



Spatial and Transport Impacts of Automated Driving

NEW MOBILITY MODELLER BACHTIJAR ASHARI

- > What is the New Mobility Modeller?
-) What can it do?
- > Motivation for development
-) Timeline
-) Brief model outline
- > Province of North Holland study results
-) Finishing remarks



-) A fast, high-level, explorative model to investigate the impact of:
 - > (Connected) automated mobility
 - > Shared mobility
 - > Parking and road pricing policy measures
-) ... on:
 - Mode choice
 - > Vehicle km's
 - Congestion
 - > Parking activity



- > Calculate many different scenario's quickly
- Reveal impact mechanisms
- > Find avenues to pursue in more precise models
- Example questions it could answer:
- > What is the effect on traffic congestion if highly automated vehicles are adopted by X% of the population?
- > How does parking price affect mode usage in an urban region?
- > What is the effect of pricing policy measures on the modal split?
- > If more people are willing to share vehicles, how does it impact vehicle use?



MOTIVATION FOR DEVELOPMENT

SHARING

- Transition from owning cars and bikes to using
- Both car sharing and ride sharing are part of this trend



ELECTRIFICATION

- Transition to electric vehicles
- Soon: reasonable priced models, with a range of >400 km
- Charging infrastructure to be integrated in mobility plans



MOBILITY AS A SERVICE

- MaaS envisions one convenient way to travel
- Unlocking all different mobility options from 1 app or platform



AUTONOMOUS VEHICLES

- Many car manufacturers and tech companies working towards automated vehicles
- Experts do not yet agree on pace of change and final outcome





TIMELINE

2018

- > Impact study province of North Holland + SURF STAD project
-) Automated driving and sharing

2019

- Back-end model improvements
 - Implementation as a module of <u>Urban Strategy</u>, a TNO modelling environment that links traffic-, noise- and emissionmodels

2020

- > Coupling with (multi user-class) network assignment
-) STAD improvements



BRIEF MODEL OUTLINE



1. Trip and personal characteristics from travel journal (OVIN)

- Every trip is distributed over road and region types
- Results in a modal split and an intensity of equivalent passenger cars (PCU) for every road and region type
- 2. Trip growth per user group
- 3. Trip growth per region
 - > Models relocations between regions

4. Destination choice elasticity model

- Decrease in travel time or value of time results in increase of travel distance
- 5. Mode choice: multinomial logit estimated on OViN data
- 6.Travel time impacts iteration
 - Macroscopic fundamental diagram calibrated on LMS
 - Converged when a mode change does not improve travel time



BRIEF MODEL OUTLINE EXAMPLE PARAMETERS: MODE CHOICE ATTRIBUTES

New modes are derived from existing modes by changing:

) Costs

- > Value of time
- Max. distance
- Travelers preferences
- Values derived from literature or expert judgement
- As attributes of new modes are subject to change this set-up allows us to explore the effects through sensitivity analyses

Mode	Fixed cost (€)	User costs (€/km)	Max. distance (km)	Extra time factor	Value of time (€/hour)	specific constant
Car	0.00	0.17	9999	1	9.00	0
Car passenger	0.00	0.00	9999	1	7.20	-1
Train	2.20	0.17	9999	1	9.25	3.5
Bus Tram Metro	0.78	0.10	35	1	6.75	5
Bike	0.00	0.00	15	1	9.00	2.5
Walking	0.00	0.00	3	1	9.00	2
Automated private car	0.00	0.17	9999	1	7.20	0
Automated taxi (not shared)	0.00	0.18	9999	1.05	7.20	2
Automated shared taxi	0.00	0.12	35	1.2	7.65	4
Automated shared van	0.00	0.06	35	1.4	7.65	5



Mode

BRIEF MODEL OUTLINE INTERFACE EXAMPLE: CHANGING PARKING COSTS

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Parking

Parking

Variable

Fixed to

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	Parking costs							24) 5 (21)
Buitenhu	Parking concept	metropolitaan centrum city area	centrum city area	city living work area	national living and recreation	hubs mainport greenports	2000	
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Parking cost 🔨 🔨							La	ndsn
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Reduce all parking costs				5101		A10		
Increase P+R costs	ESTPOOR			WIESTHAN		METEOR	ENUNG	17
Reduce P+R costs	Burn Ruigoo	rd	TRAUEH	Nume C				
Increase automated valet parking costs	Golfclub Houtrak	WESTPOOP ST	AVENWE			Het IJ		e e
Reduce automated valet parking costs	Amsterdamse Golf Club	ARCTIC:			S101			Noord
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BRIEF MODEL OUTLINE INTERFACE EXAMPLE: CHANGING PUBLIC TRANSPORT COST





BRIEF MODEL OUTLINE INTERFACE EXAMPLE: NETWORK ASSIGNMENT

- The resulting growth factor from the NMM is applied to a reference ODmatrix (from another model)
- Results in a new OD-matrix reflecting the calculated scenario
- Difference in IC-ratio between the two assignments can be shown on the map

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PROVINCE OF NORTH HOLLAND STUDY RESULTS SCENARIOS





PROVINCE OF NORTH HOLLAND STUDY RESULTS REGIONS

- > Regions are defined by:
 -) Jobs / m²
 - > Average short-term parking tariff
 - > Points of interest







5 area types

Very highly urbanized areas: Amsterdam city centre Amsterdam Zuid.

Highly urbanized areas: rest Amsterdam, center Alkmaar, Hilversum en Haarlem.

Other urbanized residential/work areas: Enkhuizen, Heerhugowaard, IJmuiden en Bussum.

Rural residential and recreational areas: Lutjebroek, Ankeveen, Callantsoog

Hubs en mainports: Amsterdam airport, Amsterdam port, Greenport Aalsmeer, Greenport Noord-Holland and Tata Steel.

¹Bron: Ontwikkelingsbeeld Mobiliteit 2050 Provincie Noord-Holland, december 2016, Strategische Visie Mobiliteit, concept, september 2016



PROVINCE OF NORTH HOLLAND STUDY RESULTS TRANSPORT MODES





PROVINCE OF NORTH HOLLAND STUDY RESULTS RESULTS: MODE CHOICE

> Large increase in vehicle use:

- > Automated private car
- > Automated taxi
- Decrease in active modes:
- Walking
- > Cycling
-) Model sensitive for:
 -) Travellers' preferences (asc)
 - > Value of time (vot)
 - Variable costs (cv)





PROVINCE OF NORTH HOLLAND STUDY RESULTS RESULTS: VEHICLE KM'S AND CONGESTION

> All scenarios have an increase in:

- Vehicle km's
- Congestion (vehicle hours of delay)
- > This offsets any wins from:
 - Increased capacity of L5 vehicles due to V2V communication
 - Less number of vehicles due to sharing



PROVINCE OF NORTH HOLLAND STUDY RESULTS RESULTS: INTERVENTIONS ON L5-NO-SHARING SCENARIO

- Possibility to introduce road pricing per road type
- > Introduce other parking options
- Change mode parameters (costs, speed) to model improvements





- > Model works well to investigate impact mechanism of shared, automated mobility
- > Model can be extended to include more emerging modes and parking concepts
- Short computation time allows exploration of large numbers of scenarios, sensitivity analyses and assessments of the impacts of interventions
- > Improvements possible with data from stated preference research and pilots
- > Integration with a network assignment opens up possibilities to assess environmental impacts of new mobility

