Outline

1. Background on Roundabouts

2. Silhavy Rd. Corridor Improvement Project in Valparaiso, IN

3. 5-points Roundabout in Valparaiso, IN
Circular Junctions

Traffic Circle

modern Roundabout

Neighborhood Circle

Rotary

(Sources: Bing maps, FHWA)
Columbus Circle, NY (Built in 1905)
Early 20\textsuperscript{th} Century Circular Junctions

- Designed for high-speed entry
- Entering vehicles had priority over circulating vehicles
- Result: high \textbf{crash} rate and \textbf{choked} traffic circles
- \textbf{Unpopular} in the US.
- United Kingdom (1960s): mandatory “yield-at-entry” rule at circular junctions $\Rightarrow$ \textbf{modern roundabouts}
Modern Roundabout – Key Features

Yield control

(Source: Bing maps)
Modern Roundabout – Key Features

Yield control
Deflection

(Source: Bing maps)
Modern Roundabout – Key Features

Yield control
Deflection
Offset

(Source: Bing maps)
Modern Roundabout – Key Features

- Yield control
- Deflection
- Offset
- Splitter island

(Source: Bing maps)
Modern Roundabout – Key Features

Yield control
Deflection
Offset
Splitter island
Peds crossing

(Source: Bing maps)
Modern Roundabout – Key Features

Yield control
Deflection
Offset
Splitter island
Peds crossing
Truck apron

(Source: Bing maps)
Modern Roundabout – Key Features

Compact junction vs. Rotary

(Source: Bing maps)
Modern Roundabout – Key Features

No traffic control for circulating vehicles vs. Traffic Circle

(Source: Bing maps)
Modern Roundabout

• Designed to **slow** the speed of vehicles

• Entering traffic **yields** to the circulating traffic

• Approach legs are **deflected** to reduce entry speed and channelize entry into correct lane

• **Compact** one-way circular junction

• **No traffic control** for circulating traffic
Roundabout – Safety Benefits

- Diverging
- Merging
- Crossing

(Source: NCHRP 672)
Roundabout – Safety Benefits

• Reduced number of conflict points => lower crash frequency

• Elimination of crossing conflicts => reduced fatal/injury crashes

• Reduced speed => less severe crashes

• Reduced angle of conflict => less severe crashes

• Correct **geometric design** is key – a challenge for multilane roundabout
Signal to Roundabout Conversion

- All crashes: 48%
- Injury + fatal crashes: 78%
Two-way Stop to Roundabout Conversion

44%  All crashes

82%  Injury + fatal crashes
All-way Stop to Roundabout Conversion

- All crashes: 0%
- Injury + fatal crashes: 0%
Roundabout – Other Benefits

• Lower overall delay compared to signalized and all-way stop-controlled intersections

• Delay reduction most significant for off-peak periods

• Environmental benefits: reduced number/duration of stops, acceleration-deceleration cycles, idling

• Lower operating and maintenance cost

• Narrower approach roadways
Roundabout – Other Benefits

• Access management: U-turns

• Traffic calming effect: speed reduction

• Aesthetics: central island
Roundabout Trade-offs

- Large footprint at the intersection
- Higher initial cost
- Low-speed (20–30 mph) operation
- Gives equal priority to all approach legs
- Can’t give priority to transit, emergency vehicles, fire trucks, etc.
Number of Roundabouts in U.S.

Year 1990
Year 1997
Year 2010
Year 2014

Number of Roundabouts in U.S.
Silhavy Rd. Corridor Improvement Project in Valparaiso, IN
Valparaiso, IN

(Source: Google maps)
Silhavy Corridor Improvement Project

(Source: Google maps)
Silhavy Corridor Improvement Project

(Source: Google maps)
Silhavy Corridor Improvement Project

Silhavy Rd. - Evans Ave. intersection

(Source: Google maps)
High crash frequency

LaPorte Ave. - Silhavy Rd. intersection

(Source: Google maps)
LaPorte - Silhavy Roundabout

- 180 ft. inscribed circle diameter (ICD)
- 35 mph design approach speed
- 25 mph travel speed in circle
- 15 foot travel lanes in circle
- Geometry determined using AASHTO Green book, FHWA guides, INDOT guides, the MUTCD
LaPorte - Silhavy Roundabout

Righ-turn bypass lane

LaPorte Ave. - Silhavy Rd. roundabout
## Silhavy - LaPorte Intersection

<table>
<thead>
<tr>
<th></th>
<th>Present Configuration</th>
<th>Designed Roundabout</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intersection Type</strong></td>
<td>Signalized intersection</td>
<td>Two-lane Roundabout</td>
</tr>
<tr>
<td><strong>Level of Service</strong></td>
<td>LOS D</td>
<td>LOS B</td>
</tr>
<tr>
<td><strong>Average Delay</strong></td>
<td>40 seconds</td>
<td>18 seconds</td>
</tr>
<tr>
<td><strong>Turning Vehicles</strong></td>
<td>Protected left turn lanes on all approaches</td>
<td>Right turn bypass lane for traffic leaving shopping area toward IN49</td>
</tr>
<tr>
<td><strong>Space / Footprint</strong></td>
<td>Large intersection due to turning lanes on each approach</td>
<td>Design will fit over current intersection, with expansion on SE corner</td>
</tr>
<tr>
<td><strong>Pedestrians</strong></td>
<td>Pedestrian crosswalks with no islands</td>
<td>Design includes pedestrian tunnel, so pedestrian traffic in the roundabout is not an issue</td>
</tr>
</tbody>
</table>
Five-points Roundabout in Valparaiso, IN
5-points Intersection

(Source: Google maps)
5-points Intersection

Past 3 years
61 crashes

11 injury crashes

Types: head on, right angle, left turn, signal violations

(Source: Bing maps)
Nearly 100 accidents at five-points roundabout in 2014

Motorists negotiate the roundabout at Calumet, Roosevelt and Vale Park in Valparaiso.
5-points Roundabout

Year 2014
98 crashes

Majority are minor fender benders, side swipes

5 injury crashes

52 crashes: northbound Calumet entering too soon.

(Source: City of Valparaiso)
5-points Roundabout

5 injury crashes:

- Rear-end on approach legs (3 crashes)
- Northbound Calumet Ave. failed to yield (1 crash)
- Motorcycle lost traction (1 crash)
Conflicts at Multilane Roundabouts

1. Fail to maintain lane
Conflicts at Multilane Roundabouts

2. Turn from wrong lane

(Source: NCHRP 672)
3. Entering next to an exiting vehicle

(Source: NCHRP 672)
Intersection-level Safety Model

Roundabout with 5 legs & 2 circulating lanes (AADT = 34,000 vehicles/day):

Total crash prediction = \(0.0073 (AADT)^{0.7490} = 18.1\) crashes/year

Injury crash prediction = \(0.0029 (AADT)^{0.5923} = 1.4\) crashes/year

Bayesian revised estimates:
Total crash prediction = 93.4 crashes/year
Injury crash prediction = 3.45 crashes/year
Future Work

• Explore intersection-level and approach-level safety models further

• Highway Safety Manual (HSM)

• Develop a microscopic simulation model of 5-point roundabouts

• Simulation-based crash potential modeling – Surrogate Safety Assessment Model (SSAM)
Thank you!