Roundabouts, A Perspective

“The safest, most efficient, and attractive form of traffic control in the world.

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September, 2015
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Introduction

Modern roundabouts are the prettiest and safest form of traffic control in the world. Well-designed roundabouts slow all vehicles, provide refuges for pedestrians, and are the only traffic control device in which trees can be planted, fountains can bubble or spray, statutes can sparkle into the next century. When constructed as part of new road construction they are cheaper to build than signalized intersections. If used instead of traffic signals they save us all money. Their maintenance cost is almost zero. They require no electricity, no regular tune-ups, and no annual replacements of parts, suffer no blackouts and cannot be blown away.

Modern roundabouts are not the old fashion traffic circles of yesteryear, those large circles about which there are many stories. Drivers had difficulty with many circles because they could not see their exit point. Traffic circles were based on high-speed entry, a high-speed merge followed by a high-speed exit design. The high speed maneuvers intimidated many drivers, yet they continued to drive through them.

![Figure 1. Elevated view of Clearwater Beach roundabout. Carries around 1.2 million vehicles with 150,000 pedestrians crossings per month.](image)

Roundabouts are the opposite of traffic circles. Well-designed roundabouts are usually designed as small as possible for their environment. When designing a roundabout the most important criterion are design speed and accommodation of the design vehicle, which may involve trucks up to 135 feet long. Depending on the environment and the design objectives the design speed can vary from 12 mph in residential streets, 15 to 18 mph on collector streets and 18 to 23 mph on arterial roads. At high-speed rural roundabouts 25 mph is the maximum desirable design speed that should be used. Design speeds above these levels usually have a higher crash rate.

Crash Reduction

There are two simple reasons for large reductions in crashes and crash severity at roundabouts, up to 99 percent, when compared to other forms of traffic control; a large reduction in the number of conflict points, as shown below, and lower vehicle speeds.

As the following figures show, the two most serious crashes, the right angle and the left turn, are eliminated by the circular pattern of vehicle flow at roundabouts.

Standard intersection has 32 vehicle-to-vehicle conflicts with 24 vehicle to pedestrian conflicts. A roundabout reduces these conflicts to 8 vehicle-to-vehicle conflicts and just 8 vehicle to pedestrian conflicts as shown below.

![The large reduction of conflicts and low speed makes roundabouts suitable for location in, at, or near schools of all grade levels. The first such roundabout in the US was constructed in Montpelier, VT in 2,000 is shown below.](image)
Figure 2. Roundabout at Montpelier, VT on a state highway only a few hundred feet from a middle school.

More specific crash data comes from the FHWA and the Insurance Institute for Highway Safety. Studies from both organizations found that roundabouts reduce crashes, fatal and injury crashes by 90 percent, injury crashes by 73 percent and all crashes by 39 percent. Yet some people think roundabouts are “crashes waiting to happen”. The first roundabout on a State Highway in the US is the above roundabout in Montpelier, VT. The crash rate before the roundabout was approximately 5.5 crashes per year. The after crash data showed no reported crashes.

Figure 3. Two-lane roundabout in Hilton Head roundabout with the large crash reduction.

A two-lane/one lane roundabout in South Carolina, Figure 3, carries approximately 2,500 vehicles per hour. In the 36 months before the roundabout there were 48 crashes with 15 injury crashes. In the 48 months afterwards there were 9 minor property damage only crashes (Insurance Institute for highway Safety). These crashes were mainly the lane change crashes that occur when drivers illegally change lanes.

Second, the low speed means that if a driver makes a mistake it is easy to stop at a low speed or at least the impact is relatively minor. Whereas signalized intersections have high-speed right angle and left turn crashes, and many others. Crashes at roundabouts are primarily rear end or low-speed merge crashes. It is very, very hard to be killed at a roundabout whereas a driver running a red light can easily kill themselves and innocent people.

Figure 4. Comparative crash rates for roundabout versus stop and traffic signal control based mainly on Australian data.

Consider this comparison. In 1999 according to the FHWA drivers who ran red signals caused 85,000 crashes, in which 81,000 people were injured and worse still 1,000 people were killed.

Roundabout Design

A roundabout consists of a central island that can vary in shape from a “square-a-bout” in Victorian areas, ovals and ellipses at odd shaped intersections to the ordinary circle. Each leg of a roundabout has a splitter island, a triangular shaped island that provides a refuge for pedestrians, prevents drivers from making the "wrong-way" left turn, guides drivers through the roundabout by directing them to the edge of the central island and helps to slow drivers.

Local street roundabouts are quite small. The central island diameter typically starts around 15 feet in diameter. Collector road roundabouts start with around a central island diameter of 30 to 40 feet. Roundabouts on arterial roads start with a minimum central island diameter of 64 feet for a single lane.
roundabout. Even large roundabouts at freeway interchanges or major intersections have central island diameters that are only 120 to 180 feet. Mini-roundabouts can vary based on the size of the intersection.

Uses

Modern roundabouts can be used at a wide variety of intersections - Freeway interchanges, Tee intersections, four-way or “Y” type intersections. Multi-leg intersections up to eight roads are an especially effective location for roundabouts. Any intersection with more than four legs will operate safer and more efficiently than the same intersection with traffic signals.

Transit

Trains or light rail vehicles can travel through a roundabout. When trains pass through a roundabout only two boom gates are required to stop circulating traffic. Both gates are placed next to the train tracks to stop the circulating traffic. When the trains come the boom gates stop the traffic, then, depending on the courtesy of drivers, the roundabout may be blocked for side street traffic. When the boom gates open it only takes less than a minute or less to clear the traffic. When on street Light Rail Vehicles pass through the center of a roundabout they usually do so without any assistance as they have absolute right-of-way. Do vehicles run into these larger vehicles? Not typically because it is hard to run into 80 foot long Light Rail Vehicles traveling at 15 mph. Melbourne, Australia has many one and multiple lane roundabouts with trams, Light Rail Vehicles Rail vehicles, passing through roundabouts as shown below in Figure 7.

Traffic Calming

Roundabouts are the most effective traffic calming treatment available. They limit vehicle speeds to and control vehicle speeds on four streets simultaneously. Gateways to communities and main streets are an effective location for roundabouts to slow traffic and create a grand entrance. They can act as a town square with fountains to create a focal point, a place to be. Besides the beauty roundabouts slow traffic and assist pedestrians to cross the street.

A traffic calming project in Clearwater, Florida included 14 roundabouts of various sizes from very small to median sized roundabouts along a major collector road used in conjunction with sections of raised median to reduce the high number of fatalities.
Figure 8. A traffic-calming roundabout in Elgin, Illinois where the roller blade rider is traveling as fast as the car.

Trucks

Accommodating trucks at roundabouts is a major challenge on two fronts, volume, and size. Roundabouts can accommodate large truck volumes. The highest that I have designed was a three lane roundabout with up to 29 percent trucks in the AM peak hour. It is important to ensure the capacity analysis accounts for the appropriate truck volumes. The control vehicle speed through roundabouts adequate deflection limit truck movements. To ensure their passage through smaller roundabouts while controlling vehicle speeds I developed truck aprons around the about 1995 that permitted truck movements by allowing the rear trucks wheels to travel over the three-inch high truck apron. Typically roundabouts can be designed to enable trucks up to 135 feet long to make left and right turns. Note the use of special truck apron for left and right turns.

Figure 9. Roundabout in Quebec, Canada designed to enable trucks up to 143 feet long to make left and right turns.

Access Management

Modern roundabouts also simplify Access Management in two ways. By replacing Two-way, Center Turn Lanes with a raised median some drivers must pass their destination and make a U-turn to access their destination. Roundabouts make U-turns very safe and provide an opportunity to sell medians to business owners. The other benefit is at an intersection where a roundabout is constructed and there are driveways to private houses or commercial properties that are at, or close to, the intersection. Sometimes, rather than buy corner properties and pay business damages for moving their driveway, provide a driveway into the roundabout which will enhance the property value. There are a few caveats. First, every vehicle must drive into the roundabout, no reversing is permitted. In the case of a private house, a turn around may be needed in their front yard. Second, there must be separation between the entry and exit points to the roundabout and the driveway. There was a two-lane roundabout in Spartanburg, SC, that has four roads, two frontage roads, on and off ramps, and five driveways accessing the roundabout.

Resistance

Yet there is resistance to roundabouts. It is often based on poor experiences with old traffic circles, a fear of change, or a reluctance to slow down. However, there is a rapidly growing awareness that roundabouts will solve many traffic problems and enhance cities that they have now been constructed in more than 42 states. Overall, roundabouts have been outstanding successes. Americans have shown their adaptability and their competence has exceeded that of their detractors.

Unfortunately, many old traffic circles have been cut up unnecessarily by roads being cut through their center and traffic signals installed. As a result, the aesthetics of the circles suffered when, in many cases, converting them to modern roundabouts by changing their entry conditions could have reduced crashes, improved capacity, and retained the aesthetic value of the circle.

Education is the best tool to help people understand that value and benefits of roundabouts.
Aesthetics

Roundabouts are the only form of traffic control whose design is as much an art form as it is science. Their design involves an interaction between design speed templates, design vehicle templates and curves that provide drivers with a smooth path and pleasing appearance. The splitter islands (triangular islands on each approach) must be large enough to provide safe refuge for pedestrians back from the entry point. Instead of using plain concrete for the center and splitter islands, we need to use a mix of pavers and low shrubbery or grass, with trees, fountains, or statues in the center island to give a unified look from right-of-way line to right-of-way line. Therefore, landscape architects and engineers should work together to give communities traffic control that is safe and effective and fits their needs while enhancing the intersection and larger surrounding area or a town center.

Modern roundabouts work by making drivers move to their right as they enter the roundabout, go left as they pass around the center island, and then go right as they exit. The degree of curvature through the roundabout is what governs the vehicle speed; the tighter the curves the lower the speed.

Freeway Interchanges

A great and cost effective use of roundabout is replace freeway interchanges with a roundabout interchange. These interchanges come in several forms, a large single, large elliptical roundabout spanning the freeway, a “Dumbbell” that uses roundabouts on both sides, or a large round roundabout that is under or over the freeway that uses two separate bridges to span the circulating roadway. Some examples of are shown below.

Redevelopment

In urban areas, villages, redesigning roads to incorporate roundabouts instead of signals, fewer and narrower lanes and on street parking can lead to increased development, safer and pedestrian friendly streets that can increase pedestrian, bicycle and retail activity. Some examples are mentioned below.

Village of Hamburg, NY

By redesigning Route 62 a State Truck Route through the Village using 10 foot lanes, a safety lane and replacing five signalized intersections with four...
roundabouts a safer, prettier and more pedestrian and bicycle friendly street was opened in 2009, cost $3M. By 2012 building permits were up tenfold. Forty building facades were improved. Over $8M in new investments has flowed in. Crashes are down by 63 percent. These improvements occurred in the middle of a recession.

**Clearwater Beach, FL**

Redesigning western end of State Road 60 from 8 lanes to four, replacing three signalized intersections with one large roundabout and beautifying the approaches, pedestrian and bicycle activity increased enormously up to 6,000 pedestrian crossings in 12 hours, up to 350 bicyclists in 12 hours and a 40 percent increase in peak hour traffic. The increased activity and accessibility lead to upwards of $80M in new investment on the island. The project opened in December 1999.

**Bird Rock, San Diego, CA**

La Jolla Boulevard in the Bird Rock neighborhood was a five lane road pedestrian unfriendly road carrying up to 22,000 vehicles per day. It was redesigned to include two 11-foot lanes, a median, safety lanes and diagonal and parallel parking with extensive landscaping and five one lane roundabouts. After opening in August 2008 pedestrian and bicycle volumes increased significantly, crashes were down 57 percent most of which involved a vehicle hitting a fixed object. Injury and fatal crashes went down 175 percent and pedestrian crashes went from 5 to zero. Vehicle speeds decreased a two-lane roundabout from 38-42 mph to 22-25 mph a two-lane roundabout from Business activity improved.

**Figure 15.** La Jolla Boulevard mid-block showing new cross-section

**Figure 16.** One of the five roundabouts along La Jolla Boulevard

**Figure 17.** An elderly lady riding through one of the five roundabouts along La Jolla Boulevard

**Summary**

Modern roundabouts are the safest and prettiest form of traffic control in the world that can also achieve many other community objectives such as traffic calming, cost savings, road diets, create gateways and town centers. Overall, they are the most versatile and fastest growing form of traffic control in this country.

Following are some additional roundabout examples.
Figure 17. The most magnificent roundabout in the US is at Clearwater Beach. The fountain was removed because of water and electricity cost.

Figure 18. Five Points, Downtown, Sarasota

Figure 19. A two lane roundabout that was reduced to two lanes by temporary curbing that will be removed as needed.

Figure 20. Rectangular roundabout, Cape Coral, 2002

All roundabouts designs in this document were laid out by the author are a small part of my more than 850 roundabouts in four countries.

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Revised 2015