WRTMAnalysis, Modeling and Performance Evaluation

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Types of Traffic Analysis/Modeling

**Macroscopic** - Analysis of speed, flow and density at an aggregate level

**Mesoscopic** - Dynamic analysis of individual vehicles based on average segment speeds

**Microscopic** - Individual movement of vehicles on the transportation network
Macroscopic Analysis of Wx and Traffic

✓ Ability to model large study areas.
✓ Using the flow, speed, and density measures of a large network, can provide simple representations of traffic behavior in that network.
✓ Does not require detailed data such as driver characteristics, model set up can be done quickly and the analysis can provide results in a timely manner

✗ Cannot model detailed behavior in individual vehicle movements (e.g., saturation headway and lost startup time)
## Macro Analysis of Wx and Traffic

<table>
<thead>
<tr>
<th>Typical Impacts</th>
<th>Weather Event</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rain</td>
</tr>
<tr>
<td>Capacity</td>
<td>-4 to -30%</td>
</tr>
<tr>
<td>Volume</td>
<td>-20%</td>
</tr>
<tr>
<td>Speed at Capacity</td>
<td>-8 to -14%</td>
</tr>
<tr>
<td>Saturation Flow</td>
<td>-2 to -6%</td>
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Microscopic Analysis

✓ Intended to simulate the movement of individual vehicles
✓ Driver behavior data is essential to simulate traffic conditions with the highest accuracy.
✓ Uses car-following models, longitudinal motion models (e.g., acceleration and deceleration models), gap-acceptance models, and lane-changing models.
✓ Allows stochastic analysis of traffic.
✗ Requires substantial amounts of roadway geometry, traffic control, traffic pattern, and driver behavior data, each simulation run can take a very long time to output results.
# Micro Analysis of Wx and Traffic

<table>
<thead>
<tr>
<th>Typical Impacts</th>
<th>Weather Event</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Rain</td>
</tr>
<tr>
<td>Lost startup time</td>
<td>+8 to 32%</td>
</tr>
<tr>
<td>Saturation Headway</td>
<td>+2.5 to 13.2%</td>
</tr>
<tr>
<td>Free-Flow Speed</td>
<td>−2 to −9%</td>
</tr>
<tr>
<td>Gap Acceptance</td>
<td>+2%</td>
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</table>
### Micro Analysis of Wx and Traffic

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Weather Event</th>
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<tbody>
<tr>
<td>Free-flow speed</td>
<td>- 28%</td>
</tr>
<tr>
<td>Speed at Capacity</td>
<td>- 13%</td>
</tr>
<tr>
<td>Capacity</td>
<td>- 46%</td>
</tr>
<tr>
<td>Perception Reaction Time</td>
<td>+13%</td>
</tr>
<tr>
<td>Gap Acceptance</td>
<td>+12%</td>
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</table>
Mesoscopic Analysis of Wx and Traffic

✓ Analyze larger geographic areas than micro analysis while still providing some of the detailed data that macro analysis cannot provide.
✓ Allows for the analysis of road segments, multiple routes within a network, basic signalized intersections, freeways and ramps.
✓ Requires almost as much data as micro and for large geographic regions the data requirements are comparable to those of transportation planning studies.
✗ Some complex traffic features currently cannot be simulated well, such as sophisticated traffic signals.
Meso Analysis using Wx-TrEPS (Simulation Results for I-95 in Maryland)
Performance Evaluation Objectives

• Ensure that the WRTM strategy is having the desired effect and outcomes
• Provide information to prioritize resources and justify future investments
• Provide hard evidence of performance and benefit
• Encourage wider deployment of WRTM strategies serving national transportation goals.
Performance Evaluation Types

- Mobility Analysis
- Safety Analysis
- Traveler/Customer Survey and Analysis
- Agency Performance Analysis
- Benefit-cost Analysis
Performance Evaluation Data

• System Installation/Implementation Details
• System Operations Records
• Traffic Data
• Crash and Safety Data
• Weather Data
• Traveler/Customer Satisfaction Data
• Agency Performance Data
WRTM
Performance Evaluation Tools

• FHWA Transportation Operations B/C Analysis Tool
• Traffic Analysis Tools
• Next Generation Simulation Models
• Traffic Estimation and Prediction Systems
Conclusions/Recommendations

• Weather affects traffic flows at the microscopic and macroscopic levels
• Traffic analysis models exist to account for weather
• Traffic and weather data are available to conduct analyses and develop weather-sensitive traffic models
• Performance analysis needed to evaluate WRTM strategies
• Much research has been done but more is needed to develop and validate models for traffic analysis and performance evaluation of WRTM strategies.