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## **Economic Commission for Europe**

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**Regulation No. 79 (Steering Equipment)**

### **Proposal for amendment to Regulation No. 79 (Steering Equipment)**

**Submitted by the expert from Germany**

The text reproduced below was prepared by the expert from Germany to include automatic steering systems under defined conditions for vehicle speeds above 10 km/h. The modifications to the Regulation are marked in red bold and strikethrough characters.

## I. Proposal

*Amend Introduction to read:*

### 0. INTRODUCTION

The intention of the Regulation is to establish uniform provisions for the layout and performance of steering systems fitted to vehicles used on the road. Traditionally the major requirement has been that the main steering system contains a positive mechanical link between the steering control, normally the steering wheel, and the road wheels in order to determine the path of the vehicle. The mechanical link, if amply dimensioned, has been regarded as not being liable to failure.

Advancing technology, coupled with the wish to improve occupant safety by elimination of the mechanical steering column, and the production advantages associated with easier transfer of the steering control between left and right hand drive vehicles, has led to a review of the traditional approach and the Regulation is now amended to take account of the new technologies. Accordingly it will now be possible to have steering systems in which there is not any positive mechanical connection between the steering control and the road wheels.

Systems whereby the driver remains in primary control of the vehicle but may be helped by the steering system being influenced by signals initiated on-board the vehicle are defined as "Advanced Driver Assistance Steering Systems". Such Systems can incorporate an "Automatically Commanded Steering Function", for example, using passive infrastructure features to assist the driver in keeping the vehicle on an ideal path (Lane Guidance, Lane Keeping or Heading Control), to assist the driver in manoeuvring the vehicle at low speed in confined spaces or to assist the driver in coming to rest at a pre-defined point (Bus Stop Guidance). Advanced Driver Assistance Steering Systems can also incorporate a "Corrective Steering Function" that, for example, warns the driver of any deviation from the chosen lane (Lane Departure Warning), corrects the steering angle to prevent departure from the chosen lane (Lane Departure Avoidance) or corrects the steering angle of one or more wheels to improve the vehicle's dynamic behaviour or stability.

In the case of any Advanced Driver Assistance Steering System, the driver can, at all times, choose to override the assistance function by deliberate action, for example, to avoid an unforeseen object in the road.

**This principle is not put into question by the latest amendment of Article 8 of the 1968 Vienna Convention on Road Traffic (VC). The main reason for introducing amendments to the Vienna Convention consisted in specifically declaring technical systems already on the market compatible with the Convention. Furthermore, it is stipulated for the future that all new (assistance) systems are permissible provided that they are either covered by ECE Regulations and meet the technical requirements of ECE Regulations, or, if this is not the case, can at least be overridden or deactivated by the driver at any time. By means of the amendments a legal fiction is created in the Convention to the effect that vehicle systems are compliant with Article 8 (5) of the Convention if they meet the above mentioned requirements.**

**However, other parts of the Convention, e.g. Article 8 (1), remain unaltered. This article stipulates that a driver is required for any vehicle in motion.**

**The amendments bring clarity to the compatibility of technical systems with the Vienna Convention. From now on, the automotive industry is free to develop technical systems as it pleases and demonstrate its innovative capacity, provided that the above mentioned requirements are met. The users are taken care of in that they can choose themselves whether they prefer to use such systems or not. A complete replacement of the driver by a system would require further amendments to the Vienna Convention. Prescriptions concerning Advanced Driver Assistance Steering Systems within the framework of UN Regulation 79 have to be seen in the light of this background.**

It is anticipated that future technology will also allow steering to be influenced or controlled by sensors and signals generated either on or off-board the vehicle. This has led to several concerns regarding responsibility for the primary control of the vehicle and the absence of any internationally agreed data transmission protocols with respect to off-board or external control of steering. Therefore, the Regulation does not permit the general approval of systems that incorporate functions by which the steering can be controlled by external signals, for example, transmitted from roadside beacons or active features embedded into the road surface. Such systems, which do not require the presence of a driver, have been defined as "Autonomous Steering Systems".

This Regulation also prevents the approval of positive steering of trailers using energy supply and electrical control from the towing vehicle as there are not any standards applicable to energy supply connectors or to control transmission digital information interchange. It is expected that at some time in the future, the International Standards Organization (ISO) Standard, ISO11992, will be amended to take account of transmission of steering control data.

*Amend paragraph 2.3.4.1., to read:*

- 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, in low speed manoeuvring or parking operations or **driving operations on road sections dedicated exclusively to motor vehicles [(Highway)] with constructional separation of the two directions of traffic.**

*Amend paragraphs 5.1.6. and add new paragraph 5.1.6.2, 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, override the ~~system function~~. **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. The vehicle shall be equipped with a means for the driver to activate or deactivate the system.**

- 5.1.6.2 **Notwithstanding the requirements of paragraph 5.1.6.1, automatically commanded steering systems may be operational up to a vehicle speed of 130 km/h on road sections dedicated exclusively to motor vehicles (Highway) with constructional separation of the two directions of traffic. Whenever the automatically commanded steering 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 haptic warning signal. This warning shall be provided before the system (function) becomes inoperational, if the termination is not intended by the driver. The time interval from the start of the warning sequence until termination of the function shall be sufficient for the driver to allow a safe shift from automatically commanded steering to manual steering. This time interval is in full responsibility of the vehicle manufacturer and not part of the granted type approval.**

*Amend paragraph 5.5.2, 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).**

## II. Justification

### A. Current situation

Driver assistance systems implemented in vehicles aim at supporting the driver with his 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 :

- Automatically Commanded Steering Functions
- Corrective Steering Functions.

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.

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.

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**

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. According to the technical setup of the system the functions may become operational on roads with reduced traffic complexity (f.e. motorways or highways).

Example and description of an automatically commanded steering system in an extended speed range:

### Highway System

The 'Highway System' is an automatically commanded steering function that provides automated longitudinal and lateral control of the vehicle on road sections with constructional separation of the two directions of traffic, which are exclusively dedicated to motor vehicles, and where no pedestrians or bicycles are present under normal conditions (f.e. motorways or highways). This may include 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**

The safety of such advanced systems can be safeguarded by applying the existing approach for Complex Electronic Systems (CEL). All safety criteria including the option to override the system by the driver will also apply to the systems at speeds above 10 km/h.

The safety concept must be assessed by using the existing annex 6 dedicated to the safety of complex electronic systems. The following items have to be considered in order to validate the safety concept:

- Systems running under non-fault conditions will not prejudice the safe operation of any steering actions by the driver.
- Safety concept under fault conditions including methods like FMEA, FTA, etc.
- Driver interface including warning concept
- Safety measures against manipulation
- Fall back strategy including fail-safe conditions

These items are covered by Annex 6 of ECE R 79. It may be used as a framework for the safety evaluation of automatically commanded steering functions at speeds above 10 km/h.