Modeling Handbook and Standards

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presented by
Cambridge Systematics, Inc.

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Introductions

Jay Evans, P.E., AICP – Principal with our Travel Demand Forecasting (TDF) Group

Smith Myung – Senior Associate with TDF Group

Barbara Sloan, P.E. – Principal with our Transportation Planning and Management (TPM) Group
Agenda

- Purpose of Travel Demand Modeling (TDM) handbook
- Project scope
- Goals for today
- Potential topic areas
- Brief breakout session with smaller groups
- Reconvene and summarize input from breakout session
- Next steps
Purpose of TDM Handbook

Why develop a handbook?

» Produce easy to reference guidelines for developing, validating, and applying travel demand models
» Provide a resource for public agency staff and consultants
» Share and encourage good practices from across the state
Project Steps

1. Project scope and input
2. Incorporate comments and develop annotated outline
3. Prepare draft handbook
4. Present draft for 2nd round of comments
5. Incorporate comments and finalize handbook
Assemble and Review Data Sources

- Acquire documentation for existing models
- Review recent publications and other materials
- State and Federal regulations
- Identify common Federal, state, and local data sources
## Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Month</th>
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<tbody>
<tr>
<td>Task 1. Assembly and Review of Potential Resources</td>
<td>1</td>
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<tr>
<td>Task 2. Prepare Annotated Outline for Handbook</td>
<td>2</td>
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<tr>
<td>Task 3. Prepare Draft and Final Handbook</td>
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<td>Task 4. Outreach Support</td>
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Goals for Today

- Refine topic areas for the handbook
- Breakout into smaller groups and discuss priorities
- Summarize findings
Modeling in West Virginia

- WVDOT Modeling and Visualization Unit – support MPOs on regionally significant projects
- MPOs – maintain and apply models for daily planning activities
Potential Topic Areas

Data development for travel modeling

» Input data
  • Networks
  • TAZs
  • Socioeconomic data – population (e.g., West Virginia University Bureau of Business and Economic Research) and employment

» Surveys – household, external, truck, visitor, special generator

» Census data

» Traffic counts and transit ridership data

» Emerging data source (e.g., cell phone, GPS devices)
Potential Topic Areas

Model validation process and standards

» Definition – process of checking models to ensure their results are reasonable and properly sensitive to changes in input data

» Guidelines and standards – FHWA Travel Model Validation and Reasonableness Manual

» Other: estimation, calibration, assertion
Potential Topic Areas

Trip generation

» Practice

• Trip production and attraction models – types, formulations
• Trip purposes – minimum categories, common extensions

» Validation

• Data – household surveys; National Household Travel Survey (NHTS)
• Compare trip rates or parameters from other regions
Potential Topic Areas

Trip distribution

» Practice
  • Model forms – gravity models, destination choice models
  • Example on next slide

» Validation
  • Data - Household surveys and CTPP for home-based work trips
  • Checks - Average trip length by trip purpose; area-to-area trip flows
### Potential Topic Areas

Acceptable and recommended practice identification allows flexibility.

Small and Large geography identification allows further flexibility.

<table>
<thead>
<tr>
<th>Component</th>
<th>Acceptable</th>
<th>Recommended</th>
<th>Large</th>
<th>Large</th>
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<tbody>
<tr>
<td>Model form</td>
<td>Gravity model</td>
<td>Gravity model</td>
<td>Gravity model</td>
<td>Destination choice model</td>
</tr>
<tr>
<td>Impedance measure</td>
<td>Highway travel time</td>
<td>Highway travel time</td>
<td>Highway travel time</td>
<td>Composite impedance that includes transit (if market is large) and any other significant modes</td>
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<tr>
<td>Income segmentation</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes for HBW</td>
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<tr>
<td>Singly versus doubly constrained</td>
<td>Singly or doubly constrained</td>
<td>HBW: Doubly or singly constrained. Other purposes: Singly constrained</td>
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*Note: Recommended characteristics are subject to resource constraints such as data availability and budget.*
Potential Topic Areas

- External travel modeling
  - External-Internal (EI) trips
  - Internal-External (IE) trips
  - External-External (EE) trips
Potential Topic Areas

Mode choice*

» Practice
  • Model form – logit models, diversion curves
  • Modes: automobiles, transit, and non-motorized

» Validation
  • Data – household travel surveys, onboard survey, transit ridership data, national sources
  • Validation checks – mode shares, modeled transit trip length

* Current West Virginia models do not include this model, but adding it could provide additional decision support where transit investment is under consideration
Potential Topic Areas

Trip assignment

» Highway assignment practice
  • Assignment algorithm – multipath or equilibrium assignment
  • Time periods – daily or daily: AM, PM, and Off-peak
  • Speed volume relationships – Akcelik, BPR, Conical

» Transit assignment practice (if transit is represented in model)

» Validation
  • Data – traffic counts, speed data, and HPMS
  • Checks – VMT by link group, screenlines and cutlines, $R^2$, RMSE
Potential Topic Areas

Feedback loops, convergence, and related checks

» Description

• Feeding back travel times that are outputs from the highway assignment process to be used as inputs in earlier model steps

» Procedures

• e.g., set of number of iterations versus defined convergence criteria
Potential Topic Areas

Truck and freight modeling

» Practice

• Trucks – as a component of MPO models
• Freight – statewide freight models (similar to 4-step models); direct commodity tables

» Validation

• Data – commercial vehicle surveys, vehicle registration data, classification counts, commodity flow data (e.g., TRANSEARCH)
• Checks – truck trip generation, truck trip distribution, and assignment
Potential Topic Areas

Application and analysis

» Developing model outputs for presentation
  • Traffic volumes, highway speeds and travel times, total travel demand

» Using model results for planning applications
  • Corridor and subarea analysis
  • Air quality conformity analysis (e.g., using MOVES)
  • Evaluation of transportation system performance
  • Project prioritization and performance measures

» Maintaining linkage with PROVIS for long-range transportation plans
Potential Topic Areas

Other topic areas?
Breakout Session
Breakout Session Objective

- Identify missing topics of high importance
- Rate the topics based on priority for developing and/or sharing West Virginia guidance and experiences
  - Essential topic areas (high priority)
  - Important, but not essential (medium priority)
  - Non-essential topic areas (low priority)

(Try to assign each rating to one-third of topics)
Summary from Breakout Session
Breakout Session Summary

- Additional topics identified
- Common high-priority topics
Next Steps

- Develop annotated outline that will become the framework for the handbook
- Develop draft handbook
- Provide opportunities for stakeholder input at key intervals
- Incorporate comments and finalize draft
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