

## Proposal for amendments to GRRF-82-08

This document shall replace the wording of Option 4 in ECE/TRANS/GRRF/2016/45

### I. Proposal

Insert a new paragraph 1.2.5., to read:

- 1.2.5. Steering systems exhibiting the functionality defined as Category B2, C, D or E in paragraphs, 2.3.4.1.3., 2.3.4.1.4., 2.3.4.1.5., or 2.3.4.1.6., respectively.**

Paragraph 2.3.4.1., amend to read:

- 2.3.4.1. "*Automatically commanded steering function (ACSF)*" means the function within a complex electronic control system where actuation of the steering system can result from automatic evaluation of signals initiated on-board the vehicle, possibly in conjunction with passive infrastructure features, to generate ~~continuous~~ control action in order to assist the driver ~~in following a particular path, in low speed manoeuvring or parking operations.~~
- 2.3.4.1.1. "*ACSF Category A*" means, a function that operates at a speed no greater than 10 km/h to assist the driver, on demand, in low speed or parking manoeuvring.
- 2.3.4.1.2. "*ACSF Category B1*" means a function which assists the driver in keeping the vehicle within the chosen lane, by influencing the lateral movement of the vehicle."
- 2.3.4.1.3. "*ACSF Category B2*" means 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
- 2.3.4.1.4. "*ACSF Category C*" means, a function which is initiated/activated by the driver and which can perform a single lateral manoeuvre (e.g. lane change) when commanded by the driver.
- 2.3.4.1.5. "*ACSF Category D*" means, a function which is initiated/activated by the driver and which can indicate the possibility of a single lateral manoeuvre (e.g. lane change) but performs that function only following a confirmation by the driver.
- 2.3.4.1.6. "*ACSF Category E*" means, a function which is initiated/activated by the driver and which can continuously determine the possibility of a manoeuvre (e.g. lane change) and complete these manoeuvres for extended periods without further driver command/confirmation.

Paragraph 2.3.4.2., amend to read:

- 2.3.4.2. "*Corrective steering function (CSF)*" means the ~~discontinuous~~ control function within a ~~complex~~ electronic control system whereby, for a limited duration, changes to the steering angle of one or more wheels may result from the automatic evaluation of signals initiated on-board the vehicle, in order:

- (a) to compensate a sudden, unexpected change in the side force of the vehicle, or;
- (b) to improve the vehicle stability (e.g. side wind, **μ-split**), or;
- (c) to correct lane departure. (e.g. to avoid crossing lane markings, leaving the road).

~~to maintain the basic desired path of the vehicle or to influence the vehicle's dynamic behaviour.~~

~~Systems that do not themselves positively actuate the steering system but that, possibly in conjunction with passive infrastructure features, simply warn the driver of a deviation from the ideal path of the vehicle, or of an unseen hazard, by means of a tactile warning transmitted through the steering control, are also considered to be corrective steering.~~

*Insert a new paragraphs 2.4.8. until 2.4.12., to read:*

- 2.4.8. **"Remote Controlled Parking (RCP)"** means a function in category A ACSF, actuated by the driver, to provide parking or low speed manoeuvring. The actuation is made by remote control in close proximity to the vehicle.
- 2.4.9. **"Specified maximum RCP operating range ( $S_{RCPmax}$ )"** means the maximum distance between the nearest point of the motor vehicle and the remote control device up to which ACSF is designed to operate.
- 2.4.10. **"Specified maximum speed  $V_{smax}$ "** means the maximum speed up to which an ACSF is designed to operate.
- 2.4.11. **"Specified minimum speed  $V_{smin}$ "** means the minimum speed down to which an ACSF is designed to operate.
- 2.4.12. **"Specified maximum lateral acceleration  $ay_{smax}$ "** means the maximum lateral acceleration up to which an ACSF is designed to operate.

*Paragraph 5.1.6.1., amend to read:*

- 5.1.6.1. ~~Whenever the Automatically Commanded Steering function becomes operational, this shall be indicated to the driver and the control action shall be automatically disabled if the vehicle speed exceeds the set limit of 10 km/h by more than 20 per cent or the signals to be evaluated are no longer being received. Any termination of control shall produce a short but distinctive driver warning by a visual signal and either an acoustic signal or by imposing a tactile warning signal on the steering control.~~

**(Reserved)**

**Justification:** these requirements must be moved to ACSF category A section, since not applicable to B1 systems.

*Insert a new paragraph 5.1.6.2, to read:*

- 5.1.6.2 **A CSF system shall be subject to the requirements of Annex 6.**
- 5.1.6.2.1 **Every CSF intervention shall immediately be indicated to the driver by an optical signal which is displayed for at least 1s or as long as the compensation exists, whichever is longer.**

5.1.6.2.2 In the case of a CSF intervention which is based on the evaluation of the presence and location of lane markings or boundaries of the lane the following shall apply additionally:

5.1.6.2.2.1 In the case of an intervention longer than:

- (a) 10s for vehicles of category M<sub>1</sub> and N<sub>1</sub>, or
- (b) 30s for vehicles of category M<sub>2</sub>, M<sub>3</sub> and N<sub>2</sub>, N<sub>3</sub>,

an acoustic warning shall be provided until the end of the intervention.

5.1.6.2.2.2 In the case of two or more consecutive interventions within a rolling interval of 180 seconds and in the absence of a steering input by the driver during the intervention, an acoustic warning shall be provided by the system during the second and any further intervention within a rolling interval of 180 seconds. Starting with the 3rd intervention (and subsequent interventions) the acoustical signal shall continue for at least 10 seconds longer than the previous warning signal.

5.1.6.2.3 The steering control effort necessary to override the directional control provided by the system shall not exceed 50 N.

**Justification:** the maximum overriding force should be below the same maximum value as for ACSF systems.

*Insert a new paragraph 5.6., to read:*

"5.6. Provisions for ACSF

5.6.1. **Special** Provisions for Category A ACSF

Any system of Category A ACSF shall fulfil the following requirements.

5.6.1.1. General

5.6.1.1.1 The system shall only operate until 10 km/h (+2 km/h tolerance)

5.6.1.1.2 The system shall be active only after a deliberate action of the driver and if the conditions for operation of the system are fulfilled (all associated functions – e.g. brakes, accelerator, steering, camera/radar/lidar etc. are working properly).

5.6.1.1.3. The system shall be able to be deactivated by the driver at any time.

5.6.1.1.4. In the case where the system includes accelerator and/or braking control of the vehicle, the vehicle shall be equipped with a means to detect an obstacle (e.g. vehicles, pedestrian) in the manoeuvring area and to bring the vehicle immediately to a stop to avoid a collision.

5.6.1.1.5. Whenever the system becomes operational, this shall be indicated to the driver. Any termination of control shall produce a short but distinctive driver warning by a visual signal and either an acoustic signal or by imposing a tactile warning signal on the steering control. In the case of a Remote Controlled Parking system, a visual signal is sufficient.

**Justification:**

This new requirement is coming from current 5.1.6.1. (which is proposed to be deleted).

Tactile warning on the steering control or acoustic warning in the vehicle is not relevant for an RCP.

- 5.6.1.2. Additional provisions for RCP systems
- 5.6.1.2.1. The parking manoeuvre shall be initiated by the driver but controlled by the system. A direct influence on steering direction, acceleration and braking via the remote control device shall not be possible.
- 5.6.1.2.2. A continuous actuation of the remote control device by the driver is required during the parking manoeuvre.
- 5.6.1.2.3. If the continuous actuation is interrupted or the distance between vehicle and remote control device exceeds the specified maximum RCP operating range ( $S_{RCPmax}$ ) or the signal between remote control and vehicle is lost, the vehicle shall stop immediately.
- 5.6.1.2.4. If a door of the vehicle is opened during the parking manoeuvre, the vehicle shall stop immediately.
- 5.6.1.2.5. The system shall be designed to protect against unauthorized activation or operation of the RCP systems and interventions into the system.
- 5.6.1.2.6. The specified maximum RCP operating range shall not exceed 6m.
- 5.6.1.2.7. [If the vehicle has reached its final parking position either automatically or by confirmation from the driver, and the ignition is switched off, the parking braking system or the park position of the automatic transmission shall be automatically engaged.]
- 5.6.1.3. System information data
- 5.6.1.3.1. Following data shall be provided together with the documentation package required in Annex 6 of this Regulation to the Technical Service at the time of type approval
- 5.6.1.3.1.1. The value for the specified maximum RCP operating range ( $S_{RCPmax}$ )
- 5.6.1.3.1.2. The conditions under which the system can be activated, i. e. when the conditions for operation of the system are fulfilled.
- 5.6.1.3.1.3. For RCP systems the Manufacturer shall provide the technical authorities with an explanation how the system is protected against unauthorized activation
- 5.6.2. Special Provisions for ACSF Category B1
- Any system of ACSF Category B1 shall fulfil the following requirements within the boundary conditions.
- 5.6.2.1. General
- 5.6.2.1.1. The activated system shall at any time ensure that the vehicle does not cross a lane marking ~~under any condition~~ for lateral acceleration below the minimum values specified in the table of 5.6.2.1.3.
- Justification:** Only the minimum values of lateral acceleration in the table of 5.6.2.1.3 are relevant for testing that the vehicle does not cross lane markings.
- 5.6.2.1.2. The vehicle shall be equipped with a means for the driver to activate and deactivate the system. The deactivation shall be possible at any time.
- 5.6.2.1.3. The system shall be designed so that excessive intervention of steering control is suppressed to ensure the steering operability by the driver and to avoid unexpected vehicle behavior, during its operation. To ensure this, the following requirements shall be fulfilled:

(a) The steering control effort necessary to override the directional control provided by the system shall not exceed 50 N.

(b) The specified maximum lateral acceleration  $a_{y_{\text{max}}}$  generated by the system shall be within the limits as defined in the following table:

For vehicles of category M<sub>1</sub>, N<sub>1</sub>

Speedrange	10-60 km/h	>60-100 km/h	>100-130 km/h	>130 km/h
Specified maximum lateral acceleration shall be lower than	3m/s <sup>2</sup>	3m/s <sup>2</sup>	3m/s <sup>2</sup>	3m/s <sup>2</sup>
Specified maximum lateral acceleration shall be higher than	no req.	0,5 m/s <sup>2</sup>	1 m/s <sup>2</sup>	0,3 m/s <sup>2</sup>

For vehicles of category M<sub>2</sub>, M<sub>3</sub>, N<sub>2</sub>, N<sub>3</sub>

Speedrange	10-30 km/h	>30- 60 km/h	> 60 km/h
Specified maximum lateral acceleration shall be lower than	2.5 m/s <sup>2</sup>	2.5 m/s <sup>2</sup>	2.5 m/s <sup>2</sup>
Specified maximum lateral acceleration shall be higher than	no req.	0.3 m/s <sup>2</sup>	0.5 m/s <sup>2</sup>

(c) The moving average over half a second of the lateral jerk generated by the system shall not exceed 5 m/s<sup>3</sup>.

**5.6.2.1.4.** The requirements in paragraph 5.6.2.1.1 and 5.6.2.1.3 shall be checked according to relevant vehicle test(s) specified in Annex 8 of this regulation.

**Justification:** the tests of Annex 8 are never called.

**5.6.2.2. Operation of ACSF Category B1**

**5.6.2.2.1.** If the system is active an optical signal shall be provided to the driver.

**5.6.2.2.2.** When the system is temporarily not available, for example due to inclement weather conditions, the system shall clearly inform the driver about the system status by an optical signal, except if the system is in the OFF mode, e.g. switched off.

**5.6.2.2.3.** A system failure shall be signaled to the driver. The optical signal mentioned in paragraph 5.6.5.2.2. may be used for this purpose. However, when the system is manually deactivated by the driver, the indication of failure mode may be suppressed.

**5.6.2.2.4.** When the system is active (i.e. ready to intervene or intervening) and in the speed range between 10 km/h or  $V_{\text{min}}$ , whichever is higher, and  $V_{\text{max}}$ , it shall provide a means of detecting that the driver is holding the steering control.

If, after a period of no longer than 15 seconds the driver is not holding the steering control, an optical warning shall be provided.

If, after a period of no longer than 30 seconds the driver is not holding the steering control, an acoustical warning shall be provided in addition to the signal mentioned above.

The warnings shall be active until the driver is holding the steering control, or until the system is deactivated, either manually or automatically.

If the acoustic warning continues for more than 30 seconds the system shall be automatically deactivated. In this case the system shall clearly inform the driver about the system status by an emergency signal which is different from the warning signal, for at least five seconds or until the driver holds the steering control again.

The above requirements shall be checked according to the relevant vehicle test(s) specified in Annex 8 of this regulation.

**Justification:** the tests of Annex 8 are never called.

#### 5.6.2.3. System information data

5.6.2.3.1. Following data shall be provided together with the documentation package required in Annex 6 of this regulation to the Technical Service at the time of type approval

5.6.2.3.1.1. The conditions under which the system can be activated and the boundaries for operation. The vehicle manufacturer shall provide values for  $V_{smax}$ ,  $V_{smin}$  and  $ay_{smax}$  for every speed range as mentioned in the table of 5.6.2.1.3

5.6.2.3.1.2. Information about how the system detects that the driver is holding the steering control.

*Insert new Annex 8, to read*

## Annex 8

### Test requirements for corrective and automatically commanded steering functions

#### 1. General Provisions

Vehicles fitted with CSF and/or ACSF systems shall fulfill the appropriate tests requirements of this annex.

#### 2. Test conditions

The test shall be performed on a flat, dry asphalt or concrete surface delivering good adhesion. The ambient temperature shall be between 0° C and 45° C.

#### 2.1. Lane markings

The lane markings used in the tests shall be in line with one of those described in Annex 3 of Regulation No. 130. The markings shall be in good condition and of a material conforming to the standard for visible lane markings. The lane marking layout used for the testing shall be recorded in the test report.

The width of the lane shall be minimum [3.5m], for the purpose of the tests of this Annex.

The test shall be performed under visibility conditions that allow safe driving at the required test speed.

The vehicle manufacturer shall demonstrate, through the use of documentation, compliance with all the other lane markings identified in Annex 3 of Regulation No.130. Any such documentation shall be appended to the test report.

**2.2. Tolerances**

All vehicle speeds specified in the tests shall be met with a tolerance of  $\pm 2$  km/h.

**2.3. Vehicle conditions**

**2.3.1. Test weight**

The vehicle shall be tested in a condition of load to be agreed between the manufacturer and the Technical Service. No alteration shall be made once the test procedure has begun. The vehicle manufacturer shall demonstrate through the use of documentation that the system works at all conditions of load.

**2.3.2. The vehicle shall be tested at the tyre pressures recommended by the vehicle manufacturer.**

**3. Tests**

**3.1 Test for CSF**

**3.1.1 CSF Warning Test 1 (CSFW1, Test for acoustical warning for CSF)**

**3.1.1.1 Drive the vehicle with an activated CSF System on a road with lane markings on each side of the lane. The Technical Service shall verify that the requirements for warning signals defined in 5.1.6.2 are met.**

**3.1.1.2 With the agreement of the Technical Service a simulation may be used. A detailed description of the simulation shall be included in the test report.**

**3.2 Test for ACSF Category B1 Systems**

**3.2.1 Functionality Test 0 (FU0a, Test for lane keeping)**

**3.2.1.1 The vehicle speed shall remain in the range from  $v_{smin}$  up to  $v_{smax}$ .**

The test shall be carried out for each speed range specified in paragraph 5.6.2.1.3. separately.

The vehicle shall be driven without any driver input to the steering wheel (e.g. by removing the hands from the wheel) with a constant speed on a curved track with lane markings at each side.

The necessary lateral acceleration to follow the curve shall be between 80 and 90% of the minimum value specified in the table of paragraph 5.6.2.1.3.

The lateral acceleration and the lateral jerk shall be recorded during the test.

**3.2.2.2 The requirements of the test are fulfilled if:**

The vehicle does not cross any lane marking.

The moving average over half a second of the lateral jerk does not exceed  $5 \text{ m/s}^3$

3.2.2.3 Data for the whole lateral acceleration and speed range: The Technical Service shall require the manufacturer to deliver data about fulfilling the test for lane keeping capabilities for the whole lateral acceleration and speed range.

### 3.2.2 Functionality Test 0 (FU0b, Test for maximum lateral acceleration)

3.2.2.1 The vehicle speed shall remain in the range from  $v_{\min}$  up to  $v_{\max}$ .

The test shall be carried out for each speed range specified in paragraph 5.6.2.1.3. separately.

The vehicle shall be driven without any driver input to the steering wheel (e.g. by removing the hands from the wheel) with a constant speed on a curved track with lane markings at each side.

The technical service defines a test speed and a radius which would provoke a higher deceleration than  $a_{y_{\max}}$  (e.g. by travelling with a higher speed through a curve with a given radius).

The lateral acceleration and the lateral jerk shall be recorded during the test.

3.2.2.2 The requirements of the test are fulfilled if:

The recorded acceleration is within the limits specified in paragraph 5.6.2.1.3.

The moving average over half a second of the lateral jerk does not exceed  $5 \text{ m/s}^3$ .

### 3.2.3 Functionality Test 0 (FU0c, Test of overriding force)

3.2.3.1 The vehicle speed shall remain in the range from  $V_{\min}$  up to  $V_{\max}$ .

The vehicle shall be driven without any driver input to the steering wheel (e.g. by removing the hands from the wheel) with a constant speed on a curved track with lane markings at each side.

The necessary lateral acceleration to follow the curve shall be between 80 and 90% of the minimum value specified in the table of paragraph 5.6.2.1.3.

The driver shall then apply a force on the steering control to override the system intervention and leave the lane.

The force applied by the driver on the steering control during the overriding manoeuvre shall be recorded.

3.2.3.2 The requirements of the test are fulfilled if the force applied by the driver on the steering control during the overriding manoeuvre is less than 50N.

### 3.2.4 Transition Test 0 (TR0, Test for holding the steering control)

3.2.4.1 Drive the vehicle with activated ACSF with a vehicle test speed between  $V_{\min} + 10 \text{ km/h}$  and  $V_{\max} - 10 \text{ km/h}$  on a curved track with road markings at each side of the lane.

Release the steering control and continue to drive until the ACSF is deactivated by the system. The track shall be selected such that it allows driving with activated ACSF for at least 60 s without any driver intervention.

Repeat the test with a different vehicle test speed between  $V_{\min} + 10 \text{ km/h}$  and  $V_{\max} - 10 \text{ km/h}$ , which differs significantly from the previous vehicle test speed.



#### 3.2.4.2 The requirements of the test are fulfilled if:

The optical warning was given at the latest 15 s after the steering control has been released and the optical warning signal remains until ACSF is deactivated.

The acoustic warning was given at the latest 30 s after the steering control has been released and the acoustic warning signal remains until ACSF is deactivated.

The ACSF is deactivated at the latest 30s after the acoustic signal has started, with an emergency signal of at least 5 s which is different from the warning signal.

#### Justification:

Annex 8 defines test procedures necessary for the approval of CSF and ACSF systems.

Paragraph 2.1. For the definition of lane markings, a reference to Annex 3 of Regulation No. 130 (LDWS) is used, to avoid repetition of the same data in two different regulations. However, for practical reasons, the lane width is explicitly specified in this Annex, based on the value specified in Annex 3 of LDWS Regulation 130.

Paragraph 3.1.1. CSFW1 test checks the warning signals required to inform driver of CSF interventions.

Paragraph 3.2.1. ACSF B1 FU0a checks if the system is able to maintain the vehicle in the lane without crossing lane markings, as specified in 5.6.2.1.1.

Paragraph 3.2.2. ACSF B1 FU0b checks if the maximum lateral acceleration generated by the system is within the specified limits of 5.6.2.1.3.

Paragraph 3.2.3. ACSF B1 FU0c checks if the maximum force to override the action of the system is below the maximum value specified in 5.6.2.1.3.

Paragraph 3.2.4. ACSF B1 TR0 checks the hands-off detection, signals to driver and deactivation as specified in 5.6.2.2.4.

## II. Justification

This document reflects the work of the Informal Working Group on ACSF.

The document is the result of 8 meetings.

It contains:

- (a) Clarification of Corrective steering function (CSF) incl. defining of new requirements;
- (b) Creation of new categories for Automatically commanded steering function (ACSF): Categories A, B1, B2, C, D and E;
- (c) Proposed wording for requirements of Category A (incl. remote parking RCP), and Category B1;
- (d) Provisions for systems of categories B2, C, D and E will be defined in the next sessions of the Informal Working Group on ACSF;
- (e) The necessary test requirements will be defined in a separate informal document.