Q&As: Roundabouts

April 2010

Video: how roundabouts work (2 minutes)

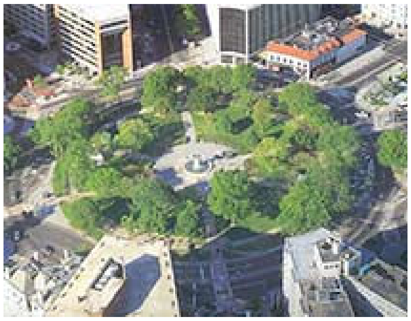
Traffic congestion and motor vehicle crashes are widespread problems, especially in urban areas. Roundabouts, used in place of stop signs and traffic signals, are a type of circular intersection that can significantly improve traffic flow and safety. Where roundabouts have been installed, motor vehicle crashes have declined by about 40 percent, and those involving injuries have been reduced by about 80 percent. Crash reductions are accompanied by significant improvements in traffic flow, thus reducing vehicle delays, fuel consumption, and air pollution.

Hide all answers

1 | What is a roundabout?

Modern roundabouts were developed in the United Kingdom in the 1960s and now are widely used in many countries. The modern roundabout is a circular intersection with design features that promote safe and efficient traffic flow. At roundabouts in the United States, vehicles travel counterclockwise around a raised center island, with entering traffic yielding the right-of-way to circulating traffic. In urban settings, entering vehicles negotiate a curve sharp enough to slow speeds to about 15-20 mph; in rural settings, entering vehicles may be held to somewhat higher speeds (30-35 mph). Within the roundabout and as vehicles exit, slow speeds are maintained by the deflection of traffic around the center island and the relatively tight radius of the roundabout and exit lanes. Slow speeds aid in the smooth movement of vehicles into, around, and out of a roundabout. Drivers approaching a roundabout must reduce their speeds, look for potential conflicts with vehicles already in the circle, and be prepared to stop for pedestrians and bicyclists. Once in the roundabout, drivers proceed to the appropriate exit, following the guidance provided by traffic signs and pavement markings.

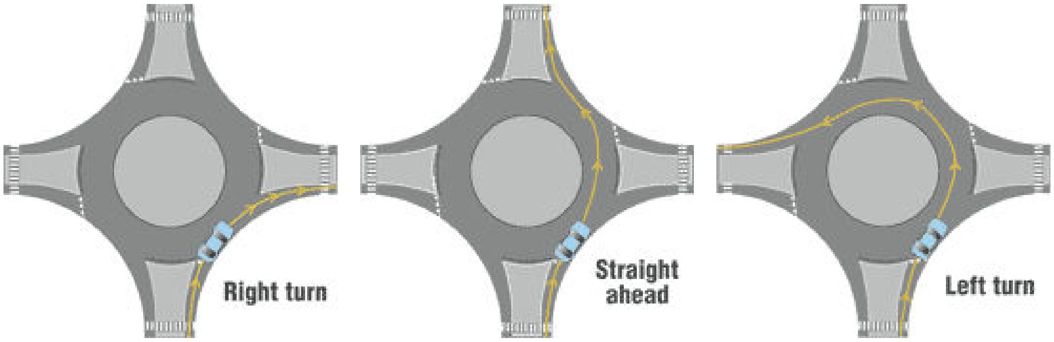
Modern roundabout



Older traffic circle

2 | How do roundabouts differ from older traffic circles and rotaries?

Modern roundabouts are much smaller than older traffic circles and rotaries, and roundabouts require vehicles to negotiate a sharper curve to enter. These differences make travel speeds in roundabouts slower than speeds in traffic circles and rotaries. Because of the higher speeds in older circles and rotaries, many were equipped with traffic signals or stop signs to help reduce potential crashes. In addition, some older traffic circles and rotaries operated according to the traditional "yield-to-the-right" rule, with circulating traffic yielding to entering traffic.



Common traffic maneuvers at roundabouts

3 | How do roundabouts affect safety?

Several features of roundabouts promote safety. At traditional intersections with stop signs or traffic signals, some of the most common types of crashes are right-angle, left-turn, and head-on collisions. These types of collisions can be severe because vehicles may be traveling through the intersection at high speeds. With roundabouts, these types of potentially serious crashes essentially are eliminated because vehicles travel in the same direction. Installing roundabouts in place of traffic signals can also reduce the likelihood of rear-end crashes and their severity by removing the incentive for drivers to speed up as they approach green lights and by reducing abrupt stops at red lights. The vehicle-to-vehicle conflicts that occur at roundabouts generally involve a vehicle merging into the circular roadway, with both vehicles traveling at low speeds — generally less than 20 mph in urban areas and less than 30-35 mph in rural areas.

A 2001 Institute study of 23 intersections in the United States reported that converting intersections from traffic signals or stop signs to roundabouts reduced injury crashes by 80 percent and all crashes by 40 percent.[1] Similar results were reported by Eisenman et al.: a 75 percent decrease in injury crashes and a 37 percent decrease in total crashes at 35 intersections that were converted from traffic signals to roundabouts.[2] A study of 17 higher speed rural intersections (40 mph and higher speed limits) found that the average injury crash rate per million entering vehicles was reduced by 84 percent and fatal crashes were eliminated when the intersections were converted to roundabouts.[3] Studies of intersections in Europe and Australia that were converted to roundabouts have reported 41-61 percent reductions in injury crashes and 45-75 percent reductions in severe injury crashes.[4]

4 | What are the features of a good roundabout design?

Proper design can help to optimize the safety benefits of roundabouts. Centerlines of roads leading to roundabouts should be properly aligned with the central island. Approach roads should be sufficiently curved, far enough in advance of roundabouts, to reduce vehicle speeds of entering drivers. Islands separating the approach and exit lanes, known as splitter islands, should extend far enough from the roundabout to provide pedestrian refuge and to delineate the roundabout. Traffic signs, pavement markings, and lighting should be adequate so that drivers are aware that they are approaching a roundabout and that they should reduce their travel speed. With multi-lane roundabouts, signs and lane markings should help drivers chose the appropriate lane when entering and exiting the roundabout. The figures below show sample guide signs and lane markings used at roundabouts.

Guide signs

Lane markings

5 | What are the common types of crashes at roundabouts? What can be done to prevent them?

Despite the demonstrated safety benefits of roundabouts, some crashes still occur. An Institute study of crashes at 38 roundabouts in Maryland found that four crash types (run-off-road, rear-end, sideswipe, and entering-circulating) accounted for almost all crashes. A common crash type at both single-lane and double-lane roundabouts involved vehicles colliding with the central island. These crashes, which often involved unsafe speeds, accounted for almost half of all single-vehicle run-off-road crashes. Collisions occurred more frequently at entrances to roundabouts rather than within the circulatory roadway or at exits. About three-quarters of the crashes involved property damage. There were no right-angle or head-on collisions, potentially severe crash types that commonly occur at traditional intersections.[5] Fewer traffic conflicts and crashes are typically seen at single lane roundabouts compared with multi-lane roundabouts; additional lanes allow for more points of contact between vehicles.[6]

In the study of crashes at Maryland roundabouts, Institute researchers concluded that unsafe speeds were an important driver crash factor. Some drivers may not have seen the roundabout in time. Measures to alert drivers of the need to reduce speeds (e.g., speed limit signs well in advance of roundabouts) and increase the conspicuity of roundabouts (e.g., larger roundabout ahead signs and YIELD signs, enhanced landscaping of center islands, pavement with reflector markings) may help to reduce crashes at roundabouts. Certain design features such as adequate curvature of approach roads also may aid in reducing speeds.

6 | How do roundabouts affect traffic flow?

Several studies conducted by the Institute and others have reported significant improvements in traffic flow following conversion of traditional intersections to roundabouts. A study of three intersections in Kansas, Maryland, and Nevada, where roundabouts replaced stop signs, found that vehicle delays were reduced 13-23 percent and the proportion of vehicles that stopped was reduced 14-37 percent.[7] A study of three locations in New Hampshire, New York, and Washington, where roundabouts replaced traffic signals or stop signs, found an 89 percent average reduction in vehicle delays and a 56 percent average reduction in vehicle stops.[8] A study of 11 intersections in Kansas found a 65 percent average reduction in delays and a 52 percent average reduction in vehicle stops after roundabouts were installed.[9]

A 2005 Institute study documented missed opportunities to improve traffic flow and safety at 10 urban intersections suitable for roundabouts where either traffic signals were installed or major modifications were made to signalized intersections.[10] It was estimated that the use of roundabouts instead of traffic signals at these 10 intersections would have reduced vehicle delays by 62-74 percent. This is equivalent to approximately 325,000 fewer hours of vehicle delay on an annual basis.

7 | Are there other benefits?

Because roundabouts improve the efficiency of traffic flow, they also reduce vehicle emissions and fuel consumption. In one study, replacing a signalized intersection with a roundabout reduced carbon monoxide emissions by 29 percent and nitrous oxide emissions by 21 percent.[11] In another study, replacing traffic signals and stop signs with roundabouts reduced carbon monoxide emissions by 32 percent, nitrous oxide emissions by 34 percent, carbon dioxide emissions by 37 percent, and hydrocarbon emissions by 42 percent.[12] Constructing roundabouts in place of traffic signals can reduce fuel consumption by about 30 percent.[11,13] At 10 intersections studied in Virginia, this amounted to more than 200,000 gallons of fuel per year.[10] And roundabouts can enhance aesthetics by providing landscaping opportunities.

8 | Can roundabouts accommodate larger vehicles?

Yes. To accommodate vehicles with large turning radii such as trucks, buses, and tractor-trailers, roundabouts provide an area between the circulatory roadway and the central island, known as a truck apron, over which the rear wheels of these vehicles can safely track. The truck apron generally is composed of a different material texture than the paved surface, such as brick or cobble stones, to discourage routine use by smaller vehicles.

9 | How do roundabouts affect older drivers?

Age-related declines in vision, hearing, and cognitive functions, as well as physical impairments, may affect some older adults' driving ability. Intersections can be especially challenging for older drivers. Relative to other age groups, senior drivers are over-involved in crashes occurring at intersections. In 2008, 37 percent of drivers 70 and older in fatal crashes were involved in multiple-vehicle intersection crashes, compared with 22 percent among drivers younger than 70. Older drivers' intersection crashes often are due to their failure to yield the right-of-way.[14] Particular problems for older drivers at traditional intersections include left turns and entering busy thoroughfares from cross streets. Roundabouts eliminate these situations entirely. A 2007 study in six communities where roundabouts replaced traditional intersections found that about two-thirds of drivers 65 and older supported the roundabouts.[15] Although safety effects of roundabouts specifically for older drivers are unknown, the 2001 Institute study of 23 intersections converted from traffic signals or stop signs to roundabouts reported the average age of crash-involved drivers did not increase following the installation of roundabouts, suggesting roundabouts may not pose a problem for older drivers.[1]

10 Are roundabouts safe for pedestrians?

Roundabouts generally are safer for pedestrians than traditional intersections. In a roundabout, pedestrians walk on sidewalks around the perimeter of the circulatory roadway. If it is necessary for pedestrians to cross the roadway, they cross only one direction of traffic at a time. In addition, crossing distances are relatively short, and traffic speeds are lower than at traditional intersections. Studies in Europe indicate that, on average, converting conventional intersections to roundabouts can reduce pedestrian crashes by about 75 percent.[16,17] Single-lane roundabouts, in particular, have been reported to involve substantially lower pedestrian crash rates than comparable intersections with traffic signals.[18]

11 Do drivers favor roundabouts?

Drivers may be skeptical, or even opposed, to roundabouts when they are proposed. However, opinions quickly change when drivers become familiar with roundabouts. A 2002 Institute study in three communities where single-lane roundabouts replaced stop sign-controlled intersections found 31 percent of drivers supported the roundabouts before construction compared with 63 percent shortly after.[7] Another study surveyed drivers in three additional communities where single-lane roundabouts replaced stop signs or traffic signals.[8] Overall, 36 percent of drivers supported the roundabouts before construction compared with 50 percent shortly after. Follow-up surveys conducted in these six communities after roundabouts had been in place for more than one year found the level of public support increased to about 70 percent on average.[15]

The additional travel lanes in multi-lane roundabouts increase the complexity of the driving task. Information is not yet available on drivers' attitudes toward multi-lane roundabouts in the United States.

12 What are the impediments to building roundabouts?

Despite the safety and other benefits of roundabouts, as well as the high levels of public acceptance once they are built, some states and cities have been slow to build roundabouts, and some are even opposed to building them. The principal impediment is the negative perception held by some drivers and elected officials. Transportation agencies also have long been accustomed to installing traffic signals, and it can take time for deeply rooted design practices to change.

13 How common are roundabouts in the United States?

The first modern roundabouts in the United States were constructed in Nevada in 1990. Since that time, although the precise number of roundabouts is unknown, approximately 2,000 have been built. By comparison, there are about 20,000 roundabouts in France, 15,000 in Australia, and 10,000 in the United Kingdom. States that have active programs to construct roundabouts include Alaska, California, Colorado, Connecticut, Delaware, Florida, Hawaii, Indiana, Kansas, Maine, Maryland, Michigan, Minnesota, Mississippi, Nevada, New Hampshire, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming.

14 Do roundabouts require more space than traditional intersections?

Roundabouts do not necessarily require more space than traditional intersections. Geometric design details vary from site to site and must take into account traffic volumes, land use, topography, and other factors. Because they can process traffic more efficiently than traffic signals and stop signs, roundabouts typically require fewer traffic lanes to accommodate the same amount of traffic. In some cases, roundabouts can require more space than stop signs or traffic signals at the actual intersection to accommodate the central island and circulating lanes, but approaches to roundabouts typically require fewer traffic lanes and less right-of-way than those at traditional intersections. The following example from Asheville, North Carolina, illustrates that roundabout dimensions can be compatible with those of traditional intersections.

Before **After**

Intersection with traffic signals converted to a roundabout in Asheville, North Carolina

15 | What are appropriate locations for roundabouts?

Roundabouts are appropriate at many intersections, including high crash locations and intersections with large traffic delays, complex geometry (more than four approach roads, for example), frequent left-turn movements, and relatively balanced traffic flows. Roundabouts can be constructed along congested arterials, in lieu of road widening, and can be appropriate in lieu of traffic signals at freeway exits and entrances.

16 | What types of intersections may not be good candidates for roundabouts?

Roundabouts are not appropriate everywhere. Intersections that may not be good candidates include those with topographic or site constraints that limit the ability to provide appropriate geometry, those with highly unbalanced traffic flows (that is, very high traffic volumes on the main street and very light traffic on the side street), and isolated intersections in a network of traffic signals.

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