Introduction to Multi-Lane Roundabout Design
INTRODUCTION

Many More Issues To Consider In Multi-Lane Roundabout Design vs. Single Lane Design

Too Many To Discuss In 25 Minutes

Best Place To Start Is In the Understanding Two Critical Safety Issues With MLR:
(1) Deflection & (2) Vehicle Path Overlap

Some Other Major Cap / Safety Issues Are:

- Entry & Exit Geometry
- Fast Path Design / Radii
- Entry, Circulating, Exit Speeds
- MLR Striping Design (Spiral, Arrows, Hatching)
- Multi-Lane Signing
- Simultaneous Truck Movements
- Vertical MLR Design, Visibility, Ped Crossings...
Safety Issue 1: **Deflection**

- With Proper Entry Path Curvature = Deflection
- Good Entry Path Curvature:
  - Provides Self-Enforced Speed Reduction
  - Controls Traffic Speed by Slowing Veh at Entry
  - Creates Speed Consistency
  - Reduces Entry Circulating Crashes…
  - Safer For All Users (Veh, Peds, Cycle)

*Entry Path Curvature Must Be Applied PRIOR to Yield Line!*
Safety Issue: **Deflection**

- Improper Deflection Causes Accidents, Speed Problems, Fear, Discomfort, Rejection…
- Too Much Deflection Result in Approach Accidents
- Very Slow Circulating Speeds Cause Accidents!
- Do Not Over-Deflect the Entry (Not Too Slow) – All Benefits Achieved at About 25 MPH
- Too Little Deflection Causes:
  - Entry/Circulating Crashes & Single Veh Acc.
  - Circulating Traffic Yielding To Approaching Vehicles
  - A Fast Approach Dominating Roundabout
  - Reduced Capacity
  - Unsafe Speeds
  - Loss of Control…
Good Entry Path Curvature

Entry Curvature = Slow Entry (R1 & R2)

Entry Curvature = Tangential Entry

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Okemos, MI

Courtesy: Ed Waddell
Effect of Entry Path Curvature

SMALL CIRCULATING FLOWS

GENTLER ENTRY PATH CURVE OPTIMUM?

LARGE FLOW
Good EPC = Deflection
Milton Keynes, U.K.
Too Much Deflection
Applying Proper Deflection

- Reduces Entry / Circulating Accidents
- Can Increase Approach Accidents
- Can Increase Single Vehicle Accidents
- Not Too Much or Too Little = Balance

- Accident Change Is Net Effect
  - Depends on Traffic Flows

**EPC R1 < 328’ (100m)**

For Multi-lane Entries
Entry Path Radius on Multi-lane

- Achieving Proper Deflection With EPR & Without Entry Path Overlap Can Be Difficult
  - Large Interaction Between Geometric Parameters
- SLR Experience Little Help - Different Ball Game
  - SLR Do Not Have MLR Design Issues
  - 2 Laners Difficult → 3 Laners More Difficult
  - Solving One Problem Tends To Create Another
- Subtle Changes = Balance = Trade-off
Multi-lane Entry Geometry

Contrasting Methods of Attaining Deflection

What about the length of arc?

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Multi-lane Entry Geometry

Contrasting Methods of Attaining Deflection
Small & Tight Entry Radii

Too STIFF? Sudden Lane Changes?

Goodyear, AZ
Smooth Entry Radius Curves

R1 = 246’
Iterative Design

- Adjusting One Geometric Parameter Affects Another
  - Lots of SMALL Changes Rather Than One LARGE Adjustment
  - HOLISTIC More Important
  - Get It Generally Correct Before Detail
  - Hand Sketch is VERY Beneficial: Get Roughly Right
  - CAD Afterwards

- Repeat Iteration Until Design is Polished & Refined
  - Use HOLISTIC Common Sense Checks
Safety Issue 2: Vehicle Path Overlap

- Large Entry Angle Causes ‘Vehicle Path Overlap’
- Small Entry Radius Causes ‘Vehicle Path Overlap’
- Large Exit Angle Causes ‘Vehicle Path Overlap’
- Small Exit Radius Causes ‘Vehicle Path Overlap’

- This Dramatically Reduces Capacity
- Causes Accidents at the Entry, Circulating, & Exit
Vehicle Path Overlap
Sudden Lane Change

Perpendicular Entries
Entry Path Overlap
Tight Exit Radii
Exit Path Overlap

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Any Problems Here?

Courtesy: Phil Demosthenes

US 6 / Post Rd - Avon, CO

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Entry Deflection & Path Overlap

- Poor Deflection
- Entry Path Overlap
- Reverse Curvature
- Tight Entry Radii
- Striping...

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Any Problems Here?

- Poor Entry
- Deflection
- Entry Path
- Overlap
- Too Large or “Loose” Entry Radii
- Perpendicular Entry

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Any Problems Here?

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Reverse Curvature

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Safety Issue 2: Path Overlap

Possible Solutions:
- Increase Entry &/Or Exit Radii
- Modify Entry Angle
  - Compound Radii & Tangential Entry/Exit
- Slightly Move Roundabout
- Modify Splitter Island Design
- Modify Road Markings
  - Exit Striping
- Seeing the Problem or Safety Issue Is Key!
  Then Determine How to Fix It Without Creating Other Problems/Safety Issues…

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CONCLUSION:

- Ensure Proper Deflection / Entry Path Curvature
- Remember: Balance is Needed
- Check Fast Path Design
- Check Speeds
- Check For Vehicle Path Overlap
- Check “Self Enforcing” Geometric Design
- Involve A Roundabout Specialist In Design & Get Design Assistance & Peer Reviews!
- Peer Review in Early Design Stages (30%)
- Peer Review Again In Final Stages