Challenges and opportunities related to the technology and functionality for automated vehicles

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Automated Vehicles
(Technology and Application)
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Technical requirements for steering systems
UNECE R-79

Regulation No. 79

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF VEHICLES WITH REGARD TO STEERING EQUIPMENT

UNITED NATIONS
**ADASS**

**ADASS** = *Advanced Driver Assistance Steering System*

- A system, additional to the main steering system
- provides assistance to the driver in steering the vehicle
- the *driver remains at all times in primary control of the vehicle*
- 2 different categories of ADASS: **ACSF** and **CSF**
ACSF = Automatically Commanded Steering Function

- A function within a complex electronic control system
- Continuous control function (no time limit for the intervention)
- System assists the driver in
  - following a particular path,
  - low speed manoeuvring, or
  - parking operations
- control action shall be automatically disabled if the vehicle speed exceeds the set limit of 10 km/h (speed limitation)
Examples of Application

Automatically Commanded Steering Function (ACSF)

Park Assist
Remote Controlled Parking
CSF = Corrective Steering Function

- A function within a complex electronic control system
- Discontinuous control function
  (limited duration of the interventions)
- Corrective steering interventions in order
  - to maintain the basic desired path of the vehicle, or
  - to influence the vehicle’s dynamic behaviour
- No speed limitation for CSF
Examples of Application

Corrective Steering Function (CSF)

Lane Keeping Assist

Sidewind Assist
Mission of the GRRF Informal Working Group on ACSF
Terms of Reference

• The informal group shall review the requirements and limitations associated with Automatically Commanded Steering Function technology (ACSF) as defined in Regulation No. 79.

• It shall prepare a draft regulatory proposal regarding advances in control system technology and the transport opportunities provided by the Vienna and Geneva Conventions.
Terms of Reference

The informal group shall address the following issues:

• Review the current speed limitation (10 km/h) with the purpose of permitting ACSF functionality during interurban journeys.

• Define HMI requirements for communicating between ACSF-system and the driver (e.g. system status, malfunction, transition)

• Define requirements to enable the evaluation of ACSF during periodic technical inspection.
Terms of Reference

- The group will focus on systems for vehicles of categories N and M.
- The group should take full account of existing data and research in developing its regulatory proposals. It should consider pre-existing standards (e.g. ISO, SAE and JSAE) and Regulations from other territories for ACSF developing its proposals.
Guidance to GRs concerning Automated Driving Technology
Guidance to GRs

• At the 164th session of WP.29 GRRF sought guidance on how to proceed with the development of technical regulations aimed at permitting the advancement of automated driving

• WP.29 tasked the ITS/AD Informal Group with developing guidance for the GRs

• As a result the ITS/AD Informal Group presented a guidance paper

• GRRF continued its work on the basis of the understanding reached with the ITS/AD Informal Group
Guidance to GRRF

Automated assistance systems shall be designed so that:

- they provide a means to keep the driver engaged to ensure that he/she constantly supervise the dynamic driving task executed by an automation system or a function of that system
- they deactivate immediately with request for immediate control by the driver
- the driver’s intention at any time shall be reliably reflected
Guidance to GRRF

Constraints:

• The system shall be designed to ensure the attentiveness of the driver during periods of use of the automated function

• The driver can be hands-on or hands-off, but monitoring the dynamic driving task and the driving environment at all times, ready to take control when required

• This should be ensured via a combination of in-use requirements and design requirements which should monitor the driver activity and define a minimum level of performance and functionality
Guidance to GRRF

Possible suggestions to be considered by GRRF (IWG ACSF):

- How to ensure a safe transition from the system to the driver
- How to prevent adverse effects on other vehicles and other traffic
- A limited use in specific road environment depending on the system
- Not to inhibit current development of such systems
Status of the IWG ACSF
Content of the new provisions for ACSF

- 5 new Categories of ACSF
- Minimum Sensor Performance (Radar, Lidar, Camera etc.)
- Longitudinal control and protective deceleration
- Minimal Risk Maneuvre
- Driver availability recognition system
- Human Machine Interaction (HMI)
- Transition from manual steering to automatic steering and vice versa
- Data Storage system
- Periodic Technical Inspection (PTI)
- Test requirements for ACSF
5 new categories of ACSF

ACSF Category

A Low speed maneuvering [Parkassist / Remote Controlled Parking]
B Lane Keeping [With subcategories B1, B2]
C Lane change [Lane change comanded by the driver]
D Lane change [System indicates possibility of a lane change, driver confirms]
E Lane change [Lane change is performed automatically by the system]
ACSF Categories and permitted combinations

Stand alone Categories
- A
- B1
- B2

Permitted Combinations
- B1 + C
- B2 + C
- B1 + D
- B2 + D
- B2 + E
Permissible field of application

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⇒ Any combination out of the categories B2, C, D and E can be only used on Highways*

* road section which is not dedicated to pedestrians or bicyclists and which has a [physical or constructional] separation of traffic moving in opposite directions
Requirements for Minimum Sensor Performance

• Vehicles equipped with the highest category of ACSF (Cat. B2, E) must be equipped with means (e.g. Radar, Lidar, Camera etc.) to monitor a minimum range to the front, the side and behind the vehicle with the purpose to avoid or to mitigate collisions

• New Provisions include detailed requirements of the sensor performance related to the respective speed
Longitudinal control and protective deceleration

- Collisions with other road users, road furniture or other objects while using ACSF shall be prevented
- The system shall ensure correct safety distances to other road users (like Adaptive Cruise Control)
- Automatic Emergency Braking in case of sudden unexpected events if the time for safe transition to the driver is too short

Source: EURO NCAP
Human Machine Interaction (HMI)

- Information about the current system status and driving mode must be clearly indicated to the driver
- Every change of the system status and driving mode must be clearly indicated to the driver
- Clear warning strategy
  - Visual warning
  - Acoustic warning
  - Haptic warning
Transition from manual steering to automatic steering and vice versa

• Activation of the ACSF only by deliberate action of the driver

• It must be possible at any time for the driver to override the ACSF

• System will initiate a transition demand to the driver, e.g.
  – In case the system boundaries are reached
  – In case of a sudden unexpected event
  – If seat belt is unfastened or driver left the driver`s seat
  – If the driver seems to be not available (not active)

• After the transition demand the vehicle shall follow the initial path for at least 4 s.

• If no reaction by the driver to the transition demand, a Minimal Risk Maneuvre shall be carried out
Minimal Risk Maneuvre

ACSF must comprise a **Minimal Risk Maneuvre** (Emergency strategy to reach a status with as less risk possible in the given traffic situation, if the driver is not able to take over steering in time)

Example of a MRM process:

- Failure warning
- Transition demand (Take Over Request)
- Driver does not respond
- Keeping the initial path for a certain time
- Cancel motor power and decelerate smoothly
- Slowing down to standstill
- Switching hazard lights on

Source: HAVEit
Driver availability recognition system

A) System shall ensure that the driver is present in the seat:

- When the driver is not present in the driver seat the system shall provide a distinctive warning until the driver is detected to be back in the driver seat or until a transition demand is initiated.

- When the driver is not back in the driver seat during the distinctive acoustical warning with a max. duration of [15 s] a transition demand shall be initiated.
Driver availability recognition system

B) System shall ensure that the driver is available to takeover steering

- The system shall check if the driver is available to take over the steering by permanently evaluating driver's activity

- When the driver does not show any activity for a time span of maximum [180] s, the system shall provide a distinctive acoustic warning until appropriate actions of the driver are detected (e.g. the driver resumes manual control) or until a transition demand is initiated

- When the system does not detect appropriate actions from the driver during the distinctive acoustic warning with a max. duration of [15 s] a transition demand shall be initiated
Data storage system

- A data storage system shall be installed into vehicles, which are equipped with ACSF (Cat. E, B2)

- In case of an accident the recorded data could be used to check
  - who was steering (ACSF system or the driver)
  - did the ACSF system worked properly according to the requirements

- Content of data to be recorded (accident time, accident location, system failures, drivers operation, etc.) and further requirements are still under discussion
Periodic Technical Inspection (PTI)

- It shall be possible that the correct operational status of the ACSF systems can be verified in a simple way during the periodic technical inspection.
- It shall be possible to check if the correct software version is installed.
- Necessary special information must be made available freely by the manufacturer.
Test requirements for ACSF (Category E)

• Function Tests
  • Lane Keeping
  • Abort of Lane change
  • Lane Change

• Transition Tests
  • Max. lateral acceleration
  • Missing Lane Marking
  • Driver not available
  • Sensor Failure
  • Overriding the Minimal Risk Maneuvre

• Emergency Tests
  • Braking behind moving target
  • Braking behind stationary target

Source: EURO NCAP
Timeline
Timeline

Feb. 2015  Proposal to establish an Informal Working Group for ACSF in the 79th session of GRRF

Mar. 2015  WP29 endorsed the creation of the Informal Working Group in the 165th session


Sept. 2016  IWG ACSF will present first drafts of amendments to R-79 in the 82nd session of GRRF for less complex ACSF categories

Sept. 2017  Final Draft proposal to amend UNECE R-79 shall be presented in the 84th session of GRRF
Thank you for your attention!

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