

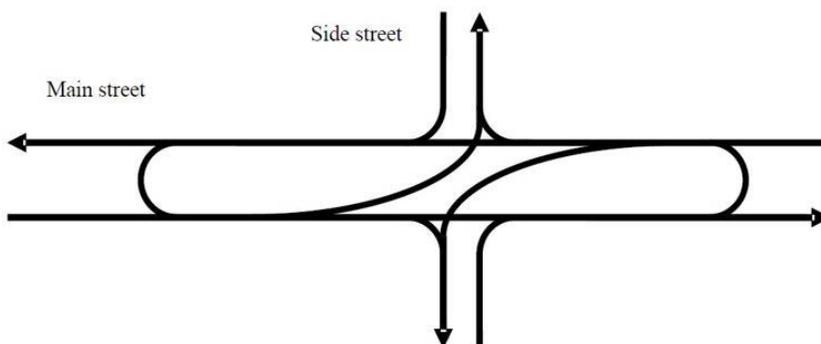
Topic: *Reduced Conflict Intersection (RCI)*

Key Points

- 90 - 100% severe right-angle crash reduction
- Nearly half of conflict points than conventional full access intersections
- Additional travel time for U-turn maneuver is nominal

What is a Reduced Conflict Intersection (RCI)?

Alternative intersections have steadily been increasing in popularity due to severe right-angle crashes at rural intersections along expressways and other divided high-speed corridors. One example of differentiating from conventional full access intersection designs is the Reduced Conflict Intersection (RCI), which is synonymous with Restricted Crossing U-turn (RCUT) intersection, superstreet intersection, J-turn intersection and synchronized street intersection. The RCI is proven to increase safety compared to conventional full access thru-stop intersections by restricting left-turn and thru movements from the minor approaches. By forcing drivers to turn right and then perform a U-turn through a channelized median 400-1000 feet away from the center of the intersection, the number of right-angle crashes can be significantly reduced.



FHWA, *Alternative Intersections/Interchanges: Informational Report (AIIR)*, 2010 (FHWA-HRT-09-060)

How effective is a RCI?

In rural areas, RCIs typically replace thru-stop intersections along expressways and other divided highways. In more suburban environments, RCIs can replace signalized intersections along divided arterials. Whether a RCI is implemented in a rural or suburban environment, the number of conflict points are reduced by nearly half, from 32 to 18. Fewer crossing conflict points ultimately leads to a reduction in right-angle crashes. Crash modification factors (CMFs) have shown to be less than 1 and a typical range of CMFs are between 0.25 and 0.85 for all crash severity types.

How does a RCI operate?

Performing a left turn movement from the mainline does not change after a RCI has been implemented. The only addition made to this maneuver is the channelization, which also happens to restrict any crossing or left-turning vehicles from the minor approaches. In order for vehicles from the minor legs to turn left or go straight, they are forced to turn right and then perform a U-turn away from the center of the intersection. In order for a RCI to perform at an acceptable level of service after implementation, left-turn and through movements from the minor legs at conventional full access intersections should be relatively low compared to the mainline movements. If minor approach volumes are of concern, signaling the RCI with only two phases can reduce the delay at these intersections.

Where is the best place for a RCI?

RCIs can be implemented at an isolated intersection or be implemented as a larger corridor improvement strategy. Appropriate isolated cases of RCIs are usually deployed where 2-lane minor roads with relatively low through and left turn volumes meet 4-lane divided highways. These isolated scenarios typically occur in rural areas and above average vehicular crashes is generally observed as well. RCIs are also implemented as a part of a larger corridor improvement. Even in a more urban/suburban setting, the minor road entering volumes should still be significantly less than the mainline volume in order for the RCI to perform optimally. The following list of cities in Minnesota are places where RCIs have already been implemented: Willmar, Cotton, Cologne, St Peter, Lake Elmo, Vermillion and Ham Lake.

How expensive is a RCI?

Isolated cases of RCI intersection installation depends on the location, available right of way (ROW) and existing conditions. A location in North Carolina, the winning bid for an approximate 2000' project was just under \$5 million in 2006. Even though construction costs may be higher than conventional intersection construction projects, the crash cost savings will be much greater in the future. In Minnesota, costs are lower ranging from \$700,000 to \$1.5 million as standalone projects.

What are some design considerations?

According to AASHTO, the U-turn maneuver should be placed 400-1000 feet away from the main intersection while the Michigan DOT recommends the crossover should be at a distance of 660 ± 100 feet and North Carolina DOT's standard is 800 feet from the main intersection. Minimum median widths between 40 and 60 feet are typically needed to accommodate nearly any type of vehicle. However, for locations with narrow medians, median bulb-outs (loons), can be constructed on the outside of the road which accommodates heavier vehicles with larger turning radii.

Other Considerations

Although location management studies have led to suggesting the implementation of RCIs across the country, there still is public opposition. The public does not necessarily readily support this alternative intersection design. It is still an ongoing process to convey that the benefits from this intersection greatly outweigh its limitations. One of the limiting factors and overall oppositions to this alternative is that it would add an undesirable amount of travel time to a drivers commute. However, additional travel time is nominal and this scenario equates to a much safer trip overall.

References

- FHWA, *Restricted Crossing U-Turn Intersection: technical summary*. 2009 (FHWA-HRT-09-059)
- FHWA, *Field Evaluation of a Restricted Crossing U-Turn Intersection*. 2012 (FHWA-HRT-11-067)
- FHWA, *Alternative Intersections/Interchanges: Informational Report (AIIR)*. 2010 (FHWA-HRT-09-060)
- MoDOT, *Evaluation of J-Turn Intersection Design Performance in Missouri*. 2014 (cmr 14-005)
- FHWA, *Restricted Crossing U-Turn Intersection: Informational Guide*. 2014 (FHWA-SA-14-070)