

Submitted by the experts of CLEPA and OICA

Informal Document: ACSF-09-07

Proposal for amendments to GRRF-82-08

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

Industry proposals

Preliminary notes.

- clarify “warning signal” vs “warning” vs “signal”, is it the same?
- Proposal to use optical / acoustic / haptic and not visual / acoustical / audible / tactile / haptical.

I. Proposal

Insert a new paragraph 1.2.3., to read:

- "1.2.3. 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, until specific provisions would be introduced in this Regulation."

Paragraph 2.3.4.1., amend to read:

- "2.3.4.1. *"Automatically commanded steering function (ACSF)"* means the function within an 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 of 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 of 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 of 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 of 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 of 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 of 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, differing adhesion road conditions " 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 new paragraphs 2.4.8. until 2.4.12., to read:

- 2.4.8. **"Remote Controlled Parking (RCP)"** means an ACSF of category A, actuated by the driver, providing 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 a_{ysmax} "** 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. **(Reserved)**

~~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."~~

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) 10 s for vehicles of category M₁ and N₁, or
 - (b) 30 s for vehicles of category M₂, M₃ and N₂, N₃,
- 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 third 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 in the whole range of CSF operations.
- 5.1.6.2.4.** The above requirements shall be tested in accordance with the relevant vehicle test(s) specified in Annex 8 of this Regulation."

Insert new paragraphs 5.4.1.2. and 5.4.1.3., to read:

- "5.4.1.2.** Optical warning signals shall be visible, even by daylight and distinguishable from other alerts; the satisfactory condition of the signals shall be easily verifiable by the driver from the driver's seat; the failure of a component of the warning devices shall not entail any loss of the steering system's performance.
- 5.4.1.3.** **Audible Acoustic** warning signals shall be by continuous or intermittent sound signal or by vocal information. Where vocal information is employed, the manufacturer shall ensure that the alert uses the language(s) of the market into which the vehicle is sold.
- Audible Acoustic** warning shall be easily recognized by the driver."

Justification

- editorial changes

Paragraph 5.4.1.2. (former) shall be renumbered as paragraph 5.4.1.4

Insert a new paragraph 5.6., to read:

- "5.6.** Provisions for ACSF

ACSF shall be subject to the requirements of Annex 6.

5.6.1. Special Provisions for ACSF of Category A

Any ACSF system of Category A 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 case 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.*

* Until uniform test procedures have been agreed, the manufacturer shall provide the Technical Service the documentation and supporting evidence to demonstrate compliance with these provisions. This information shall be subject to discussion and agreement between the Technical Service and vehicle manufacturer.

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 an optical signal and either an acoustic signal or by imposing a tactile warning-haptic signal on the steering control.

For RCP, the requirements for driver warning shown above shall be fulfilled by the provision of a visual an optical signal at least at the remote control device.

Justification

- editorial changes

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 operator of the remote control device, and the ignition is switched off, the parking braking system shall be automatically engaged.

Justification

- clarification

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 of Category B1

Any system of ACSF of 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 for lateral accelerations below the maximum lateral acceleration specified by the vehicle manufacturer $a_{y_{smax}}$.

The moving average over two seconds of lateral acceleration generated by the system may exceed the specified value $a_{y_{smax}}$ by not more than $0.3m/s^2$, while not exceeding the maximum value specified in the table in paragraph 5.6.2.1.3. of this Regulation.

Justification

- Due to the measurement noise, there is a need for filtering the measured signal (e.g. see slide 13 of document GRRF-82-34 from Germany).
- Defining a filtering time improves technical harmonization.
- Similar approach as for the lateral jerk.

- 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 $a_{y_{smax}}$ generated by the system shall be within the limits as defined in the following table:

For vehicles of category M_1, N_1

Speedrange	10-60 km/h	>60-100 km/h	>100-130 km/h	>130 km/h
Maximum value for the specified maximum lateral acceleration	3 m/s ²	3 m/s ²	3 m/s ²	3 m/s ²
Minimum value for the specified maximum lateral acceleration	0 m/s ²	0.5 m/s ²	0.8 m/s ²	0.3 m/s ²

For vehicles of category M₂, M₃, N₂, N₃

Speedrange	10-30 km/h	>30- 60 km/h	> 60 km/h
Maximum value for the specified maximum lateral acceleration	2.5 m/s ²	2.5 m/s ²	2.5 m/s ²
Minimum value for the specified maximum lateral acceleration	0 m/s ²	0.3 m/s ²	0.5 m/s ²

(c) The moving average over half a second of the lateral jerk generated by the system shall not exceed 5 m/s³.

5.6.2.1.4. The requirements in paragraphs 5.6.2.1.1. and 5.6.2.1.3. of this Regulation shall be tested in accordance with relevant vehicle test(s) specified in Annex 8 of this Regulation.

5.6.2.2. ACSF of Category B1 operation

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. When the system reaches its boundary conditions set out in paragraph 5.6.2.3.1.1. of this Regulation (e.g. the specified maximum lateral acceleration $a_{y,max}$) and both in the absence of any driver input to the steering control and when any front tyre of the vehicle is crossing the lane marking, the system shall continue to provide assistance and shall clearly inform the driver about this system status an optical signal and additionally by an acoustic or haptic signal.**~~

~~**For vehicles of categories M₂ M₃ N₂ and N₃, this requirement is deemed to be fulfilled if the vehicle is equipped with a Lane Departure Warning System (LDWS) fulfilling the technical requirements of Regulation No. 130."**~~

Industry proposal

5.6.2.2.3. When any front tyre of the vehicle has crossed a lane marking due to that the system has reached its boundary conditions (e.g. the specified maximum lateral acceleration $a_{y,max}$), the system, in the absence of any driver input to the steering control:

- **Shall** continue to provide assistance and
- **shall** clearly inform the driver about this system status by an optical signal and additionally by an acoustic or haptic signal. For vehicles of categories M₂ M₃ N₂ and N₃, this requirement is deemed to be fulfilled if the vehicle is equipped with a Lane

Departure Warning System (LDWS) fulfilling the technical requirements and transitional provisions of Regulation No. 130.

Justification

- Rewording of the first sentence for more clarity.
- Clarification that the requirement applies not only whilst the tyre is crossing the lane marking, but also after.
- Change from “shall” to “may”, because the strategy depends on the situation:
 - o The system may continue to provide assistance if v_{smax} is reached and insufficient to follow the lane; but the system may then stop the assistance e.g. if the original target lane is not visible anymore (the drift is too important, the conditions have changed...)
 - o The system may stop the assistance if the vehicle speed exceeds V_{smax}
 - o The system may increase the assistance e.g. if the required acceleration could not be installed quick enough due to limitation of maximum lateral jerk.
- Clarification that the alternative with LDWS only applies to the warning requirement.
- Alignment on the text of GRRF-2013-13 (R10 cross references)

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

5.6.2.2.5. When the system is active (i.e. ready to intervene or intervening) and in the speed range between 10 km/h or V_{smin} , whichever is higher, and V_{smax} , 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.~~ The system shall be automatically deactivated at the latest 30 s after the acoustic signal has started. 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.

Justification:

- Alignment of the requirement on the test in Annex 8 (3.2.4.2).

The above requirements shall be tested in accordance with the relevant vehicle test(s) specified in Annex 8 of this Regulation.

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 (boundary conditions). The vehicle manufacturer shall provide values for V_{smax} , V_{smin} and a_{ysmax} for every speed range as mentioned in the table of paragraph 5.6.2.1.3. of this Regulation;
- 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. **Testing conditions**

The tests 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 on the road used for 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 tests 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 other lane markings identified in Annex 3 of Regulation No. 130. Any of such documentation shall be appended to the test report.
 - 2.2. **Tolerances**

All vehicle speeds specified for the tests described in this annex shall be met within a tolerance of ± 2 km/h.
 - 2.3. **Vehicle conditions**
 - 2.3.1. **Test mass**

The vehicle shall be tested in a load condition agreed between the manufacturer and the Technical Service. No load 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 load conditions.

- 2.3.2. The vehicle shall be tested at the tyre pressures recommended by the vehicle manufacturer.
- 2.4. Lateral acceleration
- The position at which the lateral acceleration shall be measured shall be determined in agreement between the vehicle manufacturer and the Technical Service. This position shall be identified in the test report.
- The lateral acceleration shall be measured without taking into account the additional effects due to the movements of the vehicle body (e.g. roll of sprung mass).
3. Tests procedures
- 3.1. Tests for CSF
- 3.1.1. Warning test for CSF
- 3.1.1.1. The vehicle shall be driven 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 paragraph 5.1.6.2. of this Regulation are met.
- 3.1.1.2. With the agreement of the Technical Service, a simulation may be used. A detailed description of the simulation and its validation shall be included in the test report.
- 3.2. Tests for ACSF Category B1 Systems
- 3.2.1. Lane keeping functional test
- 3.2.1.1. 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. of this Regulation separately.
- The vehicle shall be driven without any force applied by the driver on the steering control (e.g. by removing the hands from the steering control) 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 maximum lateral acceleration specified by the vehicle manufacturer $a_{y_{\text{max}}}$.
- The lateral acceleration and the lateral jerk shall be recorded during the test.
- 3.2.1.2. The test requirements 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 m/s^3 .
- 3.2.1.3. 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. Maximum lateral acceleration test
- 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. of this Regulation separately.

The vehicle shall be driven without any force applied by the driver on the steering control (e.g. by removing the hands from the steering control) 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 acceleration than $a_{y_{\text{max}}} + 0.3 \text{ m/s}^2$ (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 test requirements are fulfilled if:

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

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

3.2.3. Overriding force test

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 force applied by the driver on the steering control (e.g. by removing the hands from the steering control) 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. of this Regulation.

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

The manufacturer shall demonstrate through appropriate documentation that this condition is fulfilled through out the ACSF operation range.

3.2.4. Transition test; hands-on test

3.2.4.1. The vehicle shall be driven with activated ACSF with a vehicle test speed between $V_{\text{min}} + 10 \text{ km/h}$ and $V_{\text{min}} + 20 \text{ km/h}$ on a track with lane markings at each side of the lane.

The driver shall 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.

The test shall be repeated with a vehicle test speed between $V_{\text{max}} - 20 \text{ km/h}$ and $V_{\text{max}} - 10 \text{ km/h}$, without exceeding 130km/h.

Justification:

- Limit test speed, for safety reasons during the test, and to limit the length of the test track. At 180km/h, a test track of more than 3km would be needed, which is quite seldom and may require a test on open road, which may not be relevant for a hands-off test at high speed.

3.2.4.2. The test requirements 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 30 s after the acoustic signal has started, with an emergency signal of at least 5 s, which is different from the warning signal."
