Planning Level Analysis

Roundabout Traffic Operations Analysis
Short Course
Planning-Level Models

- NCHRP Report 672, Chapter 3
- Rules of thumb
- Simple volume relationships
- AADT-level graphs
## Selection of Analysis Technique

<table>
<thead>
<tr>
<th>Application</th>
<th>Typical Outcome Desired</th>
<th>Input Data Available</th>
<th>Potential Analysis Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning-level sizing</td>
<td>Number of lanes</td>
<td>Traffic volumes</td>
<td>Chapter 3 of this guide, HCM, deterministic software</td>
</tr>
<tr>
<td>Preliminary design of roundabouts with up to two lanes</td>
<td>Detailed lane configuration</td>
<td>Traffic volumes, geometry</td>
<td>HCM, deterministic software</td>
</tr>
<tr>
<td>Preliminary design of roundabouts with three lanes and/or with short lanes/flared designs</td>
<td>Detailed lane configuration</td>
<td>Traffic volumes, geometry</td>
<td>Deterministic software</td>
</tr>
<tr>
<td>Analysis of pedestrian treatments</td>
<td>Vehicular delay, vehicular queuing, pedestrian delay</td>
<td>Vehicular traffic and pedestrian volumes, crosswalk design</td>
<td>HCM, deterministic software, simulation</td>
</tr>
<tr>
<td>System analysis</td>
<td>Travel time, delays and queues between intersections</td>
<td>Traffic volumes, geometry</td>
<td>HCM, simulation</td>
</tr>
<tr>
<td>Public involvement</td>
<td>Animation of no-build conditions and proposed alternatives</td>
<td>Traffic volumes, geometry</td>
<td>Simulation</td>
</tr>
</tbody>
</table>

Note: Deterministic software includes models like ARCADY, RODEL, and SIDRA.
Planning Rules of Thumb

- Roundabout gives higher capacity and lower delays than AWSC under same conditions
- Roundabout likely to have higher delays than TWSC if TWSC is operating without problems
- Single-lane roundabout can be assumed to operate within capacity any location where peak hour volume signal warrant not met
- Roundabout within capacity will generally produce lower delays than signal under same conditions
### Planning-Level Volume Thresholds

<table>
<thead>
<tr>
<th>Volume Range</th>
<th>Number of Lanes Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1,000 veh/h</td>
<td>▪ Single-lane entry likely to be sufficient</td>
</tr>
<tr>
<td>1,000 to 1,300 veh/h</td>
<td>▪ Two-lane entry may be needed</td>
</tr>
<tr>
<td></td>
<td>▪ Single-lane may be sufficient based upon more detailed analysis.</td>
</tr>
<tr>
<td>1,300 to 1,800 veh/h</td>
<td>▪ Two-lane entry likely to be sufficient</td>
</tr>
<tr>
<td>Above 1,800 veh/h</td>
<td>▪ More than two entering lanes may be required</td>
</tr>
<tr>
<td></td>
<td>▪ A more detailed capacity evaluation should be conducted to verify lane numbers and arrangements.</td>
</tr>
</tbody>
</table>

Source: New York State Department of Transportation

NCHRP Report 672 Exhibit 3-14
How many lanes to serve demand?

Planning level approach

Basic assumptions:

- AADT level
- K factor of 0.09 to 0.10 (ratio of peak-hour to daily traffic)
- D factor of 0.52 to 0.58 (direction distribution of traffic)
- Ratio of minor street to total entering traffic of 0.33 to 0.50
- Acceptable v/c ratio of 0.85 to 1.00
- Proportion of left turns

Three legs: Use 75% of values
Planning-Level Daily Intersection Volumes

Exhibit 3-12, p. 3-22
Planning-Level Daily Intersection Volumes: Mini-Roundabouts

Exhibit 3-16, p. 3-22
Example Planning Problem

- Existing AADT: 15,000 veh/day
- Assume 3% growth rate per year
- 10 Year Horizon AADT:
  \[13,000 \times (1.03)^{10} \approx 20,000 \text{ veh/day}\]
- 20 Year Horizon AADT:
  \[13,000 \times (1.03)^{20} \approx 27,000 \text{ veh/day}\]
- Assume ~20% left turns
Example Planning Problem (cont.)

- For 20% left turns, the double-lane roundabout is likely to operate acceptably, while a single-lane roundabout may be sufficient (additional analysis needed).
- At an AADT of 27,500, a double-lane roundabout is recommended.
- At an AADT of 20,000, a single-lane roundabout is sufficient (additional analysis needed).
- At an AADT of 15,000, a single-lane roundabout is likely to operate acceptably.

AADT:
- 27,500 AADT
- 20,000 AADT
- 15,000 AADT
- 10,000 AADT
- 5,000 AADT
- 0 AADT

Left-Turn Percentage:
- 0%
- 10%
- 20%
- 30%
- 40%
Example Planning Problem (cont.)

- Roundabout size requirements:
  - Today: Single-lane
  - 10 years: Single-lane (may require more analysis)
  - 20 years: Double-lane
- Do you build it today as single-lane or double-lane?
Class Exercise

Existing Intersection Geometry
Intersection Context

- Suburban area.
- Predominantly commercial land uses with accesses near intersection.
- Nearest signal = 0.5 miles
- Overhead utility lines along both roads.
- Posted speed = 40 mph
- Pedestrian & bicyclist volumes currently minimal, but potentially growing.
## Average Daily Traffic Volumes

<table>
<thead>
<tr>
<th>Road</th>
<th>Existing AADT</th>
<th>+10 Years AADT</th>
<th>+20 Years AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmon Dr.</td>
<td>11,200</td>
<td>13,600</td>
<td>16,600</td>
</tr>
<tr>
<td>River Rd.</td>
<td>9,100</td>
<td>11,100</td>
<td>13,600</td>
</tr>
<tr>
<td>Total AADT</td>
<td>20,300</td>
<td>24,700</td>
<td>30,200</td>
</tr>
</tbody>
</table>

Assume 15% left turns
Determine:

- Is a roundabout a feasible solution?
- Single or double-lane?
  - Existing Condition
  - + 10 Years
  - + 20 Years