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1958 Agreement:

Consideration of draft amendments to existing

UN Regulations submitted by GRVA

Proposal for Supplement 3 to UN Regulation No. 157 (Automated Lane Keeping System (ALKS))

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 tenth session in May 2021 (ECE/TRANS/WP.29/GRVA/10, paras. 35-36). It is based on Annexes III and VIII to the session report. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee (AC.1) for consideration at their November 2021 sessions. The text from Annex VIII is submitted subject to reconfirmation by GRVA at its September 2021 session and is marked in square brackets.

* In accordance with the programme of work of the Inland Transport Committee for 2021 as outlined in proposed programme budget for 2021 (A/75/6 (part V sect. 20) para 20.51), 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.



[*Introduction*, amend to read:

"Introduction

The intention of the Regulation is to establish uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems (ALKS).

ALKS ...

ALKS can be activated under certain conditions on roads where pedestrians and cyclists are prohibited and which, by design, are equipped with a physical separation that divides the traffic moving in opposite directions and prevent traffic from cutting across the path of the vehicle. In a first step, the original text of this Regulation limits the operational speed to 60 km/h maximum.

This Regulation ... (See e.g. Informal Document 4 Revision 1 of the seventy-eight session of WP.1)."

Paragraph 1.1., amend to read:

"1.1. This Regulation applies to the type approval of vehicles of Categories M and N¹ with regards to their Automated Lane Keeping System."]

Paragraph 2.5., amend to read:

"2.5. "Unplanned event" is a situation which is unknown in advance, but assumed as very likely in happening and which requires a transition demand. This may include: road construction, inclement weather, approaching emergency vehicles/enforcement vehicles, missing lane markings, load falling from truck."

Paragraph 5.1.2., amend to read:

"5.1.2. The activated system shall comply with traffic rules relating to the DDT in the country of operation, including responding to emergency/enforcement vehicles."

[*Paragraph 5.2.3.3.*, amend to read:

"5.2.3.3. The activated system shall detect the distance to the next vehicle in front as defined in paragraph 7.1.1. and shall adapt the vehicle speed in order to avoid collision.

While the ALKS vehicle is not at standstill, the system shall adapt the speed to adjust the distance to a vehicle in front in the same lane to be equal or greater than the minimum following distance.

In case the minimum time gap cannot be respected temporarily because of other road users (e.g. vehicle is cutting in, decelerating lead vehicle, etc.), the vehicle shall readjust the minimum following distance at the next available opportunity without any harsh braking unless an emergency manoeuvre would become necessary.

The minimum following distance shall be calculated using the formula:

$$d_{\min} = v_{\text{ALKS}} * t_{\text{front}}$$

Where:

d_{\min} = the minimum following distance

v_{ALKS} = the present speed of the ALKS vehicle in m/s

¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.6, para. 2 - www.unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions

t_{front} = minimum time gap in seconds between the ALKS vehicle and a leading vehicle in front as per the table below:

Present speed of the ALKS vehicle	Minimum time gap		Minimum following distance	Minimum time gap		Minimum following distance
	M_1/N_1	M_1/N_1	M_1/N_1	$M_2/M_3//N_2/N_3$	$M_2/M_3//N_2/N_3$	$M_2/M_3//N_2/N_3$
(km/h)	(m/s)	(s)	(m)	(s)	(s)	(m)
7.2	2.0	1.0	2.0	1.2		2.4
10	2.78	1.1	3.1	1.4		3.9
20	5.56	1.2	6.7	1.6		8.9
30	8.33	1.3	10.8	1.8		15.0
40	11.11	1.4	15.6	2.0		22.2
50	13.89	1.5	20.8	2.2		30.6
60	16.67	1.6	26.7	2.4		40.0

For speed values not mentioned in the table, linear interpolation shall be applied.

Notwithstanding the result of the formula above for present speeds below 2 m/s the minimum following distance shall never be less than 2 m for M_1, N_1 and 2.4 m for M_2, M_3, N_2, N_3 ."

Paragraph 5.2.5.2., amend to read:

- "5.2.5.2. The activated system shall avoid a collision with a cutting-in vehicle,
- Provided the cutting in vehicle maintains its longitudinal speed which is lower than the longitudinal speed of the ALKS vehicle and
 - Provided that the lateral movement of the cutting in vehicle has been visible for a time of at least 0.72 seconds before the reference point for *TTCLaneIntrusion* is reached,
 - When the distance between the vehicle's front and the cutting in vehicle's rear corresponds to a TTC calculated by the following equation:

$$TTCLaneIntrusion > v_{rel} / (2 \times 6 \text{ m/s}^2) + 0.35 \text{ s}$$

Where:

v_{rel} = Relative velocity between both vehicles, positive for vehicle being faster than the cutting in vehicle

$TTCLaneIntrusion$ = The TTC value, when the outside of the tyre of the intruding vehicle's front wheel closest to the lane markings crosses a line 0.3 m beyond the outside edge of the visible lane marking to which the intruding vehicle is being drifted."

Paragraph 5.3.4., amend to read:

- "5.3.4. The vehicle shall implement a logic signal indicating emergency braking as specified in UN Regulation No. 13-H or 13, as appropriate."

Paragraph 7.1., amend to read:

- "7.1. Sensing requirements

"The fulfilment of the provisions of this paragraph shall be demonstrated by the manufacturer to the technical service during the inspection of the safety approach as part of the assessment to Annex 4 and according to the relevant tests in Annex 5.

The ALKS vehicle shall be equipped with a sensing system such that, it can at least determine the driving environment (e.g. road geometry ahead, lane markings) and the traffic dynamics:

- (a) Across the full width of its own traffic lane, the full width of the traffic lanes immediately to its left and to its right, up to the limit of the forward detection range;
- (b) Along the full length of the vehicle or combination and up to the limit of the lateral detection range.

The requirements of this paragraph are without prejudice to other requirements in this Regulation, most notably paragraph 5.1.1. and 5.1.2."

Paragraph 7.1.2, amend to read:

"7.1.2. Lateral detection range

The manufacturer shall declare the lateral detection range. The declared range shall be sufficient to cover the full width of the lane immediately to the left and of the lane immediately to the right of the vehicle or combination.

The Technical Service shall verify that the vehicle sensing system detects vehicles during the relevant test in Annex 5. This range shall be equal or greater than the declared range."

Paragraph 7.1.5., amend to read:

"7.1.5. The fulfilment of the provisions of paragraph 7.1. and its subparagraphs shall be demonstrated to the technical service and tested according to the relevant tests in Annex 5.

Where the ALKS can operate with a vehicle combination, the manufacturer shall demonstrate to the Technical Service at the time of type approval the strategies implemented to ensure that the sensing capability is always sufficient for the length of trailer attached."

Paragraph 8.4.3., delete and replace by new heading with subparagraphs to read:

"8.4.3. Retrieval of data

8.4.3.1. For vehicles of Category M₁ and N₁ the data shall be retrievable even after an impact of a severity level set by UN Regulations Nos. 94, 95 or 137 as applicable.

8.4.3.2. For vehicles of Categories M₂, M₃, N₂ and N₃, the following applies.

Either:

- (a) The data shall be retrievable even after a mechanical shock of a severity level as specified in the component test of Annex 9C of the 03 series of amendment to UN Regulation No. 100, and
- (b) The DSSAD shall be mounted in a position such as to be protected against mechanical damage resulting from a typical vehicle crash (e.g. frontal impact). This shall be demonstrated to the technical service together with appropriate documentation (e.g. calculations or simulations);

Or, alternatively,

Sufficient crash protection may be demonstrated by the manufacturer by fulfilling the requirements of paragraph 8.4.3.1. (e.g. for M₂ / N₂ vehicles derived from M₁ / N₁).

8.4.3.3. If the main on-board vehicle power supply is not available, it shall still be possible to retrieve all data recorded on the DSSAD, as required by national and regional law."]