

# STATUS REPORT

INSURANCE INSTITUTE  
FOR HIGHWAY SAFETY

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## Roundabouts

**They sharply reduce crashes, study finds**

Roundabouts may be an unfamiliar type of intersection in the United States, but they're becoming more familiar as evidence of their benefits grows. Improved traffic flow, aesthetics, and cost savings make roundabouts a good idea, and the safety gains are compelling. An Institute study shows far fewer crashes occur at intersections with roundabouts than at intersections with signals or stop signs. This is especially true of crashes

resulting in occupant injuries. Researchers at Ryerson Polytechnic University, the Institute, and the University of Maine studied crashes and injuries at 24 intersections before and after construction of roundabouts. The study found a 39 percent overall decrease in crashes and a 76 percent decrease in injury-producing crashes. Collisions involving fatal or incapacitating injuries fell as much as 90 percent.

These findings are consistent with those from other countries where roundabouts have been used extensively for decades. They also are consistent with preliminary studies of U.S. roundabouts.

The safety benefits don't come at the expense of traffic flow. In fact, where roundabouts replace intersections with stop signs or traffic signals, delays in traffic can be reduced by as much as 75 percent.

"Given the magnitude of these crash reductions, there's no doubt that roundabouts are an important countermeasure for many intersection safety problems," says Institute president Brian O'Neill. "Replacing signals or stop signs with roundabouts will reduce the number of crashes and save lives while at the same time improving traffic flow."

The recent study focuses on urban and rural intersections in California, Colorado, Florida, Kansas, Maine, Maryland, South Carolina, and Vermont. The roundabouts replaced stop controls or traffic signals.

**Old idea improved:** Rotary intersections aren't new. They predate the automobile. In 1905, the first U.S. traffic circle, then known as a "gyratory," was constructed in New York City, and European countries built them in great numbers through the early part of this century.

In its basic form, a traffic circle consists of a raised island at the center of an ordinary right-angle intersection. The island, which directs cars counterclockwise, is intended to reduce speeds, although this goal isn't always achieved. Other configurations can be more complex. They may involve split lanes and combinations of yield signs, stop signs, and traffic lights — all of which can be confusing to drivers trying to negotiate them.

The modern roundabout improves on such designs. This is an important distinction, because the older traffic circles aren't always easy to navigate, so they haven't been very popular.

"At modern roundabouts, triangular islands at each entrance slow approaching vehicles," explains Richard Retting, Institute senior traffic engineer and an author of the study. "In older traffic circles, no physical structures prevent drivers from speeding right into the intersection. This lack of control contributes to high-speed conflicts inside the circle" — a problem solved by the islands at roundabouts.

Another feature is that vehicles approaching roundabouts yield to circulating traffic. No stopping is required. Some older traffic circles and many conventional intersections alternate traffic with stop signs or signals. Roundabouts enable all cars to move continuously through intersections at the same low speed.

"People assume that because there are so many traffic signals out there, they must be efficient. The fact is, they're not. When half of the cars are stopped at an intersection at any given time, delays are inevitable. It may seem counterintuitive that roundabouts increase capacity while lowering speeds, but that's exactly what happens," Retting points out.

Other design elements set roundabouts apart from traffic circles. Pedestrians cross only at the perimeter, vehicles can't turn left ahead of the central island, and parking isn't allowed inside the circle. These requirements minimize distractions and opportunities for collisions.

**More common in other countries:** The traffic calming properties of roundabouts may explain why they've been widely used in other countries but not in the United States. The American penchant for fast driving has created a culture where "slowing down" seems an encroachment on convenience. But the bias for speed isn't just among drivers. American universities and institutions that influence road planning and engineering have reinforced the historical practice of building high-speed intersec-



tions. Teachings haven't emphasized traffic calming as a preventive measure, at least not until recently.

"The priority for road planners and engineers in this country has been to process as much traffic as possible. Traffic signals have become the technology of choice. It's hard to deviate from that approach," O'Neill explains. "Countries in Europe and elsewhere have been much more progressive in focusing on traffic calming and making intersections safe for pedestrians. They caught on long ago to something we've ignored because of our fascination with technology. Recent interest in roundabouts in the United States is one sign that priorities finally are shifting."

**Geometry eliminates the worst crashes:** Roundabouts benefit from good geometry, exhibiting only a fraction of the troublesome crash patterns typical of right-angle intersections. Such intersections "place vehicles on a high-speed collision course, with crashes avoided only if drivers obey traffic laws and use good judgment. Research shows many drivers don't, so the potential is high for right-angle, left-turn, and rear-end conflicts," Retting explains. Such conflicts make up about two-thirds of police-reported crashes on urban arterials.

The geometry of roundabouts eliminates many of the angles and traffic flows that create opportunities for crashes, particularly the right-angle and rear-end kind that tend to produce injuries. The lack of right angles, combined with reductions in speed, make the intersections safer for pedestrians and bicyclists as well as people in cars. The speed depends on the intersection but generally remains at about 15 mph. At that speed, drivers and others on the road have more time to react, so there's a smaller chance of collision. When crashes do happen, most will be minor.

**Fewer pedestrian crashes:** Concern has been expressed that installing roundabouts might endanger pedestrians, but these fears appear unfounded. Experience in Europe shows roundabouts reduce the risk of pedestrian crashes. Such crashes also declined at the U.S. roundabouts (continues on p.6)



## In pedestrian crashes, it's vehicle speed that matters the most

### Elderly pedestrians are at greater risk of dying than younger pedestrians

Regardless of age, pedestrians involved in crashes are more likely to be killed as vehicle speeds increase. In crashes at any speed, older pedestrians are more likely to die than younger ones. These are the two main findings of a report on pedestrian injuries recently prepared by the Preusser Research Group for the National Highway Traffic Safety Administration.

Analyzing crashes across the country, researchers found that fewer than 2 percent of struck pedestrians died in crashes that occurred where posted speed limits were slower than 25 mph. Where speed limits were 50 mph or higher, more than 22 percent of struck pedestrians died. The correlation was much the same when researchers looked at vehicle travel speeds — crash data from Florida show the proportion of serious injuries and fatalities among pedestrians went up along with vehicle speeds, as estimated by police investigating the crashes.

"Pedestrians age 65 and older are more than 5 times as likely to die in crashes than pedestrians age 14 or less, and the likelihood of death increases steadily for ages in between," the authors observe. Younger pedestrians generally have a greater chance of withstanding impacts unharmed, while elderly pedestrians are more susceptible to serious injury or death.

These findings aren't surprising given the physical disproportions between cars and pedestrians. Anyone who has walked along a street and felt the rush of cars whizzing by has a visceral sense of the danger. Car occupants have several tons of metal surrounding them, and safety belts and airbags buffer them from crash forces. In contrast, pedestrians are unprotected and weigh a small fraction of any car that strikes them, so they're extremely vulnerable.

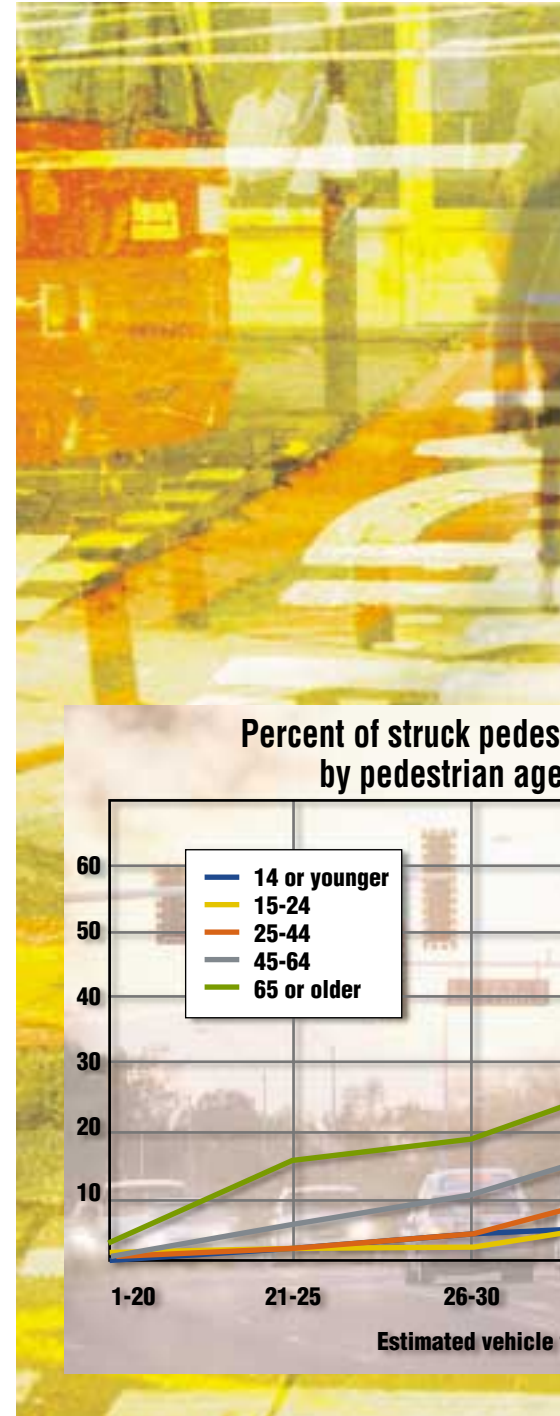
The logical solution is to limit vehicle speeds in areas where pedestrians are present, because speed determines impact severity. With every small increase in speed, pedestrian deaths go up even faster. The authors cite research concluding that about 5 percent of pedestrians hit by a vehicle traveling 20 mph will die. The fatality rate jumps to 40 percent for cars traveling 30 mph, 80 percent for cars going 40 mph, and 100 percent for cars going 50 mph or faster.

Lowering speed limits alone can bring small improvements. In most studies, the authors report, actual travel speeds dropped by a quarter or less of the posted speed limit reductions. Effective enforcement is more critical. Institute senior vice president Allan Williams explains that "for enforcement to

**Lowering speed limits can bring small improvements, but effective enforcement is more critical. The consequences of getting stopped for speeding have to be meaningful enough to keep drivers from knowingly taking the risk.**

deter speeding, drivers must believe the enforcement efforts are being made in the specific locations where they drive and at the times when they drive there. Even the presence of enforcement isn't enough. The consequences of getting stopped for speeding have to be meaningful enough to keep drivers from knowingly taking the risk."

It's impossible to put a police officer on every street, so cameras are a practical means of increasing the perception of enforcement. Red-light cameras already have won favor in jurisdictions around the country. Speed cameras aren't as popular, but they're equally effective deterrents (see *Status Report*, March 11, 2000; on the web at [www.highwaysafety.org](http://www.highwaysafety.org)).



On the other hand, the designs of roadways often encourage drivers to go faster than the posted speed limits. Travel speeds can be restricted by introducing road treatments such as humps, rumble strips, paving stones or other rough surfaces instead of asphalt, and by road narrowing (see *Status Report*, May 2, 1998; on the web at [www.highwaysafety.org](http://www.highwaysafety.org)). With the right planning,

modern roundabouts and other road treatments designed to reduce speeds can serve pedestrian safety as well as ease other traffic problems.

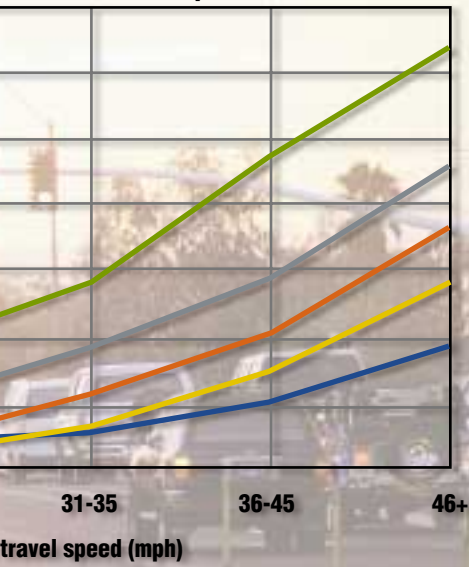
To make roads safer for pedestrians, engineers also should place crosswalks away from stop lines and merge areas. Traffic signal intervals should be set to allow pedestrians enough time to cross. And installing

sidewalks or better lighting can prevent unnecessary collisions.

“Literature review on vehicle travel speeds and pedestrian injuries” by W.A. Leaf and D.F. Preusser is available by writing to the National Technical Information Service, Springfield, VA 22161. Or find the study at [www.nhtsa.gov/people/injury/research/pub/HS809012.html](http://www.nhtsa.gov/people/injury/research/pub/HS809012.html).



**pedestrians with fatal injuries,  
and vehicle speed**



(continued from p.3) in the new study, but the numbers were too small to be significant.

The combination of a rotary design and yield at entry, as opposed to right angles

### Technical guide on the way

The Federal Highway Administration (FHWA) has laid some groundwork to support roundabouts. The agency's new guide aims to be "the definitive source of information related to the planning, operation, design, and configuration of modern roundabouts in the United States."

As FHWA points out, roundabouts have limitations as well as strengths. The guide presents information on both positives and negatives to help engineers and planners make the best decisions about when and how to use roundabouts.

This information comes just in time. "Interest in modern roundabouts has grown as a result of positive international experience," says FHWA's Joe Bared, who directed the project. "Hundreds of research papers are now available, and designs are being copied from the Australians and Europeans." The publication interprets best practices from around the world in light of accepted U.S. design standards.

"Designing roundabouts requires a lot of skill," Bared notes. "It's not high tech, but it takes skill to get the speed right and leave enough room inside the circle for vehicles to maneuver."

This attention is important in boosting roundabout construction — and helping towns and cities reap the benefits. "The more roundabouts, the better," Bared says.

"Roundabouts: an informational guide" (FHWA-RD-00-067) will be on the internet at [www.fhrc.gov](http://www.fhrc.gov). It also will be available by faxing FHWA's Report Center, 301/577-1421.

and stop controls, lends other safety benefits. Because there are no traffic signals to obey, drivers don't feel compelled to "beat the red light" or be first to cross the line when the light turns green. This not only reduces collisions but also takes the edge off at least one manifestation of aggressive driving. Plus the absence of a traffic signal and the curved roadway associated with roundabouts force drivers to pay attention to their surroundings, which further enhances road safety.

#### Cheaper, cleaner, and a nicer view:

Roundabouts are becoming popular in the United States for more than just safety reasons. They're less expensive than intersections controlled by traffic signals, saving up to \$5,000 per year per intersection in electricity and maintenance.

Fewer traffic snarls due to blocked intersections or backups can mean additional savings. For example, a pair of roundabouts introduced at a freeway interchange in Vail, Colorado, saves \$85,000 each year in traffic control costs.

Environmental and aesthetic benefits add to the appeal. Roundabouts cut vehicle emissions and fuel consumption by reducing the time drivers sit idling at intersections. Traffic that moves more slowly through intersections creates less noise and congestion, minimizing the expressway look and feel of roads in urban and suburban areas. Landscaping on the islands replaces the asphalt of conventional intersections, which offers visual appeal and restores a bit of nature. Roundabouts also create visual gateways to communities or neighborhoods, and in commercial areas they can improve access to adjacent properties.

"Roundabout construction should be strongly promoted as an effective safety treatment at intersections," Retting concludes. "There's nothing to lose from constructing them and everything to gain. The proof is already there."

For a copy of "Crash reductions following installation of roundabouts in the United States" by B. Persaud et al., write: Publications, Insurance Institute for Highway Safety, 1005 N. Glebe Rd., Arlington, VA 22201.

## Worst theft losses are for Mercedes model; 2 of 3 worst are Acuras

The Mercedes S class, a very large luxury car, heads the list of passenger vehicles with the highest insurance losses for theft. Overall losses for this car are 10 times higher than the average for all passenger cars.



This is the first time in five years that a utility vehicle hasn't topped the list of vehicles with the worst theft losses, which are published annually by the Highway Loss Data Institute (HLDI).

"The Mercedes S class has appeared on the 10 worst list for 5 years. It's obviously an attractive target for professional thieves because of its value," says Kim Hazelbaker, HLDI senior vice president.

The two-door Acura Integra has the second worst result, with losses also 10 times higher than the average among 1997-99 passenger vehicles. These high overall losses are produced by different factors, Hazelbaker explains. The Mercedes has extremely high average loss payments per claim, while the Acura's claim frequency is very high.

The four-door Integra has the third highest overall theft loss result. Now Honda,

which manufactures Acuras, has equipped all Integras for the 2000 model year with passive immobilizing antitheft devices.

During the 1980-99 model years, theft claim frequencies have declined significantly, but this trend has been mostly offset by increasing theft losses per claim. In 1999, the last year for which information is available, the average theft loss payment per claim also declined.

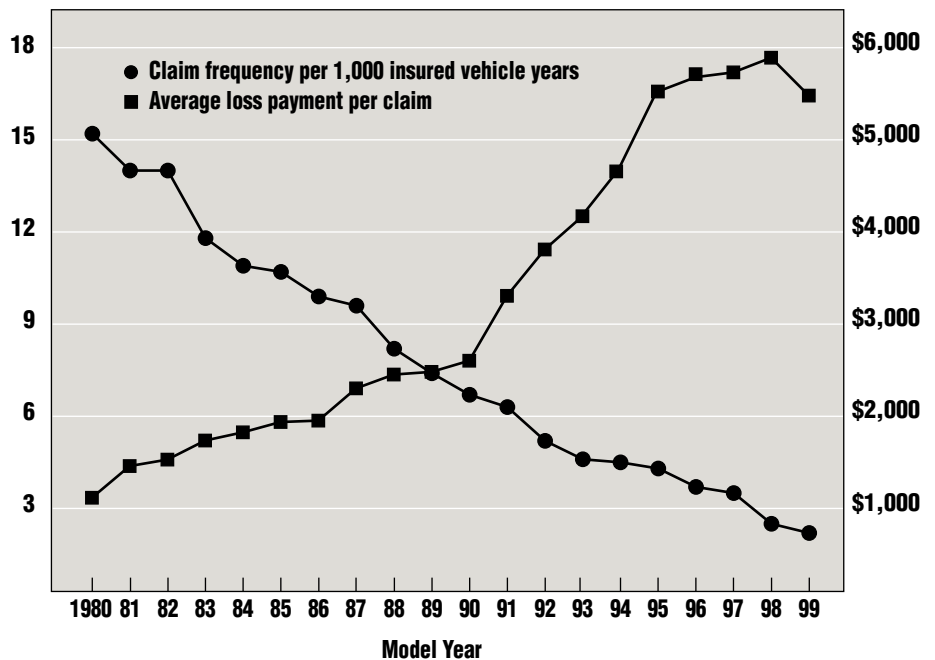


### Worst overall theft losses

Make and series	Model years	Size and type	Result
Mercedes S class long wheelbase	1997-99	Very large luxury four-door car	1001
Acura Integra	1997-99	Small two-door car	996
Acura Integra	1997-99	Small four-door car	757
Mitsubishi Montero Sport 4 wheel drive	1997-99	Midsize four-door utility vehicle	616
Mercedes SL class convertible	1997-99	Small sports car	539
Nissan Maxima	1997-99	Midsize four-door car	509
Lexus GS 300/400	1997-99	Large luxury four-door car	421
BMW 3 series	1997-99	Midsize luxury two-door car	409
BMW 7 series long wheelbase	1997-99	Very large luxury four-door car	387
Lincoln Navigator 4 wheel drive	1998-99	Large four-door utility vehicle	387

Note: Results are relative average loss payments per insured vehicle year; 100 represents the average for all cars.

### Insurance theft claim frequencies and average loss payments per claim, 1980-99



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