Submitted by the Secretary

Informal Document - ACSF-20-04r1

Consolidated version after 19th meeting of IWG on ACSF,
based on documents: ACSF-19-09 and furthermore incorporating ACSF-19-03.

The following legend explains how all changes in this document are marked:
New Reminder, new text, text from ACSF-19-03 (OICA/CLEPA).

In case of two options, both options are marked with an "A" or "B", so that:
A = ACSF-19-09 and **B** = ACSF-19-03.

Text discussed in 19th meeting only to paragraph 2.5.11. of the specific requirements.

PLEASE NOTE: Paragraphs 2.6. to 2.10. do not reflect the outcome of discussions of 19th ACSF meeting ›› **need to be redrafted!** Therefore corresponding sections of ACSF-19-03 were not incorporated in these paragraphs of this document.

Industry will prepare proposal for paragraphs 2.6. to 2.10 reflecting the outcome of discussions of 19th 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 electronic (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. 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.

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)].

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.

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.

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.

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 ~~activated~~ 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,
- 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 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 by a driver input on the system controls. For example, a minimum steering input of [X] seconds.

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.

Reminder: Definition for "manual control" needed, to explain what driver took over manual control means?

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, ~~heavy rain,~~ 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.

The above shall also be ensured for lead vehicles slowing down or cutting-in.

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.

~~2.5.9. Minimum safety distance to the front~~

~~*Reminder: Contents of paragraph 2.5.9. covered in new paragraph 2.5.6.HW.*~~

2.5.10.**A** Maximum operational speed

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.

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 $S_{front\text{-}B2\ Range}$ 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** $S_{front\text{-}}$ **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:

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

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

Required sensor range to the front in [m]

$v_{max\text{-}\text{~~B2~~}}$ = ~~**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**~~

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

[1] ~~**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.**~~

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
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 %].

Homework Industry, UK and Germany revisit and take UK document into account

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].

Note of the Secretary: Text below (paragraphs 2.6. to 2.10.) was not discussed in 19th ACSF meeting!

PLEASE NOTE: Paragraphs 2.6. to 2.10. do not reflect the outcome of discussions of 19th ACSF meeting
›› need to be redrafted!

If available, please see proposal for redrafted paragraphs, reflecting the outcome of 19th ACSF meeting/ HW industry!

[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.**

2.6. Driver Availability Recognition System

[2.6.: Document after Den Haag (ACSF-18) ACSF-18-10; Modifications **red**]

The **activated** system shall comprise a driver availability recognition system~~, **that is active whenever the ACSF system is active**~~.

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** ~~**he**~~ is available to take over the driving task.

Remark: A safety belt reminder according to UN-R 16 shall be installed.

2.6.1. Driver not present in the driver seat

When**ever** 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. ~~**until the driver is detected to be back in the driver seat or until a transition demand is initiated.**~~

When the driver is not **detected in the seat for a period of more than [1] second** ~~**back in the driver seat during the distinctive acoustic warning with a max. duration of [15 s]**~~ a transition demand shall be initiated according to para**graph 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.

2.6.2. Driver not available to take over the driving task

The system shall **detect** ~~**check**~~ if the driver is available to take over the driving task by permanently evaluating **the** driver's activity. The manufacturer shall **declare** ~~**select**~~ appropriate means to detect **the** driver's activity **to the technical service and the type approval authority**.

The driver's activity shall be ~~**checked**~~ **detected** by the use of at least two independent means.

When the driver does not show any activity for a **period** ~~**time span of maximum**~~ **more than** ~~**[3] min**~~ **[270] seconds** the system shall provide a distinctive warning until appropriate actions of the driver are detected or until a transition demand is initiated.

When the system does not detect appropriate actions from the driver during the distinctive warning ~~**with a max. duration of**~~ **for a period of more than** [15 s] a transition demand shall be initiated according to para**graph 2.7.4**.

Remark: (from ACSF-18): Next meeting information about technology and text proposal by OICA.

2.7. Transition Demand and System Operation during Transition

[2.7.: Document after Den Haag (ACSF-18) ACSF-18-10; Modifications **red**]

~~2.7.1. If the system boundaries are reached or will be reached shortly or in case of a system failure which is relevant to the performance requirements of this category B2, it shall provide a transition demand.~~

2.7.1. During transition the system shall cope with all dynamic driving tasks as defined in paragraph x.x.x., until the driver resumes manual control or either the minimum risk manoeuvre or the emergency manoeuvre is terminated, whichever is appropriate.

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 ~~normal operating conditions~~ **an expected event, as defined in paragraph 2.2.4.,** ~~and in case that the system has the information that system boundaries will be reached [(e.g. exit of the highway)]~~ a transition demand shall be **initiated** ~~given~~ not later than [15] s before ~~system boundaries are reached~~ **the expected event occurs.**

Reminder: Sufficient time to perform an emergency manoeuvre shall be taken into account! Shall a lane keeping function or longitudinal control continue?

~~2.7.2.2. In the case of a sudden unexpected event with imminent danger of a collision [(e.g. an obstacle in front of the vehicle which cannot be avoided a collision by normal braking with lower than [3.7 m/s^2])] an emergency manoeuvre shall be initiated.~~

2.7.2.~~2.~~**3**. In the case of a sudden unexpected event without imminent danger ~~of a collision [(e.g. road construction, approaching an emergency vehicle, missing a lane marking)]~~ a transition demand shall be ~~provided~~ **initiated** and the system shall control the vehicle ~~so that the vehicle does not cross any lane marking~~ for at least [10] s after the **initiation of the** transition demand.

2.7.2.3. In the case of a sudden unexpected event with imminent danger an emergency manoeuvre type II as defined in paragraph 2.10.2. shall be initiated.

2.7.2.4. In the case of a system failure a transition demand shall be provided and the system shall control the vehicle so that the vehicle does not cross any lane marking for at least [10] s after the transition demand.

2.7.2.5. In the case of an electrical failure, including a failure of the electrical energy storage system, there shall be a transition demand and it shall be ensured that the vehicle does not cross any lane marking until such time as manual control is resumed.

2.7.2.6. If a ~~transition demand is given because a~~ driver availability recognition system has detected that the driver is not ~~present in his/her seat and/or is not~~ available to take over the driving task, **a transition demand shall be initiated immediately.**

~~The system shall control the vehicle so that the vehicle does not cross any lane marking until when the driver takes the manual driving or the Minimum Risk Manoeuvre (specified in para. x.x.x.) is initiated.~~

~~2.7.2.7. The transition demand shall be provided by an acoustic signal and either a visual signal or by imposing a haptic signal. These signals shall include cause of the transition in order to make the driver recognize the situation [(e.g. voice guidance etc.)].~~

2.8. Information to the driver

[2.8.: Document after Den Haag (ACSF-18) ACSF-18-10; Modifications **red**]

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

- the system status “active” by at least an optical signal,
- any failure of the system by at least an optical signal,
- transition ~~**[demand / period]**~~ by an optical signal and either an acoustic or a haptic signal,
- minimum risk manoeuvre by an optical signal and either an acoustic or a haptic signal **and**
- emergency manoeuvre by an optical signal and either an acoustic or a haptic signal.

2.8.2. 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. The optical signal shall consist of pictorial information showing hands and the steering control as describe~~**sd**~~ below:

Example 1.

Example 2.

2.8.3. The following colour scheme shall be used to visually emphazise and escalate the optical warning symbol:

- green steering control for “active”,
- yellow steering control with moving hands for “transition ~~**period**~~”,
- red flashing steering control with moving hands for “~~**MRM**~~ **minimum risk manouevre**”.

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

2.8.4 Acoustic warning signals shall be continuous or intermittent sound signal**s**, unless otherwise specified. These acoustic warning signals shall be loud and clear.

Reminder: Check wording in other regulations if more precise.

2.9. Minimum Risk Manoeuvre **(as risk mitigation strategy)**

[2.9.: OICA HW Update after ACSF-18; Modifications **red**]

The activated system shall detect if the driver resumed manual control after the transition demand has been issued as specified in **~~P~~p**aragraph ~~5.6.3.4~~**.2.7.** If the driver did not resume manual control **[X] s after the transition demand has been issued**, a ~~**minimal**~~ **minimum** risk manoeuvre shall immediately be initiated.

During the ~~**minimal**~~ **minimum** risk manoeuvre the vehicle shall be slowed down inside the lane with a deceleration not greater than [4] m/s². Higher deceleration values are permissible for very short durations, e.g. **as haptic warning** in order to stimulate the driver's attention. Additionally the hazard warning lights shall be activated to warn the ~~**following**~~ traffic behind not later than [4] seconds after the start of the minimum risk manoeuvre ~~**and latest when the vehicle comes to standstill. An acoustic signal to warn other road users may be provided.**~~

Each minimum risk manoeuvre may be terminated as soon as the vehicle detects that the driver took over manual control of the vehicle.

If the driver did not resume manual control [X] s after the transition demand has been issued, the minimum risk manoeuvre shall be terminated and an emergency manoeuvre shall immediately be initiated.

2.10. Emergency Manoeuvre

[2.10.: OICA HW Update after ACSF-18; Modifications **red**]

2.10.1. Type I: Bring the vehicle to standstill **after a minimum risk manoeuvre**

In case the driver has not reacted to a minimum risk manoeuvre by resuming control, the activated system shall aim to bring the vehicle to standstill **[**in any other lane than the fast lane (e.g. slower lane, hard shoulder, the emergency lane or beside the road)**]**.

During this **emergency manoeuvre,** the vehicle shall indicate the manoeuvre to the ~~**following**~~ traffic **behind** by flashing the hazard warning lights. ~~**Additionally an acoustic warning may be provided to warn other road users.**~~

In order ~~**to**~~ not **to** endanger other road users, the vehicle shall perform all necessary lane changes across regular driving lanes only if the situation is not critical ~~**as defined in Paragraph 5.6.4.7 for the ACSF of Category C**~~**.**

[The vehicle shall be equipped with all necessary measures to enable an assessment of the criticality of a lane change across regular driving lanes as defined in paragraph ~~**5.6.4.7.**~~ This shall be demonstrated to technical service during type approval.]

Reminder: *Technical requirements for performing a lane change need to be defined in this Regulation.*

2.10.2. Type II: Deceleration or evasive manoeuvre

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

In case of **insufficient lead time to transition to the driver, ~~the time up to a potential collision is too short for a safe transition of the control back to the driver [as defined in paragraph 5.6.3.x. 2.6. "Driving Control Transition"]~~** an emergency manoeuvre shall be initiated **~~automatically~~ immediately.**

This manoeuvre shall decelerate the vehicle up to its full braking performance if necessary and / or perform an **~~automatic~~** evasive manoeuvre **~~following the provisions for an Emergency Steering Function, ESF as described in paragraph 5.1.6.2.,~~** whatever is appropriate. **[The dynamic driving task may be resumed if the imminent danger is over or the vehicle may be brought to a standstill (as described in paragraph 2.10.1.), whatever is appropriate.]**

Reminder: *Technical requirements for an evasive manoeuvre need to be defined in this Regulation.*

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.

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.

* * * 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