Model and Data Frameworks for Multi-Resolution Analysis

presented to
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Agenda

- State of the Practice
  - Desired Level of Analysis
  - Traditional Analysis Tools
  - New Generation Analysis Tools

- Integrating Planning and Operations

- Multi-Resolution Analysis

- Case Studies
  - Buffalo Urban Simulation Framework
  - Atlanta Radial Freeways
Analysis Tools: Desired Capabilities

- Tool(s) Must be able to represent existing operations of the corridor
- Tool(s) must be able to account for Transit Operations and Improvements, Truck Operations
- Tools must be able to analyze Operational Strategies
- Tools Must be able to Forecast Future operations of the corridor
- Tools must dynamic and demonstrate systems operations

Traditional Analysis Tools

- Regional Travel Demand Models
- Traditional Traffic Operations Analysis Tools
  - Highway Capacity Software (HCS) / Level of Service (LOS)
  - Deterministic Microsimulation Models
    - FREQ
    - Synchro/SimTraffic
    - Corsim
New Generation of Microsimulation Models

- Dynamic Assignment Microsimulation Models
  - Assignment is Based on Origin – Destination
  - Microscopic Simulation of OD Tables
  - Ability to Integrate with Planning Models
  - Time of Day Simulation – Peak Period vs. Peak Hour
  - Multimodal Capabilities – Transit, Parking, Pedestrians
  - Operational Strategies such as ramp metering, signal coordination, ITS
  - Ability to test land use and transportation scenarios

Integrated Planning and Operational Model Capabilities

- Corridor Operations
- Intersection Operations Design Evaluation
- Signal Coordination / Re-timing
- Transit Operations / BRT LRT Mixed Operations
- MOT/MPT/ Diversion Route Planning
- 3D Animation Capabilities
Integrated Approach = Interlinked Performance Measurement, Data and Models

Multi-Resolution Analysis Framework

- Macroscopic travel demand models
  - Analysis of regional travel patterns and mode shift; enhanced by pivot-point mode shift module
- Mesoscopic simulation models
  - Analysis of traveler information, tolling, Special use lanes, congestion pricing and regional diversion
- Microscopic simulation models
  - Analysis of traffic control strategies such as ramp metering and arterial traffic signal coordination
Network Representations in Multi-Resolution Analysis

Multi-Resolution Modeling: Advancing the Practice

Case Study #1: GBNRTC Urban Simulation Framework Demonstration Project
Greater Buffalo-Niagara Regional Transportation Council (GBNRTC)

- Urban Simulation Framework and Guidance

Developing the Regional Simulation Framework

- Software Platform Selection
- Regional Network Development
- Regional Network Calibration
- Application of Framework to Expressway Design Project
**Developing the Regional Simulation Framework**

- **Software Platform Selection Considerations**
  - Dynamic Assignment Capabilities – VISSM, Paramics, Transmodeler
  - Mesoscopic and Microscopic Capabilities – TransModeler
  - Interface Capabilities with Regional Model – TransModeler
  - US Vendor Support – TransModeler, Vissim
  - Import Capabilities of other Regional Modeling Tools and Data – TransModeler
  - Geographic Information Systems (GIS) Based – Transmodeler

- **Regional Network Development**
  - Identify Priority Corridors
  - Data Requirements for Priority Corridors
    - Traffic Volumes
    - Turning Movement Volumes
    - Travel Times
    - Bottleneck Location, Duration and Causality
  - Regional Model/Mesoscopic Model Interface
  - Regional Mesoscopic Model Calibration
    - Capacity Calibration, Route Choice Calibration, Systems Calibration
  - Develop Future Year Condition Regional Network
Urban Simulation Framework

GBNRTC TDM

- TDM Refinement
- Meso-Model Extraction
- Meso Model
  - Refinement
  - Calibration
- Micro-Model Extraction

Planning Level Outputs e.g. Scajaquada
Micro-Area Trip Tables e.g. inputs to Microsim Models
Microsimulation Models e.g. I-290

Urban Simulation Framework

GBNRTC TDM

- TDM Refinement
- Meso-Model Extraction
- Meso Model
- Hybrid Meso/Micro Model e.g. I-290

Planning Level Outputs e.g. Scajaquada

Hybrid Meso/Micro Model e.g. I-290
Develop Operational Analysis Framework

- Regional Framework for Planning Analysis
- Regional Framework for use with other Microsimulation Models
  - Corridor Operations
  - Interchange Operations
  - Signalized Arterial/Downtown Operations
  - Freeway/Expressway Operations
  - Thruway/Toll Facility Operations

Develop Project Analysis Framework and Guidelines

- Project Scoping Guidelines
- Data Collection Guidelines
- Model Development and Calibration Guidelines
- Alternatives Analysis Guidelines
- Reporting and Presentation Guidelines
Application of Framework to NYSDOT Design Project

Mesoscopic Simulation of Regional Diversion Regional Diversion Routes

Framework to provide input to Designers Microsimulation Models

Demonstration of TransModeler Microsimulation to be performed Concurrently for assessment as complete Regional Suite of Model Framework.
Scajaquada Demonstration Microsimulation Extent

I-290 Demonstration Microsimulation Extent
Developing the Framework Guidelines

- Stakeholder Requirements
  - Procedural and Policy Requirements
    - Policy Stakeholders Group
      - Immediate need for scoping and data guidelines
      - Initiation of requirements for agency incorporation of guidelines and framework
      - Identify decision process for deployment and application of guidelines
  - Technical Requirements
    - Technical Stakeholders Group
      - Input on development and analysis guidelines
      - Input application of guidelines for project analysis
      - Input on deployment of framework

Developing the Framework Guidelines (cont.)

- Project Solicitation Guidelines:
  - Project Understanding
  - Methodology
  - Project Personnel
  - Similar Experience
  - Scope of Work
  - Schedule
  - Cost Estimate

- Policy Group – Incorporation of Guidelines into Agency

- Technical Group – Development of Solicitation Guidelines
Developing the Framework Guidelines (cont.)

- Project Development Guidelines:
  - Project Scoping
  - Data Requirements
  - Model Development
  - Model Calibration
  - Scenario/Alternatives Analysis
  - Reporting

- Policy Group – Incorporation of Guidelines into Agency

- Technical Group – Development of Project Guidelines

Multi-Resolution Modeling: Advancing the Practice

Case Study #2: Georgia Department of Transportation: Atlanta Radial Freeways Plan
AM Congested Links

- Ratio extracted after Origin Destination Matrix Extraction Process

PM Congested Links

- Ratio extracted after Origin Destination Matrix Extraction Process
Prominent mainline bottlenecks occurred along area 1 (as marked)

Corresponding V/C ratios were high

The area was extracted for comparison with actual field conditions

AM: On I-75 SB between SR-92 and I-285
  » Queue Length: 12 to 14 miles
  » Est. Speed: 20 to 50 mph

PM: On I-75 NB between the Perimeter and Chastain Rd
  » Queue Length: 12 to 14 miles
  » Est. Speed: 25 to 50 mph
Detailed Skycomp Aerial Survey Reports for Location 1

I-75 N Speed Profile Plot (Area 1)
**Proposed Sub-Area 1**

- North of Barrett Parkway on I-75 and I-575
- South of Cumberland Blvd

**VISSIM Sub-Areas for Analysis**
Multi-Resolution Analysis Tools

- Provide Framework for Consistency:
  - Data / Model Inputs
  - Appropriate level of Analysis
  - Development of Life-Cycle Analysis Tools
  - Consistent Analysis using approved growth patterns

- Enhanced Planning and Operational Analysis Capabilities

- Expensive Data Requirements and Model(s)
  Calibration/Validation

- Lack of Guidance for Mesoscopic/DTA Calibration Requirements