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**1958 Agreement:**
**Consideration of draft amendments to existing UN Regulations submitted by GRVA**

# Proposal for Supplement 2 to the 02 series of amendments to UN Regulation No. 79 (Steering equipment)

### Submitted by the Working Party on Automated/autonomous and Connected Vehicles *

The text reproduced below was adopted by the Working Party on Automated/autonomous and Connected Vehicles (GRVA) at its fifth session, in February 2020 (see ECE/TRANS/WP.29/GRVA/5, paras. 46 and 52). It is based on ECE/TRANS/WP.29/GRVA/2020/10, ECE/TRANS/WP.29/GRVA/2020/11 and ECE/TRANS/WP.29/GRVA/2019/19 as amended. It is submitted to World Forum for Harmonization of Vehicle Regulations (WP.29) and the Administrative Committee of the 1958 Agreement (AC.1) for consideration and vote at their June 2020 sessions

* 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.

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*Paragraph 5.1.6.1., add a new sub-paragraph 5.1.6.1.2.3.*, to read:

"5.1.6.1. A CSF system shall be subject to the requirements of Annex 6.

5.1.6.1.1. Every CSF intervention shall immediately be indicated to the driver by an optical warning signal which is displayed for at least 1 s or as long as the intervention exists, whichever is longer.

5.1.6.1.2. 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:

5.1.6.1.2.1. In the case of an intervention longer than:

(a) 10 s for vehicles of category $M_1$ and $N_1$, or

(b) 30 s for vehicles of category $M_2$, $M_3$ and $N_2$, $N_3$,

an acoustic warning signal shall be provided until the end of the intervention.

5.1.6.1.2.2. 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 signal 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 acoustic warning signal shall continue for at least 10 seconds longer than the previous warning signal.

5.1.6.1.2.3. For vehicles of categories $M_2$ and $M_3$ equipped with a Lane Departure Warning System (LDWS) fulfilling the technical requirements of Regulation No. 130, the acoustic warning signal specified in paragraphs 5.1.6.1.2.1. and 5.1.6.1.2.2. may be replaced by a haptic warning, provided it is not solely given via the steering wheel."

*Paragraph 5.6.2.1.1.*, amend to read:

"5.6.2.1.1. The activated system shall at any time, within the boundary conditions, ensure that the vehicle does not cross a lane marking for lateral accelerations below the maximum lateral acceleration specified by the manufacturer $ay_{smax}$.

It is recognised that the maximum lateral acceleration specified by the vehicle manufacturer $ay_{smax}$ may not be achievable under all conditions (e.g. inclement weather, different tyres fitted to the vehicle, laterally sloped roads). The system shall not deactivate or unreasonably switch the control strategy in these other conditions.

The system may exceed the specified value $ay_{smax}$ by not more than 0.3 $m/s^2$, while not exceeding the maximum value specified in the table in paragraph 5.6.2.1.3. of this Regulation.

Notwithstanding the sentence above, for time periods of not more than 2 s the lateral acceleration of the system may exceed the specified value $ay_{smax}$ by not more than 40 per cent, while not exceeding the maximum value specified in the table in paragraph 5.6.2.1.3. of this Regulation by more than 0.3 $m/s^2$."

*Paragraph 5.6.2.3., insert a new sub-paragraph 5.6.2.3.1.3.*, to read:

"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 to this regulation to the Technical Service at the time of type approval;

…

5.6.2.3.1.3. Information about inputs other than lane markings (e.g. road boundaries, infrastructural separation, surrounding traffic, map data) that the system uses to reliably determine the course of the lane."

*Annex 8*

*Paragraph 2.1.* amend to read:

"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 UN 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 3.5 m, for the purpose of the tests of this annex. At the manufacturer's discretion and with the agreement of the Technical Service, a lane with a width of less than 3.5 m may be used, if the correct function of the system on roads with wider lanes can be demonstrated.

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 UN Regulation No. 130. Any of such documentation shall be appended to the test report. "

*Paragraph 2.4.,* amend to read:

"2.4. Lateral acceleration

The lateral acceleration and the lateral jerk at vehicle's center of gravity shall be determined. The raw lateral acceleration data shall be measured closest as possible to the position of the vehicle's center of gravity. The position at which the lateral acceleration is measured and the centre of gravity of the vehicle shall be identified in the test report. The sampling rate shall be at least 100 Hz.

To determine the lateral acceleration, the raw data shall be filtered by applying a fourth order Butterworth filter with a cut-off frequency of 0.5 Hz.

To determine the lateral jerk, the 500ms moving average of the time derivation of the filtered lateral acceleration shall be considered.

The lateral acceleration data at the vehicle center of gravity shall be determined by removing additional effects due to the movements of the vehicle body (e.g. roll of sprung mass) and by correcting for sensor placement via the use of coordinate transformation. As reference, the intermediate axis system as described in ISO 8855:2011 shall be used."

*Insert a new paragraph 2.5.*, to read:

"2.5. Overriding force

The measurement of the overriding force during the test can be performed by two methods: either through the internal driver torque signal or by an external measurement device fitted, which doesn’t induce any deactivation of the system.

Prior to performing the overriding force test~~,~~ by the internal driver torque signal, it shall be verified by an external measurement device that there are no relevant differences between the both measured values. Differences shall be less than or equal to 3N. This requirement is deemed to be fulfilled if the correlation between the values of the internal driver torque signal and the external measurement device was determined and is applied in the overriding force test.

*Paragraph 3.1.1.1.*, amend to read:

"3.1.1. Warning test for CSF

3.1.1.1. The vehicle shall be driven with an activated CSF on a road with lane markings on each side of the lane. In case of a CSF whose interventions are solely based

on the evaluation of the presence and location of lane boundaries, the vehicle shall be driven on a road delimited by the boundaries as declared by the manufacturer (e.g. road edge).

The test conditions and the vehicle test speed shall be within the operating range of the system.

During the test, the duration of the CSF interventions and of the optical and acoustic or haptic warning signal, as relevant, shall be recorded.

In the case of paragraph 5.1.6.1.2.1. of this Regulation, the vehicle shall be driven such that it attempts to leave the lane and causes CSF intervention to be maintained for a period longer than 10s (for $M_1$, $N_1$) or 30s (for $M_2$, $M_3$, $N_2$, $N_3$). If such a test cannot be practically achieved due to e.g. the limitations of the test facilities, with the consent of the type approval authority this requirement may be fulfilled through the use of documentation.

The test requirements are fulfilled if:

(a) The acoustic or haptic warning, as relevant, is provided no later than 10s (for $M_1$, $N_1$) or 30s (for $M_2$, $M_3$, $N_2$, $N_3$) after the beginning of the intervention.

In the case of paragraph 5.1.6.1.2.2. of this Regulation, the vehicle shall be driven such that it attempts to leave the lane and causes at least three interventions of the system within a rolling interval of 180 s.

The test requirements are fulfilled if:

(a) An optical warning signal is provided for each intervention, as long as the intervention exists, and

(b) An acoustic or haptic warning signal, as relevant, is provided at the second and third intervention

and

(c) The acoustic or haptic warning signal, as relevant, at the third intervention is at least 10s longer than the one at the second intervention."

*Paragraphs 3.2.1.1. and 3.2.1.2.*, amend to read:

"3.2.1.1. The vehicle speed shall remain in the range from $V_{smin}$ up to $V_{smax}$.

The test shall be carried out for each speed range specified in paragraph 5.6.2.1.3. of this Regulation separately or within contiguous speed ranges where the $ay_{smax}$ is identical.

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 or with a predefined initial speed when using an embedded vehicle speed control system (e.g. for vehicles automatically decelerating in curves) on a curved track with lane markings at each side.

The necessary lateral acceleration to follow the curve shall be between 80 and 90 per cent of the maximum lateral acceleration specified by the vehicle manufacturer $ay_{smax}$. The measured lateral acceleration during the test execution can be outside of the above-mentioned limits.

The lateral acceleration and the lateral jerk shall be recorded during the test.

3.2.1.2. The test requirements are fulfilled if:

No outside edge of the tyre tread of the vehicle's front wheel does cross the outside edge of any lane marking.

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

*Paragraphs 3.2.2.1. and 3.2.2.2.,* amend to read:

"3.2.2.1. The vehicle speed shall remain in the range from Vsmin up to Vsmax

[…] 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.

If an embedded vehicle speed control system will automatically decelerate the vehicle in the curve, it shall be inhibited.

[…]

3.2.2.2. The test requirements are fulfilled if:

The recorded acceleration is within the limits specified in paragraph 5.6.2.1.1. of this Regulation.

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

*Paragraph 3.2.3.1*. amend to read*:*

"3.2.3.1. The vehicle speed shall remain in the range from Vsmin up to Vsmax.

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 per cent of the maximum lateral acceleration specified by the vehicle manufacturer $a_{ysmax}$.

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. "

*Paragraph 3.2.4.1. and 3.2.4.2.,* amend to read:

"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 Vsmin + 10 km/h and Vsmin + 20 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 65 s without any driver intervention.

The test shall be repeated with a vehicle test speed between Vsmax – 20 km/h and Vsmax – 10 km/h or 130 km/h whichever is lower and may be stopped upon the start of the optical warning.

Additionally, the vehicle manufacturer shall demonstrate to the satisfaction of the Technical Service that the requirements for the whole speed range are fulfilled. This may be achieved on the basis of appropriate documentation appended to the test report.

3.2.4.2. The test requirements are fulfilled if:

During both tests the optical warning signal was given at the latest 15 s after the steering control has been released and remains until ACSF is deactivated.

During the lower speed test the acoustic warning signal was given at the latest 30 s after the steering control has been released and remains until ACSF is deactivated.

During the lower speed test the ACSF is deactivated at the latest 30 s after the acoustic warning signal has started, with an acoustic emergency signal of at least 5 s, which is different from the previous acoustic warning signal."

*Insert new paragraphs 3.2.5. to 3.2.5.2.*, to read:

"3.2.5. Lane Crossing Warning Test for $M_1$ $N_1$ and for $M_2$ $M_3$ $N_2$ and $N_3$, if not equipped with a Lane Departure Warning System (LDWS) fulfilling the technical requirements of UN Regulation No. 130.

3.2.5.1. The vehicle shall be driven with activated ACSF with a vehicle test speed between $V_{smin}$ and $V_{smax}$.

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) on a curved track with lane markings at each side.

The technical service defines a test speed and a radius which would provoke a lane crossing. The test speed and radius shall be defined such that the necessary lateral acceleration to follow the curve is in between $ay_{smax}$ + 0.1 m/s² and $ay_{smax}$ + 0.4 m/s².

3.2.5.2. The test requirements are fulfilled if:

The optical warning signal and additionally the acoustic or haptic warning signal was given at the latest when the outside edge of the tyre tread of the vehicle's front wheel has crossed the outside edge of the lane marking."

The system continues to provide assistance as required in paragraph 5.6.2.2.3."