

Document for ALKS for low speed application (based on the Chair proposal ACSF-23-02-r4)

Justification:

The Commission would like to thank the chair for the proposal for ALKS in ACSF-23-02-r4 as lastly revised.

As agreed before, the new ALKS requirements should be part of a new regulation. As announced at the last meeting the Commission would like to propose to following structure:

1. SCOPE AND PURPOSE
 2. DEFINITIONS
 3. APPLICATION FOR APPROVAL
 4. APPROVAL
 5. SYSTEM SAFETY IN THE AUTOMATED MODE
 - 5.1 NORMAL OPERATION
 - 5.2 EMERGENCY MANOEUVRE
 - 5.3 TRANSITION DEMAND AND SYSTEM OPERATION DURING TRANSITION PHASE
 - 5.4. MINIMUM RISK MANOEUVRE
 6. INTERACTION BETWEEN THE DRIVER AND THE SYSTEM
 7. OBJECT EVENT DETECTION AND RESPONSE WITHIN THE AUTOMATED MODE AND OPERATIONAL SPEED
 8. EDR/DSSAD
 9. CYBERSECURITY:SOFTWARE UPDATES
 10. MODIFICATION OF VEHICLE TYPE AND EXTENSION OF APPROVAL
 11. CONFORMITY OF PRODUCTION
 12. PENALTIES FOR NON-CONFORMITY OF PRODUCTION
 13. PRODUCTION DEFINITELY DISCONTINUED
 14. NAMES AND ADDRESSES OF THE TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS AND OF TYPE APPROVAL AUTHORITIES
- ANNEX 1: COMMUNICATION AND SYSTEM INFORMATION DATA
ANNEX 2: ARRANGEMENT OF APPROVAL MARKS
ANNEX 3: AUDIT/CEL
ANNEX 4 : TESTS

At this stage the numbering of the initial paragraphs in ACSF-23-02-r4 as revised in the small drafting group have been kept to make the comparison easier.

Drafting suggestion as also proposed in strikethrough and bold/underlined.
Some comments are also added using Word comments.

Proposal:

1. SCOPE AND PURPOSE

This Regulation e following set of requirements applies to the approval of vehicles of categories M₁ with regard to their “Automated Lane Keeping System (ALKS) for low speed application”,

a system 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 at the speed of [60] km/h or below.

2. DEFINITIONS

2.1 Automated Lane Keeping System (ALKS) for low speed application means a system 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 at the speed of [60] km/h or below.

Kommentiert [Author1]: Moved from previous para.

2.1.bis "Vehicle Type with Regard 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 the Automated Lane Keeping System (ALKS);

(b) The type and design of the Automated Lane Keeping System (ALKS).

Kommentiert [Author2]: A type definition is needed.

2.2. "Transition demand" is a logical and intuitive procedure to transfer the dynamic driving task from automated control by the system to human driver control. This request given from the system to the human driver indicates the transition phase.

2.2. "Transition phase" means the duration of the transition demand.

2.3. "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, **planned road construction**) etc. and which requires a transition demand.

2.4. "Unplanned event" is a situation which is unknown in advance, but assumed as very likely in happening, e.g. **unplanned** road construction, inclement weather, approaching emergency vehicle, missing lane marking, load falling from truck (collision)] and which requires a transition demand.

2.5. "Imminent collision risk" describes a situation or an event which leads to a collision of the vehicle with another road user or an obstacle unless an emergency manoeuvre is executed.

2.6. "Minimum risk manoeuvre" means a procedure aimed at minimising risks in traffic, which is automatically performed by the system after a transition demand.

2.2.7. "Emergency Manoeuvre" is a manoeuvre performed by the system in case of a sudden unplanned event in which the vehicle is at imminent risk of a collision [and in case of insufficient lead time to transition the control back to the driver,] with the purpose of avoiding or mitigating a collision.

2.2.8. "Operational speed" is the maximum vehicle speed at which the system may be active [and shall be determined by the capability of the system's sensing technology].

Alternative German proposal covering also 2.2.8

2.2.x Speeds

2.2.x.1 “Specified maximum speed” is the speed declared by the manufacturer up to which the system operates under optimum conditions (v_{max}).

2.2.x.2 “Maximum operational speed” is the speed selected by the system up to which the system operates under current environmental and sensor conditions ($v_{\text{now-max}}$). It is the maximum vehicle speed at which the system may be active and shall be determined by the capability of the sensing system.

2.2.x.3 “Set speed” is the speed selected by the driver for the active ALKS system, which defines an upper limit for v_{now} (v_{set}).

2.2.x.4 “Present speed” is the current speed selected by the system due to traffic (v_{now}).

Kommentiert [Author3]: Delete?

2.2.9. “Detection range” of the sensing system is the distance at which the system can reliably recognise a target and generate an appropriate control signal.

[2.2.10. “Operating range” shall be determined from the value of the verified detection range after taking account of the deterioration of components of the sensing system due to time and usage throughout the normal life of a vehicle.]

[2.2.11. “Normal life” of a vehicle is understood to be [10] years or [160 000] kilometres.]

[2.2.12. A “severe ALKS failure” is a failure specific to the operation of the ALKS that affects the safe operation of the system with an acceptable occurrence or when accompanied by another influence affecting the safe operation of the system, e.g. unsuitable environmental conditions, a second failure of the ALKS or of another component in the vehicle.]

The occurrence of a severe ALKS failure is deemed acceptable if it is comparable to similar failures in other well-established and well trusted safety systems (e.g. braking or steering systems).

[2.2.13. A “severe vehicle failure” is any failure in the vehicle (e.g. electrical, mechanical) that affects the dynamic driving task [and would also leave the manually driven vehicle in a state unfit to drive] (e.g. loss of power supply, failure of the braking system, sudden loss of tire pressure).]

Kommentiert [SR(4)]: Comment from the SDG: Can be deleted when sensor self test is introduced??

See paragraph 2.4.3. last bullet point for a first proposal

2.2.14. 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.

[2.2.15. The “Dynamic Driving task” means the control of all longitudinal and lateral movements of the vehicle.]

Kommentiert [Author5]: Delete?

3. Application for approval

3.1. The application for approval of a vehicle type with regard to the ALKS shall be submitted by the vehicle manufacturer or by his authorized representative.

3.2. It shall be accompanied by the documents mentioned below in triplicate:

3.2.1. A description of the vehicle type with regard to the items mentioned in paragraph 2.1.bis., together with a documentation package which gives access to the basic design of the ALKS and the means by which it is linked

to other vehicle systems or by which it directly controls output variables. The numbers and/or symbols identifying the vehicle type shall be specified.

- 3.3. A vehicle representative of the vehicle type to be approved shall be submitted to the Technical Service conducting the approval tests.

4. Approval

- 4.1. If the vehicle type submitted for approval pursuant to this Regulation meets the requirements of paragraph 5. below, approval of that vehicle shall be granted.
- 4.2. An approval number shall be assigned to each type approved; its first two digits (at present 00 corresponding to the 00 series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same number to another vehicle type.
- 4.3. Notice of approval or of refusal or withdrawal of approval pursuant to this Regulation shall be communicated to the Parties to the Agreement which apply this Regulation by means of a form conforming to the model in Annex 1 and documentation supplied by the applicant being in a format not exceeding A4 (210 x 297 mm), or folded to that format, and on an appropriate scale or electronic format.
- 4.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation, an international approval mark conforming to the model described in Annex 2, consisting of:
- 4.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval;¹
- 4.4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in paragraph 4.4.1. above.

¹ The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev. 3 - www.unece.org/trans/main/wp29/wgs/wp29gen/wp29resolutions.html

4.5. If the vehicle conforms to a vehicle type approved under one or more other Regulations, annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 4.4.1. above need not be repeated; in such a case, the Regulation and approval numbers and the additional symbols shall be placed in vertical columns to the right of the symbol prescribed in paragraph 4.4.1. above.

4.6. The approval mark shall be clearly legible and be indelible.

4.7. The approval mark shall be placed close to or on the vehicle data plate.

5. SYSTEM SAFETY IN THE AUTOMATED MODE

5.1. Dynamic Driving Task-NORMAL OPERATION

2.3.1. The activated system shall cope with all dynamic driving tasks and situations including failures, and shall maintain the safety of the vehicle occupants and all other road users until the human driver has fully resumed manual control.

5.1.x The vehicle shall not cause not cause any traffic accidents that are rationally foreseeable and preventable. If an accident can be safely avoided without causing another one, it shall be avoided.

2.3.3. The activated system shall comply with all relevant traffic regulations of the country of operation (including those applying to human driver) unless there is no other way to avoid an accident.

2.5.1. The activated system shall have a predictable and careful behaviour. It 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.

5.1.x The vehicle shall allow an appropriate interaction with other road users and shall e.g. obey to orders by authorities.

2.5.2. 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. It shall leave time and space for others (e.g. motorcycles) in lateral manoeuvres.

2.5.3. The activated system shall control the speed of the vehicle.

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

2.5.3.2. The activated system shall detect the distance to another road user or obstacles in front located within the operating range as defined in paragraph 2.5.6., and shall adapt the vehicle speed in order to avoid 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 of a lead vehicle decelerating or cutting in, there shall not be an appreciable time interval between the detection of a following distance below the required minimum distance and the start of the adjustment process.

The minimum following distance shall be calculated using the formula:

Kommentiert [Author6]: Moved into particulate sections below.

Kommentiert [Author7]: Basis is UK text. Sufficient time for transition demand already covered in TD section. TD should remain optional for level 4.

Kommentiert [Author8]: activated system can be deleted everywhere.

Kommentiert [Author9]: Still to be discussed

Kommentiert [Author10]: Is this needed? (covered by next paras)

Kommentiert [Author11]: The point is not so much about the appreciable time between detection and reaction, but more what should be the safety distance when the minimum cannot be respected because of other road users. See proposal below

$$d_{\min} = v_{\text{ALKS}} \cdot t_{\text{front}}$$

Where:

- d_{\min} = the minimum following distance
 v_{ALKS} = the present speed of the ALKS vehicle;
 t_{front} = minimum time gap between the ALKS vehicle and a leading vehicle in front as per the table below :

Present speed of the ALKS vehicle		Minimum time gap
km/h	m/s	
7,2	2,0	1,0
10	2,78	1,1
20	5,56	1,2
30	8,33	1,3
40	11,11	1,4
50	13,89	1,5
60	16,67	1,6

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.

In case the minimum time gap cannot not be respected temporally because of other road users (e.g. vehicle is cutting in, decelerating lead vehicle with a close vehicle behind the ego vehicle, fallen object, stationary vehicle, etc), the vehicle shall adjust its speed to maximize overall traffic safety and shall come back to the minimum time gap at the next opportunity.

2.5.4. ~~The activated system shall be able to bring the vehicle to a complete stop behind a stationary vehicle or obstacle blocking its lane of travel. This shall be ensured up to the maximum operational speed of the system, as defined in paragraph 2.5.7.~~

Kommentiert [Author12]: Not clear what the value added of this paragraph is vs 2.5.5. and 2.5.3.2? what about object and other obstacles?

2.5.5. ~~The activated system shall detect the risk of an imminent collision e.g. [with another road user ahead or beside the vehicle,] due to **with a hard decelerating the** lead vehicle, a suddenly cutting in vehicle or a suddenly appearing obstacle after a lane change of a leading vehicle and **or if the ego vehicle is crashed by another vehicle, the system** shall automatically perform an appropriate emergency manoeuvre as specified in paragraph 2.10.~~

~~2.10.1. An emergency manoeuvre shall be carried out only in case of [an imminent collision risk / paragraph 2.5.5].~~

Kommentiert [Author13]: Value added vs 2.5.5.?

2.3.2. ~~If determined necessary, the activated system shall issue a transition demand with sufficient lead time and ensure the safety of vehicle occupants and all other road users until the human driver has fully resumed manual control.~~

Kommentiert [Author14]: From UK text. The conditions for TD fits better here. TD is the choice of the manufacturer

When it is difficult to continue in the automated driving mode (i.e. the conditions for automated driving are not met) the system shall be able to

transfer to a minimal risk condition (with or without transition demand) through a minimal risk manoeuvre.

Kommentiert [Author15]: Conditions for minimal risk manoeuvre fits better here. MRM capability is mandatory

No transition demand may be asked to the driver in the middle of an emergency manoeuvre.

5.1.x An override or a deactivation of the automated driving mode by the driver shall trigger a transition demand (see section on interaction between the driver and the system).

5.1.x Behaviour capabilities of the vehicle required in this section shall be demonstrated to the satisfaction of the technical service in the analysis conducted under Annex 3 (Audit/CEL).

5.1.x Situations in which the vehicle will generate an emergency manoeuvre, a transition demand to the driver and minimum risk manoeuvres shall be declared by the vehicle manufacturer and included in the documentation package required in Annex 3 [Audit/CEL].

Kommentiert [Author16]: From 2.3.1.

2.7.4.1.3. The manufacturer shall declare and include in the documentation package required in Annex 3 [Audit/CEL] the types of severe vehicle failures and severe ALKS failures that will lead the ALKS to initiate a MRM immediately.]

Kommentiert [Author17]: From 2.3.1.

Kommentiert [Author18]: Not needed if 2.3.2. is amended as above

5.2. EMERGENCY MANOEUVRE

~~2.10.1. An emergency manoeuvre shall be carried out only in case of [an imminent collision risk / paragraph 2.5.5].~~

Kommentiert [Author19]: Already covered in section normal driving conditions

~~2.10.2. This manoeuvre shall decelerate the vehicle of more than [4] m/s² up to its full braking performance if necessary and/or perform an automatic evasive manoeuvre, whichever is the most appropriate~~

Kommentiert [Author20]: What is the difference with MRM?

In case of a vehicle crashing into the ego vehicle, the emergency manoeuvre shall be performed in the best possible way, according to vehicle operational status and current situation

5.2.x The system may also perform an evasive manoeuvre. During the evasive manoeuvre the ALKS vehicle shall not cross the lane marking [outer edge of the front tyre to outer edge of the lane marking][unless the system is capable of confirming and has confirmed that no critical situation would result from this manoeuvre].

The situation is deemed critical either if there is a risk of a collision with another vehicle in the evasive path, or if a vehicle approaching from the rear in the evasive lane with the allowed or advised maximum speed would be forced to decelerate more than [4] m/s² in order to maintain a safety distance of [1]s to the ALKS vehicle once it has crossed the lane marking.

After the evasive manoeuvre the vehicle shall aim at resuming a stable position either in its original or the adjacent lane of travel.

The system shall demonstrate its capabilities to the satisfaction of the technical service in the analysis conducted under Annex 3 (Audit/CEL) and in particular the capability to assess the criticality of an evasive manoeuvre crossing lane markings ~~according shall be demonstrated~~ to the relevant test in Annex X.].]

Kommentiert [Author21]: Do we need this for a system below 60 km/h? It can lead to a very complicated discussion

2.10.3. An emergency manoeuvre shall be terminated as soon as the collision risk disappeared

2.10.3.1 After an Emergency Manoeuvre the system shall ~~continue to operate in the automated driving mode~~~~//initiate a transition demand~~.

2.10.3.2 Once the Emergency Manoeuvre has led the vehicle to standstill, the hazard warning lights shall be activated ~~unless the ALKS will drive off without a manual input. In case the vehicle will not drive off without manual input and [a transition demand shall be initiated/~~ an appropriate information shall be given to the driver].

Kommentiert [Author22]: After an emergency manoeuvre, it is very likely that the driver will react. So do we need to ask for a transition demand?

2.10.4. The vehicle shall implement a logic signal indicating emergency braking as specified in UN R13H [or UN R13 as appropriate].

5.2.x The driver may override the emergency manoeuvre at any time.

Kommentiert [Author23]: To be discussed.

5.3. TRANSITION DEMAND AND SYSTEM OPERATION DURING TRANSITION PHASE

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

Kommentiert [Author24]: This Is not really a requirement.

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

Kommentiert [Author25]: Not sure this is needed as 2.7.1.1 and 2.7.1.2. are more detailed

2.7.1.1. In case of a planned event, a transition demand shall be given latest [10] seconds before the event occurs.

Kommentiert [Author26]: Moved to the AD mode section

2.7.1.2. In case of an unplanned event (e.g. **a driver manual deactivation, a driver input/override, or a failure**) 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.

Kommentiert [Author27]: Covered above

2.7.3. During the transition phase, the system shall continue to operate **in the automated driving mode (including emergency manoeuvre) for at least [10 sec] unless the driver has resumed lateral control [and is looking at the road ahead] or has brought the vehicle to standstill by braking. The system shall maximize controllability by the driver.**

Kommentiert [Author28]: moved to AD mode section

Kommentiert [Author29]: Shall we fix this value? Distinction between planned and unplanned event?

Kommentiert [Author30]: To be reviewed. No timing?

Kommentiert [Author31]: To be reviewed. To cover 2.4.5.2.1. proposed by the chair

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).~~

Kommentiert [Author32]: Simplification. Standstill shall be allowed?

Once in standstill the vehicle ~~[may / shall] remain in this condition and shall activate the hazard warning lights [if the driver has not deactivated the system] latest [5] s after the start of the transition demand.~~

2.7.4. A transition demand shall only be terminated once the system is deactivated or a minimum risk manoeuvre has started.

Kommentiert [Author33]: This wording not clear when the transition demand stops. See instead paragraph

Kommentiert [Author34]: After at least 10 seconds

Kommentiert [Author35]: To be reviewed. To cover 2.4.5.2.1. proposed by the chair

At the end of the transition phase **[of at least 10 seconds]**, unless the driver has resumed **lateral control [and is looking at the road ahead] or has brought the vehicle to standstill by braking**, a minimum risk manoeuvre shall be performed.

Kommentiert [Author36]: To be discussed . Para

~~2.7.4.1.~~ In case the driver is not responding to a transition demand by deactivating the system either manually as per paragraph 2.4.4. or automatically as per paragraph 2.4.5, a minimum risk manoeuvre shall be started automatically, earliest [10 s] after the start of the transition demand.

Kommentiert [Author37]: 10 seconds covered above

~~2.7.4.1.1.~~ Notwithstanding paragraph 2.7.4.1, a MRM may be initiated immediately in case of a severe vehicle failure. It is recognized that in case of a severe 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.

Kommentiert [Author38]: Covered by new para. 2.3.2 (no need for a mandatory transition demand)

~~2.7.4.1.2.~~ Notwithstanding xxx a MRM may be initiated immediately in case of a severe ALKS failure.

Kommentiert [Author39]: Covered by new para. 2.3.2 (no need for a mandatory transition demand)

~~2.7.4.1.3.~~ The manufacturer shall declare the types of severe vehicle failures and severe ALKS failures that will lead the ALKS to initiate a MRM immediately.

Kommentiert [Author40]: Included in para 2.3.2. in "normal operation" section 5.1.

2.7.5. **If the driver has resumed lateral control [and is looking at the road ahead] or has brought the vehicle to standstill by braking, the automated driving mode shall be deactivated at the end of any transition phase, unless a minimum risk manoeuvre needs to be performed.**

Kommentiert [Author41]: To be reviewed

Kommentiert [Author42]: To be reviewed. To cover 2.4.5.2.1. proposed by the chair

~~The specification for confirming these criteria~~ **technical solution use by the manufacturer to meet these criteria** must be declared by the manufacturer and supported by documented evidence. This shall be assessed by the technical service according to **Annex3 (CEL/AUDIT)**.

Kommentiert [Author43]: from 2.4.5.2.1. proposed by the chair

5.4. MINIMUM RISK MANOEUVRE

2.9.2. The minimum risk manoeuvre shall bring the vehicle to standstill unless the system is deactivated **or overridden by the driver** during the manoeuvre, **in which case a transition demand shall be issued.**

2.9.1. During the minimum risk manoeuvre, **the vehicle shall continue to operate in the automated driving mode (including emergency manoeuvre). It shall maximize controllability by the driver.**

Without prejudice to emergency manoeuvres, the vehicle shall be slowed down until standstill inside the lane with a deceleration demand 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.

The vehicle shall stay 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,~~

Kommentiert [Author44]: Is this really necessary?

The hazard warning lights shall be activated at the start of the minimum risk manoeuvre. ~~Additionally, the hazard warning lights shall be activated not~~

Kommentiert [Author45]: From 2.9.1. To be discussed

later than [4] seconds after the start of the minimum risk manoeuvre or once the vehicle comes to standstill whichever is earlier.

~~In case of a severe 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.] (2.4.9)~~

- 2.9.3. In case the ALKS is capable of performing lane change manoeuvres during the MRM, including to the hard shoulder, this shall only be permitted if the situation is not critical. Such lane changes are deemed critical either if there is a risk of a collision with an obstacle ~~other vehicle~~ in the target lane, or 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.

Any lane change must be indicated to other road users according to traffic regulation

The system's safety strategies must be declared and proved with evidence by ~~documentation to the Technical Service,~~ **to the satisfaction of the technical service in the analysis conducted under Annex 3 (Audit/CEL).**

- 2.9.4. ~~A minimum risk manoeuvre shall only be terminated once the system is deactivated or the system has brought the vehicle to a standstill.~~

- 2.9.5. The system shall be **automatically** deactivated at the end of any minimum risk manoeuvre (**i.e. vehicle standstill**). **However** the hazard warning lights shall remain activated ~~[unless deactivated manually]~~ and the vehicle shall **remain not move away after standstill** **until the driver has resumed manual control**, without manual input.

- 2.9.6. Reactivation of the ~~system~~ **automated driving mode** after the end of any minimum risk manoeuvre shall only be possible after each new engine start/run cycle. When a new engine start/run cycle is performed automatically, e.g. by the operation of a stop/start system, it is not regarded as a new engine start/run cycle.

6. INTERACTION BETWEEN THE DRIVER AND THE SYSTEM (HMI)

- 6.x **In case of cohabitation on a single vehicle of several driving modes with different automation/assistance levels, the necessary measures shall be taken to control driver mode confusion risks.**

This shall be demonstrated to the satisfaction of the technical service in the analysis conducted under Annex 3 (Audit/CEL)

- 2.4. Activation **by the driver**, Deactivation and Driver Input
- 2.4.1. The vehicle shall be equipped with a means for the driver to activate (active **automated driving** mode) and deactivate (off mode) the system **automated driving mode**.
- 2.4.2. 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 to start/run cycle performed automatically, e.g. by the operation of a stop/start system.
- 2.4.3. The system shall become active only upon a deliberate/intentional action by the driver and ~~fall~~ **when** all the following conditions are met:

Kommentiert [Author46]: Do we need this for a system below 60 km/h. Could lead to a very complicated discussion. Would propose to delete

Kommentiert [Author47]: Already covered by 2.9.2.

Kommentiert [Author48]: Is this needed. This is still a kind of automated mode.

- The driver is in the driver seat and the driver seatbelt is fastened according to paragraph 2.6,
- the driver is available to take over control of the dynamic driving tasks according to paragraph 2.6,
- no failure affecting the safe operation or the functionality of the ALKS is present,
- EDR/DSSAD is operational
- the environmental and infrastructural conditions allow the operation of the automated driving mode 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, and
- [after ignition on 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 2.5.6.1.

2.4.4. Manual deactivation by the driver

It shall be possible to manually deactivate (off-mode) the **automated driving mode** system by an intentional action of the driver.

Using The same means as to activate the system **may be used**, as mentioned in paragraph 2.4.1.

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.

A manual deactivation by the driver shall trigger a transition demand.

Kommentiert [Author49]: The intention is good. But what if the driver is not in control of the steering wheel? transition demand or nothing? Alternative to this paragraph proposed below

Kommentiert [Author50]: Also covered in section 'Normal operation'

2.4.5. Automatic Deactivation

The system shall not be automatically deactivated by any driver input other than those described in 2.4.5.1 and 2.4.5.2 and 2.4.5.3.

2.4.5.1. Deactivation by input to driving controls

The system shall be deactivated automatically when at least one of the following conditions is met:

- The driver maintains the vehicle in standstill for at least [1] s by any braking system
- The driver overrides the system by steering, while holding the steering control, and this override is not suppressed, as specified in paragraph 2.4.8
- The driver is holding the steering control and overrides the system by braking or accelerating, as specified in paragraph of 2.4.8

Kommentiert [Author51]: This section is far too complicated. It is much easier to describe that any override or deactivation by the driver will trigger a transition demand. This is not automatic deactivation but deactivation triggered by a driver input (delayed deactivation).

2.4.5.2. Deactivation during an ongoing transition demand initiated by the system

~~In the case where a transition demand [initiated by the system] is on-going, the system shall be deactivated automatically upon detection that the driver has taken hold of the steering control as a response to the transition demand, provided the system confirms the driver is attentive as per 2.4.5.2.1.~~

Kommentiert [Author52]: Already covered in the TD section

~~2.4.5.2.1. Driver attentiveness shall be confirmed by at least one of the following criteria:~~

~~— Driver gaze direction is being confirmed as primarily looking at the road ahead,~~

~~— Driver head movement is being confirmed as primarily directed towards the road ahead, or~~

~~— alternative criteria to be defined by the manufacturer~~

~~The specification for confirming these criteria must be declared by the manufacturer and supported by documented evidence. This shall be assessed by the technical service according to Annex X (CEL).~~

Kommentiert [Author53]: If Annex 3 (Audit is used in any case), is it really needed to go into these technical solutions? This can become outdated very quickly.

~~2.4.5.3. Deactivation during an ongoing transition demand initiated by the driver input~~

~~In the case where a transition demand initiated by the driver input is on-going, the system shall be deactivated automatically upon detection that the driver has taken hold of or inputted to the steering control.~~

~~2.4.6. Following a deactivation, the driver may only be supported in his driving task by any driver assistance function which was active at the time of the activation of the ALKS or which was activated during the operation of the ALKS, [except such driver assistance functions which allow the driver make his/her hands be off from the steering control, or his/her foot be off from both the accelerator control and the braking control].~~

~~[The manufacturer shall provide evidence that suitable information is provided to the driver to ensure mode awareness when changing from ALKS to assisted driving mode.]~~

~~[Any longitudinal control that will be active after the deactivation of the ALKS shall not exceed upon [automatic] activation the speed limit valid at the time of deactivation of the ALKS.]~~

~~2.4.7. An automatic deactivation shall be indicated to the driver by an optical and an acoustic signal. The acoustic signal is not required when the deactivation occurs following a transition demand that contains an acoustic signal.~~

Kommentiert [Author54]: Is this really needed? Outside the scope of this regulation and covered by para. 6.x at the beginning of this section.

Kommentiert [Author55]: This is outside the scope of this regulation

~~2.4.8. System Override **of the automated driving mode by the driver**~~

Kommentiert [Author56]: Moved to HMI.

~~2.4.8.1. Any driver input to the steering control shall override the lateral control function of the system. The system shall be when the input exceeds a reasonable threshold (e.g. based on force and duration) designed to prevent unintentional override.~~

~~The **efficiency of the design used to prevent unintentional override** threshold including a possible variation **of thresholds** depending on parameters like speed, gaze direction of the driver, or two ~~a-second~~ deliberate action (e.g. the use of the turn indicator accompanying the steering input) and~~

the rationale for the variation **shall be demonstrated to the satisfaction** provided to of the Technical Service during the assessment according to Annex 3 X (Audit/ CEL).

2.4.8.2. Any driver input to the braking control resulting in a higher deceleration than that induced by the system shall override the longitudinal control function of the system.

2.4.8.3. Any 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, unless the driver is holding the steering control.

~~2.4.8.4. Notwithstanding the provisions laid down in paragraphs 2.4.8.1. to 2.4.8.3., the effect of the driver input on any control may be reduced or suppressed by the system in case the system has detected the risk of a collision due to this driver input.~~

~~2.4.8.5. Any system override due to driver input to the steering control, accelerator or brake control shall immediately initiate a transition demand as specified in paragraph 2.7.~~

2.4.9. In case of a severe vehicle failure or a severe ALKS failure the ALKS may employ different strategies with regard to deactivation and override. These different strategies shall be declared by the manufacturer and their efficiency with regard to ensuring a safe transition of control back to the driver shall be assessed by the Technical Service.

2.4.10. The fulfilment of the provisions in paragraph 2.4 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 3 [Audit/CEL]**.

2.8. Information to the driver

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

- the system status as defined in paragraph 2.8.2.
- any failure of the system with at least an optical signal unless the system is deactivated (off mode),
- transition demand by at least an optical and in addition an acoustic and/or haptic warning signal. The warning shall be escalated latest [4]s after the initiation.
- minimum risk manoeuvre by an optical signal and either an acoustic or a haptic warning signal and
- emergency manoeuvre by an optical signal

The optical signals above shall be in an adequate size and contrast and contain standardized symbols. The acoustic signals above shall be loud and clear.

2.8.2. System status

2.8.2.1 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/optically] displayed to the driver.

Kommentiert [Author57]: In the present text, there is no description of what kind of support shall still be provided to the driver for other controls. With the proposal to cover this in the TD, the control given by the system is clearer. It could be however to include de definition of what is meant by override.

Kommentiert [Author58]: Not clear what we mean here. If the system goes to TD, the driver will in any case have to grab the steering wheel. Do we mean that there may be cases where override by acceleration is not possible? If so we should not allow override by acceleration. It will be solved in the TD.

Kommentiert [Author59]: Do mean emergency manoeuvre? Then it is already covered in the relevant section

Kommentiert [Author60]: Already a proposal to cover this in the section 'automated driving mode)

2.8.2.2 System status display when activated

Upon activation the system status (active mode) shall be displayed by an optical signal to the driver.

The optical signal shall be constant and shall contain an unambiguous indication including a steering control or a vehicle, with an additional “A” or “AUTO”, and shall contain a clearly perceptible indication in the driver’s field of view (e.g. prominent indication in the instrument cluster or on the steering control covering part of the outer rim perimeter facing towards the driver).

The optical signal shall be unambiguous and indicate the active system state until the system is deactivated (off mode).

2.8.2.3 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.

Additionally, an acoustic warning signal shall be provided unless the system is deactivated either manually (according to paragraph 2.4.4) or following a transition demand which contained an acoustic signal.

2.8.3. ~~Transition Phase and Minimum Risk Manoeuver~~

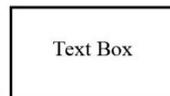
During the transition phase and the minimum risk manoeuver, the system shall instruct the driver in an intuitive and unambiguous way to take over manual control of the vehicle. The instruction shall include a pictorial information showing hands and the steering control and may be accompanied by additional explanatory text or warning symbols, as shown in the example below.



Example 1.



Example 2.



2.8.4. ~~3.2.~~ **Minimum Risk Manoeuver**

With the start of the minimum risk manoeuver, 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.

2.4.7. Override

An override by the driver shall be indicated to the driver by an optical and an acoustic signal. The acoustic signal is not required when the deactivation occurs following a transition demand which contains an acoustic signal.

Kommentiert [Author61]: From override section

2.8.5. 4. 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 the ALKS operation shall be declared by the manufacturer to the Technical Service during Type Approval **as part of the assessment under Annex 3 (CEL/Audit).**

2

2.6. Driver Availability Recognition System

The 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.

2.6.1. Driver not present in the driver seat

A transition demand shall be initiated according to paragraph 2.7. if one of the following conditions is met:

- When the driver is detected not to be in the seat for a period of more than [1] second or
- 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

2.6.2. Driver availability

The system shall detect if the driver is available to take over the driving task by continuously monitoring the driver.

2.6.2.1 Criteria for deeming Driver availability

[Driver availability shall be confirmed in a rolling interval of [60]s based on at least two availability criteria (e.g. input to driver-exclusive vehicle control, eye blinking, eye closure, conscious head and body movement) ~~or by a dedicated confirmation by the driver every [180]s~~]

As soon as the system has assessed the driver to no longer be available, 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.

2.6.3. The fulfilment of the provisions of paragraph 2.6. and its subparagraphs shall be demonstrated to the technical service **shall be demonstrated to the satisfaction** of the Technical Service during the assessment according to Annex 3 (Audit/ CEL) and be tested according to the relevant tests in Annex [X].

Additionally The manufacturer shall **in particular demonstrate** declare to the technical service **that**:

- the vehicle's capability to detect that the driver is not in the seat,
- the vehicle's capability to detect that the driver is available to take over the driving task.
- the specifications for confirming the driver's attentiveness criteria in paragraph 2.6.3 or equally safe criteria supported by documented evidence.

The declarations of the manufacturer shall be assessed by the technical service according to Annex X (CEL).

xx. Non-driving activities allowed in the AD mode and available through the vehicle system shall be available in the AD mode only and be interrupted with a specific HMI, when the vehicle request the driver to takeover or when the driver takes control on her/his own.

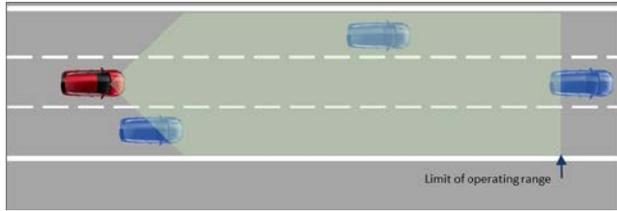
5.3 (2.5.6.) OBJECT EVENT DETECTION AND RESPONSE WITHIN THE AUTOMATED MODE AND OPERATIONAL SPEED.

The ALKS vehicle shall be equipped with a sensing system such that it can determine the driving environment (e.g. road geometry ahead, lane markings) and the traffic dynamics across its own traffic lane, the traffic lane immediately to its left and to its right up to the limit of the operating range.

The ALKS vehicle shall be equipped with a sensing **and processing** system such that it can determine the driving environment ~~(e.g. **in particular** road geometry ahead, lane markings)~~ and the traffic dynamics across its own traffic lane, the traffic lane immediately ~~to its left and to its right up~~ **(in particular objects, other vehicles, other road users such as roadside workers)** to the limit of the operating range.

Kommentiert [Author62]: Should we not include close proximity as well. What about the rear if the vehicle is able to perform evasive manoeuvre or to give way to priority vehicles/motorcycles?

Kommentiert [Author63]: This shall not be examples but shall be clearly described.



Schematics of the Sensing System of the ALKS

2.5.6.1 Object Detection range to the front

The object detection, recognition and response range shall be declared by the vehicle manufacturer and shall be at least [46] meters measured from the forward most point of the ALKS vehicle.

The Technical Service shall verify the distance at which the vehicle sensing system is able to detect, recognise and respond to a leading vehicle during the relevant tests in Annex 4. The analysis done within Annex 3 (CEL/Audit) shall demonstrate the ability of the system to detect, recognise and respond to any other relevant scenario in the automated mode.

The measured value shall be equal to or higher than the declared value.

2.5.6.2. The ALKS shall implement strategies to detect and cope with environmental and technical conditions which might reduce the detection range of the sensing system, 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 vehicle manufacturer and assessed according to the Annex X (CEL).

These strategies shall be described by the vehicle manufacturer and their safety shall be demonstrated to the satisfaction of the technical service in accordance with Annex 3 (CEL/Audit) assessed according to the Annex X (CEL).

2.5.6.3. The vehicle manufacturer shall provide evidence in accordance with Annex 3 (CEL/Audit) about how the effect of wear/ageing influencing the performance of the sensing system is managed over lifetime.

5.3.x **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 3 (CEL/Audit)**

2.5.7 Maximum Operational Speed

The maximum speed up to which the system is permitted to operate shall be calculated with the formula below:

$$V_{max-ALKS} = -a_{ALKS} * t_{system} + \sqrt{(a_{ALKS} * t_{system})^2 + 2a_{ALKS} * D_{range}}$$

Where:

Kommentiert [Author64]: Only the front? What about other object on the road? One alternative would be to require that for the ALKS to be active the vehicle shall be surrounded by other vehicles. What about close proximity detection in order to other vehicles?

Kommentiert [Author65]: A test will only give a small picture of the capability of the vehicle.

Kommentiert [Author66]: We should make clear against what this shall be assessed.?

- $V_{\max-ALKS}$ = Maximum operational speed of the system
- a_{ALKS} = [3.7] m/s² = feasible deceleration under wet conditions ²
- t_{system} = System delay of 0.5s until deceleration level is reached
- D_{range} = Detection range in m determined according to paragraph 2.5.6.1.

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.

Notwithstanding the result of the formula above the maximum operational speed is limited to [60] km/h.

2.5.8 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 4 **and shall be demonstrated to the satisfaction of the technical service in accordance with Annex 3 (CEL/Audit).**

{It is recognised that the fulfilment of the requirement in paragraph 2.5.5 may not be fully achieved in other conditions than those for the tests in Annex [X]. However, the system shall not deactivate or unreasonably switch the control strategy in these other conditions. This shall be demonstrated in accordance with Annex ~~3~~ **Audit/CEL** of this Regulation.}

8. EDR/DSSAD

Placeholder to be filled by the EDR/DSSAD group

9. CYBERSECURITY:SOFTWARE UPDATES

Placeholder to be filled by the Cybersecurity/software update group

10. MODIFICATION OF VEHICLE TYPE AND EXTENSION OF APPROVAL

- x.1. Every modification of the vehicle type as defined in Paragraph 2.x. above shall be notified to the Type Approval Authority which approved the vehicle type. The Type Approval Authority may then either:
 - x.1.1. Consider that the modifications made do not have an adverse effect on the conditions of the granting of the approval and grant an extension of approval;
 - x.1.2. Consider that the modifications made affect the conditions of the granting of the approval and require further tests or additional checks before granting an extension of approval.

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

- x.2. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in **paragraph 4.3.** above to the Contracting Parties to the Agreement which apply this Regulation.
- 8.3. The Type Approval Authority shall inform the other Contracting Parties of the extension by means of the communication form which appears in Annex 1 to this Regulation. It shall assign a serial number to each extension to be known as the extension number.

11. CONFORMITY OF PRODUCTION

- x.1. Procedures concerning conformity of production shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3) and meet the following requirements:
- x.2. A vehicle approved pursuant to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements of this regulation;
- x.3. The Type Approval Authority which has granted approval may at any time verify the conformity of control methods applicable to each production unit. The normal frequency of such inspections shall be once every two years.

12. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

- x.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 8. above are not complied with.
- x.2. If a Contracting Party withdraws an approval it had previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation by sending them a communication form conforming to the model in Annex 1 to this Regulation.

13. PRODUCTION DEFINITELY DISCONTINUED

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he shall so inform the Type Approval Authority which granted the approval, which in turn shall forthwith inform the other Contracting Parties to the Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

14. NAMES AND ADDRESSES OF THE TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS AND OF TYPE APPROVAL AUTHORITIES

The Contracting Parties to the Agreement applying this Regulation shall communicate to the United Nations Secretariat³ the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval are to be sent.

³ The UNECE secretariats provides the online platform ("343 Application") for exchange of such information with the secretariat: <https://www.unece.org/trans/main/wp29/datasharing.html>

Annex 1

COMMUNICATION AND SYSTEM INFORMATION DATA

To be developed+ Include current section 5.7

5.7. 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 control.
- 2.11.4. The means to monitor the driving environment.
- 2.11.5. The means to activate, override or deactivate the system (as relevant) including the strategy how the system is protected against unintentional deactivation, the threshold values for a steering override [and how the system assesses that the driver has directed his gaze to the driving task].
- 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.
- 2.11.7. Description of the types of severe vehicle failures and severe ALKS failures that will lead the ALKS to initiate a MRM immediately.
- ~~2.11.8. 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.~~
- 2.11.8. For driving situations not covered by the tests of Annex [X], the safe operation of the system shall be demonstrated by the vehicle manufacturer on the base of Annex X of this Regulation.
- 2.11.9. Installation

The manufacturer shall provide information regarding the installation options that will be employed for the individual components that comprise the sensing system. These options shall include, but are not limited to, the location of the component in/on the vehicle, the material(s) surrounding the component, the dimensioning and geometry of the material surrounding the component, and the surface finish of the materials surrounding the component, once installed in the vehicle. The information shall also include installation specifications

that are critical to the system's performance, e.g. tolerances on installation angle.

Changes to the individual components of the sensing system, or the installation options, shall be notified to the Type Approval Authority and be subject to further assessment.

2.11.10. The system behaviour during a MRM.

Kommentiert [Author67]: To be reviewed once the discussion on requirements has been finalized.

Annex 2

Arrangements of approval marks

To be developed

Annex 3

Audit/CEL

Placeholder for VMAD outcome.

Annex 4: TESTS

TO BE DEVELOPED ONCE THE REQUIREMENTS ARE AGREED

The width of a traffic lane shall be considered to be 3.65m.

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 $[4m/s^2]$
- 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)

TESTS