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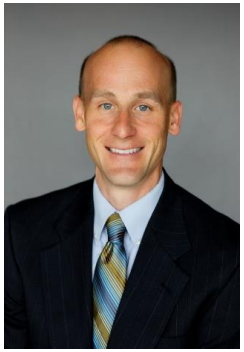
SIO
SYSTEMS IMPLEMENTATION OFFICE

Statewide Access Management and Transportation Site Impact

WEBINAR SERIES

Webinar Staff

Gina Bonyani



Kevin Kuhlow

David Amato

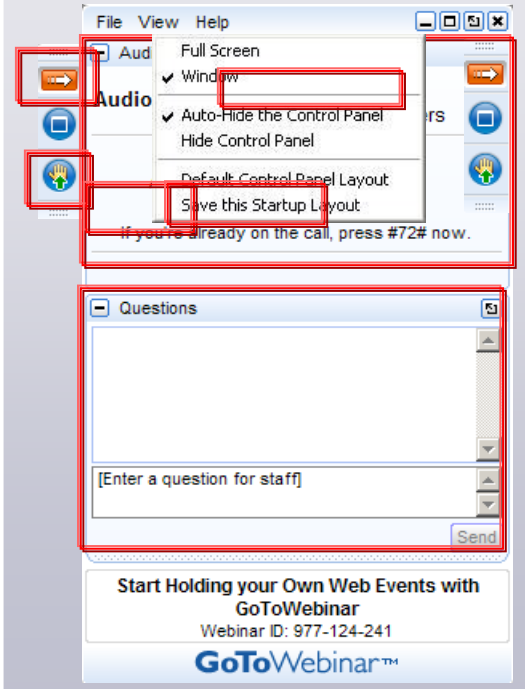
Jenna Bowman

Karla Matos

Agenda

- How to Participate
- Credits and Webinar Material
- Roundabouts and Access Management
- Questions
- Contact Info

How to Participate Today



- Open and close your Panel
- View, Select, and Test your audio
- Submit text questions
- Raise your hand
- Q&A addressed throughout the webinar

Statewide Access Management and Transportation Site Impact

WEBINAR SERIES

The FDOT Access Management and Transportation Site Impact Webinar Series 2020-2021 have been scheduled for the following dates:

Tue, Aug, 18, 2020 | 2:00PM - 3:30PM EDT

NEXT! Tue, Nov 17, 2020 | 2:00PM - 3:30PM EST

Tue, Feb 16, 2021 | 2:00PM - 3:30PM EST

Tue, May 18, 2021 | 2:00PM - 3:30PM EDT

Learning Curve

FDOT's Systems Implementation Office is utilizing the **Learning Curve** system for participant communications and management of the Statewide Access Management Quarterly Webinar.

Credits Information

- Credits will be distributed four to **five** business days after the webinar, through Learning Curve.
  - PDH's Credits, AICP Credits Information, and Course Certificates
- Your participation will be recorded by GoToWebinar.
  - You will need to attend to the **entire webinar** with the ***unique link*** provided by GoToWebinar.

GoToWebinar LearningCurve

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Webinar Material

- Webinar materials will be sent via the **Learning Curve System.**
- Recorded webinars and presentation material will be posted on the Systems Implementation Office website:
  - Training & Webinars
    - Access Management

What organization do you Represent?

- FDOT
- Local Government
- Private Firm
- Other

Statewide Access Management and Transportation Site Impact

WEBINAR SERIES

Today's Webinar

Roundabouts and Access Management

Tuesday, August 18, 2020

2:00PM – 3:30 PM, EDT

Credits: 1.5

Speaker:

Kevin Kuhlow, PE

Manager-Transportation Services

How familiar are you with Roundabouts?

- Very Familiar
- Somewhat Familiar
- Not Familiar

FDOT Statewide Access Management Webinar Series 2020 – 2021

Webinar #1

Roundabouts and Access Management

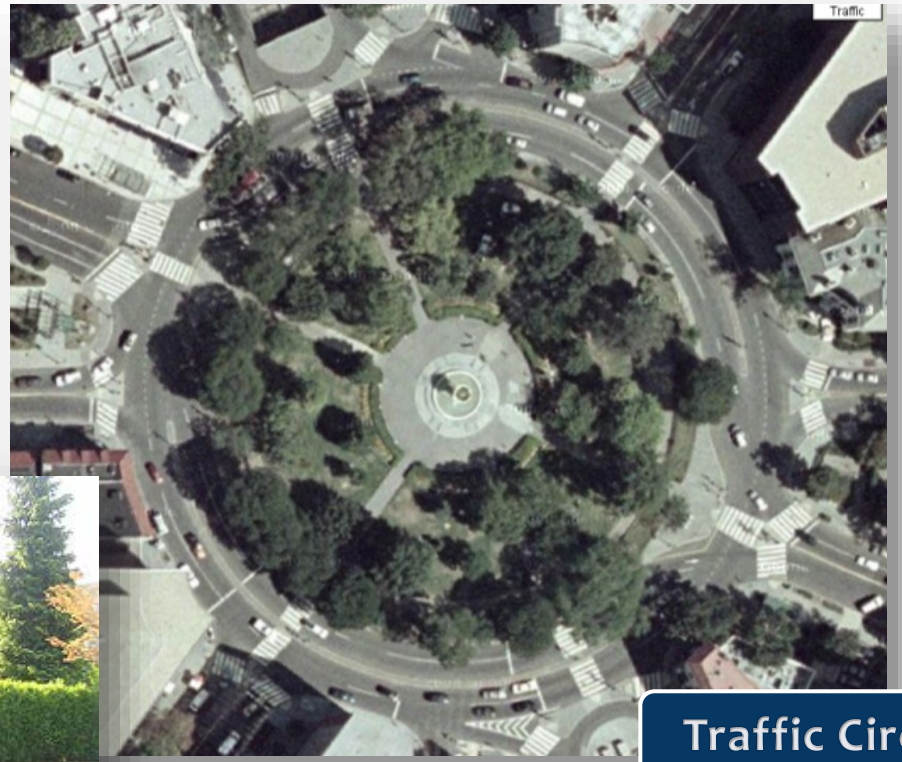
Kevin Kuhlow, PE

Ayres

August 18, 2020

What isn't a Modern Roundabout?

Rotary



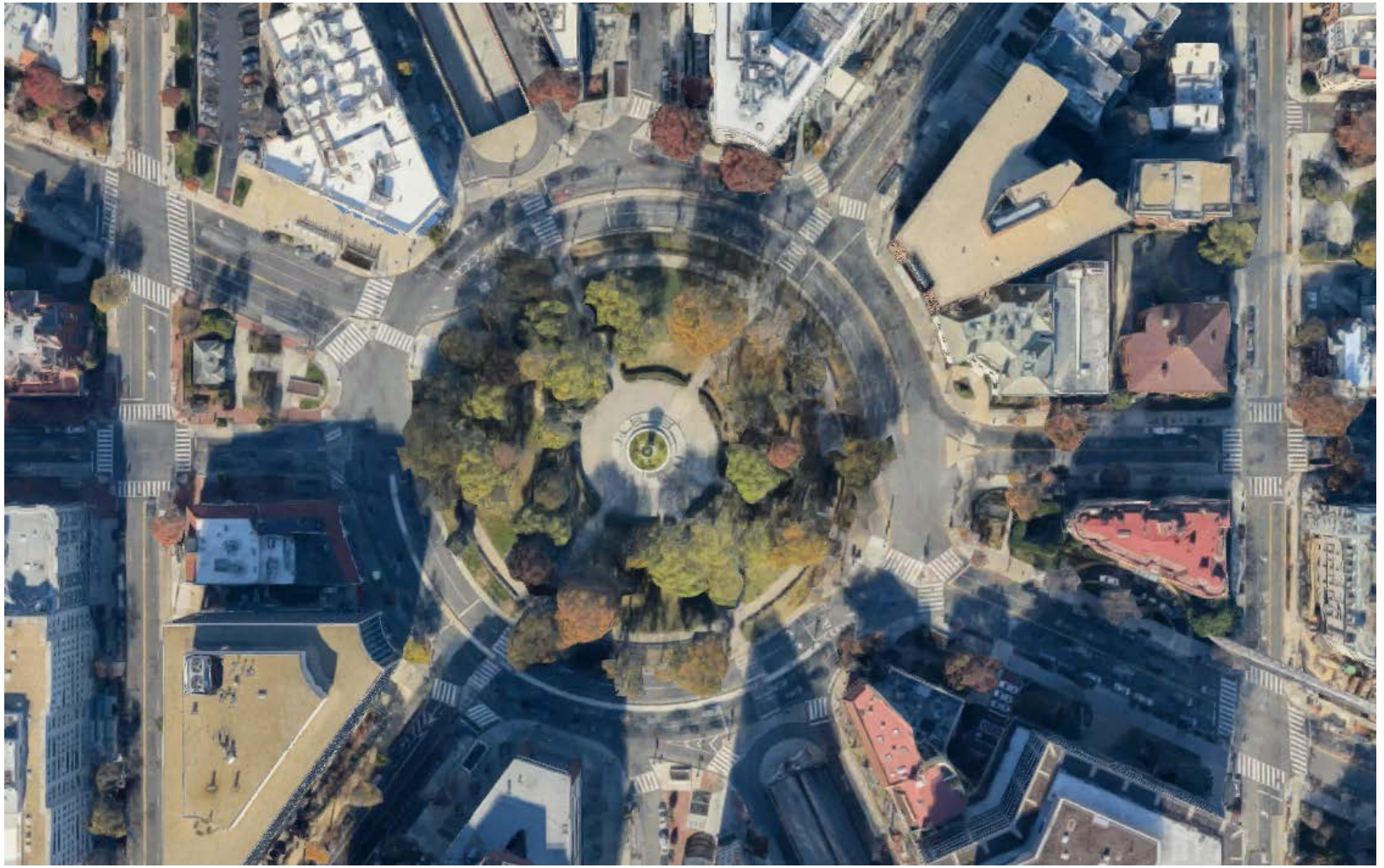
Traffic Circle

Traffic Calming Circle

FDOT

Dupont Circle

Northwest Washington, DC - 1871



Columbus Circle

Central Park Southwest, New York, NY - 1905

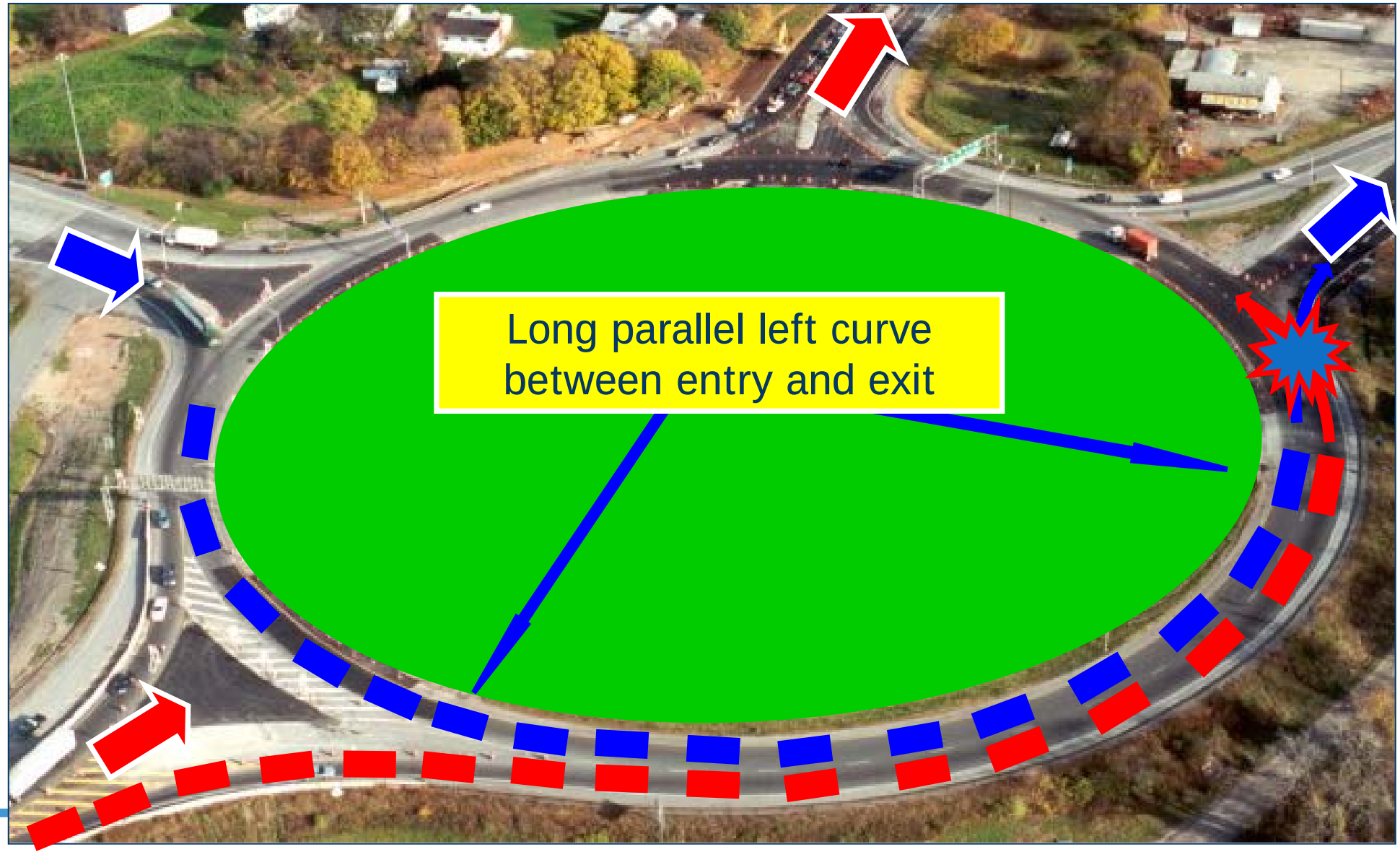
Not just intersections: Landmarks!

Rotaries

- Very large
- High speeds entry and circulating
- A ‘free for all’
- Weaving in circle
- Scary to drive
- Low capacity
- High speed crashes

Interstate 87 - Interstate 587 Interchange, Kingston, NY

Weaving in a Rotary



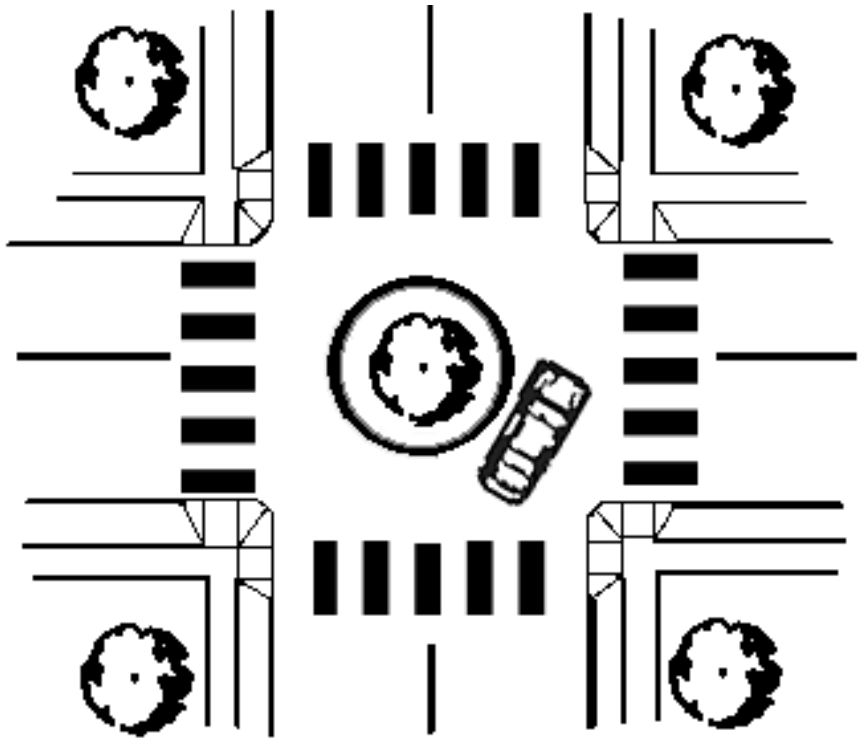
Rotary Conversion

Worcester, Mass.

Before

After

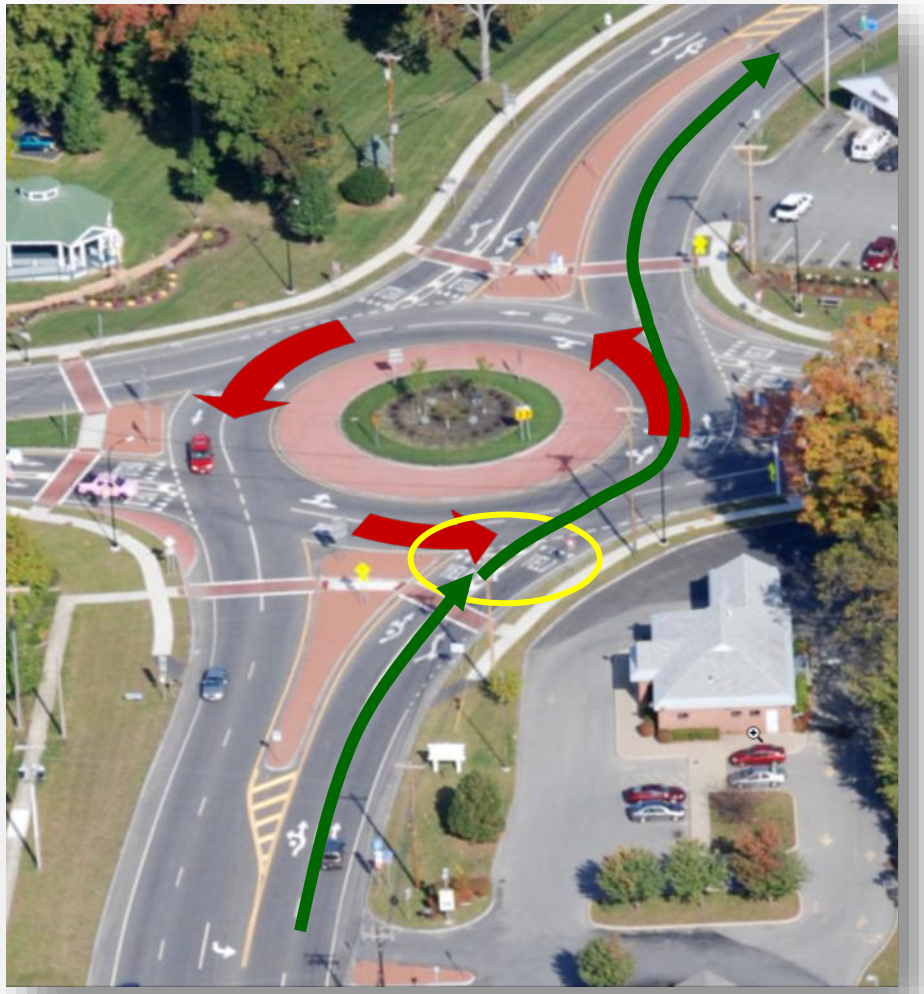
Traffic Calming Circles



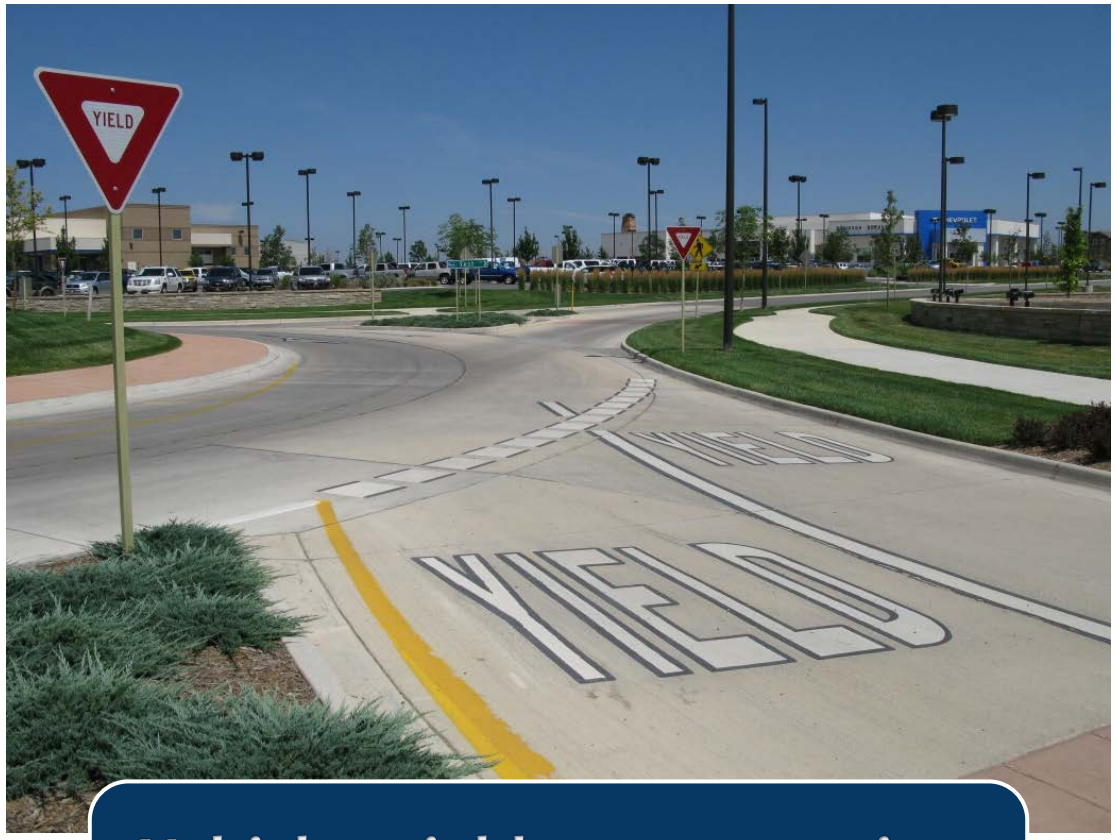
- Often limited speed control
- Rarely fit a larger vehicle
- No splitter islands

What is a Modern Roundabout?

- A compact circular intersection in which traffic flows counter-clockwise around a center island
- Entering traffic yields
- Approaches are channelized to deflect traffic to slow entry speeds



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

Truck Apron

Where trucks are common, a properly designed apron may be necessary

Pedestrian Accommodations

Two stage crossing

A Modern Roundabout is:

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

Types of Roundabouts

Roundabouts may be considered for a wide range of intersection types

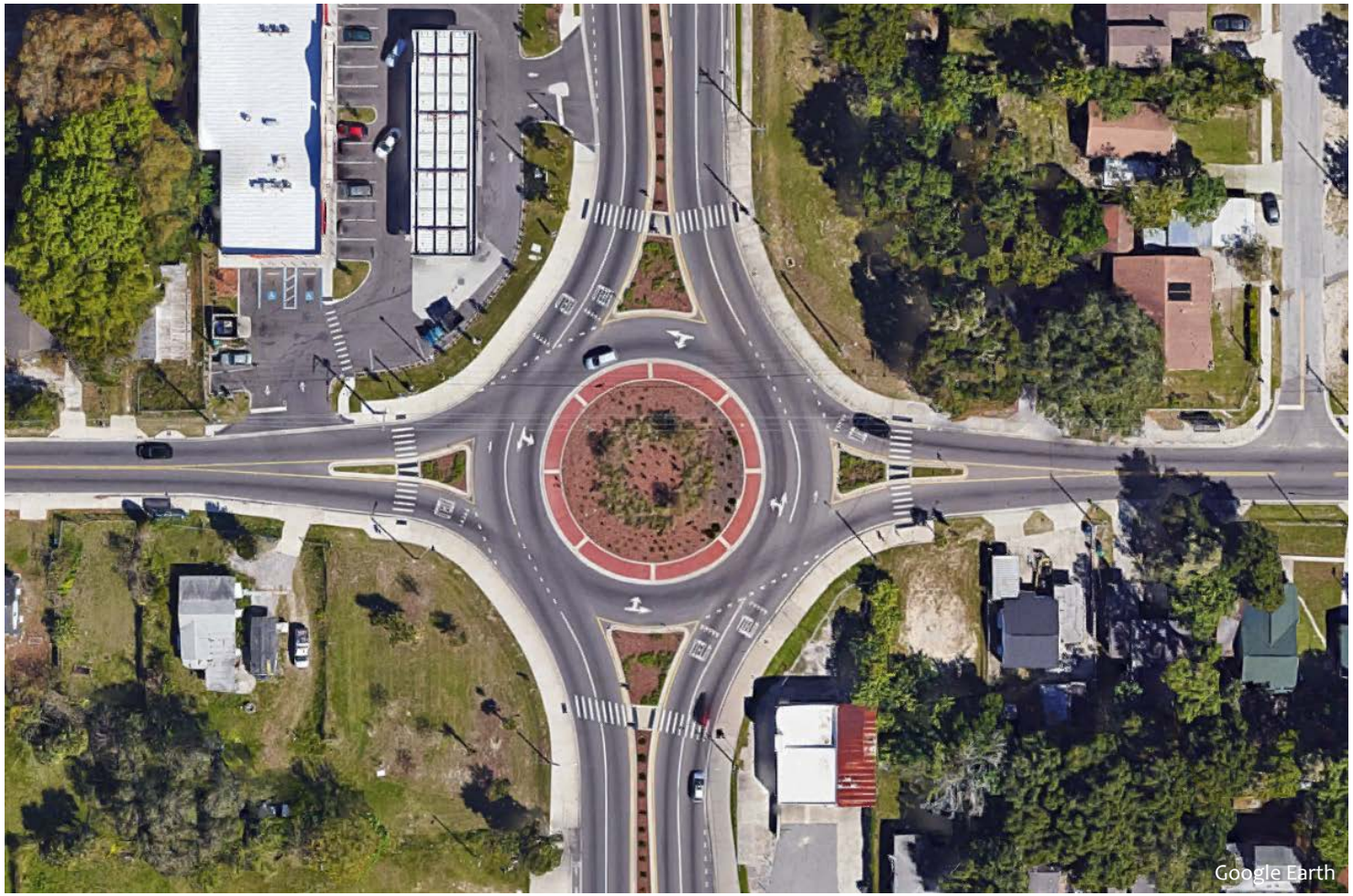
- Generally process high volume left turns more efficiently than all-way stop control or traffic signals
- Process a wide range of side road volumes
- Improve safety by simplifying traffic movements
- Reduce vehicle speeds
- Required intersection sight distance is greatly reduced

Types of Roundabouts

Single-lane Roundabouts

Types of Roundabouts

Multilane Roundabouts

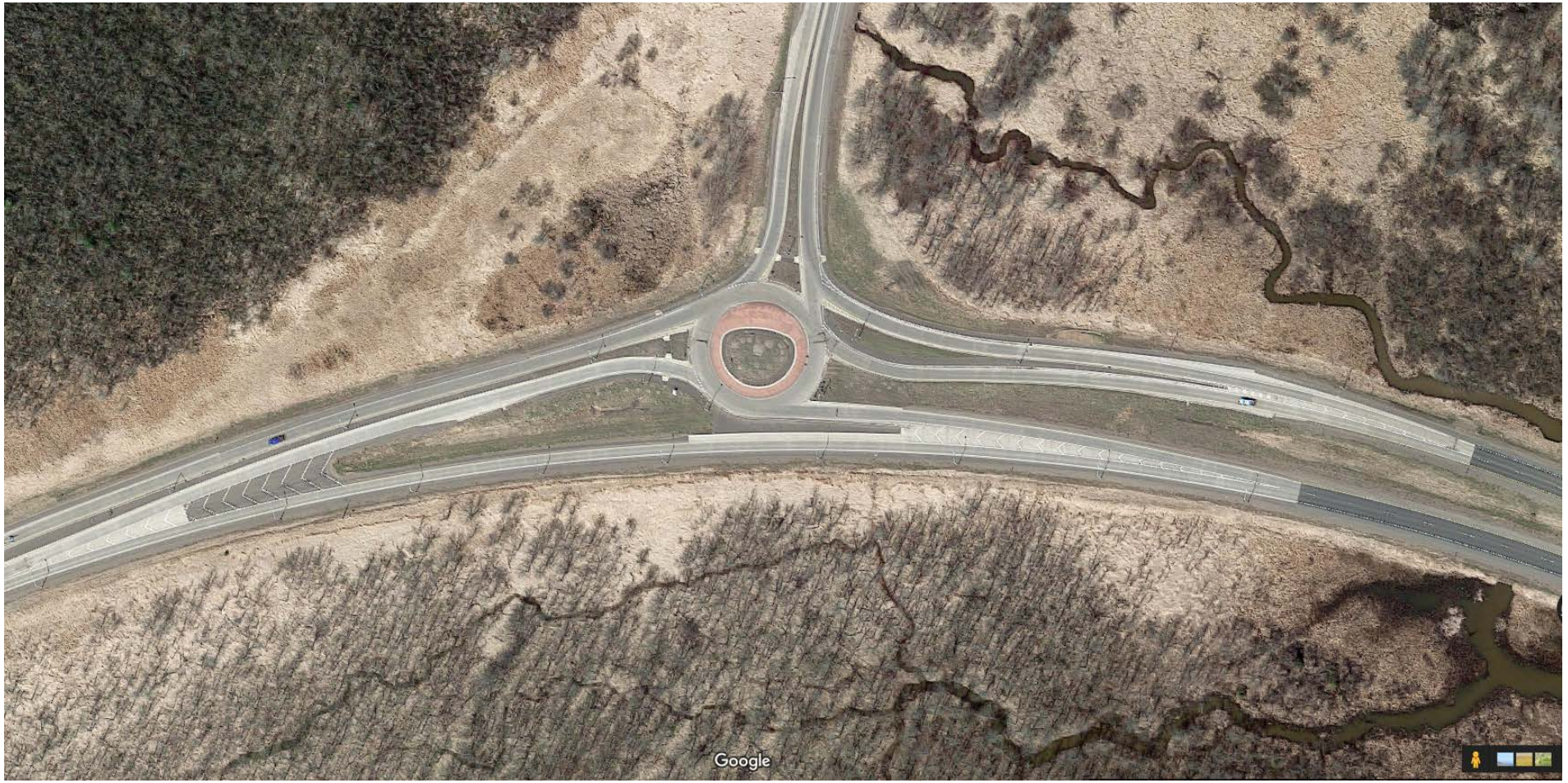


Types of Roundabouts

Multilane Roundabouts

Types of Roundabouts

With free flow bypass lane



Types of Roundabouts

Closely spaced intersections

Types of Roundabouts

Closely spaced intersections

Types of Roundabouts

Interchange Roundabouts

Types of Roundabouts

Interchange Roundabouts

Types of Roundabouts

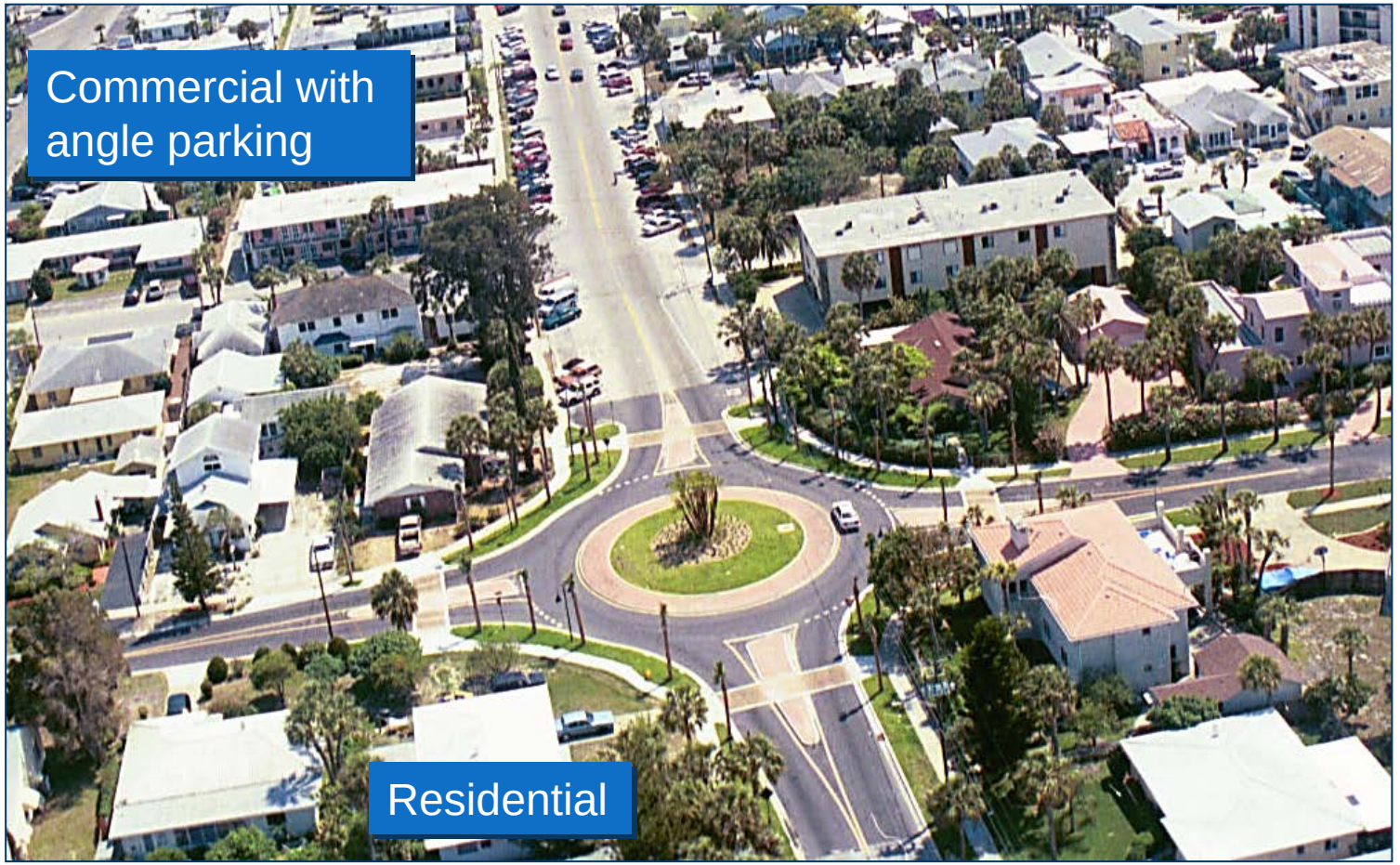
Roundabout Corridors

Types of Roundabouts

Rural to urban transitions

Types of Roundabouts

Commercial to residential transitions



Why Roundabouts?

- Traffic Safety – Significant reduction in injury crashes
- Traffic Calming - Reduce vehicle speeds
- Pedestrian Safety - Focus on one traffic stream
- Operational Performance - Reduce overall delay
- Operations and Maintenance – Reduce costs
- Approach Roadway Width – Reduce impacts
- Environmental Factors
- Access Management and Land Use
- Aesthetics

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FDOT KABCO Crash Costs 2011-2015

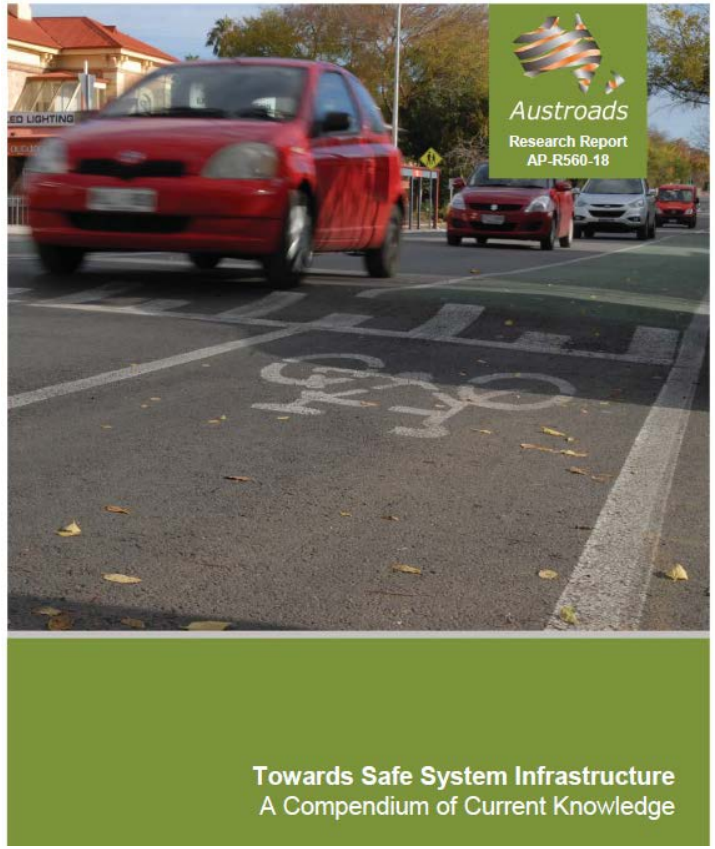
Crash Severity	Comprehensive Crash Cost
Fatal (K)	$ 10,560,000
Severe Injury (A)	$ 599,040
Moderate Injury (B)	$ 162,240
Minor Injury (C)	$ 100,800
Property Damage Only (O)	$ 7,600

SOURCE: Florida Department of Transportation State Safety Office's Crash Analysis Reporting (CAR) System, analysis years 2011 through 2015.

Cost of Crashes

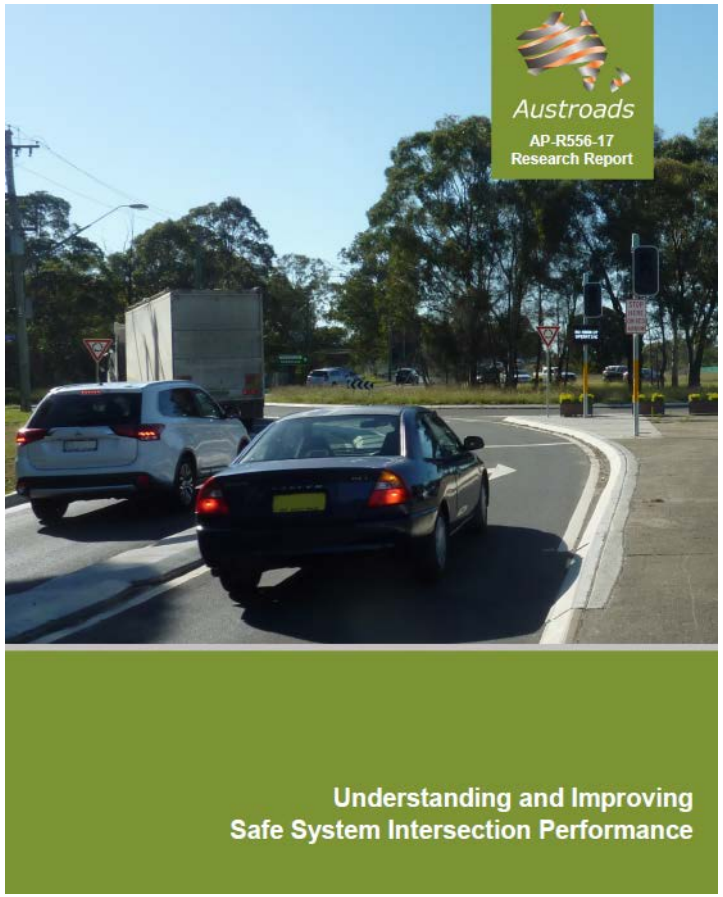
Safe System Approach

"Safe System is the management and design of the road system such that impact energy on the human body is firstly avoided or secondly managed at tolerable levels by manipulating speed, mass and crash angles to reduce crash injury severity."



Reference: Austroads Report AP-R560-18 Towards Safe System Infrastructure: A Compendium of Current Knowledge

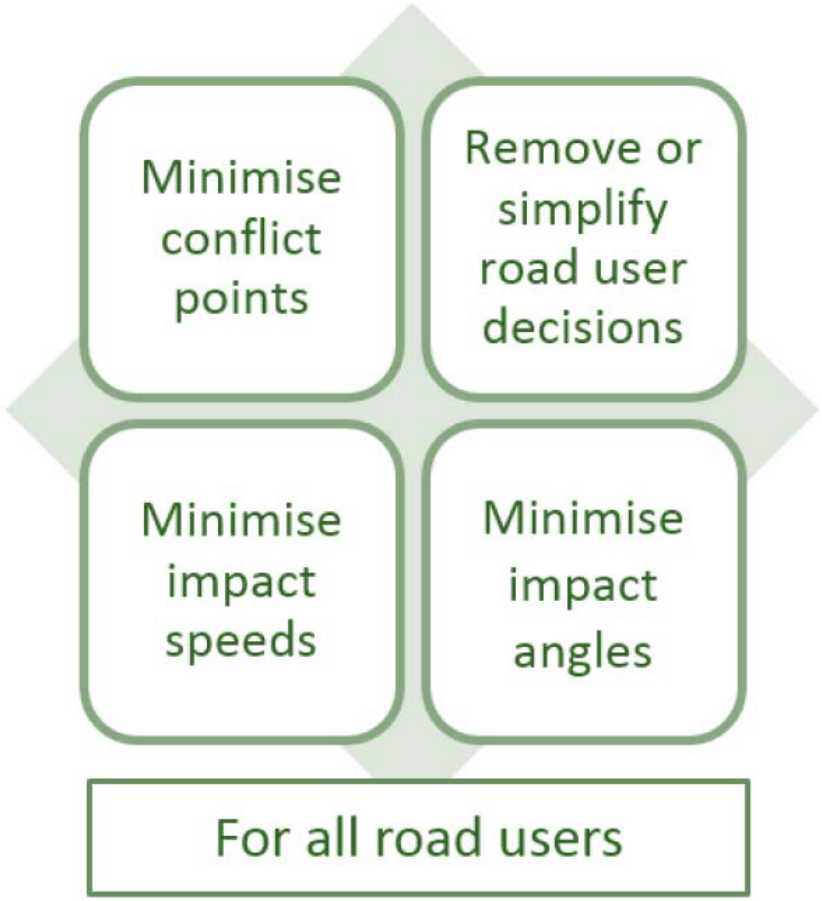
Safe System for Intersections



Intersection design principles for a Safe System:

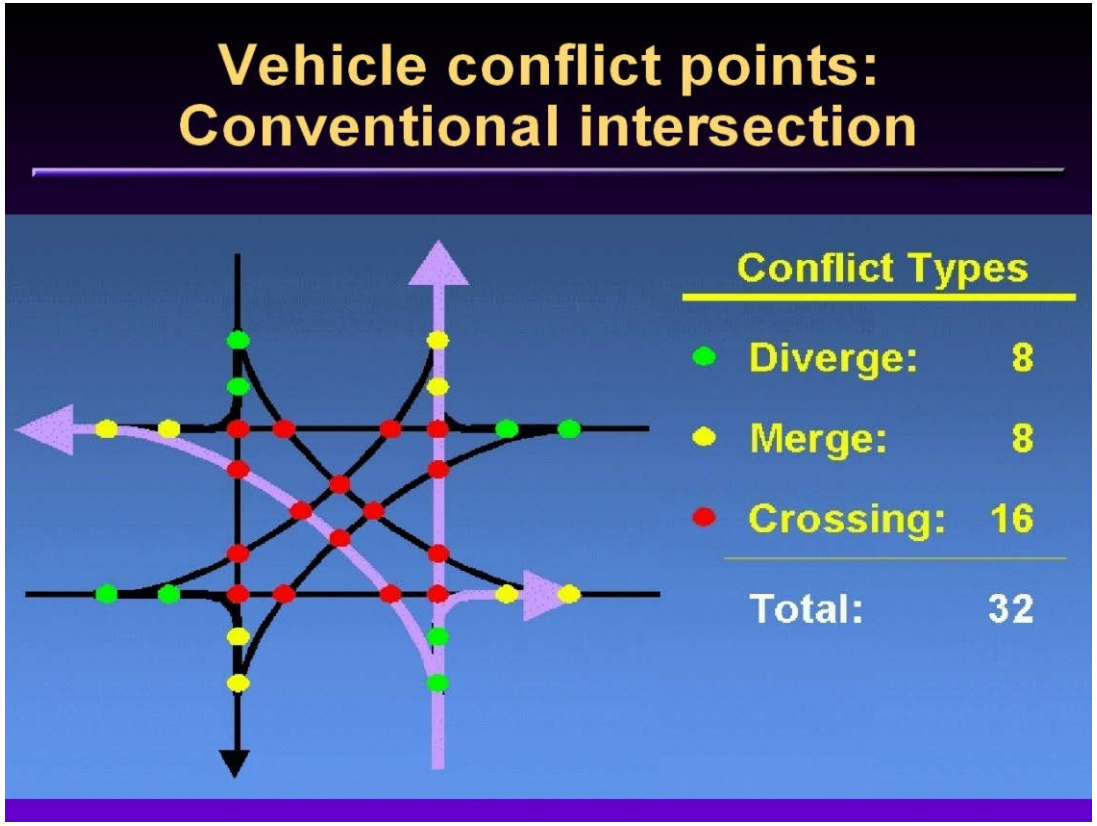
- Simplify (or remove) road user decisions
- Reduce the number of crossing conflict points
- Reduce collision impact angles
- Minimize impact speeds

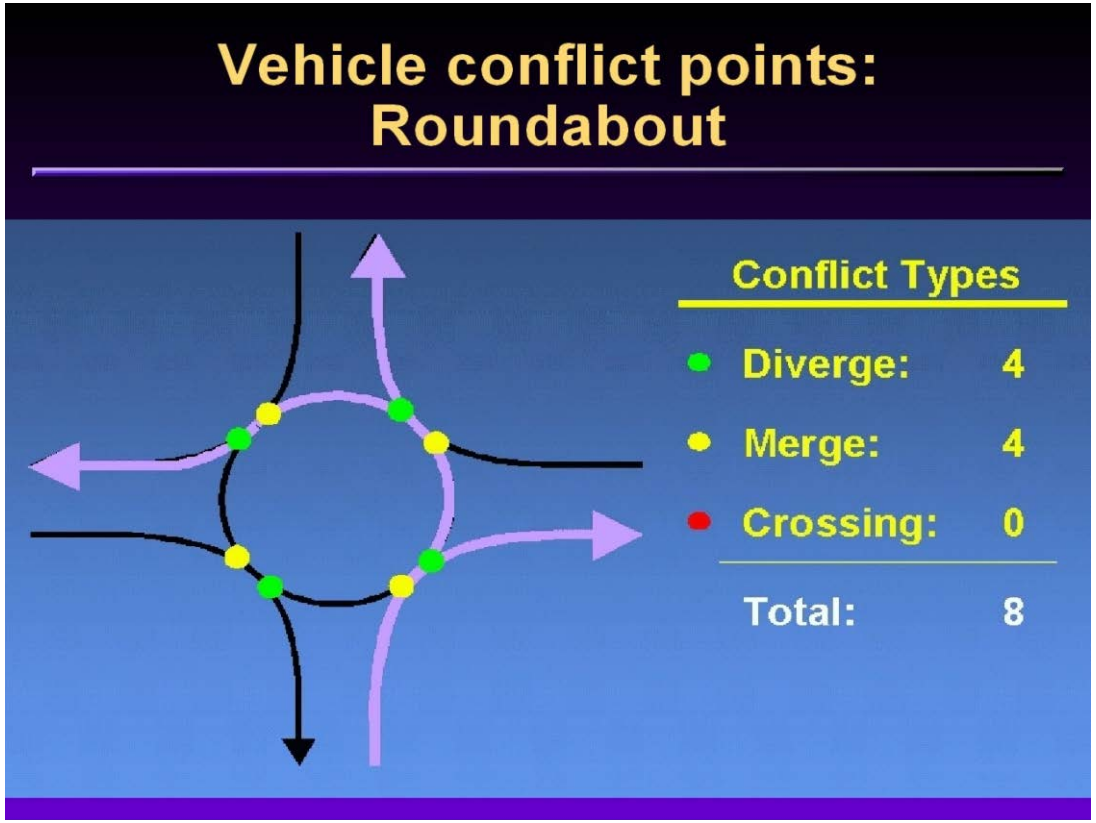
Safe System Intersection Design Principles



Source: Understanding and Improving Safe System Intersection Performance, Austroads Research Report AP-R556-17

Conflict Points Comparison





- Crashes of this type are more severe

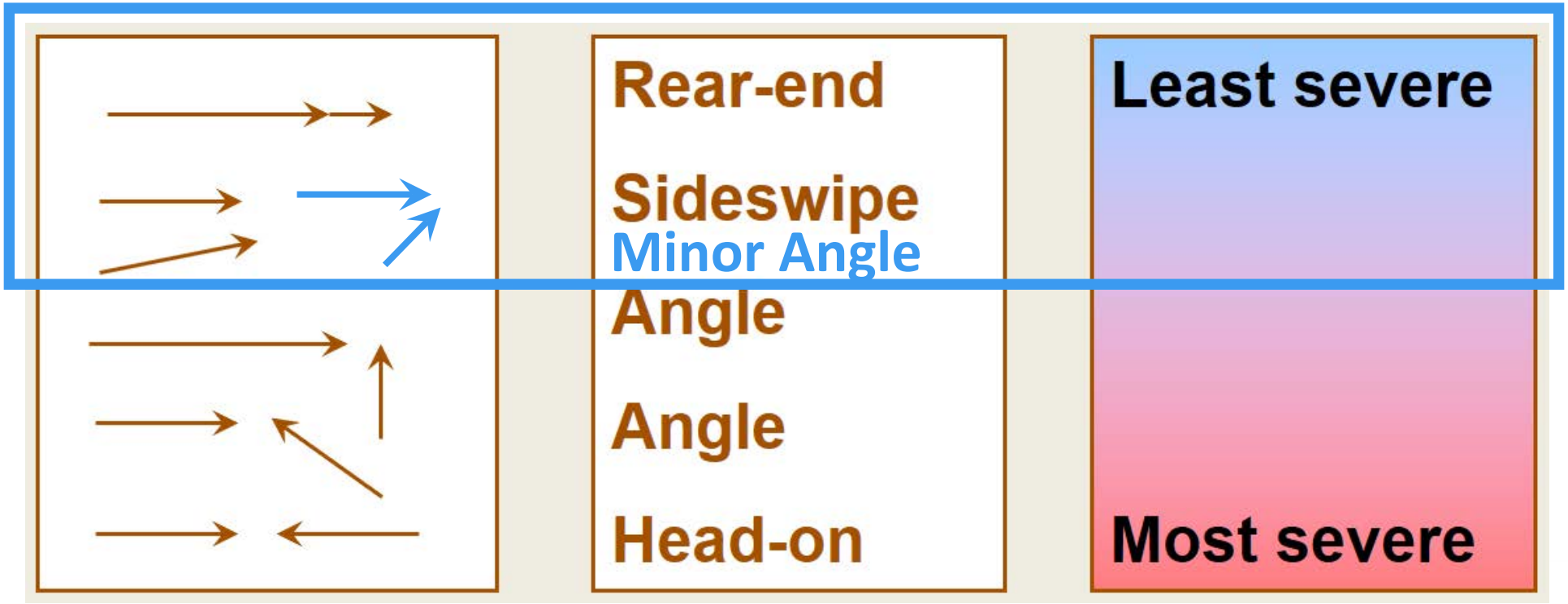
Traffic Safety

Severe angle and turning movement collisions are avoidable

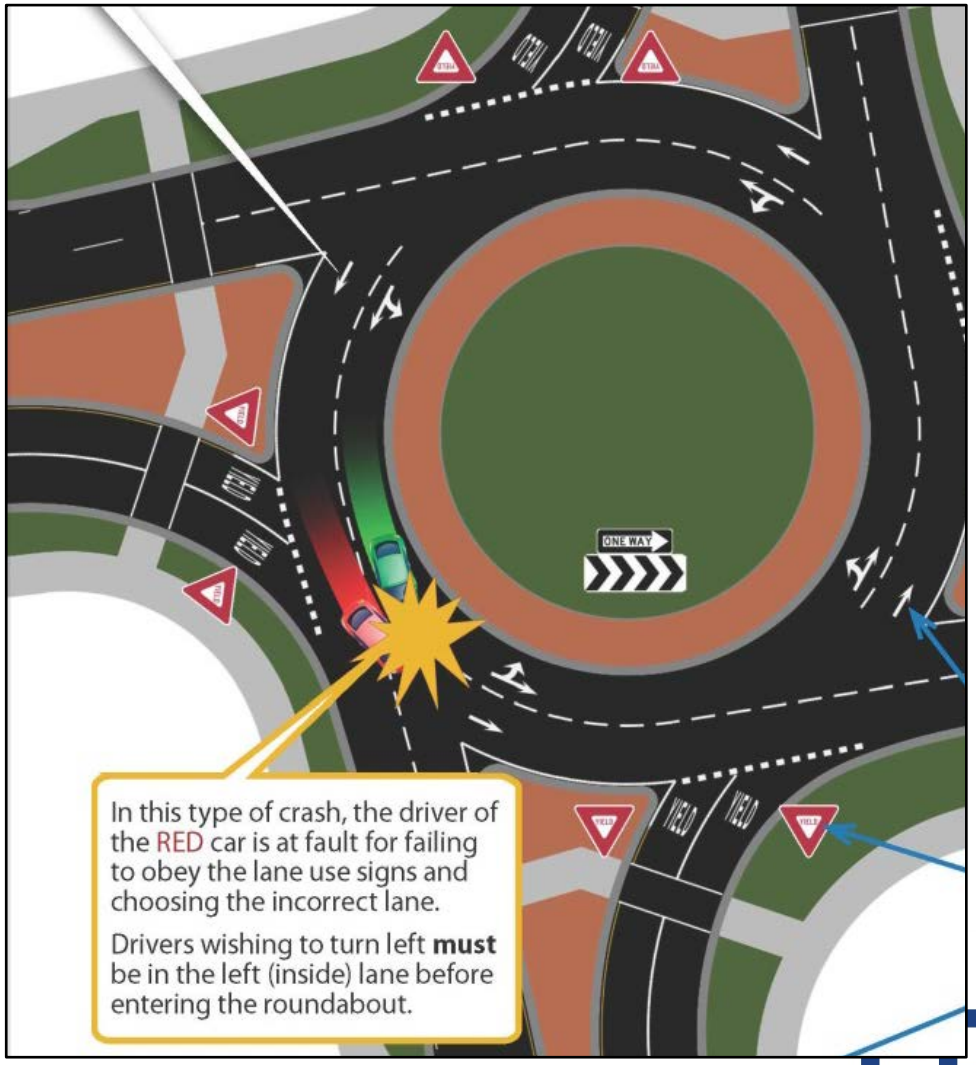
Traffic Safety

Traffic Safety

Intersection crash severity is highly influenced by SPEED and ANGLE of IMPACT



Less Severe Crashes



Safety Comparison

	Traffic Signal	Roundabout
Crash Severity	⬆	⬇
Number of Driver Decisions	⬆	⬇
Severity of Driver Errors	⬆	⬇
Traffic Calming	Not Effective	Geometrics Limit Speeds

⬆ Higher ⬇ Lower

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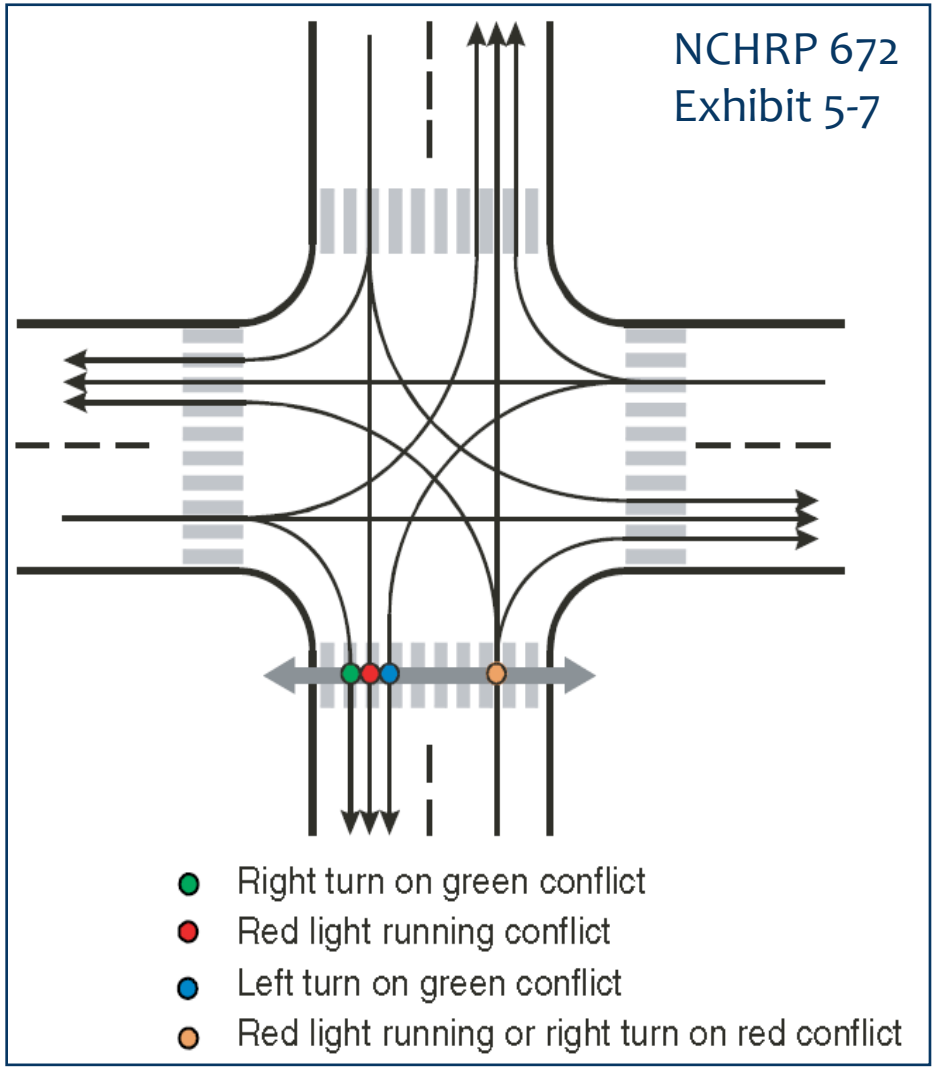
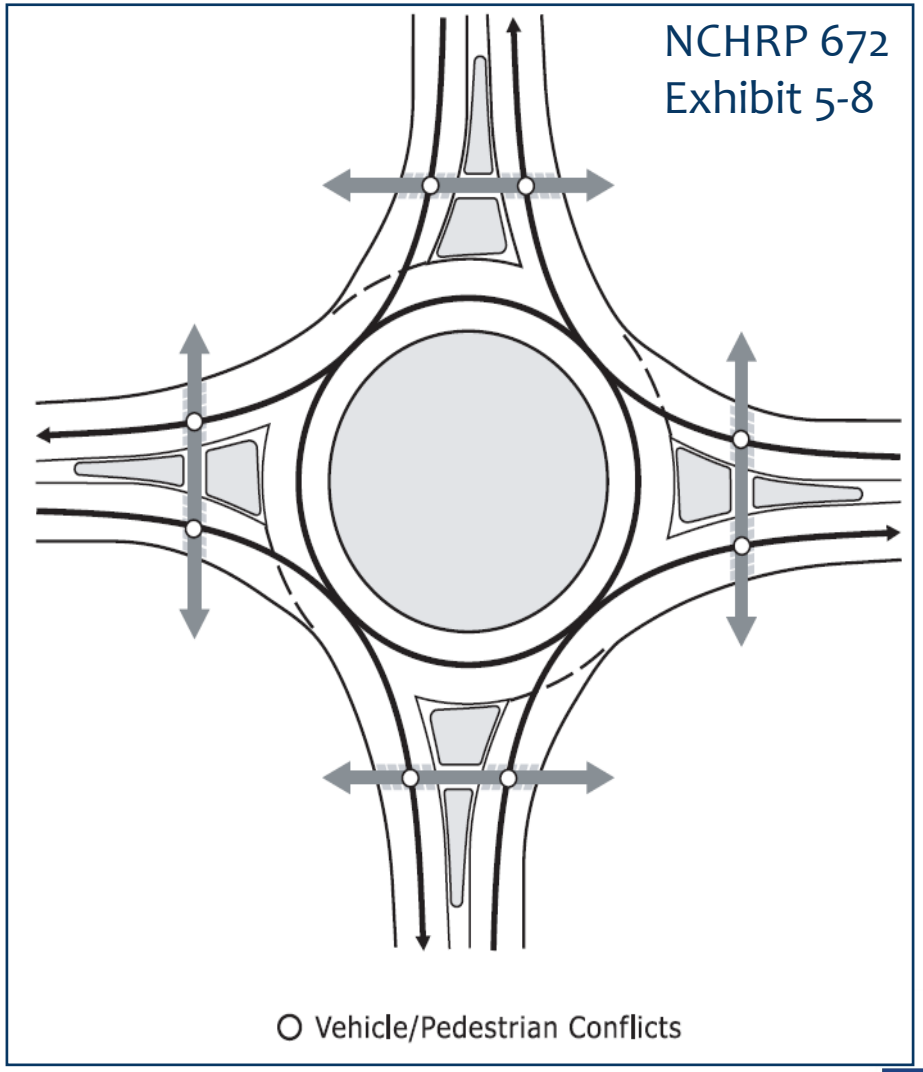
Vehicle-Pedestrian Conflicts

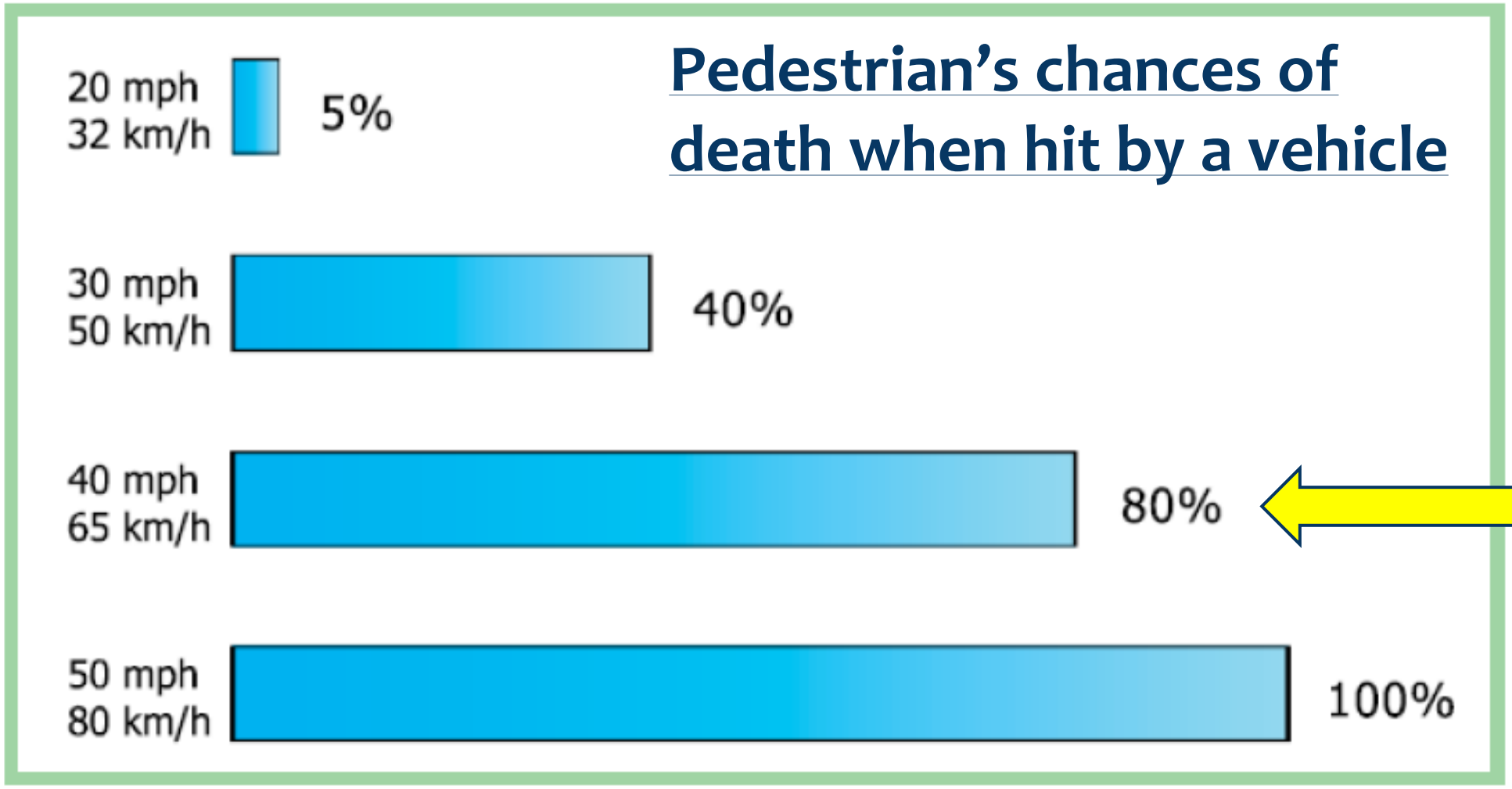


16 Conflicts



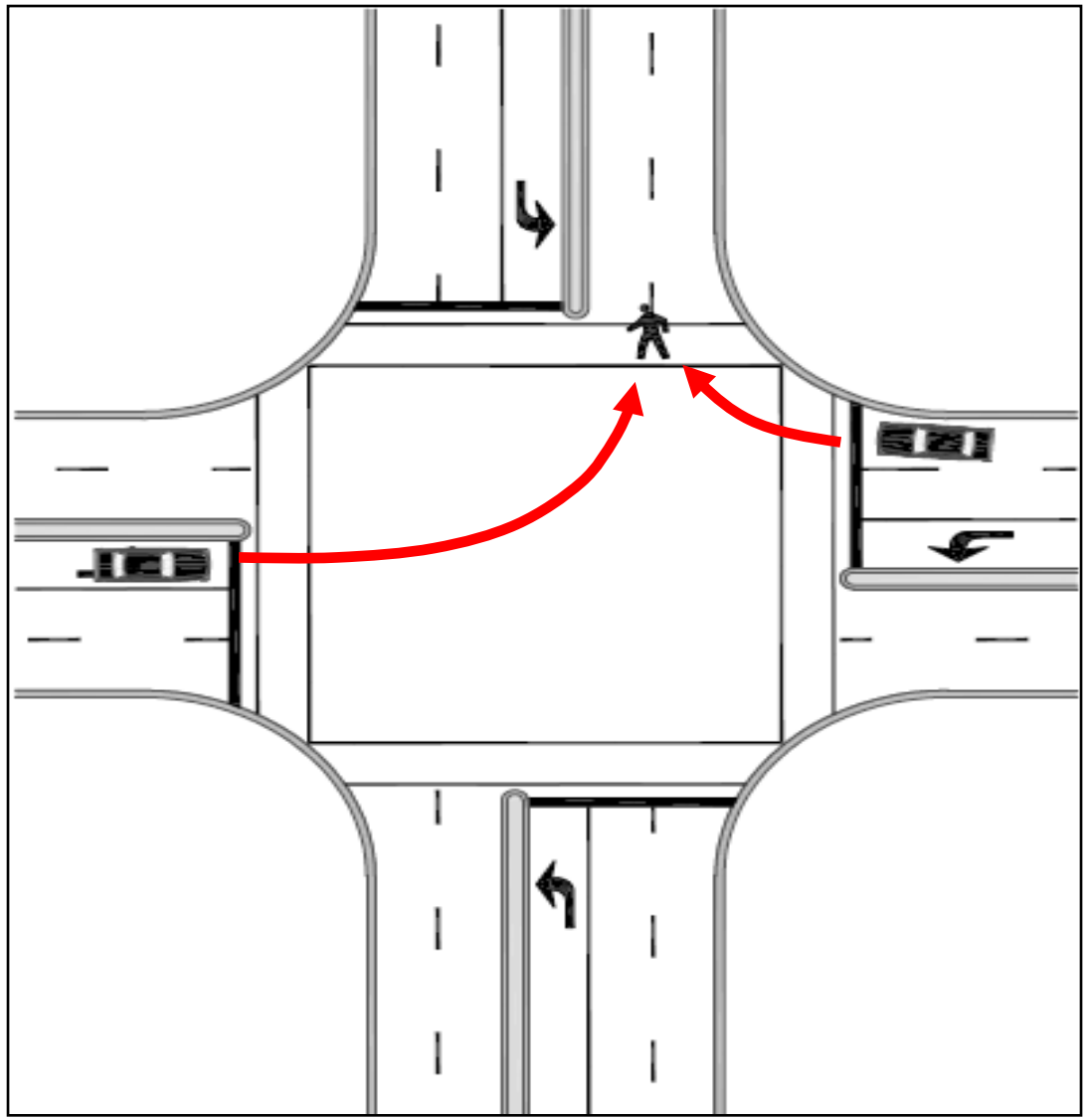
8 Conflicts

Speed and Crash Severity



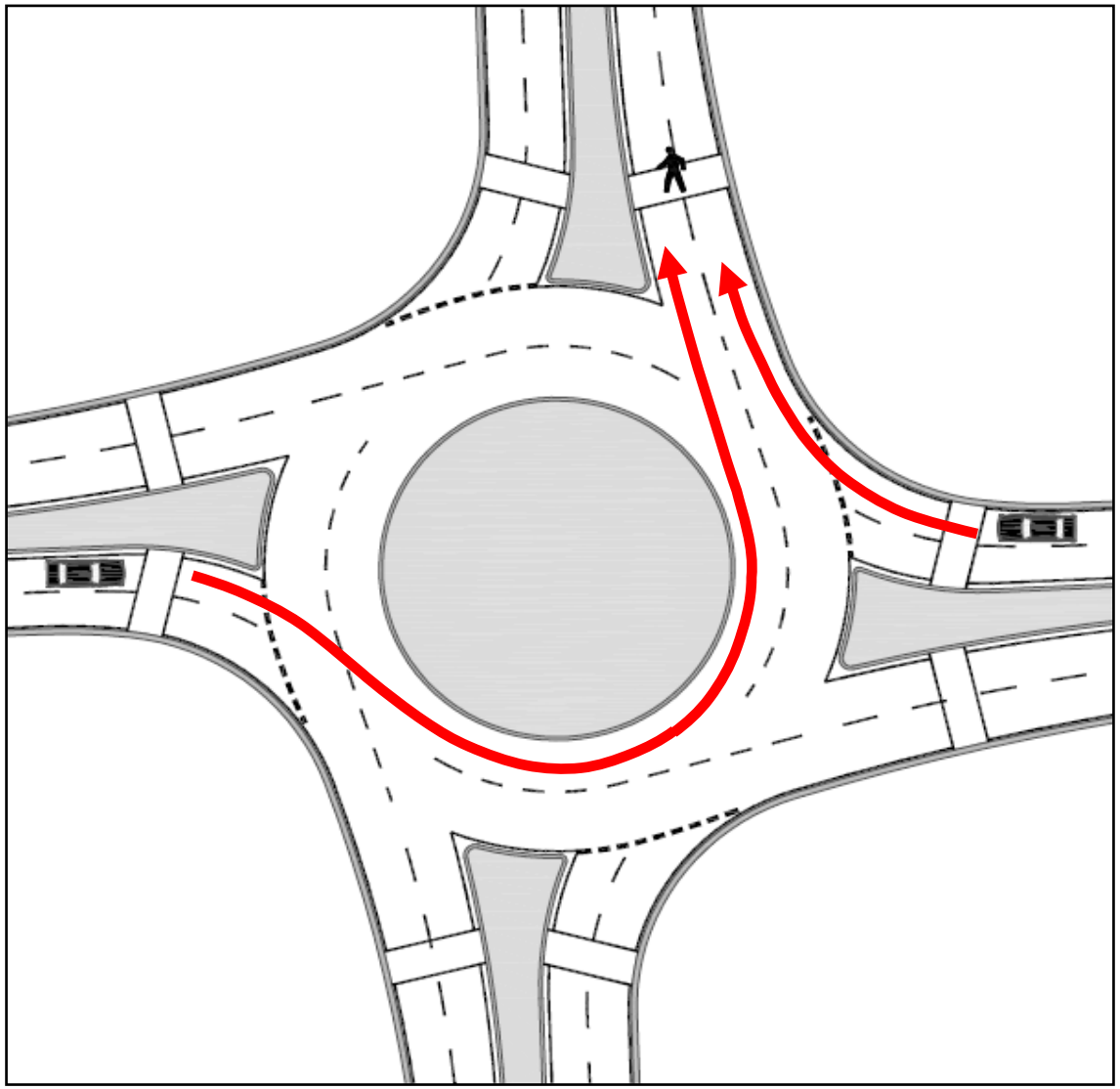
Source: NHTSA 1999

Safety at Signalized Intersection



- 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 at Roundabouts



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

Safety at Roundabouts

Pedestrian Roundabout Accommodations

Pros

- ✓ Low speed environment allows more time to react
- ✓ Shorter crossing distances – Reduced exposure
- ✓ Reduced conflict points
- ✓ Crossing one direction of travel at a time
- ✓ Splitter island provides refuge
- ✓ No signal delay

Cons

- ✓ Uninterrupted flow, can be difficult to assess gaps
- ✓ Disabled, children, and older adults may have difficulty
- ✓ Entries/exits with more than one lane may be difficult to cross
- ✓ Low driver yield compliance

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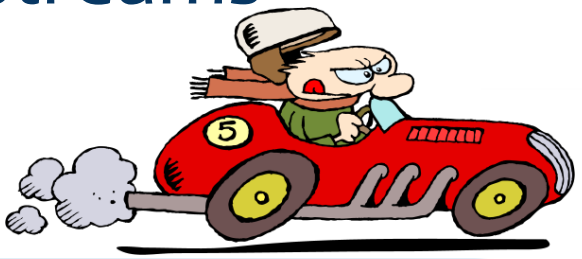
Speed Management

- Achieving appropriate vehicular speeds for entering and traveling through the roundabout is a ***critical*** design objective
  - Profound impact on safety of all users
  - Easier to use and more comfortable for pedestrians and bicyclists
- A well-designed roundabout reduces vehicle speeds upon entry and achieves consistency in the relative speeds between conflicting traffic streams



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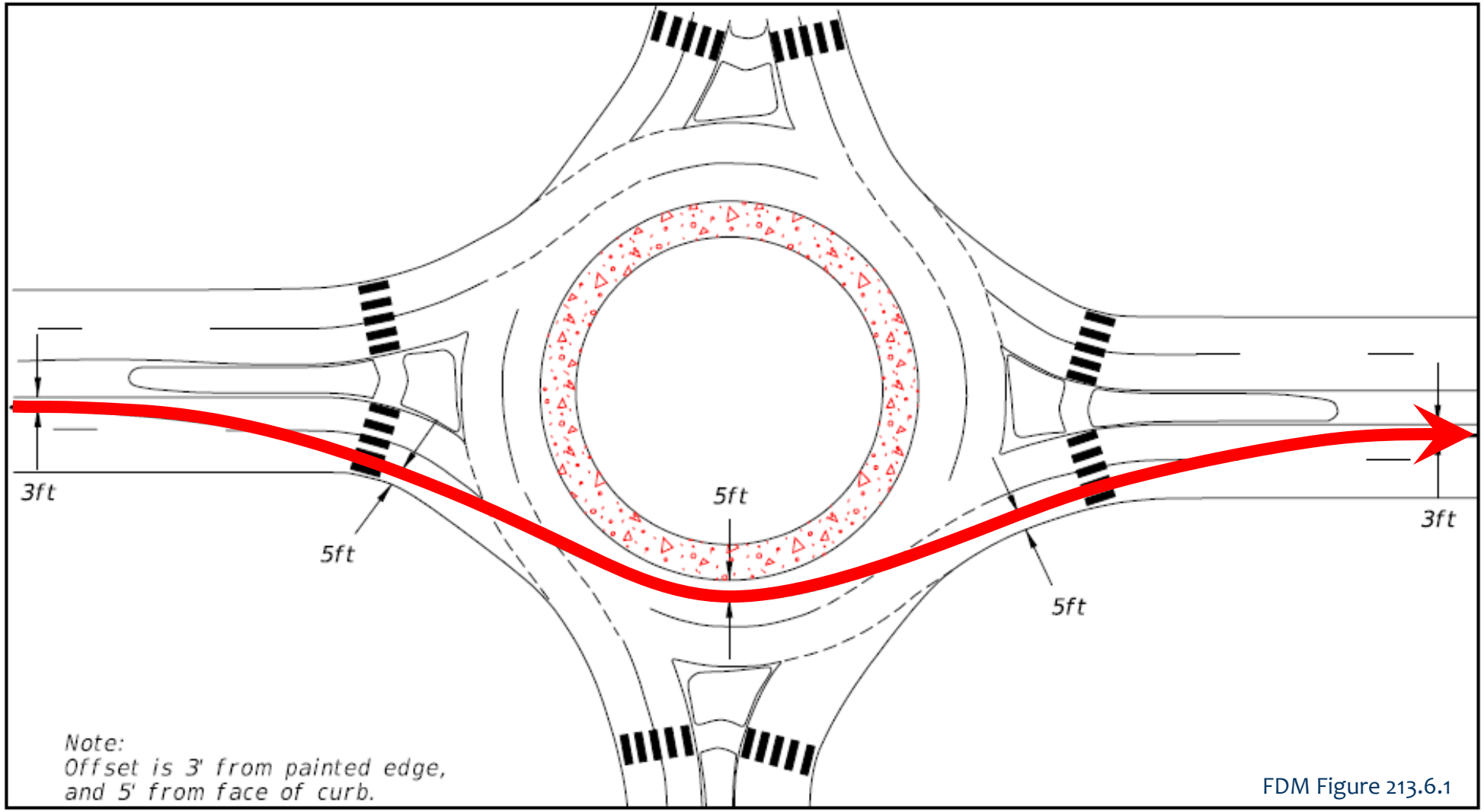
Speed Management

- Operating speed is widely recognized as one of the most important attributes in terms of safety performance, in general:
  - Frequency of crashes is most directly tied to volume
  - Severity of crashes is most directly tied to speed
- Maximum entering design speeds based on theoretical fastest path:
  - Single-lane = 20-25 mph
  - Multilane = 25-30 mph

Speed Management

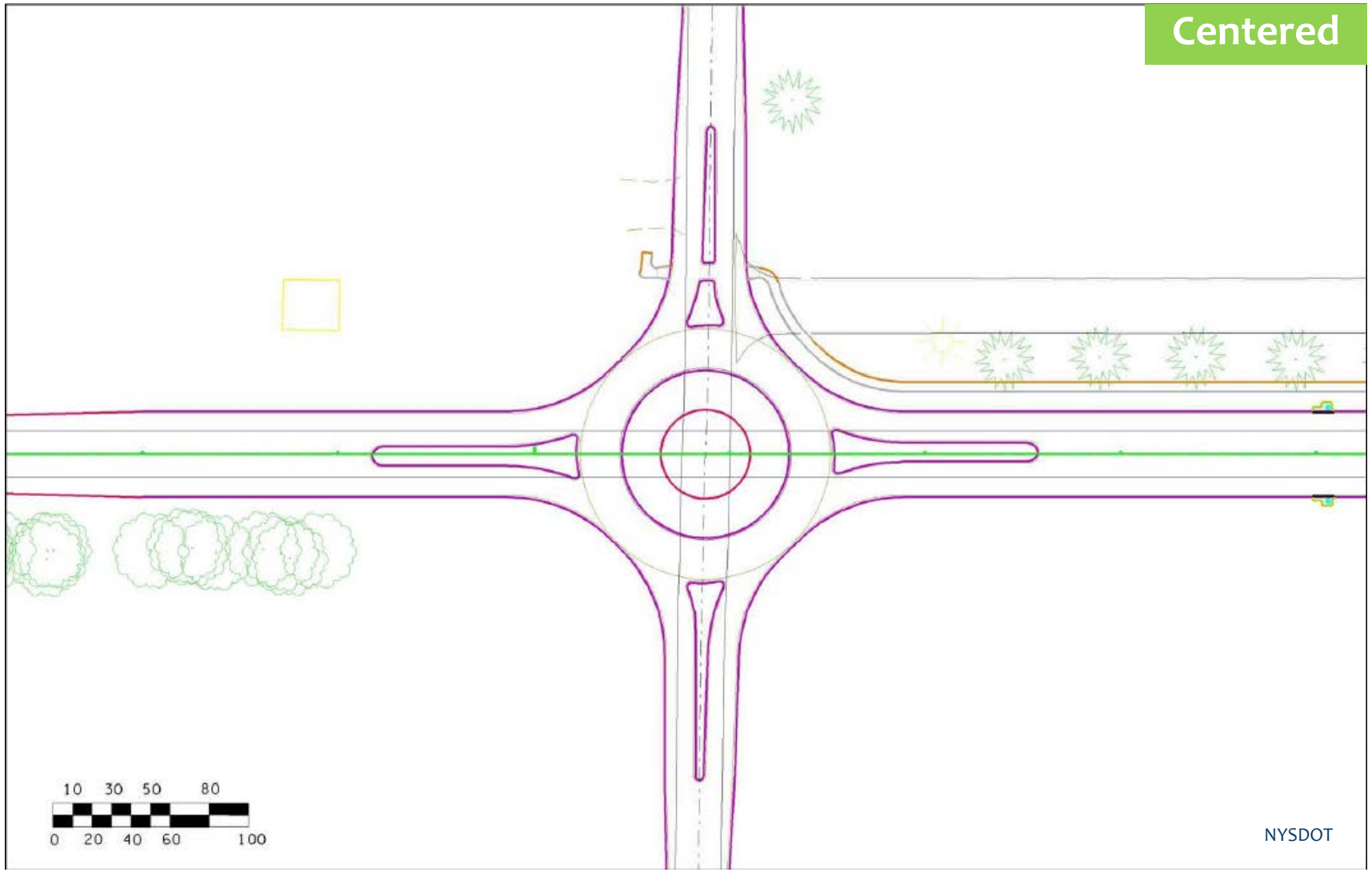
- Speed management is often a combination of managing speeds at the roundabout itself and managing speeds on the approaching roadway
- Studies have shown that reducing the vehicle path radius at the entry decreases the relative speed between entering and circulating vehicles and thus results in lower entering-circulating crash rates

Fastest Path - Multilane

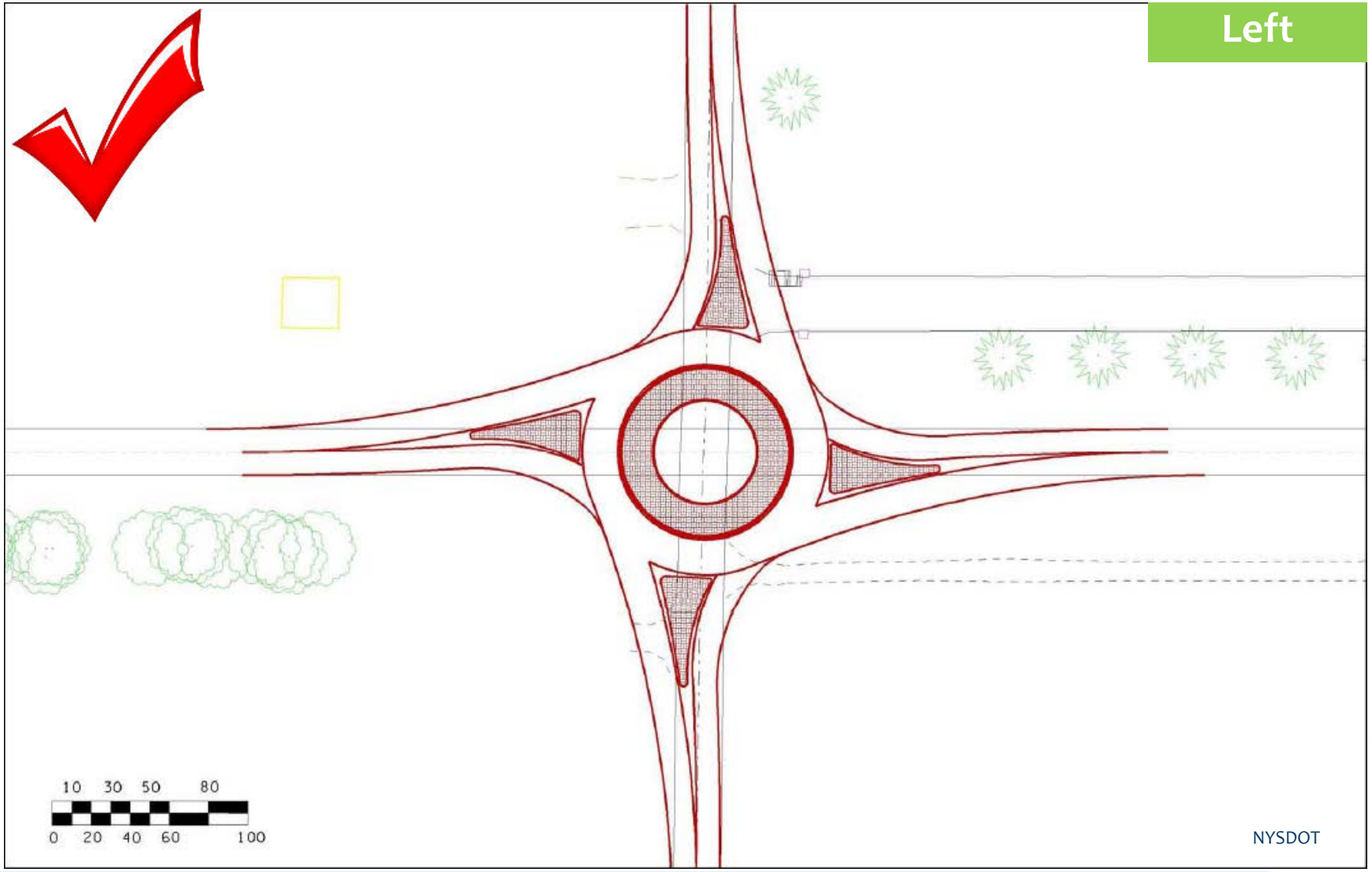


FDM Figure 213.6.1

Alignment of Approaches

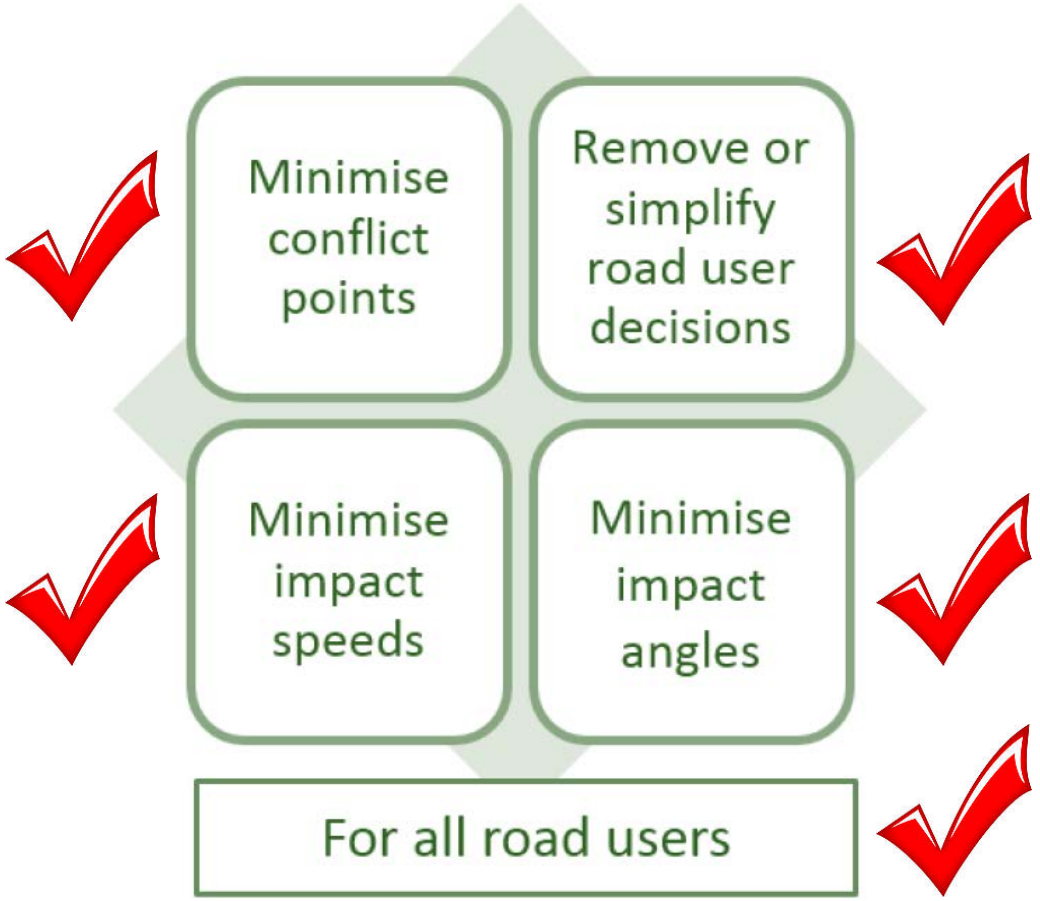


Alignment of Approaches



Safe System Intersection Design Principles

Roundabouts



Source: Understanding and Improving Safe System Intersection Performance, Austroads Research Report AP-R556-17

Operational Performance

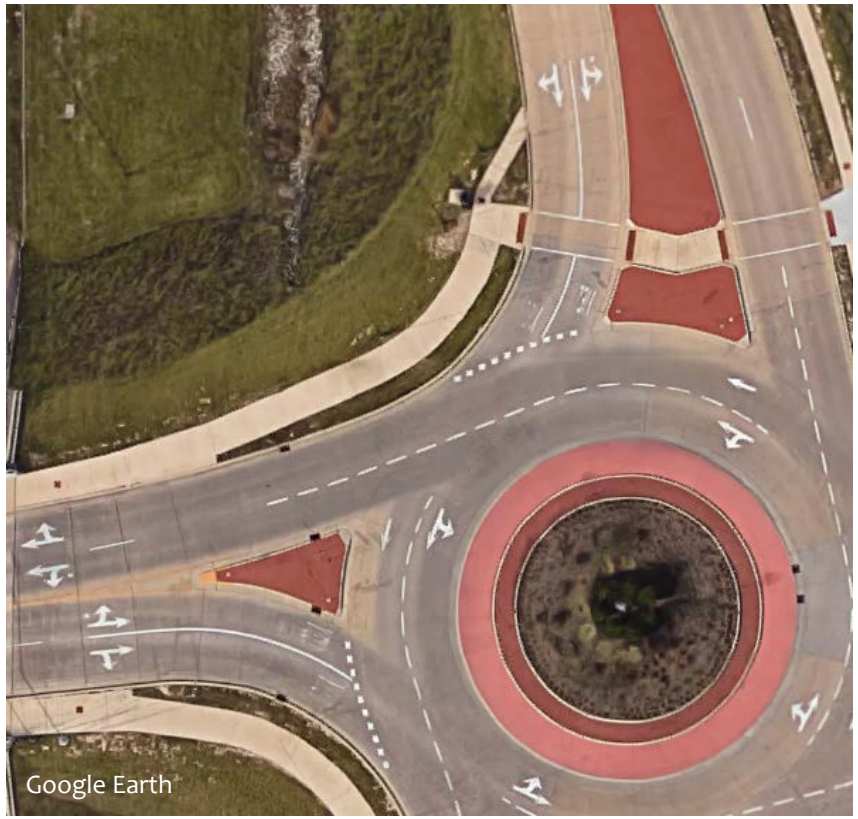
- Typically have lower overall delay than signalized and all-way stop-controlled intersections
- Delay reduction is often most significant during non-peak traffic periods
- Often results in reduced lane requirements between intersections (Wide nodes narrow roads)

Pros

- ✓ Capacity
- ✓ Level of Service
- ✓ Reduced Delay
- ✓ Speed Control

Roundabout Operation

- A roundabout brings together conflicting traffic streams at reduced speeds, allowing the streams to safely cross paths, traverse the roundabout, and exit
- Modern roundabouts do not have merging or weaving between conflicting traffic streams

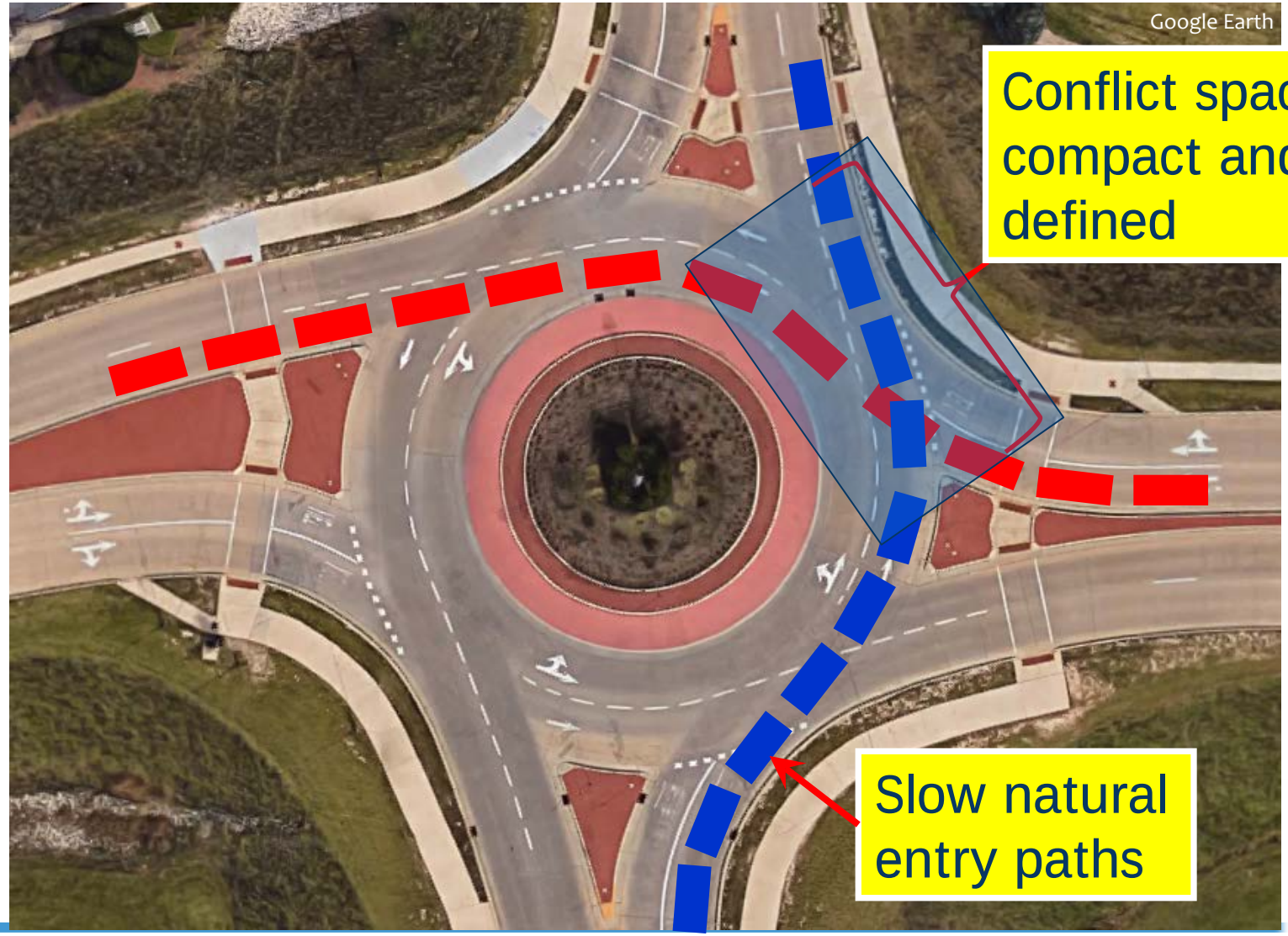


Roundabout Operation

- Vehicles at each approach must yield right-of-way to circulating vehicles and accept gaps in circulating traffic
- Compactness of circle size and geometric speed control make it possible to establish priority to circulating traffic

Ensure geometry creates the correct operations!

Roundabout Operation

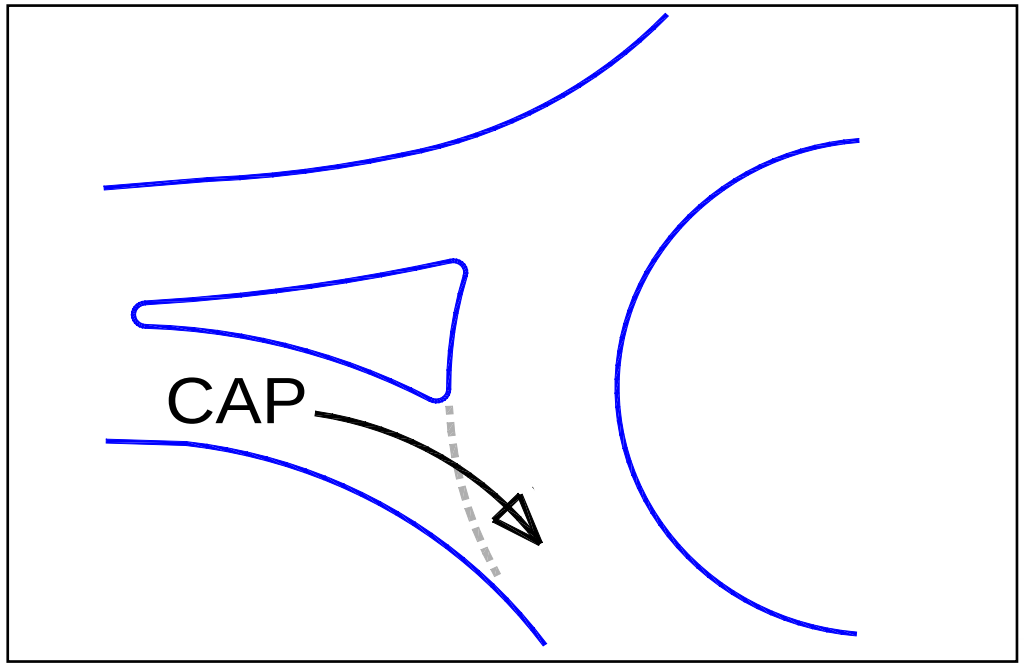


Roundabout Capacity

- The capacity of a roundabout entry depends on two factors:

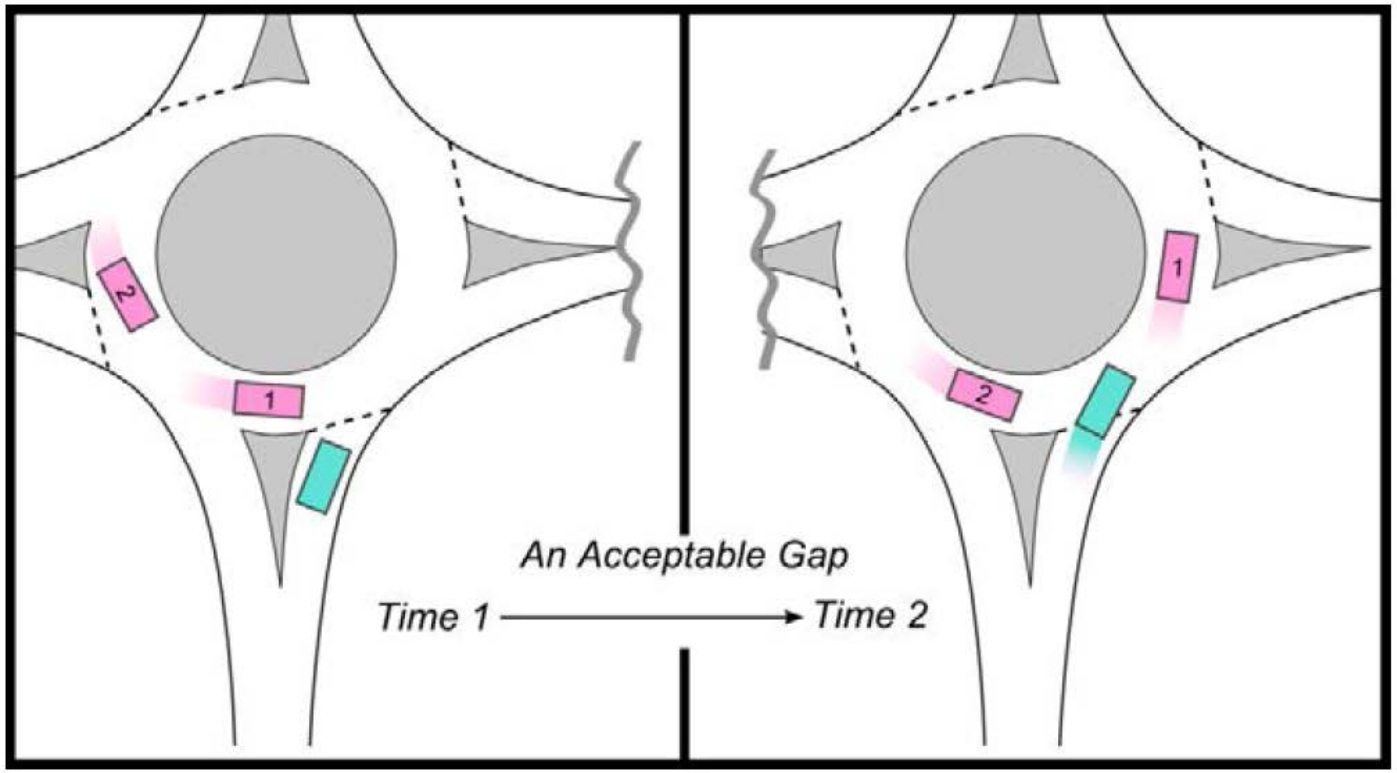
1. Circulating flow in the roundabout that conflicts with the entry flow

2. Number of entering lanes on the approach to the circulatory roadway



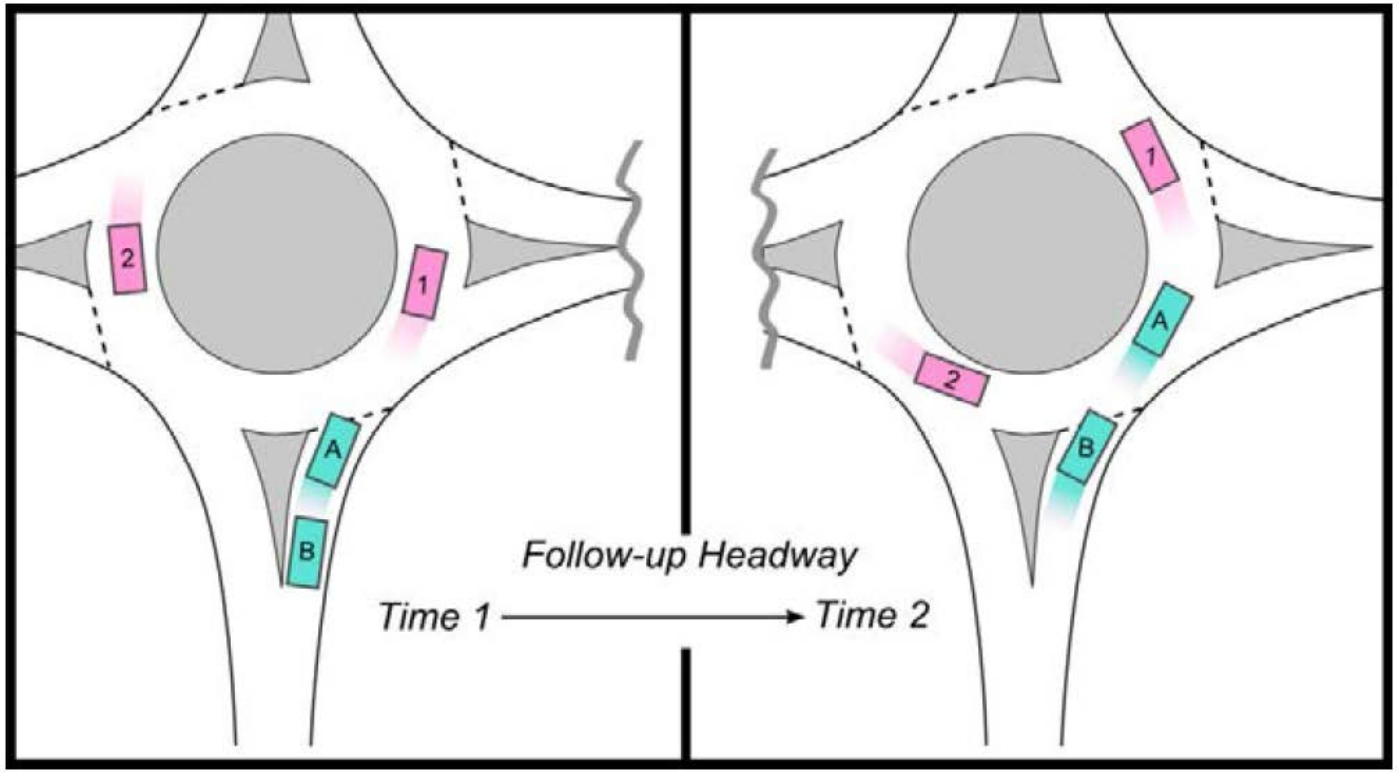
Critical Headway

The smallest gap in circulating traffic that an entering driver would accept to enter the roundabout



Follow-up Headway

The time between two successive entering vehicles accepting the same gap in circulating traffic

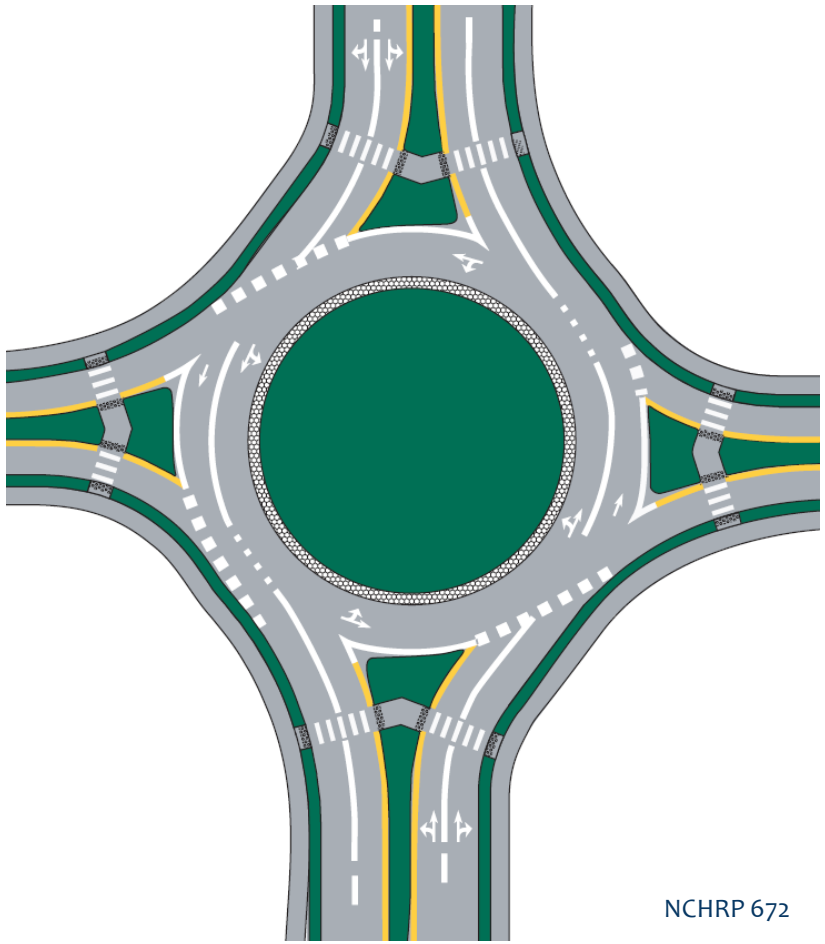


Typical AADT

Roundabout Type	Typical Inscribed Circle Diameter	Typical AADT 4-leg roundabouts
Single-lane	120 – 160 ft	Less than 25,000
Multilane (2-lane entry)	160 – 200 ft	25,000 to 45,000

Operational Analysis

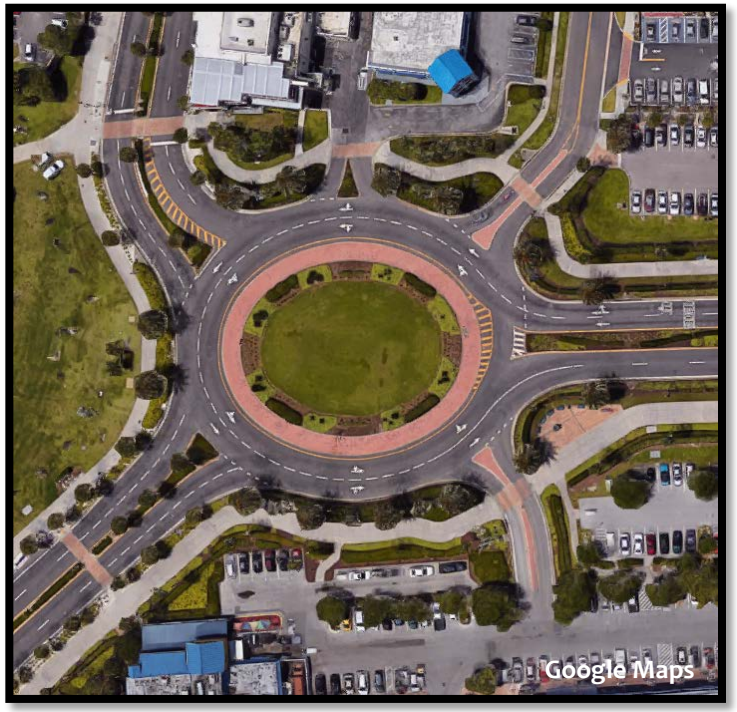
- Analysis of all peak hour periods is critical to assess the level of performance at each entry and the roundabout as a whole
- Each approach leg of the roundabout is evaluated individually to determine the number of entry lanes



NCHRP 672

Roundabout Access Management

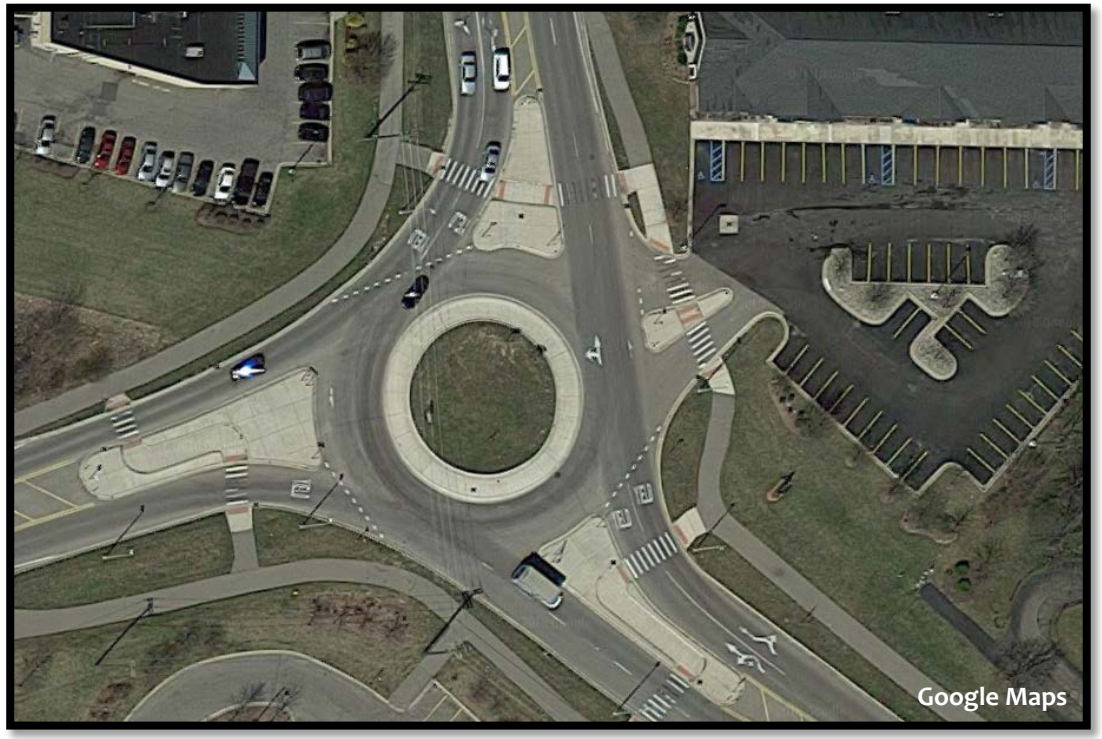
- Operational characteristics of roundabouts may offer advantages
- Roundabout benefits include:
  - ✓ Increased capacity along arterial roads
  - ✓ Reduction of traffic congestion
  - ✓ Improved safety (slower speeds)
  - ✓ More efficient use of land
  - ✓ Saving on infrastructure investments



Roundabout Access Management

- Access points must be evaluated with site specific criteria
  - ✓ Proximity to the intersection
  - ✓ Roadway and driveway volumes
  - ✓ Expected users
  - ✓ Sight distance

- Two potential options
  1. Access into roundabout
  2. Access near the roundabout



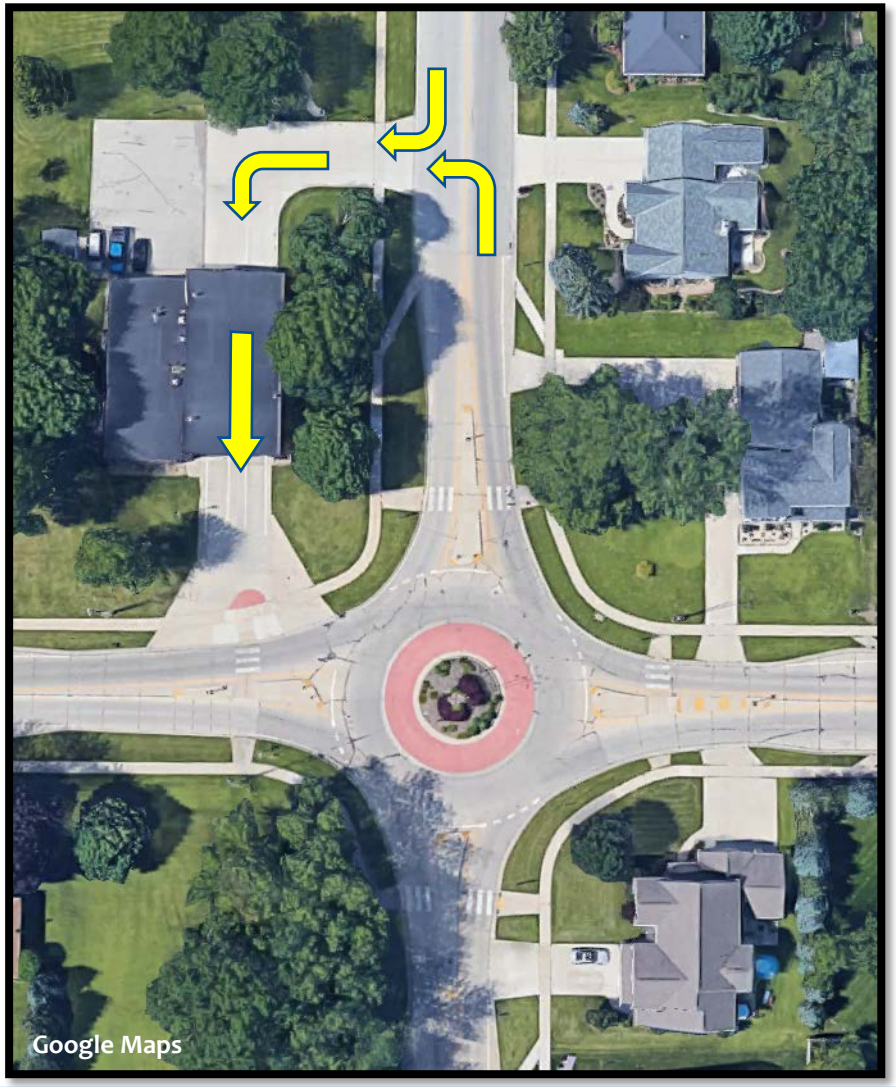
Access into the roundabout

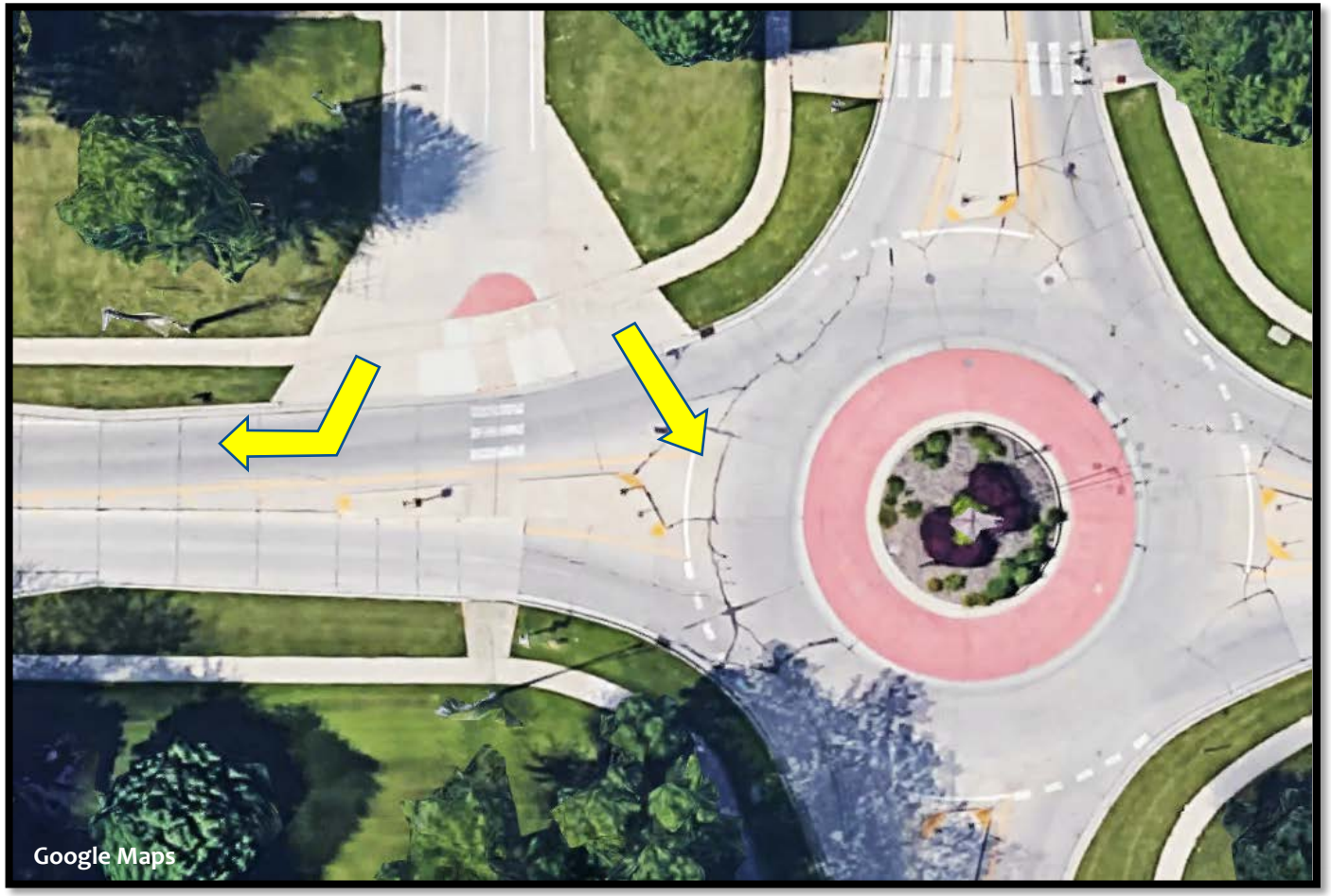
- Preferable to avoid driveways with direct access to roundabout
  - ✓ Introduces conflicts into the circulatory roadway
    - Acceleration and deceleration
  - ✓ Traditional driveway designs do not discourage wrong way movements
- May consider driveways with direct access to circulatory roadway
  - ✓ No reasonable alternative
  - ✓ Low traffic volumes (single-family house)
  - ✓ Entry facing roundabout (no backing into roundabout)
  - ✓ Ensure proper sight
  - ✓ Provide clear visual indication it is a private driveway

Access into the roundabout

Access into the roundabout

Access into the roundabout





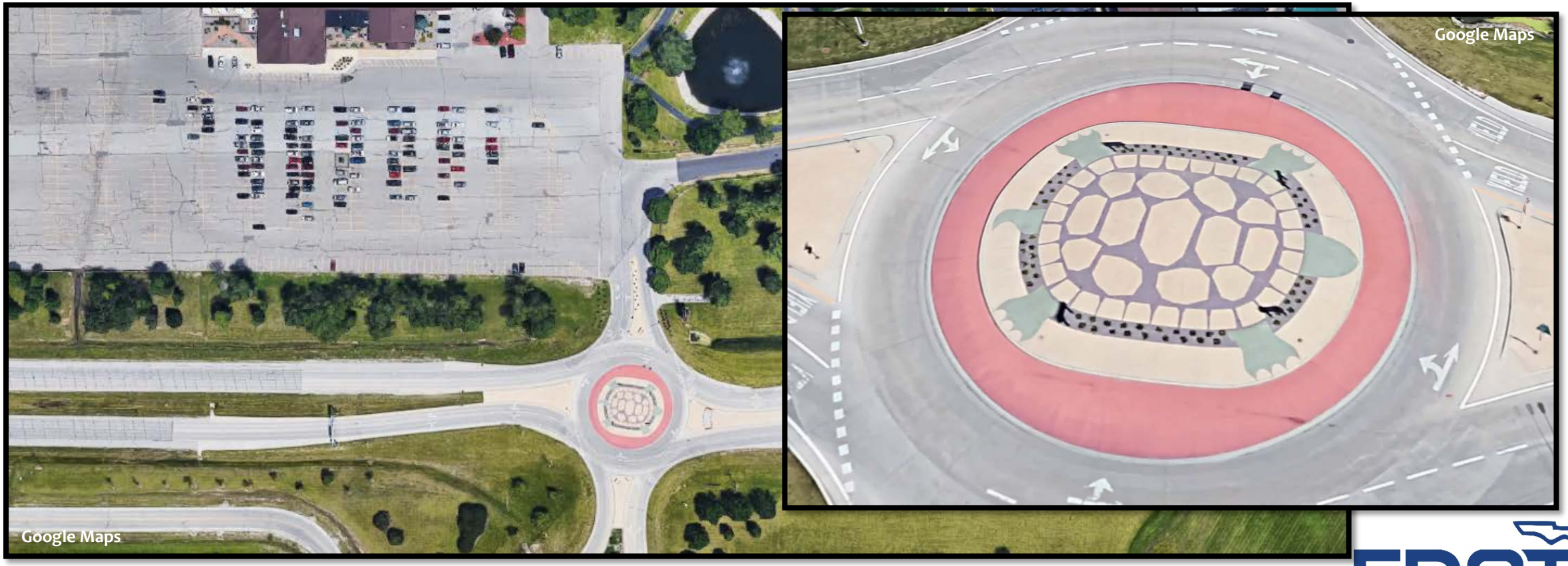
Access into the roundabout

Access into the roundabout

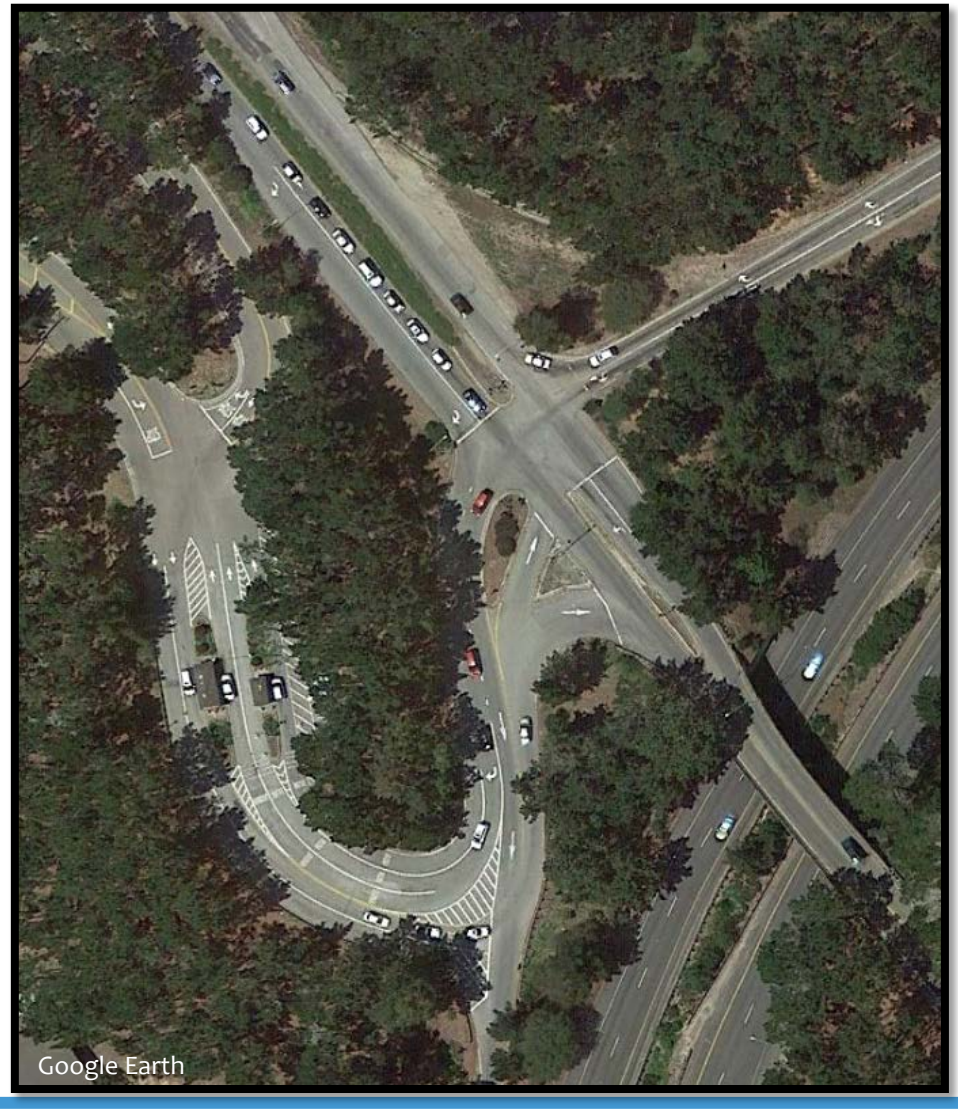
- Or incorporate driveway as a leg of the roundabout

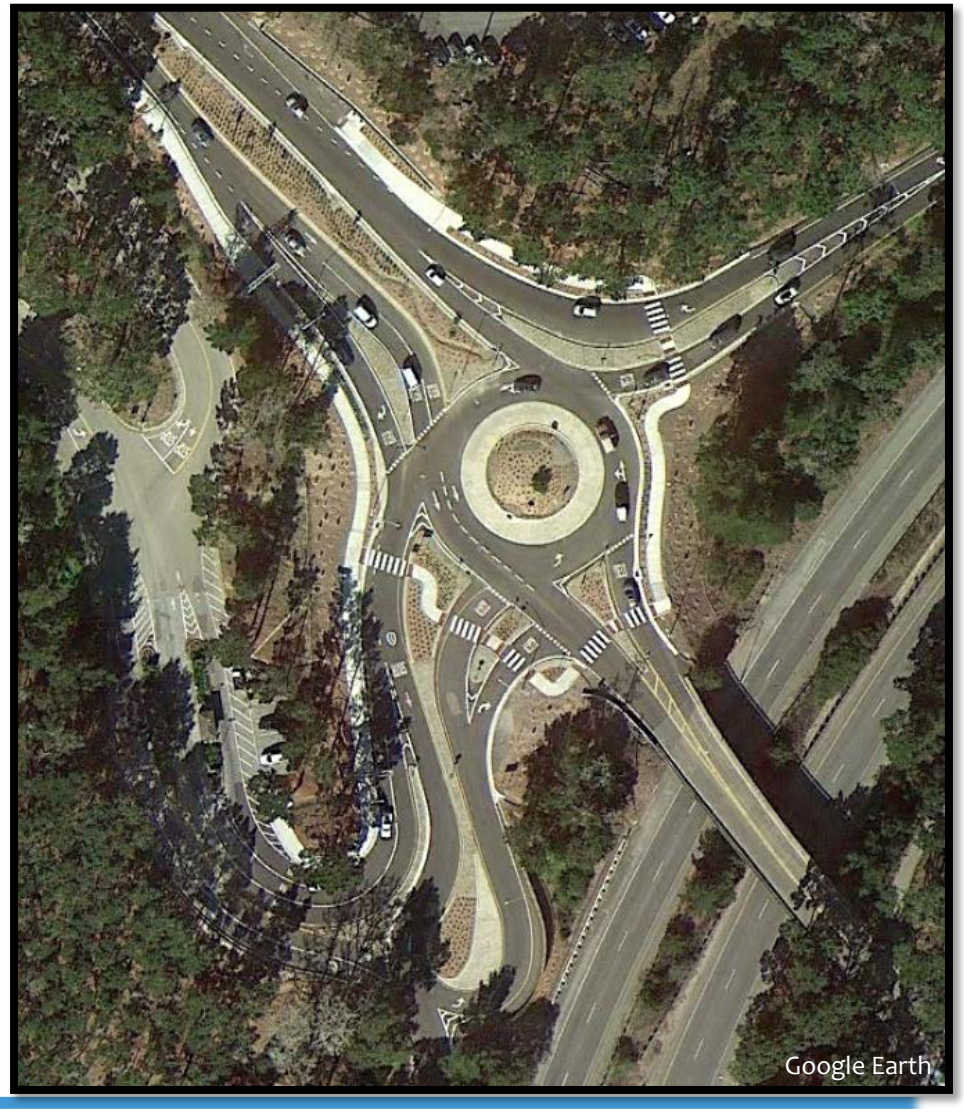
Access into the roundabout

- Or incorporate driveway as a leg of the roundabout



Access into the roundabout





Access near the roundabout

- Generally less restrictive than a signalized intersection because of reduced speed and queuing
- May be feasible to consider a full access driveway closer to a roundabout than with other types of intersection control
- Can restrict access to right-in/right-out with splitter islands
- Typically not desirable to have a driveway between crosswalk and yield line

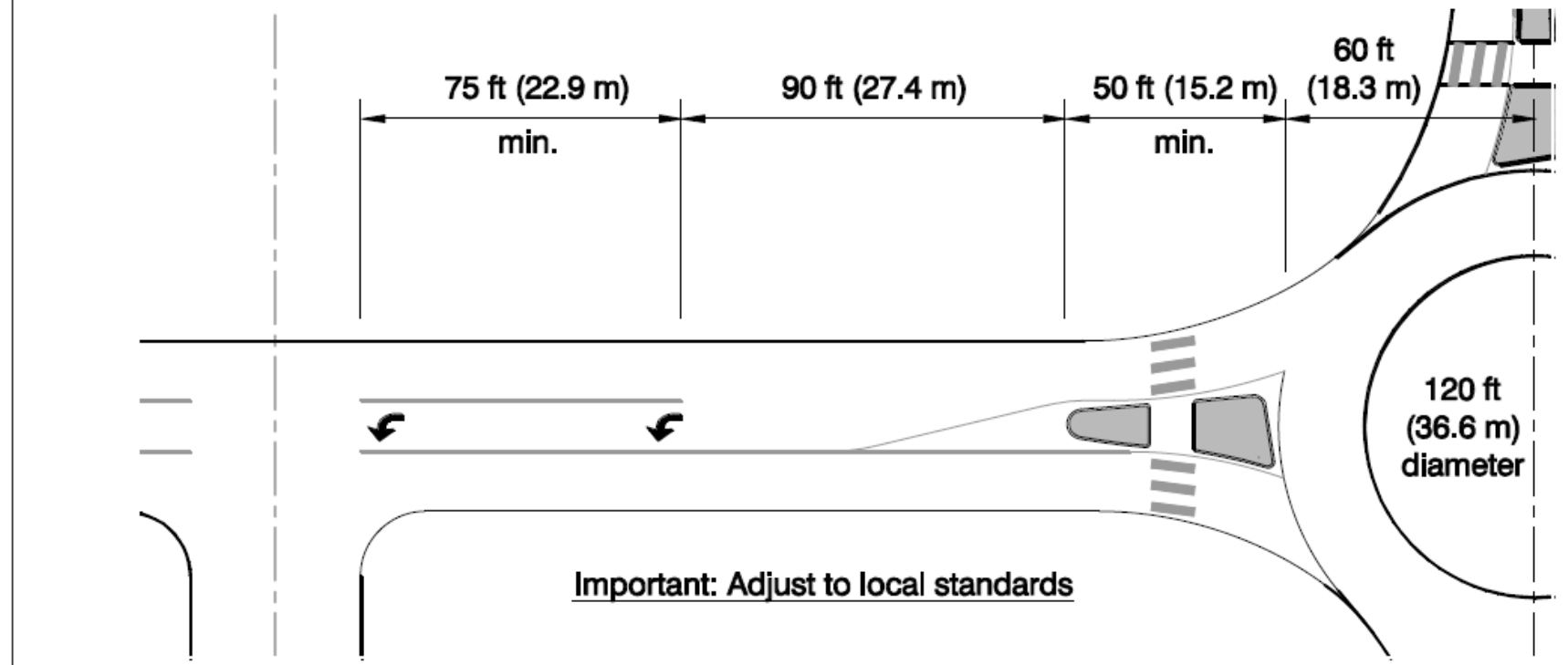
Access near the roundabout

- Full access driveways are governed by a number of factors:
  - ✓ Volume of the driveway (residential or commercial)
  - ✓ Available space between driveway and roundabout
  - ✓ Capacity of the driveway
    - Unsignalized capacity analysis
    - Randomly distributed traffic (no platooning of traffic typical with signals)
    - May have less capacity and more delay than downstream from a signal
  - ✓ Sight distance needs

Access near the roundabout

- Desirable to provide left turn storage on major street

Exhibit 6-91
Typical Dimensions for Left-Turn Access near Roundabouts

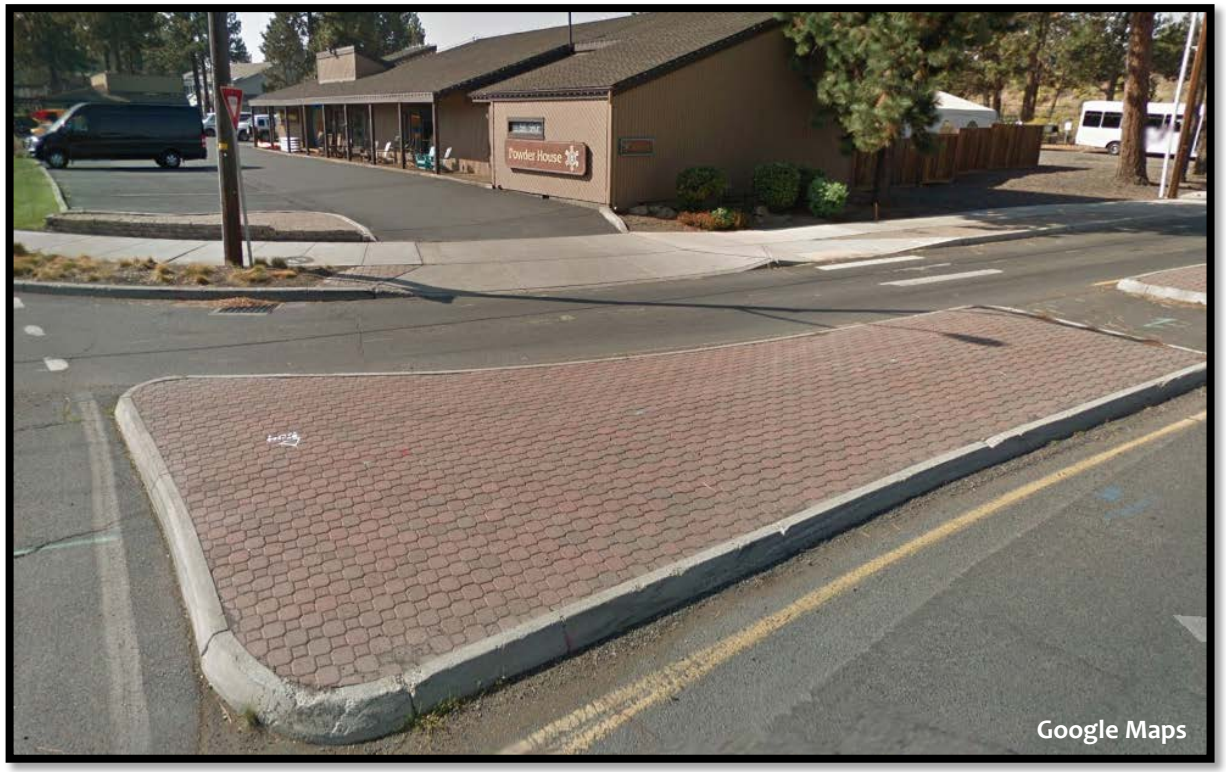


NCHRP Report 672

Desirable, but not always practical!

Access near the roundabout

- Driveway between crosswalk and yield line

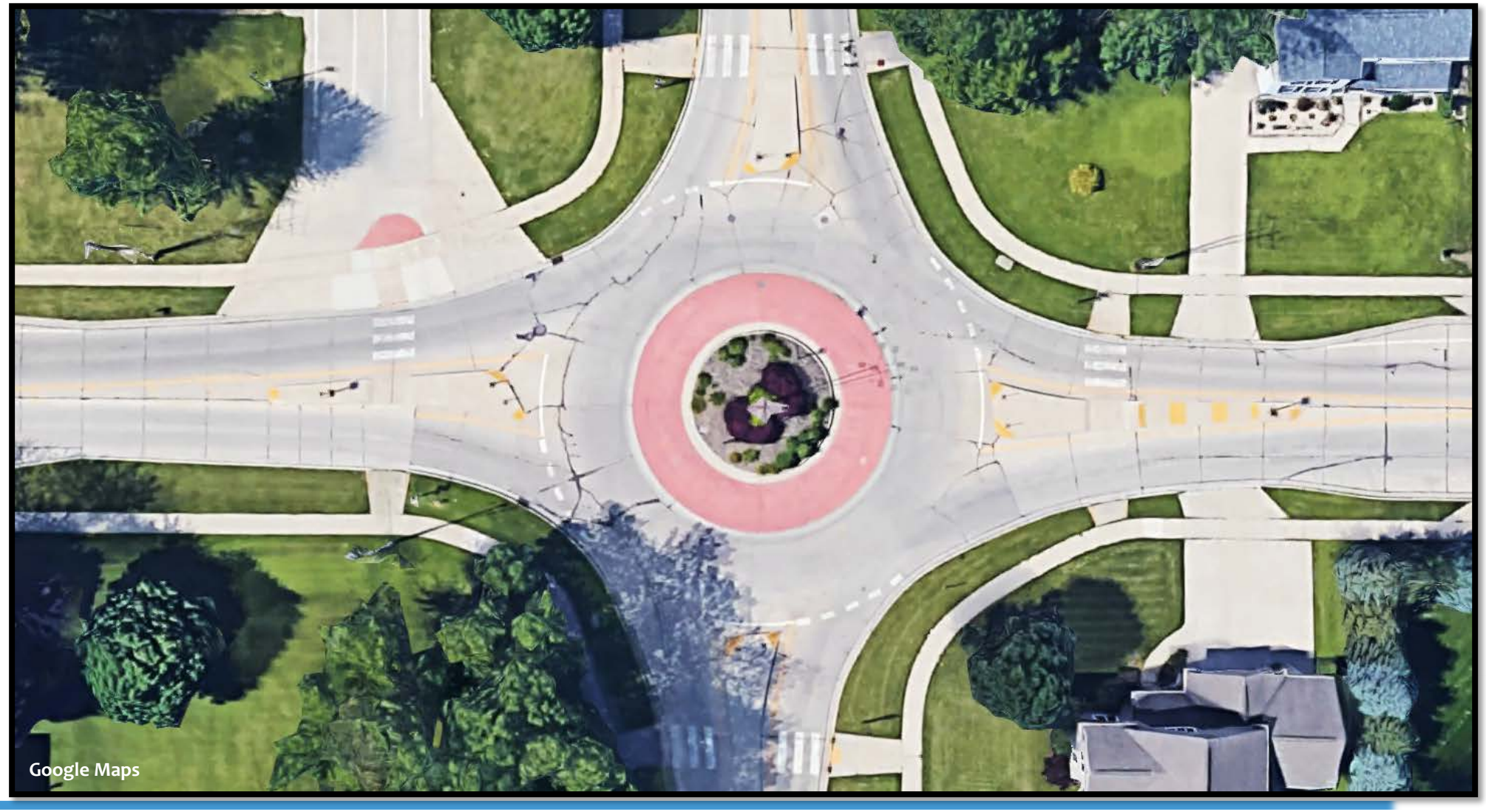


Access near the roundabout

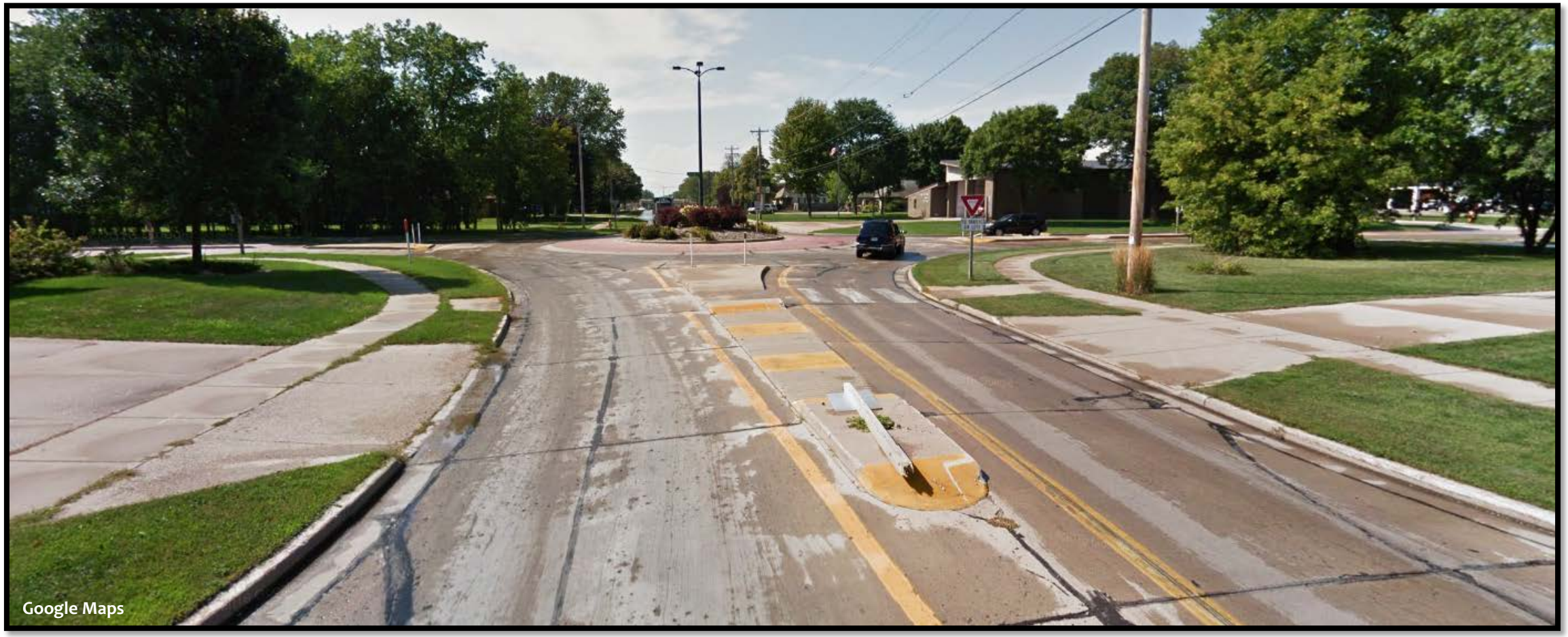
- Driveway aligned with crosswalk

Access near the roundabout

Access near the roundabout



Access near the roundabout

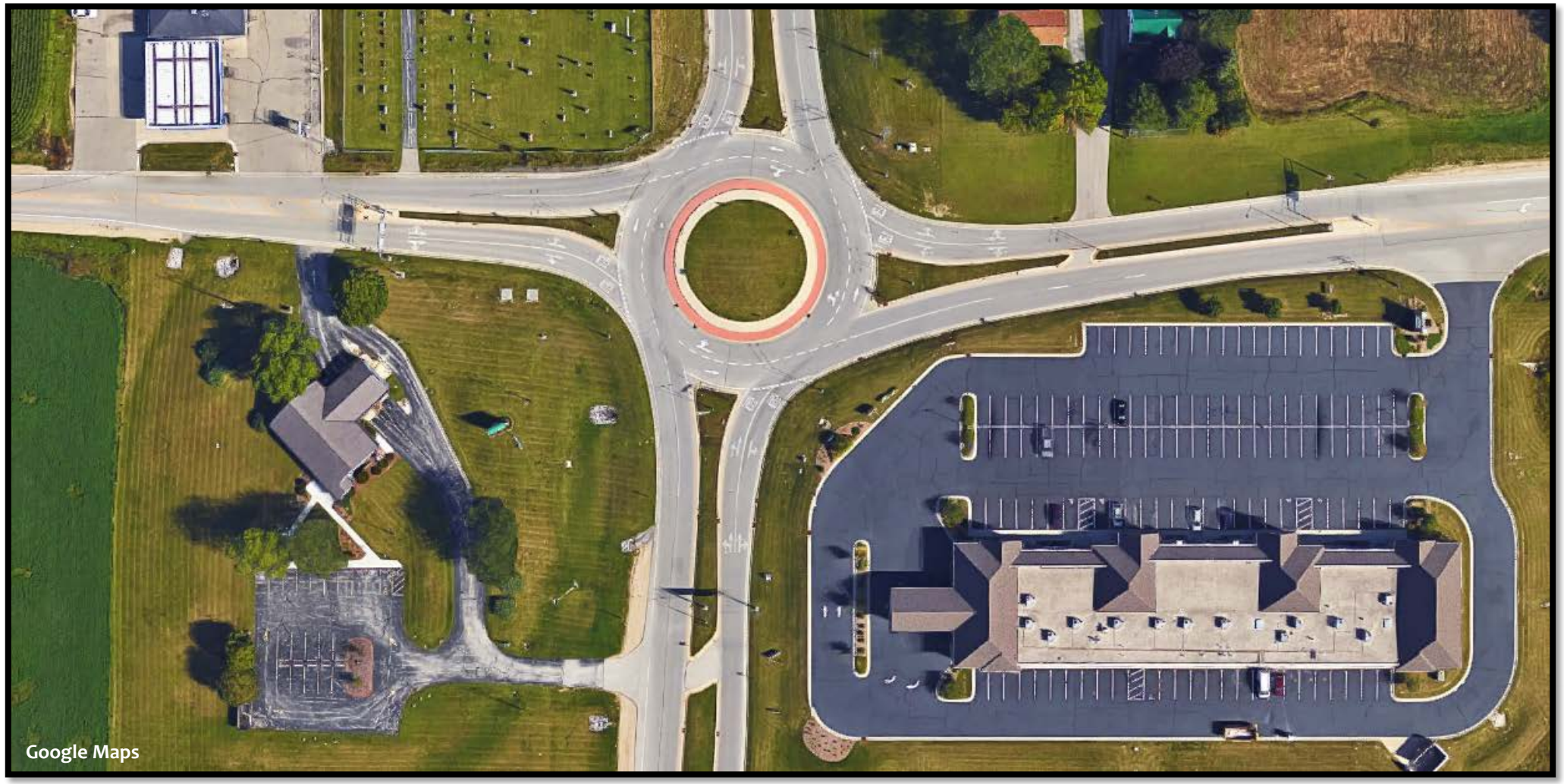


Access near the roundabout

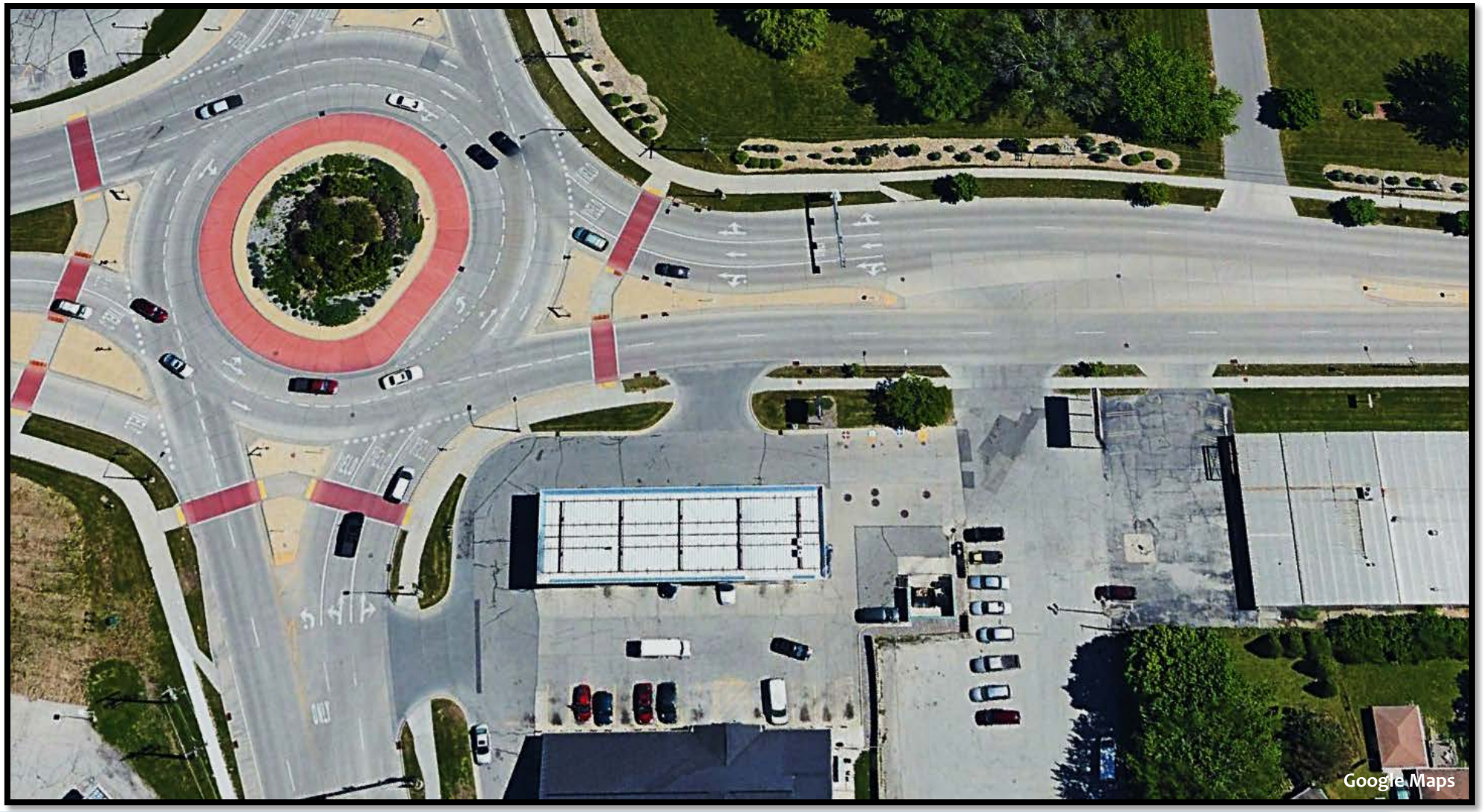
Access near the roundabout

Access near the roundabout

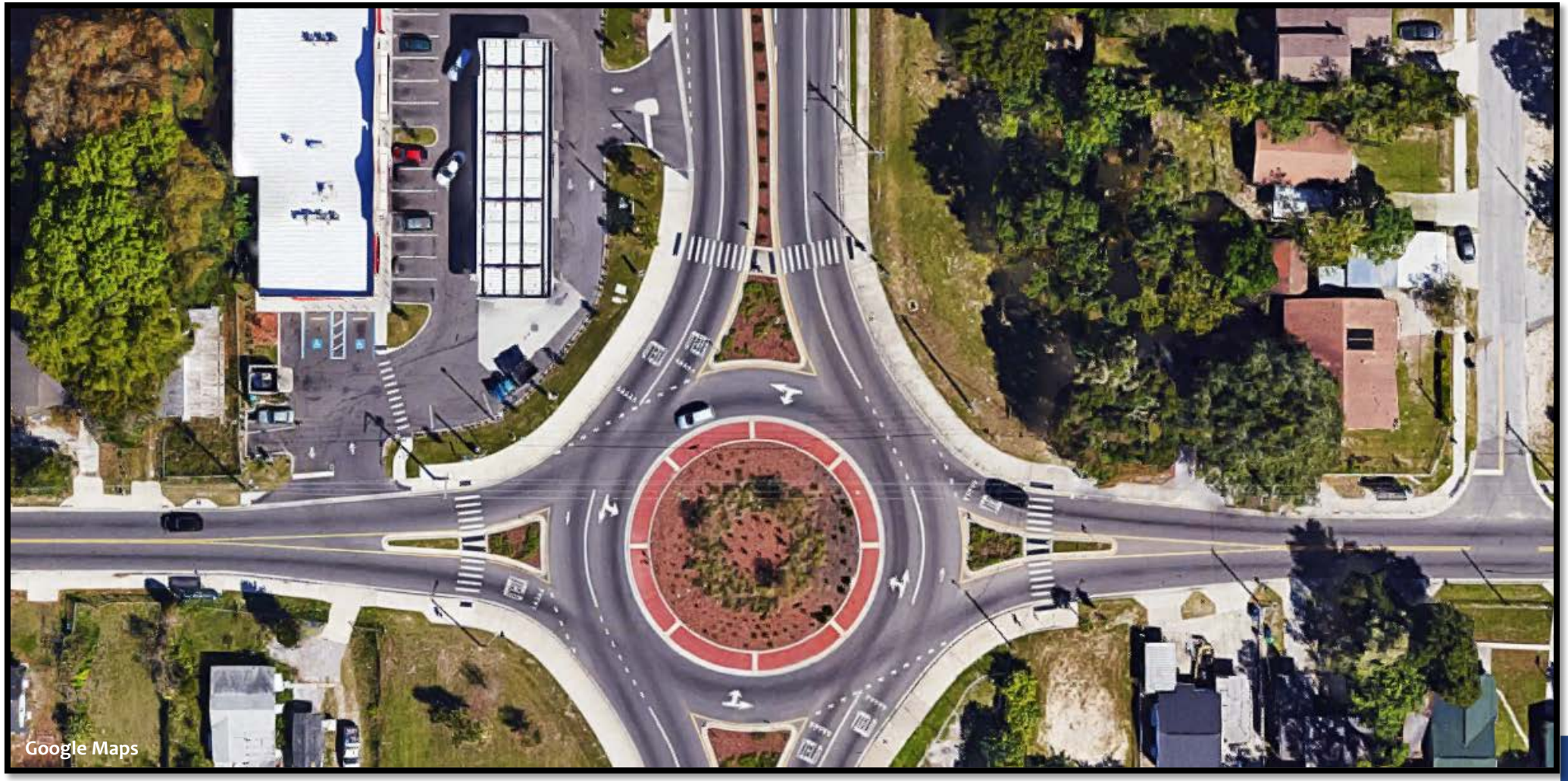
Access near the roundabout



Access near the roundabout



Access near the roundabout



Access near the roundabout

Access with roundabout corridors

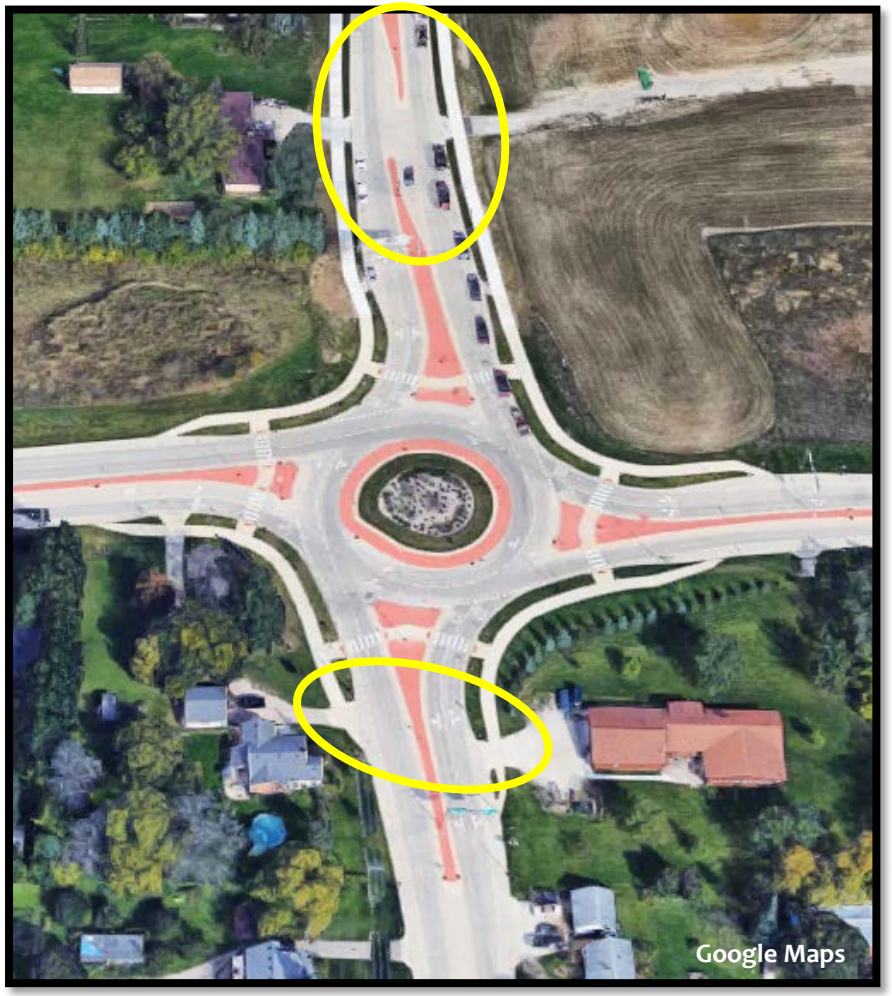
- Roundabouts provide easy U-turn opportunities
  - Allow for a reduction of full access points along the corridor
- Connecting two roundabouts with a raised median will restrict left-in/left-out access
  - Protect capacity and improve safety

Access with roundabout corridors

- Rural 2 lane to 4 lane urban expansion
- Traffic signals vs roundabouts
- Raised median – 30’ vs 8’
- U-turns?

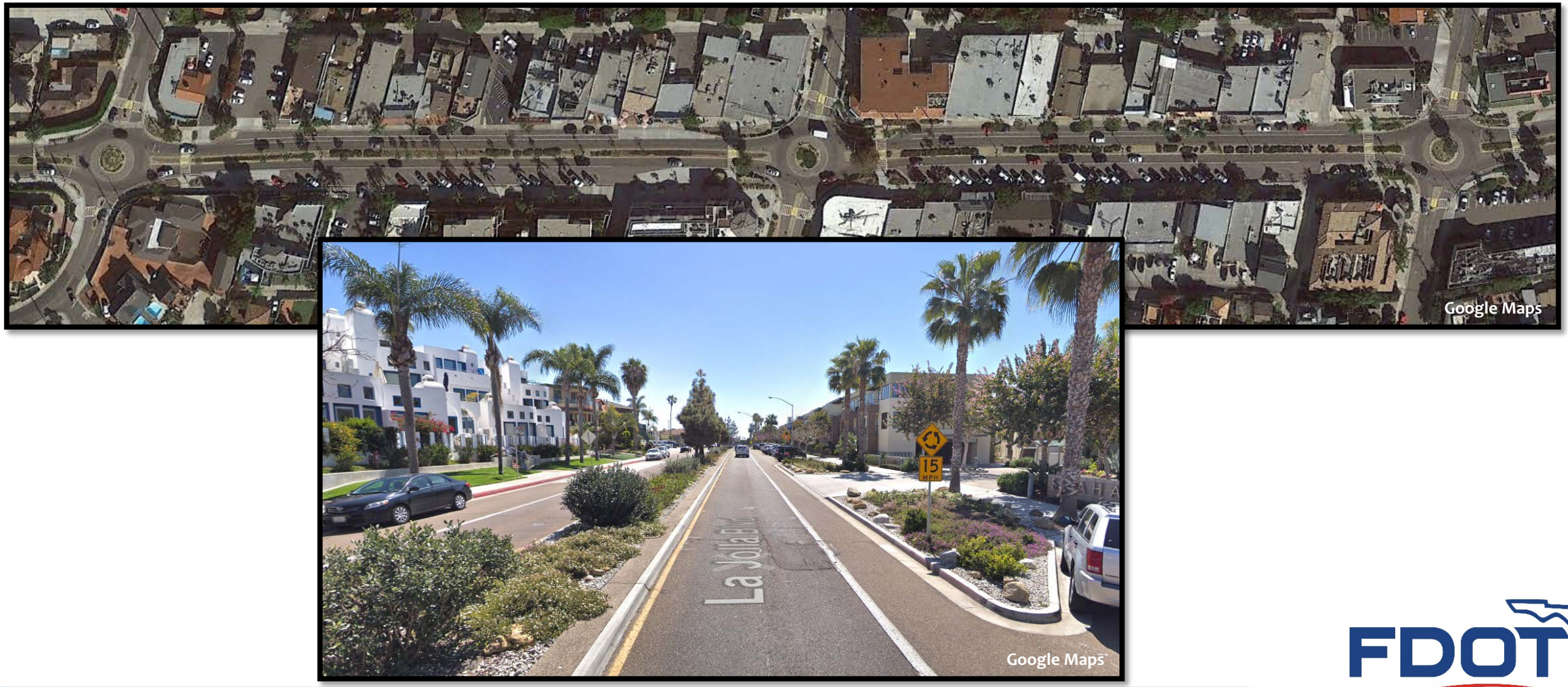
Access near the roundabout

Access with roundabout corridors

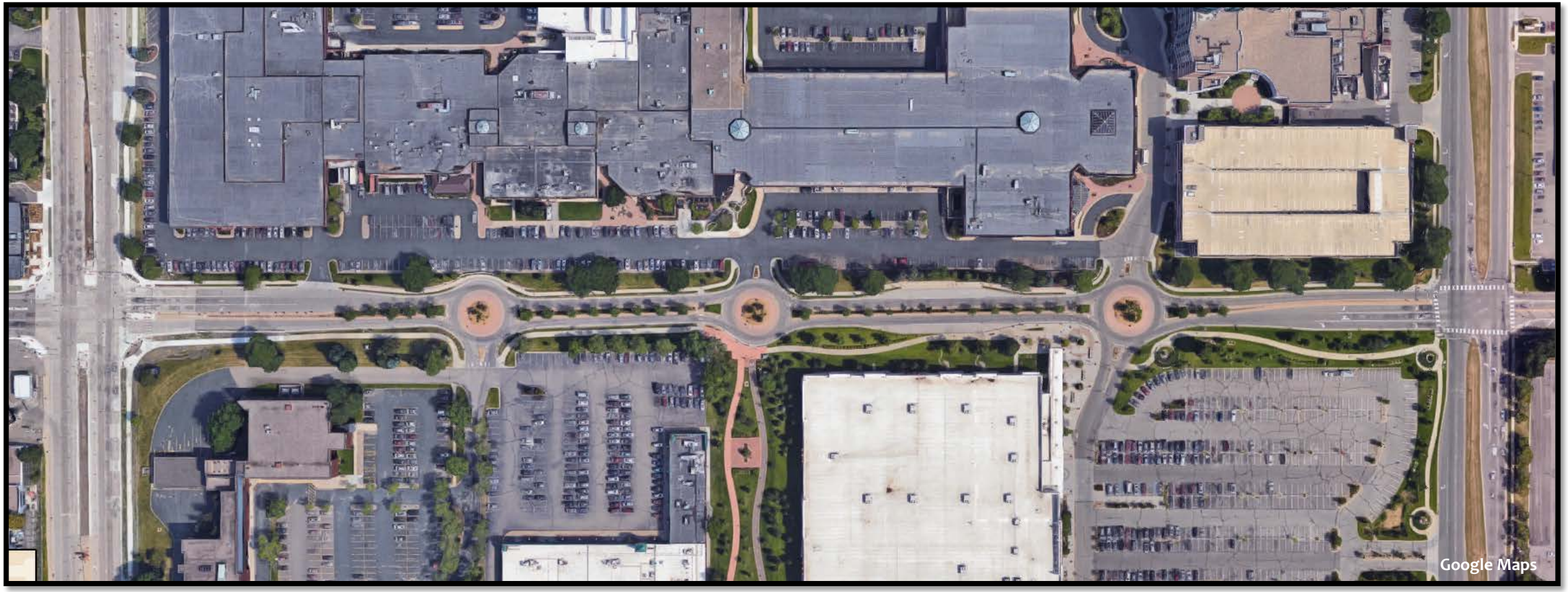


Access with roundabout corridors

Access with roundabout corridors



Access with roundabout corridors



Access with roundabout corridors

Access with roundabout corridors

Access with roundabout corridors

South Golden Road, Golden, CO

- ✓ Primary commercial corridor, ½ miles long
- ✓ 4 signals replaced with roundabouts in 1998-1999
- ✓ Slower speeds, but lower travel time and less delay
- ✓ Aesthetically pleasing, maintained traffic flow, additional pedestrian accommodations
- ✓ Accidents rates dropped by 88%
- ✓ Injury accidents rates dropped by 93% (31 – 3 years prior/1 – 4 ½ years after)
- ✓ Sales tax revenues increased 60%

Source: Are Roundabouts Good for Business? Alex Ariniello, 2004

Questions

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