

VOLVO

Collaborative Research for Safe Connected Automated Driving

AMAA Conference, Berlin

September 26, 2017

On the road

In the city



**WHAT
WE
DO**

Off road

At sea

With the customer in focus

- Improving fuel efficiency
- Optimizing handling and maneuverability
- Improving security
- Preventing information overload
- Reducing weight
- Autonomous driving
- Exploring uptime services: Extended Vehicle technologies



For all Volvo Group brands

Dongfeng Trucks

SA



Nova Bus



SDLG

JV



UD



Eicher

JV



Prevost



Sunwin

JV



Volvo



Mack



Renault Trucks



Terex Trucks



Volvo Penta



JV = Joint Venture
SA = Strategic Alliance

Planning for the future and setting the direction

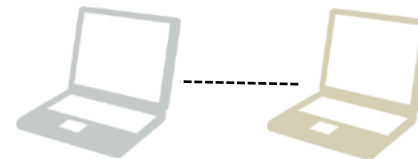
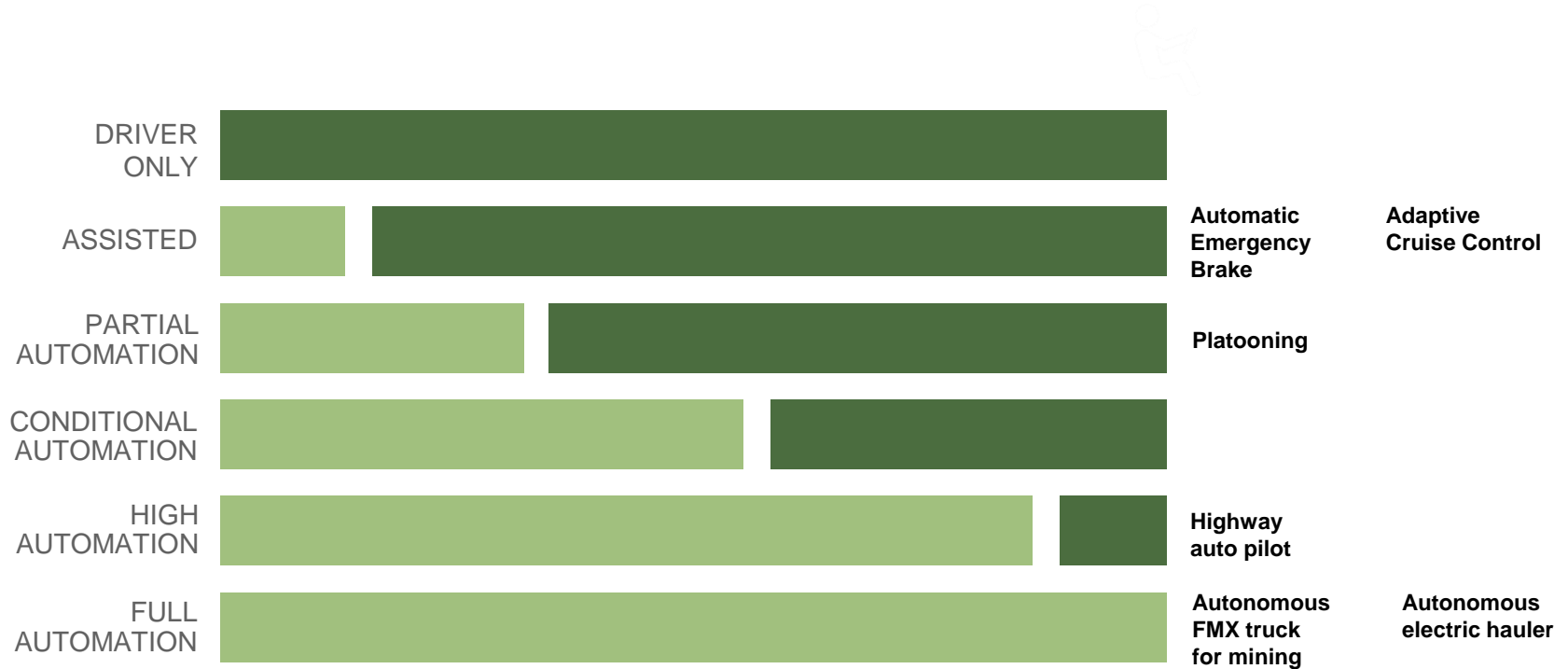
Analyzing customer and society needs

Long term technology development and planning

Planning for competitive product ranges and vehicle services

Research collaboration with suppliers, academia, institutes and authorities

Different levels of automation introduced in parallel



Different solutions for different needs

Automation in confined areas



Automated maneuvering



Urban automation



On-road automation



Traffic Safety

- In the hands of the **human factor**

10%

30%

90%

Volvo's Accident Research Team has been learning from real life accidents since 1969



Vehicle-related



Road environment



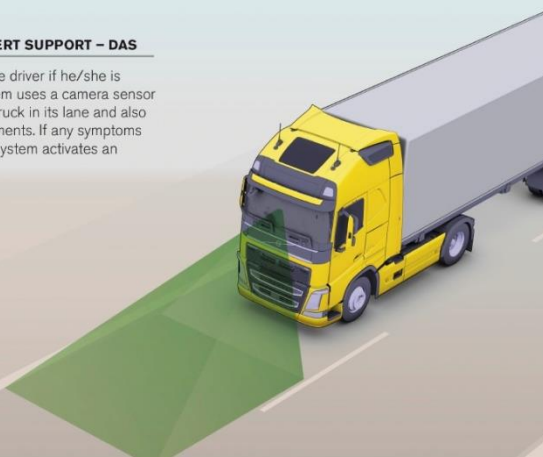
Driver-related

Active Safety products

Driver Alert Support

HOW IT WORKS: DRIVER ALERT SUPPORT – DAS

A support system that alerts the driver if he/she is inattentive or drowsy. The system uses a camera sensor that tracks the position of the truck in its lane and also monitors steering wheel movements. If any symptoms of tiredness are detected, the system activates an audiovisual alert.



Lane Changing Support

HOW IT WORKS: LANE CHANGING SUPPORT – LCS

Changing lanes can be a challenge for drivers due to the trucks blind spots on the passenger side. Lane Changing Support, Volvo Trucks' radar system, is designed to help the driver.

1. THE TURN SIGNAL
ACTIVATES THE SAFETY
SYSTEM.



2. A LIGHT SIGNAL AND
A BUZZER INSIDE THE
TRUCK WARNS THE DRIVER.



Lane Keeping Support

HOW IT WORKS: ADAPTIVE CRUISE CONTROL – ACC

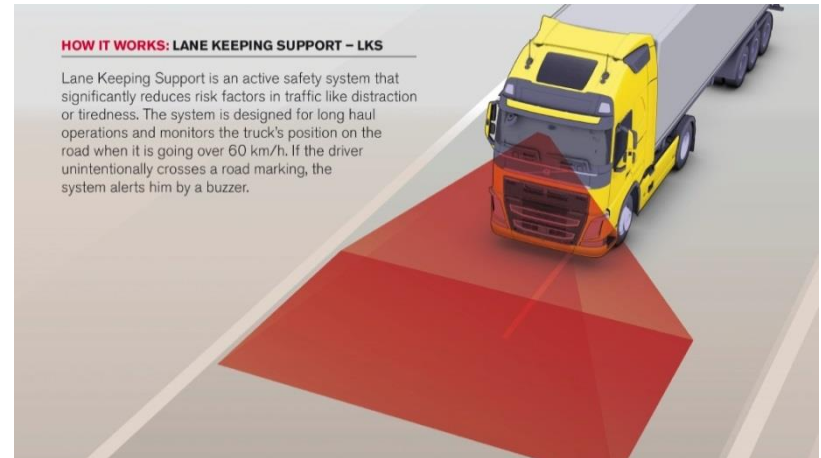
The Adaptive Cruise Control automatically adapts the vehicle's speed to the actual flow of traffic and lets the driver know when the distance to the vehicle in front presents a risk. The system has a radar fitted to the front of the truck, which interacts with I-Shift and the vehicle's brakes. If the distance becomes unsafe, the wheel brakes are activated.



Adaptive Cruise Control

HOW IT WORKS: LANE KEEPING SUPPORT – LKS

Lane Keeping Support is an active safety system that significantly reduces risk factors in traffic like distraction or tiredness. The system is designed for long haul operations and monitors the truck's position on the road when it is going over 60 km/h. If the driver unintentionally crosses a road marking, the system alerts him by a buzzer.



On Road: ADAS towards Autopilot

Customer Value

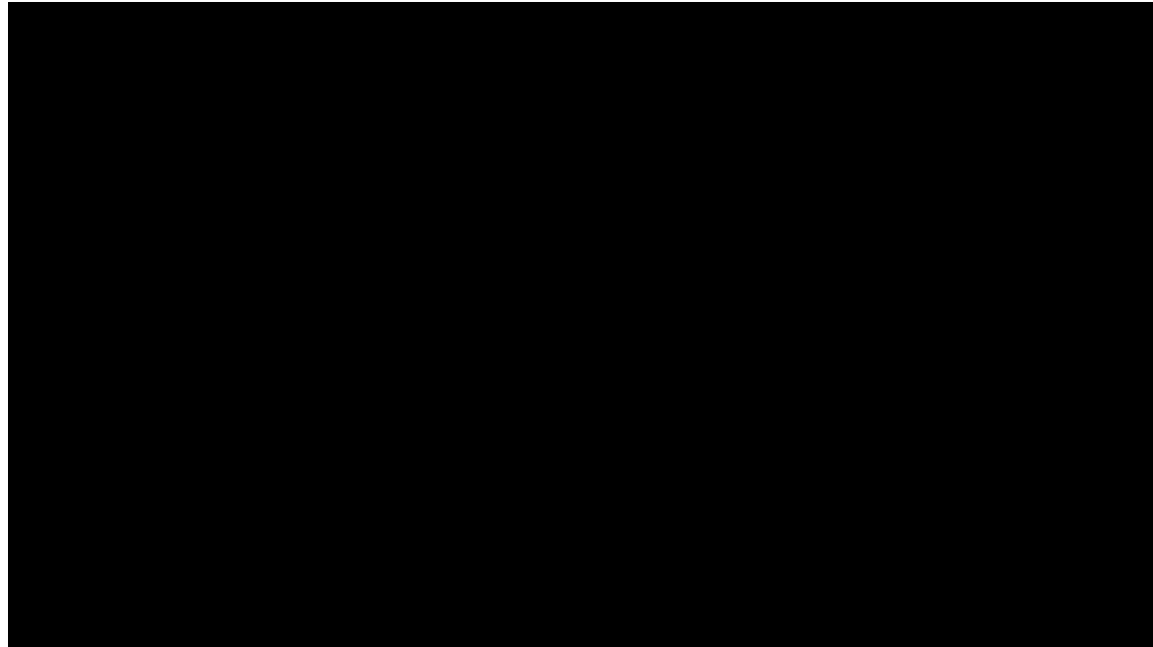
- Safety, Productivity, Convenience

Technology

- Environment perception - sensor and sensor fusion
- Vehicle control and decision

Challenges

- Safety
- Environment perception
- Acceptance
- Regulation
- Infrastructure
- Human factors
- Transition of control



Collision Warning with Emergency Brake

Collaborative ACC towards Automated Platooning

Customer & society Values

- Safety, fuel savings & traffic flow

Definition

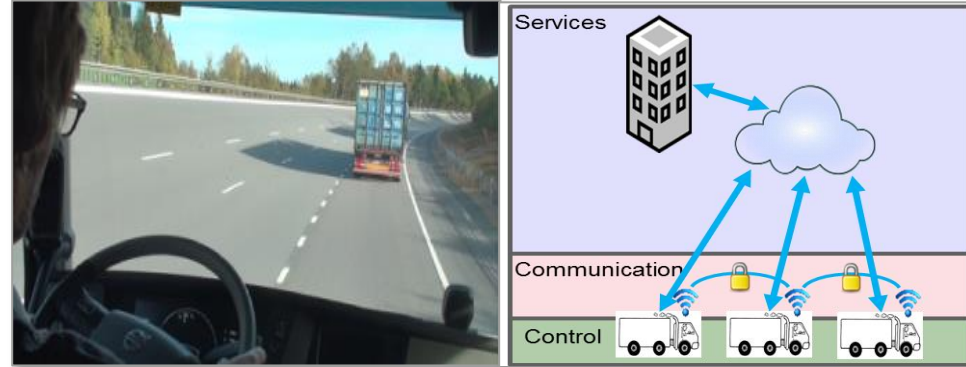
- Communication between trucks for cooperative driveline control and safety

Technology

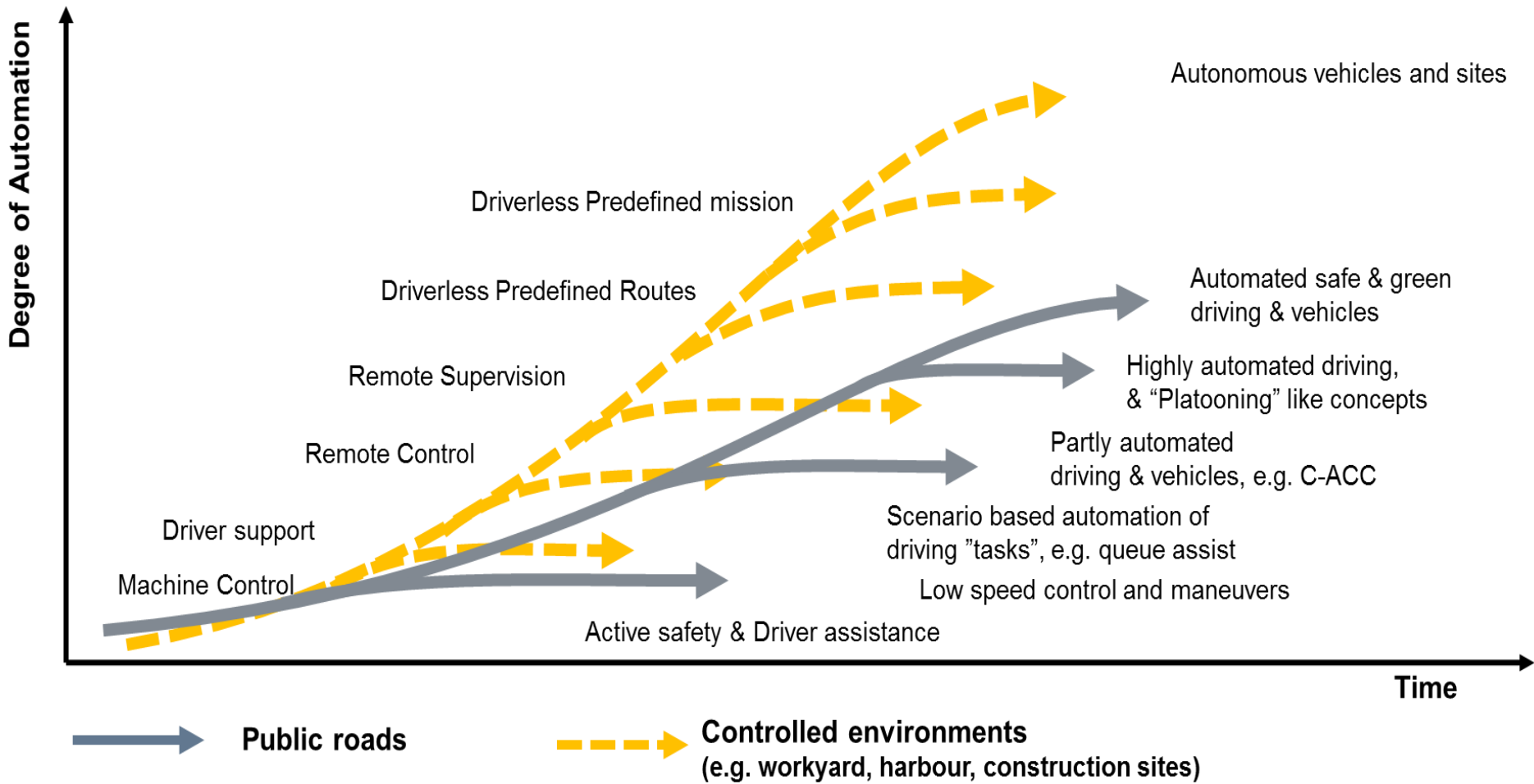
- V2X communication
- High integrity safety

Challenges

- Vehicle to Vehicle introduction cross brand
- Safety sets the limits on time-gap
- User and society acceptance (time-gap and platoon length dependant)
- Regulation and certification



Automation from **Controlled Environments** towards **Public Roads**



Confined Area & Terminals

Customer Value

- Productivity
- Safety
- Energy Efficiency

Definition

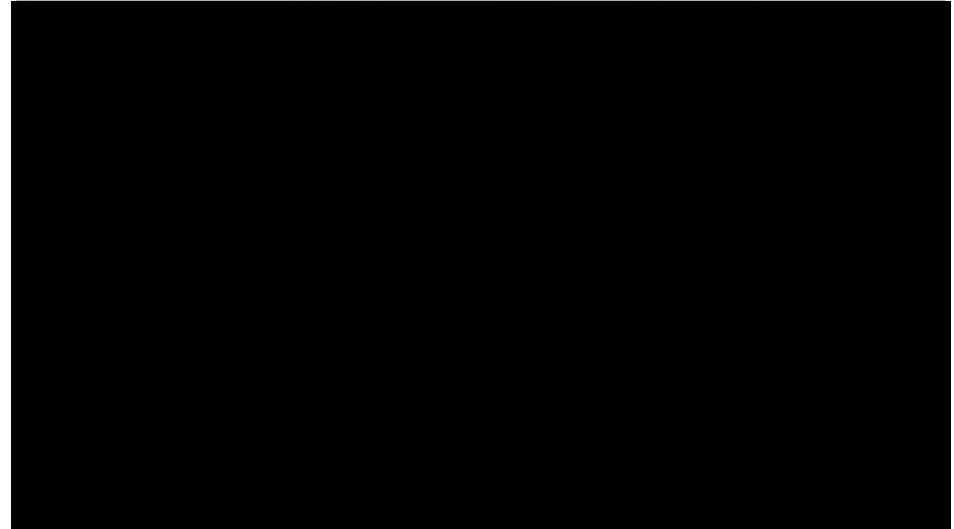
- Automated hauling systems
- Low speed scenarios

Technology

- Fully autonomous vehicles
- Site management & control

Challenges

- Localisation
- Site production system integration



Automated mining truck



Electric automated hauler

Autonomous Refuse Truck in the Urban Environment

Customer Value

- Productivity and Safety
- Improved working condition
- Lower environmental impact

Definition

- Automated refuse handling

Technology

- Automated vehicles
- Reversing operation
- Site management & control

Challenges

- Localisation
- Manuvering
- Recycling system integration



*Volvo Group, together with Swedish waste and recycling specialists **Renova**, is testing a pioneering autonomous refuse truck that has the potential to be used across the urban environment. The project explores how automation can contribute to enhanced traffic safety, improved working conditions and lower environmental impact*

Industry and society need to work together

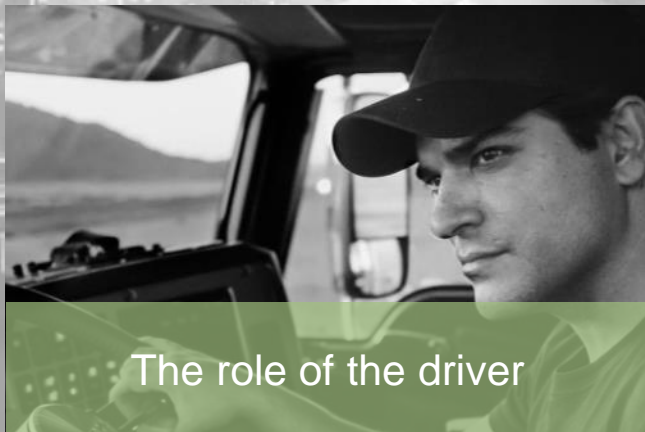
Standards, rules and regulations



Cyber security



The role of the driver



Social acceptance





Working Group: Connectivity & Automated Driving *Roadmap Update in Progress*

Automated Vehicle Development Paths
for Freight Transport

Extract from the final version 7.0
29 May 2017

ERTRAC Roadmap on Automated Driving



- New 2017 version: full update!
- ✓ Common definitions agreed by the industry
 - ✓ Up-to-date development paths for 3 applications
 - ✓ Updated information on EU and national initiatives
 - ✓ New structure for 11 key challenges
 - ✓ Recommendations for H2020 WP2018-2020



Why Automated Driving?

Automated Driving is seen as one of the key technologies and major technological advancements influencing and shaping our future mobility and quality of life. The main drivers for higher levels of Automated Driving are:

- **Safety:** Reduce **accidents** caused by human errors.
- **Efficiency and environmental objectives:** Increase **transport system efficiency** and reduce time in congested traffic. Smoother traffic will help to decrease the energy consumption and emissions of the vehicles.
- **Comfort:** Enable user's **freedom** for other activities when automated systems are active.
- **Social inclusion:** Ensure **mobility** for all, including elderly and impaired users.
- **Accessibility:** Facilitate access to city centres.

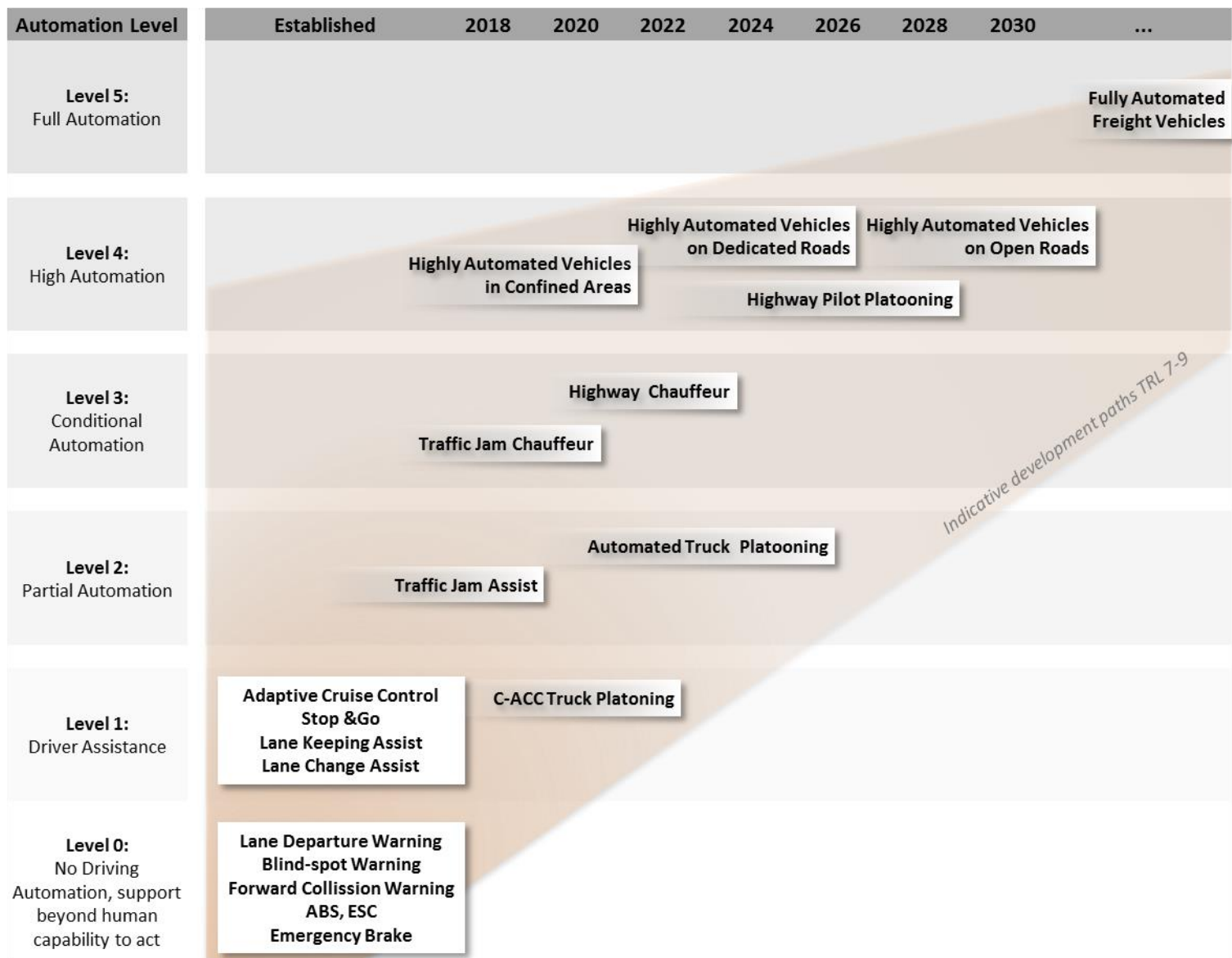


Road Definitions

- **Public road** with mixed traffic in single or multiple lane operation on regional, and highway operation, various automation level vehicles. Local, regional, national and European and cross border regulation needs to be taken into consideration when targeting automation level.
- **Dedicated road/lane** where vehicles with defined automation level are allowed but the area is not confined, such as parking areas and dedicated lanes . Higher level of automation could be considered.
- **Confined areas** with restricted access control, such as terminal areas and ports. Full automation for autonomous vehicles could be considered.



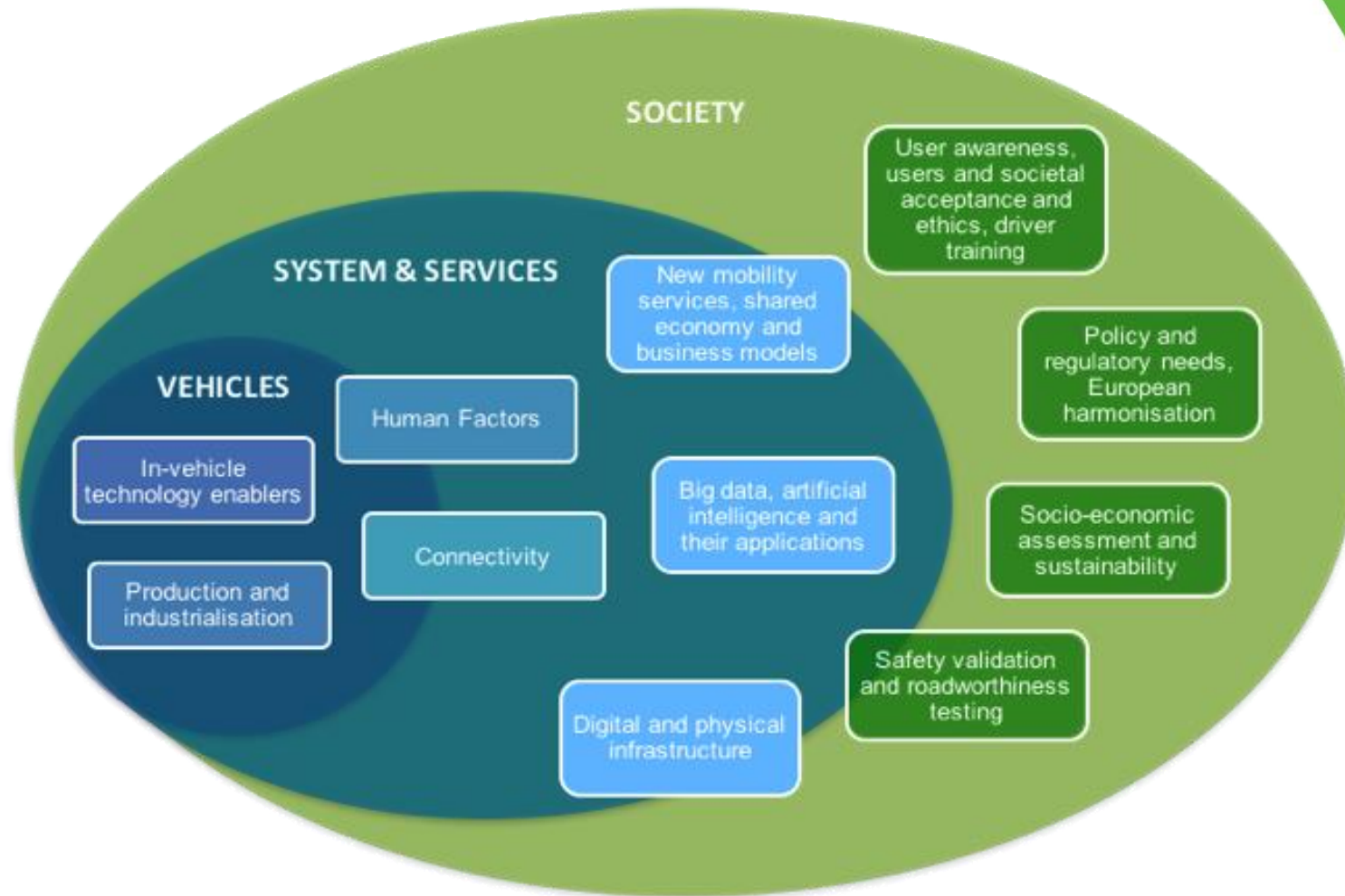
Automated Freight Vehicle Development Paths

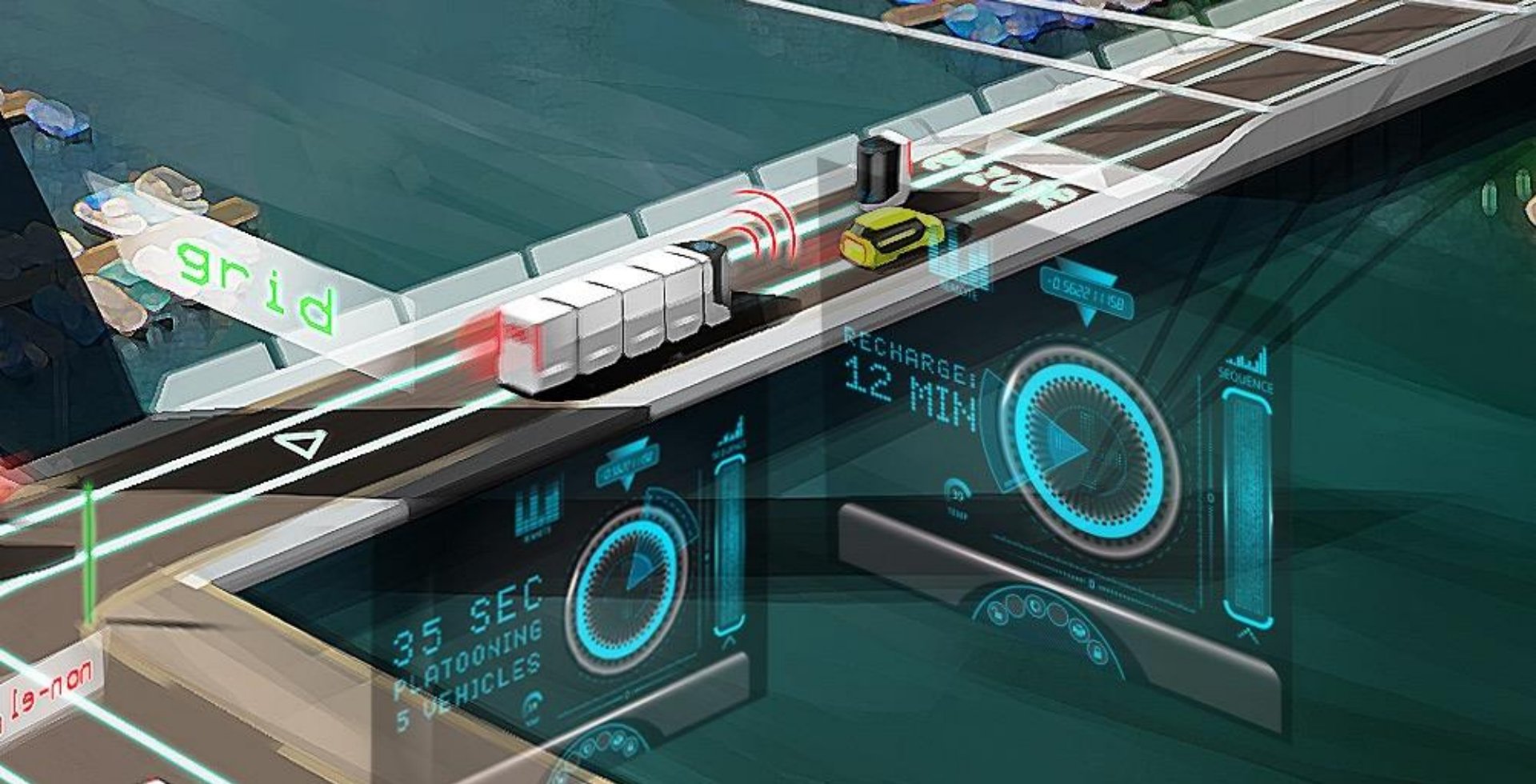


Truck: Freight vehicle > 3.5 tonnes categorie N2 or N3



Key Challenges on the Path to Higher Levels of Automated Driving





VOLVO GROUP TRUCKS TECHNOLOGY

Safe Connected Automated Driving
AMAA Conference September 25

Volvo Group Trucks Technology

Collaborative Research for Safe Automated Driving

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