

Proposal for amendments to ECE/TRANS/WP.29/GRVA/2020/33

The text reproduced below was prepared by the expert from the Republic of Korea, proposing intention to amend to change UN Regulation No. [157 (Automated Lane Keeping System) proposed in ECE/TRANS/WP.29/GRVA/2020/33. The modifications are marked in bold for new, and strikethrough for deleted characters with red color.

I. Proposal

Paragraph 2.25, amend to read:

- 2.25. A "Lane Change Manoeuvre (LCM)" is part of the LCP and**
- (a) Starts when the outside edge of the tyre tread of the vehicle's front wheel closest to the lane markings crosses the ~~outside~~ **inside** edge of the lane marking to which the vehicle is being manoeuvred and**
 - (b) Ends when the rear wheels of the vehicle have fully crossed the lane marking.**

Paragraph 5.2.6.2, amend to read:

- 5.2.6.2. The activated system shall only undertake a LCP if the following requirements are fulfilled:**
- (a) The vehicle is equipped with a sensing system capable of fulfilling the ~~rearward~~ detection range requirements as defined in paragraph 7.1. and subparagraph ~~7.1.1., 7.1.2. and 7.1.3.~~**
 - (b) The system self-check as defined in paragraph 5.1.6. is positively confirmed;**
 - (c) The assessment of the target lane as defined in paragraph 5.2.6.6. and its subparagraphs is positively confirmed;**
 - (d) The LCP is anticipated to be completed before the ALKS vehicle comes to standstill (i.e. in order to avoid coming to standstill while in the middle of two regular lanes due to stopped traffic ahead). In case the ALKS vehicle becomes stationary between two regular lanes during the LCM nonetheless (e.g. due to the surrounding traffic), it should at the next available opportunity either complete the LCP or return to its original lane.**

Paragraph 5.2.6.3, amend to read:

5.2.6.3. In compliance with paragraph 5.1.2. in particular, the activated system may undertake a LCP if:

(a) Operation cannot be continued in the current lane (e.g. due to a blocked lane ahead, ending lane ahead, **Y-split of highway lanes**), for the purpose of overtaking a slower moving vehicle ~~or~~, to prevent violation of the obligation to drive in the slowest lane, **or to go out on the road** when possible; **and**

(b) A gap allowing a LCM is already present or expected to open up shortly.

Paragraph 5.2.6.5, amend to read:

5.2.6.5. Specific requirements for LCM

The lateral movement to approach the lane marking in the starting lane and the lateral movement necessary to complete the LCM shall aim to be one continuous movement.

The LCM shall not be initiated before a period of 3.0 seconds and not later than ~~7.0~~**10.0** seconds after activation of the direction indicator lamps.

The LCM may be terminated before being completed if the situation requires it. In this case the ALKS vehicle has to be steered back into the starting lane.

The ALKS vehicle shall be in a single lane of travel at the end of the LCM.

Paragraph 5.2.6.6 and 5.2.6.6.1., amend to read:

5.2.6.6. Assessment of the target lane

A LCP shall only be initiated if ~~an approaching vehicle in the target lane is not forced to unmanageably decelerate due to the lane change of the ALKS vehicle~~ the following conditions are met in paragraph 5.2.6.6.1. and 5.2.6.6.2.

5.2.6.6.1. An **A** in the target lane should not have to decelerate at a higher level than **AB** m/s², **BC** seconds after the ALKS vehicle starts crossing a lane marking, to ensure the distance between two vehicles is never less than that which the **CD** travels in 1 second.

With :

	Forward assessment	Rearward assessment
A	ALKS vehicle	approaching vehicle
B	6.0	3.0
C	0.35	(i) / (ii)
D	leading vehicle	ALKS vehicle

(i) 0.4 seconds after the ALKS vehicle has crossed the lane marking, provided there was at least 1.0 s lateral movement of the ALKS vehicle

within the starting lane in principle visible to an approaching vehicle from the rear without an obstruction before the LCM starts; or

(ii) 1.4 seconds after the ALKS vehicle has crossed the lane marking, provided there was not at least 1.0 s lateral movement of the ALKS vehicle within the starting lane in principle visible to an approaching vehicle from the rear before the LCM starts.

Renumber paragraphs 5.2.6.6.2. into 5.2.6.6.3

Paragraph 5.2.6.6.2., insert to read:

5.2.6.6.2. A vehicle in the target lane should not be detected by system within the sideward range along the full length of the vehicle and up to the full width of the target lane.

Paragraph 5.2.6.7, amend to read:

5.2.6.7. The distance to a vehicle leading in front in the target lane at equal or higher speed or following behind in the target lane at equal or lower speed shall never be less than ~~the speed~~ that which the leading vehicle or following vehicle travels in 1 second.

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 and up to the limit of the lateral detection range;

(c) ~~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 rear detection range, if fitted to perform a LCP.**

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

Paragraph 7.1.3., amend to read:

7.1.3. Rearward detection range

The requirements of this paragraph apply to the system, if additionally fitted to perform a LCP.

The manufacturer shall declare the rearward detection range measured from the rearward most point of the vehicle.

~~The vehicle manufacturer shall provide evidence that the effects of wear and ageing do not reduce the performance of the sensing system below the minimum required value specified in this paragraph over the lifetime of the system/vehicle.~~

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. Paragraph 2.25. : The proposal is to be in line with paragraph 2.4.17 of UN Regulation No. 79. for the definition of "*Lane Change Manoeuvre (LCM)*"
2. Paragraph 5.2.6.2. : For safe lane change, the sensing system should fulfil the detection range requirement of not only rearward but also forward and sideward. It is also related to fulfilling the paragraph 5.2.6.6.
3. Paragraph 5.2.6.3. : The proposal is to clarify the sentence because safe LCP should fulfil both (a) and (b), and to expand the conditions that LC is activated by including Y-split of highway lanes which is one of the general lane changes.
4. Paragraph 5.2.6.5. : Giving 10 seconds is proposed because most drivers normally would wait and undertake until a vehicle passes if there is a vehicle approaching from the rearward and the space for lane change is not sufficient after they activate the direction indicator, with views of considering the time for a vehicle to pass (time to pass from the end of rearward safety distance to the forward most point of the lane change vehicle in the target lane : 8.8 seconds for 80km/h, 10.8 seconds for 100km/h, and 12.8 seconds for 120km/h of lane change vehicle and $V_{LC} + 10\text{km/h}$ for approaching vehicle) and preventing the confusion and distraction of drivers by often termination of the LCP due to shortage of the allowed time period to change lane. Also, paragraph 5.2.6.5 requires that the lateral movement to approach the lane marking and necessary to complete the lane change manoeuvre, shall be completed as one continuous movement. So there is no safety risk if the 10 second is allowed since the vehicle will maintain the centre of the driving lane until the approaching vehicle is not in the $S_{critical}$.
5. Paragraph 5.2.6.6., 5.2.6.6.1., 5.2.6.6.2., and 5.2.6.7. : This main purpose is to secure safe LCP by applying the timing and defined minimal gap for an automated lane change procedure, to not only the rearward but also to the forward and sideward for clarification. For reference, the assessment of forward corresponds with parameters (the typical delay : 0.1sec, typical jerk and available deceleration : 0.5sec from 0 to 6m/s^2) from the paragraph 5.2.5.2 of this regulation, and the

assessment of sideward corresponds with the subparagraph (b) of paragraph 7.1. of this regulation.

6. Paragraph 7.1. : The proposal is to delete the sentence because detecting the rearward of vehicle's own traffic lane seems unnecessary for safe lane change.
 7. Paragraph 7.1.3. : This proposal is to delete a redundant sentence because the paragraph 7.1.4 of the current regulation (paragraph 7.1.5 of Document ECE/TRANS/WP.29/GRVA/2020/33) already has the same requirement for the lifetime of the system/vehicle.
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