Cutting It Down

MATSim User Meeting 2025

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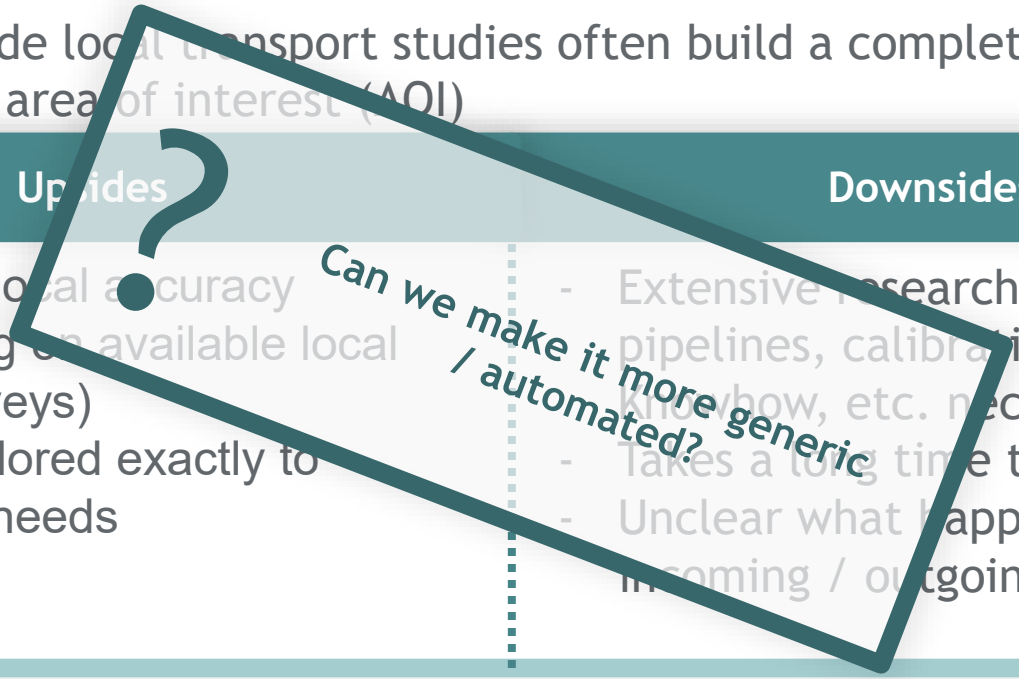
senozon

The traditional approach to transport studies - Building It Up

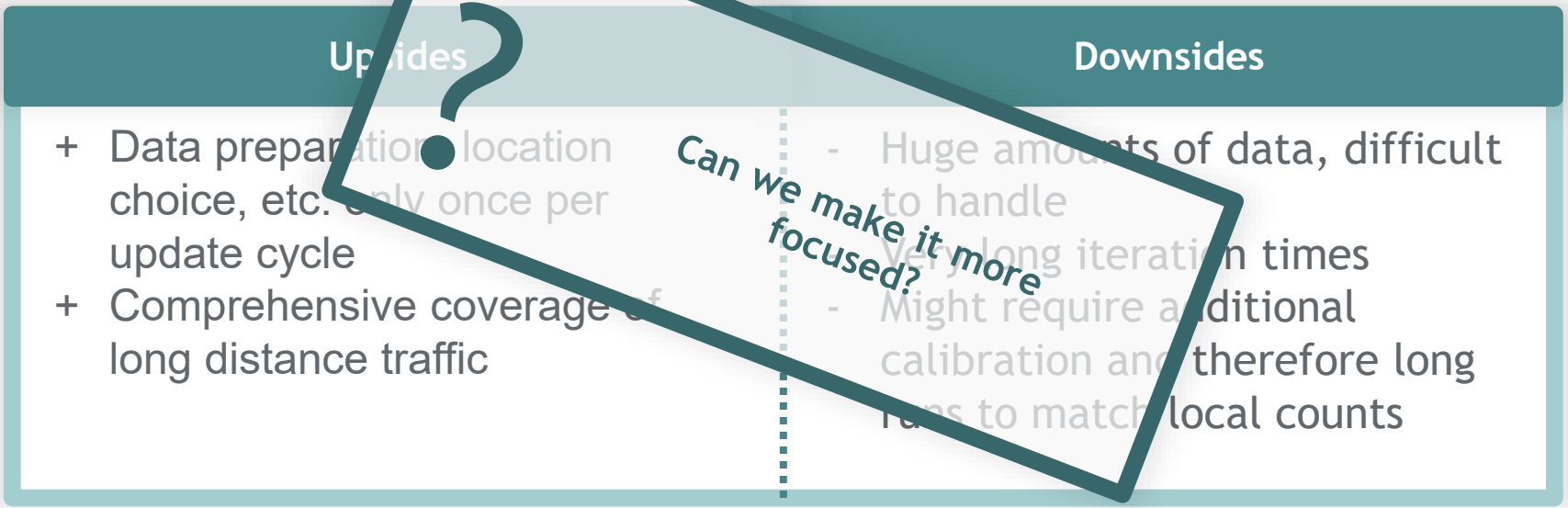
- Custom made local transport studies often build a completely new model around the area of interest (AOI)

Upsides	Downsides
+ Very high local accuracy (depending on available local data / surveys) + Can be tailored exactly to customer needs	- Extensive research, data pipelines, calibration, know-how, etc. necessary - Takes a long time to build - Unclear what happens with incoming / outgoing traffic



Covering it all

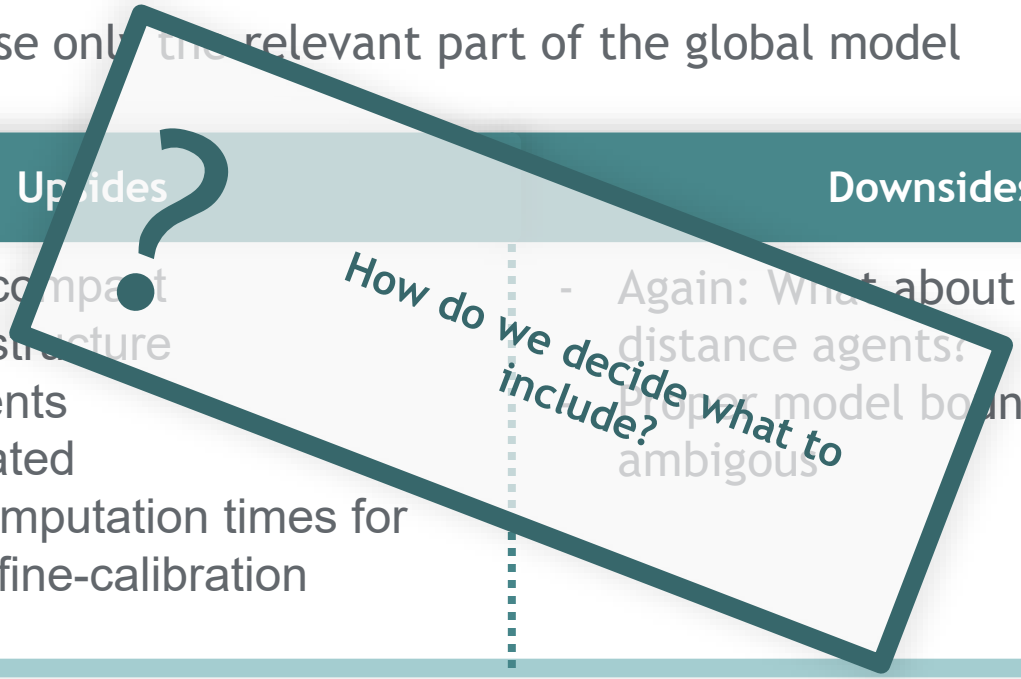
- Suggestion: Just build a reusable model for the whole country!



Cutting it down

- Solution: Use only the relevant part of the global model

Upsides	Downsides
+ Neat and compact + Less infrastructure + Fewer agents + Pre-calibrated + Shorter cumputation times for additional fine-calibration	- Again: What about the long-distance agents? Proper model boundaries a bit ambigous

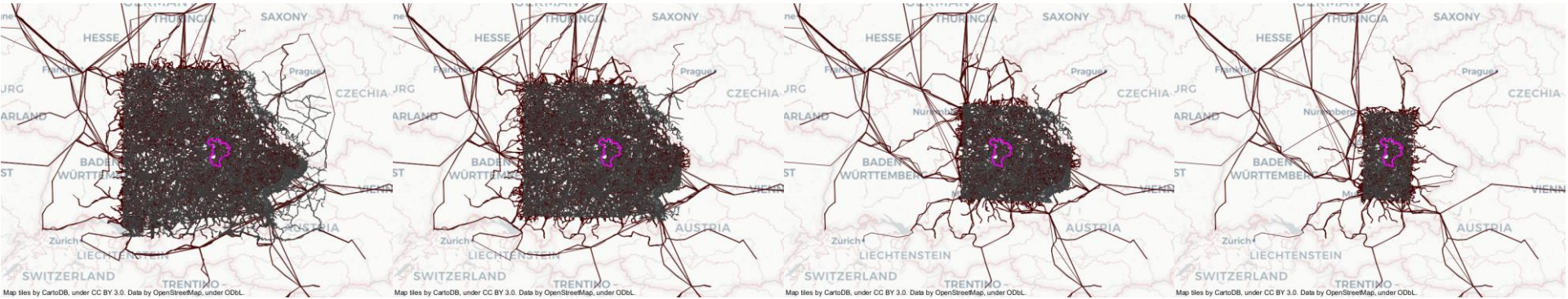


Our old approach – Finding a compromise

- «demand first» approach
- Remove all agents not interacting with the AOI at all
- Optional: Cut away some agents, starting with the ones having activities furthest away from the AOI
- Retain all infrastructure necessary to have the remaining agents be able to perform their plan and do mode choice, cut the rest

Our old approach – Finding a compromise

- Infrastructure for percentage of retained agents
- Example: Kehlheim; pink outline is AOI

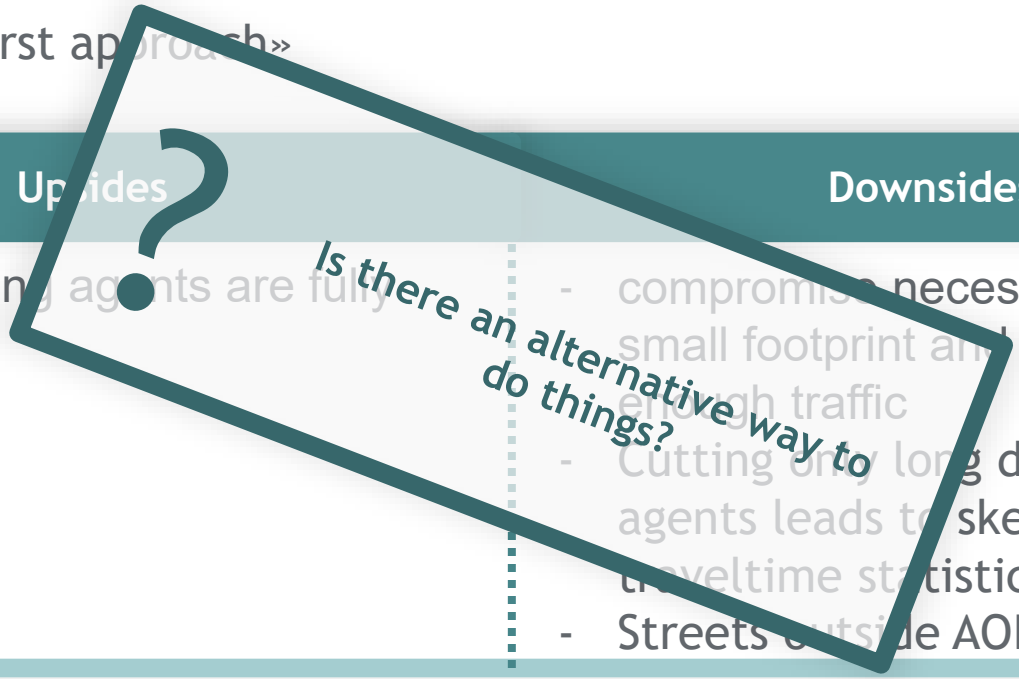


99% 98% 95% 90%

Our old approach - Finding a compromise

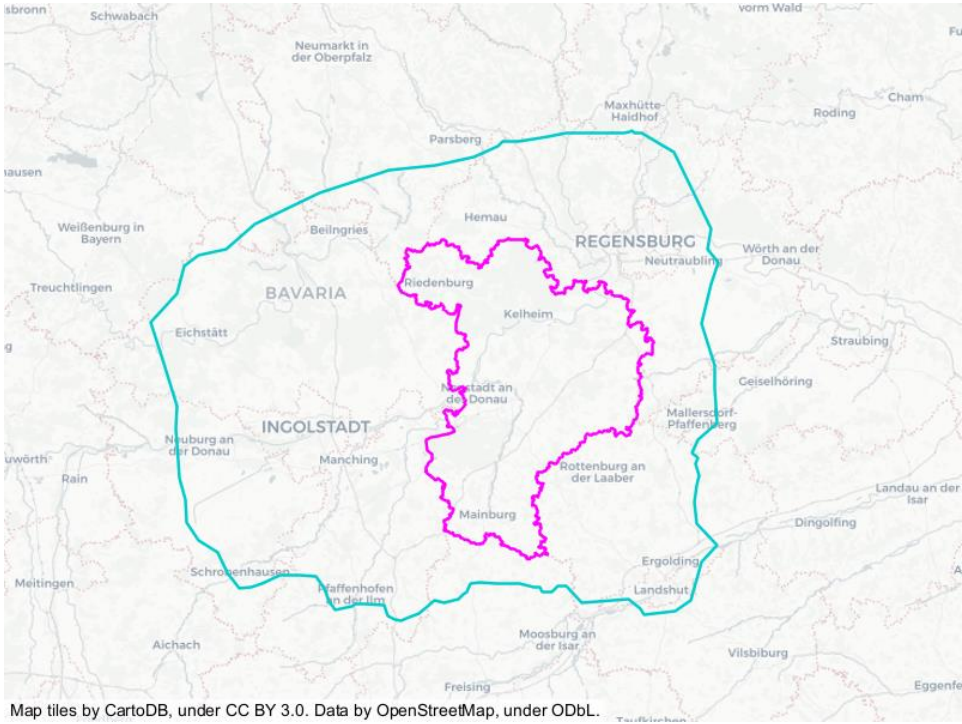
- «demand first approach»

Upsides	Downsides
+ All remaining agents are fully usable	- compromise necessary between small footprint and having enough traffic - Cutting only long distance agents leads to skewed traveltime statistics - Streets outside AOI quite empty



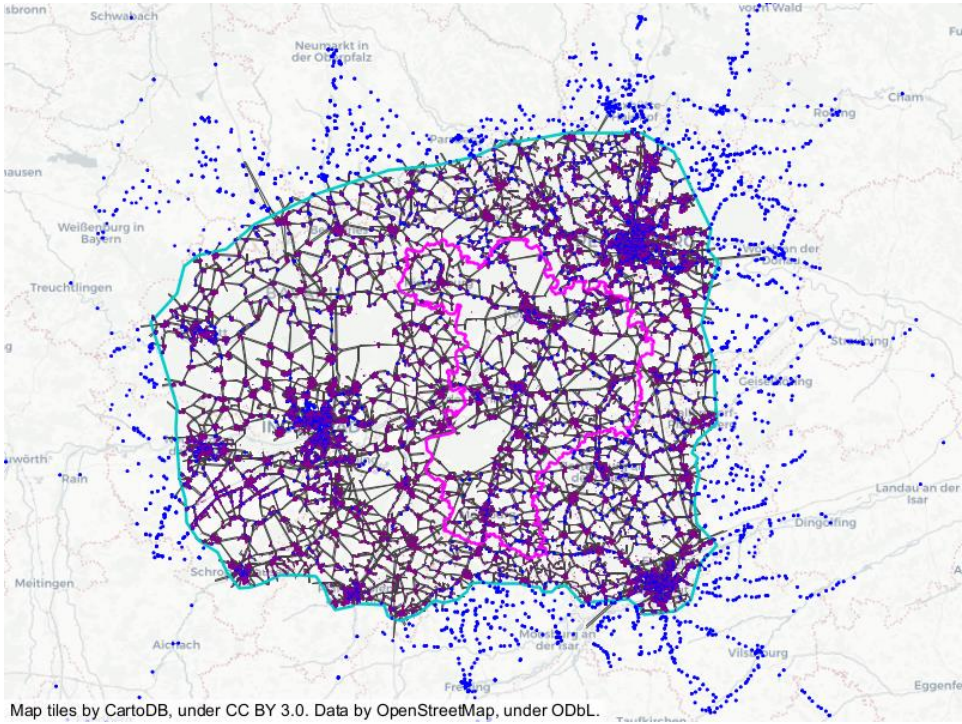
Our new approach – Strict cutting

- «infrastructire first» approach
- Manually define a model region (MR) larger than the AOI



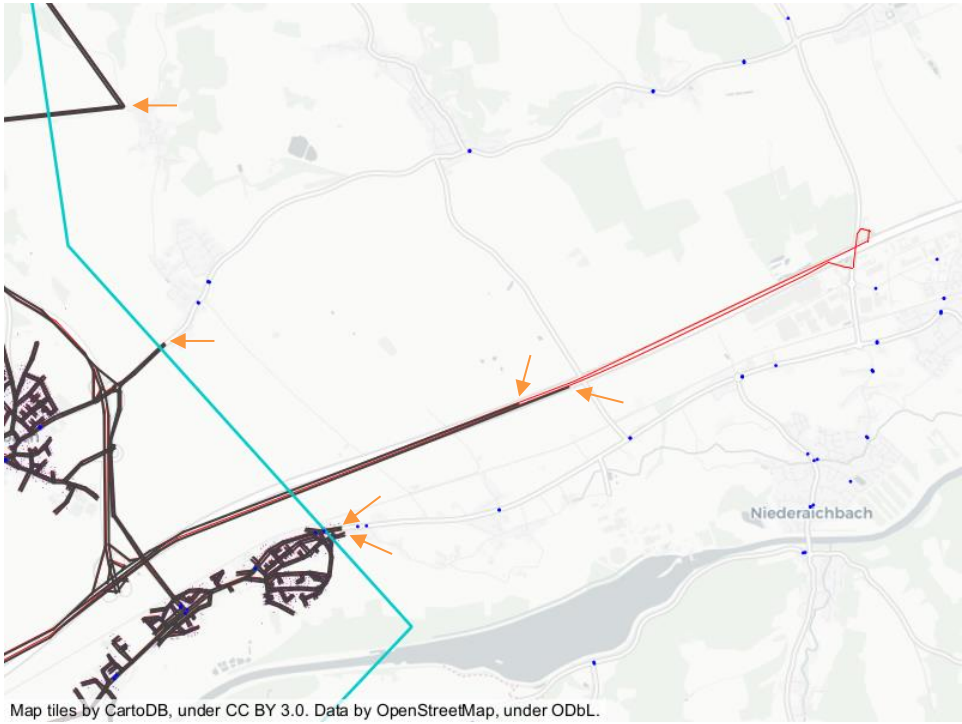
Our new approach – Strict cutting

- Remove all infrastructure (streets, facilities, pt) outside the MR
- Exception: Keep pt lines that go through the MR (for convenience)



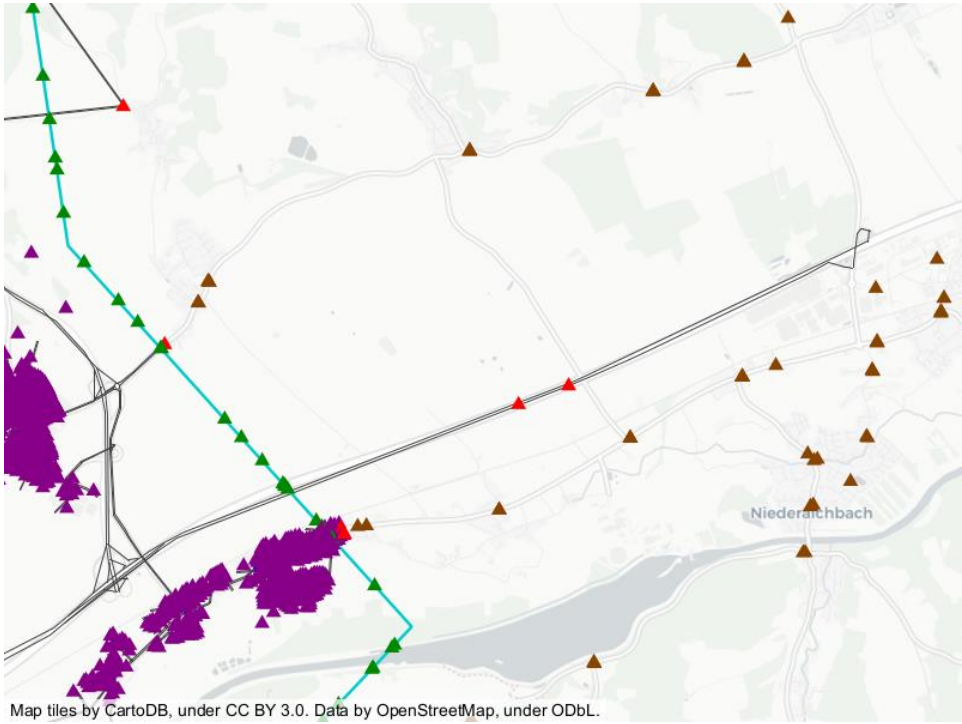
Our new approach – Strict cutting

- Make sure the street graph is still strongly connected by adding links (red)
- Add loop links to all entrance- and exit-nodes (at orange arrows)



Our new approach – Strict cutting

- Add border facilities to every entrance or exit
  - For car on the loop links (red)
  - For pt on each stop outside (brown)
  - For walk/bike on the model border at intersections with OSM ways (green)



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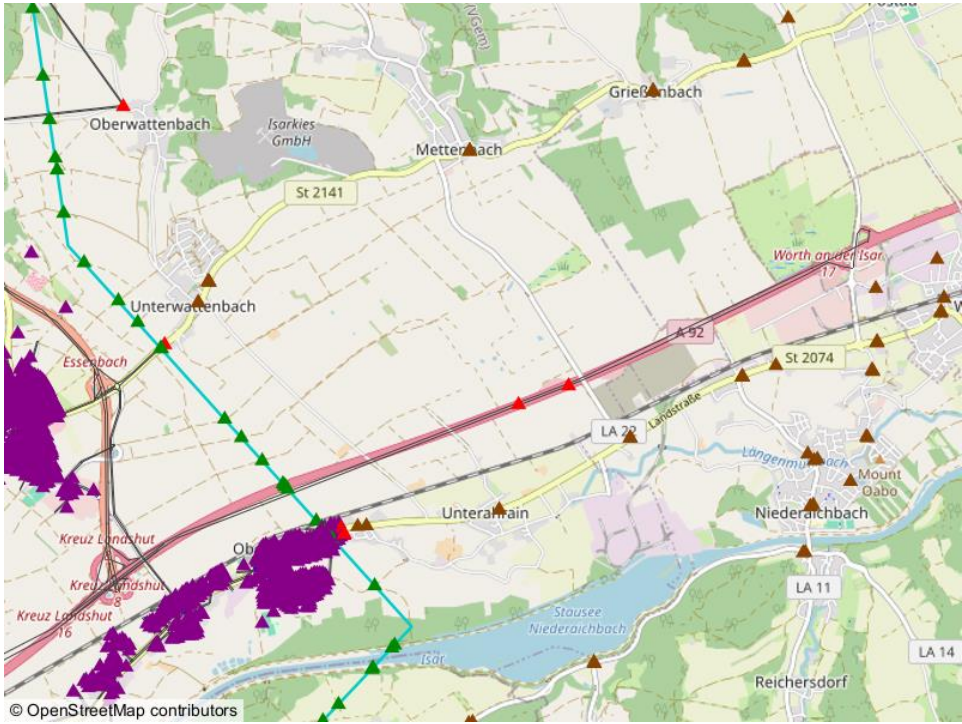

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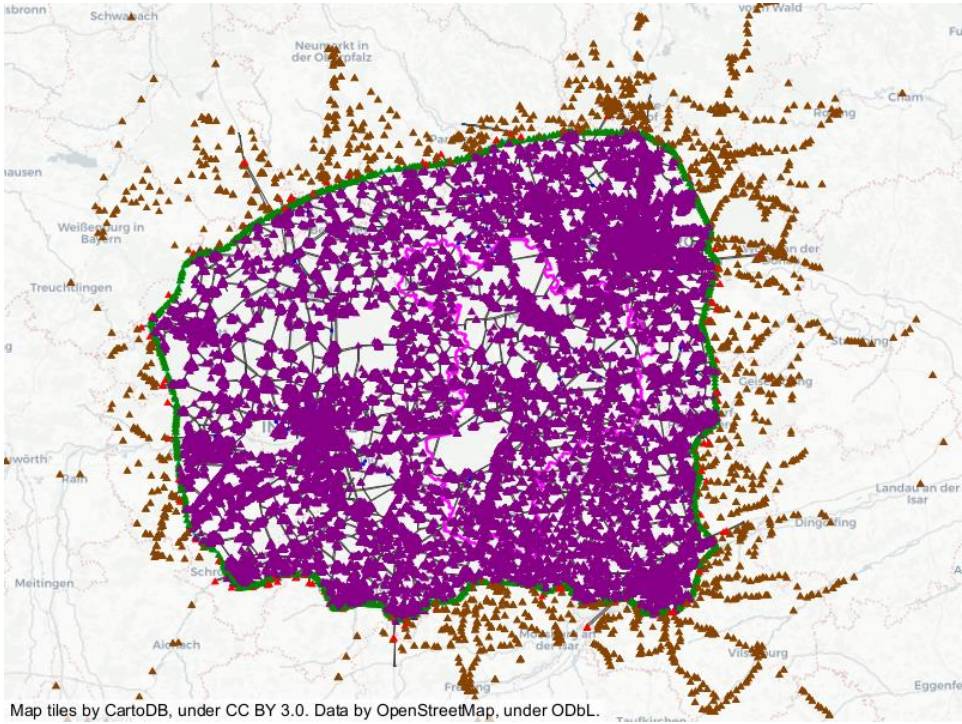


But what about the agents?

- Depends on the agent…
  - ? Whole plan never interacts with remaining infrastructure → Delete
  - ? Whole plan exclusively interacts with remaining infrastructure → Keep as is
  - ? Whole plan partially interacts with remaining infrastructure → Split into SingleTripAgents

SingleTripAgents (STAs)

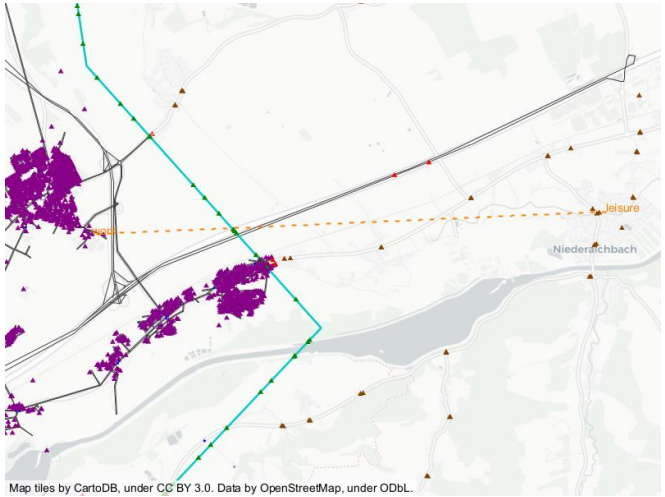
- One STA for each trip of the original plan:
  - ? STAs never interacting with the remaining infrastructure → Delete
  - ? STA completely inside remaining infrastructure → Keep as is
  - ? STA crosses model boundary somewhere → Modify the trip

Modifying the trip

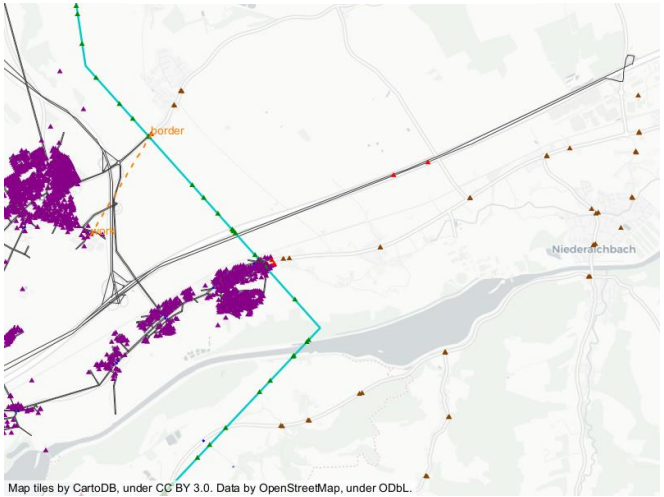
- If original first activity would be outside the MR:
  - Set activity to border facility at entry point (for car/ride/walk/bike)
  - For pt, use border facility at where they get on the pt vehicle that takes them inside
  - Adjust activity end time accordingly, so they leave the border facility at the same time the original plan would have suggested they come past it
    - For pt: Take from schedule
    - For car/ride: Estimate via link travel time
    - For walk/bike: Estimate via walk/bike routing

Modifying the trip

- ☑ Activity: leisure
  09:18:59 – 09:31:02
- ☑ Leg: car
  09:31:02 – 09:45:42
- ☑ Activity: work
  09:45:42 – 10:07:52



- ☑ Activity: border
  – 09:42:24
- ☑ Leg: car
  09:42:24 – 09:45:42
- ☑ Activity: work
  09:45:42 –



Modifying the trip

- Same for if original last activity would be outside the MR
- Activities inside the MR stay unchanged
- If original trip crosses border multiple times:
  - Cut trip into multiple STAs, similar to standard case
  - Example: Agent needs to leave MR because they need to change pt routes outside but then drive back in

Ups and downs of the new approach

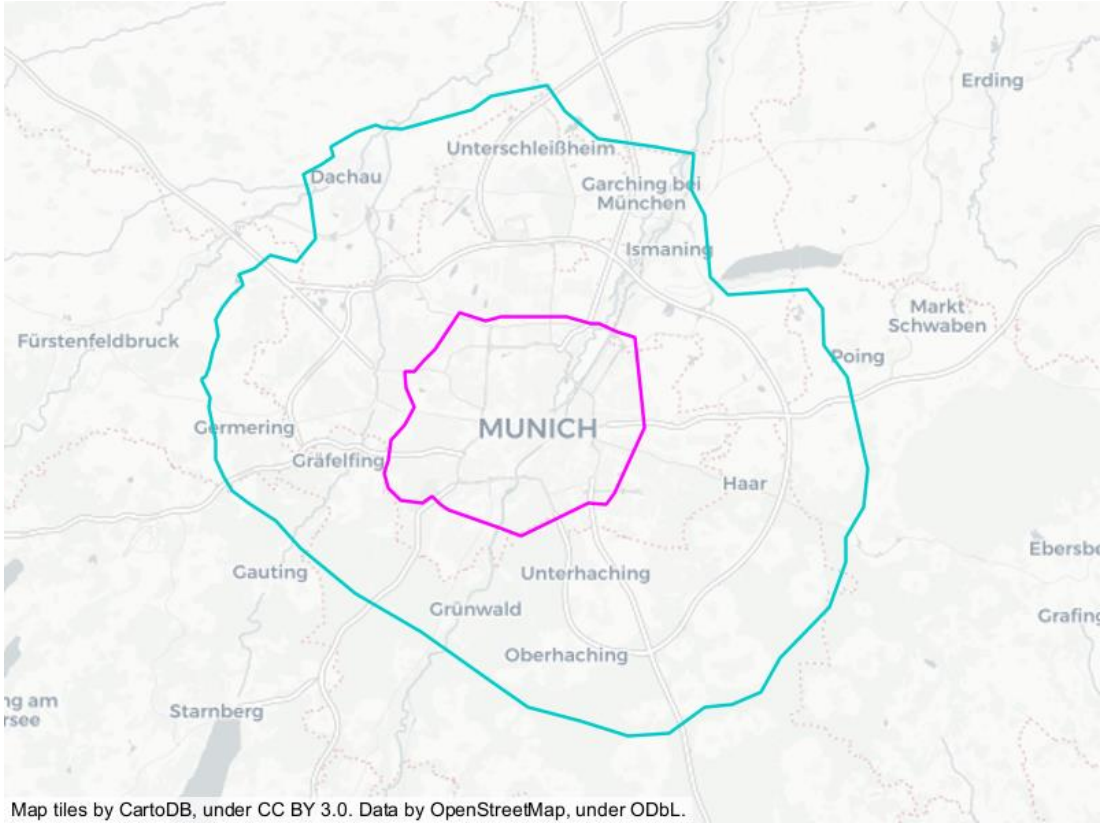
Upsides	Downsides
+ Compact infrastructure + Full traffic volumes + Fast creation time + Fast iteration times	- STAs have fixed border facilities e.g. on a certain road. Therefore they are not suitable for mode choice, more like background traffic - Choice of MR has to be done manually and is sensitive to the kind of study to be conducted - Not very flexible

Example: DRT study in Munich

- Idea: Introduce DRT service in the core city of Munich
- Test for different service configurations

The choice of model region

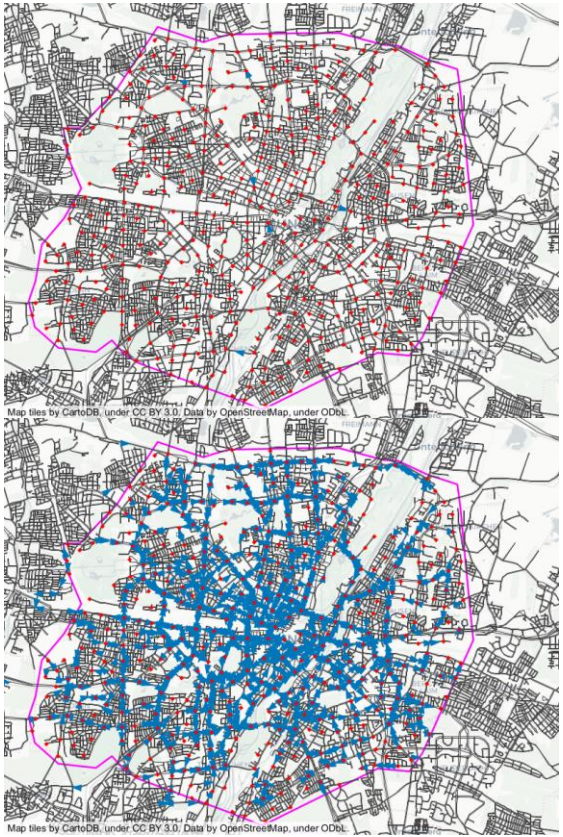
- Include the most important connections around Munich
  - Outer highway ring
  - Towns with strong commuting relations
- For some studies should be bigger to include e.g. the airport and Starnberg



Example: DRT study in Munich

- Based on the current Senozon Model of Germany 2025
- 100pct Sample of the Munich Region
  - 1.8 million agents with complete daily schedules
  - 1.6 million STAs
  - 33% of STAs live in AOI
- Took only a few hrs to cut from full plans file
- Runtime: approx. 3 days for 160 iters

Example: DRT study in Munich



03:00

10:00

17:00

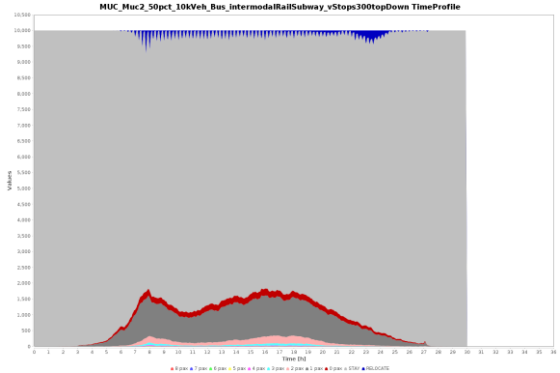
24:00

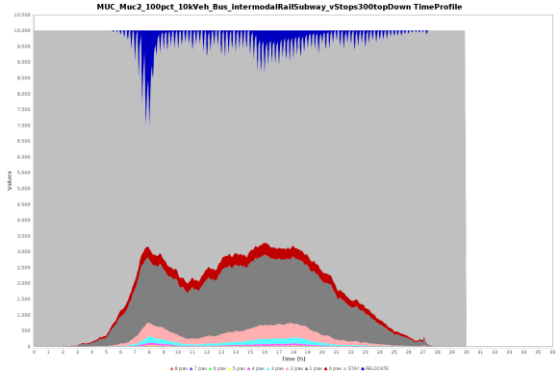
Example: DRT study in Munich

50pct

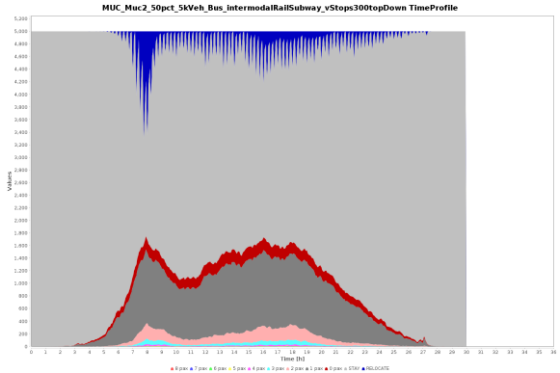
100pct

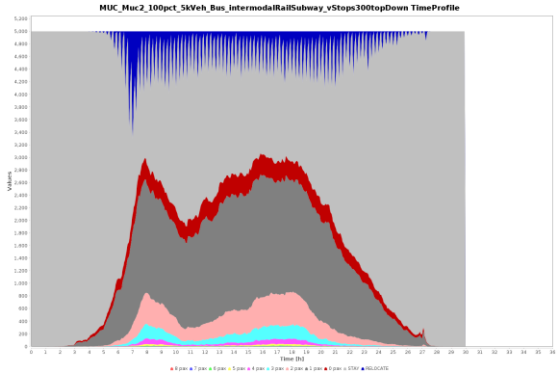
10k drt vehicles



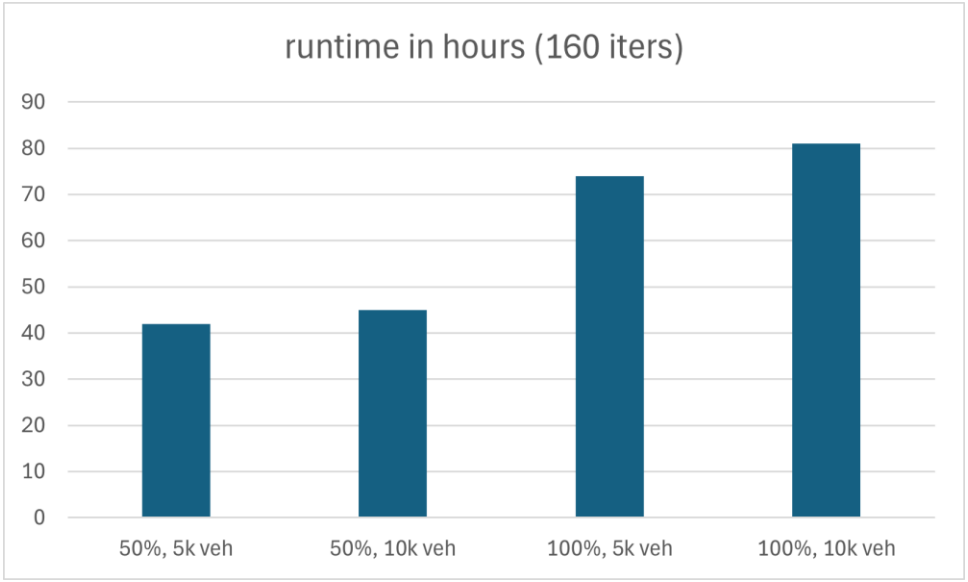


5k drtvehicles





Example: DRT study in Munich



Final thoughts

- Cutting a large model down to small study models saves a lot of time and energy
- Several approaches to it are possible
- Use our old approach (demand first) if you…
  - Need all agents to perform mode choice
  - Are not sure yet what studies will be conducted exactly
- Use our new approach (infrastructure first) if you…
  - Need the full traffic behavior
  - Need small infrastructure footprint
  - Know how to define a MR that suits your scenario (we can help)

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