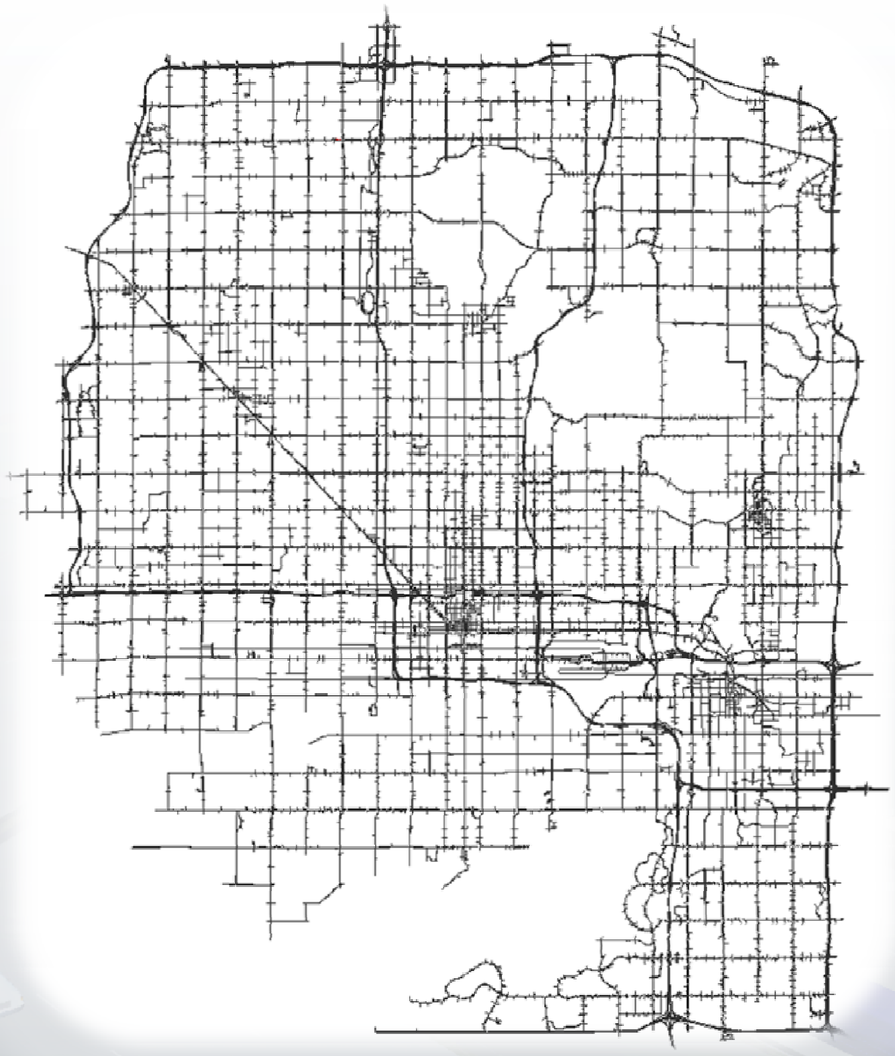
Development and Application of a Traffic Simulation and Dynamic Traffic Assignment Model Framework for Central Phoenix



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Purpose

- Add analysis of operations and traffic simulation modeling to the set of services MAG offers to its member agencies
- Build a model to complement MAG's regional travel demand model that:
  - Has the **operational sensitivity** to capture effects of signal operations, ITS projects
  - Is able to capture the **mobility benefits** of major projects whose impacts will be felt throughout Central Phoenix
  - Accurately portrays the traffic impacts of **transit improvements**, namely on high-capacity transit corridors
  - Provides a **calibrated base model** from which smaller, more focused studies can be derived

Approach

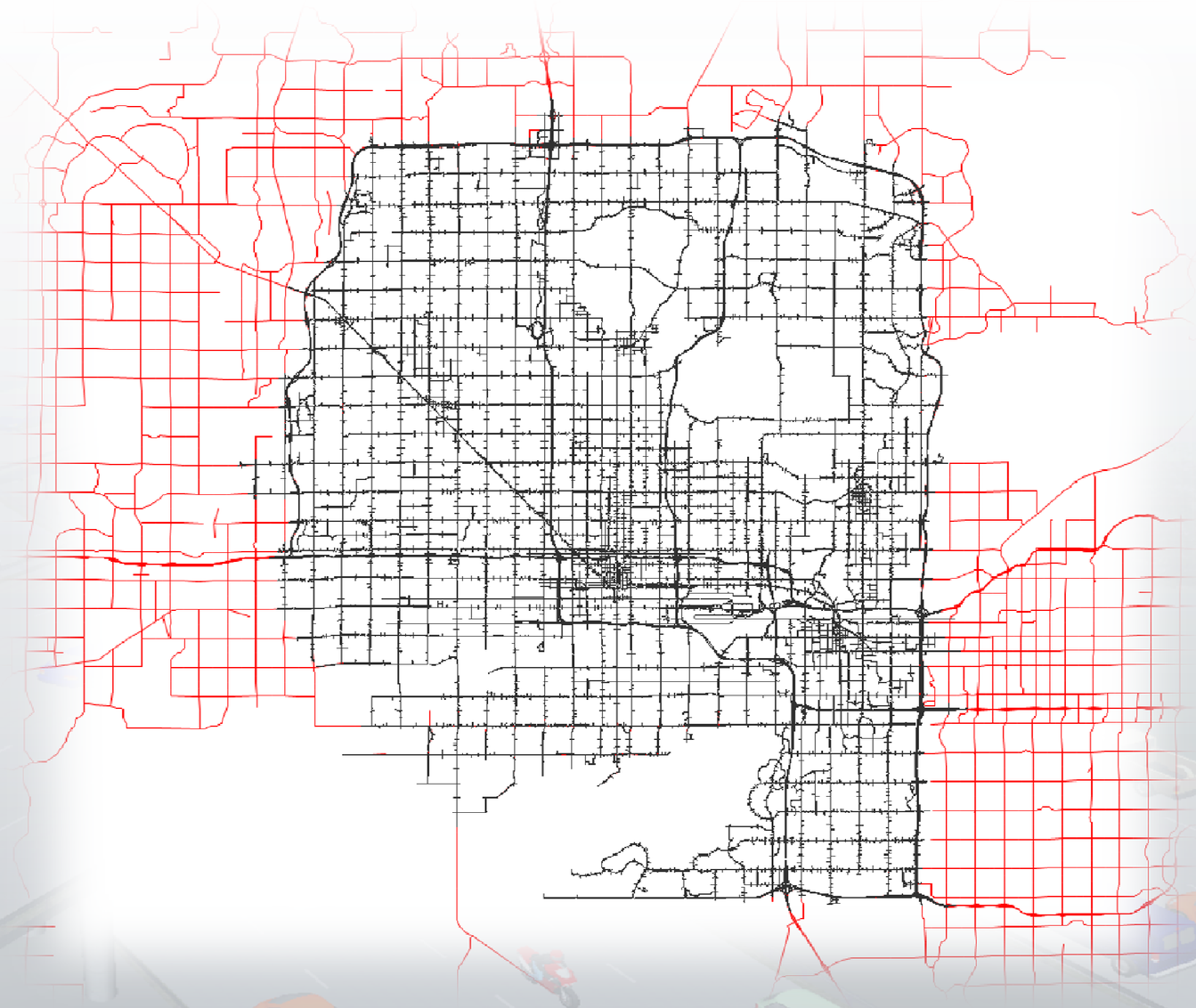
- Study Design Stage
  - Solicit stakeholder input/support
  - Scope the model framework, design parameters, and geographic scope
- Model Data Preparation
  - Assemble traffic count and signal timing data
  - Develop simulation model network and relationship to travel demand moel
- Framework Development and Testing
  - Test, calibrate, and validate the model
- Training

Design

- A model congruous with the regional travel demand model
  - *Objective*: To achieve a degree of integration with the regional travel demand model such that they can share key model data seamlessly
  - *Solution*: A simulation model in TransModeler capable of reading all file formats and data structures of the regional model in TransCAD and sharing a common zonal system (and, hence, ready exchange of origin-destination matrices)
- A multi-resolution traffic simulation model
  - *Objective*: A simulation model with an appropriate balance of high-fidelity treatment of traffic flow phenomena and practical computational performance
  - *Solution*: A microsimulation model enabling selective application of lower-resolution (e.g., meso) and multi-resolution (e.g., hybrid micro-meso) models

Development

1. Preparation of highly detailed lane-level geography/geometry
2. Import of centroids and connectors from regional model
3. Auto-adjustment of TAZ connectivity
4. Manual addition of centroids along study area boundary



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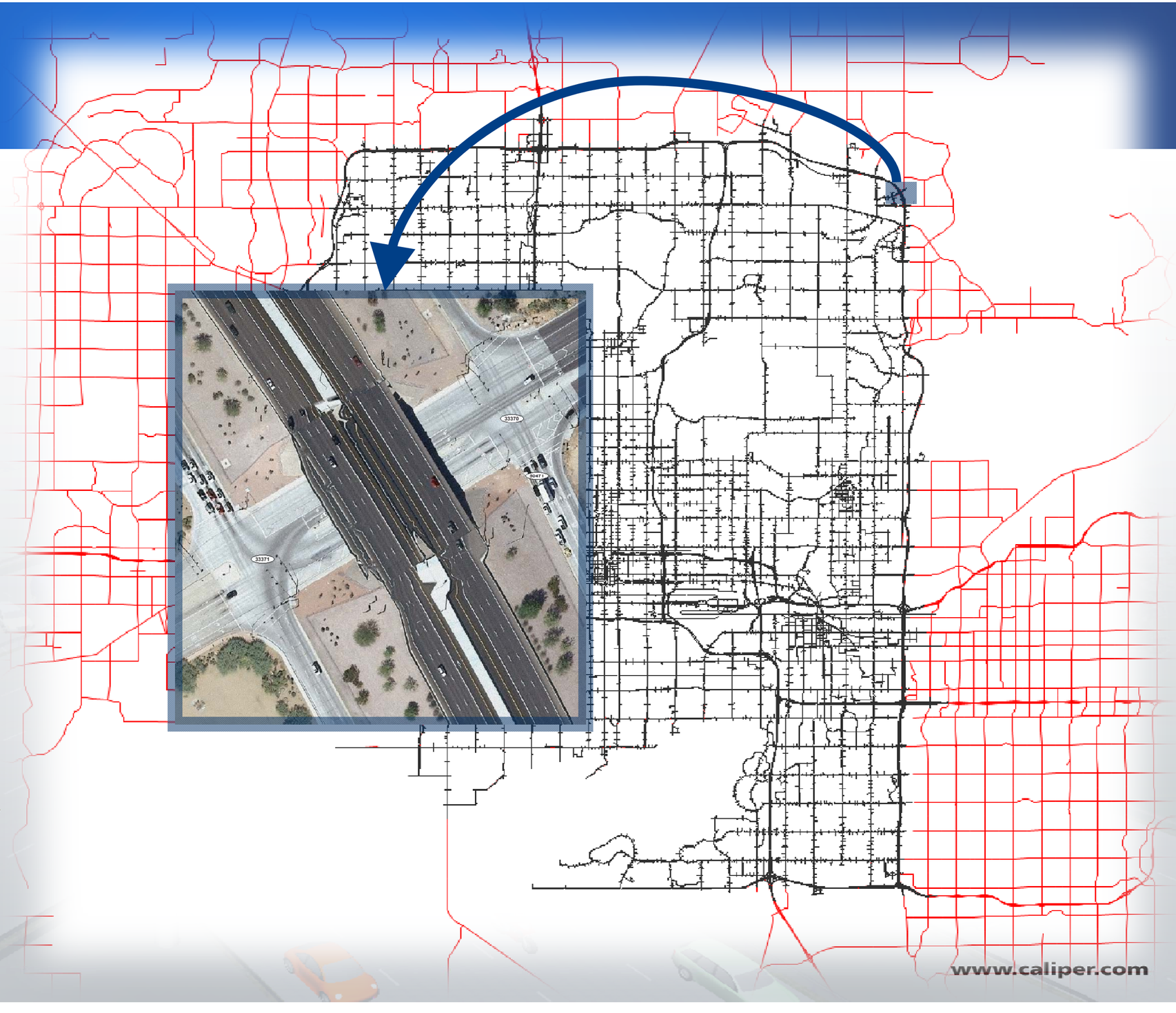

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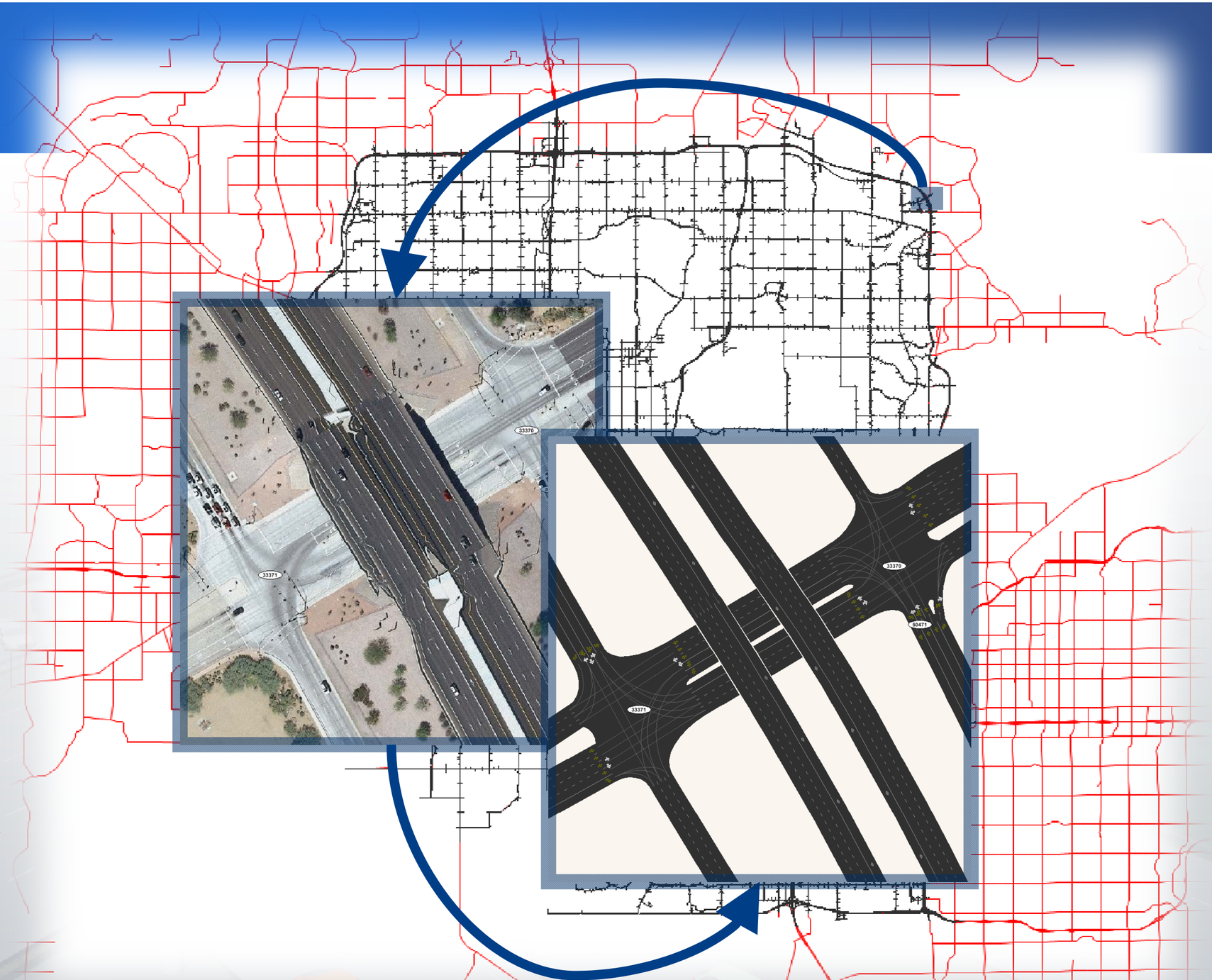

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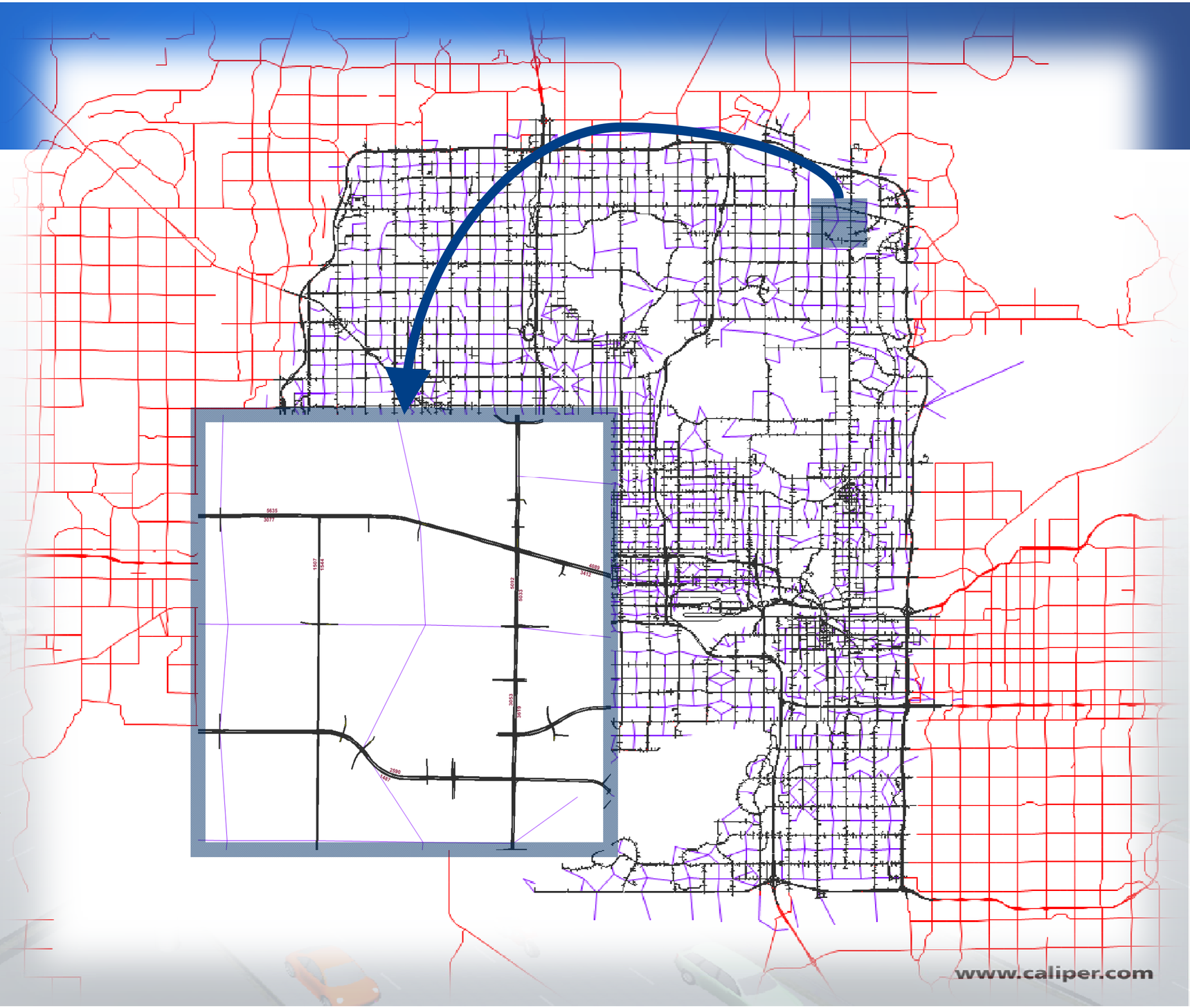

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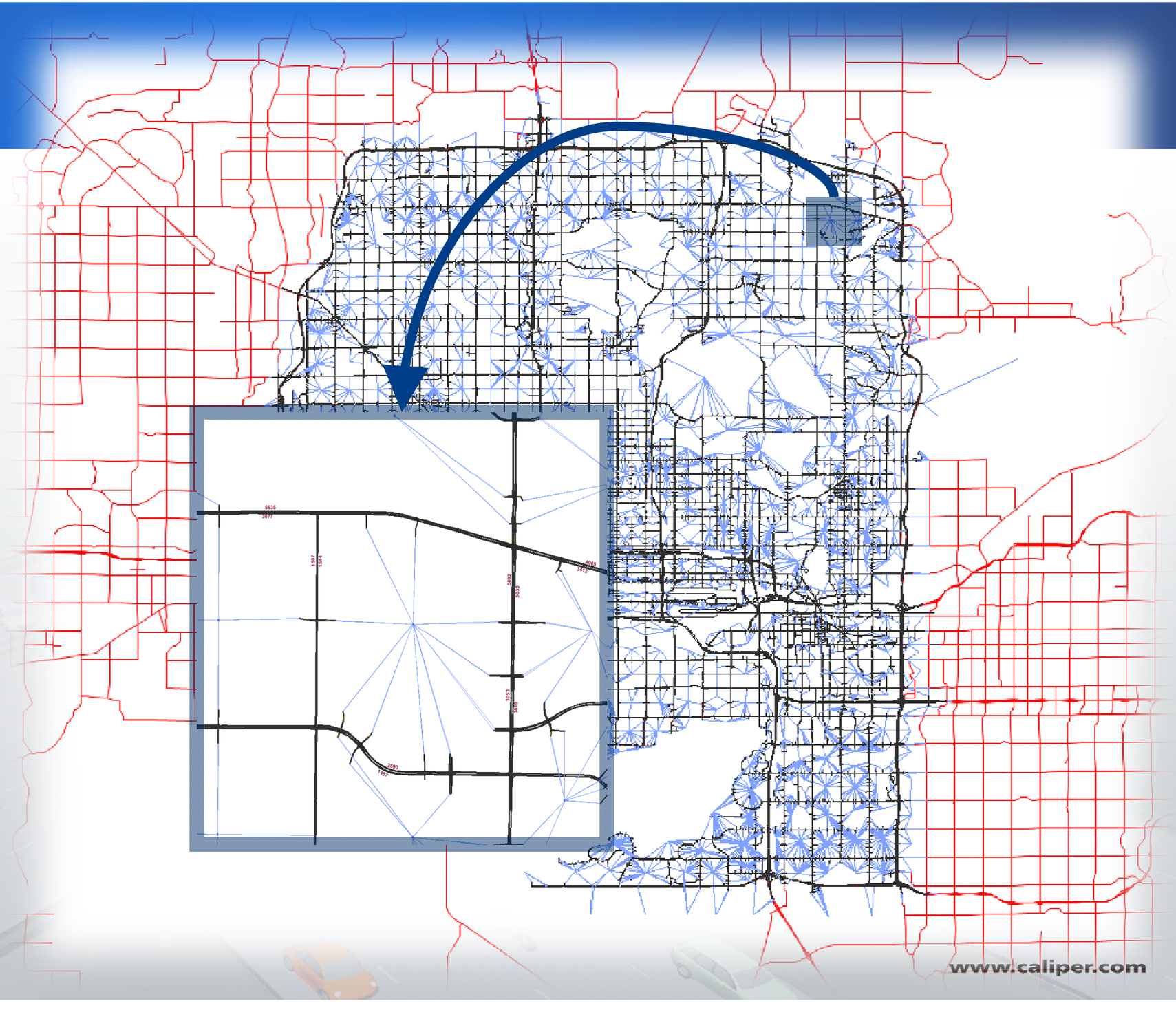

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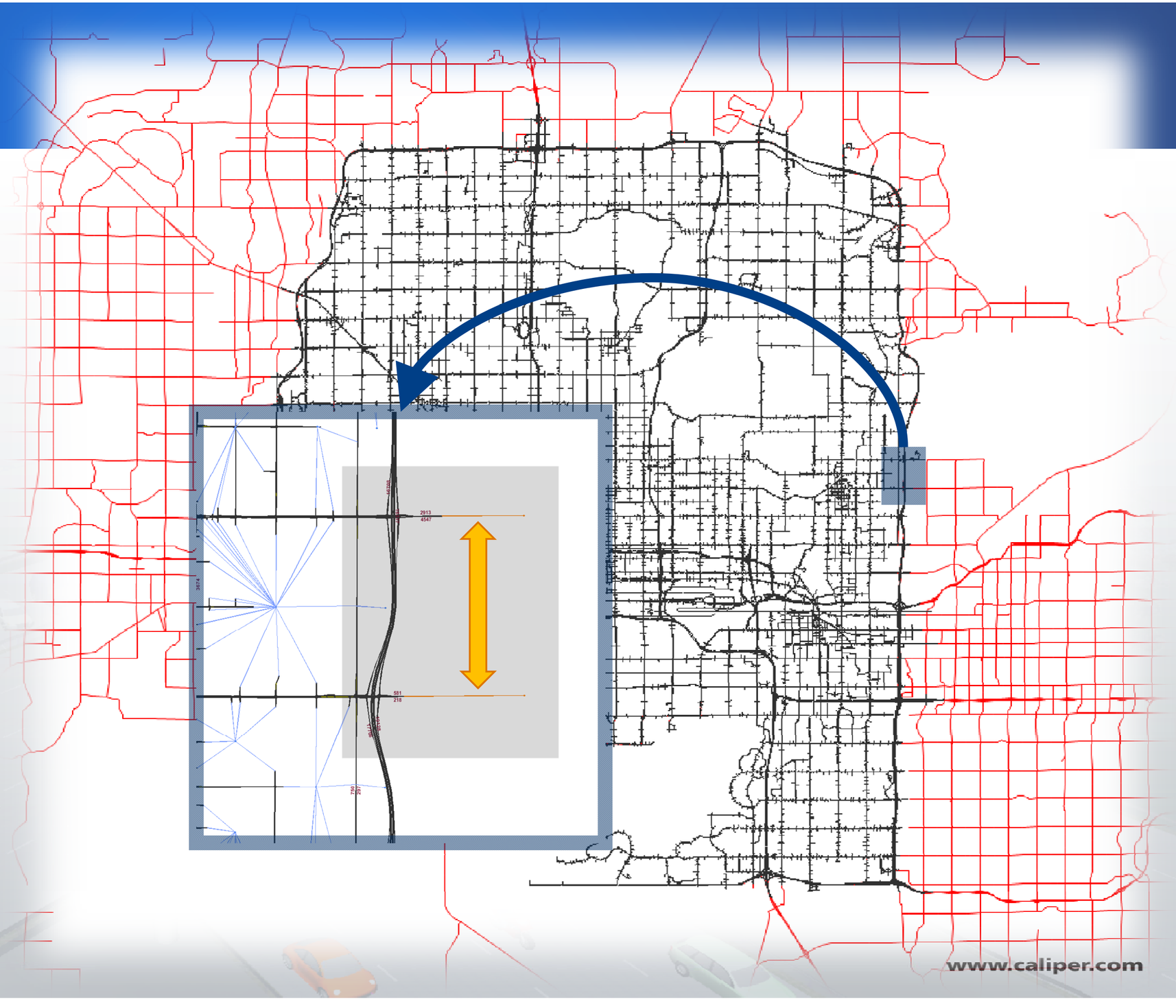
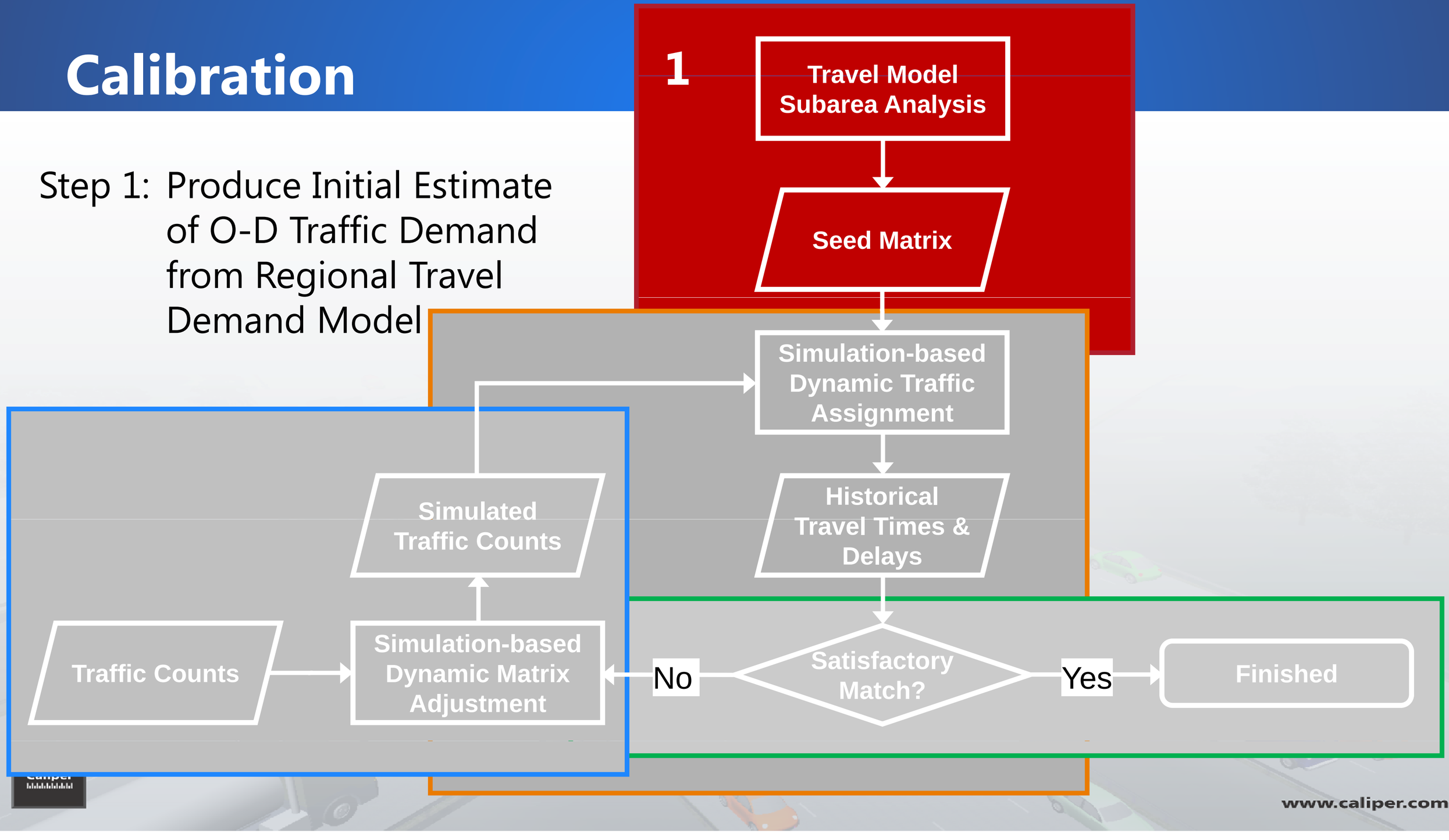


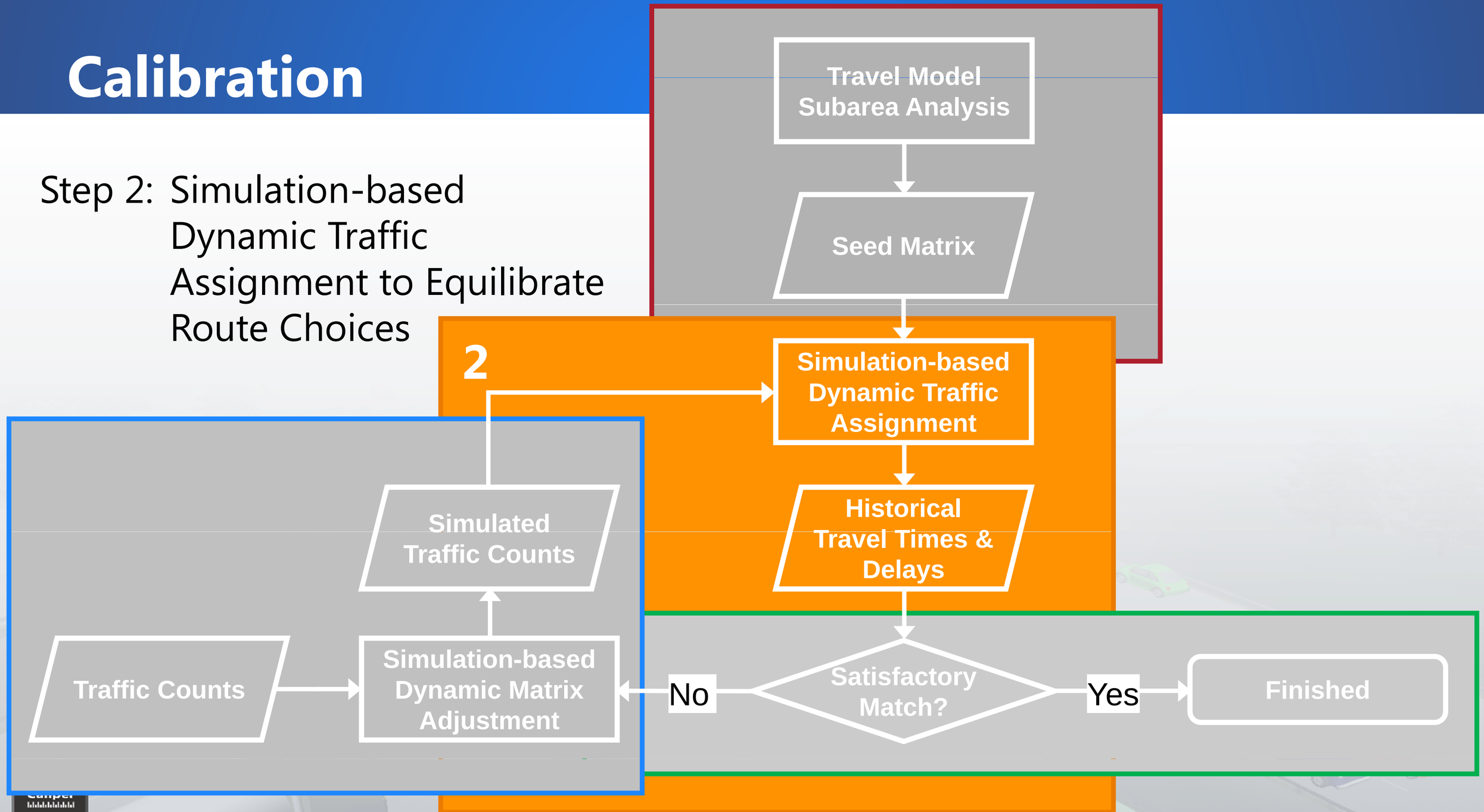
Calibration

Step 1: Produce Initial Estimate of O-D Traffic Demand from Regional Travel Demand Model



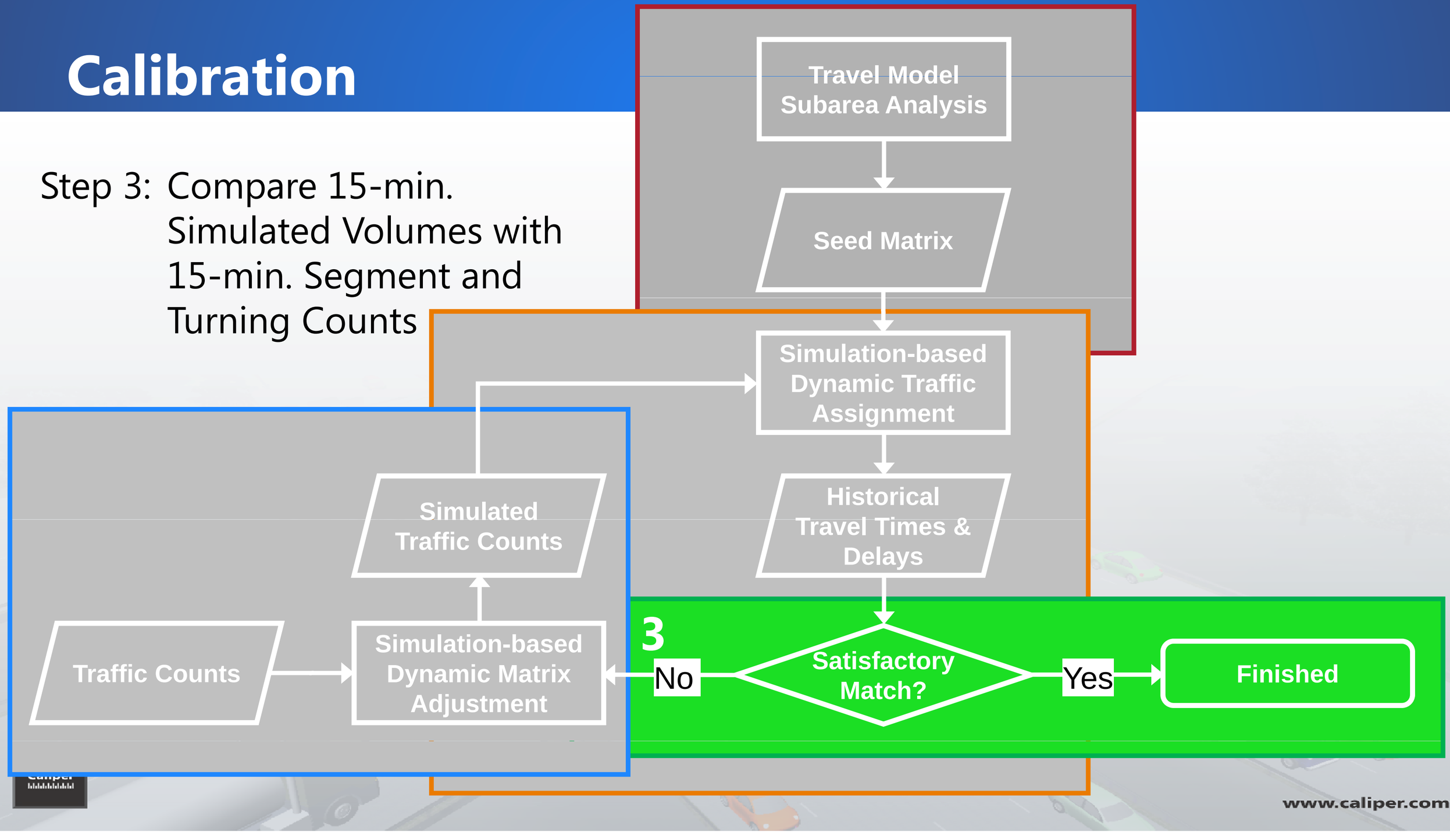
Calibration

Step 2: Simulation-based Dynamic Traffic Assignment to Equilibrate Route Choices



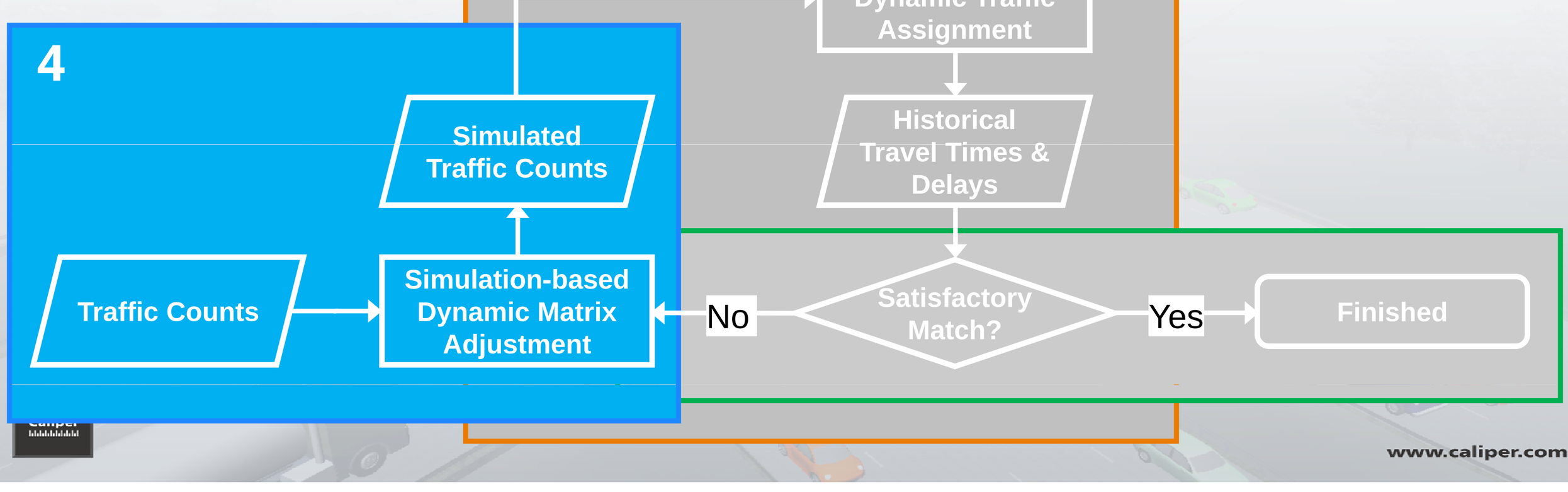
Calibration

Step 3: Compare 15-min. Simulated Volumes with 15-min. Segment and Turning Counts



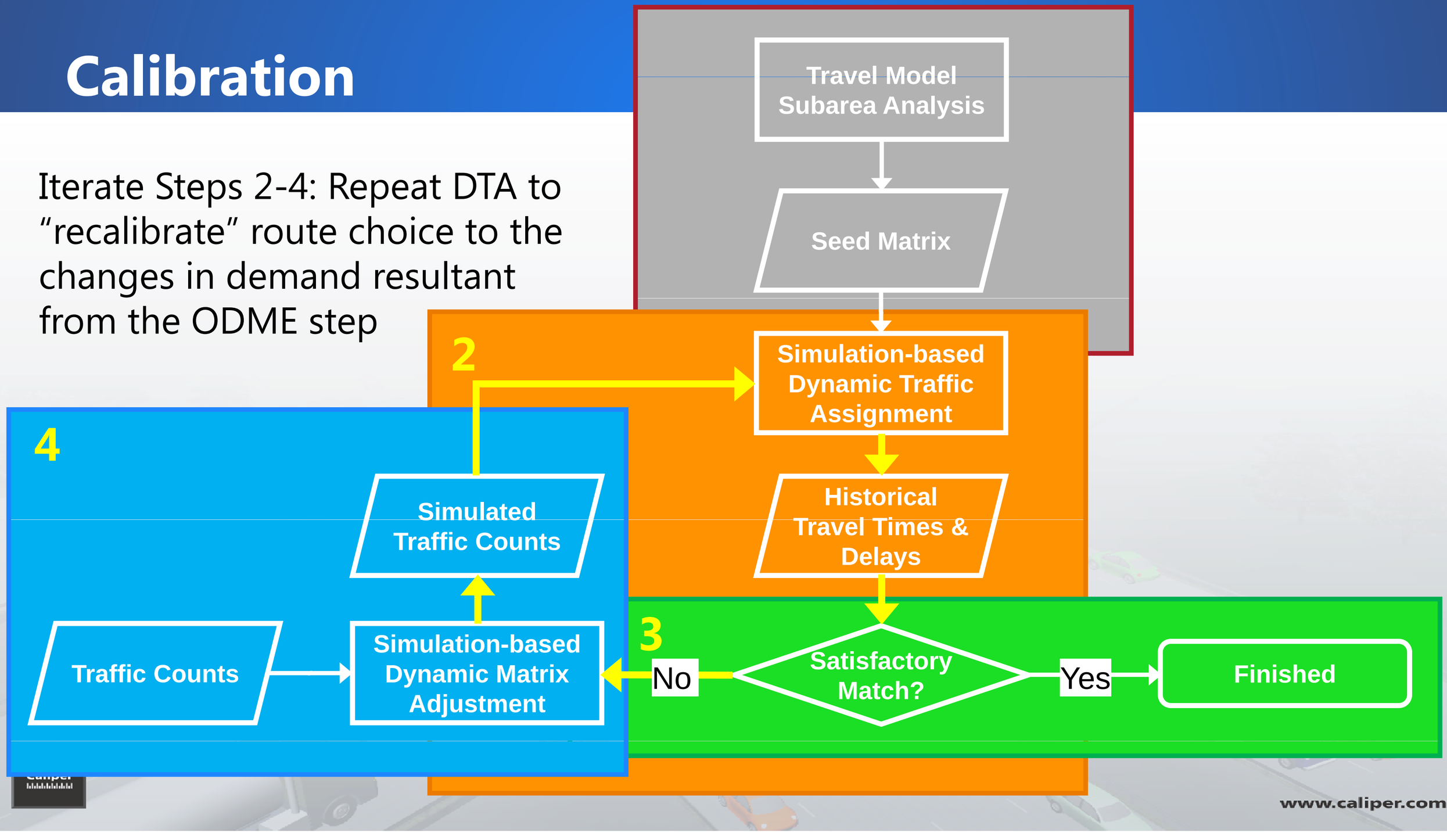
Calibration

Step 4: Simulation-based Dynamic O-D Estimation to Improve Match with Counts



Calibration

Iterate Steps 2-4: Repeat DTA to "recalibrate" route choice to the changes in demand resultant from the ODME step

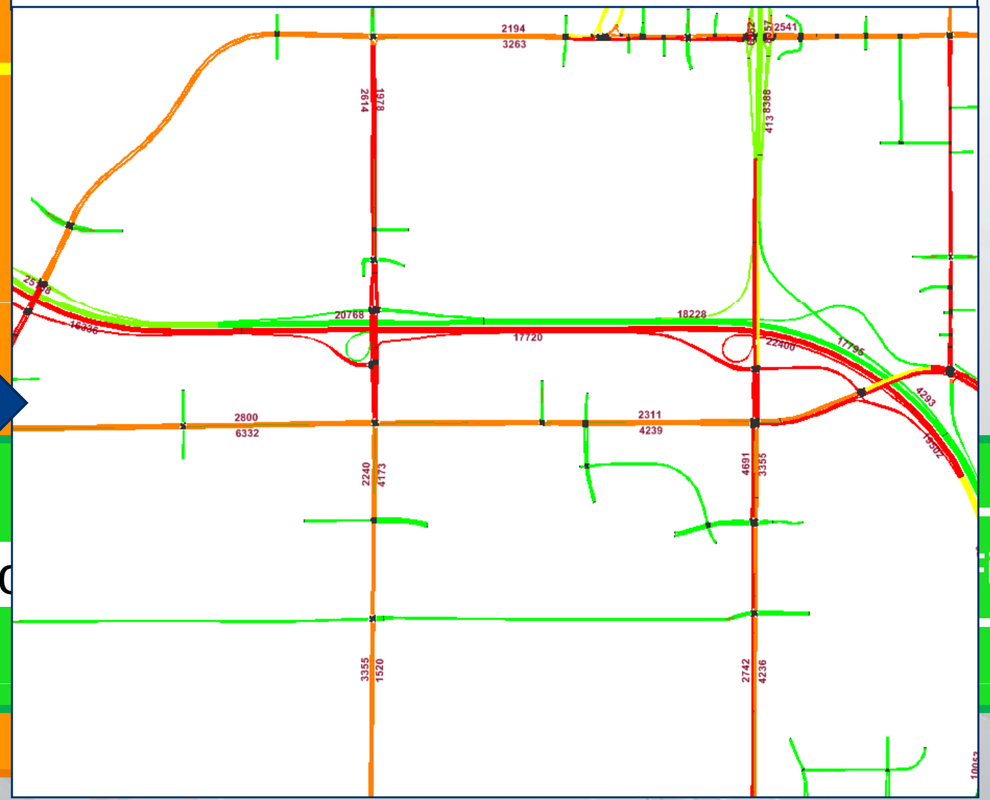


Validation

Travel Model
Subarea Analysis

Visual comparison of 15-min. speed maps with 15-min. INRIX maps to ensure start, severity, duration of bottlenecks

Targeted adjustment of trip table to improve match with bottlenecks while maintaining goodness-of-fit with counts

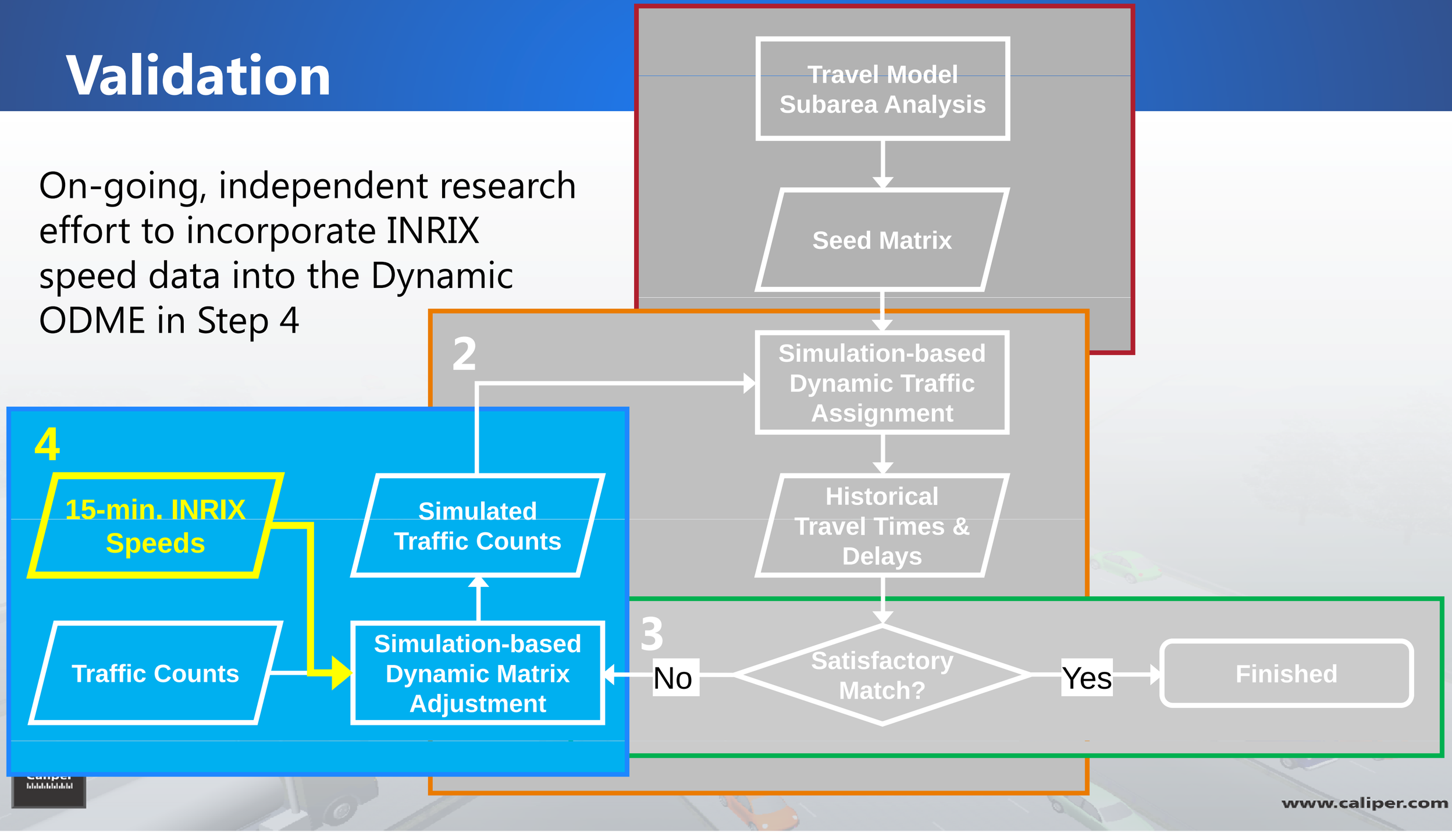


3

Finished

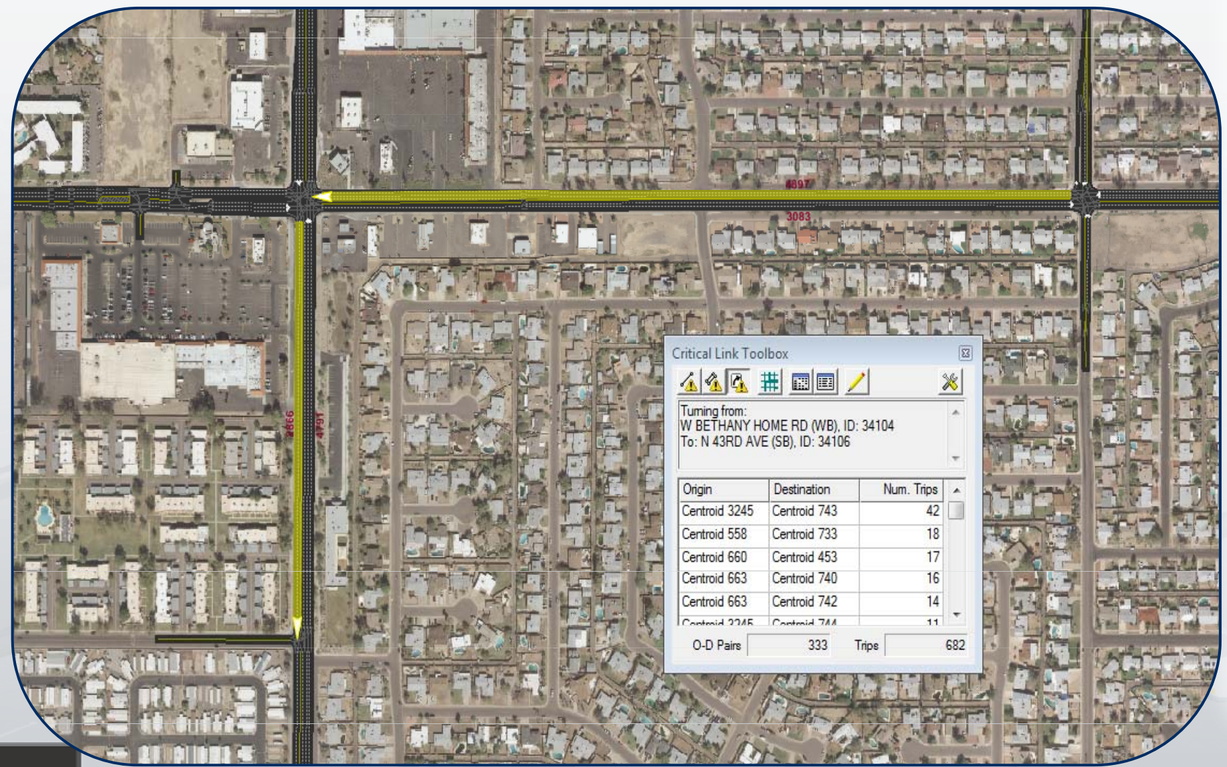
Validation

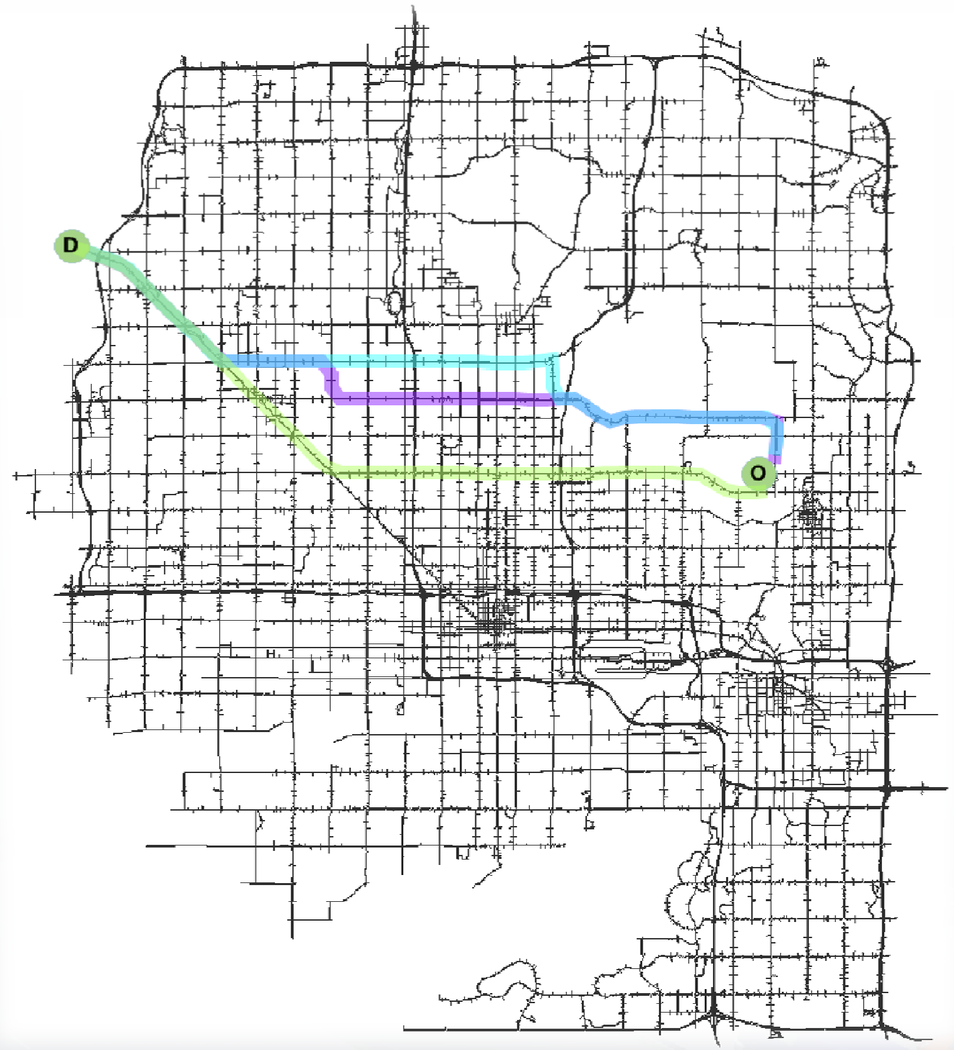
On-going, independent research effort to incorporate INRIX speed data into the Dynamic ODME in Step 4



Visual Audit

- Do route choices comport with expectations, local knowledge?

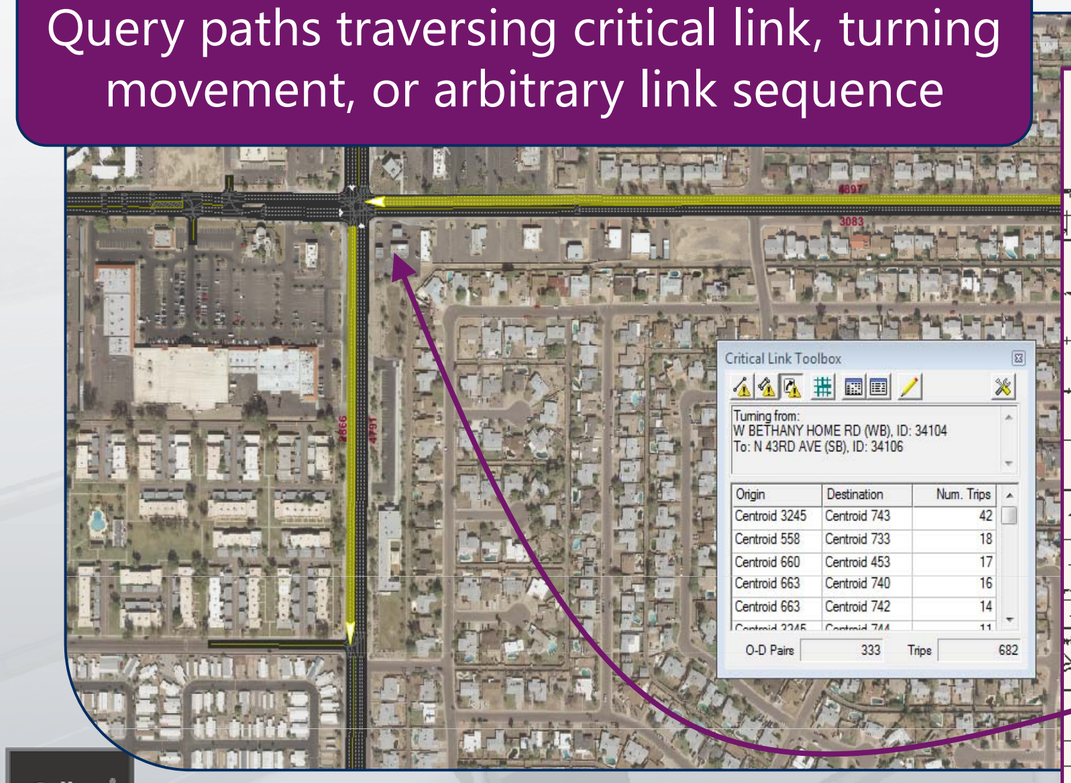


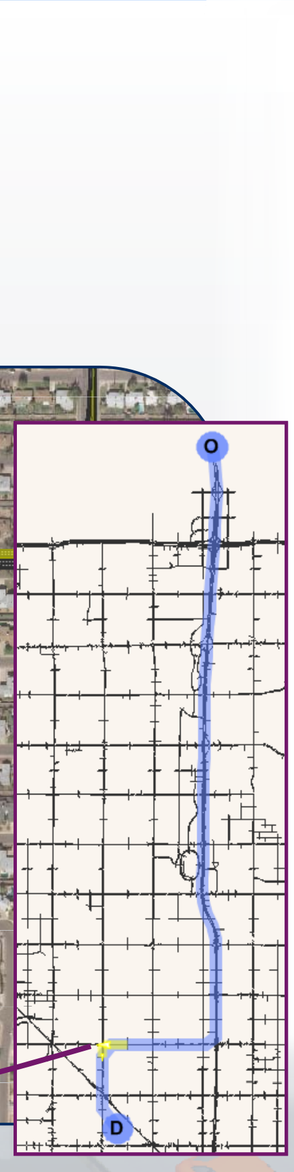


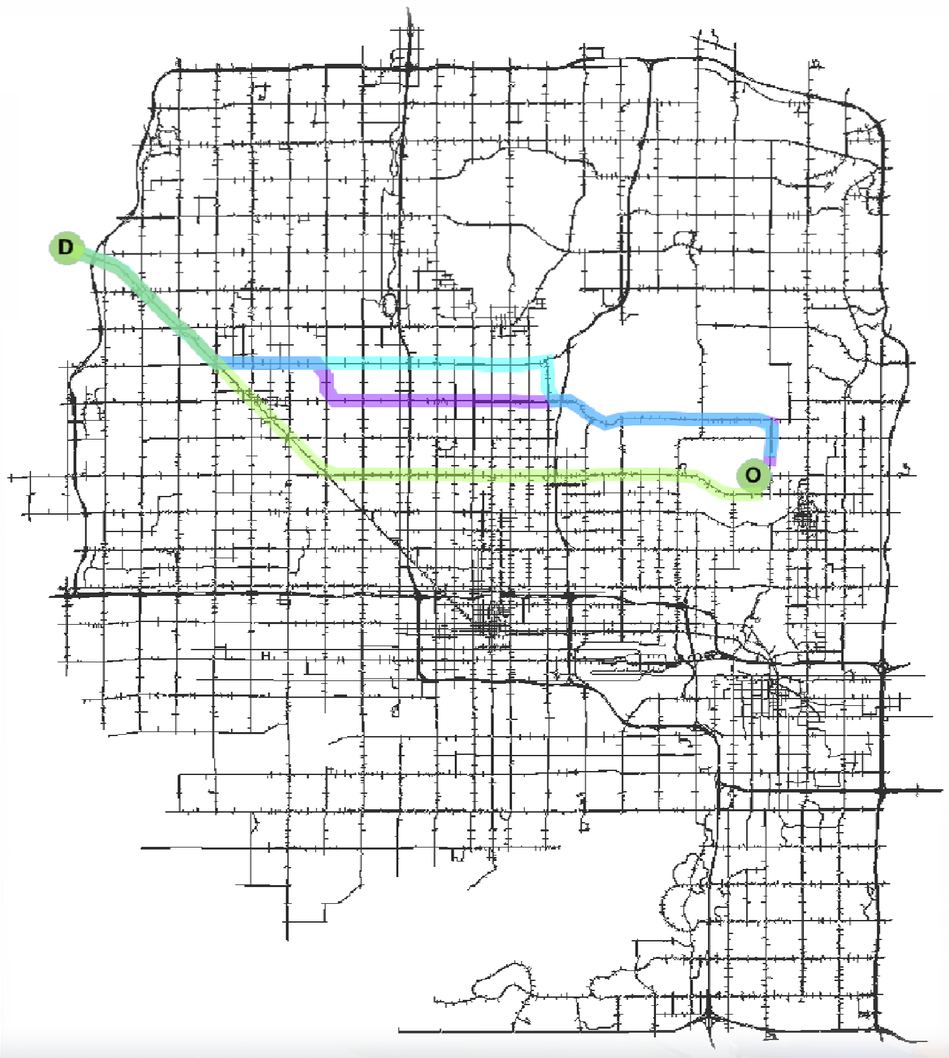
Visual Audit

- Do route choices comport with expectations, local knowledge?

Query paths traversing critical link, turning movement, or arbitrary link sequence







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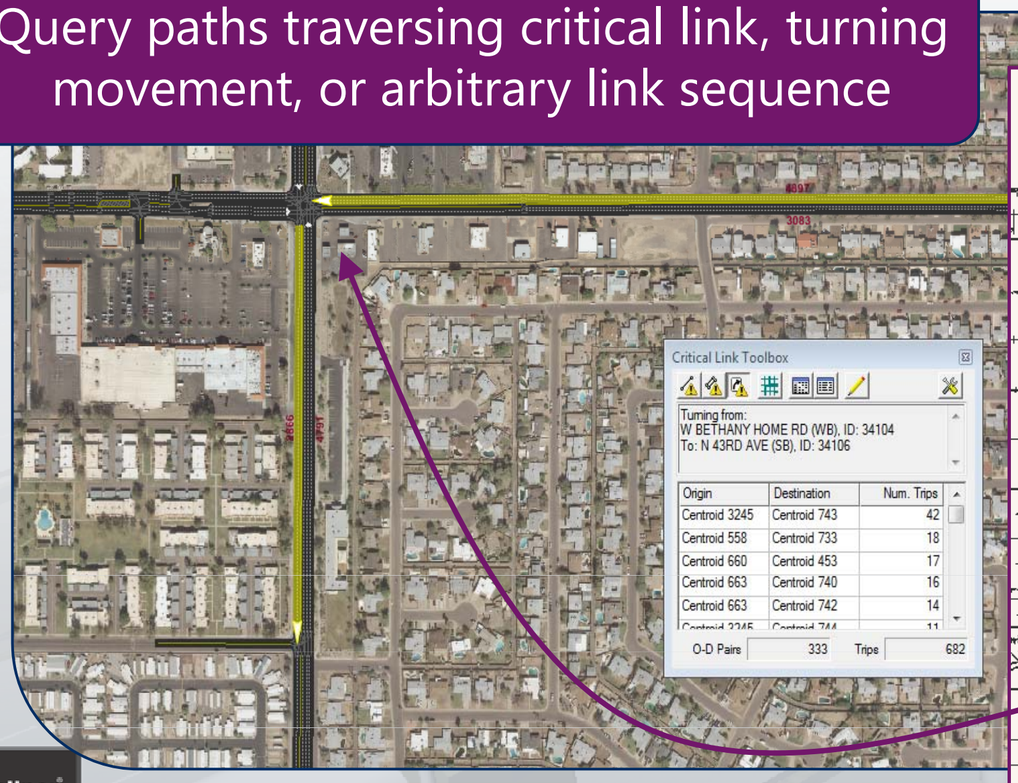
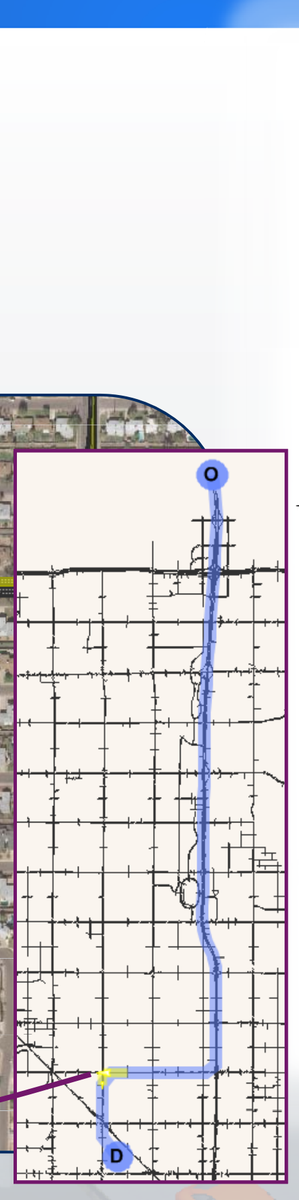
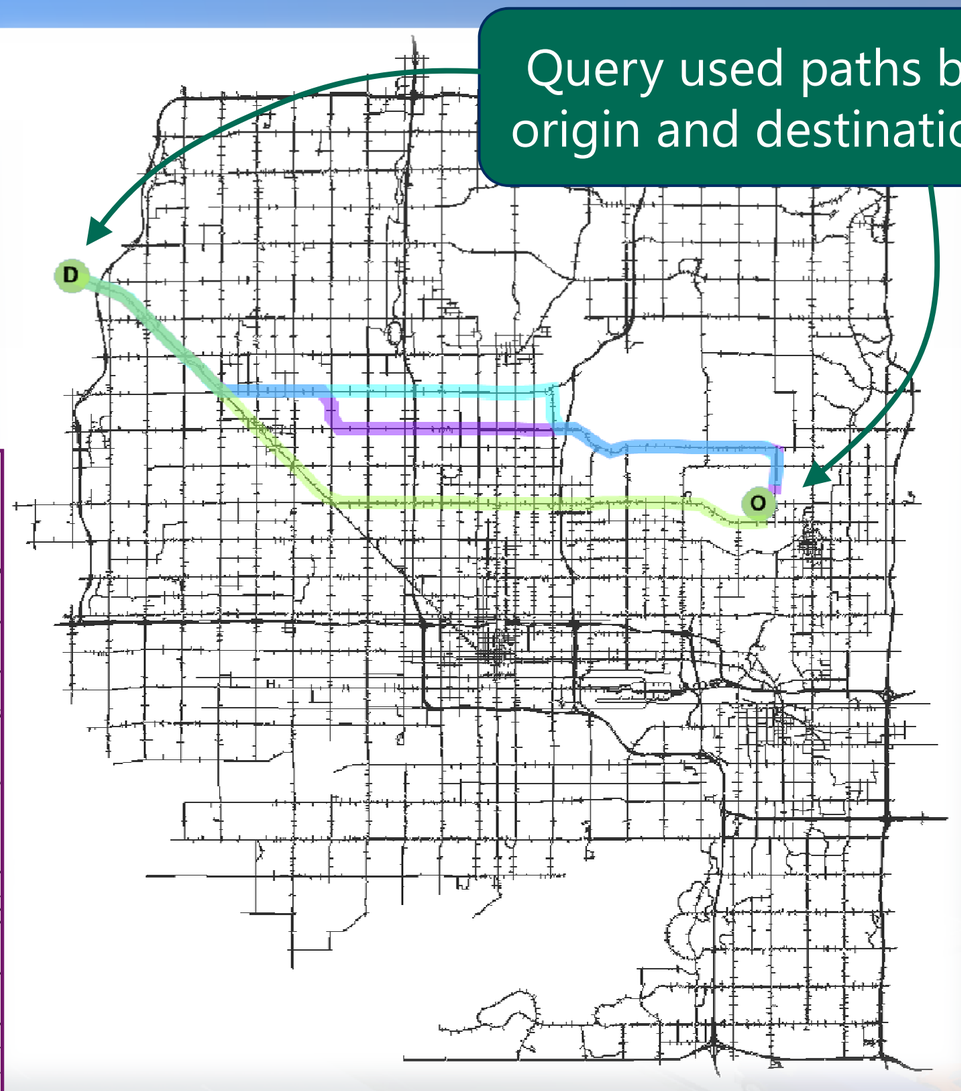




Query used paths by origin and destination



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Goodness of Fit

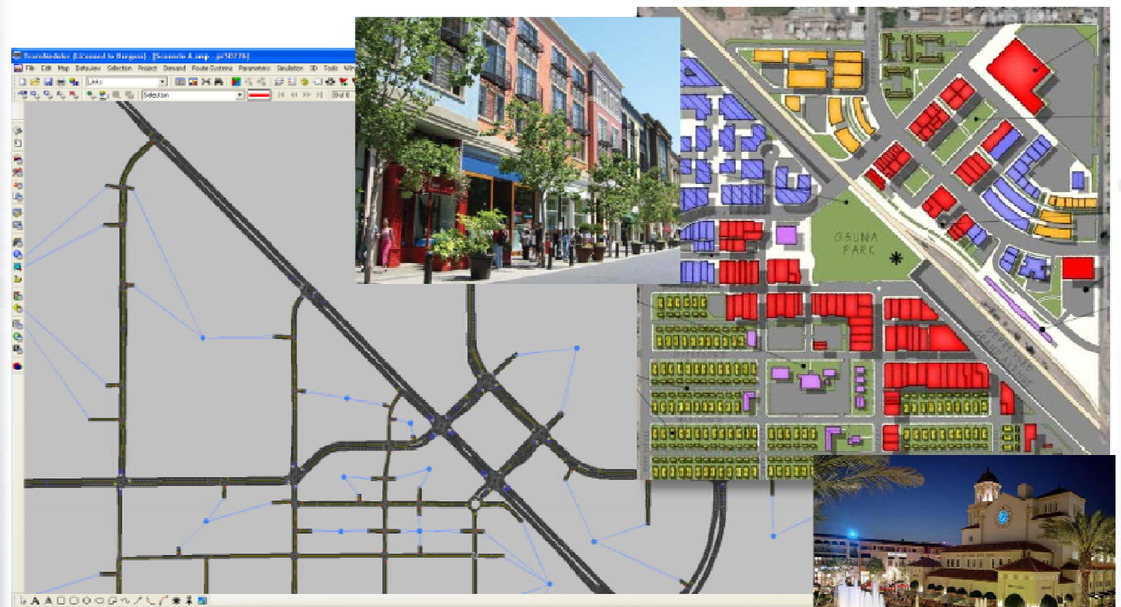
- How well do simulated volumes match the field data? In %RMSE:

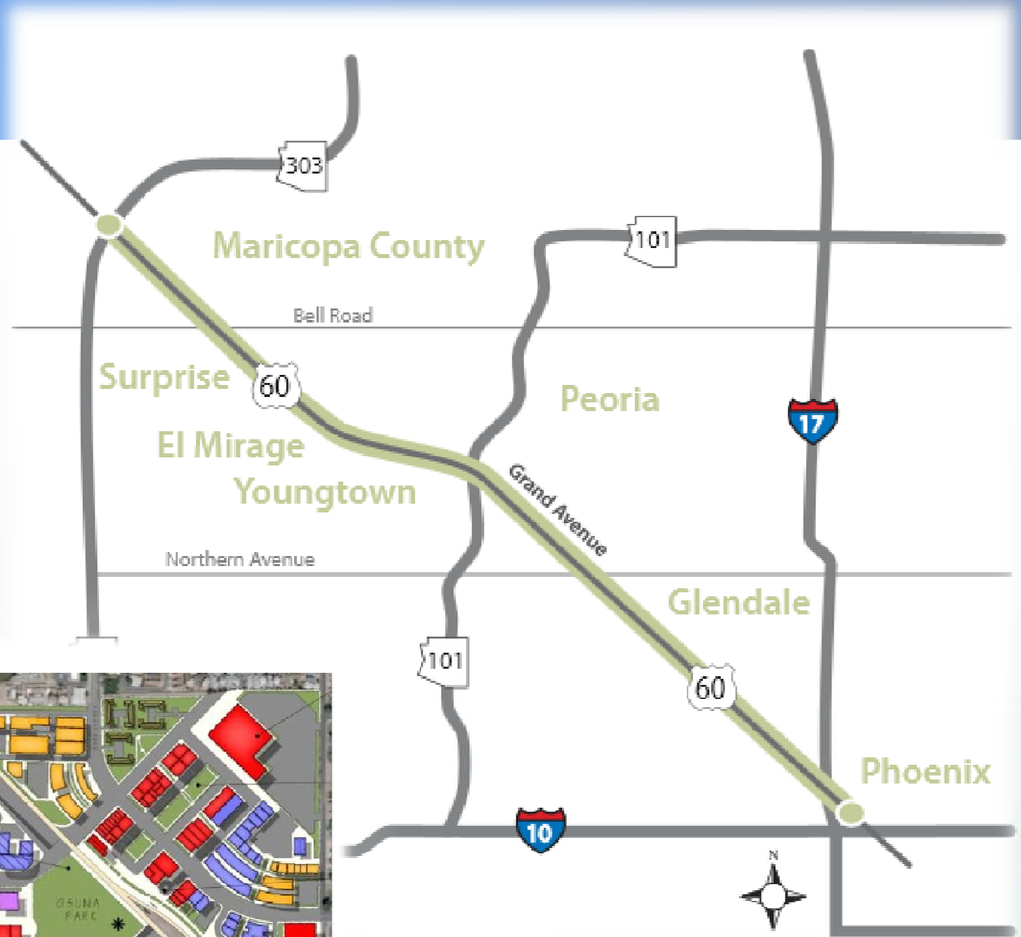
AM Period	All Counts	Freeway and Ramp
Observations	1,497	279
6:00 – 7:00 AM	37.8%	20.4%
7:00 – 8:00 AM	31.9%	18.0%
8:00 – 9:00 AM	30.7%	18.0%
6:00 – 9:00 AM	**29.25%**	**15.7%**

PM Period	All Counts	Freeway and Ramp
Observations	1,497	279
3:00 – 4:00 PM	31.9%	17.7%
4:00 – 5:00 PM	29.6%	18.7%
5:00 – 6:00 PM	34.4%	21.0%
3:00 – 6:00 PM	**28.8%**	**16.7%**

Applications

- US-60/Grand Avenue COMPASS Study
- Old Town Peoria Traffic Study
- Various analyses of traffic interchange redesigns and other roadway improvements





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