Roundabouts & Traffic Engineering

Presents:

Roundabout Design Guides In Practice

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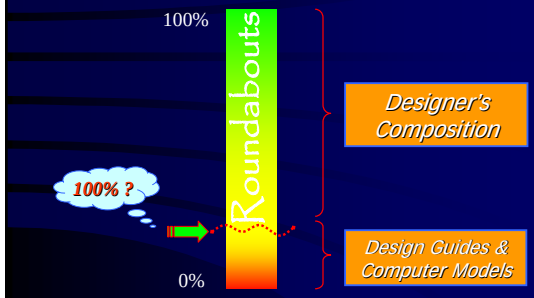
Rbt Guides in Practice

- Through All My Years of Designing Roundabouts & Writing Rbt Design Guides, I've Learned There are No Substitutes to Thinking Through a Rbt Design
  - Common Sense / Judgment
  - Good Composition
  - Use BOTH Sides of Brain (...See Presentation on CD)
- Engineering Nature is to Standardize Everything!
- Must Focus on the Principles of Good Rbt Design
- Use Guides as a Resource

Three Sources of Knowledge

1) **Design Guides**
   - Excellent Resource ~ Not STANARDS!
   - Guides are Mostly for SLR (Lack Correct Details on MLR)
   - Within are Some Good Principles of Design
2) **Computer Models**
   - Check Your Entry Lane Configurations (Bypass?)
   - Empirical Models (Also Theoretical Gap Models)
   - Mostly for MLR or Verifying SLR
3) **Expert Heuristic Knowledge of Qualified Designer**
   - Skill at using Guides and Models
   - Designs Using the Principles of Rbt Design (Not Standards)
   - Uses BOTH Sides of Brain for an Optimized Design

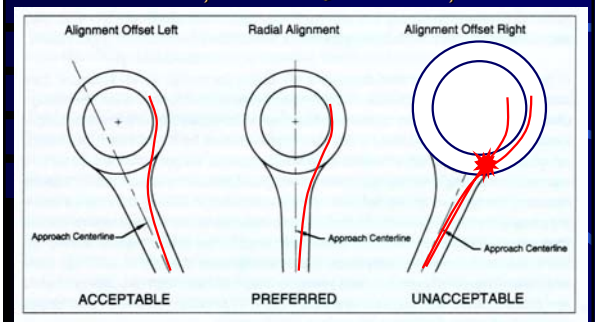
Designer's Composition



Rbt Guides in Practice

- Guides Give Some Good Design Principles
- Provide Some Good Parts of Design
- Give a Few Good Design Checks
- Yet, Engineering Judgment Still MUST be Exercised!
- Focus on the Ideology w/in Guide
- Many Engineers Justify **BAD** Designs w/ Guide's Text
- Many Point to Guides Improperly or as Standards
- Design GUIDE not Design RULES!

Example of a Rule that should be Replaced by a Principle



Deflection Matters ~ Not Centerlines

"The Guide Says..."

- If a Number is Used in a Guide, is the Number Therefore Always Acceptable for a Design?
- Actual Design Review Case Study:
  - Some Guides State Circulatory Roadway Width 1.0 to 1.2 Times the Maximum Entry Width
    - 18' Entry = 20' Circulatory Roadway (Good)
  - Yet the Designer Used a 26.5' Entry Width (Inappropriate for SLR = TWO 13' lanes!)
    - 26' Entry = 32' Circulatory Rdwy (Guide Says)...
  - 32' = Two-Lane Rbt!
  - Designer Justified 26.5' Entry for Wb-67 Trucks
  - SLR < 18-20' **and** Work for WB-67 Trucks!
  - Again, Don't Justify **BAD** Designs w/ Guide's Text

Guide's Idea on No Overlap

11-26-30 Principal based Design Guidance

- **NOT** A Good Design Practice
- Does **NOT** Work w/out Good Entry Design
- Does **NOT** Ensure No Path Overlap!

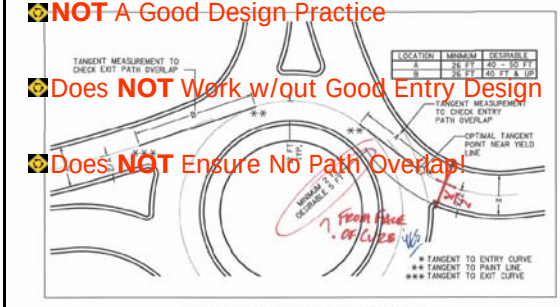


Figure 8. Method for checking path overlap

Path Overlap?

Meets Guidelines... Does it Work?

Video Courtesy of Phil Demosthenes

US 6 / Post Rd - Avon, CO

Guide's Idea on No Overlap

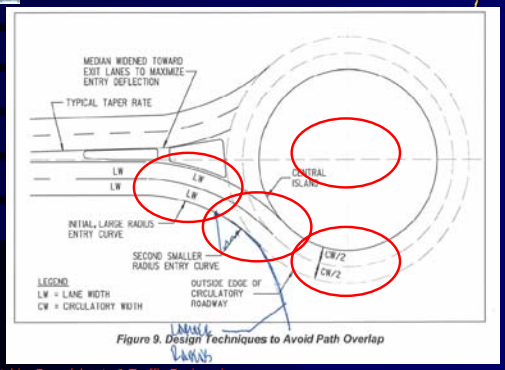
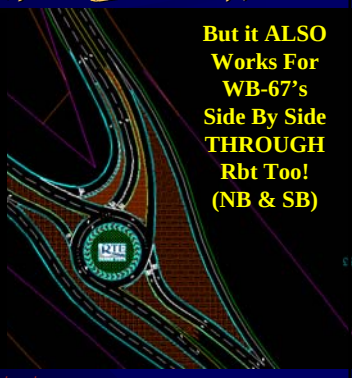


Figure 9. Design Techniques to Avoid Path Overlap

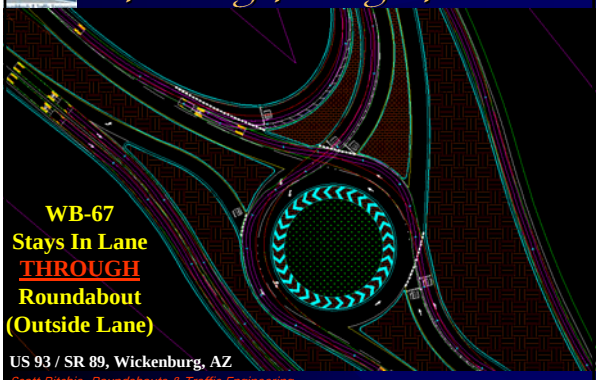
Doesn't Meet Guide... Works!

- LW Not Equal - 14'/16'... Safer!
- CW NOT Equal
  - 15'/17'... Safer!
- Centerlines Right of Center of Rbt
  - Yet Balanced 25mph Speeds & Good Deflection!
- No Entry Tangent
  - Yet No Path Overlap Either!



But it ALSO Works For WB-67's Side By Side THROUGH Rbt Too! (NB & SB)

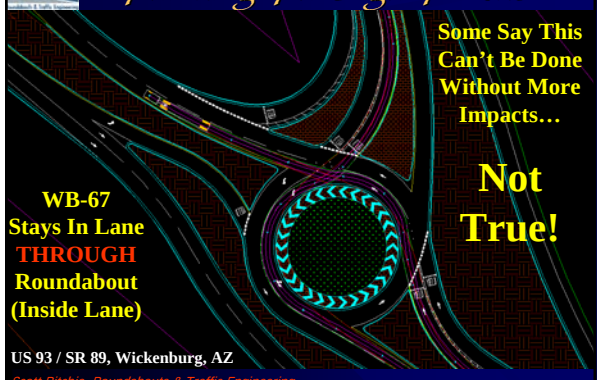
Thinking Through Trucks



WB-67 Stays In Lane THROUGH Roundabout (Outside Lane)

US 93 / SR 89, Wickenburg, AZ

Thinking Through Trucks



Some Say This Can't Be Done Without More Impacts…

Not True!

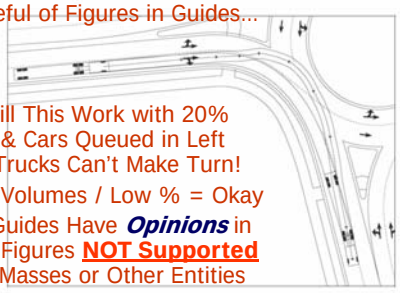
WB-67 Stays In Lane THROUGH Roundabout (Inside Lane)

US 93 / SR 89, Wickenburg, AZ

Do You Believe Everything Printed?

Multilane roundabouts can be designed in two different ways to accommodate large trucks. The most commonly accepted way to design a multilane roundabout is to assume a truck will use two lanes to enter, circulate and exit the roundabout, as shown be below.

- Be Careful of Figures in Guides…

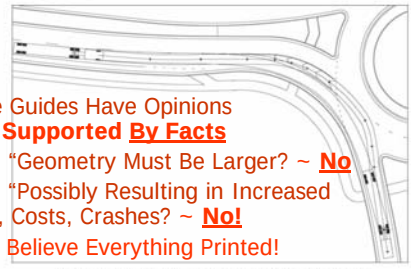


- How Will This Work with 20% Trucks & Cars Queued in Left Lane? Trucks Can't Make Turn!
  - Low Volumes / Low % = Okay
- Some Guides Have ***Opinions*** in Text & Figures **NOT Supported** By the Masses or Other Entities

Figure 15. AutoTURN Right turn Movement

Do You Believe Everything Printed?

Alternatively, a roundabout can be designed so that trucks can remain in one lane as they traverse the intersection. This approach is less commonly used since overall geometry must be larger, possibly resulting in increased ROW needs, higher cost, and a potential for increases in certain types of crashes. An example of this design is shown below. This example utilizes a truck hatching area to allow the truck to make the right turn without encroaching on the adjacent left lane.



- Some Guides Have Opinions **NOT Supported By Facts**
- Says: "Geometry Must Be Larger? ~ **No**
- Says: "Possibly Resulting in Increased ROW, Costs, Crashes? ~ **No!**
- Don't Believe Everything Printed!

Figure 16. AutoTURN Right turn Movement w/truck hatching

"The Guide Says…"

- If a Number is Used in a Guide, is the Number Therefore Correct & Appropriate to Use? If a Range of Values is Provided & the Design Has Numbers Outside this Range, Is the Design BAD or WRONG?

Table 2. Default Geometric Parameters[A] for Both Urban & Rural Roundabouts

Geometric Parameter	Single-Lane Entry	Dual-Lane Entry	Triple-Lane Entry
1 Half width [B]	Travel lane w… approaching the roundabou… to any flared section.		
2 Entry width [B]	Face of … to face … shortest dis… at yiel…		
3 Effective Flare length [B]	15-330 … (100 m) if nec…		
4 Inscribed diameter [C]	13… (40 m)	…m)	250 …5 m)
5 Entry Radius	65 …0 m)	…m)	10… …0 m)
6 Entry angle		30 Degree…	
7 Circulating roadway width	20-25 ft (truck apron needed)	30 ft (10 m) (truck apron not needed)	…(14 m) …uck apron not needed)
8 Exit radius	50-65 ft (15-20 m)	…m)	100-130 ft (30-40 m)

Focus On Principles

- What's the ICD?
  - (Several ICDs!)
- What Circulatory Rdwy Width?
  - SLR → 2 → 3
- Entry / Exit Radii…
- Trucks Work **In Lane** No Issues!

US 60 / US 93, Wickenburg, AZ

Design Works!

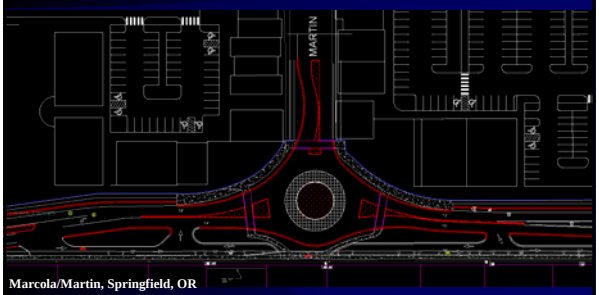
Focus On Principles

- Different Types of Roundabouts Require Different Design Techniques
- Different Design Methods Apply to Different Situations
- Different Site Issues/Req'mts = Different Solutions
- Designing Roundabouts Properly Are As Far as You Can Get From 'Cooker Cutter' Design OR as Specified in a Tables or Figures w/in Guides...
- Engineers Point to Guides Improperly or as Standards

Improper Use of Guides

- Guides Typically Address Model Situations
  - 90 Angles with 4 Legs at SLR
  - OR 2 Lane Entries, 2 Circ., 2 Exits For All 4 Legs
- How Often Does This Occur in Practice? ~ Rarely
  - Find in Guide Multiple ICDs, Ellipse, 5 Legs, skews...
- Engineers Often **Limit** Rbts To "The Guide"
- City of Springfield, Oregon stated: *"We approve roundabout designs based on Design Principles... not specific standards."* This is Exactly Correct!

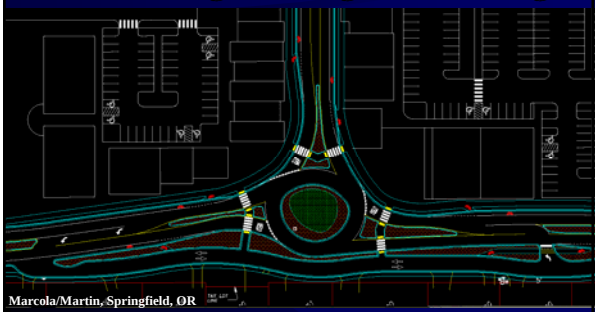
Thinking Through Rbt Design



Marcola/Martin, Springfield, OR

Original Design (By Others)

Thinking Through Rbt Design



Marcola/Martin, Springfield, OR

REVISED Design (By RTE)

Cut & Paste From Guide?

- Be Careful of Figures in Guides... Use as INTENDED
- Often, They Are Not Actual Designs
- Yet I See Engineers Cut & Paste Figures As Designs OR They Warp Their Design To Match the Figure
  - Assuming It Will Function Properly!
- Guides Are Trying to Help the Designer
- Usually on a Specific Issue for Each Figure
- Don't Manipulate Your Design to Match the Figure
  - Not Guide's Intended Use!

Conclusions

- Guides Are Definitely Needed & Useful Resource
- But Guides Generalize & Cover Model Situations
  - 10%(?) of Actual Design Practice
- Most Intersections Have Unique Lane Configurations, ROW Constraints, Truck %'s, Skewed Angles, Etc...
- There is No Standard Rbt Design to Apply
- Don't Assume Your Design Works Simply Because it Follows "The Guide"!

Conclusions

- **I Fully Support Guides** (I Help Write Many)
- Guides Are A Conglomeration of Information
- Think of All Those Who Contributed & Help Write…
  - Other States, Other Design Experts, Etc…
- While Each May Be Capable w/in Specific Field, **Using Parts** from RTE, Parts From Kittleson, Parts From WisDOT, or Specifics w/in Guides, May Not Produce A Good Rbt Design or Even a Desired Result!

Conclusions

- Although I Support Guides…
- I Do Not Support **HOW** Guides Are Often **USED**
- I Do Not Support Many Specifics (#s/Figs) Shown
- Use the Guide as it is Intended (Reference/See Cover)
- Don't Justify a Poor Design With the Guide!
- Does the Design Work with **Capacity** & **Safety**?
- Does the Design **Flow** & Have Good Composition?
- These Things Matter Most! Then Check Details…
- Ask For Help With Anything Roundabout Related…

Roundabout Questions:

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Designing & Implementing
Roundabouts Nationwide

Fools the Best Reviewers

Original Design (By Others)