



# Intersection and Interchange Geometrics

## PROJECT CASE STUDY

### Minnesota Significantly Reduces Fatal and Severe Injury Crashes and Improves Travel Times with Restricted Crossing U-Turn (RCUT) Intersections

Unsignalized intersections on rural four-lane divided highways pose safety risks for severe right-angle crashes (commonly called “T-bone” crashes), especially for drivers attempting to cross all lanes of traffic or turning left. Restricted Crossing U-Turn (RCUT) intersections have proven effective for decreasing fatalities and injuries on four-lane divided highways. The Minnesota Department of Transportation (MnDOT) has implemented RCUT intersections in several high-crash locations around the state, and plans to build additional RCUT intersections over the next several years.

**How do they work?** At an RCUT intersection, mainline drivers have full access, while drivers approaching divided highways from a side street are restricted from making direct left turns or crossings. Instead, they are required to turn right onto the divided highway then make a U-turn at a designated median opening. Direct left turns from the divided highway are allowed and are made from channelized directional-median openings to enhance safety.

**Why are they safer?** At a traditional intersection, drivers from the side street need to judge for sufficient gaps in traffic in both directions in order to cross or turn left at a four-lane divided highway. With an RCUT, drivers from the side street only have to be concerned with one direction of traffic at a time on the divided highway. In many circumstances, this actually saves travel time since drivers (particularly truck drivers) don't need to wait for long gaps in traffic from both directions. Under most conditions, the RCUT design greatly reduces the probability of right-angle crashes at the trade-off of a minimal increase in travel time. As traffic volume on the divided highway increases, the travel time penalty declines and the safety benefit is likely to increase.



### BENEFITS OF RESTRICTED CROSSING U-TURN (RCUT) INTERSECTIONS

Safety	Operations	Cost
<ul style="list-style-type: none"> <li>▶ RCUT intersections reduce the number of severe crossing conflict points from 26 to 10.</li> <li>▶ In the first three years since implementation of the Willmar RCUT (the first in Minnesota), there were no fatal or serious injury crashes at this location.</li> <li>▶ An FHWA evaluation of RCUT intersections concluded that the design reduces crashes by 28 to 44 percent.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Throughput (the number of vehicles exiting the intersection) increases up to 30%.</li> <li>▶ Network intersection travel time decreases up to 40%.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Compared to constructing grade separated interchanges, RCUT intersections offer substantial cost savings and reduced construction time.</li> </ul>

## KEYS TO SUCCESS

Implementing RCUT intersections and their associated changes to traffic patterns is most often hindered by a lack of understanding from project stakeholders. A major key to success is the need to clearly explain the safety benefits of the RCUT intersection, especially the safety advantages afforded to traffic coming from the side street. Initial stakeholder reactions may focus on the increased travel distance and U-turn maneuver the side street traffic must make in a proposed RCUT implementation. However, at many traditional intersections the delay that side street traffic incurs while waiting for a lengthy gap in traffic to safely make a left turn or crossing maneuver can offset the additional travel time needed at an RCUT intersection. Other issues may include concerns from emergency-response personnel with the new traffic patterns. An effective stakeholder engagement process should include promoting an understanding of the trade-offs and the overall value of the improvement.

To be successful in allaying these concerns, agencies must provide stakeholders with accurate and credible data regarding the changes in travel times likely to occur with an RCUT implementation. Thanks to funds from an FHWA grant, and in collaboration with FHWA, MnDOT produced an informational video that was used as part of a media campaign to raise awareness and provide education on RCUT intersections. The video and associated public relations efforts played a role in obtaining buy-in from skeptical stakeholders, including area residents and city/county officials.

### Keys to Success

- ▶ **Active and ongoing stakeholder engagement, buy-in, and promotion.**
- ▶ **Supporting decisions with credible and reliable data.**
- ▶ **Coordination among agency practices including planning, design, safety, and operations.**
- ▶ **Supporting policies or actions, such as a driver education campaign, and funding improvements, multi-agency agreements, and policies where roadways cross jurisdictional boundaries.**
- ▶ **Complementary strategies such as intersection pedestrian treatments and access management.**

## ADDITIONAL RESOURCES

- ▶ MnDOT Reduced Conflict Intersections web page: <http://www.dot.state.mn.us/roadwork/rci.html>
- ▶ MnDOT RCUT informational public outreach video: <http://www.youtube.com/watch?v=WebW5JZNrT8&feature=youtu.be>
- ▶ Field Evaluation of Restricted Crossing U-Turn Intersection, FHWA Publication No.: FHWA-HRT-11-067, June 2012. <http://www.fhwa.dot.gov/publications/research/safety/hsis/11067/index.cfm>
- ▶ Alternative Intersections/Interchanges: Informational Report (AIIR), FHWA Publication No.: FHWA-HRT-09-060, April 2010: <https://www.fhwa.dot.gov/publications/research/safety/09060/>

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