

**TACERA Annual
Conference 2023**

*College Station, TX
October 24, 2023*



K·FRIESE
+ ASSOCIATES
PUBLIC PROJECT ENGINEERING



Roundabouts for “ALL”

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(former Waller County Engineer, 2016-2023, and TACERA President in 2020)

Roundabouts for “ALL”

Full Disclaimer...to set expectations early:

I am NOT a designer, simply an advocate for safe transportation facilities for all Texans. I am a champion of roundabouts as a proven safety improvement.

Word of the Day - Inculcate

Inculcate is a formal word that has to do with teaching and persuading especially by frequent repetition. If you inculcate someone, you gradually cause the person to fully understand something. If you inculcate an ideal, practice, or behavior in someone, you impress it upon them.

// The teacher inculcated in her students the importance of good study habits. //

Table of Contents:

- ✓ Definitions
- ✓ Roundabout Features
- ✓ Safety Benefits
- ✓ Mobility Benefits
- ✓ Operational Benefits
- ✓ Geometric Design Elements
- ✓ Examples (State-level, Local-level)
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- ✓ Driver Behavior
- ✓ References
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Roundabout, defined:

- ✓ A roundabout is a form of a circular intersection in which traffic travels counterclockwise around a central island and entering traffic yields to the circulating traffic. Roundabouts have been demonstrated to significantly reduce the number of severe crashes at intersections, improve Level of Service (LOS), and increase capacity.
- ✓ Roundabouts, when located and designed well, provide significant SAFETY, MOBILITY and OPERATIONAL benefits to all road users.
- ✓ NCHRP Report 1043 (supersedes Report 672) is the primary source for roundabout design guidelines.

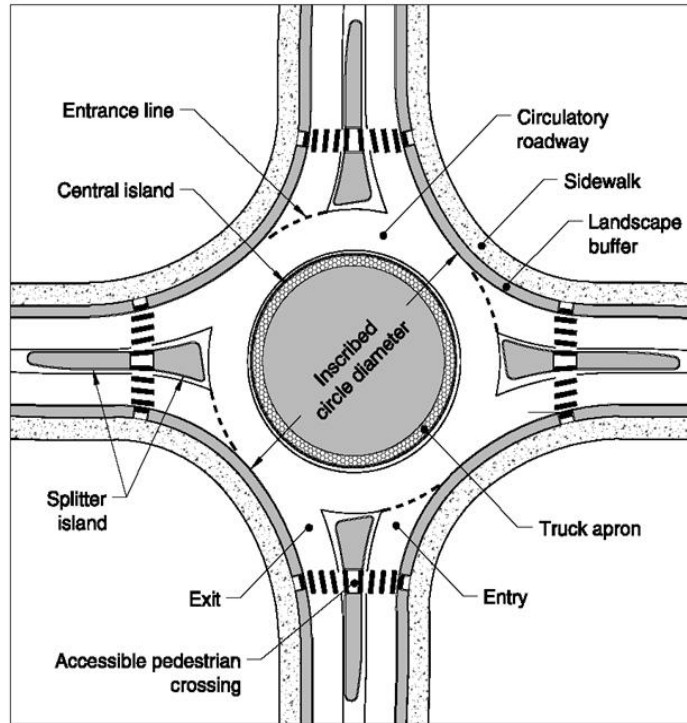
Roundabout, defined again:

- ✓ The modern roundabout is an intersection with a circular configuration that safely and efficiently moves traffic. Roundabouts feature channelized, curved approaches that reduce vehicle speed, entry yield control that gives right-of-way to circulating traffic, and counterclockwise flow around a central island that minimizes conflict points. The net result of lower speeds and reduced conflicts at roundabouts is an environment where crashes that cause injury or fatality are substantially reduced.

- FHWA, 508

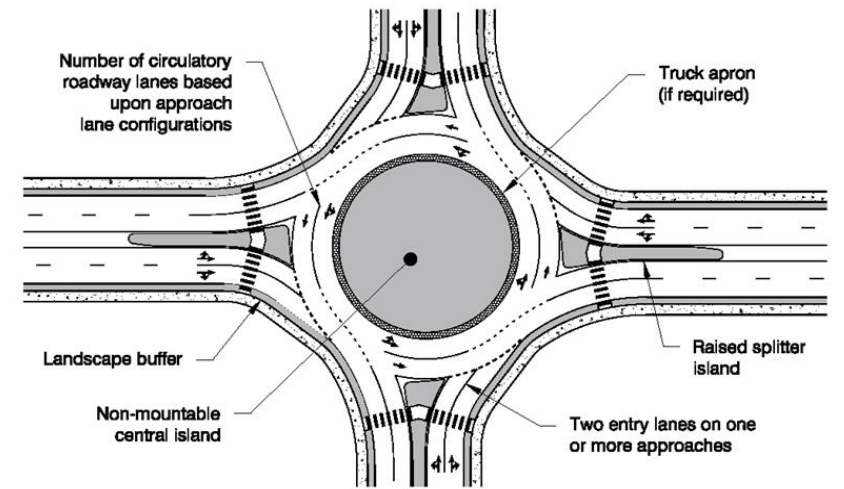
Roundabouts for "ALL"

ROUNDABOUT FEATURES



Source: NCHRP Report 672 - Exhibit 6-2

Single-Lane Roundabout



Source: NCHRP Report 672 - Exhibit 1-14

Multi-Lane Roundabout

Status of Roundabouts in North America, 2022 Edition

Snapshot of the Online Database at roundabouts.kittelson.com

A volunteer effort as a service to the TRB Standing Committee on Roundabouts and Other Intersection Design and Control Strategies

Credits

Data sources: Everyone (Thank you!)
 Special thanks to dedicated volunteer Dan Tilque, who singlehandedly located over 3,000 sites and counting!
 Database programming: Ian Cameron
 Quality control team: Lee Rodegerdts, Pete Jenior, Matt Kittelson, Radu Nan
 Analysis: Lee Rodegerdts
 GIS graphics: Jon Sommerville, Steven Rhyne
 Poster layout: Ralph Bentley

METHODS AND ASSUMPTIONS

Data pulled May 1, 2022

- Other circular intersections excluded.
- Current database compared to what was known in 2021, 2020, 2016, 2013, and earlier to estimate undercounting.
- Total estimated unknown sites in 2022:
 - U.S.: 7.5%
 - Canada: 9.4%
- Unknown sites are distributed over multiple years, biased towards most recent years.

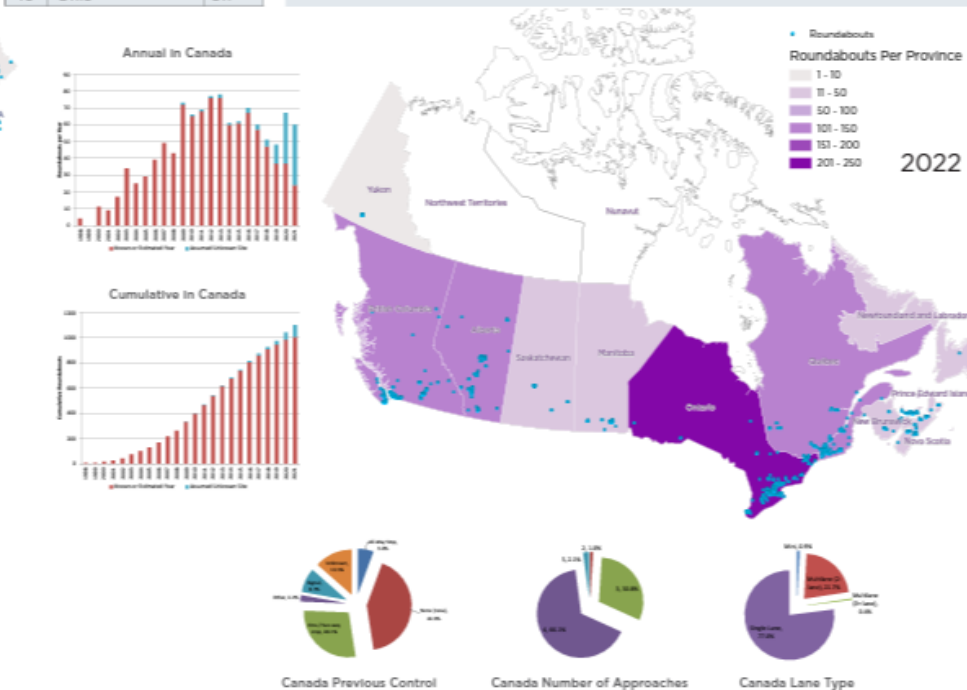
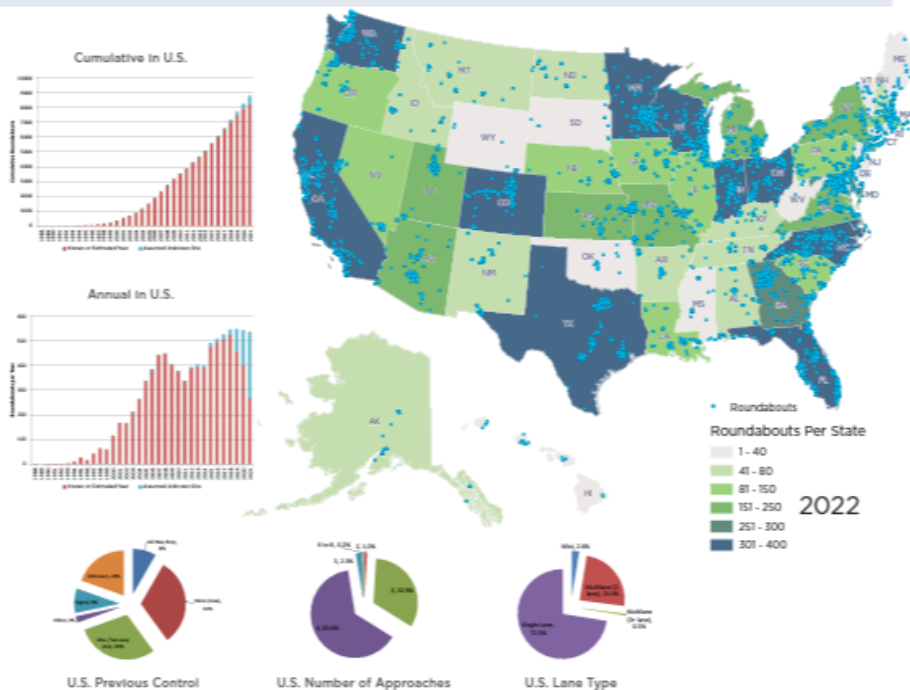
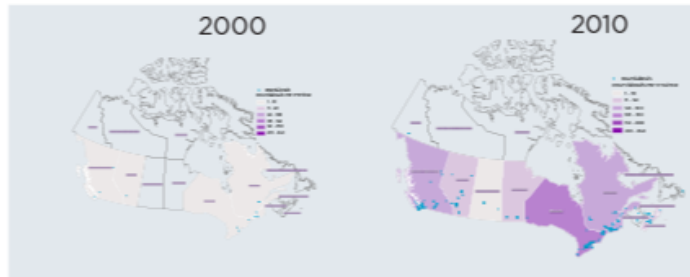
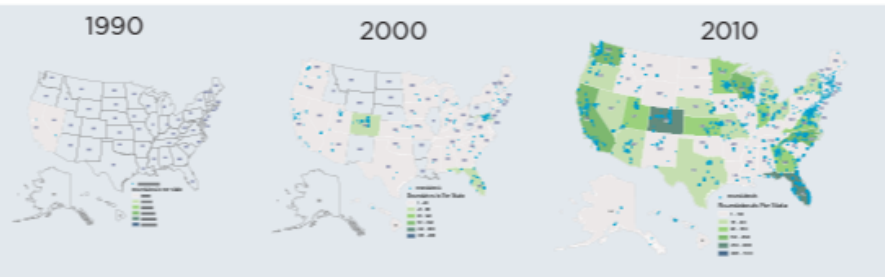
Estimated total roundabouts through 2021:

United States: **8,800**

Canada: **1,150**

TOP TEN STATES

1	Florida	589
2	Washington	488
3	Indiana	480
4	Wisconsin	471
5	North Carolina	447
6	California	446
7	Colorado	410
8	Texas	396
9	Minnesota	390
10	Ohio	311



Please Help Us Keep This Database Current!
roundabouts.kittelson.com

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K FRIESE + ASSOCIATES

SAFETY

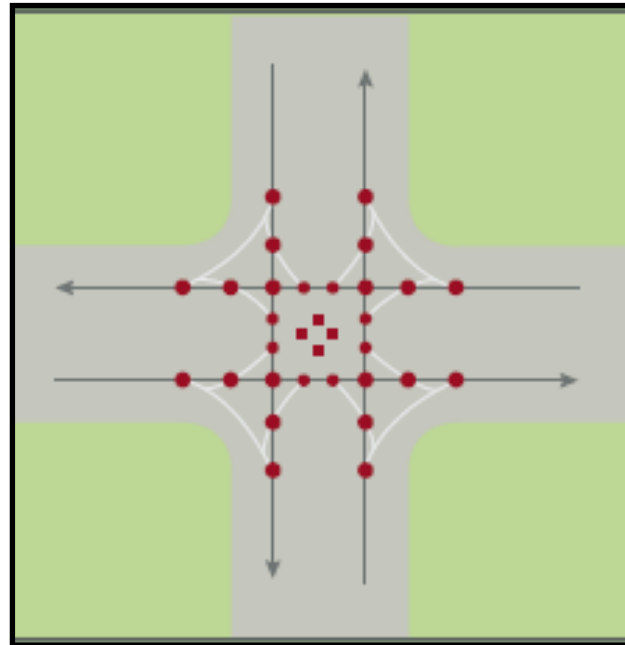


Improve Safety -- #ENDTHESTREAK

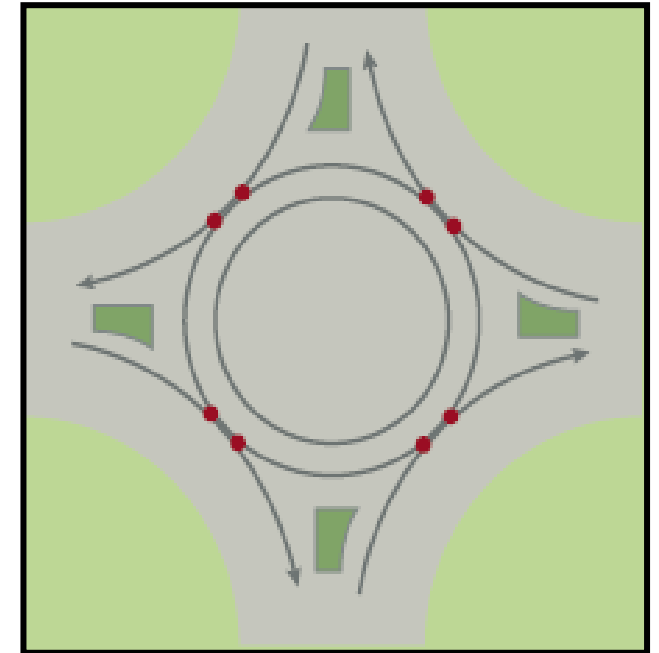
- ✓ • Fewer Conflict Points
- ✓ • More than 90% reduction in fatalities
- ✓ • 76% reduction in injuries
- ✓ • 35% reduction in all crashes
- ✓ • Slower speeds are generally safer for pedestrians, 30-40 percent reduction in pedestrian incidents
- ✓ • 10 percent reduction in bicycle crashes
- ✓ • 30-50 percent increase in traffic capacity

Roundabouts for “ALL”

With roundabouts, head-on and high-speed right angle collisions are virtually eliminated.



Traditional Intersection – 32
Conflict Points

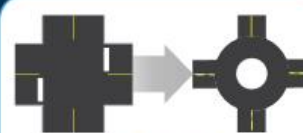


Roundabout – 8 Conflict Points,
non at right angles

Roundabouts for "ALL"

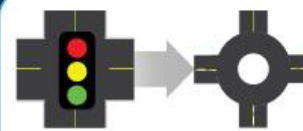


Safety Benefits: Two-Way Stop-Controlled Intersection to a Roundabout



82%
reduction in fatal
and injury crashes.¹

Signalized Intersection to a Roundabout



78%
reduction in fatal
and injury crashes.¹

For more information on this and other FHWA Proven Safety Countermeasures, please visit <https://highways.dot.gov/safety/proven-safety-countermeasures> and <https://highways.dot.gov/safety/intersection-safety/intersection-types/roundabouts>.

Roundabouts

The modern roundabout is an intersection with a circular configuration that safely and efficiently moves traffic. Roundabouts feature channelized, curved approaches that reduce vehicle speed, entry yield control that gives right-of-way to circulating traffic, and counterclockwise flow around a central island that minimizes conflict points. The net result of lower speeds and reduced conflicts at roundabouts is an environment where crashes that cause injury or fatality are substantially reduced.

Roundabouts are not only a safer type of intersection; they are also efficient in terms of keeping people moving. Even while calming traffic, they can reduce delay and queuing when compared to other intersection alternatives. Furthermore, the lower vehicular speeds and reduced conflict environment can create a more suitable environment for walking and bicycling.

Roundabouts can be implemented in both urban and rural areas under a wide range of traffic conditions. They can replace signals, two-way stop controls, and all-way stop controls. Roundabouts are an effective option for managing speed and transitioning traffic from high-speed to low-speed environments, such as freeway interchange ramp terminals, and rural intersections along high-speed roads.



Illustration of a multilane roundabout. Source: FHWA



Example of a single-lane roundabout. Source: FHWA

¹ (CMF ID: 211,226) AASHTO. The Highway Safety Manual, American Association of State Highway Transportation Professionals, Washington, D.C., (2010).

MOBILITY



Roundabouts for “ALL”

The primary goals of any roundabout design are to provide:

- ✓ Slow entry and consistent speeds throughout the roundabout by using deflection.
- ✓ The appropriate number of lanes and lane assignment to achieve capacity, lane volume balance, and lane continuity.
- ✓ Smooth channelization that results in vehicles naturally using the intended lanes.
- ✓ Better flow of traffic during both peak and off-peak conditions.
- ✓ Adequate accommodation for the design vehicles.
- ✓ Safe accommodations for pedestrians and bicyclists.

The primary goals of any roundabout design are to provide:

- ✓ No more than the minimum intersection sight distance for driver recognition of the intersection and conflicting users.
- ✓ Oftentimes installing roundabouts instead of traditional intersections will decrease the need for additional ROW along the connecting roadways.
- ✓ Some Counties and Cities are adopting a “Roundabout 1st” philosophy...TXDOT as well in some Districts!

OPERATIONS



Roundabouts for “ALL”

Roundabouts offer operational advantages over traditional signalized intersections:

- ✓ Because roundabouts don't require any signals (typically), operations during power outages often isn't a concern.
- ✓ Not having to rush a crew out in the middle of peak traffic or at 2am to address a flashing signal.

Roundabouts for “ALL”

NCHRP RESEARCH REPORT 1043

Guide for Roundabouts

KITTELSON & ASSOCIATES, INC.
Portland, OR

SUNRISE TRANSPORTATION STRATEGIES, LLC
Portland, OR

TEXAS A&M TRANSPORTATION INSTITUTE
College Station, TX

KIMLEY-HORN AND ASSOCIATES, INC.
Peachtree Corners, GA

ACCESSIBLE DESIGN FOR THE BLIND, LLC
Fairbanks, AK

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in cooperation with the Federal Highway Administration

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2023

Roundabout Geometric Design:

- ✓ Stopping Sight Distance (SSD) – Approach, In, Exit
- ✓ Entry Width
- ✓ Entry Curve
- ✓ Exit Curve
- ✓ Circulatory Roadway Width
- ✓ Speeds – approaches vs circle (type)
- ✓ Cross Slope
- ✓ Vertical Geometry
- ✓ Splitter Islands
- ✓ (Access Management)

Roundabouts for “ALL”

ROUNDABOUT DESIGN ELEMENTS

Design Element	Mini-Roundabout	Single-Lane Roundabout	Multilane Roundabout
Desirable maximum entry design speed	15 to 20 mph (25 to 30 km/h)	20 to 25 mph (30 to 40 km/h)	25 to 30 mph (40 to 50 km/h)
Maximum number of entering lanes per approach	1	1	2+
Typical inscribed circle diameter	45 to 90 ft (13 to 27 m)	90 to 180 ft (27 to 55 m)	150 to 300 ft (46 to 91 m)
Central island treatment	Fully traversable	Raised (may have traversable apron)	Raised (may have traversable apron)
Typical daily service volumes on 4-leg roundabout below which may be expected to operate without requiring a detailed capacity analysis (veh/day)*	Up to approximately 15,000	Up to approximately 25,000	Up to approximately 45,000 for two-lane roundabout

*Operational analysis needed to verify upper limit for specific applications or for roundabouts with more than two lanes or four legs.

Source: NCHRP Report 672 - Exhibit 1-9

TxDOT

TxDOT updates to Roadway Design Manual Incorporating Roundabout Guidance (released July 2020)...being updated:

- ✓ Primary Sources: NCHRP 672 (Roundabouts an Informational Guide, 2nd Edition). NCHRP Synthesis 488 – Roundabout Practices.
- ✓ Consideration for Roundabouts for locations that meet or nearly meet signal warrants; and proposed all-way stop control intersections.
- ✓ Typical Design Vehicle WB-67



State
(TxDOT) level
examples:

ability
CAPITAL AREA



I-35 at 51st Street
Conceptual - Subject to C



State (TxDOT) level examples: (UT-El Paso Campus)

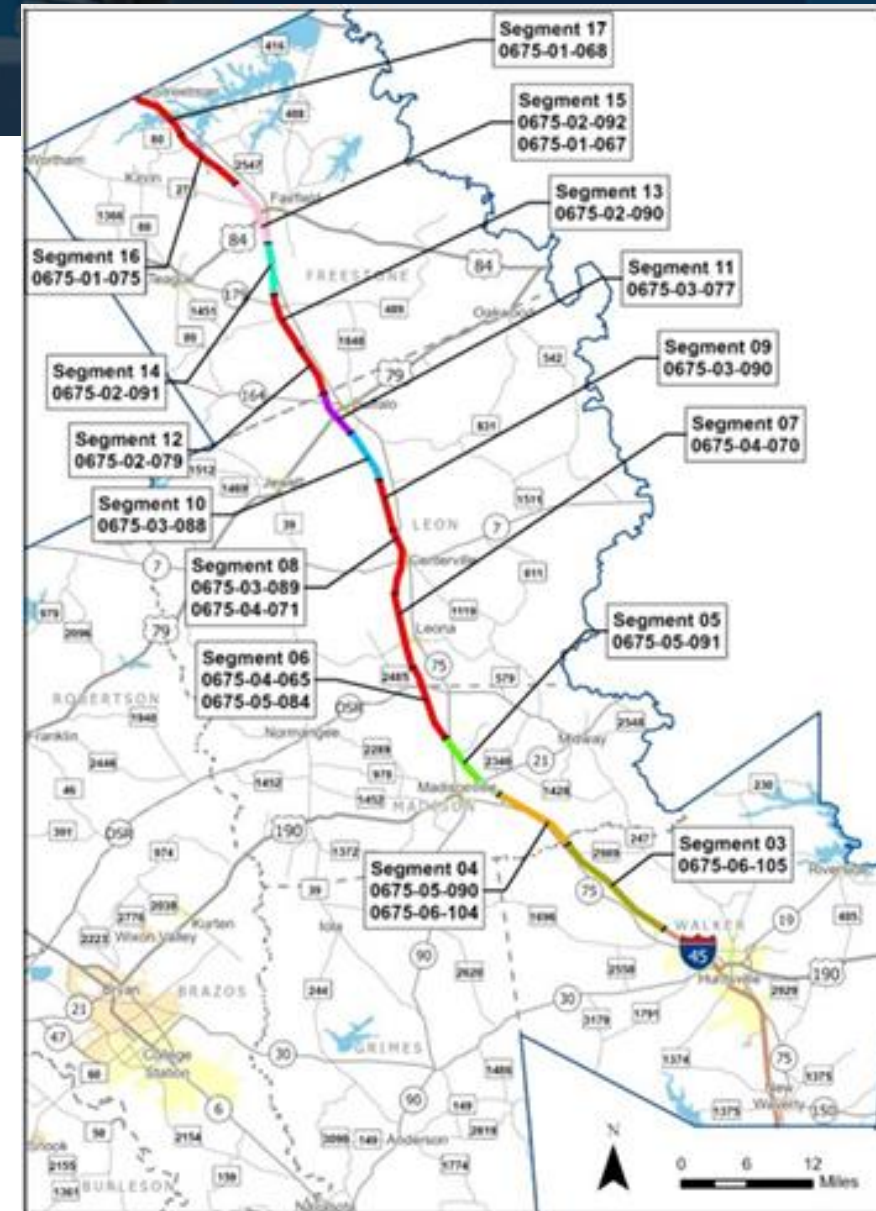
Roundabouts for “ALL”

State (TxDOT) level examples:

IH 45 (BRY-45)

Bryan District

- ✓ Project to improve safety and mobility along about 90 miles of IH-45 within Walker, Madison, Leon and Freestone counties.
- ✓ All intersections are being scoped to be roundabouts 1st, including at Buc-ee’s in Madisonville.



Local (Counties and Cities)

Of course we are in Texas and many people are very skeptical of roundabouts, especially if they've experienced a bad one, but we can't ignore the tremendous safety benefits they provide even as the State (TxDOT) and many Counties and Cities adopt Vision Zero.

- ✓ Consideration for roundabouts for locations that meet or nearly meet signal warrants; and proposed all-way stop control intersections. (
- ✓ Design Vehicle is more of a function of local context



Local level
examples:
Fort Bend
County, Texas
Heritage
Pkwy

Local level examples:

Exhibit 2.17. Example of single-lane roundabout in rural context with extended splitter islands.



LOCATION: Bullfrog Road/Suncadia Trail, Kittitas County, Washington.
SOURCE: Map data ©2022 Google.

Local level examples:

Exhibit 3.3. Example of a roundabout supporting desired role of facility.



LOCATION: La Jolla Boulevard, San Diego, California. SOURCE: Map data ©2022 Google.



PUBLIC/ELECTED OFFICIAL INVOLVEMENT

- ✓ **Invest in Renderings or 3D Visualizations**
- ✓ **Education for Drivers and Pedestrians**
- ✓ **Positive Publicity**
- ✓ **Clear Signing and Pavement Markings**

DRIVER BEHAVIOR



- ✓ ALWAYS SLOW DOWN
- ✓ ALWAYS YIELD, TO TRAFFIC ALREADY IN THE CIRCLE

References

[TxDOT Roadway Design Manual – Chapter 6 and Appendix E](#)

[NCHRP Research Report 1043: Guide for Roundabouts](#)

[Texas Manual on Uniform Traffic Control Devices \(2011\)](#)

[TxDOT Highway Illumination Manual](#)

[Roundabouts TxDOT Style - NHI-FHWA course Presentation 12/2021](#)

[TxDOT Roundabout Factoid Sheets available on CrossRoads, DES, Pages, Roadway Design Guidance](#)

[AASHTO. 2021. Guide for the Planning, Design, and Operation of Pedestrian Facilities, 2nd ed. Washington, DC](#)

[ITE Rural Roundabouts Save Lives¹](#)

[Evaluation of Geometric Parameters that Affect Truck Maneuvering and Stability, FHWA-SA-15-073](#)

[MN DOT Strategies for Effective Roundabout Approach Speed Reduction](#)

[Bryan District IH 45 Segment 1A example - 1-Lane Roundabout at FM 1375 \(0675-07-096 as-builts\)](#)

[Bryan District IH 45 Segment 2B example - 2-lane roundabouts \(0675-06-103, 97pct plans\)](#)

[Roundabouts Database \(kittelson.com\) -](#)

<https://roundabouts.kittelson.com/>

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**#ENDTHESTREAK
#VISIONZERO**

**QUESTIONS AND
COMMENTS?**



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+ ASSOCIATES

PUBLIC PROJECT ENGINEERING

Yancy Scott, PE, CFM | Senior Engineer
(former Waller County Engineer, 2016-2023, and
TACERA President in 2020)

