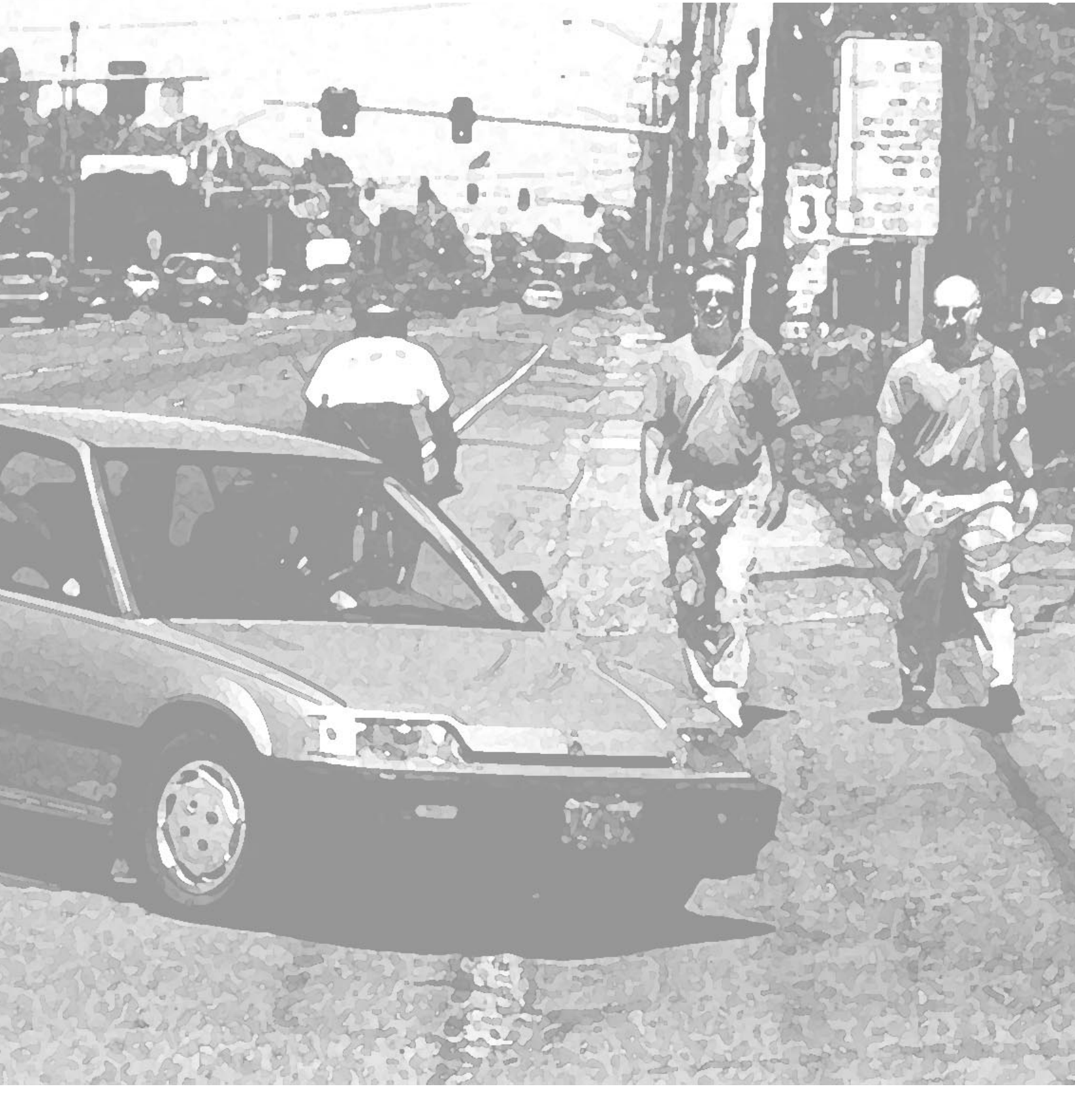
IV. SAFETY CONSIDERATIONS



This section implements Strategy 3A:

STRATEGY 3A: *Monitor and analyze bicyclist and pedestrian crash data to formulate ways to improve bicyclist and pedestrian safety.*

Engineering, education and enforcement are necessary components of bicycle and pedestrian safety. For bicyclists, equipment and riding skills are also important factors. In Oregon, the quality of engineering for bikeways is very good and facility-related bicycle crashes are few. As long as facilities are well-maintained, there should be few major problems in this area.

It is more difficult to assess pedestrian crashes related to facility design; the lack of facilities, especially safe crossings, may be a contributing factor in some crashes.

Education and enforcement need more attention. State highway funds cannot be expended for these activities, but federal safety funds are available for safety programs and activities.

TRANSPORTATION SAFETY AT ODOT

Bicycle and Pedestrian Program: The Program's main responsibilities are the planning, design and construction of safe, attractive and convenient facilities.

Bicycle and Pedestrian Safety Programs: The Programs' main responsibilities are education activities aimed at user behavior, as well as developing programs targeted at motorists to encourage them to "share the road" with all users.

Transportation Safety Action Plan (TSAP): ODOT's primary procedure for developing policy regarding safety is through the TSAP, which defines ODOT's role in developing programs aimed at increasing safety through education and promotional campaigns.

The TSAP establishes priorities for improving transportation safety in Oregon over a twenty-year period. It considers all transportation modes as well as education, engineering, enforcement and emergency medical services. The TSAP includes the following actions specifically related to bicycling and walking:

ACTION 66: *Increase emphasis on programs that will encourage pedestrian travel and improve pedestrian safety.*

ACTION 67: *In public education and enforcement efforts, recognize bicycles as an alternative mode of travel that are required to follow the same rules of the road as motorized vehicles.*

ACTION 68: *Increase emphasis on programs that will encourage bicycle travel and improve bicycle safety.*

IV.1. BICYCLE SAFETY

INTRODUCTION

Most bicycling crashes (65%-85%) **do not** involve collisions with motor vehicles; they usually involve falls or collisions with stationary objects, other cyclists and pedestrians.

Injury crashes caused by loss of control can be greatly reduced by:

- Improving riding skills;
- Ensuring that all equipment is functional (brakes, tire pressure and condition, etc.);
- Ensuring that bikeways are clear of obstructions, debris and rough surfaces.

Many bicycles/motor vehicle crashes are not reported. ODOT statistics represent reported crashes: approximately 800 injury crashes a year, including 10-15 fatalities (1%-2% of total).

To help develop programs aimed at bicyclists and motorists, one must understand what types of crashes are responsible for most injuries, and who is at fault. ODOT has been tracking bicycle/motor vehicle crashes for many years and bases many of its engineering solutions on analysis of these statistics.

The data for 1994 (see Table 10) are typical of data collected in other years.

Most crashes are due to bicyclists or motorists disobeying the rules of the road, often out of ignorance. Overall, the fault lies equally with motorists and bicyclists. Most crashes occur where two roadways or a roadway and a driveway intersect, and one user failed to yield the right of way to the other. The fault in these situations is slightly more often the motor vehicle driver's than the bicyclist's.

Wrong-Way Riding

The leading cause of crashes in which the bicyclist is at fault is wrong-way riding. This behavior is observed in about 15% of riders, and is responsible for 17% of crashes. It is often based on an unfounded fear of traffic, and a sense that looking at on-coming traffic will prevent crashes; the inability to cross a street also contributes to wrong-way riding.

The danger is that, at intersections, bicyclists riding against traffic are invisible to drivers entering, crossing or leaving the roadway, who are looking for traffic from a certain direction; wrong-way riders are not noticed.

BICYCLE/MOTOR VEHICLE CRASHES: 1994 STATEWIDE STATISTICS

- 45% occurred at intersections:
  - 27%: motorist failed to yield to bicyclist at a stop, signal or turn.
  - 19%: bicyclist failed to yield to motorist at a stop, signal or turn.
- 20% occurred at mid-block (driveway or alley):
  - 12%: motorist entered or left the road
  - 8%: bicyclist entered or left the road (mostly young riders)
- 17% resulted from wrong-way bicycle riding.
- 8% were caused by turning or swerving movements:
  - 5%: bicyclist turned or swerved
  - 3%: motorist turned or swerved
- 3% occurred when a cyclist was hit from behind by a motorist.

The other 7% were due to miscellaneous causes, e.g. motorist opening car doors into the path of a bicyclist (1%).

Table 10: Bicycle/motor vehicle crashes: 1994 statewide statistics

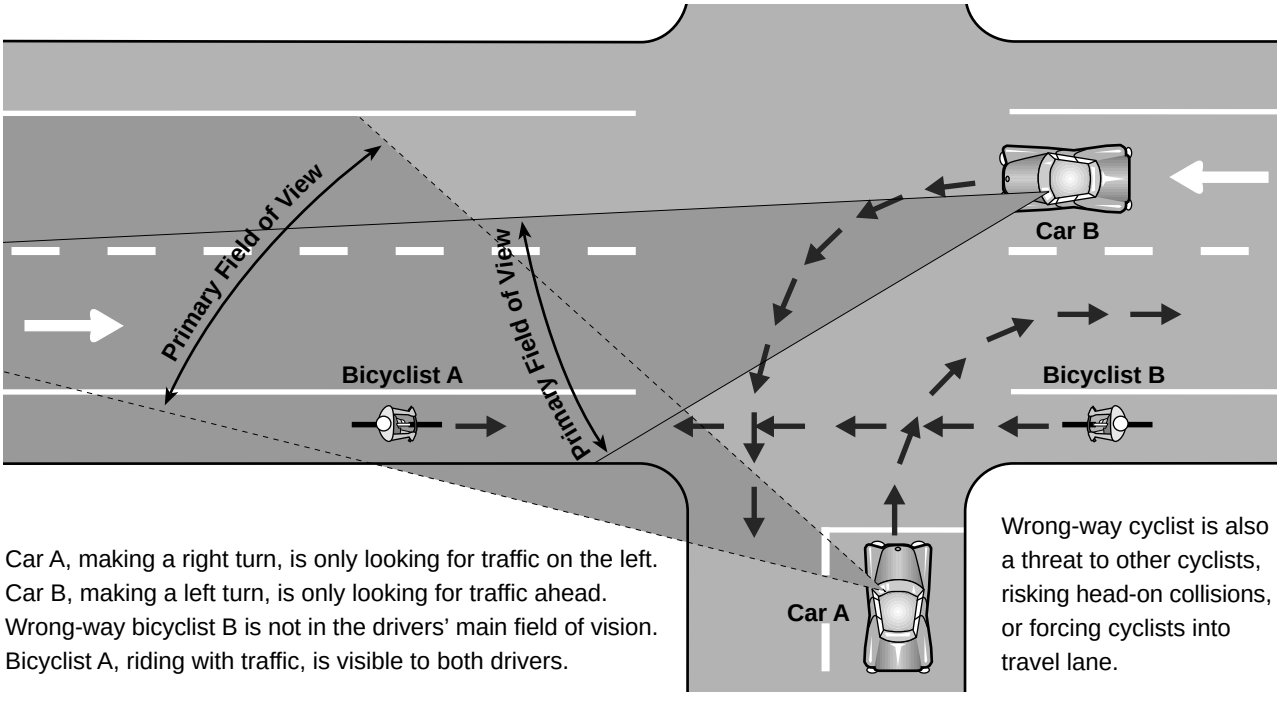


Figure 163: Hazards of wrong-way riding

Another hazard of wrong-way riding is the increase in closing speed:

- A wrong-way bicyclist going 20 km/h approaching a vehicle going 50 km/h will have a 70 km/h closing speed, greatly reducing reaction time.
- A vehicle going 50 km/h gaining on a cyclist going 20 km/h will have a 30 km/h closing speed, allowing more reaction time.

On one-way streets, the problem is compounded by the fact that signs and traffic signals are not visible to the wrong-way rider.

Wrong-way cyclist is not easily seen by right-turning motorist

A. ENGINEERING SOLUTIONS TO COMMON PROBLEMS

Even though most bicycle/motor vehicle crashes are caused by improper behavior, many improvements can be made to roads to reduce the potential for crashes. Well-designed facilities encourage proper behavior, decreasing the likelihood of crashes.

Transportation agencies should provide bicycle facilities that encourage all users to obey the rules of the road.

When surveying bicycle usage, the Bicycle and Pedestrian Program records several behaviors. There appears to be a correlation between good facilities, high use and proper behavior:

- Cities with good bikeway networks have the highest number of riders, and behavior is the best: wrong-way riding is minimal and fewer ride on the sidewalk (helmet use is above the statewide average).
- Cities with fewer facilities experience lower ridership numbers and poorer rider behavior: more ride against traffic or on the sidewalks (helmet use is lower than the statewide average).

Bike lane stencil with arrow

A.1. WRONG-WAY RIDING

Riding against traffic can be discouraged by:

- Including a directional arrow on bike lane markings;
- Placing bike lanes on both sides of a two-way street or placing bike lanes on both legs of a one-way couplet;
- Replacing existing two-way bike lanes with one-way bike lanes on each side of the road;
- Providing equal width shoulders on each side of the road;
- Providing more crossing opportunities on wide streets; and
- Avoiding two-way multi-use paths that begin or end at mid-block.

A.2. CYCLIST DISREGARDS STOP SIGN

It is natural for bicyclists to want to ride without breaking their momentum. Good planning places bikeways on streets where there aren't excessive stops, by:

- Providing bike lanes on arterials, which have the right-of-way at most intersections;
- Avoiding directing cyclists to local streets with many stops, which encourages bicyclists to disregard stop signs that slow them down (see Figure 7, page 50);
- Avoiding placing unnecessary four-way stop signs on local streets; and
- Creating Bicycle Boulevards.

A.3. CYCLIST ENTERS THE ROAD FROM DRIVEWAY OR ALLEY

This behavior is common in young riders, who have not yet fully-developed perception skills. Some simple steps that can help improve motorists' awareness of children are:

- Improving sight distance, by restricting on-street parking and by removing excessive vegetation and other obstructions;
- Designing residential streets to discourage excessive motor vehicle speeds.

A.4. MOTORIST ENTERS THE ROAD FROM DRIVEWAY OR ALLEY

This is a constant source of conflicts for cyclists riding on busy streets with many accesses. Engineering solutions include:

- Reducing the number of accesses by elimination or consolidation; and
- Improving sight distance, by restricting on-street parking and by removing excess vegetation and other obstructions.

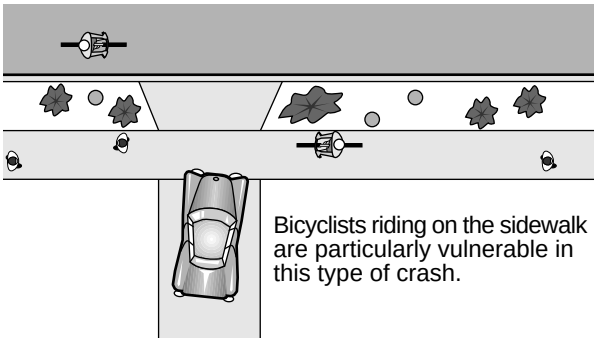


Figure 164: Conflicts at driveway

A.5. MOTORIST DISREGARDS SIGN OR SIGNAL

Motorists often commit this infraction because they didn't see a bicyclist. The best engineering solutions to improve cyclists' visibility include:

- Designing on-road bikeways that place bicyclists in the flow of traffic; and
- Improving sight distance, by restricting on-street parking and by removing excess vegetation and other obstructions.

B. EDUCATION SOLUTIONS

Education of both motorists and bicyclists can curtail unintentional infractions as well as promote other safe riding and driving practices.

For bicyclists to safely coexist with motorists, they need to understand the vehicle code and develop good cycling skills. Education provides these skills and knowledge. Comprehensive bicycle safety education programs are designed for each age group with emphasis on errors commonly committed by that group. On-bike training is an important element of such a program. Education also stresses the value of helmets and other protective measures.

At present, only a few Oregon communities have a comprehensive bicycle safety education program. Others have only some of the basic elements. More funds, expert personnel, and persons or agencies directly responsible for bicycle safety education are needed to improve programs. In some communities, volunteer service groups or police departments do some education, but they typically need better support materials. Often, only elementary school age children are selected as the target group.

In 1987 the Legislature passed Senate Bill 514 (ORS 802.325), requiring the former Traffic Safety Commission to establish a bicycle safety program. ODOT is continuing this program to help educate young and adult cyclists, motorists, parents, and law enforcement personnel.

There are hundreds of volunteers in dozens of communities trained in on-bicycle education programs such as the *Smart Cycling I & II* curriculum, as well as the staging of bicycle safety events. Thousands of students have taken this training. ODOT publishes two safety brochures: *Say, you're not from this Planet, Are You?* and the *Oregon Bicyclist's Manual.*

DMV includes information on bicyclists and pedestrians in its publications aimed at motor vehicle drivers. At least one question regarding bicyclists or pedestrians is included on every written driver's license test.

Bicycle safety education materials, services, and information may be obtained from:

BICYCLE SAFETY COORDINATOR
Mill Creek Office Park
555 13th Street NE
Salem, OR 97310
Tel: (503) 986-4196

Children learn traffic safety through "Safety Town" program

C. ENFORCEMENT SOLUTIONS

Law enforcement is a necessary component of bicycle safety. Stricter enforcement can limit both intentional and unintentional infractions. As with any law, lack of enforcement leads to a general disregard of the law. Local police officers should be willing to enforce the motor vehicle code with bicyclists and motorists. There are practical problems in citing bicyclists, since they often lack positive identification, such as a driver's license.

Frequent contact between local bicycle advisory committees, traffic safety groups and the police can highlight the need for enforcement and identify problem areas. Significant violation problems that have been identified by the bicycling community include:

- Motorists not yielding to bicyclists;
- Motorists not giving bicyclists enough room on the roadway;
- Bicyclists running traffic signals;
- Bicyclists riding on sidewalks;
- Bicyclist riding the wrong way; and
- Bicyclists riding at night without lights.

Motorists and cyclists must learn to coexist on narrow roads

Bicycle-mounted police can often more easily apprehend offenders. Community education and support of enforcement efforts builds respect between bicyclists and motorists.

D. EQUIPMENT SOLUTIONS

There are several bicycle features which contribute to riders' ability to control their movements:

- **SIZE:** a bicycle must be properly fitted. If it is too small or too big, the rider will have trouble reacting properly when stopping, turning or accelerating. The wrong size bicycle is also uncomfortable, leading to fatigue.
- **BRAKES:** by law, brakes must be sufficiently powerful to enable a rider to bring a bicycle to a skid on dry pavement. Brake levers must be readily accessible.
- **TIRES:** must be in good condition and inflated to their recommended pressure.
- **FENDERS:** prevent lights and reflectors from getting dirty in wet weather.
- **LUGGAGE RACKS AND PANNIERS:** bicyclists should never attempt to carry loads in their arms while riding.
- **LIGHTS:** by law, when riding after dark, the bicycle or the rider must be equipped with a white light visible at least 500 feet to the front and a red light or reflector visible at least 600 feet to the rear. A rear light is more effective than a reflector. The front white reflectors sold with bicycles do not provide visibility to a motorist entering from a side street (see Figure 165, page 190).

Well-equipped cyclist, with lights, fenders, luggage rack and helmet

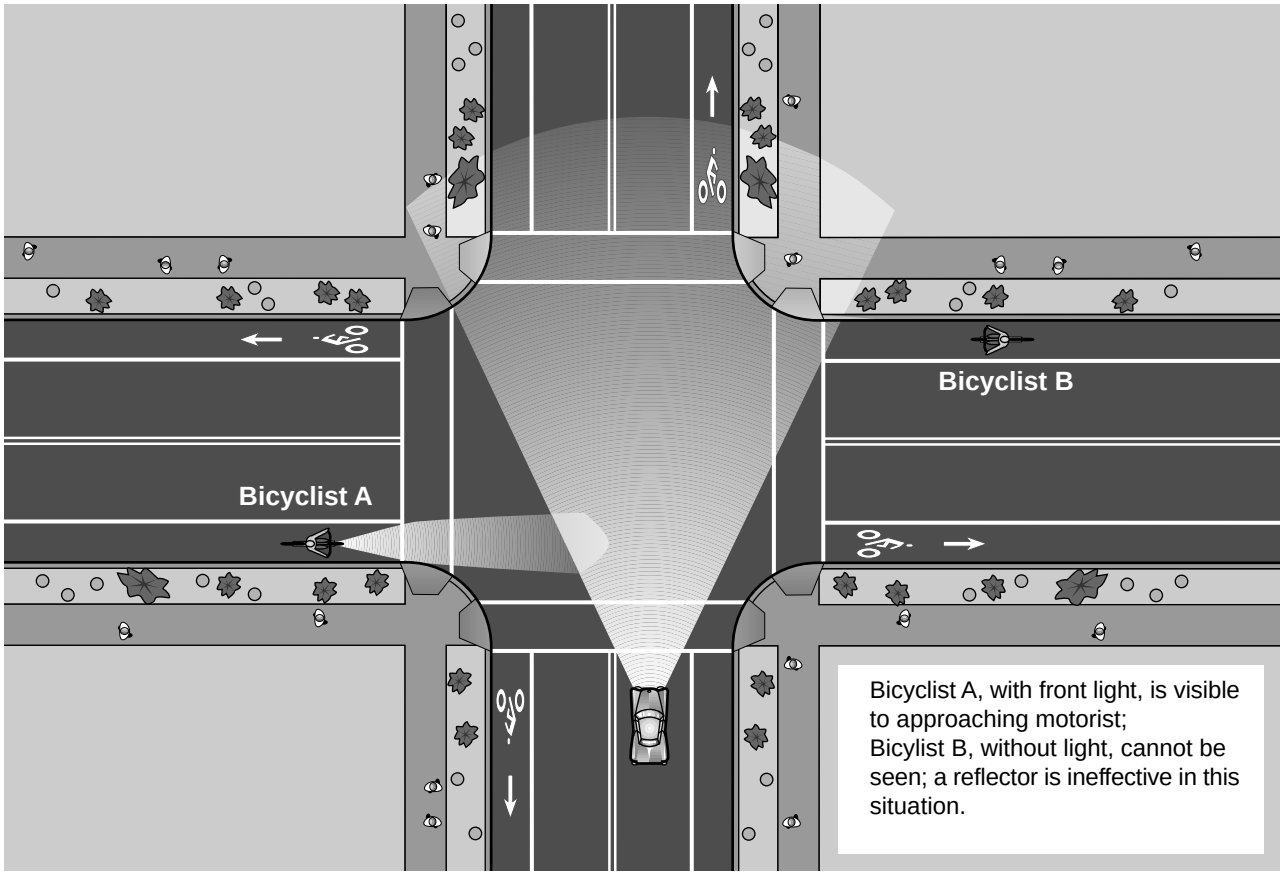


Figure 165: Effectiveness of bike lights at intersections

E. RIDING SKILLS

Since most bicycle crashes do not involve motor vehicles, poor riding skills must be responsible for many injury crashes. By ensuring that one has a good sense of balance, by looking ahead and to the sides, by avoiding distractions such as personal stereos, and by ensuring that one's bike is in good working order, falls and collisions with fixed objects can be largely avoided.

Many crashes with motor vehicles could be avoided if riders learned to control their bicycles better, including riding in a straight line and turning or stopping faster to avoid collisions.

F. HELMETS

Wearing a helmet does not reduce the chances of a crash, but can reduce the severity of injuries or the possibility of a fatality. A properly worn bicycle helmet can reduce the severity of head injuries by up to 80%. Many communities are promoting awareness campaigns aimed at increasing helmet use, especially among children.

Proper fit is an important aspect of responsible helmet use. ODOT produces a brochure on this subject, "Get Head Smart." It is available from the Bicycle Safety Coordinator.

In 1993, the State of Oregon passed a mandatory helmet law for riders and passengers under the age of sixteen (Senate Bill 1088), which went into effect on July 1, 1994.

1994 ODOT statistics indicate that approximately 36% of riders in urban setting wore a helmet (24% of youth and 40% of adults). Helmet use is higher than the state average in cities with well-developed bikeway systems; use is highest on the Coast Highway, where virtually all of the touring riders wear helmets.

IV.2. PEDESTRIAN SAFETY

INTRODUCTION

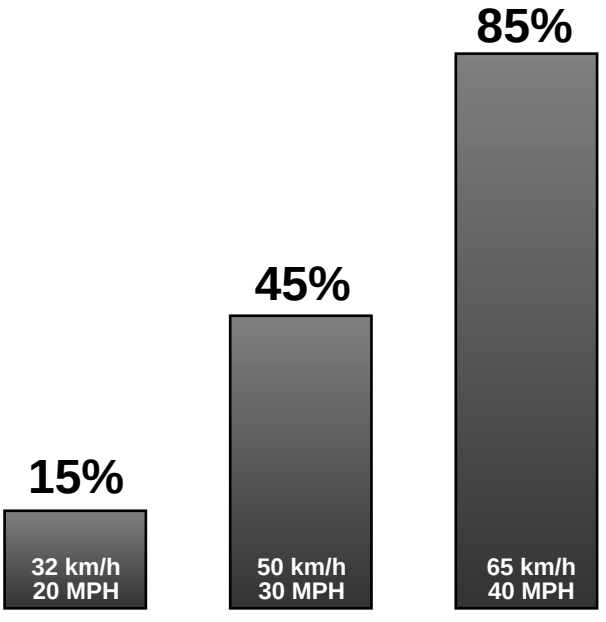
Compared to bicycle crashes, virtually all reported pedestrian crashes are the result of a collision with a motor vehicle. This is mostly due to our perceptions: when a person trips and falls while walking, the resulting injury is rarely reported as a pedestrian crash.

Most pedestrian crashes are the result of an attempt to cross a roadway; fewer occur as pedestrians walk along a roadway.

Effective pedestrian safety programs should target behaviors that cause the majority of crashes. Analysis of pedestrian/motor vehicle crashes can help establish engineering, education and enforcement solutions.

One important factor in all pedestrian crashes is speed. A recent study conducted in Great Britain (Killing Speed and Saving Lives) demonstrates a dramatic correlation between motor vehicle speeds and fatality rates.

Reducing traffic speeds not only reduces the severity of pedestrian crashes, but may reduce their occurrence, as slower speeds decrease braking distances and reaction time. All engineering, education and enforcement programs should include reducing speeds as an important step. This does not necessarily mean reducing existing speed limits, as much as ensuring that the current limits are observed.



Pedestrians' chances of death if hit by a motor vehicle
SOURCE: *Killing Speed and Saving Lives*, UK Department of Transportation

Figure 166: The relationship between speed and the pedestrian fatality rate

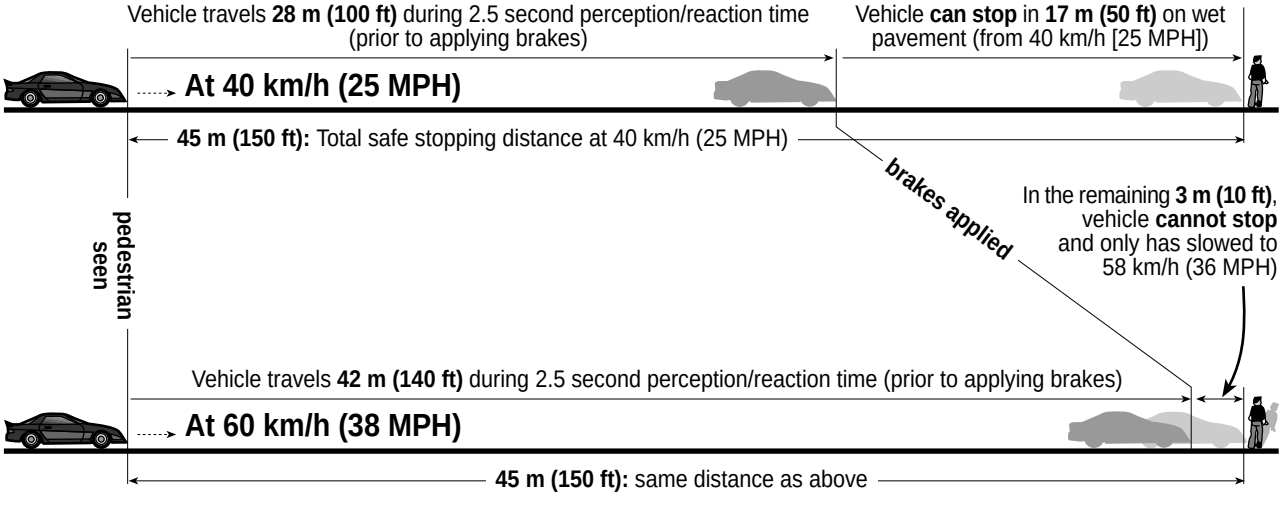


Figure 167: Relationship between safe stopping distance and travel speed

Refuge helps pedestrians cross street

LONG-TERM TRENDS

The number and severity of pedestrian crashes could rise in the future due to an unintentional consequence of cars being built with more safety features: as drivers and passengers are better protected within their vehicles, and further isolated from the outside world (with quiet interiors and improved sound systems), the unprotected pedestrian will not be noticed or perceived as a threat. This could lead to pedestrians being invisible to or ignored by motorists. Pedestrian fatalities have been on the rise the last few years.

The statewide data collected by ODOT (see Table 11) reveal the nature of crashes between pedestrians and motor vehicles.

Most safety efforts should be aimed at crossing movements; greater education of motorists is necessary to make them aware of the rights of pedestrians.

Pedestrians should be secure when using crosswalks

PEDESTRIAN/MOTOR VEHICLE CRASHES

- There are approximately 700-800 pedestrian injury crashes reported each year.
- Of these, approximately 60-80 are fatal (10%)
- 80% of the crashes occur in urban areas.
- 80% occur as a pedestrian crosses a street:
  - Of the crossing accidents, 50% occur at mid-block locations.
  - Of the crossings that occur at intersections, about half are at signalized intersections, and half are at non-signalized intersections.
  - In 90% of the intersection crashes, the pedestrian was in a crosswalk.
  - At signalized intersections, in 65% of the crashes, the pedestrian was crossing with the signal.
- The moves of motor vehicles in intersection crashes were:
  - Motor vehicle going straight: 50%
  - Motor vehicle turning: 50% (63% turning left, 37% turning right)

Table 11: Pedestrian/motor vehicle crashes

A. ENGINEERING SOLUTIONS

Even though most pedestrian/motor vehicle crashes are caused by improper behavior, many improvements can be made to roads to reduce the potential for crashes. If facilities are well-designed and pedestrians and motorists use them correctly, the likelihood of crashes will decrease.

The most important step that transportation agencies can take is to design pedestrian facilities that enable motorists to clearly see pedestrians along the roadway and those preparing to cross the roadway. Pedestrians must be given opportunities to cross roadways with minimal conflicts with motor vehicles.

Most of the proposed engineering solutions are covered in greater detail in the chapters on walkway and intersection design (II.4 to II.7).

A.1. PEDESTRIAN WALKING ALONG THE ROADWAY

- The addition of sidewalks in urban areas and wider shoulders in rural areas are the preferred treatments.
- Sidewalks separated from traffic with planter strips increase pedestrian safety.

Lack of sidewalk forces pedestrian onto roadway

A.2. PEDESTRIAN CROSSING AT INTERSECTION

- Shortening the total distance to be crossed shortens the exposure time; techniques include curb extensions, median islands and islands at complicated turn movements.
- Placement of signs reminding motorists of their duty to yield to pedestrians when they turn left or right can help improve awareness of the pedestrian's right of way.
- Illumination can improve visibility of pedestrians under nighttime conditions.
- Improved marking of crosswalks enhance their visibility.

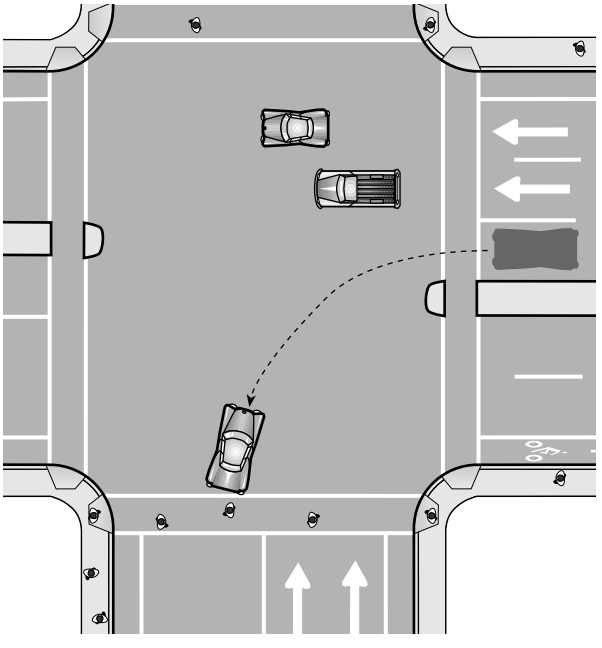


Figure 168: Left-turning vehicle and pedestrian conflict

Left-turning conflicts

A.3. PEDESTRIAN CROSSING OUTSIDE AN INTERSECTION

- On wide, multiple lane roads, a center median improves crossing opportunities: a pedestrian only has to concentrate on traffic coming from one direction at a time, as the median provides a refuge.
- Mid-block curb extensions can reduce crossing distance and improve the visibility of pedestrians waiting to cross.
- Illumination improves the visibility of pedestrians under nighttime conditions.
- Improved marking of crosswalks enhances their visibility.

A.4. MOTORIST SPEEDING

Though this is usually considered an enforcement issue, there are many roadway design features that influence the speed at which motorists drive - motorists will usually travel at speeds that seem appropriate for the roadway.

The traffic calming measures can be used on local streets and minor collectors. On arterials and major collectors, there are features that can be incorporated that discourage excessive speeds: trees along the road, narrower lanes, landscaping, bike lanes, etc. (See page 159)

B. EDUCATION SOLUTIONS

Many of the pedestrian crashes are due to the ignorance of the rules pertaining to the right-of-way. A recent study conducted by the AAA revealed that close to 50% of Americans do not know some of the basic laws as they apply to pedestrians. More information should be made available to motorists so they know that pedestrians have the right-of-way at crosswalks, *both marked and unmarked.*

The consequences of excessive travel speeds must be made known to the motorists; many do not understand that traveling above the speed limit in residential areas can result in a fatal pedestrian crash.

Pedestrians must know how to safely cross streets. It should never be assumed that a signal guarantees safety; one should always look before crossing. The meaning of "WALK/DON'T WALK" signals is not clearly understood by all (the white WALK phase of a signal is time during which pedestrians may begin to enter the crosswalk; the flashing red DON'T WALK phase indicates that pedestrians in the crosswalk may safely proceed across the street, but pedestrians approaching the intersection should wait).

Though there are many situations in which the pedestrian is technically at fault (e.g. mid-block dart out), more emphasis needs to be placed on the driver's responsibility, since he or she is the one moving in a high-speed, heavy vehicle.

C. ENFORCEMENT SOLUTIONS

Along with education, increased enforcement can have the greatest effect on pedestrian safety. The lack of consequences to motorists who run lights and stop signs or fail to yield at crosswalks is mostly due to the insufficient numbers of law enforcement officers dedicated to traffic enforcement.

Increased education efforts aimed at law enforcement officers can help them understand the severity of pedestrian infractions. An effective program in Seattle combined increased citation of motorists at crosswalks with extensive media coverage. The result was a dramatic decrease in the number of pedestrian crashes following these efforts.

Attitudes towards the relative severity of pedestrian crashes need to change among prosecutors and judges. Motorists often get off fairly lightly following crashes that result in pedestrian injuries or deaths. The pedestrian is often assumed to be partially at fault for simply "being in the road."

The consequences of failing to yield to pedestrians need to be more severe and better publicized for motorists to change behavior.