A Framework for Assessing a Roundabout near a School Zone

Presented by: Dusadee Corhiran, Dr. Emelinda Parentela, and Michael Plotnik
Driving through an intersection is one of the most difficult traffic situations. Motorists have to constantly yield to vehicular traffic, crossing pedestrians, and bicyclists.

Most intersections have some form of controls such as yield signs, stop signs, signals, or traffic circles/roundabouts.
Introduction

Roundabouts were developed in Europe and have been used widely around the world. They are not very popular to drivers in the United States. This could be attributed to a lack of understanding or how a roundabout really works.
Methodology

Involves using the existing design guidelines to assess the viability of a roundabout and identify additional factors to assess the viability of a roundabout near a school zone.
What is a Roundabout?

AASHTO defines a (modern) roundabout as an “intersection with a central island around which traffic must travel counterclockwise and in which entering traffic must yield to circulating traffic.”

Roundabouts are considered safe and efficient because traffic flows in one direction only.
What is a Roundabout?

(Modern) roundabouts have curved and narrow entries which force drivers to slow down, resulting in an overall reduction in speed.

A typical intersection has **32** conflict points:

- 16 crossing conflict points
- 8 diverging conflict points
- 8 converging conflict points

A roundabout has **8** conflict points.
What is a Roundabout?

Since a roundabout only has 8 conflict points, it is 75% less than that of a typical intersection.

- 0 crossing conflict points
- 4 diverging conflict points
- 4 converging conflict points

Accident studies have shown that conversion of stop-controlled intersections into roundabouts reduce the number of injury collisions but even more importantly - - FATAL COLLISIONS.
What is a Roundabout?

There are 3 types of roundabouts:

Mini-Roundabout:
- Ideal for low-speed with minimal right-of-way.

Single-Lane Roundabout:
- Single lane at entry and a single circulatory lane.

Multilane Roundabout:
- More than one entry lane on one of the approaches and more than one circulatory lane.

<table>
<thead>
<tr>
<th>Design Element</th>
<th>Mini-Roundabout</th>
<th>Single-Lane Roundabout</th>
<th>Multi-Lane Roundabout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended Max Entry Design Speed</td>
<td>15 to 20 mph</td>
<td>20 to 25 mph</td>
<td>25 to 30 mph</td>
</tr>
<tr>
<td>Max # of Entering Lanes Per Approach</td>
<td>1</td>
<td>1</td>
<td>2+</td>
</tr>
<tr>
<td>Typical Inscribed Circle Diameter</td>
<td>45 to 90 ft.</td>
<td>90 to 150 ft.</td>
<td>140 to 200 ft.</td>
</tr>
<tr>
<td>Central Island Treatment</td>
<td>Mountable</td>
<td>Raised</td>
<td>Raised</td>
</tr>
<tr>
<td>Typical Daily Volumes On 4-Leg Roundabout</td>
<td>0 to 15,000</td>
<td>0 to 20,000</td>
<td>20,000</td>
</tr>
</tbody>
</table>
What is a Roundabout?

USDOT FHWA has less stringent design elements such as a typical inscribed circle being 45 to 80 ft. and daily service volume on a 4-leg roundabout of 10,000 vpd, and a maximum entry design speed of 15 mph.

HCM 2010 stated that the LOS criteria for roundabouts is “based solely on control delay,” and v/c ratio of a lane. ”Roundabouts share the same basic control delay formulation with two-way and all-way STOP-controlled intersections.”
Is a Roundabout Viable near a School Zone?

A roundabout near a school zone may be a form of traffic calming measure since vehicles are forced to slow down and yield to traffic.

With proper design, a roundabout could be a focal point where school buses, passenger cars, pedestrians (school children), and bicycles are able to share the road safely.

In the United States, roundabouts near school zones are slowly increasing in number.
Is a Roundabout Viable near a School Zone?

Study Area (Background)
City: Long Beach, CA
Intersection: Fanwood Ave. & Marita St.
School: Gant Elementary School
Current Control: 4-way STOP
Speed Limit: 25 mph
Observed Speed: 27 mph (+2 above limit)
Vehicular Flow: 1,500 to 2,000 vpd (light)
Shared: School Buses, Pedestrians, Bicycles

Existing Intersection
### Is a Roundabout Viable near a School Zone?

<table>
<thead>
<tr>
<th>Item #</th>
<th>Guidelines</th>
<th>Study Site</th>
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<th>Study Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High accident, especially related to left-turn or right-turn movements</td>
<td>No reported accidents in this intersection</td>
<td>6</td>
<td>Intersections with high left-turn flows.</td>
<td>AM Peak Hour: NB left and WB left PM Peak Hour: SB left and EB left.</td>
</tr>
<tr>
<td>2</td>
<td>Four-way stop intersections</td>
<td>Four-way stop intersection</td>
<td>7</td>
<td>Intersections with changing traffic patterns.</td>
<td>No changing traffic patterns.</td>
</tr>
<tr>
<td>3</td>
<td>Locations with traffic signal is not warranted</td>
<td>Traffic signal is not warranted based on observed traffic flow.</td>
<td>8</td>
<td>Signalized intersections with restricted storage capacity.</td>
<td>Not signalized.</td>
</tr>
<tr>
<td>4</td>
<td>Intersections with high delays</td>
<td>Intersection currently operates at LOS A.</td>
<td>9</td>
<td>To replace a pair of closely spaced intersections.</td>
<td>Will not replace closely spaced intersections.</td>
</tr>
<tr>
<td>5</td>
<td>Intersections with more than 4 legs</td>
<td>4-leg intersection.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Appropriate Locations**

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## Is a Roundabout Viable near a School Zone?

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<th>Item #</th>
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<tr>
<td>1</td>
<td>Locations with insufficient space.</td>
<td>Approach width is 34 ft. on Fanwood and 36 ft. on Marita.</td>
</tr>
<tr>
<td>2</td>
<td>Locations with high grades/slopes.</td>
<td>Flat Location.</td>
</tr>
<tr>
<td>3</td>
<td>Locations with heavy flows on the major-road and low flows on the minor-road.</td>
<td>Low flows on both roads.</td>
</tr>
<tr>
<td>4</td>
<td>Locations within the coordinated signal network.</td>
<td>Not within a coordinated signal network.</td>
</tr>
<tr>
<td>5</td>
<td>Presence of numerous bicycles or pedestrians.</td>
<td>Substantial volumes of ped and bikes.</td>
</tr>
<tr>
<td>6 *</td>
<td>Presence of numerous disabled or blind users.</td>
<td>None observed.</td>
</tr>
<tr>
<td>7 *</td>
<td>Larger proportion of heavy vehicles.</td>
<td>Low volume of school buses observed.</td>
</tr>
<tr>
<td>8 *</td>
<td>Presence of fire station.</td>
<td>No fire station nearby.</td>
</tr>
<tr>
<td>9 *</td>
<td>Rail crossing.</td>
<td>No rail crossing.</td>
</tr>
</tbody>
</table>

* Optional conditions

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Inappropriate Locations
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Is a Roundabout Viable near a School Zone?

NCHRP Roundabout Guidelines Summary

Only 2 out of 9 appropriate locations’ guidelines are met.

- Four-way stop control.
- High number of left turn movements.
- The number of accidents is an important consideration which does not seem to meet the guideline.

3 out of 4 inappropriate locations’ guidelines show that the intersection is not an inappropriate location.

- Locations with insufficient space.
- The one condition which makes this location inappropriate deals with one of the most important consideration, which is space.
Is a Roundabout Viable near a School Zone?

Study Area (Design Analysis)

Mini-roundabout would be the type of roundabout viable in this location.

AASHTO standards require a min. dia. of 45 ft. which cannot be obtained without encroaching on the right-of-way for pedestrian walkways.

The design vehicle is a conventional school bus with 84 passengers, which has a turning radius of 39.1 ft. – almost the size of a mini-roundabout.

Implementing roundabouts at inappropriate locations, such as the study site, can increase unnecessary delays, costs, and accidents.
Is a Roundabout Viable near a School Zone?

Design Standards *(Other Factors To Consider)*

Speed seems to be a factor missing in the design guideline and may be considered an important decision criterion.

85\textsuperscript{th} percentile speed is 27 mph, which is 2 mph more than the speed limit.

In a school zone, with significant presence of school children and young bicyclists, a slight increase in the posted speed limit may create problems in the future.

A roundabout at this intersection would force vehicles to slow down because of its curved and narrow entry lane.
Is a Roundabout Viable near a School Zone?

Degree of conflicting interactions between passenger vehicles, buses, pedestrians, and bicyclists may also be a design criterion.

A roundabout directs traffic in one direction only and thus eliminates vehicle to vehicle conflicts on left turning movements which are high in this study site.

A pedestrian refuge makes it less complex for a pedestrian to cross and minimizes conflicts between pedestrians and vehicles.
Is a Roundabout Viable near a School Zone?

One of the issues that could potentially affect the implementation of roundabouts near a school zone is the public’s unfamiliarity with roundabouts which often leads to misperception.

Educating the public and involving the community, especially the affect school, early in the process are imperative for a successful execution.
Conclusion

This presentation provided a framework and introduced additional factors for assessing the viability of a roundabout as an intersection control near a school zone.

Key factors:

- Volumes of left and right movements.
- Number of accidents related to those movements.
- Size of the intersection.
- Operational characteristics of the intersection.
- Speed of the vehicles in the study area.
- Degree of complexity of vehicle-pedestrian-bicycle interactions.
Closing

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ITE Western District

You, the audience...
Thank You !!!