Sub-Area Analysis Using TransCAD

A summary of recent applications and the techniques employed

Kentucky Model Users Group

October 3, 2007
Sub-Area Analysis Using TransCAD

- When is Sub-Area Modeling Required?
- Sub-Area Analysis Options
- Review of Some Recent TransCAD Sub-Area Projects
- TAZ and Network Considerations
- Trip Table Disaggregation
- Sub-Area Validation
- Forecasting Options
When is a sub-area model required?

- Detailed answers needed (turning movements, etc.)
- Main model’s structure is too coarse
- Main model is not validated for time of day
- Validation of main model is poor in the sub-area
- Involves a peripheral area in the main model
Sub-Area Analysis Options

Which way to go?

- Existing metro/regional model – Just add detail
- Stand-Alone Sub-Area Model
- Nested Sub-Area Model

- Simulation – a special case
  - May or may not need detailed sub-area model to get to a reliable simulation
Sub-Area Analysis Options

Every study has unique requirements …

- Consider the available modeling resources
  - Is the metro/regional model accurate and up-to-date?
  - Do its outputs match your study’s needs?
    - Do you need time-of-day assignments?
    - Do you need truck loadings?
Sub-Area Analysis Options

Every study has unique requirements …

- Consider how the model outputs will be used …
  - Simple traffic forecasts
  - Detailed hourly intersection analysis
  - Other performance measures to be generated
  - Additional analysis (e.g., benefit-cost)
  - Planning issues to be addressed …
    - Land use changes?
    - Network changes?
    - Both?

- Consider the schedule and budget

- Choose the approach that meets the study’s needs
Recent Projects

- I-69 Tier 2 EIS Corridor Model
- Akron, Ohio Seasons Rd Interchange
- Angola, Indiana US 20
- LaPorte, Economic Development Corridor Feasibility Study
- North Vernon, Indiana US 50
- Nashville, Tennessee Whitehouse Rd Interchange
- King City, California Annexation Study
- Gonzales, California General Plan Update
- Del Rey Oaks, California Development Impact Study
- Bentonville, Arkansas, 8th Street Corridor & Interchange
- Memphis RPO, Tennessee, SR 206 Extension
## Recent Projects: The Option Taken

<table>
<thead>
<tr>
<th>Study Name</th>
<th>Add Detail to Existing Model</th>
<th>Separate Sub-Area Model</th>
<th>Nested Sub-Area Model</th>
<th>Microsimulation</th>
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<tbody>
<tr>
<td>I-69 Tier 2 EIS</td>
<td>Indiana</td>
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<td>X</td>
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<tr>
<td>Akron, Seasons Rd. Interchange</td>
<td>Ohio</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>US 20 Angola</td>
<td>Indiana</td>
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<td></td>
<td></td>
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<td>Laporte (2)</td>
<td>Indiana</td>
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<td>X</td>
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<td>US 50 North Vernon</td>
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<td>Nashville, Whitehouse Rd. Interchange</td>
<td>Tennessee</td>
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<td>King City, Annexation and Growth Study</td>
<td>California</td>
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<td>Gonzales, General Plan Update</td>
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<td>Del Rey Oaks, Regional Traffic Impact Study</td>
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<td>8th Street Corridor and Interchange, Bentonville</td>
<td>Arkansas</td>
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<td>X</td>
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<tr>
<td>SR 206 Extension, Memphis RPO</td>
<td>Tennessee</td>
<td></td>
<td>X</td>
<td></td>
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</tbody>
</table>

(1) Model networks and trip tables converted from MINUTP to TransCAD
(2) Some model networks and trip tables converted from EMME2 to TransCAD
Define the Study Area Carefully
- Cover areas that are relevant to the planning issues
- Include areas where alternatives will have some effects

Consider the Available Data
- GIS data for roadways and required attributes
- Land use data (parcels, imagery, ES202 data, Census, etc.)
- Obtain and review the traffic data

Network Considerations
- Include everything if practical
- Avoid unrealistic collector intersection turning movements
- Consider using the TransCAD’s new Multi-Point Assignment

TAZ Considerations
- Design with traffic loading in mind
- Design with knowledge of the land use types
TAZ and Network Considerations

- Indiana I-69 Nested Corridor Model Example

Statewide Model: 32,000 Miles & 4,700 TAZs

Corridor Model: 18,000 Miles & 4,300 TAZs
TAZ and Network Considerations

- Akron Example
TAZ and Network Considerations

Akron Example

Original Model’s Zone System
TAZ and Network Considerations

Akron Example

Sub-area Model’s Zone System
TAZ and Network Considerations

Akron Example

Sub-area Model’s Network, all roads were included
**TAZ and Network Considerations**

Why include all roads?

- Because you can! Almost unlimited GIS mapping capabilities are available.
- Improves visualization / mapping quality.
- Captures the subtle, but very real shortcuts through the maze.
- Improves the realism of turning movements; traffic is diffused through local roads realistically. Should avoid unrealistically “blowing out” turning movements.
- Potential set-up for simulation.
Trip Table Disaggregation

- Use TransCAD sub-area tool
  - Via user interface, for separate sub-area model
    - Be leery. It works, but not practical for a serious study of multiple alternatives
  - Via GISDK language, for nested sub-area model

- Generate sub-area TAZ trips
  - Duplicate main model’s trip generation equations
  - Use ITE trip rates

- Trip disaggregation methods
  - Control to main model’s O-D trip totals is possible
  - Or, use new trip totals but distribute using main model trips

- Or, Incorporate Sub-Area TAZs into main model
  - Trips are generated and distributed with main model
**Trip Disaggregation**

Akron Example

*ITE Trip Generation used for Sub-Area Zones to disaggregate main model’s O-D flows*

<table>
<thead>
<tr>
<th>TAZ 556 TRIP DISAGGREGATION</th>
<th>2030 Build Seasons Road</th>
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<tbody>
<tr>
<td><strong>AMATS TAZ</strong></td>
<td><strong>SUB AREA TAZ</strong></td>
<td><strong>DWELLING UNITS</strong></td>
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<tr>
<td>556</td>
<td>5560</td>
<td>515</td>
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<tr>
<td>556</td>
<td>5561</td>
<td>57</td>
</tr>
<tr>
<td>556</td>
<td>5562</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>574</td>
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</table>

<table>
<thead>
<tr>
<th>2030 No Build</th>
<th></th>
</tr>
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*ITE Peak Hour trips are only used to create the percentage of trips by sub area traffic zone to disaggregate AMATS TAZ to TAZ trips*
Sub-Area Validation

Option 1: Manually validate the sub-area model
- adjust centroid connectors
- adjust link attributes (capacity, speed, BPR parameters)
- adjust time of day factors
- incorporate special generators

Option 2: Create a synthetic validation using ODME
- start with a disaggregated sub-area base trip table
- run TransCAD’s ODME to estimate a new base trip table

Option 3: Add detail to main model and validate
- same process as general model validation
Forecasting Options

- **When adding detail to existing model**
  - simply run the model

- **When using a nested model**
  - model run will automatically run the main model, disaggregate the future trip table to the sub area zones, and assign flows

- **When using an ODME base trip table**
  - Option 1: for each O-D pair take difference between base trips and future trips and add to ODME base trips
  - Option 2: for each O-D pair take factor between base and future and multiply by ODME base trips
  - Option 3: for each O-D pair take factor between base and ODME base and multiply by future trips
  - Option 4: use an assumed growth factor
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  - **Option 4**: use an assumed growth factor
Forecasting Options

ODME - Option 1: Modeled Growth Difference Method

Model Base = 10 trips
Model Future = 100 trips
ODME Base = 15 trips

ODME Future:
(100-10) + 15 = 105 trips
Forecasting Options

- When adding detail to existing model
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  - Option 4: use an assumed growth factor
Forecasting Options

ODME - Option 2: Modeled Growth Factor Method

Model Base = 10 trips
Model Future = 100 trips
ODME Base = 15 trips

ODME Future:
(100/10) * 15 = 150 trips
**Forecasting Options**

- **When adding detail to existing model**
  - simply run the model

- **When using a nested model**
  - model run will automatically run the main model, disaggregate the future trip table to the sub area zones, and assign flows

- **When using an ODME base trip table**
  - **Option 1**: for each O-D pair take difference between base trips and future trips and add to ODME base trips
  - **Option 2**: for each O-D pair take factor between base and future and multiply by ODME base trips
  - **Option 3**: for each O-D pair take factor between base and ODME base and multiply by future trips
  - **Option 4**: use an assumed growth factor
Forecasting Options

ODME - Option 3: Redistribution Factor Method

Model Base = 10 trips
Model Future = 100 trips
ODME Base = 15 trips

ODME Future:
(15/10) * 100 = 150 trips
Forecasting Options

- **When adding detail to existing model**
  - simply run the model

- **When using a nested model**
  - model run will automatically run the main model, disaggregate the future trip table to the sub area zones, and assign flows

- **When using an ODME base trip table**
  - **Option 1:** for each O-D pair take difference between base trips and future trips and add to ODME base trips
  - **Option 2:** for each O-D pair take factor between base and future and multiply by ODME base trips
  - **Option 3:** for each O-D pair take factor between base and ODME base and multiply by future trips
  - **Option 4:** use an assumed growth factor
**Forecasting Options**

**ODME - Option 4: Simple Growth Factor Method**

- **Model Base** = 10 trips
- **Model Future** = n/a
- **ODME Base** = 15 trips

**ODME Future:**

\[ 15 \times 2.0 = 30 \text{ trips} \]
many thanks!