

# Netwerk transmissie model

## Verkeersmodel voor groot-stedelijke gebieden

05-03-14

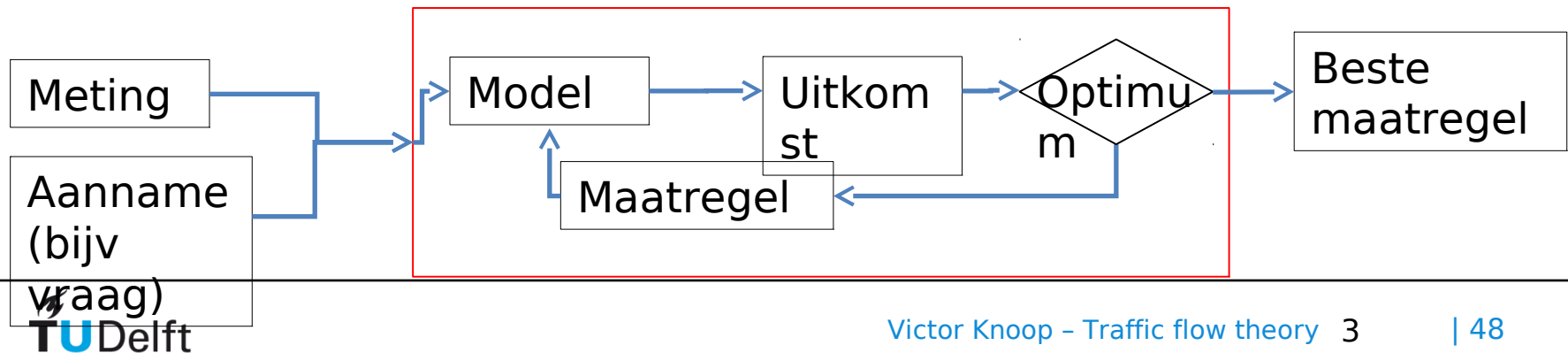
Victor L. Knoop

## Bijdrage

- Stedelijke gebieden zijn sterk met elkaar verbonden, en daarmee verkeersmaatregelen ook
- Noodzaak tot dynamische verkeersmodellen voor langere tijdsschaal (1 uur en meer) en groot gebied
- Nieuwe mogelijkheid: simulatiemodel op basis van **gebieden**

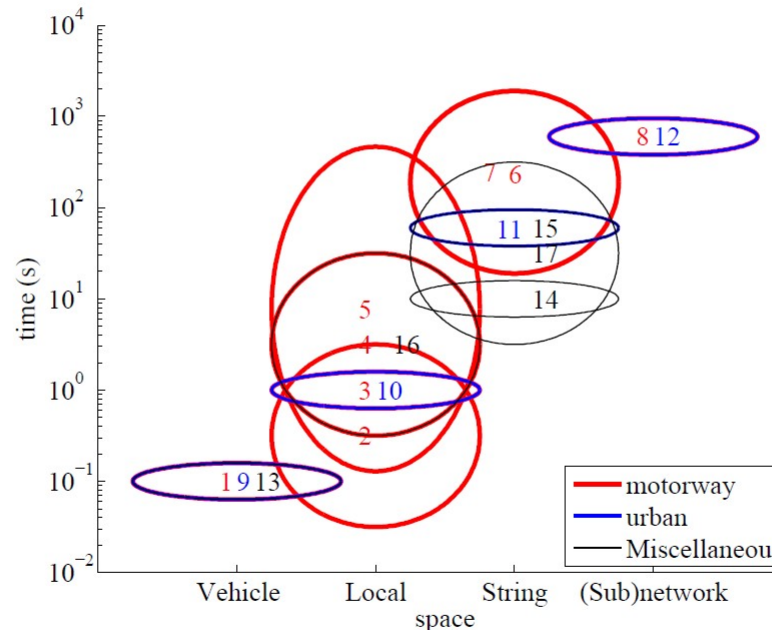
# Voorspellen – het doel

- Verkeersmanagement-maatregelen kunnen dynamisch worden ingezet
- De beste inzet kan effect hebben over het hele netwerk
- Daarom: modelmatig voorspellen in optimalisatie



# Verkeersregeling: tijd- en ruimteschalen

- Tijdsschaal: hoe ver moet je vooruit voorspellen?
- Ruimteschaal: welk gebied moet ie meenemen?

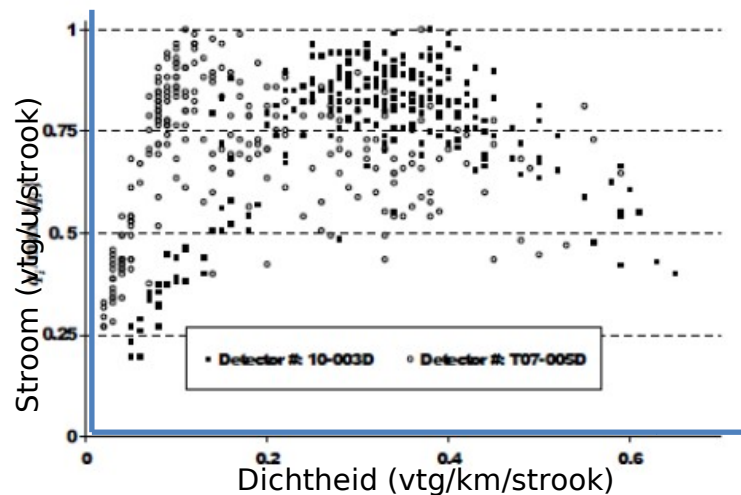


## Statisch vs dynamisch

- Statische modellen hebben geen tijdscomponent  
Bijv, strategische modellen voor beslissingen  
infrastructuur
- Dynamische modellen hebben wel een  
tijdscomponent
  - Vraagpatroon
  - Filevorming
  - Filelokatie (fileterugslag)

# Gebiedsniveau

- “Fundamental diagram” op weg-niveau (theorie)

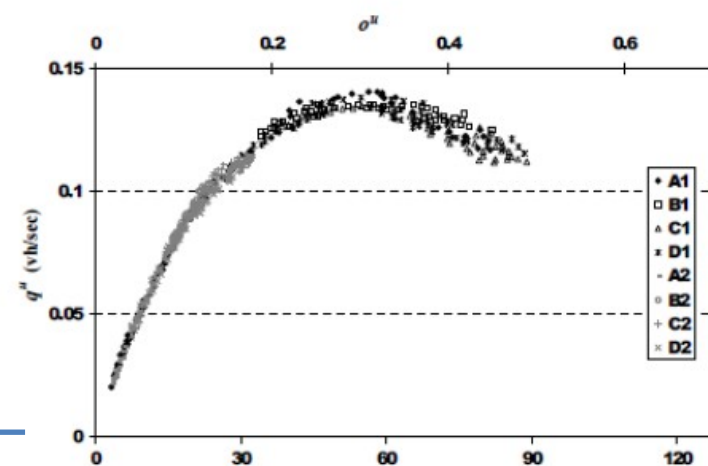
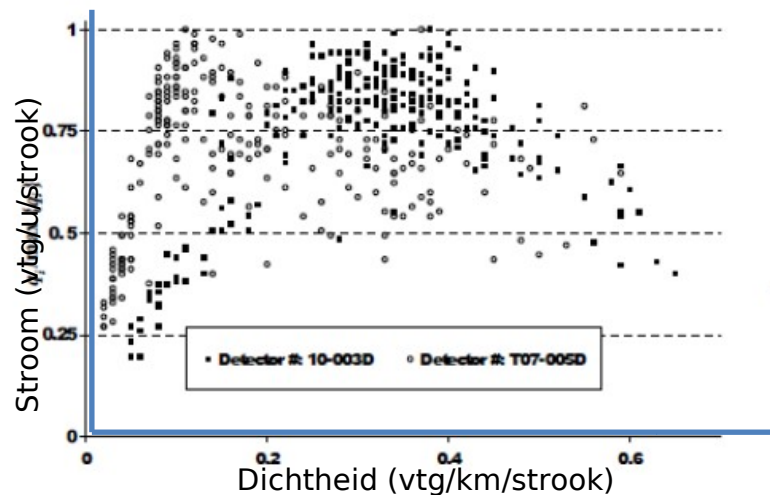


Praktijk...

Gemiddeld!

# Gebiedsniveau

- “Fundamental diagram” op weg-niveau (theorie)



Praktijk...

Gemiddeld!

# Schalen

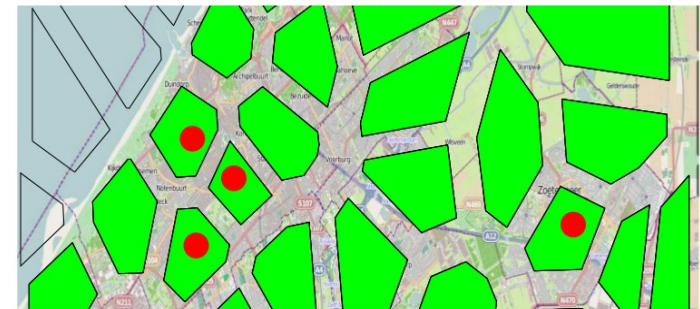
- Microscopic: vehicle level
- Macroscopic: link level
- New level: network level



Vehicle level



Link level

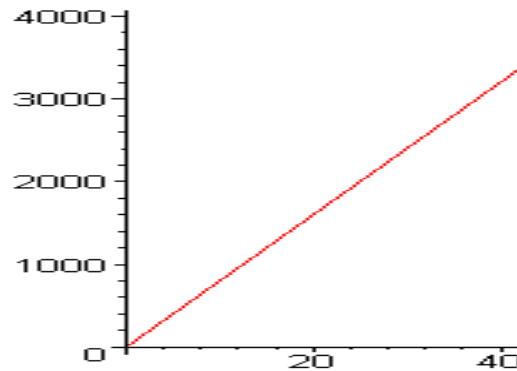


(Sub-)network level

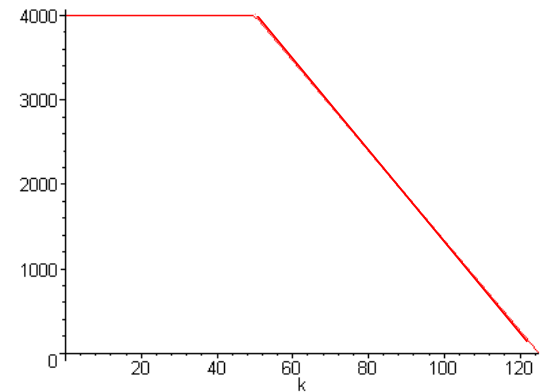
| Statisch |                                 | Dynamisch   |
|----------|---------------------------------|---|
| Micro    |                                 | Bv. Vissim, Paramics, Fosim (snelwegen)                       |
| Meso     |                                 | Bv. Dynasmart   |
| Macro    | BPR-functies                    | Bv. METANET, Cell transmission model, link transmission model |
| Gebied   | BPR-functies op netwerk-niveau? | Netwerk transmissie model?                                    |



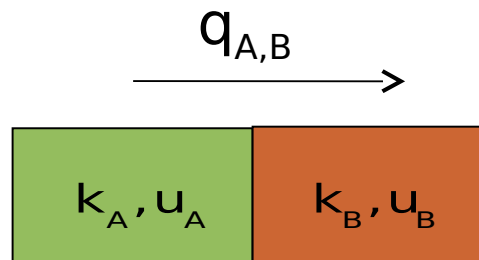
# Beperking van vraag en aanbod



Vraag



Aanbod

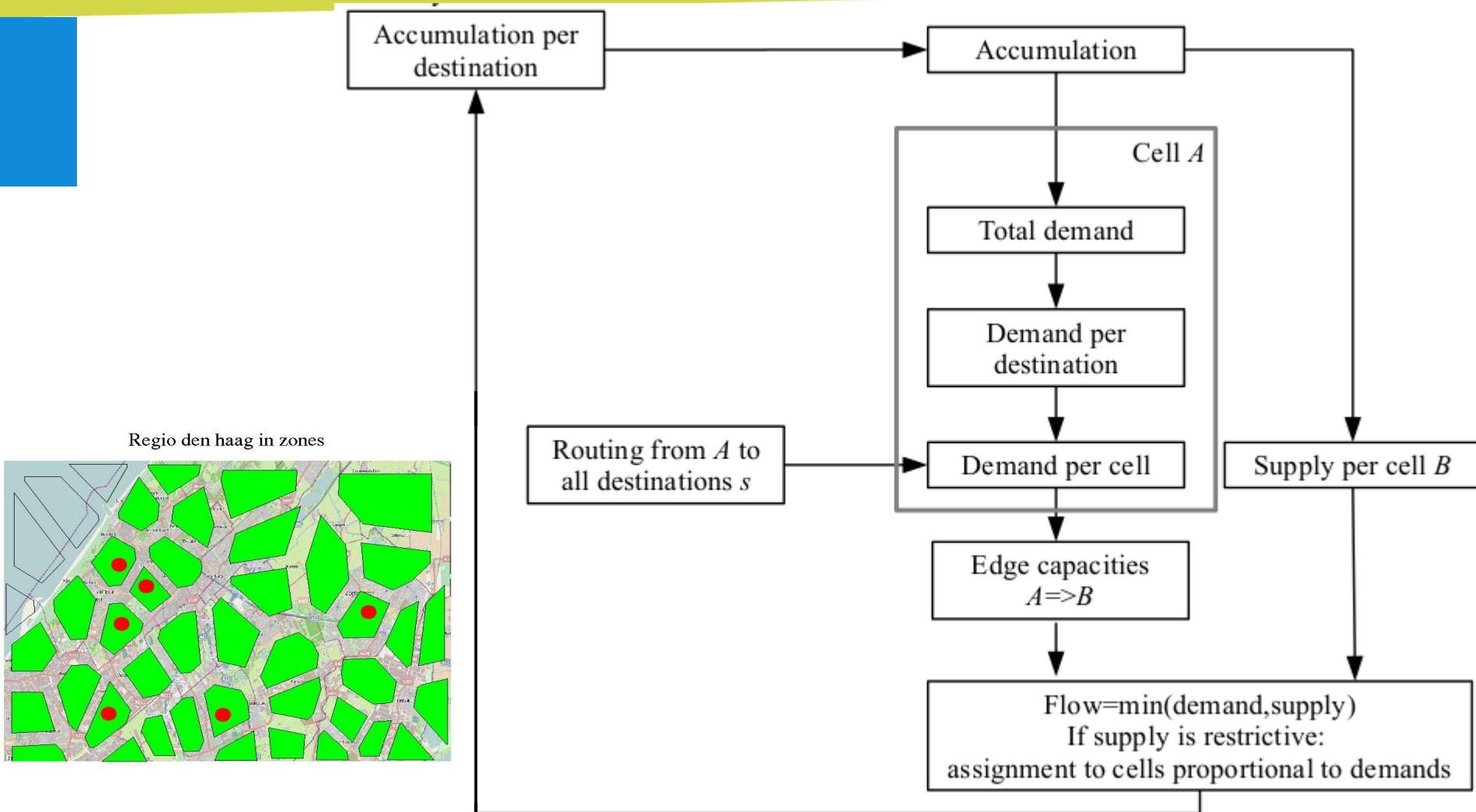


- => proportioneel toelaten

## Regio den haag in zones



# Beperking van vraag en aanbod



# Toepassing: perimeter control

- Houd verkeer buiten de stad
- Vertraging buiten de stad
- Binnen de stad soepelere doorstroming
- Is dat de moeite waard?
- Evenzo: routeren
- Zie [www.victorknoop.eu/research/networktransmissionmodel](http://www.victorknoop.eu/research/networktransmissionmodel)

- Beperking: routeren moet mogelijk zijn
- Gebaseerd op theoretische principes - Validiteit nog niet in real life getoetst
- Effecten van voetgangers/fietsers/OV niet meegenomen

- Er is een snel dynamisch verkeersmodel (~10 seconden voor een stad)
- Op basis van eerdere studies veelbelovend qua accuratesse, maar nog niet getoetst
- Mogelijkheden bij DTM, en planning
- Mogelijk in real time te “voeden” door snelheidsdata

# Verder lezen:



## Network Transmission Model A dynamic traffic model at network level

Victor L. Knoop  
Serge P. Hoogendoorn

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[www.victorknoop.eu/research](http://www.victorknoop.eu/research)

Victor L. Knoop, PhD  
TRAIL Research School  
Delft University of Technology  
Transport & Planning  
[v.l.knoop@tudelft.nl](mailto:v.l.knoop@tudelft.nl)



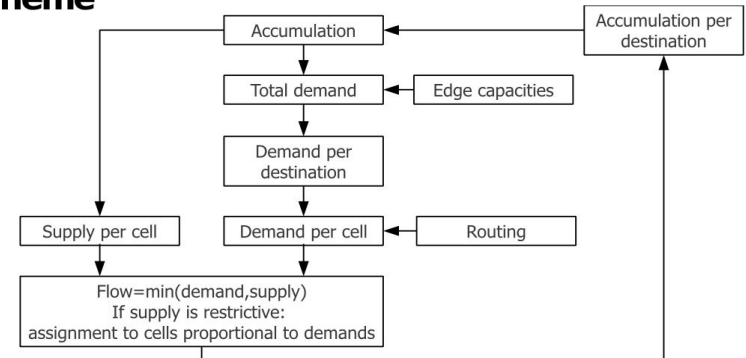
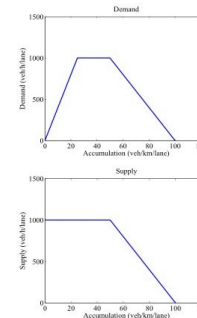
### Abstract

New IT techniques allow communication and coordination between traffic measures. To best use this, one needs to coordinate over longer distances. Optimization of the measures is not possible using traditional microscopic or macroscopic simulation models. The Network Fundamental Diagram (NFD) describes the relation between flow and density on a network level. This paper introduces a traffic model which uses this relationship, representing traffic and traffic dynamics at a high spatial scale. The model shown to work on an example network. The model can be used to predict the effect of routing information or perimeter control.

### Supply & demand

- Supply and demand are based on the NFD.
- Demand is the same as the NFD for all densities. This is contrary to the cell transmission model where demand stays high for overcritical situations. However, in networks gridlocks can occur.
- Supply is, similar to the cell transmission model, at capacity at under critical accumulation and follows the NFD for higher accumulations. Supply reduction is essential for blocking back

### Simulation scheme

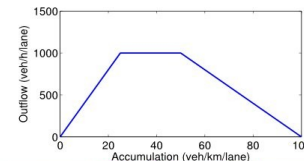


### Background

#### Introduction

- Modern IT techniques allow for coordination of traffic management measures.
- Larger areas need a longer time horizon for the traffic optimization
- Microscopic and macroscopic simulation programs are too slow for large area and long simulation times

The **Network fundamental diagram** describes the relationship between accumulation (average density) and the (unrestricted) outflow out of the network



Vehicle level

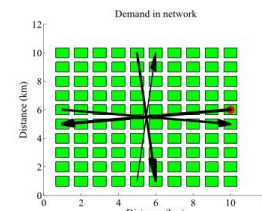


Link level



(Sub-)network level

### Case study



- 20x20 square areas of 1x1 km
- Cross demands

#### Results

- Gridlocks prevented
- Considerable decrease of delay

#### Control measures

- Dynamic route guidance
  - based on speeds in areas
  - variable update times
- Gating
  - Limit inflow such that accumulation stays under critical accumulation
  - Vary the traffic areas where gating is applied

#### Next steps

- Calibrate for a real world network
- Implement in a model predictive control framework

### Conclusions

We propose a model that describes the traffic dynamics on a network level scale. The base elements are the subnetworks, and the flows from one subnetwork to another are calculated using the proposed scheme. The model accounts for blocking back from downstream as well as internal gridlocks within a cell.

A case study showed how the model can be for traffic control (gating and routing). We used feedback controllers to optimize the traffic stream, but given the limited computation steps the model can also be used in a model predictive control framework.