Travel Demand Modeling for a Small MPO Using TRANSIMS
Study Background

• The study was funded by the Federal Highway Administration (FHWA)

• The study started in November 2008 and completed on November 2009

• This study was a complimentary study to another project titled Illinois Travel Demand Modeling Technical Support Group, funded by the Illinois Department of Transportation through Illinois Center for Transportation, ICT.
Study Objectives

• To promote better understanding of travel behavior and transportation systems through development, calibration, validation, and analysis of a travel demand model for a small sized MPO using TRANSIMS.

• To develop methods for applying TRANSIMS modules to evaluate the transportation policies and issues related to planning agencies (especially small MPOs) as identified in SAFETEA-LU 5512.

• To extend TRANSIMS technology by identifying issues and opportunities of using TRANSIMS for a small sized MPO.
Key Parts of the Study

• Evaluating Travel Demand Modeling status in small MPOs in Illinois.

• Determining functional requirements for TRANSIMS Track 1 implementation in a small MPO.

• Data requirements and conversion steps for Track 1 implementation of TRANSIMS.

• Model calibration and validation steps.

• TRANSIMS model sensitivity analysis with highway network changes.

• Comparing Four-Step Travel Model and TRANSIMS use issues for a small MPO.
TDM Status in Illinois MPOs

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Functional Requirements for TRANSIMS Implementation

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# Functional Requirements for TRANSIMS Implementation

<table>
<thead>
<tr>
<th>Input Data</th>
<th>Purpose</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway (Node, Link)</td>
<td>Network Preparation &amp; Editing</td>
<td>MPO (Transportation Planning/GIS Dept.)</td>
</tr>
<tr>
<td>Traffic Analysis Zone</td>
<td></td>
<td>MPO (Transportation Planning/GIS Dept.)</td>
</tr>
<tr>
<td>Trip Table</td>
<td>Route Planning</td>
<td>MPO (Transportation Planning Dept.)</td>
</tr>
<tr>
<td>Vehicle Type</td>
<td>Microsimulation</td>
<td>MPO (Transportation Planning Dept.)</td>
</tr>
<tr>
<td>Traffic and Transit Volumes</td>
<td>Calibration &amp; Validation</td>
<td>MPO, Cities, Transit Authorities</td>
</tr>
</tbody>
</table>
Trip Table Conversion

In House Household Survey 2002

In House CUBE 4 Step Model

Production/Attraction Splits

Diurnal Distribution Data

SmoothData

Smoothed Diurnal Distributions

TRANSIMS Trip Tables

Link, Node

ConvertTrips

Activity Location Process Link

Trip

Population

Household

Vehicle

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Diurnal Distribution

Time of Day vs. Percentage of Trips
Router, Microsimulator, and Convergence Iterations

<table>
<thead>
<tr>
<th>Process</th>
<th>Iterations</th>
<th>% Time Diff.</th>
<th>Min. Time</th>
<th>Max. Time</th>
<th>Diff.</th>
<th>Selection %</th>
<th>Max. %</th>
<th>Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router Stabilization</td>
<td>1 - 5</td>
<td>4</td>
<td>2min</td>
<td>30min</td>
<td></td>
<td>50</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Router Stabilization</td>
<td>6 - 10</td>
<td>V/C=2.00</td>
<td>2min</td>
<td>30min</td>
<td></td>
<td>50</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Microsimulator Stabilization</td>
<td>11 - 15</td>
<td>4</td>
<td>2min</td>
<td>30min</td>
<td></td>
<td>50</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Convergence</td>
<td>16 - 25</td>
<td>4</td>
<td>2min</td>
<td>30min</td>
<td></td>
<td>50</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

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Model Calibration and Validation

- Testing the following model components:
  - Network
  - Socio-economic data
  - Trip Generation
  - Trip Distribution
  - Traffic Assignment
    - A network-wide validation comparison to field counts utilizing Validate utility program
    - Using Screenlines
    - Critical links comparison using major and minor arterials
Model Calibration and Validation
## Model Calibration and Validation

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>FHWA Guideline(^3)\ (+/-)</th>
<th>CUUATS 4-Step Model</th>
<th>CUUATS TRANSIMS Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway</td>
<td>7%</td>
<td>-3.10%</td>
<td>2.80%</td>
</tr>
<tr>
<td>Major Arterial</td>
<td>10%</td>
<td>1.60%</td>
<td>-1.20%</td>
</tr>
<tr>
<td>Minor Arterial</td>
<td>15%</td>
<td>-13.80%</td>
<td>8.40%</td>
</tr>
<tr>
<td>Collector</td>
<td>25%</td>
<td>-42.60%</td>
<td>4.30%</td>
</tr>
</tbody>
</table>
## Model Calibration and Validation

<table>
<thead>
<tr>
<th>Measure</th>
<th>FHWA Guideline</th>
<th>CUUATS 4-Step Model</th>
<th>CUUATS TRANSIMS Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation Coefficient</td>
<td>0.88</td>
<td>0.88</td>
<td>0.901</td>
</tr>
<tr>
<td>Percent Diff Reg. Wide</td>
<td>5%</td>
<td>12%</td>
<td>4.3%</td>
</tr>
</tbody>
</table>
Model Calibration and Validation

Building the Future...Together!
Model Sensitivity Analysis

Building the Future...Together!
# Model Sensitivity Analysis

<table>
<thead>
<tr>
<th>Roadway</th>
<th>24-Hour Volume</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Estimated</td>
</tr>
<tr>
<td></td>
<td>Observed (Year)</td>
<td>(TRANSIMS Output)</td>
</tr>
<tr>
<td>I-57 South of Curtis Road</td>
<td>28,980 (2005)</td>
<td>29,586</td>
</tr>
<tr>
<td>I-57 North of Curtis Road</td>
<td>28,980 (2005)</td>
<td>29,749</td>
</tr>
<tr>
<td>Curtis Road to I-57 SB</td>
<td>650 (2009)</td>
<td>692</td>
</tr>
<tr>
<td>I-57 NB to Curtis Road</td>
<td>750 (2009)</td>
<td>2,011</td>
</tr>
<tr>
<td>I-57 SB to Curtis Road</td>
<td>1,370 (2009)</td>
<td>1,105</td>
</tr>
<tr>
<td>Curtis Road to I-57 NB</td>
<td>1,375 (2009)</td>
<td>1,760</td>
</tr>
<tr>
<td>Curtis Road E of I-57 Ramps</td>
<td>No data</td>
<td>2,916</td>
</tr>
<tr>
<td>Curtis Road W of I-57 Ramps</td>
<td>No data</td>
<td>1,613</td>
</tr>
</tbody>
</table>
4-Step TDM and TRANSIMS

4 Step Model

- Trip Generation
- Trip Distribution
- Mode Choice
- Traffic Assignment

TRANSIMS

- Population Synthesizer
- Activity Generator
- Router
- Microsimulator

Feedback
4-Step TDM and TRANSIMS

• The cost of four-step travel model software packages is the biggest initial cost for a small sized MPO.

• Skill development for software operation (training) and maintenance costs are also significant, e.g. typical yearly maintenance fee is around $5,000.

• TRANSIMS is available free of cost, but it requires strong GIS capabilities.

• TRANSIMS training and maintenance are also available free of cost.
Opportunities for Future Work

- Developing travel models for small sized MPOs in Illinois which do not have a travel demand model in place by considering both Track 1 implementation and integrating other Population Synthesizer and Activity Generator models blended with the Router and Microsimulator modules.

- Utilizing the TRANSIMS travel model for emergency evacuation planning for small urbanized areas.

- Addition of transit component with the current TRANSIMS based model for Champaign-Urbana Urbanized Area.
Thank You!

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Questions?