

Sept. 1, 2008, IVT Seminar

1

Michael Balmer, balmer@ivt.baug.ethz.ch

# “Westumfahrung Zurich”: Real World Study with MATSim

**ETH**

Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology Zurich

Technische Universität Berlin

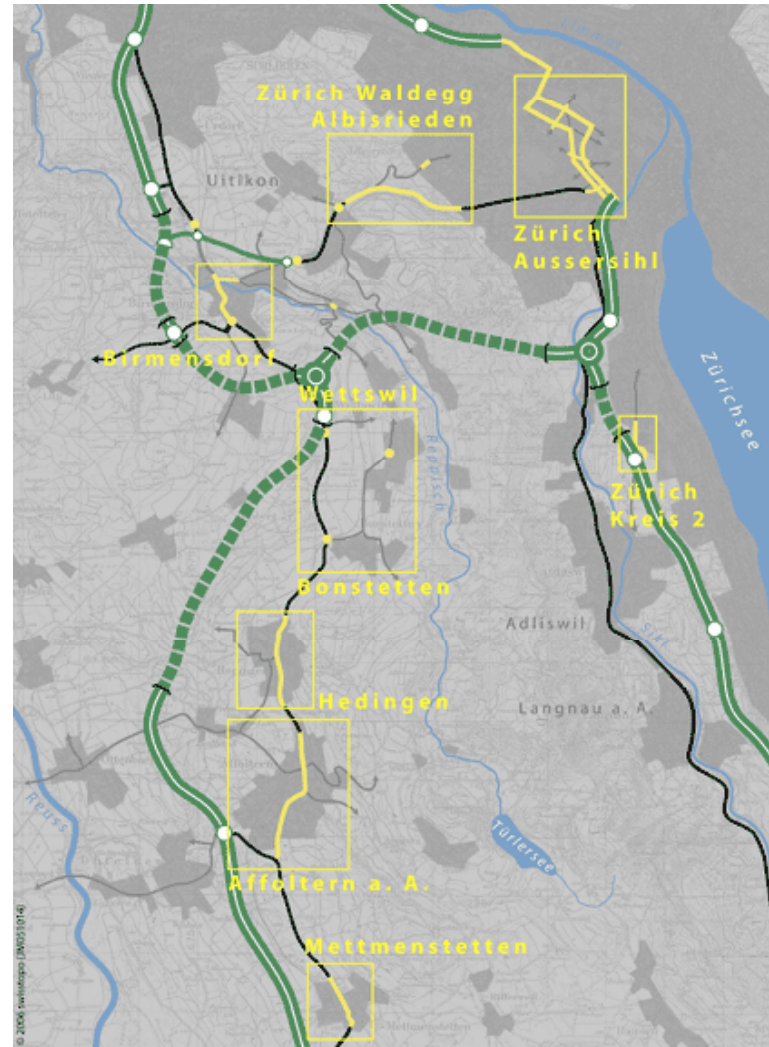


**MATSim**  
Multi-Agent Transport Simulation

# Structure

- Target
- Case Study Process Steps with MATSim
- Project “Westumfahrung”
- Comparisons:
  - Actual State
  - Case Study I: Westumfahrung (WU)
  - ...
- Conclusions

# Target



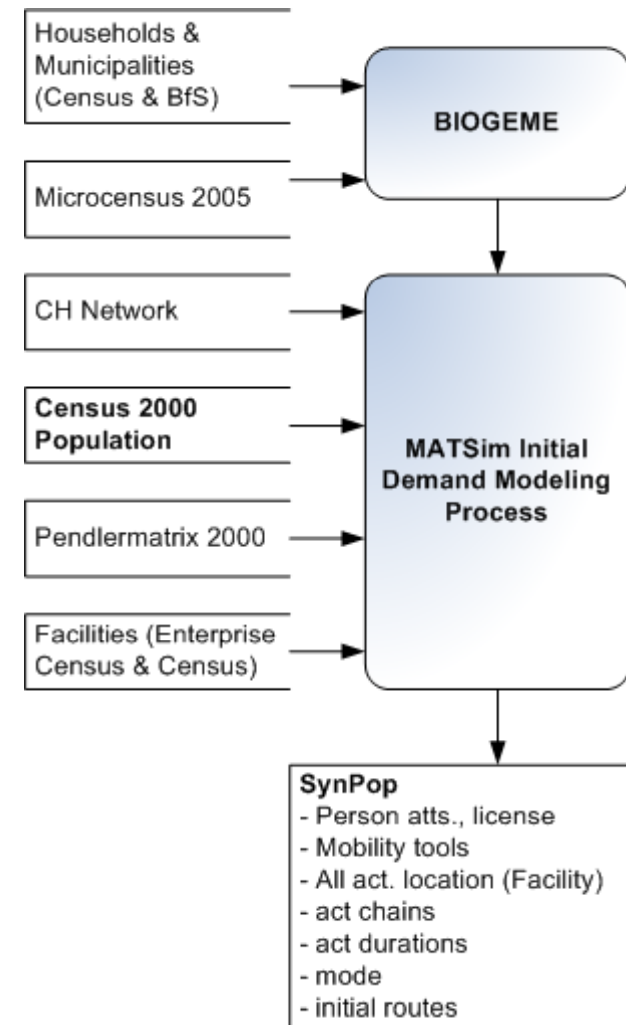
Source: westumfahrung.ch (2008)

# Target: Effects Measures

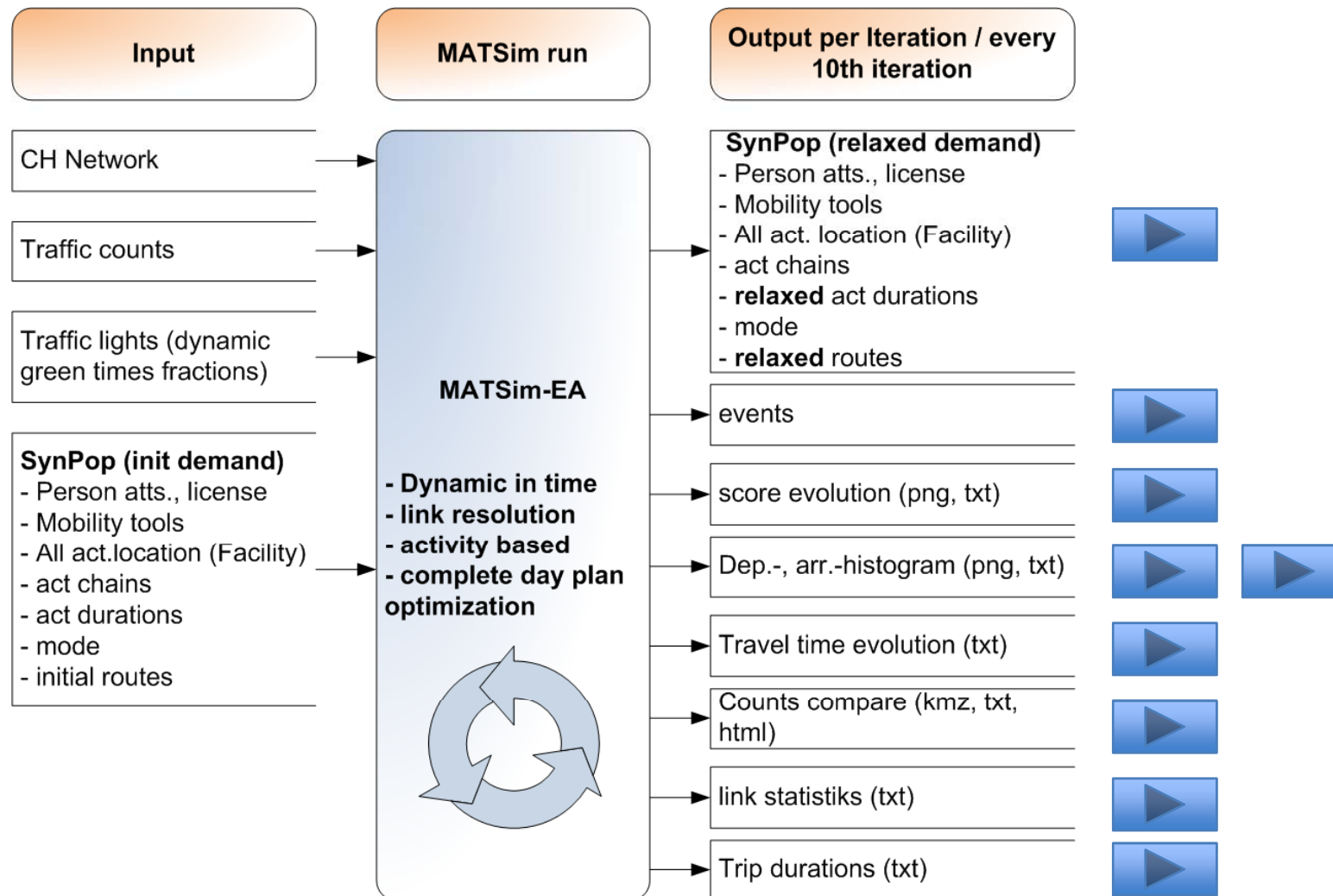
- Westumfahrung & Motorway A4 (Knonaueramt)
  - Traffic volumes
  - User of the WU
- ...

# Process Steps: Initial Demand Creation

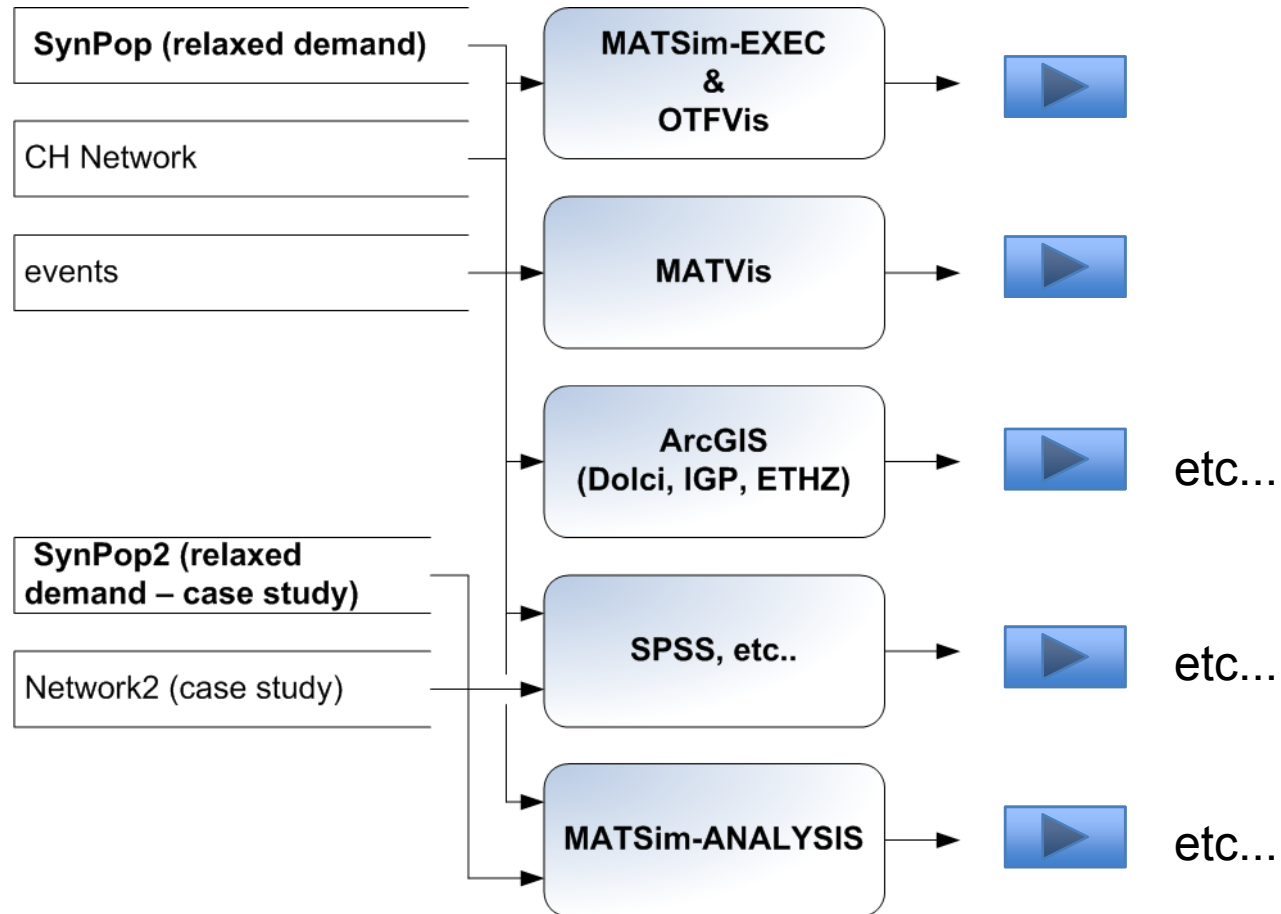
- Creating initial individual time-dynamic demand based on:
  - Census 2000
  - Micro census 2005
  - Commuter matrices 2000
  - Enterprise census 2000
  - National network model
- ➔ 7.2 Mio agents (demographics)
- ➔ ca. 3.1 trips per agent
- ➔ 5 different activity types (h,w,e,s,l)
- ➔ Mobility tools
- ➔ Mode choice



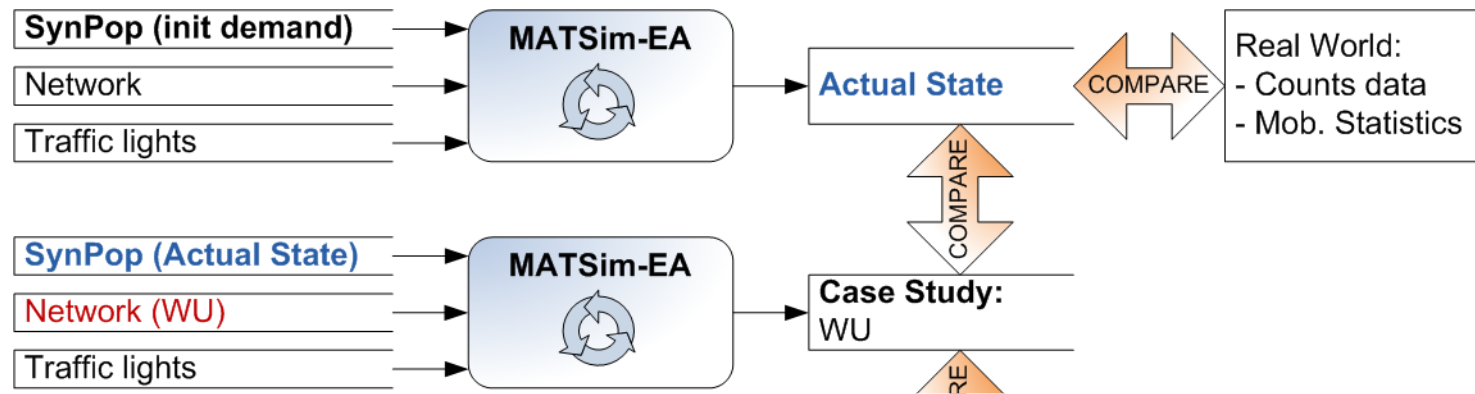
# Process Steps (cont.): relaxation → actual state



# Process Steps (cont.): post process analysis



# Project “Westumfahrung”: process steps



Etc...

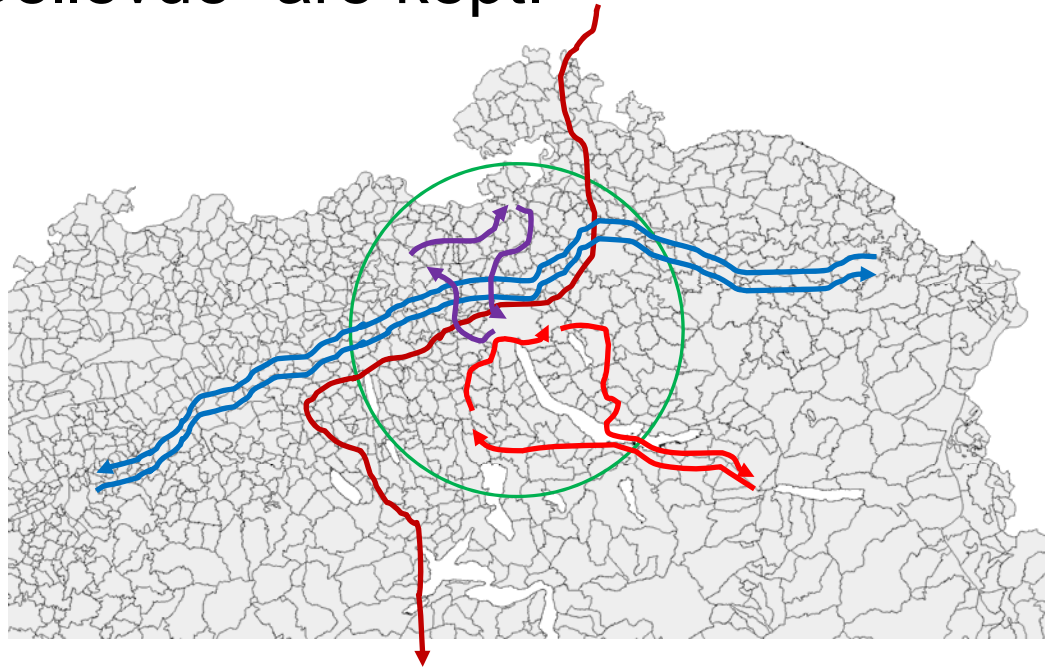


# Project “Westumfahrung”: Initial demand

- ~7.2 Mio. agents of Switzerland (~22 Mio. trips)
- Additional ~570‘000 agents / ~870‘000 trips (Swiss border crossing traffic)
  - Commuters
  - Shopping / leisure traffic
  - Transit traffic
  - → motorized individual transport only

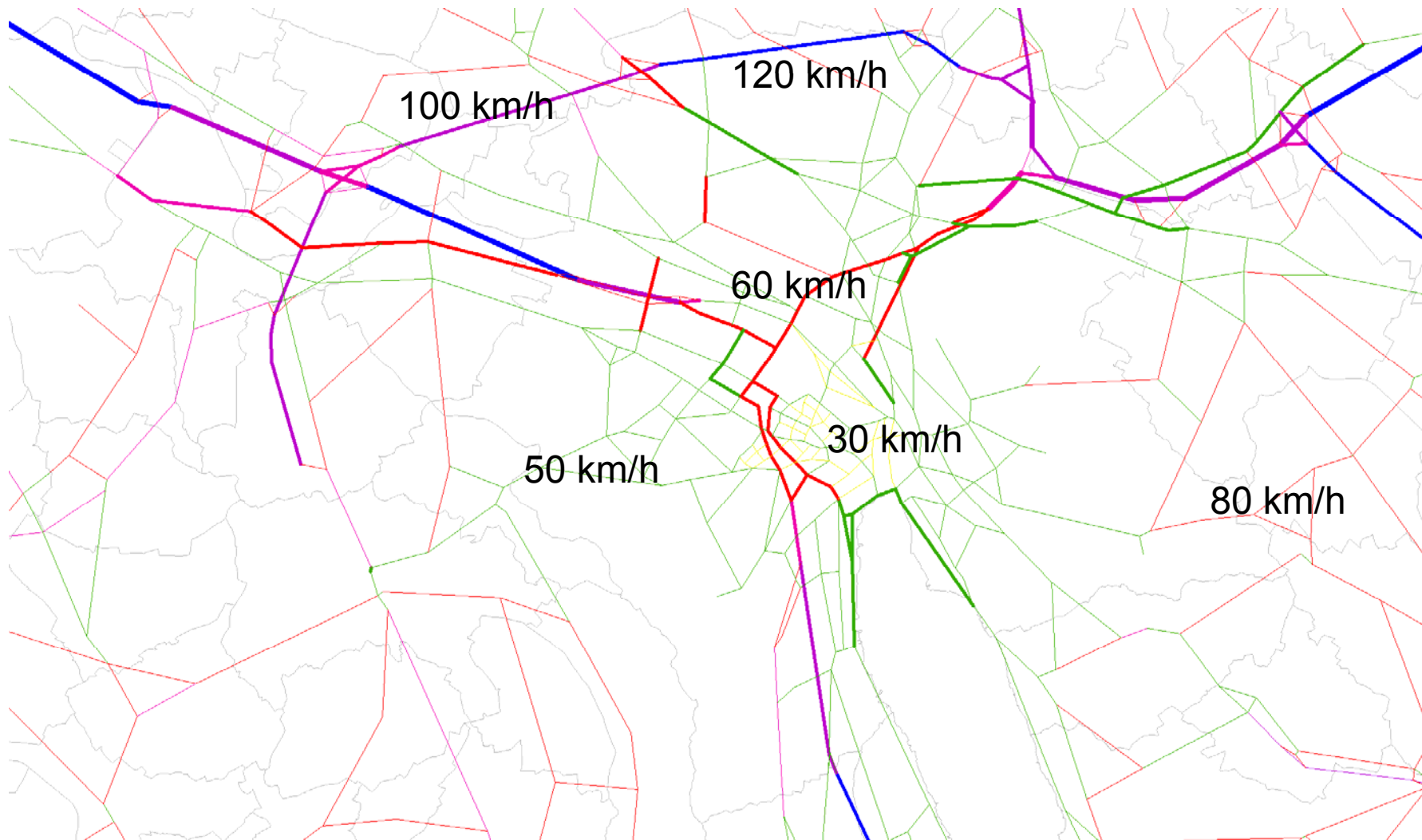
# Project “Westumfahrung”: Region of Zurich

Agents which pass the area of circle := 30km radius around „Bellevue“ are kept.



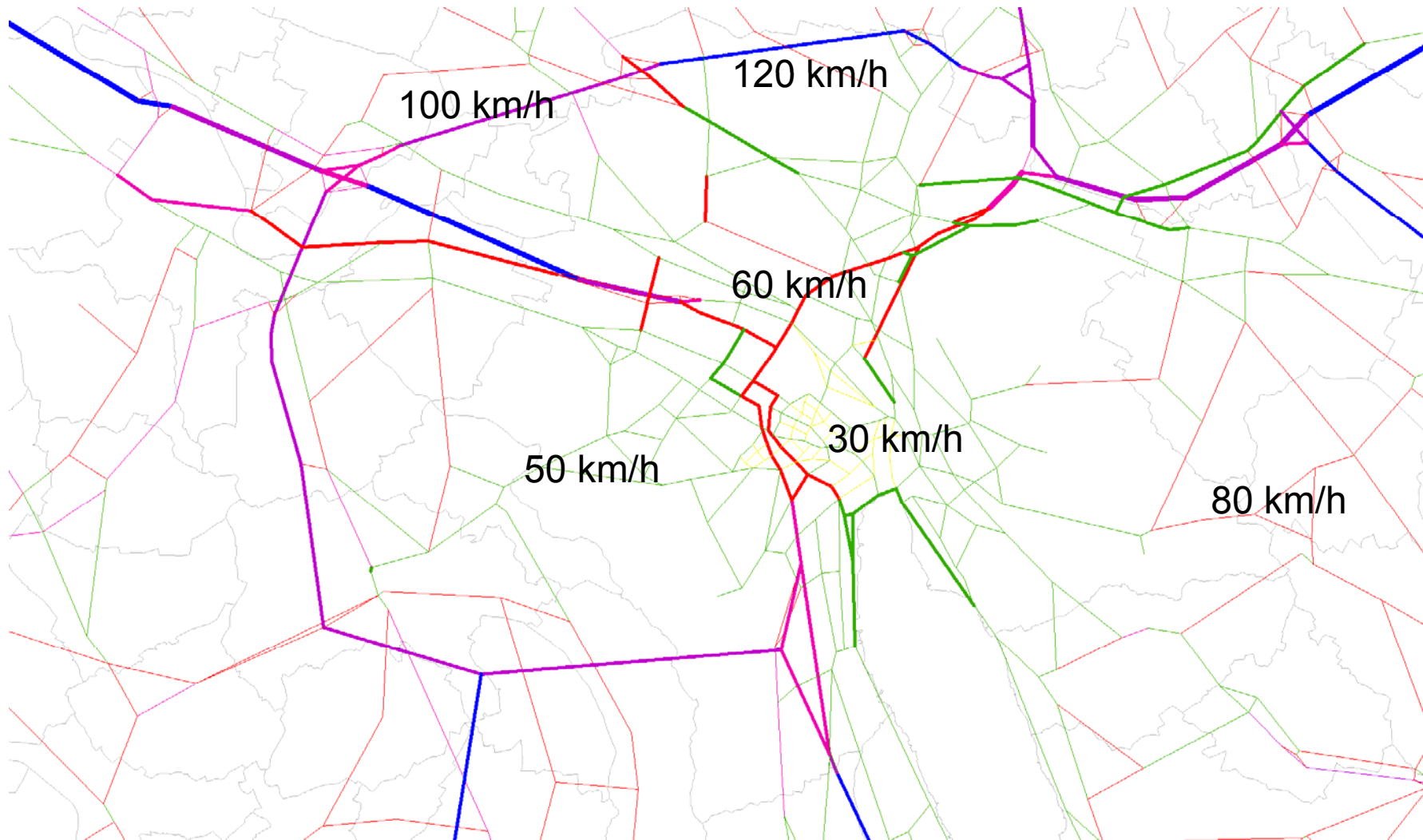
➔ 673'706 agents / 2'173'235 trips (MIT)

# Project “Westumfahrung”: network





colors: free speed, thickness: # lanes

# Project “Westumfahrung”: network (WU)



colors: free speed, thickness: # lanes

# Reality vs. Actual State

- Dynamic traffic volumes 
- Counts comparison 

# Actual State vs. CS I (WU)

- Statistics

Border crossing agents	Actual State	Case Study I (WU)	Effects
av. daily utility	64.84	69.31	● 106.90%
av. trip travel time	02:13:14	02:06:40	● 95.07%
av. trip distance [km]	189.77	189.40	● 99.80%
<b>Census population</b>			
Census population	Actual State	Case Study I (WU)	Effects
av. daily utility	183.72	185.61	● 101.03%
av. trip travel time	00:16:22	00:14:23	● 87.88%
av. trip distance [km]	12.35	12.36	● 100.02%
<b>Population WT ==&gt; WU</b>			
Population WT ==> WU	Actual State	Case Study I (WU)	Effects
av. daily utility	158.26	165.08	● 104.31%
av. trip travel time	00:48:20	00:39:10	● 81.03%
av. trip distance [km]	45.61	46.69	● 102.38%
<b>Population WT</b>			
Population WT	Actual State	Case Study I (WU)	Effects
av. daily utility	164.68	166.04	● 100.83%
av. trip travel time	00:21:54	00:18:57	● 86.53%
av. trip distance [km]	8.57	8.50	● 99.23%

# Volume comparison

- Actual State vs. CS I (WU)



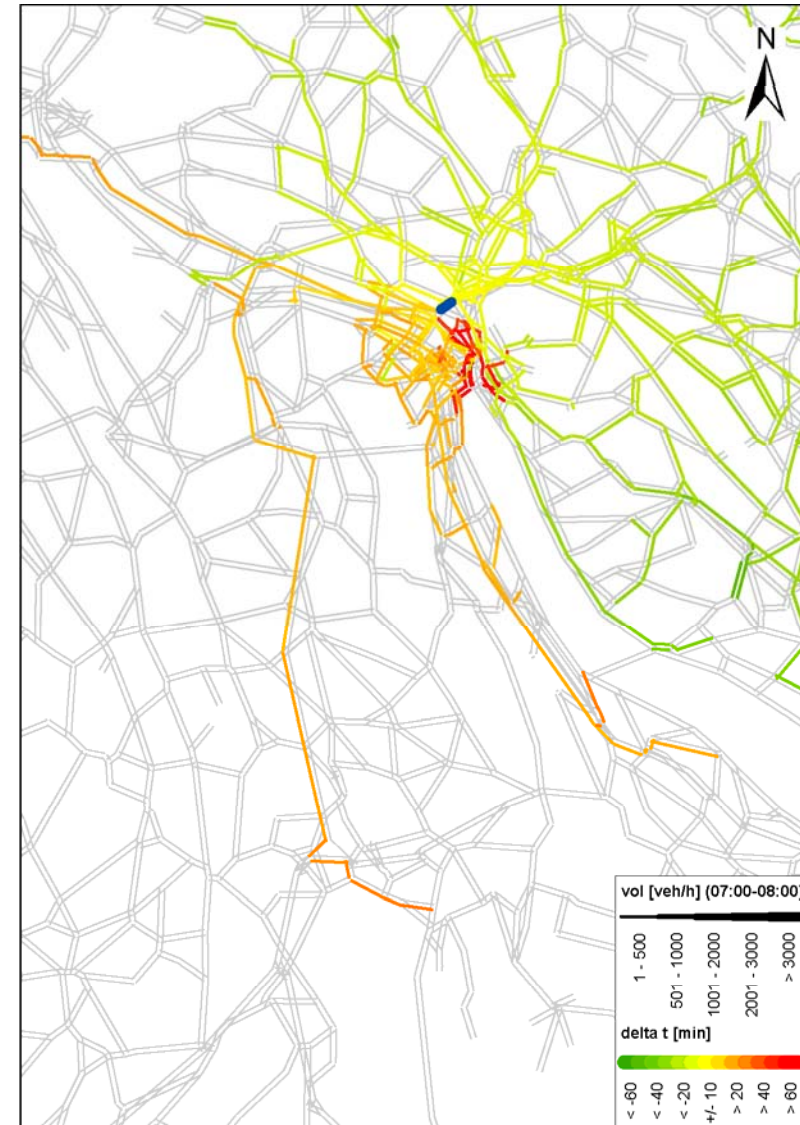
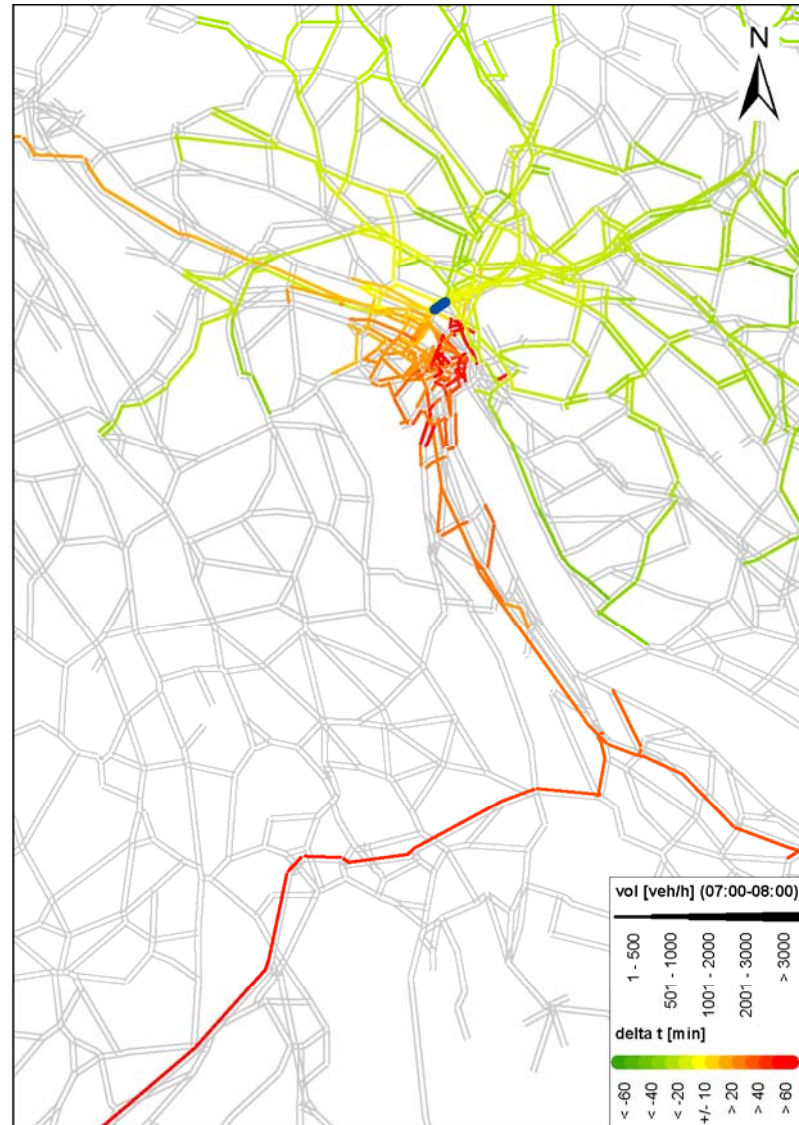


# Spider analysis: 7-8am, N→S

actual state

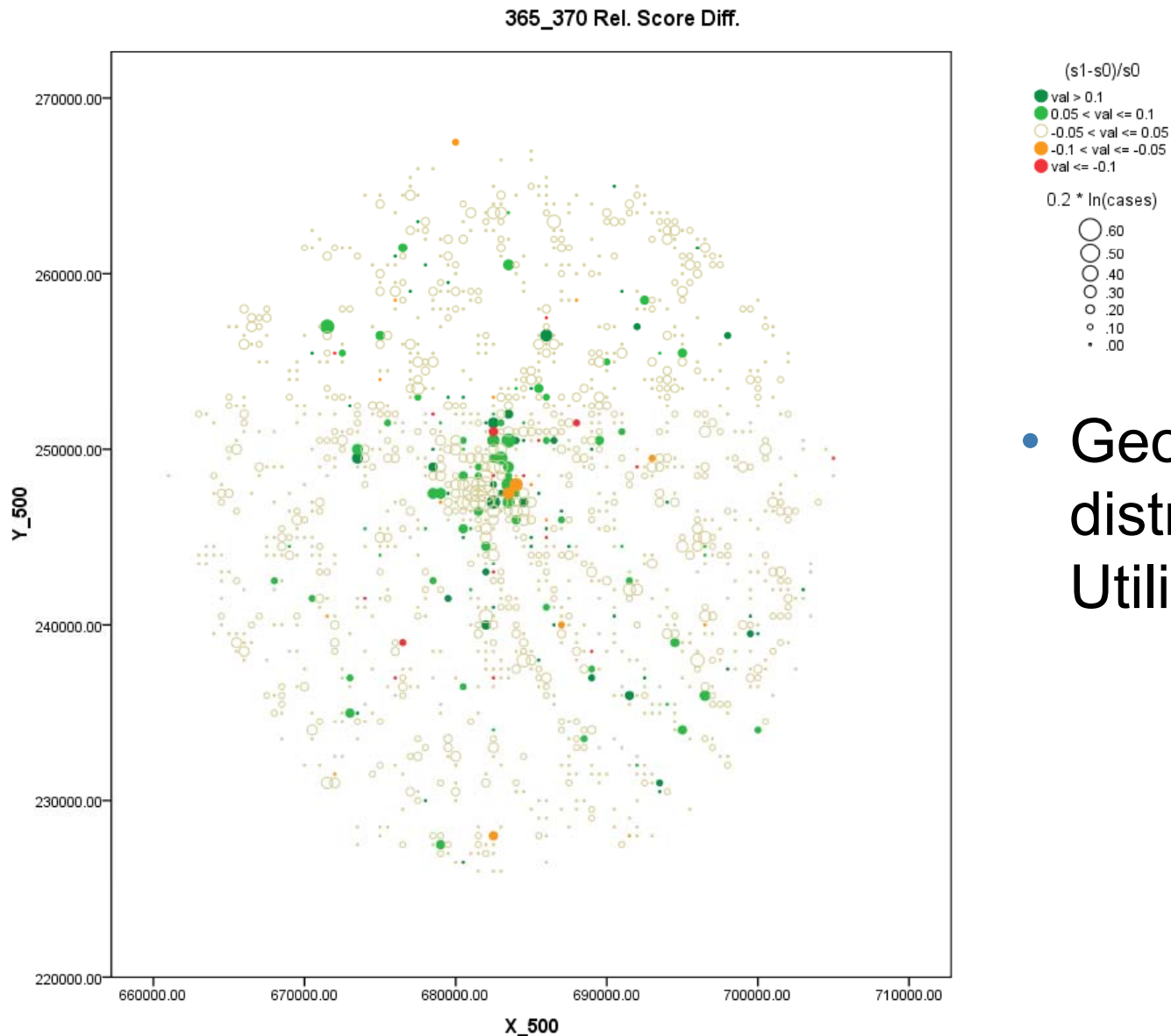
vs.

WU



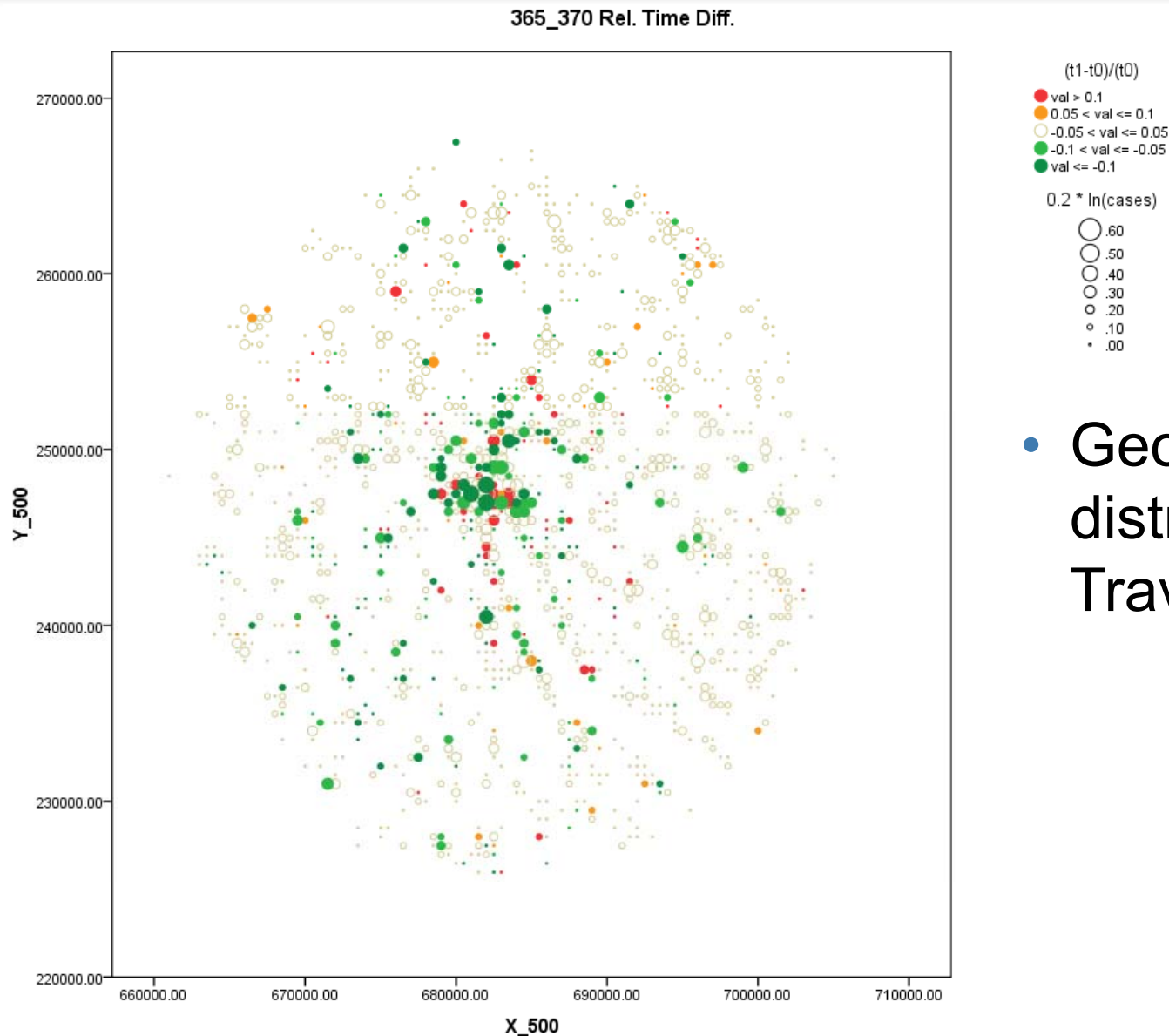


# Actual State vs. CS I (WU)



- Geographical distribution: Utility

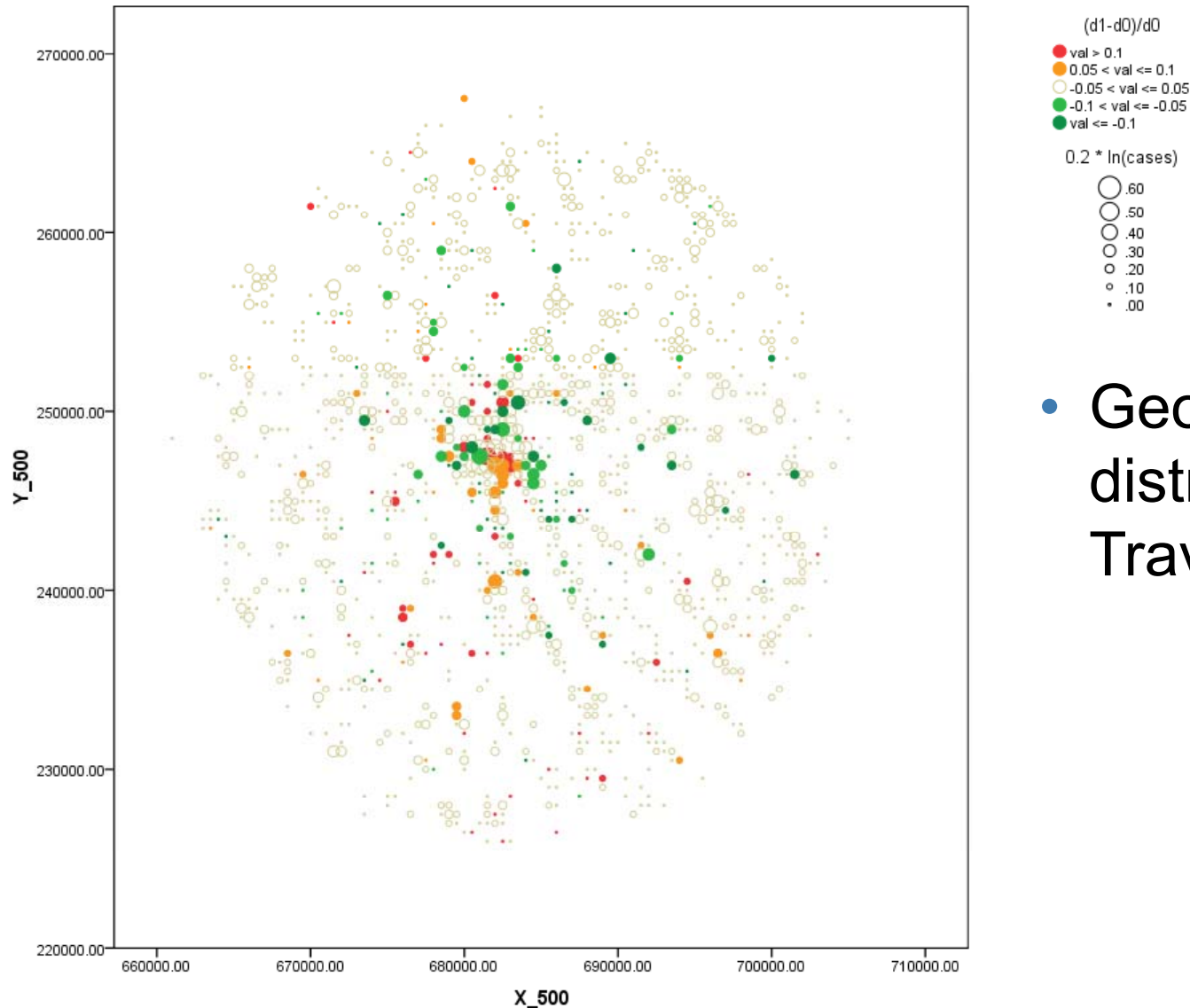
# Actual State vs. CS I (WU)



- Geographical distribution:  
Travel time

# Actual State vs. CS I (WU)

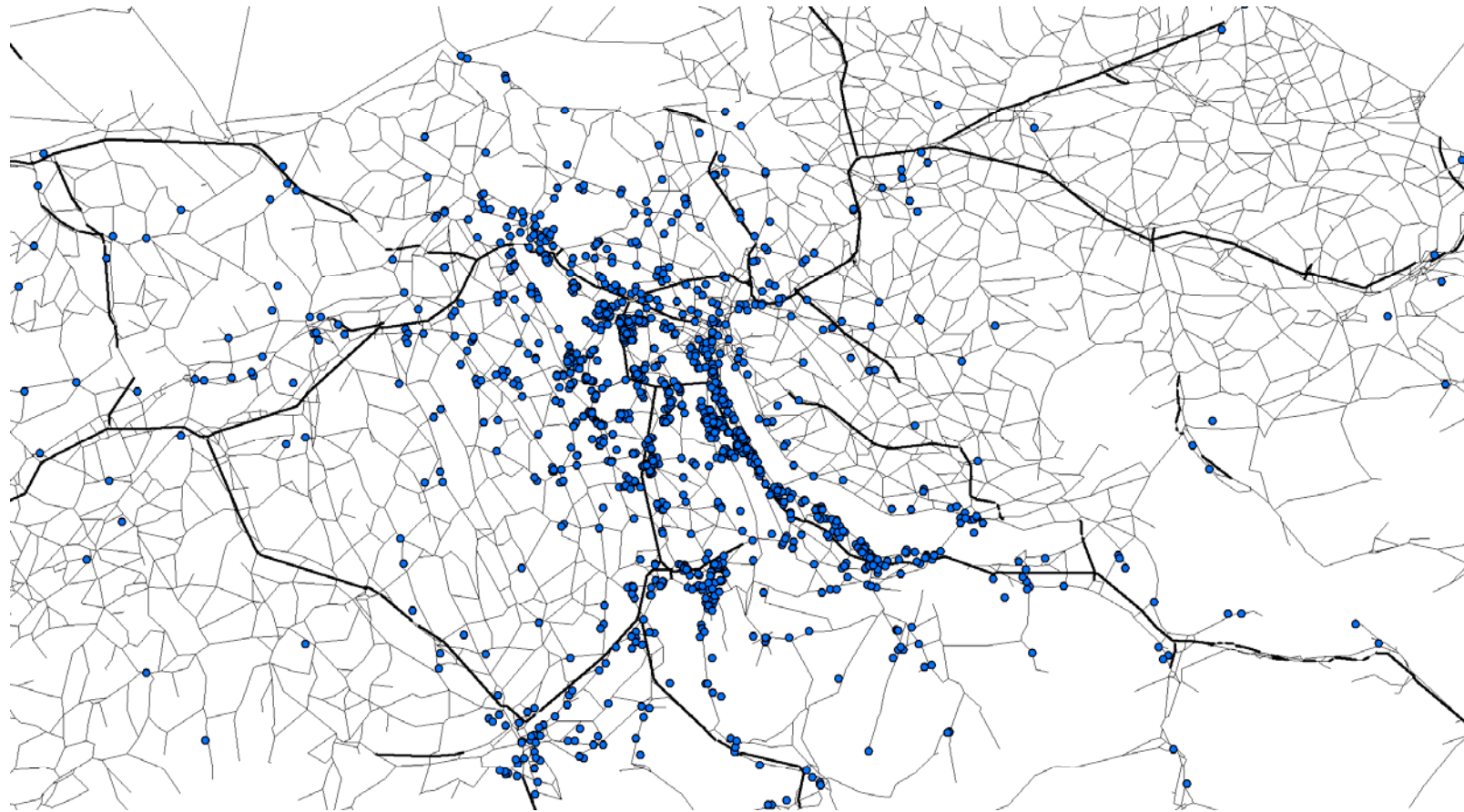
365\_370 Rel. Dist. Diff.



- Geographical distribution:  
Travel distances

# Actual State vs. CS I (WU)

Geographical distribution: „Route switchers“ WT→WU



# Conclusions

- Effect measures of the case studies approve the expected effects; no new consolidated findings
- ➔ MATSim produces similar results than previous expertises.

## Advantages:

- Detailed statistics possible on disaggregated level (individuals, activities, activity-chains, links)
- Complete time dynamic results for a whole day

*„For each agent, we know—at any time of the day—where it is, and what it is doing“*

# Notes

- Static landuse → results only useful for short term predictions
- Mode choice as a preprocess (no optimization)
- „Low“ resolution network

# Acknowledgment

- Volkswirtschaftsdirektion  
Kanton Zürich, Verkehr  
und Infrastruktur Strasse
  - Stadt Zürich,  
Dienstabteilung Verkehr,  
Regelung + Entwicklung
  - Bundesamt für Statistik
  - ETH Zürich
  - IVT
  - Prof. K.W. Axhausen
  - David Charypar
  - Francesco Ciari
  - Andreas Horni
  - Konrad Meister
  - VSP, TU Berlin
- Special Thanks to
- Claudia Dolci

Thank you for your attention!



# Plans.xml

```
<plans>
...
  <person id="123" sex="m" age="34" license="yes" car_avail="always" employed="yes">
    <plan selected="yes">
      <act type="home" link="101" end_time="07:30:33" />
      <leg mode="car">
        <route> 4 17 3 </route>
      </leg>
      <act type="work" link="112" dur="07:08:42" />
      <leg mode="car">
        <route> 22 1 7 </route>
      </leg>
      <act type="shop" link="301" dur="00:48:12" />
      <leg mode="car">
        <route> 2 4 </route>
      </leg>
      <act type="home"/>
    </plan>
  <person id="456" sex="f" age="5" ... etc.
</plans>
```

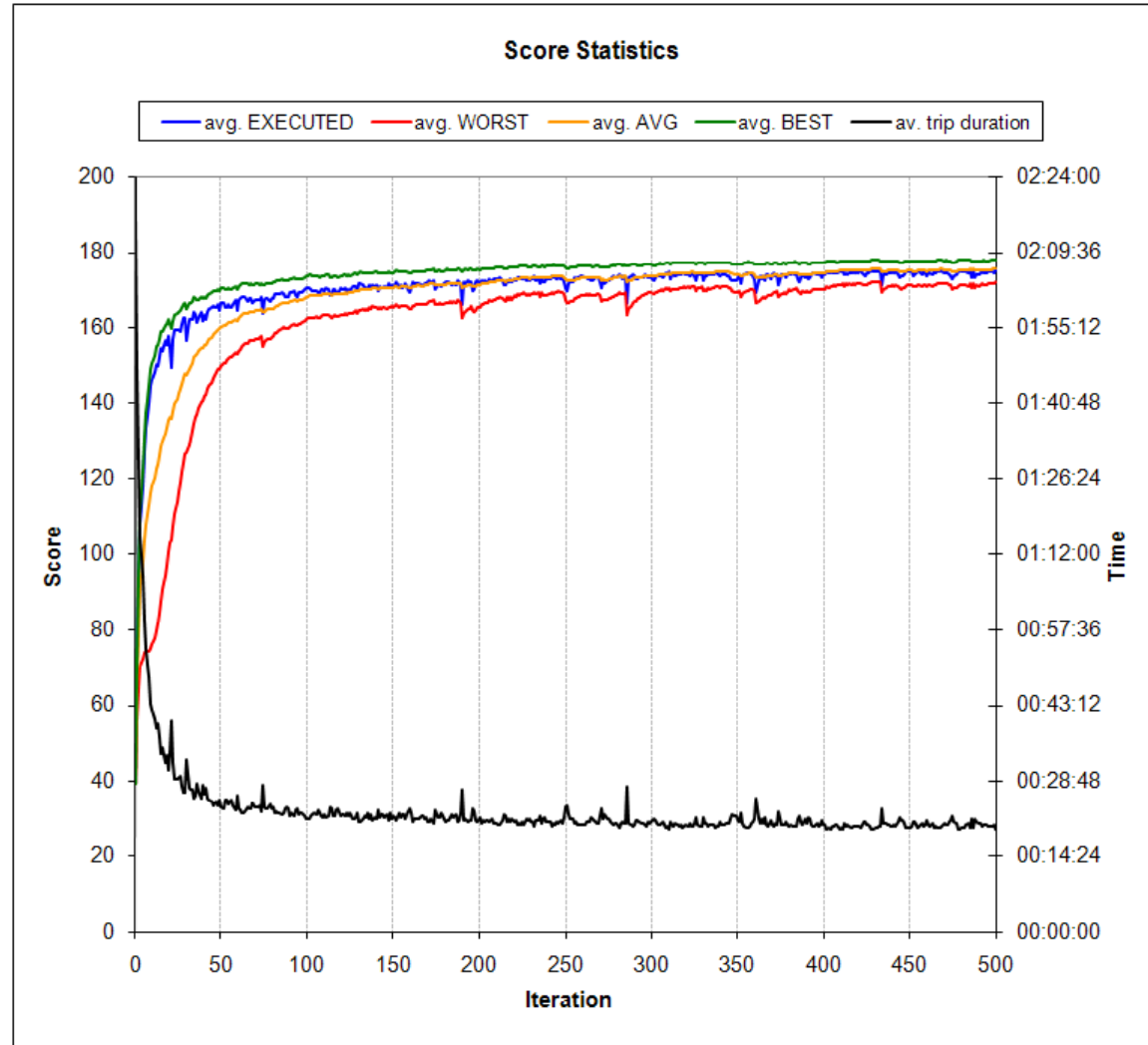


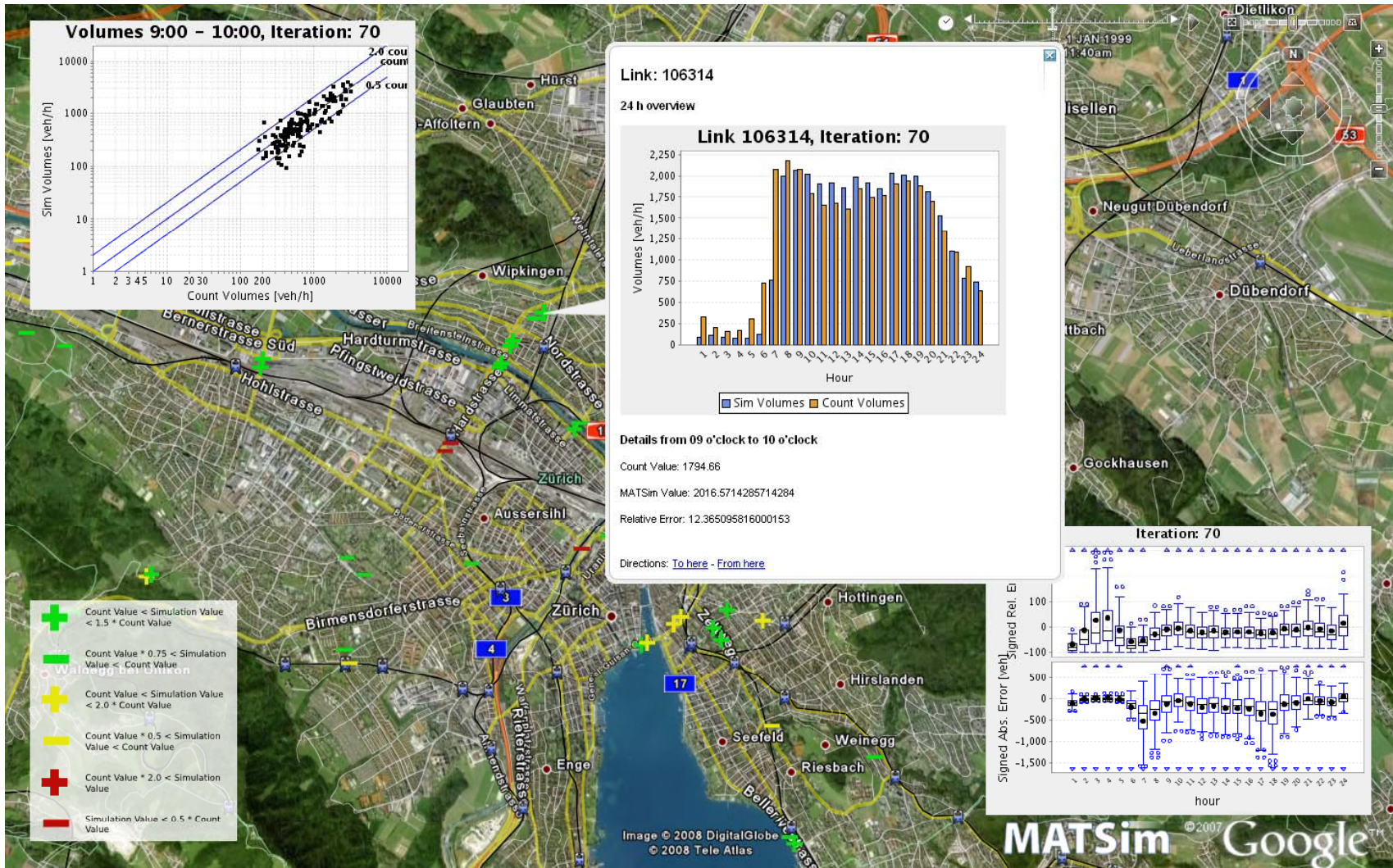
# Events.txt

time	agent	leg	link	from_node	event	type	description
0	1000264255	0	149393	49122372	6		starting
0	1000264255	0	149393	49122372	4		enter net
0	1000264255	0	149393	49122372	5		enter
0	1000264238	0	149393	49122372	6		starting
0	1000259345	0	149155	49121519	6		starting
0	1000259345	0	149155	49121519	4		enter net
0	1000259345	0	149155	49121519	5		enter
0	1000259107	0	159565	49125482	6		starting
0	1000259107	0	159565	49125482	4		enter net
0	1000259107	0	159565	49125482	5		enter
0	1000259097	0	159567	49125566	6		starting
0	1000259097	0	159567	49125566	4		enter net
0	1000259097	0	159567	49125566	5		enter
0	1000259057	0	159569	49125566	6		starting
0	1000259057	0	159569	49125566	4		enter net
0	1000259057	0	159569	49125566	5		enter
0	1000258750	0	115637	5422	6		starting
0	1000258750	0	115637	5422	4		enter net
0	1000258750	0	115637	5422	5		enter
0	1000258710	0	115637	5422	6		starting
0	1000258687	0	115637	5422	6		starting
30.51	6098477	0	111585	4481	2		leave
30.51	6098477	0	111589	4490	5		enter
39.06	3201394	0	106047	1571	2		leave
39.06	3201394	0	106046	2747	5		enter
40	1000258687	0	115637	5422	4		enter net
40	1000258687	0	115637	5422	5		enter
42.01	1000259107	0	159565	49125482	2		leave
42.01	1000259107	0	159569	49125566	5		enter
45.27	6098477	0	111589	4490	2		leave
45.27	6098477	0	111597	4491	5		enter
48.71	1000258710	0	115637	5422	2		leave
48.71	1000258710	0	115638	6326	5		enter
49.68	5087984	0	109853	2965	2		leave
49.68	5087984	0	109854	4025	5		enter
50.03	5709577	0	110891	2791	2		leave
50.03	5709577	0	107163	3225	5		enter

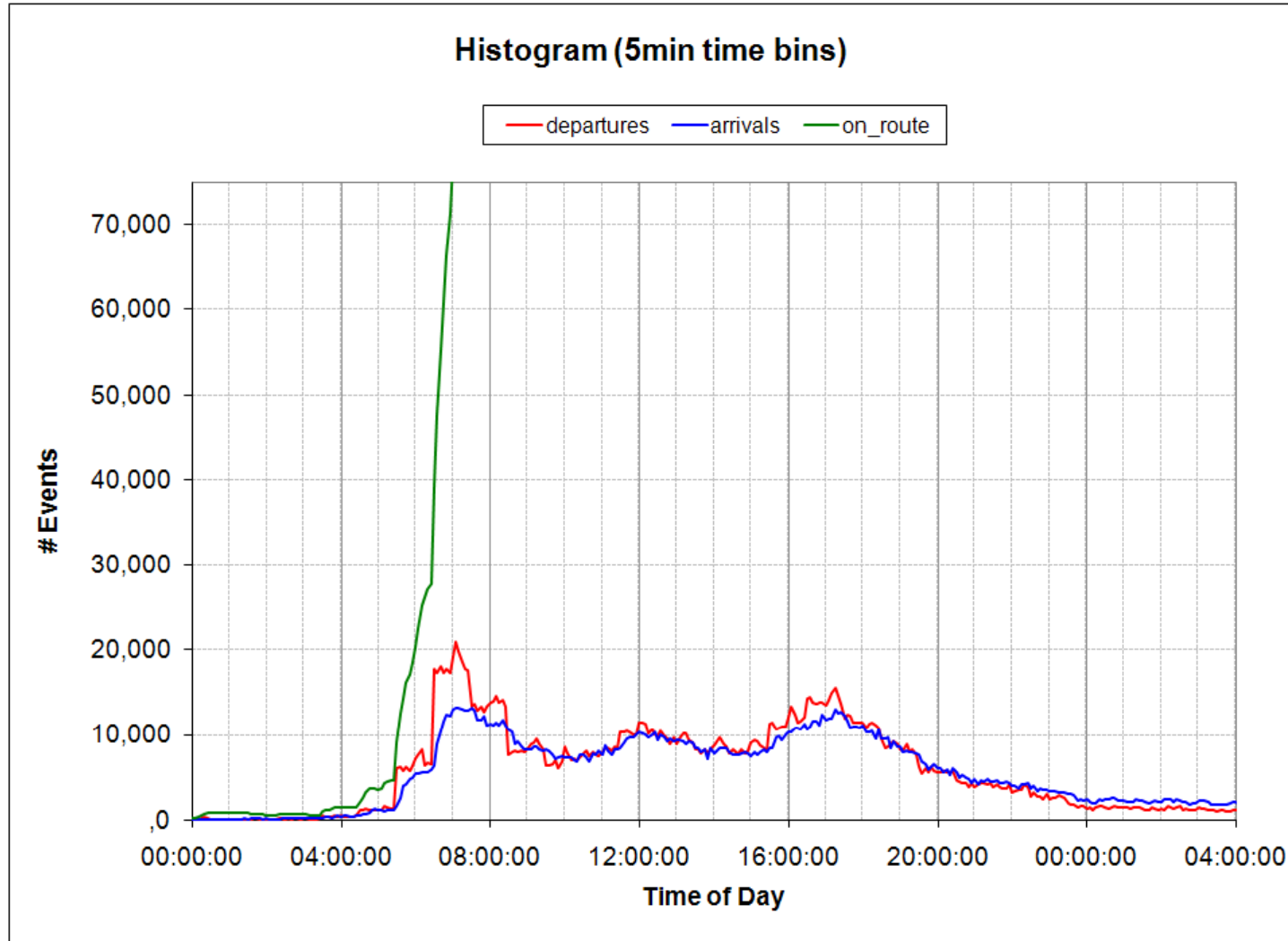


# scores & times



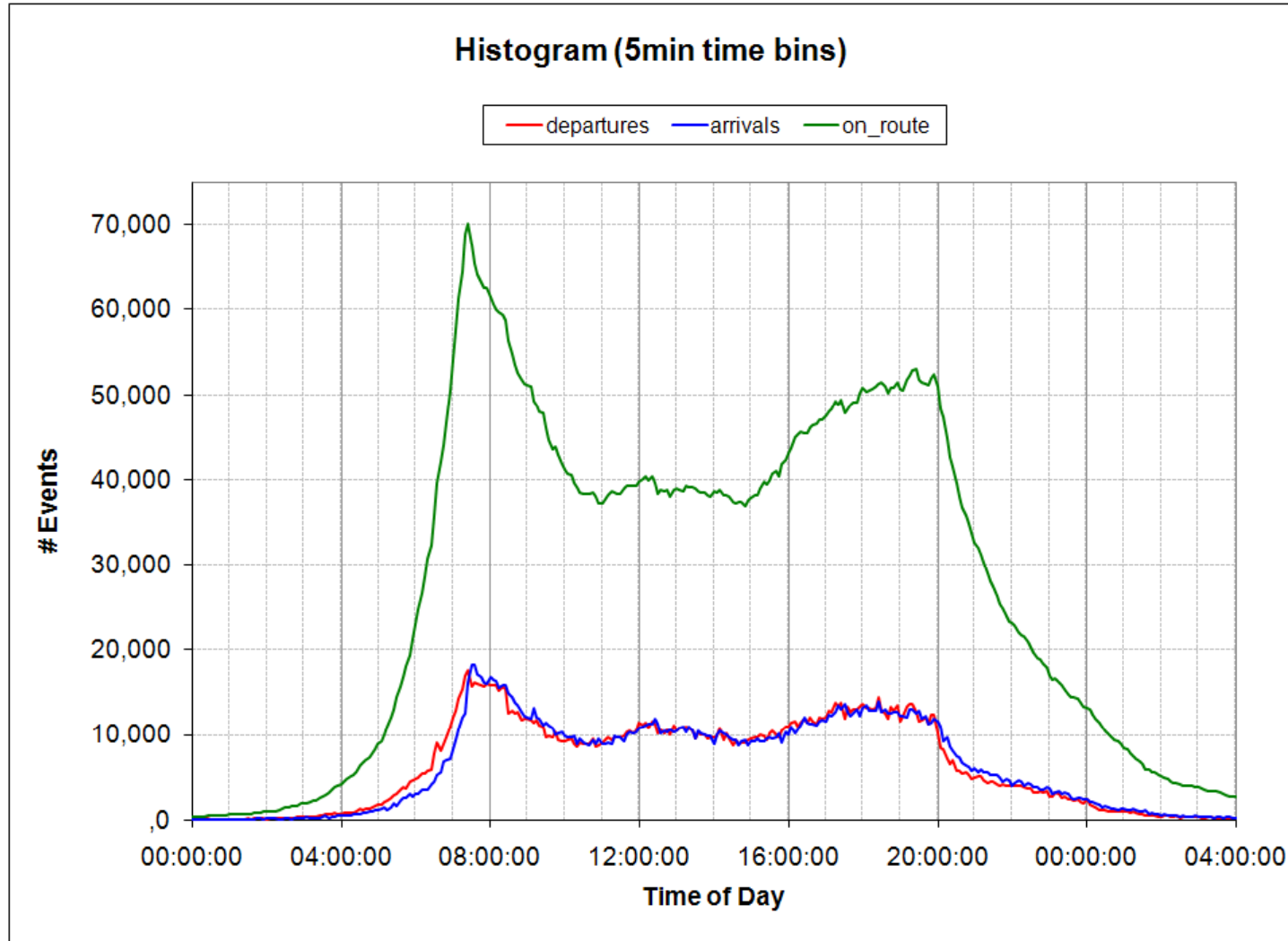


# histogram (iteration 0)





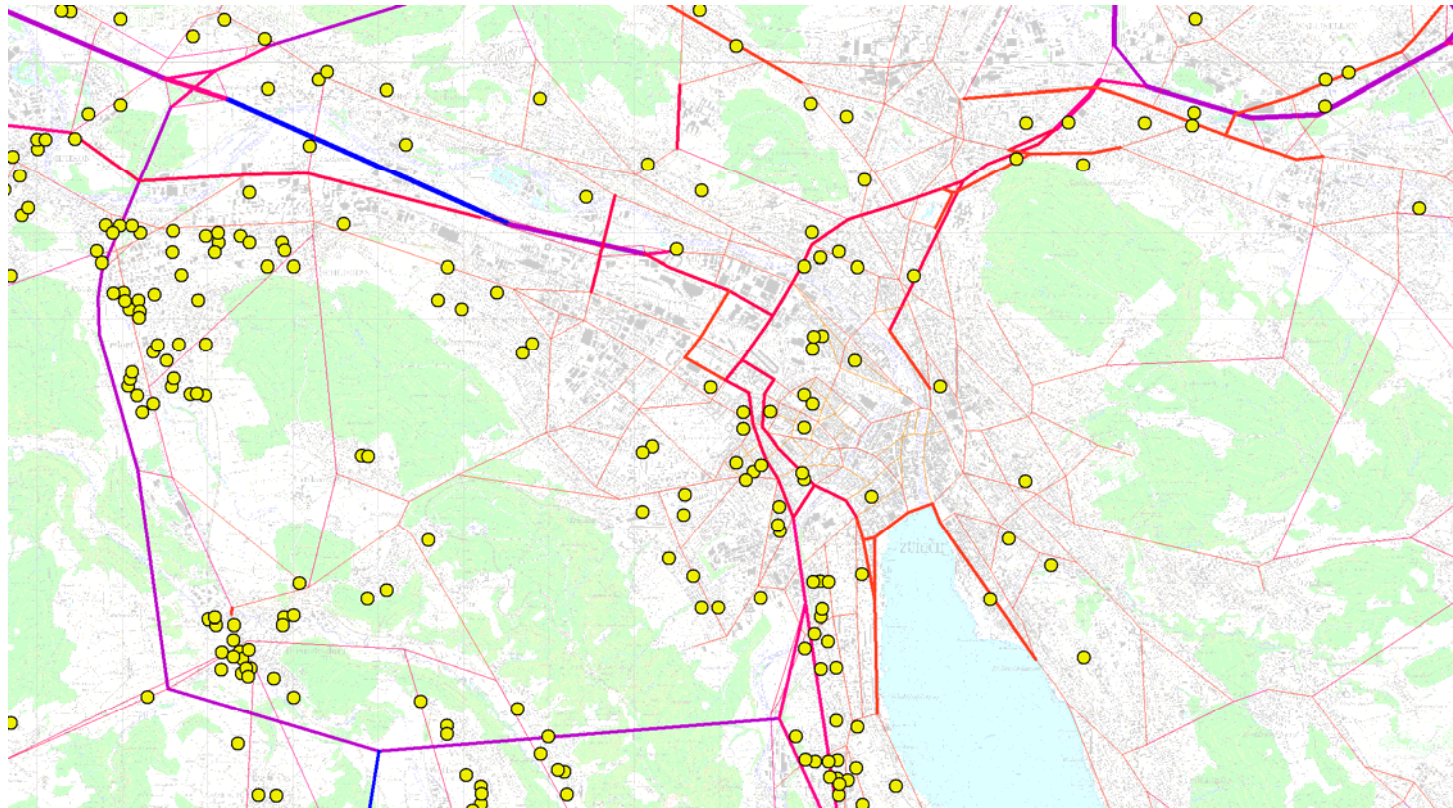
# histogram (iteration 150)



# OTFVis

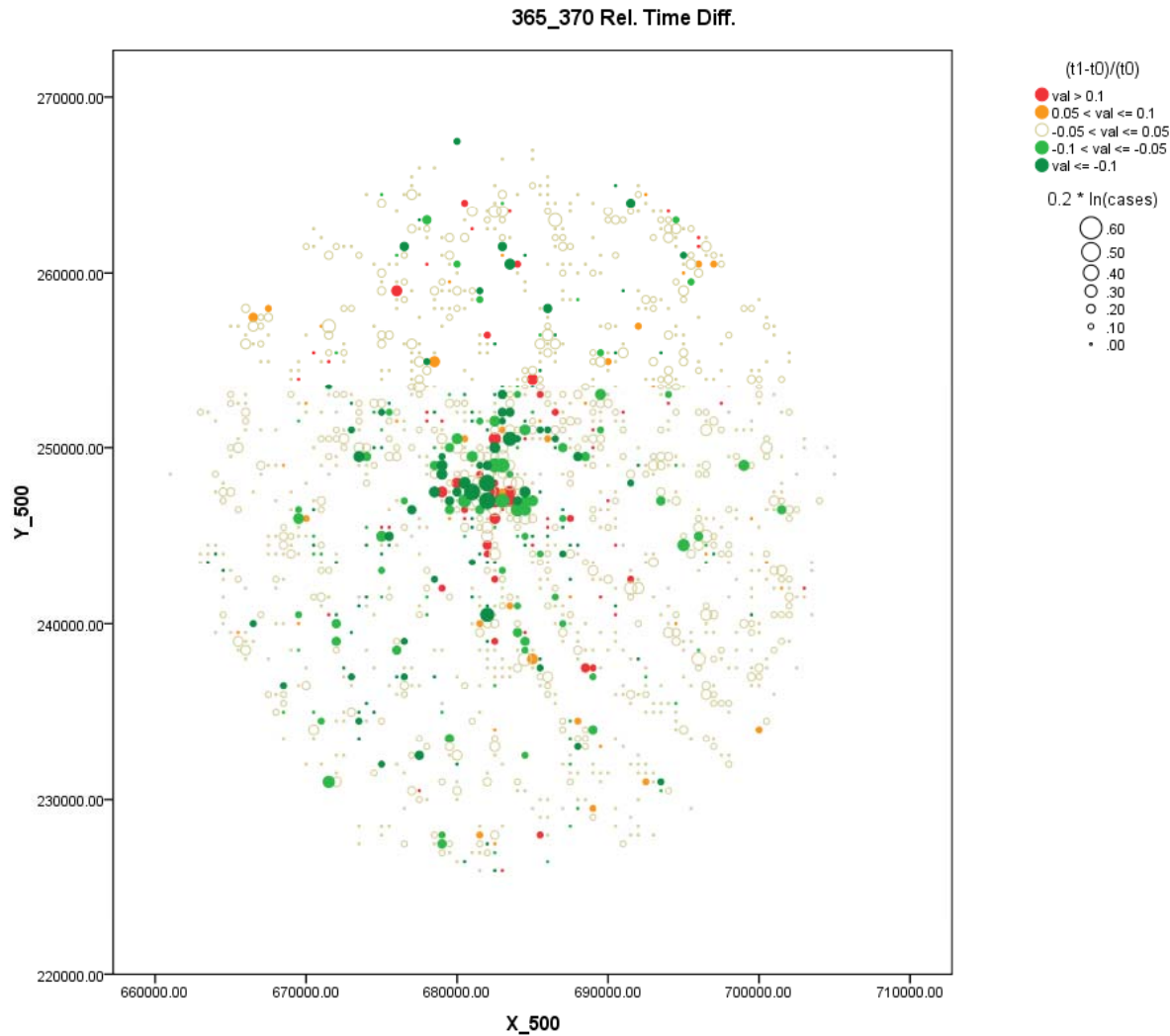


# MATSim-ANALYSIS: route switchers (WT→WU)

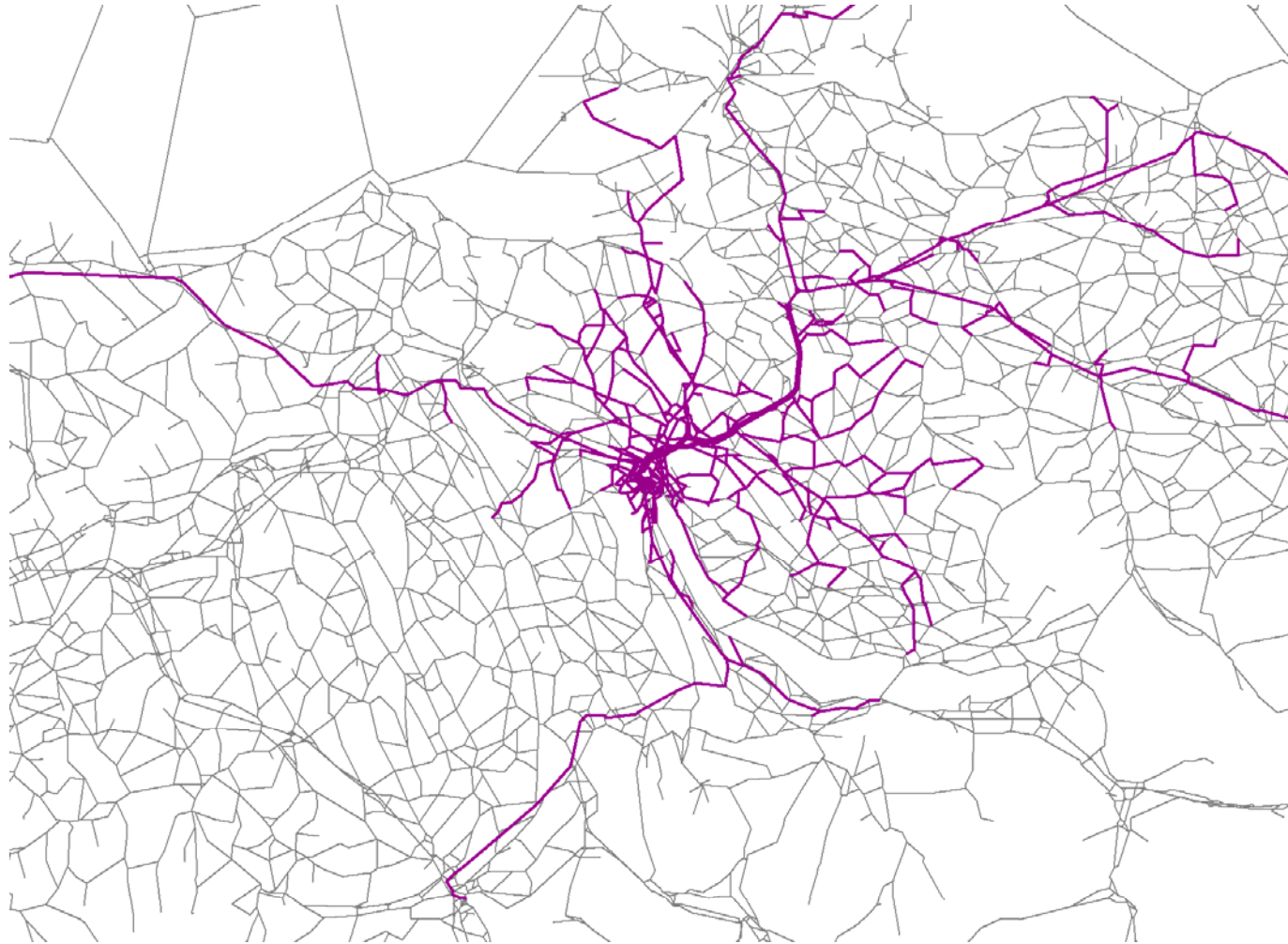




# MATSim-ANALYSIS: winner-looser



# MATSim-ANALYSIS: spider analysis



Claudia Dolci, IGP, ETHZ



# Actual State: volumes, 7-8am



Claudia Dolci, IGP, ETHZ

Graduated colors / thickness: volumes (1-4530 veh)



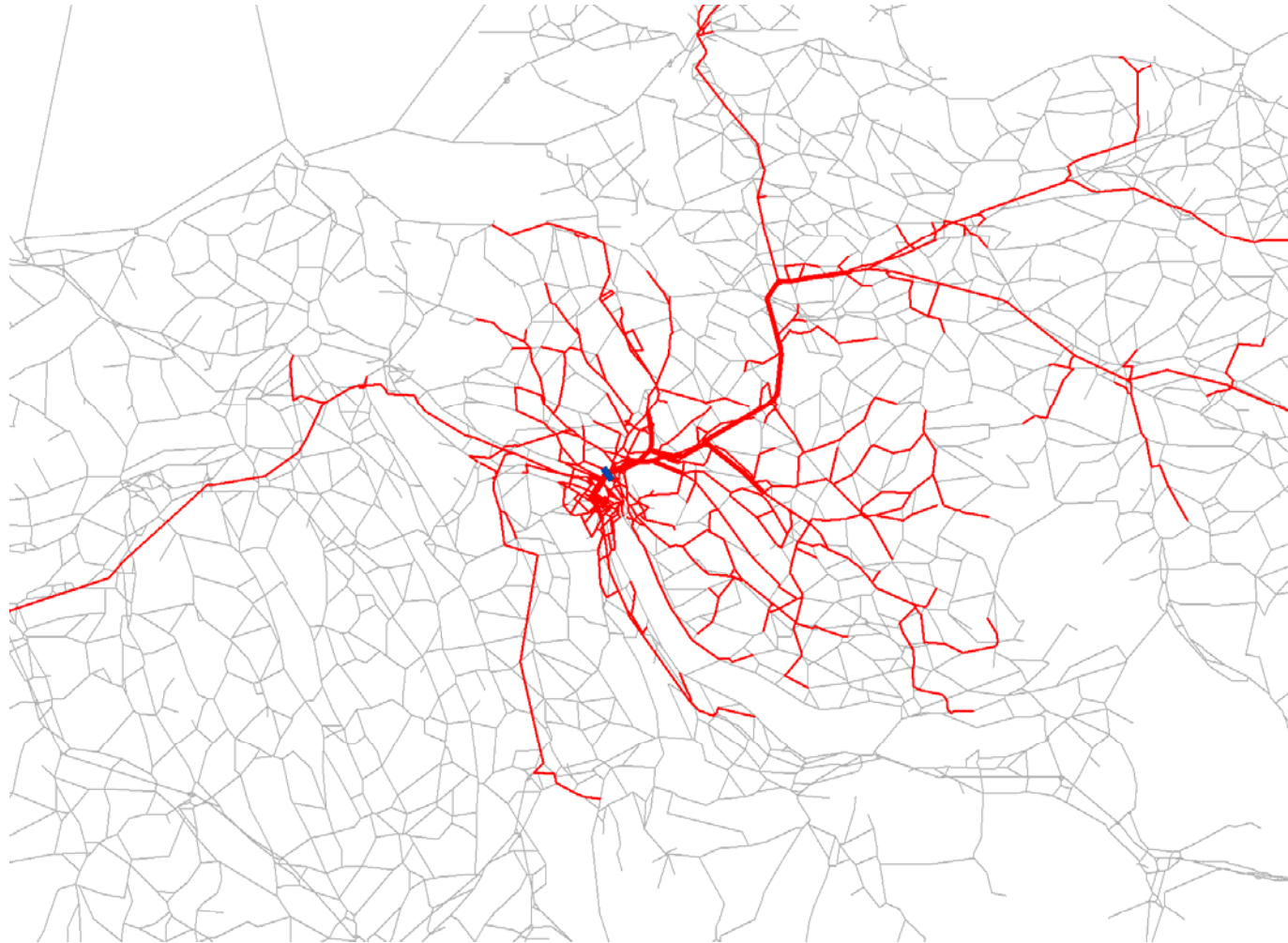
# Spider: actual state: 7-8am, N→S



Claudia Dolci, IGP, ETHZ



# Spider CS I (WU): 7-8am, N→S



Claudia Dolci, IGP, ETHZ