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

- **34 t/ 36 t/ 38 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**
  - ISO-Container 20 t

*) depending on axis-centre distance

Maximum Length: 16.50 m

**60 tons Trucks („Gigaliner“)**

- **28 t**
  - 18 t

- **34 t/ 36 t/ 38 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)

- **ISO-Container 20 t**

*) depending on axis-centre distance

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
CUSTOMERS’ PROBLEM – BLIND SPOTS

- Truck drivers have to cope with large blind spots around the tractor-trailer combination.
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 next to truck observed
- Precise detections behind 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
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.
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

► 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
PUBLIC DEMONSTRATION OF TRAFFIC JAM PILOT WITH SECONDARY TASKS BY SCANIA CV IN SÖDERTÄLJE/ SWEDEN (OCTOBER 2013)
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
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- 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