Smart Mobility in Smart Cities

Seamless Integration of Networks and Services
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Some background: two decades of research...

Traffic Operations and Management
Change in research focus…
Towards Smart Urban Personal Mobility

- Anticipatory decentralised control
- Demand responsive transport services
- Urban active mode mobility
- Cooperative systems and driver automation
- Urban Traffic and Transport data
Why the change of focus?

- Urbanisation is a global trend!
- Accessibility is a major issue in many car-centric cities and appears persistent
- Most delays are experienced on arterials (not on freeways!), speeds may drop off to below 20 km/h during peak...
- Urban space is very scarce, so building new infrastructure is generally not straightforward
- 2/3rd of traffic accidents occurs within city boundaries
- High impact (traffic-related) emissions and noise (people live near roads...)
- Potential change is there: in some cities, low operational speed of cars in combination of pull / push measures has lead to modal shifts...
• Cycling and walking have become main modes of transport in Amsterdam (and many other Dutch cities)

• For Amsterdam: big impacts on emissions (4-12% reduction), as well as on noise, accessibility and health

• Popularity of rail has increased as well (because of?): for many rail trips, cycling is used for access and egress

• But these positive trends also has some negative (but interesting) impacts…

Changing modal shares in The Netherlands
Examples of interesting ‘side-effects’ of a very desirable trend...
Amsterdam Institute of Advanced Metropolitan Solutions

- To tackle these (and other) big city issues, Amsterdam sponsored foundation of AMS
- Collaboration between MIT, TUD, WUR and industry partners with municipality of Amsterdam as main ‘client’
- Annual budget 30 million EUR
- Learning by doing: the city as a living lab!
- Urban Mobility (and Logistics) as one of the key issues
- Developing a vision on Smart Sustainable Urban Mobility
Towards a vision on Smart Urban Mobility

• Ingredients of a vision…

• What are expected main trends (next to spatial trends)?
  - trends affecting mobility demand (demographic changes, socio-economic developments)
  - trends affecting supply transport modes and services (e.g. technological trends, innovations)
  - trends that affect aims and requirements

• Analysis and confrontation trends: are current issues resolved? Do we see new issues? Are they in line with current and future policy objectives? Should we accelerate / decelerate certain developments?

• What is a feasible and desirable situation and how do we get there? What are the roles of various actors?

• A first step (EU strategic agendas + brainstorm)…
Trends affecting urban mobility

Examples of analysing identified trends and how they could impact urban mobility
Example trend: electrification (or rather: the e-bike)

• About 65% of trips are shorter than 7.5 km; about 75% are shorter than 15 km
• Acceptable distances that can be travelled by e-bike is about 15 km; for bikes it is about 7.5 km
• E-bike reduces impact of grade, and is less demanding, enabling cycling for wider audience
• Potential for e-bikes seems large, but new challenges do emerge!
  - Safety? In particular an issue for older cyclists
  - Mixing ‘normal’ cyclist / pedestrians and motorised bicycles (e.g. larger speed differences)
• The (e-) bike will not be the only answer, but can be an important element of the system

How to mix w/ Motorized Bicycles

Courtesy of Kevin Krizek
Example trend: driving automation

- Introduction will have huge impacts, beyond changing capacity and safety: ripple model
- Travel time becomes work time! Impacts of Value of Time changes on mobility patterns?
- Driving automation gaining lots of attention, but with strong focus on freeway applications
- Feasibility in dense urban areas?
  - Will own infrastructure be needed? Where do we find the space in our dense cities?
  - Throughput and safety impacts, also in case reduced automation when cars enter city?
  - Privately owned vehicles or shared services?
  - Interaction with vulnerable road users?
- Driving automation not likely to be a panacea!
The Dutch alternative to the self-driving car?

Developing a comprehensive vision requires analysing all identified trends and predicting their impact on urban mobility.
Contours of a vision: Integrated & hyper-connected urban mobility

• Using key **technological trends** (big data, hyper-connectivity), **social trends** (e.g. attitude towards (car-) ownership), and **changing objectives / requirements** regarding urban mobility…

• **Uni-modal urban transport system not likely to achieve identified objectives / requirements** (in particular: health, sustainability, liveability)

• We believe we should foster transition to a less car-centric **urban mobility system**, with pillars:
  1. Seamless integration of mobility services, “prioritising” sustainable and healthy modes
  2. Flexible / efficient use infrastructure & space
  3. Requiring open urban multi-modal data platform
What does seamless integration of services entail?

• Transfer / access / egress resistance is high (1 transfer ~ 17 min travel time)
• Reduction essential to make a multi-modal trip compete with car:
  - Seamless transfer between appropriate modes, also in terms of infrastructure
  - Seamless payment schemes
  - Accurate personalised multi-modal real-time info and advice giving fair information about all alternatives
• Important role of (shared) active modes for shorter (legs of multi-modal) trips
• Role autonomous vehicles as a mobility service (driverless Uber)?

Idea not a new per se, but becomes feasible with availability of new and improved BIG data sources and methods to fuse them...
UML: Open Multi-modal Data Platform

- Data platform to unravel multi-modal traffic patterns
- Example application example during triple event in Arena area
- Pilot shows potential of system for multi-modal information and guidance during events
Flexible and efficient utilisation of network capacity

- Key since space to build new roads in our dense cities is often not available!
- Many examples already available:
  - Integrated traffic control and management (e.g. Practical Pilot Amsterdam)
  - Integrated management of Traffic, Public Transport and Crowd management during events (SAIL)
- Major opportunity is in integrating measures influencing demand and supply (e.g. anticipatory control)
- Note: flexible use also allows improving robustness and better dealing with extraordinary situations
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<tr>
<th>DTM transition paths</th>
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<td><strong>REISINFO</strong></td>
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<td>From collective guidance to smart mix of collective and individual services</td>
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<td><strong>STAND ALONE</strong></td>
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<td>A changing role of road-side traffic management systems</td>
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<td><strong>B2G</strong></td>
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<td>From local / regional to national traffic information and management</td>
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<td><strong>From business to government to business to consumer and business to consumer</strong></td>
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<td><strong>From owner of data to maximal openness and availability (private and public)</strong></td>
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<td><strong>From government to public-private collaboration and alliances</strong></td>
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**Closing remark:**

*importance of clear transition paths!*

- Development of comprehensive transition paths to enable Smart Urban Mobility:
  - Integration of current, often uni-technology / uni-modal transition paths
  - Identification of no-regret activities and developing pilots that contribute to transition

- Examples: 1) Transition DTM and 2) Transition driver automation

*Visions are wonderful, but there are also problems to be solved right now!*
Q&A
What do we want our cities to be like?
Trends and implications for transport modelling?

• Days of traditional (static) transport modelling seem over, new techniques in modelling and calibration open alleyways for practical application of such models, including activity-based modelling

• With big-data, data-driven modelling will become more important

• Hyper-connectivity makes process more complex and potentially more unstable

• Importance of behaviour and human factor

• Travel time becomes work time (self-driving vehicles) or recreation / exercise time (active modes): shift in activity patterns, VoT, etc.

• Active mode transport is poorly described in many transport models, yet important in (almost) all (multi-modal) trips!

• Importance of including non-transport