILLY WHISTLE

The Willy Whistle program is a behaviorally oriented program designed to teach children (grades K-3) not to dart out at nonintersection locations. The anti-dart out messages include a 6- to 7-minute classroom film, three 30-second TV spots, three 60-second TV spots, and a poster. All employ an original animated character named "Willy Whistle" as the "spokesperson." The six TV spots cover the behavioral messages contained in the classroom film. The three 60-second spots cover:

- "The Whole Story" -- stopping at the curb and looking left-right-left (L-R-L) before crossing; stopping at the edge of a parked car and looking L-R-L before crossing; and reinitiation, beginning the L-R-L all over again if interrupted.
- "Reinitiation" -- beginning the stop and L-R-L sequence all over again if interrupted so that you can obtain a "clean" L-R-L before crossing.
- "Curbs and Parked Cars" -- the stop (at the curb or edge of a parked car) and look L-R-L message with particular emphasis on the stop part.

The three 30-second TV spots are abbreviated versions of the 60-second materials and are titled "Search," "Curbs," and "Parked Cars."

Advantages

- Proved effective.
- Relatively inexpensive.
- Coordinates with "Safe Street Crossing" and "And Keep on Looking" programs.
- Requires minimal teacher preparation.
- Addresses most frequent behavioral errors for elementary school children.

Disadvantages

- Addresses only one type of behavior.
- Limited availability of copies.

Implementation Considerations

- Materials should not be considered a single application countermeasure. They are designed for effectiveness with repeated and multimedia exposure.
- Can be used as part of a curriculum if behavioral messages are consistent.
- Available from NHTSA.

SAFE STREET CROSSING

The safe street crossing program is a behaviorally oriented in-class program to teach children (grades K-3) to safely cross the street. The basic advice is to always stop at the curb and always look left-right-left. The program uses the Willy Whistle film and provides a variety of classroom and simulated traffic activities.

Advantages

- Provides practice in a controlled environment as well as classroom teaching.
- Has been shown to be effective based on extensive research and field testing.
- Contains all teacher and student materials and audio-visuals.
- Contains materials for parents.
- Coordinates with "Willy Whistle" and "And Keep on Looking" programs.

Disadvantages

- Requires some teacher preparation.
- Requires the commitment of significant teaching time and staff resources.

Implementation Consideration

- Available from NHTSA.

CHILD PEDESTRIAN INTERSECTION DASH TV SPOT

The child pedestrian intersection dash TV spot is a 60-second spot. The general message carried in the spot is:

> Green lights, "Walk" signals, and crosswalks do not necessarily mean that it is safe to start crossing. Rather, they tell you to stop at the curb and look left-right-left to be sure that it is safe.

The spot features Willy Whistle and is designed for children who are slightly older than the grades K-3 children shown in the Willy Whistle film. Child crossings are depicted at both signalized and unsignalized intersections. A companion TV spot teaching adult intersection safety is also available.

Advantages

- Addresses known accident type.
- Provides specific behavioral advice.
- Very inexpensive.
- Child spot coordinates with "Willy Whistle."

Disadvantages

- Limited availability.
- Public service air time may be difficult to obtain.

Implementation Considerations

- Requires assistance from television stations.
- Available from NHTSA.

"AND KEEP ON LOOKING" FILM

"And Keep on Looking" is a 15-minute in-classroom film covering many of the more complex traffic situations encountered by children (grades 4-7) as they walk beyond their own neighborhoods. The following messages are covered:

- Stop and look left-right-left at intersections even if the light is green or the signal says "Walk."
- Flashing "Don't Walk" means don't start crossing, but if you have started keep on going.
- Flashing "Walk" means that vehicles <u>can</u> turn across your path.
- Look for turning vehicles at intersections and look at the driver not just the car. Also, look for vehicles about to turn right on red.
- Proper procedures for crossing near a school bus.
- Recognize "visual screens" that block your view of oncoming traffic (e.g., parked car or truck, stopped car, bush or tree). If one is present, go out to where you can just see around the visual obstruction, stop and look left-right-left before crossing.
- Open areas in parking lots are really just like roadways. Always stop and look left-right-left before entering an open area, watch for vehicles that might pull across your path into a parking spot, and watch for vehicles that are backing out.

<u>Advantages</u>

- Relatively inexpensive.
- Based on proven techniques.
- Coordinates with Safe Street Crossing and Willy Whistle programs.
- Requires minimal teacher preparation.
- Provides behavioral advice to counteract a wide range of accident types.

<u>Disadvantage</u>

- Limited availability of copies.

Implementation Considerations

- Film can be used alone, but is designed to follow "Willy Whistle" used in the lower grades.
- Can become the basis for a pedestrian safety curriculum.
- Available from NHTSA.

ASSEMBLIES

Assemblies on pedestrian safety, including films and speeches, preferably by fellow students.

Advantages

- Reach a large group of students.
- Don't take much time out of the class s. edule.

Disadvantages

- Are usually too large to permit questions and discussion.
- Usually have no follow-up.

Implementation Consideration

- Not effective individually. Must be part of a coordinated program.

DRIVER EDUCATION

Inclusion of data on pedestrian safety in driver education courses.

Advantages

- Reaches a large group of students.
- Allows for questions and discussion.
- Doesn't take time from other classes.
- Information is presented in an opportune setting, i.e., students want to learn subject matter so they can get their licenses.
- Information is presented by an authority figure.
- Emphasizes need for drivers to watch out for pedestrians and bicyclists.

Disadvantages

- The teacher may not be enthusiastic about having to teach pedestrian safety and may present the information badly.
- Material must be prepared for inclusion in these courses.

Implementation Consideration

- Not effective individually. Must be part of a coordinated program.

YOUTH TRAFFIC COURT

Made up of students to discipline fellow students violating safe walking, bicycling or driving regulations. Sentences may be sessions at violator's school and/or essays on traffic safety.

Advantage

- Peer pressure is very effective.

Disadvantages

- May present legal problems and in some states may be illegal.
- Needs careful organization and great commitment of police and other law officials.

Implementation Consideration

- Not effective individually. Must be part of a coordinated program.

ASSOCIATED BEHAVIORAL AND ACCIDENT DATA

- A majority of pedestrian accidents involve a pedestrian who has committed some unsafe act.
  - -- A large percentage of adults involved in accidents appear suddenly in the street.
  - -- People may notice a safety problem, but they are unlikely to do anything about it out of a feeling that accidents always happen to someone else.
  - -- Adults are inclined to take high risks by dodging between moving vehicles or by demanding a right-of-way irrespective of the speed and location of approaching vehicles.
- Many pedestrians do not know how to act safely in traffic or how to use traffic facilities.
  - -- About 35 percent of all adult pedestrian accidents occur at traffic signals.
- Teaching adults the correct use of roads is difficult because many adults are not psychologically attuned for more education.
  - -- Adults already have a base of safety knowledge. They need reminders and motivational messages.

GENERAL IMPLEMENTATION CONSIDERATIONS

- Provide positive information, give the pedestrian or driver ideas on what he can do, rather than a list of don'ts.
- Detailed information on organizing a public education program is available from the AAA.
- Many pamphlets are available from local AAA clubs.
- There is no guarantee people will read materials or follow their advice.
- Many adults cannot read.

TALKS TO GROUPS

Talks by police or safety officials to civic groups and special organizations.

Advantages

- Reach a large number of people at one time.
- Allow for group discussion, questions, and answers.

Disadvantages

- Don't reach a large percentage of the total population.
- Tend to be a one-time thing with no follow-up.

Implementation Considerations

- Informed and willing speakers must be found.
- Groups must be contacted.
- A speaker's outline or guide should be developed.
- Pamphlets should be available to hand out.

COMMUNITY ACTION PROGRAMS

Use of community organizations to construct and implement programs tailored to their specific needs.

Advantage

- Inclusion of interested community members on pedestrian committees.

Disadvantages

- May have organizational and operational problems.
- Need strong leadership.

USE OF THE MASS MEDIA

- Television: News spots explaining new changes, short action clips on safety activities, and national programs explaining safety problems and solutions in depth (such as the National Safety Council's National Driver's Test).

- Radio: Short news items, public service spot announcements, talk shows to air problems, and daily programs giving safety tips and pointing out hazards.

- Newspapers: Well-timed press releases on changes or particular problems, pictures, feature stories, accident facts, editorials, and articles written on a regular basis by safety personnel or police.

	Advantages	Disadvantages
Television	Reaches a very large audience.	Can be costly.
	Can be explained verbally and in pictures.	Television production is very complicated.
	Retention of messages which are both verbal and visual is high.	
Radio	Reaches a large audience.	Messages must be limited to short and simple news spots or safety tips.
	Can reach motorists when they are in their cars and may be most receptive to traffic safety messages.	
Newspapers	Can explain in words and pictures.	Can be difficult to get someone on the newspaper staff interested.
	Can cover a new development on a continuing basis.	
	Can cover a subject more fully.	

MULTIPLE THREAT SAFETY SPOTS

The multiple threat accident type develops when one car stops for a crossing pedestrian and thereby blocks the pedestrian from the view of overtaking motorists. These accidents are covered by two 60-second and two 30-second TV spots and one 60-second and one 30-second radio spot. All of the materials are targeted for adult pedestrians and drivers. The specific materials include:

- Spots to drivers telling them to look for cars stopped in traveled lanes, slow down, and ask themselves why the car is stopped. The audience is then told and/or shown that the stopped car could be hiding a pedestrian.
- Pedestrian-oriented spots presenting the message to stop at the edge of any car that stops to allow a crossing and to look around it for any cars coming in the next lane.

Advantages

- Addresses known accident type.
- Provides specific behavioral advice.
- Very inexpensive.

Disadvantages

- Limited availability.
- Public service air time during adult viewing hours and drive time may be difficult to obtain.

Implementation Considerations

- Requires assistance from television and radio stations.
- Available from NHTSA.

VEHICLE TURN-MERGE SAFETY SPOTS

Vehicle turn-merge (VTM) accidents are covered by two 60-second and two 30-second TV spots and 60- and 30-second radio spots. The VTM materials are targeted for adult pedestrians and drivers. The VTM messages include:

- Spots addressed to drivers to remind them to take a last look for pedestrians before making turns at intersections.
- Spots addressed to pedestrians telling them that drivers making turns have a lot to watch out for and may sometimes forget to look for pedestrians.

Advantages

- Addresses known accident type.
- Provides specific behavioral advice.
- Very inexpensive.

Disadvantages

- Limited availability.
- Public service air time during adult viewing hours and drive time may be difficult to obtain.

Implementation Considerations

- Requires assistance from television and radio stations.
- Available in both English and Spanish.
- Available from NHTSA.

ADULT PEDESTRIAN INTERSECTION DASH TV SPOT

The adult pedestrian intersection dash TV spot is a 30-second spot. The general message carried in the spot is:

> Green lights, "Walk" signals, and crosswalks do not necessarily mean that it is safe to start crossing. Rather, they tell you to stop at the curb and look left-right-left to be sure that it is safe.

The spot depicts crossings at a signalized location. A similar TV spot teaching child intersection safety is also available.

Advantages

- Addresses known accident type.
- Provides specific behavioral advice.
- Very inexpensive.

Disadvantages

- Limited availability.
- Public service air time during adult viewing hours may be difficult to obtain.

Implementation Consideration

- Requires assistance from television stations.
- Available from NHTSA.

ASSOCIATED BEHAVIORAL AND ACCIDENT DATA

- Older adults account for about 20 percent of all pedestrian fatalities and about 10 percent of all pedestrian injuries.
- In many of the accidents involving older adults, the pedestrian was at fault.
- Older adults, as pedestrians, have a higher risk of accidents.
  - -- They may never have had a driver's license and may not know the limitations of vehicles.
  - -- They may have such physical limitations as: reduced vision or hearing, less accurate depth perception, decreased lateral field of vision, slower perception and response, or chronic illness.
  - -- They may have problems understanding traffic control devices.
  - -- They may be confused by traffic. Common behaviors range from timidity and fear to brashness and contempt for traffic.

GENERAL IMPLEMENTATION CONSIDERATIONS

- Some older adults may have trouble reading.
- Education of older adults should emphasize overcoming their limitations and breaking outdated habits.
- Older adults should be represented on safety committees.
- Specific guidelines on older adult pedestrian behavior are available from your local AAA office.
- A pamphlet on the problems of older adult pedestrians and possible countermeasures has been published by the AAA.
- A 15-minute slide and tape show, called "Safety Steps for Pedestrians," is available from the American Association of Retired Persons (AARP). It provides safe walking tips specifically aimed at older adults. Contact AARP, Traffic Safety Department, 1909 K Street, N.W., Washington, D.C. 20049.

SAFETY COURSES

Made up of several sessions using films, talks, group discussion, and site visits.

Advantages

- Can cover large amounts of material.
- Allow discussion and questions.

Disadvantages

- Older adults may have trouble getting to the classes.
- May be costly.

Implementation Considerations

- Convenient locations must be found.
- Materials must be gathered and an instructor trained.

TALKS TO GROUPS

Talks to senior citizen's groups by police or safety officers.

Advantages

- Allow for discussion and questions.
- Involve less planning than a course.

Disadvantage

- Tend to be a one-time presentation with no follow-up.

Implementation Consideration

- Materials must be prepared carefully to provide maximum instruction in a short time.

COMMUNITY CONTACT PROGRAM

Members of senior citizen's groups contact other older adults and provide them with safety materials.

Advantages

- Reach people who might not have any other opportunity to learn about safety.
- Personal contact.

Implementation Consideration

- Involves cooperation and commitment of senior citizen's groups.

ENFORCEMENT COUNTERMEASURES

ASSOCIATED BEHAVIORAL AND ACCIDENT DATA

- A majority of pedestrian accidents are caused by the pedestrian's unsafe walking habits. The most common violators are the young and older adults -- the two groups overrepresented in accidents.
- There are conflicting views on the effectiveness of enforcement in increasing pedestrian safety:
  - There are no quantitative studies showing a reduction of pedestrian accidents in urban areas where there is a high level of pedestrian law enforcement.
  - There are also no quantitative studies which indicate that pedestrian law enforcement does not reduce accident rates.
- The majority of reprimanded or ticketed pedestrians will violate the law again at the first opportunity.
- Many motorists do not know pedestrian rights and laws.
- Safety officials in many cities consider enforcement to be one of the most important pedestrian countermeasures.
- Fifty (50) to 75 percent of fatal or severe injury accidents (vehicular and pedestrian) involve drivers who have been drinking.

PEDESTRIAN AND MOTORIST ENFORCEMENT PROGRAMS

Enforcement programs can be targeted at the driver, the pedestrian, or a combination of both. Each program has its own set of advantages and disadvantages.

	Advantages	Disadvantages
Pedestrian Enforcement Programs	Enforcement campaigns can substantially reduce unlawful behavior.	Violation behavior tends to be a habit and is difficult to change.
	Cities with effective enforcement programs have shown the greatest reduction in pedestrian fatalities.	Since the effects of enforcement campaigns have been shown to be short-lived, they must be periodically reinforced.

	Advantages	Disadvantages
Pedestrian Enforcement Programs (Continued)	Force the pedestrian to exercise more care. Can help eliminate conflicts between pedestrians and motorists.	Possible lack of support from police patrols because: - It's poor public relations. - Lack of government and police department policy. - Courts don't back up pedestrian enforcement.
Motorist Enforcement Programs	Violation sentences or fines are stricter than those for pedestrians. Can take some of the dangerous drivers off the road. Motorist enforcement is already in effect and is understood by motorists.	Require manpower and vehicles.

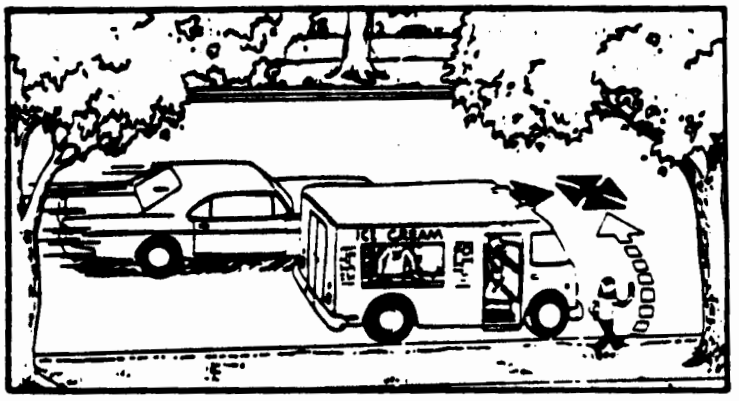
GENERAL IMPLEMENTATION CONSIDERATIONS

- Laws must be sensible, fair, clear, and enforceable.
- Laws must be made known to the public. Enforcement should go hand-in-hand with an education program.
- Enforcement must be consistent, uniform, and long-term.
- Files should be kept on violators.
- Suitably strict sentences must be given, based on the severity of the behavior.
- Support of the courts in upholding citations is necessary.
- A peer group, citizen's arrest program may be effective.
- Required attendance at safety schools for flagrant or frequent violators is helpful.
- If a comprehensive enforcement program is not feasible, selective enforcement at dangerous locations or at hazardous times of the day should be considered.

MODEL ICE CREAM TRUCK ORDINANCE

This regulation is intended to reduce accidents to pedestrians, primarily children, going to and from ice cream vending trucks. The regulation strives to eliminate the inherent hazards in the situation by controlling motorist and vendor behaviors. The major provisions include:

- A requirement for drivers to stop before overtaking a vending truck in the act of vending.
- Mandatory equipment of vendor trucks with swing arms saying "Stop Then Go if Safe" and alternately flashing red lights.
- Restrictions on the locations at which vending is allowed and the practices to be used.
- Mandatory yearly inspections of vending vehicles.



Advantages

- Demonstrated 77 percent accident reduction.
- One-time installation cost.
- Self-activating equipment on ice cream truck carries the message and promotes the correct driver behavior.
- Modified version enacted as state law in New Jersey.

Disadvantages

- Needs a law or ordinance passed.
- Only addresses a small proportion of all pedestrian accidents.

Implementation Considerations

- Flashing lights, light color, and/or swing arm may conflict with existing state laws. An exemption or revision of existing laws may be required.
- Suboptimization by changing "Stop" to "Slow" or light color appears to significantly degrade performance.
- The swing arm is a critical ingredient.
- Designed for either state or municipal implementation.
- Provided by NHTSA.

MODEL BUS STOP ORDINANCE

The model bus stop ordinance attempts to move as many bus stops as possible to the far sides of intersections and to regulate pedestrian behavior at the remaining near-side bus stops. The intent of the ordinance is to minimize the amount of street crossing that must be made by pedestrians. Its provisions require:

- The city traffic engineer to establish bus stops.
- The location of bus stops on the far sides of intersections unless unsafe or unreasonable to do so.
- The maintenance of a public record detailing the reasons for not moving any bus stops to the far side.
- Pedestrians to avoid crossing the street in front of a stopped bus unless allowed to do so by a traffic control device or police officer.

Advantages

- Has shown accident reduction potential.
- Easy to apply to new bus stops and those relocated for other reasons.

Disadvantage

- Can be expensive if done city-wide.

Implementation Considerations

- Already an Institute of Transportation Engineers recommended practice.
- Provided by NHTSA.

MODEL REGULATION FOR SCHOOL BUS PEDESTRIANS

The model regulation mandates a uniform appearance for school buses (paint scheme and legend) and the use of compelling signaling devices (flashing amber pre-stop warning lights, flashing red lights, and a "Stop" signal arm) to remind motorists of their obligation to stop and remain stopped for a school bus which has stopped to receive or discharge passengers. Aids, such as convex mirrors, are required to enhance the bus driver's ability to detect a child in front of the bus, and the bus driver is held responsible for clearing the front of the bus before moving forward.

Advantages

- Thoroughly researched.
- No major pupil transportation system changes are needed.
- Shown drop in school bus passing violations when the "Stop" signal arm is employed.
- Minimum training requirement for school bus drivers.
- Minimum safety education requirement for pupils riding school buses.

Disadvantages

- Requires state law changes in many cases.
- Only addresses a small proportion of pedestrian accidents.
- Inspection requirements to ensure special signaling equipment is operational.

Implementation Considerations

- All equipment requirements are "off the shelf" and in use currently in many locations.
- Provided by NHTSA.

MODEL DISMOUNTED MOTORIST SAFETY REGULATION

This model regulation attempts to avoid unnecessary stops on a through roadway system and protect dismounted drivers and passengers who must stop. The provisions:

- Prohibit stopping except under specifically defined circumstances.
- Require placement of disabled vehicles off the roadway whenever possible.
- Require a driver to actuate his vehicle's 4-way flashers if it is so equipped.
- Mandate the carrying and use of conspicuous materials (retroreflective and fluorescent).
- Require deployment of a fuse or approved warning triangle.
- Prohibit standing or walking in the roadway.

Advantages

- Based on accident analysis research and thorough development.
- Minimal equipment requirements.
- Low cost.

Disadvantage

- No field test data available.

Implementation Considerations

- Needs education.
- Should be implemented in a package with the Model Regulation for Pedestrians on Highways and the Model Freeway Walking Restrictions.
- Provided by NHTSA.

MODEL VEHICLE HAZARD WARNING LIGHTS REGULATION

In this model, vehicle hazard warning lights (4-way flashers) are defined and their use mandated whenever a vehicle stops upon the highway, with certain exceptions. The use of vehicle hazard warning lights is also required by slow moving vehicles.

Advantages

- All equipment is already mandated.
- Research has shown effectiveness of vehicle hazard warning lights if used.
- High severity crashes covered.

Disadvantage

- Only covers a small percentage of pedestrian accidents.

Implementation Considerations

- Education is required -- both mass media and coverage in driver's manuals are recommended.
- Provided by NHTSA.

MODEL FREEWAY WALKING RESTRICTIONS

This model law basically bans unnecessary "foot traffic" from freeways, with notable exceptions (e.g., dismounted motorists, police officers, road workers, tow truck operators). A requirement to post the ban on foot traffic is also stated to insure that motorists and stray pedestrians are aware of the law and the danger.

Advantages

- Deals with high severity events.
- Easy and inexpensive to implement.
- Based on research.

Disadvantages

- Almost impossible to evaluate.
- No effectiveness data.
- Difficult to enforce due to large areas covered.

Implementation Considerations

- Appears worth trying even without feedback to determine effectiveness because of low cost.
- Definitely needs public education efforts to make people aware of the provisions.
- Should be implemented in a package with the Model Regulation for Pedestrians on Highways and the Model Dismounted Motorist Safety Regulation.
- Aimed at the state level.
- Provided by NHTSA.

MODEL REGULATION FOR PEDESTRIANS ON HIGHWAYS

To improve the nighttime conspicuity of pedestrians on rural and suburban highways, specified high visibility materials or devices are to be mandated and worn by pedestrians between the hours of sunset and sunrise, with certain exceptions.

The provisions of this regulation require preferential use of various highway elements (e.g., sidewalk, shoulder, roadway edge) under certain conditions to minimize the risk of traffic collisions. Walking on the left, facing traffic, is required in the absence of sidewalks.

Advantages

- Low cost to the state and to the individual pedestrian.
- Carefully researched.
- Deals with high severity crashes.

Disadvantages

- No effectiveness data yet.
- Will require education.

Implementation Considerations

- Must be coupled with a good education/promotion effort to make it work.
- Should be implemented in a package with the Model Freeway Walking Restrictions and the Model Dismounted Motorist Safety Regulation.
- Recent research suggests that both retroreflective materials and a flashlight should be used.
- Provided by NHTSA.

MODEL VEHICLE OVERTAKING LAW

The Model Vehicle Overtaking Law counters the multiple threat accident type by:

- Requiring drivers to yield to pedestrians in crosswalks while simultaneously mandating the use of care by pedestrians.
- Requiring cars stopping for a pedestrian to stop at a clearly marked sign or stop line in advance of a crosswalk.
- Prohibiting the passing of a vehicle stopped at a crosswalk without first coming to a complete stop and determining that it is safe to proceed.
- Mandating the signing, painting of stop lines, or alteration of crosswalk geometry at crosswalks without traffic control signals to insure that stopping motorists make their stop at least 20 feet from the crosswalk line farthest from the motorist.

Advantages

- Corrects a logical problem with the Uniform Vehicle Code and the laws of most states.
- Thoroughly researched.
- Low cost, except for the education.

Disadvantage

- Change is subtle -- much education would be needed.

Implementation Considerations

- Education should include mass media and driver's manuals.
- The notion of stopping for cars that could be stopped for pedestrians is worth promoting even in the absence of a law.
- Coordinates with multiple threat TV and radio spots.
- Provided by NHTSA.

MODEL ORDINANCE ON PARKING NEAR INTERSECTIONS AND CROSSWALKS

This model ordinance, based on extensive analysis of accident data, establishes:

- No parking zones 50 feet from a marked crosswalk or 60 feet from an intersection without a marked crosswalk on the approach side.
- Requirements for signs or markings indicating the parking prohibition at midblock crosswalks and at intersections without traffic lights or stop signs.

Advantages

- Provides stopping sight distances needed to reduce identified accident problem.
- Easy to implement.

Disadvantages

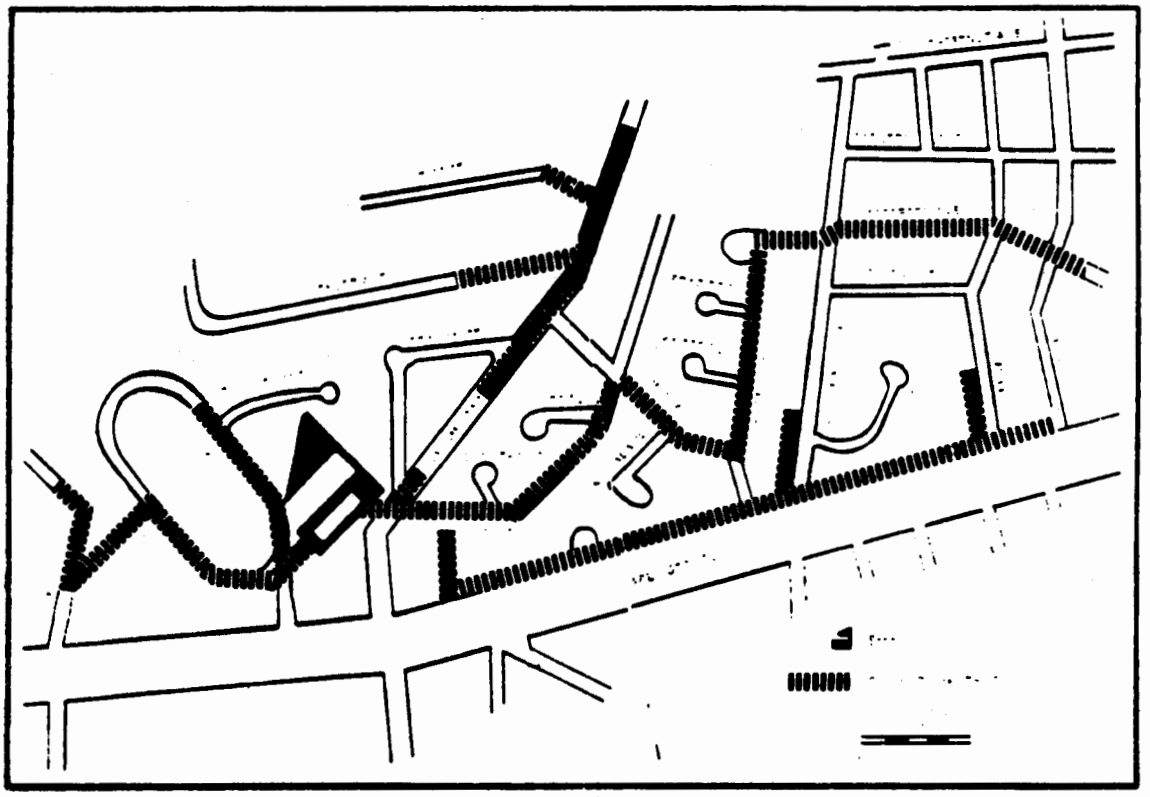
- Likely needs enforcement to make it work.
- Some on-street parking is lost.
- Signage costs could be high.

Implementation Considerations

- Even if not enacted as a law, it is a good practice to follow through signing and/or marking at busy or dangerous locations.
- Provided by NHTSA.

SAFE ROUTE TO SCHOOL PROGRAM

During the first two years of school (ages 5-6), a child's accident risk rises. The Safe Route to School Program can involve children in planning their own routes and gives them a safe route to take, stressing hazards and proper crossing practices. The program establishes, organizes, and operates safe routes for children to use when traveling between home and school. Simple maps are drawn showing streets, the school, and the suggested route.



Advantages

- Teaches children about hazards and safe walking practices.
- May foster improved school/community cooperation.
- Provides for the most effective use of protective measures such as traffic control devices, adult crossing guards, and school patrols.
- Provides a basis for engineering studies of traffic control needs.
- Indicates priorities for sidewalk construction.

Disadvantages

- Involves extensive planning and ongoing commitment.
- It may be difficult to get teachers, parents, and the community interested and involved.
- Expensive -- must be continually updated.
- The safest routes are not always the shortest. Children prefer the shortest routes and use shortcuts.

Implementation Considerations

- It is absolutely necessary to have community and school support.
- Parents should play a large role in school route planning as children will follow routes prescribed by their parents. Parents should walk the route with their child.
- The program must be maintained through review of routes and possible replanning.
- The traffic engineering department should study the routes to see if changes are needed.
- Routes may be marked by use of marked crosswalks.

SCHOOL BUS ROUTING PLAN

School bus routing involves the determination of safe and efficient school bus routes and stops. Routes should be planned to reduce the need for children to cross major streets or unsignalized intersections on their way to or from a bus stop.

Associated Behavioral and Accident Data

- Up to 65 percent of fatal accidents involving school buses also involve young pedestrians approaching or leaving a loading zone.
- School bus mirrors have not been found adequate in preventing some accidents involving the bus and discharged passengers.

Advantages

- Provides safe, efficient, and economical bus routes.
- May reduce accidents involving school buses and child pedestrians.
- Helps determine the hazards at or on the way to bus stops.
- Bus routing is already done at some level in all communities.

Disadvantage

- Expensive.

Implementation Considerations

- School bus routing involves:
  - Determination of transportation needs.
  - Preparation of a school district map.
  - Determination of hazardous locations.
  - Development of routes and schedules.
  - Continual reevaluation and modification.

SCHOOL BUS PATROLS

School bus patrols are student patrols trained to maintain order on buses and prevent accidents to riders on buses and to those crossing roadways at bus stops.

Advantages

- Help children safely cross streets at bus stops.
- Make sure children are away from the bus before it starts.
- Help children learn safe bus passenger behavior.
- Children controlled by patrols can develop a keen road sense.
- Help children develop a sense of responsibility and self-reliance.
- Children are eager to belong if being a patrol member is regarded as an honor.
- Cost-effective.
- Peer pressure is a strong incentive for correct behavior.
- The school bus patrol program can be part of the crossing patrol program (see section on School Crossing Guards).

Disadvantages

- Parents may be reluctant to allow their child to be a patrol.
- Need special training.
- Possible organizational and class scheduling problems.
- Require planning, coordination, and training.
- Incentive must be provided to patrols.

Implementation Considerations

- Details on school bus patrols are available from the AAA.
- A school official or teacher should be responsible for operation of the student patrol.
- Civic and service organizations may provide support, funds, or uniforms if asked.
- A method for appointing patrols must be developed. Scholastic standing may not be the best determinant of a child's ability to be a good patrol.

SCHOOL CROSSING GUARDS

School crossing guards can be trained parents, police, or older children who instruct, direct, and control students at street crossings. Student patrols are trained boys and girls who control other children and choose safe gaps in vehicle traffic during which they can cross, or who control children at bus stops. They are often appointed on the basis of scholastic merit. School bus patrols are discussed in the section on School Bus Patrols.

Adult crossing guards are paid, uniformed community members trained to stop traffic, if necessary, to help children across streets.

Police guards are members of the police department who stop traffic to allow school children to cross.

Associated Behavioral and Accident Data

- Very few accidents occur at school crossings.
- Communities with student or adult guards have reported large decreases in elementary school child accidents.
- Children tend to obey an authority figure.

Advantages

- Can substantially reduce school crossing accidents.
- High user compliance.
- Children feel safer at intersections with guards.
- A majority of drivers notice guards.
- Help children learn safe behavior by enforcing it.
- Adult crossing guards can instruct young children in safe walking habits.
- Police crossing guards:
  - Are more highly respected than other guards.
  - Can improve police/child relations.
  - Already have training in traffic control.

Disadvantages

- Possible organizational problems.
- Guards must be trained and supervised; without proper training, they may encourage improper behavior.
- Adult crossing guards:
  - Must be paid.
  - Require uniforms.
  - Must be recruited.
  - Have potential insurance liability problems.
  - May have reliability or absenteeism problems.
- Police crossing guards:
  - Are expensive.
  - Take officers away from other duties.

Implementation Considerations

- A successful student or adult guard program requires the cooperation and authorization of the schools, the community, and the police department.
- Crosswalks should be marked at controlled intersections to mark the preferred route.
- Sources of detailed plans for school patrol or adult guard organization are the Institute of Transportation Engineers and the AAA.
- The police department should be responsible for adult guards and police guards.

PLAY STREETS

Play streets are residential streets, usually in high density urban environments, closed to through traffic during specified hours in the summer to permit a supervised or general program of recreational activities to take place.

Associated Behavioral and Accident Data

- Children playing in urban streets are the most highly represented group in pedestrian accident statistics.
- The major cause of child pedestrian accidents is the child darting out into the street.
- The majority of accidents involving children occur in residential areas, near the child's home.
- Children involved in accidents tend to live in areas with few play facilities.
- Development of play and recreation areas in congested, high accident areas has significantly reduced the frequency of child pedestrian accidents.

Advantages

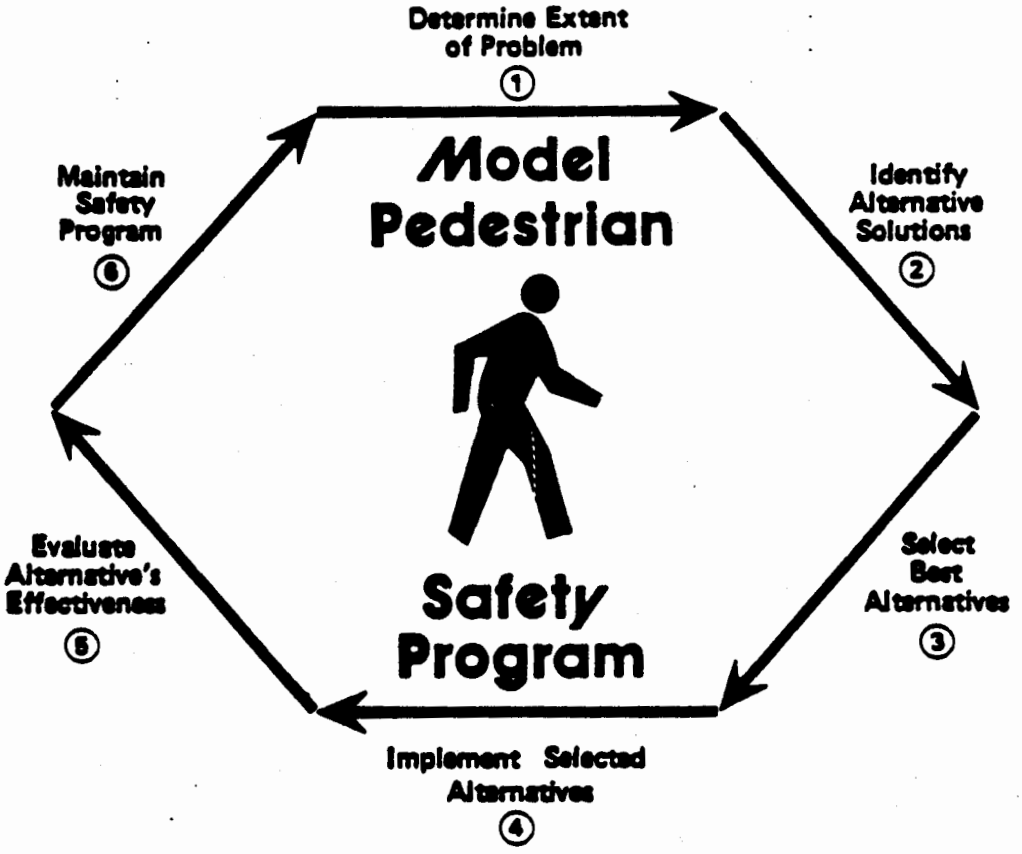
- Completely separate children from vehicular traffic.
- Can reduce accidents involving children playing in or darting out into the street.
- Inexpensive compared to the alternatives (parks and playgrounds).
- Provide safe places for children to play.

Disadvantages

- Reduce available parking space.
- Vehicle circulation is reduced.
- Adult commitment and time is needed.
- Official city approval is required.

Implementation Considerations

- Successful play streets have:
  - Community support and a continuation of community activities at times when the street is open to traffic.
  - A sponsoring organization (police, recreation departments).
  - A majority of residents in favor of the play street.
  - Commitment from adults to supervise the play street.
- Streets can be marked for games and equipment provided for group games.
- The streets may be closed using police barricades, s[illegible]ing and signs, or signs alone. (More information can be found in the section on Barriers.)
- Further information on play streets and their design is available in a Federal Highway Administration report that is available from NTIS. School Trip Safety and Urban Play Areas (FHWA/RD-75/104), developed guidelines for the protection of young pedestrians walking to and from school, entering and leaving school buses and at neighborhood play.


Determine Extent of Problem
1
Identify Alternative Solutions
2
Select Best Alternatives
3
Implement Selected Alternatives
4
Evaluate Alternative's Effectiveness
5
Maintain Safety Program
6
Model Pedestrian Safety Program