ROUNDABOUT DESIGN GUIDES:
The WIDOT Experience

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INTRODUCTION

– Provide an overview WIDOT’s Roundabout Guide Development:

• The process and rational for preferences in design and analysis methodology

• How has the WIDOT Guide effected roundabout implementation

• Summary of Current Policy by Patrick Fleming
INTRODUCTION

• PROCESS began in 1997 with educational workshops

• Roundabout Committee Created 2002:
  – Traffic Operations
  – Planning
  – Project Development
  – Districts and Central Office
  – FHWA

• Guide published 2004
INTRODUCTION

− WIDOT Desired a Capacity Model and Design Methodology that:

− Was accurate in wide range of traffic volumes
− Robust to handle wide range of contexts, including tightly spaced high volume interchanges, to urban and rural highways
− Readily applicability to our State Highway System and tested by time and US applications
INTRODUCTION

– WIDOT Desired a Capacity Model that:

– Models ‘interaction’ between legs (not independent legs like the FHWA equations)
– Relates Capacity and Safety to Geometry
– Is Interactive and easily understood by designers (not just for checking)
– Models lane-by-lane capacity (very important to avoid overloading any one entry lane)
– Models ‘interaction’ of closely spaced roundabouts (via exit flow profiles)
– Can be easily calibrated to U.S. conditions
INTRODUCTION

– WIDOT reviewed existing applications and design methodologies to determine best fit for the State Highway System
Design Methods
Multi-lane Geometry Interchange

- ‘Standards’ or Rules based design methodology

- Less geometric variability

- Lower capacity predictions
  - Precluding Implementations at higher volume sites

- Less Robust Applications
  - Precluding implementation at more challenging applications
Multi-lane Geometry

U.K. Interchange

Three-lane entry

Two-lane entry

Pedestrian Crossings

Off-ramp flares to three-lane entry

Single-lane approach flares to three-lane entry

Geometrically Robust: Designs Tailored to Problem
US Experience with UK Methods

Vail, CO  Constructed Oct. 1995

• Voted Best Public Works Project 5 Years

Video Courtesy of: Ourston Roundabout Engineering
‘UK’ Capacity Model

• From 1973 - 1985 U.K. TRL Developed Their Capacity Equations - **Cost ~$11 million to develop...**

Their Capacity Formula is based on:
• 11,000 min of “at capacity” analysis of 86 roundabout entries over the full range of geometries and traffic volumes.

Safety database Included:
• Over 5 years of accident data
History of ‘UK’ Capacity Model

- This research revealed a strong relationship between
- **GEOMETRY:**
  - SAFETY
  - CAPACITY
  - DELAY

- TRL Re-Checked their equations in 1997…stable no changes required,

- This stability is attributed to the large statistical data base collected over a wide range of geometry, and traffic volumes
• WIDOT adopted the design ‘Principles’ as described in the FHWA Publication: “Roundabouts an Informational Guide”

• The WIDOT Guide also incorporated TRL (British) based design methodology and capacity prediction and design software ‘Rodel’ to supplement the FHWA Roundabout Guide
Implementation
WisDOT Implementation

- Roundabouts on State Highway System
  - 4 Multi-Lane Constructed in 2004
  - Since the Guide was Published:
    - 17 Single Lane planned
    - 33 Multi-Lane planned

- Many others on Local Road System
Mount Horeb, WI
Problem Statement

- Traffic ~2,000 VPH
- 6% Heavy Truck
- Average 7 crashes per year
- Signals knocked down 2-3 times per yr
Alternatives Evaluation
Conceptual Design

Signalized

Roundabout
Mount Horeb, WI
Mount Horeb, Wisconsin

Pedestrian Comparison
Mount Horeb, Wisconsin
2,000 VPH, (2,800 design)
1 Crash in 12 month

Two-Line Tapered Exit

Flared Two-lane entry

Two-Thru lanes WB

Single-lane entry

Varying circulating width 24-32'

Principle Based Design Methods Achieves Solutions
Existing Conditions

3 Year Crash History
• 10 crashes per year
• 7 serious injuries/yr
• 1.2 crashes MEV
• 70% Injury Crashes

• Peak Hour Congestion and Delay
Thompson Drive
Wisconsin Rapids, WI

- Challenging Ex. Geometry
- Evaluate Alternatives
  - Costs
  - Operations
  - Business Impacts
Wisconsin Rapids

All Conventional Alternatives Create Substantial Residential and/or Business Impacts (High Cost)
Wisconsin Rapids
Roundabout

Testimonial
As a resident of the neighborhood for 55 years, Earl Keding, 82, figures the roundabout will control traffic flow.

"They've got it marked well and it'll help, because people will have to slow down some," said Keding, who took his turn around the intersection Tuesday.

"I went around it. It's not any worse than any other street."
WisDOT Policy

Why is this important?

- AASHTO Strategic Highway Safety Plan
- Key emphasis area # 17 “Improving the design and operation of highway intersections”
- WisDOT/FHWA initiative to improve intersection safety
WisDOT Policy

• Wisconsin intersection safety statistics
  – 48,927 intersection crashes/year
  – 39% of all reported crashes
  – 26% of total fatalities
  – 52% of total injuries
WisDOT Policy

• Starting January 1, 2005, Design Study Reports for all projects involving the construction or reconstruction of a signalized or a 4-way stop intersection shall address how the roundabout alternative was considered and evaluated.
WisDOT Policy Design Reviews

- **What is it?**
  - It is a mentoring process to acclimate designers to the challenges of a holistic roundabout design methodology.

- **Why is this important?**
  - Provides design quality and consistency.

- **How does it work?**
  - Master contract developed to provide quick turnaround.
  - Designer & reviewer agree on scope and cost of review.
  - Evaluate design concepts, alternatives, key design parameters, fastest speed paths, and constraints.
References and Educational Aids

• Roundabouts: An Informational Guide (FHWA)

• WisDOT Roundabout Design Guide (4/04) on WisDOT web site:

• The Wisconsin Experience (WisDOT video of testimonials)

• WisDOT brochure & FHWA brochure

• Wisconsin Motorist’s Handbook
WisDOT Efforts

- WisDOT Roundabout Design Guide, FDM
- WisDOT Brochure and Video Developed
- Wisconsin Motorists’ Handbook
Summary

- WIDOT Roundabout Design Guidance is Based on:
  - Proven Traffic/Transportation Engineering Science and Principles
  - Significant Safety and Operational benefits have been achieved
  - Correct Design Required for Optimal Operations