HOMOLOGATION FOR AUTOMATED AND CONNECTED DRIVING - CURRENT STATUS ON REGULATION AND EXISTING CHALLENGES

dSPACE World Conference 2019

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HOMOLOGATION FOR AUTOMATED AND CONNECTED DRIVING
CURRENT STATUS ON REGULATION AND EXISTING CHALLENGES

- The UN ECE Vehicle Type Approval Framework – An Overview
- Automated and Connected Vehicles – Legal Situation and Type Approval Regulations
- Vehicle Safety – Challenges for Stakeholders
THE UN ECE VEHICLE TYPE APPROVAL FRAMEWORK
HOMOLOGATION WITHIN THE VEHICLE LIFE CYCLE

- Development-Related V&V
  - Specified requirements on module, system and function level
  - Product integrity within the operational environment
- Type-Approval Testing
  - Legal requirements for traffic safety and environment protection of vehicle types
- Periodic-Technical Inspection
  - Traffic safety and environment protection within the lifecycle of existing vehicles
Vehicle Type Approval Procedure

- Manufacturer applies for type approval at a national authority
- Accredited technical service assesses compliance of the product with the corresponding regulations
- Authority issues type approval for vehicle type or system type
UN ECE & EC Homologation Framework

- Interlock between EU and UN ECE framework, EU 2007/46/EU\(^1\) refers to UN ECE regulations
- Supranational system for approval of vehicle types and systems
- More than 140 regulations defined for vehicle type approval
- Mutual acceptance between signatory states (on basis of Wiener agreement of 1958)
- Applicable for 28 European states
- More than 50 states accept UN ECE regulation framework, e.g. European states, Australia, Brazil, Mexico, Russia, South Korea
- Non-signatories, e.g. China and USA, (but partial recognition)
- German acceptance is anchored within the German traffic law (StVG)

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\(^1\) will be replaced by 2018/858/EU
Extension of regulations R79 and R13 for steering and braking systems

- Enhanced with Annex 6 and 8 for special requirements to be applied to Safety Aspects of Complex Electronic vehicle control systems
- Within type approval, application of appropriate safety process and safety measures is inspected

Subject of assessment according to Annex 6, UN-R79 ÄS03
THE UN ECE VEHICLE TYPE APPROVAL FRAMEWORK
AUTONOMOUS AND CONNECTED DRIVING

For higher automated vehicles

- Only exceptional EC type approval for test vehicles on national / regional basis possible
- Extension of existing regulations with regard to higher automation in progress (e.g. R79 ALKS – automated lane keeping)
- New regulation R0 as horizontal framework for connecting single regulations and holistic consideration of whole vehicle in progress
- New regulations for new vehicle functions and operational design domains needed
- New methods to assess and validate appropriate safety concept needed

Regulation Framework with interaction between system functions needed

Horizontal ECE Regulation for connecting base functions ECE R0

<table>
<thead>
<tr>
<th>Level 3</th>
<th>Partly automated</th>
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<tbody>
<tr>
<td>Level 4</td>
<td>Highly automated</td>
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- Function: Steering
- Function: Braking
- New Function: Perception
- New Function: Decision Making
- New Functions: Cyber Security SW Updates etc

ECE R79 ECE R130
ECE R13H ECE R131
ECE R???
ECE R???
ECE R???
ECE R???

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Assisted and partly automated driving within level 1 and 2 in accordance with German traffic law and international regulations

- Conventional condition given, that vehicle is controlled by a human driver

Revision of the Wiener agreement and StVG in 2016 and 2017

- Automated driving L3 to L4 within the intended use is generally permissible on national and international level
  - Driver may head off from driving task, but sensory awareness and ready to take over driving task must be given
  - System has to detect necessity to hand over driving task and issue request within sufficient time
  - Automated driving must be oversteered or deactivated any time for the driver
  - System behaviour must be in compliance with the traffic regulations
  - System must be in compliance with UN ECE regulations and type approved by an authority

L5 functions only allowed für parking areas, that are structural separated from public traffic area

- Driverless parking systems with low speed
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L5 functions

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Ethic rules for automated and connected driving (published by the German ethic committee summoned by federal minister of transport and digital infrastructure)

III.1 - Type Approval of automated systems is only justifiable, if is promises a positive risk balance for the reduction of damage compared to human driving performance

III.5 - The introduction of higher levels of automated driving systems, esp. with the possibility of automated collision avoidance can be a social and ethical imperative, if it is possible to exploit the connected potential for reduction of damage and harm.

To be applied for deriving safety acceptance and validation criteria
Guidelines published by European Commission in 2019

- Ensure harmonized approach on exemption procedure for EU approval of automated vehicles
- Technologies not foreseen by EU vehicle regulations, such as automated driving can already be approved through EU exemption procedure
- Pending adoption of harmonized EU requirements, **approval is granted on basis of national ad-hoc safety assessment** which is mutually recognized by other member states through commission decision. Vehicle type can then be placed on EU market like any other EU approved vehicle
- Focus on these guidelines will be on automated vehicles that can **operate in a limited number of driving situations (SAE levels 3 and 4)** which are already being tested and are expected on a commercial basis by 2020

Safety Requirements described for different categories

|--------------------------------------------------|------------------------------------------|---------------------------------|------------------------|-------------------------------------|--------------|---------------------------|-----------------------------------------------|

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Active Task Forces

- Functional Requirements for Automated and Autonomous Vehicles (FRAV)
- Validation Method for Automated Driving (VMAD)
- Task Force on Cyber Security and (OTA) software updates (CS/OTA)
- Event Data Recorder / Data Storage for AD (DSSAD / EDR)
- Automatically Commanded Steering Function (ACSF)
- Automatic Emergency Braking and Lane Departure Warning Systems (AEBS/LDWS)
- Modular Vehicle Combinations (MVC)

(FRAV) focus on the development of general safety and performance requirements for vehicle automation:

- Environment detection and perception
- Driving strategy and Failsafe Response
- System interaction with driver and other road users
- Minimum Risk Maneuver

(VMAD) focus on assessment and validation methods for safety of automated vehicles

- Safety Assessment
- Virtual Testing
- Track Testing
- Real World Testing
- In Service Monitoring

- ISO 26262 and ISO 21448 might be initial frameworks to interact with
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(CS/OTA) focus on type approval regulations for vehicle cybersecurity and (over the air) software updates

- Implementation of Cybersecurity management system by OEM / supplier
- Implementation of Software update management system by OEM / supplier
- CSMS Assessment and certification by authority / technical service
- SUMS Assessment and certification by authority / technical service
- Vehicle Type Approval by authority / technical service

- ISO/SAE 21434 - Intended framework for CSMS
- ISO/AWI 24089 - Intended framework for SUMS
Homologation of automated and connected driving

- Legal basis for L3 to L4 systems available
- Exceptional approval for test vehicles possible to trial new technologies possible
- Need and challenges for new type approval regulations identified
  - Different working groups initiated, but not all topics covered now

Main challenges to solve

- Technologies and complex algorithms for environment detection and decision making
- Distributed systems with vehicle function rely on backend and infrastructure data from different stakeholders
- Artificial intelligence in automotive brings new challenges
- Methods for safety development and safety validation
- Acceptance and validation criteria for development and type-approval
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