

Minnesota Roundabout

A Scott County Success Story

This case study is one in a series documenting successful intersection safety treatments and the crash reductions that were experienced. Traffic engineers and other transportation professionals can use the information contained in this case study to answer the following questions:

- What is an intersection alternative that can dramatically reduce crashes (particularly dangerous angle crashes) at high-speed, rural stop-controlled intersections?
- How many crashes did the treatment reduce?
- Are there any implementation issues associated with roundabouts in general and if so, how can they be overcome?



Photo by Andy K. Hasek (used with permission).



U.S. Department of Transportation
Federal Highway Administration

FHWA-SA-09-013



Introduction

The first roundabout in Scott County, Minnesota was constructed at the intersection of State Highway 13 and County Road 2 (see Figure 1). The intersection, previously with two-way stop-control on County Road 2, was the site of two fatal crashes and 50 injury crashes in a five-year period between June 2000 and June 2005. Both rural roads have speed limits of 55 miles per hour (mph). State Highway 13 has an average daily traffic (ADT) of 4,650, and County Road 2 has an ADT of 4,300.

Prior to converting the intersection to a roundabout, the Minnesota Department of Transportation (Mn/DOT) tried several safety improvement treatments to reduce the number of crashes. However these treatments, including larger stop signs, striping, and flashing lights, met with little success. Mn/DOT also considered converting the intersection to a four-way stop-controlled intersection or to a signalized intersection, but there were concerns that neither of these alternatives would resolve the crash problem. As Paul Kachelmyer, Project Manager with Mn/DOT stated, “Only in a fraction of the cases where signals and four-way stop signs are put in do they actually reduce crashes[1].”

Then, Kachelmyer learned that Maryland reduced crashes by 90 percent by converting a similar intersection to a modern roundabout[2].

**“It’s worked great.
We could not have
hoped for better
results.... All of the
serious crashes have
just gone away.”**

*Paul Kachelmyer
Minnesota Department of
Transportation*



Figure 1: Intersection of State Highway 13 and County Road 2

Photo by Judy K. Hassel (used with permission).

Objective

The following case study showcases the measurable safety benefits experienced by Scott County, Minnesota, following conversion of a high-speed rural, two-way stop-controlled intersection to a roundabout.

Treatment Summary

The existing intersection of Highway 13 and County Road 2 met minimum Manual on Uniform Traffic Control Devices (MUTCD) standards.

This case study examines conversion of a high-speed, two-way stop-controlled intersection to a roundabout.

Roundabouts are circular intersections with specific design and traffic control features. These features include yield control of all entering traffic, channelized approaches, and appropriate geometric curvature to ensure that travel speeds on the circulatory roadway are typically less than 30 miles per hour (mph). Also, traffic movement is possible only in a counter-clockwise direction within the roundabout. Federal Highway Administration's (FHWA) *Roundabouts: An Informational Guide* provides more information on the defining characteristics and definitions for each of the key features of a roundabout (see Figures 2 and 3)[5].

Roundabout intersections eliminate a number of vehicle conflict points typically associated with traditional intersections. A four-legged, single-lane roundabout has 75 percent fewer vehicle conflict points than a traditional stop-controlled intersection[5]. Roundabouts also enhance safety by reducing vehicle speeds both in and through the intersection.

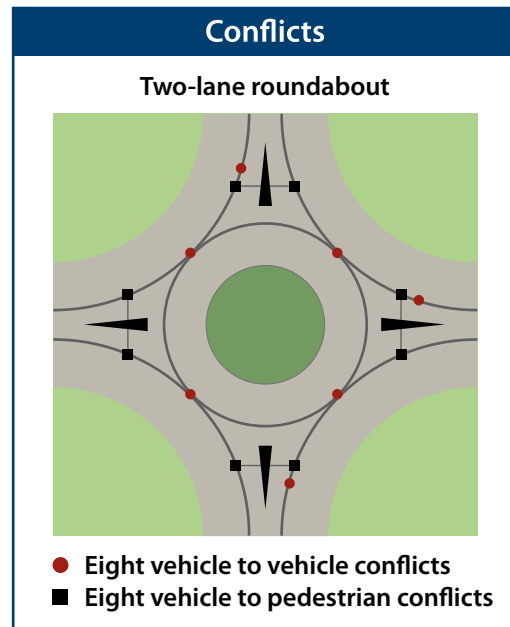


Figure 2: Eight vehicle conflict points
Source: FHWA Roundabouts: An Informational Guide

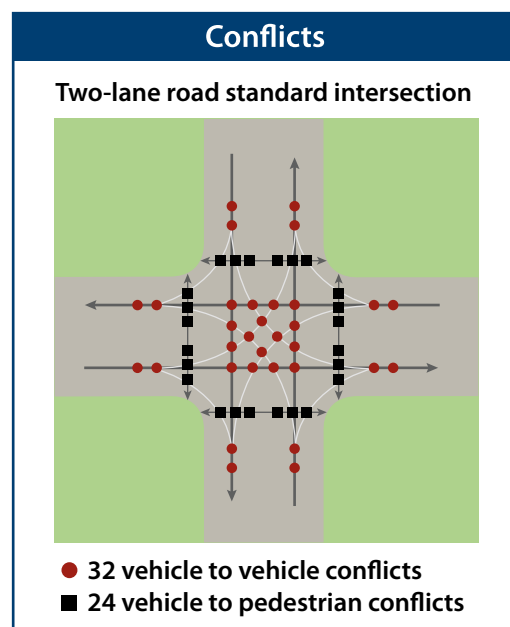


Figure 3: 32 vehicle conflict points
Source: FHWA Roundabouts: An Informational Guide

Evaluation Methodology

This case study examines crash data before and after conversion of a high-speed, rural, two-way stop-controlled intersection in Scott County, MN, with a high incidence of crashes (many with injuries) due to driver violation of the stop-control condition. Crash reduction results were based on a review of “before and after” data from this intersection during a minimum of five years, between 2002-2007¹. (The “before” and “after” observation periods were approximately 36 and 24 months respectively).



¹ Note that crash reduction averages in this report reflect the percent reduction per year based on the difference between the total number of “before” and “after” crashes. Injury reductions per year are noted where supporting data was available.

Results

Problem: A rural, high-speed intersection, controlled by a two-way stop was the site of two fatal crashes and 50 injury crashes (most of which were angle crashes) in a five-year period. Attempts to reduce crash frequency with a variety of safety treatments at the intersection (including larger stop signs, striping, and flashing lights) were relatively unsuccessful.

Solution: Mn/DOT sought to reduce crashes by converting the two-way stop controlled intersection to a single-lane roundabout. The roundabout was constructed with a central island 110 feet in diameter. Approach lanes to the roundabout were 16 feet wide, and departure lanes from the roundabout were 14 feet wide. A 200-foot long median island was provided on County Road 2, and a 300-foot long median island was provided on State Highway 13. Splitter islands were 25 feet wide, and the truck apron is 10 feet wide with rumble strips spaced at approximately 20 feet, center to center.

Table 1 summarizes the results of the “before and after” crash analysis at the intersection. Mn/DOT completed the three-month construction of the roundabout in August 2005. In the three-year period “before” construction of the roundabout, there were 19 total crashes and 14 injury crashes. In the two-year period following the construction of the roundabout, there were only three total crashes and two injury crashes reported.

While the old two-way stop-controlled intersection experienced 18 right-angle crashes (one of which involved a fatality) in the three-year period prior to the roundabout conversion, there have been no angle crashes since the intersection was converted to a roundabout (a 100% reduction). **Total crashes per year at the intersection have been reduced from 6.3 to 1.5 (a 76.2 percent reduction) and injury crashes per year have been reduced from 4.7 to only 1 (a 78.7 percent reduction).**

As a result of this project, Mn/DOT has more than a dozen roundabouts planned in the state over the next few years, especially at rural intersections with high crash rates.

Location	Implementation Date	Before				After				Reduction In Crashes/Year		
		Months	Total Crashes	Injury Crashes	Angle Crashes ⁽²⁾	Months	Total Crashes	Injury Crashes	Angle Crashes	Total Crashes	Injury Crashes	Angle Crashes
State Highway 13 and County Road 2	Aug-05	36	19	14	18 (1-fatality)	24	3	2	0	76.2%	78.7%	100%

Table 1: Summary of crash reductions after conversion to a roundabout intersection

Discussion

Implementation Issues

Scott County experienced no implementation issues with the roundabout. Because of the rural environment in which the roundabout was located, the design of the curb and apron were modified to allow wide farm vehicles and large snow removal vehicles to effectively maneuver through the roundabout. In addition, the roundabout design incorporated additional signage (as shown in Figure 4), extended medians and curbs, and a raised center mound to visually convey to drivers the need to slow down and navigate the turn.

Construction Period

The construction of the roundabout took place in 2005 and lasted 90 days. During this time, both State Highway 13 and Scott County Road 2 were closed at the intersection, and motorists were advised to follow the posted detour routes during the closure. Figure 5 shows the construction techniques during construction.



Figure 4: Sign on the approach to the roundabout



Photo courtesy of Mn/DOT (used with permission).

Figure 5: Construction of the roundabout

Construction Cost

The cost of constructing the roundabout was approximately \$725,000 (Additional right-of-way acquisition was not required).

Effectiveness

The conversion of this intersection from a two-way stop-controlled intersection to a roundabout was effective at reducing total crashes, and angle crashes. “We’re definitely going for these in the future,” Kachelmyer said. “This is the way to go if we’ve got a crash problem.”

Summary of Results

The “before” conditions at this intersection met minimum MUTCD standards. Mn/DOT converted this high-speed rural intersection to a roundabout to reduce high crash rates that had not been mitigated through other lower-cost treatments. **Converting this intersection to a roundabout resulted in a 76.2 percent reduction in total crashes, a 78.7 percent reduction in injury crashes, and a 100 percent reduction in angle crashes.**

The average reductions in crashes achieved by this roundabout conversion exceed the overall crash reductions of 72 percent for all crash types for a rural two-way stop-controlled single lane roundabout mentioned in the Desktop Reference for Crash Reduction Factors by the Department of Transportation (USDOT) FHWA[4].

References

- 1) "Minnesota successful with Roundabouts", Independent Record, March 20, 2008.
(http://www.helenair.com/articles/2008/03/20/local/54lo_032008_minnesota.txt).
- 2) "Roundabouts: Coming to a road near you", Chaska Herald, Transportation, March 14, 2008.
(<http://www.chaskaheald.com/news/transportation/roundabouts-coming-road-near-you-3893>).
- 3) Known Modern Roundabouts On Minnesota's City/ County Systems – July 2007.
(<http://www.richfieldroundabouts.com/RoundaboutsMN.pdf>).
- 4) Desktop Reference for Crash Reduction Factors, FHWA-SA-07-015, USDOT FHWA September 2007, p. 30.
- 5) Roundabouts: An Information Guide, FHWA-RD-00-67, Federal Highway Administration, June 2000.

For More Information

Ed Rice

Intersection Safety Team Leader,
FHWA Office of Safety

202.366.9064

ed.rice@dot.gov

Anthony J. Winiacki, P.E., PTOE

Scott County Public Works Department
Jordan, MN

952.496.8346

twiniacki@co.scott.mn.us

Visit FHWA's intersection safety web site to download this and other case studies highlighting proven intersection safety treatments from across the country:

<http://safety.fhwa.dot.gov/intersection>



U.S. Department of Transportation
Federal Highway Administration