Mini-Roundabouts
Design and Evaluation

WASHINGTON STATE ITE ANNUAL MEETING
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Presentation Outline
- Definition and defining features
- Desired site/traffic conditions
- Design objectives of central island
- Control parameters and sizing procedures
- Status of FHWA mini-roundabout evaluation contract
- Examples
- Traffic handling capacity
- Mini-roundabout evaluation sites in Lake Stevens, WA
  - Improvement objectives
  - Capacity analysis
  - Environmental impacts

Mini-Roundabout, what is it?
- A single-lane roundabout with inscribed circular diameter (ICD) between 50 ft to 90 ft
- Defining feature is a traversable central island (and split islands) to handle large vehicles
- Advantages include:
  - Higher capacity than stop control
  - Fit into existing intersection ROW
  - Improve intersection operating efficiency and safety
  - Low cost ($25,000 to $50,000 per intersection)

Mini in Stevensville, MD

Suitable Locations for Mini-roundabout
- Intersections on 2-lane or 3-lane “high volume” collector roads
- Post speed 35 mph or less
- Low truck volume
- Comparable traffic volume from major and minor approaches

Design Objectives of the Mini Central Island
- Traversable by large vehicles
- Un-comfortable for small vehicles
- Not causing problems for winter maintenance
### Suggested Mini-roundabout Control Parameters
- Circulating lane width: 14 ft to 16 ft
- Entrance lane width: 10 ft to 11 ft
- Pedestrian crossing: 10-ft wide, and placed at least 20 ft before the yield line
- Splitter island width: \(\geq 4\) ft
- Central island crown height: \(\leq 5\) in

Make the central island as large as possible after achieving the desired circulating lane width.

### Recommended Signing and Pavement Markings

### FHWA Evaluation Sites
- Atlanta, GA (1 site)
- Maryland
  - Baltimore (1-2 sites)
  - Takoma Park (2 sites)
- Twin Cities, MN (2 sites)
- Elmire, New York (2 sites)
- Lake Stevens, WA (2 sites)

### Reasons for Implementing Mini-roundabouts at FHWA Evaluation Sites
- Improve access for pedestrians and bicyclists
- Attract more school age children to walk to school
- Reduce frequency of speeding and running stop sign
- Reduce noise caused by hard braking/acceleration
- Preserve property value
- Increase intersection capacity
- Improve intersection safety
- Cost: \$25K - ? Per site

### Examples of Constructed Minis
Mini-roundabout, France

Mini-roundabout in England

Mini-roundabout in Australia

Newly constructed in Takoma Park, MD
Mini in Solomon Islands, MD

Traffic Handling Capacity of Mini-Roundabout

Theoretical Capacity of Mini-roundabout (one approach)

Field Observed Traffic Flow at Mini-roundabout in Stevensville, MD

Before Condition

Recommendation

<table>
<thead>
<tr>
<th>Leg 1</th>
<th>Gap</th>
<th>Follow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leg 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Simultaneous entries

Stevensville MD

- Large vehicle exiting expressway
- Semi-truck entering expressway
- Single-Unit truck making left turn
- Long truck and boat
- Long truck making right and left turns
- Simultaneous entries

Traffic Characteristics

<table>
<thead>
<tr>
<th>Measures</th>
<th>Leg 1</th>
<th>Leg 2</th>
<th>Leg 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry flow (peak)</td>
<td>329</td>
<td>327</td>
<td>268</td>
<td>924</td>
</tr>
<tr>
<td>Peak-hour factor *</td>
<td>0.6</td>
<td>0.65</td>
<td>0.65</td>
<td>-</td>
</tr>
<tr>
<td>Potential maximum Volume_1</td>
<td>468</td>
<td>348</td>
<td>324</td>
<td>1140</td>
</tr>
<tr>
<td>Potential maximum Volume_2</td>
<td>468</td>
<td>492</td>
<td>408</td>
<td>1368</td>
</tr>
<tr>
<td>Vehicle composition %Car</td>
<td>47%</td>
<td>48%</td>
<td>44%</td>
<td>46%</td>
</tr>
<tr>
<td>%SUV/Pickup</td>
<td>51%</td>
<td>49%</td>
<td>48%</td>
<td>49%</td>
</tr>
<tr>
<td>%Truck</td>
<td>2%</td>
<td>3%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Turning movement (Left-turn/Right-turn)</td>
<td>LT = 80%</td>
<td>LT = 60%</td>
<td>LT = 35%</td>
<td>LT = 60%</td>
</tr>
<tr>
<td></td>
<td>RT = 20%</td>
<td>RT = 40%</td>
<td>RT = 65%</td>
<td>RT = 40%</td>
</tr>
</tbody>
</table>

* Calculate from the maximum 5-minute entry flow

Two mini-roundabout sites in Lake Stevens, WA

- Problems need to be addressed
  - Recurring queues at T-intersection (PM peak)
  - Queuing on Shopping Center NB makes it hard to drivers to get out of shopping center
  - Drivers observed not stopping at Stop Control

- Improvement objectives:
  - Reduce congestion
  - Improve safety
  - Attract businesses to come and stay in the shopping center

Nearby Signalized Intersection

Lake Stevens Mini-Roundabout Sites
How Did FHWA Get Involved?

- Referral by Gibson Traffic Consultants
- Match of interests between FHWA and Lake Stevens
- Webinar presentations and videos to illustrate how mini-roundabout works.
- Technical supports in forms of:
  - Capacity analysis
  - Simulation analysis
  - Environmental analysis
  - Creation of simulation videos visualizing the differences between All-Way Stop and mini-roundabout
  - Explain ways to mitigate possible failures, etc.

AWSC Intersections (2010)

Mini-Roundabouts (2010)

AWSC Intersections (2016)

Mini-Roundabouts (2016)

Year 2010

AWSC Intersections (2030)

Mini-Roundabouts (2030)

AWSC Intersections

Mini-Roundabouts

Fuel Consumption (gal/veh)

NOx (g/veh)

CO (g/veh)

CO2 (g/veh)
Questions?

FURTHER INQUIRIES CONTACT

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