• Review KYTC Policy Background
• New Policy Approach
• Draft Policy Technical 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
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
• Conservative Approach
  ◦ <0.85 V/C Ratio for Roundabouts
  ◦ Comprehensive design review and guidance
  ◦ Prefer traffic signals over roundabouts where questions remain
- Warrants
- Operational Analysis
- Basic Design Elements
- Geometric Design
- Sight Distance
- Signing, Markings and Lighting
- Pedestrian and Bicycle Accommodations
- Review and Approval
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
• Measures of Effectiveness
  ◦ Volume to capacity (V/C) ratio of each approach lane
  ◦ Delay by lane, approach, and intersection
  ◦ Queue estimates
• NCHRP 572 Analysis
  ◦ Volume to Capacity (V/C)
  ◦ Delay by Lane/Approach
  ◦ Queue Estimates

• $V/C \leq 0.85$

\[
c = 1130 \cdot \exp(-0.0010 \cdot \nu_c)
\]

where

- $c$ = entry capacity (passenger car units [pcu]/h)
- $\nu_c$ = conflicting flow (pcu/h)
Operational Analysis

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<table>
<thead>
<tr>
<th>Direction</th>
<th>Lane</th>
<th>Volume</th>
<th>Capacity</th>
<th>V/C</th>
<th>Delay (s)</th>
<th>Queue</th>
</tr>
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<tbody>
<tr>
<td>Eastbound</td>
<td>1</td>
<td>300</td>
<td>837</td>
<td>0.36</td>
<td>4.45</td>
<td>25</td>
</tr>
<tr>
<td>Eastbound</td>
<td>2</td>
<td>0</td>
<td>837</td>
<td>0</td>
<td>4.3</td>
<td>0</td>
</tr>
<tr>
<td>Eastbound</td>
<td>3</td>
<td>0</td>
<td>837</td>
<td>0</td>
<td>4.3</td>
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<td>0</td>
</tr>
</tbody>
</table>
• 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

<table>
<thead>
<tr>
<th>Route Classification</th>
<th>Design Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State Routes</strong></td>
<td></td>
</tr>
<tr>
<td>Principal Arterial</td>
<td>WB-65</td>
</tr>
<tr>
<td>Designated Truck Route</td>
<td>WB-65</td>
</tr>
<tr>
<td>Other State Routes</td>
<td>WB-50</td>
</tr>
<tr>
<td><strong>Non-State Routes</strong></td>
<td></td>
</tr>
<tr>
<td>Major Streets</td>
<td>WB-50</td>
</tr>
<tr>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Single Unit</td>
</tr>
<tr>
<td></td>
<td>Fire truck</td>
</tr>
</tbody>
</table>
• 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.*
**Inscribed Circle Diameter**

### Single Lane Roundabout

<table>
<thead>
<tr>
<th>Movement</th>
<th>Bus / Single Unit Truck</th>
<th>WB-50</th>
<th>WB-65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through</td>
<td>75</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>Left Turn</td>
<td>90</td>
<td>95</td>
<td>120</td>
</tr>
<tr>
<td>U-Turn</td>
<td>90</td>
<td>100</td>
<td>135</td>
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</tbody>
</table>

### Dual Lane Roundabout

<table>
<thead>
<tr>
<th>Movement</th>
<th>Bus / Single Unit Truck</th>
<th>WB-50</th>
<th>WB-65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through</td>
<td>110</td>
<td>125</td>
<td>150</td>
</tr>
<tr>
<td>Left Turn</td>
<td>125</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>U-Turn</td>
<td>125</td>
<td>150</td>
<td>200</td>
</tr>
</tbody>
</table>
• Other Elements
  ◦ Truck Aprons
  ◦ Central Island
  ◦ Splitter Island

• FHWA Roundabouts: An Informational Guide
- 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

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• Entry/Exit Path Overlap

KYTC Policy-Design Elements
- Minimum 25’ Tangent
  - Entry
  - Exit
• Sight Distance
  ◦ FHWA Roundabouts: An Informational Guide

Sight Distance

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

- Sight Distance based on anticipated operating speeds

<table>
<thead>
<tr>
<th>Radius (ft)</th>
<th>Entry/Exit Curve Operating Speed (mph)</th>
<th>Circulatory Operating Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>100</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>125</td>
<td>20</td>
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<tr>
<td>150</td>
<td>22</td>
<td>20</td>
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<tr>
<td>175</td>
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<td>22</td>
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<tr>
<td>200</td>
<td>26</td>
<td>23</td>
</tr>
<tr>
<td>225</td>
<td>27</td>
<td>25</td>
</tr>
<tr>
<td>250</td>
<td>29</td>
<td>26</td>
</tr>
</tbody>
</table>
• Lighting
  ◦ AASHTO Roadway Lighting Design Guide

• Signing and Markings
  ◦ 2009 MUTCD
• 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
• Traffic Operations Approval
  ◦ Lighting, Signing and Pavement Markings shall be presented at the Joint Inspection Meeting for approval by the Division of Traffic Operations.
Acknowledgements

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- Jeff Jasper
- Jeff Wolfe
- Vicki Boldrick

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- Greg Groves
- Paul Slone
- Bill Madden
Adam Kirk
Research Engineer
Traffic & Safety
Kentucky Transportation Center
859.257.7310
akirk@engr.uky.edu

Questions