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Delaware Department of Transportation Guidelines on Roundabouts

The Department recognizes the potential benefits of modern roundabout designs. Throughout the United States, Europe, Asia, and Australia, their growing use has clearly demonstrated significant improvements to safety and traffic operations when placed at appropriate locations with careful design. Widely documented performance statistics show large reductions in collision severity and injury, where traditional intersections have been replaced with roundabouts. The potential benefits of reductions in injuries and costs associated with crashes are sufficient alone to recommend modern roundabouts as a first option when safety, capacity, or traffic calming are chief reasons for intersection projects.

At the same time, there have been notable failures, which have caused negative public opinion. The best way to alter the undeserved negative image of roundabouts is to apply sound decision making when choosing locations to construct roundabouts, applying the best possible project development and construction practices, and conducting an effective public education program. The efforts to gain acceptance would be harmed, if applications fail to live up to expectations. For that reason, it is very important that the Department exercise care in terms of planning locations, analyzing traffic performance, and in design.

I. Location

One of the first considerations is to decide if the intersection is an appropriate location. The following list is a composite of several guidelines and Delaware specific conditions.

A. Potentially Appropriate Locations

1. *Highway Safety Improvement Program* and relatively high crash sites, especially where high left/right turn, or crossing crashes occur
2. High delays, especially where four way stop capacity is exceeded
3. More than four legs occur
4. Unusual intersection geometry exists (such as Y or acute angles)
5. High left turn movements
6. Highly variable traffic patterns
7. High U-turn movements
8. Constrained storage capacity for signalization or where signal queues create operational or safety problems
9. Joining two closely spaced intersections

10. Junctions where speed or character of traffic changes (e.g., rural transition to town or residential areas)
11. Urban design aesthetics, such as gateways and parks
12. Single lane capacity is adequate for the design year
13. Traffic calming needed

B. Inappropriate locations

The following conditions do not necessarily exclude the location, however, there needs to be other compelling reasons to choose these sites. Chief Engineer approval is required to choose such locations.

1. Existing traffic suggests a multi-lane roundabout is warranted. Multi-lane roundabouts require considerably more experience, comfort, and acceptance than presently exists. Additionally, there are unresolved ADA issues for sight-impaired pedestrians. Design and right-of-way may allow for future capacity expansion to multi-lanes when warranted, presuming these issues are resolved in the future.
2. Unfavorable right-of-way constraints
3. Grades in the intersection of 3% or less cannot be achieved
4. Within a coordinated signal system where platoons would be disrupted
5. Low volumes on the minor road cause undesirably high delays on the major road
6. On primary evacuation routes where through traffic needs priority.
7. Along secondary evacuation routes with special circumstances or the potential to become primary routes as development occurs
8. Unbalanced flows, where major street traffic is greater than 90% of total traffic entering the intersection, and V/C ratios are projected to be greater than 0.7

C. Special considerations

The following conditions require particular caution in choosing sites for roundabouts. Additional data and analysis is required.

1. Somewhat unbalanced flows, where major street traffic is between 70% and 90% of the total traffic, and V/C ratios are projected to be greater than 0.7
2. Presence of numerous bicycles or pedestrians
3. Presence of pedestrians with vision impairment
4. Back-ups through a roundabout are possible due to the proximity of signals, rail crossing, etc.

5. Back-ups are possible into rail crossings or signalized intersections due to roundabout queues
6. Presence of high volumes of large trucks

II. Project development

A. Traffic analysis shall be in accordance with procedures outlined in *National Cooperative Highway Research Program Report 572*, as recommended by FHWA. Operational analysis procedures are located in Appendix M of the report.

(http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w94.pdf)

Where any v/c approach exceeds 0.70, additional analysis may be required using aaSIDRA with USA environmental factor (1.2).

Microscopic simulation models should be used to estimate network effects, such as queuing, platooning, or other operational performance measures.

1. When signal warrants are also met, comparison to a roundabout for delay, queues, level of service, costs for right-of-way, construction and maintenance shall be estimated.

B. Design shall be consistent with recommendations and guidance of:

1. *Federal Highway Administration Roundabout Guidelines (Publication FHWA-RD-00-067)*
2. *National Cooperative Highway Research Program Report 572* (the NCHRP Report 572 should prevail over the FHWA guidelines where conflicts occur)
3. Signing and striping shall follow the *Delaware Manual for Uniform Traffic Control Devices*, Parts 2 & 3, figs. 2D-6 & 3B-27,
(http://deldot.gov/information/pubs_forms/manuals/de_mutcd/index.shtml)
 - a. Where exceptionally large trucks or farm vehicles are infrequently expected (i.e. not the design vehicle), and could strike the keep right sign on the splitter island nose, the signs may be replaced with tubular markers
4. Lighting, in accordance with *DelDOT Lighting Design Guidelines*, shall be provided at all locations on State numbered roads.

C. Design vehicle

1. WB-67 to be accommodated on State numbered roads. However, in predominantly residential areas served by urban collectors/arterials, WB-50 may be more contextually appropriate. The designer should consider vehicle mix, adjacent land uses, and functional classification of the facility both present and forecast. Where large vehicles are

less than 5% of traffic, the truck apron is sufficient. In rural areas, special attention to the requirements of large agricultural equipment shall be addressed, and include coordination with appropriate representatives of the agricultural community.

2. Within subdivisions, emergency response vehicles shall be accommodated
- D. Landscaping within the central island on State numbered roads shall be low maintenance. While some vertical growth is desirable to provide enhanced visual queues to drivers, proper sight distance in accordance with design guidelines must be assured and sustained when plantings mature.
 - E. Constructability and maintenance of traffic feasibility should be considered early in project development, particularly the decision to use detours on any of the approach roads
 - F. Consideration should be made for striping materials required for the roundabout. Tight turning radii may need striping to be placed by handcart rather than by truck.
 - G. The following typical section is intended to provide additional design guidance specific to Delaware: [Click here](#).

III. Education

- A. Practices and research continue to evolve. Transportation Solutions and Planning Divisions shall remain abreast of developments and provide training opportunities to ensure best practices are sustained. Periodic meetings shall be held to discuss evolving changes and to achieve long-term consistent standards throughout the Department.
- B. The Department will work with Public Safety to ensure that driver education curriculum addresses roundabout use.
- C. Public education is important. The Department will develop and implement a program to improve understanding and acceptance for use throughout the State.