

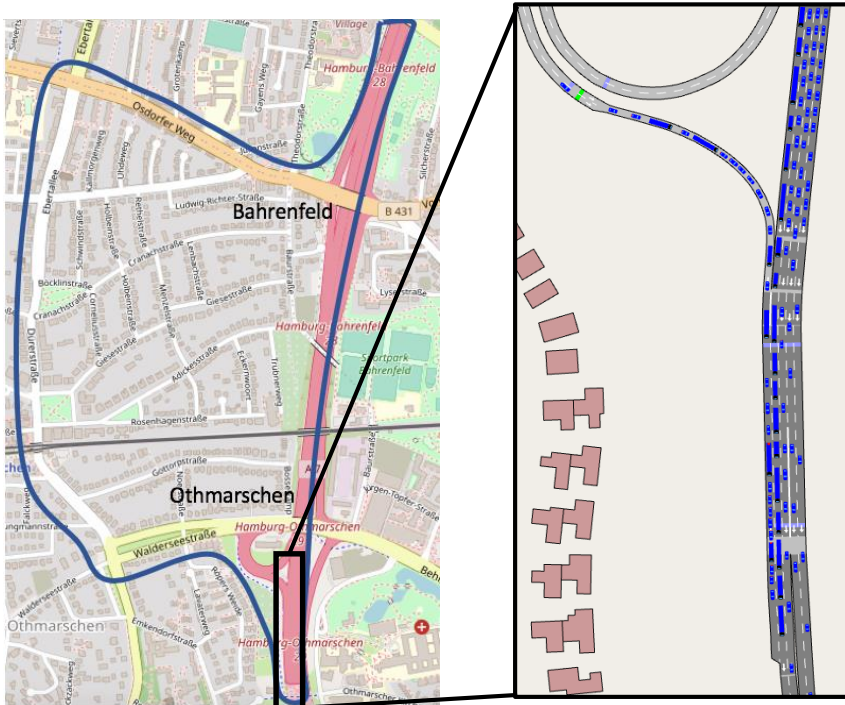
Master's Thesis of Teresa Gött

Mentoring:

M. Sc. Sasan Amini
Dr. Majid Rostami

External Mentoring:

Dr. Thomas Sachse (Siemens Mobility GmbH)



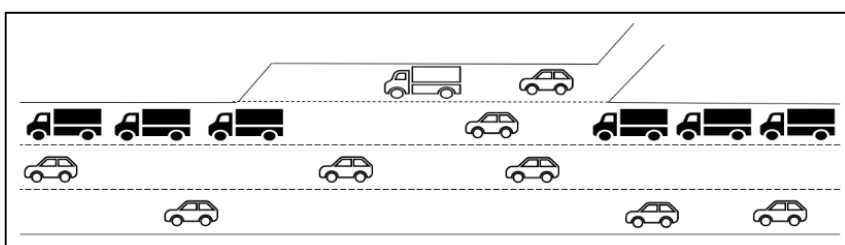
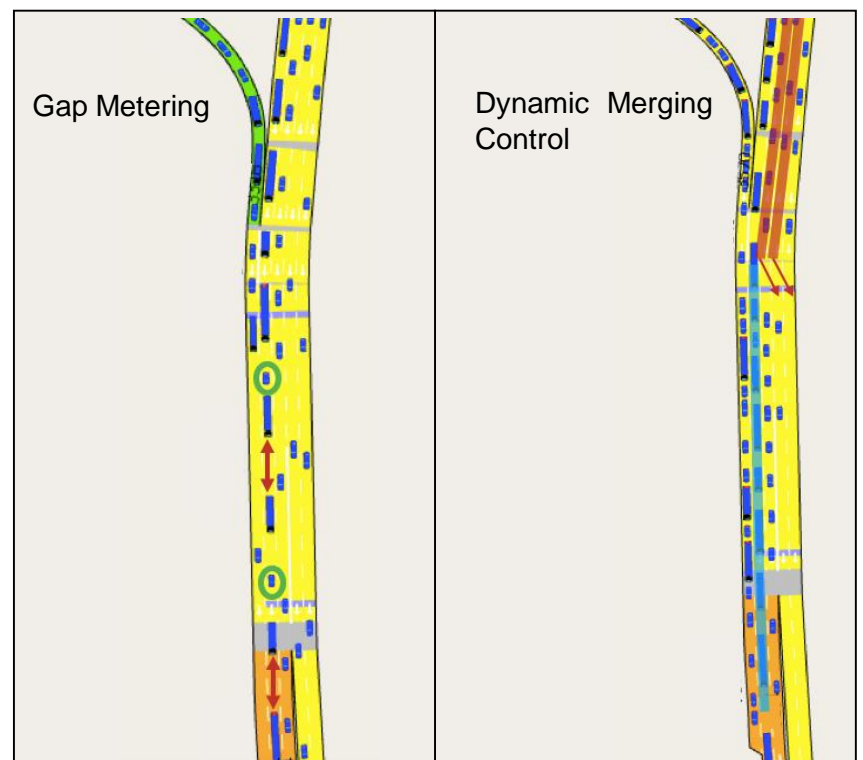
The on-ramp merging zone of motorways is a conflicting area. High truck rates, often combined with an overtaking ban for trucks, and a high traffic demand on the ramp pose an extra challenge for scientists. For many years, traffic engineers are developing traffic control strategies to facilitate the on-ramp merging process on motorways. Five very promising strategies are:

- Coordinated ramp metering
- Gap metering
- Dynamic merging control
- On-demand rerouting
- Truck platooning (innovative technology based on CACC technology)

The A7 motorway in Hamburg with the entrance to the southbound Elbe Tunnel provides an interesting study area to investigate the above-mentioned traffic control strategies. In particular, the high truck rate of more than 15 % even during rush hours make this study area notable. The strategies are implemented in their fundamental principal to investigate which one could possibly improve the situation.

In particular, the strategies Gap Metering and Dynamic Merging Control have huge potential for improvement of the traffic situation. The strategy of Gap Metering assigns a minimum distance to vehicles in the right lane of the mainline. This distance is considered a merging gap for the vehicles in the acceleration lane. It must be maintained until a vehicle has entered the motorway and the gap is closed. The red arrows in the figure on the right present the maintained gaps, the green circles present vehicles that have just entered the motorway. The efficiency of this strategy strongly depends on the compliance rate of the drivers and will be further improved by introducing a significant number of vehicles that are equipped with V2X technology.

Dynamic Merging Control already achieves an improvement without the need of V2X technology. The right lane in the merging area, which is marked in blue in the figure on the right, is closed for cars and cars are directed to the further left lanes. This relieves the merging section from traffic and automatically provides gaps to the entering vehicles.



For Truck Platooning, a certain number of trucks, that are equipped with CACC technology, connects and forms a platoon. The truck platoons are presented in black in the figure on the left. The minimum distance between trucks in a platoon is reduced. This makes the strategy generally efficient. In combination with Gap Metering, the strategy has huge potential for the future to facilitate the merging process. A larger distance is assigned between the platoons. This gap can then be used by the entering vehicles, as presented by the white car in the right lane in the figure. However, this strategy strongly depends on the penetration rate of CACC technology. If only trucks can communicate with each other, the strategy will only achieve a small improvement.