Traffic Engineering 101 - The Basics

Understanding the basic principles and how these drive the decisions regarding traffic management in Louisiana

LOUISIANA'S ON THE MOVE... DOTD BUILDS THE WAY

LOCAL TECHNICAL ASSISTANCE PROGRAM LTAP LOUISIANA TRANSPORTATION RESEARCH CENTER

Traffic Engineering 101

- Purpose:
  - To provide an overview of engineering principles; guidelines & laws which govern traffic management in Louisiana
  - Discuss how DOTD's decisions impact local communities
  - Facilitate feedback & questions from local agencies on state and local traffic engineering issues

Manual on Uniform Traffic Control Devices

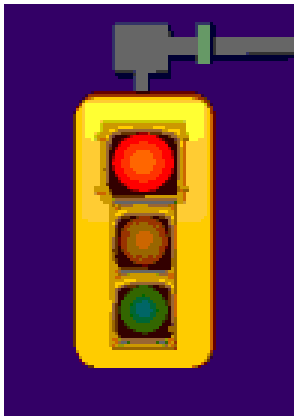
- Federal policy
- All states must adopt
- Set minimums for traffic control devices such as
  - Signs
  - Pavement marking
  - And signals

Engineering Design Standard Manual

- DOTD policy
- Signed by Chief Engineer
- Provides additional requirements

Basic Principle of Traffic Engineering

"*Everything is designed to meet Driver Expectancy*"



Even Roundabouts!

TR Engineering 101

- Module:
  1. Introduction & Overview (3/22/10)
  2. Speed Management Overview (4/26/10)
  3. School Zones (4/26/10)
  4. Intersection Traffic Control (5/24/10)
  5. Traffic Signal (5/24/10)
  6. Roundabouts (5/24/10)
  7. Sign Selection & Installation (6/28/10)
  8. Work Zones (6/28/10)
  9. Access Management (7/26/10)
  10. **Roundabouts (8/23/2010)**

TODAY

- Central, LA
- Roundabouts
  - Design Features
  - Safety Aspects
  - Operations and Capacity
  - Lafayette Roundabouts

Roundabout Myths

- “Louisiana drivers can’t handle it”
- “Not for high volume intersections”
- “Not for high speed suburban/rural intersections”
- “Trucks can’t maneuver through them”
- “The public won’t accept them”

More Suggestions?

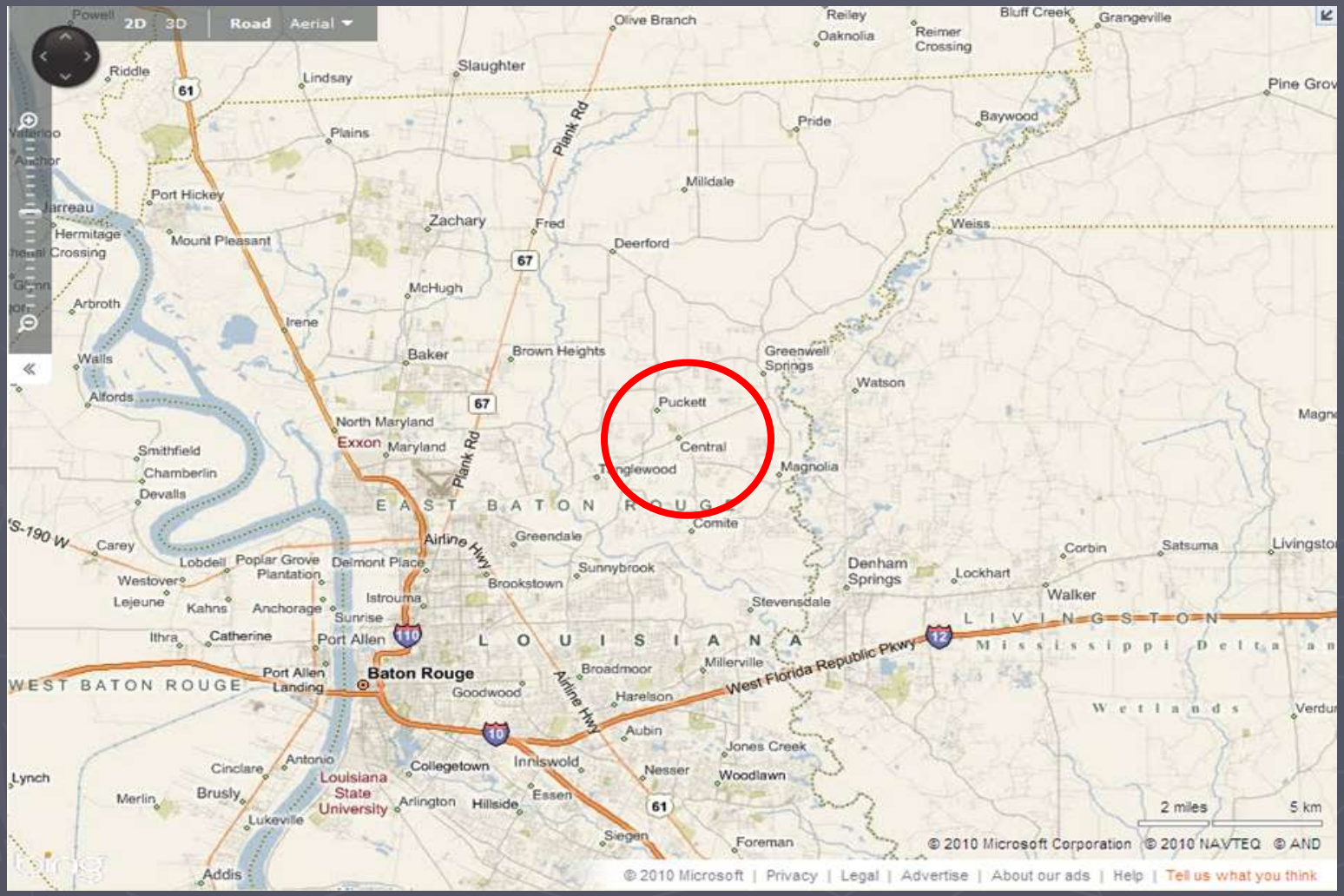
- Other traffic issues or questions?
- Contact Jody Colvin at **Jody.Colvin@la.gov**
- or Marie B. Walsh at **mbwalsh@ltrc.lsu.edu**

City of Central
East Baton Rouge Parish

Access Management

August 23, 2010

City of Central, Louisiana



CENTRAL

A COMMUNITY THAT CARES

CENTRAL, LOUISIANA

- 28,000 people
- 66 sq. miles
- 12th largest city in the state
- 2005 incorporated
- 2008 took over services from East Baton Rouge Parish
- **#5 School District** in the entire state of Louisiana*

*http://www.centraleconomicdevelopment.org/louisiana schools.php

Central Crossing on Wax Rd


To Sullivan Rd
East/West Driveway
Driveway 1
Main Driveway
Wax Rd
Wax Rd
3034
Wax Rd
Willowbrook Dr
50 feet
25 m
© 2010 Microsoft Corporation © 2010 NAVTEQ © AND
Pictometry Bird's Eye © 2010 Pictometry International Corp
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Central Crossing

- East West Driveway connecting Sullivan Rd to Willowbrook Drive through middle of shopping center.

Central Crossing

- Entrance from Sullivan Rd.

Central Crossing

- Driveway entrance #1 with bank access to entranceway.

Central Crossing

- Driveway #1 to Wax Rd. Right-in/Right-out only onto Wax Rd.
- Bank to left.
- Retail Center on right.

Central Crossing

- Main access driveway looking towards Wax Rd
- Bank on left.
- Retail business on right.
- Left and right turn lanes to Wax Rd.

Central Crossing

- Main Access Photo 2 at center intersection within shopping complex looking towards Wax Rd.
- Bank on left
- Retail office on right.

Central Crossing

- Main Entrance Photo 3 looking from Wax Rd.

Central Crossing

- View from Wax Rd headed west.
- No direct driveway access to Wax Rd.
- Driveway to the right is Main Entrance.

Cleaners / O'Reilly's

- Shared driveway to O'Reilly's Auto Parts and Central Cleaners on Wax Rd.

Cleaner's/O"Reilly's

- Another view of shared access between Central Cleaner's and O'Reilly's on Wax Rd.
- Cleaners not shown on right.

Cleaner's / O'Reilly's

- View looking toward the east of O'Reilly's and Central Cleaners on Wax Rd (LA3034)

Walgreens / Car Wash

- Shared access between Walgreen's and Car Wash at the intersection of Greenwell Springs Rd (LA37) and Sullivan Rd.

Walgreen's / Car Wash

- Shared driveway for Walgreens and Car Wash onto Sullivan Rd near Greenwell Springs Rd
- Car Wash on left. Walgreens on right.

Walgreen's / Car Wash

- View from Walgreens looking towards carwash (north)
- Shared driveway is at the stop sign.

Walgreens / Carwash

- Rear of Car Wash and Walgreens.
- This photo shows shared access along the rear of the property as well.
- Drive-thru shown at Walgreens

Central Square – Sullivan at Wax

Wax Rd extension 1

- Wax Rd extension at Central Square
- Car Wash on right
- Roundabout in background

Wax Rd extension 2

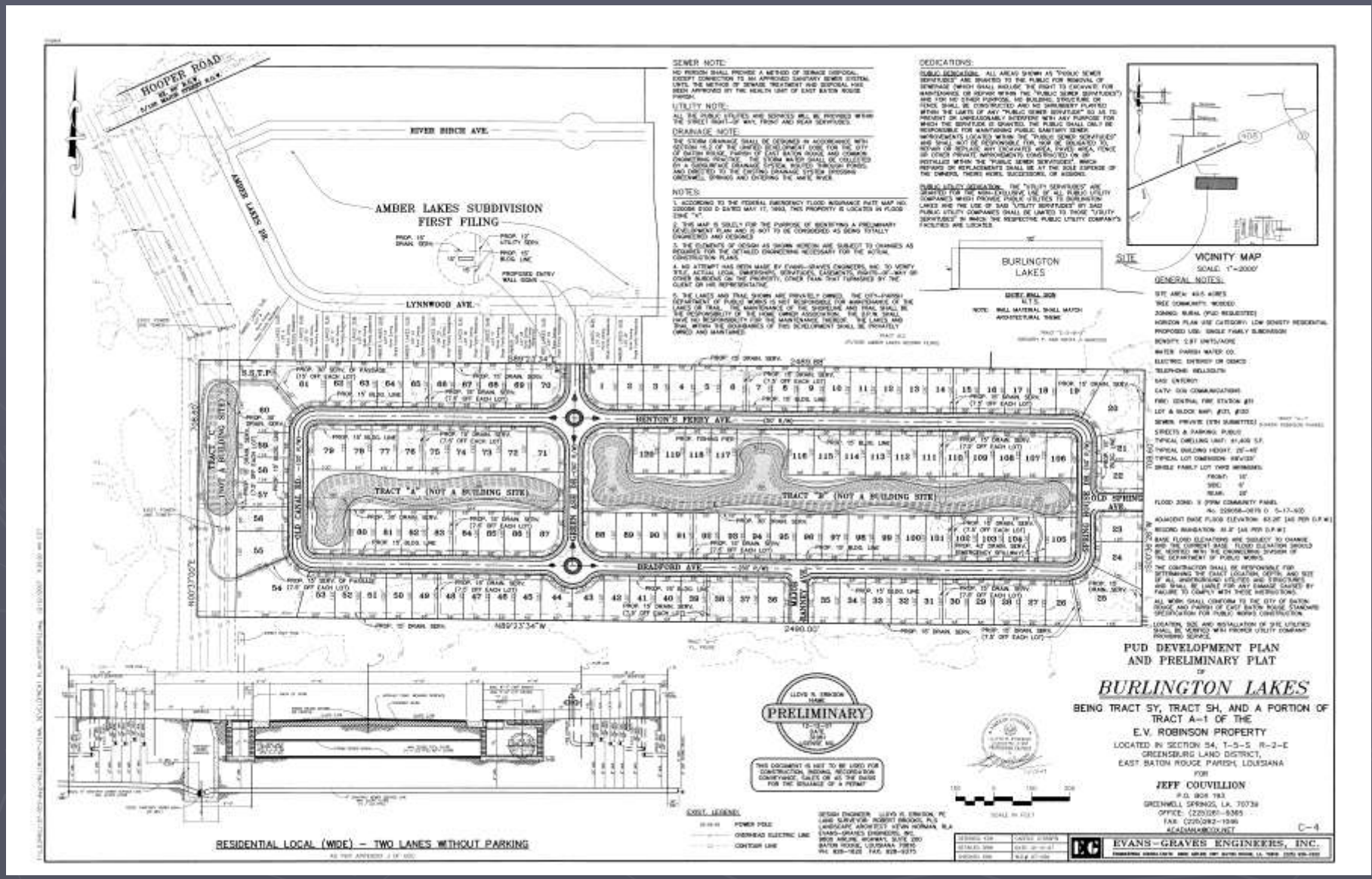
- Close up view of Roundabout.
- Roadway will be extended in the future to serve more retail and residential development.

Wax Rd extension 3

- Another view of roundabout looking west.
- Future street expansion to the west and south will connect to roundabout.

Wax Rd at Sullivan Rd EB
Developer had to add new lanes

Burlington Lakes - Roundabouts



Lovett Rd Roundabout

- Eastbound Approach to Roundabout on Lovett Rd at Magnolia Square in Central, LA

Lovett Rd Roundabout

- Roundabout on Lovett Rd at Magnolia Square

Lovett Rd Roundabout

- Roundabout on Lovett Rd installed March 2010.

Lovett Rd Roundabout

- Lovett Rd Roundabout

Lovett Rd roundabout WB

- Lovett Rd roundabout approach westbound

Lovett Rd roundabout WB

- Westbound approach to Lovett Rd roundabout

Lovett Rd roundabout WB

- Advance Warning sign on Lovett Rd WB.

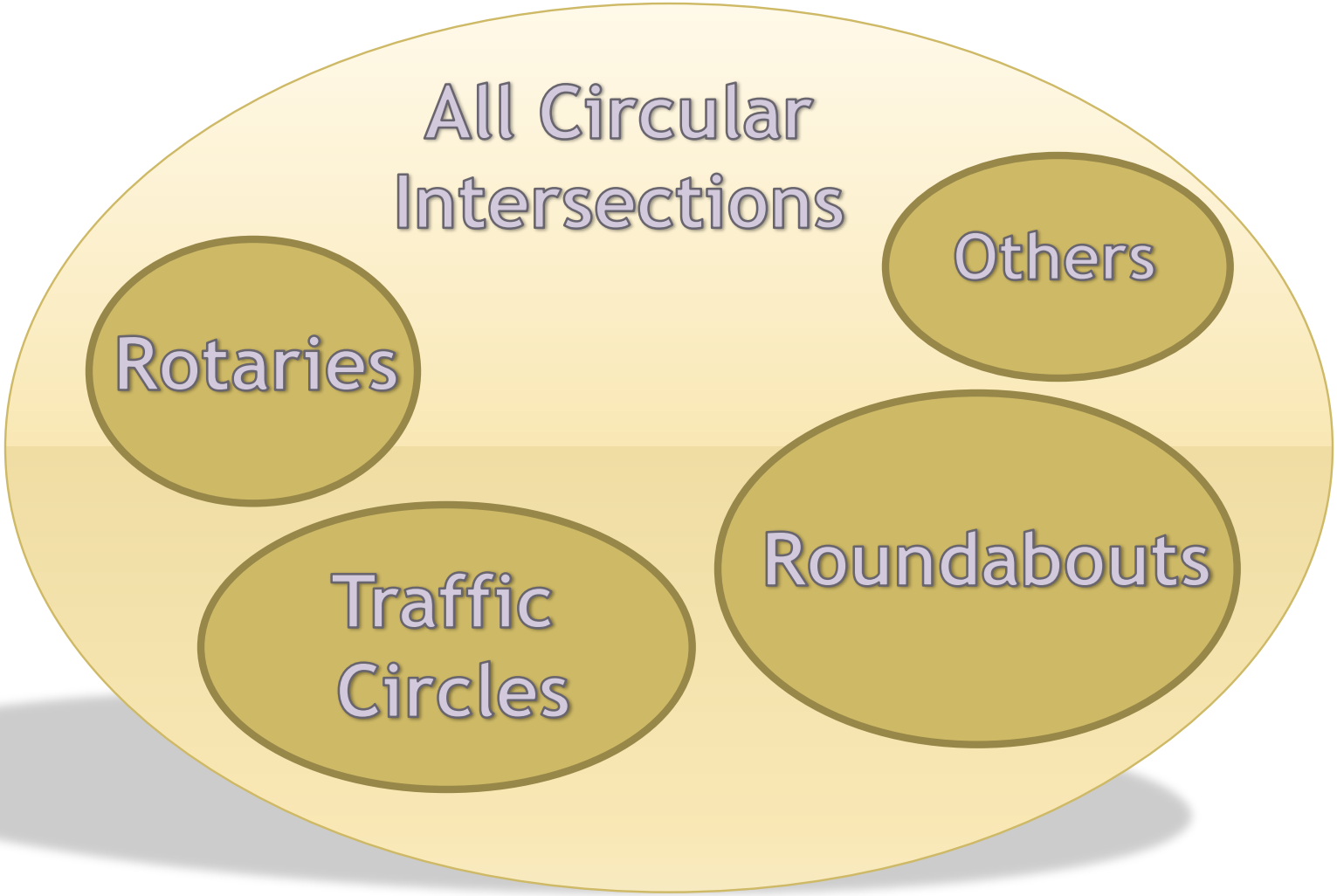
Contact Info

- David Barrow
- Central, LA (EBR Parish)
- 225-261-5255
- david.barrow@centralgov.com
- www.centralgov.com

SAFETY BENEFITS OF ROUNDABOUTS

AUGUST 23, 2010

TERMINOLOGY



WHAT ISN'T A ROUNDABOUT?

Rotary

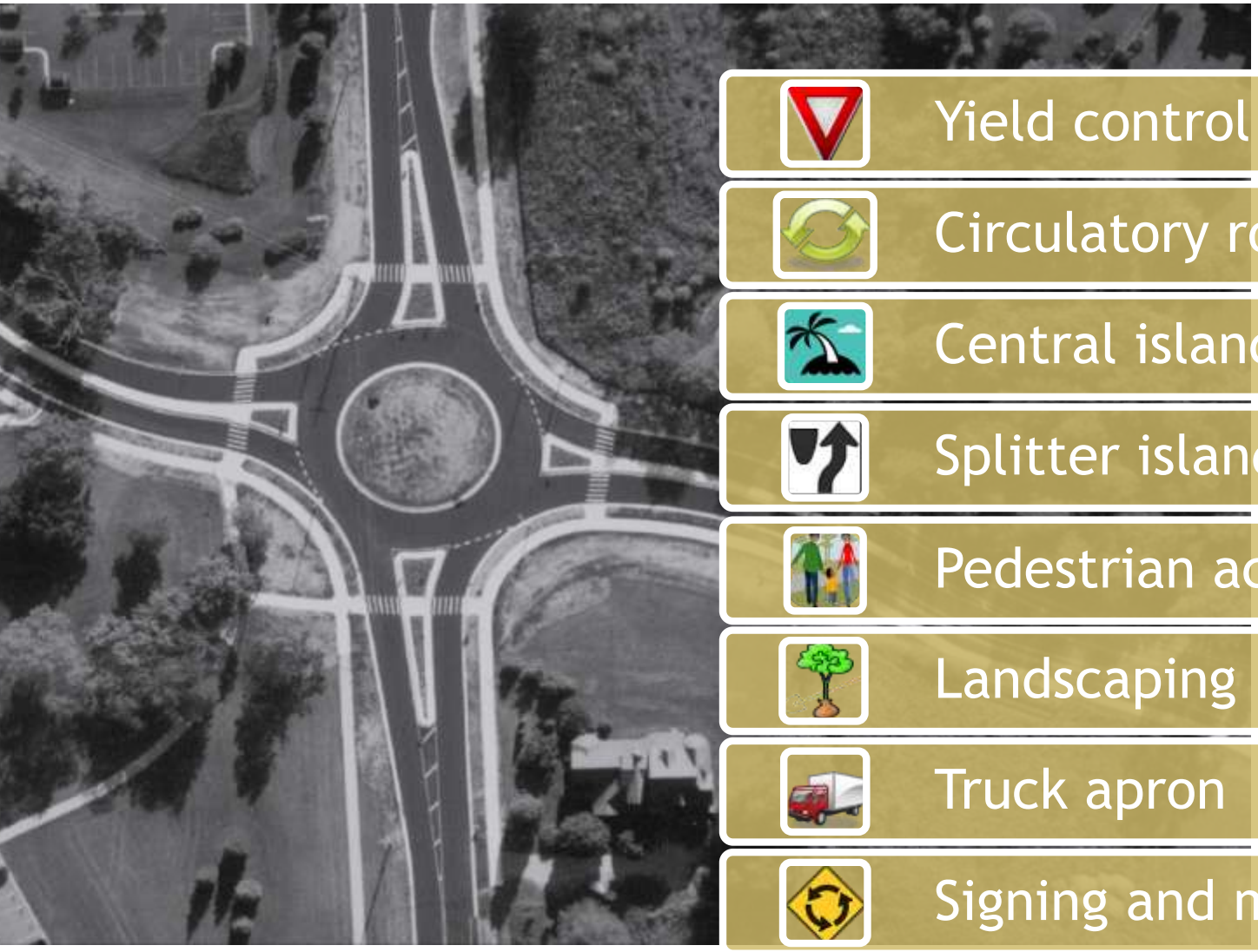
Traffic Circle

Neighborhood Circle

WHAT IS A ROUNDABOUT?

- A compact circular intersection in which traffic flows counter-clockwise around a center island
- Entering traffic yields
- Designed to slow the speed of vehicles
- Approaches are channelized to deflect traffic into a proper entry path

KEY FEATURES



- Yield control
- Circulatory roadway
- Central island
- Splitter island
- Pedestrian access
- Landscaping
- Truck apron
- Signing and marking

KEY FEATURES

Vehicles yield upon entry in a modern roundabout.

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

KEY FEATURES

Central island deflects vehicles from a straight-line path.

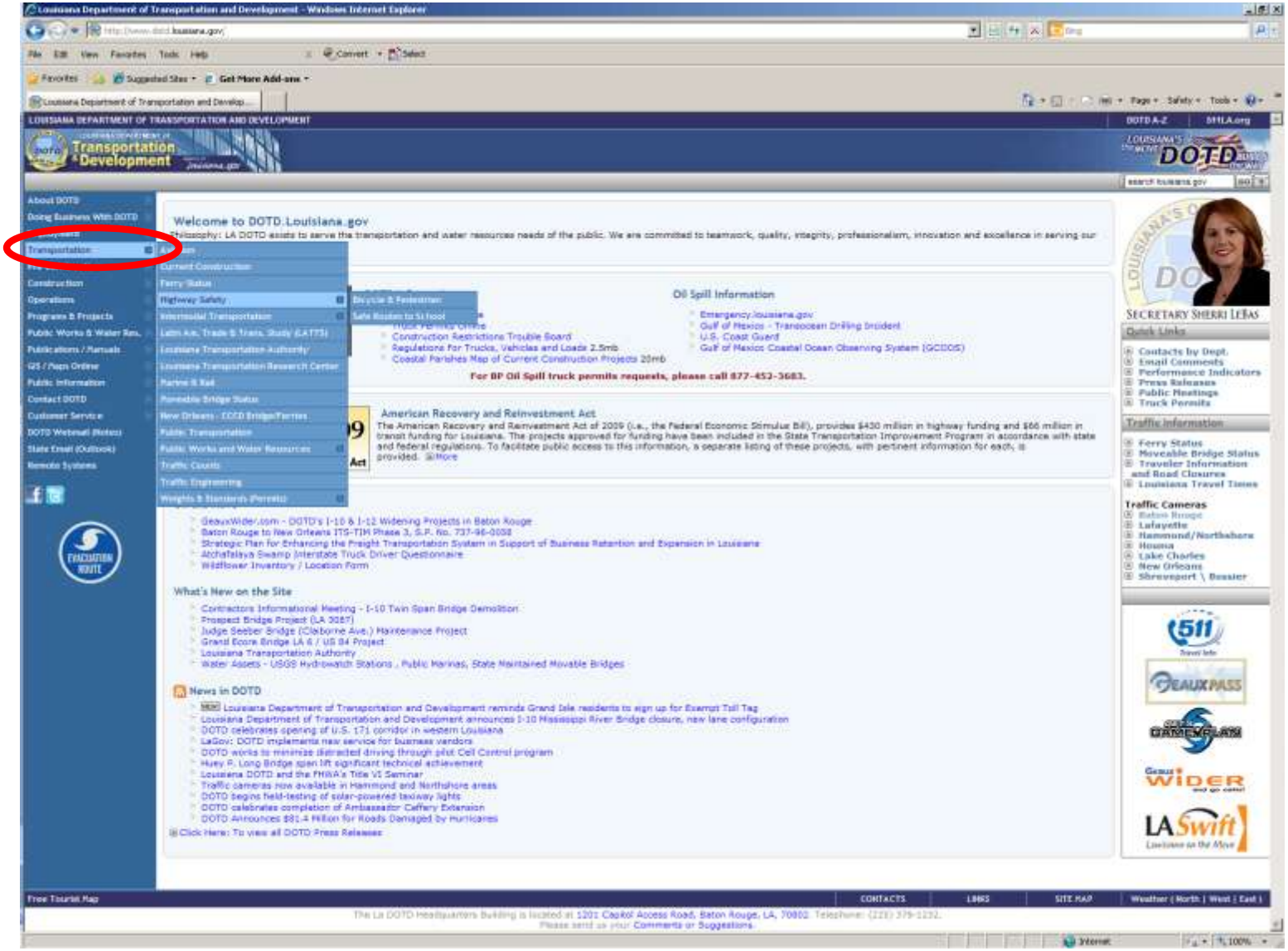
Landscaping is needed as a visual element to drivers

KEY FEATURES

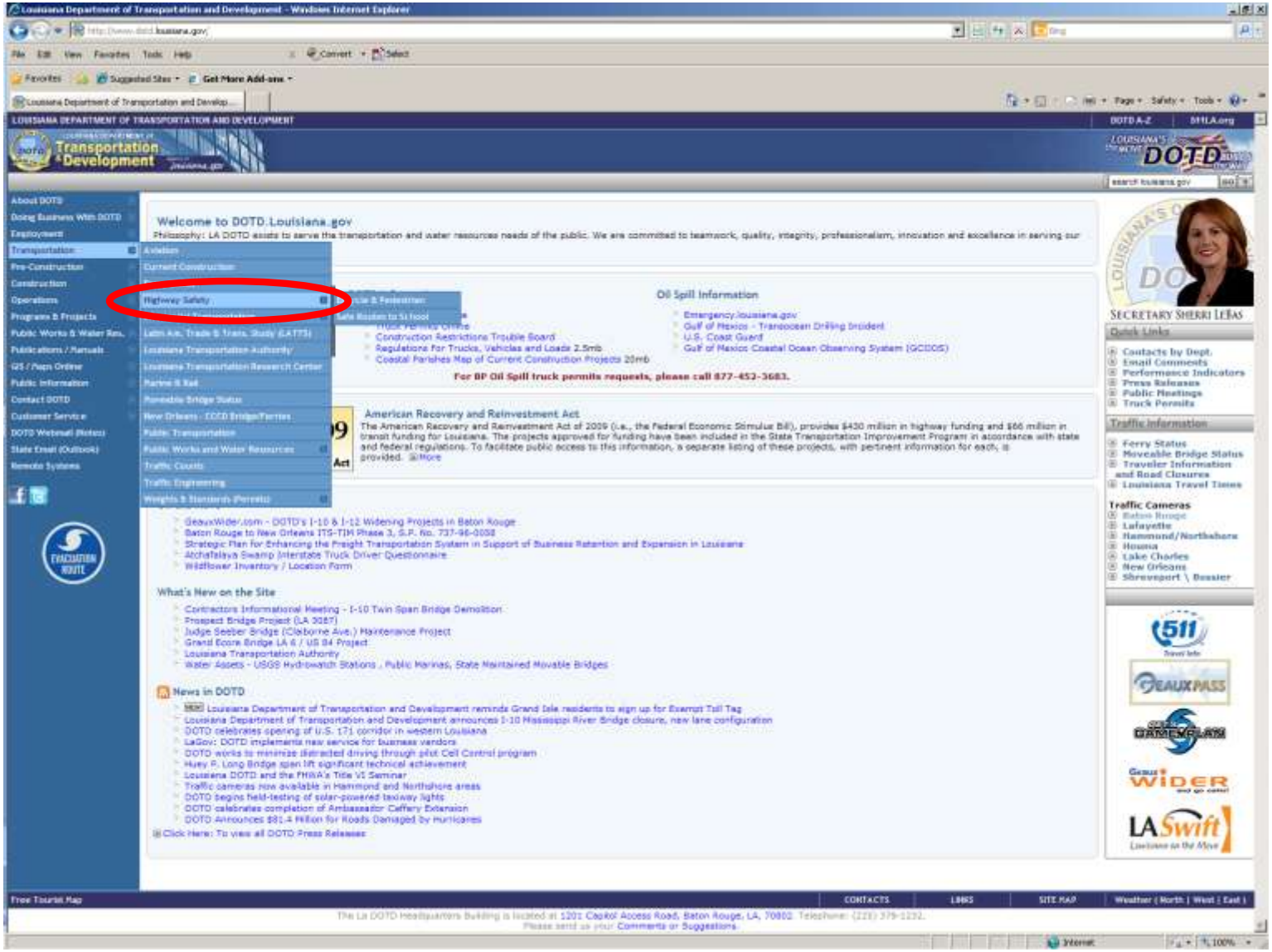
Splitter islands separate, deflect, and slow traffic.

Truck aprons should be designed to accommodate largest vehicle expected.

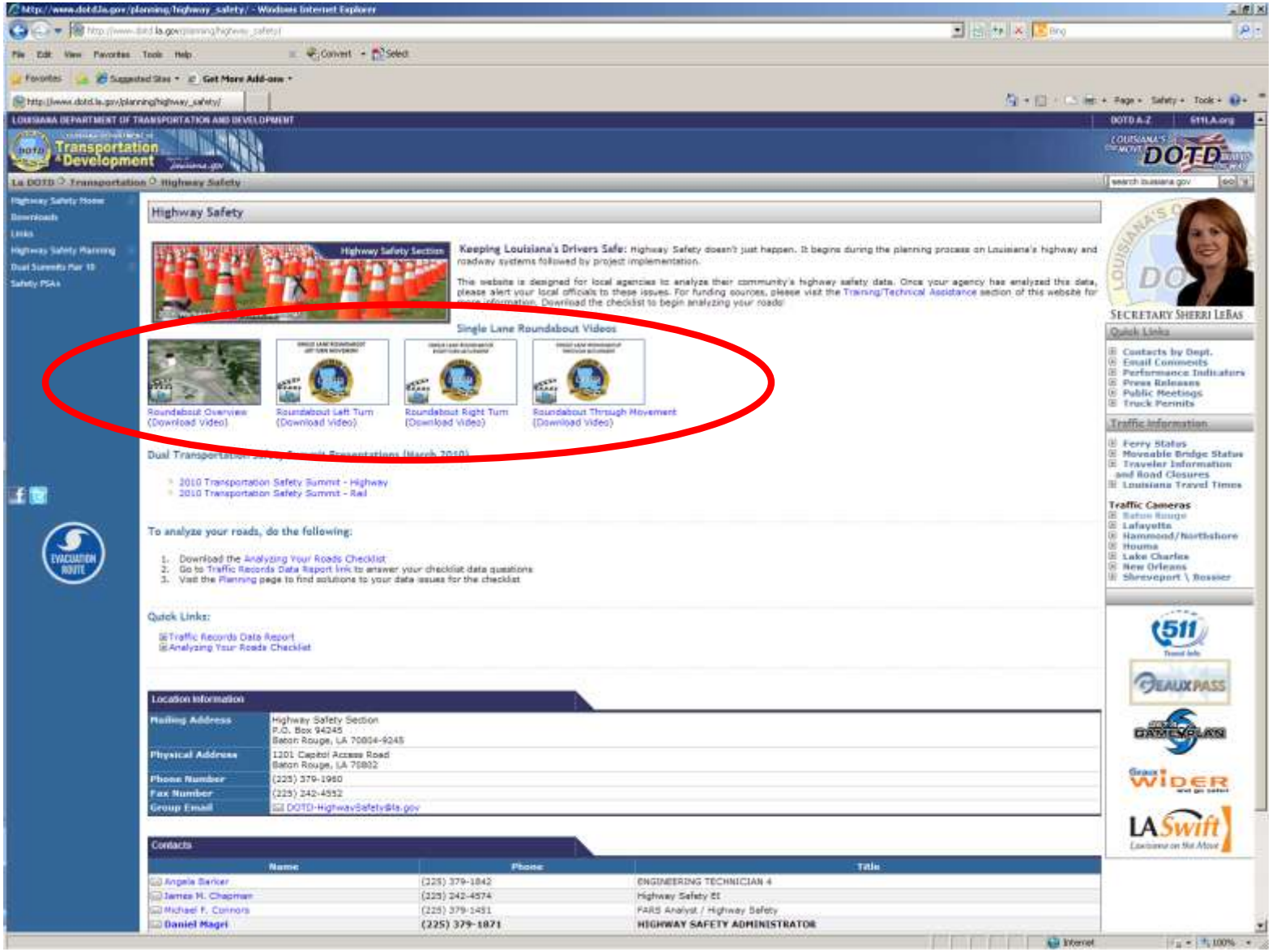
ROUNDABOUT SIMULATIONS



ROUNDABOUT SIMULATIONS



ROUNDABOUT SIMULATIONS

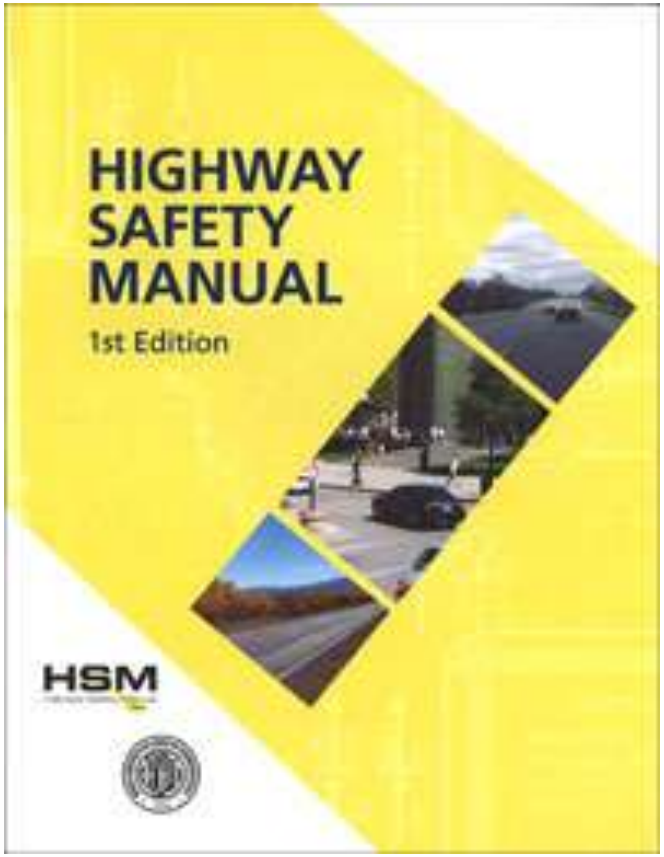


WHY ROUNDABOUTS?

- Improve safety – reduction in fatalities and serious injuries
- Save money
- Reduce congestion and pollution – less stopped delay and idling
- Complement other community values – promotes walkable communities and improved aesthetics

SAFETY BENEFITS

- Highway Safety Manual recently published by AASHTO
- Crash Modification Factor (CMF)
- Science-based approach to safety analysis



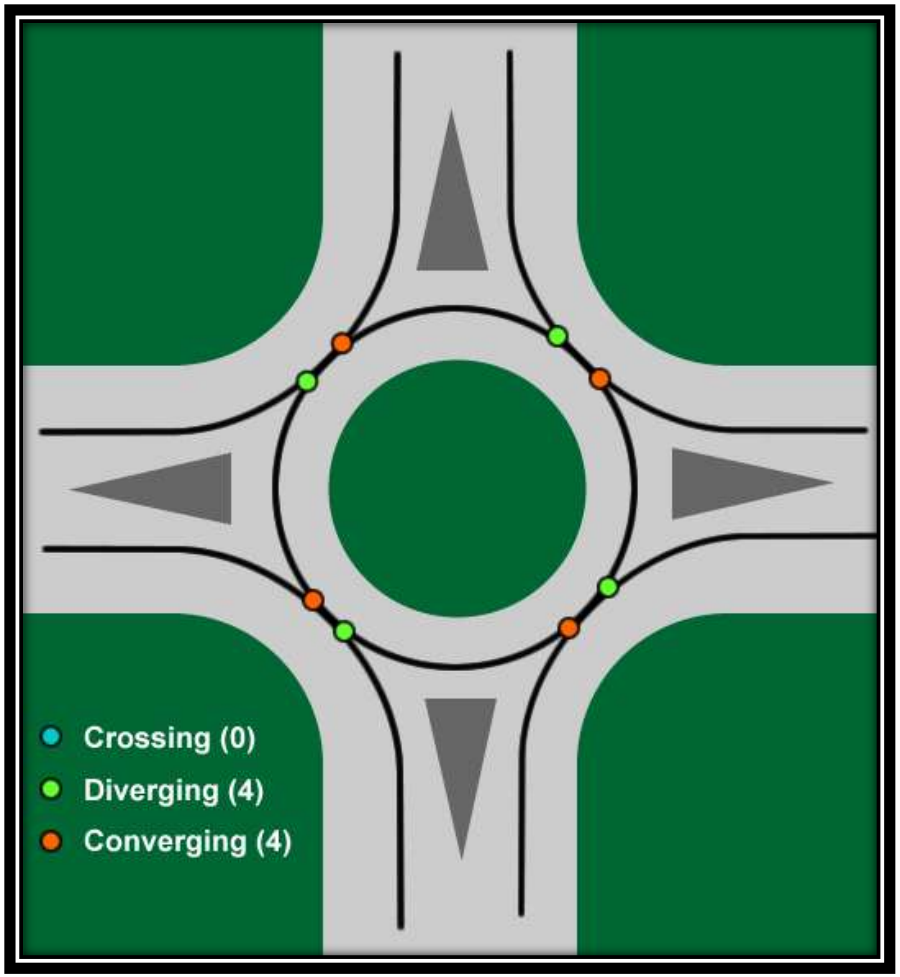
CMF FOR ROUNDABOUTS

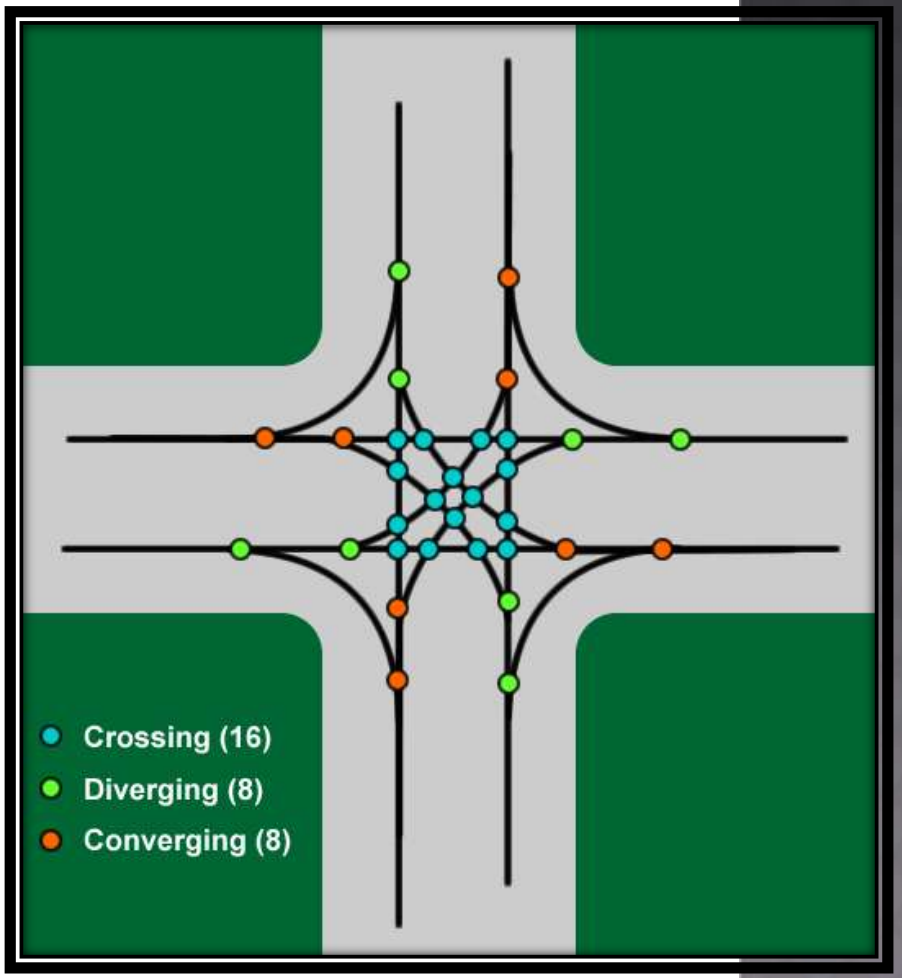
- Convert Signal to Roundabout
  - For Urban Areas (Single or Multilane)
    - CMF = 0.40 for Injury Crashes
    - 60% Reduction in Injury Crashes
  - For Suburban Areas (Multilane)
    - CMF = 0.33 for All Crash Severities
    - 67% Reduction in All Crashes

CMF FOR ROUNDABOUTS

- Convert 2-Way STOP to Single Lane Roundabout
  - For Rural Areas
    - CMF = 0.13 for Injury Crashes
    - 87% Reduction in Injury Crashes
  - For Urban and Suburban Areas
    - CMF = 0.22 for Injury Crashes
    - 78% Reduction in Injury Crashes

CONFLICT POINTS

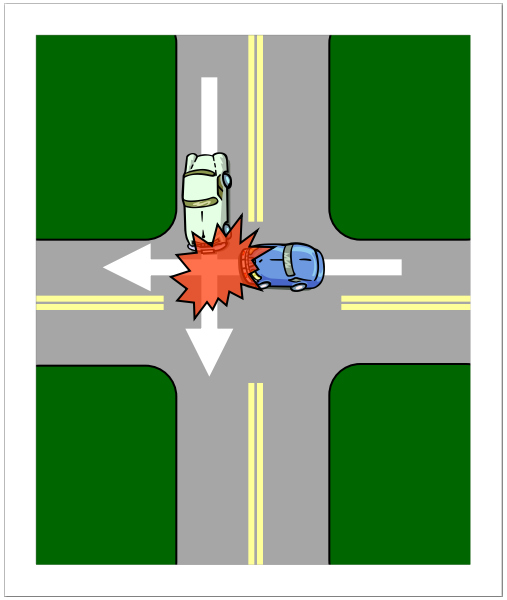




TYPE OF CRASHES

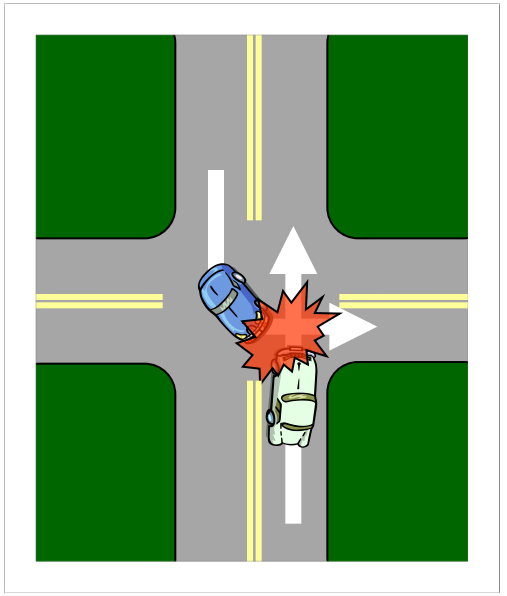
Typical 4-leg intersection

Angle



High Severity

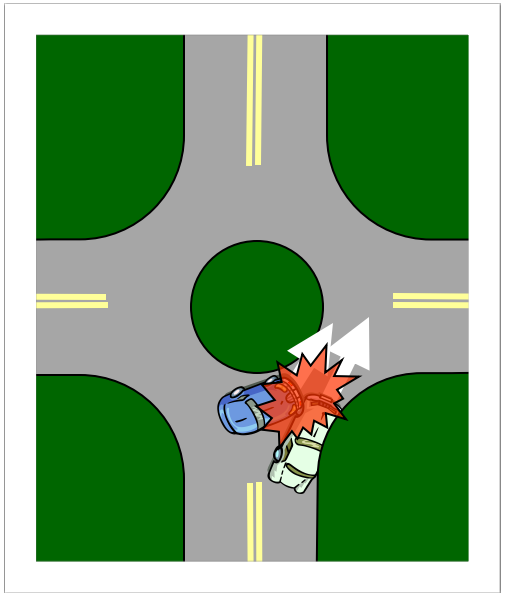
Left turn



High Severity

Roundabout

Sideswipe



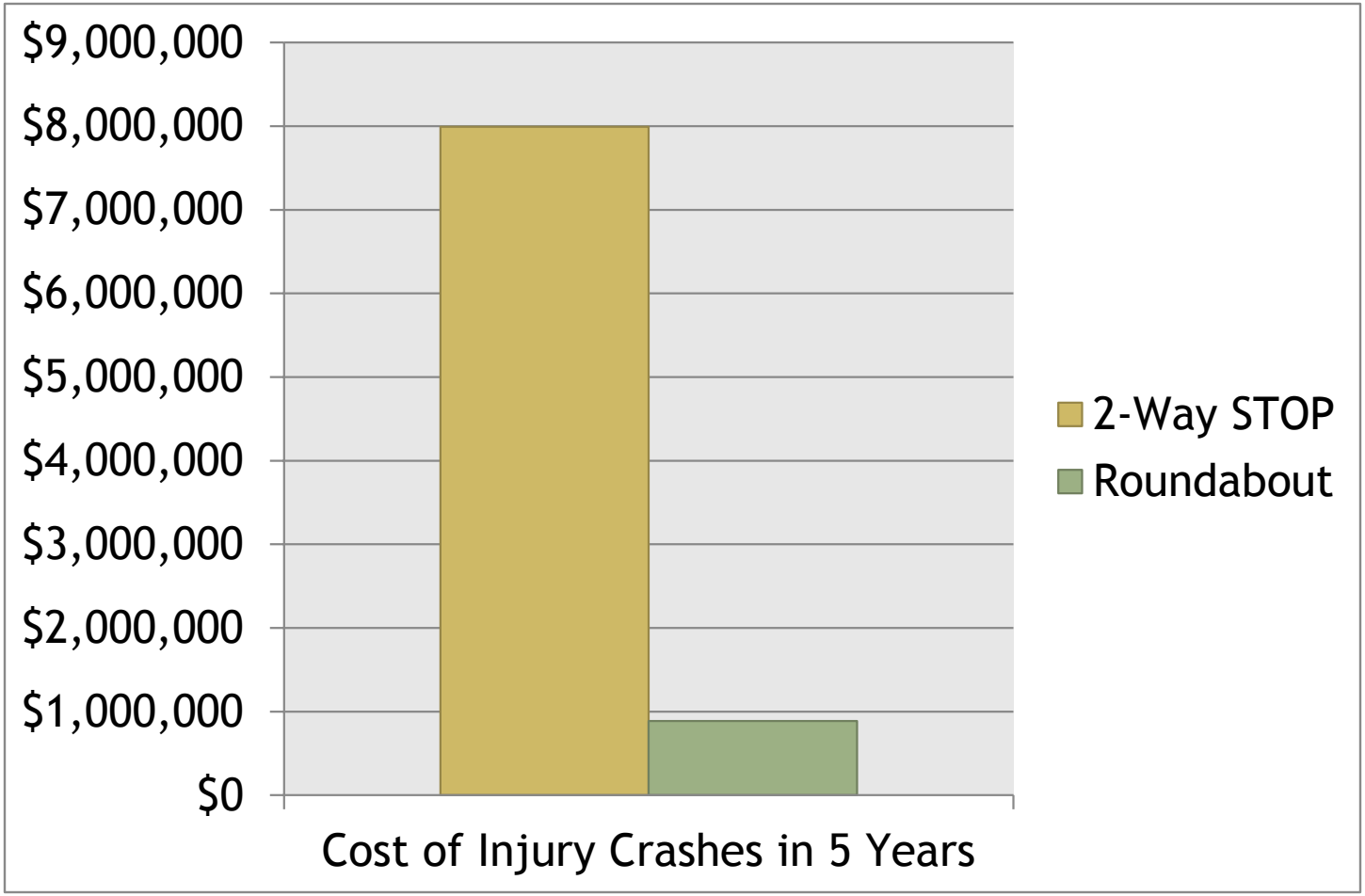
Low Severity

COST OF CRASHES IN LOUISIANA

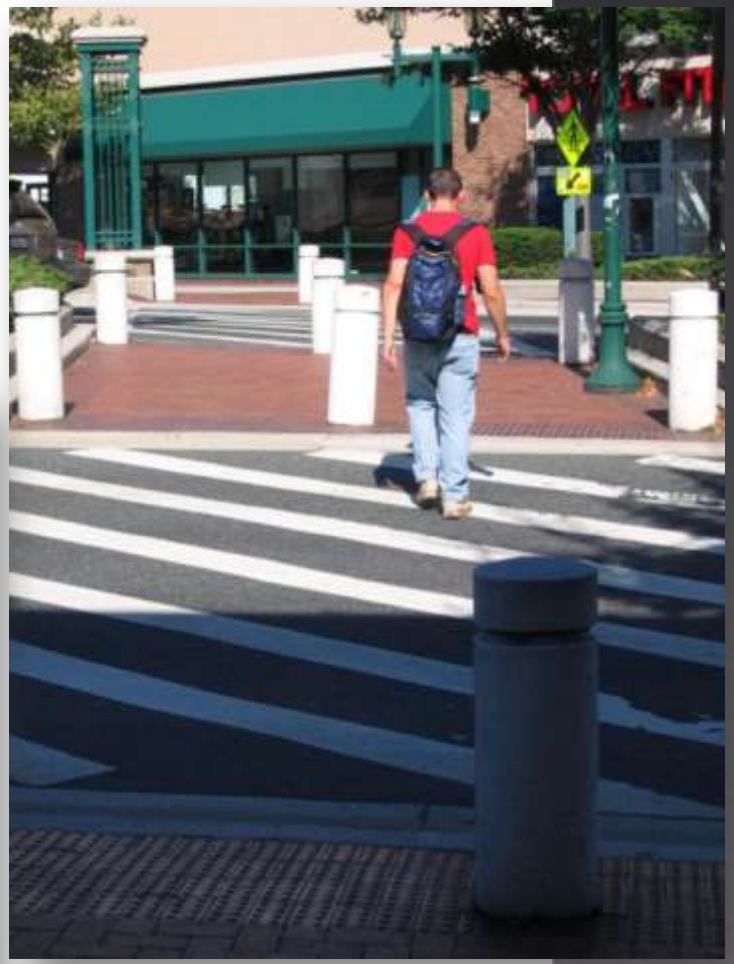
- Fatal Crash = $1,201,965.84*
- Serious Injury Crash = $888,240.81*
- PDO Crash = $3,114.36*

*Includes loss of productivity, medical costs, legal and court costs, emergency services costs, insurance administration costs, travel delay, property damage, and workplace losses.

LESS CRASHES = MORE MONEY



SPECIAL CONSIDERATIONS



ROUNDABOUT RESOURCES

CONTACT INFORMATION

April Renard, P.E.

Highway Safety Engineer

Louisiana Department of Transportation and Development

1201 Capitol Access Road

Baton Rouge, LA 70802

(225)379-1919

april.renard@la.gov

Roundabouts – Operation & Design

Adapted from photo by Lee Rodegerdts (used with permission)

Presentation Overview

- Characteristics of modern roundabouts with emphasis on principles-based approach to design
- Key considerations for analysis and design of roundabouts

Photo: Kittelson & Associates, Inc.

Presentation Outline

- **Louisiana Roundabouts**
- Benefits of Roundabouts
- Location Considerations
- DOTD Policy
- Conclusions

Louisiana Roundabouts Installed

- LA 59 @ LA 36 - Abita Springs
- LA 1067 @ Airport Road - Hammond
- LA 93 @ Ridge Road - Lafayette
- LA 92 @ Chemin Metairie Parkway - Lafayette metro (Youngsville)
- LA 89 @ Chemin Metairie Parkway – Lafayette metro (Youngsville)

….and other local installations.

Louisiana Roundabouts Under Construction

- LA 1091 @ Brownswitch Road - Slidell
- US 11 @ Cleo - Slidell
- LA 1067 @ Airport Road - Hammond

Note: These locations are on State highways near Interstate access in a high speed, high traffic volume environment.

Louisiana Roundabouts Under Consideration

- Lafayette urban area –
  - LA 342 @ LA 724
  - LA 93 @ LA 3168
  - Regional consideration
- Baton Rouge urban area –
  - US 190 @ Juban
  - US 190 @ Eden Church Rd
  - LA 16 @ LA 22
  - LA 431 @ LA 42

Louisiana Roundabouts Under Consideration

- North Shore
  - US 51 Bus @ I-12
  - LA 1077 @ LA 1085
  - US 190 @ La 434
  - LA 40 @ Barkers Corner
- Alexandria urban area
  - LA 8 @ LA 3144/Susek Drive
- Monroe urban area
  - I-20 @ Garrett Rd Interchange
- Jefferson Parish
  - LA 3154 @ Hickory

Roundabouts in Louisiana

LA 93 (Rue De Belier) @ LA 342 (Ridge Rd)

Roundabouts in Louisiana

LA 92 @ Chemin Metairie Parkway

Roundabouts in Louisiana

LA 59 @ LA 36

Presentation Outline

- Louisiana Roundabouts
- **Benefits of Roundabouts**
- Location Considerations
- DOTD Policy
- Conclusions

Benefits of Roundabouts

- Operational Performance
  - Lower overall delay than other controlled intersections
  - Specific users do not receive priority
- Ongoing Operations and Maintenance
  - Lower operating and maintenance costs than a traffic signal
  - Lower life cycle cost
- Approach Roadway Width
  - May not require lengthy turn lanes
  - May have greater right-of-way needs at the intersection quadrants

Benefits of Roundabouts (Continued)

- Access Management
  - Facilitate U-turns, enabling left-turn restrictions at driveways
- Environmental Factors
  - Less noise, fuel consumption and fewer air quality impacts
- Aesthetics
  - Islands offer opportunity for landscaping and art displays
- Land Use
  - Provide transition areas between different environments

Presentation Outline

- Louisiana Roundabouts
- Benefits of Roundabouts
- **Location Considerations**
- DOTD Policy
- Conclusions

Location Considerations

- A modern roundabout should be considered anywhere a traffic signal or stop control is under consideration
- Roundabouts can be advantageous in a number of locations
- However, certain constraints may adversely affect their feasibility at a specific site

Common Site Applications – Schools / High Pedestrian Volumes

- Schools / High Ped Locations: Reduce vehicle speeds

Common Site Applications - Interchanges

- Interchanges: More efficient use of bridge / underpass between ramp terminals

Common Site Applications – Commercial Developments

- Commercial Developments: Safe, slower speeds, meets capacity needs and aesthetically pleasing.

Common Site Applications – Residential Subdivisions

- Residential Subdivisions

Common Site Applications - Corridors

Saratoga County: NYS Route 67 corridor, Town of Malta

Common Site Applications – Gateway Treatments

- Gateway Treatments: Create community focal point

Common Site Applications – Intersections with High Delay

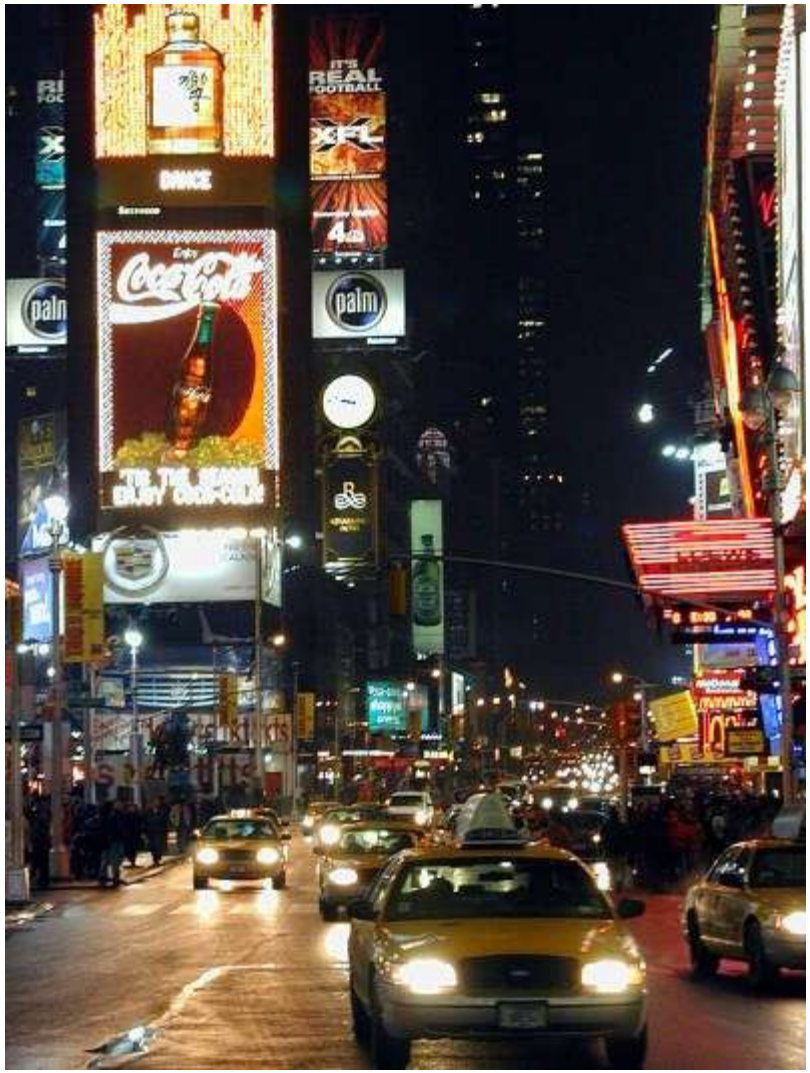
- Intersections with high delay

Common Site Applications – Rural Intersections

- Rural Intersections: significantly reduce fatal and serious injuries compared to signals and 4-way stops

Potential Site Constraints – Arterial Signal Systems

Potential Site Constraints – Right of Way Constraints



Presentation Outline

- Louisiana Roundabouts
- Benefits of Roundabouts
- Location Considerations
- **DOTD Policy**
- Conclusions

DOTD Policy

- Planning level
  - EDSM VI.1.1.5
  - “Roundabout Study and Approval”
- Design level
  - EDSM VI.1.1.6
  - “Roundabout Design”

DOTD Policy – Roundabout Study and Approval

- Comprehensive investigation and report of traffic conditions and physical site
- Installation recommended by District and approved by the Chief Engineer
- Report includes:
  - Crash history
  - Traffic volumes
  - Speed study
  - Modeling
  - Capacity Analysis
  - Identify safety concerns
  - Nearby land use / ROW
  - Conceptual drawing

DOTD Policy – Roundabout Study and Approval

- DOTD has identified conditions that may justify a roundabout in policy
  - Intersection with 5 or more reported crashes
  - Intersections with poor visibility
  - Need to increase capacity of intersection
  - Intersections with limited space for queuing
  - Intersections with difficult skew angles, significant offsets, odd number of approaches or close spacing to other intersections
  - Intersections where U-turns need to be accommodated.

DOTD Policy – Roundabout Design EDSM VI.1.1.6

- Operational
- Geometry
- Pedestrians
- Bicycles
- Transit vehicles
- Signing
- Pavement Markings
- Landscaping
- Lighting

Key Objectives of Roundabout Design

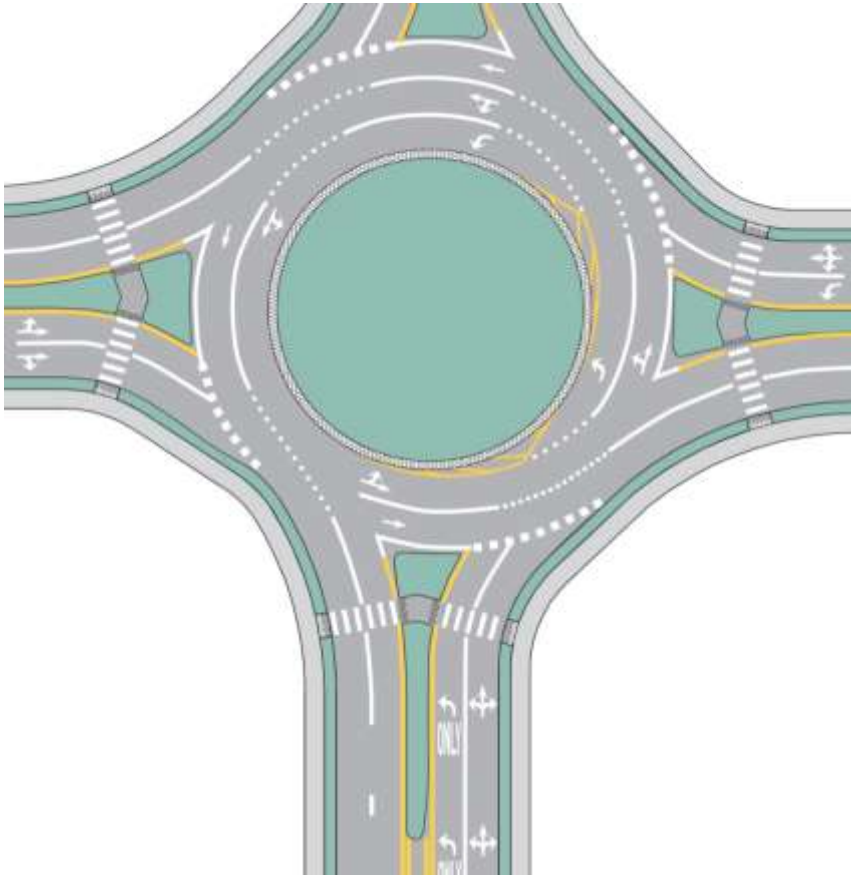
- Slow entry speeds
- Appropriate number of lanes
- Smooth channelization
- Adequate accommodation for design vehicles
- Meeting needs of pedestrians and bicyclists
- Appropriate sight distance and visibility

Pavement Markings and Signs

- Markings and signs are integral to roundabout design and should facilitate through and turning movements

- Typical pavement markings delineate the entries, exits, and circulatory roadway

- Overall signing concept similar to intersection signing



Presentation Outline

- Louisiana Roundabouts
- Benefits of Roundabouts
- Location Considerations
- DOTD Policy
- **Conclusions**

Conclusion

- In general, roundabouts are much safer and perform better than traffic signals or 4-way stops.
  - Installation of a traffic signal should be a “last resort”.
- Roundabouts can be installed in most locations.
- Roundabout design features work together to effectively control an intersection.
- In Louisiana, roundabouts are here to stay!

References

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- Federal Highway Administration. *Roundabouts: An Informational Guide*. June 2000.
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- Federal Highway Administration. *Technical Summary on Mini-Roundabouts*. 2010.
- National Cooperative Highway Research Program. *Roundabouts in the United States*. 2007.
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- Transportation Research Board. *Highway Capacity Manual*. 2010.
- American Association of State Highway and Transportation Officials. *A Policy on Geometric Design of Highways and Streets*. 2004.
- Kansas Department of Transportation. *Kansas Roundabout Guide: A Supplement to FHWA's Roundabouts: An Informational Guide*. October 2003.
- Federal Highway Administration. *Manual on Uniform Traffic Control Devices*. January 2009.
- Illuminating Engineering Society. *Design Guide for Roundabout Lighting*. February 2008.

For More Information

- Visit FHWA's intersection safety web site to access more materials highlighting roundabouts:

  http://safety.fhwa.dot.gov/intersection

John M Broemmelsiek, P.E.
Traffic Operations Engineer,
FHWA Louisiana Division

Phone: (225) 757-7614

E-mail: john.broemmelsiek@dot.gov

Background

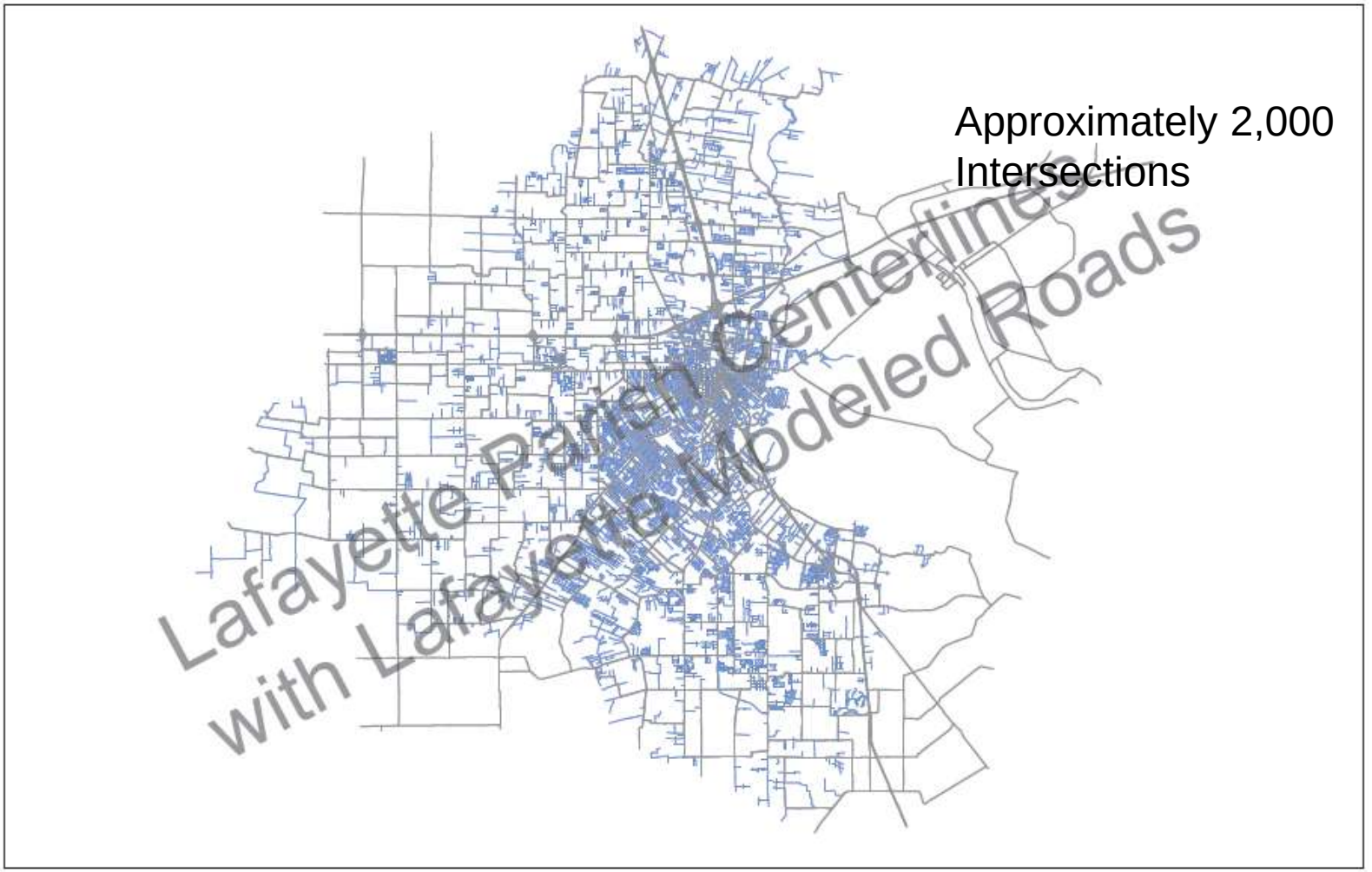
Background

- MPO Committees (community) bought into roundabout plan and roundabouts as Traffic control.
- Learned about TIGER Grant in May, applications were due by September 15th (4 months).
- Prompted the MPO to come up with a quick method to select potential locations for Roundabouts.

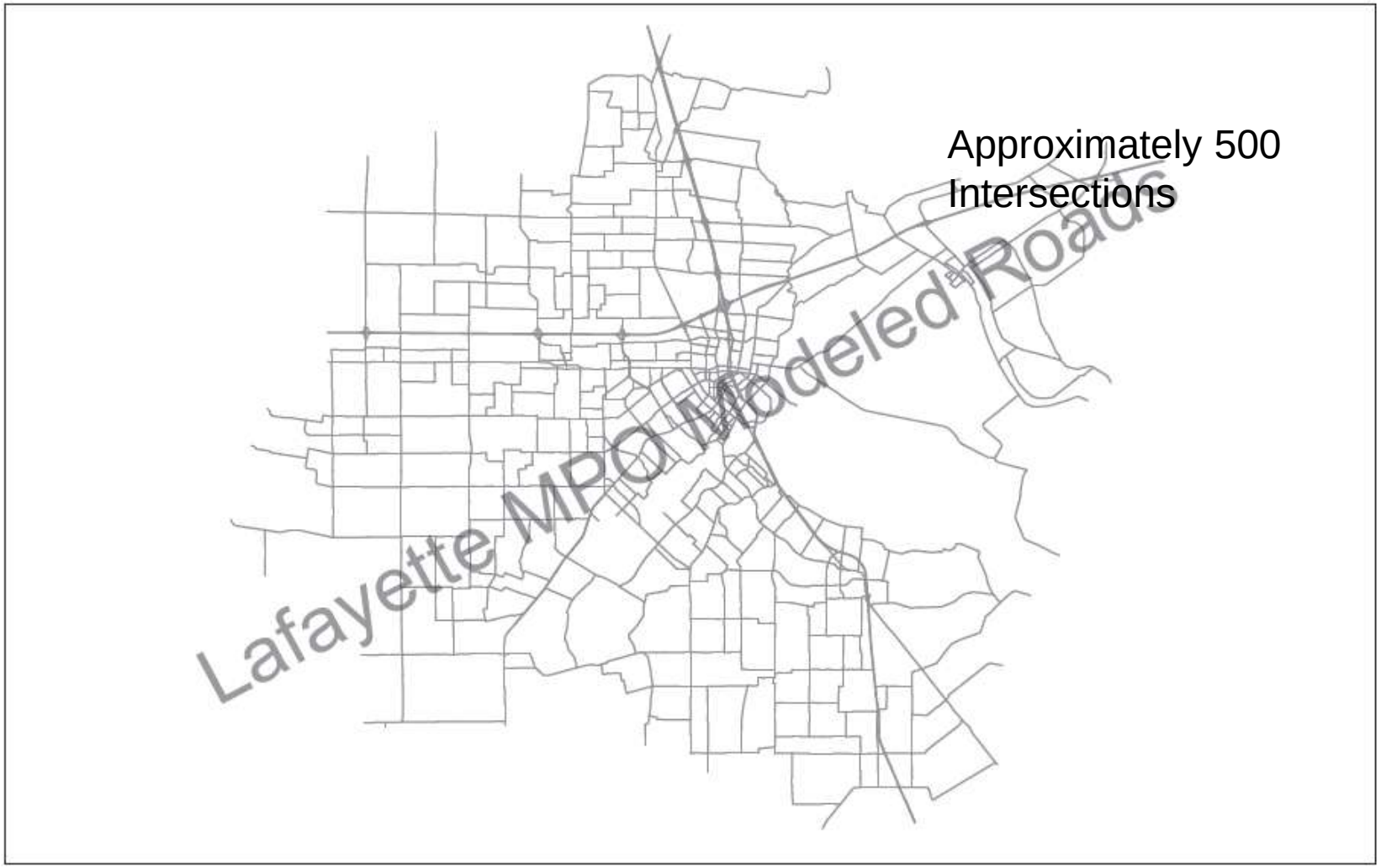
Methodology

- Selection of Variables
  - Intersection Volume
    - Volume split ratio
  - Safety
    - 3 year summary of crashes
  - Right of way assignment
    - Current traffic control
  - Existing Geometrics
    - Intersection Geometrics

Intersection Volume (1)

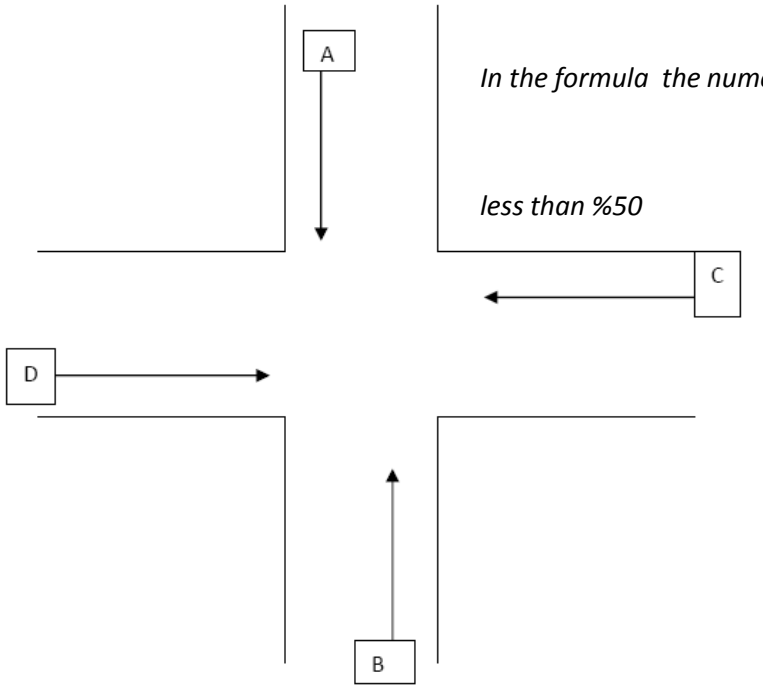


Intersection Volume (2)



Intersection Volume (3)

- 1. Volume Split Ratio- The ratio of volumes of the two entering directions



*3 or C+D))/ (A+B)+(C+D))*100*

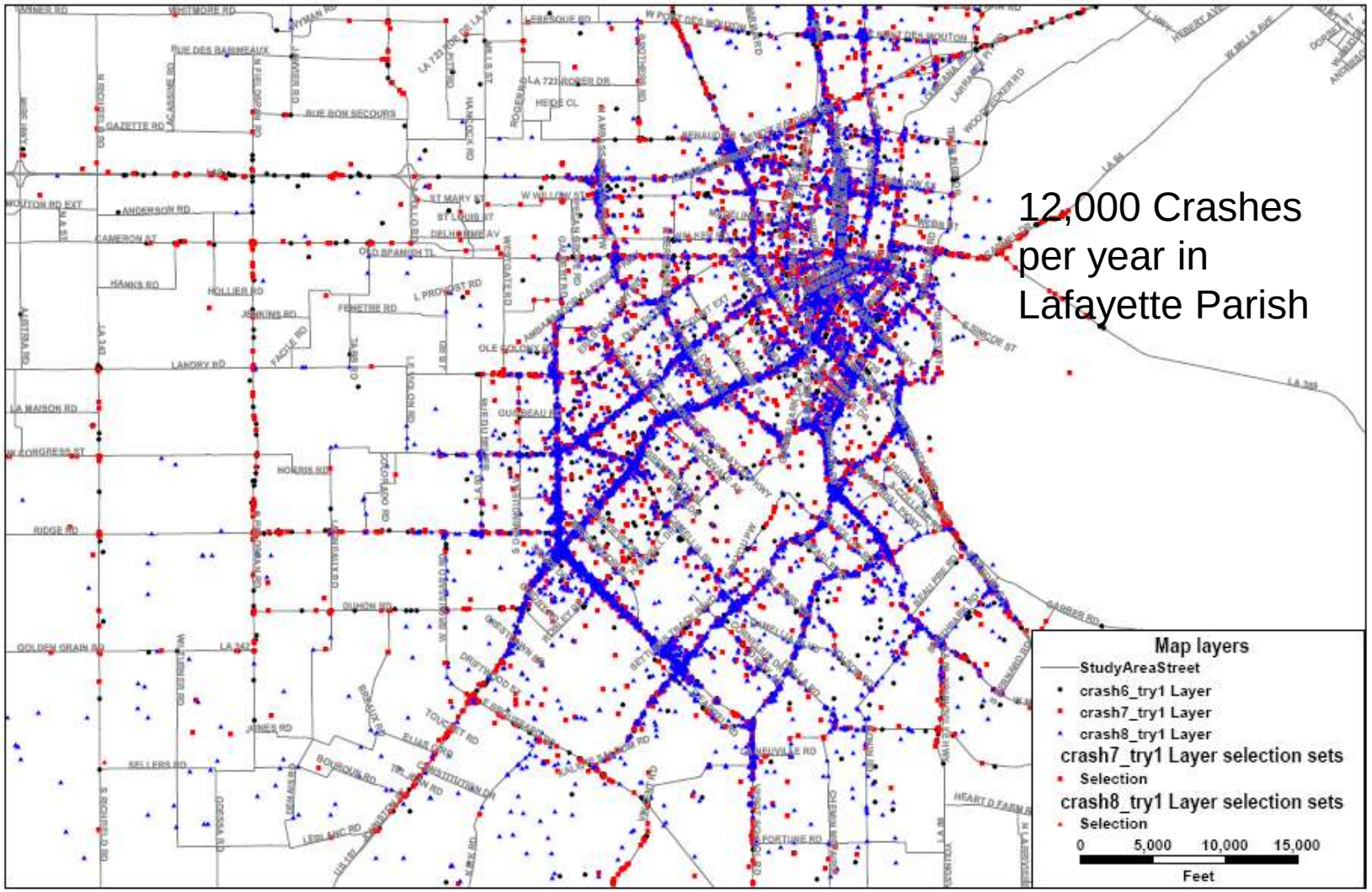
In the formula the numerator will always be the smaller

or C+D, this will make the percentage

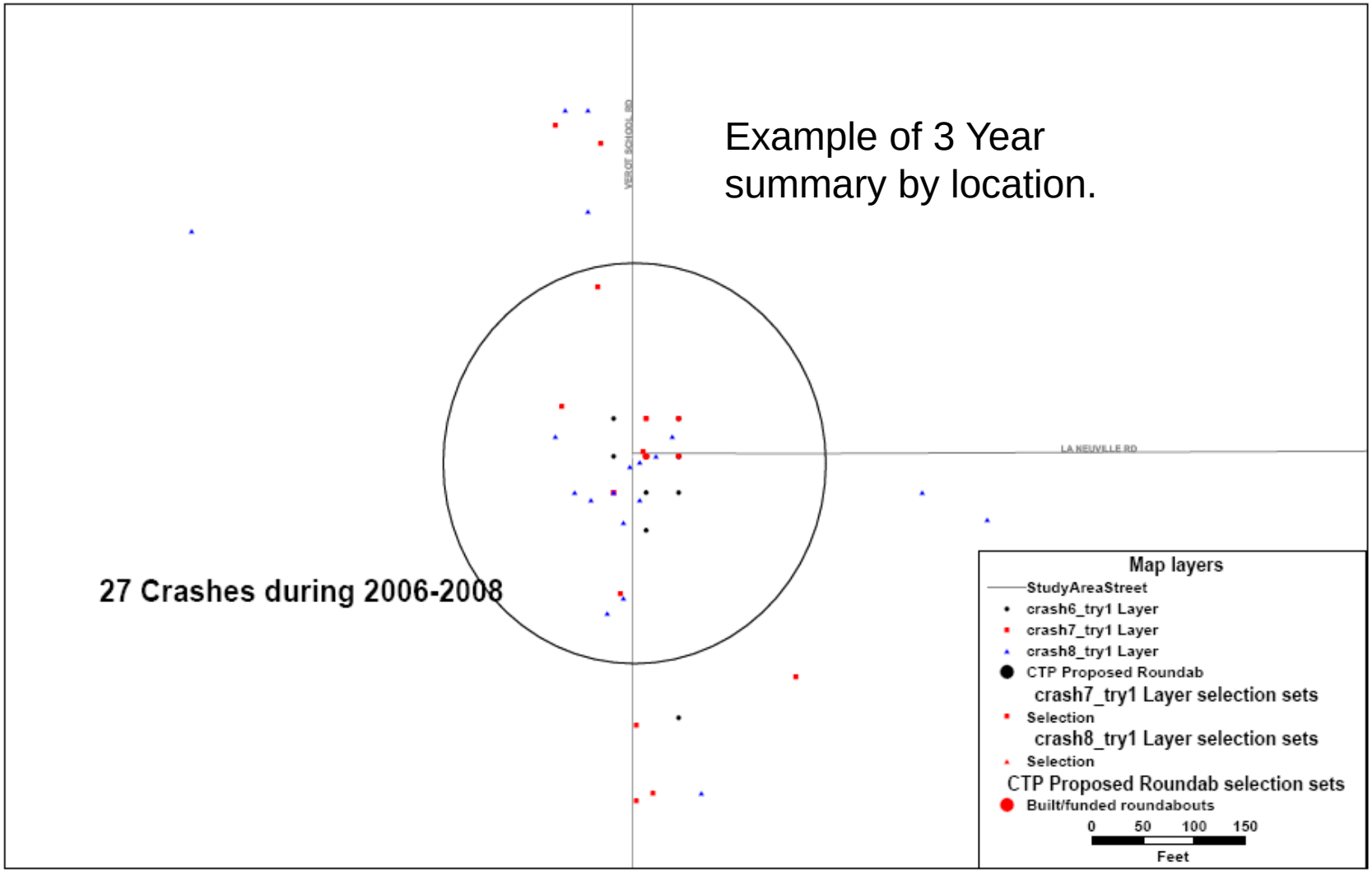
less than %50

Traffic Control	Ratio
Good for Stop control	10%
	20%
	30%
	40%
Worse for Stop Control	50%

Safety (1)


12,000 Crashes per year in Lafayette Parish
Map layers
StudyAreaStreet
crash6_try1 Layer
crash7_try1 Layer
crash8_try1 Layer
crash7_try1 Layer selection sets
Selection
crash8_try1 Layer selection sets
Selection
0 5,000 10,000 15,000
Feet

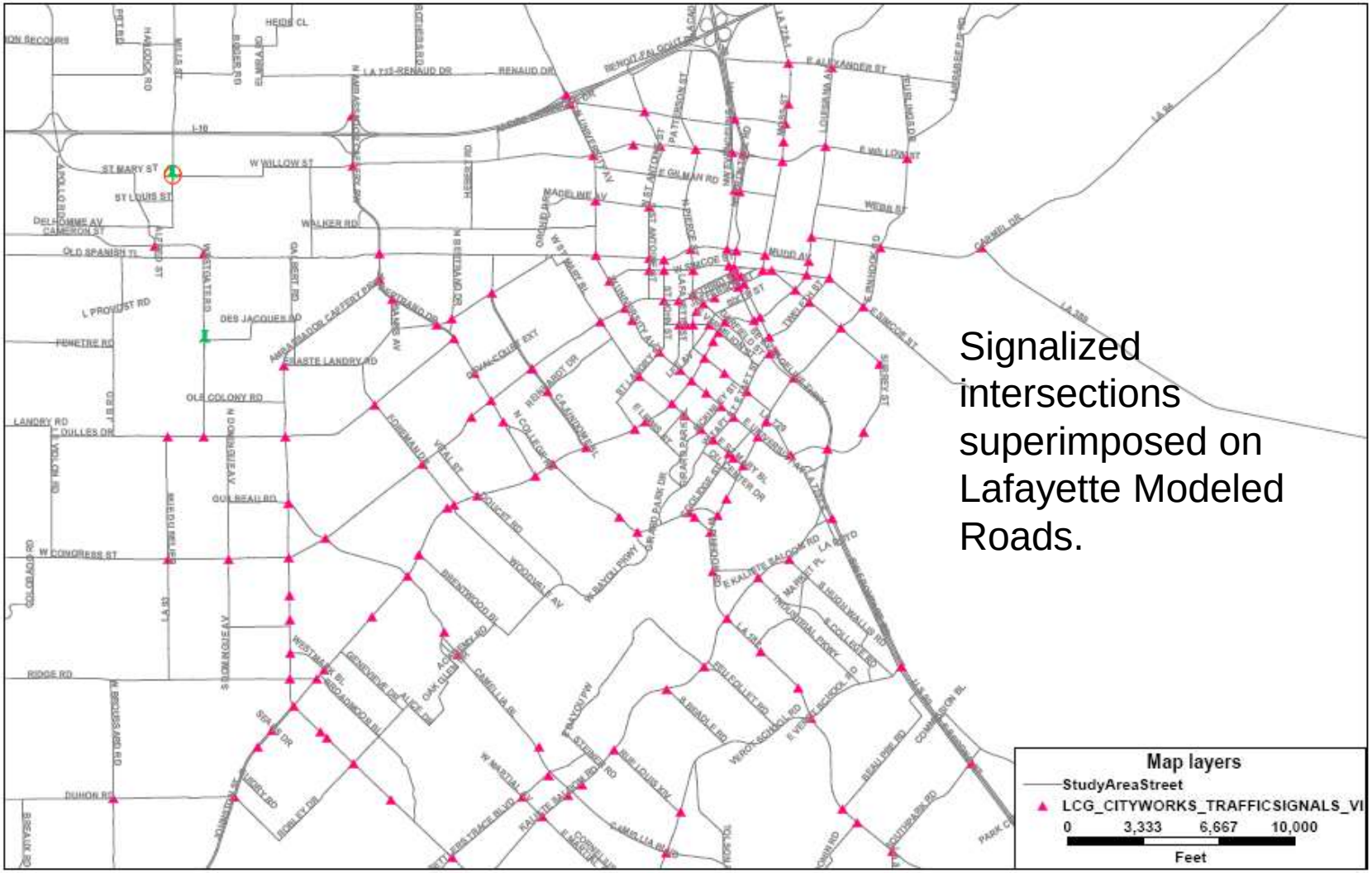
Safety (2)


Example of 3 Year summary by location.
27 Crashes during 2006-2008
VERDOT SCHOOL RD
LA NEUVELLE RD
Map layers
StudyAreaStreet
crash6_try1 Layer
crash7_try1 Layer
crash8_try1 Layer
CTP Proposed Roundab
crash7_try1 Layer selection sets
Selection
crash8_try1 Layer selection sets
Selection
CTP Proposed Roundab selection sets
Built/funded roundabouts
0 50 100 150
Feet

Right of way assignment (1)

Example of Google Earth Streets view

Right of way assignment (2)



Existing Geometrics (1)

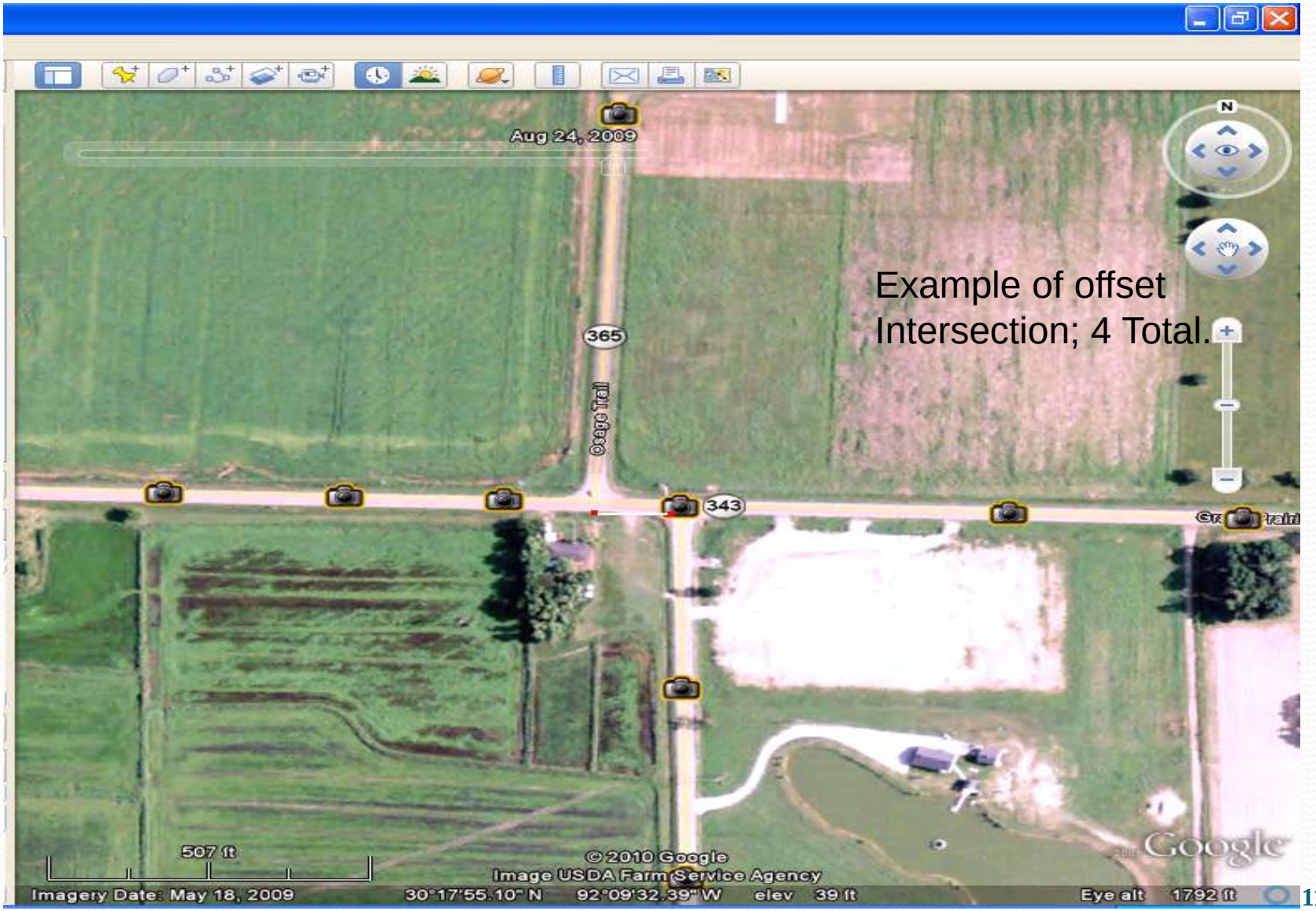
- Intersection Geometry viewed to look for offset intersections.
- Roundabout Islands are normally in between 130-180' for a single lane roundabout that accommodates a WB-67 type design vehicle. See table below. http://safety.fhwa.dot.gov/intersection/roundabouts/fhwasa10006/

Table 2: Common Inscribed Circle Diameter Ranges

Roundabout Configuration	Typical Design Vehicle	Inscribed Circle Diameter Range*
Mini-Roundabout	SU-30 (SU-9)	45 to 90 ft (14 to 27 m)
Single-Lane Roundabout	B-40 (B-12)	90 to 150 ft (27 to 46 m)
Single-Lane Roundabout	WB-50 (WB-15)	105 to 150 ft (32 to 46 m)
Single-Lane Roundabout	WB-67 (WB-20)	130 to 180 ft (40 to 55 m)
Multilane Roundabout (2 lanes)	WB-50 (WB-15)	150 to 220 ft (46 to 67 m)
Multilane Roundabout (2 lanes)	WB-67 (WB-20)	165 to 220 ft (50 to 67 m)
Multilane Roundabout (3 lanes)	WB-50 (WB-15)	200 to 250 ft (61 to 76 m)
Multilane Roundabout (3 lanes)	WB-67 (WB-20)	220 to 300 ft (67 to 91 m)

* Assumes 90-degree angles between entries and no more than four legs.

Existing Geometrics (2)



Calculations (1)

- Variable A

Variable a = safety

The range will be inbetween 0.0 and 4.0, 4 being the highest.

# Crashes	Variable A Value
1	0.2
5	1
10	2
11	2.1
20	3
21	4

* Notes:
From 1 to 10 the incremental increase in Variable A value will be .2/crash
From 10-20 the incremental increase in Varible A value will be .1/crash
Anything above 20 will be a 4.

Calculations (2)

- Variable B

Variable b = Intersection type

Variable b will carry a 3 max, 3 will be a Multi-way stop intersection, 2 will be a yield stop type intersection, and 1 will be an offset type intersection

Intersection Type	Variable B Value
Multiway Stop Intersection	3
Yield-Stop Intersection	2
Offset Intersection (150' or less)	1

*Note:
Any other kind of intersection will carry a 0 value.

Calculations (3)

- Variable C

Variable c = Volumes

Variable c = Volumes will carry a max of 3.

*Split Ratio =((A+B)/ (A+B)+(C+D))*100*

In the formula the numerator will always be the smaller combination of numbers A+B or C+D, this will make the percentage less than %50

Ratio	Variable C Value
1%	0.06
10%	0.6
20%	1.2
30%	1.8
40%	2.4
50%	3

*Note:
All numbers less than 1% are =0

Conclusion

- The Grant was completed and submitted on Sept 15th.
- The final list of roundabouts for the Tiger Grant was 121. They were divided into 3 sets; A, B, and C.
- Link to the TIGER Grant on Lafayette MPO's website:
  http://mpo.lafayettela.gov/tigergrant/Tiger_Rndabout/Tiger_Rndabout.asp

Post Grant application work and effort

- The Grant was not awarded to the MPO.
- MPO took steps to refine the work and continue it.
  - roundabout subcommittee started. Subcommittee comprised of Various MPO committee members. The initiative was too analyze and examine each location for reasonableness, as well as to refine the list to a set of absolute good locations.
  - The subcommittee looked at different criteria to help them streamline the 121 roundabouts.
  - Roundabout rating system devised.

Post Grant application work and effort

Roundabout Rating System

Rate each roundabout 1 – 3 in each category with 1 being best and 3 being worst

Traffic volumes – intersection total:

1. 18,000 – 27,000 vehicles per day
2. 9,000 – 18,000 vehicles per day
3. 0 – 9,000 vehicle per day

Geometry/Design:

1. No roadway/intersection re-alignment/no driveway or streets in roundabout area
2. Some roadway or intersection constraints/ one driveway or street in roundabout area
3. Offset intersection/ geometry change/multiple drives or streets in roundabout area

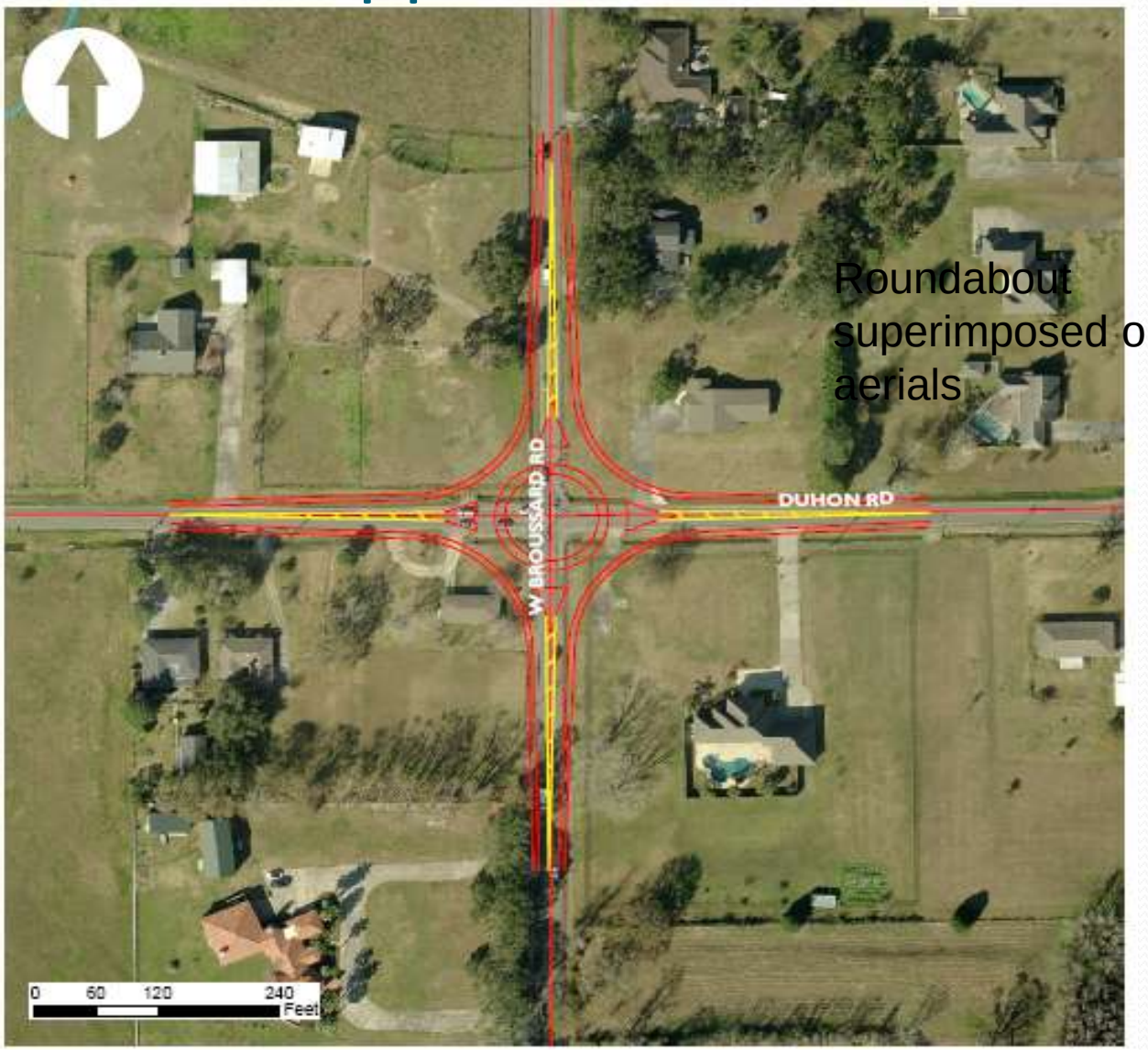
Utilities:

1. No/minimal known utility adjustments
2. Some utility adjustments
3. Major utility impacts (coulees or other structures)

Matching Funds:

1. 50% matching funds
2. 10 - 20% matching funds
3. No matching funds

Post Grant application work and effort



Roundabout superimposed on aerials

Post Grant application work and effort

- Roundabout Subcommittee streamlined the list of 121 roundabouts to approximately 70, eliminating roundabouts based off of the "roundabout rating system"
- The MPO is in the process of adding the list of 70 roundabouts to its roundabout plan. http://mpo.lafayettela.gov/plans/RoundaboutPlan/Roundabout_Plan.asp
- The MPO is also in the process of hiring a consultant to perform in depth analysis for 60-70 of these intersections.

Contact me or us

Name: Chris Cole E.I.

E-mail: ccole@lafayettela.gov

Number: 337-291-8456

Lafayette MPO Website:
http://mpo.lafayettela.gov/

Questions?

Traffic Engineering 101

Thank You for joining us every month!

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Thanks to LMA and LTAP for all of their assistance!