



RESEARCH SERVICES SECTION

TECHNICAL SUMMARY

Technical Liaison:

Paul Stine, Mn/DOT
paul.stine@dot.state.mn.us

Administrative Liaison:

Clark Moe, Mn/DOT
clark.moe@dot.state.mn.us

Principal Investigator:

Shauna Hallmark, Iowa State University

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\$39,444



Roundabouts are becoming increasingly popular for controlling traffic flow at intersections.



Determining the Impacts of Roundabouts on Roadway Networks

What Was the Need?

Roundabouts are gaining popularity in Minnesota as a way to control traffic flow at particular intersections or over roadway corridors. Even though they often resolve identified safety or operational problems at intersections, roundabouts can also negatively affect overall roadway system performance. For example, introducing a roundabout can disrupt planned traffic signal timings and coordination between signals.

When planning an intersection project, highway officials may give little consideration to how roundabouts impact the entire roadway system. Agencies needed a comprehensive resource to help them determine the likely corridor or system impacts of roundabouts for a given highway scenario.

What Was Our Goal?

The main goal of this research was to develop a toolbox to help cities, counties and other agencies evaluate roundabout impacts on urban, rural and transitional intersections, accounting for system continuity, land use and access control scenarios. This project was intended to complement Mn/DOT's [Intersection Control Evaluation](#) process.

What Did We Do?

Researchers reviewed existing literature about roundabout performance for various scenarios in the United States. Interviews with officials in jurisdictions with experience in roundabout implementation provided case histories, including insight into seldom-researched scenarios such as roundabouts in a series, impacts to systemwide mobility and access management.

Because sparse data existed on the use of roundabouts in signalized corridors (such as a series of intersections with coordinated traffic signals), two of these were selected for computer modeling. The analysis compared average corridor travel time, delay, stop time and travel speeds to better understand the interaction of signals and roundabouts.

To analyze unbalanced flows, researchers used computer simulations of different traffic scenarios on an intersection modeled after one in Ames, Iowa, analyzing two alternative configurations of the intersection: a traffic signal with left turn lanes and a roundabout.

What Did We Learn?

The completed toolbox provides guidance for:

- The use of roundabouts in both short- and long-term comprehensive planning, for both new and existing roadway networks
- Impacts of roundabouts on corridor mobility and rights of way
- Land-use implications, including school, agricultural and commercial zones
- Impacts of roundabouts on systemwide mobility
- Roundabout performance with unbalanced traffic flows
- Roundabouts and access management
- Impacts on other planning considerations, such as air quality, nonmotorized users, maintaining consistency among neighboring jurisdictions and community character

“This one-of-a-kind resource provides critical guidance for correctly implementing roundabouts on highway corridors.”

–Shauna Hallmark,
Transportation Engineer,
Center for Transportation
Research and Education,
Iowa State University

“Transportation providers can avoid unintended problems when roundabouts are considered first from a ‘big picture’ perspective rather than as isolated, individual intersections.”

–Paul Stine,
Mn/DOT State Aid
Engineer for Local
Transportation

Produced by CTC & Associates for:

Minnesota Department
of Transportation
Research Services Section
MS 330, First Floor
395 John Ireland Blvd.
St. Paul, MN 55155-1899
(651) 366-3780
www.research.dot.state.mn.us



The toolbox provided data about roundabout effectiveness in a variety of settings. In commercial areas, roundabouts speed up traffic flow, especially during peak travel times.

The project produced models for two scenarios that compared roundabouts to other traffic control alternatives. In one scenario, a corridor was modeled with the existing configuration, addition of left turn lanes and a roundabout. The alternative with left turn lanes performed better in terms of delay than the roundabout alternative. The analysis indicated the use of roundabouts in a corridor with signalized intersections may actually disrupt the smoothness of overall flow along the length of the corridor.

In the second scenario, investigators modeled a roundabout and the left turn lane alternative using unbalanced flows. In this case, the delays at roundabouts were considerably shorter than those at signalized intersections, regardless of whether the volumes were balanced or unbalanced. Both unbalanced and balanced flows showed similar delays and queues. Consequently, roundabouts should not be ruled out as a viable alternative at intersections with unbalanced flows.

What's Next?

Mn/DOT expects this high-value toolkit to be readily accepted and used across the country. The guidelines give local, county and state highway agencies another tool for addressing both short- and long-term safety and operational issues related to roundabouts at intersections. Future “big picture” engineering decisions regarding roundabouts should save money and reduce both crash severity levels and unnecessary delays.

The researchers recommend more study for determining the air quality impacts related to roundabouts. Emissions can actually be higher at roundabouts, in some cases, as compared to similar traffic flows at signalized intersections.