Proposal for amendments regarding GRVA-12-52

Modifications to the existing text of UN-Regulation No. 157 are in **bold** for new or ~~strikethrough~~ for deleted characters.
Modifications to GRVA-12-52 are in **green bold** for new or ~~green strikethrough~~ for deleted characters.
Amendments *highlighted yellow* are still to be confirmed.

I. Proposal

Paragraph 2.26., amended to read:

2.26. **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 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 ~~[or combination]~~.

Paragraph 2.32., amended to read:

2.32. **"Potential Vehicle Presence Area (PVPA)" is the area in which another vehicle could be relevant to the ALKS when performing a lane change and that is enclosed by the following:**

(a) a line to the front of the vehicle, perpendicular to the direction of travel at the minimum following distance specified in paragraph 5.2.3.3. measured from the forward most point of the vehicle;

(b) a line to the rear of the vehicle, perpendicular to the direction of travel at the critical distance established by paragraph 5.2.6.7.2.~~3.~~1. measured from the rearward most point of the vehicle;

(c) a line parallel to the direction of travel along the side of the vehicle that is not adjacent to the target lane; and

(d) a line parallel to the direction of travel along the furthest lane marking of the lane beyond to the target lane or of the target lane if there is not one beyond it.

Lines (a) and (b) change according to the speed at which the ALKS vehicle travels.

Insert new paragraph 2.33., to read:

2.33. **A "vehicle" means a single vehicle or a combination of vehicles if they are operated in combination.**

Paragraph 4.4.2., amended to read:

4.4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in paragraph 4.4.1. ~~above.~~;

Insert new paragraph 4.4.3., to read:

4.4.3. **An additional symbol after the letter "R" prescribed in paragraph 4.4.2. (if applicable):**

4.4.3.1. **"LC" in the case of a ALKS capable of a LCP.**

Paragraph 5.1.1., amended to read:

5.1.1. The activated system shall perform the DDT shall manage all situations including failures, and shall be free of unreasonable risks for the vehicle occupants or any other road users.

The activated system shall not cause any collisions that are reasonably foreseeable and preventable. If a collision can be safely avoided without causing another one, it shall be avoided. ~~When the vehicle is involved in a detectable collision the vehicle shall be brought to a standstill.~~

Renumber original paragraph 5.1.1.1. to 5.1.1.2. and insert a new paragraph 5.1.1.1., to read:

5.1.1.1. The ALKS shall respond whilst active to any collision which requires a response according to national traffic rules (e.g. bringing the vehicle to standstill) and which could be expected to be recognised by a competent and careful human driver. In the case of such a collision and without prejudice to paragraph 5.4.4.1.1., a transition demand shall be given, unless one is already being given.

Paragraphs 5.2.1.1. to 5.2.1.5., amended to read:

5.2.1.1. A vehicle with ALKS enabled, and equipped with a sensing system to the front, side and rear that is sufficient to assess the criticality of crossing into another lane, is permitted to intentionally cross lane markings when:

(a) performing a LCP according to paragraph 5.2.6.;

(b) performing an evasive lane crossing during an EM according to paragraph 5.3.;

(c) forming an access an access corridor for emergency and enforcement vehicles according to paragraph 5.2.1.2.;

(d) partly entering into the adjacent lane according to paragraph 5.2.1.3. in order to drive around an obstacle partly blocking the lane.

5.2.1.2. Forming an access corridor for emergency and enforcement vehicles

The ALKS shall only leave its current lane of travel to form an access corridor for emergency and enforcement vehicles where this is required according to national traffic rules or common practise by other road users.

The ALKS shall ensure sufficient lateral and longitudinal distance to road boundaries, vehicles and other road users.

The vehicle shall return completely to its original lane of travel once the situation that required this access corridor has passed.

5.2.1.3. Crossing lane markings in order to drive around an obstacle

5.2.1.3.1. The ALKS shall only respond to an obstacle by entering partly into the adjacent lane if a regular lane change out of its current lane of travel is not possible, e.g. due to the traffic situation or an adjacent lane not being available and if this behaviour can be considered not to increase the risk to the vehicle occupants and other road users.

5.2.1.3.2. The vehicle shall aim at returning completely to its original lane of travel once the situation that required this manoeuvre has passed.

5.2.1.3.3 These manoeuvres shall not endanger the safety of the vehicle occupants or any other road user by:

(a) ensuring sufficient lateral and longitudinal distance to road boundaries, vehicle and other road users;

(b) the lateral acceleration not exceeding [1.0] m/s2; and

(c) complying with the assessment of the target lane according to paragraph 5.2.6.7.2. and its sub-paragraphs when

crossing the lane marking by more than [half/a third] of the vehicle's width.

5.2.1.4. The manufacturer shall demonstrate to the Technical Service how the system fulfils the requirements of paragraphs 5.2.1.2. and 5.2.1.3. if the system is capable of performing any of the manoeuvres described therein.

Paragraphs 5.2.6.1.1. and 5.2.6.1.2., amend to read:

5.2.6.1.1. The intervention shall not cause a collision with ~~an~~other vehicle**s** or **other** road user**s** in the predicted path of the vehicle during a lane change.

5.2.6.1.2. A lane change procedure shall be predictable and manageable for **other vehicles or** other road users.

Paragraph 5.2.6.5.1., amended to read:

5.2.6.5.1. Lane Change Procedure: Additional specific requirements for regular lane changes

…

(d) There is no other vehicle in the PVPA, whose priority resulting from its active direction indicators, would prevent a LCP by the ALKS **according to national traffic rules**.

Paragraph 5.2.6.5.2.3., amended to read:

5.2.6.5.2.3. A lane change procedure shall not start within the first 3 seconds following the start of the MRM intervention, unless a**n earlier** ~~sooner~~ initiation is required either in order to reach a minimal risk target stop area (e.g. when the hard shoulder is ending ahead or in case of failure) or if the lane change manoeuvre can be performed with a criticality equal to that of a regular lane change.

Paragraph 5.2.6.6.1., amended to read:

5.2.6.6.1. 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. ~~[~~During the lane change manoeuvre, the system shall aim to avoid a lateral acceleration of more than 1 m/s2 in addition to the lateral acceleration generated by the lane curvature.

Paragraph 5.1.6.6.4., renumbered to 5.2.6.6.4.

5.~~1.~~2.6.6.4. When several consecutive lane changes are performed, the direction indicator may remain active throughout these lane changes while the lateral behaviour shall ensure that each lane change manoeuvre can be perceived as an individual manoeuvre by following traffic.

Paragraphs 5.2.6.6.5.1.1. and 5.2.6.6.5.1.2., amend to read:

5.2.6.6.5.1.1. Another vehicle's potential for changing into the target lane on a conflicting trajectory shall be assessed**,** based on **aspects such as:** its direction indicator status, **the** vehicle**'s** dynamics**,** ~~and~~ the surrounding traffic.

5.2.6.6.5.1.2. If there is an area in the PVPA where the system is not able to assess the status of the direction indicator on another vehicle on the basis of the declaration in 7.1.4., a LCM shall not be initiated if there is another vehicle in that part of the PVPA, except whose movement can be assessed not to conflict with the trajectory of the ALKS vehicle**,** ~~except~~ **and** for following vehicles at and near merging and departing lanes. In such circumstances, an approaching vehicle in the lane next to the target lane shall be treated like an approaching vehicle in the target lane.

Paragraphs 5.1.6.6.6.1., 5.1.6.6.2. and 5.1.6.6.6.3, renumbered to 5.2.6.6.6.1, 5.2.6.6.6.2. and 5.2.6.6.6.3.

5.~~1.~~2.6.6.6.1. A lane change manoeuvre during MRM shall be indicated in advance to other road users by activating the appropriate direction indicator lamps instead of the hazard warning lights.

5.~~1.~~2.6.6.6.2. Once the lane change manoeuvre is completed the direction indicator lamps shall be deactivated in a timely manner, and the hazard warning lights shall become active again.

5.~~1.~~2.6.6.6.3. When bringing the vehicle to a safe stop beside the road or on a hard shoulder not wide enough to fit the entire vehicle, the vehicle may come to a standstill on the lane marking.

Paragraph 5.2.6.7.2.1., amended to read:

5.2.6.7.2.1. When there is an approaching vehicle

~~An approaching vehicle in the target lane should not have to~~ The ALKS vehicle shall not make an approaching vehicle in the target lane decelerate, particularly in the case where the lane change is not urgent (e.g. for the purpose of overtaking a slower moving vehicle). But where this is necessary due to the traffic situation, in the absence of more specific traffic rules, the approaching vehicle shall not have to decelerate at a higher level than A m/s², B seconds after the ALKS vehicle starts, to ensure the distance between the two vehicles is never less than that which the ALKS vehicle travels in C seconds.

With:

(a) A equal to 3.0 m/s²

(b) B equal to:

(i) 0.4 seconds after the start of the LCM, provided that ~~the full width of the approaching vehicle was detected by the ALKS vehicle during its lateral movement for at least 1.0 second~~ there was at least 1.0 s lateral movement of the ALKS vehicle within the starting lane visible to the approaching vehicle from the rear without any obstruction of the ALKS vehicle before the LCM starts; or

(ii) 1.4 seconds after the start of the LCM.

(c) C equal to 1.0 second.

Paragraph 5.2.6.7.2.2., deleted:

~~5.2.6.7.2.2. Determination of whether a situation is critical shall consider any deceleration or acceleration of the ALKS vehicle.~~

Paragraph 5.2.6.7.2.3. (first), renumbered to 5.2.6.7.2.2.

5.2.6.7.2.~~3.~~2. When there is no vehicle detected

If no approaching vehicle is detected by the system in the target lane, the assessment shall be calculated as per 5.2.6.7.2.1. with the assumption that:

(a) the approaching vehicle in the target lane is at a distance from the ALKS vehicle equal to the actual rearward detection range;

(b) the approaching vehicle in the target lane is travelling with the allowed maximum speed + 30km/h or 160km/h, whichever is lower; and

(c) ~~the full width of the approaching vehicle is detected by the ALKS vehicle during its lateral movement for~~ there was at least 1 second lateral movement of the ALKS vehicle within the starting lane visible to a potential approaching vehicle from the rear without any obstruction of the ALKS vehicle.

Paragraph 5.2.6.7.2.3. (second), amended to read:

5.2.6.7.2.3. When there is an equally fast or slower moving vehicle

At the beginning of the LCM, the distance between the rear of the ALKS vehicle and the front of a vehicle following behind in the target lane at equal or lower longitudinal speed shall never be less than the distance which the following vehicle in the target lane travels in 1.0 second.

Paragraph 5.2.6.7.3.1., amended to read:

5.2.6.7.3.1. When there is an approaching vehicle

In the absence of more specific traffic rules, ~~an approaching vehicle in the target lane should not have to~~ the ALKS vehicle shall not make an approaching vehicle in the target lane decelerate at a higher level than A m/s², B seconds after the ALKS vehicle starts the lane change manoeuvre, to ensure the distance between the two vehicles is never less than that which the ALKS vehicle travels in C seconds.

With:

(a) A equal to 3.7 m/s²

(b) B equal to:

(i) 0.0 second, if the lateral movement of the ALKS vehicle continued for at least 1 second while the vehicle had not yet crossed the lane marking and the direction indicator had been active for at least 3.0 seconds prior to crossing of the lane markings while the ~~full width of the vehicle approaching from the rear was detected by the sensing system~~ ALKS vehicle was visible to the approaching vehicle from the rear without any obstruction of the ALKS vehicle;

(ii) 0.4 seconds after the start of the LCM, provided that ~~the full width of the approaching vehicle was detected by the ALKS vehicle during its lateral movement for at least 1.0 second~~ there was at least 1.0 s lateral movement of the ALKS vehicle within the starting lane visible to the approaching vehicle from the rear without any obstruction of the ALKS vehicle before the LCM starts; or

(iii) 1.4 seconds after the start of the LCM.

(c) C equal to:

(i) 0.5 second, if the lane change is performed towards a lane intended for slower traffic or towards the hard shoulder; or

(ii) 1.0 second, for all other conditions.

Paragraph 5.2.6.7.3.1., amend to read:

5.2.6.7.3.2. When there is no vehicle detected

If no approaching vehicle is detected by the system in the target lane, the assessment shall be calculated as per 5.2.6.7.3.1. with the assumption that:

(a) the approaching vehicle in the target lane is at a distance from the ALKS vehicle equal to the actual rearward detection range;

(b) **the approaching vehicle in the target lane is travelling with the allowed maximum speed +30 km/h or 160km/h, whichever is lower, or if the target lane is a hard shoulder,**

the approaching vehicle is travelling at a speed of 80 km/h or has a speed difference to the ALKS vehicle at the start of the LCM of 40 km/h, whichever is the lower speed; and

(c) ~~**the full width of the approaching vehicle is detected by the ALKS vehicle during its lateral movement for**~~ **there was at least 1 second lateral movement of the ALKS vehicle within the starting lane visible to a potential approaching vehicle from the rear without any obstruction of the ALKS vehicle.**

5.2.6.7.3.3. When there is an equally fast or slower moving vehicle

At the beginning of the LCM, the distance between the rear of the ALKS vehicle and the front of a vehicle following behind in the target lane at equal or lower longitudinal speed shall never be less than the distance which the following vehicle in the target lane travels in 0.7 seconds.

Paragraphs 5.2.6.7.4. and 5.2.6.7.5., amended to read

5.2.6.7.4. **Determination of whether a situation is critical shall consider any deceleration or acceleration of the ALKS vehicle** ~~**after it has crossed the lane marking**~~**.**

5.2.6.7.5. **In case the ALKS decelerates the vehicle during a lane change procedure into a regular lane of traffic, this deceleration shall be factored in when assessing the distance to a vehicle approaching from the rear, and the deceleration demand shall not exceed 2 m/s^2, except for the purpose of avoiding or mitigating the risk of an imminent collision or when required to ensure reaching the target stop area during an MRM.**

How the provisions of this paragraph are implemented in the system design shall be demonstrated to the Technical Service during type approval.

Paragraph 5.3.5.1. and 5.3.5.2., amended to read:

~~**[**~~**5.3.5.1.** **An ALKS shall aim to avoid an evasive lane crossing** ~~**shall only be performed by the ALKS**~~ **when the imminent collision risk was** ~~**not**~~ **present or occurring within the detection ranges declared by paragraph 7.1. before it became an imminent collision risk.**~~**]**~~

5.3.5.2. **If utilising an evasive lane crossing as part of an emergency manoeuvre, the ALKS shall ensure that it is** ~~**as**~~ **at least as safe to the vehicle occupants and other road users as avoiding the imminent collision risk** ~~**with the vehicle's full**~~ **by braking** ~~**performance**~~**.**

Paragraph 5.3.5.5., amended to read:

~~**[**~~**5.3.5.5.** **The vehicle shall only perform an evasive lane crossing if another vehicle in the evading lane is not forced to unmanageably decelerate due to that manoeuvre.**~~**]**~~

Paragraph 6.4.3. and its sub-paragraphs, amended to read:

6.4.3. Transition phase and minimum risk manoeuvre

6.4.3.1. During the transition phase and the MRM, the system shall instruct the driver in an intuitive and unambiguous way to take over manual control of the vehicle. The instruction shall include …

Paragraphs 7., 7.1., 7.1.1., and 7.1.1.1., amended to read:

7. Object and Event Detection and Response (OEDR)

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.

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.

If the ALKS is capable of performing a LCP, in addition to above, a sensing system shall …

7.1.1. Forward detection range

The manufacturer shall …

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 based on a deceleration of 5m/s²:

…

7.1.1.1. The requirements of this paragraph additionally apply to the system, if the ALKS is capable to perform a LCP.

The declared range in paragraph 7.1.1. shall be sufficient to cover at least an area 9m to the side(s) to which the ALKS performs a LCP measured from the centreline of the ALKS vehicle.

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

Paragraphs 7.1.2. and 7.1.2.1., amended 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.

7.1.2.1. The requirements of this paragraph additionally apply to the system, if the ALKS is capable to perform a LCP.

The manufacturer shall also declare the lateral detection range that shall be sufficient to cover at least an area 9m to the side(s) to which the ALKS performs a LCP measured from the centreline of the ALKS vehicle.

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

Paragraph 7.1.3., amended to read:

7.1.3. Rearward detection range

The requirements of this paragraph apply to the system, if the ALKS is capable to perform a LCP.

The manufacturer shall declare the rearward detection range measured from the most rearward point of the vehicle. This declared range shall be sufficient to cover at least an area 9m to the side(s) to which the ALKS performs a LCP measured from the centreline of the ALKS vehicle.

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

Paragraph 7.1.4., amended to read:

7.1.4. Direction indicator status detection area

The manufacturer shall declare the area, if any, within the PVPA in which the system is able to assess the status of other vehicle's direction indicators. This shall account for the different direction indicator positions of vehicles which are normally operated in the PVPA in the system's countries of operation.

The Technical Service shall verify this area during the relevant test in Annex 5.

Paragraph 7.1.7., amended to read:

7.1.**7.** 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 Annex5.

Where the ALKS can operate ~~with~~ **in** 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 8.2.1., amended to read:

8.2.1. Each vehicle equipped with a DSSAD shall at least record an entry for each of the following occurrences upon activation of the system:

…

(e) Start of Emergency Manoeuvre;

(f) End of Emergency Manoeuvre;

(i) Vehicle has remained in lane;

(ii) Vehicle has crossed into evading lane.

(g) Event Data Recorder (EDR) trigger input;

(h) Involved in a detected collision;

(i) Minimum Risk Manoeuvre engagement by the system;

(j) Severe ALKS failure;

(k) Severe vehicle failure;

(l) Start of Lane Change Procedure;

(m) End of Lane Change Procedure;

(n) Aborted Lane Change Procedure;

(o) Start of intentional lane crossing (not LCP);

(p) End of intentional lane crossing (not LCP).

Paragraph 8.4.5 and its subparagraphs., amended to read:

[8.4.5. Retrieval in conjunction with EDR data

8.4.5.1. **For vehicles fitted with an EDR in accordance with UN Regulation 160, it shall be possible to retrieve through the standard interface (OBD port) the DSSAD data elements as referred to in paragraphs 8.3.1(a) and 8.3.1.(b) recorded for at least the last 30 seconds before the last setting of the occurrence flag "Event Data Recorder (EDR) trigger input", alongside the data elements specified in UN Regulation 160, Annex 4 (EDR data).**

8.4.5.2. **In the absence of any occurrence referred to in paragraph 8.2.1. within the last 30 seconds before the last setting of the occurrence flag "Event Data Recorder (EDR) trigger input", it shall be possible to retrieve, alongside the EDR data, the data element corresponding to the last occurrences within the same power cycle referred to in paragraphs 8.2.1.(a) and (b), as a minimum.**

8.4.5.3. **If required by national or regional law, the data elements retrieved in accordance with paragraph 8.4.5.1. or 8.4.5.2. shall not include the date (as referred to in paragraph 8.3.1.(c)) and the timestamp (as referred to in paragraph 8.3.1.(d)) or any other information allowing for identification of the vehicle, its user or owner. Instead the time stamp shall be replaced with information representing the time difference between the occurrence flag "Event Data Recorder (EDR) trigger input" and the occurrence flag of the respective DSSAD data element.~~]~~**

Paragraph 12.1., amended to read:

12.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph ~~8~~ **11**, above are not complied with.

Paragraph 15. and its subparagraphs, amended to read:

[15. Transitional provisions

15.1. **As from the official date of entry into force of the 01 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 01 series of amendments.**

15.2. **As from 1 September 2023, Contracting Parties applying this Regulation shall not be obliged to accept type approvals to the original version of this Regulation, first issued after 1 September 2023.**

15.3. **Until 1 September 2024, Contracting Parties applying this Regulation shall accept type approvals to the original version of this Regulation, first issued before 1 September 2023.**

15.4. **Contracting Parties applying this Regulation shall not refuse to grant type approvals according to any preceding series of amendments to this Regulation or extensions thereof.]**

Annex 1 amended to read:

Annex 1

…

6.4. Software Identification of the ALKS (if applicable): .....

6.5 ALKS capable of: MRM lane change / Regular lane change / Evasive lane crossing / other lane crossing[2]

7. Written description and/or drawing of the ALKS Human Machine Interface including:

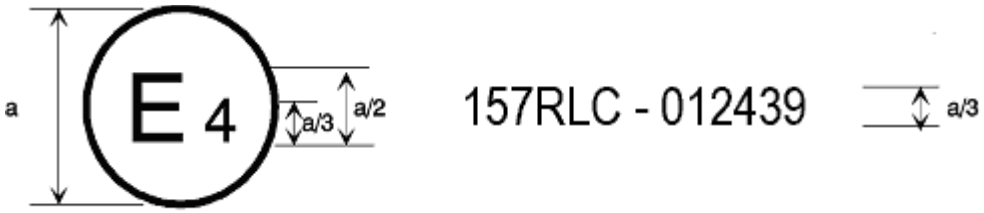
…

Annex 2, amended to read:

Annex 2

Arrangements of approval marks

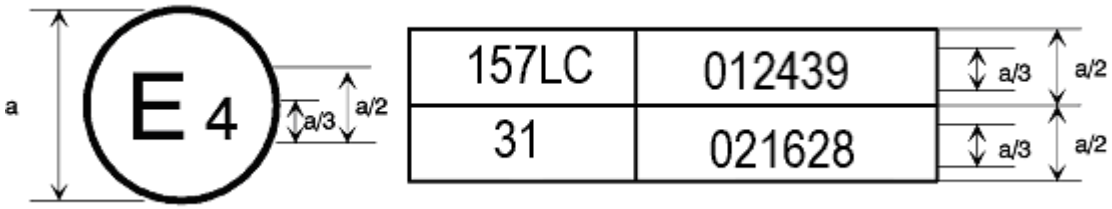
Model A
(See paragraph 4.4. of this Regulation)



a = 8 mm min

The above approval mark affixed to a vehicle shows that the vehicle type concerned has, with regard to ALKS, been approved in the Netherlands (E 4) pursuant to UN Regulation No. 157 under approval No. ~~002439~~ **012439 and is capable of a lane change procedure**. The approval number indicates that the approval was granted in accordance with the requirements of UN Regulation No. 157 ~~in its original version~~ **with the 01 series of amendments incorporated**.

Model B
(See paragraph 4.5. of this Regulation)



a = 8 mm min

The above approval mark affixed to a vehicle shows that the vehicle type concerned has been approved in the Netherlands (E 4) pursuant to Regulations Nos. 157 **(capable of a lane change procedure)** and 31.[1] The approval numbers indicate that, at the dates when the respective approvals were given, UN Regulation No. 157 ~~was in its original version~~ **included the 01 series of amendments** and UN Regulation No. 31 included the 02 series of amendments.

Annex 5, paragraph 4.6.4., amended to read:

4.6.4. ~~**Reward**~~ **Rearward detection range**

Annex 6, paragraph 7.3.1., amended to read:

7.3.1. **The data recorded from the activated system shall be assessed for the sections falling within the declared ODD ~~including~~ as well as those sections when the system has left the ODD inadvertently without correctly ending its operation.**

Annex 6, paragraph 7.3.4., amended to read:

7.3.4. **Time gap to leading vehicle, time gap left to the ~~upcoming~~ approaching vehicle in the target lane in case of lane-change and lateral position deviation shall be quantitatively evaluated according to the technical requirements in paragraph 5 in this Regulation.**

II. Justification

1. .
2. .