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Steering equipment - Automated Controlled Steering Function

Proposal for amendment to Regulation No. 79 (Steering equipment)

Submitted by the experts of the European Commission, France, Germany, Japan, Republic of Korea, the Netherlands and Sweden*

The text reproduced below was prepared by the experts of the European Commission, France, Germany, Japan, Republic of Korea, the Netherlands and Sweden to amend the requirements of advanced driver assistance steering systems.

* In accordance with the programme of work of the Inland Transport Committee for 2016–2017 (ECE/TRANS/254, para. 159 and ECE/TRANS/2016/28/Add.1, cluster 3.1), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

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I. Proposal

A. Option 1

Paragraph 2.3.4.2., shall be deleted:

~~"2.3.4.2. — **Corrective steering function**" 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 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."~~

B. Option 2

"12.1. As from [the date of entry into force...] no Contracting Party applying this Regulation shall grant Type Approvals to this Regulation for Corrective Steering Functions (CSF) according to paragraph 2.3.4.2. until this paragraph has been revised."

C. Option 3

Paragraph 2.3.4.2., amend to read:

"2.3.4.2. *"Corrective steering function (CSF)"* means the control function within a electronic control system whereby, for a limited duration [and independent of the drivers demand], 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 to assist the avoidance of a collision, or to compensate a sudden, unexpected change in the side force vehicle or to improve the vehicle stability (e.g. side wind, μ -split) or to correct lane departure after crossing the lane marking."

Insert a new paragraph 5.1.6.1.2., to read:

"5.1.6.1.2. Every CSF intervention shall immediately be indicated to the driver by an optical signal which is displayed for at least one second or as long as the compensation exists, whichever is longer.

In the case of a lane departure intervention longer than [thirty seconds], an acoustic warning shall be provided until the end of the intervention.

In the case of two or more consecutive lane departure 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.

Any CSF system shall fulfil the provisions of Annex 6."

D. Option 4

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.

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 lateral manoeuvring or lateral parking operations.

2.3.4.1.2. **"ACSF Category B1"** means a function [which is initiated/activated by the driver and] which continuously assists the driver in keeping the vehicle within the chosen lane, by influencing the lateral movement of the vehicle."

Paragraph 2.3.4.2., amend to read :

"2.3.4.2. **"Corrective Steering Function (CSF)"** means the control function within a electronic control system whereby, for a limited duration [and independent of the drivers demand], 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 to assist the avoidance of a collision, or to compensate a sudden, unexpected change in the side force vehicle or to improve the vehicle stability (e.g. side wind, μ -split) or to correct lane departure after crossing the lane marking."

Insert a new paragraph 5.1.6.2., to read :

"5.1.6.1.2. 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.

In the case of a lane departure intervention longer than [30s], an acoustic warning shall be provided until the end of the intervention.

In the case of two or more consecutive lane departure 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.

Systems, which intervene before the outside of the tyre of the vehicle's front wheel closest to the lane markings crosses the inside edge of the visible lane marking shall meet the requirements of paragraph 5.6.2.

Any CSF system shall fulfill Annex 6."

Insert a new paragraph 5.6. to read:

"5.6. **Provisions for Automatically Commanded Steering Functions**

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

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

5.6.1.1. Whenever the 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 twenty 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.

5.6.2. Special Provisions for ACSF Category B1

Any system of ACSF Category B1 shall fulfill the following requirements within the boundary conditions.

5.6.2.1. General

5.6.2.2.1. The activated system shall at any time ensure that the vehicle does not cross any lane marking under any condition defined by the specified boundary conditions.

5.6.2.2.2. 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.

5.6.2.2.3. The system shall be designed so that excessive intervention of steering control (e.g. an excessive steering torque) is suppressed to ensure the steering operability by the driver and to avoid unexpected vehicle behavior, during its operation.

The end of the intervention shall be such that the system reduces its directional control to zero in a progressive manner, to ensure easy and safe handling of the vehicle, as defined in paragraph 5.1.1.

The steering control effort necessary to override the directional control provided by the system shall not exceed the value specified in paragraph 6.2.4.2. for an intact steering equipment.

5.6.2.2. Operation of ACSF

5.6.2.2.1. If the system is active a 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), it shall provide a means of detecting that the driver is holding the steering control.

If the driver is not holding the steering control for a time span not exceeding [thirty seconds], a warning shall be immediately provided until this is no longer the case or until the system is deactivated, either manually or automatically.

This warning shall be provided by at least two means out of optical, acoustic and haptic given simultaneously or in a cascade.

If this warning continues for more than thirty 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 for at least five seconds which is different from the warning signal.

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 (e.g. V_{smax} , V_{smin} , a_{ysmax}),**
- 5.6.2.3.1.2. Information about how the system detects that the driver is holding the steering control.**
- 5.6.2.3.1.3. [Documentation/information about the system software and version.]**
- 5.6.2.3.1.4. [Information about how the failure warning signal status and the confirmation of the valid software version can be checked via the use of an electronic communication interface.]**

II. Justification

1. Paragraph 2.3.4.2. defines Corrective Steering Functions (CSF). CSF are primarily dedicated for short interventions regarding vehicle stability, to improve the vehicle dynamics or to correct the steering angle to prevent lane departure. Up to now, Regulation No. 79 does not contain specific technical requirements for CSF.
2. Experience has shown that systems have been introduced under the definition CSF, which delivers continuous lane guidance functions. Meanwhile these systems are available on the market and we see, that they partly show automated driving functions. There are systems on the market which allow keeping the vehicle continuous in the lane without any steering input by the driver.
3. To recognize the state of the art and to guarantee a minimum safety level for Lane Keeping Systems, the Small Drafting Group "Lane Keeping Assist Systems (LKAS)" already developed technical requirements for these systems. It was agreed, that the results of the LKAS group shall be incorporated into the work of the Informal Working Group (IWG) on ACSF to be at "unison" with the requirements of ACSF.
4. It is unclear whether the IWG on ACSF will be able to deliver a text for suitable technical requirements for LKAS soon.
5. Therefore it is necessary to prevent any further misuse of the CSF definition for the approval of LKAS systems until suitable technical requirements are available.
6. This proposal offers 4 options, how to handle this issue:
 - (a) The purpose of option 1 and option 2 is:
Not to grant any type approvals for corrective steering functions until detailed technical requirements for CSF are incorporated into this Regulation.
 - (b) The purpose of option 3 is:
To amend the definition of CSF as proposed in this document.
 - (c) The purpose of option 4 is:
To amend the definition of corrective steering functions and to include technical requirements for LKAS as an ASCF of Category B1 as proposed in this document.