Usefulness of Bypass Lanes at Roundabout Intersections

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Overview

Roundabout bypass lane concepts
   Speaker: Jeremy Grenard, PE, PTOE
            American Structurepoint, Inc.
   - Definition
   - Types
   - Pros/cons and tips for design

Case studies of roundabout bypass lanes on upcoming projects
   Speaker: Jason Rowley, PE
            RW Armstrong & Associates
   - US 31 Hamilton County
   - Keystone Avenue

Q & A
Bypass Lane: Definition

A lane designed in order to fully or partially remove a right turn or through movement from conflict with the circulatory traffic in the roundabout.
Why Use Bypass Lanes?

- Increase capacity of roundabout
- Increase motorist safety
  - Reduction of potential vehicular conflicts
  - Potential reduction in the number of circulatory lanes in the roundabout
- Improve design vehicle turning radius at skewed intersections
**Types of Bypass Lanes**

**Full Bypass/ Added Lane**

Introduction of an added lane downstream – no need for traffic to yield or merge with exiting traffic

Pros:
- Highest capacity
- No vehicular delay
- Great for continuity on major routes that turn

Cons:
- Highest speeds
- Can introduce downstream weaving
- Least pedestrian-friendly
Types of Bypass Lanes

Full Bypass / Merge

Requires bypass traffic to merge with exiting traffic

Pros:
- High capacity (function of the downstream merge)
- Low vehicular delay
- Good for route continuity
- Requires less R/W than added lane

Cons:
- Relatively high speeds
- Downstream merge
Hoosier Heartland Highway

This lane merges in

Purdue Road School 2013 - Usefulness of Bypass Lanes at Roundabout Intersections
Types of Bypass Lanes

Full Bypass / Yield

Requires bypass traffic to yield to exiting traffic

Pros:
• Slower speeds
• Yield condition compatible with roundabout
• Similar to right turn bypass used at traditional intersections
• Provides larger island for pedestrian facilities

Cons:
• Yield angle can be too small
• Lower capacity
Types of Bypass Lanes

Partial (Snag) Bypass / Yield

Separated from through and left turn traffic by a raised vane island. Yields to exiting traffic.

Pros:
• Slower speeds
• Better for pedestrians
• Good yield angle
• Encourages better yield rates than full bypass / yield

Cons:
• Lower capacity due to frequent gap misjudgments

Design best practices: better than full bypass / yield for yielding angle. Should aim toward splitter island to make it tough for drivers to enter circulatory roadway.
Types of Bypass Lanes

Exclusive right turn lane:
No vane island. Similar to exclusive right turn lane at standard intersection.

Pros:
• Easiest for snow plowing
• Yields at roundabout with other lanes (rules are the same)
• Least R/W impacts

Cons:
• Pedestrians do not have additional refuge island
• Lowest capacity

Design best practice: Make sure that ERT aims toward splitter island, making it obvious to the driver that they aren’t to try to get into the circulatory lanes. Should yield to ALL circulatory lanes.
Types of Bypass Lanes

Through bypass lane

Used at T-intersections
Should always be free-flowing or merge.

Pros:  
• Can increase safety
• Greatly increases capacity if done right

Cons:  
• Very poor angle for yielding
Design note: Through bypass can be straight or hold tight to the entry/exit geometry. Holding tight to the entry/exit geometry serves to slow traffic in the bypass lane, reduces R/W impacts, and doesn’t reduce capacity by much.
Pedestrian Concerns

Can complicate pedestrian crossings

Designer must be sensitive to the needs of all pedestrians

Is this a single or multi-lane pedestrian crossing according to PROWAG?

SINGLE, because pedestrian only crosses one lane at a time
**Design Tips**

If pedestrian crossings are provided, check vehicular speeds at pedestrian crossings

<table>
<thead>
<tr>
<th>Vehicle Speed</th>
<th>Pedestrian Survival Rate, Study 1</th>
<th>Pedestrian Survival Rate, Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mph</td>
<td>95%</td>
<td>95%</td>
</tr>
<tr>
<td>30 mph</td>
<td>55%</td>
<td>63%</td>
</tr>
<tr>
<td>40 mph</td>
<td>15%</td>
<td>17%</td>
</tr>
</tbody>
</table>


Design Tips

It is sometimes possible to avoid having a pedestrian crossing in the bypass lane.
Design Tips

Yielding angle – try to avoid too small of an angle

Drivers with physical limitations may find it more difficult to turn their heads, necks, or upper bodies in order to have an adequate line-of-sight down an acute angle approach.
Design Tips

Balance the pedestrian, capacity, and R/W needs to determine the type of bypass that makes the most sense for your situation
Case studies of roundabout bypass lanes on upcoming projects
Roundabout Capacity

- ADT Capacity approximate Capacity
  - Single lane roundabout
    • 25,000 vehicles per day
  - Two lane roundabout
    • Up to 50,000 vehicles per day

- Hourly Capacity – ALL MOVEMENTS
  - ≈2,000 vph single lane
  - ≈4,000 vph two lanes

- Capacity can be significantly increased via bypass lanes
Carmel / Westfield RAB Interchanges

- 106th St. – Roundabout Interchange
- 116th St. – Roundabout Interchange
- 131st St. – Roundabout Interchange
- 136th St. – Roundabout Interchange
- Rangeline Rd / Clay Terrace Blvd
- 161st St. – Roundabout Interchange
- SR 32 – Single Point Urban Interchange (SPUI) with RAB at Poplar St.
- 191st St. – Roundabout Interchange
SR 32 Interchange at Poplar Street

- high school and middle school = bus and pedestrian considerations
- Accommodate PROWAG where possible
US 31 Hamilton County – Existing 136th St Intersection

Constraints
- Surrounding area slopes dramatically from west to east
- St. Vincent’s Hospital located on the south east corner
- Illinois Street was recently extended to the south
- Wetlands in area on eastside preserved
US 31 Hamilton County – Proposed 136th St Interchange
US 31 Hamilton County – 136th St
VISSIM Analysis
Questions?

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