Roundabout design guides:
The WIDOT Experience

By: Mark T. Johnson, P.E.
Patrick Fleming, P.E.

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

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 GUIDE

- 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 Implmentation

- 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

Flared Two - lane entry

Two- Thru lanes WB

Flared Two - lane entry, RT only

Varying circulating width 24-32’

Two-lane Tapered Exit

Single-lane entry

Principle Based Design Methods Achieves Solutions

Existing Conditions

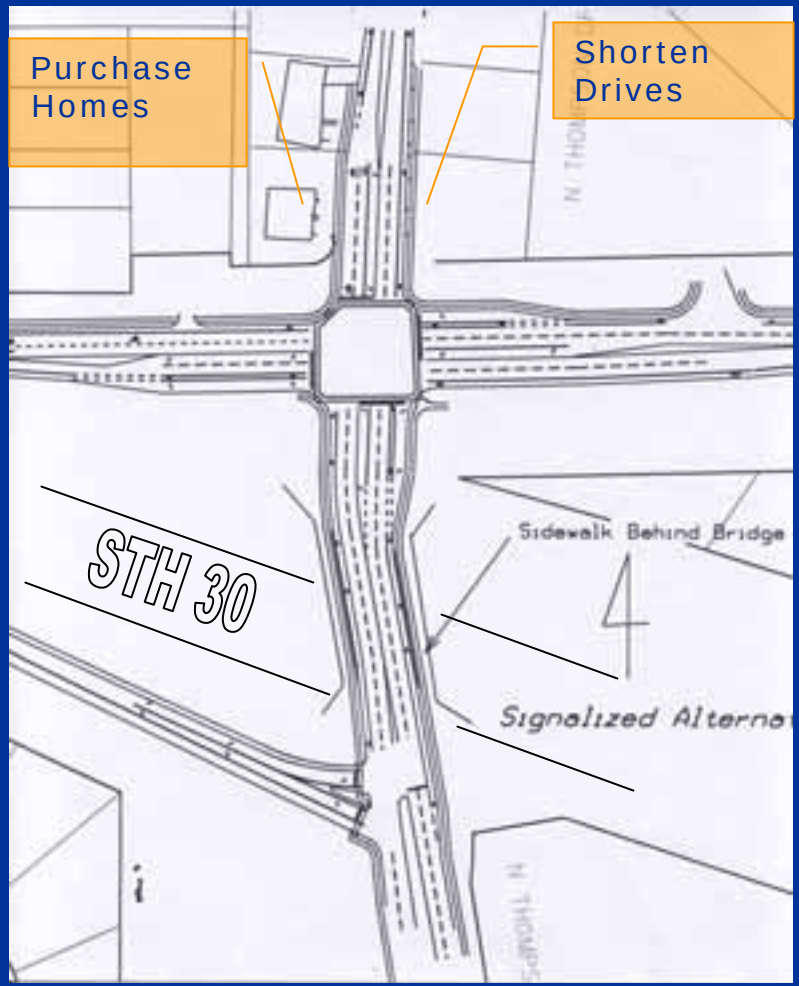
- *Peak Hour Congestion and Delay*

3 Year Crash History

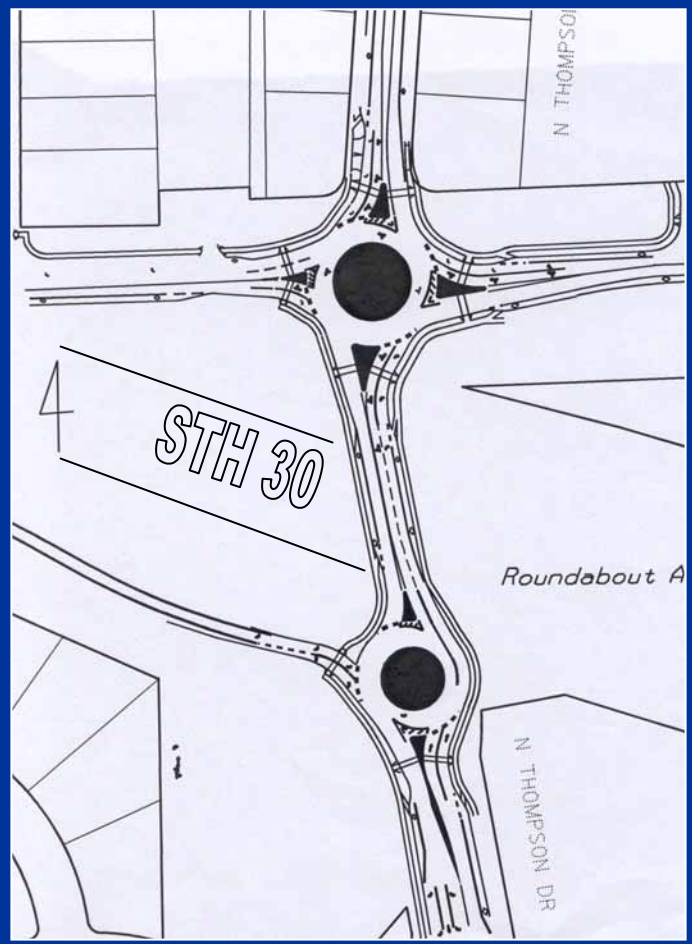
- *10 crashes per year*
- *7 serious injuries/yr*
- *1.2 crashes MEV*
- *70% Injury Crashes*

STH 30/Thompson Drive - Madison

Signal Alternative



Roundabout



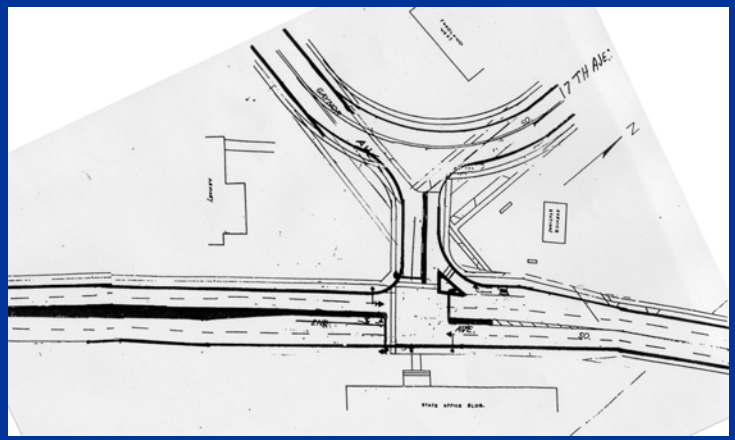
Thompson Drive

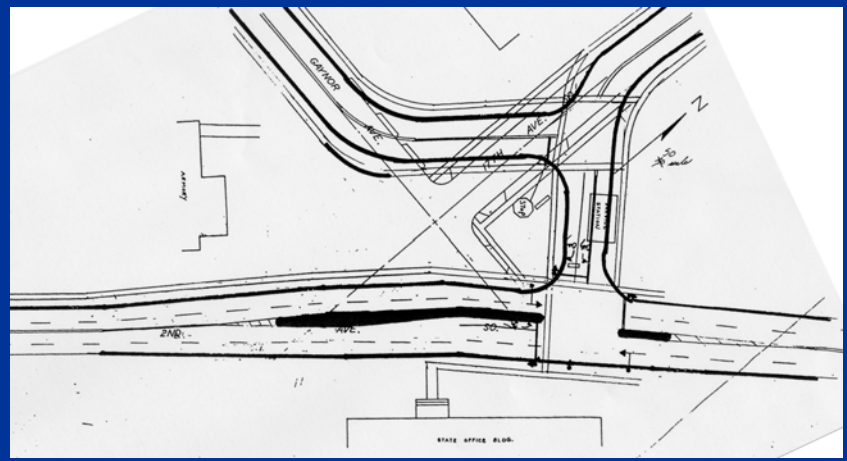
Wisconsin Rapids, WI

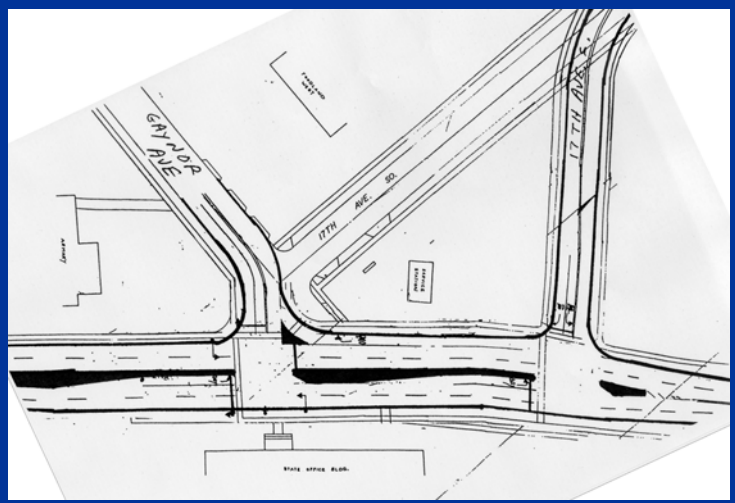
- Challenging Ex. Geometry
- Evaluate Alternatives
  - Costs
  - Operations
  - Business Impacts

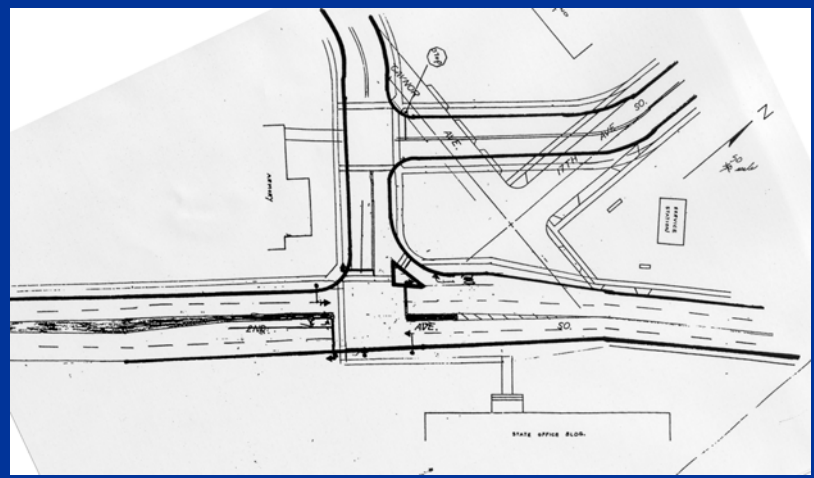
Wisconsin Rapids

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.

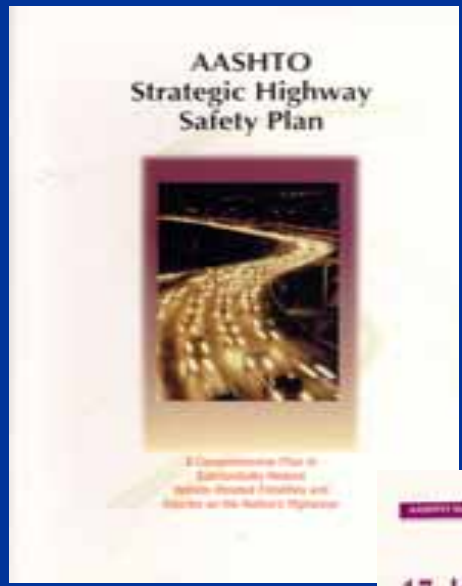
"I went around it. It's not any worse than any other street.“

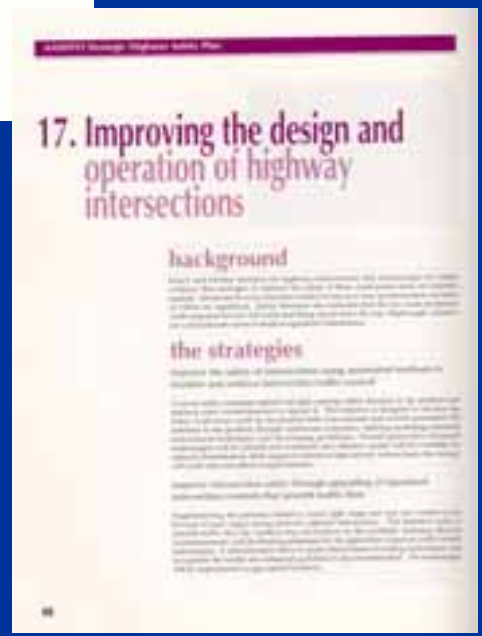
Policy Overview

by: Patrick Fleming, WIDOT

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)
  - http://www.tfhrc.gov/safety/00068.htm
- WisDOT Roundabout Design Guide (4/04) on WisDOT web site: http://www.dot.wisconsin.gov/safety/motorist/roaddesign/roundabout-design.htm
- 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

WISCONSIN MOTORISTS' HANDBOOK

Shared Center Lane

Shared center lanes are reserved for making left turns (or U-turns when they are permitted) by vehicles traveling in either direction. On the pavement, left-turn arrows for traffic in one direction alternate with left turn arrows for traffic coming from the other direction. These lanes are marked on each side by a solid yellow and dashed yellow lines. Be sure you enter the lane only if it is safe to do so.

Alternative Intersections: "Roundabout"

Modern roundabouts are a new form of intersection in the U.S. They are becoming more common because they provide safer and more efficient traffic flow than standard intersections. Roundabouts are safer because they provide easy decision making about where to go, slower speeds, and fewer conflict points with other traffic.

When driving a roundabout, follow these general rules:

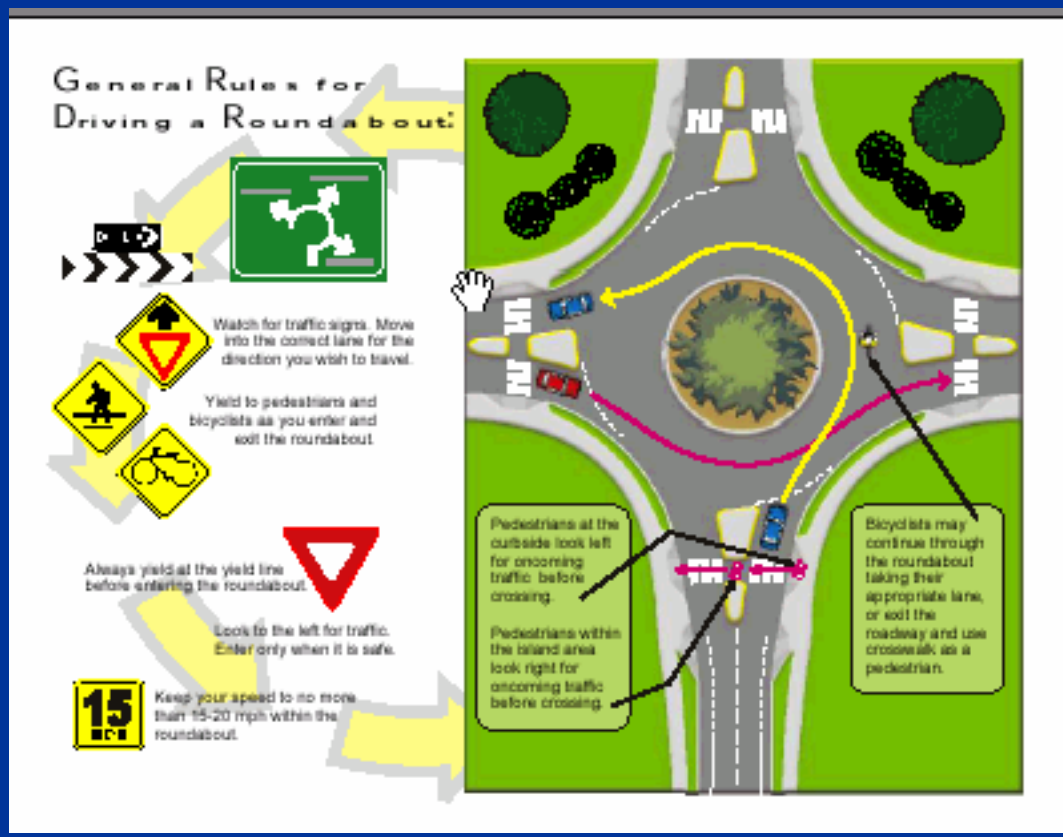
- Slow down. Watch for traffic signs. Move into the correct lane for the direction you wish to travel.
- Yield to pedestrians and bicyclists as you enter and exit the roundabout.
- Look to the left for traffic. Yield to traffic already in the roundabout.
- Keep your speed low within the roundabout.
- Exit to your destination.

General Rules about Traffic Lanes

When there are no signs or markings to control the use of lanes, there are rules that indicate which lane is to be used. These rules cover general driving, passing and turning.

General driving - It is illegal and unsafe to back a vehicle in any travel lane unless you are parallel parking or completing a Y turn. Drivers do not expect a vehicle to be backing toward them and may not realize it until it is too late. If you miss your turn or exit on a freeway, do not back up. Go on to the next exit where you can exit and re-enter the freeway to go back to the exit you missed.

20



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