Agenda

- Need for Analytical Tools
- Overview of Analysis Methods for Planning and Operations
- Key Properties of Dynamic Traffic Assignment Methods
- TRB Study Findings
- Integrated Model Linkages with DTA
- Closing Thoughts
SAFE TEA-LU Requires Plans to…

“Include Operational & Management Strategies to Improve Performance of Existing Transportation facilities, Relieve Vehicular Congestion & Maximize the Safety & Mobility of people & goods.” [1]

Developing SMART Operations Objectives

Operations Objectives Included in an MPO Plan are developed collaborative by planning partners to reflect regional values:

Specific. Sufficient to guide Approaches
Measurable. Quantitative Measurement
Agreed. Consensus among Partners
Realistic. Can be Accomplished
Time-bound. Identified time-frame for Accomplishment
<table>
<thead>
<tr>
<th>Fact Sheet Title/Page Number</th>
<th>Operations Objective</th>
</tr>
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<tbody>
<tr>
<td></td>
<td><strong>System Efficiency</strong></td>
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| **Extent of Congestion**     | • Reduce the percentage of facility miles (highway, arterial, rail, etc.) experiencing recurring congestion during the peak period by X percent by year Y.  
                              | • Maintain the rate of growth in facility miles experiencing recurring congestion as less than the population growth rate (or employment growth rate).  
                              | • Reduce the share of major intersections operating at LOS F by X percent by year Y. |
| **Duration of Congestion**   | • Reduce the daily hours of recurring congestion on major freeways from X to Y by year Z.  
                              | • Reduce the number of hours per day that the top 20 most congested roadways experience recurring congestion by X percent by year Y. |
| **Intensity of Congestion (Travel Time Index)** | • Reduce the regional average travel time index by X percent per year. |
| **Travel Time**              | • Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y.  
                              | • Improve average travel time during peak periods by X percent by year Y. |
| **Delay**                    | • Reduce hours of delay per capita by X percent by year Y.  
                              | • Reduce hours of delay per driver by X percent by year Y. |
| **Energy Consumption**       | • Reduce total energy consumption per capita for transportation by X percent by year Y.  
                              | • Reduce total fuel consumption per capita for transportation by X percent by year Y.  
                              | • Reduce excess fuel consumed due to congestion by X percent by 2020. |
Role of Analysis Tools for Planning and Operations

Analytical Support for Improved decision making

• Set priorities among competing projects
• Consistent approach for comparing alternatives
  – “Balanced” comparison for programming projects
  – Impacts, benefits, and costs of construction & operations strategies considered
• Provides data to support planning needs
• Forecasts future operations resource needs
• Provides benefit information that can be communicated to agency management, politicians, and the traveling public
How Analysis Tools Support the Planning Process

- Regional Vision and Goals
- Alternate Improvement Strategies
  - Operations
  - Capital
- Evaluation & Prioritization of Strategies
- Development of Transportation Plan (LRP)
- Development of Transportation Improvement Programs (S/TIP)
- Project Development
- Systems Operations (Implementation)
- Monitor System Performance (Data)
Congestion Management in the U.S.

- Travel demand is on the rise
- Traffic congestion is increasing
- Financial constraints are a reality
- Reduce traffic congestion by bringing supply and demand into alignment
- Active Traffic Management (ATM) is one of the operational strategies to manage congestion
Operational Strategies

Improving the efficiency of the transport system by:

- Providing real-time, multi-modal information
- Predicting travel times
- Active traffic management
- Traffic management centers
- Parking management
- Improved public transport
- Managing large-scale events and emergencies
- Highway reconstruction mitigation

Sources: ATAC, Schreffler, Hull, AVV
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<th>Increased throughput</th>
<th>Increase capacity</th>
<th>Decrease in primary incidents</th>
<th>Decrease in secondary incidents</th>
<th>Decrease in incident severity</th>
<th>More uniform speeds</th>
<th>Decreased headways</th>
<th>More uniform driver behavior</th>
<th>Increased trip reliability</th>
<th>Delay onset of freeway breakdown</th>
<th>Reduction in traffic noise</th>
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</table>
Key Considerations for Selecting Analysis Tools

Analysis Context:
Planning, Design, or Operations/Construction

1 Geographic Scope
- Isolated Location
- Segment
- Corridor/Small Network
- Region

2 Facility Type
- Isolated Intersection
- Roundabout
- Arterial
- Highway
- Freeway
- HOV Lane
- HOV By-pass Lane
- Ramp
- Auxiliary Lane
- Reversible Lane
- Truck Lane
- Bus Lane
- Toll Plaza
- Light Rail

3 Travel Mode
- SOV
- HOV (2, 3, 3+)
- Bus
- Rail
- Truck
- Motorcycle
- Bicycle
- Pedestrian

4 Management Strategy
- Fwy Mgmt
- Arterial
- Incidents Mgmt
- Emerg Mgmt
- Work Zone
- Special Event
- APTS
- ATIS
- Electronic Payment
- RRX
- CVO
- AVCSS
- Weather Mgmt
- TDM

5 Traveler Response
- Route Diversion
  - Pre-Trip
  - En-Route
- Mode Shift
- Departure Time Choice
- Destination Change
- Induced/Foregone Demand

6 Performance Measures
- LOS
- Speed
- Travel Time
- Volume
- Travel Distance
- Ridership
- AVO
- v/c Ratio
- Density
- VMT/PMT
- VHT/PHT
- Delay
- Queue Length
- # Stops
- Crashes/Duration
- TT Reliability
- Emissions/Fuel
- Noise
- Mode Split
- Benefit/Cost

7 Tool/Cost Effectiveness
- Tool Capital Cost
- Effort (Cost/Training)
- Ease of Use
- Popular/Well-Trusted
- Hardware Requirements
- Data Requirements
- Run Time
- Post-Processing
- Documentation
- User Support
- Key Parameters
- User Definable
- Default Values
- Integration
## Integrating Planning and Operations
### Categories of Tools

<table>
<thead>
<tr>
<th>Transportation Planning Needs</th>
<th>Sketch Planning Tools</th>
<th>Deterministic Models</th>
<th>Travel Demand Forecasting Models</th>
<th>Simulation</th>
<th>Archived Operations Data</th>
<th>Traffic Signal Optimization Tools</th>
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</table>
Sketch-Planning Tools

Provide quick order of magnitude estimates with minimal input data in support of preliminary screening assessments

• Typically depend on behavioral assumptions

Examples

• Sketch
  – SCRITS
  – Quickzone
  – Turbo Architecture
  – Cal B/C
  – Simple spreadsheets

• Hybrid
  – IDAS
Cal-B/C Demo
Parameters

This page contains all economic values and rate tables. To update economic values automatically, change "Economic Update Factor."

### General Economic Parameters
- **Year of Current Costs for Model:** 
  - Value: 2023
- **Economic Update Factor:** 
  - Value: 5.0
- **Real Discount Rate:** 
  - Value: 3.0

### Highway Operation Parameters
- **Minimum TOC Ratio:** 
  - Value: 1.0
- **Percent ADT in Average Peak Hour:** 
  - Value: 2.0
- **Cheapest Lane (per kilometer):** 
  - Value: 2.0
- **Capacities (per lane):** 
  - Value: 2.0

### Travel Time Parameters
- **Average Hourly Wage:** 
  - Value: $16.71
- **Value of Time:** 
  - Value: $1.00
- **Operating Cost:** 
  - Value: $2.95

### Operating Cost Parameters
- **Fuel Cost Per Gallon (Includes Taxes):** 
  - Value: $2.95
- **Non-Fuel Cost Per Mile:** 
  - Value: $0.12

### Accident Cost Parameters
- **Cost of a Fatality:** 
  - Value: $3,147,469
- **Cost of Injury:** 
  - Value: $157,359
- **Cost of Highway Accident:** 
  - Value: $2,682,459

### Project Types

### Operating Cost Tables

### Accident Tables

### Fuel Consumption Rates (gallons/vehicle)

<table>
<thead>
<tr>
<th>Event</th>
<th>Pass Train</th>
<th>Light Rail</th>
<th>Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

### Cost of Transit Accident Events (in millions)

<table>
<thead>
<tr>
<th>Event</th>
<th>Pass Train</th>
<th>Light Rail</th>
<th>Bus</th>
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### Rates for Transit Accident Events (per million vehicles)

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<th>Event</th>
<th>Pass Train</th>
<th>Light Rail</th>
<th>Bus</th>
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<tbody>
<tr>
<td></td>
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</table>

### Transit Accident Costs (in thousands)

<table>
<thead>
<tr>
<th>Event</th>
<th>Value</th>
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<tbody>
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<td></td>
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</table>

### Passing Lane Accident Reduction Factors

<table>
<thead>
<tr>
<th>Event</th>
<th>Value</th>
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<tbody>
<tr>
<td></td>
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</table>

Advantages
• Low cost
• Fast analysis times
• Limited data requirements
• View of the “big picture”

Challenges
• Limited in scope, robustness, and presentation capabilities
• Results constrained by quality of input data
Travel Demand/Forecasting Models

Estimates the regional traffic impact of changes in travel demand or system capacity

Examples

- Travel Demand Models
  - TRANPLAN
  - EMME/2
  - Cube
  - TransCAD
- Hybrid
  - IDAS (post-processor)

Source: IDAS
Trip vs. Activity [Tour] Based Models

• Trip based models represent the state of the practice in travel modeling

• Activity models developed or under development in many large US cities

• Key advantages of activity based models:
  • Disaggregate treatment of household activities
  • Representation of household interactions
  • Tours in lieu of trips
  • Improved behavioral realism
  • Greater policy sensitivity
Regional network models limited in their ability to:

- Reflect oversaturated conditions
- Understand the time-dependent characteristics of congestion
- Represent impacts of bottlenecks on downstream links
- Understand how reliability impacts route choice (and other) decisions
• Used to estimate the benefits and costs of ITS/operational deployments
• Hybrid between sketch planning tool and travel demand model
• Originally developed in 2000 for FHWA
### Performance Summary

**Project:** Metro ITS Plan, ITS Option(s): Transit ATS

#### Vehicle Miles of Travel

<table>
<thead>
<tr>
<th>By: Facility Type</th>
<th>Arterial</th>
<th>Expressway</th>
<th>Freeway</th>
<th>Ramp</th>
<th>Transit</th>
<th>Total</th>
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<tbody>
<tr>
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<td>655,452</td>
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<td>63,390</td>
<td>3,018</td>
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<td>828,300</td>
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<td>-287 (-0.4%)</td>
<td>-11 (-0.4%)</td>
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#### Vehicle Hours of Travel

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<tr>
<th>By: Facility Type</th>
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<th>Expressway</th>
<th>Freeway</th>
<th>Ramp</th>
<th>Transit</th>
<th>Total</th>
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<td>1,794</td>
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<td>710</td>
<td>1,791</td>
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<td>43,405</td>
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<td>Difference (%)</td>
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#### Average Speed

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#### Person Hours of Travel

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#### Number of Trips

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#### Number of Fatality Accidents

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<td>1.9604E+04</td>
<td>2.5266E+04</td>
<td>4.76E+02</td>
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<td>ITS Option</td>
<td>4.9102E+03</td>
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<td>Difference (%)</td>
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<td>1.142E-06 (-2.2%)</td>
<td>1.457E-07 (-0.1%)</td>
<td>1.006E-05 (-0.4%)</td>
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#### Number of Injury Accidents

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<td>1.120E+00</td>
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<td>ITS Option</td>
<td>1.0265E+00</td>
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<td>4.570E+02</td>
<td>1.116E+00</td>
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<td>Difference (%)</td>
<td>2.75E-03 (-0.4%)</td>
<td>1.669E-04 (-2.2%)</td>
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#### Number of PDO Accidents

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<tr>
<td>Control Alternative</td>
<td>1.4387E+00</td>
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<td>7.5733E+02</td>
<td>1.5763E+00</td>
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*Explanations: data does not include cold-start amounts*
Advantages
• Validated models available for most metro areas
• Evaluation of the regional impacts
• Consistent with current planning practices

Challenges
• Limited ability to analyze operational strategies
• High initial costs
Deterministic Methods

Analyzes the performance for small segments of the transportation system

- Capacity, speed, delay, queuing
- Typically based on the HCM

Examples

- Highway Capacity Software (HCS)
- Traffix
FDOT’s Generalized Service Volume Tables

...provide estimates of maximum service volumes for various types of road facilities

...represent average roadway conditions for an area; not representative of any single roadway

...allow analysts to quickly and easily compare volumes to estimate LOS
### TABLE 1

Generalized Annual Average Daily Volumes for Florida's Urbanized Areas

<table>
<thead>
<tr>
<th>Class I (2.00 or more signalized intersections per mile)</th>
<th>Lanes</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Unsignalized</td>
<td>15,400</td>
<td>16,500</td>
<td>***</td>
<td></td>
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<tr>
<td>3 Signalized</td>
<td>29,300</td>
<td>35,500</td>
<td>36,700</td>
<td>***</td>
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<tr>
<td>4 Signalized</td>
<td>43,000</td>
<td>55,700</td>
<td>57,300</td>
<td>***</td>
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<tr>
<td>5 Signalized</td>
<td>60,800</td>
<td>71,800</td>
<td>73,800</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td><strong>Class II (0.00 to 1.39 signalized intersections per mile)</strong></td>
<td>Lanes</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>2 Unsignalized</td>
<td>10,500</td>
<td>15,200</td>
<td>16,000</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>3 Signalized</td>
<td>25,800</td>
<td>35,800</td>
<td>35,100</td>
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<td></td>
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<tr>
<td>4 Signalized</td>
<td>39,000</td>
<td>50,300</td>
<td>53,100</td>
<td>***</td>
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<tr>
<td>5 Signalized</td>
<td>53,100</td>
<td>67,300</td>
<td>70,900</td>
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#### FREEWAYS

<table>
<thead>
<tr>
<th>Lanes</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>44,500</td>
<td>63,800</td>
<td>79,300</td>
<td>***</td>
</tr>
<tr>
<td>6</td>
<td>67,200</td>
<td>95,400</td>
<td>118,800</td>
<td>122,700</td>
</tr>
<tr>
<td>8</td>
<td>91,000</td>
<td>128,000</td>
<td>158,000</td>
<td>166,000</td>
</tr>
<tr>
<td>10</td>
<td>113,700</td>
<td>161,600</td>
<td>197,900</td>
<td>209,200</td>
</tr>
<tr>
<td>12</td>
<td>155,200</td>
<td>213,000</td>
<td>252,200</td>
<td>252,500</td>
</tr>
</tbody>
</table>

**Freeway Adjustments**

- Auxiliary Lanes: +20,000
- Ramp Metering: +5%
- Oversaturated Conditions*: -10% of E

---

[Link to FDOT website]

2009 FDOT QUALITY/LEVEL OF SERVICE HANDBOOK
### Deterministic Methods: Strengths, Limitations

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Quickly predict impacts for an isolated area</td>
<td>• Limited ability to analyze broader network impacts</td>
</tr>
<tr>
<td>• Widely accepted</td>
<td>• Limited performance measures</td>
</tr>
</tbody>
</table>
Travel Demand Model: Adoption of HCM relationships

Regional Model

- Traffic signal timing data
- Intersection data
- Arterial segment data
- Segment capacities
- Adjust operations parameters

HCM-implementing software (ARTPLAN)

Database (file conversion)
Traffic Signal Optimization Tools

Analyze delay and identify optimum signal phasing and timing plans for isolated intersections or small signal systems

Examples
- PASSER
- TRANSYT-7F
- Synchro
# Traffic Signal Optimization: Strengths, Limitations

## Advantages
- Effective tool for testing plans prior to field implementation
- Proven operational benefits

## Challenges
- Limited ability to analyze broader network impacts
- Calibration process can be difficult/time consuming
Sources

- Surveillance equipment on freeways
- Probe vehicles
- Cell phone tracking
- Toll tags
- Third-party providers

Data types

- Travel times
- Volumes
- Lane occupancies
Quantitatively understand traffic conditions and bottlenecks

Data sources:

- Freeway Performance Monitoring System (PeMS)
- MTC 511 system
- Caltrans Highway Congestion Monitoring Program (HICOMP)
- Caltrans Traffic Accident Surveillance and Analysis System (TASAS)
- Historical probe vehicle runs and traffic counts
Mobility: Delay

Average Daily Vehicle Hours of Delay (@60mph)

Hour of the Day

- 2006 Weekday
- 2005 Weekday
- 2004 Weekday
Simulation Methods

Macroscopic
- Simulation of flow, speed, and density made on a segment-by-segment basis
- Examples: FREQ, PASSER, Transyt-7F, VISTA

Mesoscopic
- Hybrid model where dynamic estimation of individual vehicles based on average segment speeds
- Examples: DYNASMART-P/DynusT, DynaMIT-P, TransModeler, TRANSIMS

Microscopic
- Simulates detailed movement of individual vehicles throughout the network
- Examples: CORSIM, Paramics, VISSIM, AIMSUN, TransModeler
Spatial Resolution

Aggregate

Detailed
Simulation Methods: Strengths, Limitations

Advantages
• Network-based
• Detailed results, particularly microsimulation
• Dynamic analysis of incidents and real-time diversion patterns
• Visual presentation opportunities
• Reuse for future analyses

Challenges
• Demanding data and computing requirements, particularly microsimulation
• Calibration may be time consuming for larger, more complex, or congested networks
“Despite all of these advantages, very few of the study participants believed their micro simulation studies were cost-effective. They almost always agreed that the tool answered the study questions and influenced the design decisions, and they plan to do similar studies in the future because they see no viable analysis alternative. But from the perspective of cost-effectiveness, they found the time and cost of developing and applying microscopic simulation models to be excessive.”

Dynamic Traffic Assignment

DTA is emerging as a practical tool for numerous planning and operational applications

- Addresses both the short- and long-term impact of operation plans and strategies at the investment and regional/systems level
- Capable of reflecting true capacity constraints on upstream and downstream system performance over time
  - Better equipped (than) macroscopic models to evaluate the effectiveness of operations alternatives
- Can interface with signal optimization, macro, and microscopic models
  - Ideal analysis scale for corridor studies
## TRB Study: Resolution

<table>
<thead>
<tr>
<th>Decision Criteria</th>
<th>Criteria Value Options</th>
<th>Macroscopic Simulation</th>
<th>Mesoscopic Simulation</th>
<th>Microscopic Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Regional</td>
<td>Yes</td>
<td>Maybe</td>
<td>Rarely</td>
</tr>
<tr>
<td></td>
<td>Corridor</td>
<td>Yes</td>
<td>Yes</td>
<td>Maybe</td>
</tr>
<tr>
<td></td>
<td>Subarea</td>
<td>Maybe</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Network Size</td>
<td>Large (&gt; 10K Links, &gt; 3K Nodes, &gt; 1,000 Zones)</td>
<td>Yes</td>
<td>Maybe</td>
<td>Rarely</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>Yes</td>
<td>Yes</td>
<td>Maybe</td>
</tr>
<tr>
<td></td>
<td>Small (&lt; 1K Links, &lt; 400 Nodes, &lt; 100 Zones)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Time Periods</td>
<td>24 Hours</td>
<td>Yes</td>
<td>Maybe</td>
<td>Rarely</td>
</tr>
<tr>
<td></td>
<td>6 Hours</td>
<td>Yes</td>
<td>Yes</td>
<td>Maybe</td>
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<tr>
<td></td>
<td>Peak Period</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Peak Hour</td>
<td>Maybe</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Demand</td>
<td>Large (&gt; 1 M vehicles)</td>
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<td>Maybe</td>
<td>Rarely</td>
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<tr>
<td></td>
<td>Intermediate</td>
<td>Yes</td>
<td>Yes</td>
<td>Maybe</td>
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<tr>
<td></td>
<td>Small (&lt; 200k vehicles)</td>
<td>Yes</td>
<td>Yes</td>
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## TRB Study: Analysis Capabilities

<table>
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<tr>
<th>Decision Criteria</th>
<th>Criteria Value Options</th>
<th>Macroscopic Simulation</th>
<th>Mesoscopic Simulation</th>
<th>Microscopic Simulation</th>
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<tbody>
<tr>
<td>Performance Measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Required Accuracy</td>
<td>&lt; 15 Minutes</td>
<td>Rarely</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td>15 Minutes – 1 Hour</td>
<td>Maybe</td>
<td>Yes</td>
<td>Maybe</td>
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<tr>
<td></td>
<td>&gt; 1 Hour</td>
<td>Yes</td>
<td>Maybe</td>
<td>Rarely</td>
</tr>
<tr>
<td>Analysis Dimension</td>
<td>Vehicle/Person-Based</td>
<td>Rarely</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td>Link-Based</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td>Path-Based</td>
<td>Rarely</td>
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<td>Yes</td>
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<tr>
<td></td>
<td>Network-Based</td>
<td>Yes</td>
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<td>Yes</td>
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# TRB Study: Resources

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<th>Decision Criteria</th>
<th>Criteria Value Options</th>
<th>Macroscopic Simulation</th>
<th>Mesoscopic Simulation</th>
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<td>Yes</td>
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<tr>
<td></td>
<td>&lt; 2</td>
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<td>$250K-$1M</td>
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<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td>&lt;$250K</td>
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<td>Yes</td>
<td>Maybe</td>
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<td>Time Deadlines</td>
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<td>4-12 Months</td>
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<td>Maybe</td>
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<tr>
<td></td>
<td>&lt; 4 Months</td>
<td>Yes</td>
<td>Maybe</td>
<td>Rarely</td>
</tr>
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## TRB Study: Model Capabilities

<table>
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<tr>
<th>Decision Criteria</th>
<th>Criteria Value Options</th>
<th>Macroscopic Simulation</th>
<th>Mesoscopic Simulation</th>
<th>Microscopic Simulation</th>
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<tbody>
<tr>
<td>Animation</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Weaving/Merging</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Queuing/Shock Waves</td>
<td>No</td>
<td>Somewhat</td>
<td>Yes</td>
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<tr>
<td>Link-Based Flow Model</td>
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<td>Yes</td>
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<td>Lane-Based Flow Model</td>
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<td>Signals</td>
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<td>Yes</td>
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<tr>
<td>Sign Control</td>
<td>No</td>
<td>Somewhat</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

San Francisco DTA Model
Dynamic Performance Measures

DTA Predicted Volume Differences and Diversions

Travel Time Changes

Golden gate Bridge to ParkPresido/Geary

- Base
- Phase I
- Phase II

Travel Time (seconds)

Time of Day

10 minutes
7 minutes
4 minutes
DTA Methods and Integrated Corridor Management

Analysis, Modeling, and Simulation (AMS) Methodology

- Regional Travel Demand Model
  - Trip Generation
  - Trip Distribution
  - Mode Choice
  - Trip Assignment
  - Trip Table
  - Network
  - Other Parameters

ICM Interface
- Peak Spreading
- Network Resolution
  - Refined Trip Table (Smaller Zones and Time Slices)
  - Refined Network

Meso- and/or Micro-simulation
- Dynamic Assignment
- Pivot Point Mode Choice
- Refined Transit Travel Times

Convergence?
- Yes
- No

Enhanced Performance Measures
- VMT/VHT/PMT/PHT
- Travel Time/Queues Throughput/Delay
- Environment
- Safety

Benefit Valuation

Outputs
- Benefit/Cost Analysis
- Sensitivity Analysis
- Ranking of ICM Alternatives

User Selection of ICM Strategies

Cost of Implementing ICM Strategies
“The peer exchange participants .. viewed the ultimate goal as a suite of integrated modeling tools that support regulatory requirements and studies representing a broad spectrum of spatial and temporal fidelity…(and)… should include macroscopic, mesoscopic, and microscopic components that share common data and work together to support the analytical needs within the region.”

Integrated Models in Atlanta

Georgia Department of Transportation (GDOT)

- In cooperation with Atlanta Regional planning partners

Radial Freeway Strategic Improvement Plan

- Interstate System Plan (outside Atlanta region)
- I-285 Study
- Downtown Connector Study

Objective

- Identify and analyze impacts of operational strategies
- Use innovative modeling tools to overcome limitations of traditional forecasting methods
Integrated Model Platform

- Macro-Level
  - ARC 20 County TDM
- Meso-Level
  - 20 County dTA model
- Micro-Level
  - Corridor VISSIM models
Improved Forecasting Using DTA Methods

Macro-Level

- Traffic forecasting models and microsimulation models do not integrate well
  - Demand models have flexible capacity constraint
  - Microsimulation models have fixed capacity constraint

Source: Improving the Application of Existing Methods to Advance Transportation Operations: Two Case Studies of Microsimulation Applications (Dowling et al, 2009)
Lessons Learned

Demand models may overestimate benefits of bottleneck relief projects
• “Downstream” effects not captured

Practical limitations on OD adjustment
• Labor intensive
• Ad hoc nature of OD adjustments

Simulation model could not cover full extent of congestion
• State agency wanted more analysis
• Local agency could not afford it
Partially Integrated Model

• Refine demand model using DTA methods
  – Create subarea DTA model
  – Estimate subarea OD against counts
  – Apply adjustments to future OD as well
• Export subarea DTA outputs to simulation model
• Feedback congested speeds to subarea DTA model
• Apply peak hour spreading in subarea DTA model
• Re-run microsimulation model
Chained Models, No Integration
• Doing all refinement work in simulation model is expensive
• Resulting in simulation model covering too small an area

Partial Integration
• Doing significant refinement of demand model [using DTA methods] reduced effort needed on simulation
• Improved equilibration between supply and demand
• Simulation model able to cover larger area
Closing Thoughts

• Limitations of traditional Network-Based Models amplified when evaluating operations alternatives
  • Trip assignment is a ‘weak link’ of network models
    – Poor representation of speeds and congestions
• Meso methods (including DTA) provide a suitable level of fidelity for the effective evaluation of operations-based alternatives
  • Ideal temporal and geographic detail for corridor level analysis
  • Also applicable for regional analysis in large-scale networks
  • Retain some important properties of microsimulation methods
  • Can improve existing 4-step models and help enhance the effectiveness of microsimulation models
• Not “just” another tool, but a valuable addition to existing regional models