1 - System Considerations

Roundabouts may need to fit into a network of intersections with the traffic control functions of a roundabout supporting the function of nearby intersections and vice versa. Because the design of each roundabout generally follows the principles of isolated roundabout design, this guidance is at a conceptual and operational level and generally complements the planning of isolated roundabouts. In many cases, site-specific issues will determine the appropriate roundabout design elements.

Roundabout corridors containing multiple roundabouts may be analyzed with proper knowledge and extreme care in calibrating the system to comply with RODEL output. Software that is used to model a corridor uses the gap method of analysis and RODEL uses the British empirical method of analysis. Therefore, only those that understand these differences and know how to calibrate volumes appropriately should model a roundabout corridor. Even with calibration the simulation modeling may not be truly accurate but may provide information when comparing the magnitude of differences between alternatives. Simulation programs at this time use the gap method of analysis and therefore tend to show more congestion at the approach to a roundabout than the British Empirical Method when the v/c ratio is high.

2 - Adjacent Intersections and Highway Segments and Coordinated Signal Systems

A comprehensive traffic analysis is needed to determine how appropriate it is to locate a roundabout within a coordinated signal network. There may be situations where an intersection within the coordinated signal system requires a very long cycle which is caused by high side road traffic or large percentage of turning movements and is dictating operations and reducing the overall efficiency for the coordinated system. Replacing a signalized intersection with a roundabout may allow for the system to be split into two systems thus improving the efficiency of both halves while also improving the efficiency of the entire roadway segment. A traffic analysis is needed to evaluate each specific location.

It is generally undesirable to have a roundabout located near a signalized intersection; however, a corridor analysis may show the roundabout as a good option. Traffic queues that extend into adjacent intersections need to be analyzed further.

Prohibit on-street parking within 75 feet of the yield point or further depending on site-specific conditions. Also, avoid parking near the roundabout exit. Factors that influence the decision to prohibit on-street parking near a roundabout may include: Adjacent access, location of pedestrian crossing, and approach or departing curvature. Generally, it is not desirable to allow parking on either side of the roadway within the splitter island area or in the transition to the splitter island.

3 - Roundabouts in an Arterial Network

In order to understand how roundabouts operate within a roadway system, it is important to understand their fundamental arrival and departure characteristics and how they may interact with other intersections and highway features.

3.1 - Planned Network, Access Management

Rather than thinking of roundabouts as an isolated intersection or replacement for signalization, identify likely network improvements early in the planning process. This is consistent with encouraging public and other stakeholder interaction to prepare or update local comprehensive or corridor plans with circulation elements. Project planning and design are likely to be more successful when they are part of a larger local planning process. Then, land-use and transportation relationships can be identified and future decisions related to both.

Roundabouts may be integral elements in village, town, and city circulation plans with multiple objectives of improving circulation, safety, pedestrian and bicycle mobility, and access management. Roundabouts rely on the slowing of vehicles to process traffic efficiently and safely which results in a secondary feature of “calming” traffic. It can be expected that local studies and plans will be a source of requests for roundabout studies, projects, and coordination on state arterials. A potential use of arterial roundabouts is to function as gateways or entries to denser development, such as villages or towns, to indicate to drivers the need to reduce speed for upcoming conflicts including turning movements and pedestrian crossings.

Retrofit of suburban commercial strip development to accomplish access management objectives of minimizing conflicts can be a particularly good application for roundabouts. Raised medians are often designed for state arterials to minimize left turn conflicts; and roundabouts accommodate U-turns, where U-turn at signals in Wisconsin is illegal. Left-turn exits from driveways onto an arterial that may currently experience long delays and require two-stage left-turn movements could be replaced with a simpler right turn, followed by a U-turn at the next roundabout. Again, a package of improvements with driveway consolidation, reverse frontage, and interconnected parking lots, should be planned and designed with close local collaboration. Also, a roundabout can provide easy access to corner properties from all directions.

3.2 - Platooned Arrivals on Approaches

Vehicles exiting a signalized intersection tend to be grouped into platoons. Platoons, however, tend to disperse as they move down-stream. Roundabout performance is affected by its proximity to signalized intersections and the resulting distribution of entering traffic. If a signalized intersection is very close to the roundabout, it causes vehicles to arrive at the roundabout in closely spaced platoons. The volume of the arriving platoon and the capacity of the roundabout and will dictate the ability of the roundabout to process the platoon. Analyze these situations carefully to achieve a proper design for the situation. Discuss proposed roundabout locations with the Regional traffic section staff.

3.3 - Roundabout Departure Pattern

Traffic leaving a roundabout tends to be more random than for other types of intersection control. Down stream gaps are shorter but more frequent as compared to a signal. The slower approach and departing speeds along with the gaps allow for ingress/egress from nearby driveways or side streets. The slowing effects are diminished as vehicles proceed further down stream. However the gaps created at the roundabout are carried downstream and vehicles tend to disperse again providing opportunities for side street traffic to enter the main line roadway.

Sometimes traffic on a side street can find it difficult to enter a main street at an un-signalized intersection. This happens when the side street is located between two signalized intersections and traffic platoons from the signalized intersections arrive at the side street intersection at approximately the same time. If a roundabout replaced one of these signalized intersections, then its traffic platoons would be dispersed and it may be easier for traffic on the side street to enter the main street. Alternatively, when signals are well coordinated they may provide gaps at nearby intersections and mid-block for opportunities to access the main line.

If a roundabout is used in a network of coordinated signalized intersections, then it may be difficult to maintain the closely packed platoons required. If a tightly packed platoon approached a roundabout, it could proceed through the roundabout as long as there was no circulating traffic or traffic upstream from the left. Only one circulating vehicle would result in the platoon breaking down. Hence, this hybrid use of roundabouts in a coordinated signalized network needs to be evaluated carefully.

Another circumstance in which a roundabout may be advantageous is as an alternative to signal control at a critical signalized intersection within a coordinated network. Such intersections are the bottlenecks and usually determine the required cycle length, or are placed at a signal system boundary to operate in isolated actuated mode to minimize their effect on the rest of the surrounding system. If a roundabout can be designed to operate within its capacity, it may allow a lowering of the system cycle length with resultant benefits to delays and queues at other intersections.

4 - Closely Spaced Roundabouts

It is sometimes desirable to consider the operation of two or more roundabouts in close proximity to each other. In these cases, the expected queue length at each roundabout becomes important. Compute the expected queues for each approach to check that sufficient queuing space is provided for vehicles between the roundabouts. If there is insufficient space, then drivers may occasionally queue into the upstream roundabout and may cause it to reduce the desired operations. However, the roundabout pair can be designed to minimize queuing between the roundabouts by limiting the capacity of the inbound approaches.

Closely spaced roundabouts may improve safety and accessibility to business or residential access or side streets by slowing the traffic on the major road. Drivers may be reluctant to accelerate to the expected speed on the arterial if they are also required to slow again for the next close roundabout. This may benefit nearby residents. Additional information including closely spaced offset T-intersections is contained in FHWA's: Roundabout guide

5 - Roundabout Interchange Ramp Terminals

Freeway ramp junctions with arterial roads are potential candidates for roundabout intersection treatment. This is especially so if the subject interchange typically has a high proportion of left-turn flows from the off-ramps and to the on-ramps during certain peak periods, combined with limited queue storage space on the bridge crossing, off-ramps, or arterial approaches. In such circumstances, roundabouts operating within their capacity are particularly amenable to solving these problems when compared with other forms of intersection control.

Traffic performance evaluation of the roundabout interchange is the same as for a single conventional roundabout. The maximum entry capacity depends on the circulatory flow and the geometry of the roundabouts. The evaluation process is included in FDM 11-25-3.

The benefits and costs associated with this type of interchange also follow those for a single roundabout. Some potential benefits of roundabout interchanges are:

- The queue length on the off-ramps may be less than at a signalized intersection. In almost all cases, if the roundabout would operate below capacity, the performance of the on-ramp is likely to be better than if the interchange is signalized.
- The intersection site distance is much less than what it is for other intersection treatments.
- The headway between vehicles leaving the roundabout along the on-ramp is more random than when signalized intersections are used. This more random ramp traffic allows for smoother merging behavior onto the freeway and a slightly higher performance at the freeway merge area similar to ramp metering.

There are no special design parameters for roundabout interchanges. They are only constrained by the physical space available to the designer and the configuration selected. The raindrop form, which does not allow for full circulation around the center island, can be useful if grades are a design issue since they remove a potential cross-slope constraint on the missing circulatory road segments. If there are more roads intersecting with the interchange than the single cross road, then two independent circular roundabouts are likely to be the best solution.

Refer to the FHWA Roundabout Guide, Chapter 6, all of Sections 6.2 and 6.3. for additional information.

6 - Traffic Signals at Roundabouts

Roundabouts typically are not planned to include metering or signalization.

The "pedestrian hybrid signal" sometimes referred to as the HAWK crosswalk signal is discussed in FDM 11-26-10, Section 1.1.

7 - At-Grade Rail Crossings

Locating any intersection near an at-grade railroad crossing is generally discouraged. However, due to necessity, intersections are sometimes located near railroad-highway at-grade crossings. When considering locating a roundabout near a railroad, contact the Region Railroad Coordinator early in the process. It is preferable to cross one of the legs of a roundabout and leaving a desired distance of at least 100 feet from the center of the track to yield line at the entrance to the roundabout. Consider allowing the railroad track to pass directly through the circle center of the roundabout rather than through another portion of the circular roadway if the at-grade crossing is not on one of the legs. Also, consider the design year traffic on the roadway and the rail number of daily trips, speed of train, and length of train when evaluating the intersection control needed in close proximity to the railroad.

There are a few documents available besides FDM 11-60-1 for additional information on roundabouts in the vicinity of at-grade rail crossings.

1. WisDOT Transportation Synthesis Report, US search, which includes a link to the FHWA Roundabout Guide. http://www.dot.wisconsin.gov/library/research/docs/tsrs/tsrroundaboutsrail.pdf
2. WisDOT Transportation Synthesis Report, International search. Technical Guide "Railroad Crossing Safety In the Proximity to Roundabouts" http://www.dot.wisconsin.gov/library/research/docs/tsrs/tsrroundaboutsrail-europe.pdf). This document has 3 parts. It starts by (1) showing the WisDOT synthesis of the international search results, (2) French Guide about rail crossings in the French language, (3) The French Guide translated into English.
3. A national listing of roundabouts in close proximity to a railroad crossing: FDM 11-26-25, doc1