

Alternative Intersections – RCIs and Roundabouts What the \$#*!!!? Why are you doing this to me?



Jim Miles
District Traffic Office
May 31, 2023

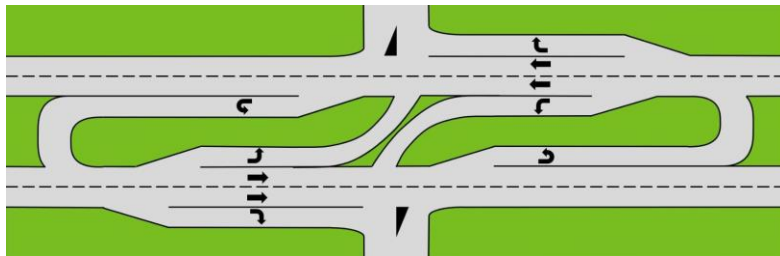
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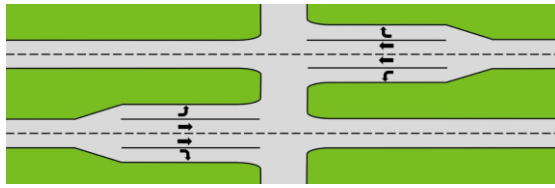
What is an RCI anyway?

Might have heard them referred to as:

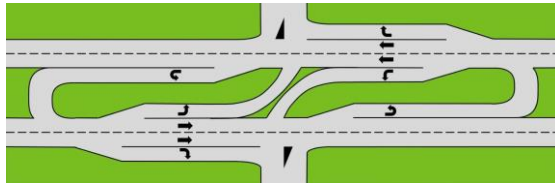
- RCI – Reduced Conflict Intersection
- RCUT – Restricted Crossing U-turn Intersection
- J-Turn

THEY ARE THE SAME THING! We just can't quite decide what to call them.

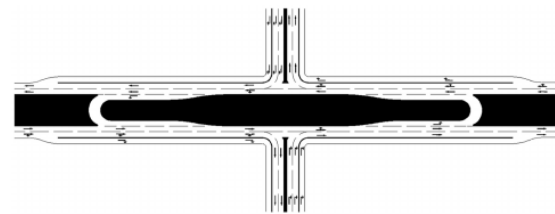




Standard expressway intersection



RCI

MUT – Median U-Turn Intersection
• Variation of RCI

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Okay, now I know what it is but **Why are you messing with MY intersection?** ... It works just fine as is.

ACTUALLY most intersections where RCIs have been placed are not working just fine ...

- Up until recently RCI's were placed where there has been history of fatal and serious injury crashes
- Now we are also installing them at intersections that exhibit risks similar to intersections with fatal and serious crashes
 - Proactive – not waiting until we have a problem
 - Frequent question that every traffic engineer has heard
 - *How many people have to die before you are going to do something?*

Expressway intersection have been traditionally very challenging intersections for drivers to navigate

- Lots of decisions to make
- Generally high speed and higher volume facilities
- Multiple lanes of traffic approaching from the left and the right
- Median widths often require a driver to find a gap in both directions
- Typical crash is a right angle crash on the far side of the intersection
 - Right angle crashes are the crashes that have more severe injuries and fatalities

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MnDOT has been promoting the TZD (Toward Zero Deaths) Program for years

- Goal is to reduce fatal and serious injury crashes
- Should not have to pay with your life for your driving mistake or someone else's driving mistake

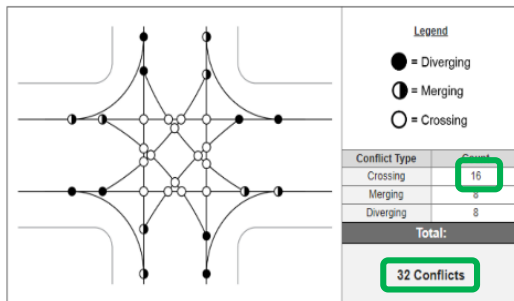
RCI's are a **GREAT** tool to reduce fatal and serious injury crashes at expressway intersections

2021 MnDOT analysis of 45 existing RCI locations in MN shows:

- **70% Reduction** in Fatal and Serious Injury crash rate
- 100% Reduction in right angle Fatal and Serious Injury Crash rate
- There was a 103% increase in rear end crashes
- There was a 7% decrease in overall crashes at the intersections
 - This was deemed statistically insignificant
 - This suggests that RCIs shift the severity of crashes from higher severity to lower severity

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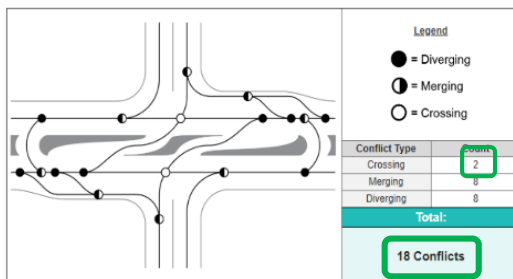


Intersection Conflict Points

Crossing Conflict Points result in the most severe crashes

RCIs reduce the number of conflicts

- Overall conflicts drops from 32 to 18
- Crossing Conflicts drops from 16 to 2



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Yeah, but I still don't like it

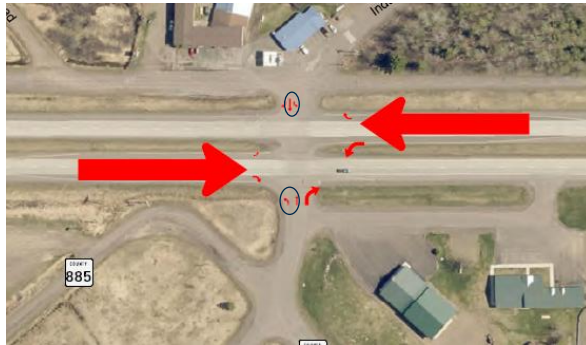
- Why can't you install a signal instead?

The same 2021 study showed:

- Comparative rural signal sites have similar K and A crashes rates to RCI's ... that's good
- Overall rural signal crash rates are about 40% higher with twice as many rear end and angle crashes ... that's not good

Typical intersection where an RCI is installed does not meet signal warrants

- There simply is not enough traffic justify a signal
- Overall intersection delay with a signal goes up – All movements are impacted!
- The movements side street movements served by the signal are probably comparable to the delay with an RCI



Twig Intersection with comparative traffic volumes

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D1 Case Example - Cotton



Before RCI
 3 Fatal Crashes in 7 years from 2002 to 2008
 2002 crash resulted in 4 deaths
 3X the number of angle crashes for similar intersections
 63% of at fault drivers lived within a 30 mile radius



After RCI
 0 Fatal or Serious Injury crashes since 2012 construction
 1 angle crash from 2012 – Oct 2022
 Routinely questioned by State Patrol Captain Silcox when we were going to implement more of these – even at locations where it is not feasible.

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Ongoing issues to continue working on:

- Sea of signs and associated knockdowns
 - Statewide looking at how to keep signs to a minimum for what is needed for the motorist
- General design
 - Need to make sure to accommodate vehicles and modes that use the intersection including MnDOT plows
 - Need to address side street drivers who “cheat” and zig zag across the intersection
 - U-turns have moved closer to the intersection to decrease weaving and travel distance
- Public acceptance
 - Businesses believe that the RCIs will have a negative economic impact – MnDOT study will attempt to address
 - Belief that an RCI is more confusing and can’t possibly solve a crash issue
 - Comment the public about the Stanley Road RCI:

Dear Mr Lamb,

With a full winter now under the belt of the Highway 61 RCI, I can say that I have had no issues with sight distances/stopping distances. While there was an occasional plowing issue (the turn lanes leading into the u-turns not being as cleared to the left hand side as they might have ideally been), it seems just fine to me.

One aspect of the RCI that I feel was under-emphasised two years ago is that when using it I only have to look in one direction at a time for (law-abiding) traffic that might intersect with where I want to go, which is an enormous improvement over the previous Stanley Road crossing arrangement where one needed the neck flexibility of an owl.

Well done!

Sincerely,
Geoff Tolley

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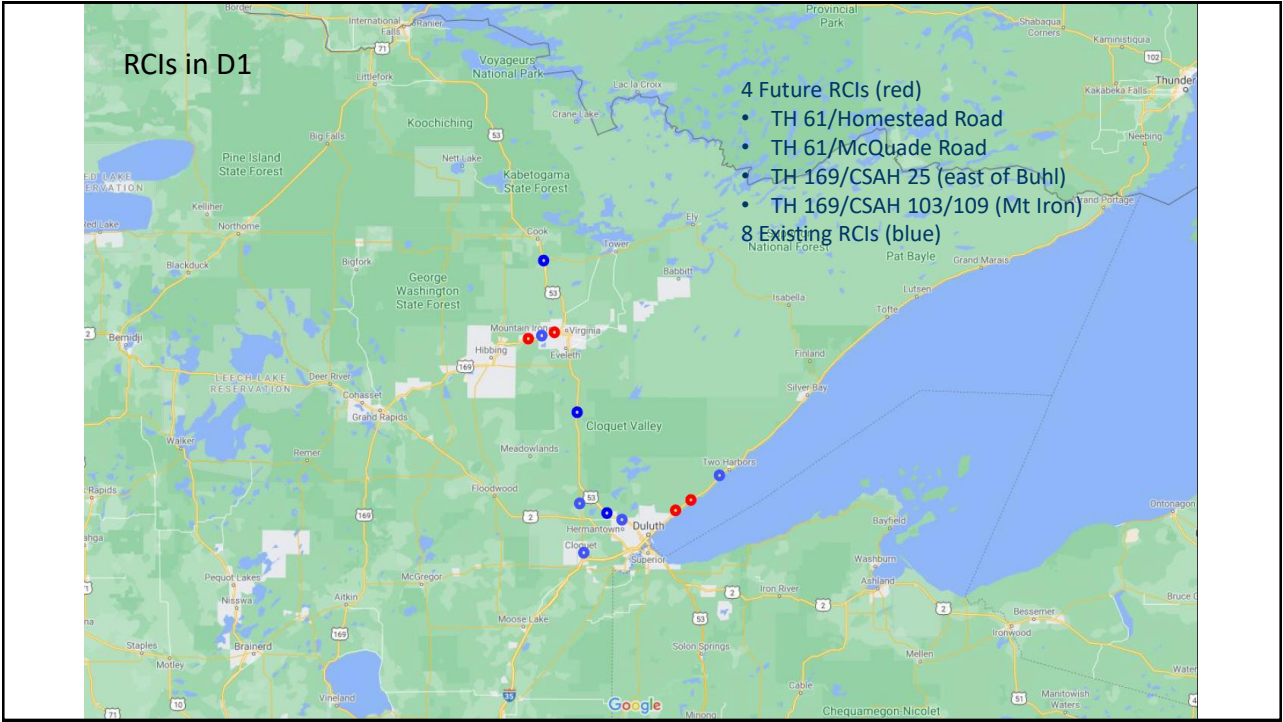
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So why are we installing RCIs?

- Reduces overall number of conflict points and particularly crossing conflicts and
- Simplifies the decision-making process for the side street drivers resulting in:
 - **70 % reduction in fatal and serious injury crashes**
 - Consistent with the TZD goal of reducing fatal and serious injury crashes
- Keeps traffic moving
 - Limits impacts to side street left turns and side street through movements
 - Mainline movements are not affected

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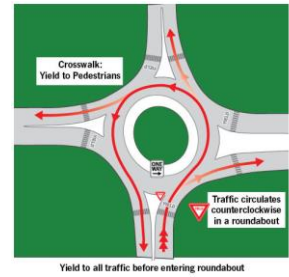
Driving in circles - ROUNDABOUTS

Now you're going to tell me that driving in circles is safer than other intersections too ... right?

YEP! And they move traffic more efficiently too

How does a roundabout work?

- As you approach a roundabout in a vehicle you only have two key decisions:
 - Is there a pedestrian crossing that you need to yield to?
 - Is there traffic approaching from the left in the circulating lanes in the roundabout?



If the answer to these questions is NO you enter the roundabout and exit at whichever leg you are headed

- Remember ... once you are in the roundabout you have the right of way.
- IT'S THAT SIMPLE!

Cloquet Roundabout



Before (2004-April 2018) 14 years – 4 months

- 2 Fatalities
- 5 Severe Injury Crashes
- 9 Injury Crashes
- 19 Possible Injury Crashes
- Injury or Possible Injury Crash every 5 months!**



After (Nov 2018 – Oct 2022)

- 0 Fatalities
- 0 Severe Injury Crashes
- 0 Injury Crashes
- 1 Possible Injury Crash
- Injury or possible injury crash every 4 years.**

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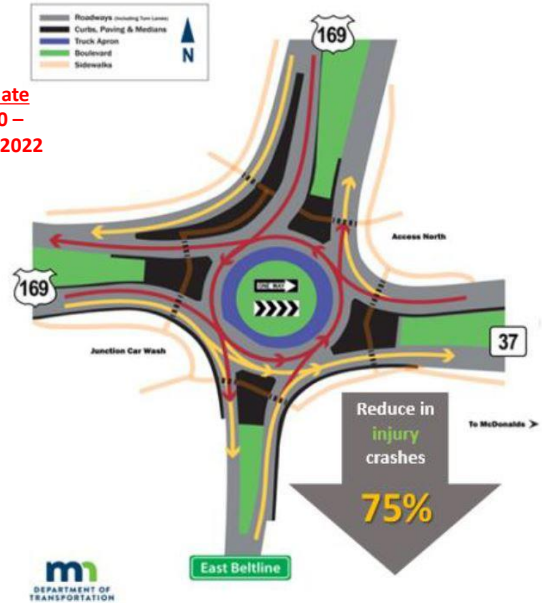
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Hibbing (US-169 & TH 37)

The roundabout was completed in September 2017. A two year before and after crash summary is shown in the table below:

Crashes	Jan 2015- Dec 2016	Jan 2018- Dec 2019	Update 2020 – Oct 2022
Minor Injury	2	0	0
Possible Injury	2	1	2
Property Damage Only	19	14	15
Total	23	15	17

Injury crashes have improved by 75% and property damage only crashes by 26%. The improvement in property damage only crashes is not as high as expected, although 7 of the crashes were related to snow/ice and 1 involved texting.



But why do roundabouts reduce injury crashes? They just look confusing to me.

It's all about **kinetic energy** and **types of conflict points!**

$$KE = 1/2mv^2$$

Roundabouts are designed to be driven at no more than 20 miles per hour

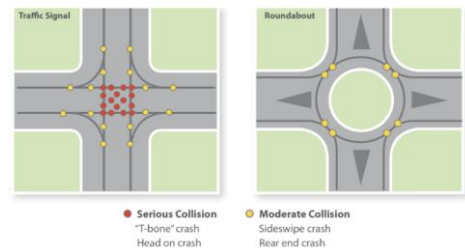
- A car traveling 30 mph has **2.25** times the kinetic energy of a car traveling 20 mph
- A car traveling 55 mph has **7.6** times the kinetic energy of a car traveling 20 mph

MEMORY CHECK!

Remember those conflict points and which one is most associated with injuries crashes?

The answer is CROSSING conflicts!

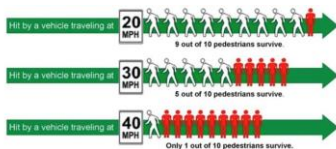
How many crossing conflicts does a roundabout have? **ZERO**



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I like to walk and there is no way I can cross a roundabout safely. I need a signal!

Not True!



Since early 1990s when the first modern roundabout was installed

in the US there have been only **6** pedestrian fatalities (30 year period)

- Of those 6 fatalities none of them occurred in the marked crosswalk
- As of 2021 there was approximately 8000 modern roundabouts
- NHSTA estimates 7500 pedestrian fatalities for 2021
 - 15% are at intersections (1125 fatalities)

For reference there have been 14 pedestrian fatalities in St Louis Co in the last 10 years

Roundabouts make pedestrian crossings easier by:

- Crossing prior to the roundabout
- Only crossing 1 direction of travel at a time
- Shorter crossings
- Roundabout approach design reduces vehicle speeds making drivers more likely to stop and reducing *kinetic energy*
- Roundabout approach design makes pedestrians more visible to the driver
- Roundabout design limits the decisions that a driver needs to make increasing awareness of pedestrians

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Other roundabout benefits:

- Promotes reduced speeds and can be a gateway treatment to a different roadway type such as:
 - Rural environment turning into an urban environment.



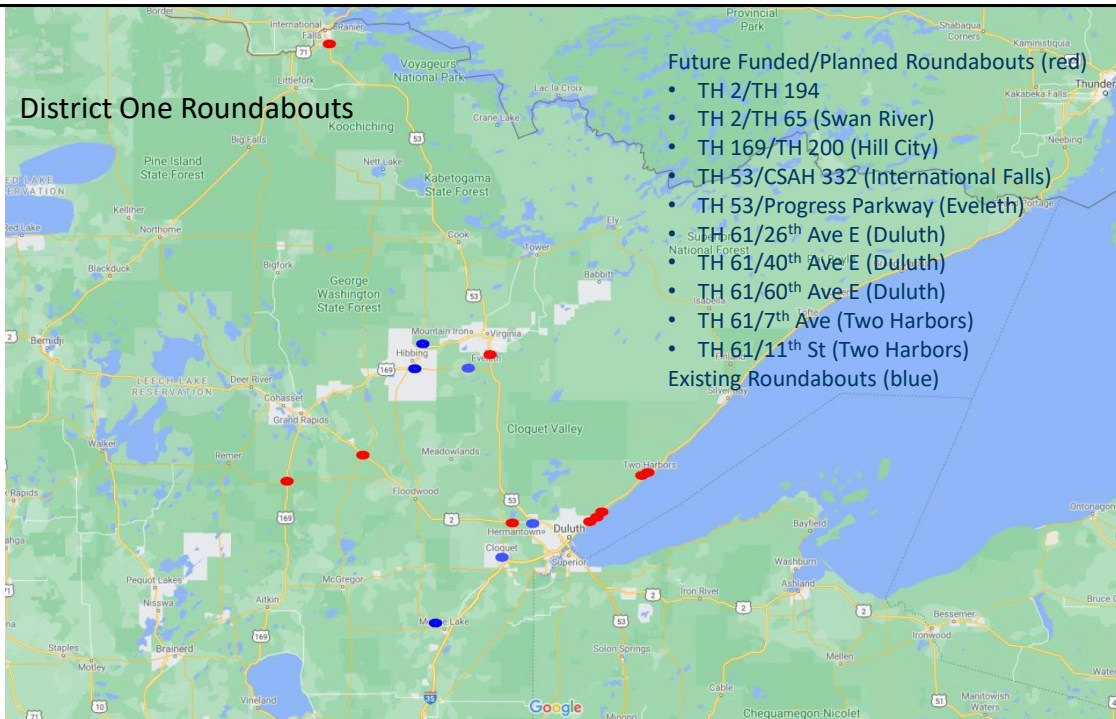
- Limits vehicle delay and pollution
 - No need to stop if there is no conflicting traffic
 - Think about being at a signal with no conflicting traffic and wishing you did not have to wait for a green!



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District One Roundabouts



Questions?

Thank you again!