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# Network Fundamental Diagrams and their dependence on Network Topology

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Traditionally, traffic is described at the level of individual vehicles (microscopic) or at the level of a link (macroscopic). Recent studies have shown that also aggregated over a whole network a rather crisp relation between average density (accumulation) and average flow (production) exists. This relationship is called the Macroscopic or Network Fundamental Diagram (NFD). This paper will show what the effect is of the exact network topology on the shape of the NFD. We developed a tool to automatically design networks. Using this tool, different networks are created for which the following general properties are the same: (1) the number of intersections, (2) length of signalised multi-lane arterial roads, (3) lengths of single-lane urban roads. Two examples are shown in the figure below. These networks are simulated in the microscopic simulation package VISSIM.

From the resulting traffic operations a NFD is created (fig c). The NFDs for different networks have different capacities and critical accumulations. The main contribution of the paper is that it shows that NFDs are not only dependent on the general network properties mentioned above, but also on the exact network layout (e.g., which link connects to which link) and/or origin-destination pattern. As a consequence, the NFD needs to be determined for each network separately and cannot be derived from these general properties.

