




Reviewing Roundabouts in Iowa

2024 Iowa Transportation Conference
 September 24, 2024
 Ben Wilkinson, PE
 bwilkinson@msa-ps.com

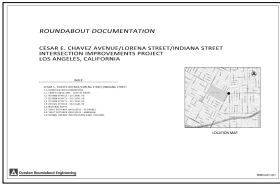

Review Process



REVIEW PROCESS

What to provide:

- Operational analysis, if completed, or any traffic information (especially important for multilane roundabouts)
- Geometric layout in CAD format and PDF
- Constraints
- Design vehicle, including oversize/overweight vehicles
- Fast path calculations
- Sight distance checks (maybe)

REVIEW PROCESS

Roundabout Design Guidelines

- NCHRP 1043 (NCHRP 672 and 572)
- Wisconsin DOT
- Ourston Roundabout Design Guidelines (good source of principles)



REVIEW PROCESS

Roundabout Design Principles

- » Good roundabout design should be about several core principles
 - Achieving good speed control and speed consistency
 - Accommodating the design vehicle
 - Accommodating all expected users of the roundabout
 - Creating natural driving paths
 - Maintaining good sightlines (where necessary)
 - Achieving sufficient vehicle capacity through number of lanes and lane balance



REVIEW PROCESS

Horizontal Geometry Design Checks

- » These principles can be evaluated through the use of design checks, including:
 - Assessing vehicle paths (Fast paths)
 - Accommodation of design vehicle
 - Entry and exit path overlap (multi-lane roundabouts)
 - Entry angle
 - Sight Distances



REVIEW PROCESS

Design Composition

- » Not captured through design checks is design composition, such as
 - Roundabout size and location
 - Whether to take approaches off alignment to square up the intersection
 - Number of entry and exit lanes
 - How to balance speed control, natural driving paths (multi-lane roundabouts) and sight-to-the-left at entry



Horizontal Geometry
DESIGN CHECKS



HORIZONTAL GEOMETRY

Assessing Vehicle Paths (Fast Paths)

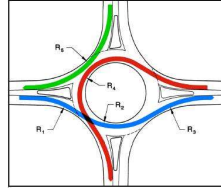
2019-Mar-31 02:57:52.123 AM (CDT)



HORIZONTAL GEOMETRY

Assessing Vehicle Paths (Fast Paths)

Radius	Description
R_1 – Entry Path Radius	The minimum radius on the fastest through path prior to the yield line. <i>(This is not the same as Entry Radius.)</i>
R_2 – Circulating Path Radius	The minimum radius on the fastest through path around the central island.
R_3 – Exit Path Radius	The minimum radius on the fastest through path into the exit.
R_4 – Left-turn Path Radius	The minimum radius on the path of the conflicting left-turn movement.
R_5 – Right-turn Path Radius	The minimum radius on the fastest path of a right-turning vehicle.

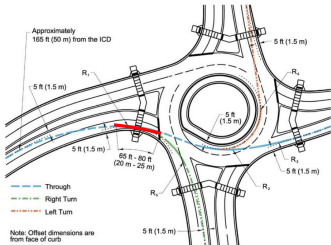


NCHRP 1043, Exhibit 9.5



HORIZONTAL GEOMETRY

Assessing Vehicle Paths (Fast Paths)



NCHRP 1043, Exhibit 9.8

Calculate speed using measured radius:

$$V = 3.4415R^{0.3661}, \text{ for } e = +0.02 \text{ (unfavorable cross slope)}$$

$$V = 3.4614R^{0.3673}, \text{ for } e = -0.02 \text{ (favorable cross slope)}$$

where

V = predicted speed, mph;
 R = radius of curve, ft; and
 e = superelevation, ft/ft.

NCHRP 1043, Equations 9.3 and 9.4

Site Category	Recommended Maximum Theoretical Entry Design Speed
Single-lane Entry	25 mph
Multi-lane Entry	25-30 mph



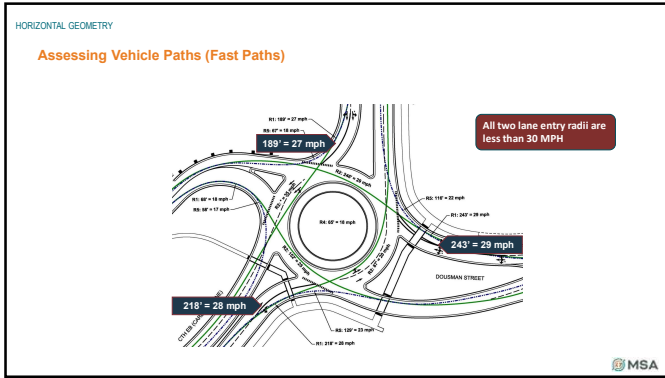
HORIZONTAL GEOMETRY

Offset the approach to the left of the centerline.



Deflecting vehicles around the central island.



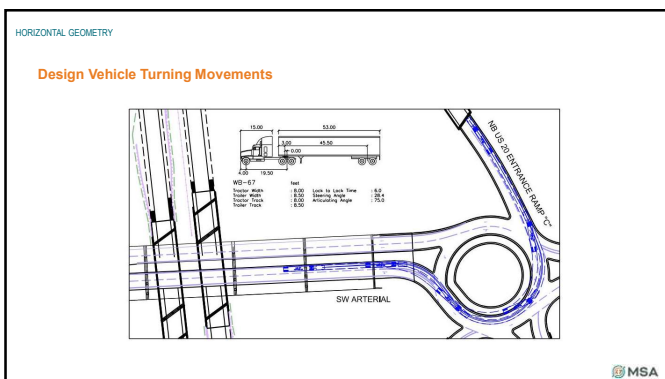


HORIZONTAL GEOMETRY

Speeds and Speed Consistency

- » For a single-lane roundabout, fastest-path entry speeds should be 20-25 mph, depending on site context.
- » For a two-lane roundabout, fastest-path entry speeds should be 25-30 mph, depending on site context. (lower is better for best crash reduction) **Just because the designer has it at 30 MPH, doesn't mean that it can't be better without other affects (Research suggests lower speeds will result in fewer crashes)**
- » Speeds between conflicting traffic streams should be no more than 15 mph.

MSA



HORIZONTAL GEOMETRY

OSOW Turning Movements

Image: Google Earth

MSA

HORIZONTAL GEOMETRY

Path Overlap on Multilane Roundabouts

- » Check for tangents between circulating road and entries/exits.
- » Desirable tangents: 40'-50' on entry, >40' on exit

WisDOT FDM 11-26, Figure 30.24

MSA

HORIZONTAL GEOMETRY

ENTRY PATH OVERLAP & POOR DEFLECTION

MSA

EXIT PATH OVERLAP

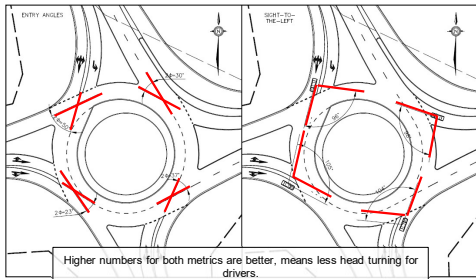
EXIT PATH OVERLAP



MSA

HORIZONTAL GEOMETRY

Entry Angle and Sight-to-the-Left

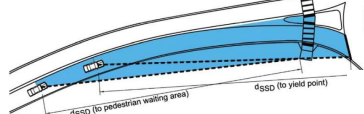


MSA

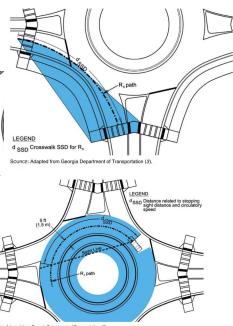
HORIZONTAL GEOMETRY

Stopping Sight Distance

LEGEND
d_{SSD} Stopping sight distance related to approaching speed



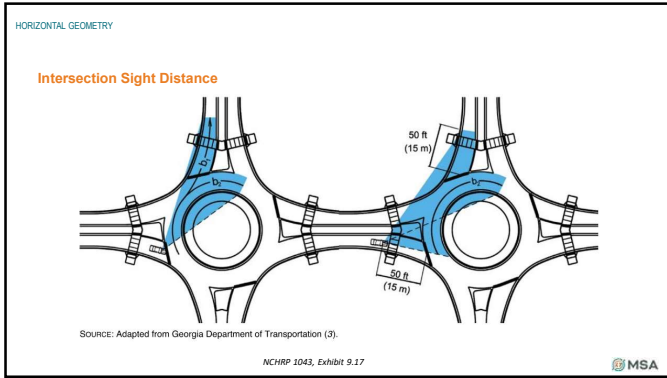
SOURCE: Adapted from Georgia Department of Transportation (3).



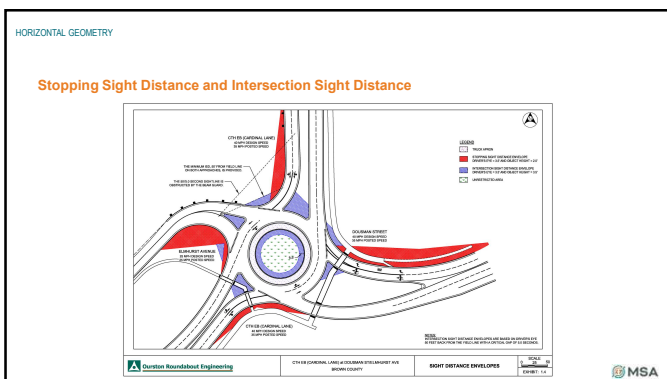
SOURCE: Adapted from Georgia Department of Transportation (3).

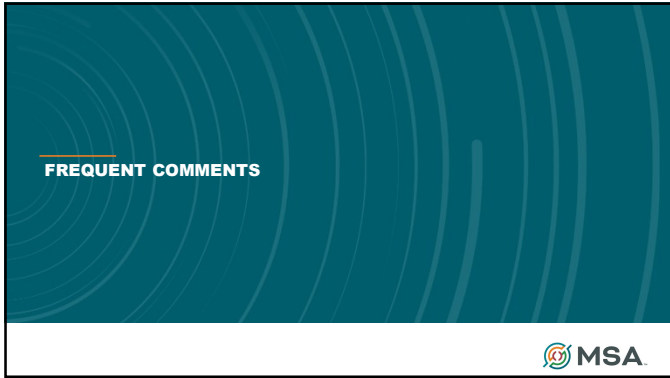
NCHRP 1043, Exhibits 9.12, 9.15, and 9.16

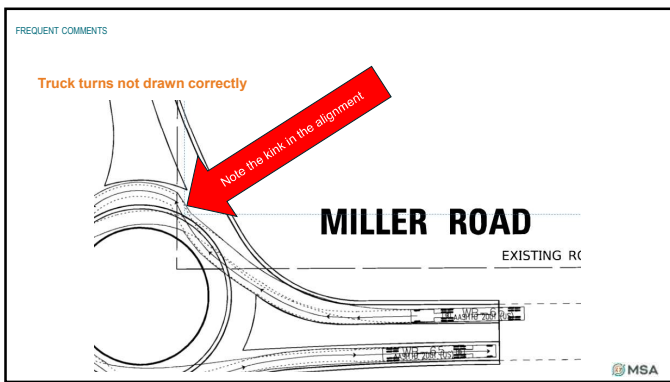
MSA

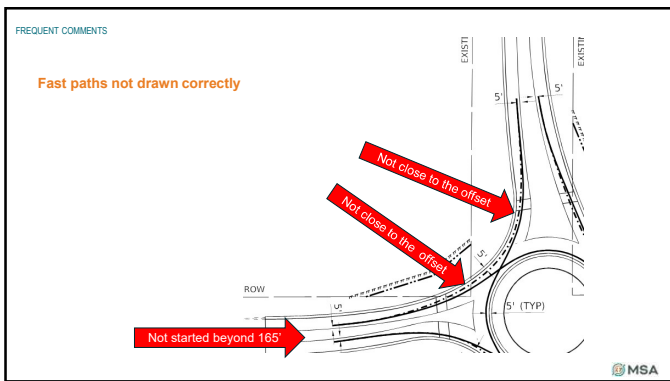






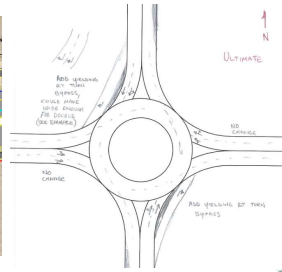
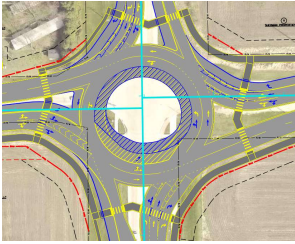






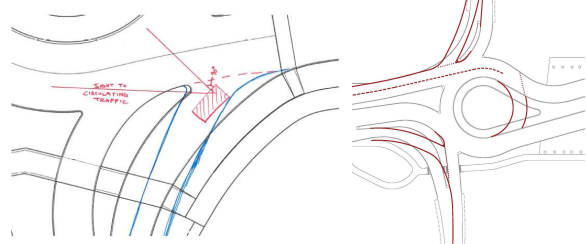
FREQUENT COMMENTS

Over complicating the lane configuration



FREQUENT COMMENTS

Poor entry angles, especially for bypass lanes



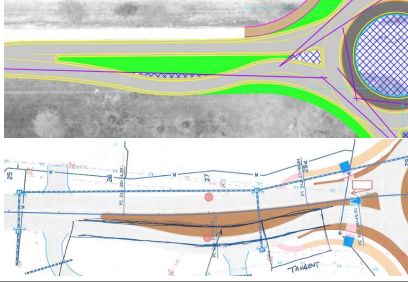
FREQUENT COMMENTS

But....



FREQUENT COMMENTS

Excessive curvature on entries, and reverse curves on entries



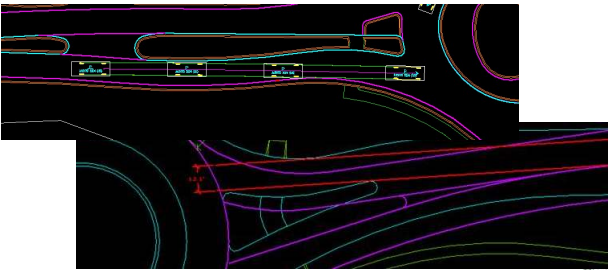
FREQUENT COMMENTS

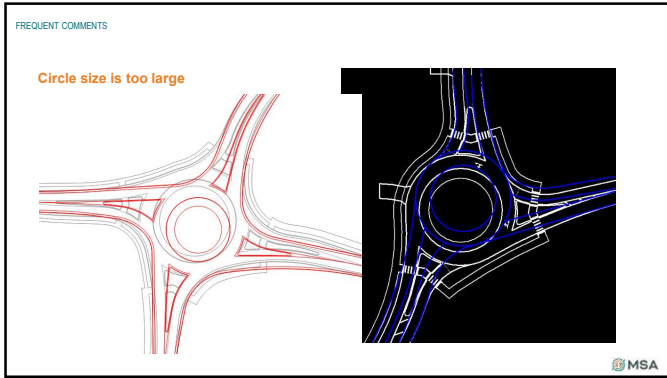
Which entry do you think works better?

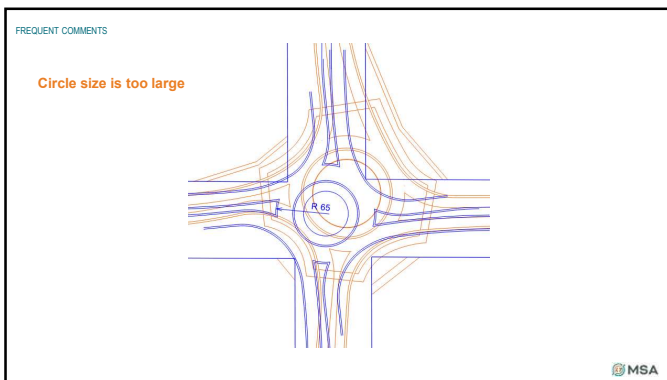


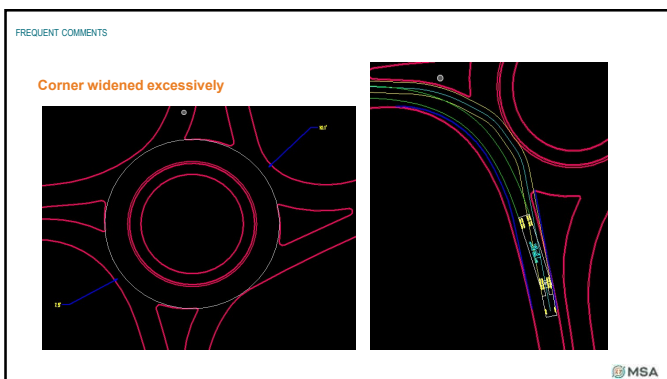
FREQUENT COMMENTS

Excessive curvature on entries, and reverse curves on entries



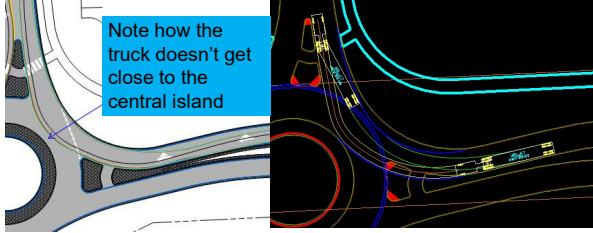






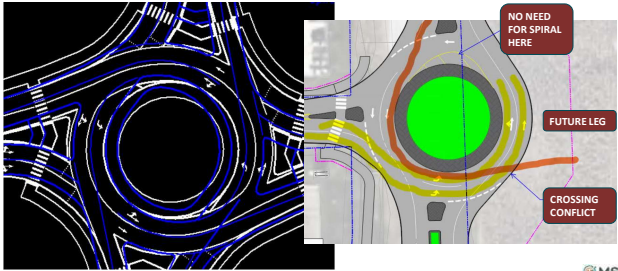
FREQUENT COMMENTS

Corner widened excessively



FREQUENT COMMENTS

Spirals developed incorrectly, or not included where it should be



Questions?