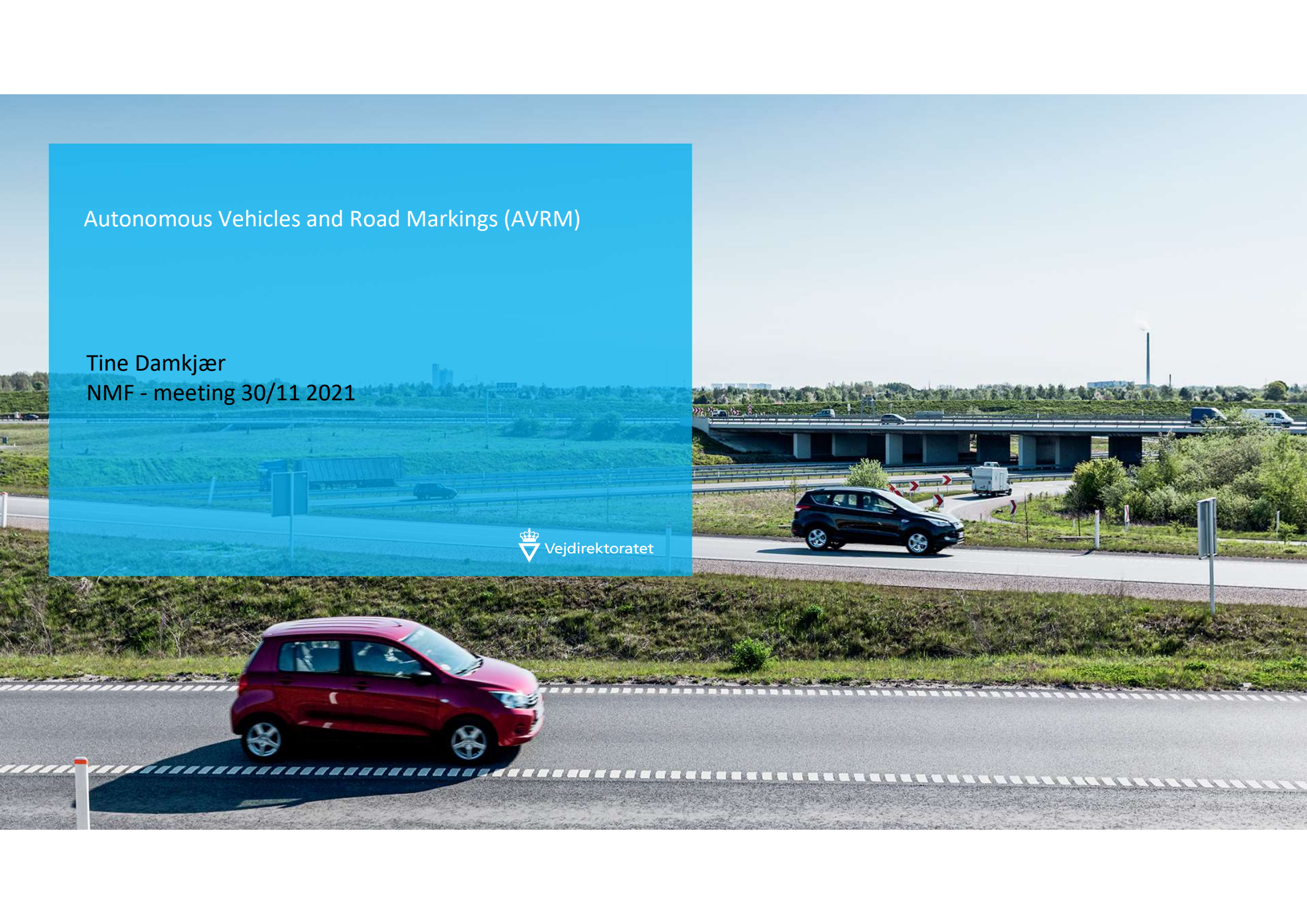


Autonomous Vehicles and Road Markings (AVRM)

Tine Damkjær
NMF - meeting 30/11 2021



The aim of the project and participants

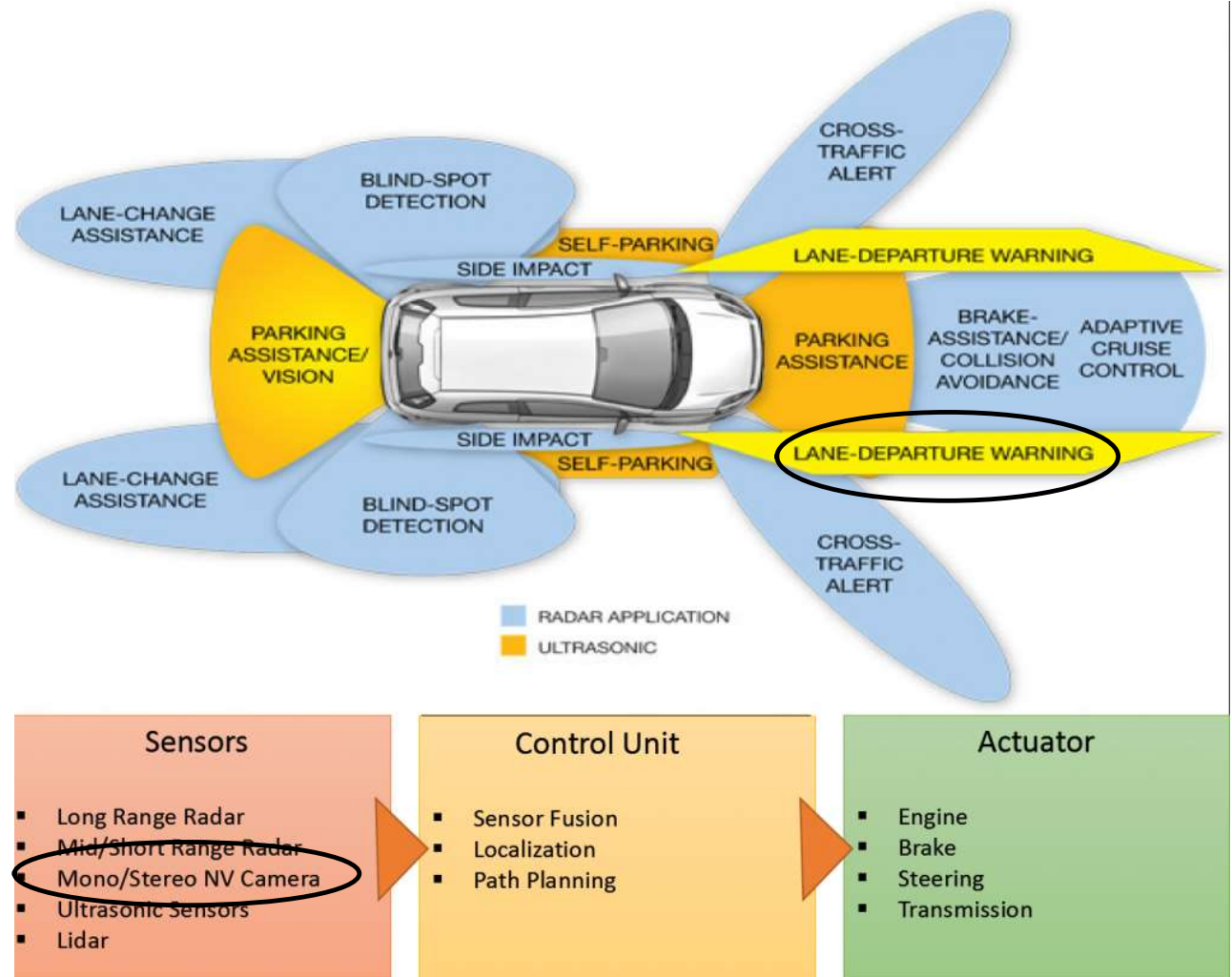
- Advanced Driver Assistance Systems (ADAS) are the common name for several systems that increase driver safety and comfort. These systems have been known for years and are standard in new cars, and the technology is constantly being developed among others because car fleet is becoming more and more self-driving.
- The aim of this project is to obtain data on the Lane Departure Warning systems' ability to register road markings in the Nordic countries and under different road and weather conditions.
- Participating countries: Sweden, Norway, Finland and Denmark (project leader)
- Consortium: VTI, Rambøll A/S and DTI (Danish Technology Institute)

ADAS and the visibility of road markings

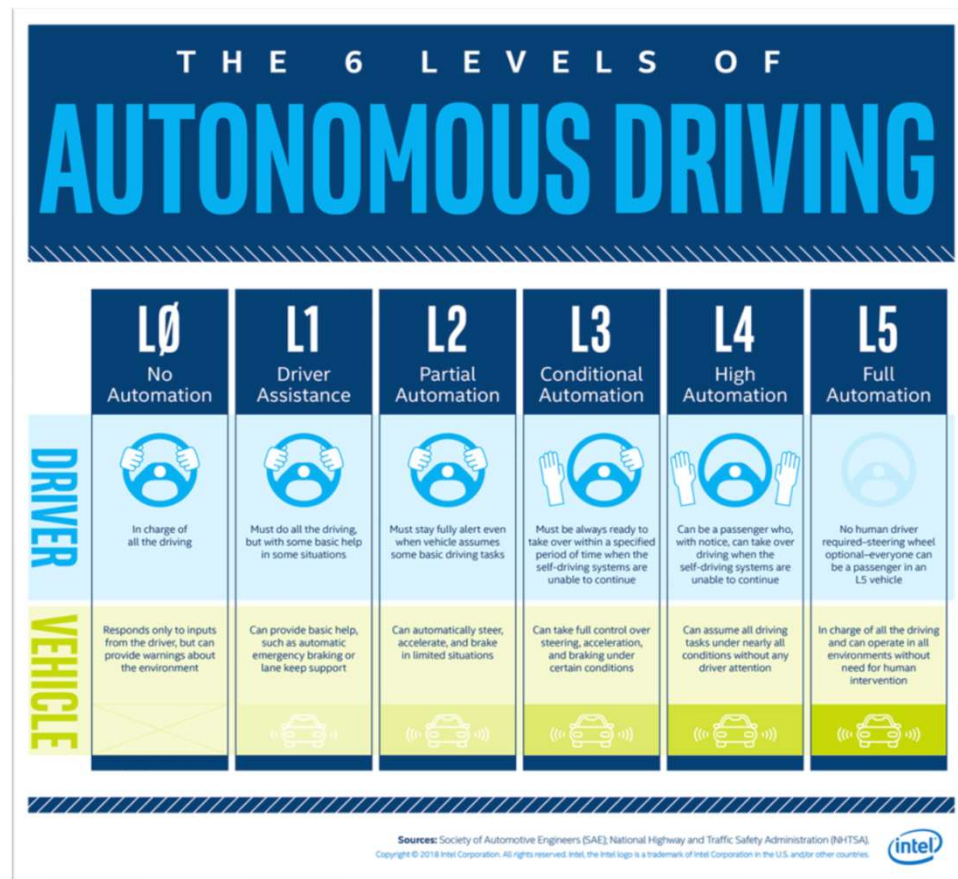
- The electronic systems where the visibility of the road markings is of great importance are:
 - **LDW (Lane Departure Warning)**
 - Systems that warns the driver if the vehicle leaves its lane with visual, audible and / or vibration warnings (Lane Departure Warning, LDW)
 - **LKA (Lane Keeping Assist)**
 - Systems that warns the driver and without response, automatically ensure that the vehicle remains in its lane (Lane Keeping Assist, LKA / Lane Keeping System, LKS)
 - **LC (Lane Centering)**
 - Systems that actively help keep the car centered in the roadway and ask the driver to take over in challenging situations (Lane Centering Assistance, LCA)

ADAS Technology

- The car is equipped with camera sensors and the captured images - constantly changing - are converted into digital data via microprocessors and data processing algorithms.
- This data is included in safety-critical systems such as automatic emergency braking, lane change warning (LDW) and activation and dimming of high beam.



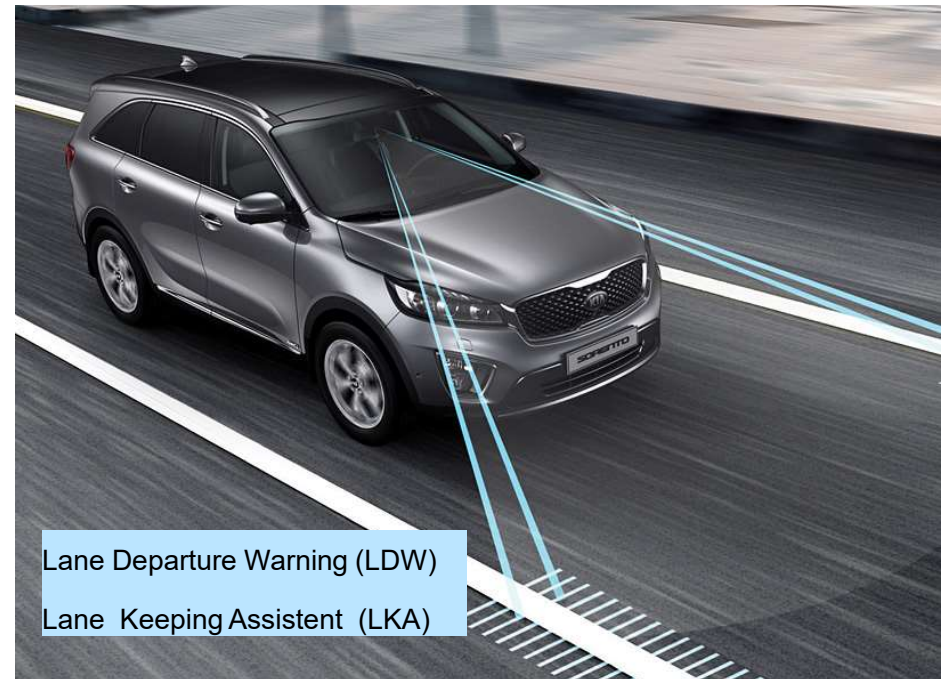
The different levels of automated driving



- Status of today: The technology is around level 2.5
- Level 0 – Level 3, will exist for many years to come.
- And for that reason: Road markings shall be readable to humans and to machine for a long time in the future.

Autonomous Vehicle detecting Road Markings

- What are the requirements for road markings?
- What requirements must / can the road authorities set for the systems?
- Part 1: Literature study with focus on the systems' function and general knowledge.
- Part 2+3: Testing of the systems' registration of the road markings in relation to the current registration.





Literature review



- LDW and LKA performance is affected by:
 - Road environment
 - Road maintenance
 - Weather and light conditions
 - Vehicle speed
- Focusing on road markings: The most important parameter is the contrast ratio between road marking and road surface

Overall discussion and conclusions, part 1

- Road markings support LKA and LDW
- If the road markings can be detected by humans, they can also be detected by machine
- More research is needed on how to improve detection in challenging weather conditions



- Literature: contrast ratio is crucial

Field study implications

- Adverse weather conditions are most relevant
- Determine the relation between systems performance and road marking functionality in wet conditions
- 1: Get knowledge on detecting in challenging weather conditions.
- 2: Get test results on the limit of detection under different conditions and with different types and quality of road markings.

