City of Carmel Roundabouts

- in place
- under construction or design
- planned
what about roundabouts?

a hamilton county/city of carmel case study • road school 2005 • purdue university

AMERICAN CONSULTING
Definition of a modern roundabout

- **Yield at entry**
  - Yield signs
  - Yield lines
  - Circulating traffic has right-of-way

- **Deflection of entering vehicle path**
  - Accomplished using ‘splitter islands’

- **Entry flare**
  - Lane width is increased near yield line
  - Not mandatory
origin of the modern roundabout

• England – November 1966
  - Reversal of traffic priority at roundabouts to “yield on entry”
  - Result: low delay and high safety
  - Experiment was a huge success!
  - US was slow to accept the idea
  - First US modern roundabout in 1990
roundabout vs. traffic circle

<table>
<thead>
<tr>
<th>Roundabouts</th>
<th>Traffic circles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low to high capacity</td>
<td>Low capacity</td>
</tr>
<tr>
<td>Yield signs and yield lines at entry</td>
<td>Stop signs and stop bars</td>
</tr>
<tr>
<td>Flare on entries</td>
<td>No flare</td>
</tr>
<tr>
<td>No parking near roundabout</td>
<td>Parking on circulatory roadway</td>
</tr>
<tr>
<td>Pedestrians discouraged from using circulatory</td>
<td>Pedestrians on central island</td>
</tr>
<tr>
<td>roadway</td>
<td></td>
</tr>
</tbody>
</table>
Indianapolis – monument circle

Not a roundabout!
<table>
<thead>
<tr>
<th>Roundabouts</th>
<th>Rotary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low to high capacity</td>
<td>Medium to high capacity</td>
</tr>
<tr>
<td>Yield signs and yield lines at entry</td>
<td>Free-flow entry with no control</td>
</tr>
<tr>
<td>Flare on entries</td>
<td>Tangential entries</td>
</tr>
<tr>
<td>Low speeds</td>
<td>High speeds</td>
</tr>
<tr>
<td>Little or no weaving</td>
<td>Heavy weaving movements</td>
</tr>
<tr>
<td>Small Inscribed Circle Diameter (ICD)</td>
<td>Very large ICD</td>
</tr>
</tbody>
</table>
a rotary is not a roundabout

Kingston, NY (photo by New York State DOT)
benefits of a roundabout

• Keep traffic moving (efficient)
  – Yield instead of stop

• Aesthetically pleasing
  – Central island provides opportunity for landscaping

• Less pollution
  – Air
  – Noise

• Safer than conventional intersections
  – Greater than 90% reduction in fatalities!!
  – Studies performed by Insurance Institute of Highway Safety
safety
# Pedestrian Fatality in Pedestrian/Vehicle Crash

<table>
<thead>
<tr>
<th>Vehicle Speed</th>
<th>Odds of Pedestrian Death, Source 1</th>
<th>Odds of Pedestrian Death, Source 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mph</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>30 mph</td>
<td>45%</td>
<td>37%</td>
</tr>
<tr>
<td>40 mph</td>
<td>85%</td>
<td>83%</td>
</tr>
</tbody>
</table>


speed reduction

Source: FHWA Design Guide
roundabout design

- No “cookie-cutter” solutions – each design is unique to its surroundings
- Design is quite complicated – not just a circle with standard radii on entries and exits
- Principles vs. design standards
- Counter-intuitive when compared to traditional intersection design
roundabout design

• Design considerations
  - Vehicle speeds
    • Entry and exit radii
    • Circulatory roadway diameter
  - Design vehicle negotiation of roundabout
  - Vehicle path overlap (multi-lane roundabouts)
  - Capacity
  - Lighting
  - Signs and pavement markings
  - Vehicle sight distances
  - Pedestrian crossing locations and refuges
case study: clay terrace roundabouts
clay terrace

- **Geometric features of Clay Terrace roundabouts**
  - FHWA Classification: Urban Double-Lane
  - 150’ inscribed circle diameter (ICD)

- **Unique characteristics**
  - Amount of pedestrians and pedestrian interaction with roundabout traffic
  - Proximity of roundabouts to traffic signals
  - Paved with brick pavers
design vehicle
design vehicle
fastest path

R1 = 230'
R2 = 135'
R3 = 220'
fastest path
pedestrians

- **Lifestyle Center**
  - Located near affluent neighborhoods
  - Upscale in nature
  - Open-air concept
  - Combination of shopping and office space
  - “Glorified Strip Mall”
  - Many pedestrians
pedestrians

- Pedestrian crossing locations – 25’ back from yield line at roundabouts

Entering speeds:
~27 mph

Exiting speeds:
~27 mph

Circulating speeds:
~15 mph
Myth: Roundabouts and pedestrians don’t mix

Facts:

- Roundabouts slow vehicles – reducing number and severity of vehicle/pedestrian crashes
- Pedestrians must only look one direction at a time
- High safety ratings even at school crossings and in areas with a high percentage of elderly residents
- U.K. studies show 50% reduction in pedestrian crashes at roundabouts as opposed to traditional intersections
Facts (cont’d.):

- When compared to 4-way intersections of similar traffic volumes, pedestrians can negotiate a roundabout much quicker

- Too heavy of pedestrian volumes can cause traffic to queue or to back up into the circulatory roadway
Effect of pedestrians on capacity of a two-lane roundabout

Source: FHWA Design Guide
• Mall atmosphere
• Many pedestrians not using marked crosswalk locations
• Mid-block crossings?
• Pedestrian railing or landscaping to discourage crossing at an unmarked location
pedestrians
pedestrians
traffic signals

US 31 146th St

Approx. distance: 3,000 ft.
traffic signals

• In general, nearby traffic signals do not harm the operation of roundabouts
  - Depends on demand at each intersection
  - Must make sure queues from traffic signal do not back up into roundabout

• Roundabouts disrupt coordination when placed along a corridor with a traffic signal system
  - Traffic signal systems rely on vehicle platooning for maximum efficiency
  - Platoons are dispersed at yield signs
traffic signals

• Suggestions
  - Use a roundabout/roundabout combination
  - Roundabouts work well with random arrivals – they don’t need platoons for maximum efficiency
  - If a signal is nearby, simulate signal timings to assure that queues will not back up into roundabout
brick pavers

• Why use pavers?
  – Aesthetically pleasing
  – Encourage low circulating speeds

• Issues with pavers
  – Cost
  – Pavement markings in circulatory roadway are infeasible – acceptable at Clay Terrace
  – Must have strong foundation
  – Must use caution when snow plowing
brick pavers

- Aesthetically pleasing
brick pavers

• Aesthetically pleasing
brick pavers

CONCRETE HEADER
WEEP HOLES - CONNECT SUBBASE TO DRAINAGE COURSE
SAND SWEEP JOINTS
INTERLOCKING CONCRETE PAVERS
ASPHALT ADHESIVE
ROLLED BITUMINOUS SETTING BED
PORTLAND CEMENT CONCRETE PAVEMENT
CONSTRUCTION JOINT
AGGREGATE SUBBASE
COMPACTED SUBGRADE

STANDARD PAVER SECTION
brick pavers

• **Snow plowing**
  - If foundation settles, this causes “lipping”
  - Snow plow blades can get caught
    • Use a rubber blade tip -OR-
    • Raise blade slightly to remove bulk of snow and go back over with de-icer -OR-
    • Use stamped concrete or asphalt instead of brick pavers – not as aesthetically pleasing after several years of wear
clay terrace