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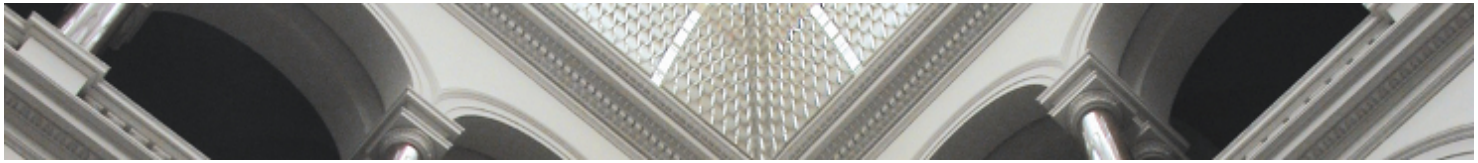
Intersection behavior in MATSim - Restricting left turns by oncoming traffic at signalized intersection

Theresa Thunig | Technische Universität Berlin | Transport Systems Planning and Transport Telematics | vsp.tu-berlin.de | matsim.org



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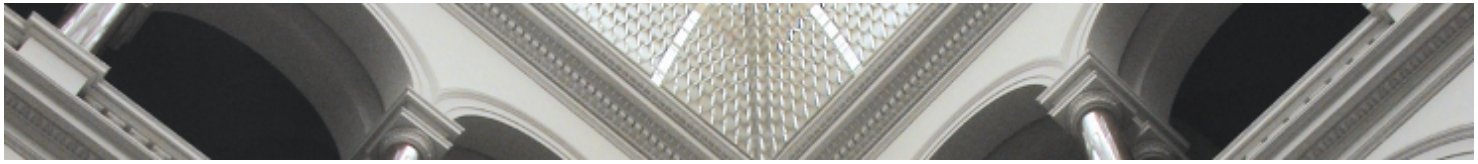
MATSim

- large-scale
- microscopic in terms of mental simulation (agent-based)
- mesoscopic in terms of link dynamics (queue-model)
- no intersection modeling

Possible extensions

- lanes
- traffic-signals
- kinematic waves
- mixed traffic ...



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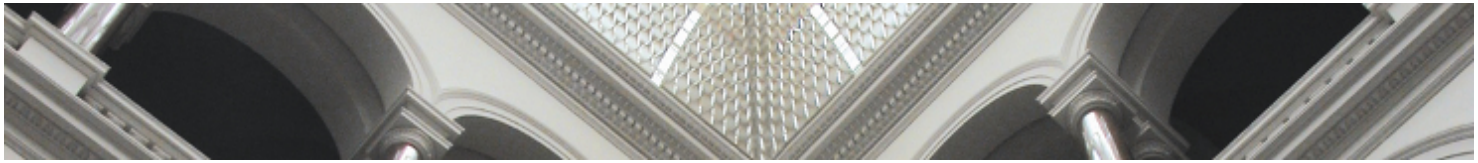
Signal modeling in MATSim - Becoming more microscopic

	no signals; flow cap. based on signal positions	with signals; restricted turns by oncoming traffic

mesoscopic ⟷ microscopic

	no signals; flow cap. based on street category	with signals; no intersection modelling

MATSim Multi-Agent Transport Simulation



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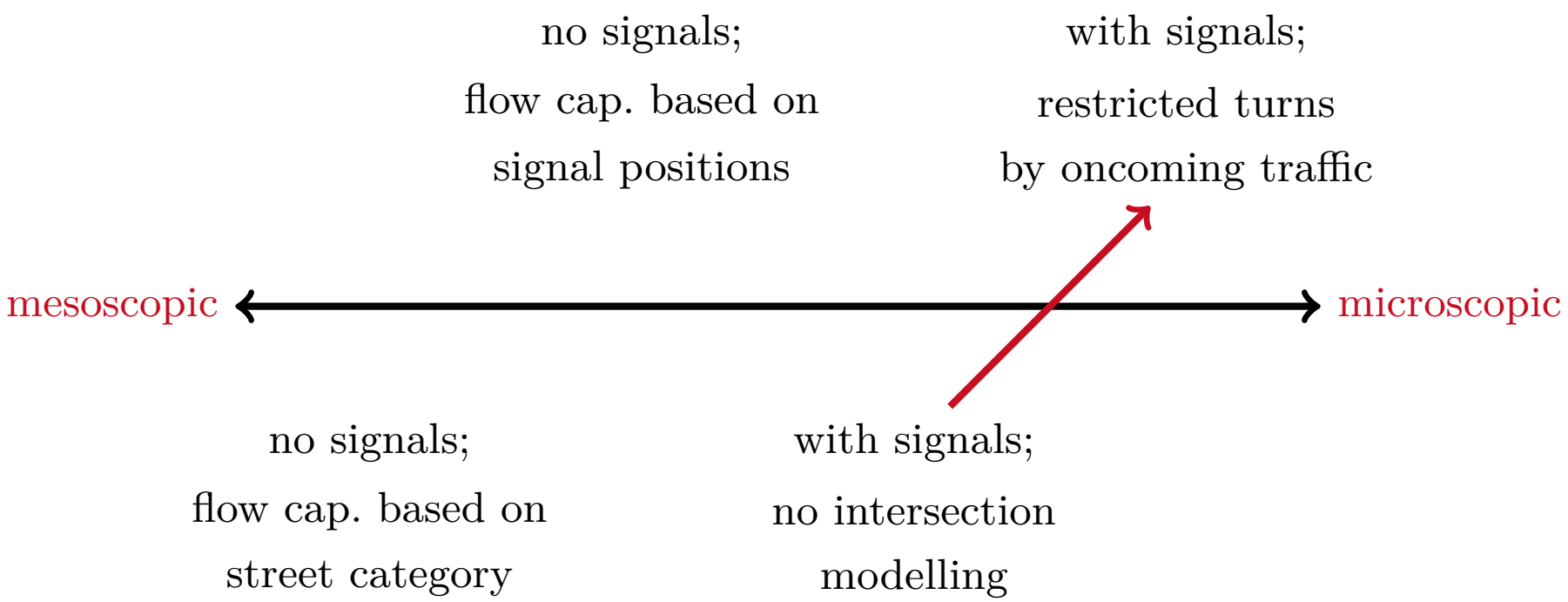

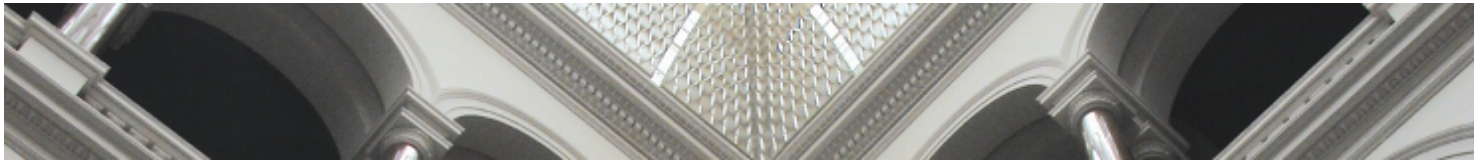

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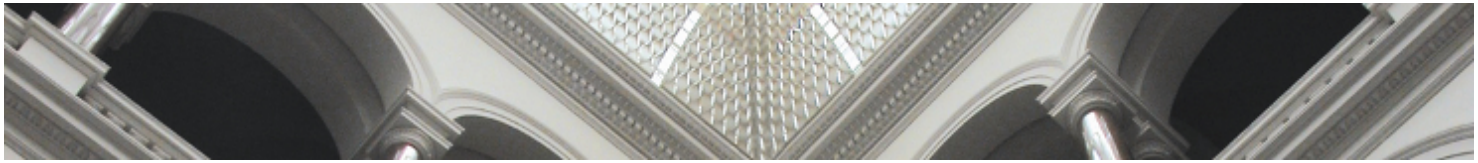
Why do we need to restrict turns by oncoming traffic?

- To evaluate the performance of signal settings (especially in congested inner-city areas).
- To compare signal settings with unprotected/ protected left turns.
- To design signal phases based on simulation results.

(So far, vehicles drive through each other at intersections.)



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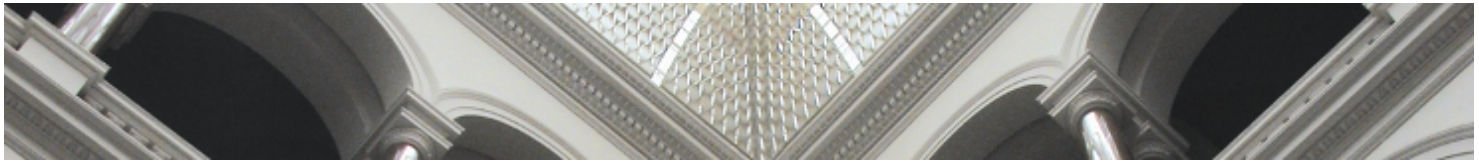
1. Get data about conflicting directions
2. Store data about conflicting directions in MATSim
3. Restrict turns in MATSim
4. Evaluate simulation results with/without restricted turns
5. Outlook



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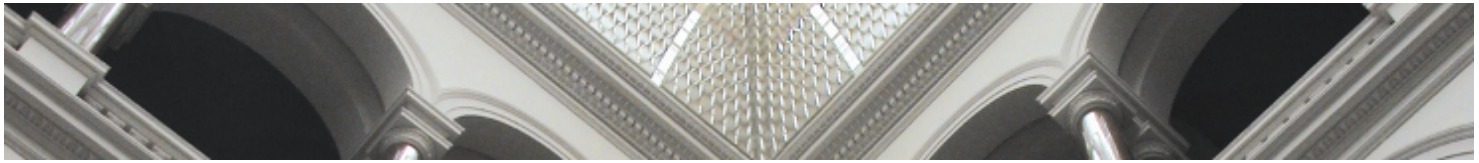

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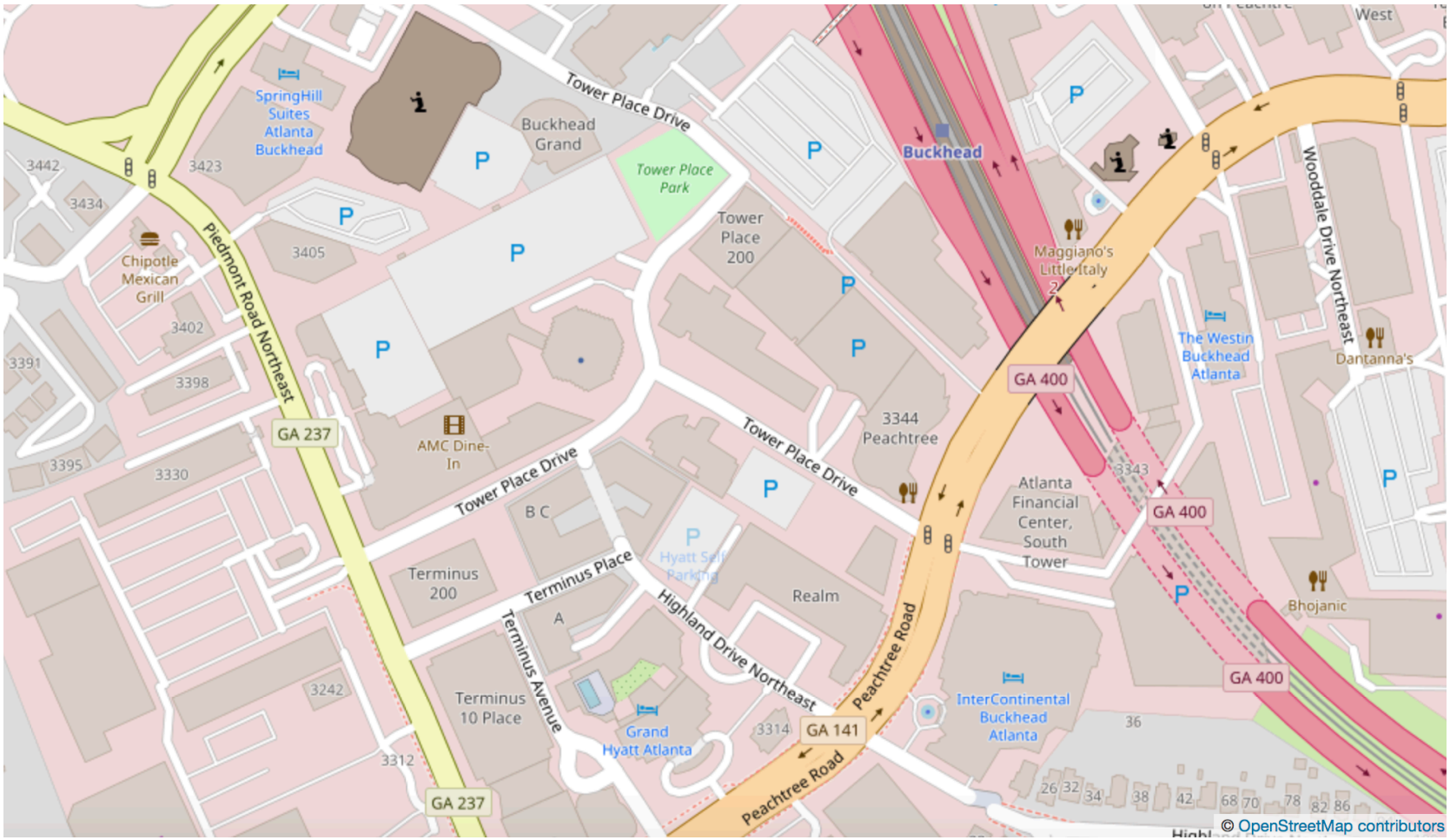
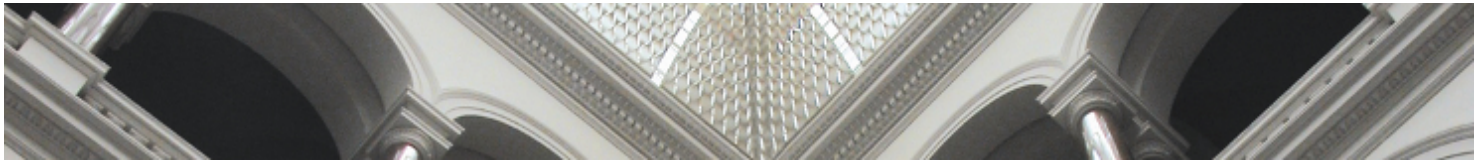
Get data about conflicting directions

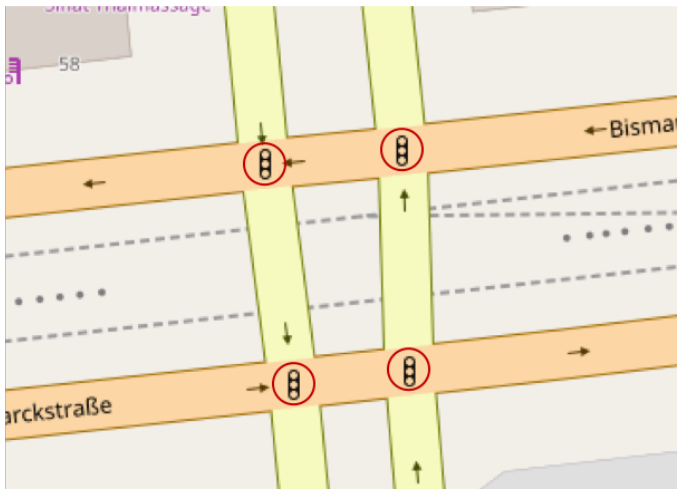


MATSim Multi-Agent Transport Simulation

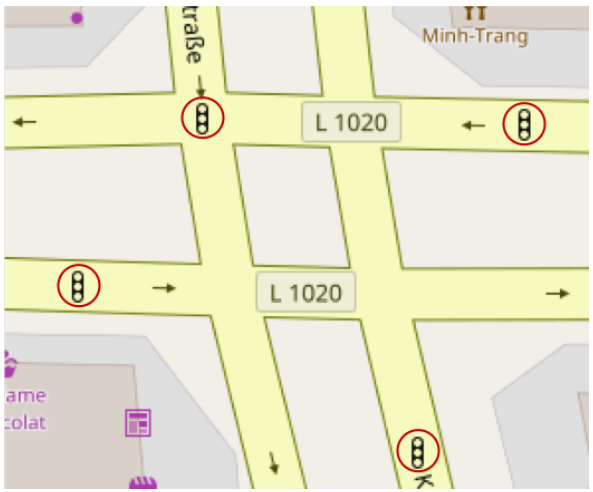


Create conflict data based on OSM - Difficulties

realistic approach

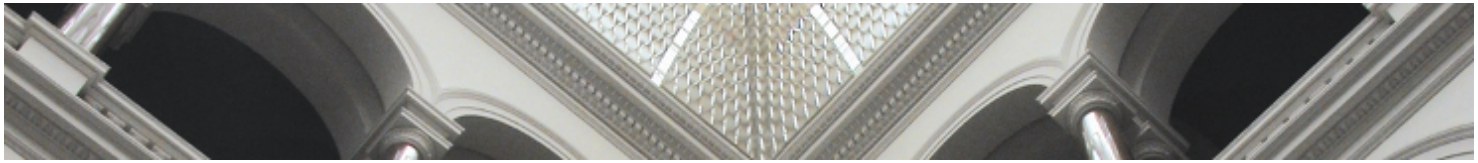


logical approach



mixed layout

Source: N. Schirrmacher, master thesis at VSP, 2017



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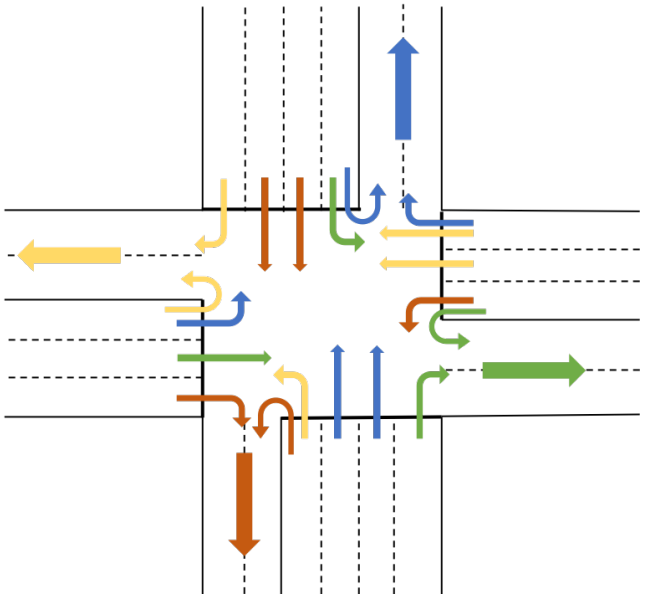

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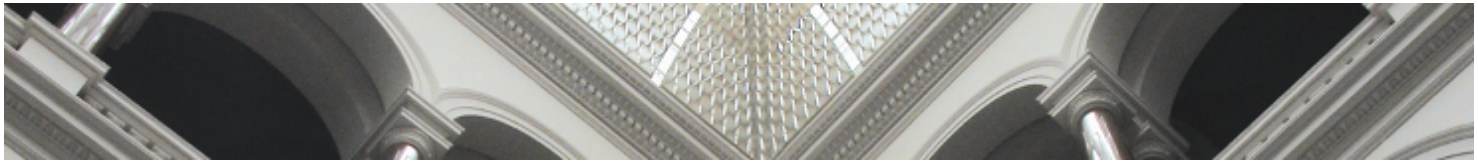

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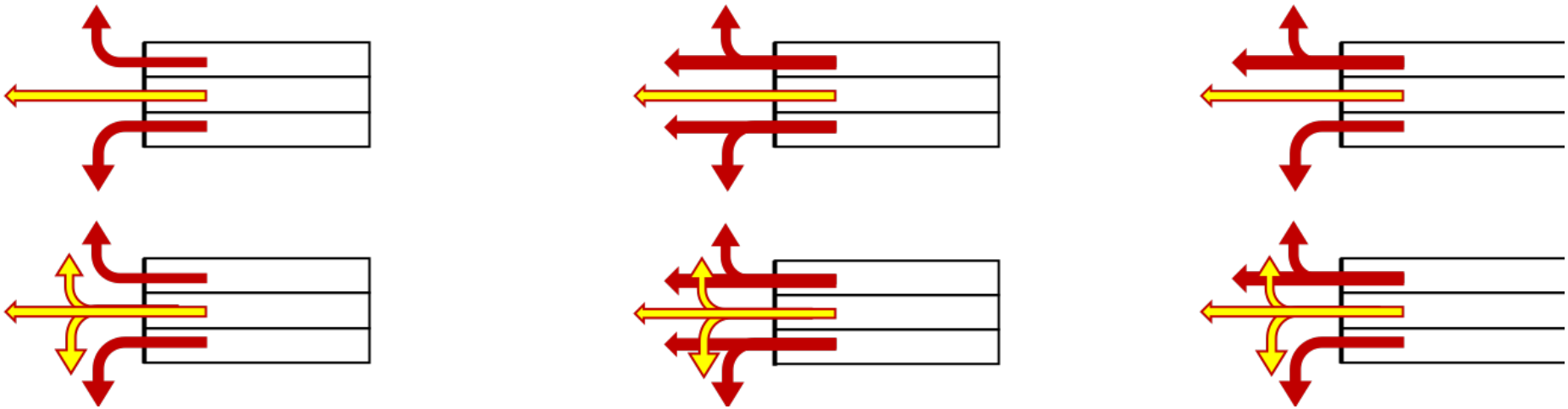

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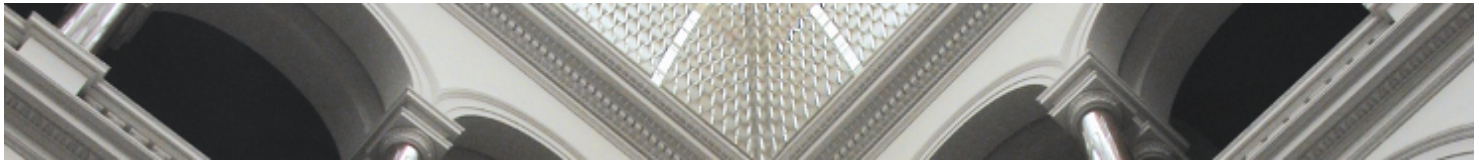

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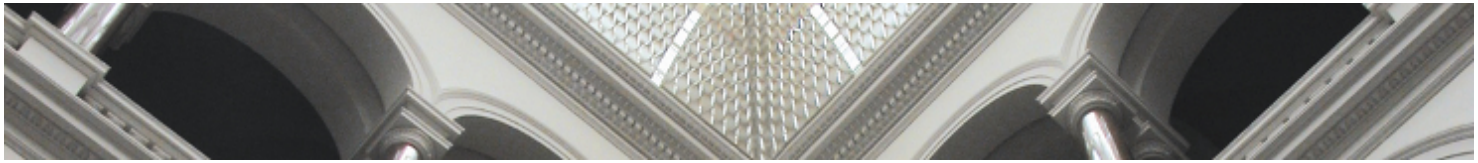

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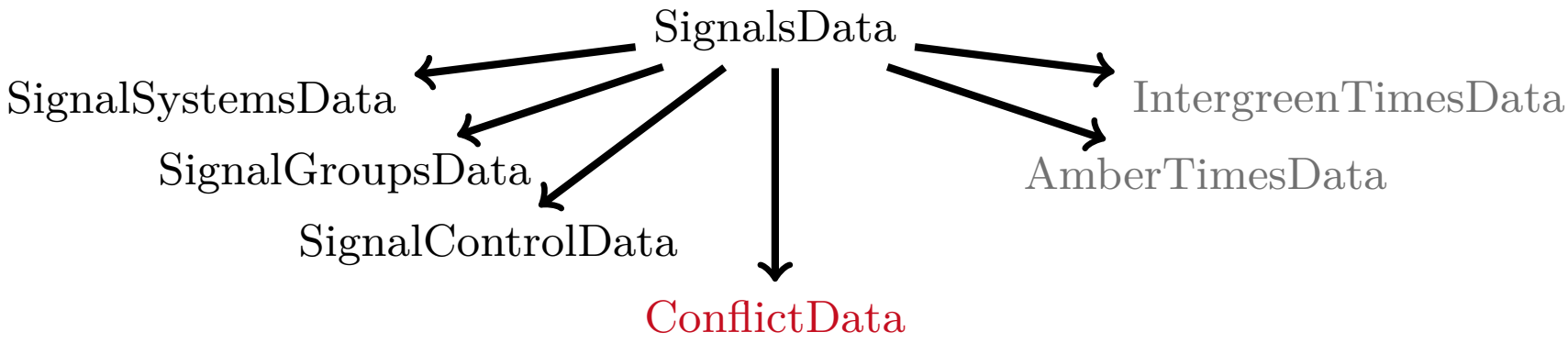

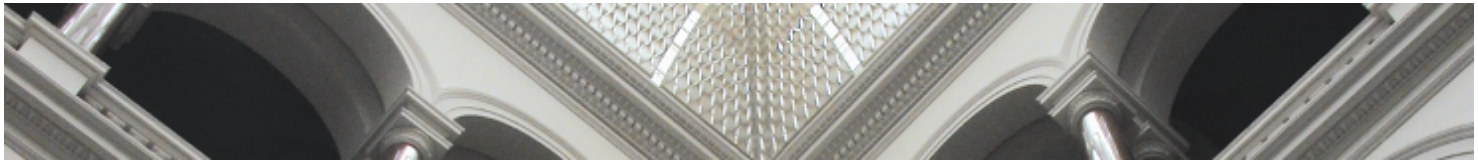

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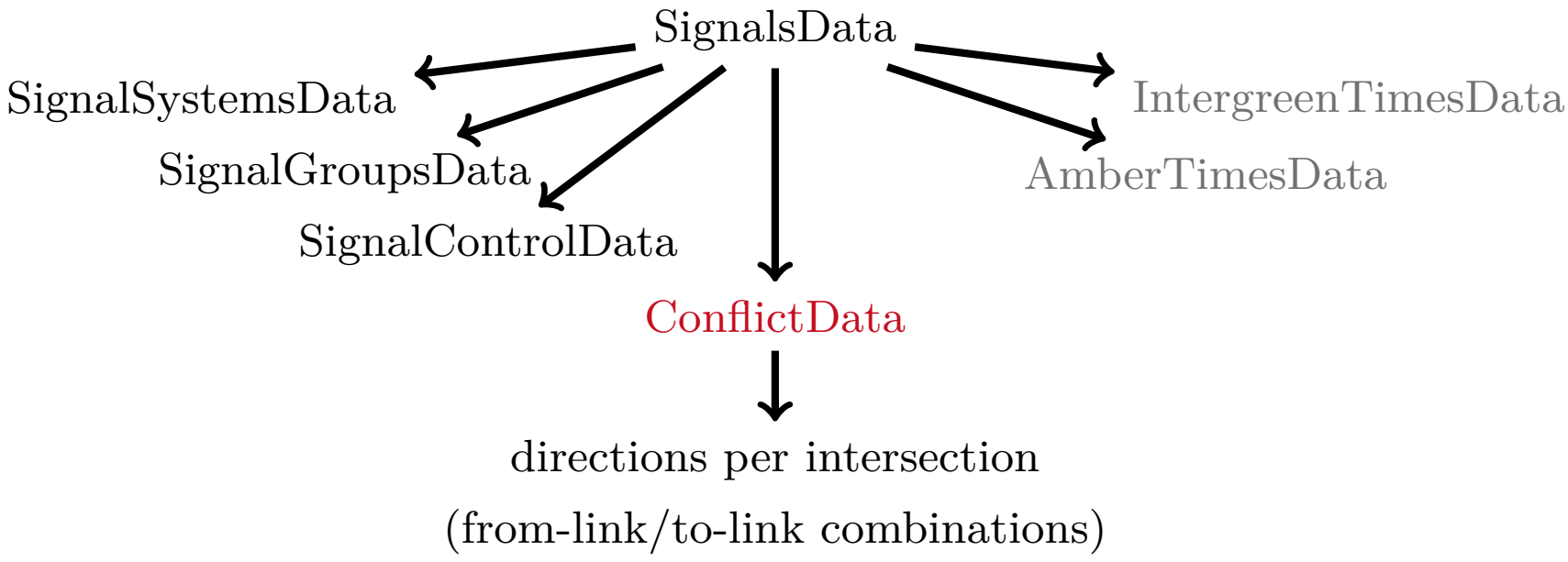

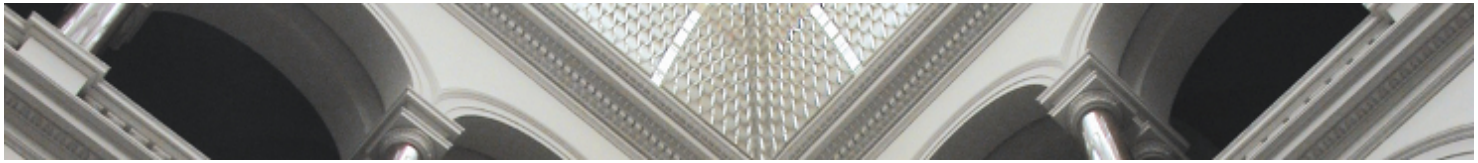

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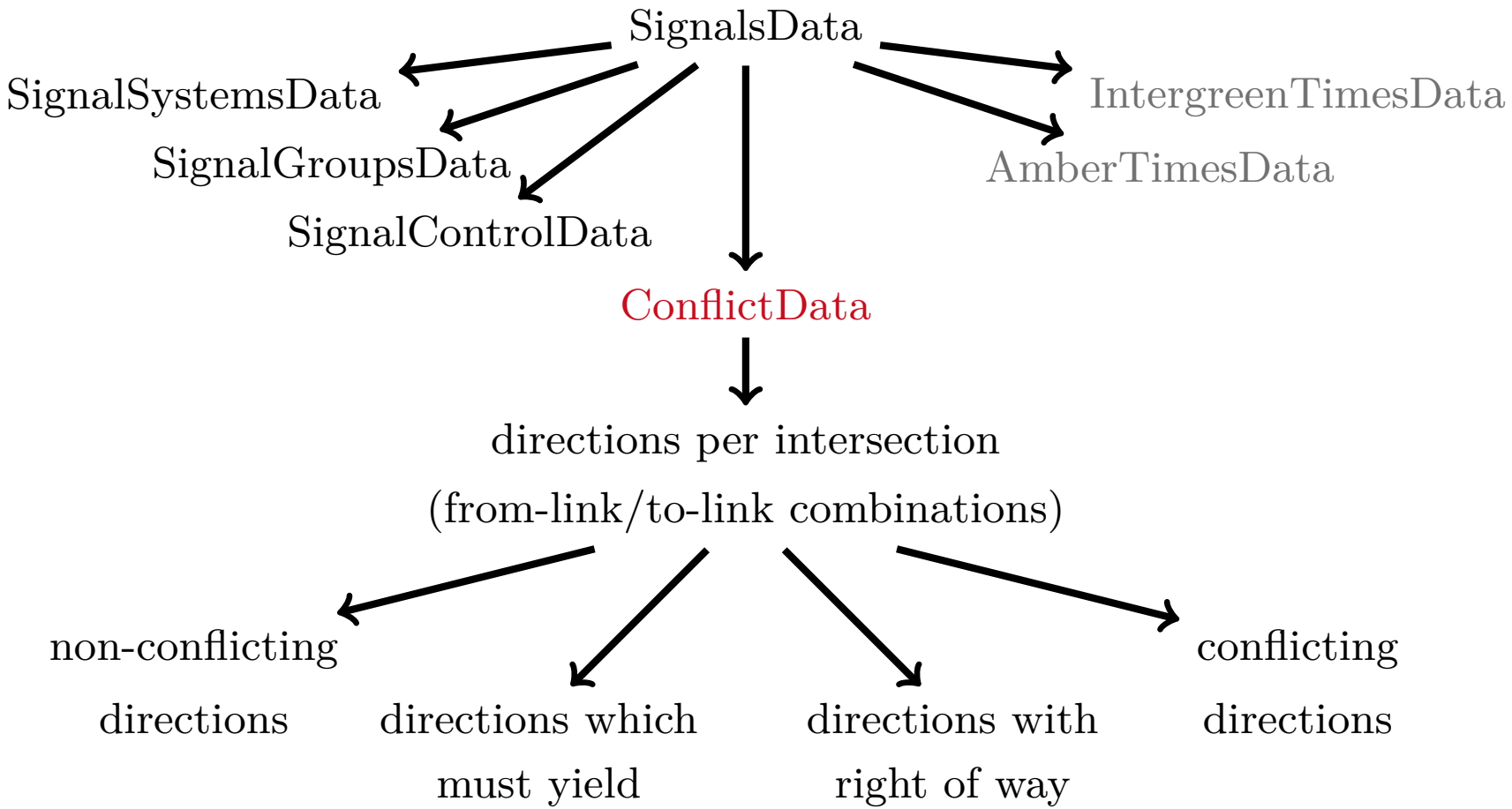

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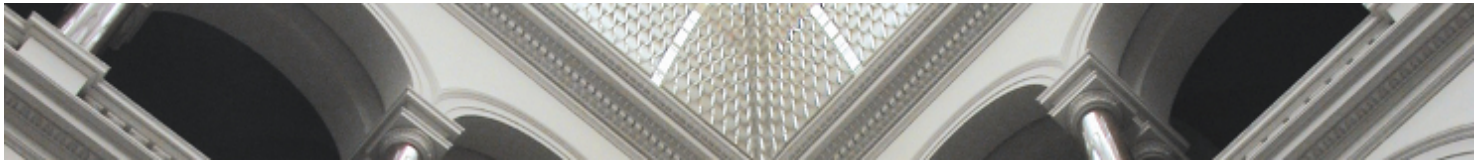

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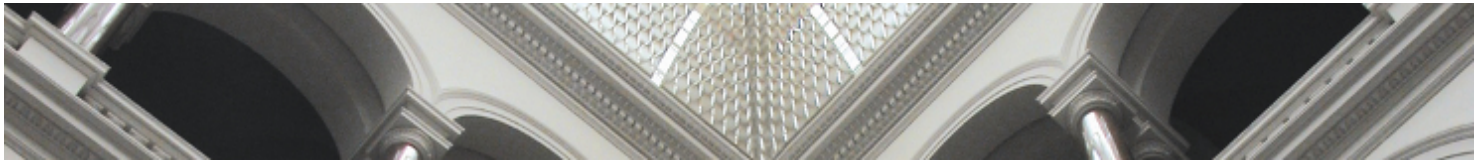

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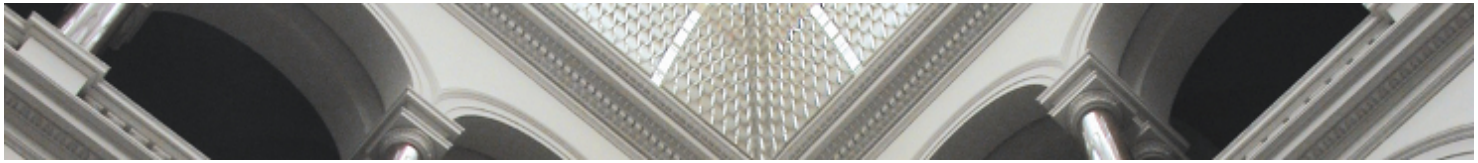
Restrict turns in MATSim

- `QNode: moveVehiclesOverNode()`
- calls the implemented `TurnAcceptanceLogic`
- checks whether a turn is allowed (e.g. links are connected)

  → `go`, `wait` or `abort`
- Traffic-signals are implemented the same way: turn is only accepted, when signal shows green
- Left-turn restriction: check for oncoming traffic at directions that have the right of way



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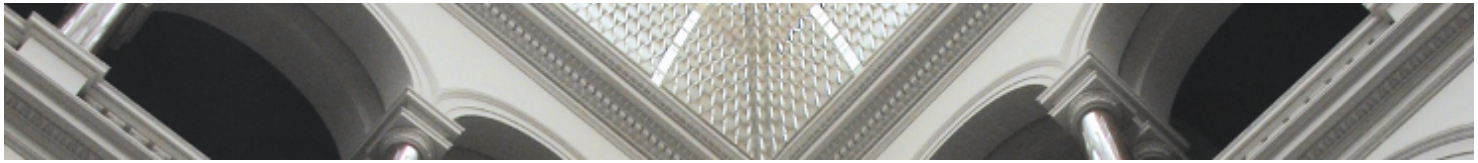

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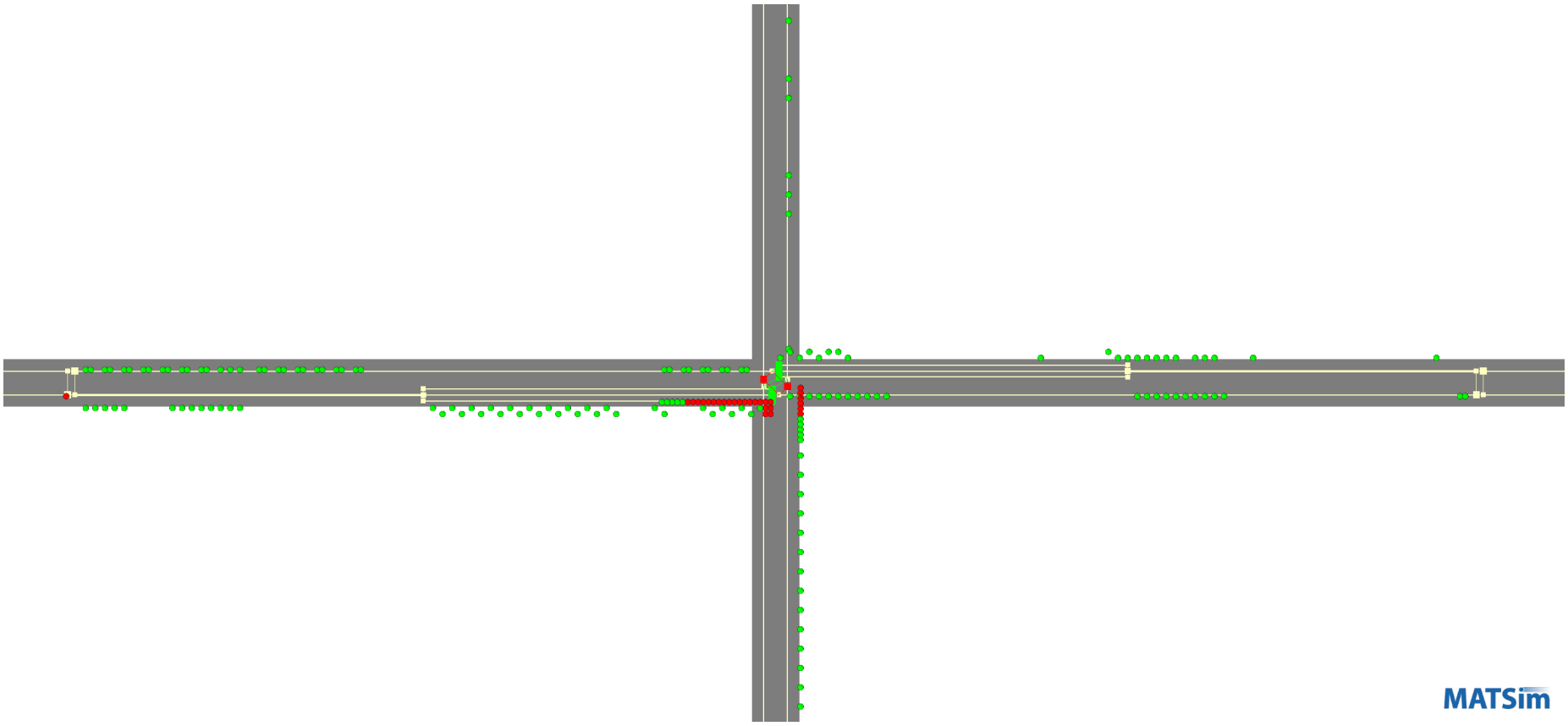
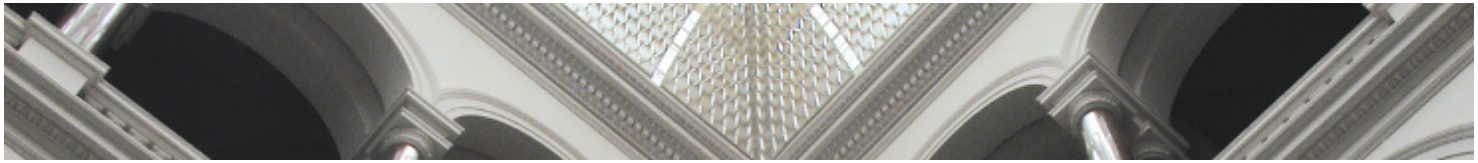
Evaluate restricted turns at a single intersection





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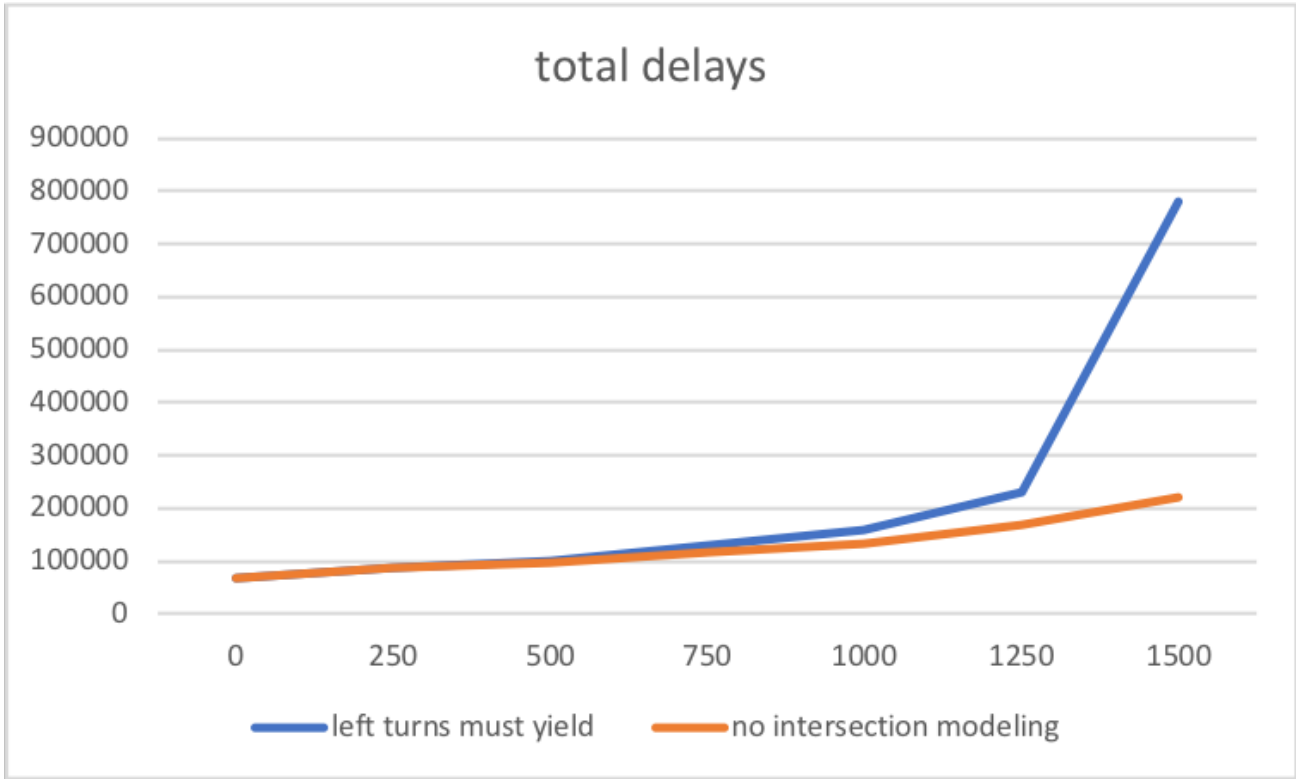
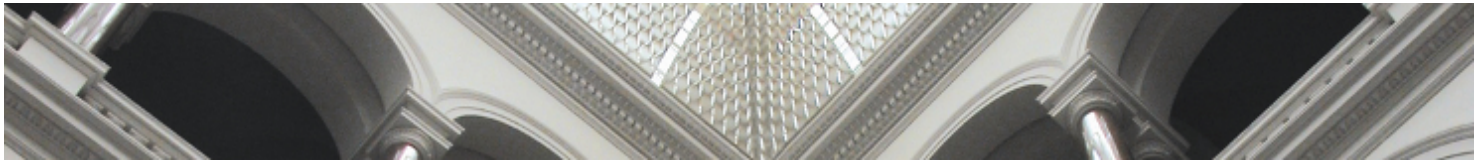


20% left turns, fixed-time signals: 35/60 s green for EW, capacity EW = 3600 veh/h



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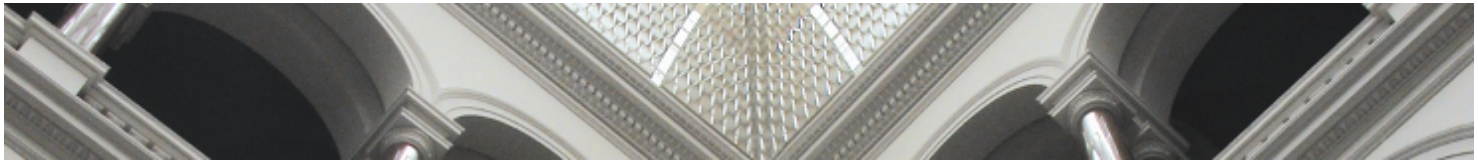

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Outlook

Next steps:

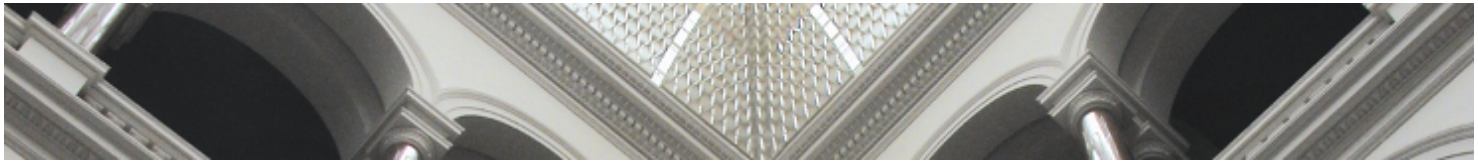
- Let adaptive signal algorithms use this data
- Apply it to real-world instances

Discussion:

- Could be used to model unsignalized/ priority intersections

→ How to avoid grid lock?

- Do we need extra buffer space for left turns?



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Thank you!