VOLKSWAGEN

AKTIENGESELLSCHAFT

AUTOMATION OF HEAVY DUTY VEHICLES

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AGENDA

- Commercial Vehicles and User Needs

- How to support truck drivers

- Traffic Jam Pilot - Automation of Trucks in dedicated scenarios

- Outlook

Presentation deals with experiences in a research cooperation between Volkswagen and SCANIA between 2011 to 2014.
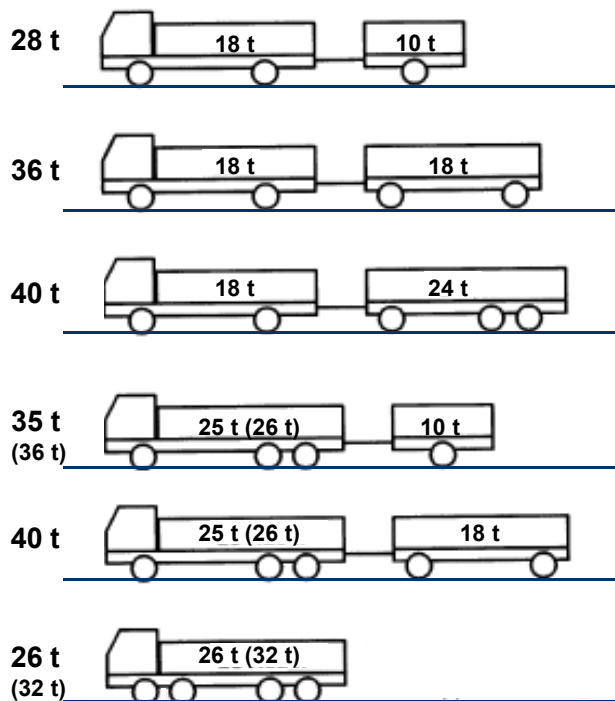
From second quarter 2015 the Volkswagen AG founded an integrated commercial vehicle company, called Volkswagen Truck & Bus GmbH. This allows to concentrate activities for trucks and busses and react much quicker and in a more efficient way. Headquarters of Volkswagen Truck & Bus GmbH is located in Braunschweig.

COMMERCIAL VEHICLES AND USER NEEDS

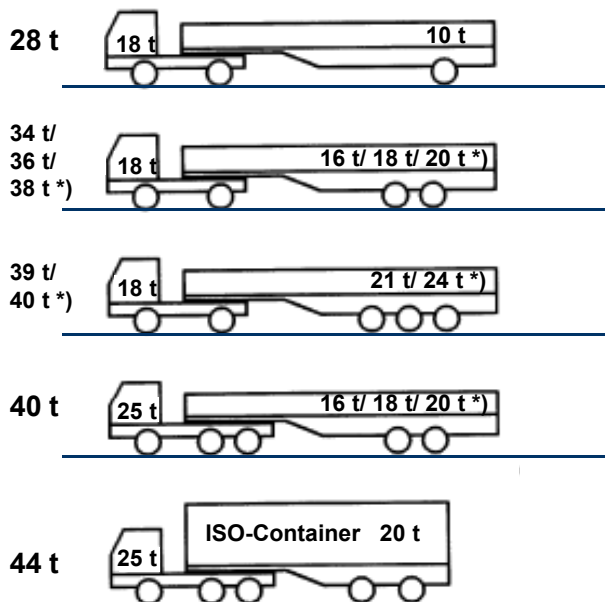# HEAVY VEHICLES – SOME LONG HAULAGE CONFIGURATIONS IN EUROPE

Truck and Trailer

28 t — 18 t — 10 t

36 t — 18 t — 18 t

40 t — 18 t — 24 t

35 t (36 t) — 25 t (26 t) — 10 t

40 t — 25 t (26 t) — 18 t

26 t (32 t) — 26 t (32 t)

( ) drive axle with air suspension and twin tyres
*) depending on axis-centre distance

Maximum Length: 18,75 m

Tractor and Semitrailer
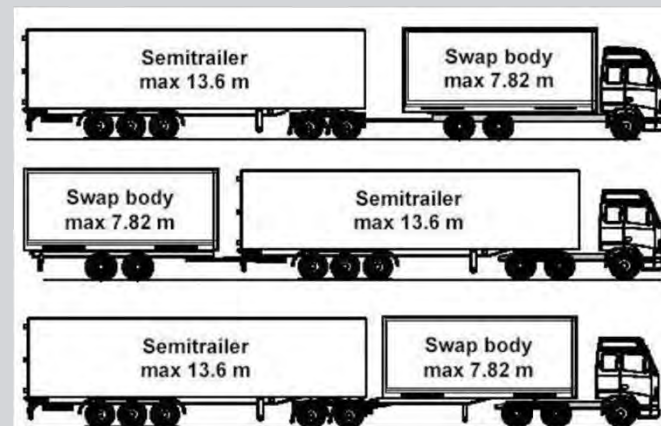

28 t — 18 t — 10 t

34 t/ 36 t/ 38 t *) — 18 t — 16 t / 18 t / 20 t *)

39 t/ 40 t *) — 18 t — 21 t / 24 t *)

40 t — 25 t — 16 t / 18 t / 20 t *)

44 t — 25 t — ISO-Container   20 t

*) depending on axis-centre distance

Maximum Length: 16,50 m

60 tons Trucks („Gigaliner")

Semitrailer max 13.6 m — Swap body max 7.82 m

Swap body max 7.82 m — Semitrailer max 13.6 m

Semitrailer max 13.6 m — Swap body max 7.82 m



Maximum Length: 25,25 m

SUPPORT DRIVERS TO REDUCE DRIVER'S LOAD — INCREASE OF PRODUCTIVITY AND EFFICIENCY BY AUTOMATION

Motivation:

- Keeping truck in lane is of high importance due to driving stability and avoiding accidents
- Numerous blind spots around the truck might cause problems while doing lane changes
- Limited driving times due to European rules (typically 9 h a day)
- Truck driver labour costs is of about 1/3 of costs of entire transport
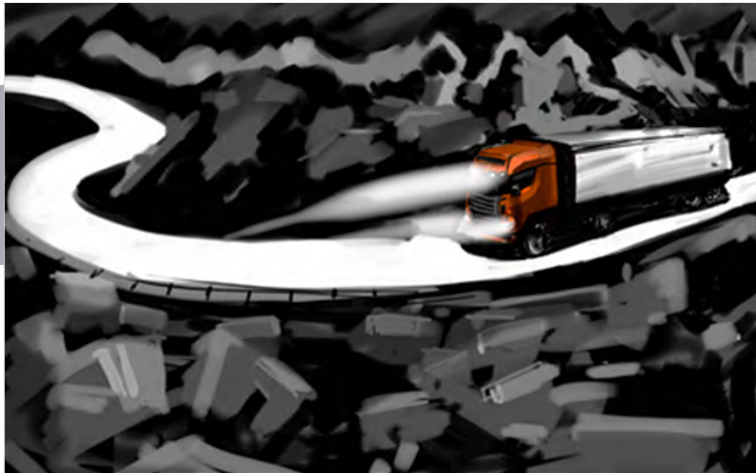
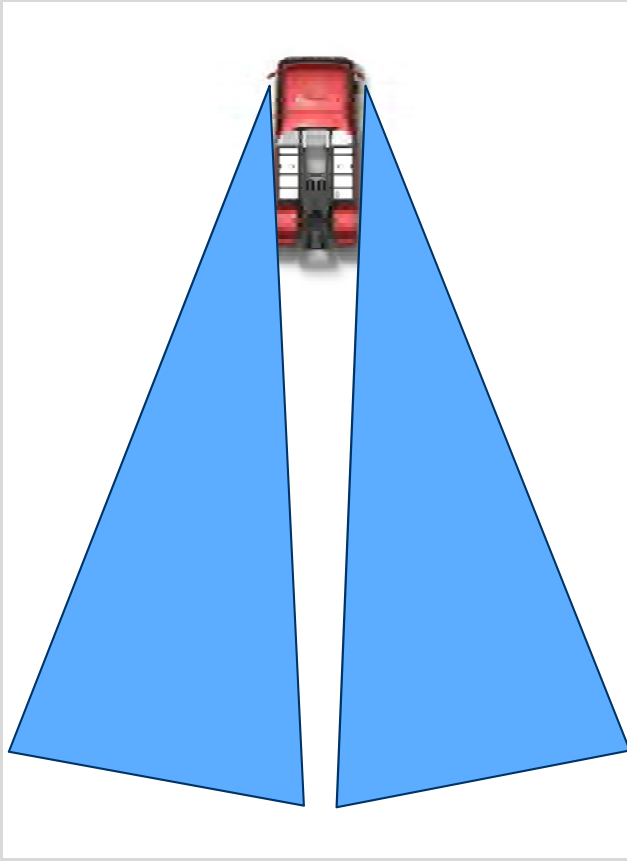Active Lane Keeping Assistance
Active Lane Change Support

Traffic Jam Pilot
(Automated Drive in Traffic Jams with Secondary Tasks)
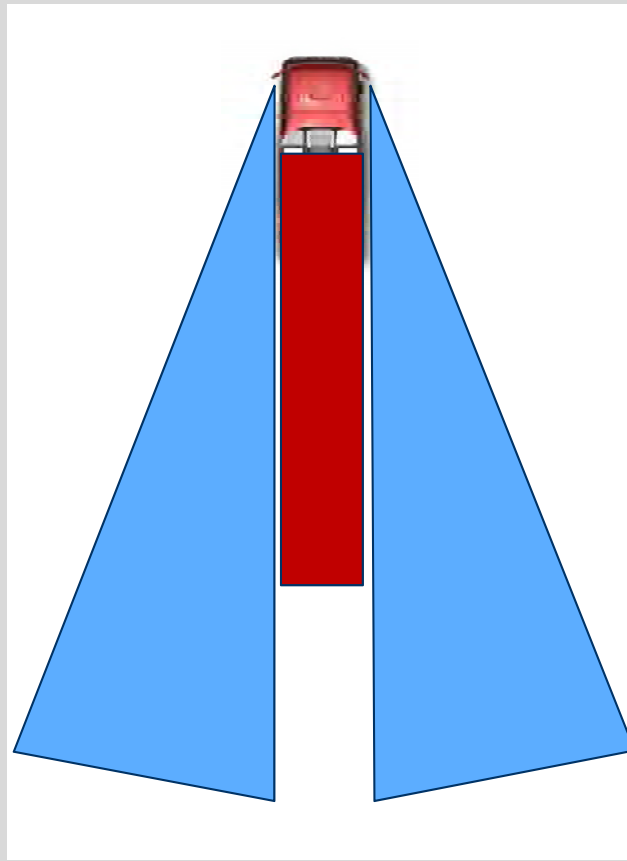
CUSTOMERS' PROBLEM – BLIND SPOTS

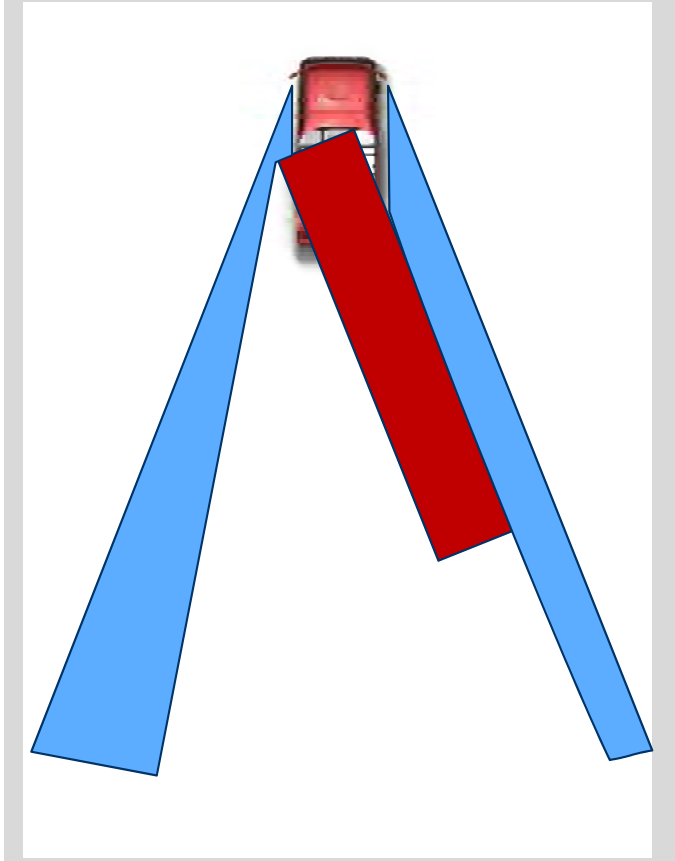- Truck drivers have to cope with large blind spots around the tractor-trailer combination.
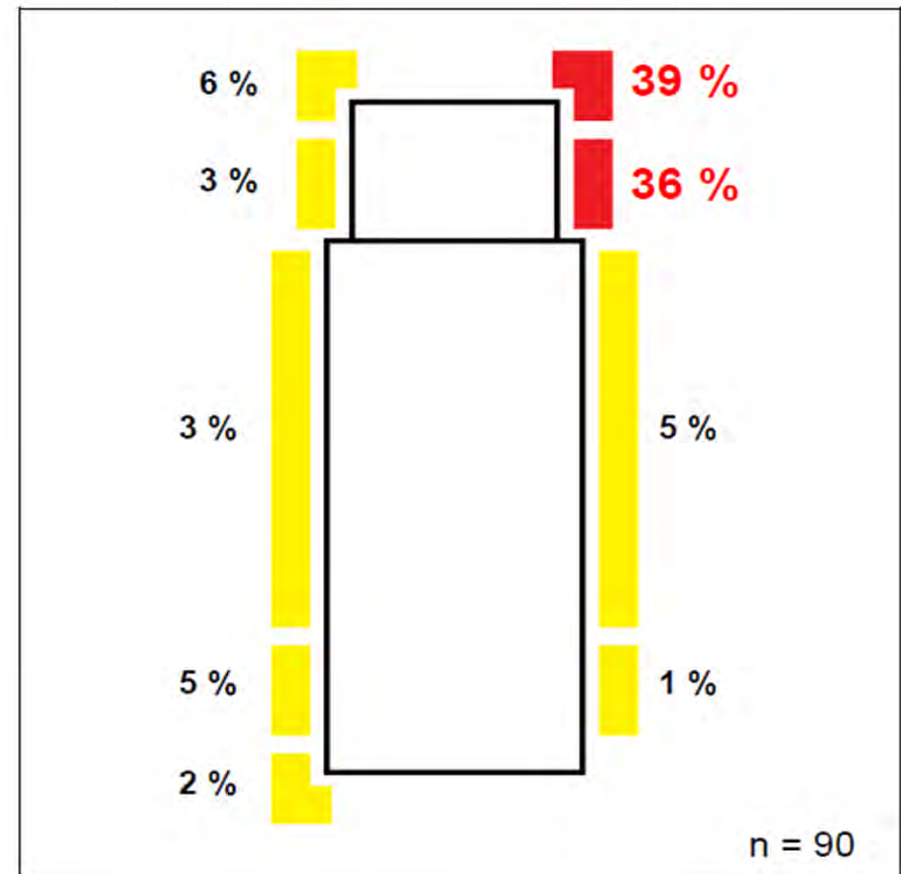
Tractor	Tractor-Trailer Configuration	...with Articulation Angle

CUSTOMERS' PROBLEM WHILE CHANGING LANES

- It is mandatory to equip trucks with 6 mirrors to increase the view.
  Still large blind spots remain.

- Majority of contacts with other traffic participants while changing lane is at right cab side.

Distribution of contact points of a truck with other traffic participants while changing lane (Source: AKTIV project)

ACTIVE LANE CHANGE SUPPORT

BENEFITS OF LANE CHANGE SUPPORT

- Lane change manoeuvres of trucks might cause conflicts with other traffic participants (due to difficulties to observe the trucks' surrounding by the driver)

- Lane change support warns truck driver in such situations

- Active lane change support counter-steers actively in case the driver really executes a lane change
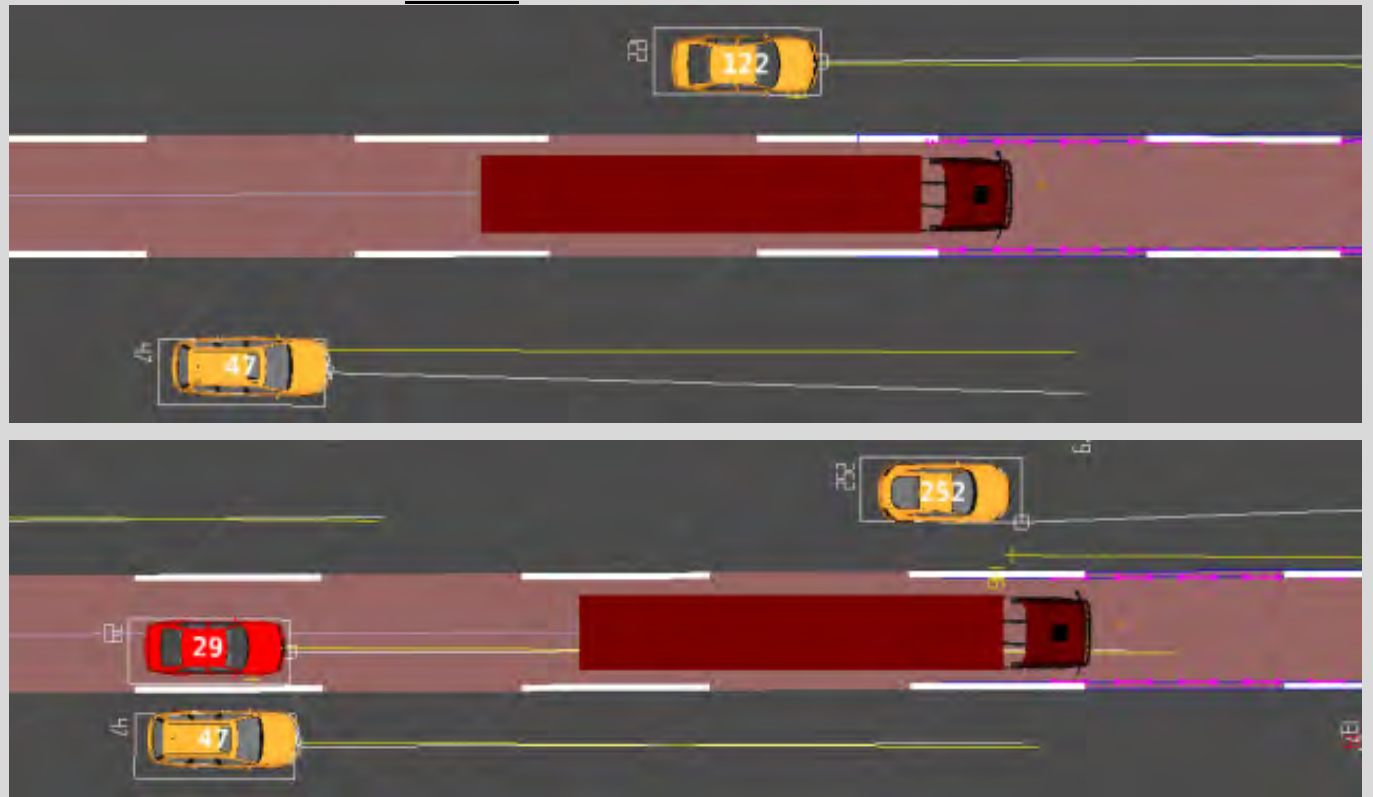
- Contribution to safety on roads
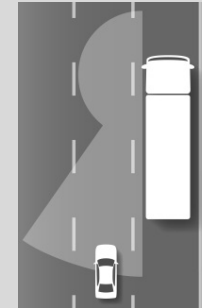
SENSING SYSTEM
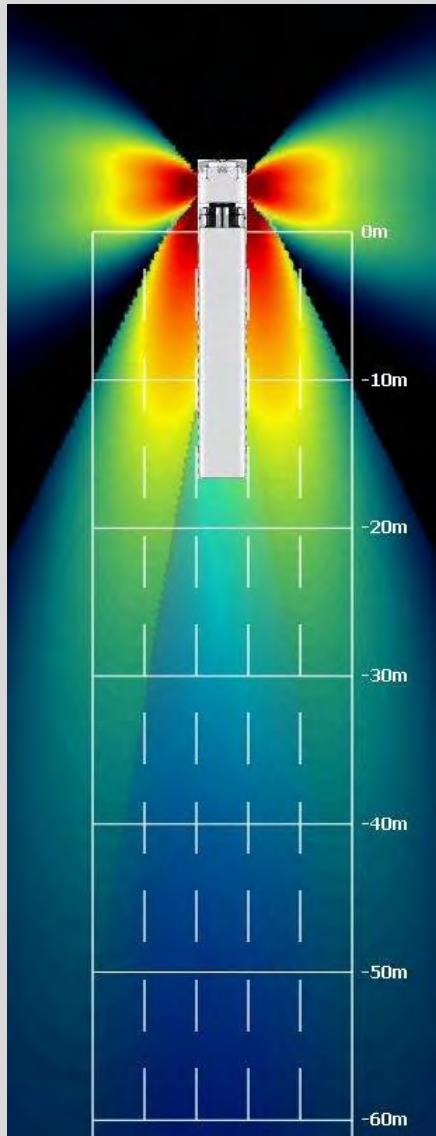
- 2x rear-looking radars (24 GHz)
- 2x side-looking radars (24 GHz)
- High performance detection system, no effects by trailer detected

- Precise detections <u>next to</u> truck observed
- Precise detections <u>behind</u> truck observed
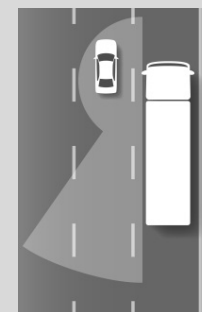
INNOVATIVE HMI FOR LANE CHANGE SUPPORT
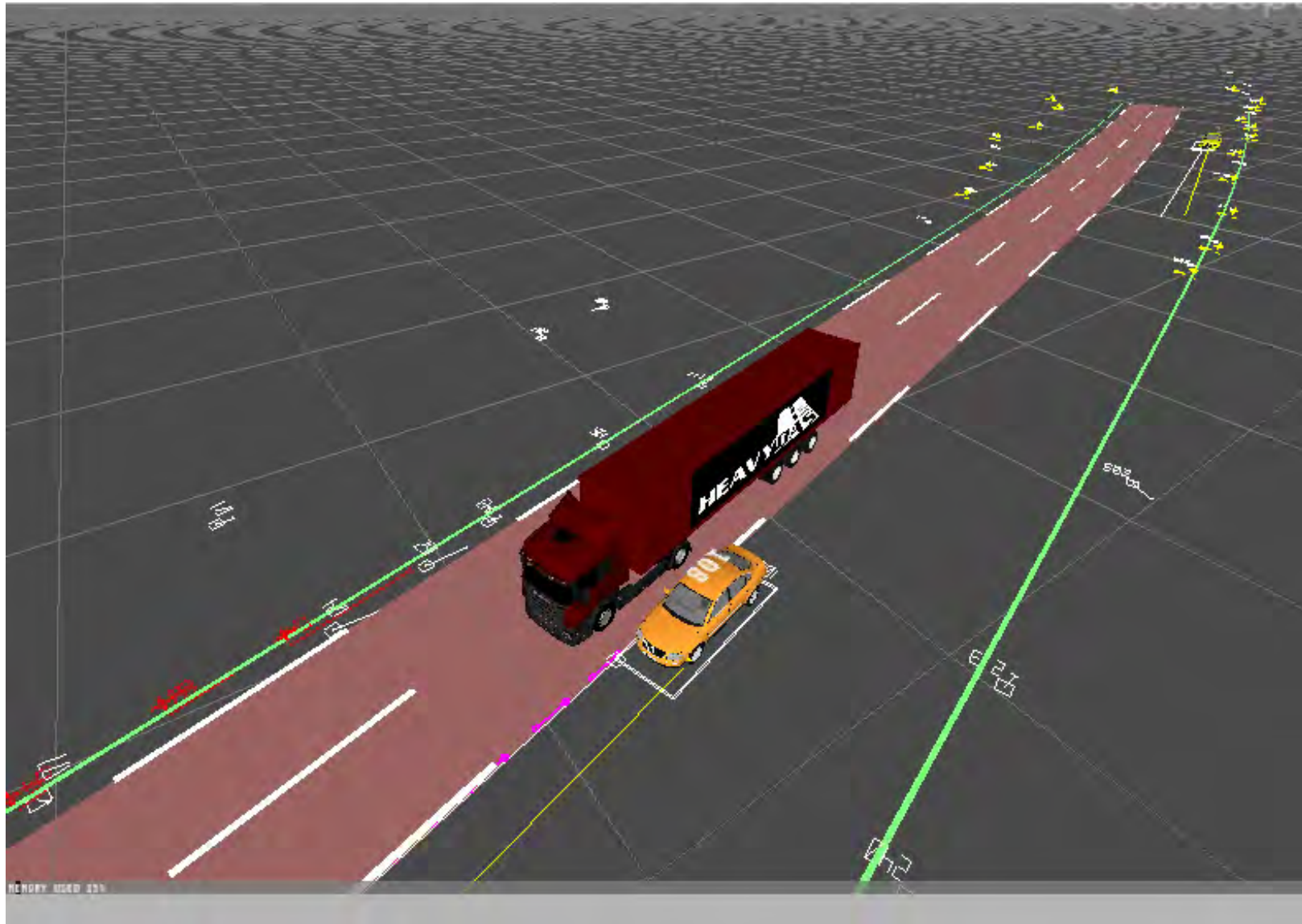
Car behind Truck

Car next to Truck

Car at left corner in front of Truck

ENVIRONMENTAL PERCEPTION SYSTEM

TRAFFIC JAM PILOT
-
AUTOMATION IN TRAFFIC JAMS WITH SECONDARY TASKS

BENEFITS OF AUTOMATED DRIVING IN TRAFFIC JAMS

- Automated drive does not count as „Steering Time" from Tachograph viewpoint *)
- Efficient driving strategy reduces fuel consumption
- Reduction of driver's load in Stop & Go scenarios
- Automation enables longer drives per day
- Increase of transport's economy

*) Legal conditions might have been adapted

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RECOGNITION SYSTEM

VRU camera

Radar (77 GHz)

Ultrasonic

Mono Camera

Stereo Camera

Radar (24 GHz)
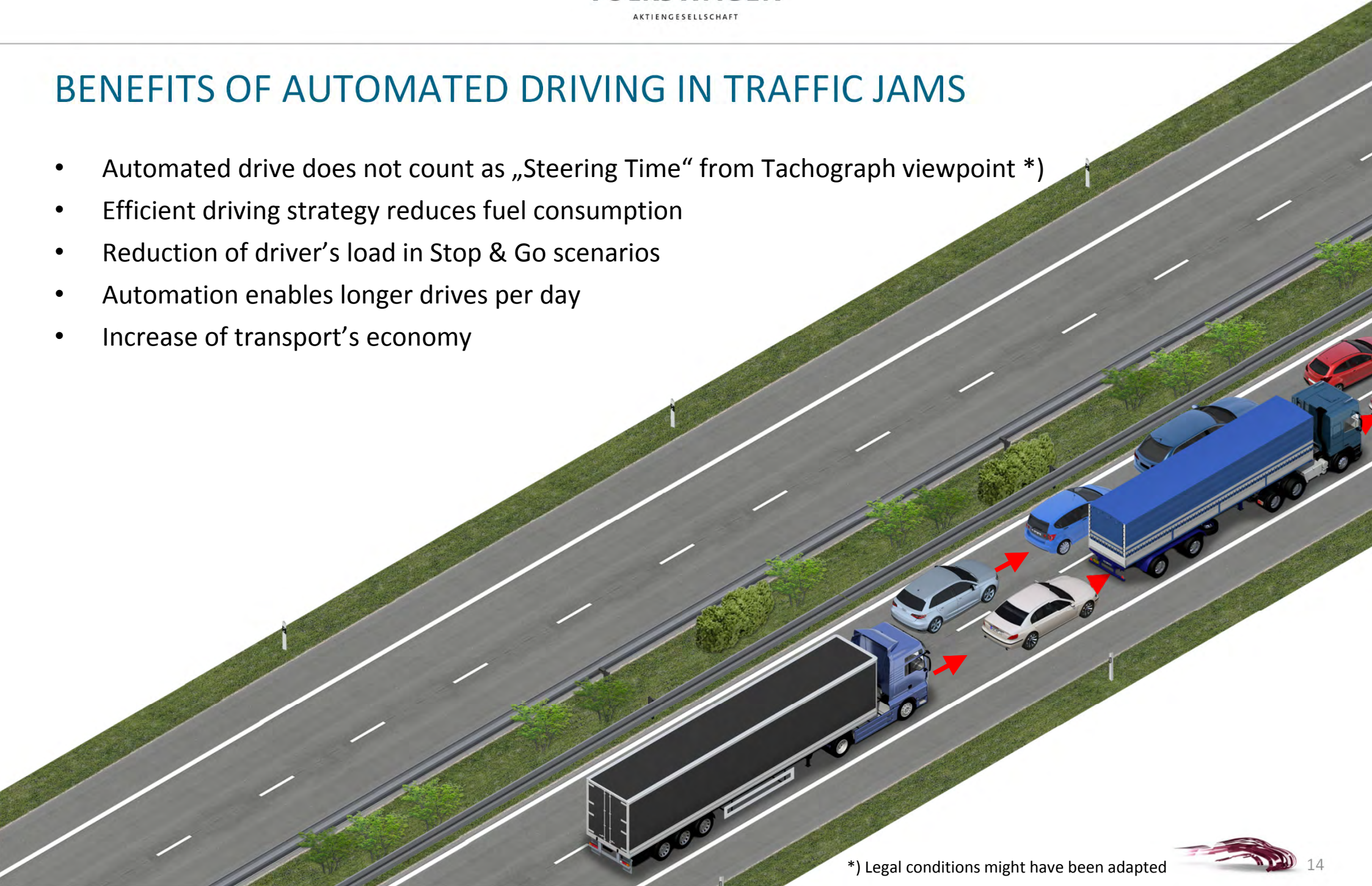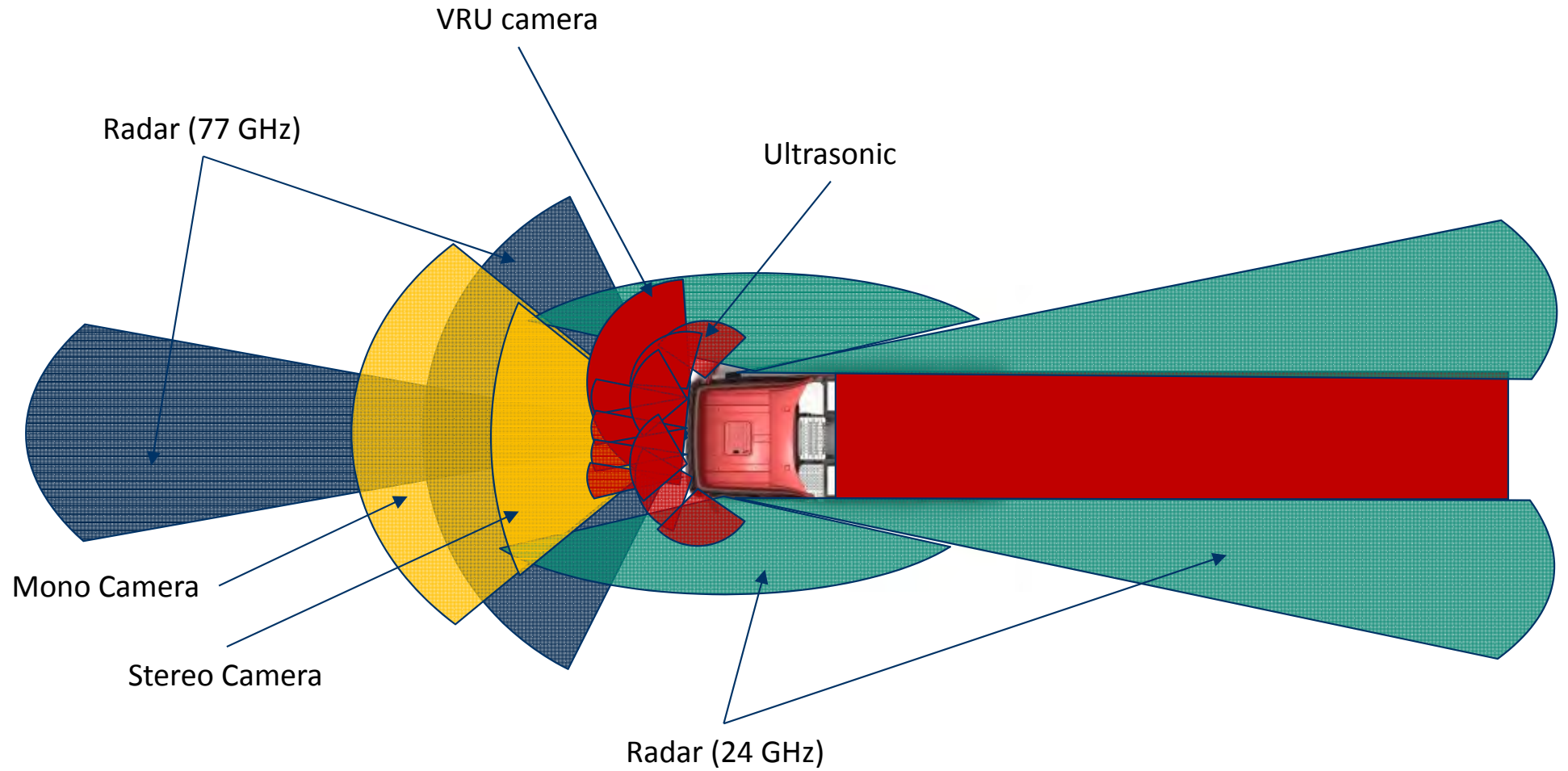
Not in scale

SECONDARY TASKS

Why secondary tasks?

- Secondary tasks allow the driver to do something different than driving.

- Idea: Tachograph can be switched from "Steering" ⊙ to "Rest" ⊢ or "Availability" ⊘   *)

- "Driver" can work longer per day. More km can be driven per day.
  Haulier increase cost effectiveness for transport.

What is the challenge for secondary tasks in L3 systems?

- Due to safety the driver should be able to take over driving task within 10 sec.

How is the required take over time guaranteed?

- Mobile device offers in the "Active Frame App"
  simultaneously information about the vehicles' state
  and its surroundings.

- This contributes in a positive way that the take over time
  is below 10 sec.

Secondary Tasks on Mobile Device „Active Frame Concept"

HMI CONCEPT IN INSTRUMENT CLUSTER
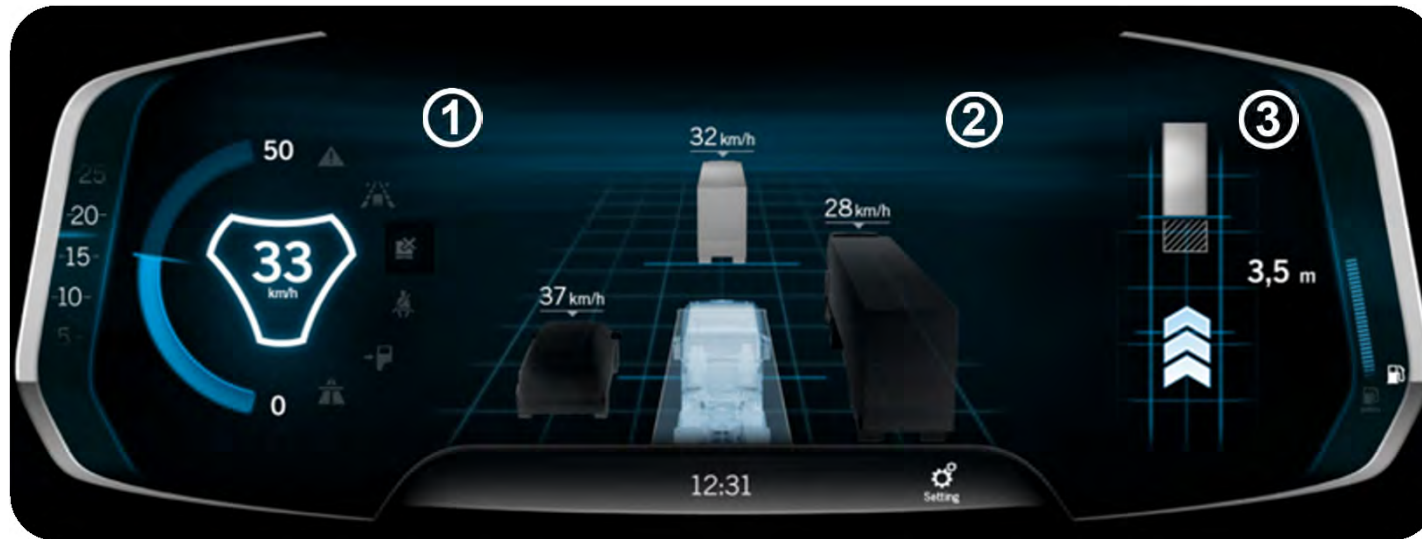
Permanent Visualization of important State Information to Driver enables an Understanding of the Situation

① State Display with Speed and Preconditions for automated drive

② Animated Display of environment with vehicle ahead and further objects in the surroundings

③ Visualization of actions of the system:
Waiting, Going, Following, Stopping

HMI CONCEPT FOR MOBILE DEVICE – SECONDARY TASKS

System Actions and Distance to Vehicle ahead

Optional Frame with further information

Full Content

Motion on adjacent lane

Speed and Probability to take-over

Activated System

„Active Frame" View

Split Screen

Full Screen

► HMI concept includes iPad

► „Traffic Jam Pilot – App" supports use of iPad during automated drive

► Content of iPads (here: Movie) is enriched by further information

► Visualization of system state, actions of automated drive and objects in the surroundings can be presented in different degrees of detail

► 3d sound system

EXPERIMENTAL RESULTS

Technical Talks to Journalists from International Press

Swedish Newspaper Article after Public Presentation

SCANIA Demonstrator Vehicle ready for being test driven by Journalists

SCANIA Board Member talks to Journalists

INNOVATIVE HMI CONCEPT HAS BEEN AWARDED (BERLIN, 2014)

Secondary Tasks on Mobile Device „Active Frame Concept"

HMI Award is given to HMI representative from SCANIA in Berlin, 2014

SUMMARY AND OUTLOOK

SUMMARY AND OUTLOOK

- Automated Demonstrator Vehicle has been presented (cooperation between Volkswagen and SCANIA)

- Automation of Commercial Vehicles will increase productivity of Transports

- Automation will reduce driver's load

- Automated commercial vehicles might be launched earlier than passenger cars,
  due to the existing business case