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Working Party on Automated/Autonomous and Connected Vehicles

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Automated/autonomous and connected vehicles:

UN Regulation on Automated Lane Keeping Systems

Proposal for an amendment to UN Regulation on Automated Lane Keeping Systems (ALKS)

Submitted by the expert from Germany*

The text reproduced below was prepared by the expert from Germany. The proposal is aimed at raising the specified maximum speed up to 130 km/h. The modifications to the existing 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 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.



I. Proposal

Paragraph 2.1., amend to read:

- 2.1. “Automated Lane Keeping System (ALKS)” ~~for low speed application~~ is a system which is activated by the driver and which keeps the vehicle within its lane for travelling speed of ~~60~~ **130** km/h or less by controlling the lateral and longitudinal movements of the vehicle for extended periods without the need for further driver input.

Within this Regulation, ALKS is also referred to as “*the system*”.

Paragraph 5.2.3.1., amend to read:

5.2.3.1. **Speed**

The manufacturer shall declare the specified maximum speed based on the forward detection range of the system as described in paragraph 7.1.1.

The maximum speed up to which the system is permitted to operate is ~~60~~ **130** km/h.

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 a 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

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
(km/h)	(m/s)	(s)	(m)
7.2	2.0	1.0	2.0
10	2.78	1.1	3.1
20	5.56	1.2	6.7
30	8.33	1.3	10.8
40	11.11	1.4	15.6
50	13.89	1.5	20.8
60	16.67	1.6	26.7
70	19.44	1.7	33.1
80	22.22	1.8	40.0
90	25.00	1.9	47.5

<i>Present speed of the ALKS vehicle</i>		<i>Minimum time gap</i>	<i>Minimum following distance</i>
100	27.78	2.0	55.6
110	30.56	2.0	61.1
120	33.33	2.0	66.7
130	36.11	2.0	72.2

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.

The requirements of this paragraph are without prejudice to other requirements in this Regulation, most notably paragraphs 5.2.4. and 5.2.5. with subparagraphs.

Paragraph 5.2.5.3., amend to read:

5.2.5.3. The activated system shall avoid a collision with an unobstructed crossing pedestrian in front of the vehicle.

In a scenario with an unobstructed pedestrian crossing with a lateral speed component of not more than 5 km/h where the anticipated impact point is displaced by not more than 0.2 m compared to the vehicle longitudinal center plane, the activated ALKS shall avoid a collision up to ~~the maximum operational speed of the system~~ **60 km/h**.

Paragraph 5.4.2., amend to read:

5.4.2. The initiation of the transition demand shall be such that sufficient time is provided for a safe transition to manual driving.

Manufacturers shall declare during type approval that drivers' adjustments in and on the vehicle when the system is active (e.g. for the purpose of engaging in non-driving related activities) do not have negative consequences to a take-over in the manual driving phase."

Paragraph 7.1.1., amend to read:

7.1.1. Forward detection range

The manufacturer shall declare the forward detection range measured from the forward most point of the vehicle. This declared value shall be at least 46 metres **for a specified maximum speed of 60 km/h**.

A specified maximum speed above 60 km/h shall only be declared by the manufacturer, if the declared forward detection range fulfils the corresponding minimum value according the following table:

<i>Specified maximum speed / km/h</i>	<i>Minimum forward detection range / m</i>
0...60	46
70	50 60
80	60 80
90	75 100
100	90 120
110	110 140
120	130 170

Kommentar [FH1]: The defined the forward detection range from braking performance 5m/s² do not fulfil expectation to detect/stop in front of standing still humans (VRU), large animals or objects. With more "normal braking the distance should be closer to 200m instead of current 150m at 130km/h (a pure extension of what is defined 46m @ 60km/h). In addition, it is obvious that 5m/s² is not reachable at bad/slippery road/whether conditions. The system are not necessary limited to operate at such conditions.

Figures should be based upon earlier agreement, 3,7m/s² and Tsys 0,5s

<i>Specified maximum speed / km/h</i>	<i>Minimum forward detection range / m</i>
130	<u>150200</u>

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

~~It is recognized that the minimum forward detection range cannot be achieved under all conditions. Nevertheless, the system shall implement appropriate strategies in order to ensure safe operation at all times.~~

The Technical Service shall verify that the distance at which the vehicle sensing system detects a road user during the relevant test in Annex 5 is equal or greater than the declared value.

II. Justification

1. In previous sessions of the former Informal Working Group (IWG) on Automatically Commanded Steering Function (ACSF) the overall objective was to develop technical requirements for Automated Lane Keeping Systems (ALKS). The limitation to low speed applications (with a specified maximum speed of 60 km/h) was agreed in order to deliver within the given timeline. After having successfully accomplished the work for the system in a first step, Germany has now reviewed and examined the existing requirements under the premise of increasing the specified maximum speed up to 130 km/h.
2. The approach taken in this proposal does not change the agreed approach in the existing UN Regulation for ALKS for low speed applications (ECE/TRANS/WP.29/2020/81): the activated system shall comply with traffic rules in the country of operation (e.g. in countries where the maximum speed is limited to 100 km/h, the ALKS is not permitted to operate at speeds above the legal speed limit), take environmental and sensor conditions for the maximum operational speed into account as well as respect the current traffic situation for the selection of the present speed.
3. The proposed requirements for high speed applications up to 130 km/h are understood to be “if fitted” requirements: if a vehicle manufacturer chooses to bring such an ALKS to the market, the proposed technical requirements shall be met and fulfilled.

Kommentar [FH2]: Our expectations are that the speed are continuously adapted to ensure the detection range required (according to table), due to different conditions. Rewording required to make it clear that the table (maximum) are also valid for “control strategies” when detection range are affected.