

Roundabouts



December 18, 2017

**Presented by:
Troy Pankratz, PE**

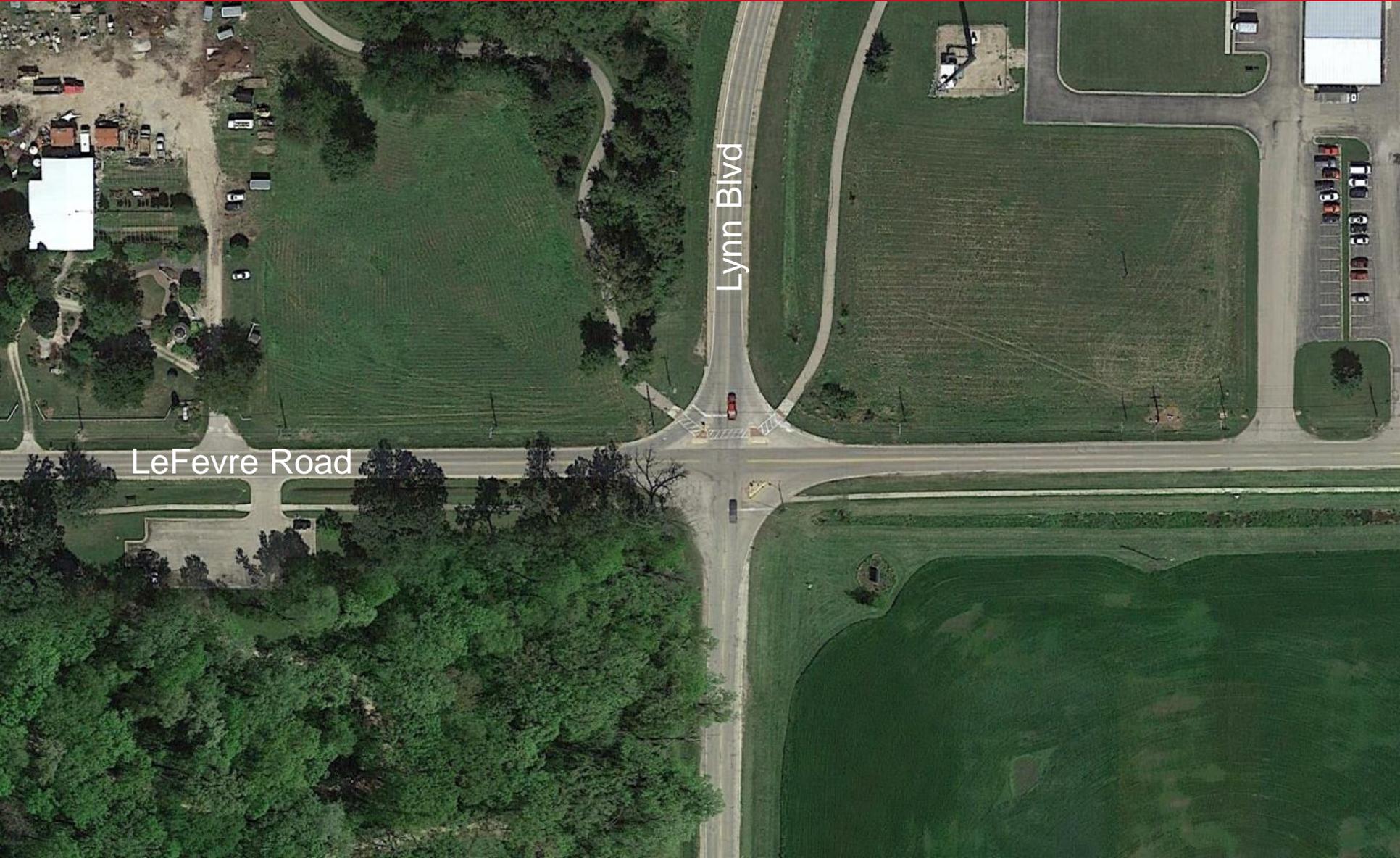
Mead&Hunt

A Modern Roundabout is:

- ✓ Simple for Drivers
- ✓ Simple for Pedestrians
- ✓ Low maintenance
- ✓ Safest treatment for high-speed intersections



LeFevre Road and Lynn Boulevard



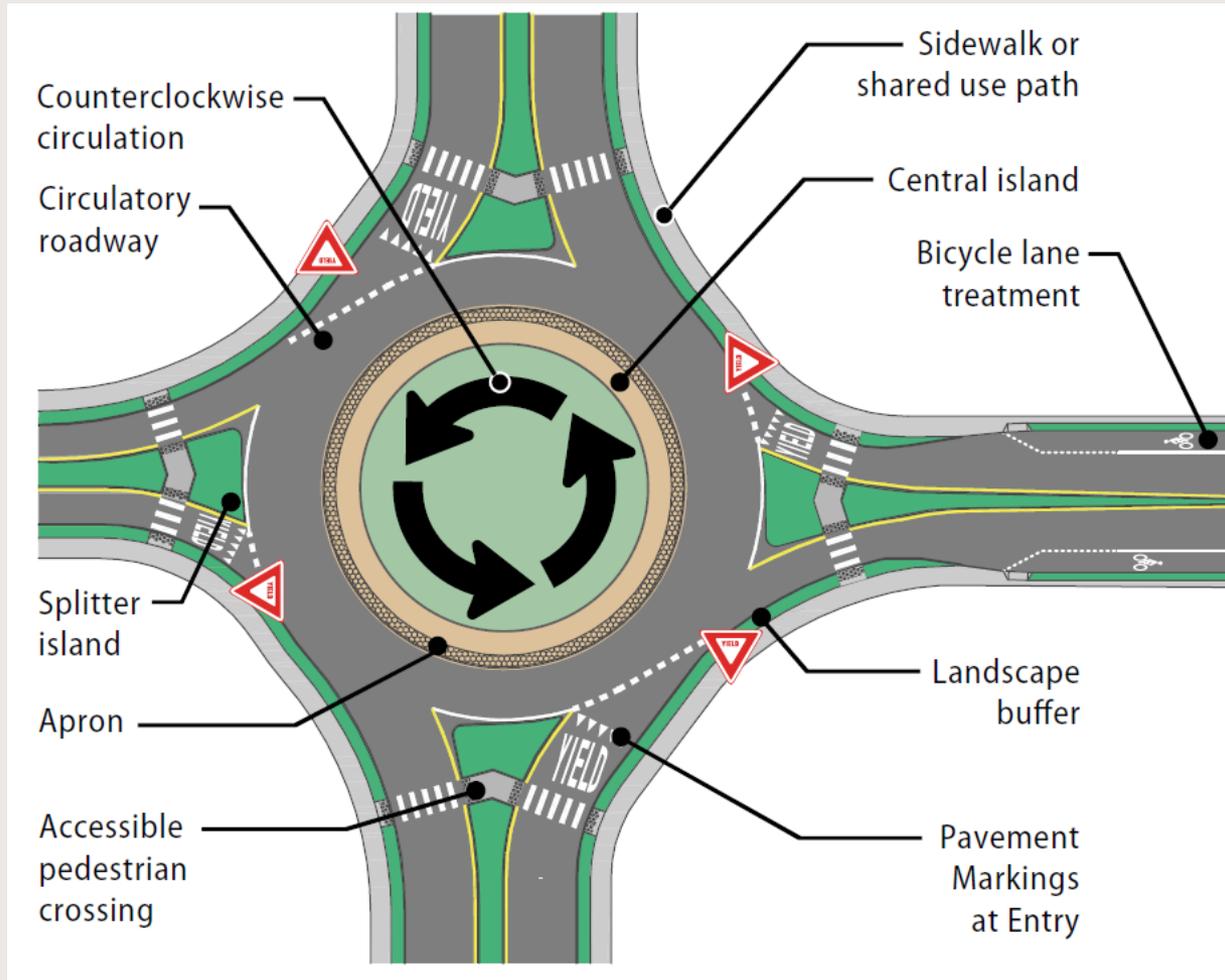
Rural Single-lane Roundabout



Myth Busting!

- “Roundabouts don’t process traffic as well as traffic signals”
- “Roundabouts aren’t safe”
- “Roundabouts aren’t safe for bicyclists and pedestrians”
- “Fire trucks, snowplows, buses and semis can’t use roundabouts”
- “Roundabouts aren’t good for older adults”
- “Roundabouts require too much land”
- “The public will object to using a roundabout”

What is a Modern Roundabout?



Source: FHWA

Yield Control



**Vehicles yield upon entry
in a modern roundabout.**

Circulatory Roadway

**No traffic control in the circulatory roadway.
Movement is counter-clockwise.**

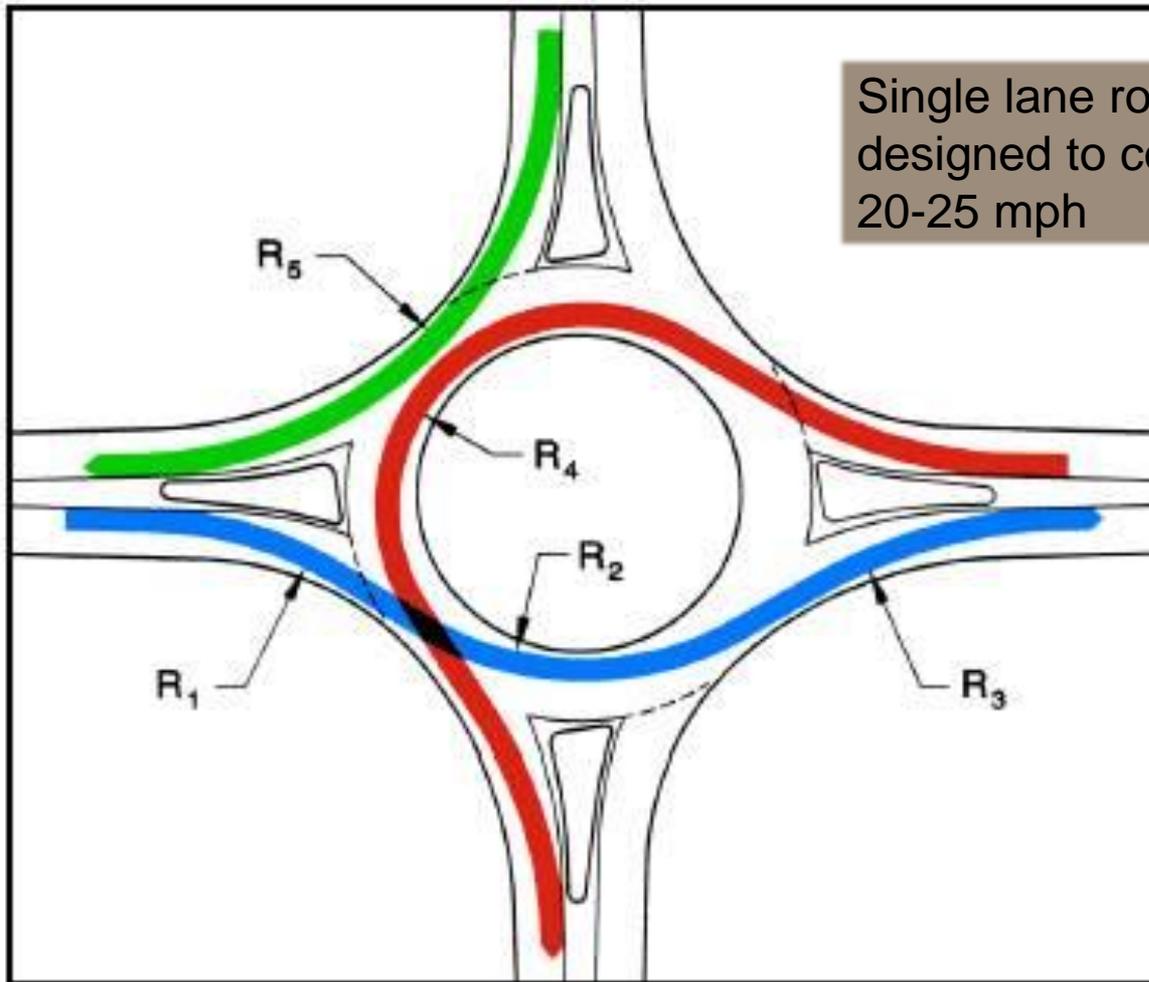


Central Island



Central island deflects vehicles from a straight-line path.

Fast Path Speeds



Single lane roundabouts are designed to control speeds to 20-25 mph

Roundabout Operations

Myth: “Roundabouts don’t process traffic as well as traffic signals.”

Roundabout vs. Traffic Signal



Operations

	Traffic Signal	Roundabout
Capacity	↓	↑
Level of Service	↓	↑
Traffic Speed	Not limited by geometrics	Restrained to 25 mph by geometrics
Operational Benefits	More delay to all vehicles	Less delay

↑ Higher

↓ Lower

LeFevre Road and Lynn Boulevard - Operations

- Traffic Signal
 - Eight-hour and four-hour warrants are not met
 - Only meets traffic signal warrants for peak hour
- All-Way Stop
 - Meets safety criteria for AWSC – (> 5 crashes/yr)

Control	LOS in 2040
Existing 2 Way Stop	F
All-Way Stop	F
Signal	B
Roundabout	A



Roundabout Safety

Myth: “Roundabouts aren’t safe”

Safety Performance of Intersections Converted to Roundabouts

Reduction in All Crashes	Reduction in Injury Crashes
35%	76%

- Single lane roundabouts saw a larger decrease in total crashes than multi-lane roundabouts.
- Fatal crashes are extremely rare at roundabouts.

Source: National Cooperative Highway Research Program Report 572

Human Capital Crash Costs

Crash Type	Capital Cost
K- Fatality	\$9,200,000
A – Severe Injury	\$440,125
B – Moderate Injury	\$120,167
C – Minor Injury	\$62,114
O – No Injury	\$6,734

Source: National Cooperative Highway Research Program Report 220
Estimating the Life-Cycle Cost of Intersection Designs

VIDEO FROM A
RED LIGHT CAMERA
IN ST. LOUIS, MO
2009-2010

T-Bone Collisions = Severe Injuries



Avoidable Collisions



- Severe angle and turning movement collisions are avoidable
- Put decisions in the hands of drivers

Roundabout Crash

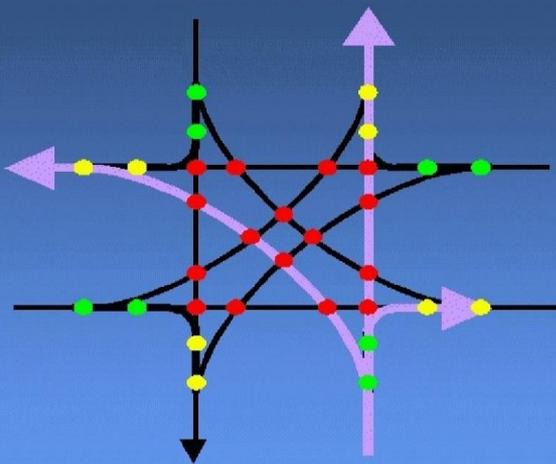


Roundabout Crash



Signals vs. Roundabouts

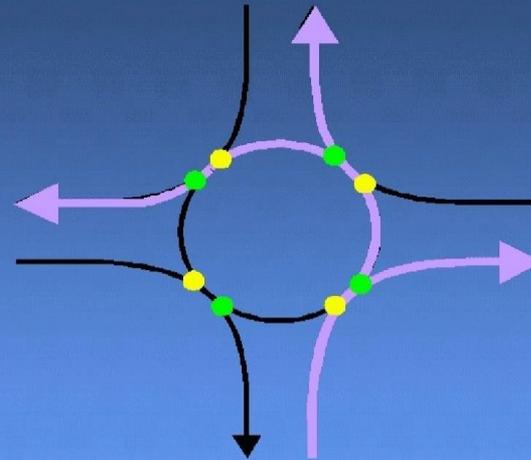
Vehicle conflict points: Conventional intersection



Conflict Types

● Diverge:	8
● Merge:	8
● Crossing:	16
Total:	32

Vehicle conflict points: Roundabout



Conflict Types

● Diverge:	4
● Merge:	4
● Crossing:	0
Total:	8

- Crashes of this type are more severe

Safety Comparison

	Traffic Signal	Roundabout
Crash Severity	↑	↓
Number of Driver Decisions	↑	↓
Severity of Driver Errors	↑	↓
Traffic Calming	Not Effective	Geometrics ensure lower speeds

↑ Higher

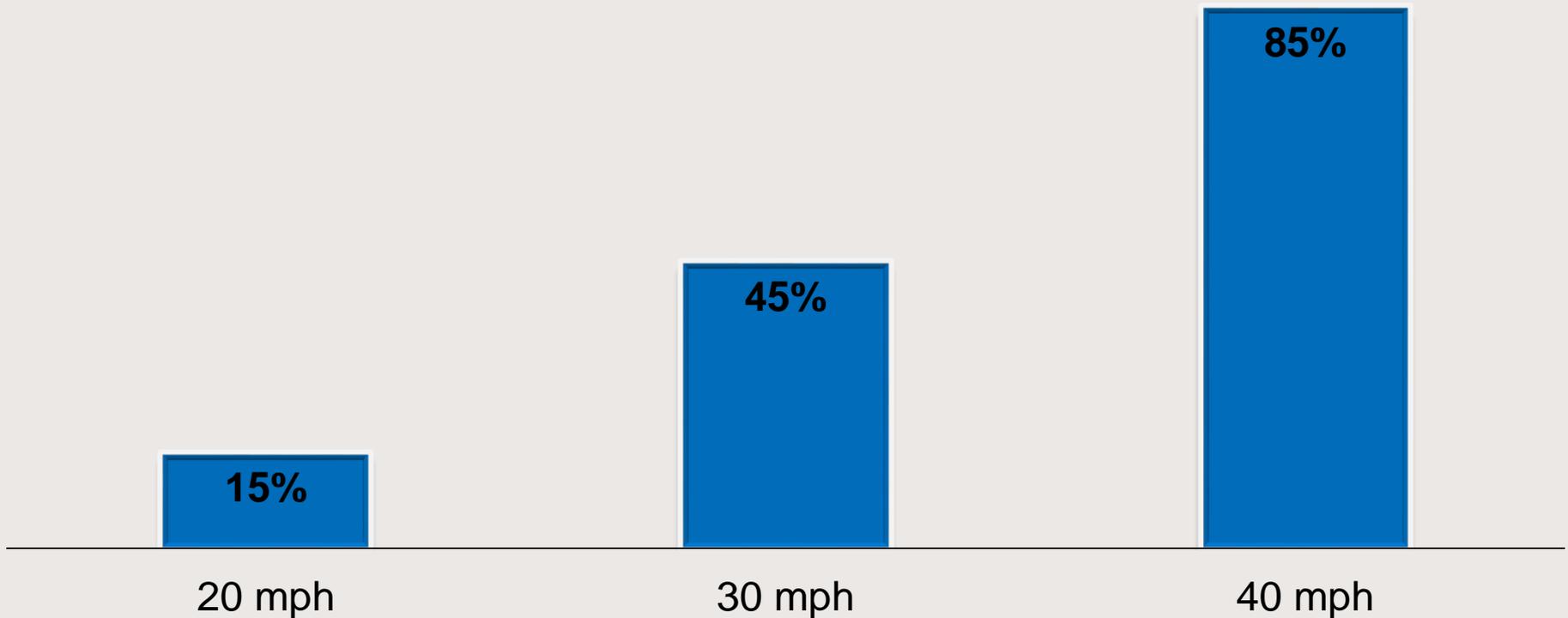
↓ Lower



Roundabout Safety

Myth: “Roundabouts aren’t safe for bicyclists and pedestrians”

Pedestrian Injury Probability

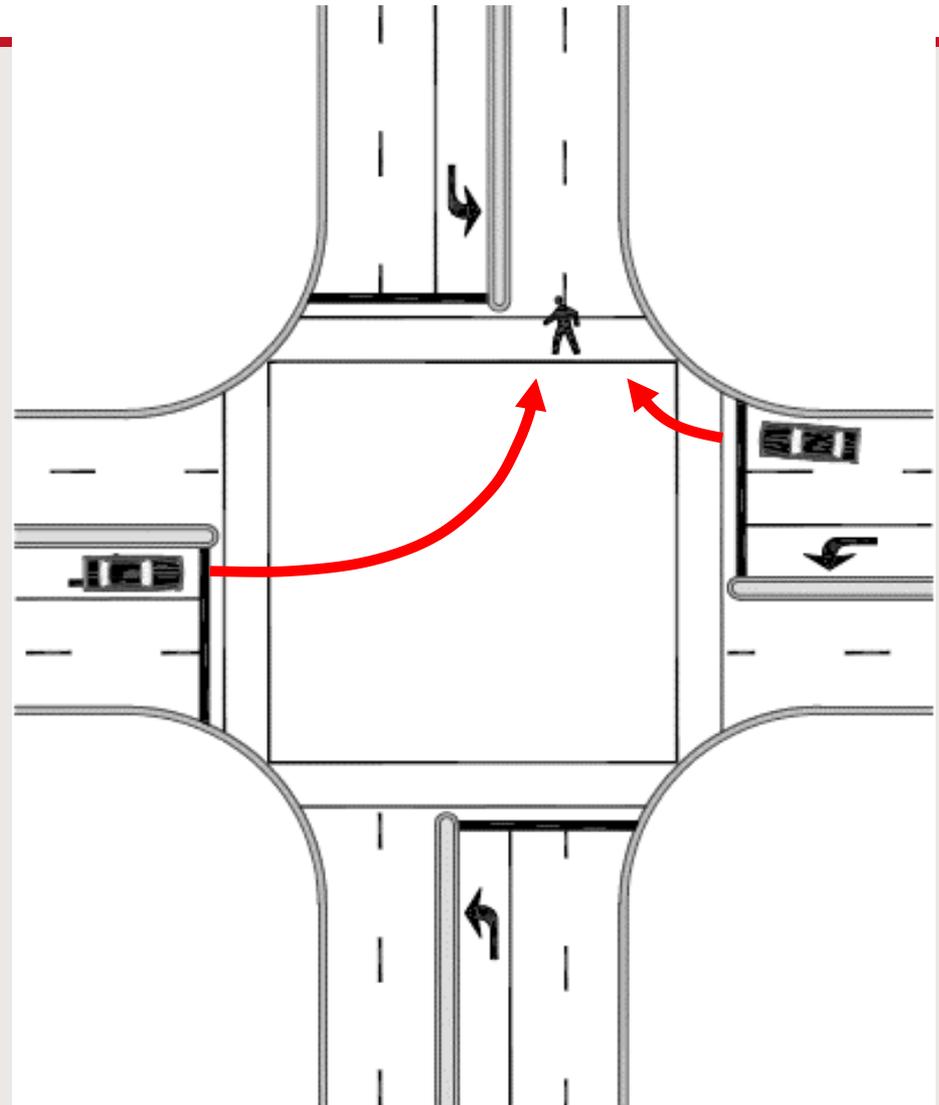


Pedestrian's chances of death if hit by a motor vehicle

Source: Oregon Department of Transportation and Department of Transport (United Kingdom)

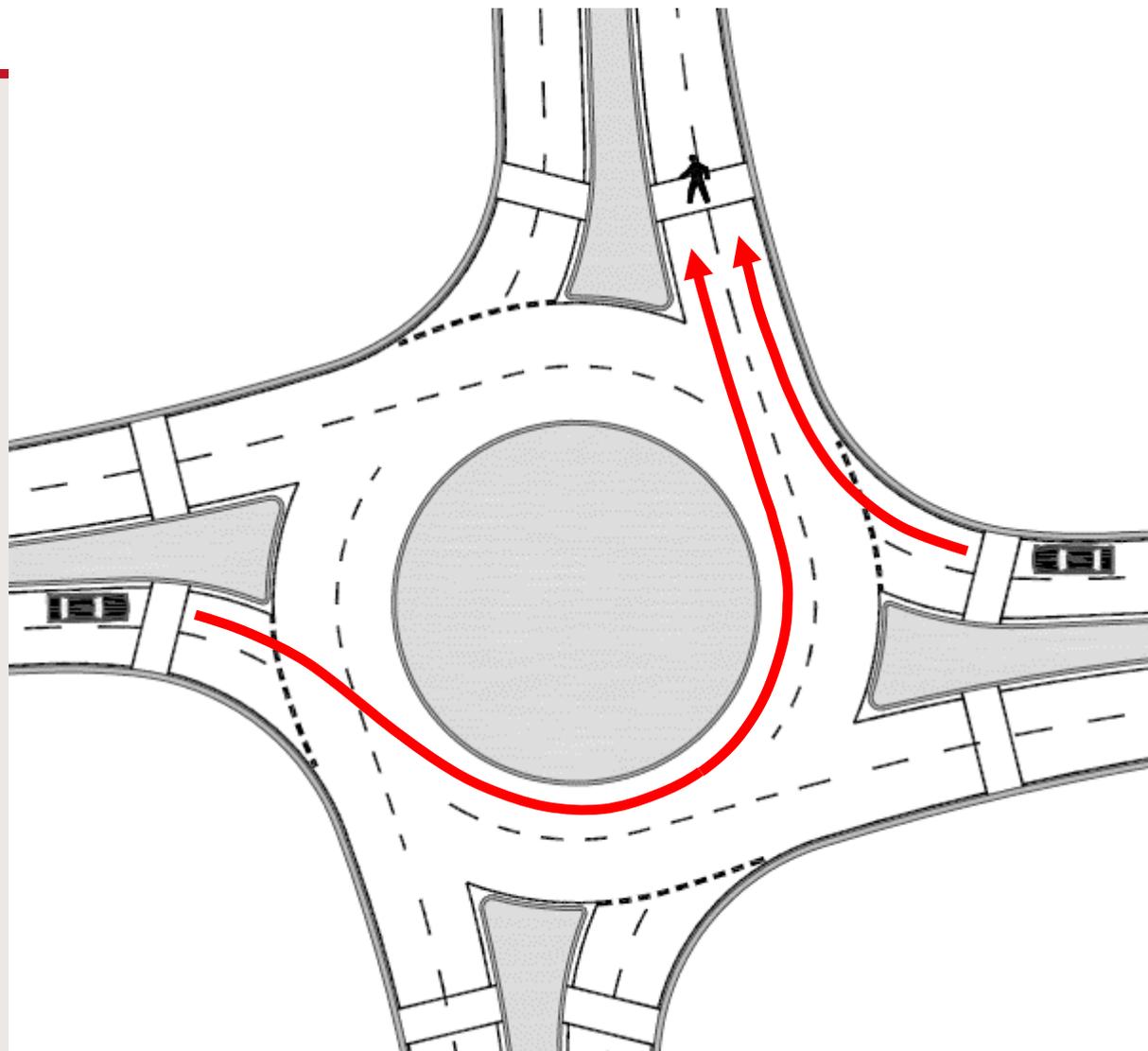
Safety vs. Security at Signalized Intersections

- Pedestrian experiences an exaggerated level of security because the signals tell them it's safe to cross
- Most crashes occur when drivers turn left or right across the crosswalk while the pedestrian has a Walk indication



Safety vs. Security at Roundabouts

- Pedestrian feeling of security more closely matches their actual level of safety



Pedestrian Accommodations



Pedestrian Accommodations



Roundabouts and Trucks

Myth: “Fire trucks, snowplows, buses and semis can’t use roundabouts”

Trucks at Roundabouts



Truck Apron

Where trucks are common, a properly designed apron is necessary.







**Ourston
Roundabout
Engineering**

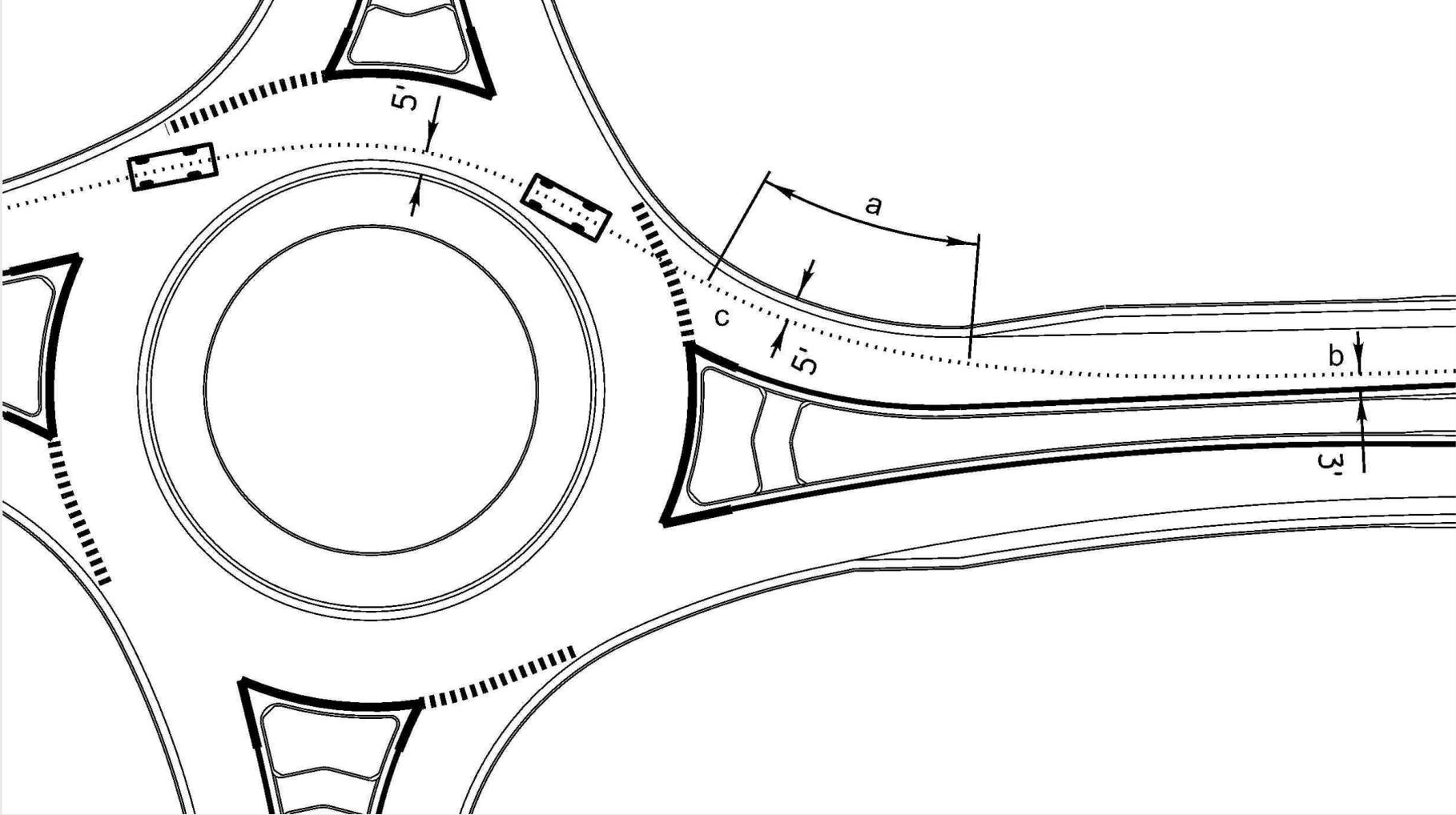
www.ourston.com

Mead & Hunt

Truck Apron??



Fast Path Speeds



Oversized Overweight (OSOW) Vehicle Accommodation

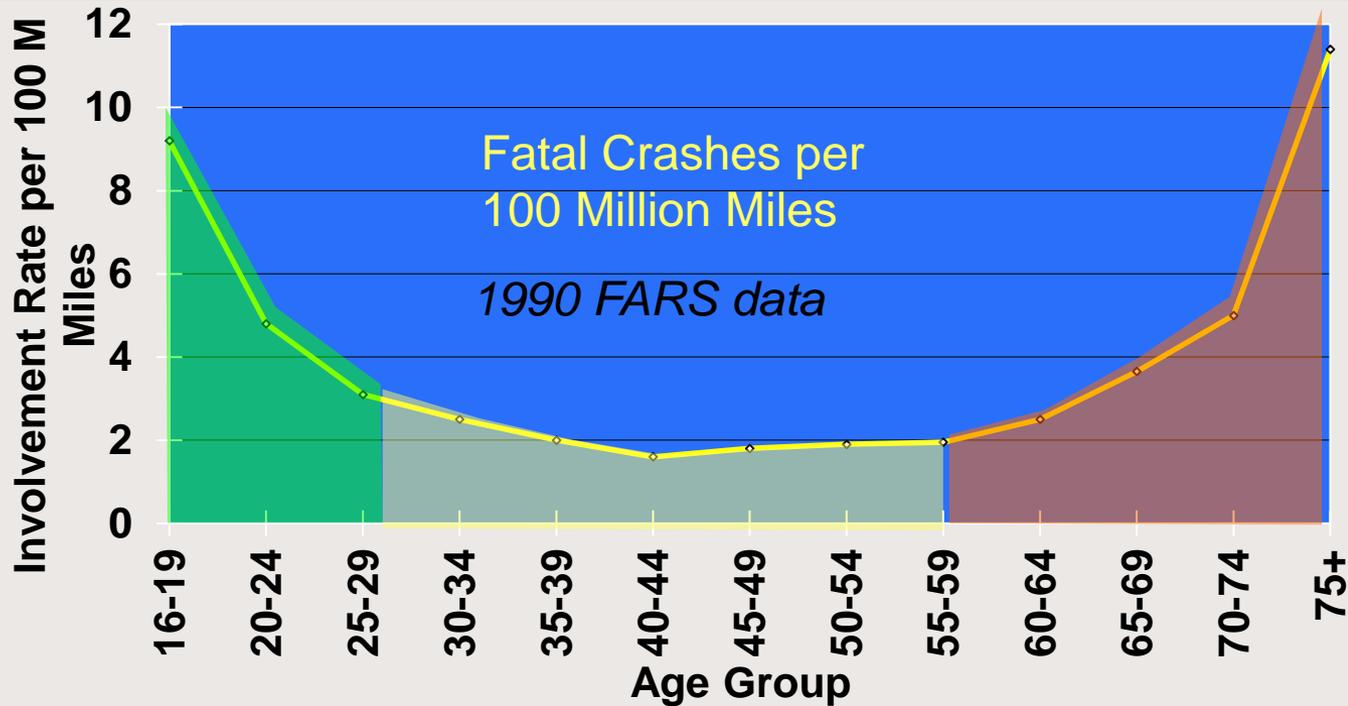




Roundabouts and Older Drivers

Myth: “Roundabouts aren’t good for older adults”

Roadway users are at risk ...



And, older roadway users are at increasing risk ...

- Between 1991 and 2001 crashes involving at least one older driver **increased 20 percent.**
- And the number of Americans aged 70 and older killed in traffic crashes **increased by 27 percent.**

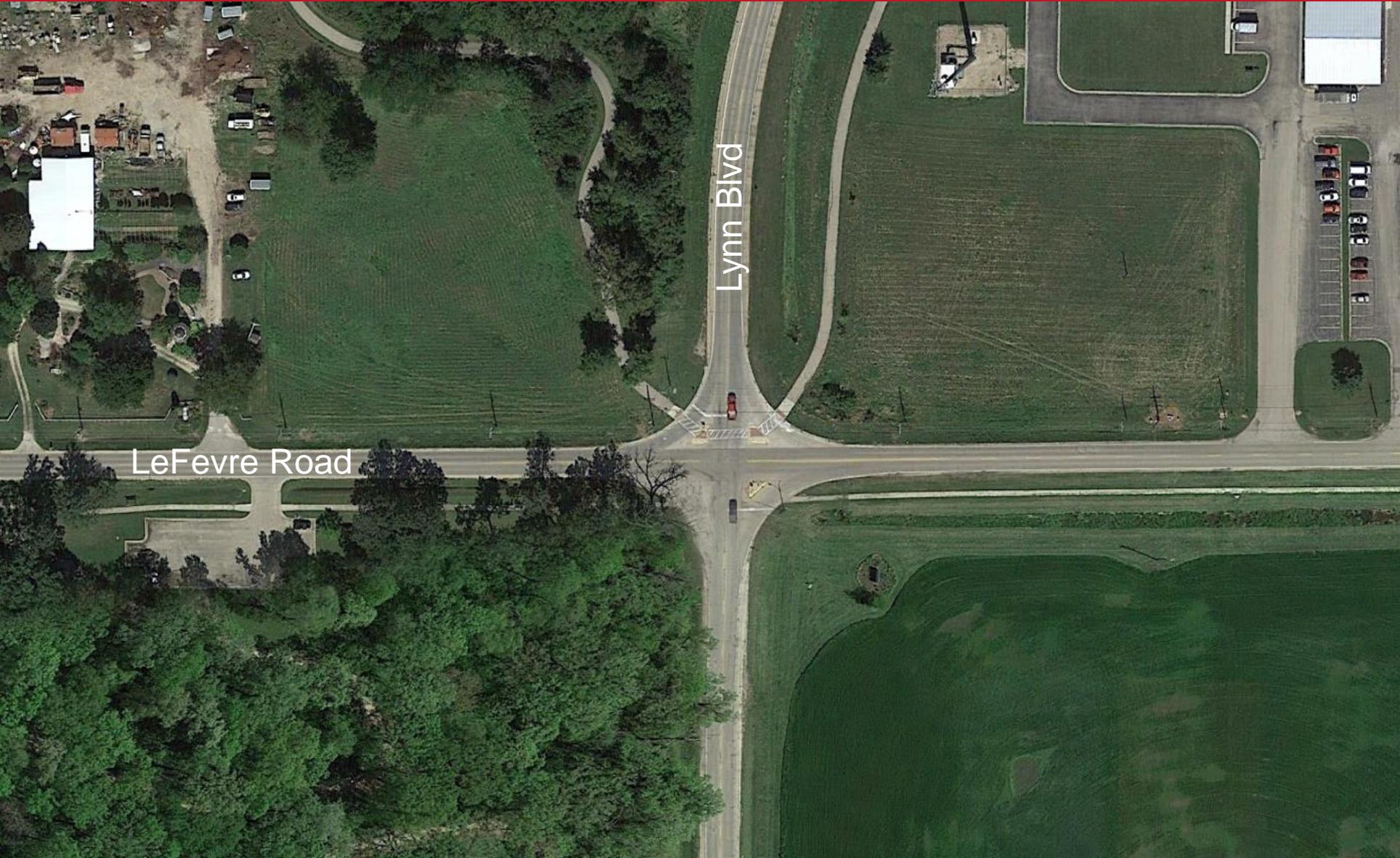
Senior drivers are becoming more numerous

- Population ages 65 and older grew nearly **twice as fast** as the total population between 1990 and 2000.
- The population of seniors is projected to **double** over the next 30 years.
- Americans age 85 and older are the **fastest growing** demographic.
- By 2020, **one in five** people will be 65 or older.

Senior users are especially at risk at intersections

- 38% of pedestrian deaths among people 65 and older in 1998 occurred at intersections
- Senior drivers are nearly **twice** as likely to be killed while driving through an intersection than younger drivers
- Drivers 85 and older are **more than 10 times as likely** as drivers 40-49 to have multi-vehicle intersection crashes

LeFevre Road and Lynn Boulevard



Safer intersections provide:

- ✓ **More time to:**
 - Perceive and evaluate situations
 - Make decisions
 - Take action
- ✓ **Less complicated** situations to interpret



Modern Roundabouts

A LIVABILITY FACT SHEET

Every day in the U.S. more than 20 people are killed at traffic intersections, and many more are seriously injured.¹

Roundabouts — circular intersections that move traffic counterclockwise around a central island — can help reduce these deaths and injuries. Modern roundabouts are calmer and safer than conventional intersections and have been deemed a “proven safety counter-measure” by the U.S. Department of Transportation.²

Roughly the size of a baseball diamond or infield, modern roundabouts differ from rotaries or traffic circles, which can be as big as the entire outfield. Roundabouts feature lower, safer vehicle speeds. They can be 80 feet across with single lanes carrying 25,000 vehicles a day or larger at 200 feet, with double lanes and 45,000 vehicles a day.³

Personal injuries and fatalities plummet as much as 90 percent in modern roundabouts when compared to conventional intersections.⁴ Roundabouts cause drivers to slow down, ideally to less than 20 mph, which reduces the risks to both pedestrians and drivers.

Because roundabouts can handle 30 to 50 percent more traffic than conventional intersections, they reduce travel delays.⁵ Since roundabouts can be designed to be aesthetically pleasing, they help create a sense of place.

By January 2014, roundabouts graced more than 1,000 intersections in the U.S., with more planned. To maximize their safety and placemaking benefits, roundabouts should be considered for many more of the 100,000 intersections in the U.S.

AARP[®]
Real Possibilities

Modern roundabouts are calmer and safer than conventional intersections and have been deemed a “proven safety counter-measure” by the U.S. Department of Transportation.



Vehicle speeds on Grandview Drive in University Place, Wash., often reached or exceeded 50 mph. After the installation of modern roundabouts, vehicle crashes dropped from one every nine months to zero in 14 years.

Intersection Comparison

Signalized Intersection	Roundabout Intersection
<ul style="list-style-type: none">• High speeds	<ul style="list-style-type: none">• Low speeds
<ul style="list-style-type: none">• Wide visual scans	<ul style="list-style-type: none">• Narrow visual scans
<ul style="list-style-type: none">• Less response time	<ul style="list-style-type: none">• More response time
<ul style="list-style-type: none">• Harder to judge gaps	<ul style="list-style-type: none">• Easier to judge gaps
<ul style="list-style-type: none">• High severity crashes	<ul style="list-style-type: none">• Low severity crashes



Roundabouts Implementation

Myth: “The public will object to using a roundabout”

Public Opinion Improves After Roundabouts Are in Place

Mount Horeb, WI

Roundabout success surprises residents

The newest intersection in Mount Horeb proves helpful in alleviating an old problem.

By Valeria Davis-Humphrey
Wisconsin State Journal

MOUNT HOREB — For a town generally skeptical that a roundabout would solve traffic problems, Mount Horeb residents are pretty pleased now that it's open.

With few hesitations, drivers were coping handily with the new road, which opened late Thursday.

Traffic flows one way—counterclockwise—around the 140-foot circular intersection where four major roads converge: highways 78, 92, ID and 18-151 leading into downtown Mount Horeb.

It replaces a cumbersome and outdated intersection that frequently lost its signal lights to semitrucks trying to negotiate turns.

"Most of the customers who have come in say it's not as bad as they thought it would be," said Lance Hook, owner of My Mechanic, one of the businesses pushed back to

make room for the roundabout.

"It used to be that you'd have to wait forever to get out of here, and I used to get to see the semis go through and take the stop lights down," Hook said.

But on Friday, drivers were adapting to the change and perhaps paying more attention to one another than in the past when negotiating the right-of-way.

While roundabouts are common in some urban areas, it's new enough in Mount Horeb to draw a temporary audience. Resident Richard Moore watched, eating

chips in his parked truck.

"I've seen a couple of close calls already," Moore said. "I guess it isn't clear who's supposed to yield to who."

Each entry to the roundabout has a yield sign to allow drivers to use their judgement, said state Department of Transportation Project Engineer Bill Strobel.

The traffic circle is designed for a speed of about 15 mph, he said, although the road's curve makes it appear that vehicles are moving

Please see **SUCCESS**, Page B2

Wisconsin State Journal

May 29, 2004

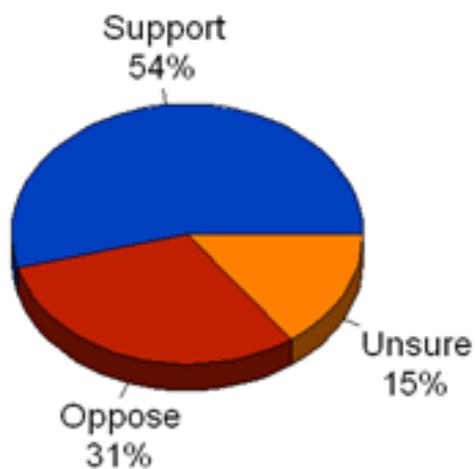
4 More roundabouts built 2 years after the first opened

Mead&Hunt

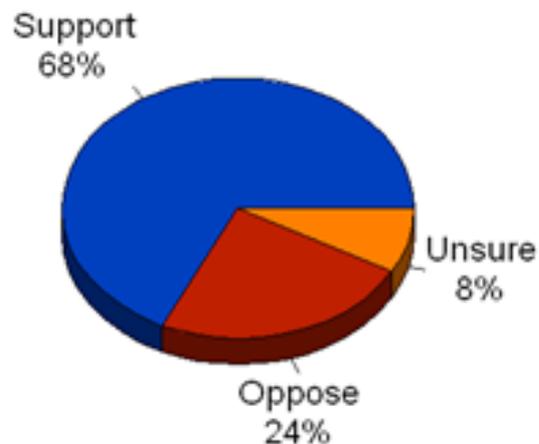
Public Opinion – A Typical Survey

Construction of More Roundabouts

2011 City of Woodbury



2009



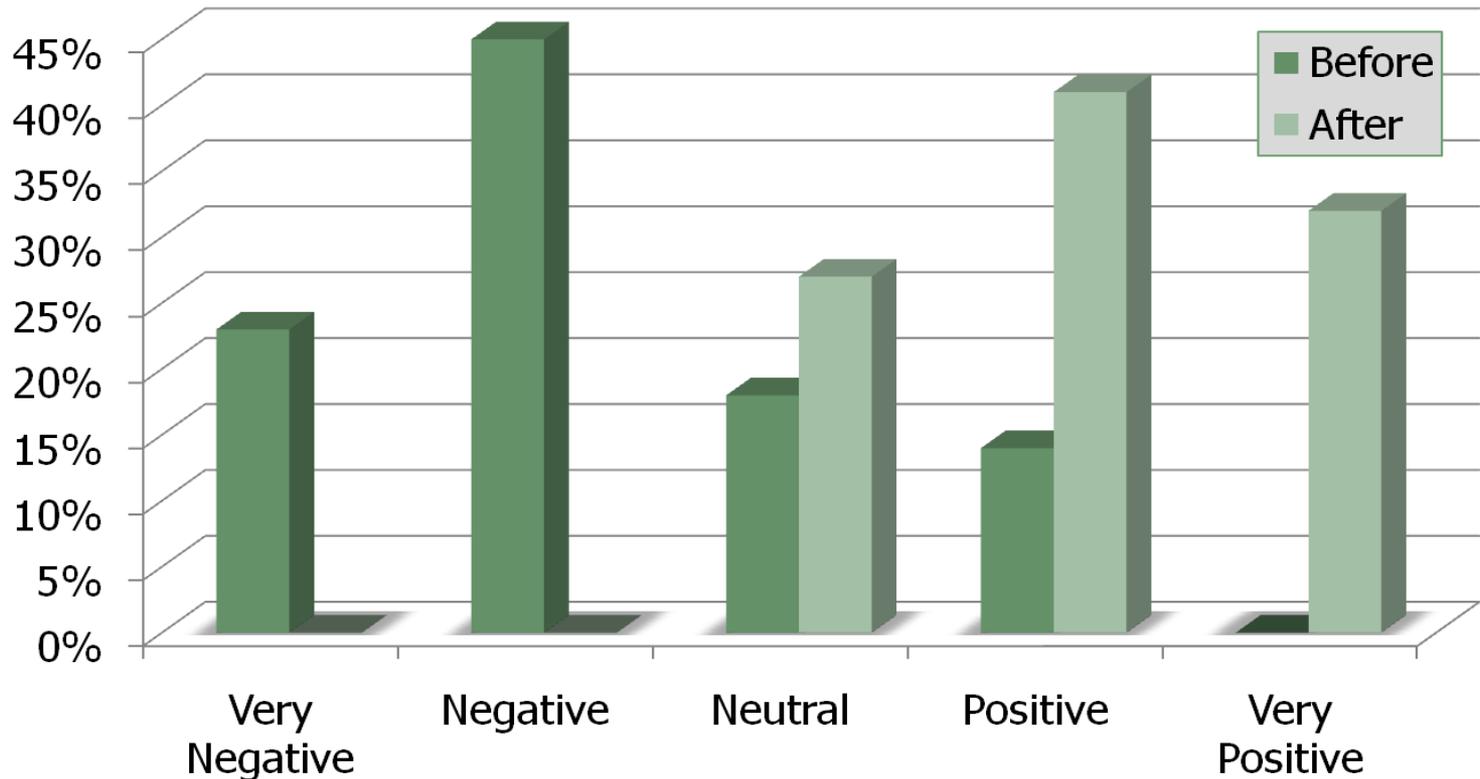
2011

Decision Resources, Ltd.

People argue against change but few oppose better safety

Typical Public Opinion

**Public Attitude Towards Roundabouts
(Before and After Construction)**



**TABLE 7
PUBLIC ATTITUDE
AND AFTER CONST**

Attitude	Percent	
	Before Construction	After Construction
Very negative	23	0
Negative	45	0
Neutral	18	27
Positive	14	41
Very positive	0	32



Where are roundabouts being installed?

FHWA Memo – Consideration and Implementation of Proven Safety Countermeasures; July 10, 2008



U.S. Department
of Transportation
Federal Highway
Administration

Memorandum

Subject: ACTION: Consideration and Implementation of Proven Safety Countermeasures Date: July 10, 2008

From: 
Jeffrey A. Lindley
Associate Administrator for Safety In Reply Refer To: HSSI

To: Division Administrators
Federal Lands Highway Division Engineers

Improving safety is a top priority of the US Department of Transportation, and FHWA remains strongly committed to reducing highway fatalities and serious injuries on our Nation's highways. We know that a comprehensive mix of strategies is required—including stronger policies to support system-wide and sustainable improvements. We believe our area of greatest potential influence is how Federal funds are used and targeted to implement improvements that will have a positive impact on safety.

In our stewardship and oversight role for federally funded highway programs, we have the opportunity to strongly encourage Federal, State, local agencies, and tribal governments to include safety in their investment decision-making process. While there is still much work to do on determining the precise effectiveness of some safety countermeasures, we are highly confident that certain processes, infrastructure design techniques, and highway features are effective and should be encouraged whenever Federal funds are used. Safety should be considered at every stage of the project development process. Every investment decision should consider the impact on safety and every federally funded project should include appropriate safety enhancement features.

This guidance memorandum highlights when and where we believe certain processes, design techniques, or safety countermeasures should be used. This document also includes countermeasure descriptions and background on the proven effectiveness and benefits; a statement on when the countermeasure or process should be applied; links to reference documents; and current FHWA technical contacts for each topic. This guidance was developed based on effectiveness data for various crash types compiled from a variety of sources. It reflects the types of circumstances and situations that we are confident will yield high pay-offs and be cost beneficial for all projects.

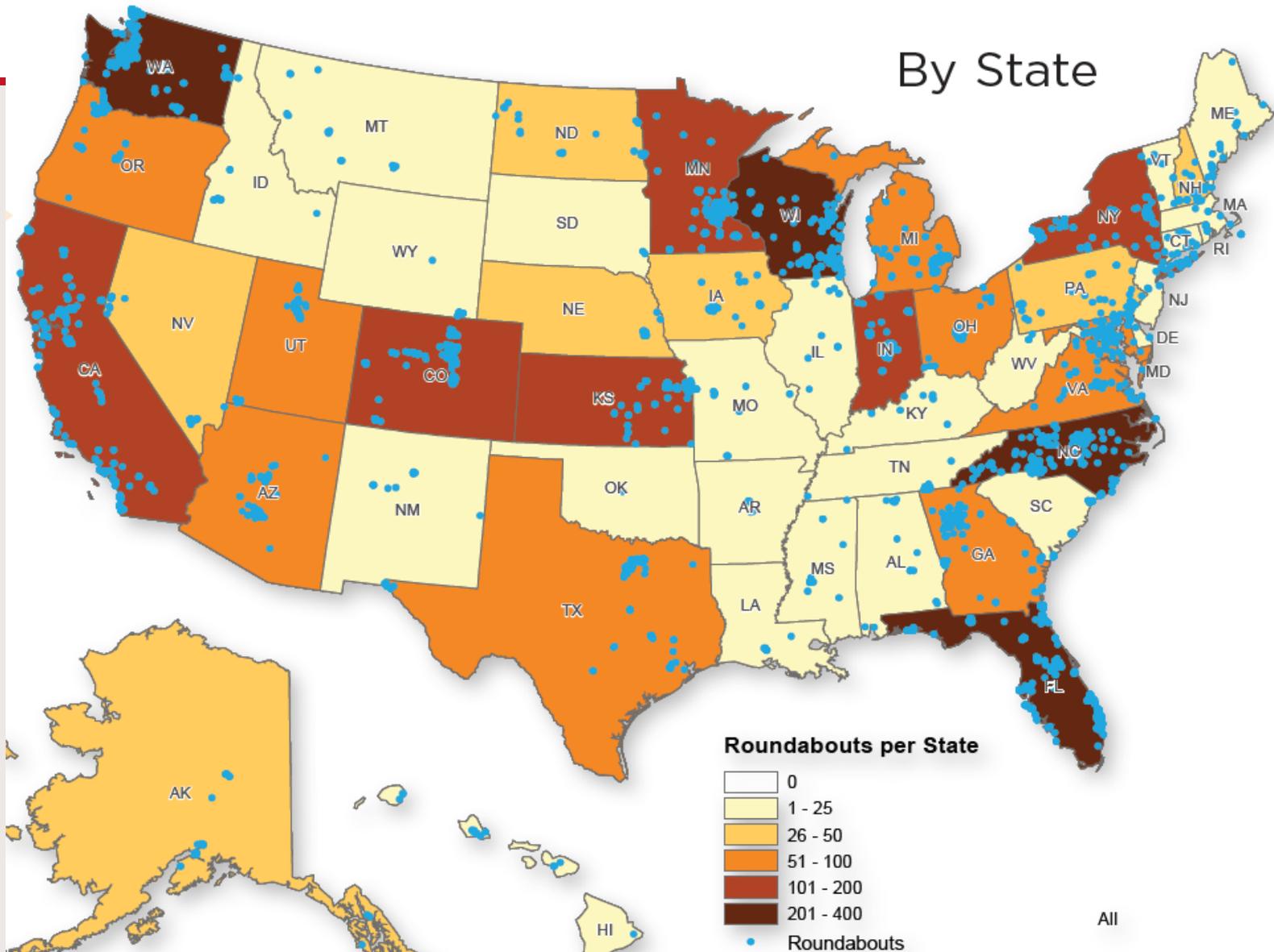
**MOVING THE
AMERICAN
ECONOMY**



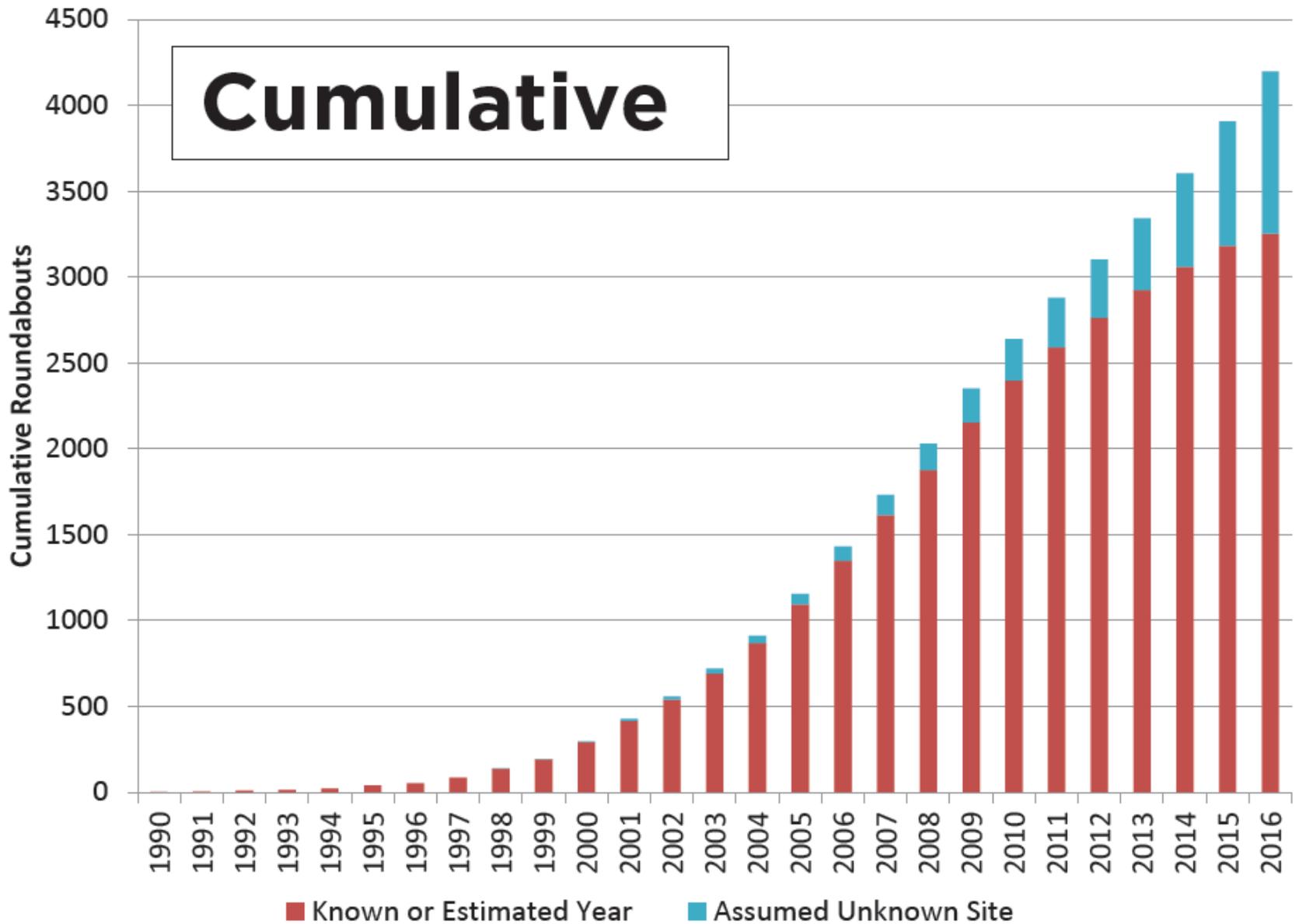
- Roundabouts are the preferred safety alternative for a wide range of intersections. Although they may not be appropriate in all circumstances, **they should be considered as an alternative for all proposed new intersections on Federally-funded highway projects**, particularly those with major road volumes less than 90 percent of the total entering volume.
- Roundabouts should also be considered for all existing intersections that have been identified as needing major safety or operational improvements. This would include freeway interchange ramp terminals and rural intersections.

Known Roundabouts in the U.S.

By State



Cumulative

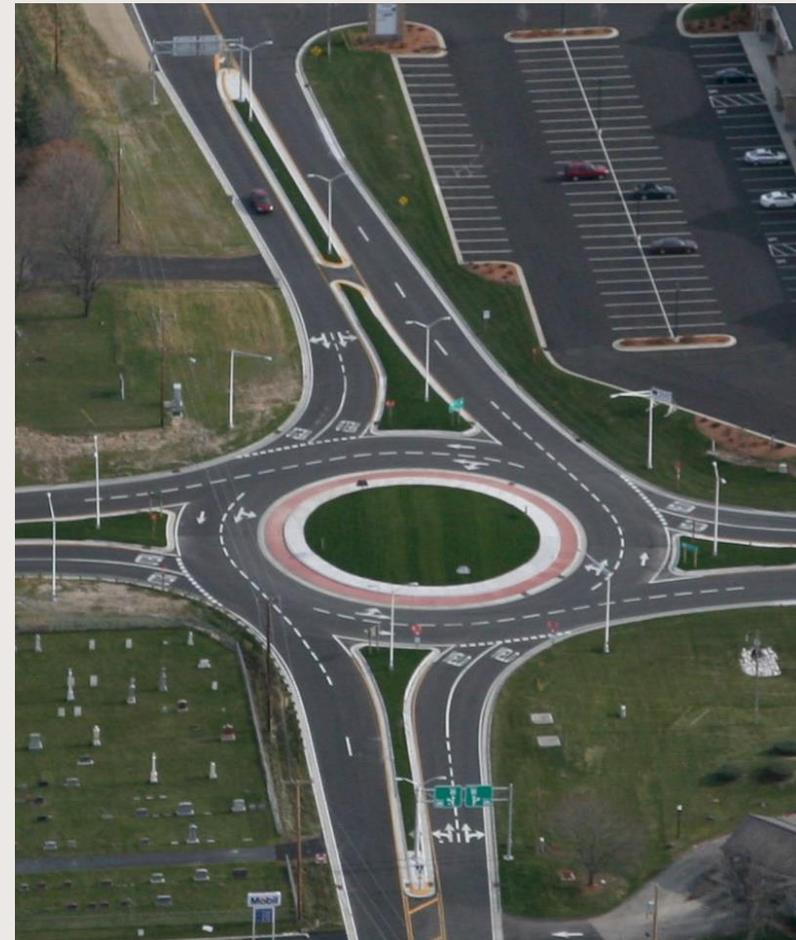


Source: Kittelson & Associates

Mead&Hunt

Price of Implementation

- Require interaction with other drivers
 - Not just a red or green light
- Some are only willing to adapt if it equates to a benefit
- Initial construction cost may be more
- Effort is worth it!!



Long Term Cost of Maintenance

- Construction cost plus cost of property acquisition usually higher with a roundabout
- Maintenance costs usually higher for traffic signals (power, periodic bulb replacement, review of signal timings, etc.)
- Roundabouts function during power outages
- Roundabouts may need landscape maintenance and more illumination
- Consider societal costs of crashes?
- Consider societal cost of delay?

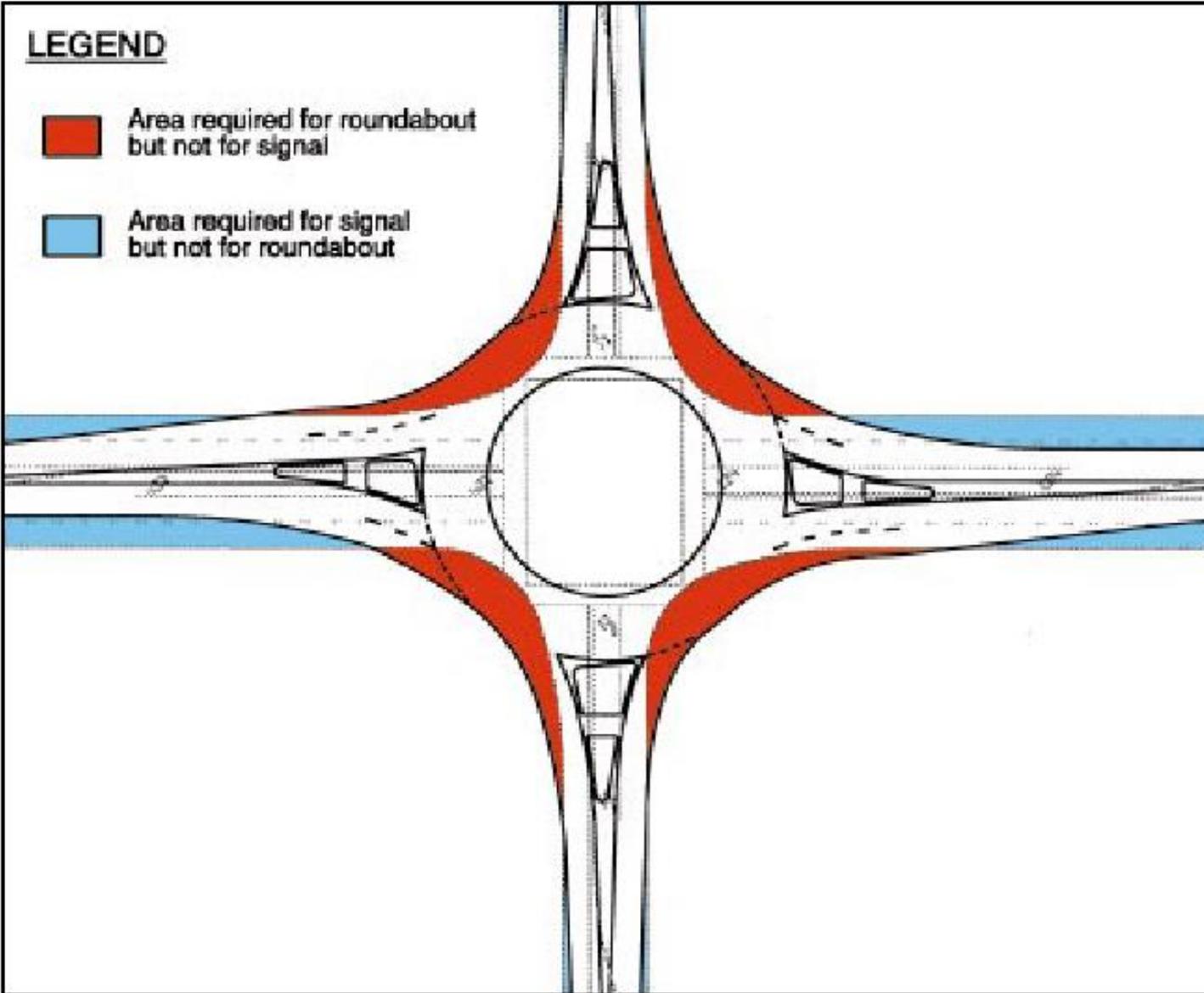
Typical Comparison Results

Intersection Control Type	Averaged Crash Costs by Confidence Level		
	Lower Limit	Mean	Upper Limit
One-Way Stop Control	\$0	\$243,000	\$626,000
Signalized Intersection	\$0	\$440,000	\$1,251,000
Roundabout	\$0	\$151,000	\$463,000

Cost Item	One-Way Stop Control	Signalized Intersection	Roundabout
Estimated Construction Cost	\$327,000	\$717,000	\$845,000
Mean Injury Crash Cost (PC)	\$243,000	\$440,000	\$151,000
Annual Signal Maintenance (PC)	-	\$22,000	-
Total Cost	\$570,000	\$1,179,000	\$996,000

LEGEND

-  Area required for roundabout but not for signal
-  Area required for signal but not for roundabout



Reduce congestion and pollution

Efficient during peak and off-peak

Stops

Idling

Delay



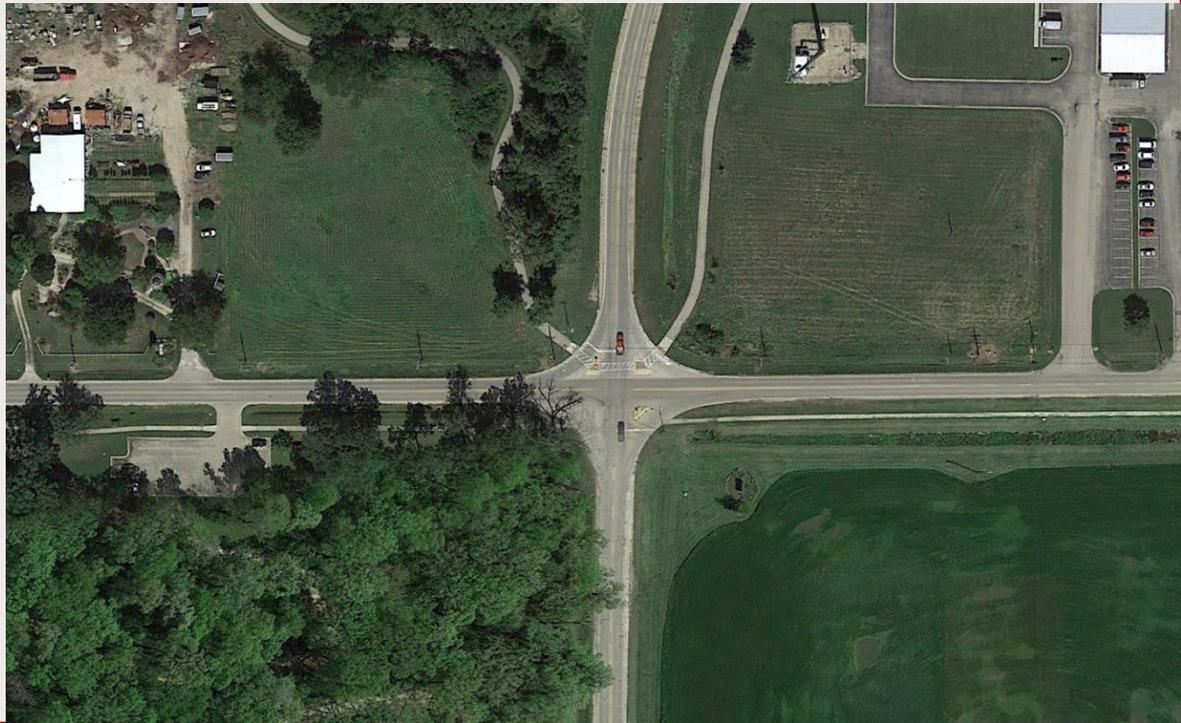
Community Enhancement

- Quieter
- Functional
- Aesthetically pleasing
- Compliment community values



LeFevre Road and Lynn Boulevard

- High Speed Approaches (35 - 45 mph)
- Sight Distance Constraints
- Truck Route
- Pedestrian and Bicycle Path Crossings
- Developing Area





Safety Benefits Can be Realized with Roundabouts

- Provide more time for entering drivers to judge, adjust speed for, and enter a gap in circulating traffic, allowing for safer merges
- Reduce the size of sight triangles needed for users to see one another
- Increase the likelihood of drivers yielding to pedestrians (compared to an uncontrolled crossing)
- Provide more time for all users to detect and correct for their mistakes or mistakes of others
- Make crashes less frequent and less severe
- Make the intersection safer for novice users

Transitions or “Gateways” from higher speed to lower speed areas

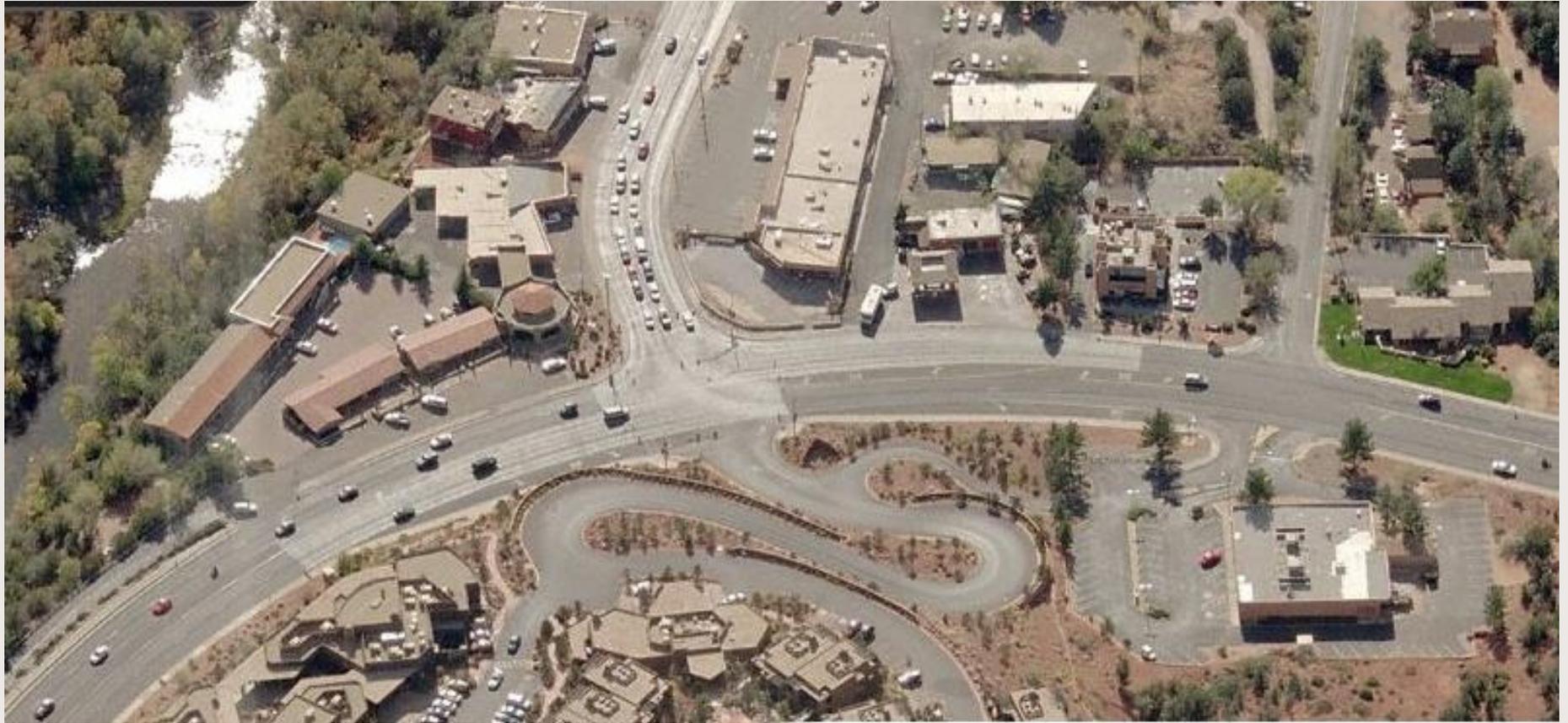
Roundabouts make for good transitions in speed change (including rural to urban transitions).



Driving a Roundabout

- Slow down approaching the roundabout
- Observe all signs and pavement markings
- Yield to pedestrians in the crosswalks
- Yield to all vehicles in the roundabout
- Travel counter-clockwise – when in the circle you have the right-of-way over entering traffic
- As you exit the roundabout watch for pedestrians in the crosswalk, and be prepared to stop
- Give large vehicles plenty of space

Sedona, AZ (11 Roundabouts)



Sedona - After

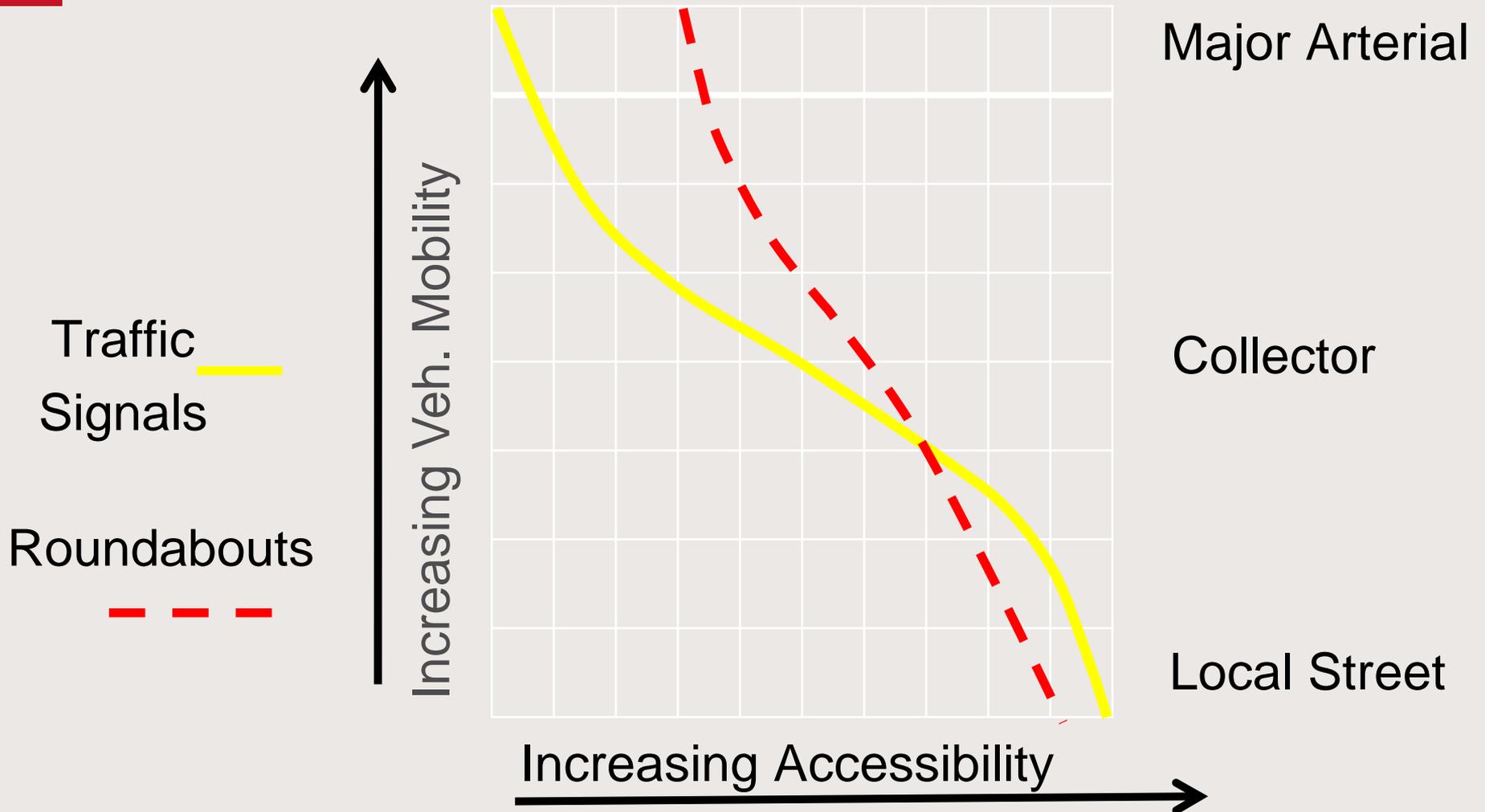


- Keep the roadways narrow
- Improve mobility without adversely impacting access
- Calm traffic – reduce speeds, uniform speeds
- Shorten pedestrian crossings
- Beautify intersections



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Mobility without loss of access...



Bike Ramps



Fast Path Speeds

