Editorial changes adopted at GRVA-07 not yet included

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1. Scope and purpose		
1.1. This Regulation applies to the type approval of vehicles of Category ~~M1~~ **M and N** with regards to their Automated Lane Keeping System.		
2. Definitions		
For the purposes of this Regulation:		
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 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".		
2.1.1. "Vehicle Type with regard to Automated Lane Keeping System (ALKS)" means a category of vehicles which do not differ in such essential aspects as: (a) Vehicle features which significantly influence the performances of ALKS; (b) The system characteristics and design of ALKS.		
2.2. "Transition demand" is a logical and intuitive procedure to transfer the Dynamic Driving Task (DDT) from the system (automated control) to the human driver (manual control). This request is given from the system to the human driver.		
2.3. "Transition phase" means the duration of the transition demand.		
2.4. "Planned event" is a situation which is known in advance, e.g. at the time of activation such as a journey point (e.g. exit of a highway) etc. and which requires a transition demand.		
2.5. "Unplanned event" is a situation which is unknown in advance, but assumed as very likely in happening, e.g. road construction, inclement weather, approaching emergency vehicle, missing lane marking, load falling from truck (collision) and which requires a transition demand.		
2.6. "Imminent collision risk" describes a situation or an event which		

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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/s2.		
2.7. "Minimum Risk Manoeuvre (MRM)" means a procedure aimed at minimising risks in traffic, which is automatically performed by the system after a transition demand without driver response or in the case of a severe ALKS or vehicle failure.		
2.8. "Emergency Manoeuvre (EM)" is a manoeuvre performed by the system in case of an event in which the vehicle is at imminent collision risk and has the purpose of avoiding or mitigating a collision.		
2.9. Speed		
2.9.1. "Specified maximum speed" is the speed declared by the manufacturer up to which the system operates under optimum conditions.		
2.9.2. "Maximum operational speed" is the speed selected by the system up to which the system operates under current environmental and sensor conditions. It is the maximum vehicle speed at which the system may be active and shall be determined by the capability of the sensing system as well as the environmental conditions.		
2.9.3. "Present speed" or "speed" is the current speed selected by the system due to traffic.		
2.10. "Detection range" of the sensing system is the distance at which the system can reliably recognise a target, taking account of the deterioration of components of the sensing system due to time and usage throughout the lifetime of the vehicle and generate a control signal.		
2.11. Failures		
2.11.1. An "ALKS failure" is any single failure specific to the operation of the ALKS (e.g. single sensor failure, loss of necessary calculation data for the driving path of the vehicle).		
2.11.2. "Failure mode" is the operation status of the system in which the system operates with an ALKS failure.		
2.11.3. A "severe ALKS failure" is a failure specific to the operation of the		

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ALKS that affects the safe operation of the system when in failure mode with a very low probability of occurrence such as generally used for essential components as e.g. an electronic control unit. Single sensor failures are only considered as such when accompanied by another influence affecting the safe operation of the system.		
2.11.4. A "severe vehicle failure" is any failure of the vehicle (e.g. electrical, mechanical) that affects the ability of the ALKS to perform the DDT and would also affect the manual operation of the vehicle (e.g. loss of power supply, failure of the braking system, sudden loss of tire pressure).		
2.12. "Self-check" means an integrated function which checks for any system failure and for the detection range of the sensing system on a continuous basis.		
2.13. A "system override" by the driver means a situation when the driver provides an input to a control which has priority over the longitudinal or lateral control of the system, while the system is still active.		
2.14. "Dynamic Driving Task (DDT)" is the control and execution of all longitudinal and lateral movements of the vehicle.		
2.15. "Data Storage System for Automated Driving (DSSAD)" enables the determination of interactions between the ALKS and the human driver.		
2.16. "Lifetime of the system" is the period of time during which the ALKS system is available, as a function, on the vehicle.		
2.17. "Occurrences" means, in the context of DSSAD provisions in paragraph 8, an action or instance of an arising event or incident, which requires storage within the data storage system.		
2.18. "R15X Software Identification Number (R15X SWIN)" means a dedicated identifier, defined by the vehicle manufacturer, representing information about the type approval relevant software of the Electronic Control System contributing to the UN Regulation No. 15X type approval relevant characteristics of the vehicle.		
2.19. "Electronic control system" means a combination of units, designed to co-operate in the production of the stated automated lane keeping function by electronic data processing. Such systems, commonly controlled by software, are built from discrete functional components such as sensors, electronic control units and actuators		

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and connected by transmission links. They may include mechanical, electro-pneumatic or electro-hydraulic elements.		
2.20. "Software" means the part of an Electronic Control System that consists of digital data and instructions.		
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.	UK: **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: **(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.**	UK: **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.**	ROK: **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.**	
5. System Safety and Fail-safe Response		
5.1. General 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 (in particular for conditions not tested under Annex 5) and		

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according to the relevant tests in Annex 5.		
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.		
5.1.2. The activated system shall comply with traffic rules relating to the DDT in the country of operation.		
5.1.3. The activated system shall exercise control over systems required to support the driver in resuming manual control at any time (e.g. demist, windscreen wipers and lights).		
5.1.4. A transition demand shall not endanger the safety of the vehicle occupants or other road users.		
5.1.5. If the driver fails to resume control of the DDT during the transition phase, the system shall perform a minimum risk manoeuvre. During a minimum risk manoeuvre, the system shall minimise risks to safety of the vehicle occupants and other road users.		
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 according to paragraph 7.1. **and its subparagraphs**).		
5.1.7. The effectiveness of the system shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by compliance with the 05 or later series of amendments to UN Regulation No. 10.		
5.1.8. The manufacturer shall take measures to guard against reasonably foreseeable misuse by the driver and tampering of the system.		
5.1.9. When the system can no longer meet the requirements of this Regulation, it shall not be possible to activate the system. The manufacturer shall declare and implement a process to manage the safety and continued compliance of the ALKS system over lifetime.		

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5.2. Dynamic Driving Task 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 (in particular for conditions not tested under Annex 5) and according to the relevant tests in Annex 5.		
5.2.1. The activated system shall keep the vehicle inside its lane of travel and ensure that the vehicle does not cross any lane marking (outer edge of the front tyre to outer edge of the lane marking). The system shall aim to keep the vehicle in a stable lateral position inside the lane of travel to avoid confusing other road users.	UK: 5.2.1. The activated system shall keep the vehicle inside its lane of travel and ensure that the vehicle does not 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. Industry: 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). The system shall aim to keep the vehicle in a stable lateral position inside the lane of travel to avoid confusing other road users.	
5.2.2. The activated system shall detect a vehicle driving beside as defined in paragraph 7.1.2. and, if necessary, adjust the speed and/or the lateral position of the vehicle within its lane as appropriate.		
5.2.3. The activated system shall control the speed of the vehicle.		
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.		*Norway: This will require the ALKS to be able to detect and react to varying speed limits.*
5.2.3.2. The activated system shall adapt the vehicle speed to infrastructural and environmental conditions (e.g. narrow curve radii, inclement weather).		
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		*EC: **String stability** should be required from an ALKS. String stability can be described as the capability of the ADS to react to a perturbation in the speed profile of the leading vehicle with a perturbation in its speed profile of lower or equal absolute magnitude independently from the driving conditions.* *EC: **How will the proposed minimum distance affect traffic flow?** The maximum theoretical flow is almost 1950 veh/h which is not bad. The problem is that such a value is achieved*

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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: dmin = vALKS* tfront Where: dmin = the minimum following distance vALKS = the present speed of the ALKS vehicle in m/s tfront = minimum time gap in seconds between the ALKS vehicle and a leading vehicle in front as per the table below: [...] (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** **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. **When the system is active, the vehicle shall comply with the minimum following distances per the local traffic rules of Contracting Party regions, as declared by the vehicle manufacturer in the Appendix of Annex 1, for vehicles of categories M2, N2, M3, N3.** **The requirements of this paragraph are without prejudice to other requirements in this Regulation, most notably**		*for a speed of 40km/h and it drops to below 1700 veh/h for higher speed resulting in quite unnatural traffic behavior. Without proper traffic consideration the flow of AVs will generate a sensibly lower road capacity.*

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paragraphs 5.2.4. and 5.2.5. with subparagraphs.		
5.2.4. The activated system shall be able to bring the vehicle to a complete stop behind a stationary vehicle, a stationary road user or a blocked lane of travel to avoid a collision. This shall be ensured up to the maximum operational speed of the system.		
5.2.5. The activated system shall detect the risk of collision in particular with another road user ahead or beside the vehicle, due to a decelerating lead vehicle, a cutting in vehicle or a suddenly appearing obstacle and shall automatically perform appropriate manoeuvres to minimize risks to safety of the vehicle occupants and other road users. For conditions not specified in paragraphs 5.2.4., 5.2.5. or its subparagraphs, this shall be ensured at least to the level at which a competent and careful human driver could minimize the risks. This shall be demonstrated in the assessment carried out under Annex 4 and by taking guidance from Appendix 3 to Annex 4.		
5.2.5.1. The activated system shall avoid a collision with a leading vehicle which decelerates up to its full braking performance provided that there was no undercut of the minimum following distance the ALKS vehicle would adjust to a leading vehicle at the present speed due to a cut in manoeuvre of this lead vehicle.		
5.2.5.2. The activated system shall avoid a collision with a cutting in vehicle, (a) Provided the cutting in vehicle maintains its longitudinal speed which is lower than the longitudinal speed of the ALKS vehicle and (b) 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, (c) When the distance between the vehicle's front and the cutting in vehicle's rear corresponds to a TTC calculated by the following equation: $TTCLaneIntrusion > vrel/(2 \cdot$ ~~6m/s²~~ **X**$) + 0.35s$ Where: **X = 6m/s² for M1, N1 and 5m/s² for M2, M3, N2, N3** Vrel = 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.		

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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~~ **60km/h**.		
5.2.5.4. It is recognised that the fulfilment of the requirement in paragraph 5.2.5. may not be fully achieved in other conditions than those described above. However, the system shall not deactivate or unreasonably switch the control strategy in these other conditions. This shall be demonstrated in accordance with Annex 4 of this Regulation.		
5.2.6. Lane Change Procedure **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.**	Industry: **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 a risk to safety of the vehicle occupants and other road users.	Industry: **5.2.6.1. A LCP shall not cause an unreasonable risk to safety of the vehicle occupants and other road users.**	
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 7.1.3.;** **(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**	UK: **5.2.6.2. 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 rearward detection range requirements as defined in paragraph 7.1. and subparagraph 7.1.3.;** **(b) ~~The~~ All system self-check~~s~~, 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**	Industry: **5.2.6.2. The activated system shall only undertake a LCP if the following ~~requirements~~ conditions 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 7.1.3.;** **(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;~~** **A gap allowing a LCM is already present or expected to open up shortly.** **(d) The LCP is anticipated to be completed**	*General: Is the lane change procedure only initiated by the system or can the driver initiate that lane change?* *Sweden: Do we need to define trigger conditions that permit the start of a lane change procedure?* *Sweden: How can it be ensured that the ODD conditions will still be fulfilled in the target lane?* *ROK: Futher scenarios that require a lane change include:* • *Y-split of highway lanes or to exit the highway*

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next available opportunity either complete the LCP or return to its original lane.	**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.** **(~~a~~ f)** **Operation cannot be continued in the current lane (e.g. due to a blocked lane ahead, ending lane ahead), for the purpose of overtaking a slower moving vehicle or to prevent violation of the obligation to drive in the slowest lane when possible, 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.**	**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.** **(~~a~~ e)** **There is a reason for a lane change (e.g. Operation cannot be continued in the current lane ~~(e.g. due to a blocked lane ahead, ending lane ahead)~~, for the purpose of overtaking a slower moving vehicle or to prevent violation of the obligation to drive in the slowest lane when possible;** **~~(b) A gap allowing a LCM is already present or expected to open up shortly.~~**	
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), for the purpose of overtaking a slower moving vehicle or to prevent violation of the obligation to drive in the slowest lane when possible;** **(b) A gap allowing a LCM is already present or expected to open up shortly.**	UK and Industry: include items of 5.2.6.3. in 5.2.6.2. and delete 5.2.6.3.		
5.2.6.4. A LCP shall be completed without undue delay. **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.**	UK: **5.2.6.~~4~~ 3. A LCP shall be completed without undue delay.**		

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	UK: **5.2.6.4. 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.**		
5.2.6.5. 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 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.**	UK: **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 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.**	Industry: **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 seconds after activation of the direction indicator lamps.~~** **The LCM may be terminated before being completed if the situation requires it. In case of a regular lane change upon termination of the LCM ~~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.** **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.**	*ROK:* *"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."*
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.**	UK and Industry: **5.2.6.6. Assessment of the target lane** **A ~~LCP~~ LCM shall only be ~~initiated~~ started if there is a sufficient gap, so that a~~n approaching~~ vehicle in the target lane would not be ~~is not~~ forced to unmanageably decelerate due to the lane change of the ALKS vehicle.**		
5.2.6.6.1. 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 3 m/s2;** **(b) B equal to:** **(i) 0.4 seconds after the ALKS vehicle has crossed**	Industry: **5.2.6.6.1. 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**	ROK: **5.2.6.6.1. An A in the target lane should not have to decelerate at a higher level than B m/s², C seconds after the ALKS vehicle starts crossing a lane marking, to ensure the distance between two vehicles is never less than that which the D travels in 1 second.** **With :** **Forward Rearward**	*EC: Would these values apply to slow moving traffic as well? Would suitable gaps be available or are there any specific provisions needed for slow moving, dense traffic?*

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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 1 second.**	**seconds.** **With:** **(a) A equal to** **(i) 3 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 s, if during a minimal risk manoeuvre the lateral movement of the ALKS vehicle continued for at least 1 s while the vehicle had not yet crossed the lane marking and the direction indicator had been active for at least 3 s prior to crossing of the lane markings while a vehicle approaching from the rear was detected by the sensing system;** **(ii) 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** **(iii) 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) 0.5s, 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 second for all other**	**Assessment / 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.**	

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	conditions.		
	UK: **5.2.6.6.x. Determination of whether a situation is critical shall consider any deceleration or acceleration of the ALKS vehicle after it has crossed the lane marking.**		
5.2.6.6.2. If no approaching vehicle is detected by the system in the target lane, the minimal 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 lanes) is travelling with the allowed or the advised maximum speed whichever is lower; 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.**	UK: **5.2.6.6.2. 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.**	Industry: **5.2.6.6.2. When there is no vehicle detected** **If no ~~approaching~~ vehicle is detected by the system in the target lane, the minimal 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 lanes) is travelling with the allowed or the advised maximum speed whichever is lower; 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~~ start 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 80km/h and a maximum speed difference to the ALKS vehicle at the start of the LCM of 40km/h.**	
5.2.6.7. The distance to a vehicle following behind in the target lane at equal or lower speed shall never be less than the speed which the following vehicle travels in 1 second.	Industry: **5.2.6.6.3. When there is an equally fast or slower moving vehicle** **~~5.2.6.7~~. The distance to a vehicle following behind in the target lane at equal or lower speed at the start of the LCM shall ~~never~~ not be less than the ~~speed~~ distance which the following vehicle travels in ~~1 second.~~** **(i) 0,7s for a lane change during a minimal risk manoeuvre** **(ii) 1s for a regular lane change.**		*EC: It seems strange that while the ALKS is required to keep always a time-gap higher than 1s to the vehicle ahead, a vehicle behind can accept a time gap of 1s.*
	UK: **5.2.6.8. 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**		

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	that all lane changes can be completed and forward collisions avoided.	
	UK: **5.2.6.9 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.** ROK: **5.2.6.7. The distance to a vehicle leading in front in the target lane at equal or higher speed shall never be less than that which the leading vehicle travels in 1 second.**	
	ROK: **5.2.6.x. 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.**	
5.3. Emergency Manoeuvre (EM) 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.		*General: Need to define provisions for an evasive manoeuvre crossing lane markings?*
5.3.1. An Emergency Manoeuvre shall be carried out in case of an imminent collision risk.		
5.3.1.1. Any longitudinal deceleration demand of more than 5.0 m/s² of the system shall be considered to be an EM.		
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). After the evasive manoeuvre the vehicle shall aim at resuming a stable position.		
5.3.3. An emergency manoeuvre shall not be terminated, unless the imminent collision risk disappeared, or the driver deactivated the system.		

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5.3.3.1. After an emergency manoeuvre is terminated the system shall continue to operate.		
5.3.3.2. If the emergency manoeuvre results in the vehicle being at standstill, the signal to activate the hazard warning lights shall be generated. If the vehicle automatically drives off again, the signal to deactivate the hazard warning lights shall be generated automatically.		
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**.		
5.4. Transition demand and system operation during transition phase 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 (in particular for conditions not tested under Annex 5) and according to the relevant tests in Annex 5.		
5.4.1. The activated system shall recognise all situations in which it needs to transition the control back to the driver. Types of situations in which the vehicle will generate a transition demand to the driver shall be declared by the vehicle manufacturer and included in the documentation package required in Annex 4.		
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.**		*Industry proposes to leave the paragraph as it is, since the concern is already addressed by other provisions. Alternatively, rephrase to read "***The ALKS shall implement strategies to minimize the risks related to necessary adjustments by the driver in and on the vehicle upon return to manual driving (e.g having to readjust the seat). These strategies shall be described by the manufacturer and assessed according to Annex 4."**
5.4.2.1. In case of a planned event that would prevent the ALKS from continuing the operation, a transition demand shall be given early enough to ensure the minimal risk maneuver, in case the driver would not resume control, would bring the vehicle to standstill before the planned event occurs.		
5.4.2.2. In case of an unplanned event, a transition demand shall be given upon detection.		
5.4.2.3 In case of any failure affecting the operation of the system, the system shall immediately initiate a transition demand upon		

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detection.		
5.4.2.4. In case a system is fitted to perform LCP, it shall be aimed that a LCP is not part of the transition phase, meaning that the transition demand is not given shortly before or during a LCP.	Industry: **5.4.2.4. In case ~~a system is fitted~~ 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.**	
5.4.3. During the transition phase the system shall continue to operate. The system may reduce the speed of the vehicle to ensure its safe operation but shall not bring it to standstill unless required by the situation (e.g. due to vehicles or obstacles obstructing the path of the vehicle) or when caused by a haptic warning according to paragraph 6.4.1 started at speeds below 20 km/h.		
5.4.3.1. Once in standstill the vehicle may remain in this condition and shall generate the signal to activate the hazard warning lights within 5 s.		
5.4.3.2. During the transition phase, the transition demand shall be escalated latest after 4 s after the start of the transition demand.		
5.4.4. A transition demand shall only be terminated once the system is deactivated or a minimum risk manoeuvre has started.		
5.4.4.1. In case the driver is not responding to a transition demand by deactivating the system (either as described in paragraph 6.2.4. or 6.2.5.), a minimum risk manoeuvre shall be started, earliest 10 s after the start of the transition demand.		
5.4.4.1.1. Notwithstanding paragraph 5.4.4.1. a minimum risk manoeuvre may be initiated immediately in case of a severe ALKS or severe vehicle failure. In case of a severe ALKS or vehicle failure the ALKS may no longer be capable of fulfilling the requirements of this Regulation, but it shall aim at enabling a safe transition of control back to the driver.		
5.4.4.1.2. The manufacturer shall declare the types of severe vehicle failures and severe ALKS failures that will lead the ALKS to initiate a MRM immediately.		
5.5. Minimum Risk Manoeuvre (MRM) 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 (in particular for conditions not tested under Annex 5) and		

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according to the relevant tests in Annex 5.		
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. Additionally, the signal to activate the hazard warning lights shall be generated with the start of the minimum risk manoeuvre.	UK: 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. **In the case of a system that can perform a lane change, the system may choose to perform one or more lane change procedures during a minimum risk manoeuvre.** ~~Additionally, the~~ **T**he signal to activate the hazard warning lights shall be generated with the start of the minimum risk manoeuvre. **In the case of a lane change procedure being undertaken during a minimum risk manoeuvre, the hazard warning lamps shall be deactivated immediately prior to the lane change procedure being initiated; the hazard warning lamps shall be reactivated without delay upon completion of the lane change procedure.**	Industry: 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** 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** **in case of an ALKS that is capable of performing a lane change according to par. 5.2.6. and when a lane change can be safely performed under the current conditions, 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.**	
5.5.2. The minimum risk manoeuvre shall bring the vehicle to standstill unless the system is deactivated by the driver during the manoeuvre.		
5.5.4. A minimum risk manoeuvre shall only be terminated once the system is deactivated or the system has brought the vehicle to a standstill.		
5.5.5. The system shall be deactivated at the end of any minimum risk manoeuvre.		

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The hazard warning lights shall remain activated unless deactivated manually and the vehicle shall not move away after standstill without manual input.		
5.5.6. Reactivation of the system after the end of any minimum risk manoeuvre shall only be possible after each new engine start/run cycle.		
6. Human Machine Interface/operator information		
6.1. Driver Availability Recognition System 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.		
6.1.1. The system shall comprise a driver availability recognition system. The driver availability recognition system shall detect if the driver is present in a driving position, if the safety belt of the driver is fastened and if the driver is available to take over the driving task.		
6.1.2 Driver presence A transition demand shall be initiated according to paragraph 5.4. if any of the following conditions is met: (a) When the driver is detected not to be in the seat for a period of more than one second; or (b) When the driver's safety belt is unbuckled. The second level warning of the safety-belt reminder according to UN-R16 may be used instead of an acoustic warning of the Transition Demand.		
6.1.3. Driver availability The system shall detect if the driver is available and in an appropriate driving position to respond to a transition demand by monitoring the driver. The manufacturer shall demonstrate to the satisfaction of the technical service the vehicle's capability to detect that the driver is available to take over the driving task.		
6.1.3.1. Criteria for deeming driver availability The driver shall be deemed to be unavailable unless at least two availability criteria (e.g. input to driver-exclusive vehicle control, eye blinking, eye closure, conscious head or body movement) have individually determined that the driver is available in the last 30		

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seconds. At any time, the system may deem the driver unavailable. As soon as the driver is deemed to be unavailable, or fewer than two availability criteria can be monitored, the system shall immediately provide a distinctive warning until appropriate actions of the driver are detected or until a transition demand is initiated. At the latest, a transition demand shall be initiated according to paragraph 5.4. if this warning continues for 15s. Justification for the number and combination of availability criteria, in particular with regard to the corresponding time interval, shall be provided by the manufacturer by documented evidence. However, the time interval required for any availability criteria shall not exceed 30 seconds. This shall be demonstrated by the manufacturer and assessed by the technical service according to Annex 4.		
6.1.4. "Other activities than driving" through on-board displays available upon activation of the ALKS shall be automatically suspended (i) as soon as the system issues a Transition Demand or (ii) as soon as the system is deactivated, whichever comes first.		
6.2. Activation, Deactivation and Driver Input 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.		
6.2.1. The vehicle shall be equipped with dedicated means for the driver to activate (active mode) and deactivate (off mode) the system. When the ALKS is activated, the means to deactivate ALKS shall be permanently visible to the driver.		
6.2.2. The default status of the system shall be the off mode at the initiation of each new engine start/run cycle. This requirement does not apply when a new engine start/run cycle is performed automatically, e.g. by the operation of a stop/start system.		
6.2.3. The system shall become active only upon a deliberate action by the driver and if all the following conditions are met: (a) The driver is in the driver seat and the driver's safety belt is fastened according to paragraphs 6.1.1. and 6.1.2.; (b) The driver is available to take over control of the DDT according to paragraph 6.1.3.; (c) No failure affecting the safe operation or the functionality of the ALKS is present;		

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(d) DSSAD is operational; (e) The environmental and infrastructural conditions allow the operation; (f) Positive confirmation of system self-check; and (g) The vehicle is 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. If any of the above conditions is no longer fulfilled, the system shall immediately initiate a transition demand unless specified differently in this Regulation.		
6.2.4 It shall be possible to manually deactivate (off-mode) the system by an intentional action of the driver using the same means as to activate the system, as mentioned in paragraph 6.2.1. The means of deactivating shall provide protection against unintentional manual deactivation for example by requiring a single input exceeding a certain threshold of time or a double press, or two separate but simultaneous inputs. Additionally, it shall be ensured the driver is in lateral control of the vehicle at the time of the deactivation, by e.g. placing the deactivation means on the steering control or confirming the driver is holding the steering control.		
6.2.5. In addition to paragraph 6.2.4., the system shall not be deactivated by any driver input other than those described below in paragraphs 6.2.5.1. to 6.2.5.4.		
6.2.5.1. Deactivation by input to driving controls The system shall be deactivated when at least one of the following conditions is met: (a) The driver overrides the system by steering while holding the steering control and this override is not suppressed, as specified in paragraph 6.3.; or (b) The driver is holding the steering control and overrides the system by braking or accelerating, as specified in paragraph 6.3.1. below.		
6.2.5.2. Deactivation during an ongoing transition demand or an ongoing minimum risk manoeuvre In case a transition demand or a minimum risk manoeuvre is on-going, the system shall only be deactivated: (a) As defined in paragraph 6.2.5.1. or (b) Upon detection that the driver has taken hold of the steering control as a response to the transition demand or the minimum risk manoeuvre and provided the system confirms the driver is attentive		

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as defined in paragraph 6.3.1.1.		
6.2.5.3. Deactivation during an ongoing emergency manoeuvre In case of an ongoing emergency manoeuvre, the deactivation of the system may be delayed until the imminent collision risk disappeared.		
6.2.5.4. Deactivation in case of a severe vehicle failure or a severe ALKS failure In case of a severe vehicle failure or a severe ALKS failure the ALKS may employ different strategies with regard to deactivation. These different strategies shall be declared by the manufacturer and their effectiveness shall be assessed by the Technical Service with regard to ensuring a safe transition of control from the system to the human driver according to Annex 4.		
6.2.6. On deactivation of the system, there shall not be an automatic transition to any function, which provides continuous longitudinal and/or lateral movement of the vehicle (e.g. ACSF of Category B1 function). After deactivation, Corrective Steering Function (CSF) may be active with the aim at accustoming the driver to execute the lateral control task by gradually reducing lateral support. Notwithstanding both paragraphs above, any other safety system delivering longitudinal or lateral support in imminent collision situations (e.g. Advanced Emergency Braking System (AEBS), Electronic Stability Control (ESC), Brake Assist System (BAS) or Emergency Steering Function (ESF)) shall not be deactivated in case of deactivation of ALKS.		
6.2.7. Any deactivation shall be indicated to the driver as defined in paragraph 6.4.2.3.		
6.3. System override		
6.3.1. A driver input to the steering control shall override the lateral control function of the system when the input exceeds a reasonable threshold designed to prevent unintentional override. This threshold shall include a specified force and duration and shall vary depending on parameters that include criteria used for driver attentiveness to be checked during the drivers input as defined in paragraph 6.3.1.1. These thresholds and the rational for any variation shall be demonstrated to the Technical Service during the assessment according to Annex 4.		

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6.3.1.1. Driver attentiveness The system shall detect if the driver is attentive. The driver is deemed to be attentive when at least one of the following criteria is met: (a) Driver gaze direction is confirmed as primarily looking at the road ahead; (b) Driver gaze direction is being confirmed as looking at the rear-view mirrors; or, (c) Driver head movement is confirmed as primarily directed towards the driving task. The specification for confirming these or equally safe criteria must be declared by the manufacturer and supported by documented evidence. This shall be assessed by the technical service according to Annex 4.		
6.3.2. A driver input to the braking control resulting in a higher deceleration than that induced by the system or maintaining the vehicle in standstill by any braking system, shall override the longitudinal control function of the system.		
6.3.3. A driver input to the accelerator control may override the longitudinal control function of the system. However, such an input shall not cause the system to no longer meet the requirements of this Regulation.		
6.3.4. Any driver input to the accelerator or brake control shall immediately initiate a transition demand as specified in paragraph 5.4., when the input exceeds a reasonable threshold designed to prevent unintentional input.		
6.3.5. Notwithstanding the provisions laid down in paragraphs 6.3.1. to 6.3.3., the effect of the driver input on any control may be reduced or suppressed by the system in case the system has detected an imminent collision risk due to this driver input.		
6.3.6. In case of a severe vehicle failure or a severe ALKS failure the ALKS may employ different strategies with regard to system override. These different strategies shall be declared by the manufacturer and their effectiveness shall be assessed by the Technical Service with regard to ensuring a safe transition of control from the system to the human driver.		
6.3.7. The fulfilment of the provisions in paragraph 6.3 and its subparagraphs 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.		

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6.4. Information to the driver		
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 fitted to perform 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.	Industry: 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 ~~fitted~~ the ALKS is capable to perform 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.	
6.4.2. System status		
6.4.2.1. System unavailability indication In case activation of the system following the deliberate action of the driver is denied by the system due to system unavailability, this shall be at least visually displayed to the driver.		
6.4.2.2. System status display when activated Upon activation the system status (active mode) shall be displayed by a dedicated optical signal to the driver. The optical signal shall contain an unambiguous indication including: (a) A steering control or a vehicle, with an additional "A" or "AUTO," or the standardized symbols in accordance with UN Regulation No. 121, and additionally (b) An easily perceptible indication in the peripheral field of vision and located near the direct line of driver's sight to the outside in front of the vehicle, e.g. prominent indication in the instrument cluster or on the steering control covering part of the outer rim perimeter facing towards the driver.		

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The optical signal shall indicate the active system state until the system is deactivated (off mode). The optical signal shall be constant while the system is in regular operation and with the initiation of a transition demand at least the indication according to (b) shall change its characteristics, e.g. to an intermittent signal or a different colour. When an intermittent signal is used, a low frequency shall be used in order to not unreasonably alert the driver. During the transition phase and minimum risk manoeuvre, the indication according to (a) may be replaced by the instruction to take over manual control according to paragraph 6.4.3.		
6.4.2.3. System status display when deactivated Upon deactivation when the system status changes from active mode to off mode this shall be indicated to the driver by at least an optical warning signal. This optical signal shall be realized by non-displaying the optical signal used to indicate the active mode or non-displaying the instruction to take over manual control. Additionally, an acoustic warning signal shall be provided unless the system is deactivated following a transition demand which contained an acoustic signal.		
6.4.3. Transition Phase and Minimum Risk Manoeuvre During the transition phase and the Minimum Risk Manoeuvre, the system shall instruct the driver in an intuitive and unambiguous way to take over manual control of the vehicle. The instruction shall include a pictorial information showing hands and the steering control and may be accompanied by additional explanatory text or warning symbols, as shown in the example below.		
6.4.3.2. With the start of the minimum risk manoeuvre, the given signal shall change its characteristics to emphasize the urgency of an action by the driver. e.g. by red flashing of the steering control and moving hands of the pictorial information.		
6.4.4. Where examples are given above, an adequate and equally perceptible interface design for the optical signals may be used instead. This shall be demonstrated by the manufacturer and shall be supported by documented evidence. This shall be assessed by the Technical Service according to Annex 4.		
6.4.5. Prioritization of ALKS warnings The warnings of an ALKS during a transition phase, a Minimal Risk Manoeuvre or an Emergency Manoeuvre may be prioritized over other warnings in the vehicle. The prioritization of different acoustic and optical warnings during		

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the ALKS operation shall be declared by the manufacturer to the Technical Service during Type Approval.		
7. Object and Event Detection and Response (OEDR)		
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. **(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.	Industry: 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. **(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~~ the ALKS is capable to perform a LCP.** The requirements of this paragraph are without prejudice to other requirements in this Regulation, most notably paragraph 5.1.1. ROK: 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. **(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.	
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.**	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~~ is permitted to be declared by the manufacturer~~,~~ only if the declared forward detection range fulfils the corresponding minimum**	

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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: **Specified maximum speed /** **km/h Minimum forward detection range /** **m** **0…60 46** **70 50** **80 60** **90 75** **100 90** **110 110** **120 130** **130 150** **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.	**value according the following table:[…]**	
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.		
7.1.3. 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**	UK + ROK: **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**	Industry: **7.1.3. Rear~~ward~~ detection range** **The requirements of this paragraph apply to the system, if ~~additionally fitted~~ the ALKS is capable to perform a LCP.** **The manufacturer shall declare the rearward detection range measured from**

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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.**	**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.**	**the rear~~ward~~ 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~~ vehicles during the relevant test in Annex 5 is equal or greater than the declared value.**	
7.1.3~~4~~. The ALKS shall implement strategies to detect and compensate for environmental conditions that reduce the detection range, e.g. prevent enabling the system, disabling the system and transferring the control back to the driver, reducing the speed when visibility is too low. These strategies shall be described by the manufacturer and assessed according to Annex 4.			
7.1.4~~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.			
7.1.5~~6~~. 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.			
7.1.6~~7~~. A single perception malfunction without failure should not induce hazardous event. The design strategies put in place shall be described by the vehicle manufacturer and their safety shall be demonstrated to the satisfaction of the technical service in accordance with Annex 4.			