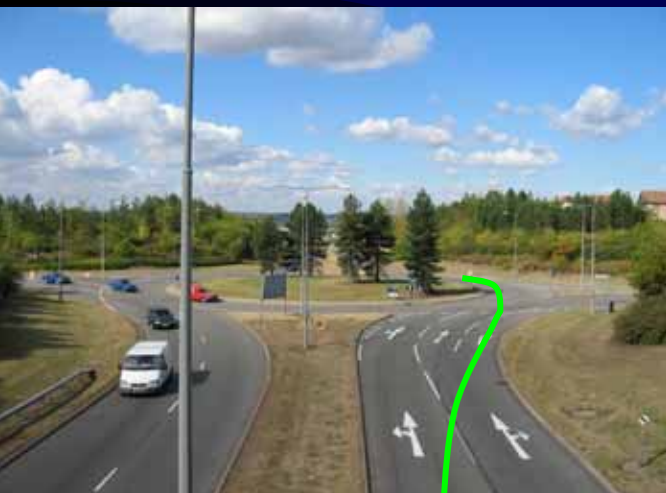




Introduction to Multi-Lane Roundabout Design



www.roundabouts.us



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

Courtesy: Mark Johnson

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Okemos, MI

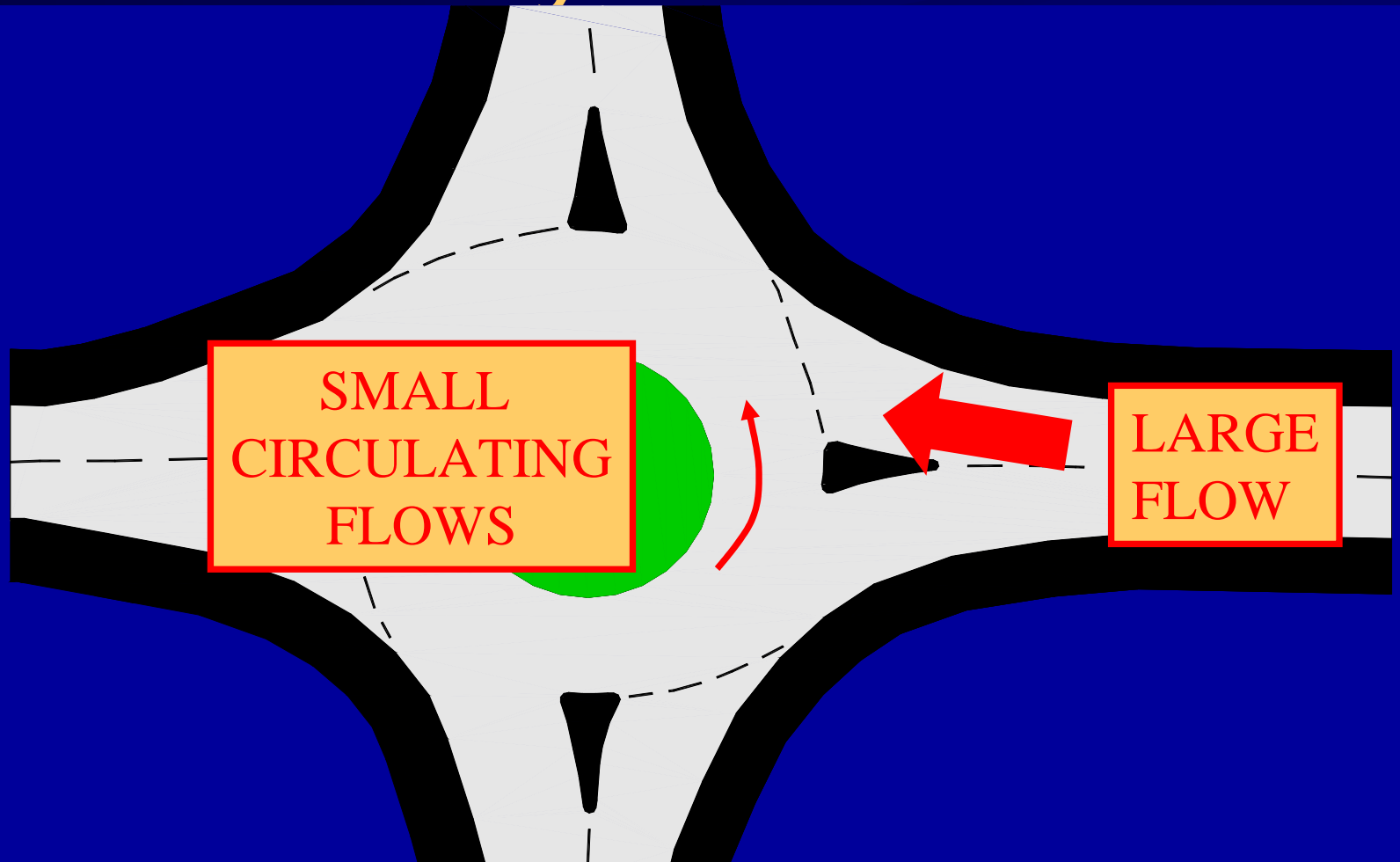


Courtesy: Ed Waddell

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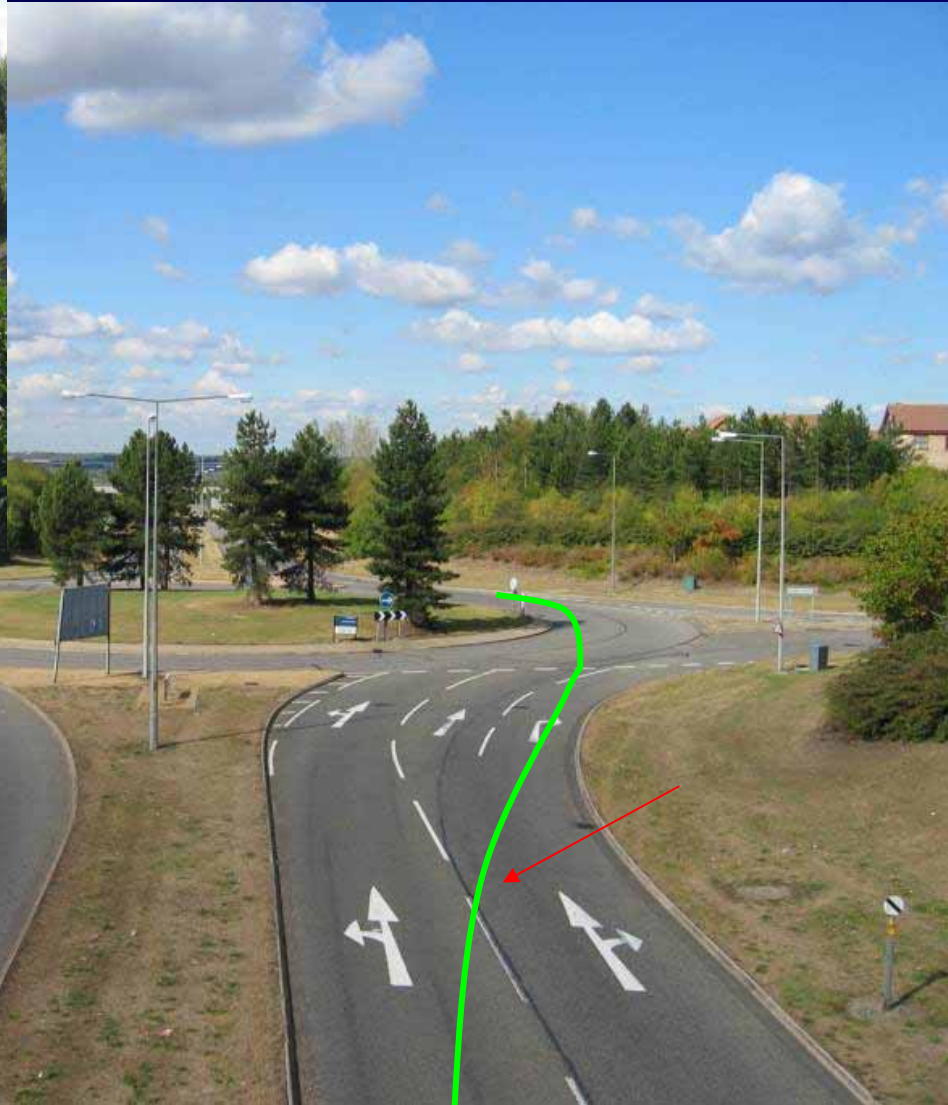


Effect of Entry Path Curvature



GENTLER ENTRY PATH
CURVE OPTIMUM ?

Good EPC = Deflection



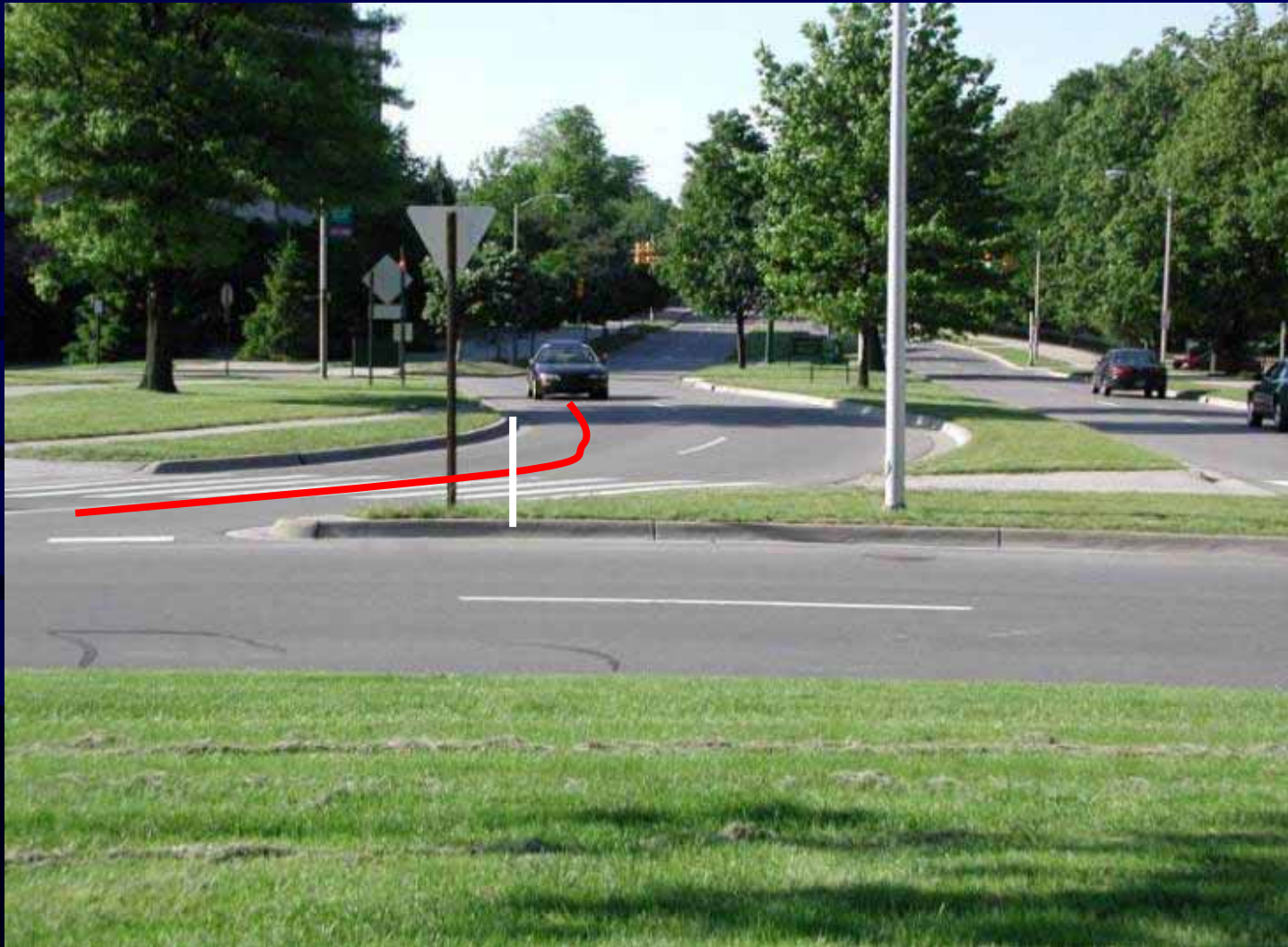
Milton Keynes, U.K.



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Too Much Deflection

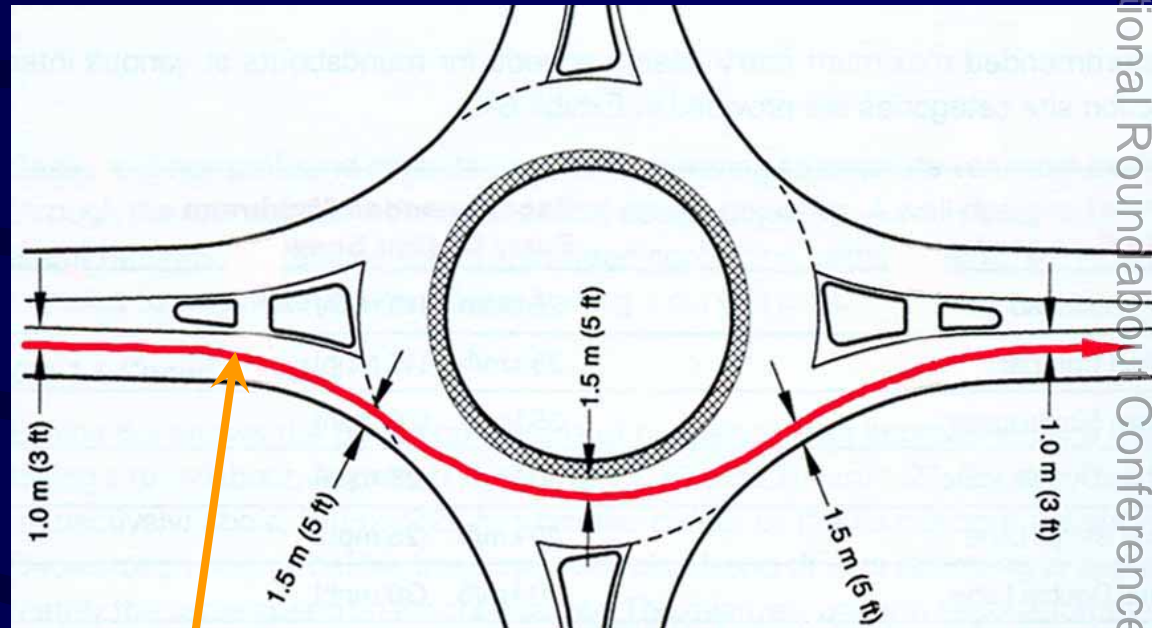


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Applying Proper Deflection

- ◆ 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

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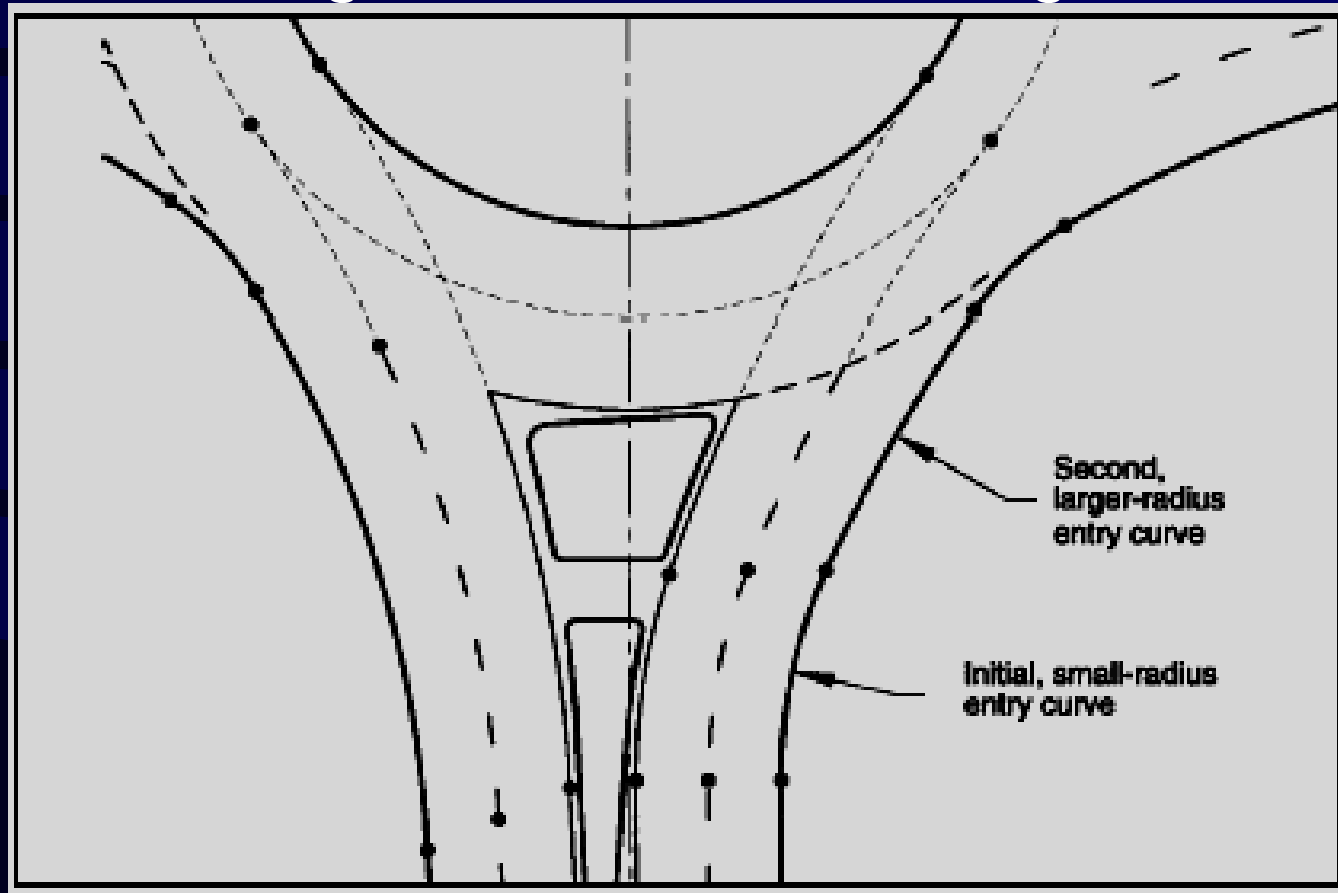


Entry Path Radius on Multi-lane

- ◆ 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

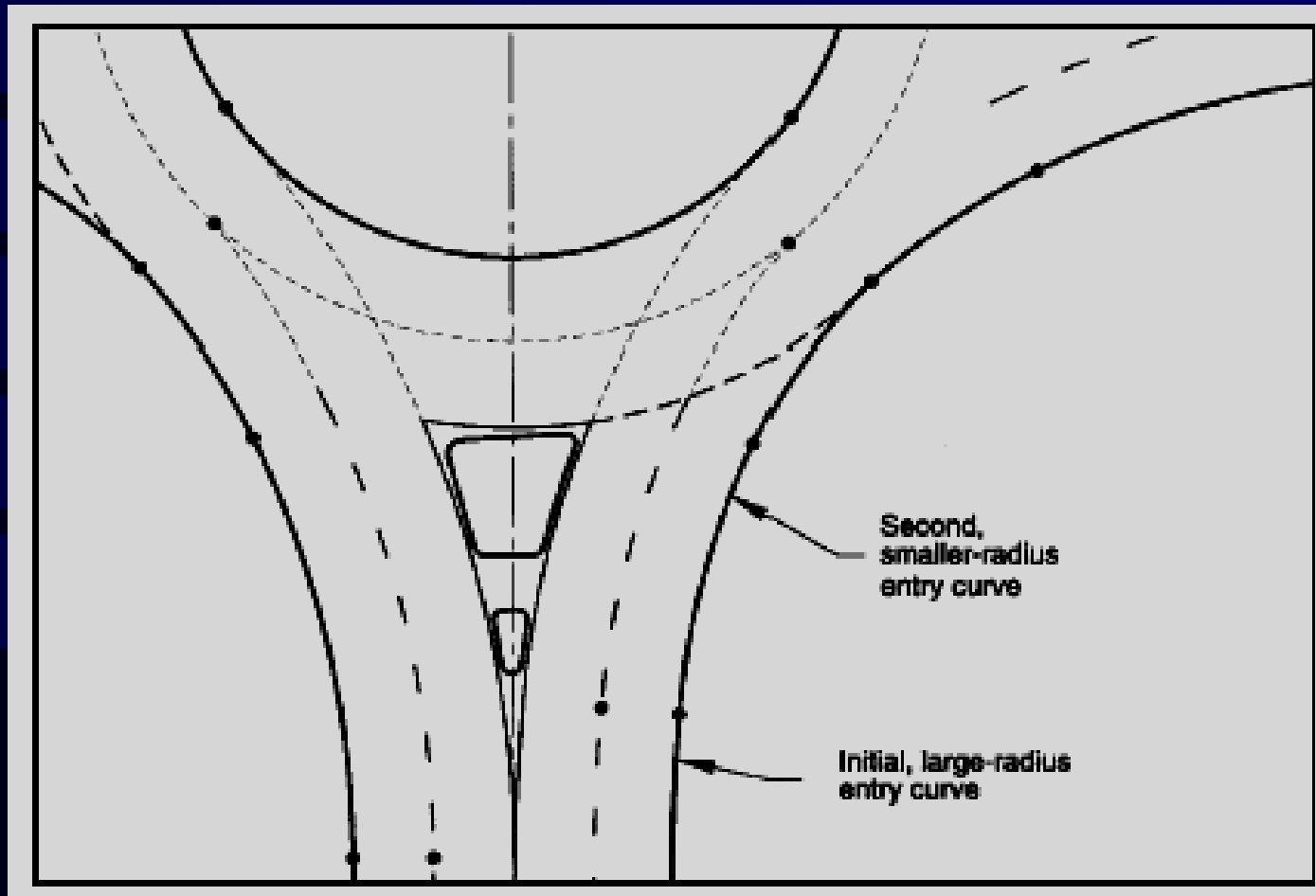
Contrasting Methods of Attaining Deflection



What about the length of arc?

Multi-lane Entry Geometry

Contrasting Methods of Attaining Deflection





Cotton Lane

Small & Tight Entry Radii

Too STIFF ? Sudden Lane Changes?

Goodyear, AZ

Estrella Parkway

RTE
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11279 HUNTSMAN LEAP TRUCKEE, CALIFORNIA 96161

Roundabouts & Traffic Engineering

COTTON LANE OVER GILA RIVER
ROUNDABOUT DESIGN ALTERNATIVE

DESIGNED BY: [Signature]
DATE: 10/27/05

Scale: 1" = 100'

PROJECT NO: 05-0011

DATE: 10/27/05

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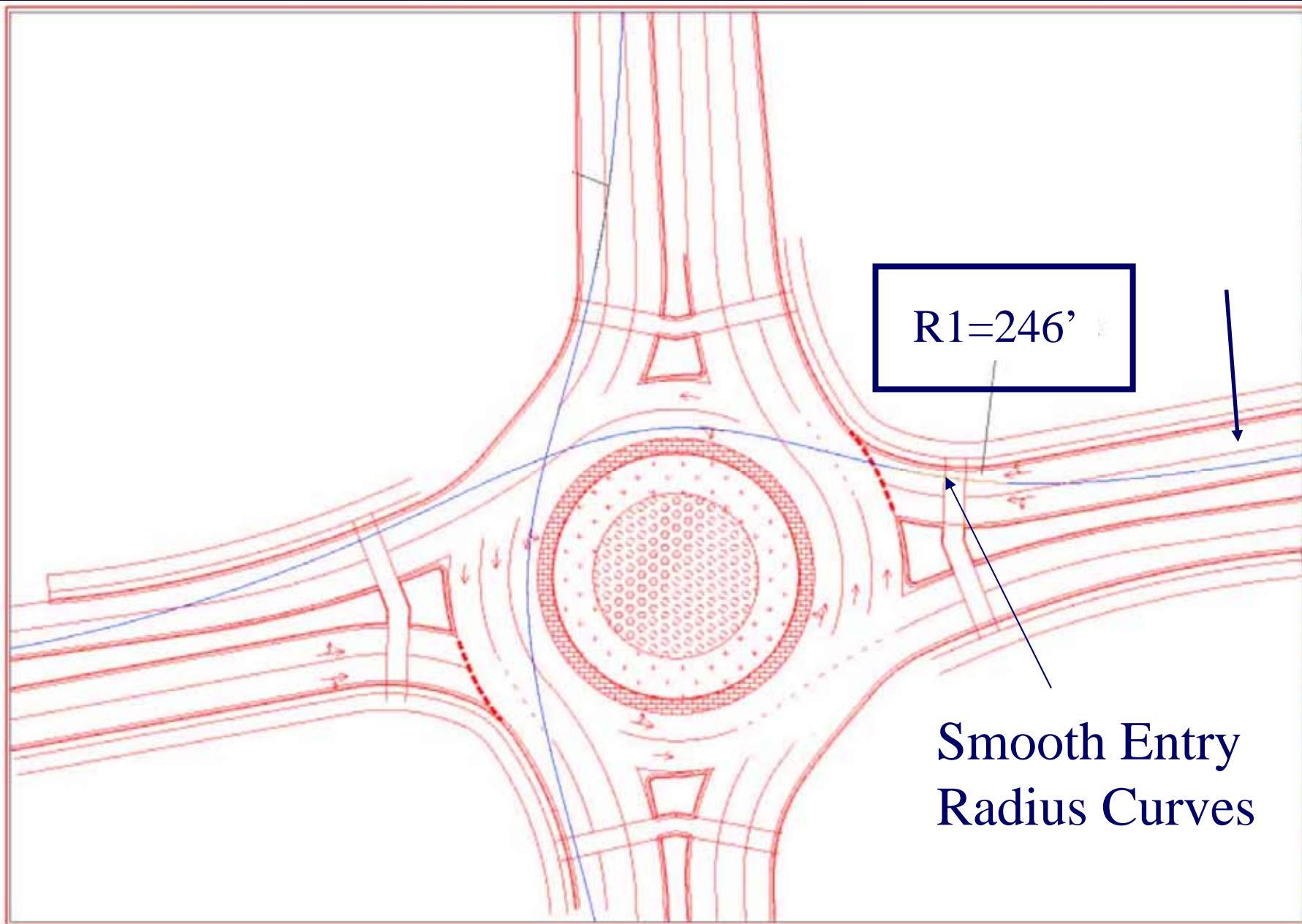
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R1=246'

Smooth Entry
Radius Curves

RTE
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SUITE 100, (505) 860-1188
RICHIE, CALIFORNIA 94588

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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

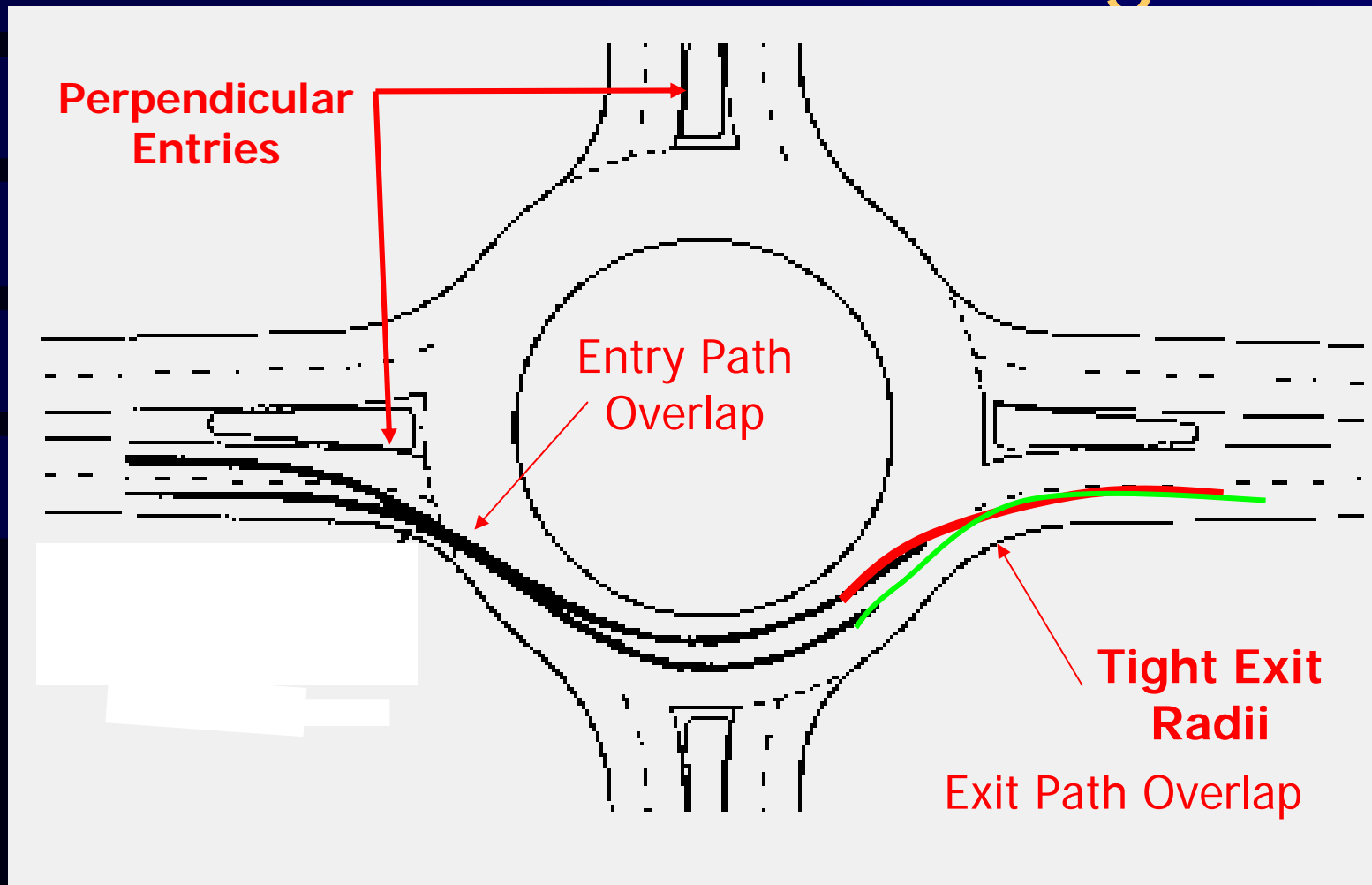
- ◆ Large Entry Angle Causes 'Vehicle Path Overlap'
- ◆ Small Entry Radius Causes 'Vehicle Path Overlap'

- ◆ 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



Any Problems Here?

Courtesy: Phil Demosthenes

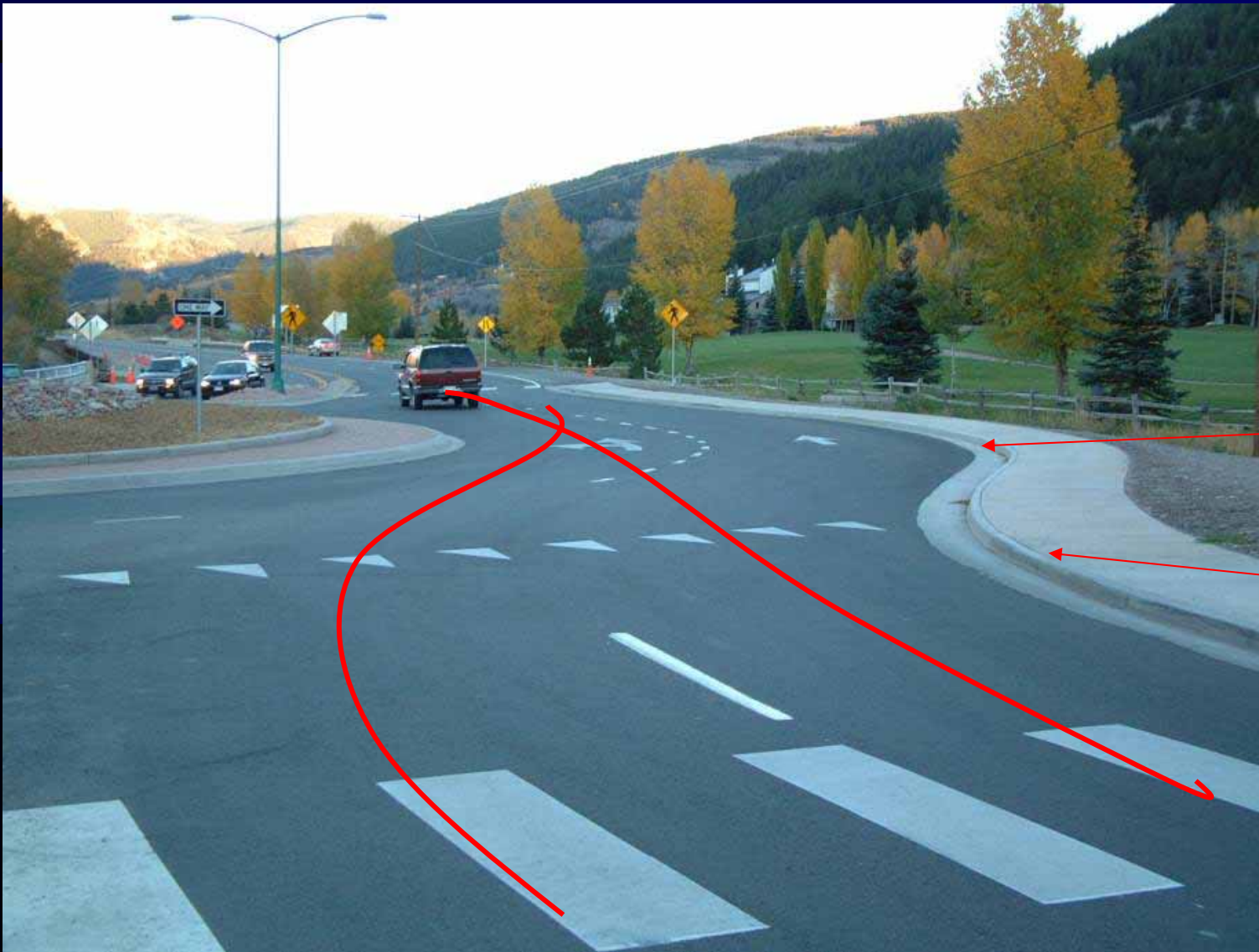


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Entry Deflection & Path Overlap



- ❖ 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?



Reverse Curvature



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...



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

