Integrated Macro-Micro Modeling for Freeway Corridors – Sustainable Simulation Models

TexITE Winter Meeting

January 29, 2010

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Talking Points

Macro-Micro (Multi-Resolution) Modeling Background

Project Application

> Background

> A Few Learning Experiences
  • Network
  • Demand

Findings + Future Vision
Multi-Resolution Modeling Background

- Match analysis question to right tool.

The Project – Background

**Background**
- **Title:** VISSIM Operational Corridor Model Development
- **Owner:** Oregon DOT
- **Location:** Portland, OR
- **Purpose:** Sustainable Simulation Models for Corridor Studies
- **Consulting Team:** PB (Prime), PTV (Sub)
- **Duration:** April – June 2009

**Scope**
- Develop calibrated VISSIM base models
  - 5 freeway corridors
  - 180 miles of directional freeway
  - 4-hour AM peak (6-10am)
  - 5-hour PM peak (2-7pm)
The Project – Challenge

**Schedule**
> How to develop calibrated microsimulation models for 180 miles of freeway and arterial ramp terminals for 9 hours of simulation within 3 months?

**Data Management**
> How to manage the tremendous amount of data?

**Sustainability**
> How to develop a workflow and models that can be used, expanded and maintained in the future?

The Project – Approach

**Data Warehouse**

- Regional Travel Model (OD, links, nodes)
- Portal
- PTV TCM
- Turning Movement Counts
- Signal Timing
- Aerials
- Network Geometry (ramps, turn bays, etc.)

**Workflow**

- One Data Warehouse
- Leverage Interfaces
- Sustainability

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*Integrated Macro-Micro Modeling for Freeway Corridors*
The Project – Model Flow

Regional Travel Model
Regional Freeway Model

Integrated Macro-Micro Modeling for Freeway Corridors

Network

- Maintain network consistency.
Demand – Peak Spreading

Peak Spreading

> How to determine operational peak demand when ground counts are capacity constrained?

1. Synthesize 2-hr OD Matrices → Consistent Demand Data Set

2005 OD

2009 Uncongested Freeway + Ramp Detector Sites

2009 Counts

TFlowFuzzy (matrix estimation)
Integrated Macro-Micro Modeling for Freeway Corridors

2. Expand 2-hr to Multi-Hour Matrices → Capture Congestion

- Aggregate Flow Data at Uncongested Regional Sites
- Identify 2-hr Peak
- Apply Factor to 2-hr ODs

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Demand – Peak Spreading

3. Expand Multi-Hour to 15-Minute Matrices → Peaking

- Aggregate Flow Data at Uncongested Corridor Sites
- Calc. 15-min %
- Apply %s to Multi-HR ODs

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Demand – Peak Spreading

4. Assign 15-Min Matrices then Export OD + Paths to VISSIM → Save Time

2009
AM 16, 15-min OD
PM 20, 15-min OD

Demand – Subarea Cut OD Adjustment

- Reduce OD trips between Zone 1 + 2 since outside study area.
## Demand – Calibrating Paths

### OR 217 SB Volume Comparison

<table>
<thead>
<tr>
<th>On/Off Ramp</th>
<th>Base Count</th>
<th>VISSIM Count</th>
<th>Difference</th>
<th>% Difference</th>
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</thead>
<tbody>
<tr>
<td>On ramp from 72nd</td>
<td>1606</td>
<td>1604</td>
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<td>Off ramp to 99W</td>
<td>2706</td>
<td>2803</td>
<td>97</td>
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<tr>
<td>Off ramp to Greenburg</td>
<td>416</td>
<td>1102</td>
<td>686</td>
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<td>Off ramp to Hall</td>
<td>1125</td>
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<tr>
<td>Off ramp to 105</td>
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<td>Off ramp from OR-10</td>
<td>1861</td>
<td>1961</td>
<td>99</td>
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<td>Off ramp from Allen</td>
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<tr>
<td>Off ramp from Allen</td>
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<td>Off ramp to Greenburg</td>
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<td>Off ramp from 72nd</td>
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<td>Off ramp to 72nd</td>
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</table>

### The Result

#### VISSIM Calibration

- **Throughput**
- **Speed**

### Integrated Macro-Micro Modeling for Freeway Corridors
Findings + Future Vision

1. Network geometry, volume and signal control coded and maintained in one platform.
2. Project completed within 3-month schedule.
3. Model workflow provided a method to maintain, expand and continue to use simulation models repeatedly.

Thank You
Control

The Project – Workflow

VISUM
Regional Travel Model
- Freeway Subarea Cut
- Synthesize 2-hr OD Matrices
- Factor to 4-5-hr OD Matrices

VISUM
Regional Freeway Model
- Corridor Subarea Cuts
- TAZs, Node Detail

VISUM
Corridor Macro-Models
- Factor to 15-minute OD Matrices
- Dynamic User Eq. 15-minute Paths
- Export to VISSIM

VISSIM
Corridor Micro-Models
- Micro Refinement + Calibration

MACRO
- Regional Network
- 2-hr AM, 2-hr PM
- 2-hr ODs + Paths

MICRO
- 5 Corridor Networks
- 4-hr AM, 5-hr PM
- 15-min ODs + Paths