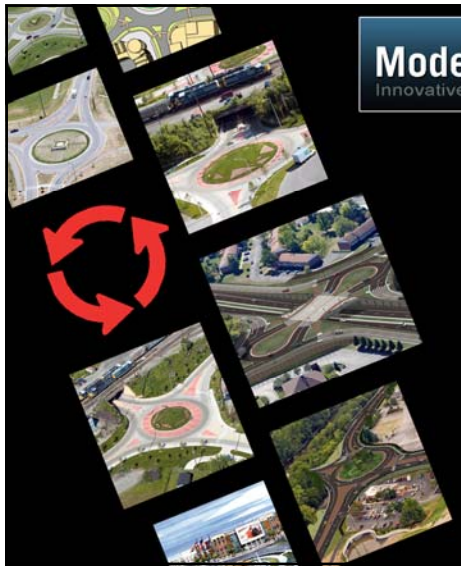


Modern Roundabouts

Innovative Roundabout Design Solutions

West Lafayette Roundabout Community Forum

Home of Purdue University

City of West Lafayette

May 20, 2009

Panelists

- Jeromy Grenard, PE – American Structurepoint
- Mike McBride, PE – City Engineer, City of Carmel, Indiana
- Craig Parks, PE – American Structurepoint

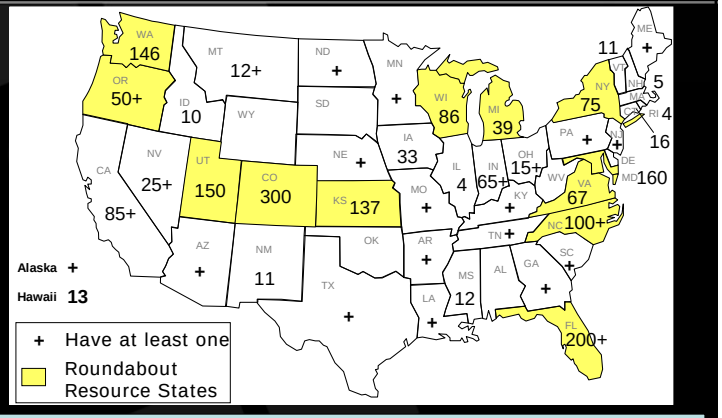
Roundabout Basics and Background

Circular Intersection History

1900s – 1940s	Rotaries and traffic circles used
1950s	Circular intersections fall out of favor
1963	UK – reversal of traffic priority at roundabouts to "yield on entry"
1980s	"Modern roundabout" used throughout Europe and Australia
1990s	"Modern roundabout" utilized in the United States
1997	First roundabouts constructed in Indiana

Roundabout Numbers

(May 2009)



Melbourne, Australia: 4,400 Roundabouts France: 27,000 in 2008 (12,000 in 1994)

Roundabouts in Indiana Communities

- Allen County / Fort Wayne
- Avon
- Bloomington
- Carmel
- Evansville
- Fishers
- Fort Wayne
- Greenfield
- Huntington County
- Indianapolis
- Kokomo
- Lafayette (planned)
- Noblesville
- Plainfield
- St. Joseph County / South Bend
- Valparaiso
- West Lafayette

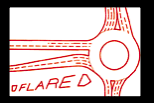
Roundabout Basics and Background

Elements of a Modern Roundabout

- Yield at entry
  - Yield signs
  - Yield line
  - Circulating traffic has right-of-way

- Deflection of entering vehicle path
  - Accomplished using “splitter islands” and central island

- Entry flare
  - Lane width is increased near yield line
  - Not mandatory



Roundabout Basics and Background

Roundabouts vs. Traffic Circles

No deflection on entries

Use of stop signs instead of yield

Parking in circulatory roadway

Pedestrians encouraged in the central island to visit monument and museum

Monument Circle in Indianapolis – NOT a roundabout

Roundabout Basics and Background

Roundabouts vs. Rotaries

High-speeds on entry and circulatory roadway

No yield signs

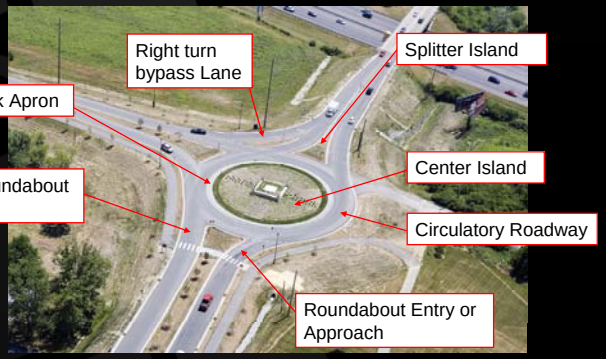
Very large diameter

High amount of lane changing

Kingston, New York rotary being replaced with roundabout

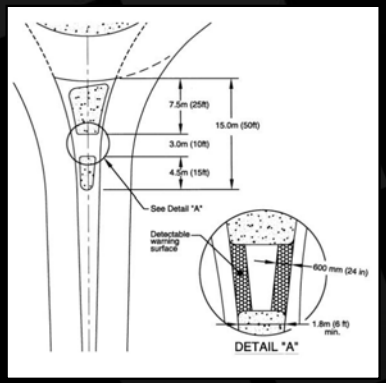
Roundabout Terminology

Basic



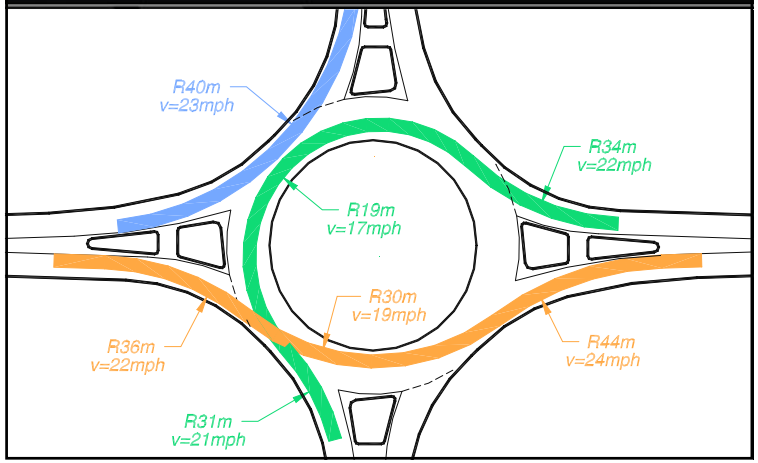
Roundabout Design Elements

Splitter Islands and Pedestrian Crossings

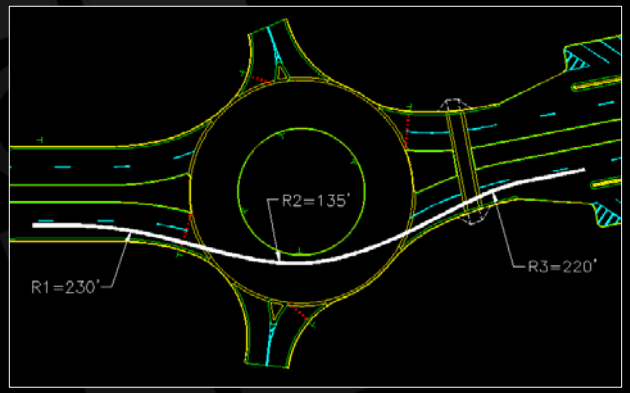


- Pedestrian crossings 25’ back from yield line at roundabouts
- Splitter island minimum 6’ wide for refuge

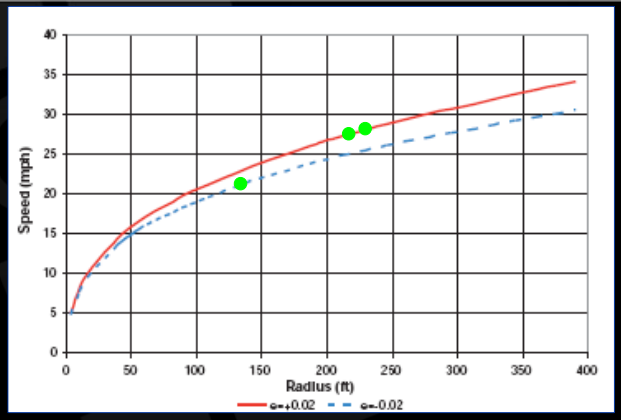
Speed Reduction



Design Tests – Vehicle Speeds

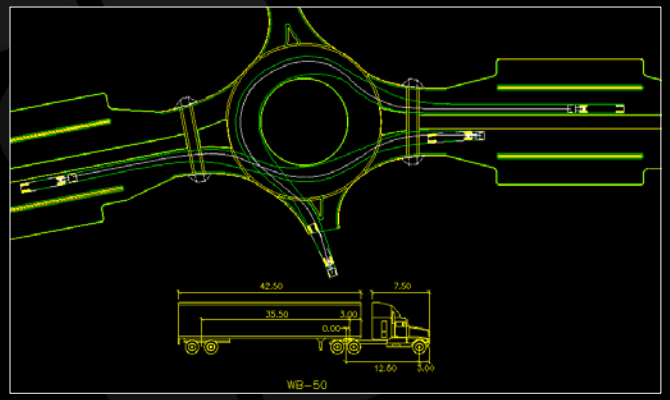


Design Tests – Vehicle Speeds



Source: "A Policy on Geometric Design of Highways and Streets", *Maximum Comfortable Speed on Horizontal Curves*, AASHTO.

Design Tests – Design Vehicle



Roundabout Advantages

1. Proven safety benefits

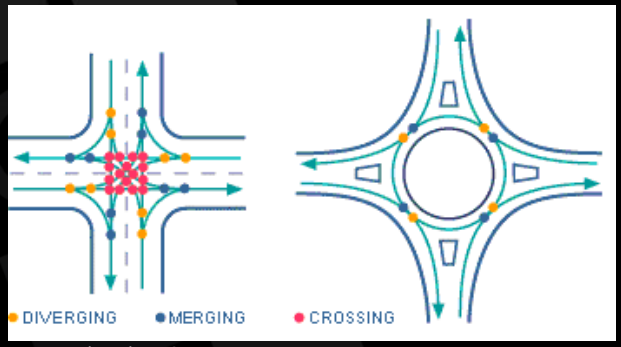
Roundabout Safety

- According to the Insurance Institute of Highway Safety (IIHS), more than 800 people die and over 200,000 are injured in the U.S. each year in crashes that involve red light running
- In 2000, the IIHS found that roundabouts had 79% fewer accidents with injuries than ordinary intersections.
- Since 2001, IIHS has issued a total of five reports promoting the use of roundabouts

Roundabout Safety

Insurance Institute for Highway Safety Video Clip

Vehicular Conflict Points



- Diverging: 8
- Merging: 8
- Crossing: 16

TOTAL: 32

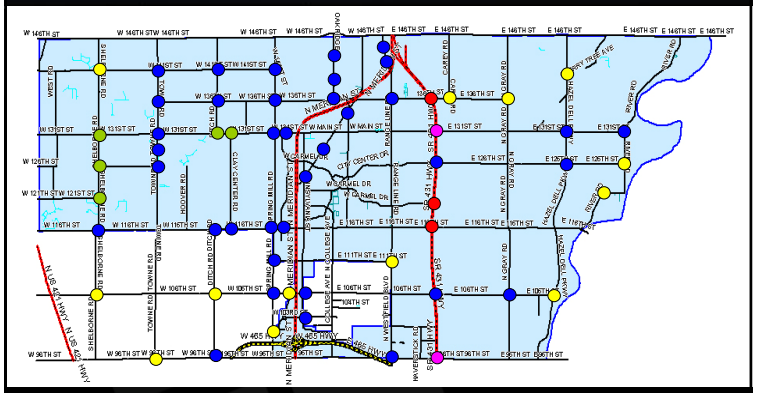
- Diverging: 4
- Merging: 4
- Crossing: 0

TOTAL: 8

Hazel Dell Parkway

Carmel, Indiana

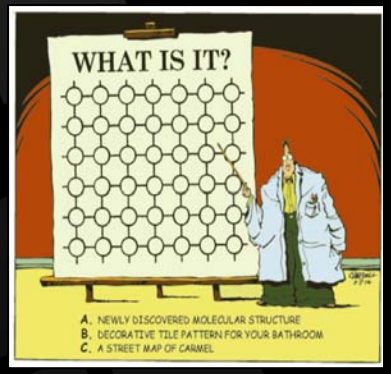
Carmel, Indiana Roundabouts



in place | in design | roundabout interchange in design

in construction | considered

Carmel Roundabout Locations



City-Wide Crash Data

2002 – 2006

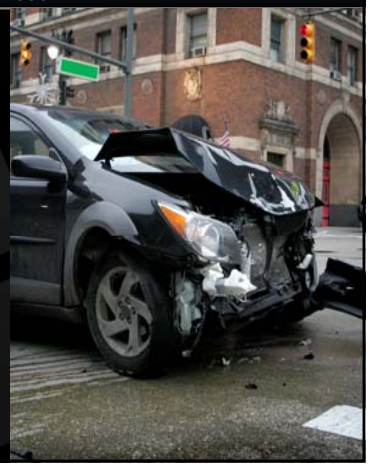
% Accidents with Injury at <u>All Intersections</u>

29%

% Accidents with Injury at <u>Roundabouts</u>

Single Lane 4%

Multi-Lane 7%



Accident Damage Cost Savings

Average Cost of Accident

Signal $10,500

vs.

Roundabout $2,500

(Statistics from Carmel Police Dept. 2006)

Arts and Design District Roundabout

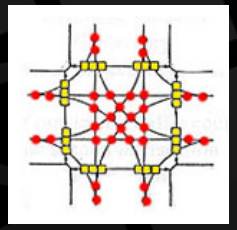
Roundabout Advantages

1. Proven safety benefits
2. **Pedestrian safety**

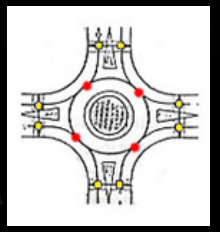
Pedestrian Experience

- Cars only coming from one direction
- Fewer lanes to cross
- Splitter island provides refuge
- Cars travelling at slower speeds
- Generally easy to determine gaps

Pedestrian Conflict Points



Pedestrian Conflict Points: 16-24



Pedestrian Conflict Points: 8

Odds of Pedestrian Fatality in Pedestrian/Vehicle Crash

Vehicle Speed	Odds of Pedestrian Death, Source 1	Odds of Pedestrian Death, Source 2
20 mph	5%	5%
30 mph	45%	37%
40 mph	85%	83%

Source 1: Limpert, Rudolph. Motor Vehicle Accident Reconstruction and Cause Analysis. Fourth Edition. Charlottesville, VA. The Michie Company, 1994, p. 663.

Source 2: *Vehicle Speeds and the Incidence of Fatal Pedestrian Collisions*, Austrailian Federal Office of Road Safety, Report CR 146, October 1994, by McLean AJ,Anderson RW, Farmer MJB, Lee BH, Brooks CG.

Pedestrian Myth

Clearwater, Florida

Myth:

Roundabouts don't handle large numbers of pedestrians well, and are unsafe when there are too many pedestrians.

Spring Break:

- 50,000 vehicles per day, as well as 5,000 + pedestrians per day
- Only one pedestrian accident has occurred since opening roundabout in 1999

ADA Issues

- Access Board of Americans With Disabilities Act (ADA) has concerns for sight-impaired pedestrians at roundabouts
- What is the concern?
  - Safety – not primarily
  - Accessibility – yes
  - Access Board Research ongoing

ADA Issues

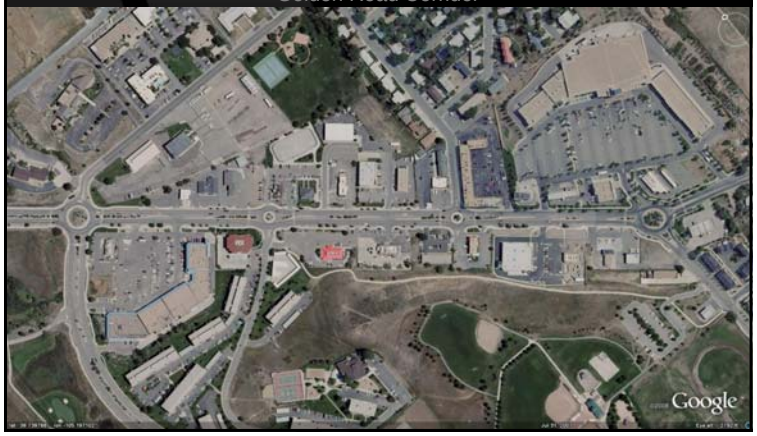
- Access Board preliminary recommendations
  - Single lane roundabout: ADA ramps
  - Multi-lane roundabout: ADA ramps & pedestrian signals that stop traffic

Roundabout Advantages

1. Proven safety benefits
2. Pedestrian safety
3. **Roundabouts in series and as an access management tool**

Golden, Colorado

Golden Road Corridor



Golden, Colorado

Golden Road Before/After Study

- Before = 3 years prior to rbt installation
- After = 6 years following rbt installation
- 85th percentile speeds
  - Before: 47 mph
  - After: 33 mph
- Crashes
  - All: reduced by 85%
  - With Injury: reduced by 96%
- Traffic Volumes increased by 35%
- Overall travel time through corridor: reduced by 34%

116th Street/Illinois Street

Carmel, Indiana

Roundabout Advantages

1. Proven safety benefits
2. Pedestrian safety
3. Roundabouts in series and as an access management tool
4. **"Wide Nodes, Narrow Roads"**

Westfield Boulevard

Carmel, Indiana

Westfield Boulevard

Carmel, Indiana

Roundabout Advantages

1. Proven safety benefits
2. Pedestrian safety
3. Roundabouts in series and as an access management tool
4. “Wide Nodes, Narrow Roads”
5. **Difficult intersection configurations**

Pontiac Street/Wayne Trace

Fort Wayne, Indiana

Pontiac Street/Wayne Trace

Fort Wayne, Indiana

Roundabout Advantages

1. Proven safety benefits
2. Pedestrian safety
3. Roundabouts in series and as an access management tool
4. “Wide Nodes, Narrow Roads”
5. Difficult intersection configurations
6. **Context sensitivity**

Center Island Landscaping

Illinois Street and West Carmel Drive

New Development

Clay Terrace and Hamilton Town Center

Redevelopment

Speedway, Indiana

Redevelopment

Speedway, Indiana

Context Sensitivity

Keystone Avenue, Carmel, Indiana

Context Sensitivity

106th Street & Keystone Parkway

Roundabout Education

- Websites
- Flyers
- Newspaper Articles
- Presentations
- Drivers Education Programs
- Or...

Early Education

Design Visualization for Educational Purposes

Questions / Comments

- Jeromy Grenard, PE – American Structurepoint
- Mike McBride, PE – City Engineer, City of Carmel, Indiana
- Craig Parks, PE – American Structurepoint