



TECHNICAL SUMMARY

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LRRB PROJECT COST:

\$105,000



Video footage allowed investigators to monitor all parts of the roundabout at once.



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Adjusting Lane Markings and Signage Improves Safety at Two-Lane Roundabout

What Was the Need?

In many instances, replacing a traditional, signalized intersection with a roundabout improves safety and reduces congestion. As a result, roundabouts have become an increasingly popular road design option in the United States. However, many drivers still do not fully understand roundabout traffic rules, particularly at multi-lane roundabouts, and this can lessen the roundabout's safety advantages.

In Richfield, Minnesota, the intersection at East 66th Street and Portland Avenue South was converted from a signalized intersection to a two-lane, two-entrance roundabout in 2008. After completion, the site maintained a higher rate of collisions than is typically experienced after an expected learning stage has passed. Though the roundabout was working well, engineers from Richfield, Hennepin County and MnDOT had several ideas for changing signage and striping at the roundabout to reduce driver confusion and further improve safety.

What Was Our Goal?

This project sought to implement and test the impact on driver behavior of changes to signage and striping at the two-lane roundabout in Richfield.

What Did We Do?

During August 2011, several changes were made to signage and lane markings at the test site:

- Turn arrows on the roundabout lanes and approaches and on signs were changed from the curved “fish-hook” style, intended to represent the flow of traffic around the center island, to the standard style.
- Additional turn arrows and lane designation signs were added approximately 450 feet upstream of yield lines.
- The solid line extending from the yield line was lengthened from 50 to 250 feet.
- Lane marking widths were increased from 4 to 6 inches, lane markings in the middle of the roundabout were made 3 feet long with a 1-foot gap, and 4-by-4-inch “cat track” concentric-spiral lane markings replaced solid lane markings.
- Signs were lowered to improve visibility, and “Roundabout Ahead” signs were moved to 500 feet from the roundabout.

Researchers used driver behavior as a surrogate for crash rates to expedite the evaluation and produce results in less than one year. (Using crash rates traditionally requires three to five years of data after changes are implemented.) They studied 216 hours of video to identify and count traffic violations, with equal amounts of footage from before the changes, shortly after the changes and one year after the changes. The before-changes video had already been collected as part of the [Investigation of Pedestrian/Bicyclist Risk in Minnesota Roundabout Crossings](#) project.

This project evaluated the impact of lane marking and signage changes on driver behavior at a collision-prone roundabout in Richfield, Minnesota. Turning violations, the most significant cause of accidents, decreased by 48 percent after the changes were implemented.

“Multilane roundabouts experience a high frequency of property-damage-only crashes. The current state of the art and practice are not enough to fix this problem, so this project was developed to explore some ideas that could help.”

—John Hourdos,
Director, Minnesota
Traffic Observatory,
University of Minnesota

“The more you look at a roundabout, the more you realize that it’s very similar to a regular intersection: A driver turns left from the left-hand lane. Adding a fish-hook sign just adds confusion. Familiar things like standard signs help drivers make the transition to roundabouts.”

—Kristin Asher,
City Engineer,
City of Richfield

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Fish-hook arrows (left), which include curvature to represent the radial direction of a roundabout, are permitted in the federal Manual on Uniform Traffic Control Devices, but this project suggests that standard arrows (right) may be less confusing to drivers and reduce the rate of turning violations.

What Did We Learn?

Turning violations, in which drivers turn right from the inner lane of the roundabout or turn left from the outer lane, caused nearly half of the crashes at this roundabout (44 out of 89 collisions in the 35 months after its construction). The signage and striping changes had significant impacts on the rate of turning violations. After these changes were implemented, violation rates decreased 48 percent—from 1.16 percent of vehicles before the changes to 0.6 percent of vehicles after the changes. The violation rate stayed near that lower level one year after the changes. According to Richfield personnel, changing from fish-hook to standard style arrows, extending the solid line and adding signs further from the intersection were the primary causes for this reduction.

Yielding violations were the other primary cause of crashes, responsible for 38 incidents. Striping and signage changes did not have as clear an impact on yielding violations, which initially dropped from 1.04 percent of vehicles before the changes to 0.85 percent after, but rebounded to 1.36 percent of vehicles one year later. Researchers suggested that extra enforcement and education immediately after the changes led to the initial, unsustainable decrease in yield violation rates, while increased traffic at the roundabout (with more opportunities for violations) caused the greater violation rates a year later.

The public reacted positively to the changes. In particular, comments received by the city expressed appreciation for the lowered signs.

What’s Next?

Richfield will continue to monitor this roundabout to collect better information about the impacts of the signage and striping changes on overall crash rates.

The rate of yield violations remains a significant concern, and Richfield personnel suggested that drivers might not understand what “yield” actually means. The city is working with a group to develop a video to educate the public about yield procedures, but other educational efforts would likely be worthwhile.

While this project offers useful information about the Richfield site, a single experiment on a single roundabout does not offer enough information to recommend changes in design guidelines. MnDOT has recently approved another project, Evaluation of Safety and Mobility of Two-Lane Roundabouts, to study three roundabouts, which should increase the amount of data available and better inform conclusions that can help to shape design guidelines.

This Technical Summary pertains to the LRRB-produced Report 2014-04, “Effect of Signing and Lane Markings on the Safety of a Two-Lane Roundabout,” published January 2014. The full report can be accessed at <http://www.lrrb.org/PDF/201404.pdf>. This research uses video originally collected for Report 2012-28, “Investigation of Pedestrian/Bicyclist Risk in Minnesota Roundabout Crossings,” available at <http://www.lrrb.org/PDF/201228.pdf>.