A Methodology for Estimation and Calibration of a City-Wide Micro-simulation Model

TRB ITM 2010

Wednesday May 11, 2010

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Outline

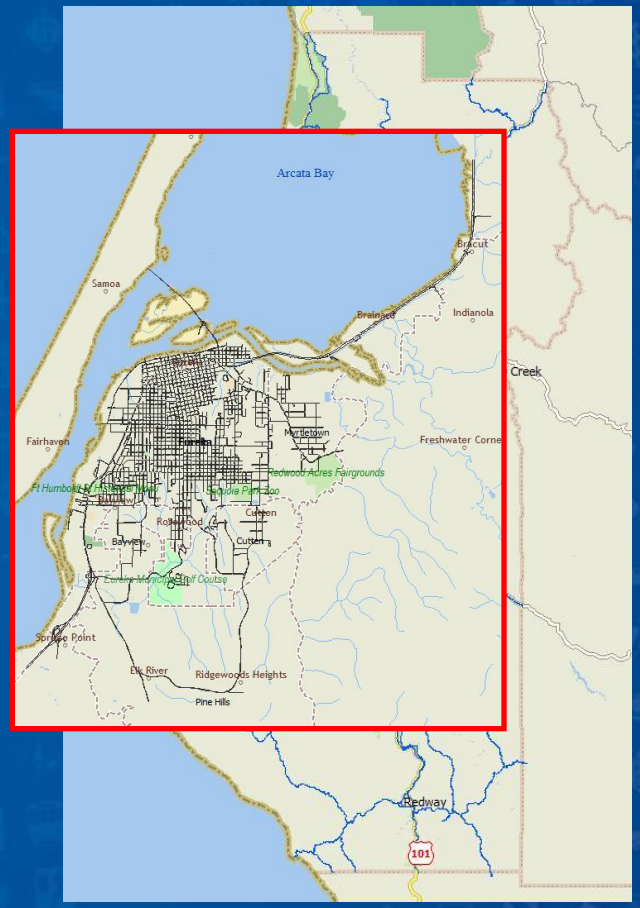
- **Background**
  - Purpose
  - Current Modeling Practice in the GEA
  - State of the Practice
- **Project Scope and Objectives**
  - Study Area, Modes of Travel, Times of Day
  - Data Input Requirements and Data Collection
  - Methodology
- **Methodology**
  - Data Collection
  - Model Development
  - Estimation, Calibration, and Validation
  - Future-Year Scenarios
  - Visual Demonstration

Purpose

- To develop a traffic operations model of the Greater Eureka Area (GEA) that would extend and complement existing modeling activities
- To transfer ownership of the model to GEA staff trained in the application, upkeep, and improvement of the model
- To have a visualization tool with which to engage public, stakeholders

Current Modeling Practice in the GEA

- **Systems Planning**
  - GEA Travel Model (GEATM)
  - Traditional 3-step Planning Model
  - Spans Humboldt County
  - Multi-agency acceptance
- **Operations**
  - Disparate software platforms
  - Models short-lived
  - No linkage with demand modeling efforts
  - No consistency, cohesion, collaboration = no confidence



State of the Practice

State of the Practice	GEA Model
• Limited in scale	• City-wide
• Sparse network detail	• All streets in Eureka included
• Few route choices	• Routes innumerable
• Turns/routes prescribed	• Route choice a central model component
• Short time periods	• 2-hour peak periods
• Single-project life span	• Model to be maintained indefinitely

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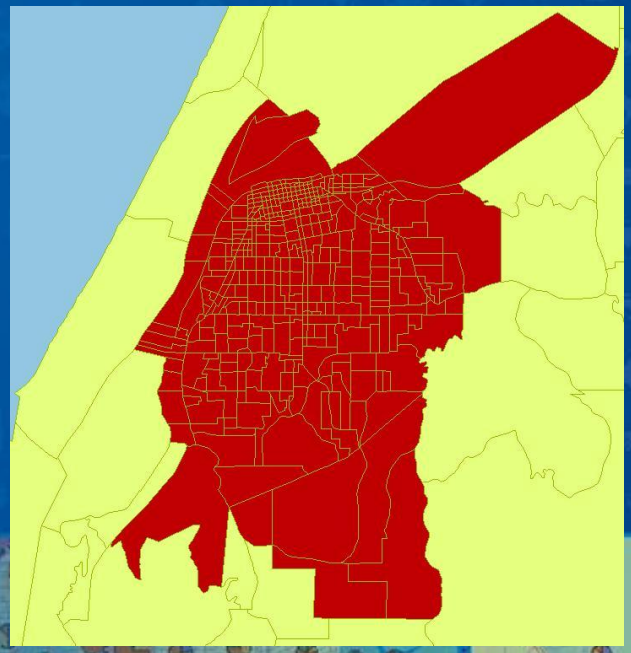
Scope

- **Scale**
  - Eureka City Limits (~16 mi^2) + Parts of surrounding Humboldt County
  - 17 miles of US 101 from Spruce Point to North of Bayside Cutoff
  - 417 total origins and destinations (409 TAZ centroids, 8 external stations)
- **Modes of Travel**
  - Private Auto
  - Truck
  - Eureka Transit Service
  - Pedestrians
- **Time Periods**
  - AM peak period 7:00 – 8:00 AM
  - PM peak period 4:00 – 6:00 PM



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Methodology

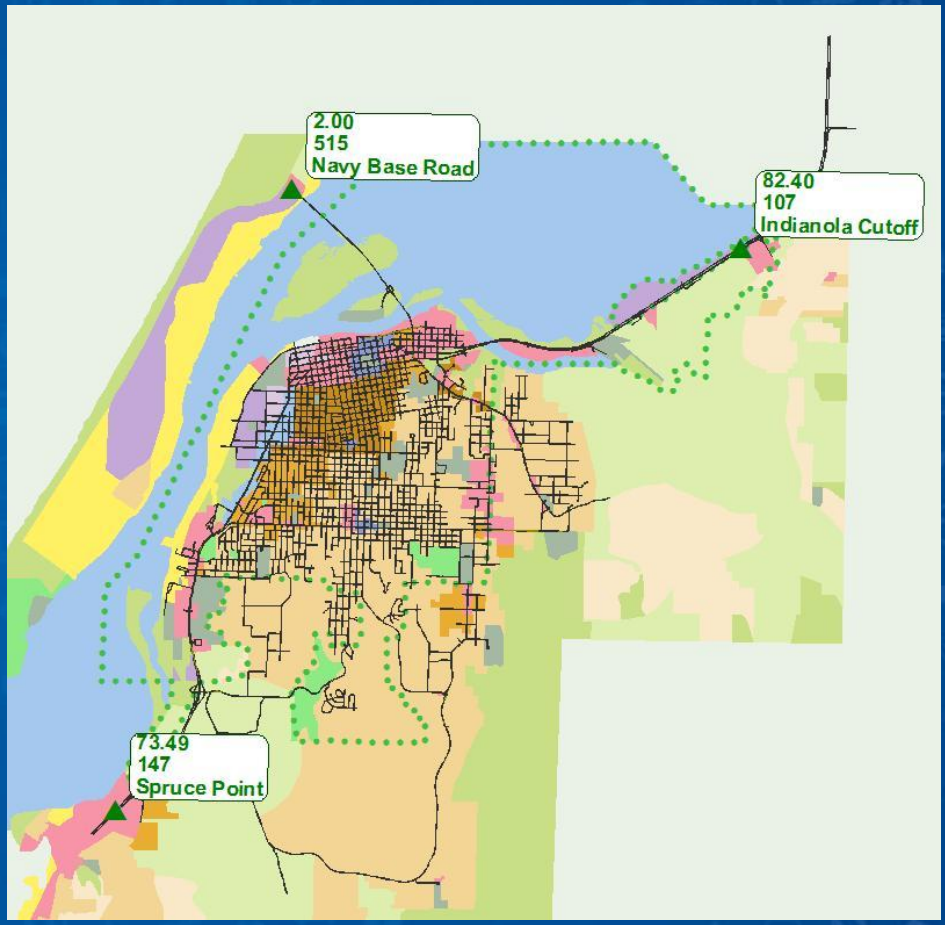
- Assemble Existing Data
- Evaluate Data Needs and Conduct Data Collection
- Model Development
- Trip Table and Route Choice Estimation
- Model Calibration & Validation
- Test Future Scenarios

Data Requirements

- **Model Inputs**
  - Geographic, geometric model of road network
  - Geographic model of transit routes and stops
  - Time-varying origin-to-destination (OD) volumes
  - Signal timings
  - Pedestrian crossing volumes
- **Data Requirements**
  - Field measurements: traffic & pedestrian counts, travel times, etc.
  - Model-generated data: GEATM OD volumes, network-wide travel times and turning movement delays
  - Other data: signal timing plans, transit schedules

Data Collection

- Turning Movement Counts (47 intersections)
- Directional Counts (70 locations)
- Floating Car Runs with GPS (28 routes)
- Queue Discharge Headways



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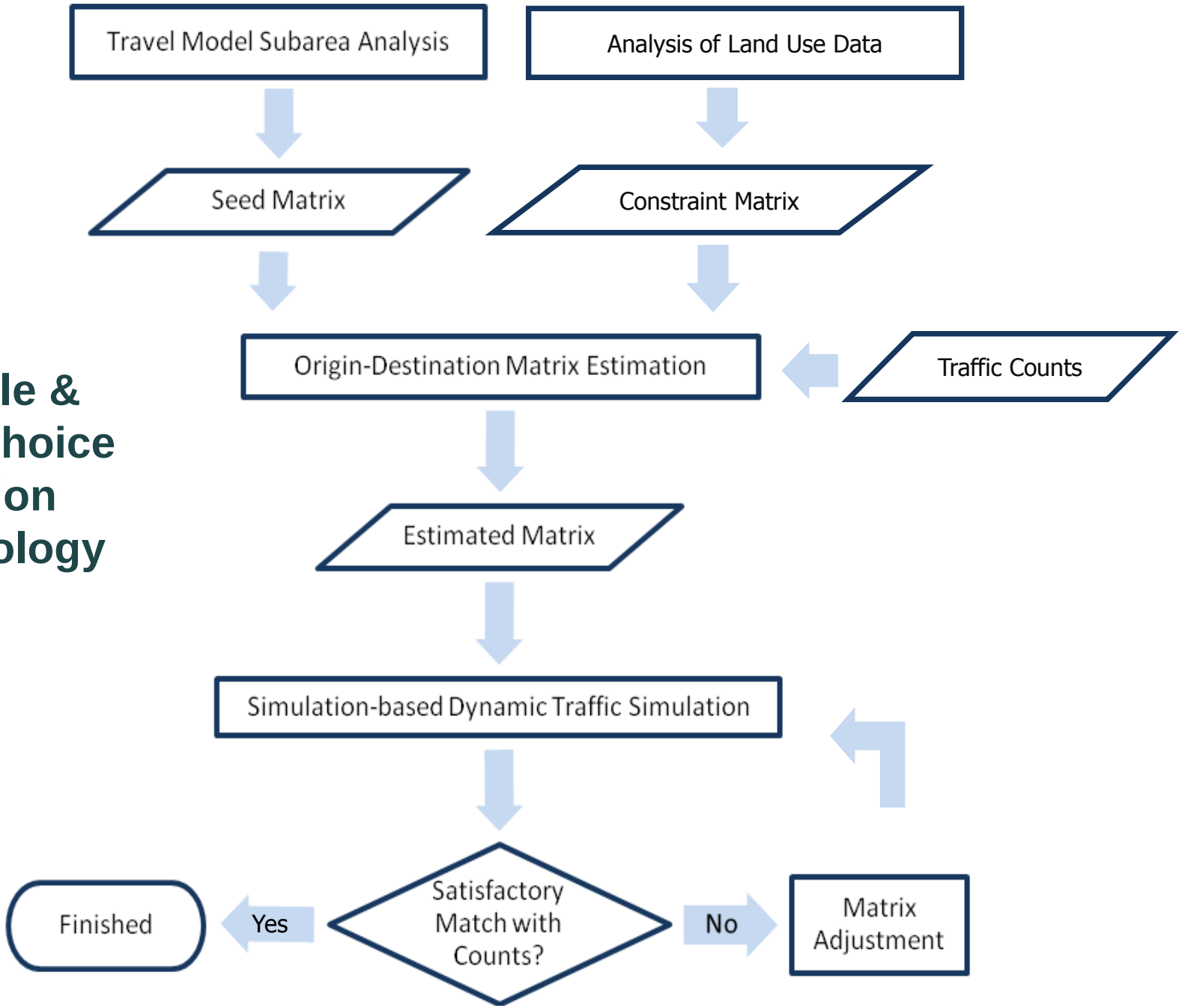
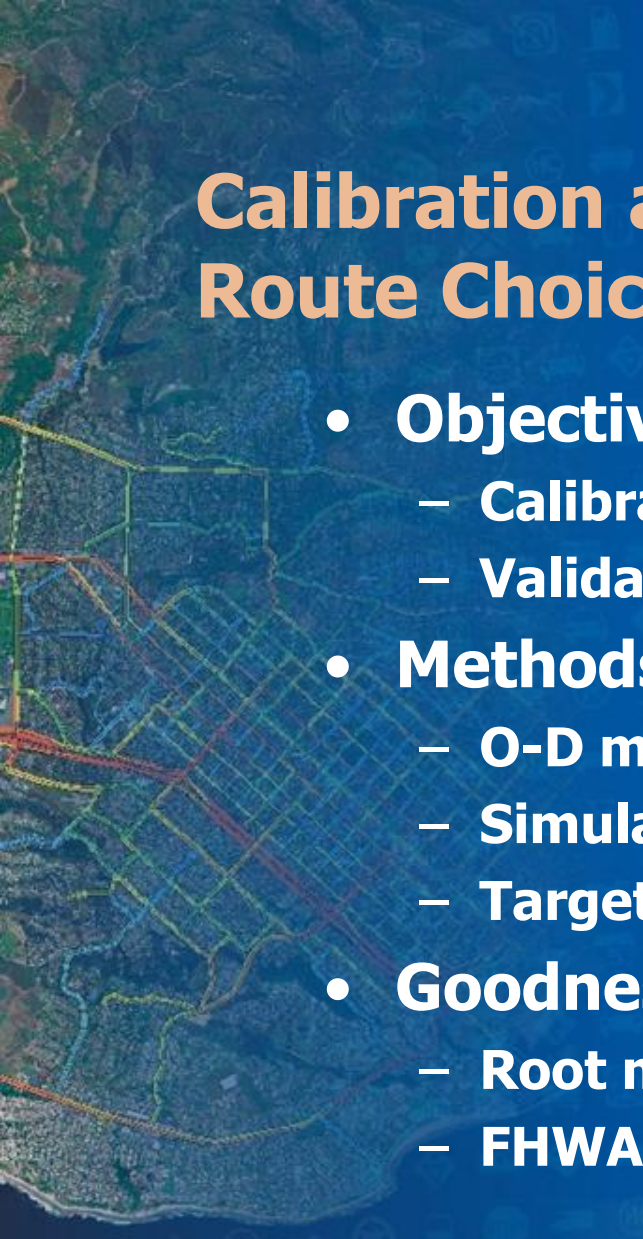
Model Development

Trip Table & Route Choice Estimation Methodology



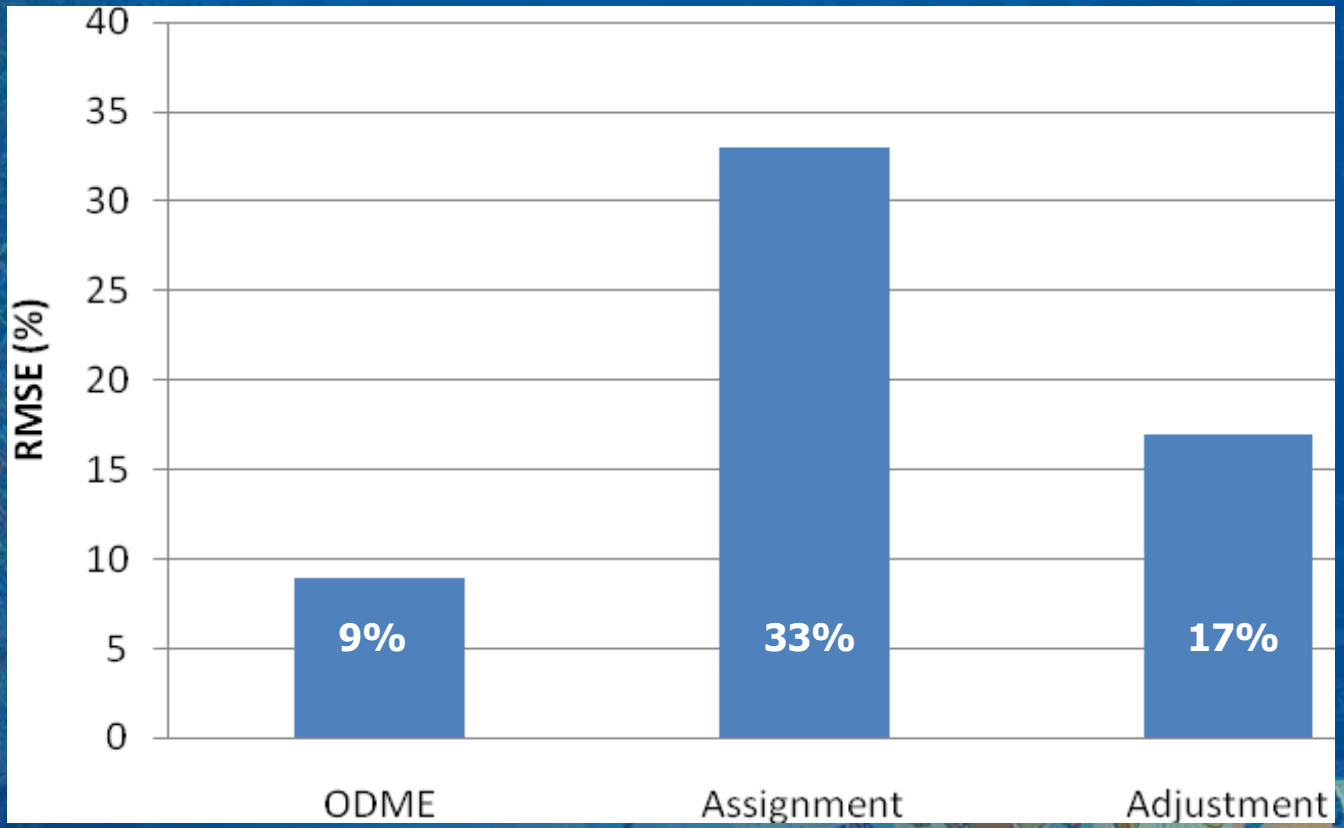
Calibration and Validation: Trip Table and Route Choice Estimation

- **Objectives**
  - Calibration: to match ground counts
  - Validation: to match point-to-point travel times
- **Methods:**
  - O-D matrix estimation & temporal disaggregation
  - Simulation-based dynamic traffic assignment
  - Targeted trip matrix adjustments
- **Goodness-of-fit measures**
  - Root mean square error
  - FHWA & Caltrans simulation guidelines



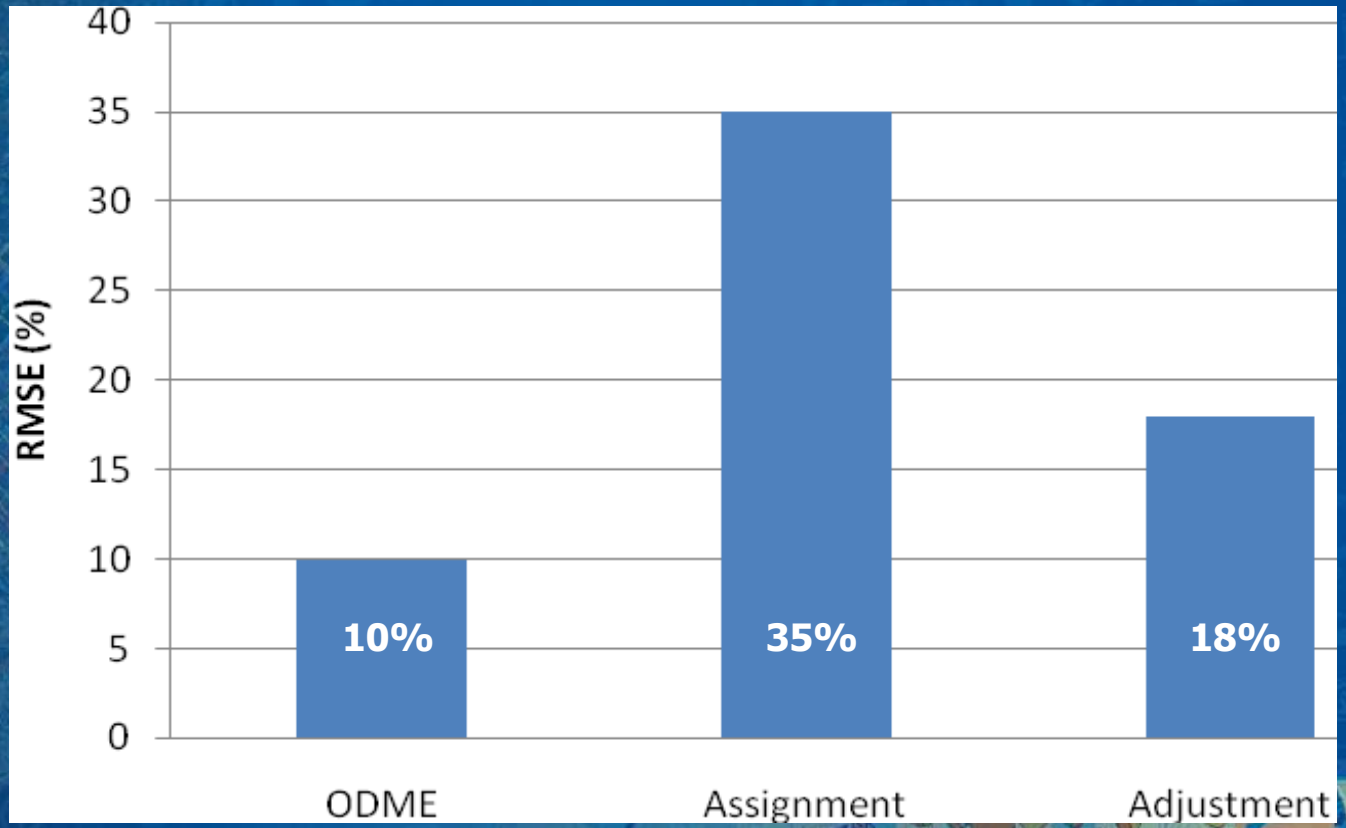
Trip Table in Three Transformations

AM



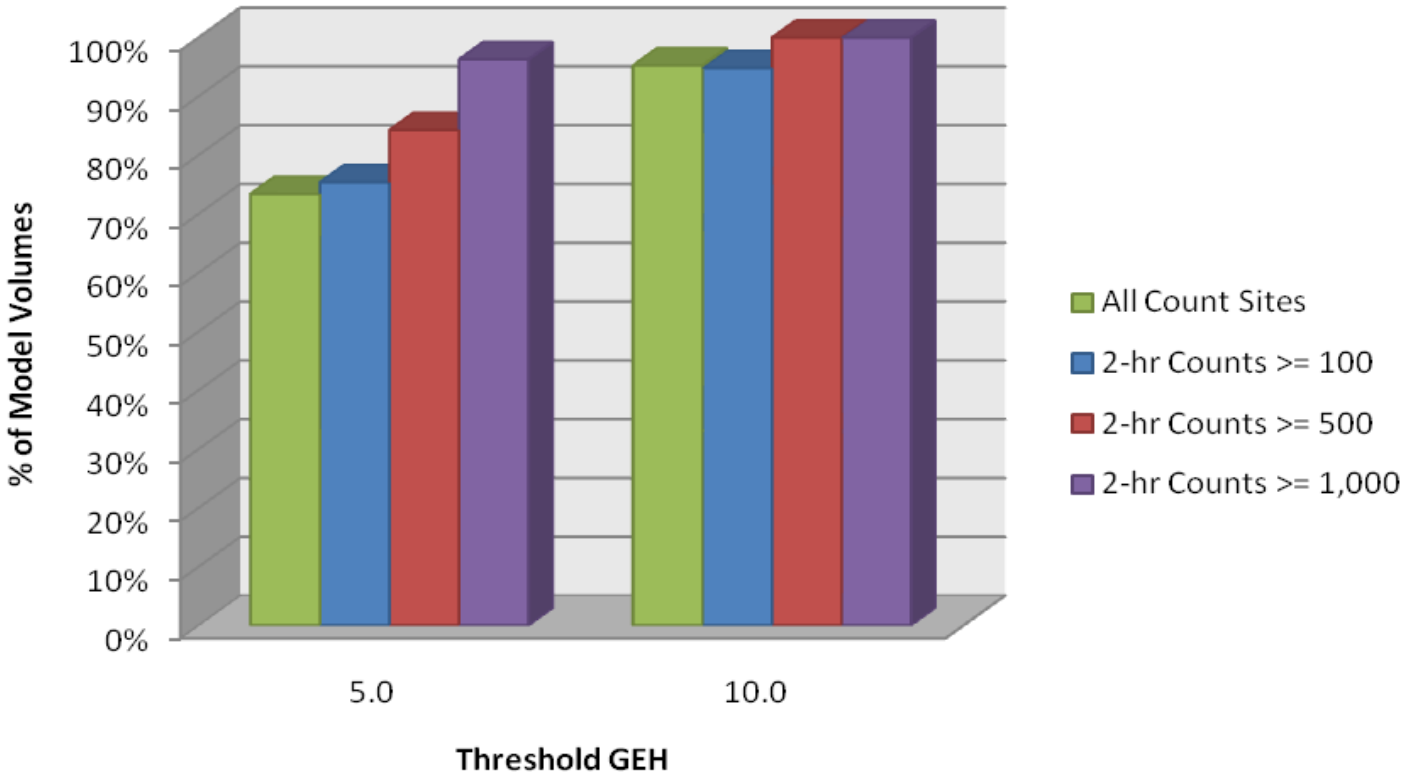
Trip Table in Three Transformations

PM



GEH Statistic

AM



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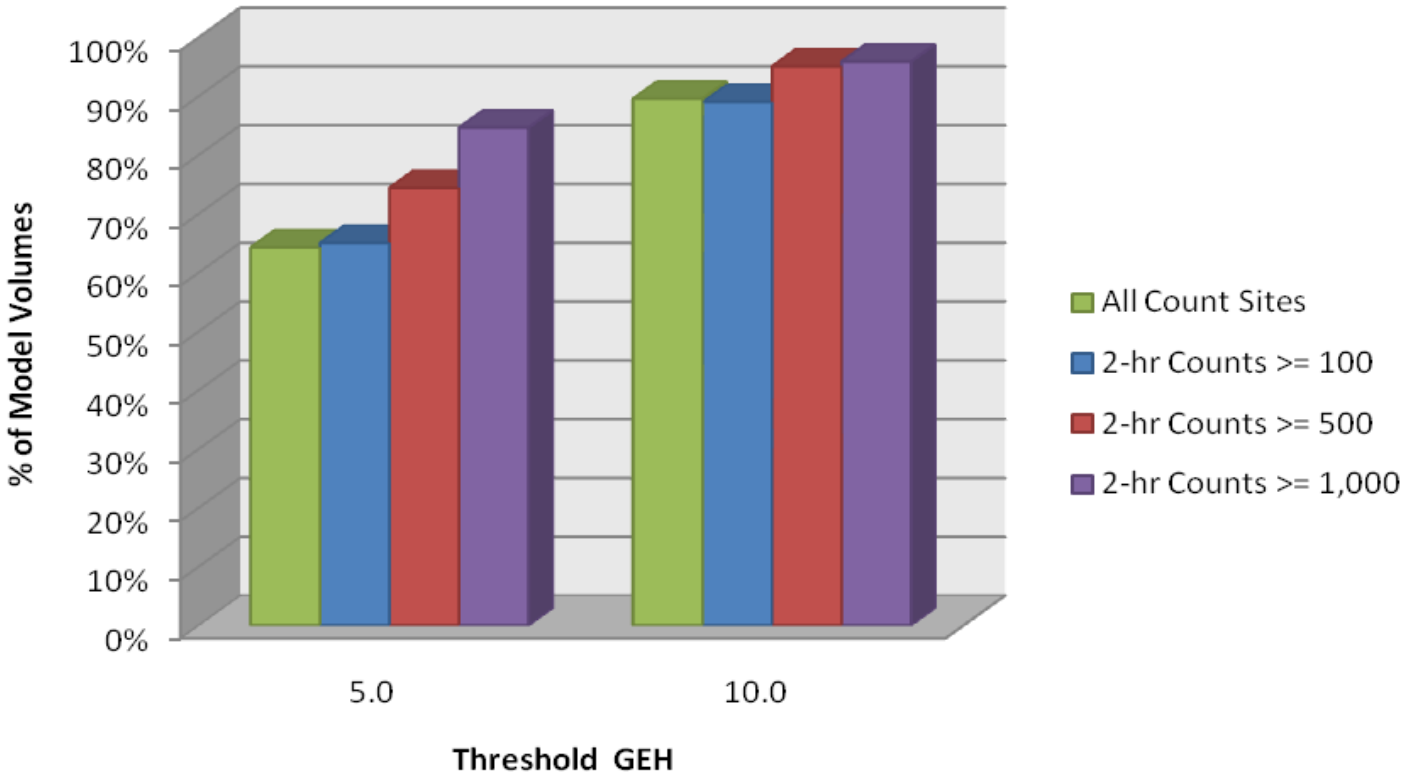


Results Summary

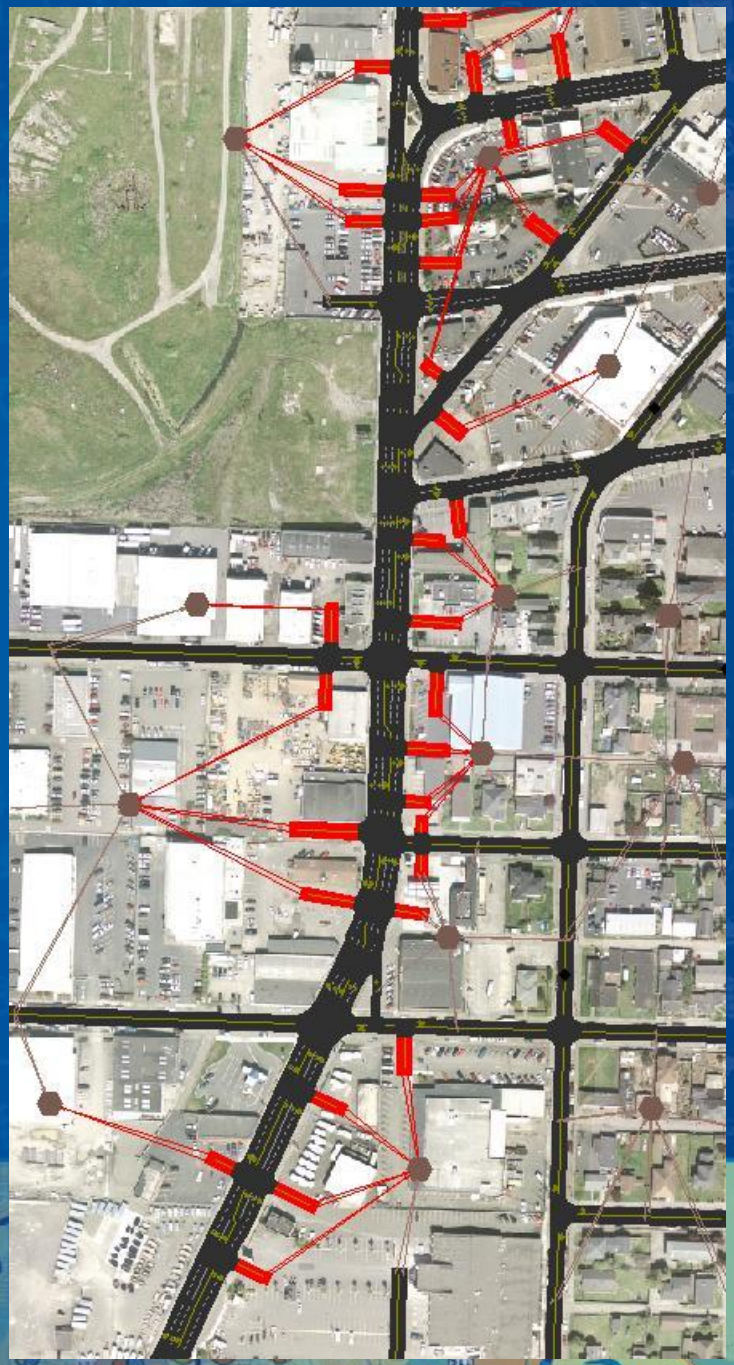
- **Industry-standard calibration on industry non-standard model**
- **Saturation Flow**
  - **Average Measured: 1840 vehicles per hour (vph)**
- **Traffic Demand Calibration**
  - **Traffic counts satisfy FHWA & Caltrans guidelines in terms of relative error, absolute error, GEH statistic**
- **Travel Time Validation**
  - **Travel times satisfy FHWA & Caltrans guidelines in terms of relative and absolute errors on all major corridors and on all but 2 routes driven**

Future-Year Scenarios

- **Future Years based on GEATM Forecasts**
  - **2020 & 2030**
  - **Future-year subarea analyses & simulation-based dynamic traffic assignments**
- **Scenarios**
  - **Broadway widening to 6 lanes**
  - **Traffic signal optimization**

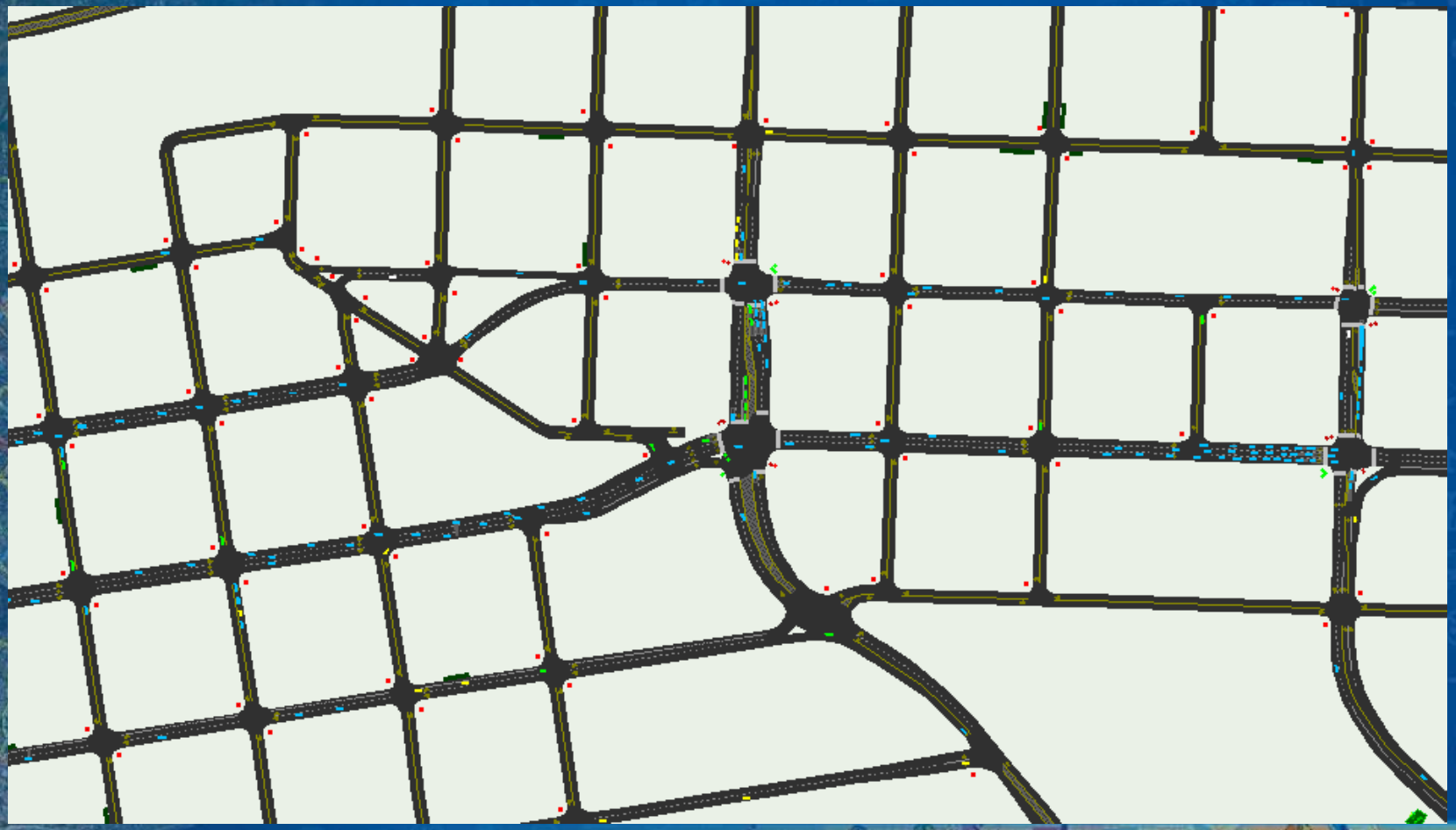
First Application

- **Broadway Feasibility Study**



Visual Demonstration

2-D Visualization



3-D Visualization