What shapes the bathtub: effects of departure time shifts

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Goals

• Traffic engineers model at different levels
• Larger areas require larger abstraction
• Levels:
  − Each vehicle
  − Each link (road)
  − Recent: network level “bathtub”
• Need: Effect of pricing on Randstad area, so low level unfeasible
Project background

• Traffic engineering: what happens on the road
• How can departure time shift change the traffic flows
Background science

- MFD (Macroscopic Fundamental diagram) governs zonal dynamics

- Relation nr of vehicles & outflow

- Common idea: keep accumulation under-critical (perimeter control)
Questions

• Effect of traffic signals on zonal dynamics
• Compare perimeter control to departure time control
• Effect of departure times on MFD
• Model for the Randstad area?
Effect of traffic signals on zonal dynamics

• Traffic signals have an effect
  - Low nr of veh => better none
  - Higher => higher speeds with

• Impact of highest nr of vehicles before flow goes down: good for network reliability
Effect of traffic signals on zonal dynamics

- Impact of highest nr of vehicles before flow goes down: good for network reliability
Perimeter control vs departure time shift

• Often assumed: highest outflow if zones are below “critical point” => incorrect!

• Travel times departure much more effective
User equilibrium in departure time into MFD-based models

- Now often inconsistent, reverse reasoning

![Diagram showing User equilibrium principle](image)
Findings for MFD shape

- Not continuous
- No congested branch
Randstad model

• Not continuous
• No congested branch

(a) Raw zone map after merging multiple zones in
(b) Final zone map, after re-arranging the boundaries of the
Randstad model

- Similar travel times to Google maps
- Next addition: Change demands
- Corona ultimate test
Take-aways

• Traffic management and demand management interact and should be combined
• Total costs and demands determine the MFD; pricing can hence influence the MFD
• Zonal based models can be used to assess travel times in large areas
References


• Mark Sloot (2019) Modelling traffic in the Randstad using a dynamic zone model based on the Network Fundamental Diagram