KYTC Roundabout Policy and Development

KYTC Partnering Conference

August 11, 2009

- Review KYTC Policy Background
- New Policy Approach
- Draft Policy Technical Overview

Overview

- July, 2006
  - Interim Roundabout Guidelines
  - Roundabout Review Committee

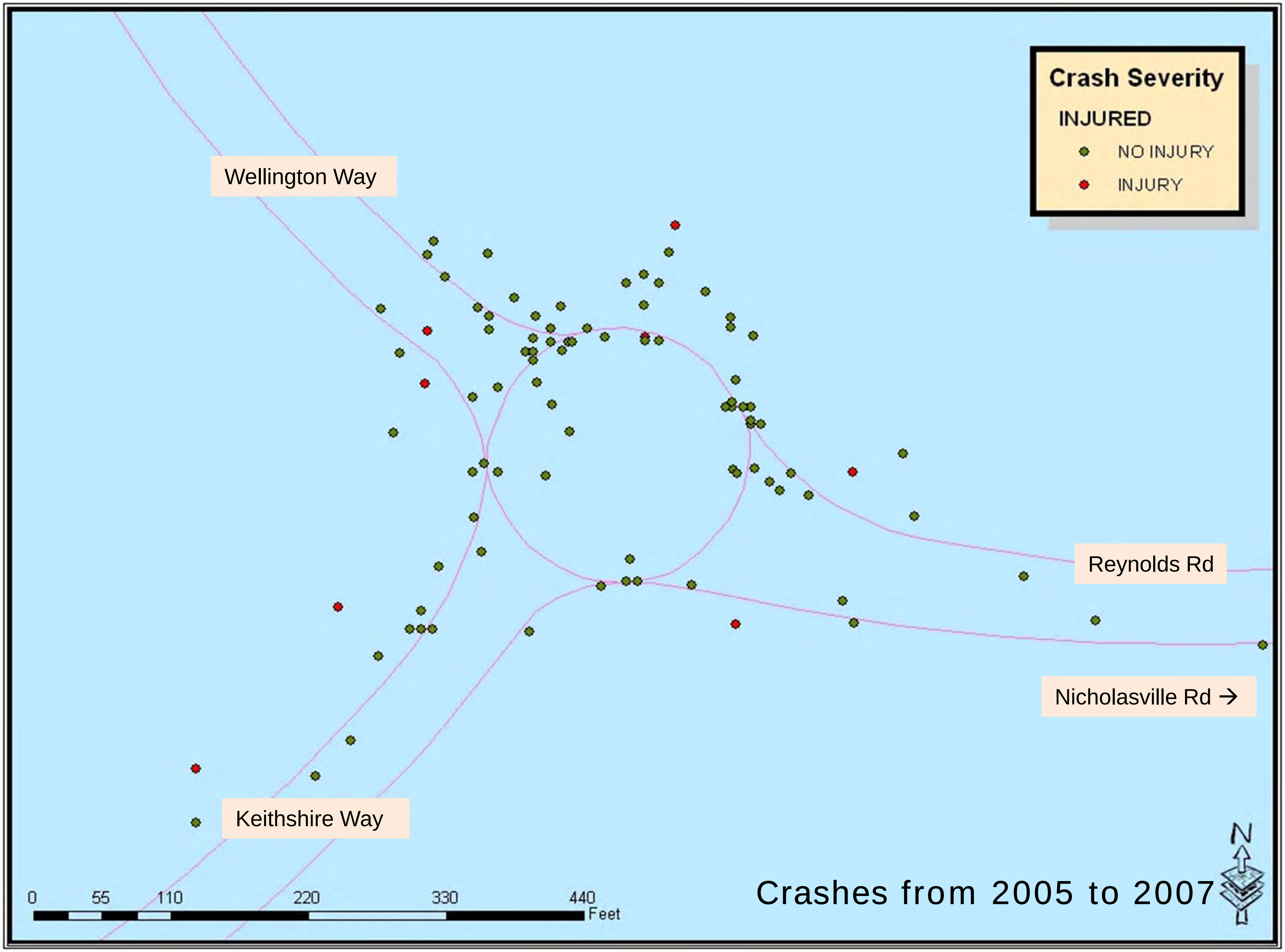
- July, 2008
  - Halt placed on new roundabout designs in Kentucky

- Why the Halt?
  - Documented issues with limited existing roundabouts
  - Lack of design guidance within roundabout guidelines
  - Increased number of roundabout proposals

Background


Nunn Dr. and University Blvd.


Reynolds Rd
Reynolds Road Roundabout


Crash Severity
INJURED
NO INJURY
INJURY
Wellington Way
Reynolds Rd
Nicholasville Rd →
Keithshire Way
0
55
110
220
330
440
Feet
N
Crashes from 2005 to 2007

- July 2009: Memorandum: Guidelines for the use of Roundabout Intersections

- July 2009 – July 2010 Policy Development
  - KYTC / URS / KTC
  - Review KYTC Staff and ACEC

- July 20, 2010
  Design Memorandum No. 03-10

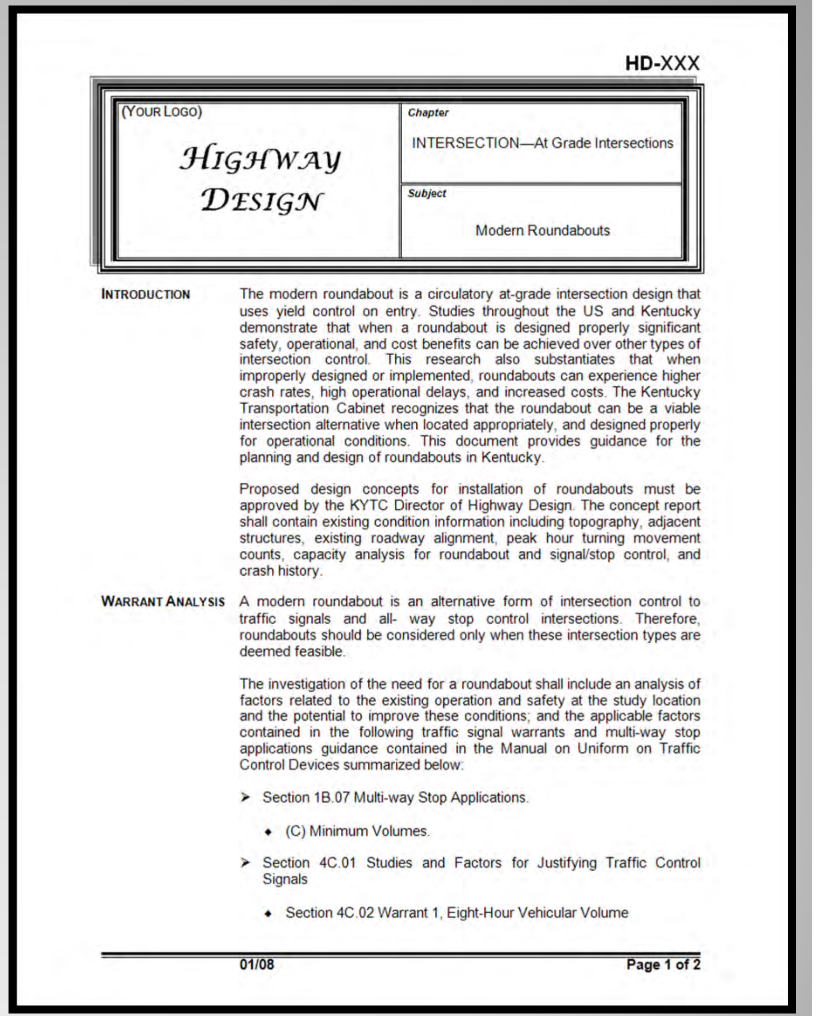
Background

Policy Approach

- Conservative Approach
  - <0.85 V/C Ratio for Roundabouts
  - Comprehensive design review and guidance
  - Prefer traffic signals over roundabouts where questions remain

KYTC Policy-Overview

- Warrants
- Operational Analysis
- Basic Design Elements
- Geometric Design
- Sight Distance
- Signing, Markings and Lighting
- Pedestrian and Bicycle Accommodations
- Review and Approval



HD-XXX

(YOUR LOGO) HIGHWAY DESIGN	Chapter: INTERSECTION—At Grade Intersections
	Subject: Modern Roundabouts

INTRODUCTION The modern roundabout is a circulatory at-grade intersection design that uses yield control on entry. Studies throughout the US and Kentucky demonstrate that when a roundabout is designed properly significant safety, operational, and cost benefits can be achieved over other types of intersection control. This research also substantiates that when improperly designed or implemented, roundabouts can experience higher crash rates, high operational delays, and increased costs. The Kentucky Transportation Cabinet recognizes that the roundabout can be a viable intersection alternative when located appropriately, and designed properly for operational conditions. This document provides guidance for the planning and design of roundabouts in Kentucky.

Proposed design concepts for installation of roundabouts must be approved by the KYTC Director of Highway Design. The concept report shall contain existing condition information including topography, adjacent structures, existing roadway alignment, peak hour turning movement counts, capacity analysis for roundabout and signal/stop control, and crash history.

WARRANT ANALYSIS A modern roundabout is an alternative form of intersection control to traffic signals and all- way stop control intersections. Therefore, roundabouts should be considered only when these intersection types are deemed feasible.

The investigation of the need for a roundabout shall include an analysis of factors related to the existing operation and safety at the study location and the potential to improve these conditions; and the applicable factors contained in the following traffic signal warrants and multi-way stop applications guidance contained in the Manual on Uniform on Traffic Control Devices summarized below:

- Section 1B.07 Multi-way Stop Applications.
  - (C) Minimum Volumes.
- Section 4C.01 Studies and Factors for Justifying Traffic Control Signals
  - Section 4C.02 Warrant 1, Eight-Hour Vehicular Volume

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Warrants

- A modern roundabout is an alternative form of intersection control to traffic signals and multi-way stop control intersections.

- Multi-way Stop Applications.
  - (C) Minimum Volumes.

- Traffic Control Signals Warrants
  - Warrant 1, Eight-Hour Vehicular Volume
  - Warrant 7, Crash Experience,
  - Warrant 8, Roadway Network

Operational Analysis

- Measures of Effectiveness
  - Volume to capacity (V/C) ratio of each approach lane
  - Delay by lane, approach, and intersection
  - Queue estimates

Operational Analysis

- NCHRP 572 Analysis
  - Volume to Capacity (V/C)
  - Delay by Lane/Approach
  - Queue Estimates

- V/C ≤ 0.85

$$c = 1130 \cdot \exp(-0.0010 \cdot v_c)$$

where

c = entry capacity (passenger car units [pcu]/h)

v_c = conflicting flow (pcu/h)

Operational Analysis

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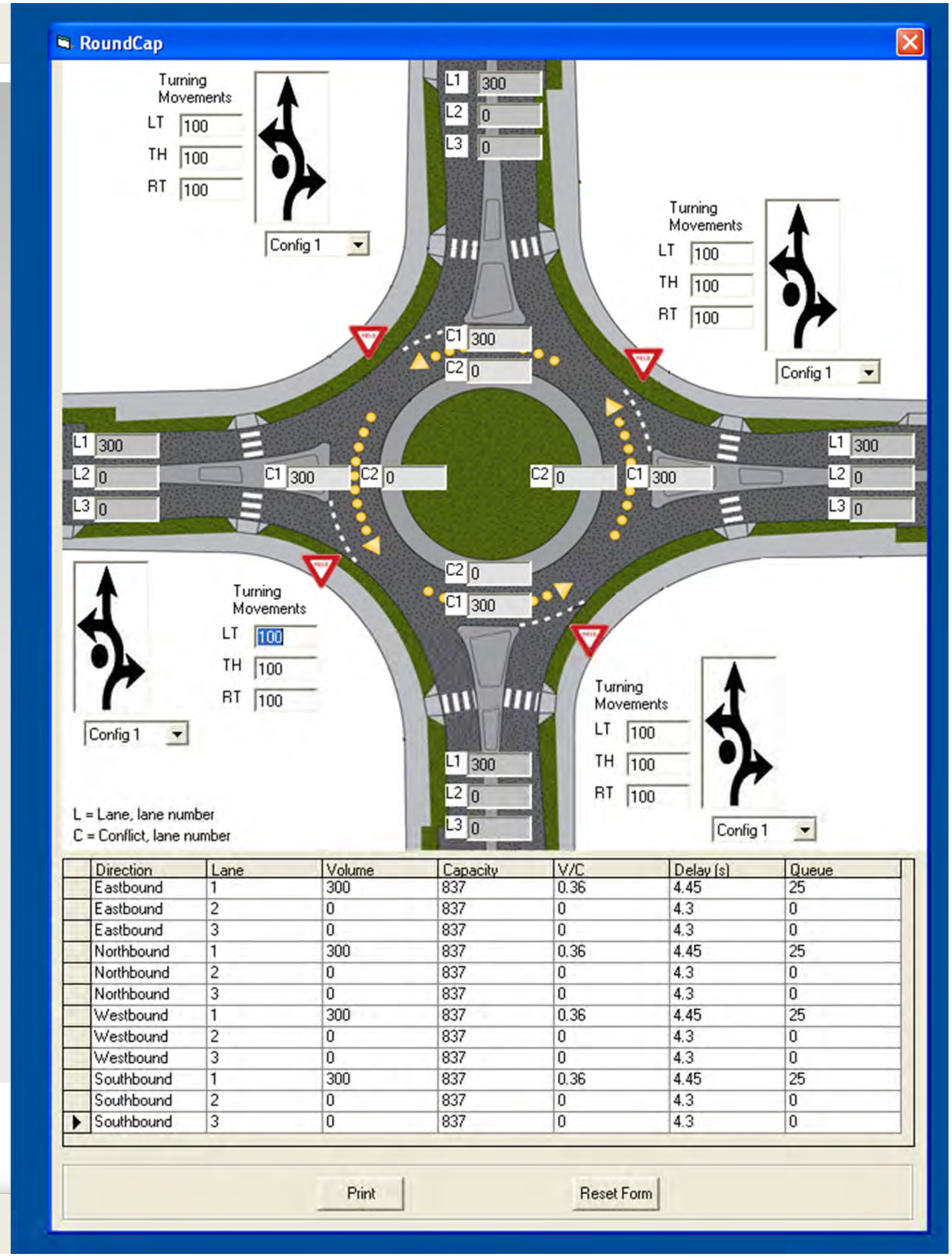
08/11/10



Direction	Lane	Volume	Capacity	V/C	Delay (s)	Queue
Eastbound	1	300	837	0.36	4.45	25
Eastbound	2	0	837	0	4.3	0
Eastbound	3	0	837	0	4.3	0
Northbound	1	300	837	0.36	4.45	25
Northbound	2	0	837	0	4.3	0
Northbound	3	0	837	0	4.3	0
Westbound	1	300	837	0.36	4.45	25
Westbound	2	0	837	0	4.3	0
Westbound	3	0	837	0	4.3	0
Southbound	1	300	837	0.36	4.45	25
Southbound	2	0	837	0	4.3	0
Southbound	3	0	837	0	4.3	0

Basic Design Elements

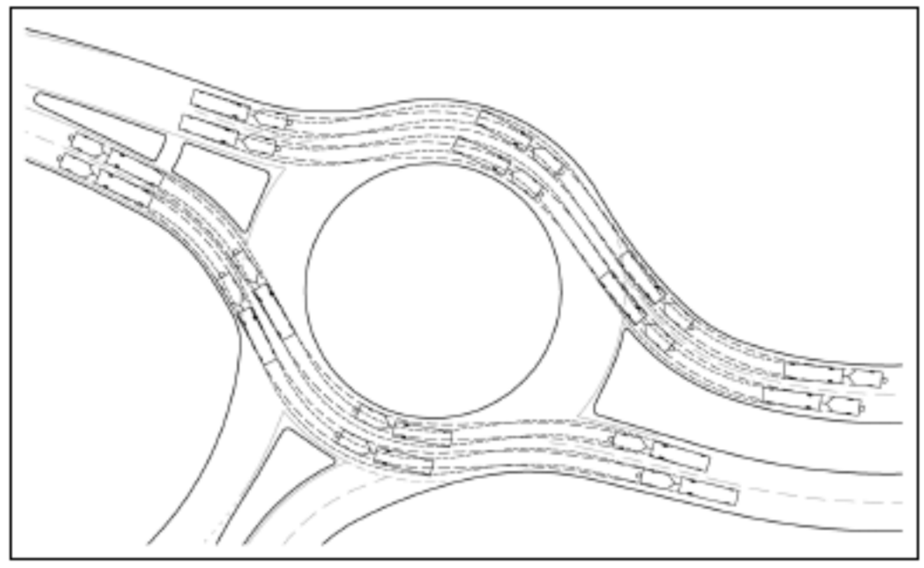
- Design Vehicle
- Circulatory Roadway
  - Inscribed Circle Diameter
  - Circulating Width
- Truck Apron
- Central Island
- Splitter Island

Design Elements

- Design Vehicle
  - Dictate minimum dimensions
  - May be determined by movement

Route Classification	Design Vehicle
State Routes	
Principal Arterial	WB-65
Designated Truck Route	WB-65
Other State Routes	WB-50
Non-State Routes	
Major Streets	WB-50
Other	Bus Single Unit Fire truck

- Circulatory Roadway Width
  - Maximum ≤ 16 ft
  - Multi-lane: *The design vehicle may encroach upon the adjacent lane, but must allow adequate space to accommodate a passenger car traveling alongside.*



Design Elements

- Inscribed Circle Diameter

Single Lane Roundabout

Movement	Minimum Inscribed Diameter (ft) Bus / Single Unit Truck	WB-50	WB-65
Through	75	85	90
Left Turn	90	95	120
U-Turn	90	100	135

Dual Lane Roundabout

Movement	Minimum Inscribed Diameter (ft) Bus / Single Unit Truck	WB-50	WB-65
Through	110	125	150
Left Turn	125	150	200
U-Turn	125	150	200

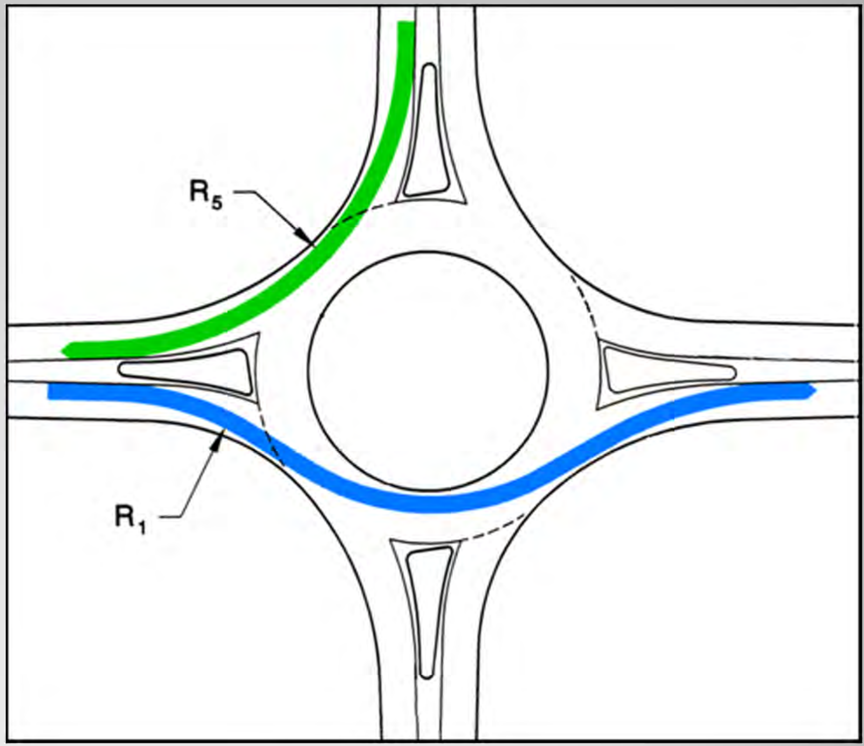
Design Elements

- Other Elements
  - Truck Aprons
  - Central Island
  - Splitter Island

- FHWA Roundabouts: An Informational Guide

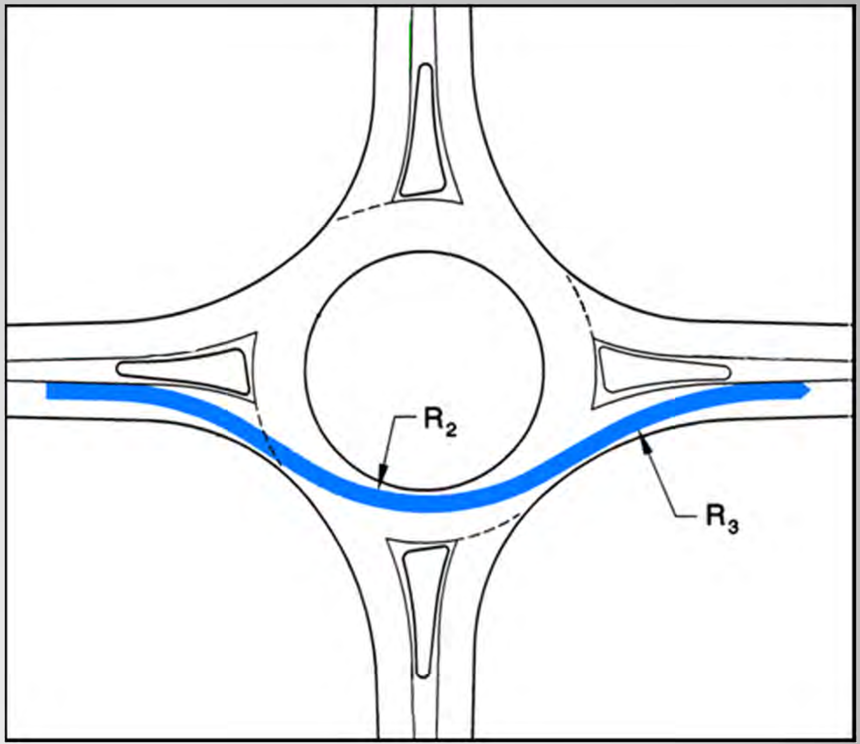
Design Elements

- Entry Deflection
  - Fastest Path Methodologies
  - R_1 and R_5
  - <225 ft Single lane
  - <275 ft Multilane



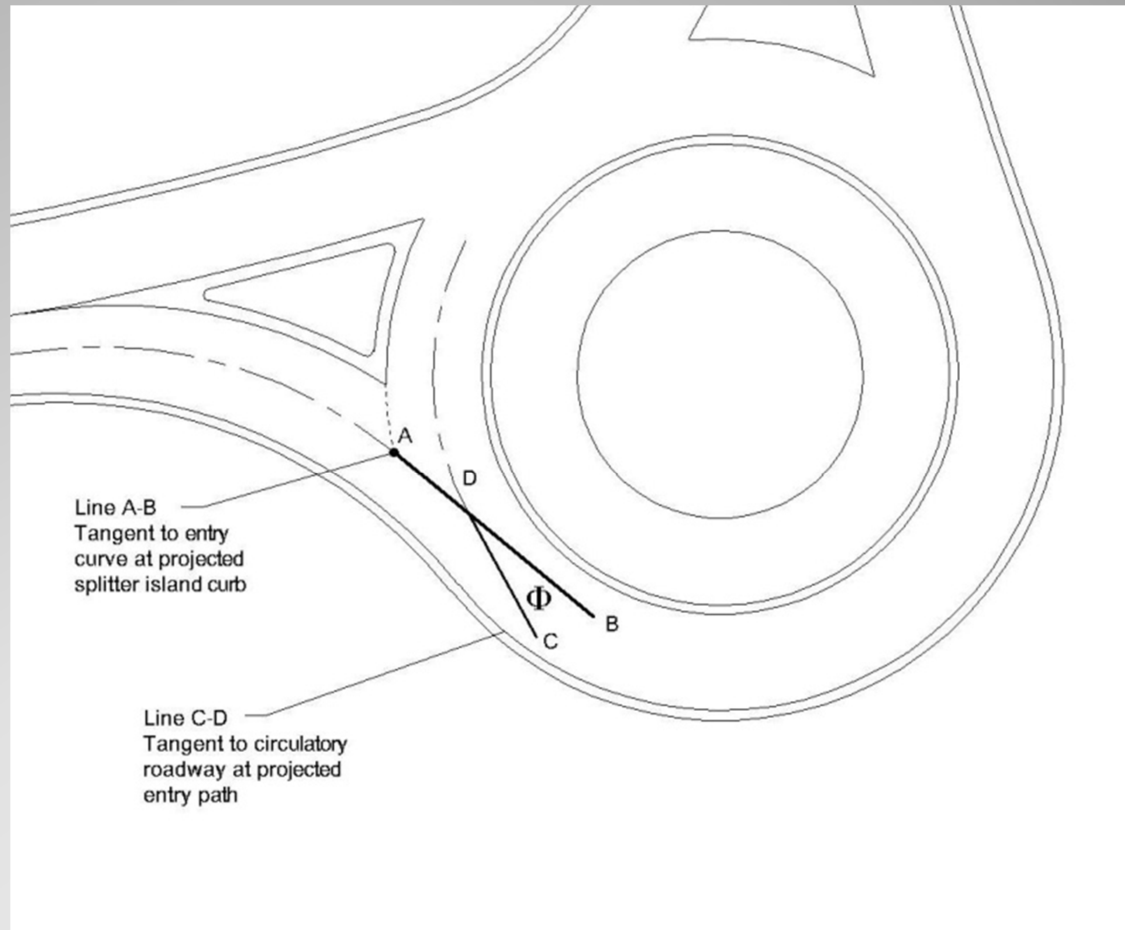
Geometric Design

- Exit Curve
  - Maximum = Tangent
  - Minimum > R_2



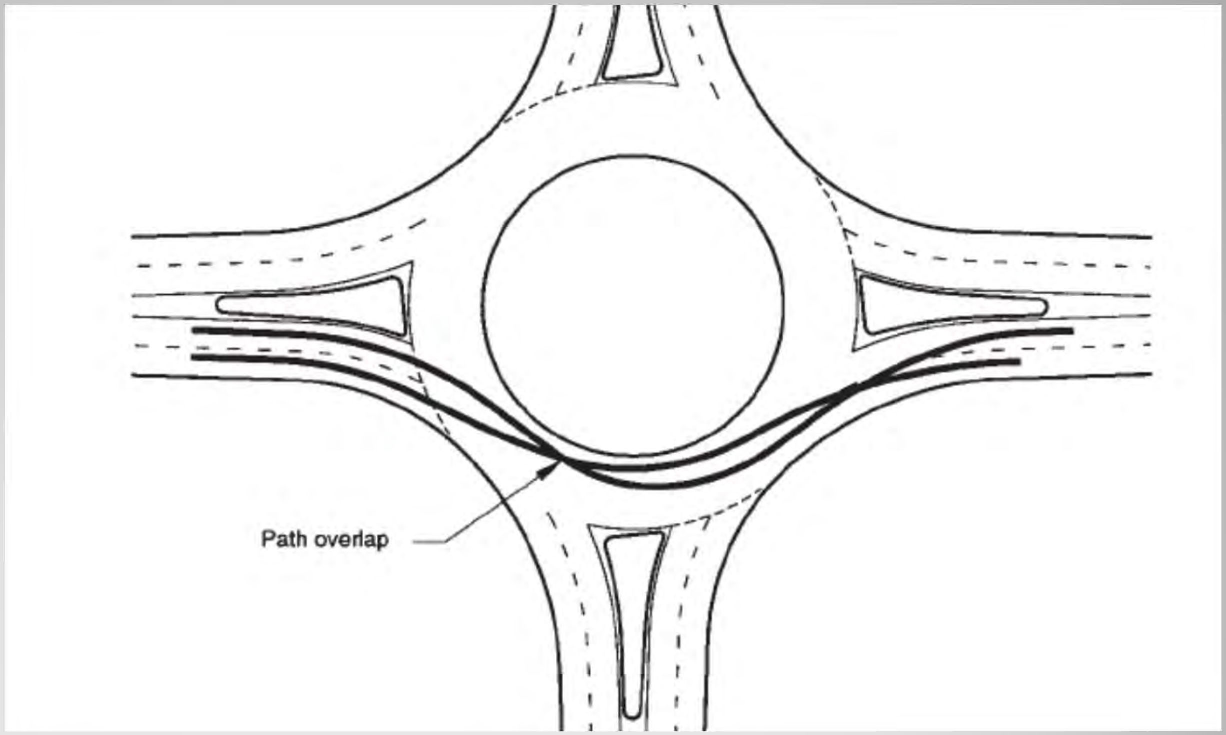
Geometric Design

- Entry Angle



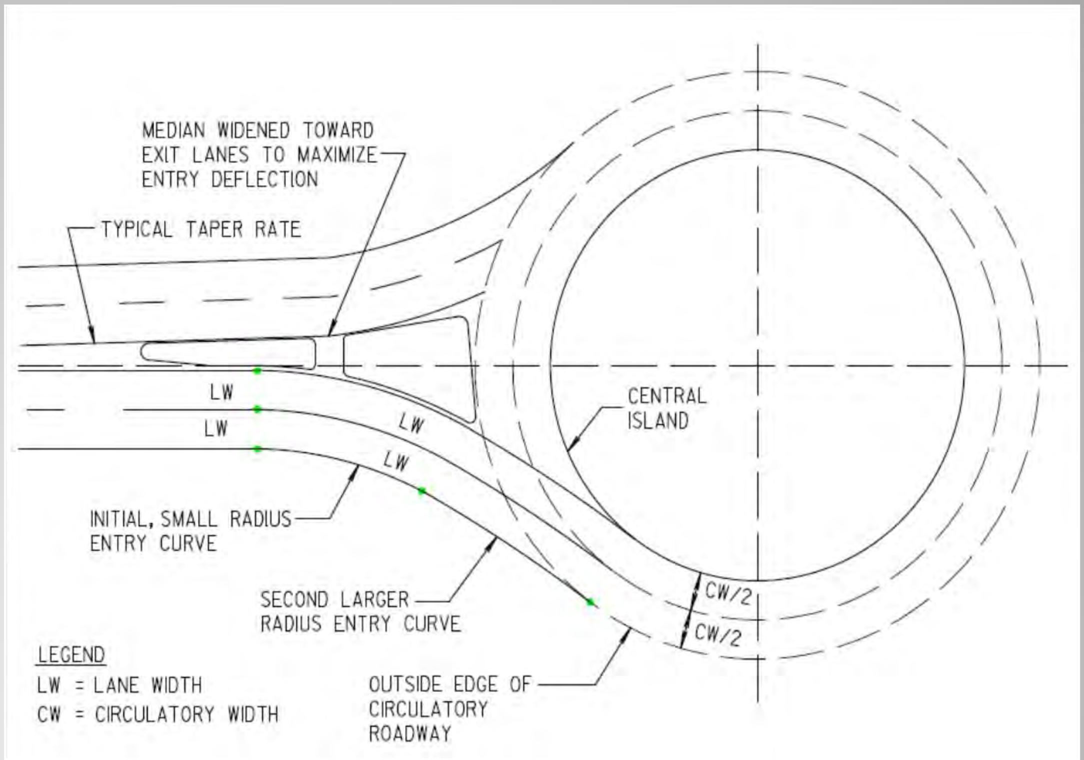
Geometric Design

- Entry/Exit Path Overlap



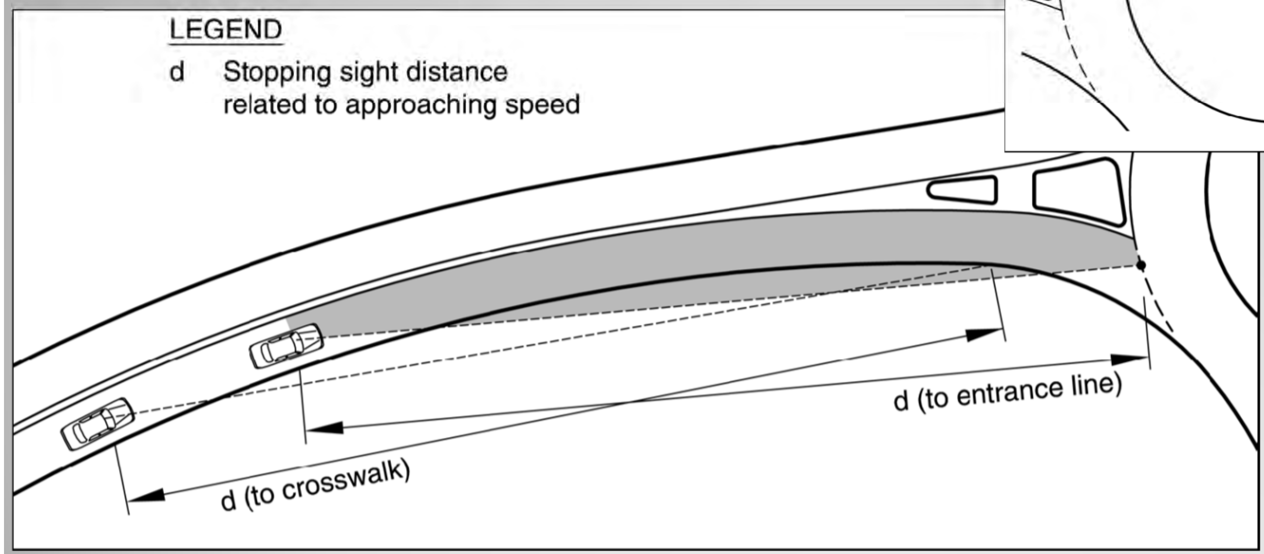
KYTC Policy-Design Elements

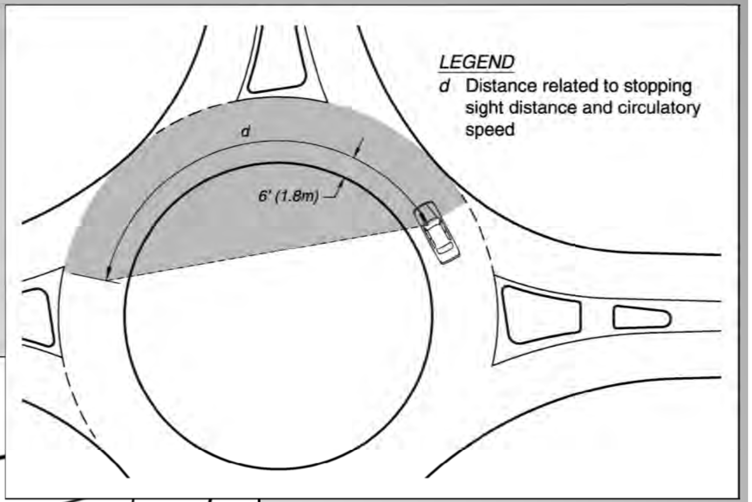
- Minimum 25’ Tangent
  - Entry
  - Exit



Geometric Design

- Sight Distance
  - FHWA Roundabouts: An Informational Guide





Sight Distance

- Approach Stopping Sight Distance
  - **Object Height = 0.5 ft**

- Sight Distance based on anticipated operating speeds

Radius (ft)	Entry/Exit Curve Operating Speed (mph)	Circulatory Operating Speed (mph)
75	16	14
100	18	16
125	20	18
150	22	20
175	24	22
200	26	23
225	27	25
250	29	26

Sight Distance

- Lighting
  - AASHTO Roadway Lighting Design Guide

- Signing and Markings
  - 2009 MUTCD

Signing, Marking and Lighting

Review and Approval

- Conceptual Design Approval
  - Concept report
    - Operational analysis and determination of lane configuration
    - Identification of design vehicle(s)
    - Preliminary layout including identification of inscribed circle diameter
  - Submitted to Division of Highway Design
  - Prior to public involvement activities and before the preliminary L&G meeting

- Final Design Approval
  - Submitted as appendix to Design Executive Summary
    - Design vehicle turning paths
    - Fastest path determination
    - Entry angle determination

Review and Approval

- Traffic Operations Approval
  - Lighting, Signing and Pavement Markings shall be presented at the Joint Inspection Meeting for approval by the Division of Traffic Operations.

Review and Approval

Acknowledgements

- KYTC
  - Jeff Jasper
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Adam Kirk
Research Engineer
Traffic & Safety
Kentucky Transportation Center
859.257.7310
akirk@engr.uky.edu

Questions