The text reproduced below consolidates the different written proposals for adding the lane change capability of ALKS into a single document. It is based on the open points list (document UNR157-05-05, column "F").

Modifications to the existing text of UN-Regulation No. 157 are marked:

- in **black bold** for new or ~~strikethrough~~ for deleted characters (as proposed in ECE/TRANS/WP29/GRVA/2020/32 (DE)),
- in **red bold** for new or ~~strikethrough~~ for deleted characters (as proposed in UNR157-03-06 (EC)),
- in **orange** for new or ~~strikethrough~~ for deleted characters (as proposed in GRVA-07-62 (UK),
- in **blue bold** for new or ~~strikethrough~~ for deleted characters (as proposed in ECE/TRANS/WP.29/GRVA/2021/04, GRVA-07-66 and UNR157-05-11 (OICA/CLEPA)) and
- in **green** for new or ~~strikethrough~~ for deleted characters (new proposed amendments by leadership following the discussions and conclusions from 6th SIG meeting in particular to align with the RMF requirements).

Comments as points of discussions or agreements are highlighted in yellow.

I. Proposal

Point of discussion: Industry proposal (UN157-05-11) for 2.6 and 2.8. on emergency manoeuvres to be confirmed (new text expected from Industry to address comments from the 6th meeting).

Paragraph 2.6., amend to read

"2.6. "*Imminent collision risk*" describes a situation or an event which leads to a collision of the vehicle with another road user or an obstacle which cannot be avoided by a braking demand with lower than 5 m/s^2. **"**

Paragraph 2.8., amend to read

"2.8. "*Emergency Manoeuvre (EM)*" is a manoeuvre performed by the system in case of an event in which the vehicle is at ~~**imminent**~~ **risk of a** collision ~~**risk**~~ and has the purpose of avoiding or mitigating a collision. **This includes manoeuvres when a collision is already imminent as well as [those where evasive steering needs to be performed by the system in order to keep the risk of a collision at a low level. / evasive steering manouvers that aim to avoid a collision to become imminent.]"**

Point of discussion: Confirm that 2.24, 2.26 and 2.27 are aligned with the RMF text (UN157-06-08) as per JP request.

Paragraphs 2.21. to 2.27., insert to read:

2.21. "*Starting lane*" is the lane out of which the ALKS vehicle intends to manoeuvre.

2.22. "*Target lane*" is the lane into which the ALKS vehicle intends to manoeuvre. The target lane can be a regular lane of travel, an enter lane, an exit lane or a hard shoulder or emergency refuge area.

2.24. A "*Lane Change Procedure (LCP)*" starts when the direction indicator lamps are activated and ends when the direction indicator lamps are deactivated by the system. It comprises the following operations in the given order:

(a) Activation of the direction indicator lamps;

(b) Temporary suspension of the mandatory lane keeping functionality of the ALKS;

(c) Lateral movement of the vehicle towards the lane boundary;

(d) Lane Change Manoeuvre;

(e) Resumption of the mandatory lane keeping function of the ALKS;

(f) Deactivation of direction indicator lamps.

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 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.

2.26. "*Target stop area*" means a potential stopping area (e.g. emergency lane, hard shoulder, beside the road, slowest lane of traffic, own lane of travel)."

2.27. *"Beside the road"* means the area of road surface beyond the boundaries of the carriageway which is not a hard shoulder or refuge area."

Point of discussion: additional definitions for "Regular lane change", "Lane change during MRM" and/or "Emergency Lane change/lane crossing(evasive)" needed?

Paragraph 5.1.6., amend to read:

5.1.6. The system shall perform self-checks to detect the occurrence of failures and to confirm system performance at all times (e.g. after vehicle start the system has at least once detected an object at the same or a higher distance than that declared as detection range**s** according to paragraph 7.1. **and its subparagraphs**).

Paragraph 5.2.1., amend to read:

5.2.1. The activated system shall keep the vehicle inside its lane of travel and ensure that the vehicle does not **unintentionally** cross any lane marking (outer edge of the front tyre to outer edge of the lane marking**), except during a Lane Change Manoeuvre, as part of a Lane Change Procedure.** The system shall aim to keep the vehicle in a stable lateral position inside the lane of travel to avoid confusing other road users.

*Point of discussion: Add text/requirements in **green** from RMF text (UN157-06-08) as per JP request in para. 5.2.6. and subparagraphs? (Section 5.2.6. may need reordering and checking of cross-references).*

Paragraph 5.2.6. and subparagraphs, insert to read:

5.2.6. Lane Change Procedure (LCP)

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

The fulfilment of the provisions of this paragraph and its subparagraphs shall be demonstrated by the manufacturer to the satisfaction of the technical services during the assessment of Annex 4 and according to the relevant tests in Annex 5.

5.2.6.1. A LCP shall not cause an unreasonable risk to safety of the vehicle occupants and other road users. LCPs shall only be performed in an uncritical way as described in paragraphs 5.2.6.1.1. and 5.2.6.1.2.

5.2.6.1.1. The intervention shall not cause a collision with another vehicle or road user 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 road users.

5.2.6.2. A LCP shall be completed without undue delay.

5.2.6.3. The system may perform a single or multiple lane change(s) across regular lanes of traffic and/or to the hard shoulder.

5.2.6.4. A lane change during shall not be performed towards a lane intended for traffic moving in the opposite direction.

5.2.6.5. The system shall generate the signal to activate and deactivate the direction indicator signal. The direction indicator shall remain active throughout the whole period of the LCP and shall be deactivated by the system in a timely manner once the lane keeping functionality is resumed.

5.2.6.6. The activated system shall only undertake a LCP in compliance with Paragraph 5.1.2, and if the following requirements are fulfilled:

(a) The vehicle is equipped with a sensing system capable of fulfilling the front, side and rearward detection range requirements as defined in paragraph 7.1. and subparagraph 7.1.3.;

(b) ~~The~~ All system self-checks, 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.

(e) The target lane is a regular lane of travel, or hard shoulder temporarily opened up as a regular lane of travel, or;

If the LCP is being undertaken as part of a MRM, the target lane may additionally be a hard shoulder, emergency refuge area, or other emergency lane, providing there is no other vehicle travelling in that lane within the rear detection range of the ALKS vehicle.

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

(f) There is a reason for a lane change (e.g. Operation cannot be continued in the current lane, for the purpose of overtaking a slower moving vehicle, to prevent violation of the obligation to drive in the slowest lane when possible or during a minimal risk manoeuvre).

or;

The LCP is being undertaken as part of a MRM

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

5.2.6.7. Lane Change Procedure: Additional specific requirements in MRM

5.2.6.7.1. Lane changes during a MRM shall be made only if under the traffic situation these lane changes can be considered to minimize the risk to safety of the vehicle occupants and other road users.

5.2.6.7.2. Before initiating a lane change procedure, the system shall, if deemed appropriate, reduce the vehicle speed to minimize the risk related to that lane change (e.g. by adapting the speed of the vehicle to that of other vehicles in the target lane).

5.2.6.7.3. **A lane change procedure shall not start within the first 5s following the start of the MRM intervention.**

5.2.6.7.4. **In case the target stop area cannot be reached in an uncritical way the system shall aim to keep the vehicle within its current lane of travel while the vehicle is stopping.**

5.2.6.8. ~~**Specific requirements for LCM**~~ **Lane change manoeuvre (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. [During the lane change manoeuvre, the system shall aim to avoid a lateral acceleration of more than 1 m/s^2 in addition to the lateral acceleration generated by the lane curvature.]

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

The LCM may be ~~terminated~~ abandoned before being completed if the situation requires it. In this case the LCM shall be completed by steering 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.

In case of a lane change during a minimal risk manoeuvre upon termination of the LCM the ALKS shall aim to bring the vehicle in a position that reduces the risk to the vehicle occupants and other road users.

5.2.6.9. **Lane change manoeuvre: Additional specific requirements in MRM**

5.2.6.9.1. **All provisions of paragraph 5.2.6.7. shall be applied except 5.2.6.6. item d)., 5.1.6.9.X, xxx and xxx .**

5.1.6.9.2. **The vehicle may come to a standstill on the lane mark beside the road.**

5.1.6.9.3. **In addition to the provisions of paragraph 5.2.6.1.1., an acoustic warning may be given as warning to other road users unless traffic rules in the country prohibits using an acoustic warning.** <JP comment: need to clarify because this paragraph mainly for the purpose of avoiding collision with pedestrian/cyclist>

5.1.6.9.4. **When bringing the vehicle to a stop beside the road the vehicle speed shall not exceed 10 km/h.** <JP comment: need to clarify because this paragraph mainly for the purpose of avoiding collision with pedestrian/cyclist>

5.1.6.9.5. **A lane change manoeuvre during an intervention shall be indicated in advance to other road users by activating the appropriate direction indicator lamps instead of the hazard warning lights.**

5.1.6.9.6. **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.**

5.1.6.9.7. **Notwithstanding paragraph 5.1.6.9.6. 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.**

Point of discussion: Confirm that option 2 is acceptable

~~**Option 1 for 5.2.6.6.**~~

~~**5.2.6.6. Assessment of the target lane**~~

~~A LCP LCM shall only be initiated if an approaching vehicle in the target lane is not would not be forced to unmanageably decelerate due to the lane change of the ALKS vehicle.~~

Option 2 for 5.2.6.9.

5.2.6.9. Assessment of the target lane

A LCP shall only be initiated if the ALKS vehicle would be able to keep a safe distance from a lead vehicle or any other obstacle in the target lane according with the previsions of paragraph 5.2.3.3. and if an approaching vehicle in the target lane is not forced to unmanageably decelerate due to the lane change of the ALKS vehicle.

Point of discussion: Confirm that option 1 is acceptable

Option 1 for 5.2.6.9.1

5.2.6.9.1. When there is an approaching vehicle

An approaching vehicle in the target lane should not have to decelerate at a higher level than A m/s², B seconds after the ALKS vehicle starts crossing a lane marking, to ensure the distance between the two vehicles is never less than that which the lane change vehicle travels in C seconds.

With:

(a) A equal to:

(i) 3.0 m/s² for a regular lane change

(ii) 3.7 m/s² for a lane change during a minimal risk manoeuvre

(b) B equal to:

(i) 0.0 second, if during a minimal risk manoeuvre 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 a vehicle approaching from the rear was detected by the sensing system;

(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.

(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 during a minimal risk manoeuvre;

(ii) 1.0 second for all other conditions.

~~**Option 2 for 5.2.6.6.1 (EC/JRC simplified text)**~~

~~**5.2.6.6.1. An approaching vehicle in the target lane should always have a TTC to the ALKS vehicle of at least [4] seconds at the end of the LCM.**~~

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

Kommentar [LA(1]: ACSF C. To allow a Motorcycle without AEBS to be able to brake on wet road. End of "comfort zone"

Kommentar [LA(2]: This is a more an emergency situation(the driver is not available). To be discussed.

Kommentar [LA(3]: Industry :to make difference with vehicle in the lane and not in the lane. Alternative is 0,4 sec.

Kommentar [LA(4]: DE: 0,4 sec for system to start braking.

Kommentar [LA(5]: 1 sec human reaction time to understand the situation. Normal reaction for a driver.

Kommentar [LA(6]: DE: Together with 1 sec reaction time +braking system reaction makes 1,4 sec reaction time.

Kommentar [LA(7]: Absolute lower limit. Remaining safety distance for short moment.

Kommentar [LA(8]: OICA: Not sure it works for all the situations. For high speed TTC would work. What about exactly the same speed (TTC would be infinite- allowing a few centimetre distance). Not sure 4 sec.
OK to take option 1.

Point of discussion: to confirm that merging of former options 1 an 2 is acceptable

5.2.6.9.3. When there is no vehicle detected

If no approaching vehicle is detected by the system in the target lane, the ~~minimal~~ minimum gap to the rear shall be calculated under the assumption that:

a) the approaching vehicle in the target lane is at a distance from the ALKS vehicle equal to rearward detection distance and

b) the ~~an~~ approaching vehicle in the ~~on a~~ target lane ~~intended for faster traffic (including enter lanes)~~ is travelling with the allowed or the advised maximum speed whichever is ~~lower~~ higher ~~or~~

(c) An approaching vehicle on a hard shoulder is travelling at a maximum speed of 80 km/h and a maximum speed difference to the ALKS vehicle at the start of the LCM of 40 km/h.

~~**Option 1 for 5.2.6.6.3.**~~

~~**5.2.6.6.23. When there is no vehicle detected**~~

~~**If no approaching vehicle is detected by the system in the target lane, the ~~minimal~~ minimum gap to the rear shall be calculated under the assumption that:**~~

~~**(a) an approaching vehicle on a target lane intended for faster traffic (including ~~enter entry~~ lanes) is travelling with ~~at least~~ the allowed ~~or the advised~~ maximum speed ~~whichever is lower~~ or, ~~on roads where no speed limit applies, at least~~ the advised maximum speed, ~~or~~;**~~

~~**b) an approaching vehicle on a target lane intended for slower traffic (including exit lanes and ~~hard~~ shoulders temporarily opened for regular traffic) is travelling with a ~~maximum~~ speed difference of ~~at least~~ [20] km/h at the beginning of the LCM ~~or while not exceeding the allowed or advised maximum speed or advised maximum speed is travelling with at least the allowed maximum speed or, on roads where no speed limit applies, at least the advised maximum speed.~~**~~

~~**(c) An approaching vehicle on a hard shoulder is travelling at a maximum speed of 80 km/h and a maximum speed difference to the ALKS vehicle at the start of the LCM of 40 km/h.**~~

~~**Option 2 for 5.2.6.6.3.**~~

~~**5.2.6.6.3. When there is no vehicle detected**~~

~~**If no approaching vehicle is detected by the system in the target lane, ~~the conditions laid down in paragraph 5.2.6.6.1 minimal gap to the rear~~ shall be ~~assessed calculated~~ under the assumption that**~~

~~**a) the approaching vehicle in the target lane is at a distance from the ALKS vehicle equal to rearward detection distance and**~~

~~**b) the an approaching vehicle in the on a target lane ~~intended for faster traffic (including enter lanes)~~ is travelling with the allowed or the advised maximum speed whichever is ~~lower higher or~~**~~

~~**b) an approaching vehicle on a target lane intended for slower traffic (including exit lanes and shoulders temporarily opened for regular traffic) is travelling with a maximum speed difference of 20 km/h at the beginning of the LCM while not exceeding the allowed or advised maximum speed.**~~

~~**(c) An approaching vehicle on a hard shoulder is travelling at a maximum speed of 80 km/h and a maximum speed difference to the ALKS vehicle at the start of the LCM of 40 km/h.**~~

Kommentar [LA(9]: Assumption to be taken by manufacturers if no vehicle detected.

Kommentar [LA(10]: Normal case

Kommentar [LA(11]: Target lane is on the right

Kommentar [LA(12]: Keep the text as it is for further discussion. To be sorted out before next meeting. Douglas+Industry.

Kommentar [LA(13]: Hard shoulder.

Kommentar [LA(14]: Conclusion: Go for option 1 . But merge it with the text above to make it clear . Chair to make an attempt

Kommentar [LA(15]: Hard shoulder.

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

At the beginning of the LCM, t~~T~~he distance between the rear of the ALKS vehicle and the front of ~~to~~ ~~to~~ a vehicle following behind in the target lane at equal or lower longitudinal speed shall never be less than the speed which the following vehicle in target lane travels in:

(a) 0.7s for a lane change during a minimal risk manoeuvre

(b) 1.0s for a regular lane change.

5.2.6.10. For the duration of the lane change manoeuvre, the lane change vehicle shall observe the minimum following distance requirements in accordance with 5.2.3.3 for any lead vehicle(s) or road user(s) in the target lane of travel or the initial lane of travel.

The strategy shall be clearly documented to ensure that this requirement is met, whilst ensuring that all lane changes can be completed and forward collisions avoided.

5.2.6.11. In the case that, in the target lane, no obstacle or road user is present within the forward detection range, the speed of the ALKS vehicle, prior to beginning the lane change manoeuvre, shall be such that the lane change manoeuvre can complete and the vehicle can be brought to a complete stop within a distance equal to the forward detection range less 2m.

5.2.6.12. In case the ALKS decelerates the vehicle during a lane change procedure, this deceleration shall be factored in when assessing the distance to a vehicle approaching from the rear, and the deceleration shall be manageable for the vehicle approaching from the rear.

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

5.2.6.13. Where there is not sufficient headway time for the vehicle behind at the end of the lane change procedure, the ALKS shall not increase the rate of deceleration for a certain period of time after the completion of the lane change procedure except for the purpose of avoiding or mitigating the risk of an imminent collision.

Kommentar [LA(16]: Coming from RMF text

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

Point of discussion: Industry proposal (UN157-05-11) on emergency manoeuvres to be confirmed (new text expected from Industry to narrow down the concept of emergency lane change to ensure this will only be used in case of emergency situations).

Paragraph 5.3., amend to read

"5.3. Emergency Manoeuvre (EM)

5.3.1. An Emergency Manoeuvre shall be carried out in case of an imminent collision risk **or when the vehicle needs to cross lane markings to mitigate the risk of a collision**.

5.3.1.1. Any longitudinal deceleration demand of more than 5.0 m/s² of the system shall be considered to be an emergency manoeuvre.

5.3.1.2. Any lateral manoeuvre that leads the ALKS vehicle to cross lane markings in response to a risk of collision and that is not considered a lane change according to paragraph 5.2.6. shall be considered to be an emergency manoeuvre.

5.3.2. This manoeuvre shall decelerate the vehicle up to its full braking performance if necessary and/or may perform an automatic evasive manoeuvre, when appropriate.

If failures are affecting the braking or steering performance of the system, the manoeuvre shall be carried out with consideration for the remaining performance.

During the evasive manoeuvre the ALKS vehicle shall not cross the lane marking (outer edge of the front tyre to outer edge of the lane marking) **unless the system is capable of fulfilling the provisions of paragraph 5.3.5.**

After the evasive manoeuvre the vehicle shall aim at resuming a stable position**.**

5.3.5. Lateral manoeuvre crossing lane markings to minimize the risk of a collision

5.3.5.1. The vehicle shall only cross lane markings in response to a risk of collision if the system has sufficient information about its surrounding to the front and side (as defined in paragraph 7.1.) and to the rear (according to the following paragraphs) in order to assess the criticality of crossing the lane markings.

5.3.5.2. The activated system shall not cause a collision with another vehicle or road user in the predicted path of the vehicle when crossing lane markings in response to a risk of collision.

5.3.5.3. The vehicle shall only cross lane markings in response to a risk of collision if another vehicle in the evasive lane is not forced to unmanageably decelerate due to that manoeuvre.

Point of discussion: Chair proposal is to remove the []. 30 cm comes from the LDWS. Industry to provide explanation where the 0.5 sec come from and to clarify if the two conditions must be fulfilled.

5.3.5.3.1. When crossing the lane markings by not more than [30] cm, it shall be ensured that

- **the distance to a vehicle following behind in the evasive lane at equal or lower speed is greater than that which the following vehicle travels in 0.5s. [or?]**
- **a minimum lateral distance of 1m to vehicles travelling in the evasive lane is ensured.**

Point of discussion: Chair proposal is to remove the []. DE would prefer a full lane change and use the same parameters than nominal lane change. To be clarified is those are cumulative conditions.

5.3.5.3.2. When crossing the lane markings by more than [30] cm up to [half the vehicle's width], it shall be ensured that

- **An approaching vehicle in the evasive lane shall not have to decelerate at a higher level than 4 m/s², 0,4 seconds after the ALKS vehicle starts crossing the lane markings, to ensure collision avoidance between the two vehicles, and**
- **the distance to a vehicle following behind in the evasive lane at equal or lower speed is greater than that which the following vehicle travels in 0.5s. and?**
- **the evasive lane is unoccupied across the length of the ALKS vehicle**

5.3.5.3.3. When crossing the lane markings by more than [half the vehicle's width], the criticality of the situation shall be assessed according to the corresponding provisions for a regular lane change in paragraphs 5.2.6.x, 5.2.6.y and 5.2.6.z.

5.3.5.4. The vehicle shall aim at returning to its original lane of travel once the situation that required the lateral manoeuvre has passed."

Paragraph 5.4.2.4., insert to read:

Kommentar [LA(17]: Comes from LDWS

Kommentar [LA(18]: Where does this come from? Same as TTC of 0,5 sec?

5.4.2.4. **In case the ALKS is capable to perform a regular LCP, it shall be aimed that a regular LCP is not part of the transition phase, meaning that the transition demand is not given shortly before or during a LCP.**

Paragraphs 5.5.1., amended to read:

5.5.1. During the minimum risk manoeuvre the vehicle shall be slowed down ~~inside the lane or, in case the lane markings are not visible, remain on an appropriate trajectory taking into account surrounding traffic and road infrastructure~~, with an aim of achieving a deceleration demand not greater than 4.0 m/s².

Higher deceleration demand values are permissible for very short durations, e.g. as haptic warning to stimulate the driver's attention, or in case of a severe ALKS or severe vehicle failure. **The ALKS shall either:**

(a) Keep the vehicle inside the lane, or in case the lane markings are not visible, remain on an appropriate trajectory taking into account surrounding traffic and road infrastructure; or,

(b) Bring the vehicle to a safe stop outside of its lane of travel, when:

(i) ALKS is capable of performing a lane change according to paragraph 5.2.6.; and

(ii) A lane change can be safely performed under the current conditions to bring the vehicle to a safe stop outside its lane of travel.

Additionally, the signal to activate the hazard warning lights shall be generated with the start of the minimum risk manoeuvre.

If a lane change procedure is performed during the minimal risk manoeuvre, the signal to activate the hazard warning lights shall be generated again once the vehicle has reached its target lane.

Paragraph 6.4.1., amend to read:

6.4.1. The following information shall be indicated to the driver:

(a) The system status as defined in paragraph 6.4.2.

(b) Any failure affecting the operation of the system with at least an optical signal unless the system is deactivated (off mode),

(c) Transition demand by at least an optical and in addition an acoustic and/or haptic warning signal.

At the latest 4 s after the initiation of the transition demand, the transition demand shall:

(i) Contain a constant or intermittent haptic warning unless the vehicle is at standstill; and

(ii) Be escalated and remain escalated until the transition demand ends.

(d) Minimum risk manoeuvre by at least an optical signal and in addition an acoustic and/or a haptic warning signal and

(e) Emergency manoeuvre by an optical signal

(f) A LCP, if the ALKS is capable of performing a LCP, by at least an optical signal.

The optical signals above shall be adequate in size and contrast. The acoustic signals above shall be loud and clear."

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.

Renumber paragraphs 7.1.3. to 7.1.6. into 7.1.4. to 7.1.7.

Paragraph 7.1.3., insert 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 rear detection range measured from the most rearward 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.

Paragraph 7.1.5., amend to read:

7.1.5. 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**s** specified in paragraph 7.1. over the lifetime of the system/vehicle.

Annex 5, Tests, paragraph 4.6., amend to read:

4.6. Field of View test

4.6.1. The test shall demonstrate that the ALKS is capable of detecting another road user within the forward detection area up to the declared forward detection range and a vehicle beside within the lateral detection area up to at least the full width of the adjacent lane. **If the ALKS is capable of performing lane changes, it shall additionally demonstrate that the ALKS is capable of detecting another vehicle within the rear detection range.**

4.6.2. The test for the forward detection …

4.6.3. The test for the lateral detection range …

4.6.4. The test for the rear detection range shall be executed at least:

(a) With a motorcycle approaching the ALKS from the rear in the left adjacent lane;

(b) With a motorcycle approaching the ALKS from the rear in the right adjacent lane.

Annex 5, Tests, insert a new paragraphs 4.7., 4.8. and 4.9. to read:

4.7. **Lane changing**

Lane Change tests (only required if the ALKS is capable of performing lane changes either during an MRM, emergency situations or during regular operation)

The tests shall demonstrate that the ALKS does not cause an unreasonable risk to safety of the vehicle occupants and other road users during a Lane Change Procedure (LCP), is capable of correctly performing lane changes and is able to assess the criticality of the situation before starting the LCM.

4.7.1. **The test shall be executed at least:**

(a) With different vehicles, including a motorcycle approaching from the rear;

(b) In a scenario where a LCM in regular operation is possible and executed;

(c) In a scenario where the LCM in regular operation is not possible due to a vehicle approaching from the rear;

(d) With an equally fast vehicle following behind in the adjacent lane at a distance of less than that which the following vehicle travels in 1.0 second preventing a lane change;

(e) With a vehicle driving beside in the adjacent lane preventing a lane change;

(f) In a scenario where a LCM during a minimal risk manoeuvre is possible and executed.

4.7.2. **The following on road-tests shall be executed:**

(a) With the ALKS vehicle performing lane change in the adjacent (target) lane;

(b) Merging at motorway entry;

(c) Merging at lane end;

(d) Merging into an occupied lane.

4.8 **Detect and response to traffic rules and road furniture**

Kommentar [LA(19]: OICA to check with para 5.4 and 5.5 of Annex 4/5.

4.8.1. **These tests shall ensure that the ALKS respects traffic rules, detects and adapts to a variation of permanent and temporary road furniture.**

4.8.2. **The test shall be executed at least with the list of scenarios below, but based on the ODD of the given system:**

(a) Different speed limit signs, so that the ALKS vehicle has to change its speed according to the indicated values;

(b) Signal lights of an ending lane. The signal lights are set above the belonging lanes, and the signal lights of adjacent lanes are kept in green state, while the one of the current lane for the ALKS vehicle is kept red.;

(c) Driving through a tunnel: at least [X]m long section of the road with no sunlight and availability of the positioning system.

(d) Toll station: a section of the motorway with toll station-, speed limit signs and buildings (ticket machines, barriers, etc.).

(e) Temporary modifications: e.g., road maintenance operations indicated by traffic signs, cones and other modifications.

4.8.3. **Each test shall be executed at least:**

(a) Without a lead vehicle;

(b) With a passenger car target as well as a PTW target as the lead vehicle / other vehicle.

4.9. **Avoid braking before a passable object in the lane**

4.9.1. **The test shall demonstrate that the ALKS vehicle is not braking without a reason before a passable object in the lane (e.g., a manhole lid or a small branch).**

4.9.2. **The test shall be executed at least:**

(a) Without a lead vehicle;

(b) With a passenger car target as well as a PTW target as the lead vehicle / other vehicle.

II. Justification