

Cambridge Systematics

Model and Data Frameworks for Multi-Resolution Analysis

presented to

**Traffic Analysis Workshop:
Florida Department of
Transportation, District 4**

presented by

**Cambridge Systematics, Inc.
John Duesing**



July 8, 2011



Transportation leadership you can trust.



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



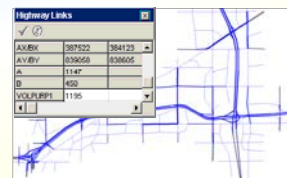
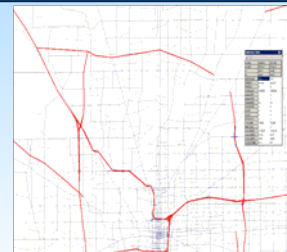
Analysis Tools: Desired Capabilities

- 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



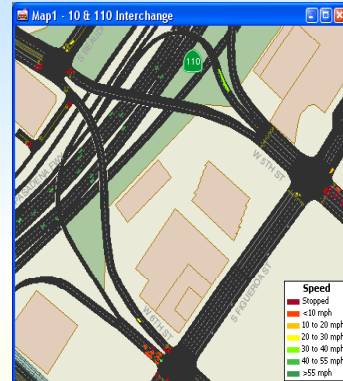
Traditional Analysis Tools

- 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



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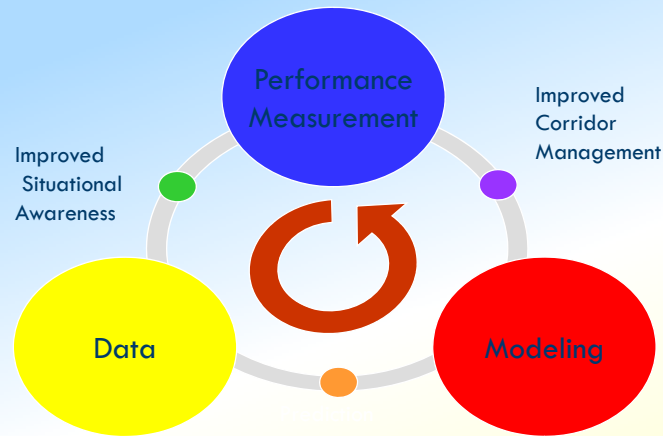
Integrated Planning and Operational Model Capabilities

- **Corridor Operations**
- **Intersection Operations Design Evaluation**
- **Signal Coordination / Re-timing**
- **Transit Operations / BRT LRT Mixed Operations**
- **MOT/MPT/ Diversion Route Planning**
- **3D Animation Capabilities**

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Integrated Approach = Interlinked Performance Measurement, Data and Models



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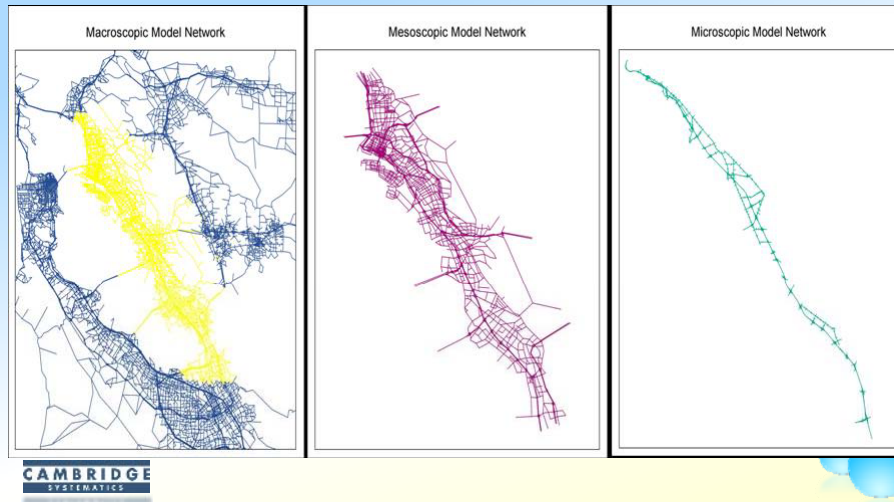
Multi-Resolution Analysis Framework

- **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



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Network Representations in Multi-Resolution Analysis



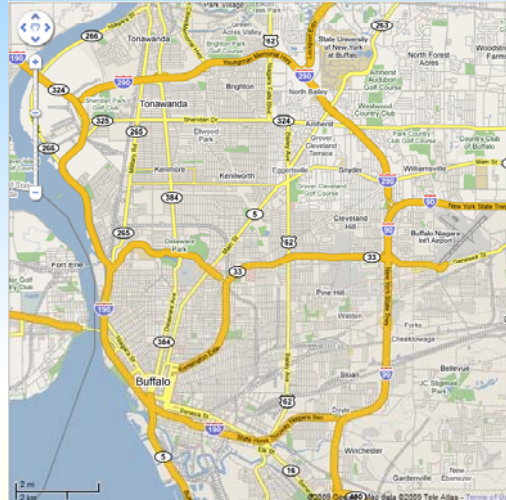
Multi-Resolution Modeling: *Advancing the Practice*

*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 – VISSIM, 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

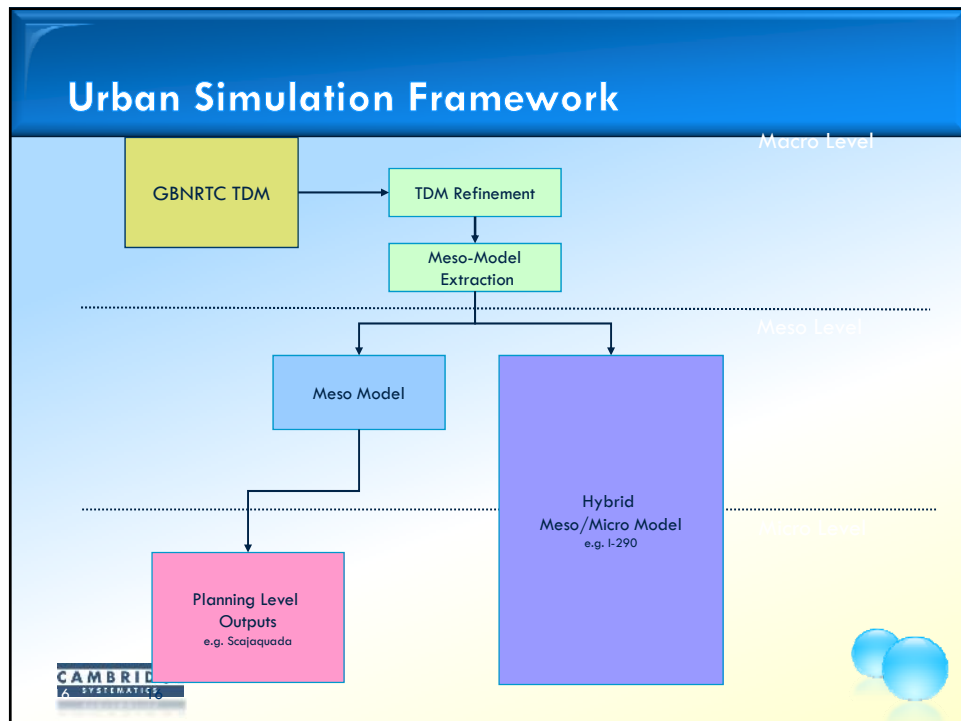
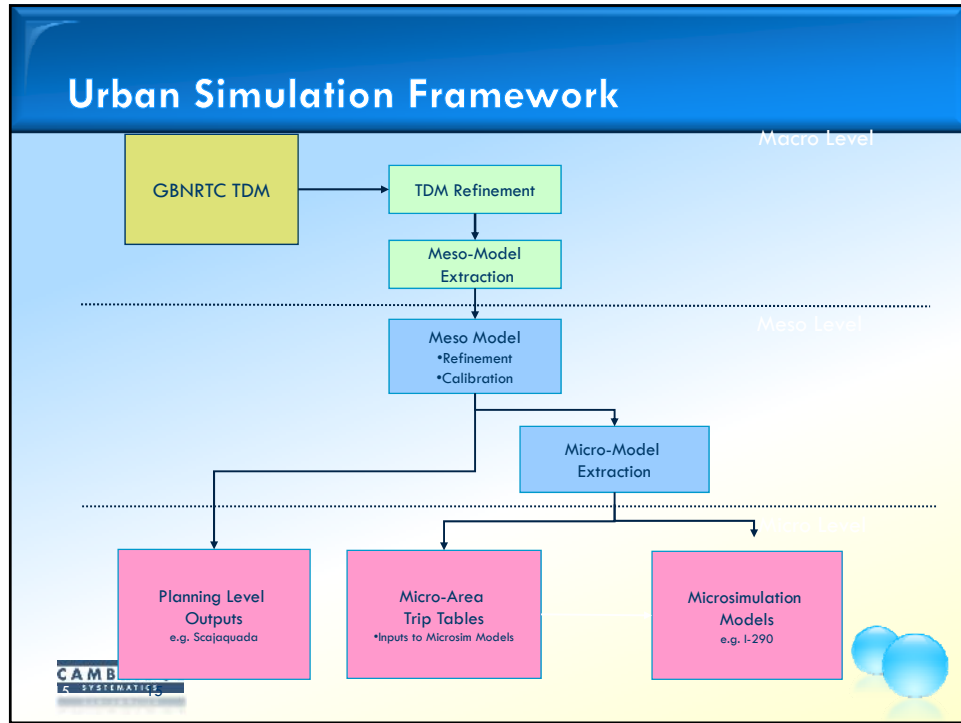


Developing the Regional Simulation Framework

● 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





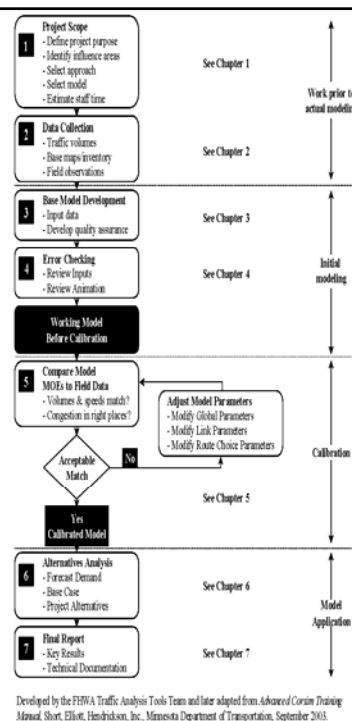
Develop Operational Analysis Framework

- **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**

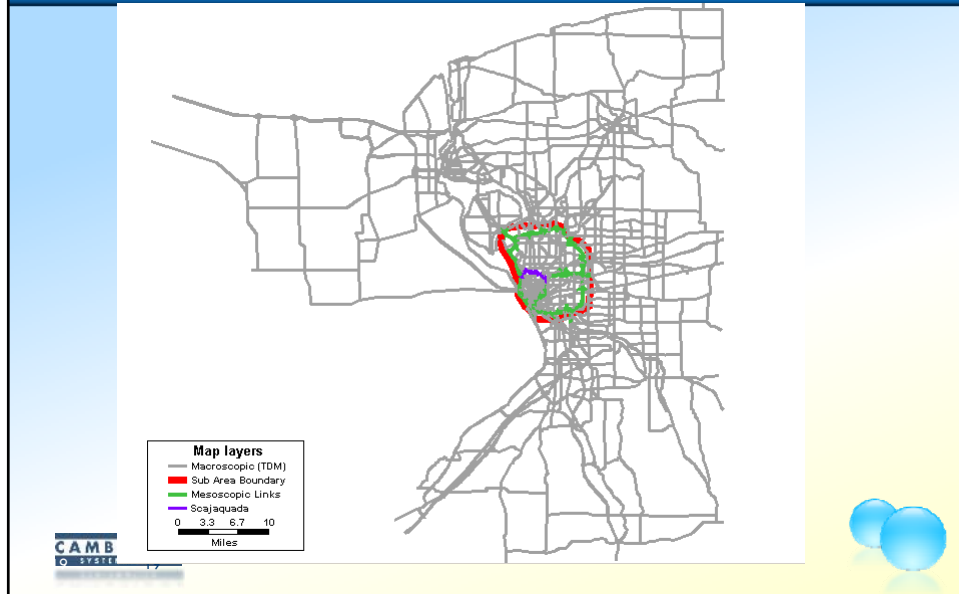


Develop Project Analysis Framework and Guidelines

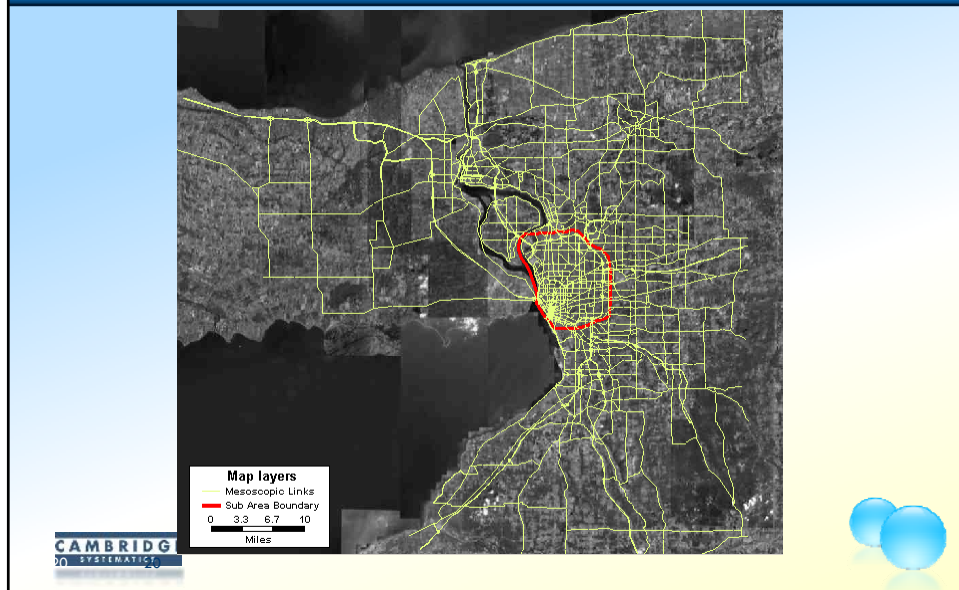
- **Project Scoping Guidelines**
- **Data Collection Guidelines**
- **Model Development and Calibration Guidelines**
- **Alternatives Analysis Guidelines**
- **Reporting and Presentation Guidelines**



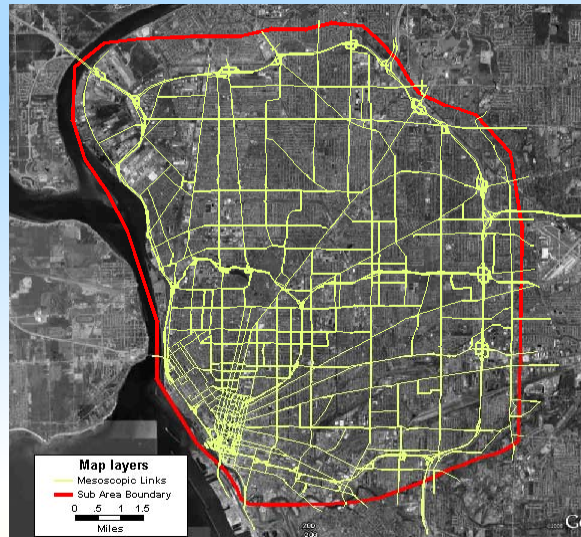
GBNRTC Travel Demand Model Extent



GBNRTC Travel Demand Model Extent



Mesoscopic Model Extent



Scajaquada Corridor Simulation Demonstration Project

- 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



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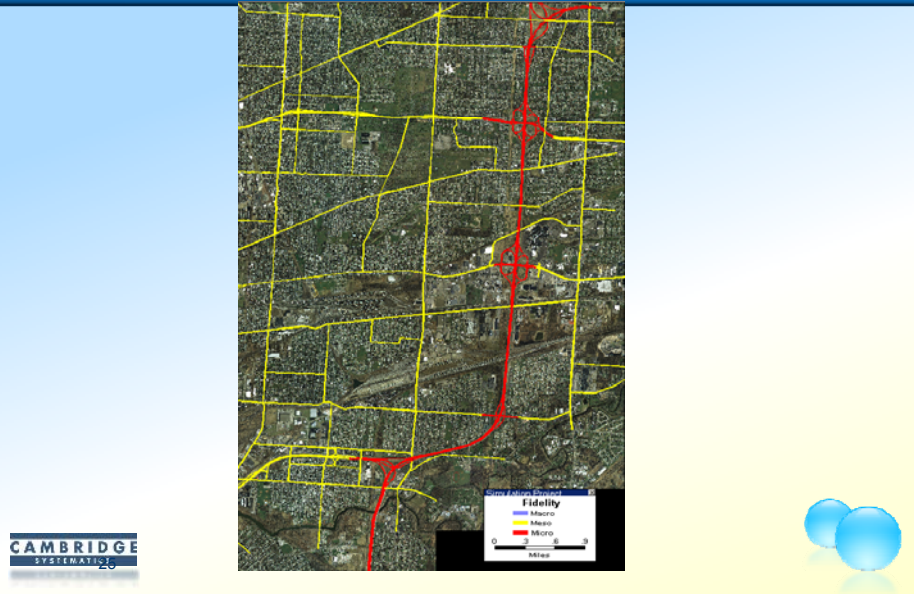
I-290 Demonstration Microsimulation Extent



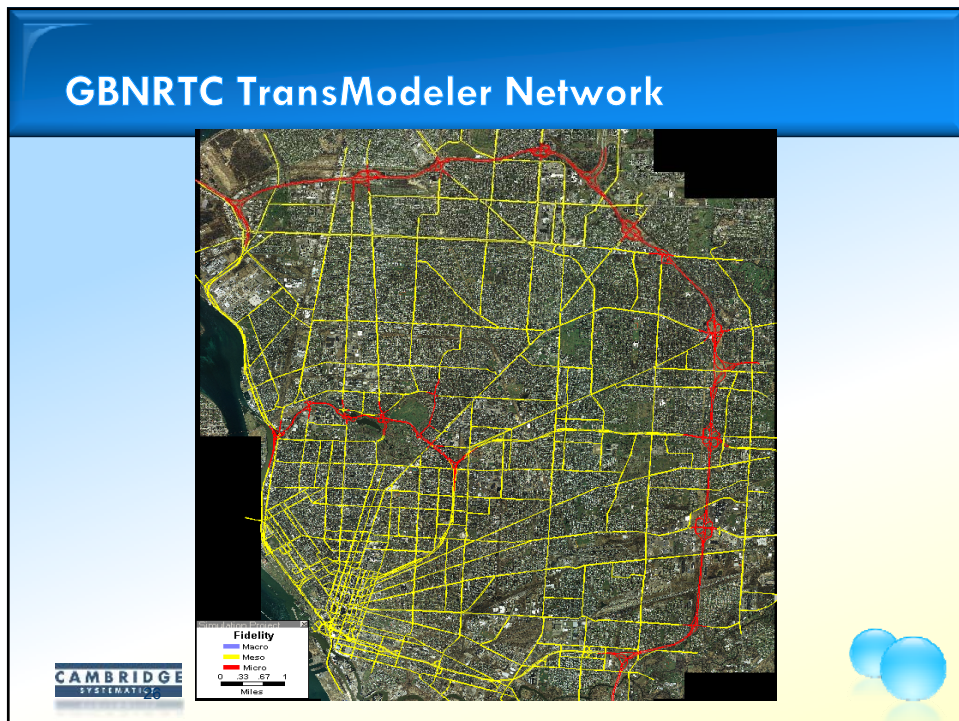
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I-90 Demonstration Microsimulation Extent



GBNRTC TransModeler Network



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*

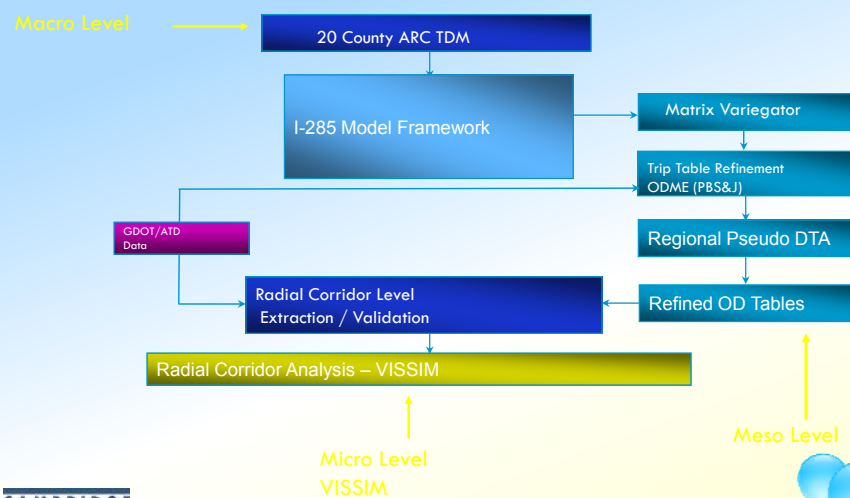
*Case Study #2 : Georgia Department
of Transportation: Atlanta Radial
Freeways Plan*



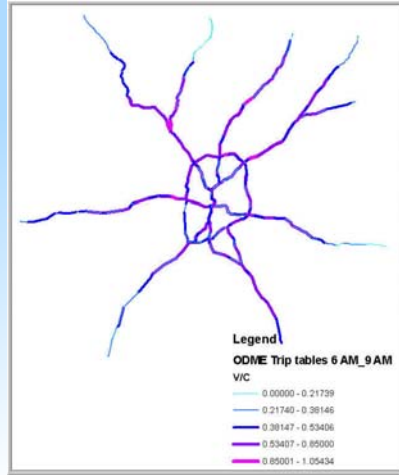
Atlanta Radials Coverage Area



Atlanta Radials Macro/Meso Model Framework



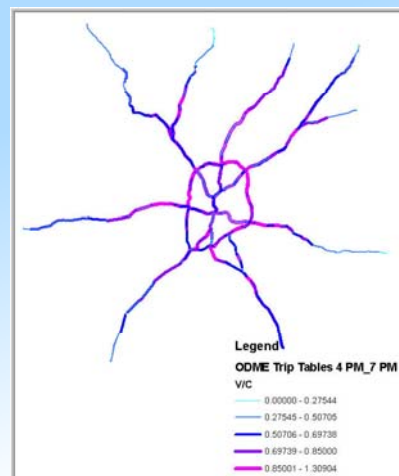
AM Congested Links



- Ratio extracted after Origin Destination Matrix Extraction Process



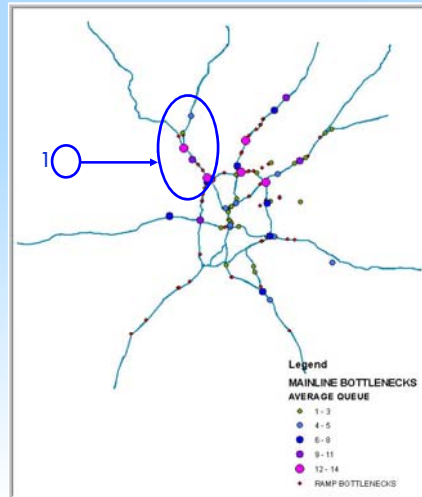
PM Congested Links



- Ratio extracted after Origin Destination Matrix Extraction Process



Skycomp Aerial Survey – Bottleneck Locations

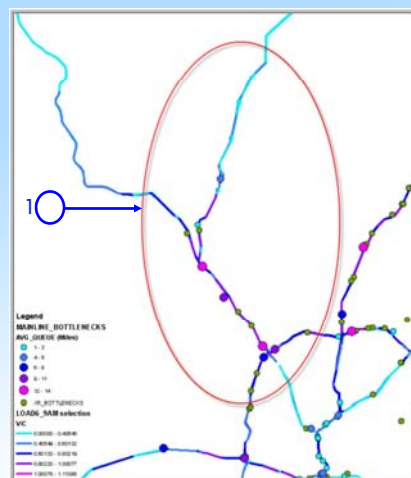


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- Prominent mainline bottlenecks occurred along area 1 (as marked)
- Corresponding V/C ratios were high
- The area was extracted for comparison with actual field conditions



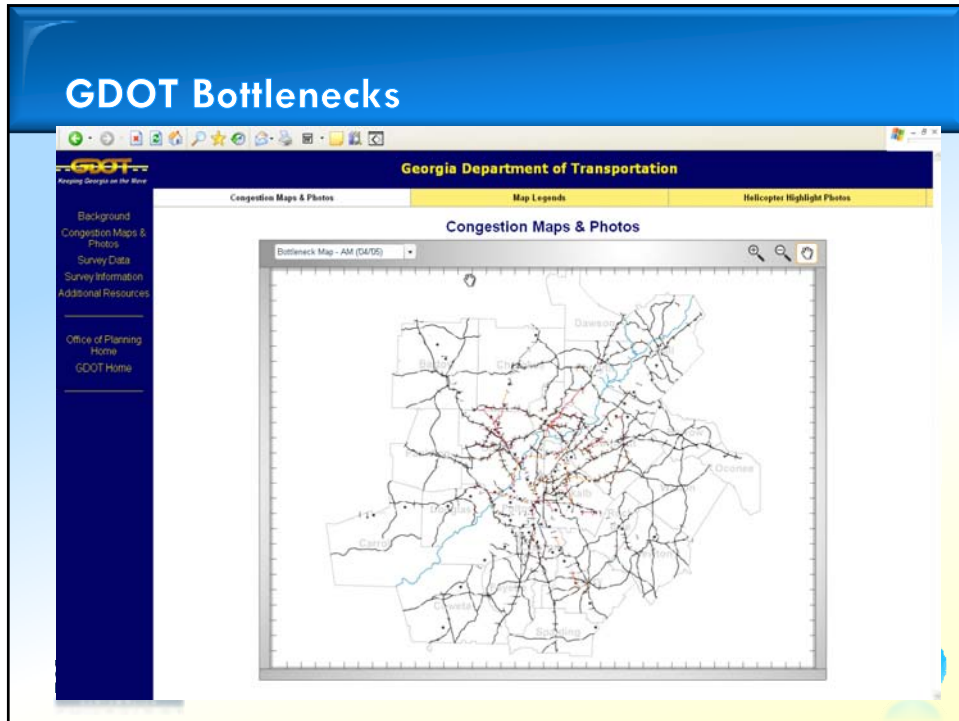
Major Bottleneck Location 1



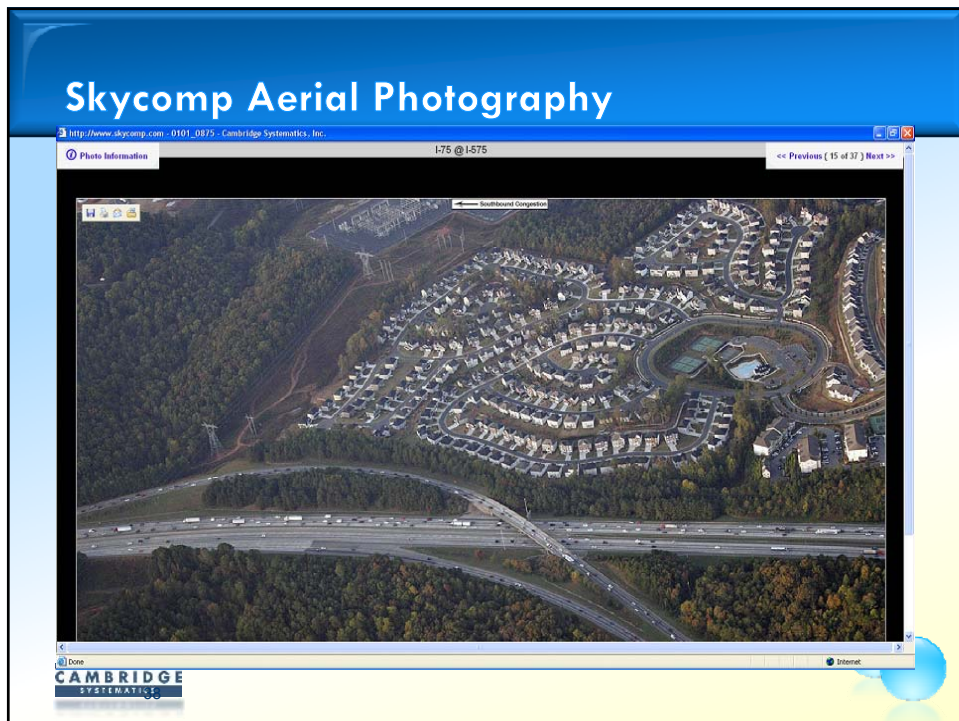
- AM:** On I-75 SB between SR-92 and I-285
 - » Queue Length: 12 to 14 miles
 - » Est. Speed: 20 to 50 mph
- PM:** On I-75 NB between the Perimeter and Chastain Rd
 - » Queue Length: 12 to 14 miles
 - » Est. Speed: 25 to 50 mph



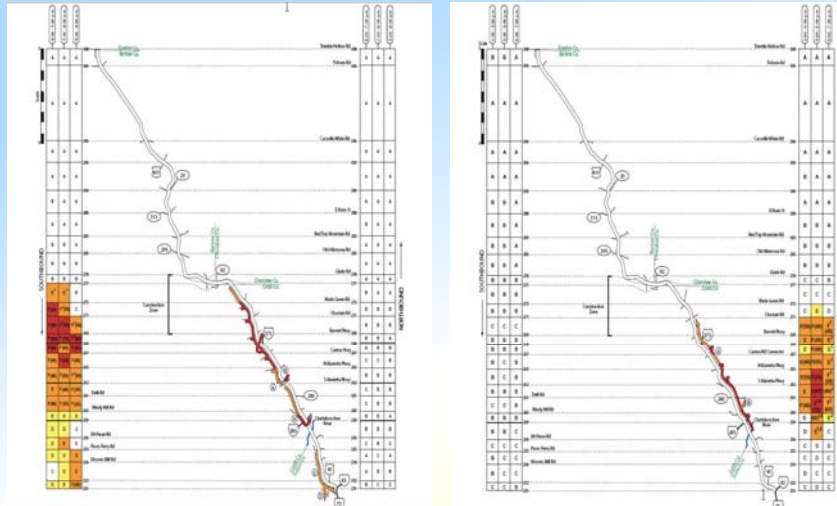
GDOT Bottlenecks



Skycomp Aerial Photography



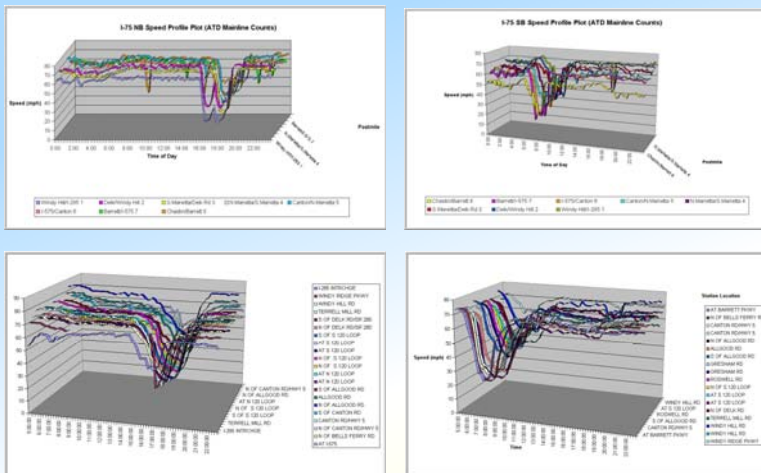
Detailed Skycomp Aerial Survey Reports for Location 1



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PM

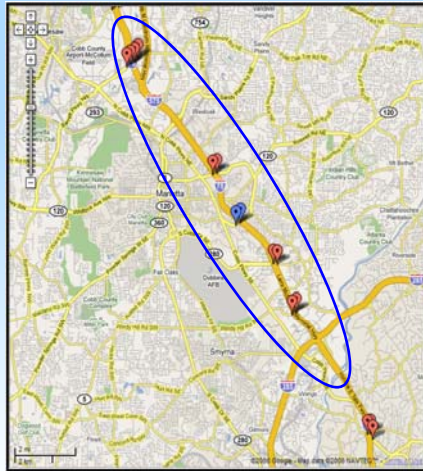
I-75 N Speed Profile Plot (Area 1)



ATD Counts

Station Location

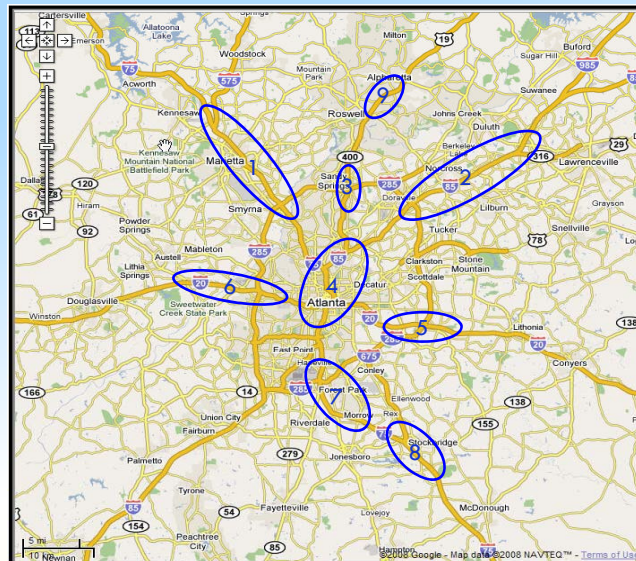
Proposed Sub-Area 1



- 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**

