Towards Sustainable Dynamic Traffic Management
Introduction

- Optimization of a road transport network
- Need for optimization multiple objectives
  - Accessibility – external effects / sustainability
- DTM – measures available
  - Optimization – expanding
  - Local – network
- Optimization at strategic level
  - Use of DTM measures to affect supply
DTM strategies
Externalities as objectives

- Dynamic Traffic Management
  - Traditionally focus on:
    - Local level
    - Efficiency
    - Predefined strategies
    - Route choice effects rarely addressed
  - Identified as measure for externalities
    - Local: level of service
    - Network: influencing route choice
  - Ideally selection DTM strategy
    - Network level
    - Several network performance measures
    - All possible strategies
    - Behavioral effects

- Question
  - Suitable approach
  - Insights in interaction between objectives
  - Insights in effective strategies
Approach

- **Multi-objective**
  - Incorporation of external effects
    - Road safety
    - Air quality
    - Climate
    - Noise

- **Dynamic Traffic Management**
  - As measure
  - Focus on supply and DTM strategies

- **Solution approach**
  - Bi-level optimization problem
    - Upper level: joined road authorities
    - Lower level: road users
  - Using DTA model for lower level
  - Pareto optimal set provides information for decision making process
  - Heuristics needed, computational expensive
General Framework

Modeling Framework and solution approach

- ARTEMIS emission model
- RMV or AR-INTERIM-CM noise model
- Accident risk based model

Evolutionary Multi Objective Algorithms
- NSGAII – SPEA2+
- RSM accelerated

OmniTRANS-Streamline DTA model
- RT version – using controls

Minimization externalities: congestion, climate, noise, air quality and traffic safety

Dynamic User Equilibrium problem

Traffic dynamics
- Flows, speeds

DTM measures

Supply – link characteristics
Pruning and ranking

- Information contained by Pareto optimal set
  - Interaction objectives
  - Lower and upper bound
  - Trade-offs and sensitivity
  - Mapping solution and objective space
- Pruning
  - Convex hull filter
  - PIT filter
  - Clustering filter
- Ranking
  - Weighted Sum Method
  - Weighted Product Method
  - Analytical Hierarchy Process
  - Weighted Average Rank
  - ELECTRE III
- Cost Benefit Analysis
Case Almelo

9 measures
6 time intervals
6.36x10^{45} possible solutions
15 minutes to solve DUE
100 iterations
250 solutions archive size
25250 assessed solutions
Pareto optimal sets
Some findings

- AR-INTERIM-CM for noise and ARTEMIS for emissions are suitable externality models for DTA
- Gap in knowledge on modeling traffic safety
- Using RSM methods can accelerate search considerably
- Solving MO NDP provides a lot of information
- Not one single solution optimal for more than one objective
- Efficiency aligned with emissions substances but opposed to noise and traffic safety
- General strategy complex to determine, but metering of traffic can be an interesting strategy for many externalities
Journal publications

- Wismans, L. J. J., E.C. van Berkum & M.C.J. Bliemer (2010). Wisselwerking tussen bereikbaarheid en externe effecten bij de optimalisatie van DVM maatregelen in verkeersnetwerken [Interaction between accessibility and external effects when optimizing DTM measures on network level (in Dutch)]. Tijdschrift Vervoerswetenschap, (ISSN 0040-7623), 46(2), 44-54
Books or bookchapters


Peer reviewed conference proceedings


Thank you for your attention

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