Use of Advanced Microscopic Traffic Simulation for Transportation Planning in Des Moines Area

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Overview

- Background Information
- Initial Development
- Model Description
  - Development
  - Calibration
- Anticipated Use
- Conclusion
Background Information

• Travel demand models (TranPlan, TransCAD, EMME/2) are used by MPOs for planning/policy decisions
• Models aggregate representation of traffic
  – No detailed analysis
• Microscopic simulation models perform a detailed operational analysis
  – Time consuming and data intensive
• MITSIM model was developed for the I-235 reconstruction project in Des Moines Area
Initial Development and Motivation

- MITSIM model was/is used heavily for evaluating the impact of construction activities (route diversions) on I-235 in the Des Moines Area
- MITSIM model network, for I-235, covered almost 50% of the entire TransCAD model network
  - MITSIM’s operational analysis capabilities justified the additional cost to include entire Des Moines Area in the model
MITSIM Model for I-235 Project
**Project Description**

- Enhance the I-235 MITSIM network for the entire Des Moines Area
  - **ALL** major roads
  - **ALL** important traffic signals
- Perform an automated calibration
  - Input sensor data available at 350 locations
  - Output an estimation of time dependent O-D
- Training for Des Moines MPO and Iowa DOT
  - Self sufficiency in running the model in future
New MITSIM Model for Des Moines Area
Model Description

- Peak Hour Model
- Covers majority of Des Moines Area
  - 500 square miles
- One of the largest microscopic simulation model networks
  - 3,500 links, 5,500 segments, and 10,000 lanes
  - 200 actuated signals
  - 15,000 O-D pairs
Model Development

- Large amount of input data
- Coordination with Iowa DOT
  - Network configuration and count data
- Coordination with various cities
  - Signal timing
- Conversion of TransCAD O-D (daily model) to MITSIM O-D (peak hour model)
Calibration

- Complex interdependencies among variables
  - Travel times, driving parameters, and O-Ds
- Individual impacts of variables cannot be separated, therefore,
  - Iterative approach used
- Historical travel times and O-Ds are most important parameters for calibrating a large network
**Calibration of the model**

- MITSIM is the only microscopic simulation model that uses aggregate traffic data (speed, flow, and density) for:
  - Automatic calibration
  - Systematic, optimization-based calibration of defined parameters
  - Joint estimation of time dependent O-Ds
- Calibration is wrapping up
Using MITSIM with TransCAD

• Short term (existing) applications
  – MITSIM will use TransCAD O-Ds as seed O-Ds
  – MITSIM will estimate time dependent O-Ds and calibrate the model to match ground counts

• Applications in future years
  – TransCAD predicts O-Ds and link volumes based on growth, land use, socioeconomic characteristics, and so forth
  – MITSIM will use the O-Ds predicted by TransCAD
  – No O-D estimation in MITSIM
Benefit of Microscopic Simulation and Travel Demand Models for Planning

- Travel demand models’ strengths lie in projecting future O-Ds and link volumes
- Microscopic simulation models’ strengths lie in their ability to perform operational analyses for a large range of scenarios, including ITS applications
- Combined use of microscopic simulation and travel demand models will provide decision makers with additional information
  - Effective decision making for capital investment
Use of MITSIM Model for Operational Planning

• Evaluation of alternatives in a planning mode
  – Geometric design and alternative improvements
  – Route diversion (construction planning)
  – ITS and Incident Management
  – Signal timings

• Special purpose applications
  – Evacuation planning
Conclusion

• Travel demand and microscopic simulation models are being developed for traffic analysis in Des Moines Area
  – TransCAD provides O-Ds and MITSIM performs detailed operational analysis
• A Very Powerful Model System Combination
Conclusion

- Des Moines Area MPO and Iowa DOT staffs have been trained by Jacobs
  - Self sufficient for undertaking new studies
- Growing interest among agencies in Des Moines Area, particularly the Iowa DOT, for application of MITSIM for various transportation system questions