Dynamic Traffic Assignment in FSUTMS

presented to
MTF Model Advancement Committee

presented by
Vladimir Majano, Florida Department of Transportation
Mohammed Hadi, Florida International University

May 26, 2010
Outline

- Introduction to DTA
- Upcoming DTA Project
DTA

- DTA uses time-variant travel demands, travel time, route choice, incident conditions, and traffic control

- Most current DTA implementations utilize simulation-based approaches
Why DTA

• Travel time is a critical factor in demand forecasting
  • Static models use average or steady state travel-time on a link
  • $V/C$ can be larger than 1.0 in static models

• Static models cannot model effectively congested conditions and spillbacks

• DTA provides better representations of driver behaviors (multiple user classes)
Why DTA?

DTA can provides better assessments of:

- Traffic control
- ITS
- Construction and incident impacts
- Managed lanes and congestion pricing
- Integrated corridor management
- Travel demand management (TDM)
**Why DTA?**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>DTA Tools</th>
<th>Static</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Variant</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Traffic Model</td>
<td>Simulation</td>
<td>Analytical</td>
</tr>
<tr>
<td>Spillback/Queuing</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Volume Exceeds Capacity</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Incident/Construction</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Traffic Control</td>
<td>Yes</td>
<td>Yes (analytical)</td>
</tr>
<tr>
<td>ITS Impacts</td>
<td>Some</td>
<td>Sketch planning tools</td>
</tr>
<tr>
<td>Pricing/HOT lanes</td>
<td>Yes</td>
<td>Yes (Level of Sensitivity to congestion)</td>
</tr>
<tr>
<td>Traveler information</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>ICM</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Traffic Model Types

- **Macroscopic models** use analytical equations that relate traffic measures to each other.

- **Microscopic models** simulate the movement of individual vehicles based upon car-following, lane changing and gap-acceptance theories.

- **Mesoscopic models** represent individual vehicles but vehicle movements are simulated using simplified car-following or traffic flow theories without describing detailed inter-vehicle interactions (e.g. lane changing or gap acceptance).
DTA Issues (1)

- Fine-grained trip matrix estimation and calibration of the model are critical steps
- Data and coding requirements
  - Traffic counts and speeds
  - Signal control and ITS
  - Network features (e.g., turn bays, zone connections, etc.)
  - Travel behavior and responses
- Interaction of O-D estimation and calibration processes
- Calibration takes longer time
DTA Issues (2)

- Take more time and resources to construct and calibrate
  - Models need to be computationally efficient
  - Purchase more powerful computers?
- Limited experience. Need to verify existing tools for some applications
- Staff and training
- Most existing DTA models focus on route choice
  - No time of trip shifts
  - Limited attempts to integrate mode choice
DTA Issues (3)

- Need for preprocessing and post processing tools
- Mesoscopic model assessment of traffic operations (such as weaving, merging, diverging, signal control, etc.) is not as detailed as microscopic models
  - Increased interest in three or two level simulation
FHWA DTA Survey (85 respondents)

<table>
<thead>
<tr>
<th>What applications would you consider using DTA for?</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridor management</td>
<td>44</td>
<td>57%</td>
</tr>
<tr>
<td>Work zone management</td>
<td>20</td>
<td>26%</td>
</tr>
<tr>
<td>Congestion management</td>
<td>51</td>
<td>66%</td>
</tr>
<tr>
<td>Value pricing</td>
<td>45</td>
<td>58%</td>
</tr>
<tr>
<td>Regional modeling</td>
<td>61</td>
<td>79%</td>
</tr>
<tr>
<td>Replacing static assignment in long-range planning</td>
<td>50</td>
<td>65%</td>
</tr>
<tr>
<td>Air quality Analysis</td>
<td>29</td>
<td>38%</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>8%</td>
</tr>
</tbody>
</table>

• Observations
  • Congested corridors are the drivers
  • Both operations and planning issues are emphasized
  • Emerging policy issues (e.g. pricing)
FHWA DTA Survey (85 respondents)

Observations:
- Less 30% considered themselves an experienced DTA user
- These include those who actually have false understanding of DTA, examined through other questions in the survey aimed at testing their knowledge about DTA
Use of Dynamic Traffic Assignment in FSUTMS in Support of Transportation Planning in Florida

- New FDOT Research Center project will start soon
- Will be conducted by FIU and Citilabs
- Goal is to develop a DTA process within the FSUTMS environment that will allow the modelers to utilize this process in all or some of the demand and performance forecasting steps
- In addition to transportation planning offices, traffic operations offices will benefit from this project
Task1: DTA Review

Review and assessment of existing literature on DTA modeling and existing off-the-shelve DTA tools
Task 2: Requirements

- Workshop will be conducted to determine the requirements for DTA modeling as part of the travel demand forecasting process in Florida.
- Ideally, the Workshop will be scheduled during an MTF meeting.
- Results from this workshop will be a set of requirements that will be used as an input to future tasks of this project.
Task 3: Assessment of Existing Tools

- Selected tools will be assessed in details with close examination of their abilities to meet Florida DTA requirements
Task 4: Integration of DTA in FSUTMS

- One or more DTA tool will be selected for the integration with the FSUTMS, depending on the results of Tasks 1 to 3.

- Modifications will be made to the tools to meet requirements
Task 5: Development and Calibration Support

- Task will identify the data required to support the DTA modeling and sources to provide the data.

- Task will develop tools for automating the process of extracting data from sources and for filtering, cleaning, grouping, and summarizing the data.

- Task will include identification and/or development of procedures and tools needed to estimate dynamic short period interval O-D matrices and to support the calibration of DTA applications.
Task 6: Testing the Developed Environment

- Testing of the developed DTA environment and tools within the FSUTMS framework will be conducted to ensure that they perform as expected.
Task 7: Workshop and Documentation

• Final report and a web-based workshop