Submitted by the experts from OICA and CLEPA

Informal Document - ACSF-21-04

Consolidated version by industry, after 20th meeting of IWG on ACSF:

This document is based on:

- **ACSF-20-04r1 (Secr.)** The same colour code is kept, except when there is a risk of confusion with new industry proposal in red (such occurrences are identified along the text)
- **ACSF-20.06r1 (OICA-CLEPA)** - chapters 2.6 to 2.10
- **ACSF-20-14 (UK)** (green text in chapter 2.5.x)
- **ACSF-20-16 (Secr.)** - Principles for chapters 2.6 to 2.10
- **Reworked industry proposals**, highlighted in red.

General industry comments:

1. The proposed classification in paragraph 5.2.1 is too complex and premature at this stage. The VMAD group (or potentially another-new GRVA working group) should first work on the regulatory structure of the future new regulation for automated vehicles L3-L4-L5. Defining this classification and structure is **not the task** of the ACSF informal group, who has enough to do with the delivery of the ALKS new regulation.

   Our industry proposal is to limit the scope of the proposal to the mandate given to the ACSF IG in the TORs, i.e. to **only deliver** a new regulation for ALKS. This is a way to **secure the delivery** of the ACSF informal group.

2. The objective of this meeting should be to consolidate a clean version of the text (hopefully with only one colour), highlighting with [ ] the subjects and paragraphs without an agreement or without a finalized proposal. A short text should also be developed to explain what remains to be done / the general principles of the proposal. For example: what would be the difference between a 0-60 and a 0-130 ALKS, justifying two different classes / specification.

3. The remaining work should be given to experts as homework, and the homework be followed up at every ACSF meeting.

Proposal for Technical Requirements for an Automated Lane Keeping System

*** G E N E R A L R E Q U I R E M E N T S ***

2. Definitions

2.4. Modes [of automated driving functions]

2.4.1. A system is in "*off mode*" (or "*switched off*") when the function is prevented from generating control action.

2.4.2. A system is in "*active mode*" (or "*active*") when the function is switched on and the conditions for being active are met. In this mode, the system continuously controls the automated driving function.

2.4.3. "*Operation*" of an activated system means continuously performing all driving tasks until the driver takes over manual control of the vehicle.

2.5. Automated driving functions of Class A (Highway)

2.5.1. *"Lane-keeping and longitudinal control"* means a function which is initiated/activated by the driver and which keeps the vehicle within its lane by influencing the lateral movement of the vehicle and controls the longitudinal movement of the vehicle for extended periods without further driver command/ confirmation.

2.5.2. *"Lane-keeping, longitudinal control and lane change"* means a function which is initiated/activated by the driver and which can additionally to the lateral and longitudinal carry out lane change manoeuvres and complete these manoeuvres for extended periods without further driver command/ confirmation.

5. Specifications

5.1.**A** General conditions (all automated driving functions)

All vehicles equipped with automated driving function shall operate under the following conditions:

5.1.1.**A** Environment

All weather conditions (including max/min temperature range). To operate in daylight, low light and in darkness.

5.1.2.**A** Road conditions

Wet/dry, low/high friction, bridge, tunnel.

5.1.3.**A** Traffic laws

All, permanent, temporary, national. Signage recognition, permanent and eelectronic (including variable speed limits).

The activated system shall not confuse other road users by unpredictable behaviour (e.g. swerving inside the lane, harsh braking manoeuvres without imminent collision risk).

5.1.**B** General Conditions (All automated and autonomous driving systems)

5.1.1.**B** An activated system shall be able to cope with all [dynamic] driving tasks either by continuing the operation or by initiating a transition demand as specified in paragraph 2.4 of Annex 3

5.1.2.**B** An activated system shall operate under all environmental conditions (e.g. weather, temperature, daylight / twilight / darkness), all road conditions (e.g. wet / dry, low / high friction, bridge, tunnel).

5.1.3.**B** An activated system shall follow all applicable traffic rules in the country of operation (e.g. speed limits including variable ones and sub signs, following

distance, provide space for cutting in vehicles, overtaking, priority for emergency vehicles).

5.1.4.**B** The activated system shall have a predictable behaviour (e.g. not swerving inside the lane, no harsh braking manoeuvres without imminent collision risk, no very slow driving without an obvious reason like traffic jam).

5.1.5.**B** Any vehicle fitted with an automated or autonomous driving system shall be equipped with means to monitor the driving environment (e.g. road signs, lane markings, road edge, other road users). These means shall monitor the driving environment any time the system is active.

5.2. General system classification

Any automated driving function shall be specified by the vehicle manufacturer according to one or more of the following classes:

5.2.1.[TP1] Class A (Highway)

Automated driving functions intended to be used 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.

5.2.1.1.**A** Automated driving functions of Class A (Highway):

Automated driving functions and the according speed range in which the vehicle must safely operate at all times are defined in table 1:

Table 1:

Automated driving functions (for Highway)	Speed range / km/h	Class
Lane-keeping with longitudinal control and lane change	0 - 130	A
	0 – 60	AA
	[60 – 130]	[AB]
Lane-keeping with longitudinal control	0 - 130	AC
	0 – 60	AD
	[60 – 130]	[AE]

The maximum operating speed must be according to traffic law.

5.2.1.1.**B** Any automated or autonomous driving function shall be of one of the following types:

Automated Driving Function (Highway)	**Class**
Lane-keeping with longitudinal control and lane change	A
Lane-keeping with longitudinal control	AA

The speed until a system is allowed to be operated is

- dependent on the maximum safe operational speed as defined in paragraph 2.5.9. of the specific requirements,

- restricted by the general speed limit of the country of operation and
- limited to maximum 130 km/h.

5.2.2. Class B (Interurban) [reserved]

5.2.3. Class C (Urban) [reserved]

5.2.4. Class D (Parking) [reserved]

5.2.5. Combinations of automated driving functions

Combinations of automated driving functions are defined in table 2. The speed range of each function is specified according to its class and defined in paragraphs 5.2.1 to 5.2.4.

Table 2:

Combinations	Class
Highway only: AC + AA	XA
[Highway only: AC + AB]	[XB]
[reserved for further combinations of Classes and functions]	[res.]

5.5. Warning signals

5.5.1. Any fault which impairs the automatic control function and is not mechanical in nature shall be signalled clearly to the driver of the vehicle.

Reminder: May be better placed in specific requirements para. 2.8. (driver information).

5.5.2. Optical warning signals shall be visible, even by daylight and distinguishable from other alerts; the satisfactory condition of the signals shall be easily verifiable by the driver from the driver's seat.

5.5.3. Acoustic warning signals shall be by continuous or intermittent sound signal or by vocal information. Where vocal information is employed, the manufacturer shall ensure that the alert uses the language(s) of the market into which the vehicle is sold.

Acoustic warning signals shall be easily recognized by the driver.

5.5.4. A haptic warning signal…

Reminder: Definition for haptic warning signal needed..?

*** S P E C I F I C R E Q U I R E M E N T S *** Class AC, AD, [AE] * * *

2.1 Scope

This Annex applies to the approval of systems of Class A as defined in paragraph 5.2.1 of this regulation. It defines specific requirements for the safe operation of such systems.

2.1.1. Automated driving functions of this Class apply to vehicles of categories M_1 and N_1 (at present).

Reminder: *Paragraph 2.1.1 might be better placed in the general requirements (main part) rather than this annex (specific requirements)?*

2.2. Definitions

2.2.1. "*Transition*" is a logical and intuitive procedure to transfer the dynamic driving task from automated control by the system to human driver control.

2.2.2. "*Transition demand*" is a request given from the system to the human driver, signalling the beginning of the transition.

2.2.3. ~~"*Expected 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.~~

"*Expected event*" is a situation which requires a transition of the control back to the driver and which is known well in advance (e.g. the end of the highway).

2.2.4. ~~"*Unexpected event*" is a situation which is unknown [in advance], but assumed as very likely in happening, e.g. [road construction, approaching emergency vehicle, missing lane marking, load falling from truck (collision)].~~

"*Unexpected event*" is a situation which requires a transition of the control back to the driver and which is unknown in advance, but assumed likely to happen (e.g. road construction, inclement weather approaching emergency vehicle, missing lane markings).

2.2.5. ~~"*Imminent danger*" describes a situation or an event possibly endangering the safety of the vehicle and its passengers, e.g. an obstacle in front of the vehicle which cannot be avoided a collision by normal braking with lower than [3.7 m/s2], a system failure, an electrical failure, etc.~~

"*Imminent danger*" describes a situation or an event which would definitely / certainly lead to a collision of the vehicle with another road user or an obstacle unless an Emergency Manoeuvre is executed.

2.2.6. ~~"*Minimum risk manoeuvre*" means a procedure aimed at minimizing risks in traffic, which is automatically performed by the system, e.g. when the driver does not respond to a transition demand.~~

"Minimal risk manoeuvre" means a procedure aimed at minimizing risks in traffic, which is automatically performed by the system, e.g. when the driver does not respond to a transition demand.

2.2.7. ~~"*Emergency Manoeuvre*" is a manoeuvre performed by the system in case of a sudden unexpected event in which the vehicle is in imminent danger to collide with another object, with the purpose of avoiding or mitigating a collision.~~

"Emergency Manoeuvre" means a manoeuvre performed by the system in case of an imminent danger of a collision, with the purpose of collision avoidance or mitigation. It shall contain an automatic deceleration and/ or an automatic evasion.[OF2]

2.2.8 The driver is deemed to have *"taken over manual control"* if:

- **The driver deactivates the function, or**
- **The driver brakes to maintain the vehicle stationary, or**

- **The driver provides an input to the steering control and additionally to brake, accelerator or clutch control, when the vehicle is moving.**[KT(3]

[KT(4]

2.2.9. **_"Driver-exclusive vehicle control element"_ means a control element located on the driver's side of the vehicle that is not normally operated by a passenger.**

2.2.10. **_"Conscious head movement"_ is a sign of the driver being awake, if the transition of fixation of two points of interest cannot be performed by a fast movement of the eyes without head movement.**[KT(5]

2.2.11. **_"Conscious body movement"_ is a sign of the driver being awake, if the movement is not normally caused by external influences like potholes or the acceleration or deceleration of the vehicle.**

2.2.12 **_"Severe system failure"_ is any failure that prevents the generation or transmission of necessary control inputs to the steering and/or braking system or the generation of the necessary control outputs by the steering and/or braking system (e.g. break down of primary power supply of the vehicle, sudden loss of tyre pressure, …)**

2.3. General requirements

2.3.1. Within the general system classification, as defined in paragraph 5.2., the activated system shall cope with all dynamic driving tasks.

2.4. Activation and deactivation

2.4.1. The vehicle shall be equipped with means for the driver to activate (active mode) and deactivate (off mode) the system.

2.4.2. The default status of the system shall be in 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.

2.4.3. The system shall only be active after a deliberate action by the driver.

The activation of the system shall only be possible if:

- The driver is in the driver seat and the seatbelt is fastened,
- ~~the driver is detected to take over control on request,~~[TP6]
- all functions needed for the operation are working properly and
- 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.

2.4.4. It shall be possible to deactivate (off-mode) the system at any time by a single deliberate action of the driver using the same control as indicated in paragraph 2.4.3 above.

2.4.5.**A** The system shall be deactivated automatically when the driver has taken over manual control.

Reminder: *Unless, in case of an emergency manoeuvre.*

2.4.5.**B.** The system shall be deactivated automatically when the driver has taken over manual control following a transition demand.

2.4.5.1. A steering input of the driver shall **[**deactivate[KT(7]**/override]** the system. The steering control effort necessary to deactivate the system shall not exceed 50 N.

2.4.5.2. The system design shall include protection against unintentional **[**deactivation**/override]** by a driver input on the system controls. For example, a minimum steering input of [X] seconds.

2.4.5.x. **When the driver takes over manual control during an Emergency Maneuver the system may continue to be active until the emergency situation has passed.**[KT(8]

2.4.5.3. An acceleration demand by the driver shall only deactivate the system if the driver is holding the steering control.

2.4.6. A braking demand by the driver shall have priority over the longitudinal control function of the system. A return to the set speed of the system shall only be possible following a deliberate action by the driver using the same control as indicated in paragraph 2.4.3. above.

2.4.7.**A** An acceleration demand by the driver may have priority over the longitudinal control of the system. However, such a demand shall not cause the speed of the vehicle to exceed the operational speed as determined in accordance with this regulation. Following the release of the accelerator control, and in the absence of a deactivation, the speed of the vehicle shall return automatically to the set speed of the system.

Reminder: *Include speed adaptation to infrastructure and environmental conditions [2.5.5. etc.]*

Reminder: *Put a note at 2.5.9 minimum safety distance to the front!!!*

Reminder: *What do we expect the system to do after deactivation? Maintain automatic control of braking/ acceleration and/or steering? "Combination" with assisted steering functions (e.g. ACSF B1, ACSF C) permitted? For example: "…notwithstanding paragraph x.x.x., automatic control of braking and acceleration may be maintained"?*

2.4.7.**B** Driver action on the accelerator control may override the longitudinal control of the system. In case the driver is not holding the steering control during this override, the system shall initiate a transition demand or a hands-on warning as specified in paragraph 2.8.

~~2.4.8. Any transition demand or minimum risk manoeuvre (specified in paragraphs xxx and xxx) shall be terminated as soon as the vehicle has detected that the driver took over manual control.~~[KT(9]

Reminder: *Definition for "manual control" needed, to explain what driver took over manual control means?*[KT(10][KT(11]

Reminder: *Paragraph 2.4.8. needed? See paragraph 2.9. (Minimum Risk Manoeuvre)*

2.5. Dynamic Driving Task and Headway Control

Reminder: *Definition for "dynamic driving task" needed?*

2.5.1. The activated system shall cope with all dynamic driving tasks and with any situation according to all general conditions as defined in paragraph 5.1 or shall otherwise transition the control back to the driver offering sufficient lead time.

Any type of situation in which the vehicle will generate a transition demand to the driver shall be declared by the vehicle manufacturer and explained by documentation.

2.5.2. The activated system shall keep the vehicle inside its lane of travel and ensure that the vehicle does not cross any 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.

2.5.3. The activated system shall detect a vehicle driving beside and if necessary adjust speed and/or the lateral position of the vehicle within its lane as appropriate.

2.5.4. The activated system shall control the longitudinal speed of the vehicle ~~unless it is overridden by the driver as defined in paragraph 2.4.7. of this Annex.~~

Reminder: Unless otherwise described? Revisit after discussion about paragraph 2.4.

2.5.5. The activated system shall adapt the vehicle speed to infrastructural and environmental conditions (e.g. narrow curve radii, inclement weather).

2.5.6.**A** The activated system shall detect the distance to another road user in front (e.g. to detect a front vehicle slowing down or cutting-in), and adapt the speed to maintain the distance equal to or greater than the minimum safety distance specified in paragraph 2.5.9.

Reminder: UK will deliver text, having in mind cutting in vehicles adjacent to the vehicle in the field of view

Germany and industry will work together to combine 2.5.6. and 2.5.9.

2.5.6.HW The activated system shall detect the distance to another road user in front.

It 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 safety distance calculated using the formula:

$S = v_{ALKS} * t_{front}$

Where:

v_{ALKS} = the actual speed of the ACSF vehicle in [m/s];

t_{front} = time gap of [2] seconds between the ACSF vehicle and the leading vehicle in front. [TP12]

The above shall also be ensured for lead vehicles slowing down or cutting-in.[KT(13]

Homework Industry, take Korean proposal with appropriate deceleration rate into account

2.5.7.**A** The activated system shall be able to bring the vehicle to a complete stop behind ~~in front of~~ a stationary vehicle blocking its lane of travel. ~~-~~This shall be

ensured up to the maximum operational speed of the system, as defined in paragraph 2.5.10.

~~2.5.7.B The activated system shall be able to brake such to avoid a collision with a stationary vehicle in its lane of travel. This shall be ensured up to the maximum operational speed of the system, as defined in paragraph 2.5.10.~~

2.5.8. The activated system shall detect the risk of an imminent collision e.g. due to a decelerating lead vehicle, a cutting in vehicle or a suddenly appearing obstacle after a lane change of a leading vehicle and shall automatically perform an appropriate emergency manoeuver as specified in paragraph 2.10.

2.5.10.**A** Maximum operational speed [KT(14]

Reminder: Move entire paragraph 2.5.10. to test section?!

The maximum operational speed of the system is defined by the speed operation limits according to the general system classification as defined in paragraph 5.2.[TP15]

The maximum speed at which the system can safely operate depends on the detection range of the sensors. Therefore, the detection range of the sensors needs to be verified in the tests described in Annex 4.

Reminder: Would it make more sense to check the sensor range rather than the vehicle speed? This would mean the formula needs to be dissolved to sfront and not vmax. The idea is that the vehicle manufacturer declares which class his system is categorized in (e.g. class IA, meaning 0-130 km/h) and also declares the system's sensor range. According to the formula the required sensor range (here e.g. for 130 km/h) can be calculated and checked whether the declared sensor range is sufficient. Of course, the required sensor range needs to be tested according to tests then described in Annex 4!

~~**The ACSF of category B2 shall be able to detect vehicles driving in front up to a distance of $S_{front-B2}$ as specified below.**~~

The distance $S_{front-B2\ Range}$ shall be declared by the **vehicle** manufacturer **and** shall not be less than ~~**[46] m and shall be less or equal than that**~~ **the required sensor range** S_{front-} **depending on the system's classification as defined in paragraph 5.2. The** value **of the sensor range defined by the vehicle manufacturer shall** ~~**to**~~ be recorded during the relevant test in Annex ~~**84**~~ using a two wheeled motor vehicle of category L3 as the vehicle in front.

~~**The maximum speed v_{max-B2} of the system up to which the ACSF of category B2 is permitted to operate shall be calculated with the distance $S_{front-B2}$ using the formula below:**~~

The required sensor range $S_{front,}$ depending on the maximum operational speed in accordance with the system's classification in the general system classification, shall be calculated using the formula below:

$$V_{max-B2} = +\sqrt{2 * a_{ACSF} * (s_{front-B2} - (v_{max-B2} * t_{System}))}$$

$$=>$$

$$V_{max-B2} = -a_{ACSF} * t_{System} + \sqrt{(a_{ACSF} * t_{System})^2 + 2a_{ACSF} * s_{front-B2}}$$

Reminder: Dissolve formula to sfront.

Where:

a_{ACSF} = [3.7] m/s² = feasible deceleration under wet conditions[1];

$s_{front\text{-}B2}$ = ~~**Distance in [m] declared by the manufacturer.**~~

Required sensor range to the front in [m]

$v_{max\text{-}B2}$ = ~~**Resulting maximal operational**~~ **Maximum operation** speed of the ~~**category B2.**~~ **system**

t_{system} = System delay [of 0.5s] until deceleration level is reached

~~**Notwithstanding the result of the formula above the maximal operational speed is also restricted to [130] km/h by paragraph 5.6.3.1.x**~~

2.5.x Visualisation System [KT(16]

2.5.10.1. The field of view of the visualisation system shall be such that it can determine the driving environment and the traffic dynamics across its own traffic lane, the traffic lane immediately to its left and to its right, and at the limit of the operating range. The width of the traffic lane shall be considered to be 3.65m.

2.5.10.2. The detection range of the visualisation system is the distance at which the system can reliably recognise a target and generate an appropriate control signal. The manufacturer may declare the detection range of the visualisation system which shall be verified by the Technical Service

2.5.10.3. The operating range shall be determined from the value for the detection range established by the procedure set out in paragraph Y.3 , qualified after taking account of the deterioration of components of the visualisation system due to time and usage~~ throughout the normal life of the vehicle. Normal life is understood to be 10 years or 160,000 kilometres~~.

2.5.10.4. A time based deterioration factor of [20%] shall be applied to the detection range value.

2.5.10.5. Notwithstanding the above, the manufacturer may provide evidence to demonstrate a lower level of deterioration. This shall be subject to agreement with the Technical Service.

2.5.10.6. The detection range shall be further qualified to take account of performance limitations resulting from environmental conditions, e.g. rain.

2.5.10.7. An environmental factor of [20%] shall be applied to the detection range value.

2.5.10.8. Notwithstanding the above, the manufacturer may provide evidence to demonstrate a lower impact of environmental factors on the performance of the system, e.g. the system may transition back to the driver when rain is detected. This information shall be subject to verification by the Technical Service.

2.5.10.9. Where the manufacturer provides alternative deterioration factors for normal life and/or environmental conditions, the Technical Service shall append details of the assessment procedures to the test report. These details shall be sufficient for replication of the assessment ~~during in-service compliance/market surveillance testing.~~

2.5.10.10 **Notwithstanding the above paragraphs 2.5.10.4 to 2.5.10.8, the manufacturer may alternatively provide evidence, that the ALK system applies a monitoring concept in order to monitor the detection capabilities of the system** [TP17]**during operation and adapt its speed to the current detection range.**

2.5.10.11. **The manufacturer shall declare the detection mechanisms applied for sensor monitoring in order to detect a reduction of viewing distance due to ageing as well as environmental conditions, e.g. rain or fog, and provide evidence of their effectiveness to the Technical Service and the Type Approval Authority.**

2.5.10.12. **Unless the sensor monitoring system used for the ALK system has been assessed by the Technical Service to be suitable to confirm the current detection range of the sensing system,** [KT(18]the operating range of the visualisation system shall be determined by the application of the deterioration factor and the environmental factor to the value for the detection range established by the procedure defined in paragraph Y.3. This value shall be rounded down to the nearest whole number.

2.5.10.**B** Maximum operational speed and lead vehicle detection

The maximum operational speed at which the ALK system may be active shall be determined by the capability of the system's visualisation technology. This speed shall not exceed that at which the visualisation system can identify a foreseeable critical situation (e.g. slow, slowing or stationary traffic, lane obstruction etc.) within its field of view and, based upon that identification, cause the vehicle to be brought to a halt behind the hazard automatically.

The system shall detect vehicles driving in front in the same lane up to a distance of $S_{front\text{-}ALKS}$ as specified below.

The distance $S_{front\text{-}ALKS}$ shall be declared by the manufacturer. This value shall not be less than [46] m and shall be less or equal than that value to be recorded during the relevant test described in Annex [X] using a two wheeled motor vehicle of category L3 as the leading vehicle.

The maximum speed $v_{max\text{-}B2}$ of the system up to which the system is permitted to operate shall be calculated with the distance $S_{front\text{-}ALKS}$ using the formula below:

$$V_{max-B2} = -a_{ALKS} * t_{System} + \sqrt{(a_{ALKS} * t_{System})^2 + 2a_{ALKS} * s_{fronst\_ALKS}}$$

Where:

a_{ALKS} = [3,7] m/s² = feasible deceleration under wet conditions[2];

$s_{front\text{-}ALKS}$ = Distance in [m] declared by the manufacturer.

$v_{max\text{-}ALKS}$ = Resulting maximal operational speed of the system

[2]**Unless a higher value is declared by the manufacturer and verified during type approval to the satisfaction of and in agreement with the technical service.**

t_{system} = System delay [0.5] seconds until deceleration level is reached.

The manufacturer shall declare the speed up to which the system will operate. This declared speed shall be less or equal to the value calculated by the formula above.

Reminder: *The declared speed might require a safety margin of [X %].*

2.5.11 The fulfilment of the provisions of paragraph 2.5. and its subparagraphs shall be demonstrated to the technical service and tested according to the relevant tests in Annex [X].

2.6. Driver Availability Recognition System

The activated system shall comprise a driver availability recognition system.

The driver availability recognition system shall detect that the driver is present in the driver seat, the safety belt of the driver is fastened and that the driver is available to take over the driving task.

Reminder: *Consider upright seat position*

2.6.1. Driver not present in the driver seat

Whenever the driver is detected not to be present in the driver seat or the safety belt of the driver is detected not to be fastened, the system shall provide a distinctive acoustic warning.

Remark: *Requirements UN-R 16 might be sufficient.*

~~When the driver is not detected in the seat for a period of more than [1] second a transition demand shall be initiated according to paragraph 2.7.4.~~

~~When the safety belt is not fastened for a period of more than [3] seconds a transition demand shall be initiated according to paragraph 2.7.4.~~

Latest[KT(19] **when the driver is not detected in the seat or the seat belt is not fastened for a period of more than [5] seconds a transition demand shall be initiated according to paragraph 2.7.4.**

2.6.2. Driver not available to take over the driving task

The system shall detect if the driver is available to take over the driving task by permanently evaluating that the driver is awake. The manufacturer shall declare appropriate means to detect that the driver is awake to the technical service and the type approval authority.

The driver shall be considered awake if he shows at least one of the following signs of activity:

- **Input to any driver-exclusive vehicle controls**
- **Driver has blinked at least [2] times during the last [60] s**
- **Driver shows conscious head or body movements**

- **The driver's eyes have been closed less than [20]% of the time over a rolling interval of [60s], where an eye is considered to be closed, if it is shut by more than [80]%.**

Remark: *ACSF-20-16: Need for measureable values for the driver presence and awareness for the Technical Service for Type Approval.*

Latest when the driver does not show any **of the above** activity for a period of [180] seconds the system shall provide a distinctive warning until appropriate actions of the driver are detected or until a transition demand is initiated.

Latest when the system does not detect appropriate actions from the driver during the distinctive warning for a period of more than [15 s] a transition demand shall be initiated according to paragraph 2.7.4.

2.7. Transition Demand and System Operation during Transition

2.7.1. The activated system shall recognise situations in which it needs to transition the control back to the driver.

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

2.7.2.1. In case of an expected event, a transition demand shall be given latest [15] seconds before the event occurs.

2.7.2.2. In case of an unexpected event, a transition demand shall be given upon detection.

2.7.2.3 In case of any failure of the system or of any function needed for the operation, the system shall immediately initiate a transition demand upon detection.

Remark: *ACSF-20-06r1: Industry homework delete or consider examples where MRM should be imitated immediately. (electrical failure, including a failure of the electrical energy storage system -> severe system failure)*

2.7.3. 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).

Once in standstill the vehicle [may / shall] remain in this condition and shall activate the hazard warning lights if the driver has not taken over latest [4] s after the standstill.

Remark: *ACSF-20-16: Need for measureable values and detailed information about the operational capabilities of the system with a single system failure and the measures of the system during the transition phase for the Technical Service for Type Approval.*

2.7.4. A transition demand shall only be terminated once the system has detected the driver has taken over manual control or a minimum risk manoeuvre has started.

2.7.4.1. In case the driver is not responding to a transition demand by taking over manual control, a minimum risk manoeuvre shall be started automatically, earliest [10 s] after the start of the transition demand.

2.7.4.2. Notwithstanding paragraph 2.7.4.1, a minimum risk manoeuvre may be immediately initiated in case a severe system failure is detected.[KT(20]

2.7.5. The transition demand shall consist at least of an optical and in addition an acoustic and/or haptic warning signal. Latest [4] seconds after the initiation of the transition demand, the warning shall be escalated and shall contain a haptic warning[KT(21]**, unless the vehicle is at standstill.**

Remark: ACSF-20-16: Need for measureable values for the warning strategies for the Technical Service for Type Approval.

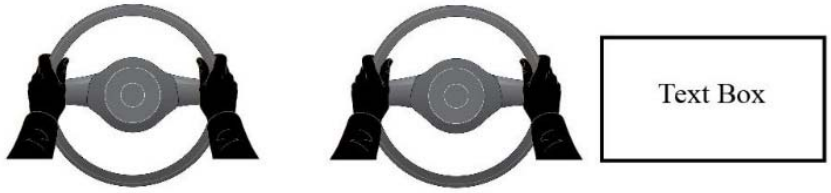
~~2.7.6. The system shall be deactivated at the end of any transition phase, unless a minimum risk manoeuvre needs to be performed.~~[KT(22]

2.8. Information to the driver [KT(23]

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

- the system status “active” by at least an optical signal, **containing an unique indication**
- any failure of the system with at least an optical signal unless the system is manually deactivated (off mode),
- transition demand as specified in **paragraph** 2.7.
- minimum risk manoeuvre by an optical signal and either an acoustic or a haptic signal and
- emergency manoeuvre by an optical signal

2.8.2. During the transition phase and the minimum risk manoeuver, the system shall instruct the driver in an intuitive and unambiguous way to take over manual control of the vehicle. The instruction **[may/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.



Example 1. Example 2.

~~2.8.2.1. To visually emphasize and escalate the optical warning symbol a yellow steering control with moving hands shall be used during the transition phase.~~

~~2.8.2.2. With the start of the minimum risk manoeuvre, the given signal shall change its characteristics to a red flashing steering control with moving hands to emphasize the urgency of an action through the driver. In the case where the pictorial information shown in the example below would be used, at least the hands or the steering control shall be turned to red.~~

With the start of the minimum risk manoeuvre, the given signal shall change its characteristics to emphasize the urgency of an action through the driver and at least the hands or the steering control shall be turned to red.

Reminder: Check if colour scheme in line with UN-R 121.

2.9. Minimum Risk Manoeuvre (as risk mitigation strategy)

2.9.1. 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 a deceleration **demand**[KT(24] not greater than [4] 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 system failure. Additionally, the hazard warning lights shall be activated not later than [4] seconds after the start of the minimum risk manoeuvre.

2.9.2. In case the driver does not take over manual control during a minimum risk manoeuvre, the system shall bring the vehicle to standstill.

2.9.3. The vehicle shall perform lane changes ~~[across regular driving lanes]~~ [KT(25]only if the situation is not critical. Such lane changes are deemed critical if an approaching vehicle in the target lane would have to decelerate at a higher level than 3m/s², 0.4 seconds after the ALKS vehicle has crossed the lane marking, to ensure the distance between the two vehicles is never less than that which the ALKS vehicle travels in 1 second.

2.9.3.1. In case the ALKS is not able to assess the criticality of a lane change or the lane change in the current driving situation has been assessed critical, the vehicle shall be brought to standstill in its lane of travel.

2.9.3.2. At speeds above [60km/h] the ALK system shall only be active in the fast lane if the system is capable of assessing the criticality of a lane change[KT(26]**.**

2.9.4. A minimum risk manoeuvre shall only be terminated once the system has detected the driver has taken over manual control of the vehicle **or the system has brought the vehicle to a standstill**.

2.9.5. The system shall be deactivated at the end of any minimum risk manoeuvre.

The hazard warning lights shall remain activated and the vehicle shall not move away after standstill without manual input.[KT(27]

2.10. Emergency Manoeuvre

2.10.1. The activated system shall detect if the vehicle is in imminent danger to collide with e.g. another road user ahead or beside the vehicle.

In case of insufficient lead time to transition the control back to the driver**,** an emergency manoeuvre shall be initiated automatically.

2.10.2. This manoeuvre shall decelerate the vehicle up to its full braking performance if necessary and/or perform an automatic evasive manoeuvre~~, whichever is the most appropriate.[KT(28)~~

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 vehicle is equipped with sensors to detect [has detected] that there is no collision relevant other road user in the relevant neighbouring lane driving to the side, the front or approaching from behind.**

Remark: *ACSF-20-06r1: Homework: define "detect" (sensors) and add test procedure as annex*

2.10.3. An emergency manoeuvre **shall be** terminated as soon as the collision risk disappeared ~~or the driver took over manual control of the vehicle~~[KT(29)]. [KT(30)]

2.10.~~3.1.4~~ In case an emergency manoeuvre has led to a complete standstill of the vehicle**,** the system shall be deactivated automatically.[KT(31)]

When coming to standstill the hazard warning lights shall be activated and the vehicle shall not move away without manual input. [KT(32)]

2.11. System information data

2.11.1. The following data shall be provided, together with the documentation package required in Annex [X] of this UN Regulation, to the Technical Service at the time of type approval.

2.11.2. A list of situations in which the vehicle may generate a transition demand to the driver.[KT(33)]

2.11.3. Information about how the system detects that the driver is available to take over the steering the steering control.

2.11.4. The means to monitor the driving environment.

2.11.5. The means to activate, override and to suppress or cancel the system (as relevant).

2.11.6. Information about how the failure warning signal status and the confirmation of the valid software version related system performance can be checked via the use of an electronic communication interface.*

* This paragraph shall be reviewed once the Task Force on Cyber Security and Over the Air issues (TF CS/OTA) reporting to the World Forum for the Harmonization of Vehicle Regulations (WP.29) Informal Working Group on Intelligent Transport Systems / Automated Driving has finalized its work on measures for software identification and, if necessary, amended accordingly.

2.118. Information on the sensor range over lifetime. The sensor range shall be specified in such way that any influence on deterioration of the sensor shall not affect the fulfilment of paragraphs 2.5.6. and 2.5.10. of this Annex.

2.11.9. For driving situations not covered by the tests of Annex [4], the safe operation of the system shall be demonstrated by the vehicle manufacturer on the base of Annex X of this Regulation.

2.11.10. The manufacturer shall provide a list of the types of severe system failures in which the ALKS will start a MRM right upon detection of the failure.

* * * TESTS * * *

Lane Keeping Functionality Test:

- approach curve with narrow (minimum) radius with the maximum operational speed
- swerving test: stable lateral position in straight lane
- driver availability test: detecting that the driver is not available to take-over the control

Following Distance Test:

- approach a slower lead vehicle which is on constant speed
- follow a leading vehicle which starts slightly decelerating

Blocked Lane Test:

- approach a stationary target in the lane of travel with the maximum operational speed

Deceleration Tests

- Lead vehicle performs an emergency braking
- Cutting in vehicle
- Deceleration during minimal risk manoeuvre is below [4m/s²]
- Maximum deceleration during emergency manoeuvre (inclusive full braking performance manually by the driver as a reference)

Maximum Operational Speed Test

- Sensor performance test
- Maximum speed test (with and without leading vehicle)

DETAILS TO BE DEFINED ONCE THE REQUIREMENTS ARE AGREED