Selling Roundabouts A Work in Progress

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With all the benefits that roundabouts provide, one would think that roundabouts would be a common sight in the U.S.; however, their implementation has been slow and concentrated.

They are a common sight for motorists around the world. Travel anywhere abroad, especially in Europe, and you are likely to travel through one. Roundabouts and traffic circles have been used since the early 1900s. Roundabouts are sometimes wrongly termed traffic circles. The modern roundabout is significantly different from a traffic circle or rotary. Traffic circles and rotaries are generally much larger and involve higher speeds than the modern roundabout. Traffic circles may also include stop signs and signals – components not used in a modern roundabout. Although sizes, shapes, and design philosophies may vary among designers of the modern roundabout, the basic goals and ideals are universal – efficiently and safely move motorists through the intersection.

The safety and traffic efficiency benefits of roundabouts are documented extensively. They provide, on average, a 70% overall safety improvement over a signalized intersection and a 90% reduction in severe right angle accidents. They are highly efficient, reduce delays and congestion, provide traffic calming, and improve pedestrian safety.

Roundabouts help reduce vehicle emissions through their efficiency, since they can drastically improve the level of service (LOS) for many intersections by lowering delays and reducing queue lengths. The principals behind the roundabout philosophy reduce or eliminate stop and go conditions. A roundabout is designed for yielding and, ideally, no stopping conditions. When properly designed, the roundabout functions like a symphony, a continuously flowing dynamic spectacle. An uninterrupted flow of traffic means no more stop and go dictated by traffic control signals. Use of a roundabout does not mean that there will be a constant flow of vehicles without usable gaps. The roundabout doesn't generate more vehicles; it just processes them more efficiently.

Aesthetics and "green" design principals are other benefits of roundabouts. Current designs are utilizing the center island as a bio-retention "rain garden" area to help with storm water quality. The center islands, as well as the approach splitter islands, can provide vegetative aesthetics such as native plantings, tree-lined boulevards, and decorative features such as fountains and monuments. Many communities are promoting roundabouts, coupled with tree-lined boulevards, to create attractive "gateways" to their communities.

Cost savings can also be a big advantage when promoting roundabouts. In many cases, the footprint of a roundabout is smaller than the footprint for widening an intersection and its approaches to accommodate turn lanes and tapers for a traffic controlled signal. This smaller footprint usually equates to lower construction and right-of-way costs.

With all the benefits that roundabouts provide, one would think that roundabouts would be a common sight in the U.S.; however, their implementation has been slow and concentrated. Visionary municipalities, agencies, and state Departments of Transportation (DOTs) have realized the benefits of roundabouts, and agencies such as New York State DOT (NYSDOT) have defined the roundabout as their default intersection improvement. Howard McCulloch, the NYSDOT roundabout

design specialist and owner of NE ROUNDABOUTS, a consultancy that specializes in roundabouts, provided the following information from Chapter 5 of the NYSDOT Highway Design Manual:

General objectives for intersection design are:

- To provide adequate sight distances.
- To minimize points of conflict.
- To simplify conflict areas.
- To limit conflict frequency.
- To minimize severity of conflicts.
- To minimize delay.
- To provide acceptable capacity for the design year.

Roundabouts are frequently able to address the above objectives better than other intersection types in both urban and rural environments and on high- and low-speed highways. Thus, when a project includes reconstructing or constructing new intersections, a roundabout alternative is to b analyzed to determine if it is a feasible solution based on site constraints, including ROW, environment factors, and other design constraints. Exceptions to this requirement are where the intersection:

- Has no current or anticipated safety, capacity, or other operational problems.
- Is within a well working coordinated signal system in a low-speed (<80 km/h) urban environment with acceptable accident histories.
- Is where signals will be installed solely for emergency vehicle preemption.
- Has steep terrain that makes providing an area, graded at 5% or less for the circulating roadways, infeasible.

When the analysis shows that a roundabout is a feasible alternative, it should be considered the Departments preferred alternative due to the proven substantial safety benefits and other operational benefits.

This is a strong statement and a testament to the benefits of roundabouts. States are pushing for safety as a top priority. The Ohio Department of Transportation (ODOT), for example, has developed a safety program that promotes and encourages local governments to apply for safety funding.

The hurdle that prevents more use of roundabouts in the U.S. is simple – peoples' resistance to "change." We are creatures of habit. Convincing local officials and the general public can at times be a hard sell. Even convincing traffic engineers can be a challenge – many are set in their traditional traffic design approaches. The public is usually the most outspoken. Initial public resistance can also be large – during the design stage, usually 70-80% of the public are against the use of roundabouts. However; the public appeal following the installation is generally reversed – 70-80% favor the controversial roundabout, and many of these previously outspoken opponents become strong advocates for promoting more roundabouts in and around their community. The key to winning the public over is with a well thought out and thorough design. Roundabouts are not the perfect solution for all intersection improvements and conversely neither are traffic control signals. If a roundabout is poorly designed, then it may likely be the last one installed in that community. However, if a roundabout is properly designed and installed at the appropriate location, then the public approval is quite high.

Tetra Tech has and is currently designing roundabouts for state departments of transportation, county and municipal governments (including two for the Lucas County Engineer – Mr. Keith Earley, P.E.), as well as for private clients. These groups have a proactive vision and are educated on the immense safety and overall benefits that roundabouts provide to the general public. Mr. Earley states, "We understand that there may be some minor public resistance to our first roundabout installation; however, the safety and efficiency benefits to our public is our true focus. Once the public adapts to using

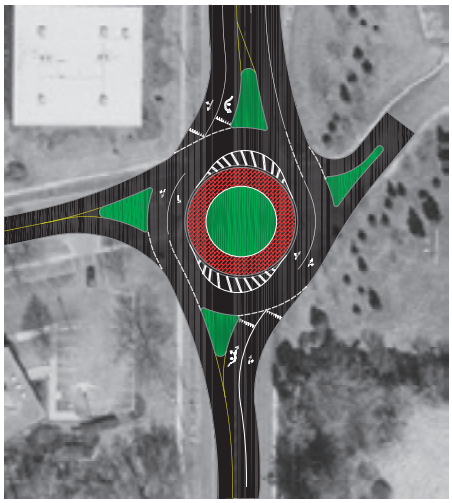

Figure 1 – Typical Major/Minor Two Lane Roundabout – Non-Radial Design

this roundabout, I am sure the public approval rating will be quite high." Mr. Ron Myers, P.E., a traffic engineer with Lucas County adds, "Roundabouts will some day be as common as traffic signals. With the state and federal government push to improve public safety on our roadways, and once people are educated that nearly 90% of all fatal crashes can be eliminated by the installation of a roundabout, we will see many more roundabout installations in our communities."

The latest advancements and trends in roundabout design involve a geometrically asymmetrical design (non-radial) – see Figure 1. This approach provides the following benefits over a symmetrical, radial design:

- Improved traffic calming
- Slower approach speeds
- Improved vehicle approach alignments

With an asymmetrical roundabout design, the safety benefits are enhanced. This design provides a more serpentine entry into the roundabout while also helping to position approach vehicles in a better alignment – facing the correct lane in the roundabout, thus eliminating "vehicle entry path overlap." Vehicle entry path overlap is defined as the condition where on a two-lane approach,

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the vehicle entering the roundabout from the right (outer) lane is positioned at the yield line so as to cause the driver to want to drive into the left (inside) circulating lane. Entry path overlap is an unsafe and inefficient condition that exists on many of the older two-lane roundabouts and some new designs include it. Below is an example of entry path overlap (Figure 2) at a roundabout followed by the striping solution utilized to minimize the entry path overlap condition at the roundabout (Figure 3).

Figure 2 – Radial Design with vehicle entry path overlap problems

Critical components to the preliminary design are in the existing layout conditions; geometric constraints; modeling with the proper design vehicle; and using the proper traffic volumes to establish the size, location, and number of lanes of the roundabout. Generally, either a single lane or a double lane configuration is used for roundabouts, although there are cases where hybrid or non-traditional designs are considered, depending on the traffic volumes, geometric constraints, and service needs. Simple calculations can be used to determine when a single lane or double lane roundabout is required at an intersection; however, modeling software should be used to verify the traffic and to check queuing lengths, delays, and approach and overall LOS. In addition to checking the traffic volumes with support software, it is critical to know your design vehicle and to check the movements with turning movement software. A truck apron should be included in the design of the roundabout for the sweeping backend of large tractor trailer trucks. Unlike traditional intersections where a tractor-trailer can use opposing lanes to assist in making certain maneuvers, roundabout designers lock in the curb-to-curb width of the circulatory roadway and truck apron that allows the maximum vehicle size for the roundabout. NYSDOT requires the WB-67 design vehicle as a minimum for all state roadways – certain truck routes require even larger design vehicles. The normal paved section is usually designed for a vehicle range of passenger vehicles up to school buses. The footprint of a roundabout is usually dictated by the existing site conditions, the availability of right-of-way, and the design vehicle size.

The modern roundabout is a great intersection improvement – one that is highly efficient and extremely safe. In a society that is more conscientious and interested in improving safety, "green" design options, and reducing emissions and congestion, roundabouts are a nice fit to this vision. Roundabouts, if given more of a chance in the U.S., may one day be as common a sight as they are in Europe and elsewhere.■

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Figure 3 – Radial Design with vehicle entry path overlap problems addressed with improved striping. (Note: Non-radial design techniques used by Tetra Tech eliminate this problem with proper geometric and design vehicle considerations.)