

**Economic and Social Council**Distr.: General
11 April 2024

Original: English

Economic Commission for Europe

Inland Transport Committee

World Forum for Harmonization of Vehicle Regulations**Working Party on Automated/Autonomous and Connected Vehicles****Nineteenth session**

Geneva, 25 June 2024

Item 6(b) of the provisional agenda

Advanced Driver Assistance Systems and UN Regulation No. 79:**UN Regulation No. 79 (Steering equipment)****Proposal for the 05 series of amendments to
UN Regulation No. 79 (Steering equipment)****Submitted by the expert from Australia***

The text reproduced below was prepared by the expert from Australia proposing the 05 series of amendments to United Nations Regulation No. 79 (Steering Equipment). The proposed amendments intend to facilitate a consistent approach across all Contracting Parties for Emergency Lane Keeping Systems (ELKS) covering vehicles of category M₁ and N₁. Currently the European Union mandates ELKS through Regulation (EU) 2021/646, with the proposed amendments closely aligning with its requirements. The modifications to the current text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2024 as outlined in proposed programme budget for 2024 (A/78/6 (Sect. 20), table 20.5), 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.

I. Proposal

Paragraph 2.3.4.2., amend to read:

2.3.4.2. “*Corrective Steering Function (CSF)*” means a control function within an electronic control system whereby, for a limited duration, changes to the steering angle of one or more wheels **and/or braking of individual wheels** may result from the automatic evaluation of signals initiated on-board the vehicle, in order:

- (a) To compensate a sudden, unexpected change in the side force of the vehicle, or;
- (b) To improve the vehicle stability (e.g. side wind, differing adhesion road conditions "μ-split"), or;
- (c) To correct lane departure. (e.g. to avoid crossing lane markings, leaving the road).

Insert a new paragraph 2.10., to read:

2.10. “*Distance To Lane Marking (DTLM)*” means the remaining lateral distance (perpendicular to the lane marking) between the inner side of the lane marking and most outer edge of the tyre before the subject vehicle crosses the inner side of the lane marking.

Paragraph 5.1.6.1.1., amend to read:

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.

The optical signal may be the flashing of the failure warning signal specified in paragraph 5.1.6.1.7.1. When a flashing mode is used, a lighting phase shall be visible at the end of the intervention or later.

In the case of a CSF intervention which is controlled by an Electronic Stability Control (ESC) or a Vehicle Stability Function as specified in the relevant UN Regulation (i.e. UN Regulations Nos. 13, 13-H or 140), the ESC flashing tell-tale indicating the interventions of ESC may be used, as long as the intervention exists, as an alternative to the optical warning signal specified above.

Paragraph 5.1.6.1.3., amend to read:

5.1.6.1.3. The steering control effort necessary to override the directional control provided by the system shall not exceed 50 N in the whole range of CSF operations. **Significant loss of steering support once overridden must not happen suddenly.**

For CSF systems which do not act on the steering itself (e.g. differential braking type CSF), the steering input for overriding the CSF must not exceed 25 degrees.

Insert a new paragraph 5.1.6.1.5., to read:

5.1.6.1.5. The CSF must be active at least between 65 km/h and 130 km/h (or the maximum vehicle speed if it is below 130 km/h) and at all vehicle load conditions, unless deactivated as per paragraph 5.1.6.1.8.

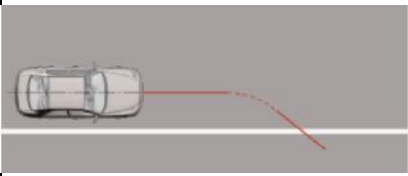
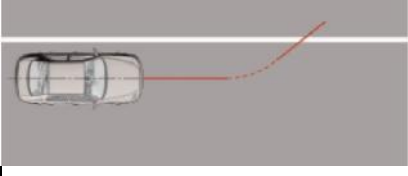
Insert a new paragraph 5.1.6.1.6., to read:

5.1.6.1.6. Lane keep

The requirements of this paragraph only apply to M₁ and N₁ category vehicles where fitted with a CSF that meets the definition of subparagraph (c) of paragraph 2.3.4.2.

In the absence of conditions leading to deactivation or suppression of the system, the CSF must be able to prevent lane departure to a maximum DTLM of -0.3m, i.e. the outer edge of the tyre must not cross the inner side of the visible lane marking by any more than 0.3 m, for each scenario shown in the following table, as well as:

- (a) for lateral departure velocities in the range of the 0.2 m/s to 0.5 m/s for vehicle speeds up to 100 km/h and for lateral departure velocities in the range of 0.2 m/s to 0.3 m/s for vehicle speeds greater than 100 km/h and up to 130 km/h (or the maximum vehicle speed if it is below 130 km/h);
- (b) on straight, flat and dry roads;
- (c) for both solid line and dashed lane markings in line with one of those described in Annex 3 (Visible lane marking identification) of UN Regulation No. 130;
- (d) with the lane markings being in good condition;
- (e) in all illumination conditions without blinding of the sensors (e.g. direct blinding sunlight) and with activated passing-beam (dipped-beam) headlamps if necessary;
- (f) in absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 0 °C) or the visibility of lane markings (e.g. no fog).

| No. | Scenario description |
|-----|---|
| 1. | Both solid and dashed lines – departure to the right side of the vehicle  |
| 2. | Both solid and dashed lines – departure to the left side of the vehicle  |

It is recognised that the performances required for the scenarios in this table may not be fully achieved in other conditions than those listed above. However, the system must not unreasonably switch the control strategy in these other conditions. This must be demonstrated in accordance with the testing requirements.

The lane keep capability must be tested in accordance with the relevant vehicle test(s) specified in Annex 8 to this Regulation.

Insert a new paragraph 5.1.6.1.7. (and subparagraphs), to read:

5.1.6.1.7. CSF failure warning

A warning must be provided when there is a failure detected in the CSF that prevents the system from fulfilling the requirements of this Regulation.

5.1.6.1.7.1. The failure warning must be a constant optical warning signal.

- 5.1.6.1.7.2. There must not be an appreciable time interval between each CSF self-check (an integrated function that checks for a system failure on a continuous basis at least while the system is active), and subsequently there must not be a delay in illuminating the warning signal, in the case of an electrically detectable failure.
- 5.1.6.1.7.3. Upon detection of any non-electrical failure condition (e.g. sensor misalignment), the warning signal as defined in paragraph 5.1.6.1.7.1. must be activated.
- 5.1.6.1.7.4. If the vehicle is equipped with a means to deactivate the CSF a warning must be given when the system is deactivated according to paragraph 5.1.6.1.8. This must be a constant optical warning signal. The failure warning signal specified in paragraph 5.1.6.1.7.1. may be used for this purpose.

Insert a new paragraph 5.1.6.1.8. (and subparagraphs), to read:

5.1.6.1.8. CSF deactivation

5.1.6.1.8.1. Manual deactivation

When a vehicle is equipped with a means to manually deactivate the CSF function, either partially or fully, the following conditions must apply as appropriate:

- 5.1.6.1.8.1.1. The full CSF function must be automatically and fully reinstated upon each activation of the vehicle master control switch.
- 5.1.6.1.8.1.2. The manual deactivation of the full CSF must not be possible with less than two deliberate actions, e.g. press and hold on a button, or select and confirm on menu option.
- 5.1.6.1.8.1.3. The manual deactivation capability must be tested in accordance with the relevant vehicle test(s) specified in Annex 8 to this Regulation.

5.1.6.1.8.2. Automatic deactivation

If the vehicle is equipped with a means to automatically deactivate the CSF function, either partially or fully, for instance in situations such as off-road use, being towed, a trailer being hitched to the vehicle or the electronic stability control (ESC) being deactivated, the following conditions must apply as appropriate:

- 5.1.6.1.8.2.1. For testing, the vehicle manufacturer must provide a list of situations and corresponding criteria where the CSF function is automatically deactivated which must be annexed to the test report.
- 5.1.6.1.8.2.2. The CSF function must be automatically and fully reactivated as soon as the conditions that led to the automatic deactivation are not present anymore.
- 5.1.6.1.8.3. A constant optical warning signal must inform the driver that the CSF function has been deactivated. The failure warning signal specified in paragraph 5.1.6.1.7.1. above may be used for this purpose.

Insert a new paragraph 5.1.6.1.9. (and subparagraphs), to read:

5.1.6.1.9. Automatic suppression

5.1.6.1.9.1. For driver intended manoeuvres

For testing, the manufacturer must provide a documentation package which gives access to the basic design and logic of the system for detection of likely driver intended manoeuvres and automatic suppression of the CSF. This package must include a list of parameters detected and a basic description of the method used to decide that the system should be suppressed, including limit values where possible. For the CSF, the Technical Service must assess the documentation package to show that driver unintentional manoeuvres, within

the scope of the lane keep test parameters (in particular lateral departure velocity), will not result in automatic suppression of the system.

- 5.1.6.1.9.2. Automatic suppression of the CSF is also permitted in situations when other driver assist or automated steering functions, (i.e. ACSF, ESF or automated lane keeping), are controlling the lateral movement of the vehicle or other safety related functions (i.e. that is capable of changing the dynamic behaviour of the vehicle such as AEBS, ESC, etc.) are intervening. These situations must be declared by the manufacturer.

Insert a new paragraph 12.4. (and subparagraphs), to read:

- 12.4. Transitional Provisions applicable to the 05 series of amendments:
- 12.4.1. As from the official date of entry into force of the 05 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept type approvals under this Regulation as amended by the 05 series of amendments.
- 12.4.2. As from [1 September 202X], Contracting Parties applying this Regulation shall not be obliged to accept type approvals to the preceding series of amendments, first issued on or after [1 September 202X].
- 12.4.3. Until [1 September 202Y], Contracting Parties applying this Regulation shall accept type approvals to the preceding series of amendments, first issued before [1 September 202X].
- 12.4.4. As from [1 September 202Y], Contracting Parties applying this Regulation shall not be obliged to accept type approvals issued to the preceding series of amendments to this Regulation.
- 12.4.5. Notwithstanding paragraph 12.4.2. and 12.4.4., Contracting Parties applying this Regulation shall continue to accept UN type approvals issued according to a preceding series of amendments to this Regulation, for vehicles which are not affected by the provisions introduced with the 05 series of amendments.

Paragraphs 12.4. and 12.4.1. (former), re-number as paragraphs 12.5. and 12.5.1., to read:

- 12.5. General transitional provisions
- 12.5.1. Contracting Parties applying this Regulation shall not refuse to grant UN Type approvals according to any preceding series of amendments to this regulation or extensions thereof.

Annex 8, paragraph 2., amend to read:

2. Testing conditions

The tests shall be performed on a flat, dry asphalt or concrete surface affording good adhesion, **which may not contain any irregularities (e.g. large dips or cracks, manhole covers or reflective studs) within a lateral distance of 3.0 m to either side of the centre of the test lane and with a longitudinal distance of 30 m ahead of the subject vehicle from the point after the test is complete.** The ambient temperature shall be between 0 °C and 45 °C.

The ambient illumination conditions shall be of at least 2,000 lux without blinding of the sensors (e.g. direct blinding sunlight) and with activated low beam head lamps if necessary.

At the request of the manufacturer and with the agreement of the Approved Testing Facility tests may be conducted under deviating test conditions (suboptimal conditions, e.g. on a not dry surface; below the specified minimum ambient temperature), whilst the performance requirements are still to be met.

Annex 8, insert a new paragraph 2.3.3., to read:

- 2.3.3 Where the CSF is equipped with a user-adjustable timing threshold, the test specified in paragraph 3.1.3. must be performed with the timing threshold set

at its latest setting for system intervention. No alteration must be made once the test procedure has begun.

Annex 8, paragraph 3.1.1.1., amend to read:

- 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).

If requested by the vehicle manufacturer the vehicle can be driven to calibrate the sensor system up to a maximum of 100 km on a mixture of urban and rural roads with other traffic and roadside furniture.

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 M₁, N₁) or 30s (for M₂, M₃, N₂, N₃). 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 M₁, N₁) or 30s (for M₂, M₃, N₂, N₃) 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 10 s longer than the one at the second intervention.

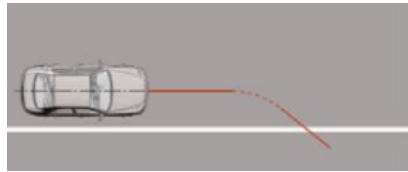
Annex 8, paragraph 3.1.2.2., amend to read:

- 3.1.2.2. The test requirements are fulfilled if:

- (a) The force applied by the driver on the steering control to override the intervention does not exceed 50 N.
- (b) **There is no sudden loss of significant steering support once CSF is overridden.**
- (c) **For CSF that do not act on the steering itself (e.g. differential braking type CSF), the steering input for overriding the CSF does not exceed 25 degrees.**

Annex 8, insert a new paragraph 3.1.3. (and subparagraphs), to read:

- 3.1.3. Lane keep test for M₁ and N₁ category vehicles where fitted with a CSF that meets the definition of subparagraph (c) of paragraph 2.3.4.2.
- 3.1.3.1. The CSF must be tested for test scenarios No 1 and No 2 described in paragraph 5.1.6.1.6.
- 3.1.3.1.1. Tests for all scenarios must be performed with lateral velocities of 0.2 m/s and 0.5 m/s.
- 3.1.3.1.2. A test path must be driven which consists of an initial straight path parallel to the lane marking being tested, followed by a fixed radius curve to apply a known lateral velocity and yaw to the subject vehicle, followed again by a straight path without any force applied on the steering control (e.g. by removing the hands from the steering control).



- 3.1.3.1.3. The subject vehicle speed during the test up to the point of system intervention must be 67 km/h +/- 1 km/h.
The curve of fixed radius driven to apply the lateral velocity required must have a radius 1,200 m or more.
The lateral velocity required must be achieved to a tolerance of +/- 0.05 m/s.
The vehicle manufacturer must provide information describing the radius of the curve to be driven and the location when the closed loop path and/or speed control must be ended so as to ensure a free drifting in order not to interfere an automatic suppression according to paragraph 5.1.6.1.9.1.
- 3.1.3.2. The test requirements are fulfilled if the subject vehicle does not cross the lane marking by greater than a DTLM of -0.3 m.
- 3.1.3.3. In addition, the vehicle manufacturer must demonstrate to the satisfaction of the Technical Service that the requirements for the whole speed range and lateral departure velocity range are fulfilled. This may be achieved on the basis of appropriate documentation appended to the test report

II. Justification

1. Australia is currently proposing to mandate the fitment of ELKS for vehicle categories equivalent to M₁ and N₁. A feasible option is to adopt Corrective Steering Function (CSF) requirements within UN Regulation No. 79 to cover Corrective Directional Control Function requirements as specified in EU Regulation 2021/646.
2. Australia does not consider the current requirements for CSF in UN Regulation No. 79 to be adequate and prefers adopting similar requirements to those in EU Regulation 2021/646 (Emergency Lane Keeping Systems). This is because the current UN Regulation does not provide sufficient stringency in the performance requirements for light vehicles, such as automatically and fully reinstating the CSF upon each activation of the vehicle master control switch etc.
3. Therefore, the expert from Australia proposes to amend the performance requirements of UN Regulation No. 79 to align with the requirements in EU Regulation 2021/646 for vehicles of category M₁ and N₁.
4. These amendments will provide a consistent approach across all Contracting Parties for the performance requirements and regulation of ELKS in vehicles of category M₁ and N₁.

5. Research published by the Monash University Accident Research Centre (MUARC) reported that 11 per cent of casualty crashes and 42 per cent of fatal crashes involving light vehicles in Australia (between 2013 to 2019) comprised of unintentional lane departure crashes occurring on sealed roads (without snow or ice) with speed limits of ≥ 70 km/h. Unintentional lane departure crashes included single-vehicle and multi-vehicle head-on and sideswipe crashes. Unintentional lane departure crashes represented 55 per cent of all road fatalities involving light vehicles, with this number increasing to 72 per cent at highway speeds of ≥ 100 km/h (Stuart et al. 2021).

6. The MUARC research demonstrated that ELKS is effective in reducing road trauma resulting from crashes involving unintentional lane departures. Results estimated a 9.09 per cent saving in total annual fatal crashes when 100 per cent of the light vehicle fleet is fitted with a lane keep assist system. This corresponded to a 11.9 per cent saving in total annual fatalities (Stuart et al. 2021).

III. References

Stuart Newstead, Linda Watson, Laurie Budd. 2021. The Potential Benefits of Lane Keep Assist Systems in Australian Light Vehicles. Melbourne: Monash University Accident Research Centre (MUARC). Accessed November 1, 2023.
