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Study of Traffic Management in the Zürich Area

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Current traffic access control system

The city of Zürich currently employs an adaptive control system. It measures the level of service in several streets around the city center. When a drop in the level of service is detected, the traffic light system in the roads accessing the city changes automatically.

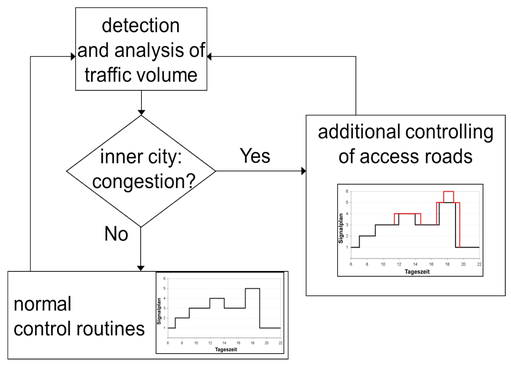


Figure 1. Links monitored in the city center and flow diagram of the control system (Source: Heimgartner, Stadt Zürich)

The Macroscopic Fundamental Diagram (MFD)

It has been proved that for a city area, there is a relationship between the accumulation of vehicles and the number of trips ended (Geroliminis and Daganzo, 2008). Such relationships can be described with a MFD. Through monitoring, the MFD allows to know at every time how the urban area is performing. By controlling the area perimeter, the system can be moved to less congested traffic states.

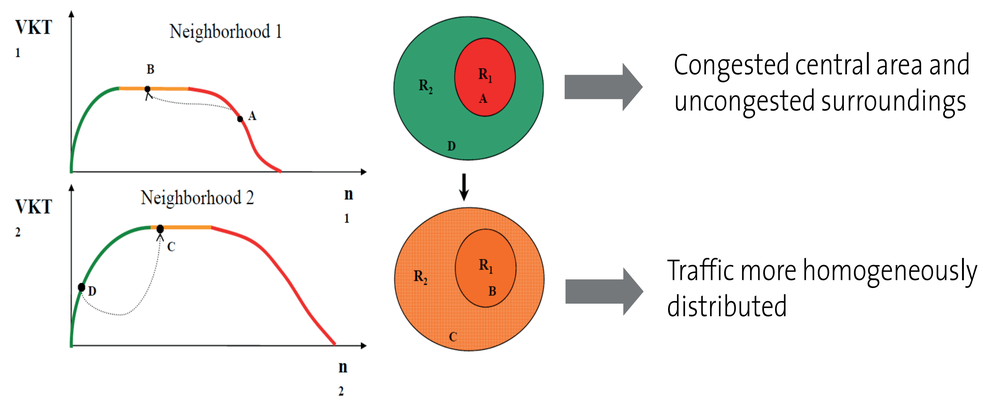
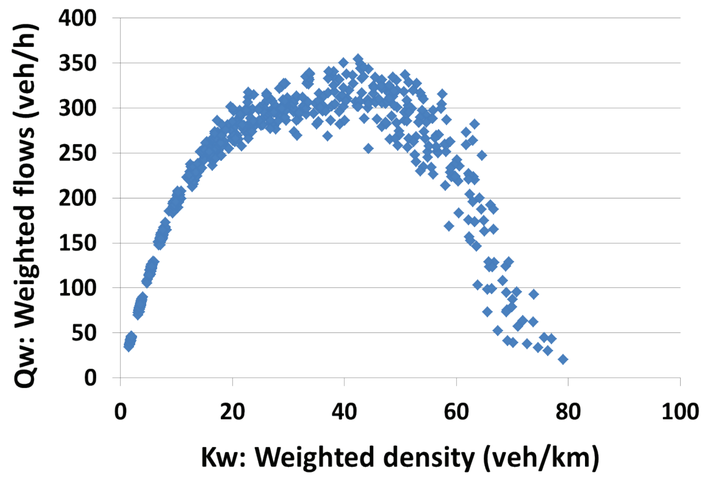


Figure 2. Access control operational scheme (Source: Geroliminis, EPFL)

Creation of a MFD using VISSIM

A MFD can be obtained with data from loop detectors. We have employed a VISSIM model of the inner city of Zürich based on the demand data of the 5-6 pm period on a work day. Flows and densities have been averaged in every link emulating a loop detector.

We obtained a well defined MFD. Nevertheless, it presents some scattering in the congested part, which we believe is due to the possible errors of the VISSIM simulation and the route choice model.



CHARACTERISTICS OF THE VISSIM SIMULATION FOR THE INNER CITY OF ZÜRICH:

- 1707 links measured
- 17 different factors of demand evaluated
- Resolution of 0.2 seconds
- Measurements taken every 5 minutes
- 500 seconds of warm-up time
- 4 random seeds employed
- Vehicles counted: cars, vans, trucks, and buses

Figure 4. MFD obtained by employing VISSIM

How many loop detectors are necessary to create a well defined MFD?

We have generated different MFDs with 6 random combinations of 25, 50, 75, 100, 125, 150, 175, 200, 225, and 250 links. The purpose is to see how many links are necessary to achieve a good accuracy level.

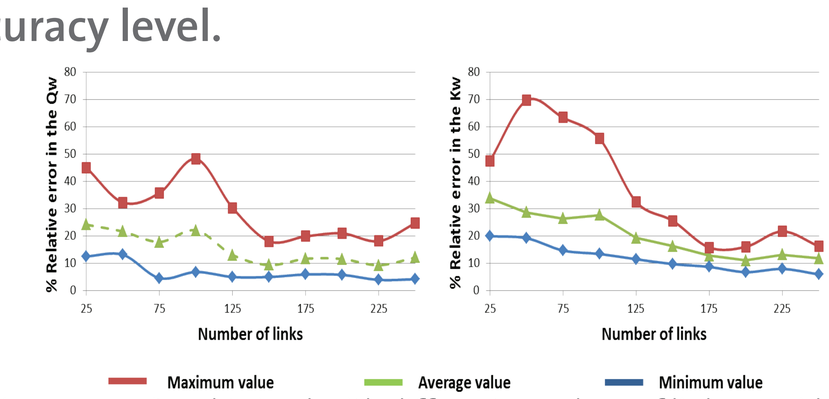


Figure 5. MFD s obtained with different numbers of links considered

MFDs created with less than 150 random links present much more variability (in comparison with the 1707 links MFD) depending on the combination.

Application of the MFD in traffic control

With VISSIM, the individual fundamental diagrams of 2 of the links that are observed by ZüriTraffic were plotted. The graphs show how one traffic state in the MFD corresponds to different levels of service in the individual links.

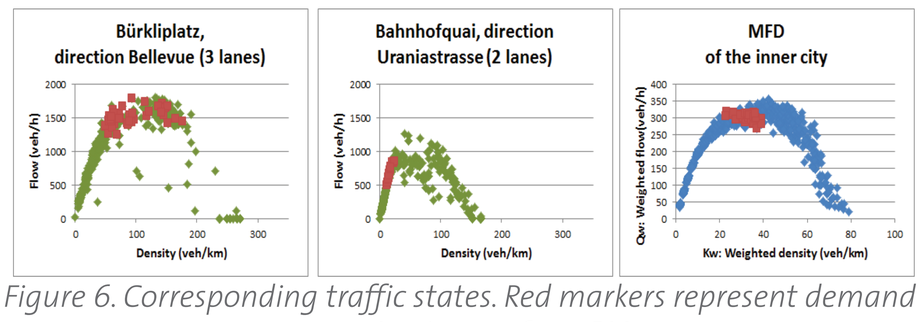


Figure 6. Corresponding traffic states. Red markers represent demand scenario at 5:00-6:00 PM

We believe that the application of the MFD in traffic control would provide a global view of the current traffic situation in Zürich. This would in turn support the development of better traffic management strategies.

References:

Geroliminis, N. and C.F. Daganzo, 2008. Existence of urban-scale macroscopic fundamental diagrams: some experimental findings. Transportation Research Part B 42, (9), 759–770

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