

Governance of the Safety of Automated Vehicles

Panel 4

Status of Government Role in Automated Vehicle Testing



TRAFIKVERKET
SWEDISH TRANSPORT ADMINISTRATION

Testing Methodology and Consumer Confidence

Gordon Moore in 1965 said;
"Change will never be this slow again"



Why me?

- Vision Zero
- Euro NCAP
- Drive Me
- ISO 39001
- (Chalmers)
- Ministry of Infrastructure manages legislation and regulation through the Swedish Transport Agency



The road transport system is an open and complex system

- Infrastructure
- Vehicles
- Road users
- Transports of goods and passengers
- Road users on duty
- Companies and organisations

- Rules and regulations
- Enforcement
- Etc.



The road transport system is an open and complex system that is killing many people



- 1.25 Million Globally
- EU – 25 500
- USA – 40 000



Source: Index Mundi

The Vision Zero Swedish parliament (1997)

- Long term target is that no one should be killed or receive long term disability
- Injury outcome instead of crashes
- Holistic approach in which system designers play an important role
- Tolerance to human failures
- Mobility a function of safety

The Vision Zero European Commission (2011)

“By 2050, move close to zero fatalities in road transport. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport.”



Volvo Cars Vision 2020 (2007)

“Our vision is that by 2020 no-one should be killed or seriously injured in a new Volvo car”

The key is the road transport system as a whole



There is a million reasons why we crash,
and more than 90% are related to human
errors





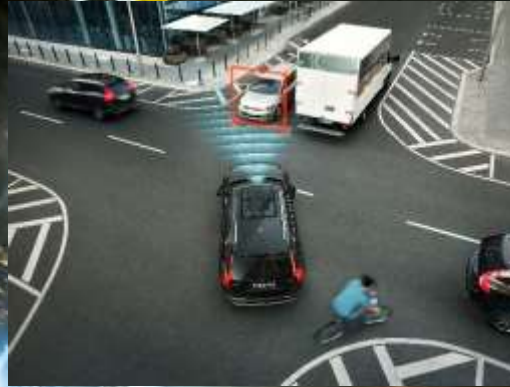
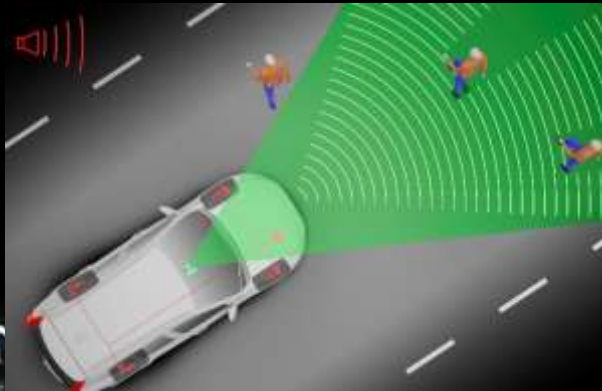
Vehicle safety has improved very much

Cars start to have situational awareness

Many work towards automated cars



There is more coming



What characterizes Autonomous vehicles

- Safety is a given and the limiting factor
- Focus on perceived safety and crash avoidance, but with injury avoidance as a paramount prerequisite
- Careful
- Polite
- Law abiding
- (Almost social)



The Vienna Convention

ARTICLE 7

General rules

- 1. Road-users shall avoid any behaviour likely to endanger or obstruct traffic, to endanger persons, or to cause damage to public or private property.*
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- 3. Drivers shall show extra care in relation to the most vulnerable road-users, such as pedestrians and cyclists and in particular children, elderly persons and the disabled.*



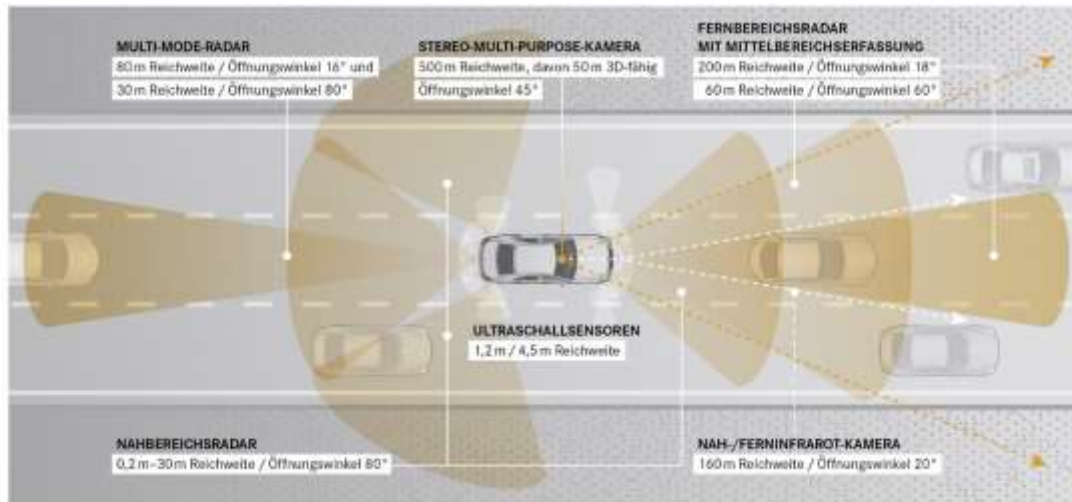
Uncertainty and safety risks can be compensated by low speeds or separation



Low speed



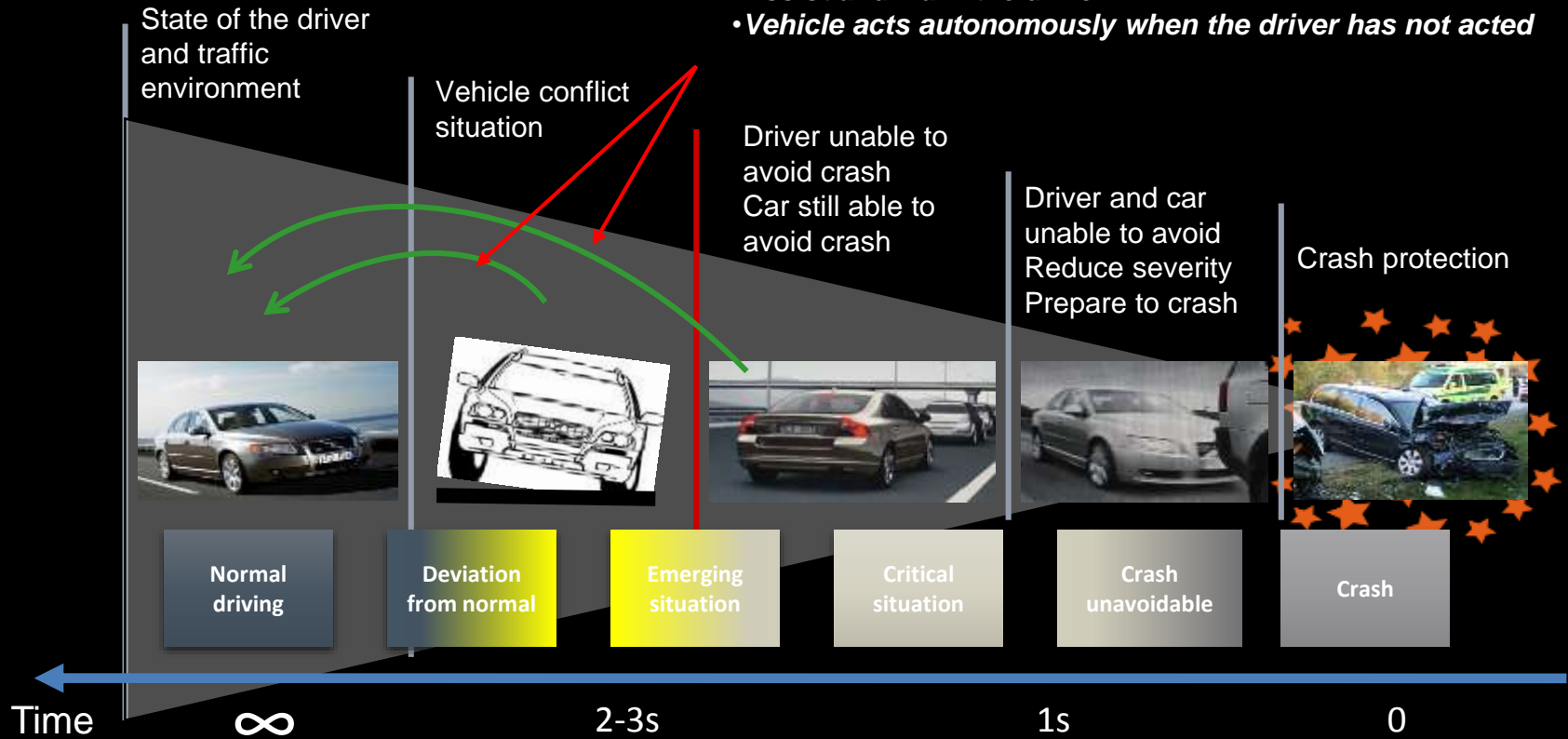
Separation



Driving Sequence

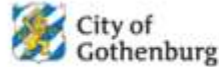
Help the driver to remain in or be pushed back into normal driving mode!

- *Assist and warn the driver*
- *Vehicle acts autonomously when the driver has not acted*



Drive Me

SELF-DRIVING CARS FOR
SUSTAINABLE MOBILITY



- Autonomous Driving on ~50 km typical commuter roads around Gothenburg
- 100 Volvo cars to select leasing customers between 2017-2020
- Autonomous parking
- Real customer experience of different versions of automation. How best to design AD.
- Safety, environment, and traffic influences will be quantified.
- Scientific approach
- Cost: 75 Million GBP



The scope

SAE Level 4

Functionality:

- Highly-automated driving on demand
- Cloud connection
- Secondary tasks allowed
- Certified roads only
- Weather limitations

Road architecture characterized by:

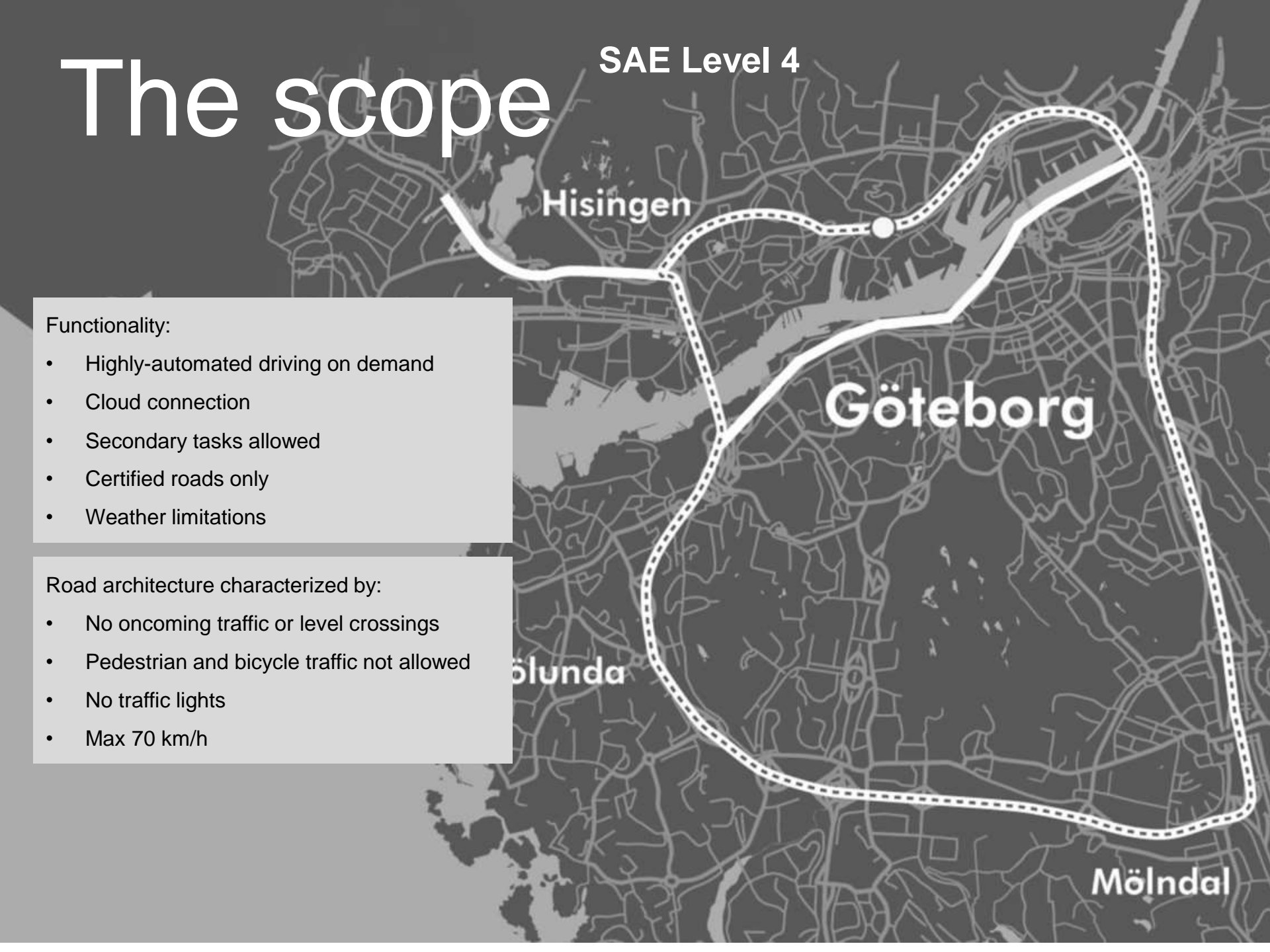
- No oncoming traffic or level crossings
- Pedestrian and bicycle traffic not allowed
- No traffic lights
- Max 70 km/h

Hisingen

Göteborg

Ölunda

Mölnadal



Drive Me Autonomous Driving functionality (L4)

FUNCTIONALITY

- Drive within lane within speed limitations and keeping suitable following distance to car in front. Adapt speed according to surroundings and changing conditions (such as weather).
- Merge to new lane or change lane when required to follow selected route. Overtake slower vehicle if required (Automatic control of turn indicator).
- Perform minimum risk maneuver if required (such as in case of near incident, technical failure, ...).
- Activate driver take over request when reaching end of autonomous driving route. In case of no driver take over initiate minimum risk maneuver, i.e bring the vehicle to a stop with minimal risk, preferably on the shoulder of the road.
- (Monitoring system status to identify potential failures. Activate driver take over request and initiate safe mode in case of failure).



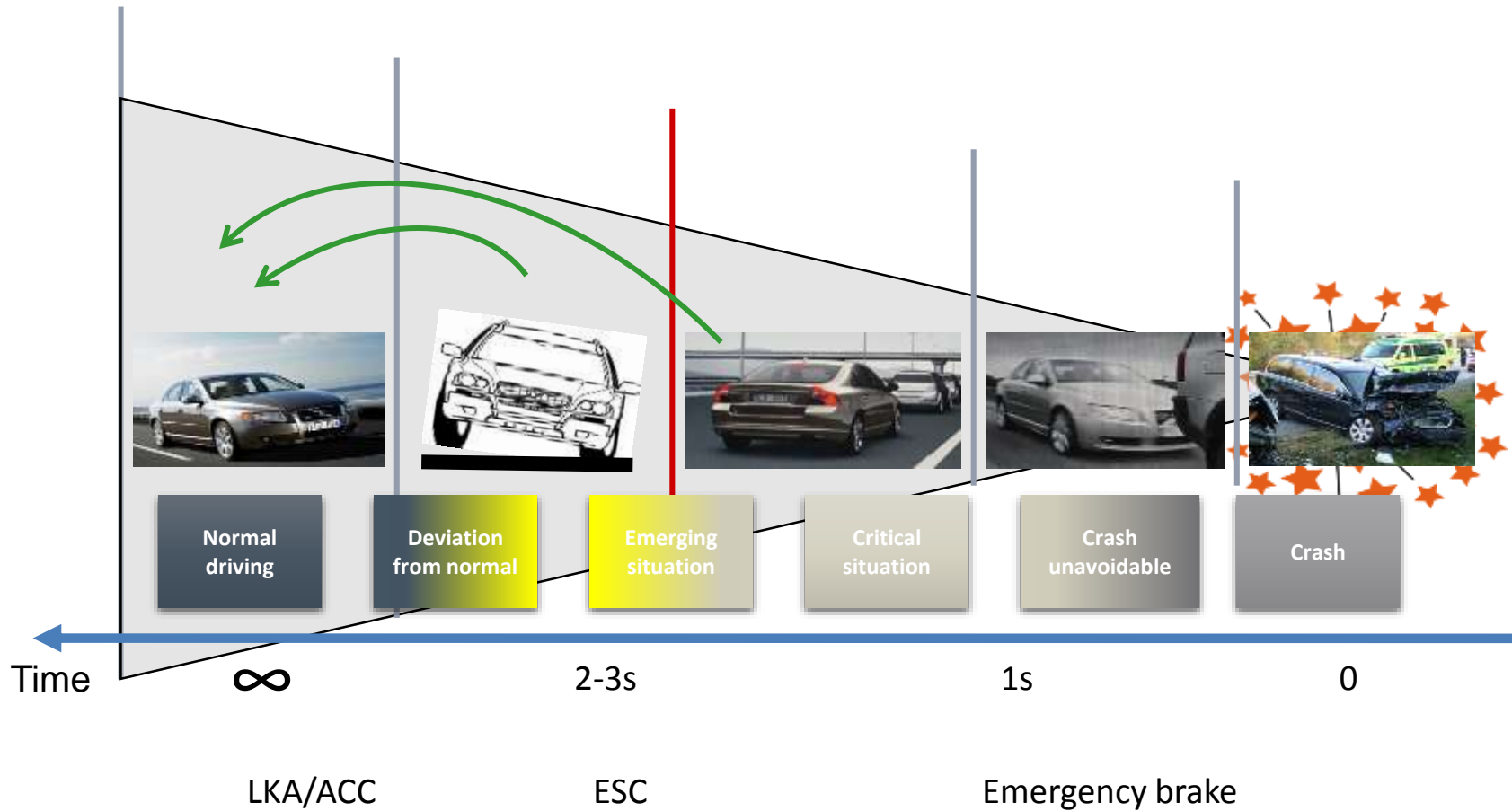
Technical requirements on AD road sections

TECHNICAL REQUIREMENTS

- Road infrastructure characterized by: multiple lanes in same direction, oncoming traffic separated by barriers, no level crossings, no roundabouts, pedestrian and bicycle traffic not allowed, no traffic lights and maximum speed of 70 km/h.
- Good road conditions: clear lane markings, readable speed signs, no speed bumps, limited amount of pot holes and construction sites.
- Preferably a traffic control center monitoring the traffic system.
- Good 3G or 4G connectivity (tunnels allowed with potentially interrupted connectivity).
- Stable weather conditions; no winter conditions or extreme heat.
- Traffic behaviour: road users follow the traffic rules in general, e.g. drive in lane



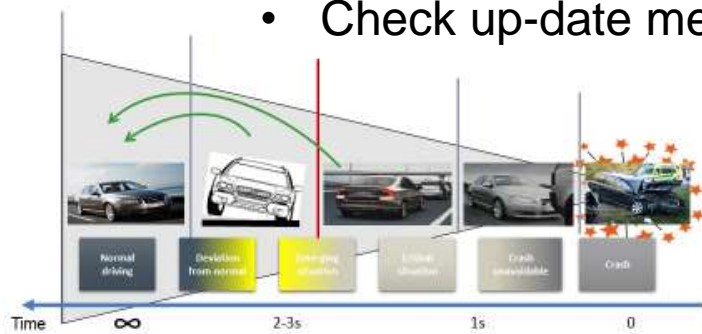
Easier to test in near crash situations, or provoked situations



Ooops per hour/year (up-time)

A way forward

- Verify emergency functions (braking, steering etc.)
- Verify provoked situations (ACC, lane change etc.)
- Check up-time (according to defined function)
- Check outside defined function (geofencing etc.)
- Check accident/incident reporting for continual improvement methods
- Check up-date methods



User is key...

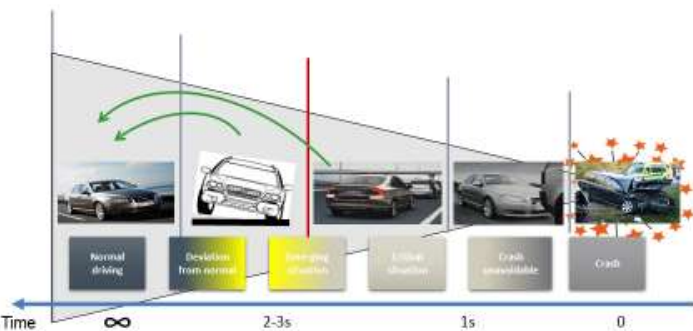
Will users trust:

- Emergency functions
- Support systems (lower levels)
- Hands off / mind off

Users must understand limitations in:

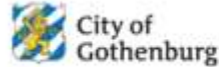
- Emergency functions
- Support systems (lower levels)
- Hands off / mind off

This is a process



Drive Me

SELF-DRIVING CARS FOR
SUSTAINABLE MOBILITY



Driver training process

- First on-line
- Personal communication about the safety systems
- Personal communication about conflict and emergency management
- Training in control handling between car and driver

Refreshing and feedback



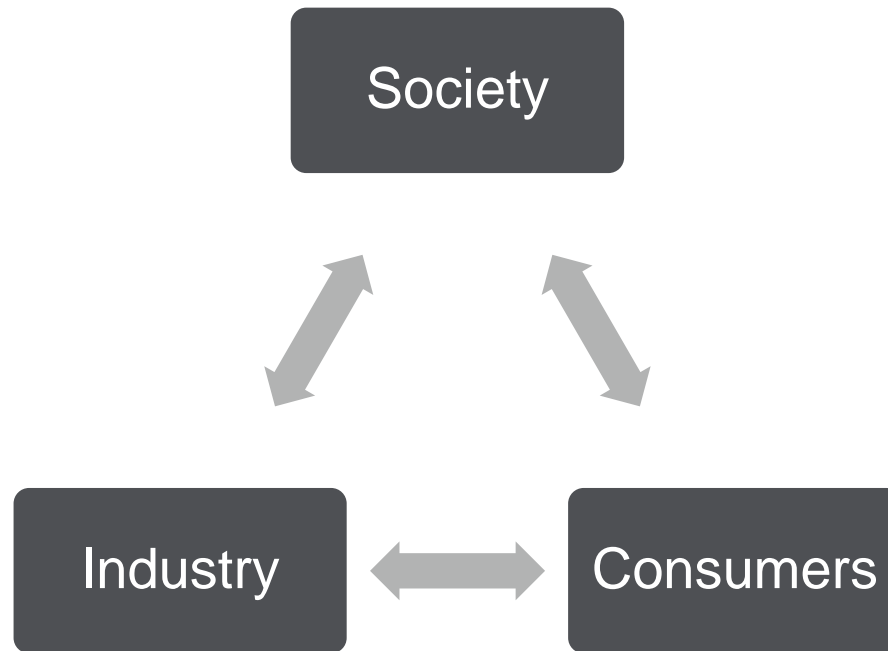


Autonomous Driving

” It is essential that the HMI for handing over the control to the vehicle and also assuming the control back from the vehicle is intuitive and does not need any specific driver training. The status of the control must at all times be perfectly clear and obvious and should not cause any driver hesitation. ”

Anders Eugensson at Volvo Cars

Common interest?



Thank you!



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