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## Economic Commission for Europe

### Inland Transport Committee

### World Forum for Harmonization of Vehicle Regulations

#### 182nd session

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Item 19.8 of the provisional agenda

#### Progress on the development of new UN GTRs and of amendments to established UN GTRs

UN GTR No. 8 (Electronic stability control systems (ESC))

## Authorization to develop amendments to UN GTR No. 8

### Submitted by the representative of the Republic of Korea\* \*\*

The text reproduced below was prepared by the representatives of the Republic of Korea. It was adopted by the Executive Committee (AC.3) of the 1998 Agreement at its June 2020 session (ECE/TRANS/WP.29/1153, para. 64). It is based on ECE/TRANS/WP.29/2020/99. This authorization is transmitted to the Working Party on Automated/Autonomous and Connected Vehicles (GRVA). This document shall be appended to the UN GTR in accordance with the provisions of paragraphs 6.3.4.2., 6.3.7. and 6.4. of the 1998 Agreement.

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\* In accordance with the programme of work of the Inland Transport Committee for 2020 as outlined in proposed programme budget for 2020 (A/74/6 (part V sect. 20) para 20.37), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

\*\* This document was scheduled for publication after the standard publication date owing to circumstances beyond the submitter's control.



## **I. Objective**

1. The objective of this proposal is to develop, in the framework of the 1998 Agreement, an amendment to UN Global Technical Regulation (GTR) No. 8 on Electronic Stability Control to amend to the testing provisions to accommodate the latest innovations for steering systems which have significantly low steering gear ratio (i.e. quick steering characteristics).

## **II. Background**

2. The expert from Republic of Korea introduced informal document (GRVA-05-11) in the fifth session of the Working Party on Automated/Autonomous and Connected Vehicles (GRVA), 10-14 February 2020, proposing draft Amendment 1 to UN Global Technical Regulation No. 8 (ESC). Also, there was the formal proposal for amendment of UN Regulation No. 140 (ESC) submitted by the experts from the International Organization of Motor Vehicle Manufacturers (OICA) (ECE/TRANS/WP.29/GRVA/2020/12, GRVA-05-56) which was formally adopted by GRVA during its fifth session. These proposals would be to ensure consistency of UN GTR No. 8 (ESC) with proposed amendment to UN Regulation No. 140 (ESC).

## **III. Proposal for amendments**

### **A. Statement of technical rationale and justification**

#### **(a) Background**

3. UN GTR No. 8 (ESC) prescribes that the “Sine with Dwell” series test of vehicle directional stability performance shall be conducted with (as defined in paragraph 7.9.):

(a) The initial steering wheel angle amplitude of 1.5A;

(b) The steering wheel angle amplitude is increased by 0.5A from a test run to next run;

(c) The final steering wheel angle amplitude of the greater of 6.5A or 270 degrees. If any 0.5 A increment, up to 6.5 A, is greater than 300 degrees, the steering amplitude of the final run shall be 300 degrees, where "A" is the steering wheel angle that produces a steady state lateral acceleration of 0.3 g for the test vehicle, which is determined from the “Slowly Increasing Steer” test.

4. In these test conditions, the normalized angle “A” evacuates the influence of the steering gear ratio in relation to the steering wheel angle and vehicle behaviour. The lower the steering gear ratio is (i.e. the quicker the steering characteristic is), the smaller the angle “A” and steering angle amplitude for each test run are, to provide constant steered wheel angle implying constant lateral movement of vehicle, regardless of the steering gear ratio, for reasonable testing of ESC.

5. However, the final steering wheel angle amplitude is fixed between 270 and 300 degrees, which are absolute values, not the normalized angles that exclude the influence of the steering gear ratio of each vehicle.

#### **(b) Concern for future steering systems**

6. There might appear in the future some vehicles which have significantly low steering gear ratio (i.e. quick steering characteristics) and which may not be able to achieve the specified final absolute angle amplitude in the ESC test, then jeopardizing future beneficial improvement of steering equipment e.g. steering-by-wire system.

#### **(c) Justification of the proposal**

7. The above proposal would be appropriate because:

(a) the final steering wheel angle amplitude of 270 to 300 degrees was decided based on the investigation of an average driver's ability to operate steering wheel as fast as possible under the specified "Sine with Dwell" condition. Thus, the decision was based on maximum achievable steering wheel input. The final steering wheel angle amplitude for the series of tests could be decided to be the maximum operable steering wheel angle of the steering system if the maximum operable angle is less than 270 degrees. It is because the maximum operable angle is equivalent to the maximum achievable steering input in this case.

(b) The ESC regulation is not intended to prescribe a maximum operable steering wheel angle. It would not be reasonable to judge that a vehicle equipped with low geared steering system (e.g. quick steering characteristics, steering-by-wire system etc.) is incompliant with the ESC regulation for the simple reason that the operable steering wheel angle is less than 270 degrees, even though it is adequately safe in practical use with technical development and complies with UN Regulation No. 79 steering requirements.

(c) When carrying out ESC test, steering robot should necessarily be used for ESC test. If the final angle for the series test directly use in steering robot for ESC test vehicles which have significantly low steering gear ratio, the overshoot normally occurs. The overshoot results in excessive moments due to the mechanical limit of steering equipment and causes the steering robot not to complete command input, so the steering robot could stop. Therefore, in order to solve this problem, the final angle should be inputted over 98% of the maximum operable steering angle.

(d) Future vehicles equipped with an improved steering system e.g. steering-by-wire system may also be unable to reach the steering wheel angle amplitude of 5A specified in the ESC responsiveness requirement, because of its significantly quick steering characteristics. It is also necessary to amend the steering wheel angle condition of the responsiveness requirement in addition to the maximum steering wheel angle value for the tests, so that future beneficial steering systems may not be jeopardized.

(e) Also, in line with the formal proposal for amendment of UN Regulation No. 140 (ESC) submitted by the experts from the International Organization of Motor Vehicle Manufacturers (OICA) (ECE/TRANS/WP.29/GRVA/2020/12), aimed at harmonising the requirements of UN Regulation No. 140 (ESC) with UN GTR No. 8 (ESC), the another objective of this proposal is to ensure consistency of UN GTR No. 8 (ESC) with proposed amendment to UN Regulation No. 140 (ESC).

## B. Proposed amendments

*Paragraph 5.*, amend to read:

"5. Performance Requirements. During each test performed under the test conditions of paragraph 6. and the test procedure of paragraph 7.9., the vehicle with the ESC system engaged shall satisfy the directional stability criteria of paragraphs 5.1. and 5.2., and it shall satisfy the responsiveness criterion of paragraph 5.3. during each of those tests conducted with a commanded steering wheel angle of 5A or greater (but limited as per paragraph 7.9.4.), where A is the steering wheel angle computed in paragraph 7.6.1.

Notwithstanding the above, the responsiveness criterion is deemed to be satisfied also for systems where the maximum operable steering wheel angle defined in paragraph 7.9.4. and the lateral displacement prescribed in paragraph 5.3. are achieved at a commanded steering wheel angle less than 5A."

*Paragraph 7.9.4.*, amend to read:

"7.9.4. The steering amplitude of the final run in each series is the greater of 6.5 A or 270 degrees, provided the calculated magnitude of 6.5 A is less than or equal to 300 degrees. If any 0.5 A increment, up to 6.5 A, is greater than 300 degrees, the steering amplitude of the final run shall be 300 degrees.

If the above calculated steering amplitude of the final run is greater than the maximum operable steering wheel angle determined by design of the steering system, the final angle amplitude for the series test shall be greater than 98 per cent of the maximum operable angle."

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