Safety of trials with self-driving vehicles on public roads

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SWOV
INSTITUTE FOR
ROAD SAFETY RESEARCH

Institute for Road Safety, SWOV

- Independent research institute
- Based in the Hague, the Netherlands
- Founded in 1962
- Around 50 employees

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SWOV's mission and scope

- Contribute to road safety with knowledge from scientific research
- Integrated approach:
  - Multi-disciplinary
  - Covering all aspects of road safety

Presentation outline

- Self driving vehicles and implications for road safety
- Research needed!
- Safety of trials with self driving vehicles
- Discussion: how safe should self driving vehicles be?

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Self driving vehicles: improving road safety?

- 94% of crashes caused by human factors:
  - Fatigue
  - Stress
  - Traffic insight
  - Drugs & alcohol
  - Personal motives (safety usually not the most important)
  - Drivers enjoy speeding
  - Inexperience
  - Ageing: (cognitive) impairment
  - Hurry
  - Distraction
  - People don't follow the (traffic) rules
  - Use the traffic system different from what was intended

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Self driving vehicles: improving road safety?

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  - Stress
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Self driving vehicles: improving road safety?

- Ánd: automation causes new problems:
  - Other road users (cyclists / pedestrians)
  - People are (much) better at some tasks than computers
    - Perceiving and anticipation of hazards
    - Improvising
- Computers make mistakes!

Emergency brake system

Emergency brake system

Self driving vehicles: improving road safety?

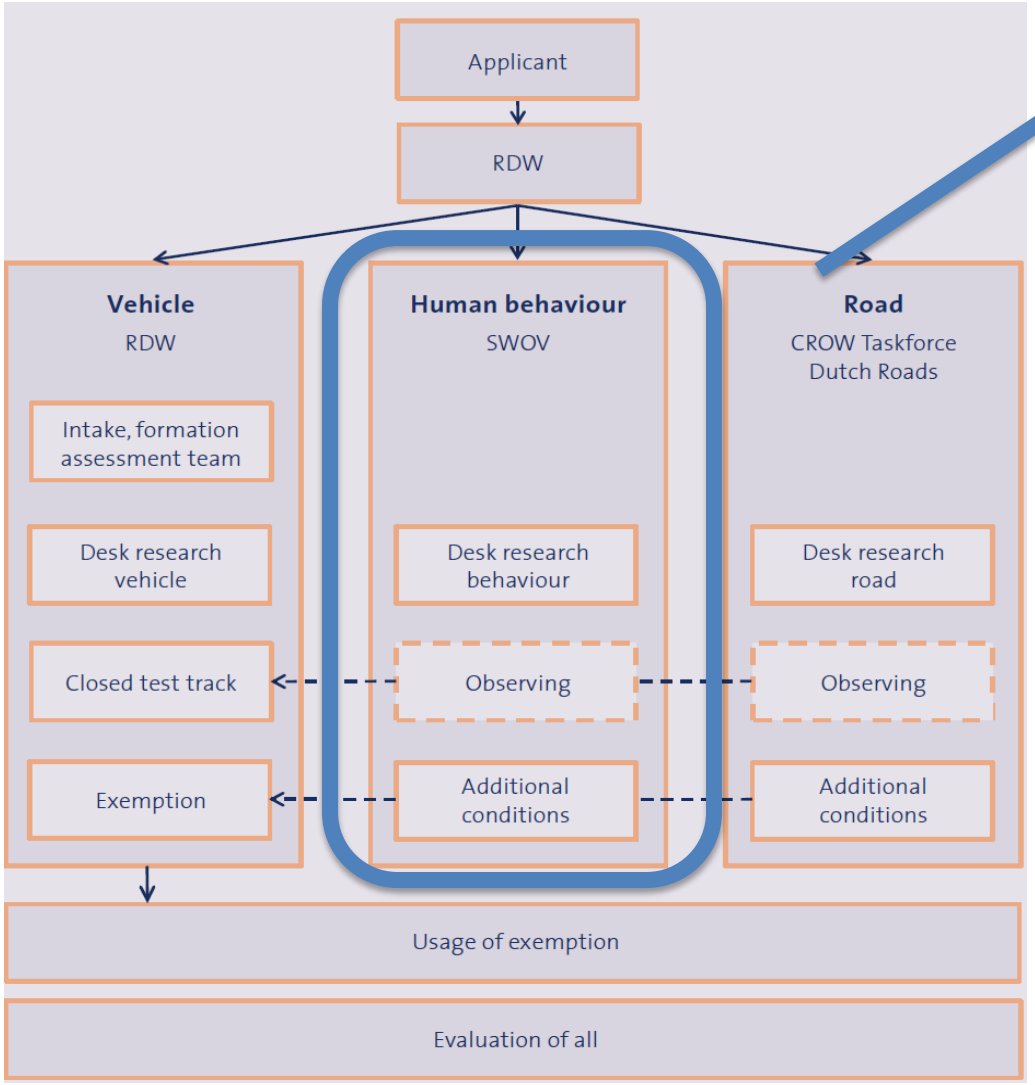
- Period of transition:
  - Vehicles partly automated: driver as a fallback
  - Vehicle fleet partly automated

➢ Research is needed!

Safety of trials with self driving vehicles

- Dutch minister: NL country for innovations with SDV's
- Large scale testing on public roads is possible
- Important condition: Road safety
- SWOV was asked to advise

Exemption procedure



- Trials differ
- Systematic approach
- Expert consulation:
  - Traffic psychologistst
  - Traffic engineers

➢ The risk matrix

Source: The exemption procedure (Ministry of Infrastructure and the Environment)

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Safety advice approach: the Risk Matrix

- 3 levels of automation:
  - Partial automation – driver is active
  - Conditional automation – driver is important
  - Full automation – driver is not important
- 4 sources of risks:
  - Interaction with system/vehicle
  - Interaction with other road users
  - Location and moment of the trial
  - General risks (project design and management)

	Partial automation	Conditional automation	Full automation
1. Interaction with system/vehicle			
Training	Have drivers been trained/informed on how to operate the system?		Has the operator been trained to take decisions?
New / different skills	Are drivers required to perform new or different tasks (e.g. overtaking with connected trucks, extreme long vehicles) and are drivers sufficiently equipped with the necessary competences?		Does the operator have enough information to make the right decision?
Situation Awareness	Does the driver stay 'in the loop' (aware of the traffic situation)? Will the driver be informed in time to be able to resume the driving task?		Will the operator (on the scene or from control room) be informed in time to be able to make correct decisions?
System failure	Is a system failure communicated clearly?	Is a system failure communicated clearly and timely to take over control	What happens when the vehicle stops unexpectedly (will this failure be communicated to operator)?
2. Interaction with other road users			
Information		Are other road users informed about the field trial?	
Predictability		Is the vehicle response/behaviour in conformity with other road users' expectations?	
Traffic rules		Does the vehicle follow the traffic rules?	
Misuse		Is there enough consideratoin for misuse of the system by other road users (e.g. other road users testing if the vehicle indeed stops automatically)?	
Copycat behaviour	What is the chance of other road users copying behaviour of autonomous vehicles inappropriately (e.g. short head ways (<5m) imitating platooning trucks)?		
3. Location and moment of the trial			
Position on the road: mass, speed and size	Is the proposed position on the road the safest one if the vehicle interacts with other road users?		
External circumstances: weather and traffic	Are unfavourable weather conditions and heavy traffic taken into account?		
4. General risks			
Project design and management	Is an incident response protocol available? Are responsibilities clearly defined?		

How safe should self driving vehicles be?

- To allow a field trial?
- Before they are permitted / available for consumers?

- 100% safe?
- As safe as driving in current traffic?

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