“Westumfahrung Zurich”: Real World Study with MATSim
Structure

• Target
• Case Study Process Steps with MATSim
• Project “Westumfahrung”
• Comparisons:
  ◦ Actual State
  ◦ Case Study I: Westumfahrung (WU)
  ◦ Case Study II: WU & accompanying measures (AM)
  ◦ Case Study III: WU & AM & traffic lights Wollishofen (TL)
• Conclusions / Summary & Outlook
Target

fm: Street restructuring
ls: Wollishofen
Uetliberg tunnel
Target: Effects Measures

- Westumfahrung & Motorway A4 (Knonaueramt)
  - Traffic volumes
  - User of the WU
- Accompanying measures: Weststrasse / Seebahnstrasse ➔ called the “Westtangente” (WT)
  - Traffic volumes
  - Winners and loosers
- Brunau / Wollishofen
  - Effects of accompanying measures (traffic light)
Process Steps I: 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 with demography
⇒ ca. 3.1 trips per agent
⇒ 5 different activity types (h,w,e,s,l)
⇒ Mobility tools
⇒ Mode choice
Process Steps II: relaxation ➞ actual state

Input:
- CH Network
- Traffic counts
- Traffic lights (dynamic green times fractions)

MATSim run:
- MATSim-EA
  - Dynamic in time
  - link resolution
  - activity based
  - complete day plan optimization

Output per iteration / every 10th iteration:
- SynPop (relaxed demand)
  - Person atts., license
  - Mobility tools
  - All act. location (Facility)
  - act chains
  - relaxed act durations
  - mode
  - relaxed routes
- events
- score evolution (png, txt)
- Dep.-, arr.-histogram (png, txt)
- Travel time evolution (txt)
- Counts compare (kmz, txt, html)
- link statistics (txt)
- Trip durations (txt)
Process Steps III: post process analysis

- SynPop (relaxed demand)
- CH Network
- events

- MATSim-EXEC & OTFVis
- MATVis
- ArcGIS (Dolci, IGP, ETHZ)
- SPSS, etc...
- MATSim-ANALYSIS

etc... etc... etc...
Project “Westumfahrung”: process steps

1. **SynPop (init demand)**
   - Network
   - Traffic lights
   → MATSim-EA

2. **SynPop (Actual State)**
   - Network (WU)
   - Traffic lights
   → MATSim-EA

3. **SynPop (Actual State)**
   - Network (WU&AM)
   - Traffic lights
   → MATSim-EA

4. **SynPop (Actual State)**
   - Network (WU&AM)
   - Traffic lights (TL)
   → MATSim-EA

→ Actual State

COMPARE

→ Real World:
  - Counts data
  - Mob. Statistics

COMPARE

→ Case Study: WU

COMPARE

→ Case Study: WU & AM

COMPARE

→ Case Study: WU & AM & TL

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**MATSim**: Multi-Agent Transport Simulation
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
Agents which pass the Area of circle := 30km radius around „Bellevue“ are kept.

⇒ 673’706 agents / 2’173’235 trips (MIT)
Project “Westumfahrung”: network (basis)

colors: capacities, thickness: # lanes

- 5600-9600 veh/h
- 3000-5600 veh/h
- 1300-3000 veh/h
- 100-800 veh/h
- 800-1300 veh/h
Project “Westumfahrung”: network (adaption)

- 6000 FZ/h
- 4000 FZ/h
- 2000 FZ/h
- 1000 FZ/h

colors: capacities, thickness: # lanes
Project “Westumfahrung”: network (adaption)

colors: free speed, thickness: # lanes
Project “Westumfahrung”: network (WU)

colors: free speed, thickness: # lanes
Project “Westumfahrung”: network (WU&AM)

colors: free speed, thickness: # lanes
Project “Westumfahrung”: traffic lights

arrows: links with traffic lights
Project “Westumfahrung”: TL Wollishofen

arrows: links with traffic lights
Reality vs. Actual State
Reality vs. Actual State

- Dynamic traffic volumes
- Counts comparison
Comparisons: Statistics
## Actual State vs. CS I (WU)

### Statistics

<table>
<thead>
<tr>
<th>Border crossing agents</th>
<th>Actual State</th>
<th>Case Study I (WU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>av. daily utility</td>
<td>64.84</td>
<td>69.31</td>
</tr>
<tr>
<td>av. trip travel time</td>
<td>02:13:14</td>
<td>02:06:40</td>
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<tr>
<td>av. trip distance [km]</td>
<td>189.77</td>
<td>189.40</td>
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</table>

<table>
<thead>
<tr>
<th>Census population</th>
<th>Actual State</th>
<th>Case Study I (WU)</th>
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<tbody>
<tr>
<td>av. daily utility</td>
<td>183.72</td>
<td>185.61</td>
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<tr>
<td>av. trip travel time</td>
<td>00:16:22</td>
<td>00:14:23</td>
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<tr>
<td>av. trip distance [km]</td>
<td>12.35</td>
<td>12.36</td>
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<tr>
<th>Population WT ==&gt; WU</th>
<th>Actual State</th>
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<tbody>
<tr>
<td>av. daily utility</td>
<td>158.26</td>
<td>165.08</td>
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<td>av. trip travel time</td>
<td>00:48:20</td>
<td>00:39:10</td>
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<tr>
<td>av. trip distance [km]</td>
<td>45.61</td>
<td>46.69</td>
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<tr>
<td>av. daily utility</td>
<td>164.68</td>
<td>166.04</td>
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<tr>
<td>av. trip travel time</td>
<td>00:21:54</td>
<td>00:18:57</td>
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<tr>
<td>av. trip distance [km]</td>
<td>8.57</td>
<td>8.50</td>
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## CS I (WU) vs. CS II (WU&AM)

### Statistics

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<tr>
<td>av. daily utility</td>
<td>69,31</td>
<td>67,78</td>
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<tr>
<td>av. trip travel time</td>
<td>02:06:40</td>
<td>02:10:04</td>
</tr>
<tr>
<td>av. trip distance [km]</td>
<td>189,40</td>
<td>189,66</td>
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<tr>
<td>av. daily utility</td>
<td>185,61</td>
<td>184,91</td>
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<tr>
<td>av. trip travel time</td>
<td>00:14:23</td>
<td>00:14:41</td>
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<td>av. trip distance [km]</td>
<td>12,36</td>
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<tr>
<td>av. daily utility</td>
<td>182,50</td>
<td>181,16</td>
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<td>av. trip travel time</td>
<td>00:32:55</td>
<td>00:32:42</td>
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<tr>
<td>av. trip distance [km]</td>
<td>31,06</td>
<td>32,28</td>
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<td>av. daily utility</td>
<td>166,04</td>
<td>164,02</td>
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<tr>
<td>av. trip travel time</td>
<td>00:18:57</td>
<td>00:18:38</td>
</tr>
<tr>
<td>av. trip distance [km]</td>
<td>8,50</td>
<td>8,45</td>
</tr>
</tbody>
</table>
### CS II (WU&AM) vs. CS III (WU&AM&TL)

#### Statistics

<table>
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<tr>
<th>Border crossing agents</th>
<th>Case Study II (WU&amp;AM)</th>
<th>Case Study III (WU&amp;AM&amp;TL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>av. daily utility</td>
<td>67,78</td>
<td>68,02</td>
</tr>
<tr>
<td>av. trip travel time</td>
<td>02:10:04</td>
<td>02:08:26</td>
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<tr>
<td>av. trip distance [km]</td>
<td>189,66</td>
<td>189,54</td>
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<tbody>
<tr>
<td>av. daily utility</td>
<td>184,91</td>
<td>184,82</td>
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<tr>
<td>av. trip travel time</td>
<td>00:14:41</td>
<td>00:14:48</td>
</tr>
<tr>
<td>av. trip distance [km]</td>
<td>12,34</td>
<td>12,35</td>
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<tr>
<th>Population WT ==&gt; WU</th>
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<tbody>
<tr>
<td>av. daily utility</td>
<td>181,98</td>
<td>182,88</td>
</tr>
<tr>
<td>av. trip travel time</td>
<td>00:33:29</td>
<td>00:33:54</td>
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<tr>
<td>av. trip distance [km]</td>
<td>30,98</td>
<td>31,71</td>
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Volume comparison
Volume comparison

- Actual State vs. CS I (WU)
- CS I (WU) vs. CS II (WU&AM)
- CS II (WU&AM) vs. CS III (WU&AM&TL)
Spider analysis
Spider: actual state: 7-8am, N→S
Spider CS I (WU): 7-8am, N→S
Spider CS II (WU&AM): 7-8am, N→S
Spider CS III (WU&AM&TL): 7-8am, N→S
Winner / Looser: Utility
Actual State vs. CS I (WU)

- Geographical distribution: Utility
CS I (WU) vs. CS II (WU&AM)

- Geographical distribution: Utility
CS II (WU&AM) vs. CS III (WU&AM&TL)

- Geographical distribution: Utility
Winner / Looser: Travel Times
Actual State vs. CS I (WU)

- Geographical distribution: Travel time
CS I (WU) vs. CS II (WU&AM)

• Geographical distribution: Travel time
• Geographical distribution: Travel time
Winner / Looser: Travel Distances
Actual State vs. CS I (WU)

- Geographical distribution: Travel distances
CS I (WU) vs. CS II (WU&AM)

- Geographical distribution: Travel distances
CS II (WU&AM) vs. CS III (WU&AM&TL)

- Geographical distribution: Travel distances
“Route Switchers (WT→WU)”
Geographical distribution: „Route switchers“ WT → WU
CS I (WU) vs. CS II (WU&AM)

Geographical distribution: „Route switchers“ WT → 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”
• 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!
scores & times

![Score Statistics Graph]

- Score Statistics
- avg. EXECUTED
- avg. WORST
- avg. AVG
- avg. BEST
- av. trip duration

**Score**

**Time**

**Iteration**

**Graph Description:**
- The graph illustrates the score statistics over iterations.
- The X-axis represents the iteration number, ranging from 0 to 500.
- The Y-axis shows the score, ranging from 0 to 200.
- The graph includes multiple lines indicating different statistics such as avg. EXECUTED, avg. WORST, avg. AVG, avg. BEST, and av. trip duration.
- The line colors and styles are used to distinguish between these statistics.

**MATSim Logo:**
- Multi-Agent Transport Simulation
Histogram (iteration 0)
histogram (iteration 150)
MATSim-ANALYSIS: route switchers (WT→WU)
MATSim-ANALYSIS: winner-looser
MATSim-ANALYSIS: spider analysis