Bart van Arem

On-line college tour Automated Driving 10th June 2020







VeRDuS





Many questions ...



When fully automated vehicles will hit the market?

Will we travel safer?

Are we going to own or share cars?

Will we need more or less road infrastructures?

Will we still need buses?

Will there be more or less congestion?

Will we drive longer or shorter distances?

How much on-street and off-street parking spaces will still be needed?

How will cities evolve?

Will we consume more or less energy to travel?







Much progress short term and small scale impacts on driver behaviour and traffic flow.

Research on longer term, indirect, wider scale impacts on mobility, logistics, residential patterns and spatialeconomic structure in its infancy.





ŤUDelft

Understanding the spatial and transport changes



Spatial and Transport Impacts of Automated Driving

















A day in the life with an automated vehicle

Stationary and On-board activities interact in daily schedules:



AVs allow to increase the role of **On-board** activities in this interaction.

What specific daily schedule changes travellers expect with AVs? What are their impacts on travel behaviour and congestion?







Unraveling truck platooning

(CrossMark

Positioning paper

	Contents lists available at ScienceDirect	TRANSPO RESE
201	Transportation Research Part B	5
ELSEVIER	journal homepage: www.elsevier.com/locate/trb	

Planning of truck platoons: A literature review and directions for future research

Anirudh Kishore Bhoopalam*, Niels Agatz, Rob Zuidwijk

Platoon routing



- Algorithms to find quickly find platoon routes
- Platoons tend to be formed with adjustments in time schedules rather than route

Acceptance of platooning technology



- Most drivers express concerns as their jobs becoming less autonomous, less meaningful, and potentially obsolete
- Drivers do see benefits of platooning but have some doubts in the capability of the system



Webinar #4 27th August



Should I stop or should I cross?

Webinar #5 10th September

(Nuñez Velasco, 2020)

Infrastructure

Road design

Automated Vehicle

Automation factors

Vehicle factors

Vulnerable Road User Demographics Psychological factors

https://www.mercedes-benz.com/en/mercedes-benz/innovation/research-vehicle-f-015-luxury-in-motion/



Road network design and impact of automated driving





- During the transition period, major network performance benefits are possible with moderate investments in road network design
- Starting with mixed traffic on enhanced infrastructure
- Gradually adding dedicated lanes









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The value of freeing up parking space!



- Welfare benefits of removing residential parking
- Welfare effects on households currently not owning a car due to high parking costs
- Welfare effects to society of not requiring parking close to shops because of AVs
- Effect on company location decisions of changes in parking allocation due to AVs

Webinar #3 25th June





Improved static traffic assignment for automated driving scenario analysis

- Solid relation between travel time and road capacity
- Relation between road capacity and traffic composition (autonomous/connected)
- Explicit modelling of capacity and waiting time at intersections (traffic lights or unsignalised, can be complex)
- Suitable for integration with travel demand choice models (including demand-responsive services)









AVs getting real... from Appelscha to Japan

Appelscha

How to maintain public transport in shrinking rural areas? The municipality experimented with an Easymile EZ10 shuttle on the bicycle lane.





Rivium ParkShuttle

Proven technology without a steward inside the vehicle, right here in Rotterdam and Capelle a/d IJssel!

AV in Japan

Looking across borders: Japan, the land of rising robotics! A case study conducted in regards to a demonstrator in Oku-Eigenji.





Container Exchange Route

AV s connecting Maasvlakte 1 with Maasvlakte 2 in Port of Rotterdam







30 Academic, private and public partners



Public and private contributions

Regional case studies: passenger cars, freight, public transport, parking

Spatial impacts, urban design, agglomeration

Business cases

Modelling tools, impacts, risks, benefits

Metropoolregio Rotterdam-The Hague Province Zuid-Holland Municipality of Amsterdam **Rotterdam The Hague Airport** Municipality of The Hague Municipality of Rotterdam AMS Advanced Metropoliton Solutions SmartPort SWOV Institute for Road Safety Research **RET NV** Mobycon Province Gelderland **DTV** Consultants Connekt ITS Netherlands Municipality of Delft Rijkswaterstaat KiM CROW Transdev-Connexxion RDW TNO **Goudappel Coffeng** Provincie Noord-Holland 2GetThere &Morgen





Smart cars and future proof provincial roads



Opdrachtgever:

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Projectteam:

provincie Noord-Holland (Arjan Selhorst) provincie Noord-Brabant (Rutger Smeets) provincie Overijssel (Alex Smienk) provincie Limburg (Jeroen Spaetgens) RWS WVL (Alex van Loon) Royal HaskoningDHV (Peter Morsink) CROW (Marco van Burgsteden) CROW (John Boender) als trekker



Implications AVs on core task and perspective of action Impacts on design and equipment of provincial roads Action on short (<5y) and long term Collaborations needed and common design standards



Innovation Network Automated Transport













Province Noord-Holland Vervoerregio Amsterdam, Arcadis TNO **TU Delft**

Automated driving and sharing in the province of **Noord-Holland** Regular modes +

DELEN Multimodal and shared automation Mobility as a service: any time, any place AUTOMATISERING Fully automated private luxury

Gebiedstypen

KIM scenario's





STAD Quick scan modeling tool

100% penetration rate in 2040

AV attractive at expense of other modes

Strong interventions needed if AVs are not shared

Webinar #2, 18th June





Five lessons...

Automated driving is (still) complex and challenging



Driver assistance/ Partial automation



Driver needs to be able to intervene at all times

Automated parking, autocruise

Conditional/ High automation





Vehicle in control in special conditions

Taxibots, platooning, automated highways









Common understanding of AV readiness....



kpmg Autonomous Vehicles Readiness Index

Assessing countries' openness and preparedness for autonomous vehicles



Overall rank	Country	Total score	legislation		innovation		Infrastructure		acceptance	
			Rank	Score	Rank	Score	Rank	Score	Rank	Score
1	The Netherlands	27.73	3	7.89	4	5.46	1	7.89	2	6.49
2	Singapore	26.08	1	8.49	8	4.26	2	6.72	1	6.63
3	United States	24.75	10	6.38	1	6.97	7	5.84	4	5.56
4	Sweden	24.73	8	6.83	2	6.44	6	6.04	6	5.41
5	United Kingdom	23.99	4	7.55	5	5.28	10	5.31	3	5.84
6	Germany	22.74	5	7.33	3	6.15	12	5.17	12	4.09
7	Canada	22.61	7	7.12	6	4.97	11	5.22	7	5.30
8	United Arab Emirates	20.89	6	7.26	14	2.71	5	6.12	8	4.79
9	New Zealand	20.75	2	7.92	12	3.26	16	4.14	5	5.43
10	South Korea	20.71	14	5.78	9	4.24	4	6.32	11	4.38
11	Japan	20.28	12	5.93	7	4.79	3	6.55	16	3.01
12	Austria	20.00	9	6.73	11	3.69	8	5.66	13	3.91
13	France	19.44	13	5.92	10	4.03	13	4.94	10	4.55
14	Australia	19.40	11	6.01	13	3.18	9	5.43	9	4.78
15	Spain	14.58	15	4.95	16	2.21	14	4.69	17	2.72
16	China	13.94	16	4.38	15	2.25	15	4.18	15	3.13
17	Brazil	7.17	20	0.93	18	0.86	19	1.89	14	3.49
18	Russia	7.09	17	2.58	20	0.52	20	1.64	18	2.35
19	Mexico	6.51	19	1.16	17	1.01	17	2.34	19	2.00
20	India	6.14	18	1.41	19	0.54	18	2.28	20	1.91



Fieldstudies RWS, PNH,... Infra reports CROW, RWS



Human factors and supervision are key!



Interaction, adaptation, situation awareness, acceptance, ...

Safety, responsibility, accountability,...

At every SAE Level above 0!



Is there a future for L3 and L5?





More than a project....



Regional case studies: passenger cars, freight, public transport, parking

Spatial impacts, urban design, agglomeration

Business cases

Modelling tools, impacts, risks, benefits

RSM

zafing



TU/e

Metropoolregio Rotterdam-The Hague Province Zuid-Holland Municipality of Amsterdam Rotterdam The Hague Airport Municipality of The Hague Municipality of Rotterdam AMS Advanced Metropoliton Solutions SmartPort SWOV Institute for Road Safety Research RET NV Mobycon Province Gelderland **DTV Consultants Connekt ITS Netherlands** Municipality of Delft Rijkswaterstaat KiM CROW Transdev-Connexxion RDW TNO Goudappel Coffeng Provincie Noord-Holland 2GetThere &Morgen







Automated Driving part of bigger puzzle.

Reclaim infrastructure and parking space

Improve environmental quality

Improve social quality

Improve economic conditions

AVs: shared and electric

Walking, cycling and Public Transport







Join us on the path of enlightenment...





Automated driving in a smart, safe and sustainable living environment

Community of research, application and learning

www.stad.tudelft.nl

Urban Mobility Observatory



North-West Europe eHUBS









