Incorporating Intersection Delays in Subarea Travel Demand Modeling

presented to
North Carolina Model User Group

presented by
Cambridge Systematics, Inc.
Feng Liu, Ph.D.

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Overview

- Objectives and Motivation
- Methodology
- Study Area
- Results
- Conclusions
Objectives

- Investigate Congestion Effects
  - Delay at the link and intersection level
- Analyze Traffic Impacts of Land Development
  - Level of services (LOS)
- Evaluate Mitigation Options
  - Measures of effectiveness
Analytical Tools

**Traffic Analysis Software**
- HCM-based methodology for analyzing intersection LOS
- Traffic volumes estimated externally
- No feedback

**Regional Travel Demand Modeling**
- Estimate/forecast traffic volumes
- No consideration of the effects of intersection delay

**Subarea Travel Demand Modeling**
- Consideration of the effects of intersection delay
Two Modeling Approaches

<table>
<thead>
<tr>
<th><strong>Control Device Method</strong></th>
<th><strong>Intersection Modeling</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Approach</strong></td>
<td>Intersection-constrained capacity-restrained assignment, with HCM intersection methodology</td>
</tr>
<tr>
<td>Capacity-restrained assignment with link capacity and speed modified by intersection delays</td>
<td></td>
</tr>
<tr>
<td><strong>Input/Parameters</strong></td>
<td>Network attributes: link and intersections, geometric characteristics, signal timing</td>
</tr>
<tr>
<td>Network attributes: control devices, link facility types, total number of turn lanes</td>
<td></td>
</tr>
<tr>
<td>Default: degree of progression (arrival type), cycle time, green time to cycle time ratios, and signal progression factor</td>
<td></td>
</tr>
</tbody>
</table>
## Two Modeling Approaches

<table>
<thead>
<tr>
<th>Intersection types</th>
<th>Control Device Method</th>
<th>Intersection Modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>No control device; Stop sign; Yield sign; Major approach to a signalized intersection; and Minor approach to a signalized intersection</td>
<td>Signal-controlled intersections (four types) All-way stop-controlled intersection Two-way stop-controlled intersection Priority intersection (two-way yield controlled intersection) Roundabout</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output</th>
<th>Link level LOS</th>
<th>Intersection Delays and LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigation measures</td>
<td>Evaluated directly (limited) and indirectly</td>
<td>Evaluated directly</td>
</tr>
</tbody>
</table>
Study Area

Core Study Area

Source: Cambridge Systematics
Intersection Modeling

Traffic Analysis Network

Source: Cambridge Systematics
Intersection Modeling

Subarea Model Network

Source: Cambridge Systematics
Intersection Modeling

AM Volume Comparison: Intersection Modeling vs Control Device Method

Source: Cambridge Systematics
Intersection Modeling

PM Volume Comparison: Intersection Modeling vs Control Device Method

Source: Cambridge Systematics
Intersection Modeling

- Intersection LOS
- Comparisons with Traffic Analysis Software

Source: Cambridge Systematics
Model Validation

Screenlines

Source: Cambridge Systematics
## Model Validation

### Model-Estimated vs. Observed Daily Volumes

<table>
<thead>
<tr>
<th>Policy Issues</th>
<th>% Difference (%RMSE)</th>
<th>Control Device Method</th>
<th>Intersection Modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway/Expressway</td>
<td>4% (32%)</td>
<td>-4% (27%)</td>
<td></td>
</tr>
<tr>
<td>Major Arterial</td>
<td>-15% (27%)</td>
<td>-7% (15%)</td>
<td></td>
</tr>
<tr>
<td>Medium/Minor Arterial</td>
<td>-1% (9%)</td>
<td>1% (12%)</td>
<td></td>
</tr>
<tr>
<td>Collector</td>
<td>-7% (38%)</td>
<td>-5% (27%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>-6% (27%)</td>
<td>-4% (18%)</td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

Subarea Travel Demand Modeling
  » Control device modeling
  » Intersection modeling
    ▪ HCM methodology
    ▪ Detailed representation of intersection
    ▪ Delays and intersection LOS
    ▪ Congestion effects on route choice and diversion

Model capability
  » Evaluate mitigation measures
  » Evaluate traffic impacts of land development
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