



## **Two Years Later**

# **Safety, Operations, and Education Lessons from Minnesota's First Two-Lane Roundabout**

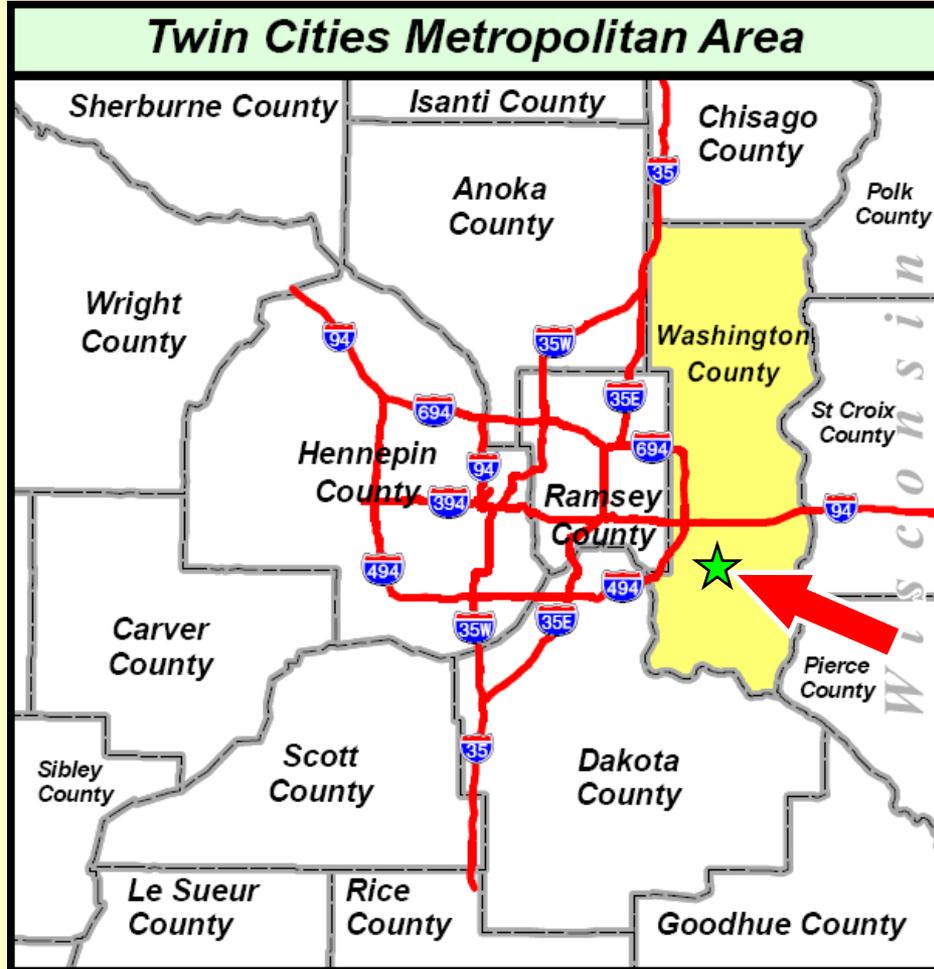
APWA Minnesota Chapter – Fall Conference  
November 15, 2012

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Washington County Public Works  
Stillwater, MN

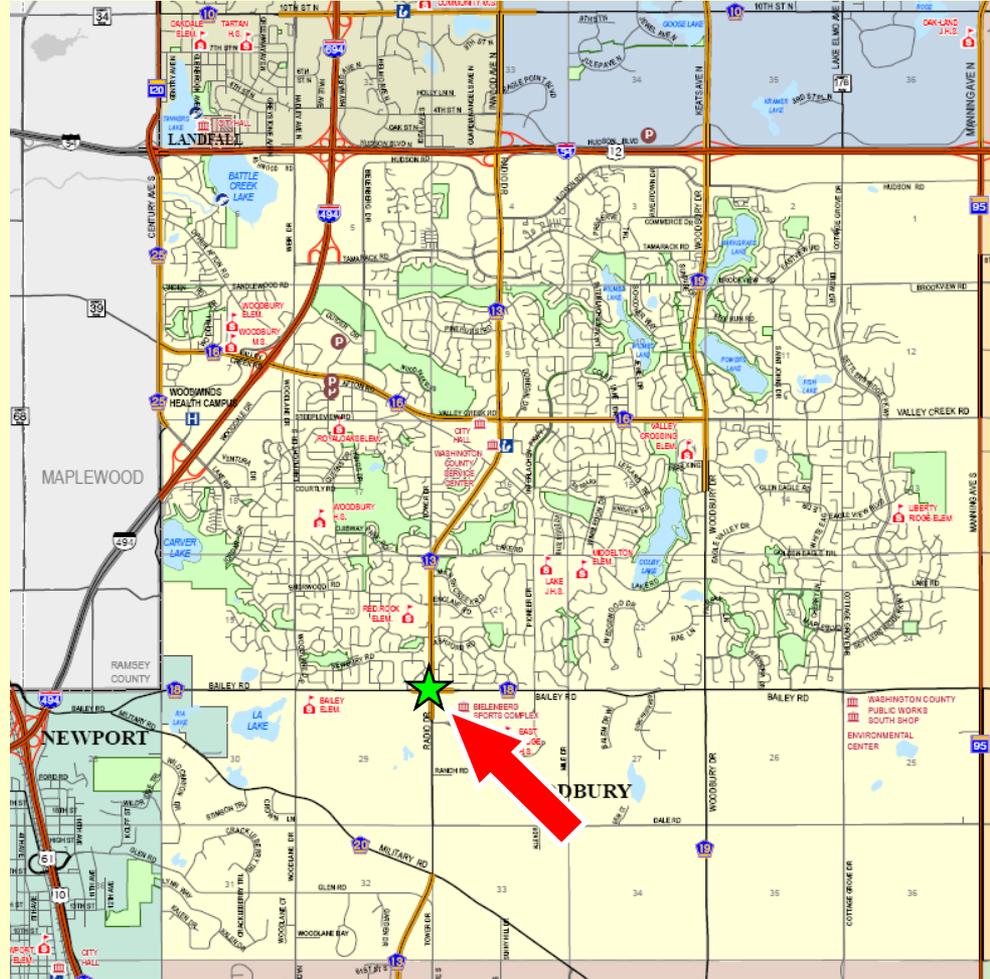
# Report Objective

- City required a 2-year study from the County
- The report documents, from a practitioner's perspective, the benefits and drawbacks encountered following the construction of Minnesota's first *fully* two-lane roundabout.
- This is not rigorous academic research, and some data is limited.
- The report is a summary of the County's experience with regard to operations, safety, and education.

# Project Location



# Project Location



# Before the Project

- All-Way Stop with long queues
- High delays during peak periods
- North leg needed reconstruction, 4 lanes
- Development expanding rapidly in 2007
- Pedestrian tunnels desired at intersection
- 2-lane roundabout chosen over a signal
  - Reduced width = Shorter tunnels
  - Road being reconstructed anyway
  - Opposition to 6-lane designs

# Project Location - Before



Copyright © Washington County GIS

Map center: 44° 53' 26.91" N, 92° 56' 37.30" W

# Project Location - After



Copyright © Washington County GIS

Map center: 44° 53' 26.91" N, 92° 56' 37.30" W



**Opening Day – 11/30/07**



# Project Location - After



# Education & Public Involvement

- County developed “Roundabout U”
- Events, mailings, web site, DVD video



We are happy to share these materials with other agencies!



# Roundabout Education

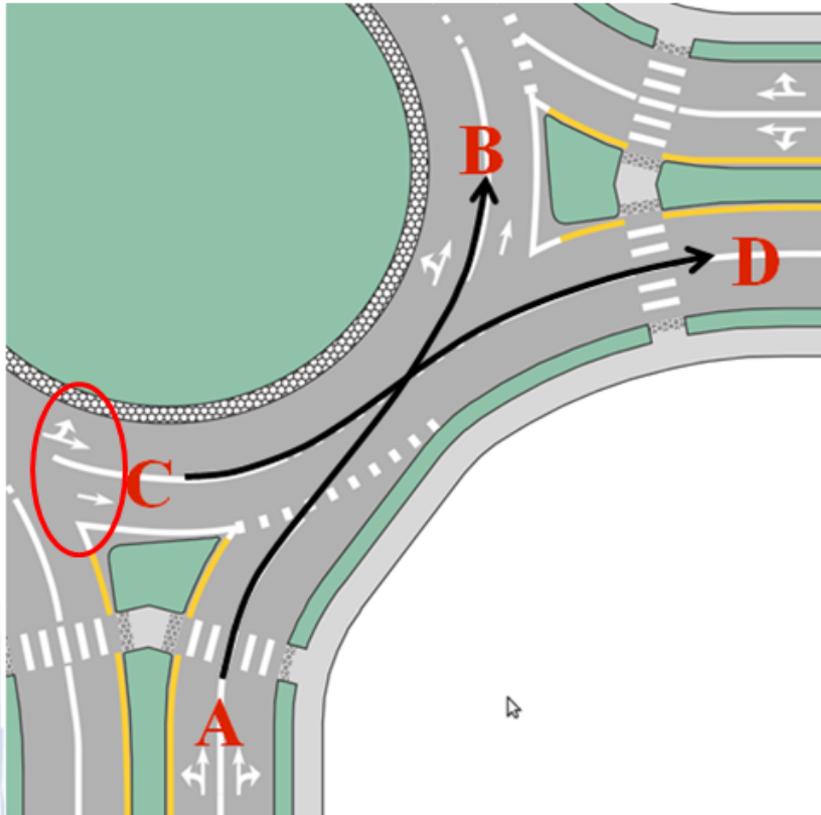


Image background from US FHWA Manual on Uniform  
Traffic Control Devices, 2009 Edition, Chapter 3.  
[muted.fhwa.dot.gov](http://muted.fhwa.dot.gov)

Note the pavement arrows.

- From A to B is “Straight ahead”
- From C to D is “Straight ahead”
- From C to B is a LEFT TURN.
- From A to D is ONE right turn, not two right turns.
- Entry and exit forms ONE intersection point, not two.

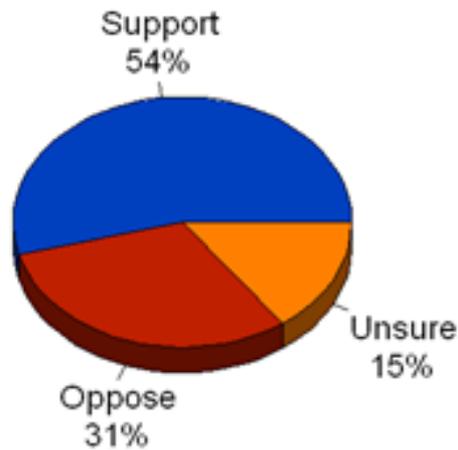
# Roundabout Education

- Education is key, but won't reach everyone.
- Recognize drivers' past experience with traffic circles and rotaries, right turns and merges, as drivers will assume that the same rules apply!
- Roundabouts stir up politics & emotions
  - “You're trying to make us like Europe.”
  - “This may work elsewhere, but not here.”
  - LOCAL information is essential for trust.
- Your message may sometimes disagree with other experts or agencies.

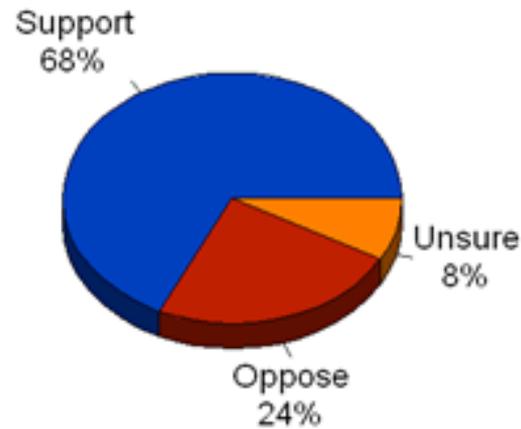
# Public Opinion

## Construction of More Roundabouts

2011 City of Woodbury



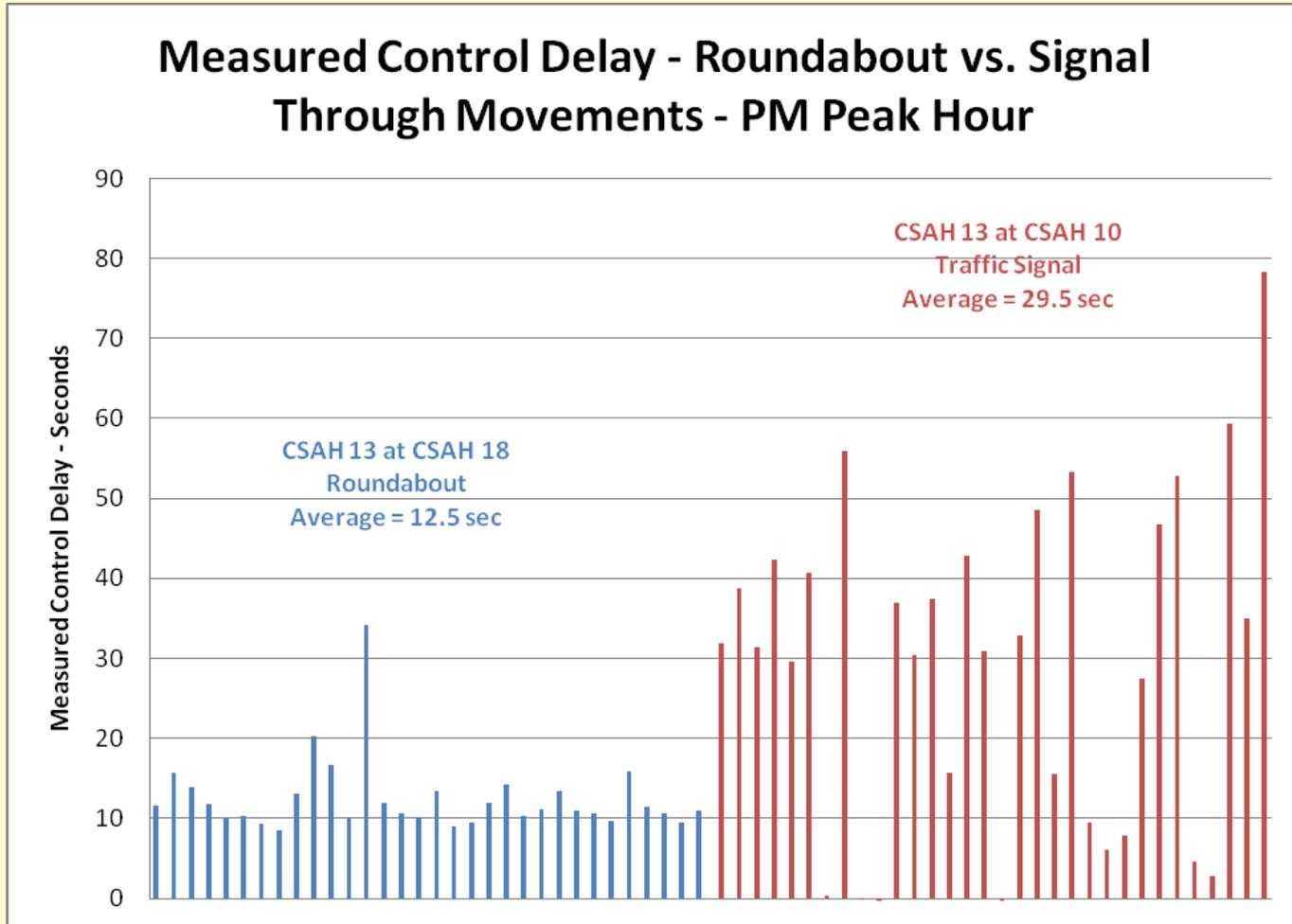
2009



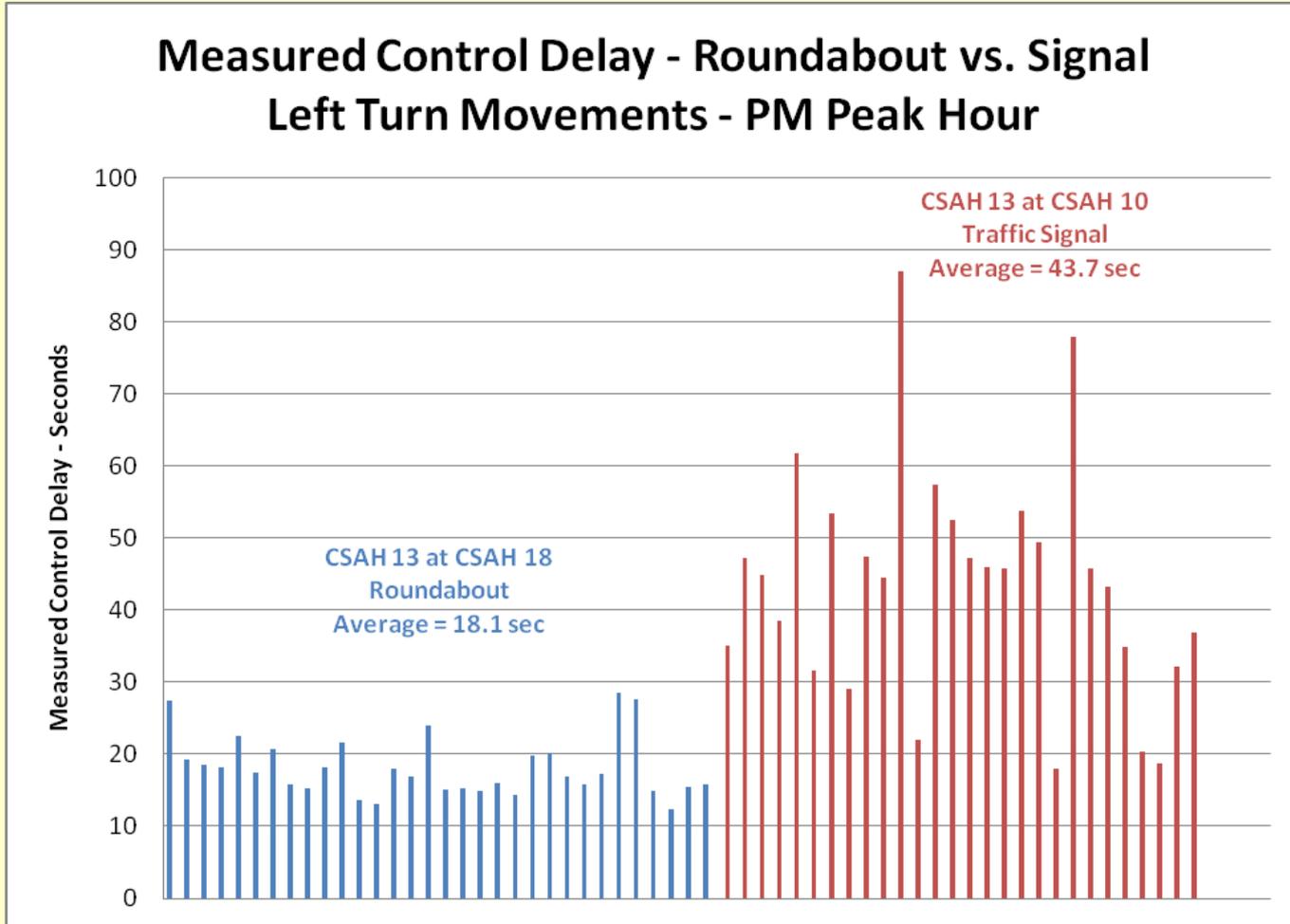
2011

Decision Resources, Ltd.

# Vehicle Delay



# Vehicle Delay



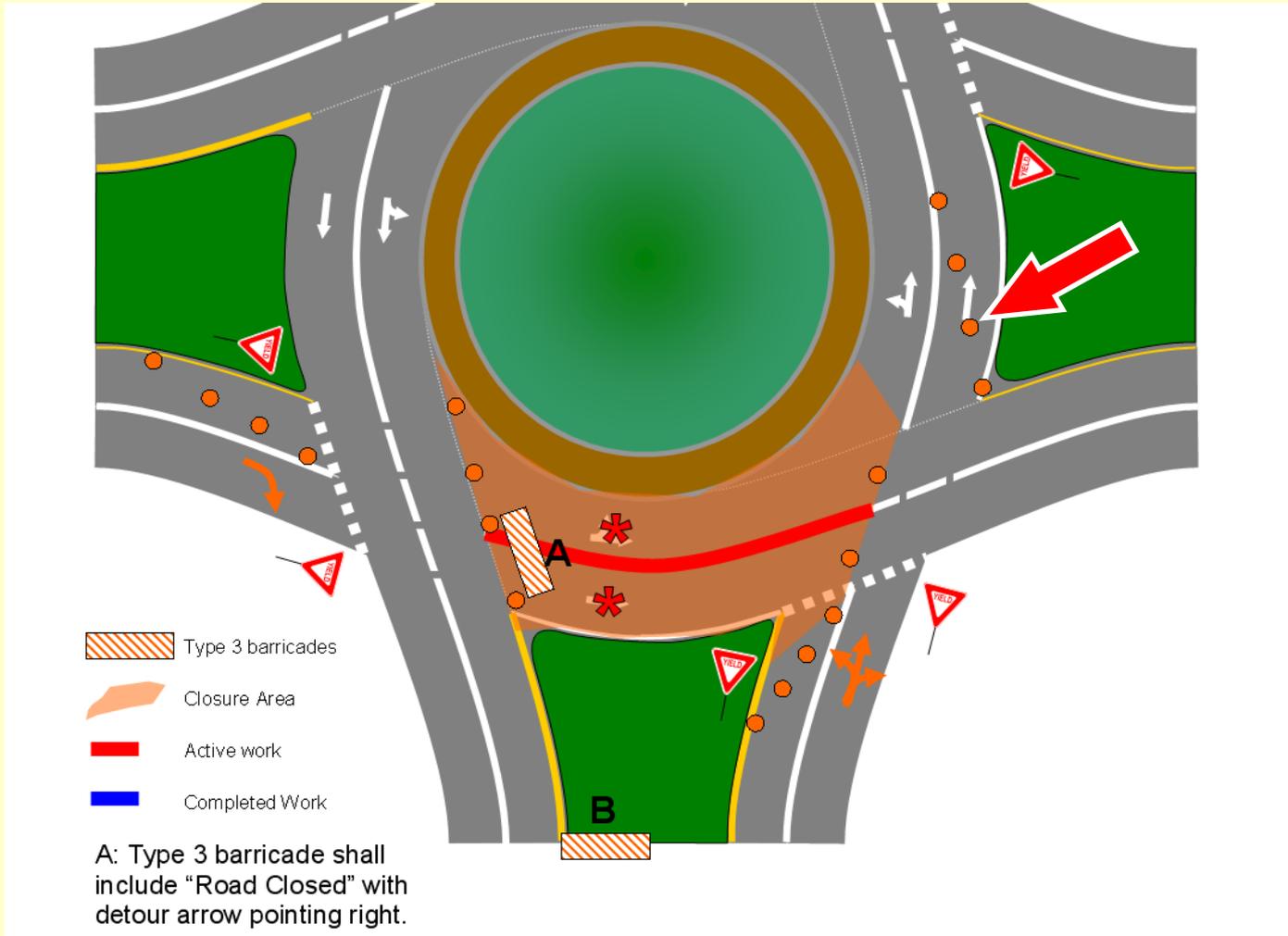
# Lessons Learned - Delays

- Yes, it requires everyone to slow down.
- BUT, peak delays are much lower.
- PM peak hour control delay was 58% lower at the roundabout than at a comparable nearby traffic signal.
- Note: This assumes that volumes are relatively balanced on the approaches.

# Work Zones

- Work zone traffic control within the roundabout can be very challenging.
- No MUTCD work zone layouts exist yet.
- Flagging is often impractical – consider this during design.
- Seek to avoid conditioning drivers to make illegal movements in the future.

# Work Zones



# Lessons Learned - Crashes

The good news:

- Center island crashes are rare.
  - 4x Yellow Chevrons = High visibility
- **Zero** Wrong-Way crashes.
- Very few “sideswipe” crashes.

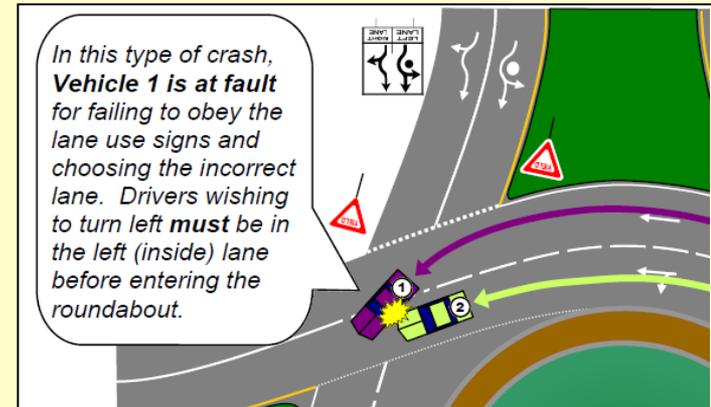
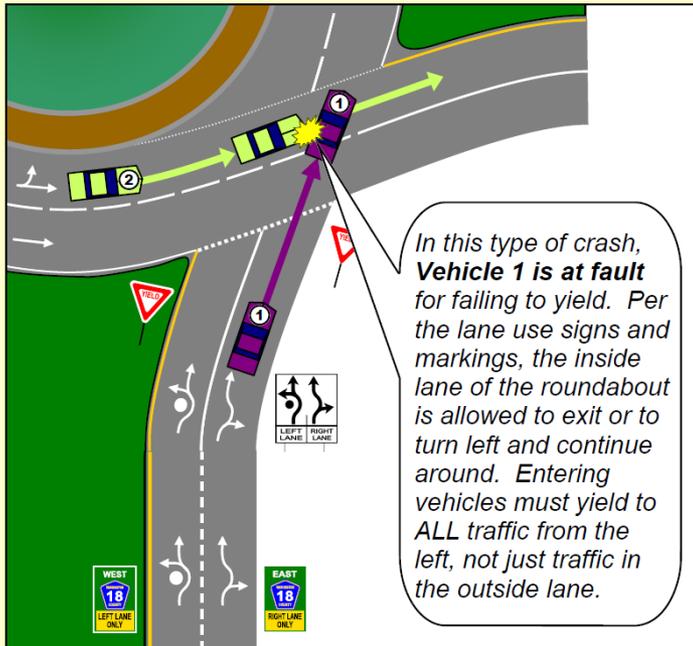
# Lessons Learned - Crashes

The bad news:

- 140 fender-benders reported to police in just under 4 years.
- Most roundabout crashes are not reported to the state, because damage is minor.

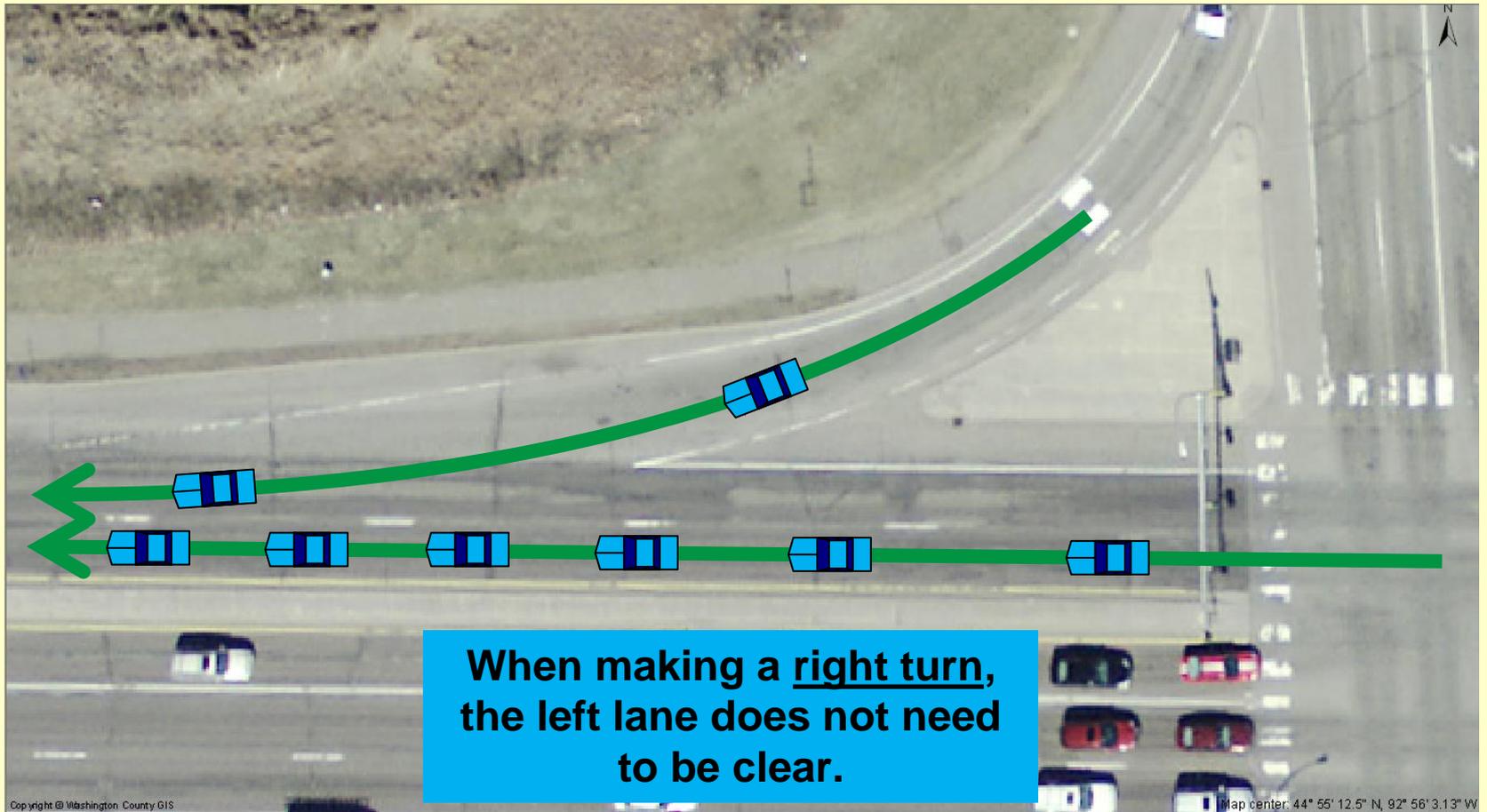
# Lessons Learned - Crashes

Two crash types are predominant:



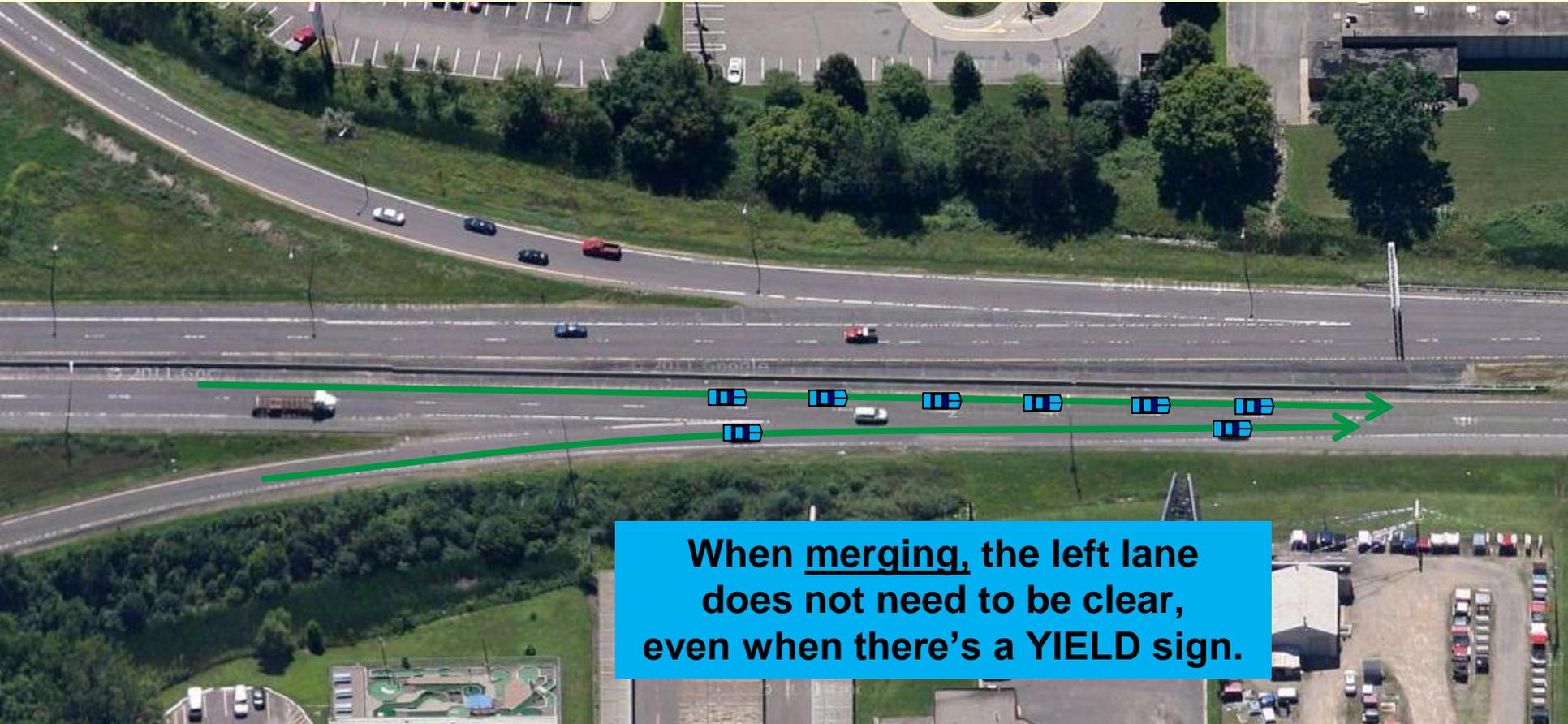
**Both relate to the “Right Turn” or “Merge” misconceptions.**

# Entering and exiting a roundabout is not a right turn.



Copyright © Washington County GIS

# Entering and exiting a roundabout is not a “merge”.



When merging, the left lane does not need to be clear, even when there's a YIELD sign.

Image from Google Maps

# Entering and exiting a roundabout is a crossing (thru) movement.

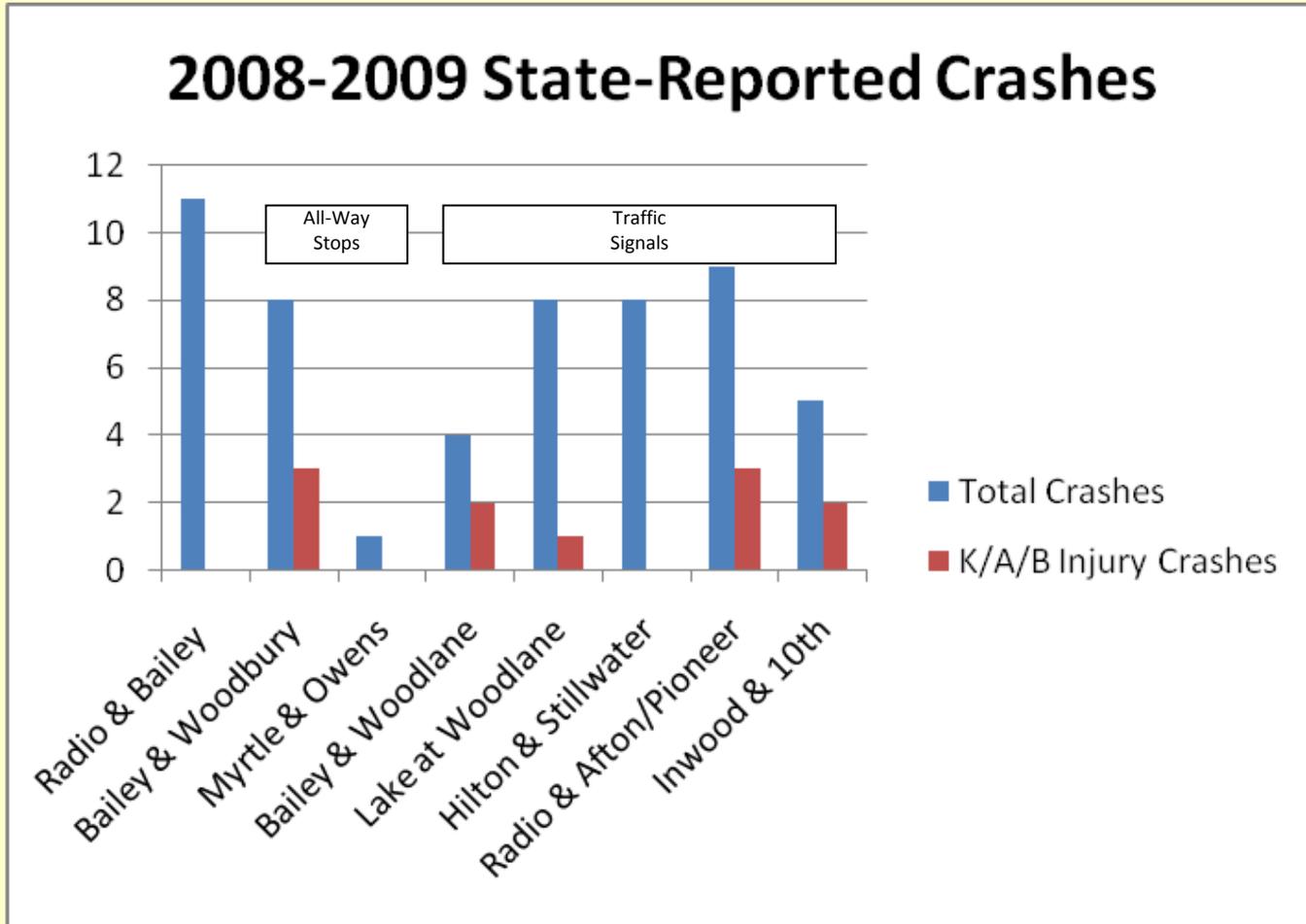


Unlike a right turn or a merge location, entering a roundabout alongside cross traffic results in a crash.

# Why Mistakes Happen

- Drivers assume (or they're told) that entering a roundabout is a merge or a right turn.
- As an engineering community, we don't adequately communicate the difference via signing or striping.
  - Cross-traffic lane striping is not easily seen by entering drivers.
  - Drivers usually encounter YIELD signs at right turns or merge locations, where it's okay to enter alongside cross traffic.
  - Why should we be surprised when they behave the same way at a roundabout?
- When drivers apply right-turn (or merge) logic at roundabouts, crashes occur.

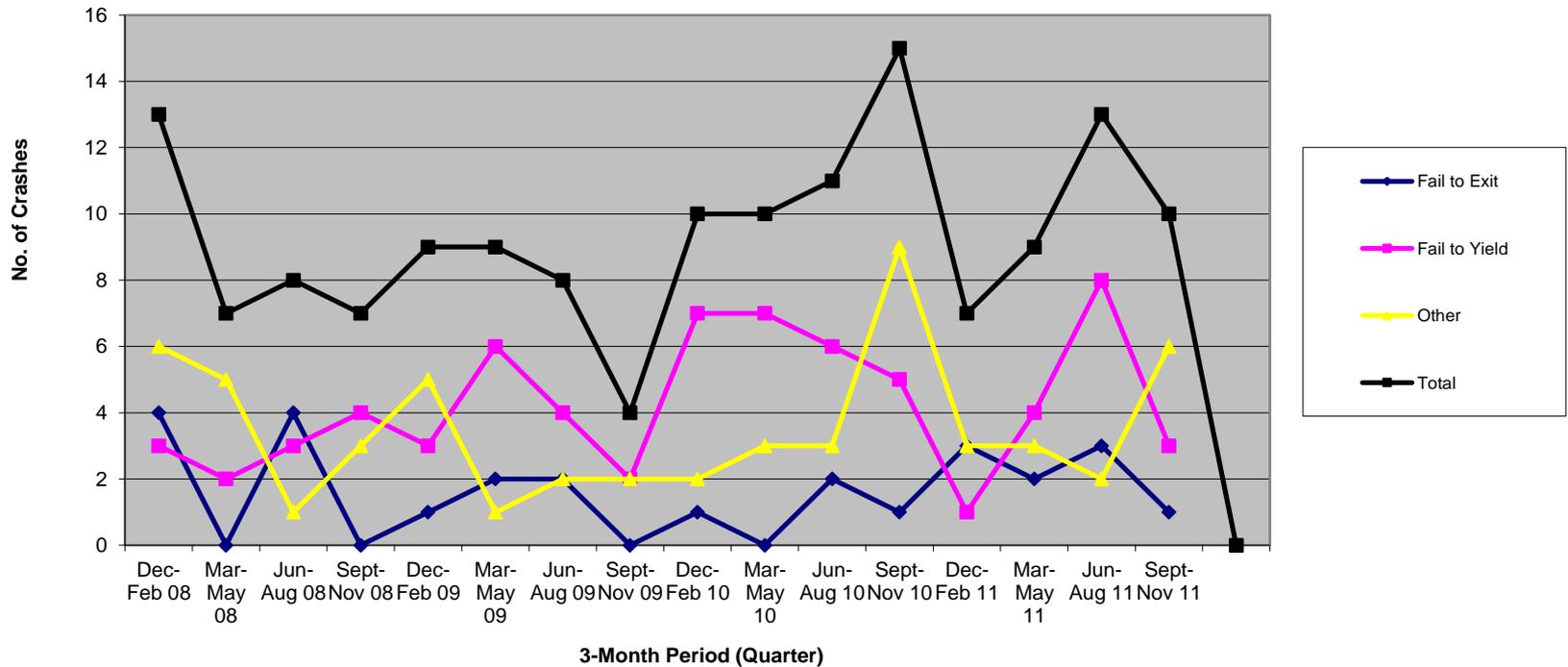
# Crash Experience – DPS



# Crash Experience - ALL

## Crashes by Type - Quarterly

Radio & Bailey Roundabout  
Includes All Police Calls for Crashes



# Signing & Striping

# Arrow Types

- We used “Fish-Hook” with the dot. Don’t.
- Recommend standard arrows with the dot.
  - Does not contribute to “right turn” misconceptions.
  - Standard arrows without dot may cause wrong-way confusion, especially if “one way” signs are used.
  - Left turns do occur, but at the second opportunity.



Photo source: 2009 FHWA MUTCD



# Changes made since project completion

- Added “LEFT LANE” / “RIGHT LANE” plaques below the lane use signs.



# Changes made since project completion

- Added destination-based signing.



# Changes made since project completion

- Added supplementary plaques below right-side YIELD signs reading:  
“TO ALL TRAFFIC IN CIRCLE”.
- Don't use this wording. There is no circular road at a roundabout, only a circular island.
- May 2011 – Revised plaques to read “TO BOTH LANES”.



# Changes made since project completion

- Short experiment – Solid lane lines at exits to discourage “Failure to Exit” errors.



# Changes made since project completion

Coming soon:  
Fewer lanes?

# Enforcement

# Lessons Learned – Enforcement

- Have a close working relationship with your traffic enforcement agencies.
- Ensure that anyone enforcing traffic laws at the roundabout hears from YOU.
- Police officers often have the same misconceptions as other drivers.
- Signal your exit? **NO.** Exiting is a through movement, not a right turn nor a lane change.

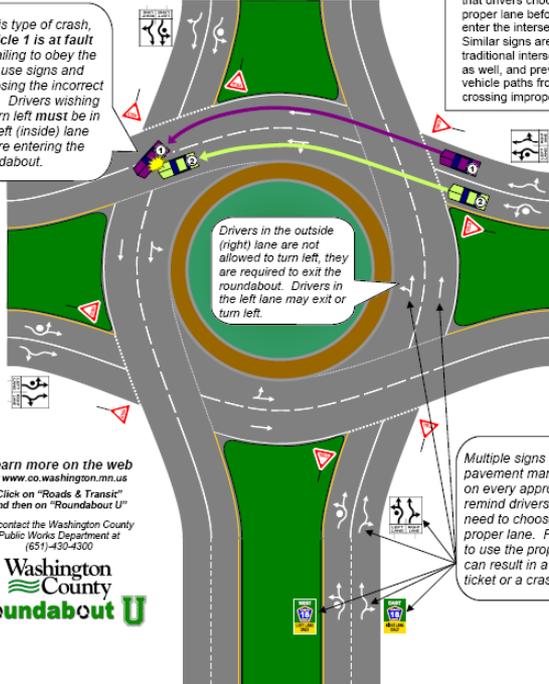
# Traffic Enforcement Handouts

## Improper Lane Use

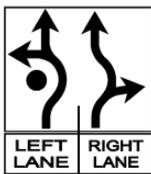
As with any other intersection, the proper lane must be chosen before entering a roundabout. Signs in advance of the intersection will always indicate which lanes may be used to turn or to continue ahead. As with any other intersection, keep left to turn left through the roundabout, and keep right to turn right. Never change lanes within an intersection, including within roundabouts.

At Radio Drive and Bailey Road, lane use signs require that drivers turning left must use **only** the left (inside) lane, preventing the type of crash shown below.

In this type of crash, **Vehicle 1 is at fault** for failing to obey the lane use signs and choosing the incorrect lane. Drivers wishing to turn left **must** be in the left (inside) lane before entering the roundabout.



Drivers in the outside (right) lane are not allowed to turn left; they are required to exit the roundabout. Drivers in the left lane may exit or turn left.



Lane use signs require that drivers choose the proper lane before they enter the intersection. Similar signs are used at traditional intersections as well, and prevent vehicle paths from crossing improperly.

Multiple signs and pavement markings on every approach remind drivers of the need to choose the proper lane. Failure to use the proper lane can result in a traffic ticket or a crash.

Learn more on the web at [www.co.washington.mn.us](http://www.co.washington.mn.us)  
Click on "Roads & Transit" and then on "Roundabout U"  
Or contact the Washington County Public Works Department at (651)-430-4300



## Failure to Yield

Entering a roundabout is similar to an intersection between two one-way roads, where the road from the left continues out of the roundabout. To proceed into the roundabout, entering drivers must **yield** to all traffic from the left, waiting until all traffic from the left is clear.

Unlike a traffic circle, drivers are not permitted to enter alongside vehicles circulating in the left lane, because those circulating vehicles are allowed to exit the roundabout.

Extra signs mounted below the yield signs remind drivers to **yield** to both lanes. Never enter unless all traffic from the left is clear.



In this type of crash, **Vehicle 1 is at fault** for failing to yield. Per the lane use signs and markings, the inside lane of the roundabout is allowed to exit or to turn left and continue around. Entering vehicles must yield to ALL traffic from the left, not just traffic in the outside lane.

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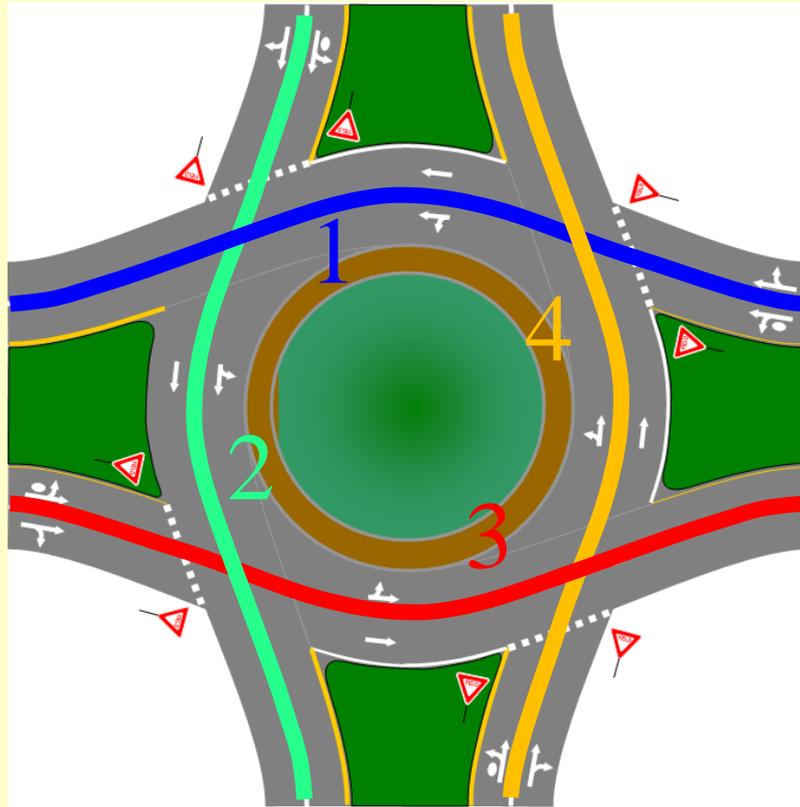


# Lessons Learned – As a Profession

- Engineers need to more explicitly define what constitutes a roundabout, as opposed to a traffic circle or rotary, and sign and educate consistent with that definition.
- Drivers may get conflicting advice from various professionals and agencies, and other sources.
- Education needs to be consistent with signing and markings – Entry/Exit is a through movement.

# Conclusions

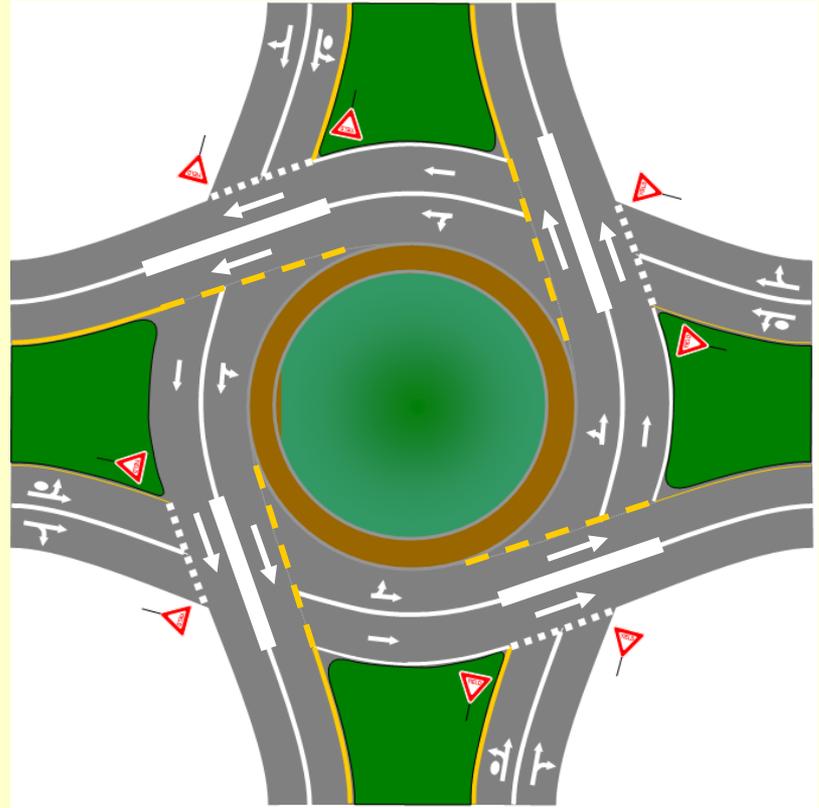
- Don't build more lanes than needed.
- Don't describe entry as a right turn or merge.
- Don't refer to the “circle” as being one road.





# Future Research

- Do research traffic control devices that clarify that entry is not a right turn nor a merge.
  - Wider Stripes?
  - Omit Stripes?
  - Yellow Extensions? Black lines? Crack Seal?
  - Additional Arrows?
  - New signs or plaques?
    - “To Both Lanes”?
    - “To Traffic From Left”?
    - A new symbol sign?



# Questions?





# The Challenge

Make it look like what it is.

