Roundabout Planning & Design Challenges

Presented by: Scott Ritchie, P.E.

www.roundabouts.us
‘Roundabouts Gaining Ground’ *USA Today*

Why American Drivers Should Learn To Love the Roundabout *(Slate Magazine, Tom Vanderbilt)*

DOTs Embracing Roundabouts

Planning of Rbt Corridors is Up

Community Involvement & Acceptance is Up

Growing Popularity = *Everyone Trying One*…
Traveling / Designing in US – Fed/State/Local…
- Basic knowledge is growing… BUT see Deficiencies!

Rbts Still Evolving In U.S., Techniques Changing…
- Personally Designed ~400 Rbts in the U.S.
- Designs are Not the same… (Past vs. Recent)

I’m Still Learning & Evolving…

What are the Issues/Deficiencies (Top 5)??
Share some details & challenges - Tips & Examples

Scott Ritchie, PE, Roundabout Specialist
www.roundabouts.us
Issues Mostly Due to Designer/Agency Compromises

Top 5 Most Common Deficiencies:

1. Lack of Deflection (*#1 Key / Design Principle*)
2. Size / Shape Not Optimized
3. Truck Operations Dysfunctional
4. Not Site Specific Design / Alternative Solution
5. Lack of Qualified Peer Reviews
Tip 1: Field Experience

Tip #1: Get Out and Drive ‘em!

- *Nothing replaces real world field experience*!

What Does it FEEL Like / How Does it Drive?

- Abrupt, Tight, Path Overlap, simply *Awkward*? OR…

- Too Fast, Sudden Stops, No Deflection? OR…

- Smooth, Slow, & Comfortable? *(Publicly Accepted)*
Challenge: 5 Legs

Jamaica Avenue and TH 61
Typical Afternoon Peak Traffic
May 9, 2008

MLR Video 3X Speed

SCOTT RITCHIE, PE, ROUNDABOUT SPECIALIST

WWW.ROUNDABOUTS.US
Tip 2: Don’t Stop w/ Guides

THINK ZONE
(Challenges & Solutions)

Rbt Guides & Standards

100% ?

0%
Challenge: Capacity

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
3: Understand Trade Offs

Balance Between Capacity, Safety, Cost (Sustainable)
- Can Lead to Multiple Alternative Solutions...
- Often Aims Conflict (Gov’t: ROW/Capacity; Designer: Truck/Speed)

Explore Objective Triangle for Optimum Trade-off
Your Project Here?
Interim Conditions

US 93 / SR 89, Wickenburg, AZ

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
US 93 / SR 89, Wickenburg, AZ

Solution: Sustainability / Costs
Planning for Growth

Ultimate Conditions
Freeway to Freeway Interchange

Scott Ritchie, PE, Roundabout Specialist
www.roundabouts.us
Sustainability / Costs
Planning for Growth

Cost Savings & Higher Safety With Phased Design
Truck Video

Expandable SLR to MLR

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
Tip 4: Accommodate Trucks

- Trucks need extra clearance whenever possible.
- Passing to the right of trucks as it straddles both entry lanes is becoming common in many areas (redesigned dozens).
- Provide Options for Trucks...

- Joint State Transportation Design Study:
  - MLRs & Std Large Trucks
- Develop Design Guidelines for Accom. Trucks @ MLRs

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
Case 1: Trucks overlap into adjacent lanes at MLRs (need both lanes to enter MLR)

(most MLRs built in the past)
**Case 2:** Trucks stay in lane within entry, but slightly overlap in circulating road/exits at MLRs

*(req’d by some states now)*
Case 3: Trucks stay in lane thru entire intx for through movements

(least common - req’d by some jurisdictions)
Case 1 Operational Issues

Trucks Can’t Stay in Lane...
Case 2: Allows trucks to stay in lane in entry...

Image Courtesy: Google Maps

Trucks use as intended / designed!
Case 3: Allows trucks to stay in lane through...

- **Inside Lane**
- **Outside Lane**
Case 1 Truck Crashes ~ 40% AVG

Percentage of Crashes Involving Trucks
STH 32 / 57 (Claude Allouez) & Broadway
- Truck Crashes: 64%
- Non-Truck Crashes: 36%

Percentage of Crashes Involving Trucks
STH 42 & I-43 Ramps*
- Truck Crashes: 58%
- Non-Truck Crashes: 42%

*Percentage of crashes is the average value per roundabout.
Crash Data: Case 2

Case 2 Truck Crashes ~ 16% AVG

Percentage of Crashes Involving Trucks

- STH 42 & Vanguard
  - Truck Crashes: 27%
  - Non-Truck Crashes: 73%

- I-43 & Mooreland Ramps
  - Truck Crashes: 23%
  - Non-Truck Crashes: 77%

- STH 53 & Old Town Hall
  - Truck Crashes: 100%
  - Non-Truck Crashes: 0%
Addressing Multiple Issues Together

Deflection Achieved

Optimized ICD (dia/size/shape)

Site Specific Design

Trucks Accommodated (stay in lane in entry)

Sound Design Principles

Sustainable Design

US 60 / US 93, Wickenburg, AZ

Built 2009
Designing for Trucks In-Lane

WB-67
Stays In Lane in Entry

Trucks on inside lane STAY IN LANE through approach, and circulating roadway and exiting....

Magenta Lines are WHEELPATHS
Green Lines are truck envirolanes

Log 1 R1 (SB) ~ 27MPH
R1 SB inside lane ~ 23mph
Log1 Phi = 26 degrees

Log 2 R1 (NB) ~ 26MPH
Log2 Phi = 23 degrees

Trucks on outside lane STAY IN LANE through approach, but occupy adjacent lanes while circulating and exiting....
Solution: Trucks in Lane

- Complex Intersections
- High Speed Approaches
- High Trucks (stay in-lane)
- Unique Site Constraints

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
South Roundabout – Looking South

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
Challenge: OSOW Trucks

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
Addressing Multiple Issues Together

- Deflection Achieved
- Optimized ICD (dia/size/shape)
- Site Specific Design
- Trucks Accommodated (stay in lane on entry)
- Sound Design Principles
- Sustainable Design

Solution: OSOW Trucks

Stick to Principles = Design is GOOD
**Tip 5: Focus on Principles**

### Good Rbt Design has:
- Sound Engineering Practices
- Calculated Capacity
- Measurable Safety
- Proper Deflection
- Balanced Speeds
- Truck Capabilities
- Multi-Modal Facilities
- No Entry Path Overlap
- Within Project Constraints
- Conform to Local Regs

### Good Roundabout Design has:
- Good Composition
- Based on Design Principles
- Optimized Lane Config - safe
- Comfortable to Drive
- Smooth Entries and Exits
- Site Specific Design
- Properly Sized/Placed ICD
- Safe & ‘Easy’ for the Public
- Positive Driving Experience
- Sustainable Design

---

**Scott Ritchie, PE, Roundabout Specialist**

[www.roundabouts.us](http://www.roundabouts.us)
Challenge: Downtown Gateway

Lancaster, California

Existing Traffic Signal

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
Solution: Downtown Gateway

Lancaster, California

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
Downtown (After)

Lancaster, California

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
Balance is Crucial... Balance the Competing Aims:

- Common Sense Planning & Engineering Practices
- Focused on the Principles of Rbts,

- Visualize the Rbt as a Whole as well as Details
  - Holistic Design = Balance of all Elements (Cap, Safety, Cost, Trucks, ROW, Speeds, Comfort, Public Acceptance, etc...)

- Use BOTH Left & Right Sides of the Brain!
Which Way is the Figure Rotating?

- **Counterclockwise?**
  (LT Arm & LT Leg Out)

- **Clockwise?**
  (RT Arm & RT Leg Out)

Video of Rotating Figure
Holistic Design

Shifting Your Brain’s Current?

- Counterclockwise or Facing Backward: (LT Arm & LT Leg Out)
- Clockwise or Facing Forward: (RT Arm & RT Leg Out)

Left Brain
- Logical
- Sequential
- Rational
- Analytical
- Objective
- **Looks at Parts!**

Right Brain
- Holistic
- Intuitive
- Random
- Subjective
- **Looks at Wholes!**

**Holistic Designers Can See It BOTH Ways**

**Scott Ritchie, PE, Roundabout Specialist**

**www.roundabouts.us**
Challenge: Holistic Design

Anyone See Issues Here?

- ROW - Size?
- Res & Com Accesses
  - Layout?
- Deflection?
  - Speeds?
  - Operation?
- Composition?

Original Design (by others)

Marcola/Martin, Springfield, OR

Scott Ritchie, PE, Roundabout Specialist

www.roundabouts.us
Solution: Holistic Design

This Would Fail the Std Template Test!

Yet it Fits and Works!
Tip 7: Get Peer Review

- **PUBLIC ACCEPTANCE** Matters!

- Don’t Accept Just a Circle = Rbt

- Creativity & Experience Identify Solution
  - May be Better Solutions from another designer…

- Design Should Be **Unique** to Achieve Safety & Capacity

- Check Composition *(Does it Flow? How Will it Drive?)*

- Check for both Holistic and Details

- Require Peer Reviews
  - Many States Already Do…

*Scott Ritchie, PE, Roundabout Specialist*  
*[www.roundabouts.us](http://www.roundabouts.us)*
Different Rbt Types Require Diff. Design Techniques

Different Design Methods Apply Diff. Environments
- Urban/Suburban/Rural High Speed

Different Site Issues/ROW Require Tailored Solutions

Goal: Slow Drivers Down But w/o being awkward… Safe?!

A Better/Smoother Design is the Latest Evolution in Rbts!
Questions?

Scott Ritchie, P.E.

Institute of Transportation Engineers
ITE Western District Annual Meeting
July 14-17, 2013
Phoenix, Arizona

Designing & Implementing
Roundabouts Nationwide!

Scott Ritchie, PE, Roundabout Specialist
www.roundabouts.us