

DTA in practice

Modeling dynamic networks in the real world

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1.1 – Tel Aviv Network

area \approx 20 sq. mi

3800 links

9 freeway interchanges

311 signalized nodes

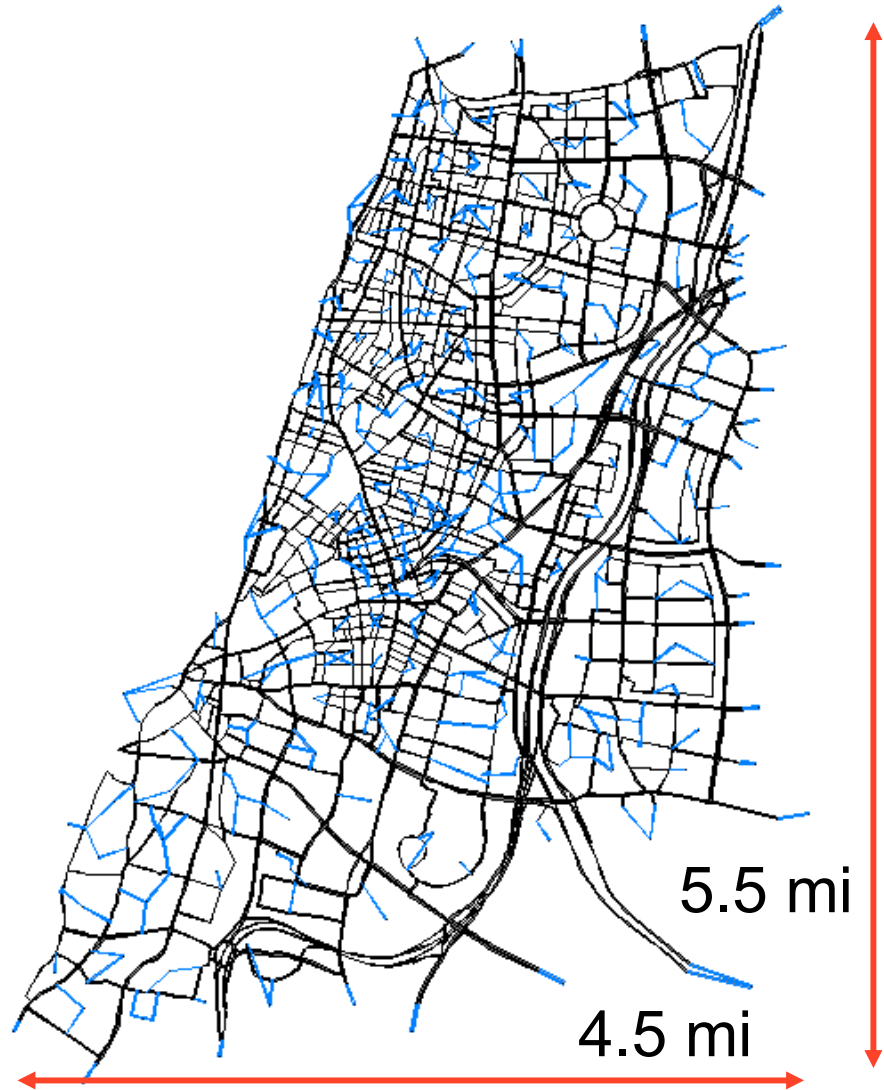
459 transit lines

200 zones

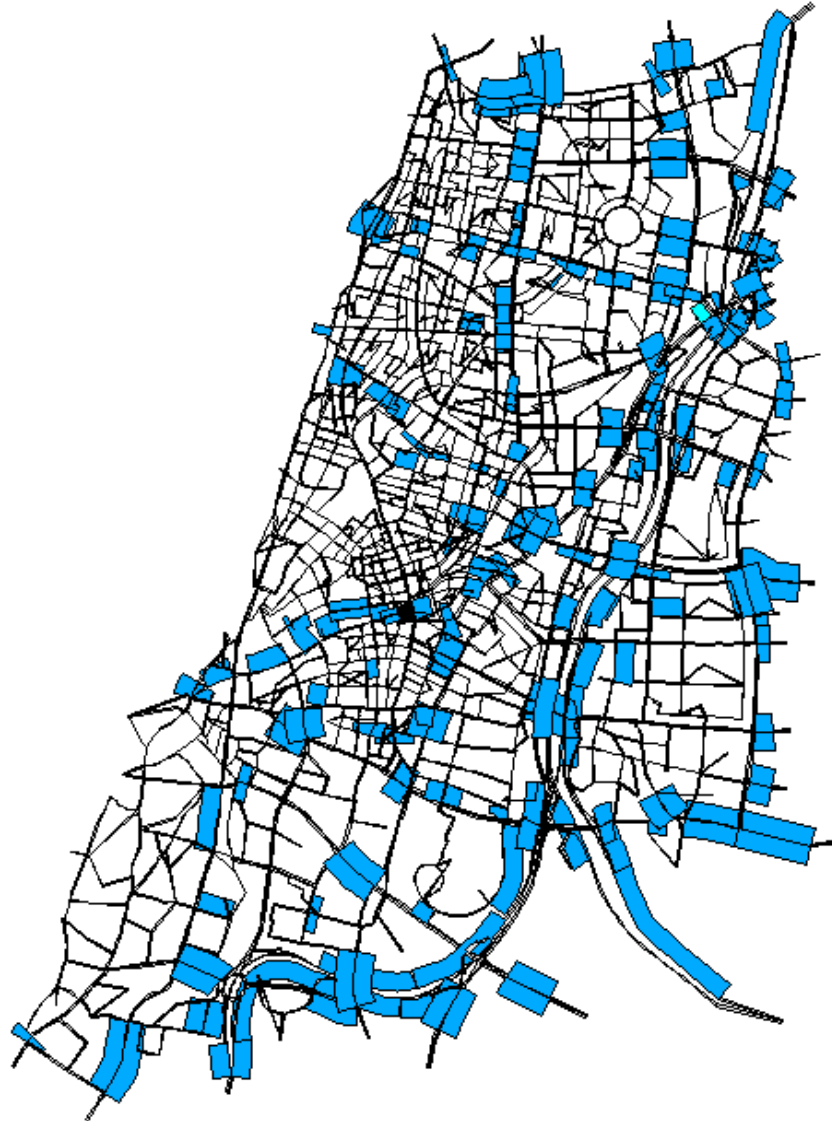
3 hr AM demand:

- cars: 187,000

- trucks: 12,000



Tel Aviv – Count Locations



1.2 – Ljubljana

area > 50 sq. mi

8500 links

215 signalized nodes

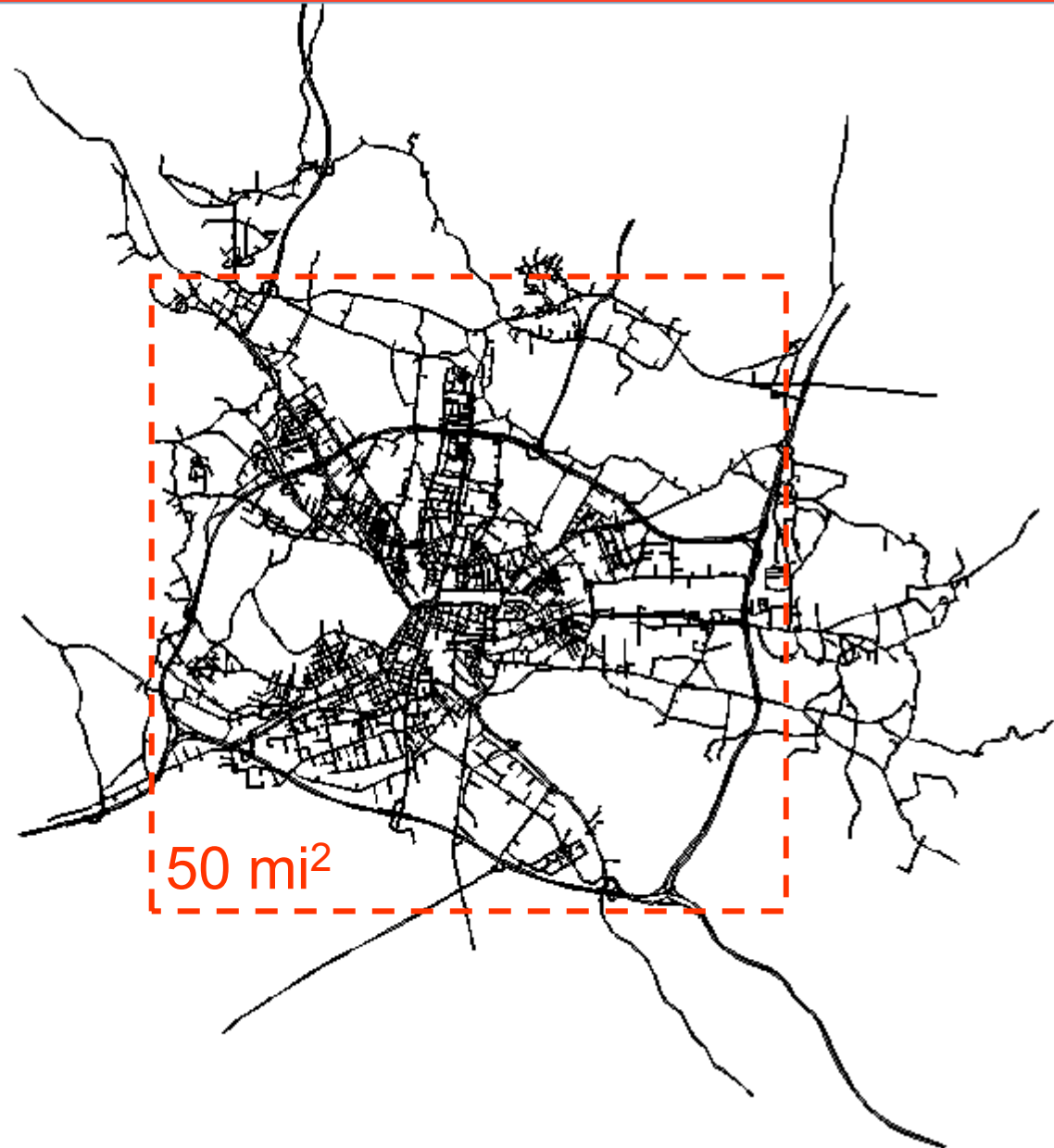
40 transit lines

325 zones

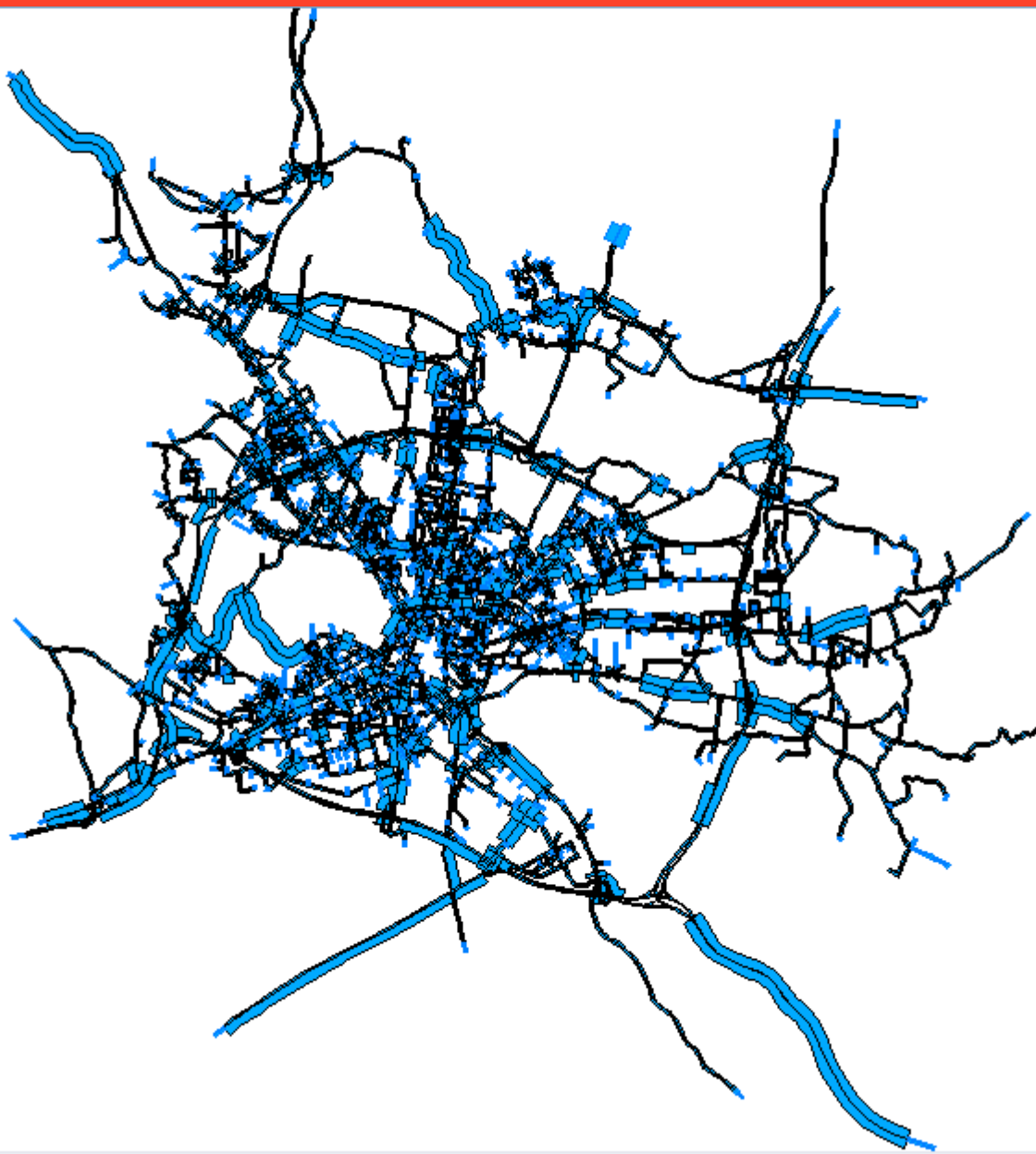
3 hr PM demand:

- cars: 167,000

- trucks: 15,000



Ljubljana – Count Locations



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2.1 – Preliminary Runs

“Stress Test”

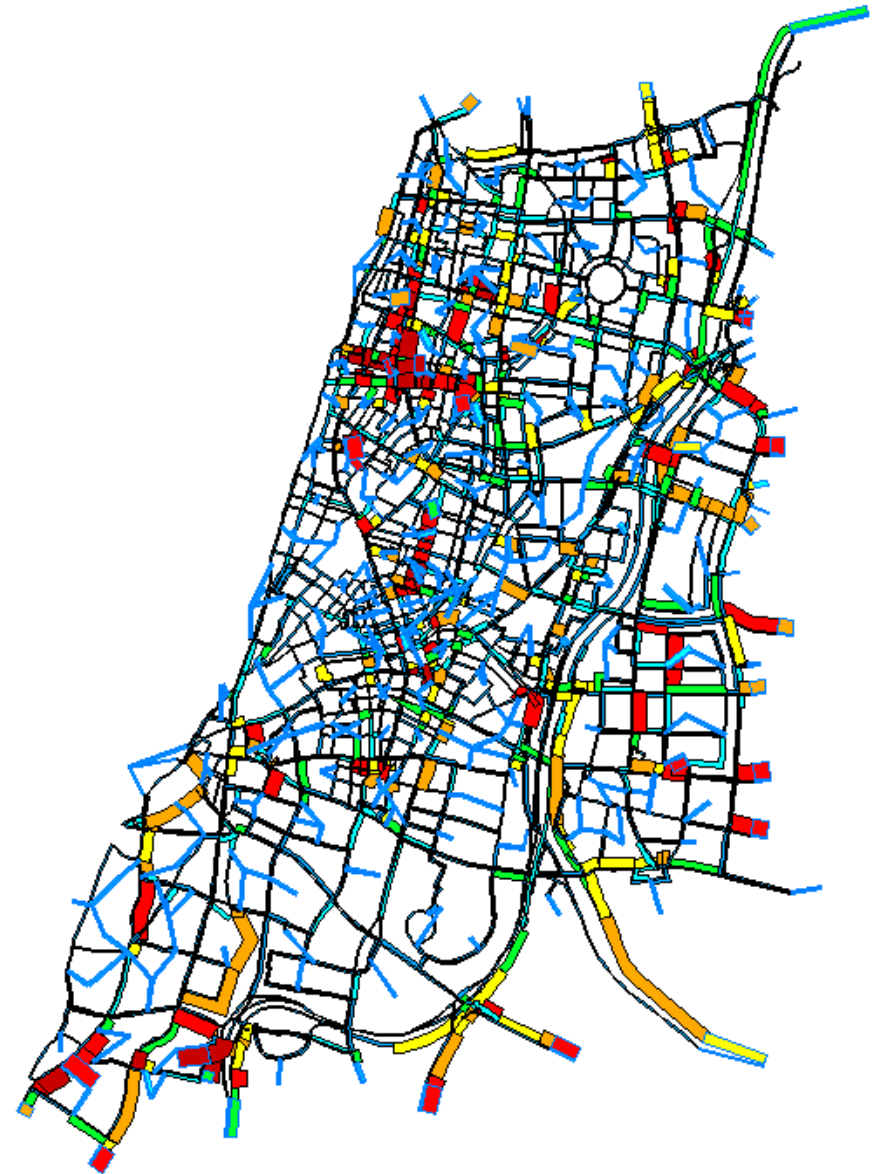
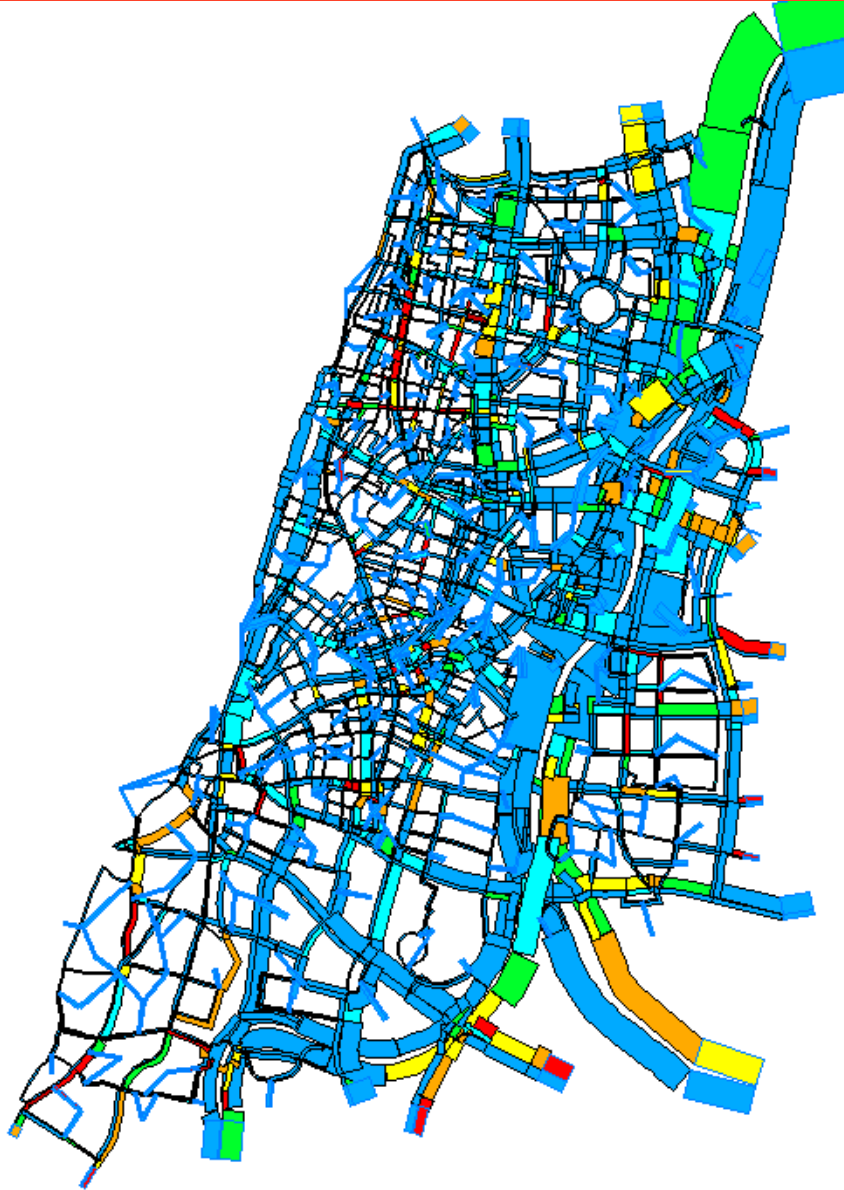
- DTA is run on basic network:
 - All links and nodes
 - Turning movement permissions, parameters
 - Centroid connectors (may need adjusting)
- Network does not include:
 - intersection detail (turn pockets)
 - traffic signals
- If cannot converge this DTA, most probably will not converge a more detailed model
- Stress test may bring out larger problems with data:
 - Significantly over-estimated demand

2.2 – Pre-Convergence Calibration

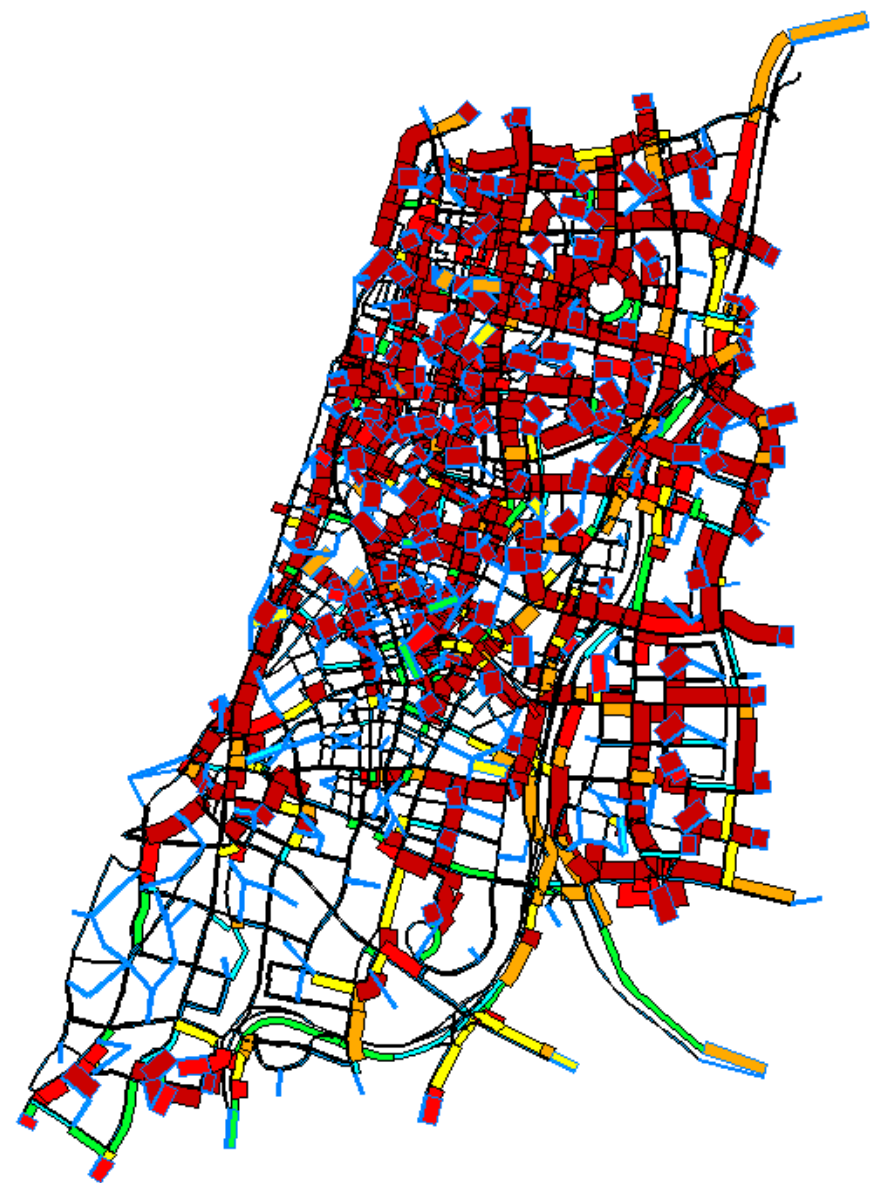
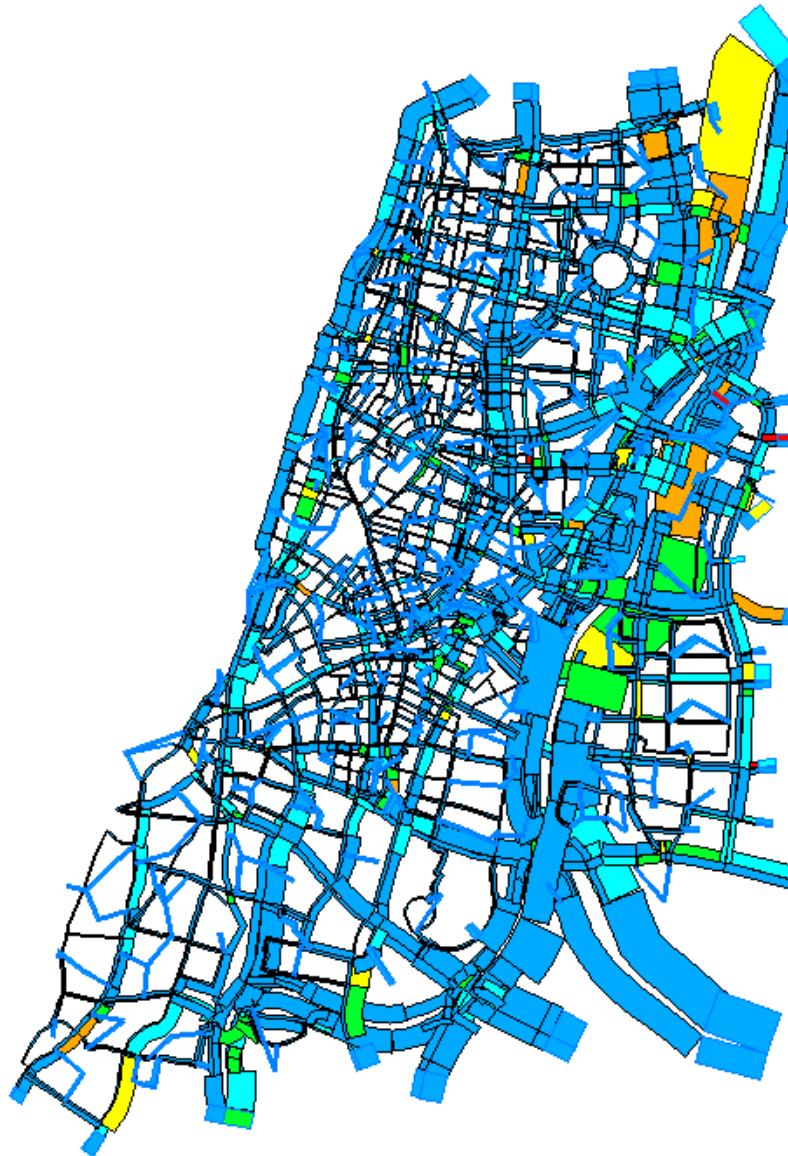
Achieving a stable solution

- DTA is run on fully detailed network:
 - Intersection detail: turn pockets and channelization
 - Traffic signals and synchronization
- This is a more challenging DTA:
 - Intersections are less “efficient”
 - Signals and synchronization add more noise to travel times
- Objectives:
 - No deadlock, acceptable convergence (to equilibrium)
 - Congestion appears in the right places in the network
- Field measurements (calibration data):
 - used to verify general location of congestion
 - Not really concerned yet with statistical measures of fit

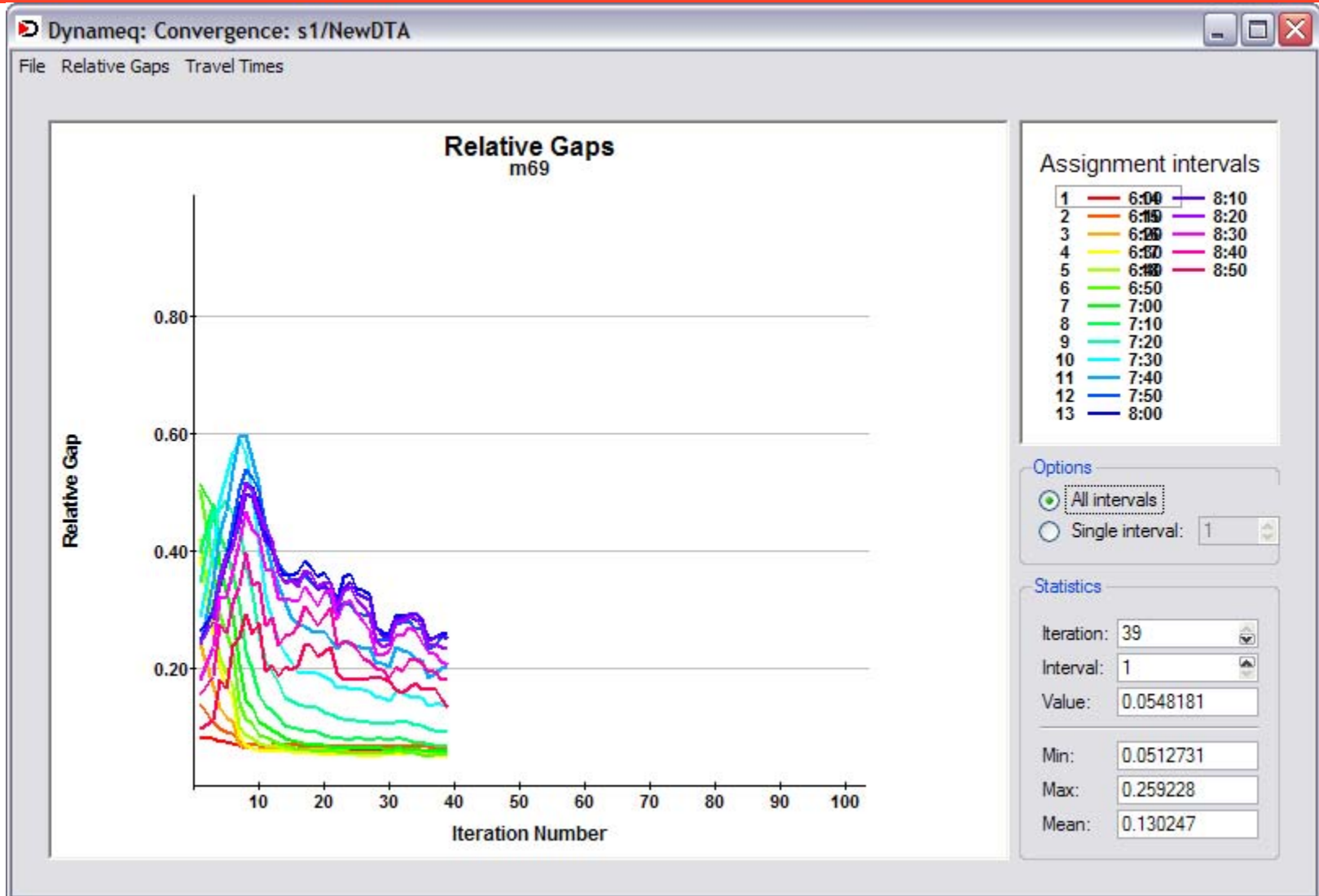
Volume & Density at 8:00 am



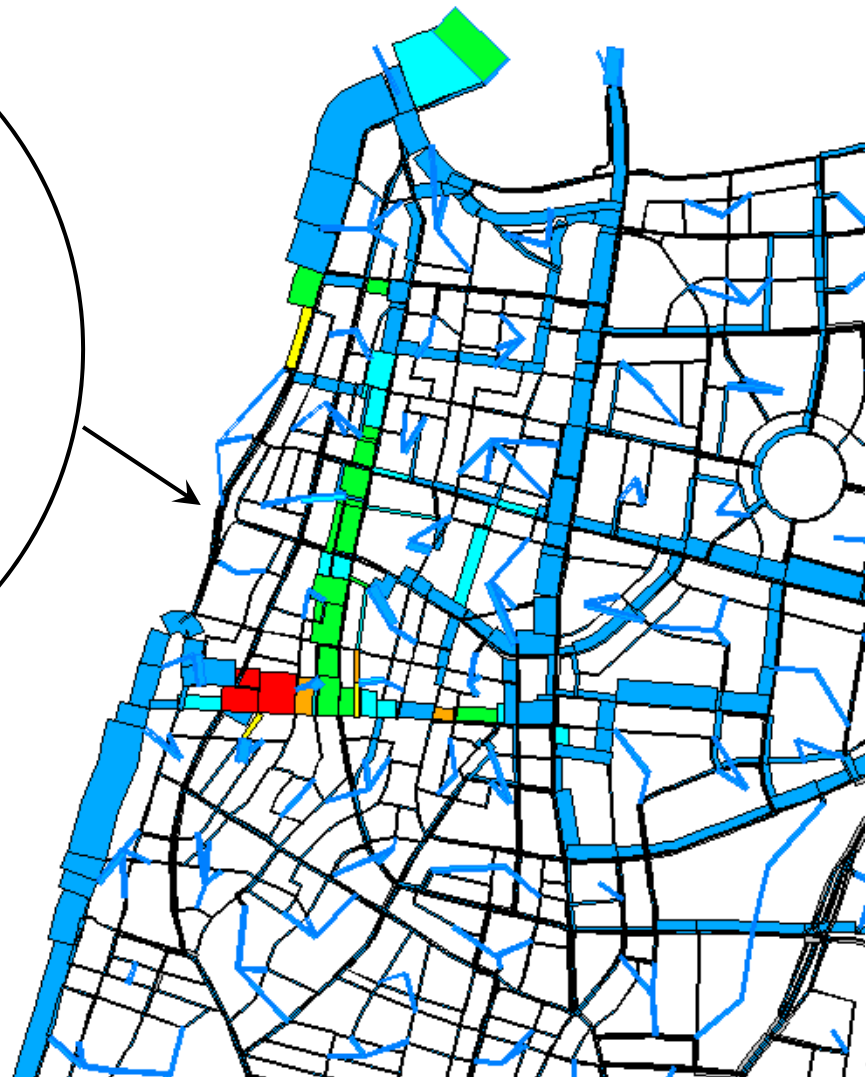
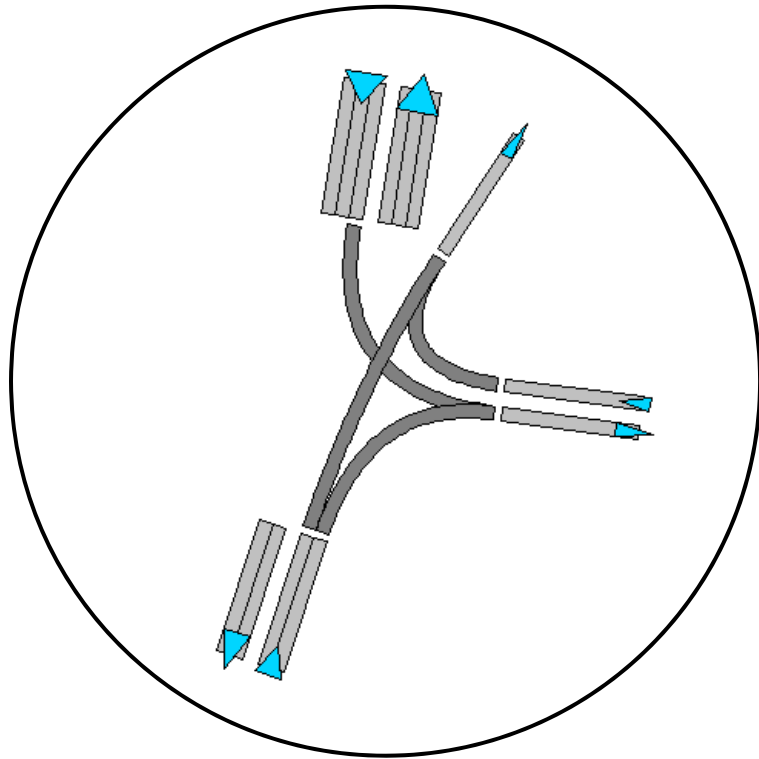
Volume & Density at 9:00 am



Relative Gaps: “Pre-convergence”



Select Link Analysis: 8:00 am

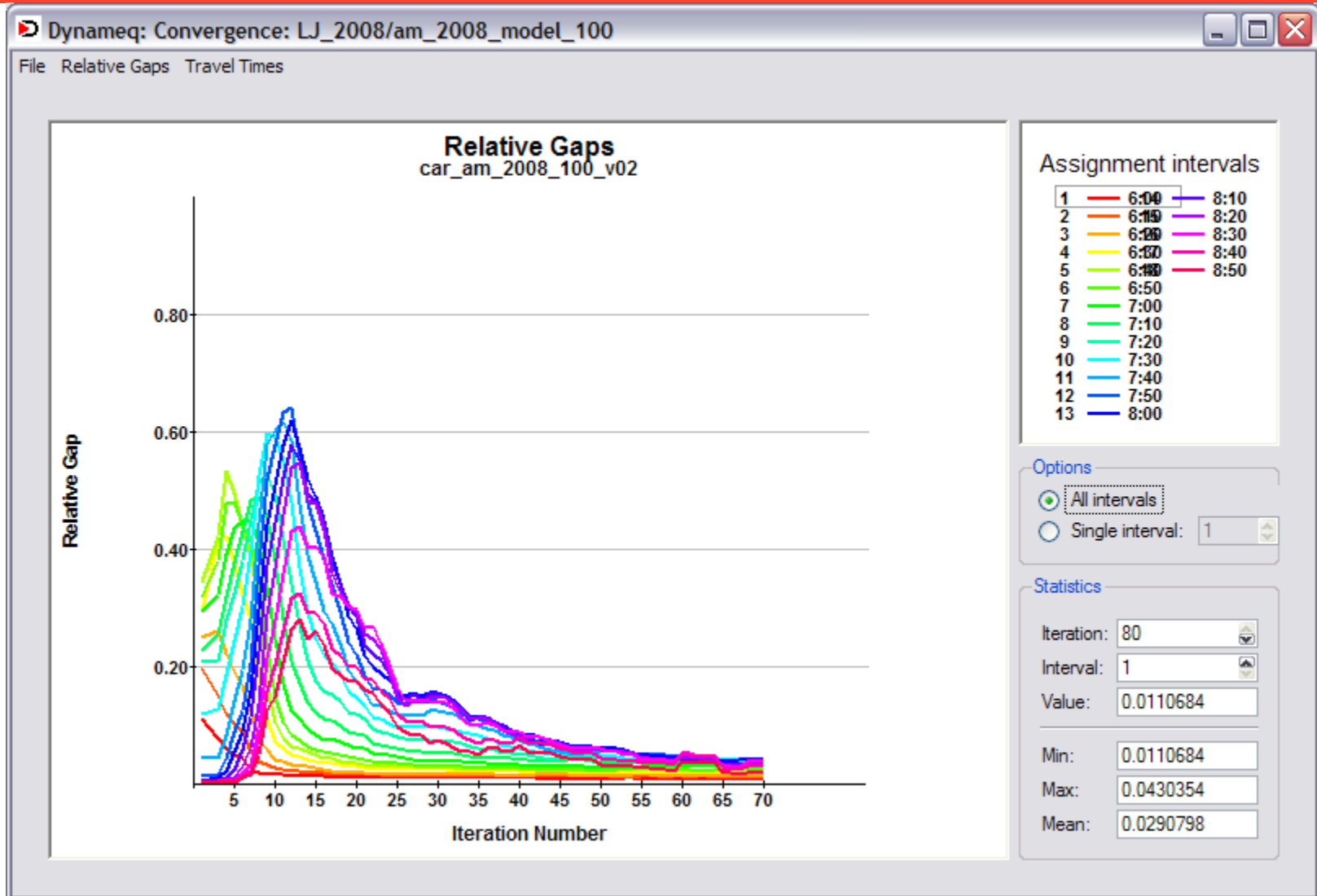


2.3 – Post-Convergence Calibration

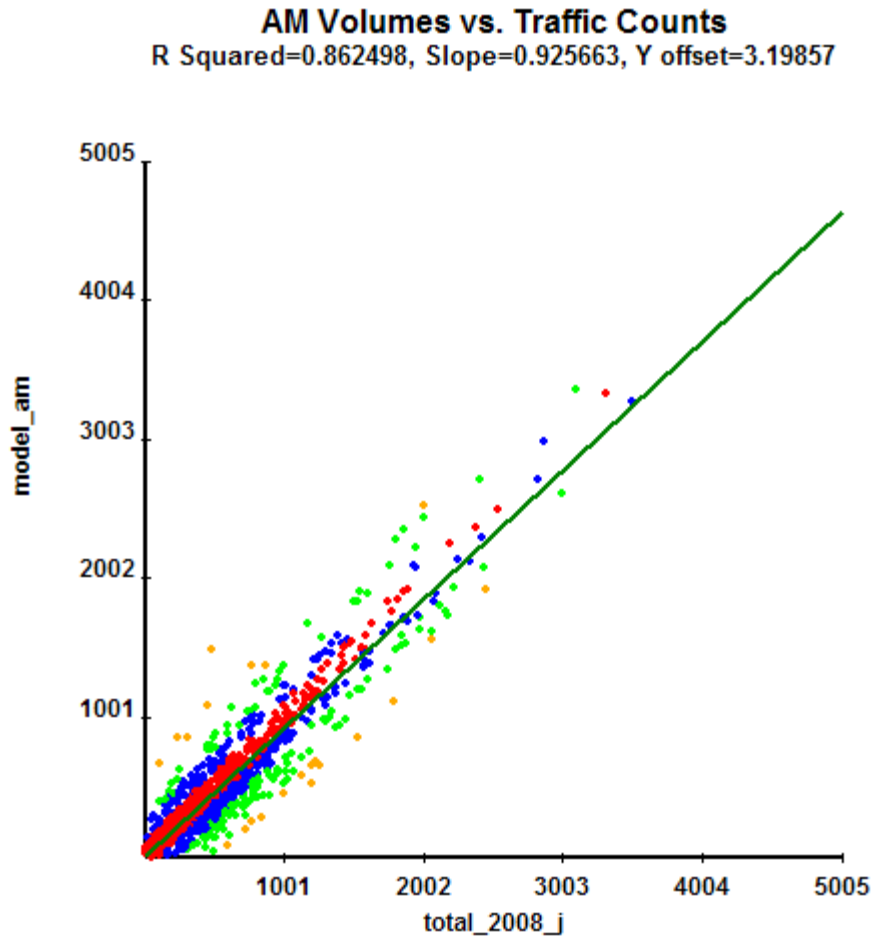
Refining the model

- If model is not hyper-congested, it is generally quite stable now:
 - Small changes to input, e.g. network coding or signals, result in small changes in the output
- Improvements in statistical measures of fit (with field data) are more difficult to achieve (than in pre-convergence):
 - Outliers can often be traced directly back to the demand data, which may require adjustment
- Statistical measures:
 - Absolute difference, percent difference, RMSE, GEH, etc..
 - Standard GEH-based criteria are generally too strict for DTA
- Linear regression (scatter-plots):
 - slope < 1 : does not indicate that demand is too low!!
 - even when calibrated, often still have slope < 1

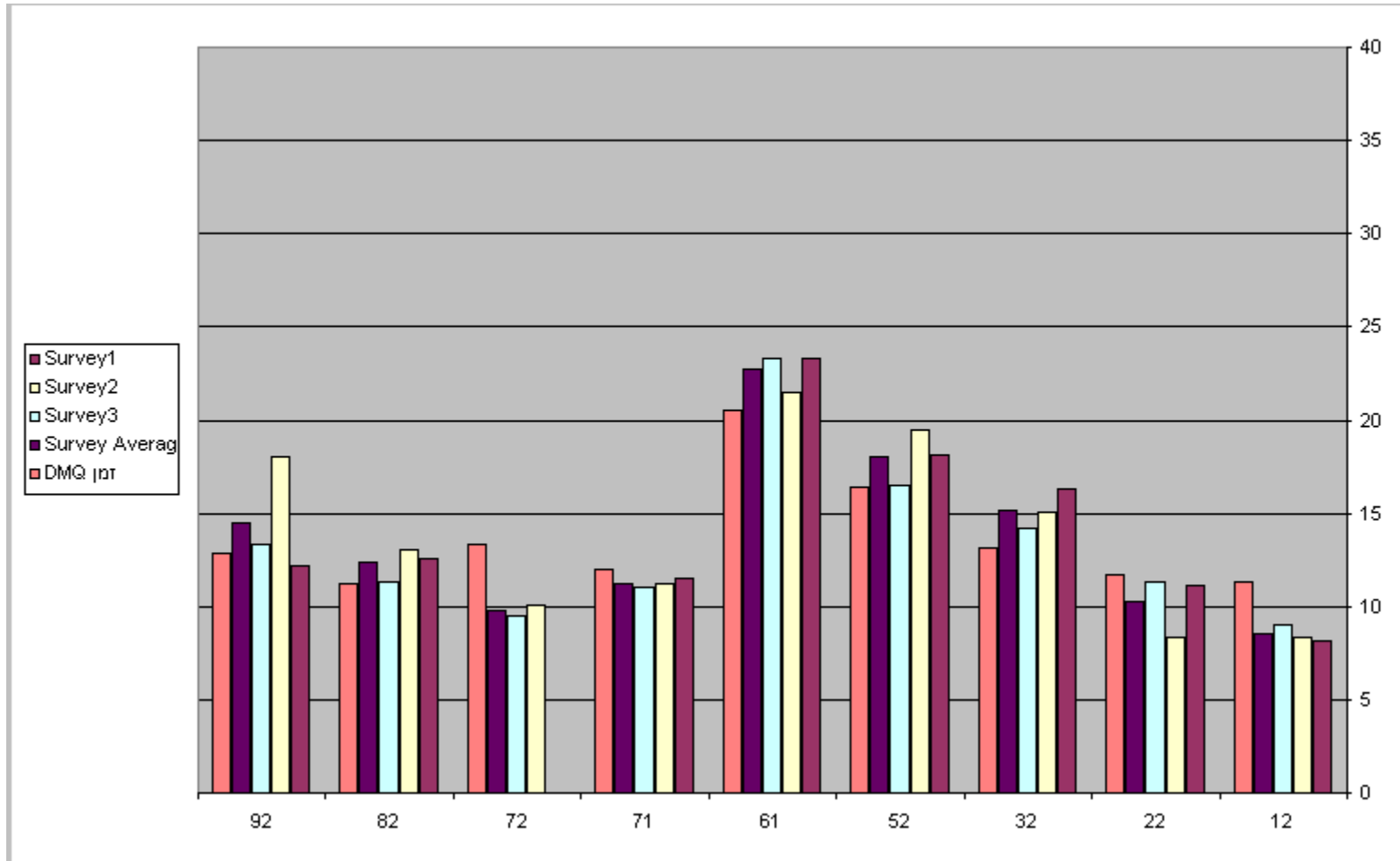
2.3 – Relative Gaps: Convergence



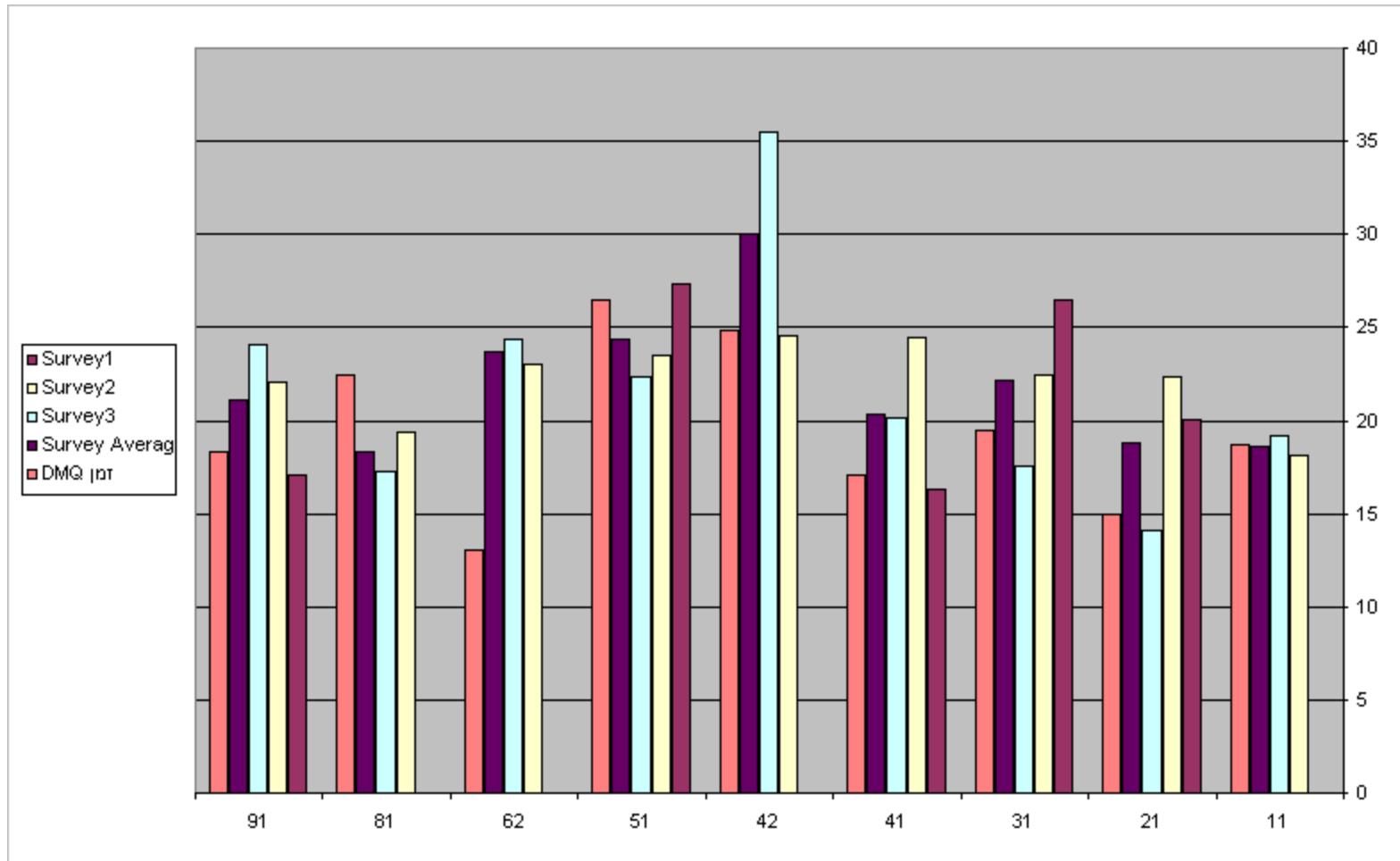
2.3 – Post-Convergence Calibration



Travel Times: departing 7:30



Travel Times: departing 8:20



2.4 – General Remarks

Calibration

- >50% of calibration time is spent finding coding errors, which may not be easy to find:
 - E.g. too little/much traffic on a road because of a coding error on a parallel route
- For this reason, advisable to get high coverage of traffic count data
 - If there are no counts on the parallel route, may be very hard to identify the actual error (cause)!
- Be careful of tendency to “over-calibrate”: this can actually degrade the predictive quality of the model

2.4 – General Remarks

DTA models

- DTA models are considerably more sensitive than static models (because they are more realistic, *which is what we want...*):
 - DTA models have “hard” capacities
- As queues spill back, they engulf vehicles not actually headed through the bottleneck
- Error checking needs to be *very* thorough, and, there is a lot more data to check than in a static model
 - e.g. missing a critical left-turn pocket can severely degrade the capacity of a signalized link

3 – Computing Resources

Tel Aviv

- RAM (2 classes):
 - 550 Mbyte
- CPU (3 hr demand): 123 s/iteration x 120 iterations
 - 4.1 hr / DTA

Ljubljana

- RAM (2 classes):
 - 600 Mbyte
- CPU (3 hr demand): 203 s/iteration x 70 iterations
 - 3.9 hr / DTA

4 – Summary and Conclusions

Significant progress

- DTA model applications have been increasing, in both size and number, over the last 4-5 years;
- Now seeing users attempting their *first applications* of DTA in the size range of 7,000 to 10,000 links, with successful calibrations:
 - DTA modeling culture is gaining critical mass
 - Software tools are maturing
- Future directions
 - Larger networks: moving towards the regional scale
 - More integrated modeling: macro/meso/micro