

Network Fundamental Diagrams and their Dependence on Network Topology



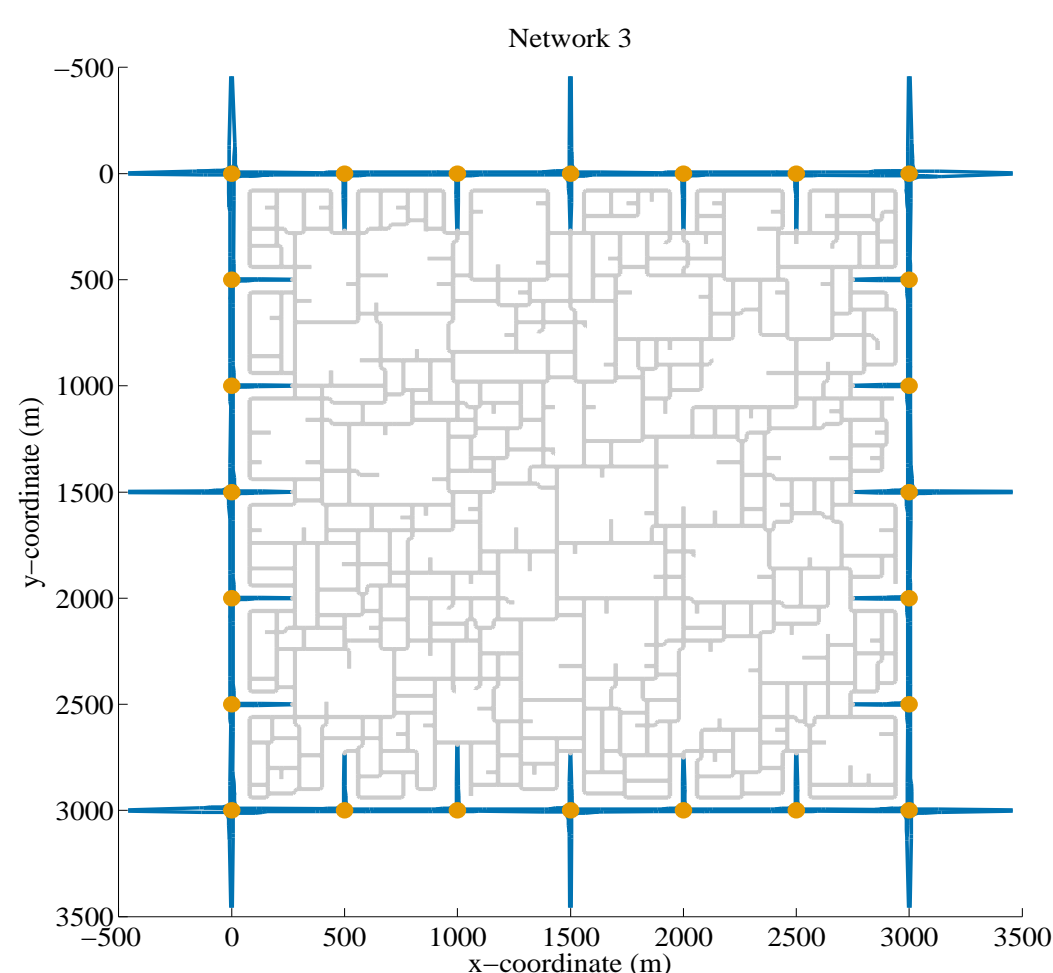
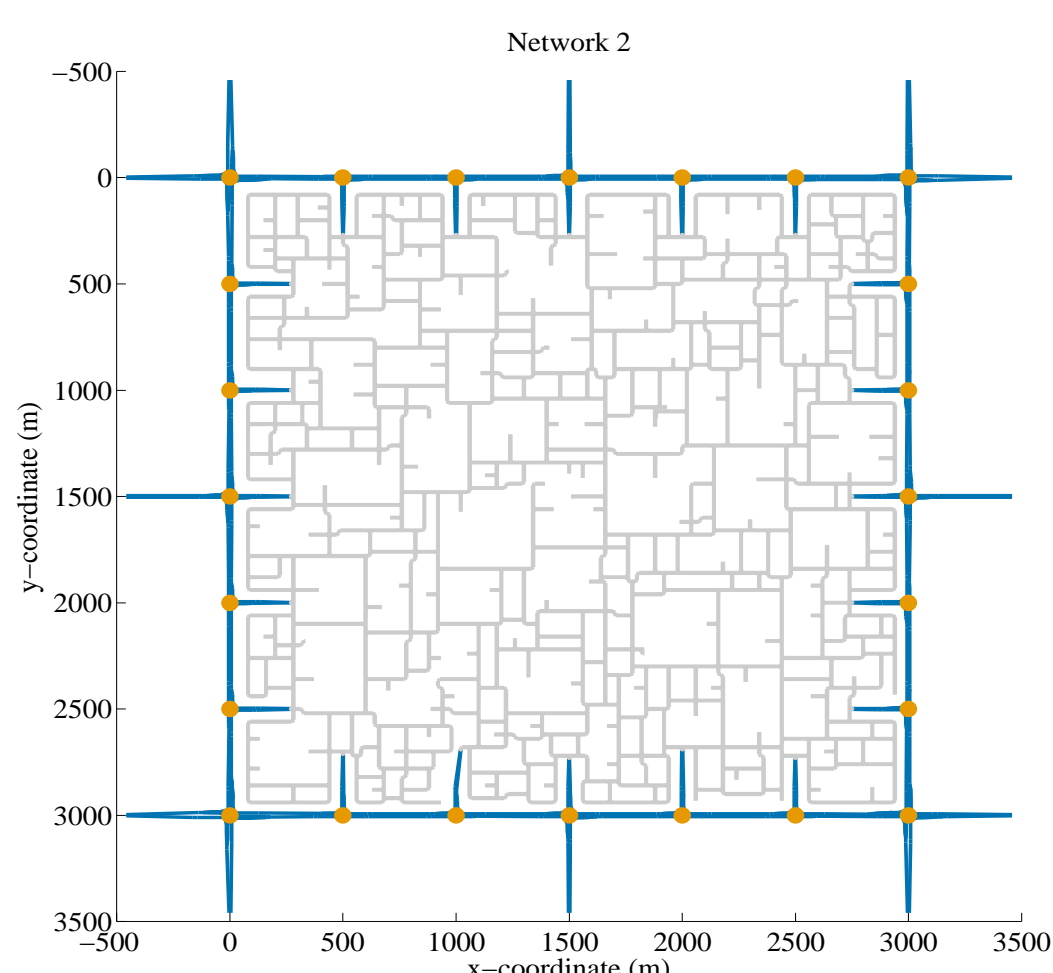
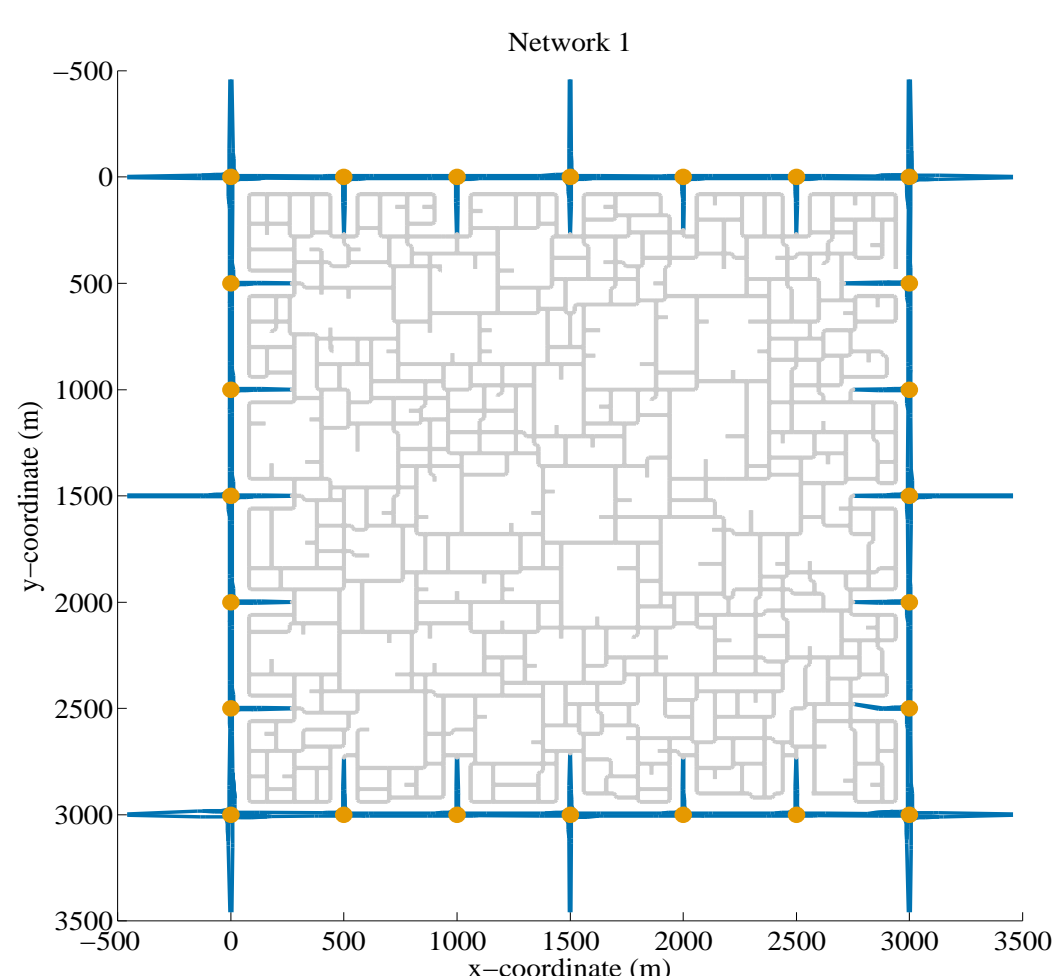
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1. Network generation tool

Randomly created networks (Matlab implemented)
Standardised intersection design
(including nr of lanes per direction)
Similar:

- Number of intersections
- Length of signalised multi-lane arterial roads
- Lengths of single-lane urban roads
- Traffic light strategy



Abstract

The Macroscopic or Network Fundamental Diagram (NFD) describes the network performance as a function of the number of vehicles. Even if the network has the same roadway length, type of roads, number of intersections and traffic light setting strategy, the shape of the NFD changes. Therefore, the NFD needs to be calculated or simulated separately for each network.

2. Simulate

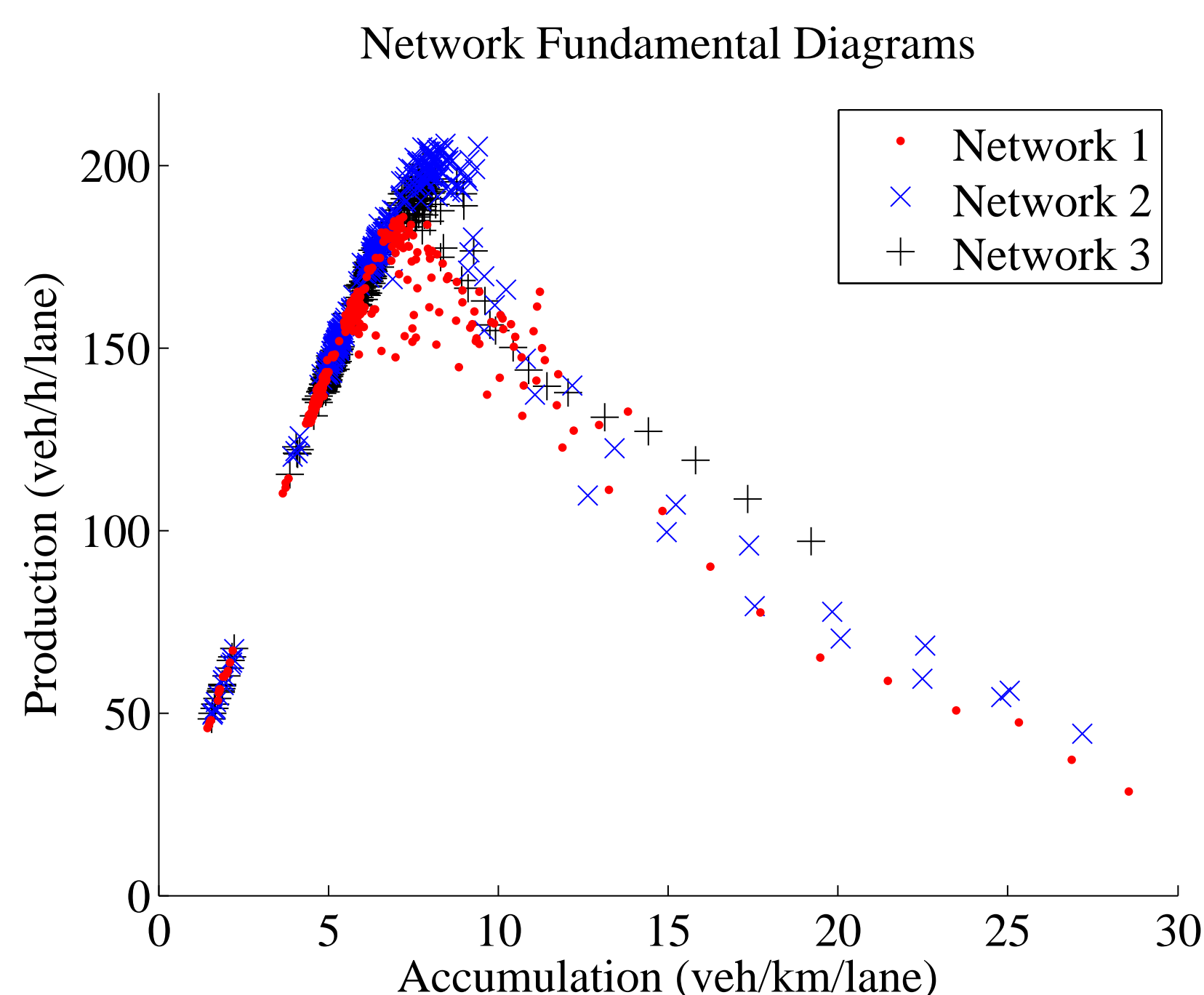
- Vissim microsimulation tool
- Different demand levels (OD proportional scaling)

3. Construct NFD

The Network Fundamental Diagram relates average density (accumulation A) to average flow (production P)

$$A = \frac{\text{Nr of vehicles in the network}}{\text{Network length}} \quad [\text{veh/km/lane}]$$

$$P = \frac{\text{Total travel distance in a time step}}{\text{Duration of time step} \times \text{Network length}} \quad [\text{veh/h/lane}]$$



4. Results

- Capacity differs up to 15%.
- Variation in the pattern differs
- Jam accumulation differs less

5. Conclusions and outlook

The NFDs for different networks have different capacities and critical accumulations. So 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 (e.g., by microsimulation) and cannot be derived from these general properties alone.



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