Preferred citation style

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Integration of Activity-Based with Agent-Based Models: An Example from Tel-Aviv Model and MATSim

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Project Overview

Work conducted can be divided into four tasks.

- Update of the existing MATSim Model of Tel Aviv (see Bekhor, Dobler and Axhausen, 2011).
- Add new features to the model: road pricing and destination choice.
- Re-run and re-calibrate the model.
- Analyze the outcomes.

Motivation

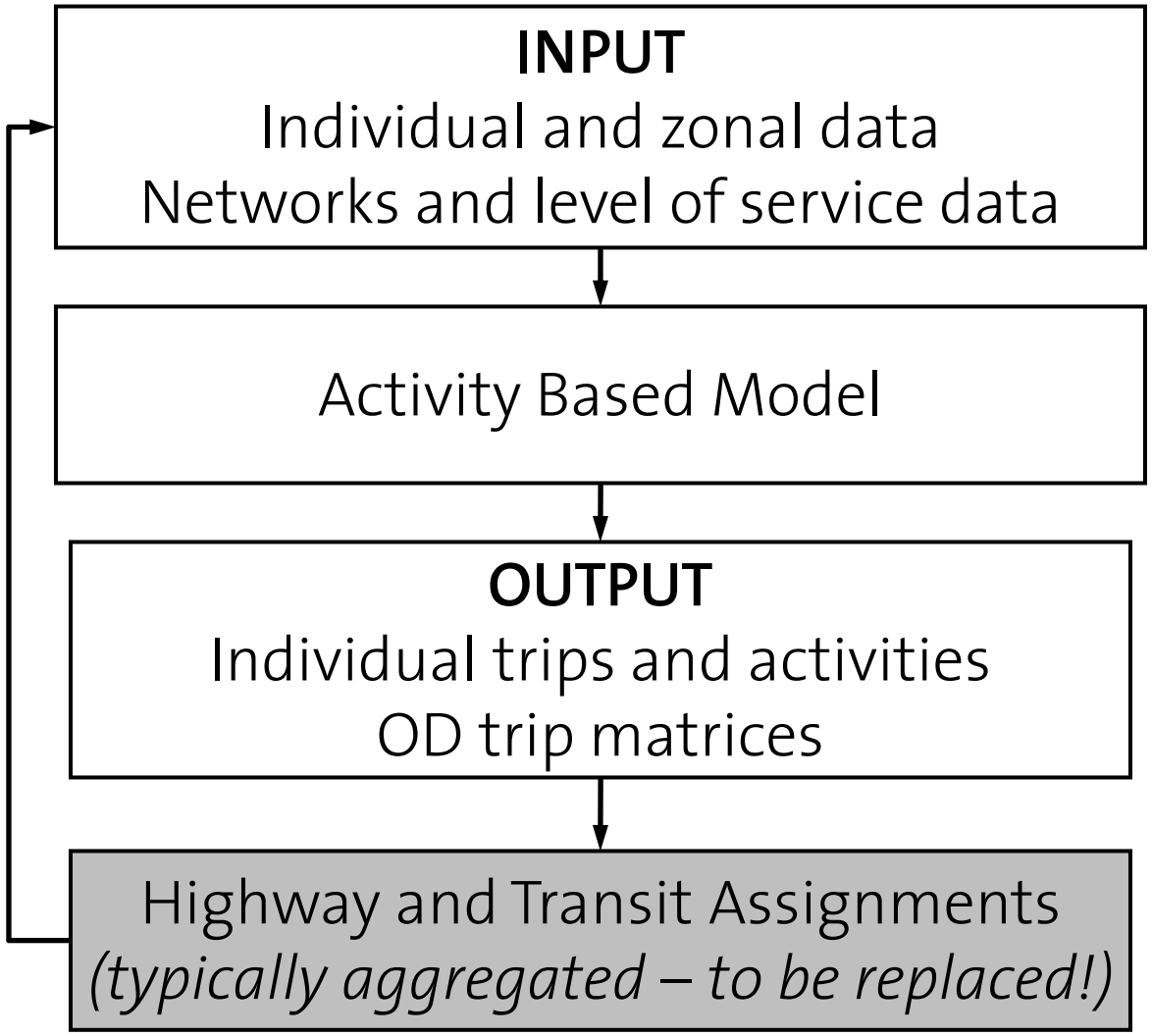
Most activity-based models have:

- a detailed activity and trip chains for each modeled person, but
- the supply side is generally modeled using aggregate methods.

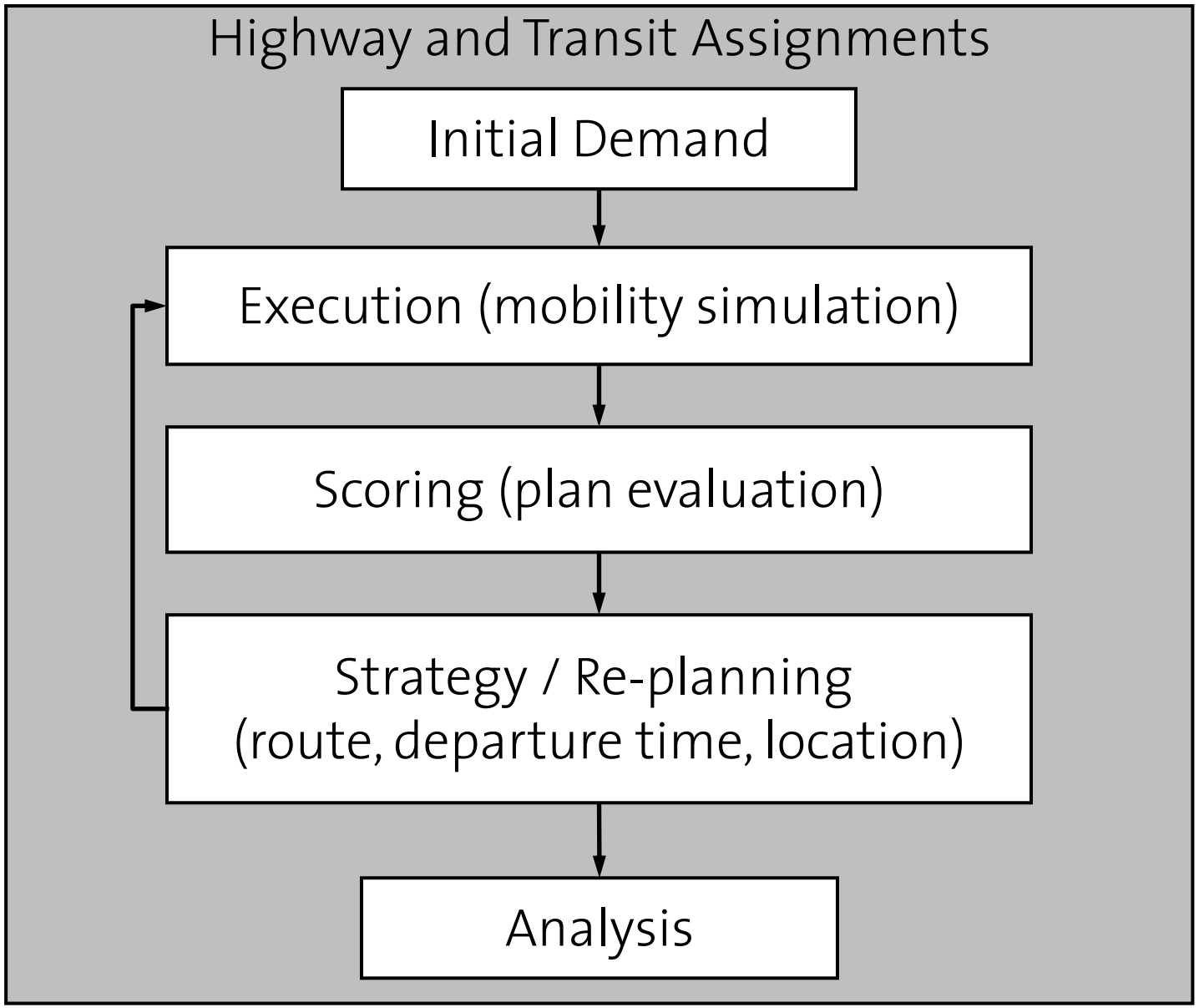
This study explores the possibility combining best features of both frameworks:

- The disaggregate demand representation of the activity-based model.
- The disaggregate supply representation of an agent-based simulation model.

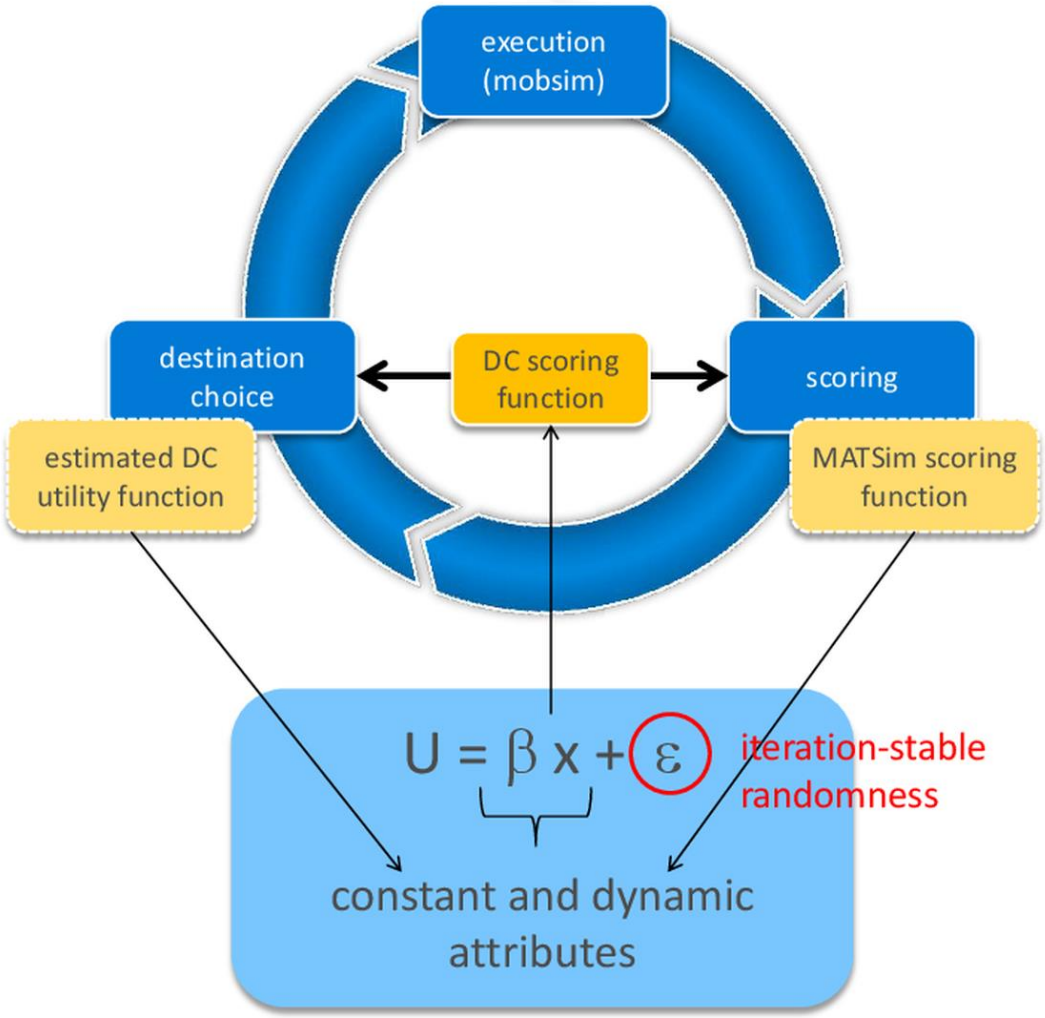
Overall Activity-Based Model Application Structure



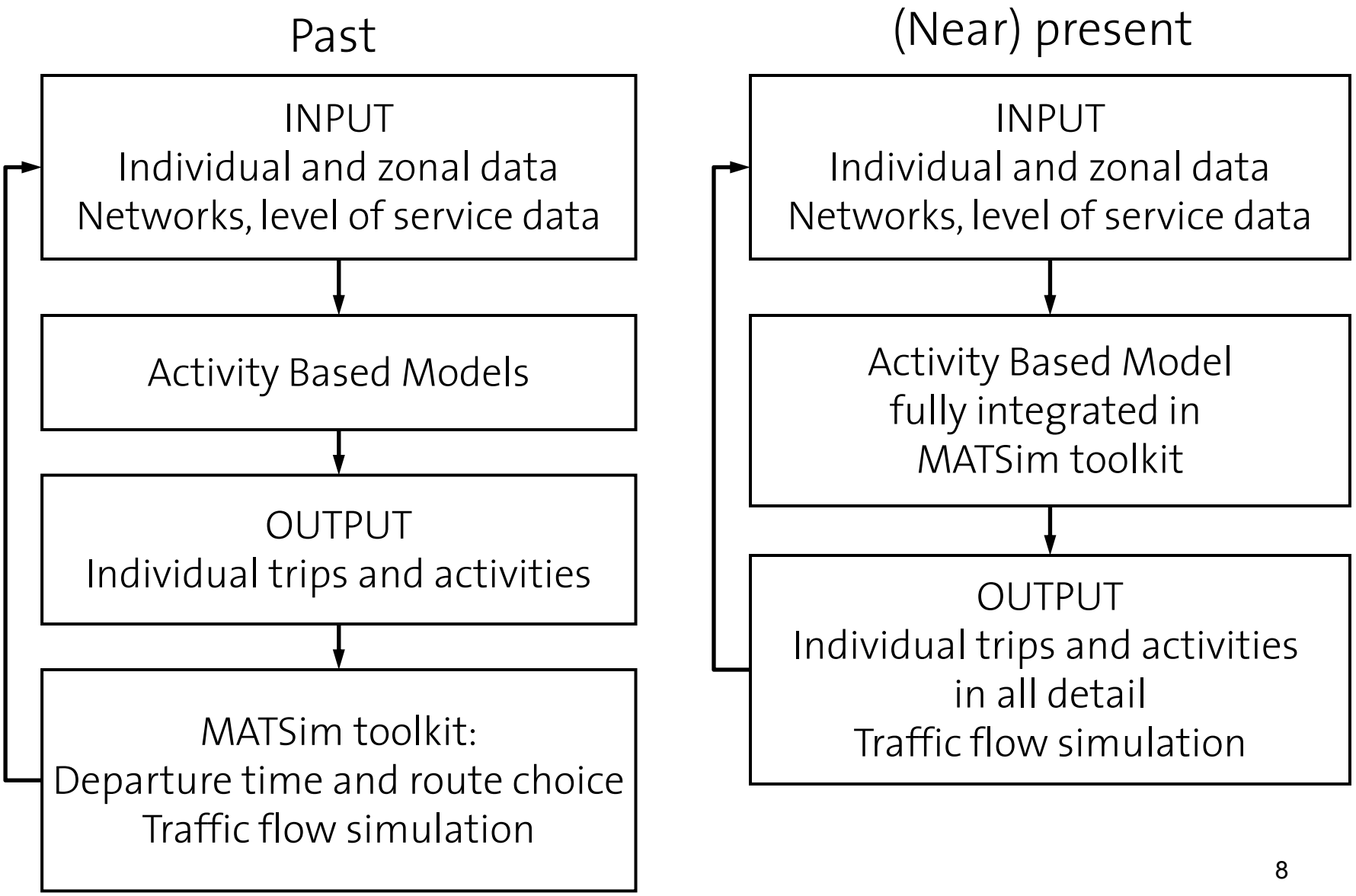
New Assignment Unit: The MATSim Agent-Based Toolkit



Consistent Implementation of Destination Choice



Modeling Framework – Past vs. Present



Steps Performed to Prepare the Initial Demand

Departure Time Disaggregation

- From time periods to hourly demand

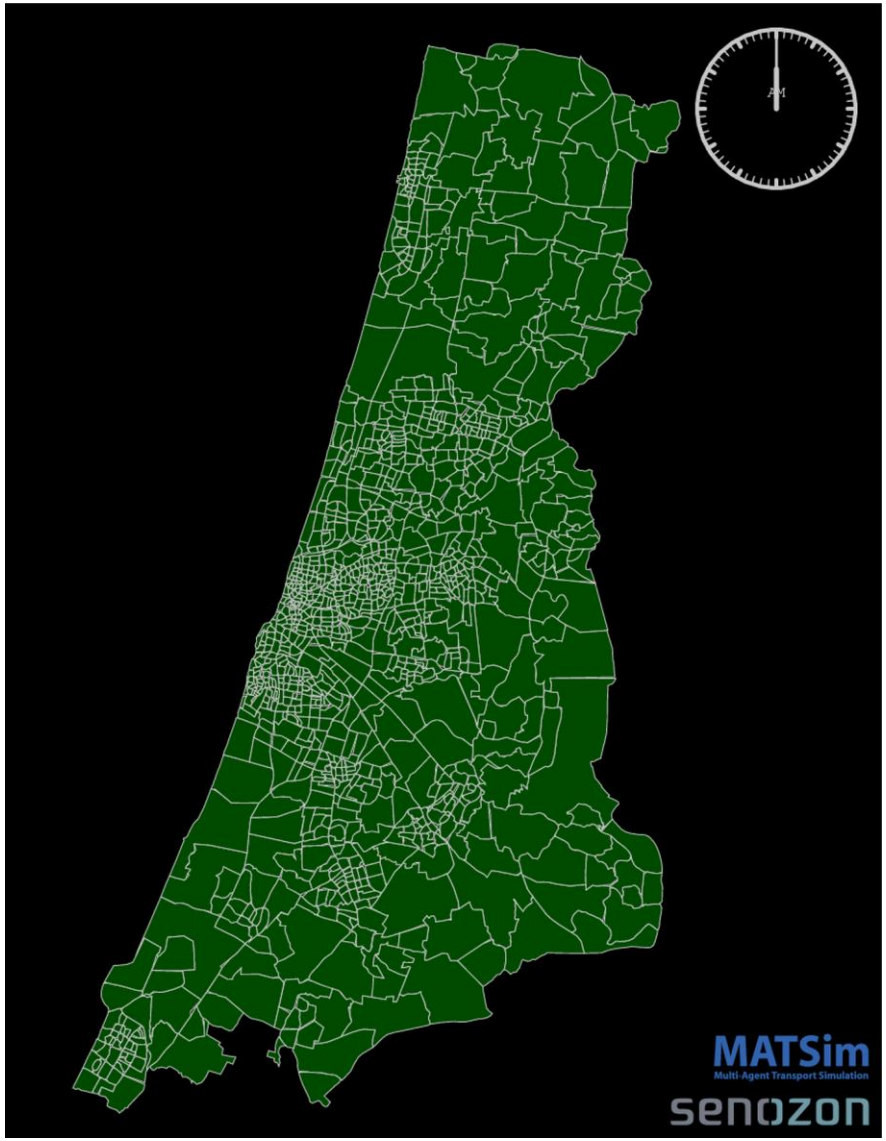
Traffic Analysis Zones Disaggregation

- From traffic zones to links and facilities

Network Conversion

- Representation of turning restrictions
- Assignment of links to zones

Project Area

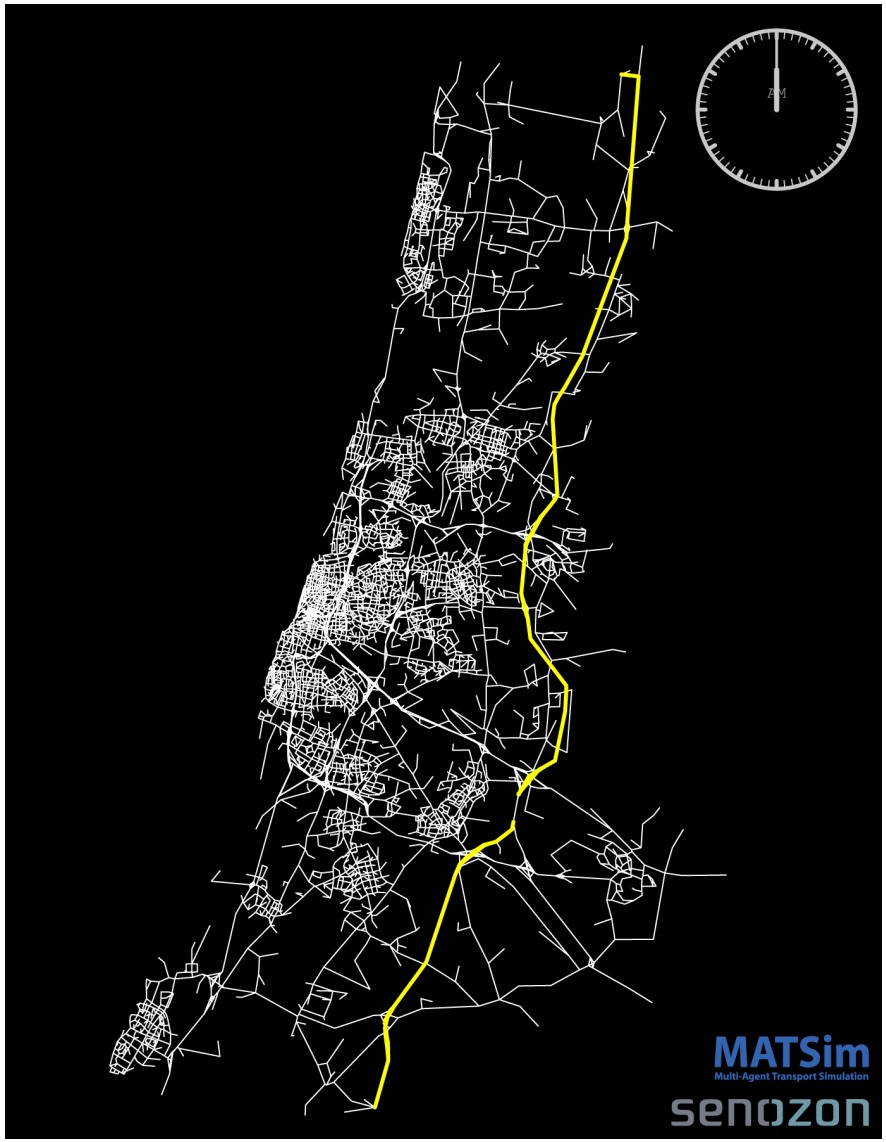


1‘219 zones
About 1‘500 km²
3.3 million habitants

Road Network

9‘474 nodes
18‘570 links

Road Pricing

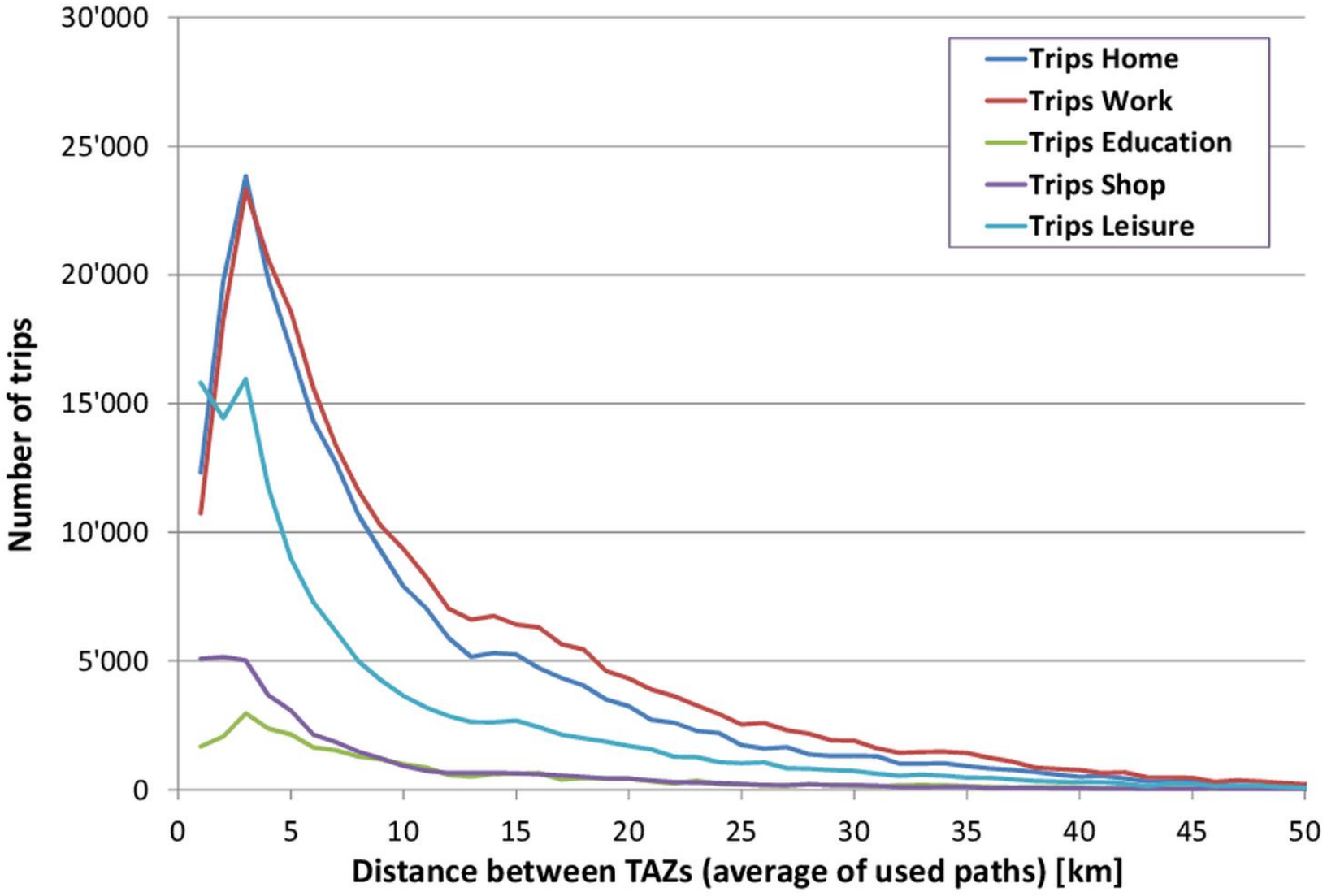


Tolled links marked yellow

Counted Links

137 links with traffic count data available marked red

Trip Length Distributions



Calibration and Outcomes

Calibration of the simulation model

- Traffic flow dynamics (flow and storage capacity)
- Destination choice
- Road toll

Analysis of the outcomes

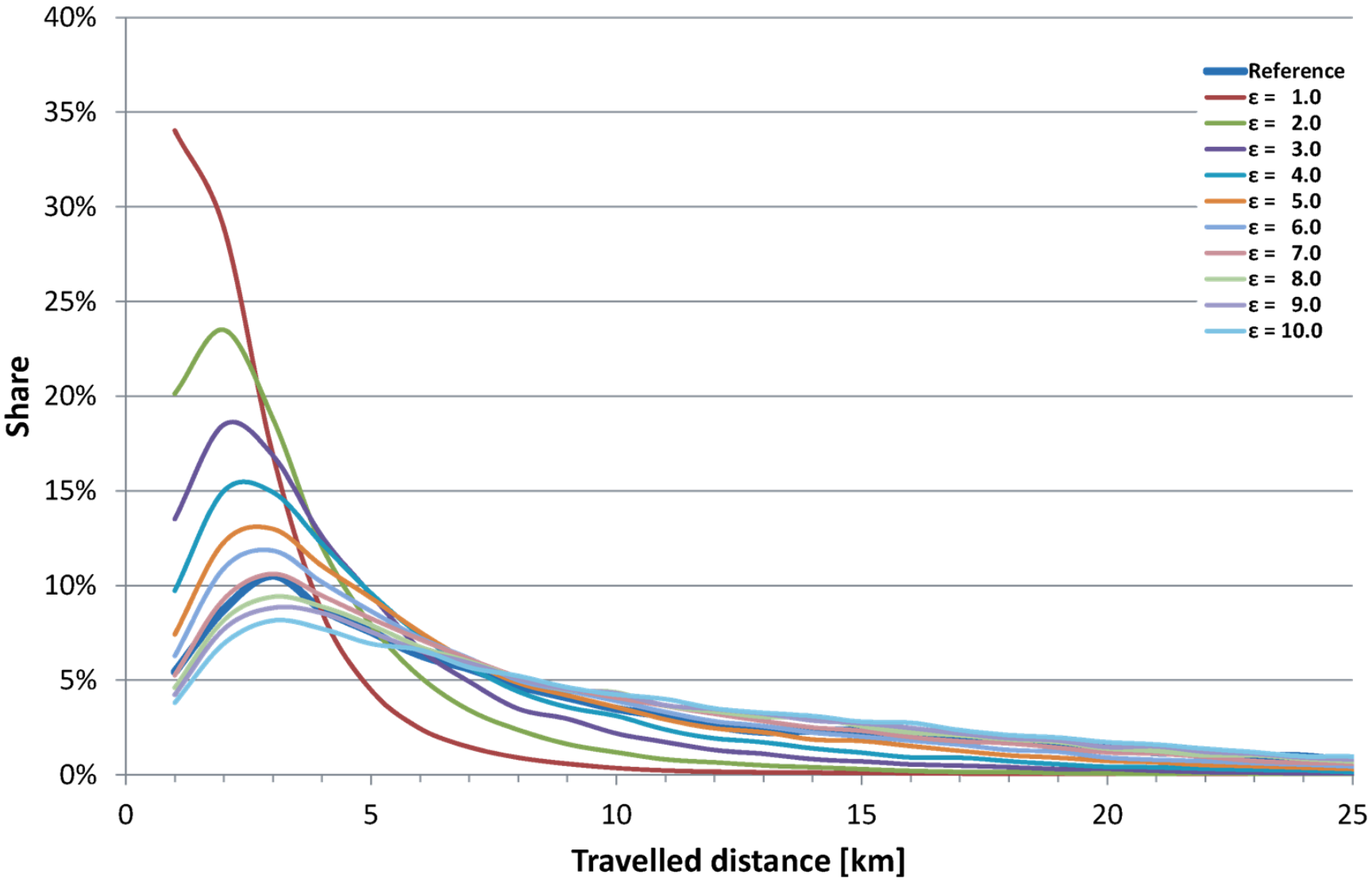
- Trip length distributions
- Road pricing
- Traffic counts

Destination Choice Calibration

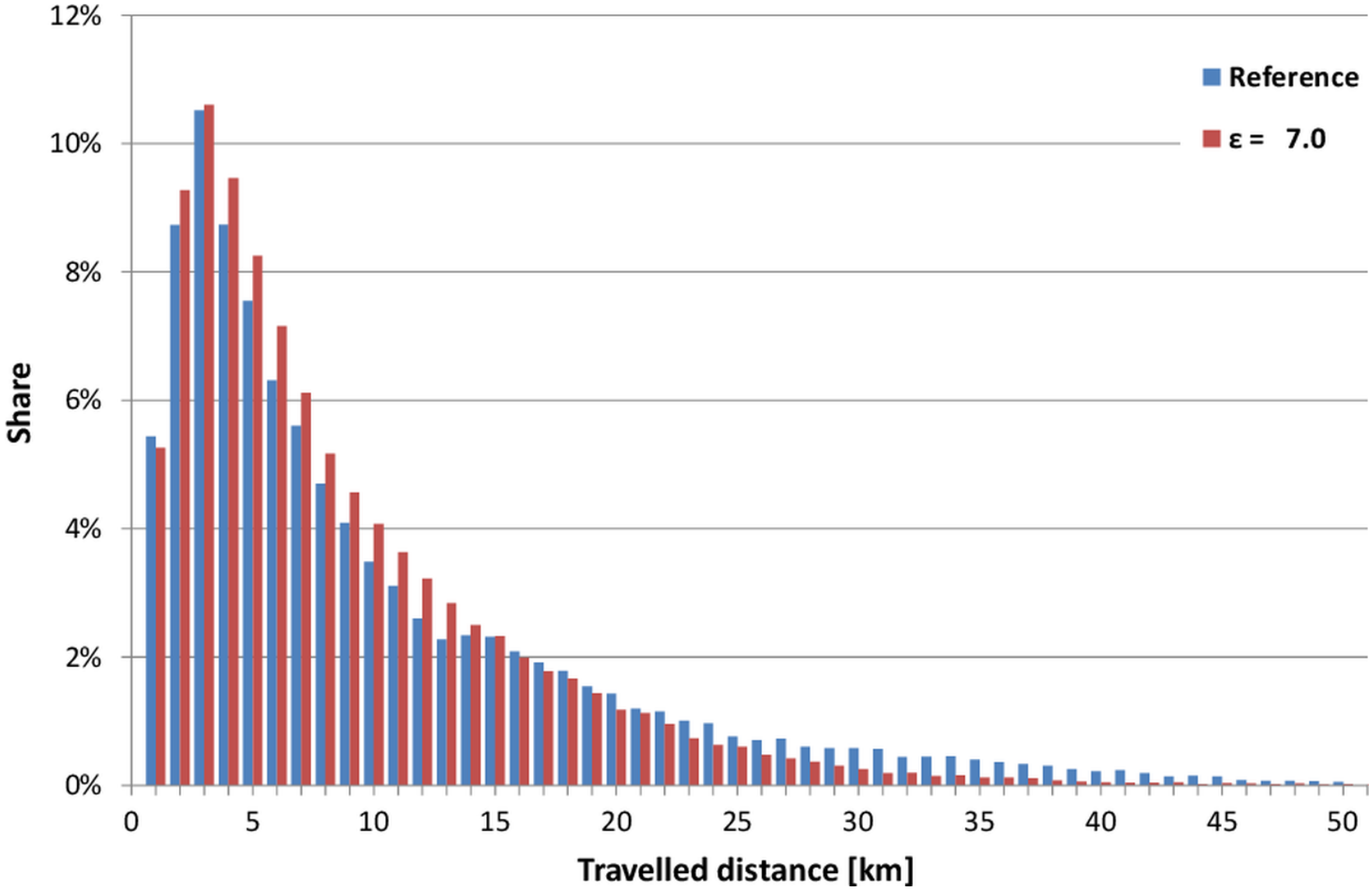
Three step approach

- Conduct parameter study for various ε values
- Find optimal ε for each trip purpose
- Apply optimal ε to a setup with bad initial location choices

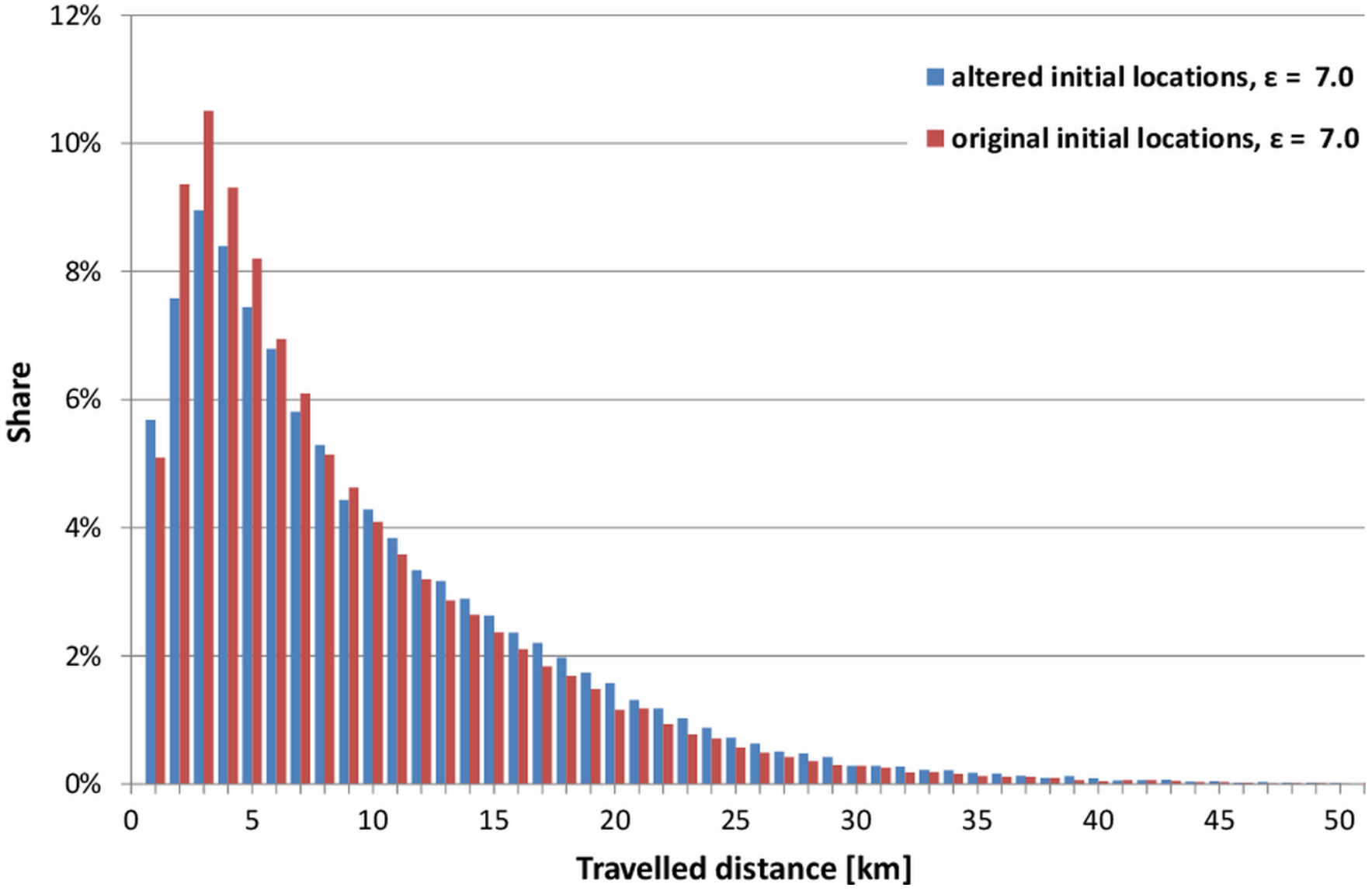
Leisure Trip Calibration



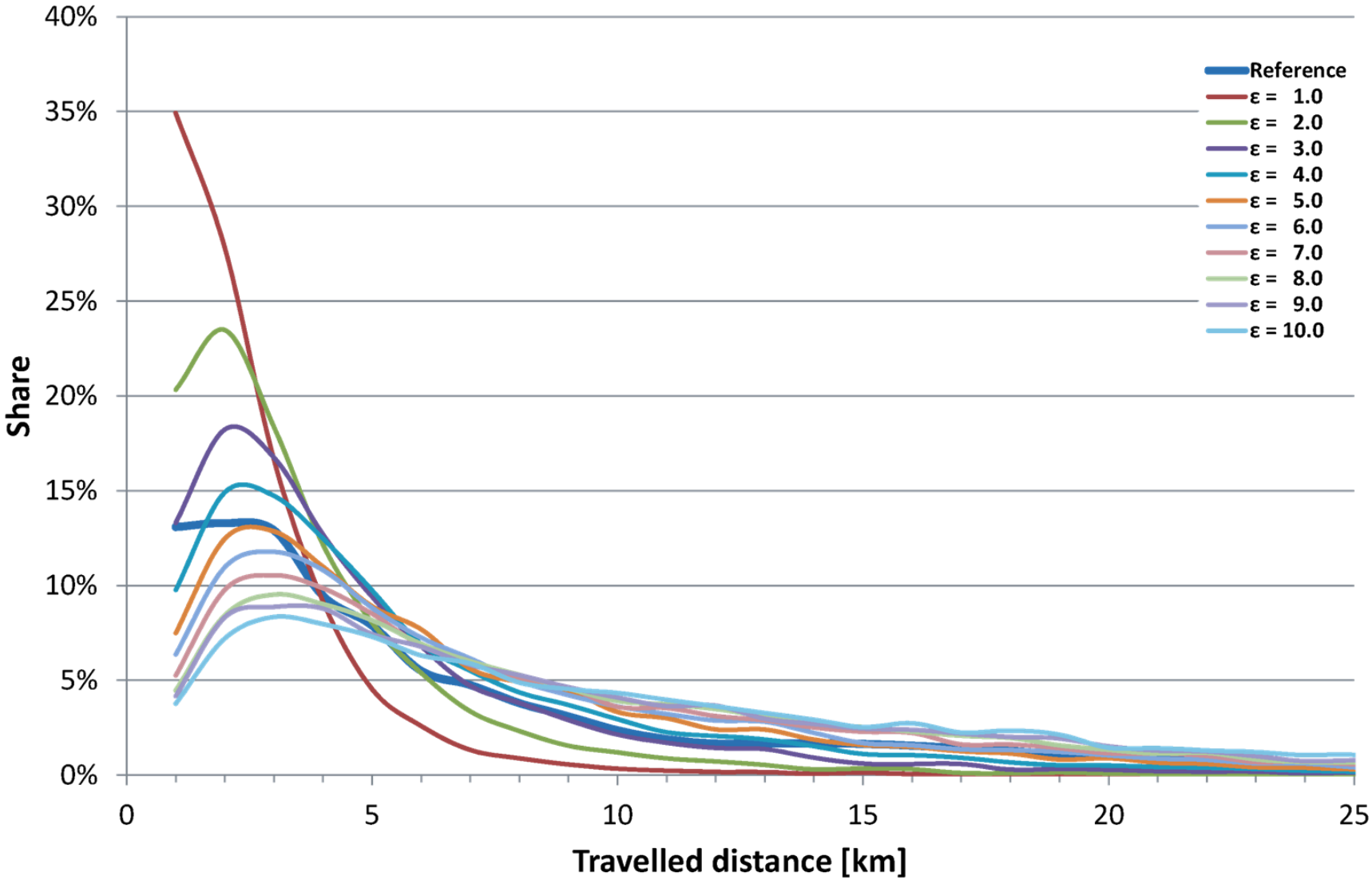
Optimal ε for Leisure Trips



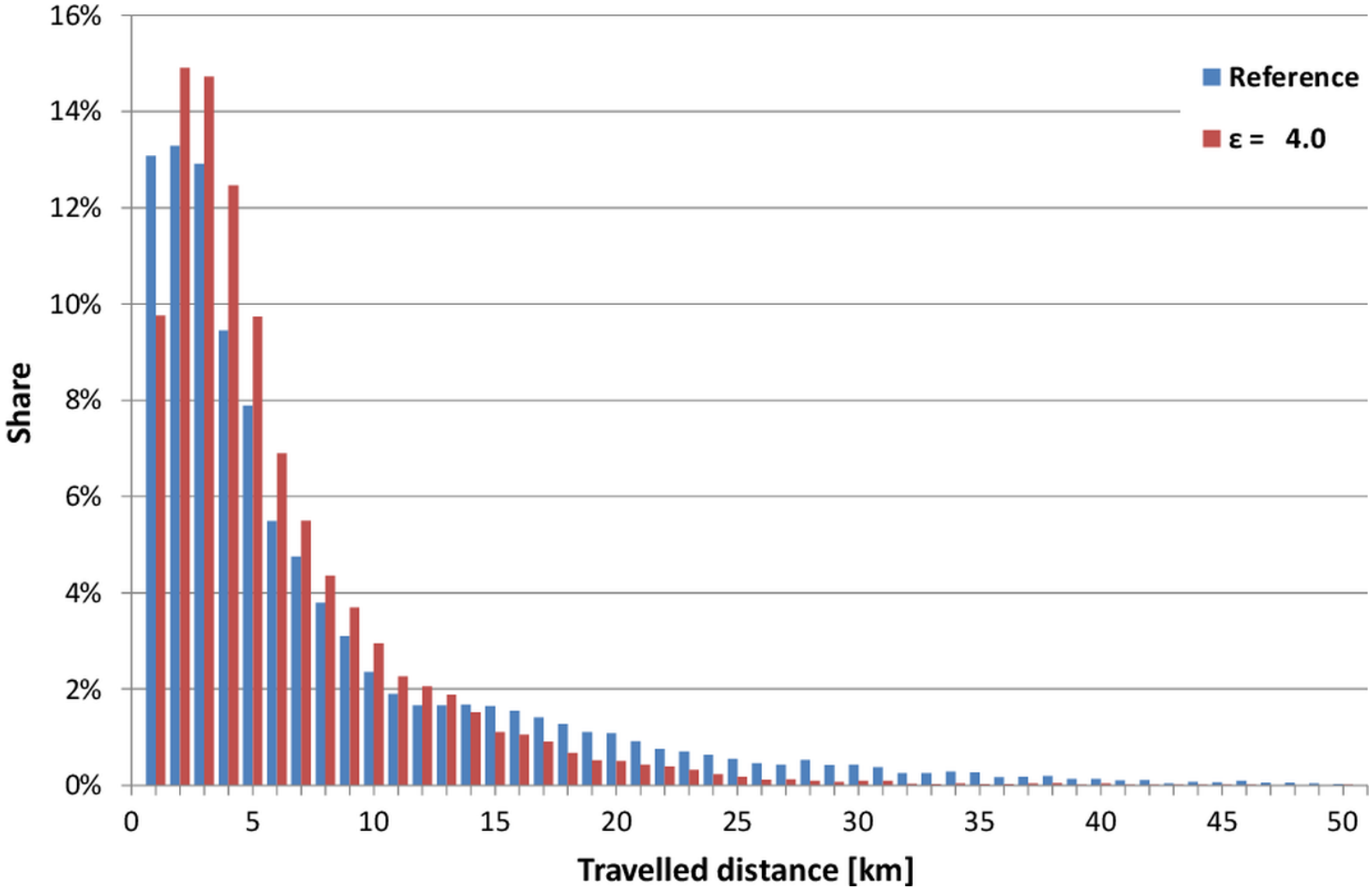
Leisure Trips with Altered Initial Locations



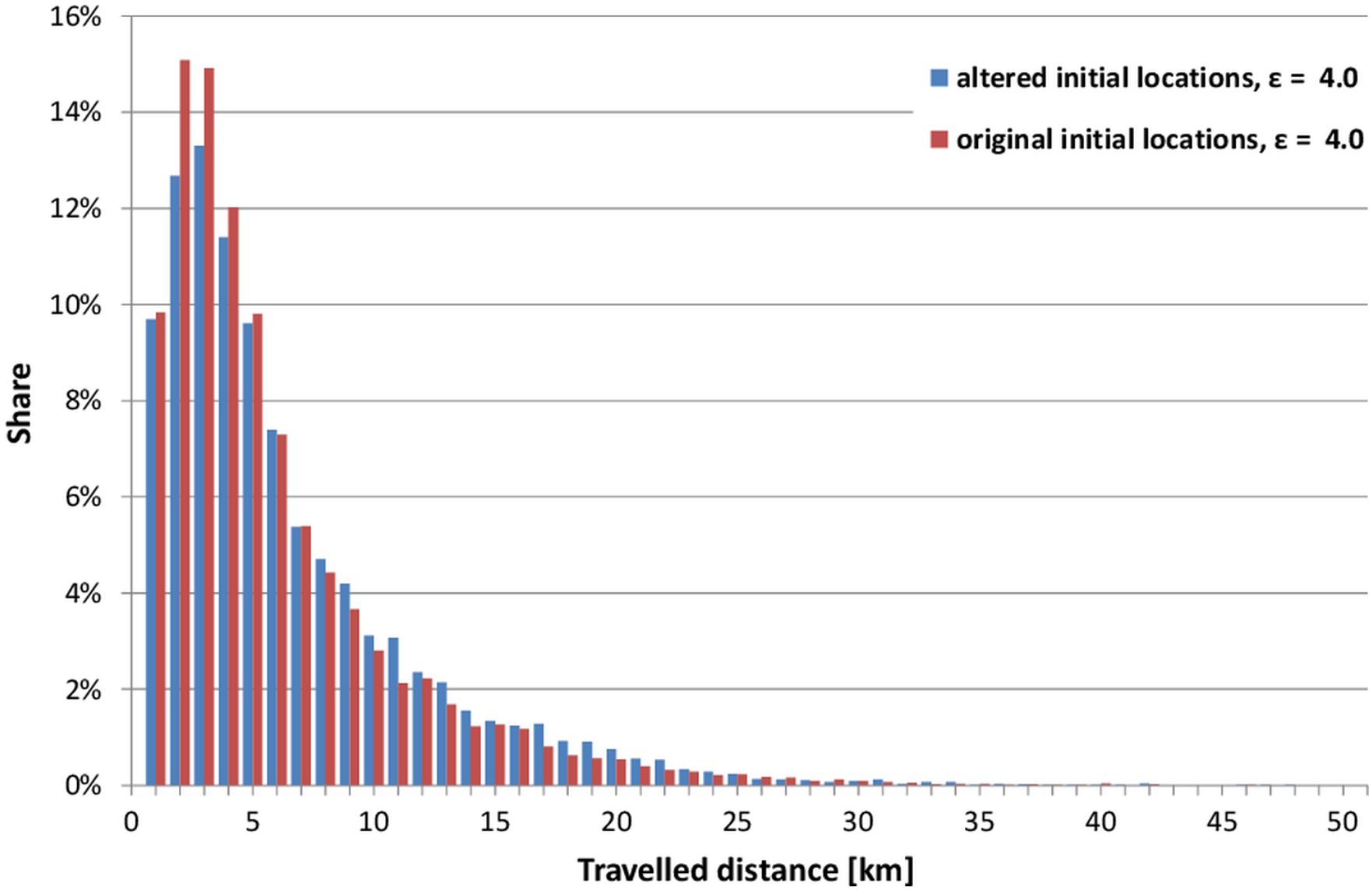
Trip Length Distributions – Shopping Trip Calibration



Optimal ε for Shopping Trips



Shopping Trips with Altered Initial Locations



Road Pricing

Adding road tolls slightly improves the model fit. Only small influence since...

- Only a few tolled links.
- Only 16 of 137 count stations are on tolled roads, i.e. effects are hard to measure.
- No count stations next to tolled roads to measure how many agents switch to non-tolled roads.

Checking the number of vehicles per period shows...

- too many vehicles in the OP period.
- too few vehicles in the AM and PM period.

Traffic Counts Analysis

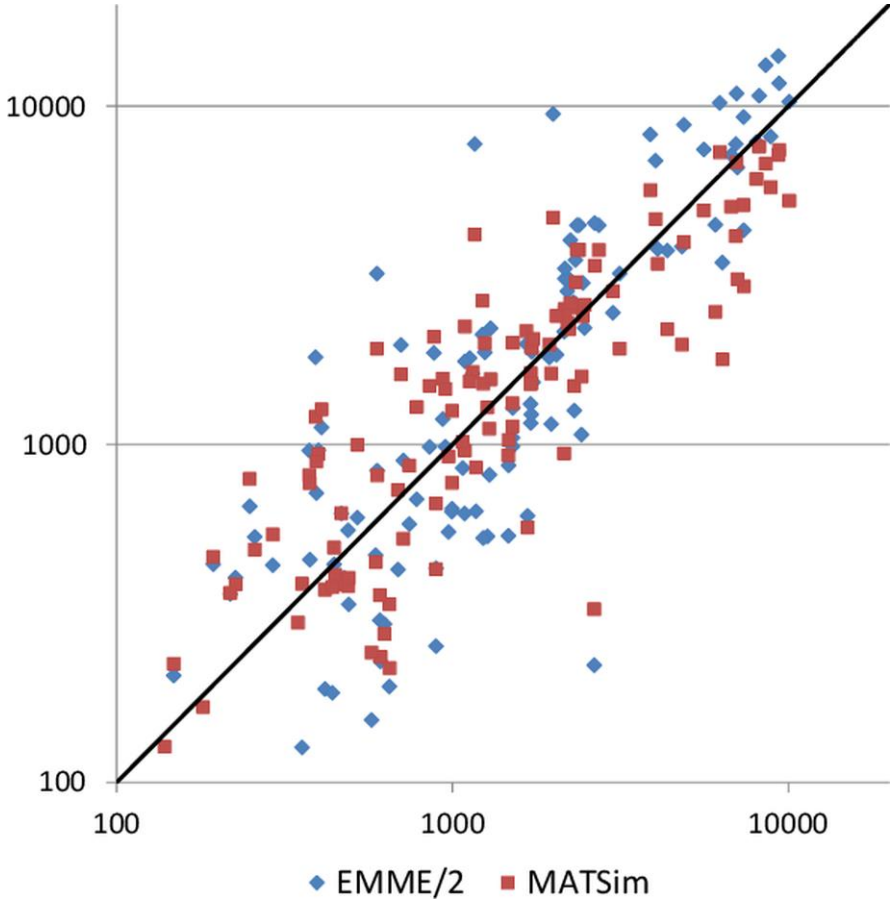
Three data sources to compare

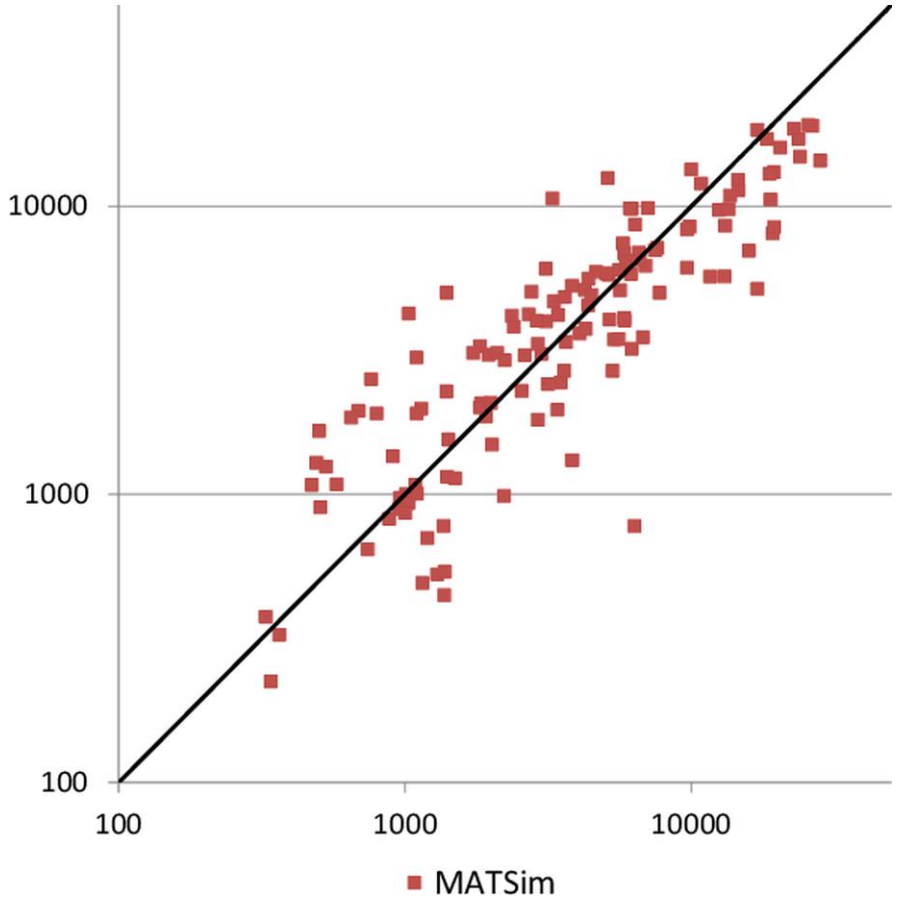
- Real world traffic count data (15 minute time bins)
- Outcomes of the EMME/2 model (3 time periods)
- Outcomes of the MATSim model (1 hour time bins)

Therefore, compare...

- peak values of all three sources for the three time periods.
- accumulated real world and MATSim values for the three time periods.
- real world and MATSim values for each hour.

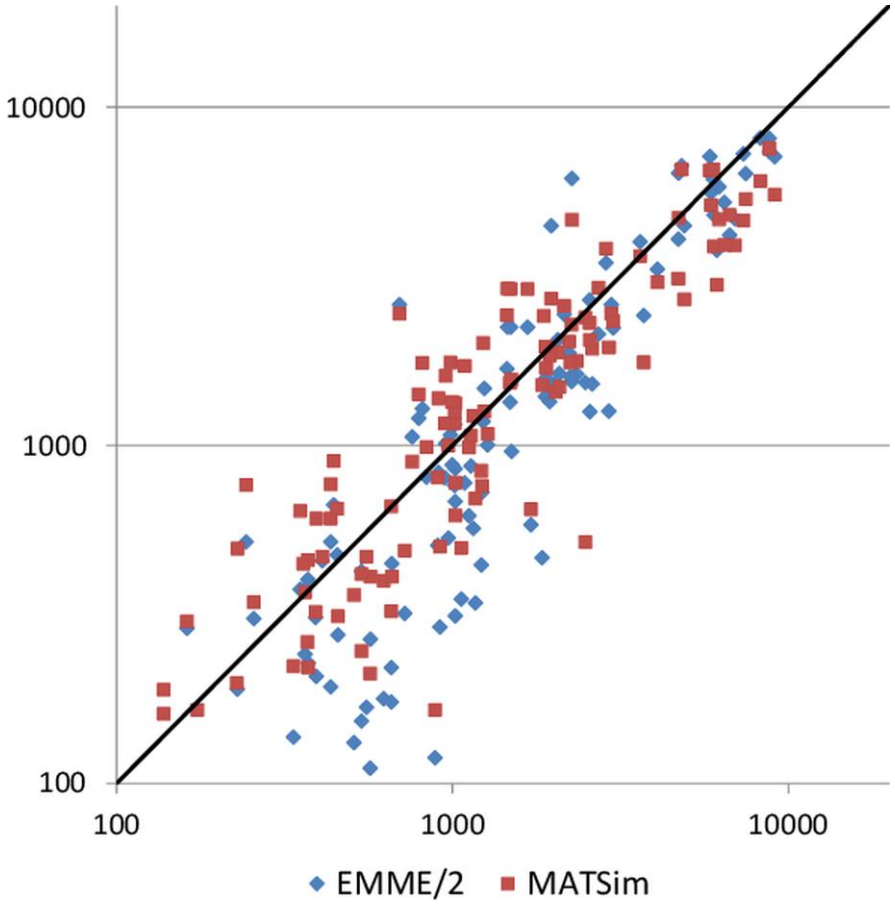
Traffic Count Analysis – AM Period

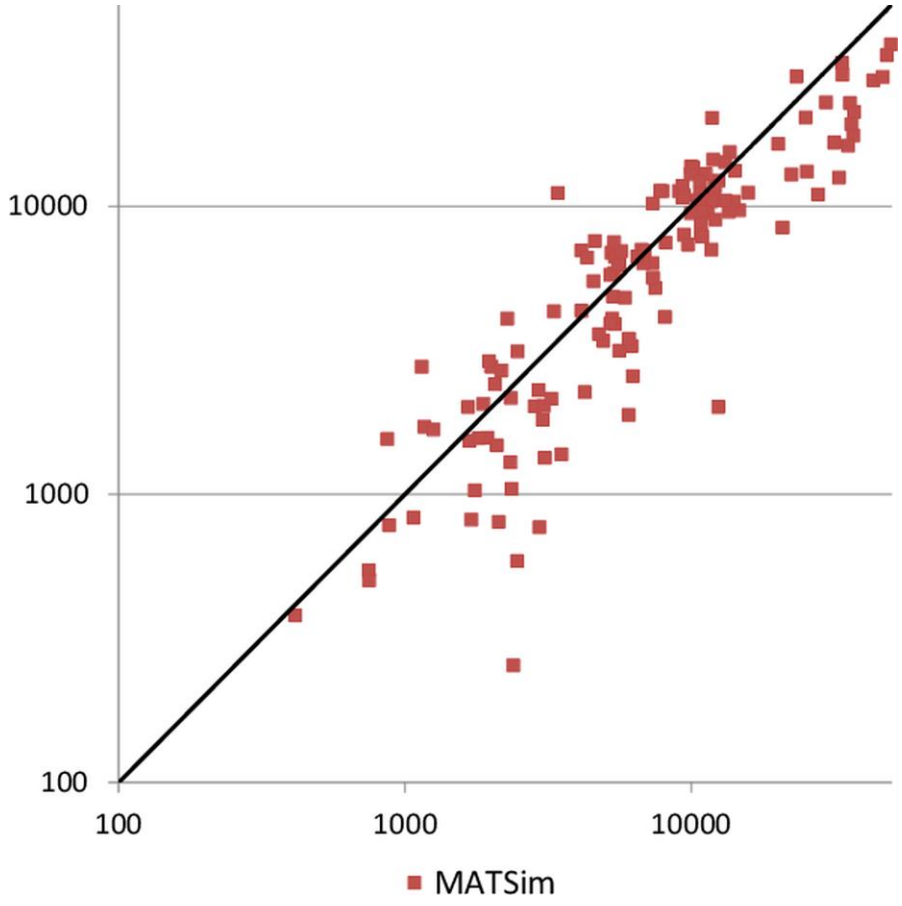




RMSE: EMME/2 – 1552
MATSim – 1240

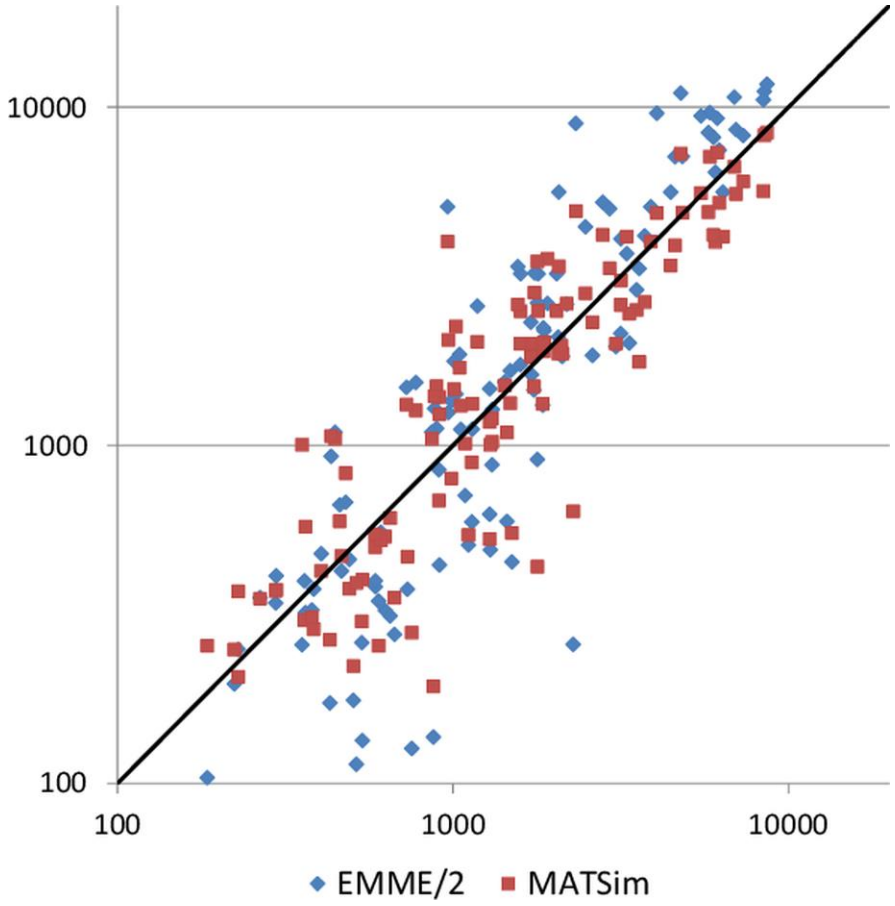
Traffic Count Analysis – OP Period

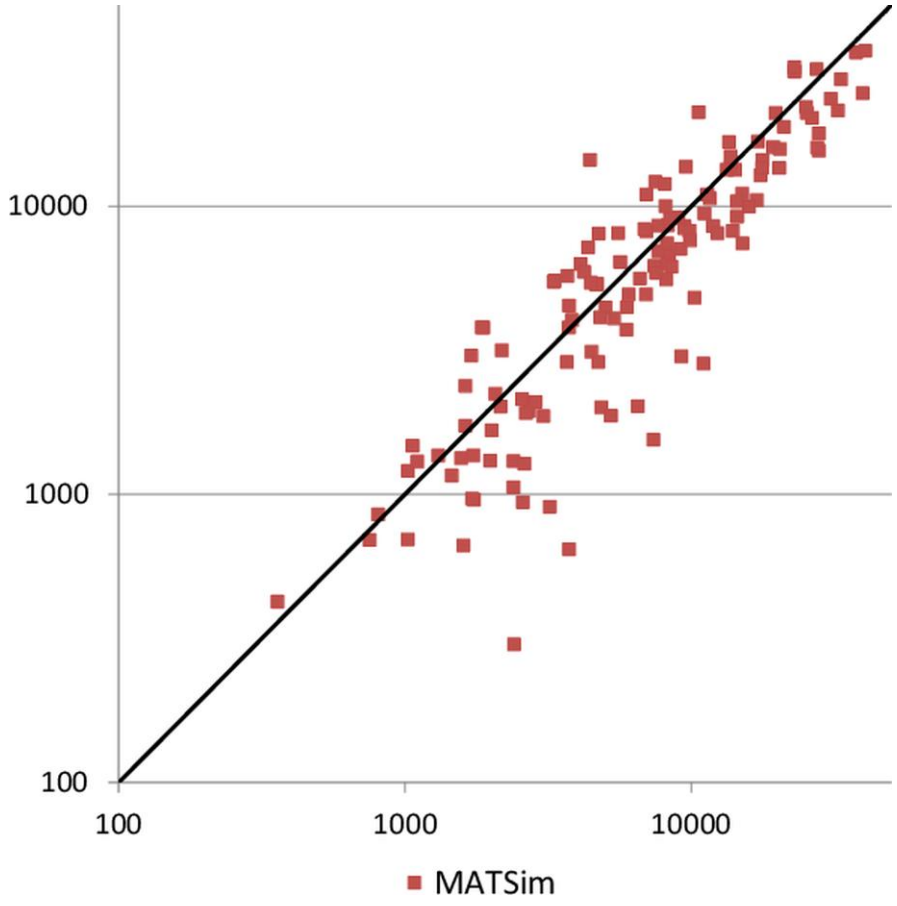




RMSE: EMME/2 – 903
MATSim – 975

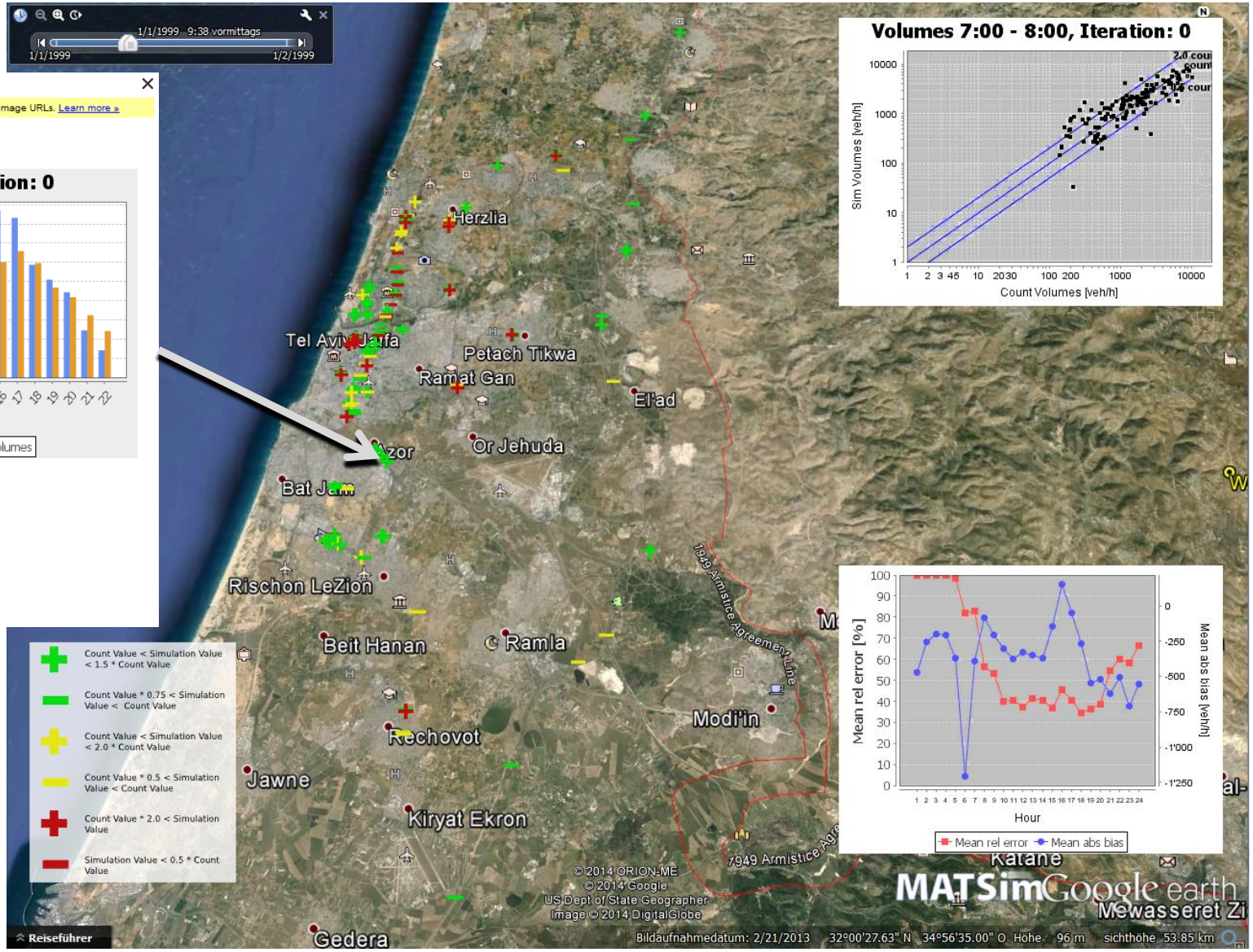
Traffic Count Analysis – PM Period





RMSE: EMME/2 – 1502
MATSim – 873

Real World vs. MATSim Traffic Flows for each Hour



Summary and Outlook

The (already very good) outcomes from the previous MATSim model were further improved.

- Model input data was updated.
- Destination Choice was fully integrated into the model.
- Analyzing traffic counts shows a better fit than the EMME/2 model.

To further improve the model...

- additional parts of the activity-based model could be implemented.
- additional data sources could be used for the calibration, e.g.
  - trip length distributions from travel surveys.
  - toll related information (origin and destination of tolled vehicles; travelled distance on tolled roads; ...)

References

Bekhor S., Dobler C., Axhausen K.W. (2011) Integration of activity-based and agent-based models: Case of Tel Aviv, Israel. *Transportation Research Record,* **2255,** 38-47.

Horni, A. (2013) Destination choice modeling of discretionary activities in transport microsimulation, Ph.D. Thesis, ETH Zurich, Zurich.

Thank you for your Attention! Questions?