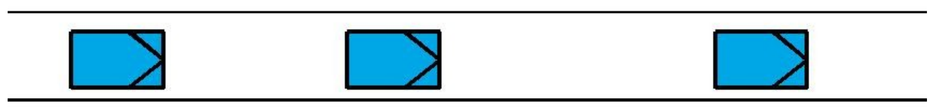
Network Transmission Model: Application to a Real-World City

Paper presented at TRB 2016
the 95th Annual Meeting of the Transportation Research Board
Paper number 16-1526

Simulation levels

Vehicle



Link

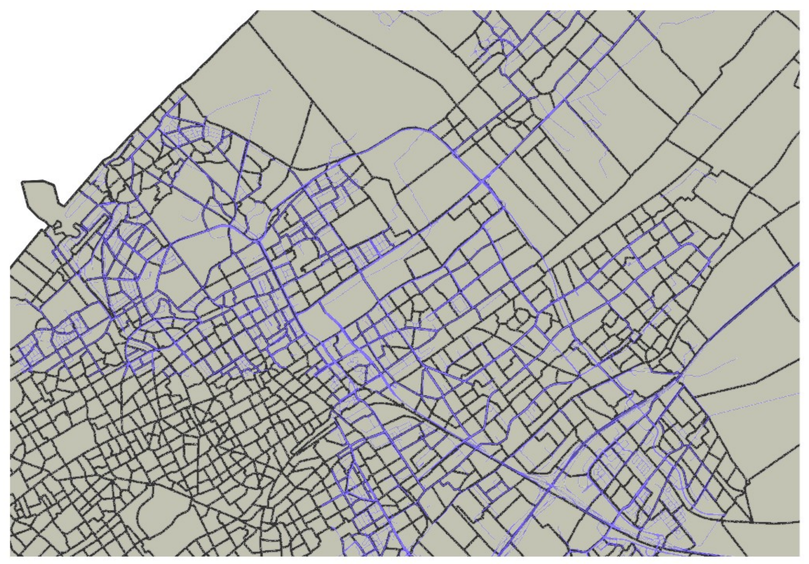
Zone

Abstract

The Macroscopic Fundamental Diagram (MFD) describes the relation between accumulation and production in a zone. The Network Transmission Model (NTM) exploits that relationship to describe traffic dynamics in a region based on a multi-zone network. This study shows that this model can show qualitatively the location and propagation of congestion. Moreover, it is easy to calibrate by practitioners.

Introduction

- Disturbances (road works, sports events)
- Disrupting large part of the network
- Desire to quickly assess impact of disturbance:
  - Online: no measure, or ATM measure (<30 sec)
  - Offline: best routing or combination of road works
  - Intuitive calibration: impact of disturbance as input
- Quick, rough *dynamic* model including network effects



Zones in static model

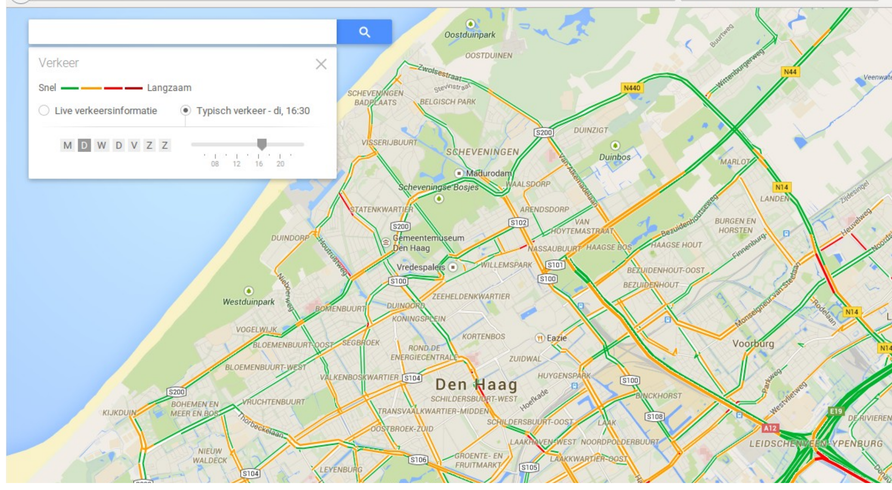
Network Transmission Model

- Zone-based, dynamic traffic simulation model
- Flow from one zone to next based on MFD
- Aggregation per zone
- Network-specific routing
- Demand & supply functions based on MFD
- *Demand reduces for overcritical accumulation*
- Destination-specific partial accumulations
- Routing via destination-specific split-fractions

Zones in NTM

Inputs

- Estimated static origin-destination matrix (many zones)
- Road network, with speeds and capacities
- Counts and travel times on main routes



The Hague area in Google maps

TU Delft

www.victorknoop.eu/research

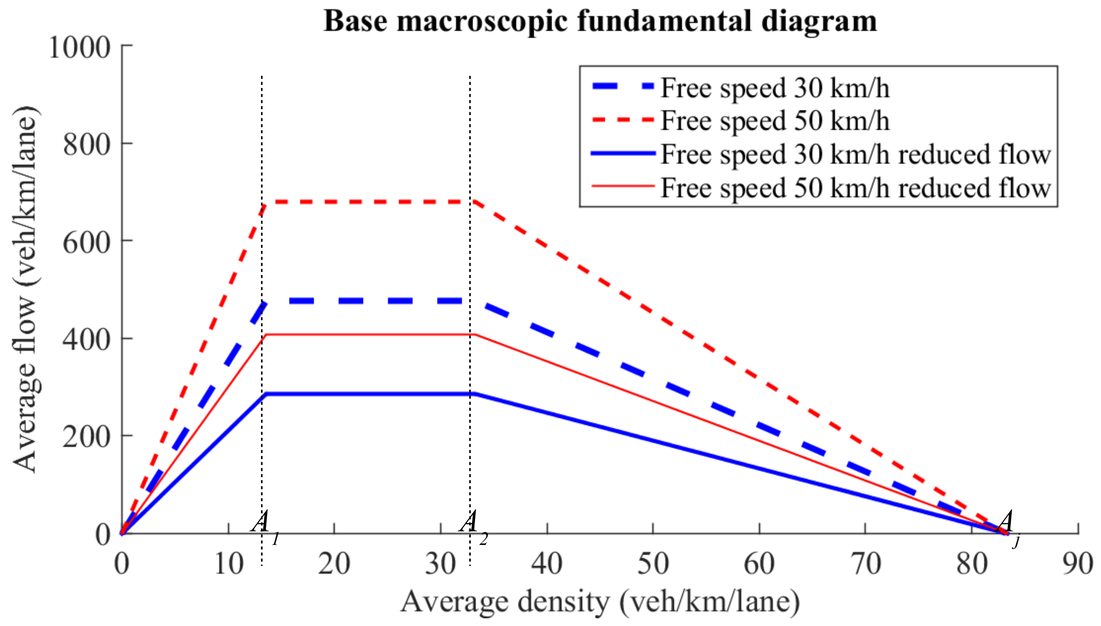
This research is sponsored by:

NWO
isation for Scientific Research

Victor L. Knoop[1]
Guus F. Tamminga [1]
Ludovic Leclercq[2]

[1]**Delft University of Technology**
[2]**Universite de Lyon, IFSTTAR, COSYS-LICIT, ENTPE**

Victor L. Knoop PhD
TU Delft (Transport & Planning)
v.l.knoop@tudelft.nl

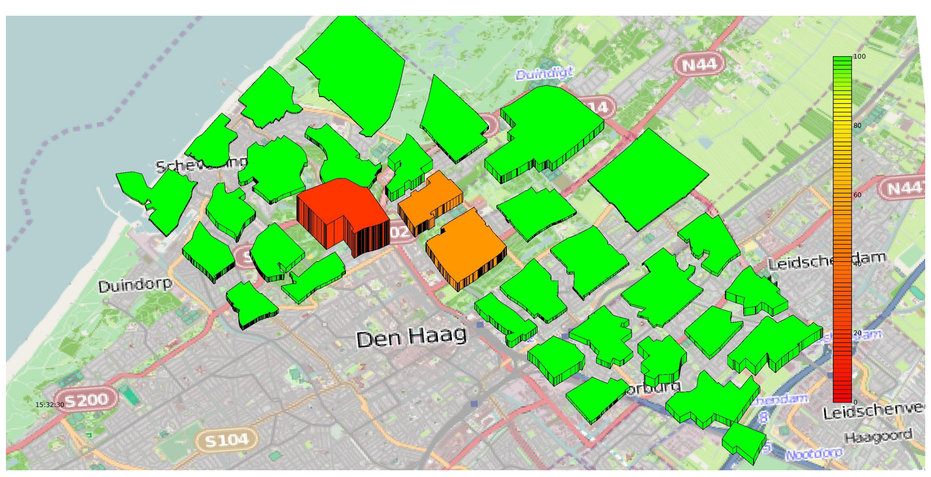


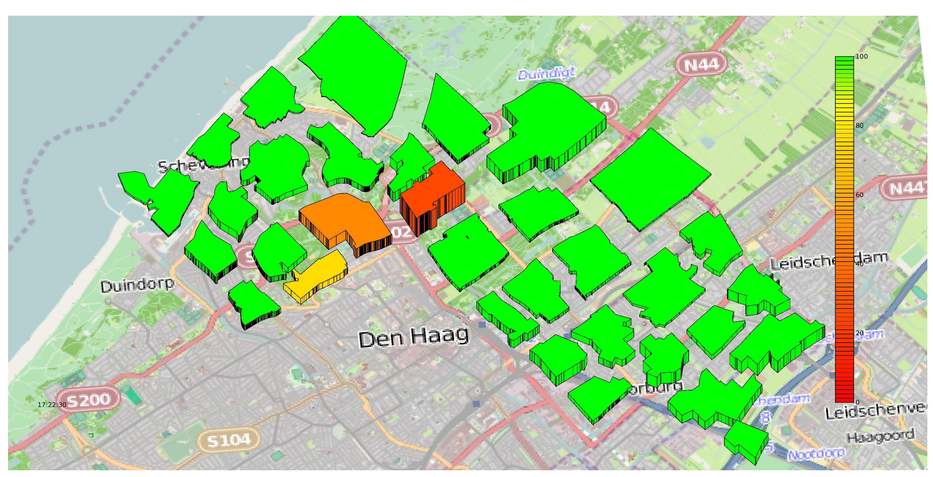
Parameter settings

- Nr of lanes: from road capacities
- Lane length per zone: from map
- Speed: weighted average from map
- Capacity: 60% of weighted capacities (reduction due to traffic lights)
- Routing: en-route update to fastest route

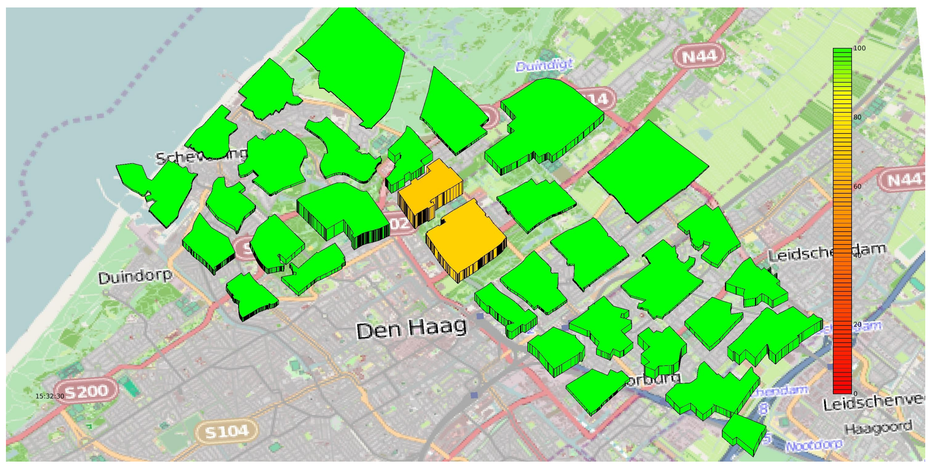
Results

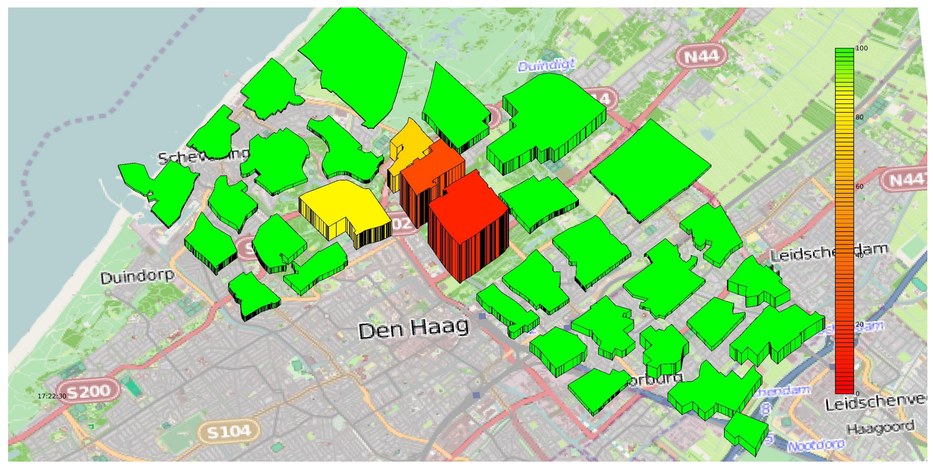
- Initial run:
  - Slight congestion
  - Adapt boundary capacities



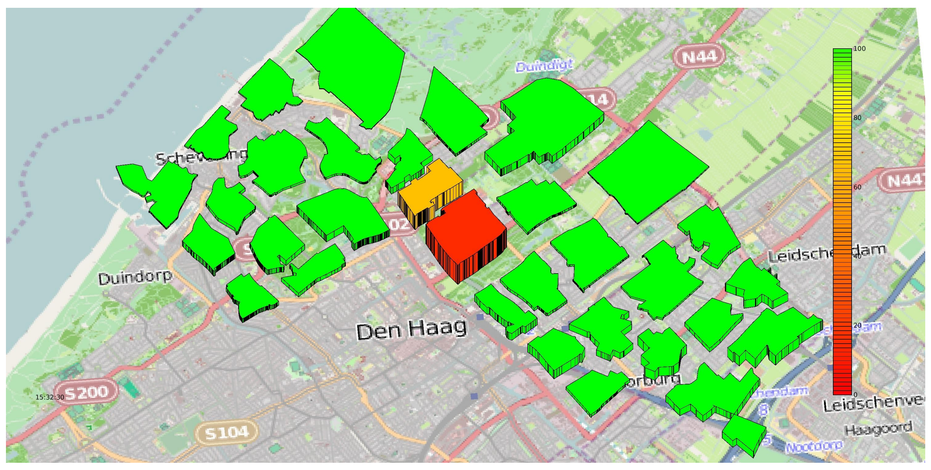


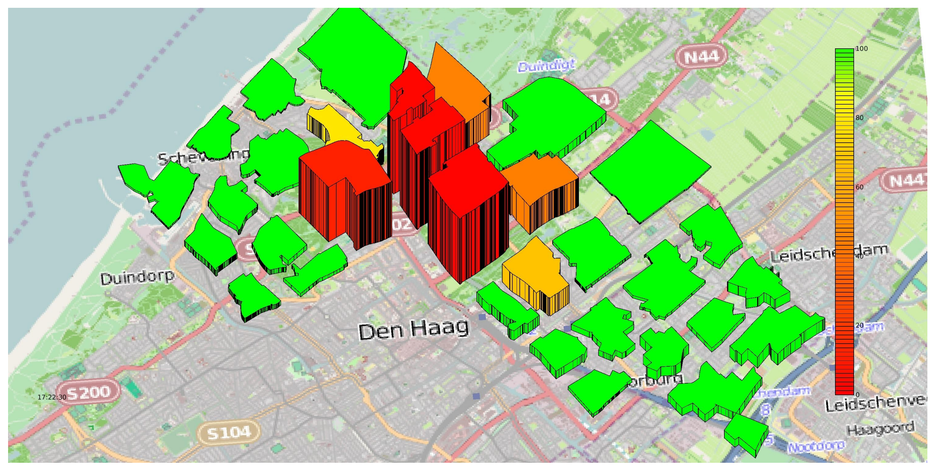
- 20 iterations:
  - Congestion and speeds correct
  - Remaining issue: impossible turns





- Face validation:
  - Accident, adapt boundary capacity
  - Congestion propagation and speed realisitic





Calibration

- Zones: capacity, A_1, $\mathbf{A_2}$, and A_j
- Boundaries: **boundary capacity**
- Routes: **update fraction, time** and spread
- Practioners can tune parameters to get expected outcome
- If data available: same intuitive adaptation, possibly other values

Conclusions

- MFD-based Network Transmission Model represents urban traffic dynamics correctly
- Initial parameter set gives reasonable traffic states
- Tuning of parameters intuitive

This research is sponsored by:
NWO
Netherlands Organisation for Scientific Research