14 ISSUE BRIEFS

Roundabouts

A proven safety solution that reduces the number and severity of intersection crashes.

History of Roundabouts

The "modern roundabout" is commonly confused with older-style traffic circles and rotaries. Traffic circles have been around almost a century, with the first documented one being built in 1905 on the southwest corner of Central Park in New York City and named after Christopher Columbus. From the start, traffic circles provided the ability for a city to tie a number of intersecting streets together and make a landscaped central circle that had aesthetic value to the community. Many large circles or rotaries were built in the United States until the 1950s when they fell out of favor. The older-style rotaries enabled high-speed merging and weaving of vehicles that led to a high crash experience.

The modern roundabout was developed in the United Kingdom to rectify problems associated with these traffic circles. In 1966, the United Kingdom adopted a mandatory "give-way" rule at all circular intersections, which required entering traffic to give way, or yield, to circulating traffic. This rule prevented circular intersections from locking up by not allowing vehicles to enter the intersection until there were sufficient gaps in circulating traffic.

What is a Modern Roundabout?

A modern roundabout is a one-way circular intersection without traffic signals in which traffic flows around a center island. Roundabouts feature yield control for all entering traffic, channelized approaches and appropriate geometric curvature to ensure that travel speeds on the circulatory roadway are typically less than 30 mph. Roundabouts must be designed to meet the needs of all users—drivers, pedestrians, pedestrians with disabilities and bicyclists. When designing roundabouts, special considerations must be given to the needs of pedestrians with visual disabilities who are unable to judge adequate gaps in traffic at roundabouts. Proper site selection and pedestrian channelization are essential to making roundabouts accessible to all users. Roundabouts can also be designed for trucks and larger vehicles and in geographic areas where significant snowfall is the norm during the winter.

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Features of Modern Roundabouts

The design and traffic control features of roundabouts are as follows:

- **Yield control** is used on all entries.
- The **circulatory roadway** has no traffic control. Circulating vehicles have the right-of-way. All vehicles circulate counter-clockwise and pass to the right of the central island.
- **Central island.** Once within the circulatory roadway, vehicles' paths are further deflected by the central island.
- **Pedestrian access** is allowed only across the legs of the roundabout, behind the yield line to the circulatory roadway. Pedestrian crossings are located at least one vehicle length upstream of the yield point.
- **Splitter island.** A splitter island is a raised or painted area on an approach used to separate entering from exiting traffic, deflect and slow entering traffic and provide storage space for pedestrians crossing the road in two stages.
- **Yield line** is a pavement marking used to mark the point of entry from an approach into the circulatory roadway. This is generally marked along the inscribed circle. Entering vehicles must yield to any circulating traffic coming from the left before crossing this line into the circulatory roadway.
- **Landscaping buffer** Landscaping buffers are provided at most roundabouts to separate vehicular and pedestrian traffic and to encourage pedestrians to cross only at the designated crossing locations. Landscaping buffers can also significantly improve the aesthetics of the intersection.
- **Accessible pedestrian crossings.** Accessible pedestrian crossings should be provided at all roundabouts. The crossing location is set back from the yield line and the splitter island is cut to allow pedestrians, wheelchairs, strollers and bicycles to pass through. Tactile surfaces should be used to warn pedestrians with visual disabilities that they are about to enter the roadway.

Roundabout Safety

Research indicates that well-designed roundabouts can be safer and more efficient than conventional intersections. Safety benefits of roundabouts include:

- Roundabouts have fewer conflict points in comparison to conventional intersections. The potential for hazardous conflicts, such as right-angle and left-turn head-on crashes is eliminated with roundabout use. Single-lane approach roundabouts produce greater safety benefits than multilane approaches because of fewer potential conflicts between road users and because pedestrian crossing distances are shorter;
- Low absolute speeds associated with roundabouts allow drivers more time to react to potential conflicts, also helping to improve the safety performance of roundabouts;
- Since most road users travel at similar speeds through roundabouts, i.e., have low relative speeds, crash severity can be reduced compared to some traditionally controlled intersections;
- Roundabouts have fewer annual injury crashes than rural two-way stop-controlled intersections, and the total number of crashes at roundabouts is relatively insensitive to minor street demand volumes; and
- Roundabouts have fewer injury accidents per year than signalized intersections, particularly in rural areas. At volumes greater than 50,000 average daily traffic (ADT), urban roundabout safety may be comparable to that of urban signalized intersections.

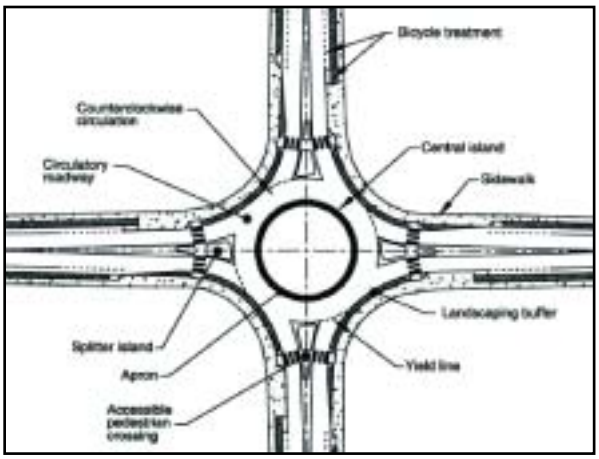
Table 1 shows the crash frequencies (average annual crashes per roundabout) experienced at 11 intersections in the United States that were converted to roundabouts. As the exhibit shows, both types of roundabouts showed a reduction in both injury and property-damage crashes after installation of a roundabout.

A December 2002 report by the Maryland Highway Administration indicates that 15 single-lane roundabouts have greatly improved intersection safety in the state. The analysis shows that there has been a 100 percent decrease in the fatal crash rate; a 60 percent decrease in the total crash rate; an 82 percent reduction in the injury crash rate; and a 27 percent reduction in the property damage only accident rate.

Table 1

		Before Roundabout			Roundabout			Percent Change 5		
Type of Roundabout	**Sites**	Total	Inj.[3]	PDO[4]	Total	Inj.	PDO	Total	Inj.	PDO
Small/Moderate[1]	8	4.8	2.0	2.4	2.4	0.5	1.6	-51%	73%	-32%
Large[2]	3	21.5	5.8	15.7	15.3	4.0	11.3	-29%	31%	-10%
Total	11	9.3	3.0	6.0	5.9	1.5	4.2	-37%	51%	-29%

Notes:
1. Mostly single-lane roundabouts with inscribed circle diameter of 100 ft. to 115 ft.
2. Multilane roundabouts with an inscribed circle diameter greater than 165 ft.
3. Inj. = Injury crashes
4. PDO = Property Damage Only crashes
5. Only injury crash reductions for small/moderate roundabouts were statistically significant. Source: Jacquemart, G. Synthesis of Highway Practice 264: *Modern Roundabout Practice in the United States*. National Cooperative Highway Research Program. Washington, DC: National Academy Press, 1998.



Safety Problems Susceptible to Correction by Roundabouts

The decision to install a roundabout as a safety improvement should be based on a demonstrated safety problem of the type susceptible to correction by a roundabout. A review of crash reports and the type of accidents occurring is essential.

Examples of safety problems include:

- High rates of crashes involving conflicts that would tend to be resolved by a roundabout (right-angle, head-on, left/through, U-turns, etc.);
- High-crash severity that could be reduced by the slower speeds associated with roundabouts;
- Site visibility problems that reduce the effectiveness of STOP sign control (in this case, landscaping of the roundabout needs to be carefully considered); and
- Inadequate separation of movements, especially on single-lane approaches.

Issues to Review When Considering Roundabout Design Alternatives

During the planning and alternatives development stage of a project, the following issues should be considered prior to making the decision to implement a roundabout design:

- **Context.** What are the regional policy constraints that must be addressed? Are there site-specific and community impact reasons why a roundabout of any particular size would not be a good choice?
- **Space feasibility.** Is there enough right-of-way to build the roundabout? Is right-of-way acquisition required? If "yes," this introduces administrative complications that some agencies might want to avoid.
- **Physical or geometric complications** such as right-of-way limitations, utility conflicts, drainage problems and unfavorable topography that may limit visibility or complicate construction.
- **Proximity of generators** of significant traffic that might have difficulty negotiating the roundabout, such as high volumes of oversized trucks.
- **Proximity of traffic control devices** that would require preemption, such as railroad tracks or drawbridges.
- **Traffic congestion** that would cause routine back-ups into the roundabout, such as over-capacity signals or freeway entrance ramps. The successful operation of a roundabout depends on unimpeded flow on the circulatory roadway.
- **Intersections of a major arterial and a minor arterial or local road** where an unacceptable delay to the major road could be created. Roundabouts delay and deflect all traffic entering the intersection and could introduce excessive delay or speed inconsistencies to flow on the major arterial.
- **Heavy pedestrian or bicycle movements** in conflict with high traffic volumes. (These conflicts pose a problem for all types of traffic control.)
- **Coordinated signal system.** Intersections located on arterial streets within a coordinated signal network. In these situations, the level of service on the arterial might be better with a signalized intersection incorporated into the system.

The existence of one or more of these conditions does not necessarily preclude the installation of a roundabout. Roundabouts have, in fact, been built at locations that exhibit nearly all of the conditions listed above. They may be resolved through coordination with and support from other agencies and implementation of specific mitigation actions.

Resources

1. FHWA has published a comprehensive guide called *Roundabouts: An Informational Guide*. The information supplied in this document is based on established international and U.S. practices and is supplemented by recent research. Call 202-366-5915 to order Publication No. FHWA-RD-00-067, or download this guide from the Internet at http://www.tfhrc.gov/safety/00068.htm

2. Florida Department of Transportation. *Florida Roundabout Guide*. Florida Department of Transportation, March 1996.

3. Garder, P. *The Modern Roundabouts: The Sensible Alternative for Maine*. Maine Department of Transportation, Bureau of Planning, Research and Community Services, Transportation Research Division, 1998.

4. Jacquemart, G. Synthesis of Highway Practice 264: *Modern Roundabout Practice in the United States*. National Cooperative Highway Research Program. Washington, DC: National Academy Press, 1998.

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