

Reference Document

Development ACSF of Category B2 (SAE Level 3 & 4) Requirements

Objectives

The objective of the ACSF IWG (as agreed by GRRF) is to develop proposals for ACSF of Category B2 systems that align at least with the SAE Level 3 categorisation or with the SAE Level 4 categorisation (for the purposes of the technical regulation, references will be made to specific functions of the technology and not to SAE levels).

That is a:

“Function which is initiated/activated by the driver and which keeps the vehicle within its lane by influencing the lateral movement of the vehicle for extended periods without further driver command/confirmation.”

And which:

Is able to cope with all dynamic driving tasks and with any situation according to the general system classification or shall otherwise transition to the driver offering sufficient lead time (in case the driver is intended as fall-back in conformity to the system’s categorisation).

The system drives and monitors (specific to the required general system classification) the environment (infrastructure and traffic).

The system requests a takeover if the general system classification boundaries are reached (planned transition, e.g. motorway exit).

In addition to the lateral control requirements, technical prescriptions for longitudinal control will be necessary for vehicles operating with ACSF of Category B2 level functionality.

The dynamic driving task comprises the operational/physical action of steering, braking and accelerating (the lateral and longitudinal control of the vehicle). This requires the vehicle to have spatial awareness (monitoring and interpreting a critical area surrounding the vehicle) and making the necessary tactical decisions (object and event detection and response) to provide a safe and lawful use of the vehicle within an agreed general system classification.

It is understood, that the development of such a system is undertaken with no presumption that certain traffic rules and obligations cannot be managed by the vehicle/function.

The ACSF of Category B2 system shall know which traffic rules apply in the territory in which it is operating and comply with them.

The technical requirements shall include:

1. General system classification

Define specific conditions under which the system, if fitted, is required to operate. The designated specific conditions shall be defined as precisely as possible by quantifiable characteristics. Clearly, if not within the defined conditions, the system shall not be active.

A methodology to verify compliance with general requirements above (e.g. road type, speed limit, etc.).

It is proposed that the technology be classified for use in specific environments, e.g. urban, inter-urban, highway, etc. These ACSF of Category B2 systems shall be identified by "Class" e.g. Class I, Class II, etc.

Initial discussion will focus on systems intended for use on roads that have been defined previously in UN ECE Regulation 79 for use with ACSF of Category C systems (roads where pedestrians and cyclists are prohibited and which, by design, are equipped with a physical separation that divides the traffic moving in opposite directions [and which have at least two lanes in the direction the vehicles are driving]).

General conditions (All Classes)

Environment

All weather conditions (including max/min temperature range)
To operate in daylight, low light and in darkness.

Road conditions

Wet/dry, low/high friction, bridge, tunnel.

Traffic laws

All, permanent, temporary, national.
Signage recognition, permanent and electronic (including variable speed limits).

Class [I]:

Scope: Focused (at present) mainly on vehicles of Categories M1 and N1

Infrastructure.

Roads where pedestrians and cyclists are prohibited and which, by design, are equipped with a physical separation that divides the traffic moving in opposite directions [and which have at least two lanes in the direction the vehicles are driving].

Speed range.

0-130 km/h

2. Headway Control

The Dynamic Driving Tasks have to be specified.

A methodology to determine a safe operational speed and traffic separation when under automated control:

The detection range of the visualisation system.

The integration of the visualisation system with vehicles speed and braking control systems.

3. Human Driver Priority

A logical and intuitive procedure to permit the driver to resume control from the automated system but including safeguards to ensure unintended driver inputs of the automated system is avoided.

4. Driving Control Transition Requirements

A logical and intuitive procedure to manage the transition from automated control to human driver control. The transition requirements shall consider:

Planned transition, e.g. journey point, general system classification boundary, etc.

Unplanned transition, e.g. temporary blinding of the visualisation system.

Emergency transition, e.g. carriageway obstruction.

The requirements shall be compatible with human response behaviour including physical and cognitive readiness.

Transition timing and transition alerts shall be established incorporating agreed HMI principles.

5. System Redundancy protocols

For systems where the driver may be called upon to intervene in a driving task (SAE Level 3 operation) the requirements will include protocols to monitor driver availability and HMI principles to ensure a timely physical and cognitive return to the driving task. The requirements will include protocols to ensure that appropriate redundancy is provided to ensure the driving task during the transition process.

Driver monitoring comprises two aspects: the driver's availability (presence) and the driver's readiness (attentiveness). The necessity and extent of monitoring the driver is closely linked to the transition process (in particular the transition duration).

For systems where the driver is not expected to intervene while the vehicle is operating within the general conditions of its classification (SAE Level 4 operation), the requirements will include protocols to ensure that appropriate redundancy is provided to ensure the driving task.

The requirements shall also include protocols to monitor driver availability and agreed HMI principles to ensure a timely physical and cognitive return to the driving task when the boundaries of the general system classification are reached.

6. Information to the driver

The requirements shall define the necessary information the human driver must have at all times, when the system is performing the dynamic driving task. This shall include protocols to ensure that the driver is able to manually override/deactivate the system at any time and, in particular, to react appropriately to a transition demand to take over the driving task again. This requirement leads to design requirements of the human machine interface (HMI) which shall also be addressed within this topic.

7. Minimum risk manoeuvres and emergency manoeuvres

The requirements shall define a safe condition of the vehicle, appropriate to the general system classification and considering the lowest possible risk for occupants of the vehicle and for other road users. This “minimum risk condition” must be respected at all times and under all driving situations.

A minimum risk manoeuvre may be required to ensure the minimum risk condition. A minimum risk manoeuvre shall be initiated by the system if the human driver has not reacted to the transition request of the system.

The requirements shall provide for minimum risk manoeuvres that address the transition conditions listed in point 4 (planned and unplanned).

The requirements shall clearly define when the minimum risk manoeuvre has to start (e.g. along with the first transition demand or after the transition procedure has ended).

The requirements shall provide for emergency manoeuvres in case of imminent danger. An emergency manoeuvre shall start as soon as the imminent danger is detected.

8. Complimentary Activities

The following additional requirements for ACSF of Category B2 systems are being developed by separate working groups:

Data Storage System for ACSF (DSSA)

Cyber Security

Software update management

Periodic Technical Inspection provisions

Revision of electric and electronic control system assessment procedures.

The requirements developed by the ACSF group shall be compatible with the outputs from those separate activities.