

## **Proposal for amendments to UN Regulation No.79 (Steering equipment)**

The modifications to the Regulation are marked in bold characters, and Lane Keeping Assistance System requirements which are already proposed in another informal document GRRF-78-05 are shown by red italic characters.

### **I. Purpose of this document**

At this moment Automatically Commanded Steering Function is restricted less than 10km/h. However, this restriction may be barriers to introduce the advanced technologies into the market. This document is a working document for proposal to discuss in the Ad-hoc group of Automatically Commanded Steering Function which will be held by the interesting members.

### **II. Proposal**

*Paragraph 2.3.4.1.*, amend to read:

"2.3.4. *"Advanced Driver Assistance Steering System"* means a system, additional to the main steering system, that provides assistance to the driver in steering the vehicle but in which the driver remains at all times in primary control of the vehicle. It comprises one or both of the following functions:

2.3.4.1. *"Automatically commanded steering function"* 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,

(a) **low speed manoeuvring or**

(b) **parking operations or**

(c) **driving operations in highway which is designed for non-urban multilane road sections with constructional separation of the two directions of traffic and at least two lanes into the driving direction."**

*Insert a new paragraph 2.3.4.2.1.*, to read:

"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.

**2.3.4.2.1. "Lane Keeping Assistance System" means a system which assists the driver in keeping the vehicle within the chosen lane, by influencing the lateral movement of the vehicle."**

Paragraphs 5.1.6., amend to read:

"5.1.6. Advanced driver assistance steering systems shall only be approved in accordance with this Regulation where the function does not cause any deterioration in the performance of the basic steering system. In addition they shall be designed such that the driver may, at any time and by deliberate action <sup>1)</sup>, override the function.

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**<sup>1)</sup> The vehicle manufacturer shall provide a list of these actions to the technical service at the time of type approval and it shall be annexed to the test report and mentioned in the communication form according to Annex I."**

Insert new paragraph 5.1.6.2. to 5.6.2.4., 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.

**5.1.6.2. Notwithstanding the requirements of paragraph 5.1.6.1., the Automatically Commanded Steering function designed for a restricted area where road traffic environment and infrastructure condition are well-developed such as a highway, e.g. Automated Lane Change system, Enhanced Lane Keeping Assistance System, Automated Safety Stop System in case of Driver's Medical Emergency etc. may be enabled at vehicle speed greater than 10km/h, provided that the following requirements of paragraph 5.1.6.2.1. to 5.1.6.2.4. are all met.**

*5.1.6.2.1. The system shall be designed so that excessive intervention of steering control (e.g. an excessive steering torque) is suppressed to assure the steering operability by the driver and to avoid unexpected vehicle behaviour, during its operation. In addition, it shall be designed such that in its non-fault condition any intervention shall fade out smoothly. The steering control effort necessary to counteract an intervention shall not exceed the specified value in paragraph 6.2.4.2. for a normally operating intact system.*

*5.1.6.2.2. 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, except if the system is in the OFF mode, e.g. switched off. This exception does not affect the required warning in the case of a system malfunction.*

**5.1.6.2.3. The vehicle shall be equipped with a means for the driver to activate or deactivate the Automatically Commanded Steering function.**

**5.1.6.2.4. The Automatically Commanded Steering Function shall have an adequate steering control strategy including a means to detect the events that is predicted to influence vehicle travelling path, such as lane markings and obstacles on a road etc. and ensuring the safe transition at the termination of its control from automatically commanded steering to manual steering. The vehicle manufactures shall provide the Technical Service with the information on the control strategy at type approval."**

*Insert new paragraphs 5.1.6.3., to read:*

*"5.1.6.3. Special provisions for Lane Keeping Assistance System*

*5.1.6.3.1. The system shall meet the requirements of paragraph 5.1.6.2.1., 5.1.6.2.2. above.*

*5.1.6.3.2. The vehicle may be equipped with a means for the driver to activate or deactivate the Lane Keeping Assistance System.*

*5.1.6.3.3. [The system shall have at least 1 type of means to detect driver attention e.g. by sensing the driver's hands on the steering wheel. When the system detects inattention of the driver, it shall give an effective warning [, which shall be at least two means out of optical, acoustic and appropriate haptic,] to call the driver's attention.]"*

*Paragraph 5.5.2., amend to read:*

*"5.5.2. It must be possible to verify in a simple way the correct operational status of those Electronic Systems, which have control over steering. If special information is needed, this shall be made freely available. **It must be possible to verify the correct operational status of those Electronic Systems via the serial interface of the standard diagnostic connector (OBD).**"*

### **III. Justification**

#### **A. Current situation**

1. Driver assistance systems implemented in vehicles aim at supporting the driver with driving task. Lateral dynamics assistance systems such as lane keeping, parking and low velocity maneuvers are already established. These advanced driver assistance steering systems can be divided in two categories :

- (a) Automatically Commanded Steering Functions
- (b) Corrective Steering Functions.

2. Today's Automatically Commanded Steering Functions cover low speed maneuvering situations – up to 10 km/h – such as automated parking functions, whereby the steering system performs without the technical necessity of driver's intervention.

3. Corrective Steering Functions may be activated at any speed. They support the driver in performing the steering task, i. e. keeping the vehicle inside a lane, and thus following a particular path for a limited duration.

4. The systems of both categories shall be designed that the driver may, at any time and by deliberate action, override the function.

## **B. Motivation to extend the speed range of automatically commanded steering functions under defined conditions**

5. The availability of reliable automotive sensors paired with efficient algorithms and high performance actuators enable Automatically Commanded Steering Functions to cover driving tasks also at speeds above 10 km/h. In future it is expected that such functionality can enhance safety of highway traffic by reducing or mostly eliminating accidents due to human error.

6. Example and description of an automatically commanded steering function in an extended speed range:

### Highway Mode

7. The 'Highway Mode' is an automatically commanded steering function that provides automated longitudinal and lateral control of the vehicle on non-urban multilane road sections with constructional separation of the two directions of traffic and at least 2 lanes into the driving direction (Highway), which are typical for motorways or highways. This may comprise driving in various lanes and lane change manoeuvres in case the road section has more than one lane for the relevant driving direction.

## **C. Safety Concept**

8. The safety of such advanced systems would be safeguarded by applying the existing approach for Complex Electronic Systems (CEL). But account of securing the safety control strategy under non fault condition is not sufficient. Therefore, the paragraph 5.1.6.2.4. is added.