Advanced Travel Models

Florida Model Task Force

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Frederick W. Duca

National Center for Smart Growth

Agenda

- Need for Advanced Models
- Characteristics of Advanced Models
- Comparison with existing Models
- Paths to Advanced Models
- Issues
- Experience
Need for Improved Models

- Current Models can not address
  - Road pricing
  - Time specific policies
    - Parking
    - Tolling
    - HOV
  - Speeds, volumes
  - Traffic operations improvements

Need for Improved Models - Continued

- Non-motorized travel
- Peak spreading
- Goods movement
(Source NCHRP – 288)
What is Needed

- Better representation of demand
  - Tours vs. trips
  - Disaggregate, household or individual vs. zones

- Better Network Representation
  - Continuous time representation vs. peak and off peak
    - Ability to integrate operational changes

Comparisons of Current and Advanced Models (Demand Side)

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<thead>
<tr>
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<th>Current Model</th>
<th>Advanced Model</th>
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<tr>
<td>Analytical Unit</td>
<td>Trips between TAZ pairs</td>
<td>Individuals’ activity-travel patterns</td>
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<td>Demand Categorization</td>
<td>Trip purpose</td>
<td>Activity type</td>
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<td>Spatial Distribution</td>
<td>Gravity model</td>
<td>Activity location choice</td>
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<td>Travel Mode</td>
<td>Trip mode split</td>
<td>Tour mode choice</td>
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<td>Time-of-Day</td>
<td>Trip time-of-day split</td>
<td>Activity timing and duration</td>
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### Comparisons of Current and Advanced Models (Supply Side)

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<td>Analytical Unit</td>
<td>Aggregated vehicle trips between TAZ pairs</td>
<td>Each vehicle with its driver/passengers</td>
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<td>Time Period</td>
<td>Multiple hours</td>
<td>Second-by-second</td>
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<td>Travel Time Estimation</td>
<td>Volume-delay function/v/c ratio</td>
<td>movement of individual vehicles</td>
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<tr>
<td>Assignment Method</td>
<td>Time-independent static assignment</td>
<td>Time-dependent dynamic assignment</td>
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### Comparison of Current and Advanced Models-Feedback

**Current Models**
- Travel times between zones
- Response - Change
  - destination
  - mode

**Advanced Models**
- Travel times
- Tours which can not be easily accomplished
- Response - Change
  - tour destination(s)
  - tour mode
  - departure time
  - activity schedule
  - Stay home
Paths to Reach the Advanced Model (from demand side)

1. Population Synthesis
2. Activity-based Model to Estimate Individual’s Travel Demand
3. Individual’s Travel Demand Aggregated to OD Trip Tables
4. Time-Independent Static Traffic Assignment

Paths to Reach the Advanced Model (from supply side)

1. TAZ-level Population Update
2. Trip-based Model to Estimate TAZ-level Travel Demand (OD Trip Tables)
3. TAZ-level Travel Demand Disaggregated by Time-of-day
4. Time-dependent assignment
The Advanced Model

Population Synthesis

Activity-based Model to Estimate Individual’s Travel Demand

Time-dependent Dynamic Traffic Assignment

ACTIVITY ADJUSTMENTS:
- Trip Cancellation
- Destination Change
- Trip Chaining (Simple/Complex)
- Departure Time (Peak/Off-Peak)
- Mode Shift (Auto/Transit/Bike/Walk)

Congested Travel Time/Speed/Delay/Toll Value (e.g., ETLs)

Route Diversion due to Congestion

Advanced Model Issues

- Run time
- Staff availability
- Data
- Presenting Results
Issues with Advanced Models- Run Time

- **Current Models**
  - Demand – Zones or zones squared
  - Network – Links

- **Advanced Models**
  - Demand – households/people
  - Network – vehicles/people/time steps

- **Computer capability**
  - Speed continues to improve
  - Algorithms improve
  - Multiprocessing capability

Issues With Advanced Models – Staff Availability

- **Current Status**
  - Most still familiar with four step

- **Future**
  - Improving as MPOs move to advanced models
  - Graduate schools teaching new methods
Issues with Advanced Models - Data

- Activity data for demand analysis
- More detailed land use data
- Traffic operations
  - When operations issues are modeled

Issues with Advanced Models – Presenting Results

- Demand
  - Tours more complex than trips
- Network
  - Can not produce v/c ratios >1
  - Visualizations powerful tool
    - But
  - Difficult to compare visualizations
Experience with advanced models - Demand

- **Implemented**
  - Columbus
  - Sacramento
  - New York
  - San Francisco County

- **Planned**
  - Atlanta
  - Dallas
  - Seattle
  - Denver
  - San Diego
  - Portland
  - Los Angeles

Experience with Advanced Models - Network

- Chicago – experimental, Argonne Labs
- Burlington, VT
- Buffalo, NY
- Southern California (Moreno valley)
- New Orleans
- Sacramento
- Austin
- El Paso
- Champaign-Urbana, Illinois
Integrating Demand and Supply

- Burlington, VT
- Jacksonville, FL
- Sacramento, CA
- Columbus, OH

Jacksonville Advanced Model

- Activity Based Demand Models
  - Operate at parcel level
  - Forecast in 30 minute time slices
  - Allocate down to closest minute
- Time-Dependent Traffic Assignment
  - Operate at sub-TAZ level (activity locations for TRANSIMS)
  - LOS feedback at 5–15 minute level
  - Allocate second-by-second
- Dynamically integrate analysis of activities, networks and environment
  - Behaviorally detailed (VOTs, reliability)
  - Spatially detailed (small scale improvements)
  - Temporally detailed (reflect variations in supply and demand)