

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

TexITE Winter Meeting

January 29, 2010

Jim Dale, PE, PTV America, Inc.



### Talking Points

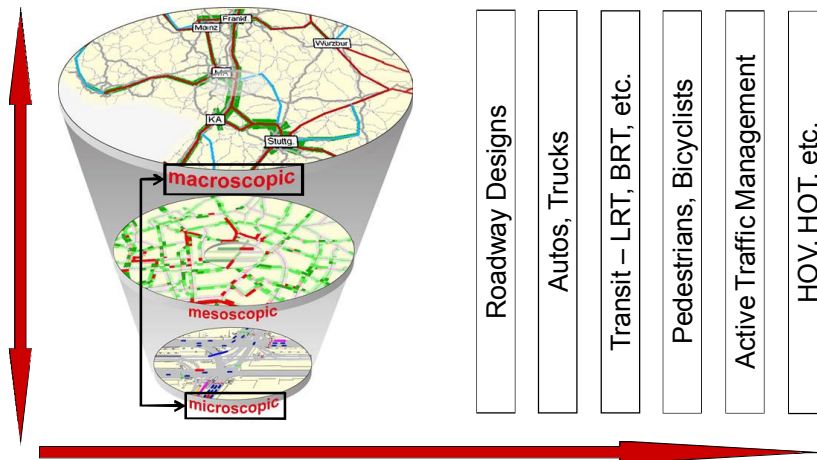
#### Macro-Micro (Multi-Resolution) Modeling Background

#### Project Application

- > Background
- > A Few Learning Experiences
  - Network
  - Demand

#### Findings + Future Vision

## Multi-Resolution Modeling Background



- Match analysis question to right tool.

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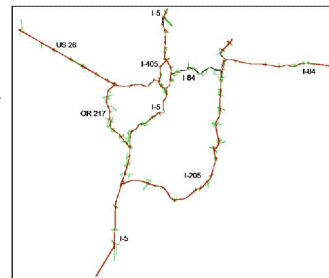
## The Project – Background

### 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)



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## 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?

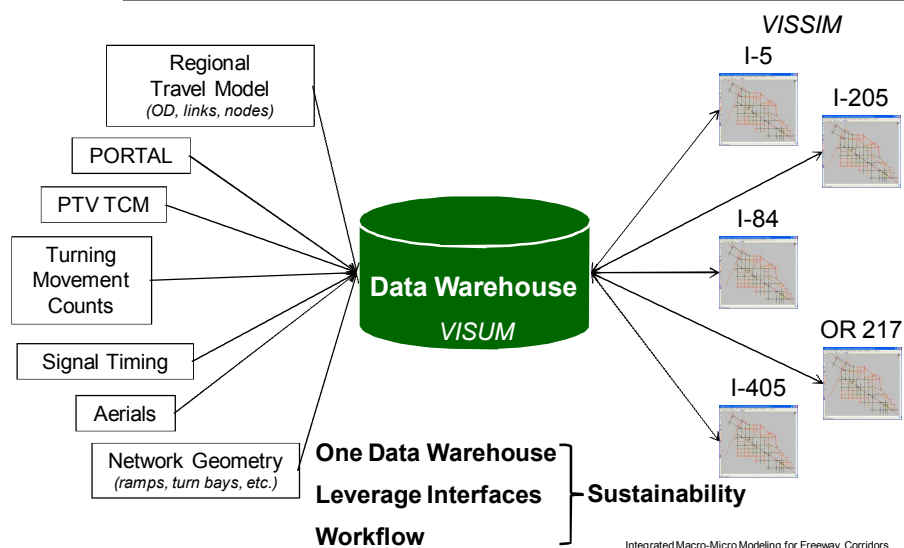
### Data Management

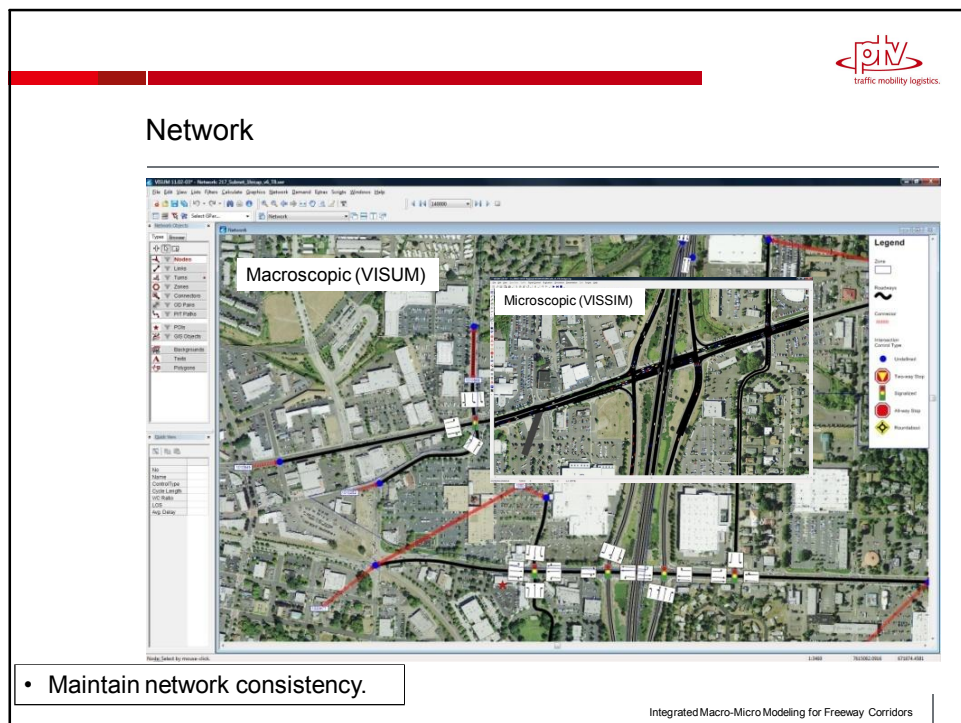
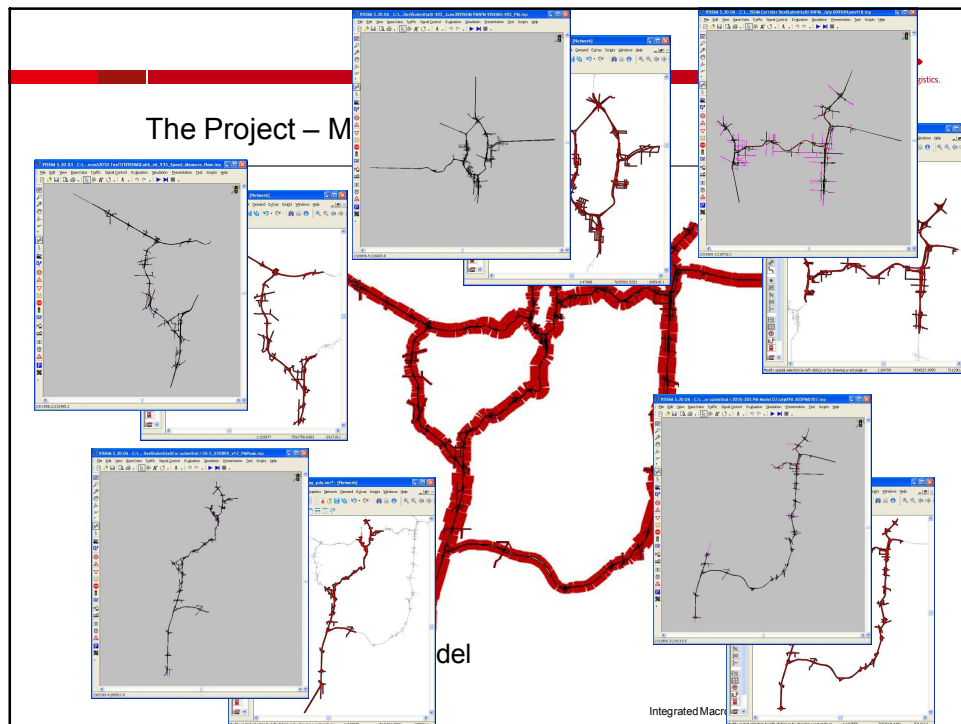
- > How to manage the tremendous amount of data?

### Sustainability

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

## The Project – Approach

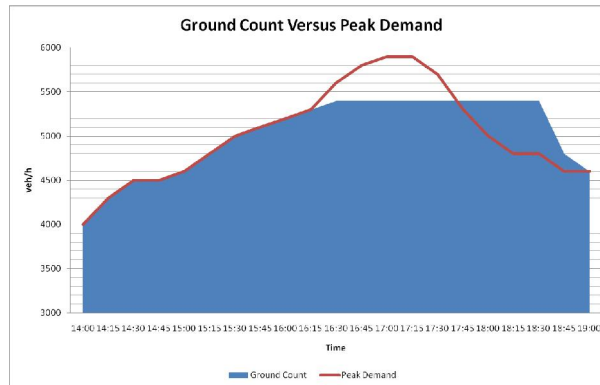




## Demand – Peak Spreading

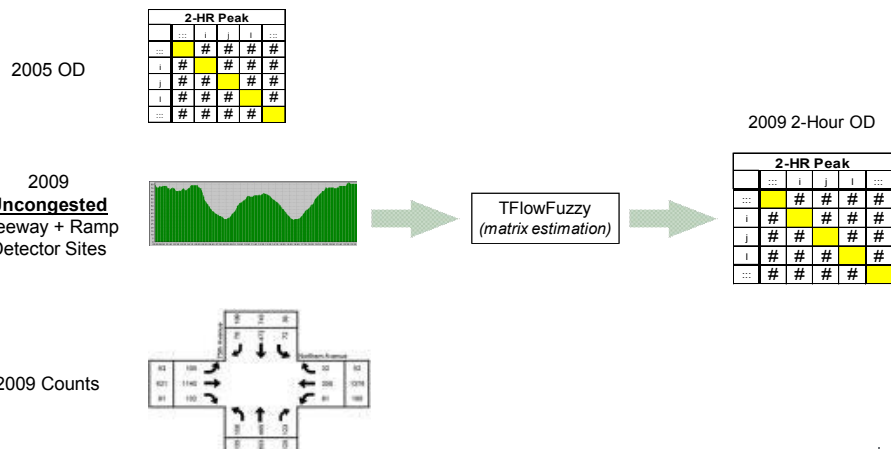
### Peak Spreading

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



## Demand – Peak Spreading

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



## Demand – Peak Spreading

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

2009  
AM 2-hr OD  
PM 2-hr OD

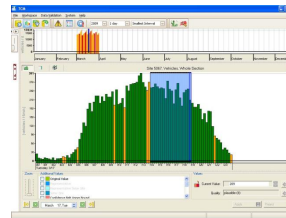
|           |
|-----------|
| 2-HR Peak |
| #         |
| #         |
| #         |
| #         |
| #         |
| #         |
| #         |
| #         |

Regional  
Factor

2009  
AM 4-hr OD  
PM 5-hr OD

|              |
|--------------|
| 8:00 - 10:00 |
| #            |
| #            |
| #            |
| #            |
| #            |
| #            |
| #            |
| #            |

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



| Time   | 6:00  | 6:15   | 6:30   | 6:45   | 7:00   | 7:15   | 7:30   | 7:45   | 8:00   | 8:15   | 8:30   | 8:45   | 9:00   | 9:15   | 9:30   | 9:45   |
|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Counts | 82390 | 104326 | 121508 | 124478 | 127535 | 139714 | 142216 | 135340 | 125483 | 125054 | 127604 | 124084 | 115205 | 119888 | 122105 | 119758 |
| %      | 4.5%  | 5.7%   | 6.6%   | 6.8%   | 6.9%   | 7.6%   | 7.7%   | 7.4%   | 6.8%   | 6.8%   | 6.9%   | 6.8%   | 6.3%   | 6.5%   | 6.6%   | 6.5%   |
| 2-HR % |       |        |        |        |        |        |        | 53.2%  | 55.5%  | 56.6%  | 56.9%  | 56.9%  | 56.3%  | 55.2%  | 54.1%  | 53.2%  |

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## Demand – Peak Spreading

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

2009  
AM 4-hr OD  
PM 5-hr OD

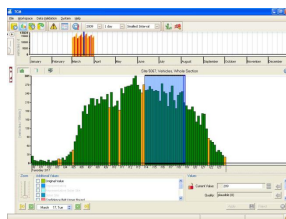
|              |
|--------------|
| 8:00 - 10:00 |
| #            |
| #            |
| #            |
| #            |
| #            |
| #            |
| #            |

Corridor  
Factors

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

|             |
|-------------|
| 8:00 - 8:15 |
| #           |
| #           |
| #           |
| #           |
| #           |
| #           |
| #           |

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

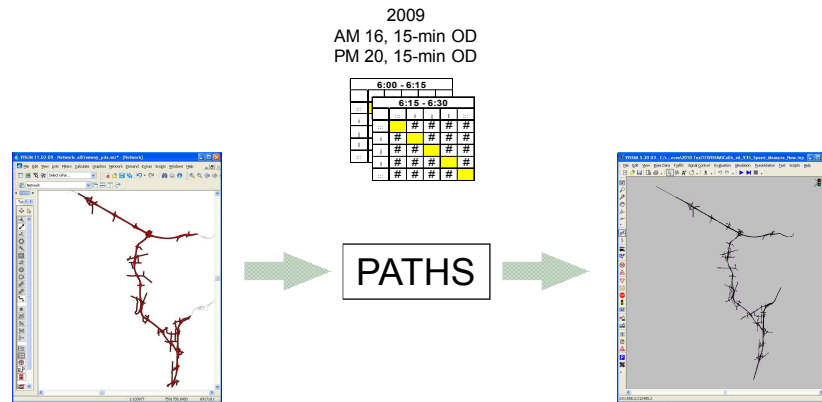


| From | To    | OR217 | I-405 | I-205 | I-5  | I-84 |
|------|-------|-------|-------|-------|------|------|
| 6:00 | 6:15  | 4.07  | 4.17  | 4.36  | 4.20 | 4.15 |
| 6:15 | 6:30  | 3.46  | 3.41  | 3.64  | 3.68 | 3.50 |
| 6:30 | 6:45  | 6.24  | 5.69  | 6.82  | 6.71 | 6.49 |
| 6:45 | 7:00  | 6.50  | 6.03  | 6.70  | 6.87 | 6.64 |
| 7:00 | 7:15  | 6.87  | 6.34  | 6.69  | 6.88 | 6.96 |
| 7:15 | 7:30  | 7.62  | 6.93  | 7.34  | 7.76 | 7.26 |
| 7:30 | 7:45  | 7.54  | 7.12  | 7.73  | 7.41 | 7.82 |
| 7:45 | 8:00  | 7.03  | 7.33  | 7.21  | 7.18 | 7.47 |
| 8:00 | 8:15  | 6.20  | 7.02  | 6.51  | 6.49 | 6.75 |
| 8:15 | 8:30  | 6.74  | 6.56  | 6.20  | 6.28 | 6.50 |
| 8:30 | 8:45  | 6.60  | 6.14  | 6.30  | 6.29 | 6.56 |
| 8:45 | 9:00  | 6.09  | 6.18  | 5.86  | 6.11 | 6.08 |
| 9:00 | 9:15  | 5.93  | 6.00  | 5.53  | 5.53 | 5.55 |
| 9:15 | 9:30  | 5.70  | 6.00  | 5.68  | 5.87 | 5.33 |
| 9:30 | 9:45  | 5.92  | 6.50  | 5.79  | 5.40 | 5.49 |
| 9:45 | 10:00 | 5.49  | 6.41  | 5.65  | 5.32 | 5.44 |

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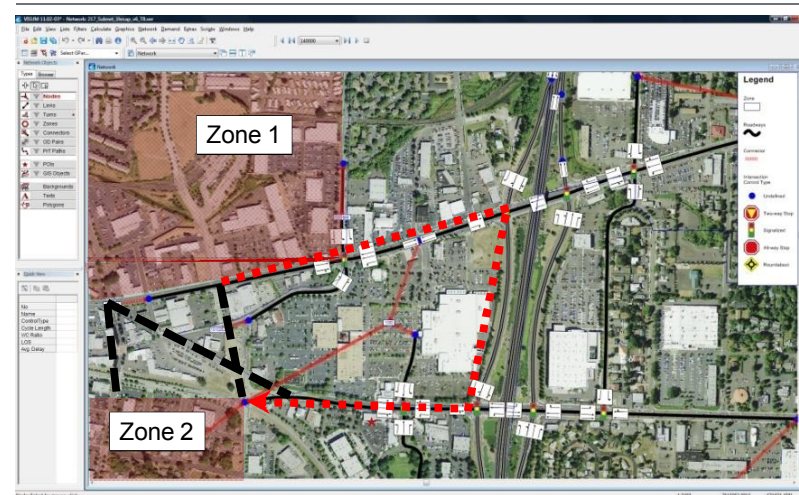
## Demand – Peak Spreading

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



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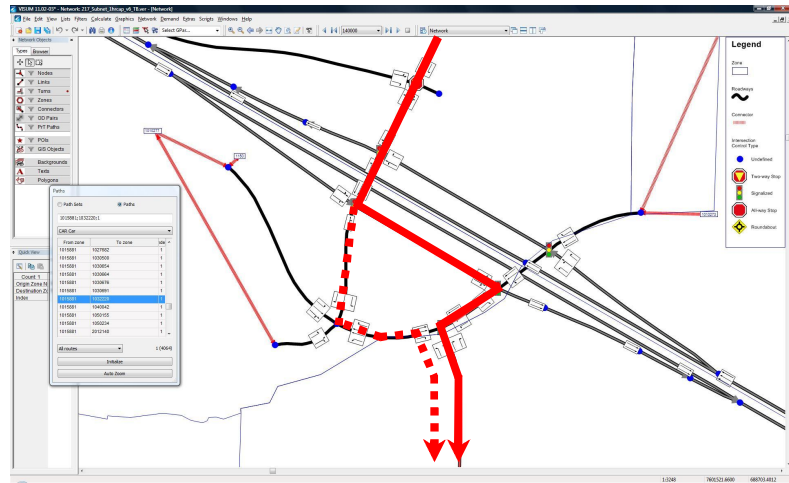
## Demand – Subarea Cut OD Adjustment



- Reduce OD trips between Zone 1 + 2 since outside study area.

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## Demand – Calibrating Paths



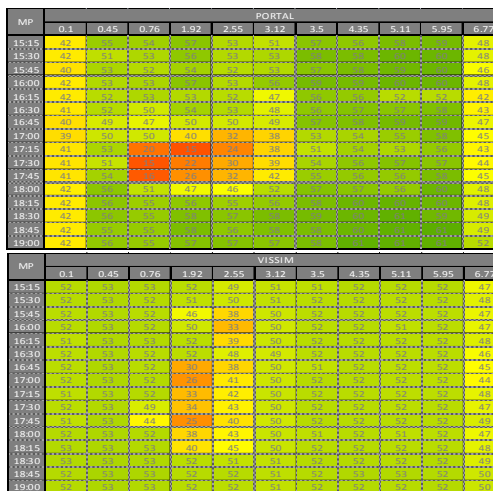
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## The Result

### VISSIM Calibration

- > Throughput
- > Speed

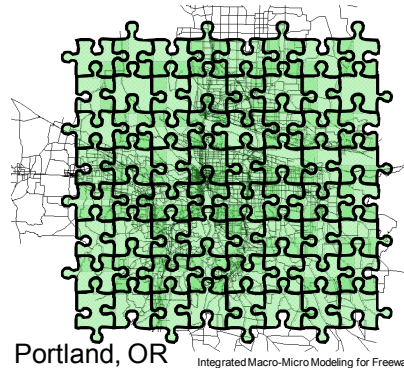
| OR 217 SB Volume Comparison  |  | Count | VISSIM | Difference |       |
|------------------------------|--|-------|--------|------------|-------|
|                              |  |       | [veh]  | [veh]      | [%]   |
| On ramp from Barnes          |  | 1808  | 1834   | 26         | 1.4%  |
| On ramp from US-26 WB        |  | 2738  | 2825   | 87         | 3.2%  |
| On ramp from Parkway         |  | 468   | 488    | 20         | 4.3%  |
| Off ramp to Walker           |  | 916   | 917    | 1          | 0.1%  |
| On ramp from Walker          |  | 1125  | 1176   | 51         | 4.5%  |
| Off ramp to OR-8             |  | 2357  | 2431   | 74         | 3.1%  |
| On ramp from OR-10           |  | 1961  | 1975   | 14         | 0.7%  |
| Off ramp to Allen            |  | 1167  | 1210   | 43         | 3.7%  |
| On ramp from Allen           |  | 1106  | 1159   | 53         | 4.8%  |
| Off ramp to Denny            |  | 577   | 590    | 13         | 2.3%  |
| On ramp from Denny           |  | 570   | 574    | 4          | 0.7%  |
| Off ramp to Hall             |  | 1191  | 1166   | -25        | -2.1% |
| On ramp from Hall            |  | 502   | 522    | 20         | 4.0%  |
| Off ramp to Scholls Fry      |  | 1052  | 1085   | 33         | 3.1%  |
| On ramp from Scholls Fry     |  | 1585  | 1596   | 11         | 0.7%  |
| Off ramp to Greenburg        |  | 1102  | 1119   | 17         | 1.5%  |
| On ramp from Greenburg       |  | 1413  | 1391   | -22        | -1.6% |
| Off ramp to 99W              |  | 1627  | 1676   | 49         | 3.0%  |
| On ramp from 99W             |  | 1024  | 1012   | -12        | -1.2% |
| Off ramp to 72nd             |  | 461   | 476    | 15         | 3.3%  |
| On ramp from 72nd            |  | 1187  | 1200   | 13         | 1.1%  |
| Off ramp to I-5 SB           |  | 5374  | 5503   | 129        | 2.4%  |
| Off ramp Kruse Way to I-5 NB |  | 2803  | 2732   | -71        | -2.5% |



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## Findings + Future Vision

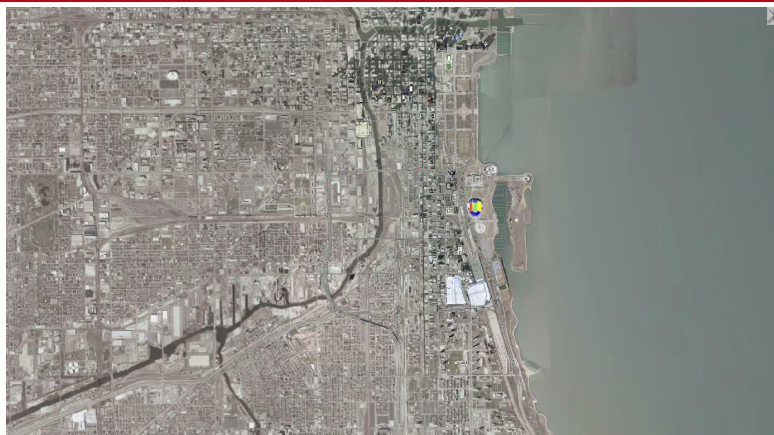
1. **Network geometry, volume and signal control coded and maintained in one platform.**
2. **Project completed within 3-month schedule.**
3. **Model workflow provided a method to maintain, expand and continue to use simulation models repeatedly.**



Portland, OR

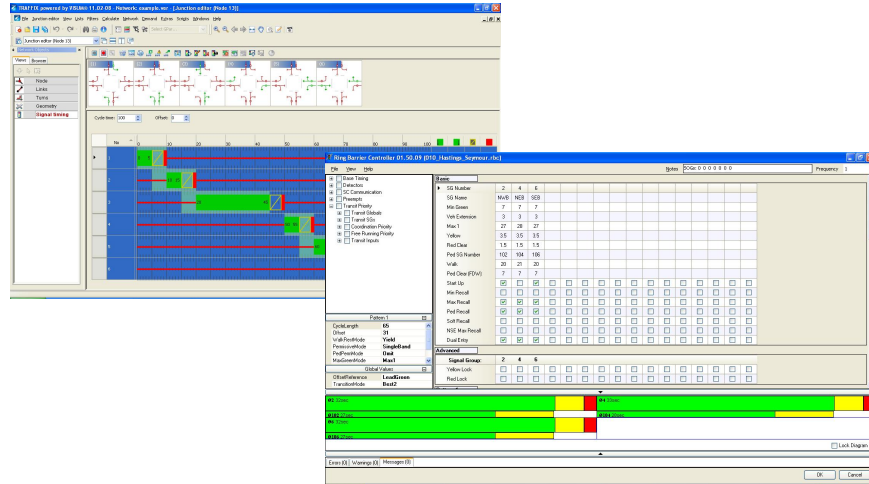
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# Thank You



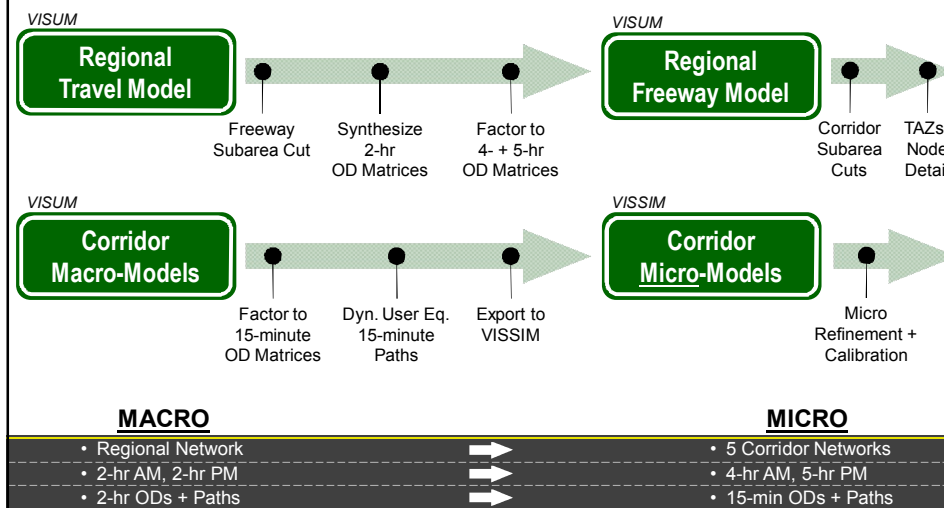
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## Control



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## The Project – Workflow



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