Simulation Model for Traffic using Network Fundamental Diagrams

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Traditionally, traffic is described at the level of individual vehicles (microscopic) or at the level of a link (macroscopic). Recently, it has been shown that traffc operations can also be described at the level of a network, using the relationship between accumulation (average density) and production (average flow). This is called the Network Fundamental Diagram (NFD). This paper introduces a traffic flow simulation model, including the numerical scheme, which uses this relationship.

We propose to split a network in cells, and for each of the cells the NFD is determined. The OD is specified. In the model, it registered which fraction of the density in each cell is heading each of the destinations. In each time step, the flow from one cell i to cell j is basically determined by the minimum of 3 elements: (1) the physical road capacity at the border between cell i and cell j, (2) the demand from cell i towards cell j, (3) the supply in cell j in relation to the total demand to cell j. Similar to the cell transmission model (CTM), the supply is at capacity for undercritical values for the accumulation. However, opposed to the CTM, the demand is reducing for overcritical accumulation in cell i due to accumulation effects. The full paper will show the description of the full network propagation model.

The proposed model provides a very powerful tool to quickly predict the traffic states for large area with many roads. This is useful to coordinate traffic control measures over a large area. The full paper will show examples the use of in perimeter control and routing (see below).

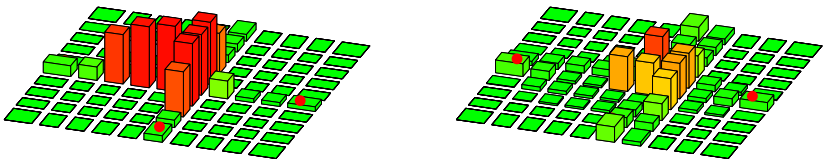

Figure 1: Representation of the traffic states in per area – bar height is accumulation, color is speed. Left: fixed routing, right: adaptive routing