Bart van Arem

Automated Driving on the Path to Enlightenment?





Masterclass I&W Hypes in Mobiliteit, 24 januari 2020



Hoe mooi kan het zijn!















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EU Truck Platooning Challenge



XE/P



















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.



Milakis et al (2017), Policy and society related implications of automated driving, Journal of ITS.





Spatial and Transport Impacts of Automated Driving

2016-2020, 2,5 M€ , www.stad.tudelft.nl













Four years of STAD...



in five lessons...



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			DD	т			
Level	Name	Narrative definition	Sustained lateral and longitudinal vehicle motion control	OEDR	DDT fallback	ODD	
Drive	er performs p	art or all of the <i>DDT</i>					
0	No Driving Automation	The performance by the <i>driver</i> of the entire <i>DDT</i> , even when enhanced by <i>active safety systems</i> .	Driver	Driver	Driver	n/a	
1	Driver Assistance	The sustained and ODD-specific execution by a driving automation system of either the lateral or the longitudinal vehicle motion control subtask of the DDT (but not both simultaneously) with the expectation that the driver performs the remainder of the DDT.	Driver and System	Driver	Driver	Limited	
2	Partial Driving Automation	The sustained and ODD-specific execution by a driving automation system of both the lateral and longitudinal vehicle motion control subtasks of the DDT with the expectation that the driver completes the OEDR subtask and supervises the driving automation system.	System	Driver	Driver	Limited	
ADS	("System") p	erforms the entire DDT (while engaged)					
3	Conditional Driving Automation	The sustained and ODD-specific performance by an ADS of the entire DDT with the expectation that the DDT fallback-ready user is receptive to ADS-issued requests to intervene, as well as to DDT performance-relevant system failures in other vehicle systems, and will respond appropriately.	System	System	Fallback- ready user (becomes the driver during fallback)	Limited	
4	High Driving Automation	The sustained and ODD-specific performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will respond to a request to intervene.	System	System	System	Limited	
5	Full Driving Automation	The sustained and unconditional (i.e., not ODD- specific) performance by an ADS of the entire DDT and DDT fallback without any expectation that a user will respond to a request to intervene.	System	System	System	Unlimited	





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



Mode choice, location choice, urban and transport planning





A walk ascending the SAE levels?

Common understanding of AV readiness....

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Autonomous Vehicles Readiness Index

Assessing countries' openness and preparedness for autonomous vehicles



Overall rank	Country	Total score	Policy and legislation		Technology & innovation		Infrastructure		Consumer acceptance	
			Rank		Rank		Rank		Rank	
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





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



LVMB Research Questions Future Infrastructure



Demand and requirements of SAE L2 and L3 and in-car information Feasibility and urgent per road type Implications on assets for traffic management Partners:

gemeente Amsterdam (Lotte Bekenkamp) provincie Gelderland (Chris Pit) provincie Noord-Holland (Boris Kock) gemeente Den Haag (Arjen Reijneveld) RWS Zuid-Nederland (Koen Steenbakkers) provincie Noord-Brabant (Terry de Zoete) gemeente Groningen (Jeroen Bekhof) gemeente Rotterdam (Dennis Scherpenberg) RWS WVL (Alex van Loon) RWS PPO (Rick Delbressine) Ministerie IenW (Melle Vroom/Nina Schaap) Gemeente Helmond (Tamara Goldsteen) Noord-Brabant (Alex Smienk) als trekker





Automated transport for disabled people



Children with Multiple Complex Disabilities

Need for flexible and safe transport 400 m between home and day care Steward and helper present Light traffic, moderate infrastructure adaptations







Automate wheelchair ready vehicle?



Make automate vehicle wheelchair ready:





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?





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Human factors and responsible innovation

SAE L1-2 vs SAE L3-4

Do we know what we want to learn by doing?





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

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 **RMC** Rotterdamse Mobiliteitscentrale 2GetThere &Morgen











Automated Driving part of bigger puzzle.....







There's life after the hype!















Het pad naar verlichting?

- AV (much) more than ascending the SAE levels
- Understanding AV readiness
- Human factors are key
- Smart, safe and sustainable living environment
- Manage a community of research, application and learning



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I&W is hype-neutraal.



