EUROPEAN
COMMISSION

ANNEXES

to the

Commission Implementing Regulation (EU) .../... of XXX

laying down rules for the application of Regulation (EU) 2019/2144 of the European Parliament and of the Council as regards uniform procedures and technical specifications for the type-approval of motor vehicles with regard to their automated driving system (ADS)

EN   **EN**

ANNEX I

Information document for EU type-approval of fully automated vehicles with regard to their automated driving system

MODEL

Information document No … relating to the EU type-approval of a type of a fully automated vehicle with regard to the automated driving system (ADS).

The following information shall be supplied in triplicate and include a list of contents. Any drawings or pictures shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

0.	GENERAL	
0.1.	Make (trade name of manufacturer):	
0.2.	Type:	
0.2.1.	Commercial name(s) (if available):	
0.2.2	For multi-stage approved vehicles, type-approval information of the base/previous stage vehicle, list the information for each stage. (This can be done with a matrix)	
	Type:	
	Variant(s):	
	Version(s):	
	Number of the type-approval certificate including extension number …	
0.3.	Means of identification of type, if marked on the vehicle / component / separate technical unit:	
0.3.1.	Location of that marking:	
0.4.	Category of vehicle:	
0.5.	Company name and address of manufacturer:	
0.5.1	For multi-stage approved vehicles, company name and address of the manufacturer of the base/previous stage(s) vehicle: …	
0.6	Location and method of attachment of statutory plates and location of vehicle identification number: …	

Commented [VS(1): NAVYA:
☐ The paragraph 0.2.2 is missing regarding multistage type approval
☐ The paragraph 0.5.1 is missing regarding multistage type approval
☐ The paragraph 0.6 is missing regarding statutory plate and VIN
☐ The number of the paragraphs does not follow the UE 2020/683
☐ For paragraph 1.1 and 1.2 it's important to clarify the expectation and what will be asked to the manufacturer
☐ For paragraph 1.1.1, what do you mean by local areas ? Why do you ask for this information ? The goal is to have a EU type approval and so to have approval in all member states.
☐ 1.3 : What do you mean by "system" ? The AD ? Is it's mandatory to have a mean to activate, override or deactivate the ADS ? Especially for Level 5 ?

Commented [G(2R1): JRC:
1.1.1 eg geofenced application on roads with specific characteristics, i.e. not everywhere in the selected MSs.
1.1 and 1.2 Guidance will be made available on the compilation of the Information Document

0.6.1.	On the chassis: …
0.6.2.	On the bodywork: …
0.8.	Name(s) and address(es) of assembly plant(s):
0.9.	Name and address of the manufacturer's representative (if any):
17.	AUTOMATED DRIVING SYSTEM (ADS)
17.1.	General ADS description
17.1.1.	Operational Design Domain
17.1.1.1	Member States and specific areas where the ADS had been assessed to comply with local traffic rules
17.1.2.	Basic Performance (e.g. Object and Event Detection and Response (OEDR, planning,etc)…)
17.2.	Description of the functions of the ADS
17.2.1.	Main automated Driving Functions (functional architecture)
17.2.1.1.	Vehicle-internal
17.2.1.2.	Vehicle-external (e.g. backend)
17.2.1.3.	Control Strategies
17.3.	Overview major components of the ADS
17.3.1.	Control Units
17.3.2.	Sensors
17.3.3.	Actuators
17.3.4.	Maps and positioning
17.3.5.	Other Hardware
17.4.	System layout and schematics
17.4.1.	Schematic system layout (e.g. block diagram)
17.4.2.	List and schematic overview of interconnections
17.5.	Specifications
17.5.1.	Specifications in Nominal scenarios
17.5.2.	Specifications in critical and failure scenarios

Commented [VS(3)]: UITP:
Member 1: To be detailed
Member 2: More specific: lighting conditions, weather conditions, involvement of control centre and other operating personnel, intelligent infrastructure such as digital traffic lights, roadside units)
Member 3: Of special interest for PTOs (besides common information by manufacturers of manual driven vehicles):
- maximum speed (automated/manual)
- intended acceleration and deceleration in different situations
- road type and conditions according to an official definition, minimum width of a road lane for full speed operations, maximum ascent/descent
- traffic environment: separated lane/mixed traffic, list of traffic scenarios successfully tested and validated
- boundary conditions (esp. when it comes to the area of operation, specific traffic scenarios and limitations of the sensors and their data fusion)
- process for crossings, etc. (automated vs. approval by human)
- main conditions and process of operation for specific manoeuvres in which humans are involved (e.g. situations with approval by control centre)
- fog: minimum range of vision necessary, rainfall: maximum power of rainfall according to an official definition and maximum fording depth allowed for operation, snow/ice: maximum power of snowfall allowed for operation, wind: maximum wind speed allowed for operation; minimum and maximum brightness and sun intensity for safe operation; minimum and maximum temperature for full speed operations

Commented [LA(4)]: CITA: Transition Demand → Driver → Scope L4 + L5?
AL: To be deleted?

Commented [G(5R4)]: JRC: transition demand (or request to control centre?) will be taken into account only if applicable

Commented [VS(6)]: NAVYA: what is expected? What do you mean by Map/positioning?

Commented [G(7R6)]: JRC: This section describes the hardware of components and subsystems devoted to ADS technology - including the navigation system, hardware used for   connectivity etc...

Commented [VS(8)]: NAVYA: What do you mean? Check the correct operating mode? Example : autonom, manual, full autonom?

Commented [VS(9R8)]: UITP: be available also to the service operator

Commented [G(10R8)]: JRC: section 5 describes in details the responses obtained when the ADS functions are called to operate. The responses must be based on a quantitative description of the behaviour of the ADS and/or the vehicle - max acceleration/decelartion in normal operation

Commented [LA(11)]: DE propose to delete. Explanation?

Commented [G(12R11)]: JRC: agree with DE: the content is part of the safety concept, moved to section 6

Commented [VS(13)]: NAVYA: What is expected of the statement? Can you provide an example or a template as the CSMS and the SUMS?

Commented [LA(14)]: CITA: What is intended by this term?

Commented [G(15R14)]: JRC: This section should describe the hardware supporting the ADS logic and its possible failures. The section should demonstrate the application of the approaches defined above to minimize the probability of hardware failures and to handle possible failures so that the consequences to the driver, passengers, and other road users are minimised

Commented [G(16)]: =ex 5.1+6.4+6.5

Commented [VS(17)]: JAMA: delete: In the case of MaaS ADS, such as relating to hand-over should be removed completely.

Commented [G(18R17)]: JRC: agree for shuttles - could that be that robotaxi can work with L4 but also L3 automated driving funcitons? Should we consider here how the requests to the remote control centre are handled?

Commented [VS(19)]: UITP: Please precise if only in-vehicle EDR?
What about offboard EDR for operational control centre or for connected infrastructure

Commented [G(20R19)]: JRC: please clarify - section 8 is only about DSSAD

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Explanatory note

This information document comprises the information relevant for the automated driving system and shall be completed in accordance with the template laid down in Annex I to Commission Implementing Regulation (EU) 2020/683.

Commented [VS(21)]: NAVYA: Redundant with paragraph 3.2 sensors no?

Commented [G(22R21)]: JRC: here the info provided is related to cybersecurity risks

Commented [LA(23)]: CITA : Approval required according to Annex II, paragraph 9.

Commented [VS(24)]: NAVYA: what is expected? A explanation of the HMI?

Commented [VS(25)]: UITP: Service operator

Commented [G(26)]: JRC: this section should describe the methods and measures (e.g., communications, tests, courses, trainings, certifications, signals) put in place in order to inform the user/operator about its responsibilities and tasks during the DDT, and any other applicable conditions.

Commented [G(27)]: JRC: agree

Commented [VS(28)]: UITP: users + service operator

Commented [G(29R28)]: JRC: agree

Commented [VS(30)]: UITP: unclear. need for more details concept is necessary, but should be defined
We can imagine that the concept provides information about the duties and rights of the operation institution and its staff while operating

Commented [VS(31)]: UITP: how the malfunctioning will be detected, through auto diagnostic or is the charge of the operator or both?

Commented [VS(32)]: combine with 10.2.3

5

Performance requirements

1.	**Definitions**

In addition to the definitions in Regulation (EU) 2018/858 and Regulation (EU) 2019/2144, for the purpose of the Annexes, the following definitions shall apply:

1.x.	"Automated Driving System" (ADS) means the hardware and software that are collectively capable of performing the entire DDT on a sustained basis.

1.x.	"Operational Design Domain (ODD)" means operating conditions under which a given driving automation system or feature thereof is specifically designed to function, including, but not limited to, environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or roadway characteristics.

1.x.	"Object and Event Detection and Response" (OEDR) means the detection by an ADS of circumstances that are relevant to the immediate driving task, as well as the implementation of the appropriate response to such circumstances

1.x.	"Minimum Risk Manoeuvre (MRM)" means a manoeuvre aimed at minimising risks in traffic by stopping the vehicle in a safe condition..

1.x.	"Dynamic Driving Task (DDT)" means all of the real time operational and tactical functions required to operate the vehicle, excluding strategic functions such as trip scheduling and selection of destinations and waypoints.

1.x.	"Nominal traffic scenarios" means operation of a vehicle equipped with an ADS within its prescribed ODD, if any, while no DDT performance-relevant system failure is occurring. Nominal traffic scenarios is the operation within specified operational limits and conditions to perform the designed activity.

1.x.	"Critical traffic scenarios" is actuated when a deviation from nominal traffic scenarios occurs (e.g. reaching ODD limits) or due to the occurrence of events (e.g. cutting in vehicles) requiring prompt action to mitigate adverse consequences on human health or property damage.

1.x.	"Failure scenarios" is actuated when a deviation from nominal traffic scenarios occurs (failure of normal operation systems) or due to the occurrence of events (e.g. crash causing failure) requiring prompt action to mitigate adverse consequences on human health or property damage.

1.x.	"Time to Collision" (TTC) means the value of time obtained by dividing the longitudinal distance (in the direction of travel of the subject vehicle) between the subject vehicle and the target by the longitudinal relative speed of the subject vehicle and the target, at any instant in time.

1.x.	"Starting lane" is the lane out of which the ADS intends to manoeuvre.

1.x.	"Target lane" is the lane into which the ADS intends to manoeuvre.

1.x.	A "Lane Change Procedure (LCP)" starts when the direction indicator lamps are

activated and ends when the direction indicator lamps are deactivated by the ADS. It comprises the following operations in the given order:

(a)   Activation of the direction indicator lamps;

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

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

(d)   Lane Change Manoeuvre;

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

(f)   Deactivation of direction indicator lamps.

1.x.   A "Lane Change Manoeuvre (LCM)" is part of the LCP and

(a)   Starts when the outside edge of the tyre tread of the vehicle's front wheel closest to the lane markings crosses the outside edge of the lane marking to which the vehicle is being manoeuvred and

(b)   Ends when the rear wheels of the vehicle have fully crossed the lane marking.

1.x   "Detectable collision" means

1.x.   "Service Operator" means operator in charge of running the transport service using a fully automated vehicles equipped with an ADS.

1.x.   "Data Recorder for ADS" means a system which aims at giving a clear picture of the status of the ADS as well as the interactions between the operator/remote operator and the ADS by storing a set of data.

1.x.   "User" means a general term referencing the human role in driving automation. means a general reference to a human being in a vehicle of which a vehicle system uses both hardware and software to exercise dynamic control on a sustained basis.

1.x.   "Operator" means a human(s) who provides assistance to an ADS-equipped vehicle in driverless operation.

1.x.   "Remote operator" or "remote assistant" means a human(s) who provides remote assistance to an ADS-equipped vehicle in driverless operation.

1.x.   "Supervision Centre" means

1.x.   "Manufacturer" means "manufacturer" as defined in Regulation (EU) 2018/858.

2   Dynamic Driving Task (DDT) under nominal traffic scenarios.

x.x.   The ADS should be capable of performing the entire Dynamic Driving Task (DDT).

x.x.x.   The capability of the ADS to perform the entire DDT should be determined in the context of the ODD of the ADS

x.x.x.   As part of the DDT, the ADS shall be able to:
-Operate at safe speeds;
-Maintain appropriate distances from other road users by controlling the longitudinal and lateral motion of the vehicle;
-Adapt its behaviour to the surrounding traffic conditions (e.g., by avoiding

disruption to the flow of traffic)
-Adapt its behaviour in line with safety risks (e.g., by giving all road users and vehicle occupants the highest priority)

x.x The ADS should detect and respond appropriately to objects and events relevant for the DDT

x.x.x Objects and events might include, but are not limited, to:
-Vehicles, motorcycles, bicycles, pedestrians, obstacles (e.g. debris, lost cargo, animals)
-Road accidents
-Road safety agents / enforcement agents.
-Emergency vehicles.
- traffic signs, road markings and speed limits
-environmental conditions (e.g. lower speed due to rain, snow).

x.x. The ADS should comply with traffic rules of the country of operation

x.x.x. The ADS should interact safely with other road users, such as via:
-Signaling maneuver intentions.

-Signaling ADS status active/inactive.

x.x.x Vehicles with ADS intended to carry standing or unrestrained vehicle occupants shall not exceed a combined horizontal acceleration of 2.4 m/s² in normal operation.

Depending on the factors influencing the risk to occupants and other road users, it might be appropriate to exceed these limits.

x.x.x. Expected ADS behaviour for a lane change (should this part be moved to Annex III?).

A Lane change The ADS may undertake a Lane change procedure if:

x.x.x.x. the vehicle with the ADS would be able to keep a safe distance from a lead vehicle or any other obstacle in the target lane and if an approaching vehicle in the target lane is not forced to unmanageably decelerate due to the lane change of the vehicle with automated driving function.;

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

With:

(a) A equal to 3.0 m/s²

(b) B equal to:

(i) 0.4 seconds after the automated vehicle has crossed the

Commented [LA(42)]: DE proposes to delete as these are part of the traffic rules.
Al: the point here is to extract key capabilities that can be tested/checked. It is not about replicating traffic rules

Commented [VS(43)]: NL: The compliance to traffic rules could potentially lead to a dedicated country admission on top to the type approval.
This point should be discussed and addressed within MVWG.
It is also important to address cross border operations with a specific requirement.

Commented [LA(44)]: CITA: How shall approval authorities and technical services be aware of traffic regulations in other countries to be able to check compliance with this requirement, or is a confirmation of the manufacturer sufficient? How can proof of compliance with the traffic regulations in the individual countries be provided?

AL: In my view some basic compliance is demonstrated with physical tests. The rest is with proof of validation (OEM simulation mostly I guess)

Commented [LA(45)]: FRAV18-06

Commented [LA(46)]: CITA: Rational for this limit?
AL: DE value for buses?

Commented [VS(47)]: NAVYA: Do you mean horizontal by lateral?
Where does the value 2,4m/s² come from?
-Combined Horizontal means longitudinal or/and lateral? Need to be precised.

Commented [VS(48)]: UITP: What about the emergency braking acceleration for the vehicle carrying standing passengers?
It shouldn't be a mandatory requirement to decelerate with full braking performance for operations in public transport, as this is not the reality with human drivers
today;
It should also be defined.

Commented [VS(49)]: ACEA addition!

Commented [LA(50)]: DE suggestion: use the requirements of ACSF Cat C or from the ALKS lane change proposal (GRVA Sept 2020).
AL: that was the idea. Any problem noticed?

Commented [VS(51)]: NAVYA: What is the requirement regarding safe distance?

Commented [VS(52)]: ACEA: delete: "other", add: "safety relevant".

Commented [LA(53)]: DE: could take 3 m/s2

lane marking, provided there was at least 1.0 s lateral movement of the automated vehicle within the starting lane in principle visible to an approaching vehicle from the rear without an obstruction before the LCM starts; or

(ii) 1.4 seconds after automated vehicle has crossed the lane marking, provided there was not at least 1.0 s lateral movement of the automated vehicle within the starting lane in principle visible to an approaching vehicle from the rear before the LCM starts.

C equal to 1.0 second

x.x.x.x.x. If no approaching vehicle is detected by ADS in the target lane, the ADS shall assume that the approaching vehicle in the target lane is at a distance equal to rearward detection distance and the approaching vehicle in the target lane is travelling with the allowed or the advised maximum speed whichever is higher.

x.x.x.x At the beginning of the LCM, the distance between the rear of the vehicle with automated driving function and the front of a vehicle following behind in the target lane at equal or lower longitudinal speed shall never be less than the speed which the following vehicle in target lane travels in 1 second.

x.x.x.x. The LCM shall not be initiated before a period of 3.0 seconds after activation of the direction indicator lamps.

x.x. Expected ADS behaviour for turning and crossings (should this part be moved to Annex III?).

The following requirements shall be taken into account with regard to interaction with other road users involved in the movement when turning and crossing (see Figure 1).

x.x.x. In the case of merging with privileged traffic during turning with and without crossing the opposite traffic direction, it must be ensured that the TTC of the approaching privileged traffic in the target road (case (a) in Figure 1) never falls below the threshold TTC_{dyn} defined as:

$$TTC_{dyn} = \frac{(v_e + v_a)}{2 \cdot \beta} + \rho$$

With:

(a) v_e equal to the speed of the ADS
(b) v_a equal to the speed of the privileged approaching traffic
(c) β equal to 3 m/s^2 being the maximum admissible deceleration for the privileged approaching traffic
(d) ρ equal to 1.5s being the reaction time of the privileged approaching traffic

x.x.x.   In the case of the turning manoeuvre crosses the opposite traffic direction, when considering oncoming traffic, it must be ensured — in addition to the distance from the approaching privileged traffic in the target road — that the TTC of the privileged crossing traffic to the fictitious collision point (point of intersection of the trajectories, case (b) in Figure 1) never falls below the threshold TTC_{int} defined as:

$$TTC_{int} = \frac{v_c}{2 \cdot \beta} + \rho$$

With:

(a) v_c equal to the speed of the privileged conflicting traffic
(b) β equal to 3 m/s^2 being the maximum admissible deceleration for the privileged crossing traffic
(c) ρ equal to 1.5s being the reaction time of the privileged crossing traffic

The same applies to cross with privileged traffic (case (c) in Figure 1): The TTC of privileged traffic to the imaginary collision point (point of intersection of the trajectories) shall never fall below the threshold TTC_{int} defined in the present paragraph
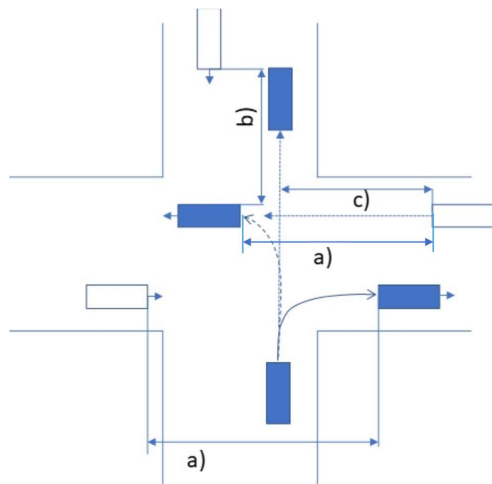

Figure1: Visualization of the distances during turning and crossings. Case (a): Distance to the approaching privileged traffic in the target lane during turning-in. Case (b): Additional distance to ~~reverse~~ opposite traffic to be observed when turning by crossing the opposite traffic direction ~~as a result of reverse traffic~~. Case (c): distance to the privileged crossing traffic to be respected when crossing.

3.   **DDT under critical traffic scenarios.**

x.x The ADS shall be able to perform the DDT for all reasonably foreseeable critical traffic scenarios in the ODD.

x.x.x The ADS shall be able to detect the risk of collision with other road users or a suddenly appearing obstacle (debris, lost load) and shall be able to automatically perform appropriate emergency manoeuvres (braking, evasive steering) to minimize risks to safety of the vehicle occupants and other road users.

x.x.x.x The ADS shall avoid a collision with a leading vehicle which decelerates up to its full braking performance provided that there was no undercut by another vehicle.

x.x.x.x Collisions with cutting in vehicles, pedestrians and cyclists which travel in the same direction, as well as pedestrians who can start jaywalking shall be avoided at least within the conditions determined by the following equation.

$$TTC_{cut-in} \geq \frac{v_{rel}}{2 \cdot \beta} + \rho + \frac{1}{2}\tau$$

With:

(a) TTC_{cut-in} being the time to-collision at the moment of the cut-in of the vehicle or cyclist by more than 30 cm in the lane of the ADS.

(b) v_{rel} being the relative speed in meters per second [m/s] between the ADS and the cutting-in vehicle (positive if the ADS is faster than the cutting-in vehicle).

(c) β being the maximum deceleration of the ADS and assumed to be equal to
    a. 2.4 m/s^2 for vehicles transporting standing or not fastened vehicle occupants;
    b. 6 m/s^2 for other vehicles.

(d) ρ being the time required by the ADS to initiate an emergency braking and assumed to be equal to 0.1 s

(e) τ being the time to reach the maximum deceleration β and assumed to be equal to
    a. 0.12 s for vehicles transporting standing or not fastened vehicle occupants;
    b. 0.3 s for other vehicles

The compliance with this equation is required only for road users cutting in, and only if the inserting road users were visible at least 0,72 seconds before cut-in:

This results in a required collision avoidance when another road user enters ego lane above the following TTC values (for example shown for speeds in 10 km/h steps). These requirements shall be met independently of environmental conditions.

v_{rel}[km/h]	TTC_{cut-in} [s] for vehicles with standing or unfastened vehicle occupants	TTC_{cut-in} [s] for other vehicles
10	0,74	0,48

Commented [LA(65)]: CITA: Definition for suddenly appearing obstacles necessary? Test-Procedere?
AL: covered by the test section

Commented [VS(66)]: ACEA addition!

Commented [LA(67)]: Shall we draft rather as example of MRM. MRM is the choice of the manufacturer at the end. Included 'be able in the second sentence. This is what we are looking at.

Commented [VS(68)]: UITP: full breaking performance is definitely not feasible for PT

Commented [VS(69)]: ACEA: to be clarified, if "undercut" should be replaced with "cut-in"

Commented [LA(70)]: CLEPA The ADS shall avoid a collision with a leading vehicle which decelerates up to its full braking performance provided that there was no undercut by another vehicle." Seems to be a duplicate of "The ADS shall be able to leave sufficient space with the vehicle in front to avoid a collision. In case this cannot be respected temporarily because of other road users (e.g. vehicle is cutting in, decelerating lead vehicle, etc.), the vehicle shall readjust the following distance at the next available opportunity."

CLEPA comments: in favour of the latter.

Commented [VS(71)]: NAVYA: Shall react or reduce speed but not possible to avoid in some case (for example if M1 decelerates at 10m/s² and the ADS is a M2 with limited deceleration)

Commented [LA(72)]: CITA: As the scope of the draft is not limited, pedestrians should also be listed in addition to vehicles and cyclists.
AL: pedestrians included now

Commented [VS(73)]: NL: Mayor lesson from Dutch experiments are that shuttles have to cope with unpredictable conditions and short time to collision, especially from jaywalking pedestrians.

Commented [MOU74]: Following discussion in ALKS industry seems open to consider the calculation of the TTC in the moment in which the cutting-in vehicle crosses the lane

Commented [LA(75)]: CITA: It seems that the value from the ALKS regulation has been taken over here, can this be assumed for all ADS and ODD?
AL: to be checked

Commented [VS(76)]: JAMA: What do these texts mean?

Commented [VS(77)]: NAVYA: Regarding the table, does it mean that the ADS shall be limited to 60 kph?
Could you explain the VTGL? Is it the speed of the other vehicle or the delta of speed between vehicle and ADS?

20	1,32	0,71
30	1,9	0,94
40	2,47	1,18
50	3,05	1,41
60	3,63	1,64

If a lane change with a lower TTC is carried out to the lane of the vehicle with ADS, it can no longer be assumed that there will be no collision avoidance. (The control strategy of the ADS may change between collision avoidance and mitigation only by prioritizing braking over an unsuccessful alternative manoeuvre.)

x.x.x.   The ADS shall avoid a collision with an unobstructed crossing pedestrian in front of the vehicle.

x.x.x.x.   In a scenario with an unobstructed pedestrian crossing with a lateral speed component of not more than 5 km/h where the anticipated impact point is displaced by not more than 0.2 m compared to the vehicle longitudinal center plane, the activated ALKS shall avoid a collision up to to 60 km/h or the maximum operational speed of the ADS if it is lower than 60 km/h.

x.x.x.   If a crash can be safely avoided without causing another one, it shall be avoided.

x.x.x.   After the evasive manoeuvre the vehicle shall aim at resuming a stable motion.

x.x.x.   If the emergency manoeuvre results in the vehicle with ADS being at standstill, the signal to activate the hazard warning lights shall be generated automatically. If the vehicle with ADS automatically drives off again, the signal to deactivate the hazard warning lights shall be generated automatically.

x.x.x.   Pursuant to a traffic accident, the ADS should stop the vehicle. ADS reactivation should not be possible until the safe operational state of the ADS has been verified by the operator or the remote operator.

4.   DDT at system boundaries

x.x.   The ADS should recognize the ODD conditions and boundaries of the ODD of its feature(s).

x.x.x.   The ADS should be able to determine when the conditions are met for activation.

x.x.x.x.   The ADS should detect and respond when one or more ODD conditions are not or no longer fulfilled.

x.x.x.x.   The ADS should be able to anticipate planned exits of the ODD.

x.x.x.x.   The ODD conditions and boundaries (measurable limits) should be established by the manufacturer.

x.x.x.x. The ODD conditions to be recognized by the ADS should include:
-Precipitation (rain, snow)
-Time of day (light intensity, including the case of the use of lighting devices)
-Visibility
-Road and lane markings

x.x.x.x. When the ADS reaches the boundaries of the ODD of the ADS, it should fall back to a Minimal Risk Condition (MRC).

5.   DDT under failure scenarios

x.x.   The ADS should detect and respond system malfunctions and abnormalities

x.x.x. The ADS should perform self-diagnosis of faults in accordance with the OEMs prescribed list

x.x.x. The ADS should detect system malfunctions/abnormalities and evaluate system's ability to fulfill the entire DDT.

x.x.   Provided a failure does not significantly compromise ADS performance, the ADS should respond safely to the presence of a fault/failure in the ADS

x.x.   The ADS should execute a safe fallback response in the event of a failure of the ADS and/or other vehicle system that prevents the ADS from performing the DDT

x.x.   In the absence of a fallback-ready user/operator, the ADS should fall back directly to a Minimal Risk Condition (MRC)

xx   The ADS should signal major [faults/failures] and resulting operational status to vehicle occupants, the operator (if relevant) or the remote operator (if relevant), as well as to other road users (e.g. activation of the hazard warning lights)

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

6.   Minimum risk manoeuvre

x.x.   During the minimum risk manoeuvre the vehicle with the ADS shall be slowed down, with an aim of achieving a deceleration demand not greater than 4.0 m/s, to a full standstill in the safest possible place taking into account surrounding traffic/road infrastructure. Higher deceleration demand values are permissible in case of a severe ADS or severe vehicle failure.

x.x.x.x. The ADS should signal its intention to place the vehicle in an MRC to ADS vehicle occupants as well as to other road users (e.g., by hazard lights)

The vehicle can only leave the minimum risk condition only after the confirmation by the operator or remote operator that the cause(s) of the risk manoeuvre is not present anymore.

8.   Human machine interface for vehicles transporting vehicle occupants and with no operator inside the vehicle

x.x.x. The ADS shall provide means for vehicle occupants to call a remote operator

Commented [VS(89)]: ACEA: Requirement could be merged with the above "The ADS shall detect…."

Commented [LA(90)]: CITA: Is the intention to require, "full use of remaining performance as required by R79, 13, 13-H"
AL: Is this paragraph really needed? (see previous one)

Commented [VS(91)]: NAVYA: Need to define a speed for the MRM
Need to define different kind of possible MRM.
What enters in MRM?

Commented [LA(92)]: DE proposal: within X seconds

through an acoustic and a video interface.

x.x.x. The ADS shall provide means to allow vehicle occupants to request a minimum risk manoeuvre to the ADS in case of emergency.

8. Functional and operational safety during the ADS lifecycle

x.x. The manufacturer shall demonstrate that an acceptable consideration of functional and operational safety for the ADS has been done during the design and development processes of the ADS and that the measures put in place by the manufacturer will guarantee that the ADS is free of unreasonable safety risks to vehicle occupants and other road users during the vehicle lifecycle (design, development, production, field operation, decommissioning).

As indicative target, hazardous errors from the vehicle equipped with the ADS should be at most at the rate of 10^-9 per hour, derived from the minimum endogenous mortality risk.

x.x.x. The manufacturer shall manage the safety and continued compliance of the vehicles with automated driving function system over lifetime (wear and tear especially for sensors, new traffic scenarios, etc.).

9. Other requirements

x.x. Cyber security and cyber security management system

The ADS should be protected from unauthorized access. The measures ensuring protection from an authorized access should be provided in alignment with engineering best practices The effectiveness of the security measures shall be demonstrated by compliance with UN Regulation No. 155.

x.x. Software update and software updates management system

The ADS shall support software updates. The effectiveness of the software update procedures and processes shall be demonstrated by compliance with UN Regulation No. 156.

10. Specific requirements regarding data recorder for ADS

x.x. Each vehicle equipped with an ADS shall be fitted with a data recorder in the vehicle that meets the requirements specified below.

x.x.x. Vehicles of categories M1 and N1 shall be fitted with an event data recorder system of a vehicle that complies comply with the technical requirements set out in the 01 Series of Amendments to UN Regulation No 160;

x.x.x. In addition for all vehicle categories each vehicle equipped with a data recorder shall at least record an entry for each of the following occurrences upon activation of the ADS:

Commented [VS(93)]: NAVYA: Requirement vs GDPR?

Commented [VS(94)]: UITP: stop to the next station? right away even if not appropriate?
At the safest possible place?

Commented [VS(95)]: ACEA suggestion to rewrite: Manage the safety and continued compliance with requirements of this regulation over lifetime of the ADS of the vehicles with automated driving function system over lifetime (wear and tear especially for sensors, new traffic scenarios, etc.).

Commented [VS(96)]: JAMA: This requirement seems to imply the intention to introduce "new framework" of approval than current classical type approval because the manufacturer is imposed to take measures the ADS to new traffic scenarios (if any) during the vehicle with ADS in service on the market. Is this required to change type approval system per se???

Commented [G(97)]: JRC: done

Commented [G(98)]: JRC: if the ADS meets "unknown" unsafe scenarios and does not perform safely enough, it will not be compliant

Commented [LA(99)]: Only requiring the "effectiveness of the security measures" as one aspect is not sufficient. The full scope of the R155 should be required (e.g., identification of threats, assessment of risks, risk management, testing) to ensure a vehicle is protected in a holistic way over its lifetime. For UN-R 156 an approval is required. Why not for UN-R 155.
AL: Refer to an approval in accordance with R155?

Commented [VS(100)]: NAVYA: Why do you add this paragraph? The compliance to the R155 and R156 will be mandatory as asked by the 2019/2144, so this paragraph will be redundant with the part III (ex: we don't ask information regarding the compliance to R13, or R79 it's directly defined in the part III)

Commented [VS(101)]: ACEA suggestion: delete,
Need for Cyber Security compliance is covered by approval framework

Commented [LA(102)]: DE: To be discussed: Cyber-Security cannot be ensured w/o SW-Updates and therefore SW-Updates should be made mandatory in this regulation.

Commented [LA(103)]: CITA: Here the processes if the SUMS are at least mentioned, in contrast to the requirement above of the Cybersecurity

Commented [VS(104)]: NAVYA: Why do you add this paragraph? The compliance to the R155 and R156 will be mandatory as asked by the 2019/2144, so this paragraph will be redundant with the part III (ex: we don't ask informa... [1]

Commented [VS(105)]: ACEA: Reference to regulation might require changes once EU implementation is agreed

Commented [VS(106)]: UITP: Data recorder only inside the vehicle?
What about data provided by external elements of the ... [2]

Commented [G(107R106)]: JRC: we should agree on that

Commented [LA(108)]: DE: To be discussed whether missing or not:
- Interactions with human supervision ... [3]

x.x.x.x.   Request sent to the remote operator

x.x.x.x.   Remote operator request/input

x.x.x.x.   Re (initialisation) of the ADS (if applicable)

x.x.x.x.   Deactivation/over-run of the ADS (if applicable)

x.x.x.x.   Start of Emergency Manoeuvre

x.x.x.x.   End of Emergency Manoeuvre

x.x.x.x.   Involved in a detected collision and crash relevant data

x.x.x.x.   Minimum Risk Manoeuvre engagement by the ADS

x.x.x.x.   ADS failure

x.x.   Data elements

x.x.x   For each event listed in paragraph 8.2., the data recorder shall at least record the following data elements in a clearly identifiable way:

x.x.x.x   The recorded occurrence flag

x.x.x.x   Reason for the occurrence, as appropriate,

x.x.x.x   Date (Resolution: yyyy/mm/dd);

x.x.x.x   Position (GPS coordinates)

x.x.x.x   Timestamp:

x.x.x.x   Resolution: hh/mm/ss timezone e.g. 12:59:59 UTC

x.x.x.x   Accuracy: +/- 1.0 s.

x.x.x.   For each Recorded occurrence, the RXSWIN, or the software versions, indicating the software that was present at the time when the event occurred, shall be clearly identifiable.

x.x.x.   A single timestamp may be allowed for multiple elements recorded simultaneously within the timing resolution of the specific data elements. If more than one element is recorded with the same timestamp, the information from the individual elements shall indicate the chronological order.

x.x.   Data availability

x.x.x.   Once the storage limits of the data recorder are achieved, existing data shall only be overwritten following a first in first out procedure with the principle of respecting the relevant requirements for data availability.

Documented evidence regarding the storage capacity shall be provided by the vehicle manufacturer.

x.x.x.   For vehicles of Category M_1 and N_1 The data shall be retrievable even after an impact of a severity level set by UN Regulations Nos. 94, 95 or 137.

x.x.x.   For vehicles of Categories M_2, M_3, N_2 and N_3, the data elements listed in paragraph 8.3.1 shall be retrievable even after an impact. To demonstrate that capability, the following applies:

Either:

(a) After a mechanical shock applicable to on-board data storage devices, if any, at a severity level as specified in the component test of Annex 9C of the 03 series of amendment to UN Regulation No. 100, and

(b) On-board data storage device(s) shall be mounted in the vehicle cab/passenger compartment or in a position of sufficient structural integrity to protect against physical damage that would prevent the retrieval of data. This shall be demonstrated to the technical service together with appropriate documentation (e.g. calculations or simulations);

Or,

(c) The manufacturer demonstrates fulfilling the requirements of paragraph 8.4.3.1. (e.g. for M_2 / N_2 vehicles derived from M_1 / N_1).

x.x.x.   If the main on-board vehicle power supply is not available, it shall still be possible to retrieve all data recorded on the data recorder.

x.x.x.   Data stored in the data recorder shall be easily readable in a standardized way via the use of an electronic communication interface, at least through the standard interface (OBD port).

x.x.x.   Instructions from the manufacturer shall be provided on how to access the data.

x.x.   Protection against manipulation

x.x.x.   It shall be ensured that there is adequate protection against manipulation (e.g. data erasure) of stored data such as anti-tampering design

x.x.   Availability of the data recorder

The data recorder shall be able to communicate with the ADS to inform that the data recorder is operational.

11.   Operation manual

x.x   The manufacturer shall draw up an operation manual based on the functional description of the vehicle with an ADS. The purpose of the operations manual is to ensure, by means of detailed instructions, the safe operation of the vehicle and to enable the operator and remote operator to respond correctly to failures and ADS request.

The manufacturer shall provide the transport service operator of the vehicle equipped with an ADS with the necessary technical and operational measures to be put in place to ensure safety during the vehicle operation:

The operation manual shall contain rules to ensure proper performance of maintenance, overall tests, further examinations and manual driving

x.x.x   The Operating Manual shall be submitted to the type approval authority together with the application for a type approval.

x.x.x   The Operating Manual shall be made available to the vehicle transport service operator.

12.   Provisions for periodic roadworthiness tests

x.x.   The manufacturer shall ensure the feasibility of periodic roadworthiness testing by taking appropriate measures (e.g.: manual driving, accessibility of brakes). In particular, it shall be able to be tested on brake test benches, it shall have light adjustment positions, etc. for all prescribed tests to be carried out.

Commented [VS(125]: JAMA: Does manufacturer mean a provider of the vehicle equipped with an ADS?

Commented [VS(126]: JAMA: What is definition of operator?

Commented [LA(127]: DE? To be discussed, whether an operator is mandatory for the operation of a vehicle with ADS.
Definition of "Operator" should be added to chapter 1.

Commented [VS(128]: NAVYA: What is the definition of operator?

Commented [VS(129]: JAMA: Providing information to the operator is the duty of the operation management company, so it has nothing to do with vehicle approval.

Commented [G(130R129]: JRC: this is at the same level as the obligation of providing information to the user/driver

Commented [VS(131]: To clarify "manufacturer"
We couldn't determine if it's a good sample for ADS PTI

Commented [LA(132]: CITA: See CITA proposal ("CITA Input PTI.docx")

Commented [VS(133]: JAMA: The sentence thereafter "e.g. manual driving, accessibility of brakes.) In particular," seems not to be appropriate requirements at type approvals for feasibility of periodic roadworthiness test for "automated driving system". (It seems to require test feasibility on some other performances.)

Commented [VS(134]: ACEA: delete this part, PTI and related tests should not be design or application restricting.

Commented [VS(135]: NAVYA: What are the requirements regarding periodical control? Replace manual driving by manual manoeuvers? Manual driving can be understood like driving in manual mode from a driver seat but autonomous vehicle doesn't have in some of them a driver seat.

Annex III

Assessment and Tests

Audit on functional and operational safety aspects of the Automated Driving System and tests are defined below to verify compliance with the performance requirements for ADS of Annex II. The overall compliance is based on the audit of the documentation provided by the manufacturer as well as tests performed by the type approval authority (or its technical service). Any requirement in Annex II may be checked by means of tests performed by the type approval authority (or its technical service).

PART 1: Audit on functional and operational safety aspects of the Automated Driving System (ADS)

1.   General

1.1.   The requirements of this part are intended to demonstrate that an acceptable thorough consideration of functional and operational safety and security for the automated driving system has been performed by the manufacturer during the design and development processes and will continue to be done throughout the vehicle type lifecycle (design, development, production, field operation, decommissioning).

1.2..   The requirements cover the documentation which must be disclosed by the manufacturer to the type-approval authority or the technical Service acting on its behalf (hereafter referred as type-approval authority), for type approval purposes and verification to be carried out by the type-approval authority.

1.3.   This documentation shall demonstrate that the ADS meets the performance requirements specified in Annex II of this Regulation and that the ADS is designed and developed to operate in such a way that it is free of unreasonable safety risks to the vehicle occupants and other road users and it ensures compliance with road traffic regulations.

1.3.   The type approval authority granting the approval shall verify through targeted spot checks and tests, in particular as specified in part 2 of this annex, that the argumentation provided by the documentation is strong enough and that the design and processes described in documentation are actually implemented by the manufacturer.

1.4.   While based on the provided documentation, evidence and the process audit/product assessment carried out to the satisfaction of the type approval authority in accordance with this Regulation, the residual level of risk of the assessed ADS is deemed to be acceptable for the entry into service of the vehicle type, the overall vehicle safety during the ADS lifetime in accordance with the requirements of this regulation remains the responsibility of the manufacturer requesting the type-approval.

2.   Definitions
For the purposes of this annex,

Commented [VS(136)]: UITP: add some details related to the auditor

Commented [LA(137)]: CITA: Text taken from L3 system. Should be redrafted for L4 and L5
AL: in which sense? Remove driver reference

Commented [VS(138)]: JAMA: Since the contents were copied and pasted from R157, the requirements for hand over to driver still exist. In the case of MaaS ADS, such requirements relating to hand-over should be removed completely.

Commented [VS(139)]: UITP: regroup all definitions for all annexes at the same place

Commented [LA(140)]: DE: To be discussed: Copied from UN-R155. Each phase should be defined in chapter 1 (compare with UN-R155)
Propose to add after 'by the manufacturer':
for the following phases:
    (a)Development phase,
    (b)Production phase,
Post-Production phase

Commented [VS(141)]: NAVYA: Need more details about the type information shared to the approval authority.

Commented [G(142R141)]: JRC: see listof contents of the iNformation Document

Commented [VS(143)]: NAVYA: System specification shall demonstrate that the ADS meets the performance requirements.
Safety analysis included in the overall safety case will prove that the ADS is free of unreasonable safety risks to the driver, passengers and other road users.

Commented [G(144R143)]: JRC: the informaiton document will provide both levels of information

Commented [LA(145)]: To be discussed: Move up to chapter 1 to avoid potential redefinitions.

Commented [G(146R145)]: JRC: agree, there are definitions relevant for more than one annex

2.1.   "The "*Automated Driving System*" or '*ADS*" means a "Higher-Level Electronic Control" system and its electronic control system(s) that provides the automated driving function. This also includes any transmission links to or from other systems that are outside the scope of this Regulation that acts on the ADS.

2.2.   "*Safety Concept*" is a description of the measures designed into the ADS , so that the vehicle operates for the relevant scenarios and events relevant to the ODD in such a way that it is free of unreasonable safety risks to the vehicle occupants and other road users under faults and non-fault conditions. The possibility of a fall-back to partial operation or even to a back-up system for vital vehicle functions shall be a part of the safety concept.

2.3.   "*Electronic control system*" means a combination of units, designed to co-operate in the production of the stated automated driving function by electronic data processing. Such systems, commonly controlled by software, are built from discrete functional components such as sensors, electronic control units and actuators and connected by transmission links. They may include mechanical, electro-pneumatic or electro-hydraulic elements.

2.4.   *Higher-Level Electronic Control*" systems are those which employ processing and/or sensing provisions to realize the dynamic driving task.

2.5.   "*Units*" are the smallest divisions of system components which will be considered in this annex, since these combinations of components will be treated as single entities for purposes of identification, analysis or replacement.

2.6.   "*Transmission links*" are the means used for inter-connecting distributed units for the purpose of conveying signals, operating data or an energy supply. This equipment is generally electrical but may, in some part, be mechanical, pneumatic or hydraulic.

2.8.   "*Boundary of functional operation*" defines the boundaries of the external physical limits within which the ADS is able to perform the dynamic driving tasks (i.e. including minimum risk manoeuvres).

2.9.   "*Operational Design Domain (ODD)*" of the automated driving system defines the specific operating conditions (e.g. environmental, geographic, time-of-day, traffic, infrastructure, speed range, weather and other conditions) within the boundaries fixed by this regulation under which the automated driving system is designed to operate without any intervention by a driver.

2.10.   "*Automated Driving Function*" means a function of "ADS" that is capable of performing the dynamic driving task of the vehicle.

2.12.   "*Functional safety*": absence of unreasonable risks under the occurrence of hazards caused by a malfunctioning. .

2.13.   "*Fault*": abnormal condition that can cause a failure.

2.14.   "*Failure*" means the termination of an intended behaviour of component or a system.

2.15.   "*Operational safety*" means the absence of unreasonable risk under the occurrence of hazards resulting from functional insufficiencies of the intended functionality

(e.g. false/missed detection), operational disturbances (e.g. environmental conditions like fog, rain, shadows, sunlight, infrastructure) or by reasonably foreseeable misuse/errors by the vehicle occupants and other road users (i.e. safety hazards — without system faults).

2.16. *"Unreasonable risk"* means the overall level of risk for the vehicle occupants and other road users which is increased compared to a competently and carefully driven manual vehicle.

2.17. *"Development phase"* means the period before a vehicle type is type approved.

2.18. *"Production phase"* refers to the duration of production of a vehicle type.

2.19. *"Post-production phase"* refers to the period in which a vehicle type is no longer produced until the end-of-life of all vehicles under the vehicle type. Vehicles incorporating a specific vehicle type will be operational during this phase but will no longer be produced. The phase ends when there are no longer any operational vehicles of a specific vehicle type.

2.20. *"Operational phase"*

2.21 *"Decommissioning"*

3. Documentation

3.1. Requirements

The manufacturer shall provide a documentation package which gives access to the basic design of "The ADS" and the means by which it is linked to other vehicle systems or by which it directly controls output variables.

The function(s) of "The ADS", including the control strategies, and the safety concept, as laid down by the manufacturer, shall be explained.

Documentation shall be brief, yet provide evidence that the design and development has had the benefit of expertise from all the ADS fields which are involved.

For periodic technical inspections, the documentation shall describe how the current operational status of "The ADS" can be checked.

Information about how the software version(s) and the failure warning signal status can be readable in a standardized way via the use of an electronic communication interface, at least be the standard interface (OBD port).

The Type-approval authority shall assess the documentation package to show that "The ADS":

(a)   Is designed and was developed to operate in such a way that it is free from unreasonable risks for a vehicle occupants and other road users within the declared ODD and boundaries;

Comments (right margin):

Commented [VS(158)]: NAVYA: Why are we comparing to an driven manual vehicle, the unreasonable risk is evaluated regarding the severity of the situation, exposure and potential controllability

Commented [G(159R158)]: JRC: and how is the acceptability threshold set?

Commented [LA(160)]: CITA: This contradicts the 10E-9 per hour under the point on page 11
AL: different internal target for the manufacturer and target for market intro/audit demonstration?

Commented [G(161)]: JRC: from UNR155 as suggested by DE

Commented [G(162)]: JRC: to discuss what is applicable to define life-cycleof the vehicle type vs lifetime of the vehicle

Commented [LA(163)]: CITA: See CITA proposal ("CITA Input PTI.docx")

(b)   Respects the performance requirements of Annex II of this Regulation;

(c)   Was developed according to the development process/method declared by the manufacturer and that this includes at least the steps listed in paragraph 3.4.4.

3.1.1.   Documentation shall be made available in three parts:

(a)   Application for type approval: The information document which is submitted to the type approval authority at the time of type approval application shall contain brief information on the items listed in Appendix 1 to Annex 1. It will become part of the approval.

(b)   The formal documentation package for the approval, containing the material listed in this paragraph 3. (with the exception of that of paragraph 3.4.4.) which shall be supplied to the Type Approval Authority for the purpose of conducting the product assessment / process audit. This documentation package shall be used by the Type Approval Authority as the basic reference for the verification process set out in paragraph 4. of this annex. The Type Approval Authority shall ensure that this documentation package remains available for a period determined of at least 10 years counted from the time when production of the vehicle type is definitely discontinued.

(c)   Additional confidential material and analysis data (intellectual property) of paragraph 3.4.4. which shall be retained by the manufacturer, but made open for inspection (e.g. on-site in the engineering facilities of the manufacturer) at the time of the product assessment / process audit. The manufacturer shall ensure that this material and analysis data remains available for a period of 10 years counted from the time when production of the vehicle type is definitely discontinued.

(c) Sensitive information included in the ID and supporting reports, the unauthorised disclosure of which could compromise intellectual property rights and vehicle security, shall be identified by the applicant. Such information shall be protected in accordance with guidance on information security in force and shall be made available for authority inspection at the applicant's premises.

3.2.   Description of the functions of "The ADS" including control strategies

A description shall be provided which gives an explanation of all the functions including control strategies to ensure robust and safe operation of "The ADS" in response to ambient and/or operating conditions (such as road surface condition, traffic intensity and other road users, adverse weather conditions, etc.), and the methods employed to perform the dynamic driving tasks within the ODD, and the boundaries under which the automated driving system is designed to operate, including a statement of the mechanism(s) by which control is exercised. The manufacturer shall describe the interactions expected between the ADS and the vehicle occupants and other road users as well as Human-Machine-Interface (HMI).

Any enabled or disabled automated driving functions for which the hardware and software are present in the vehicle at the time of production, shall be declared and

Commented [LA(164)]: In the case of prepared functions that are still locked at the time of delivery, it should be specified when and how they will be unlocked, how the driver and the operator will be informed and how the approval authorities / technical supervision will be informed.

are subject to the requirements of this annex, prior to their use in the vehicle. The manufacturer shall also document the data processing in case of continuous learning algorithms are implemented.

3.2.1. A list of all input and sensed variables shall be provided and the working range of these defined, along with a description of how each variable affects the ADS behaviour.

3.2.2. A list of all output variables which are controlled by "The ADS" shall be provided and an explanation given, in each case, of whether the control is direct or via another vehicle system. The range   over which the ADS is likely to exercise control on each such variable shall be defined.

3.2.3. Limits defining the boundaries of functional operation including ODD-limits shall be stated where appropriate to ADS performance.

3.2.4. The Human Machine interface (HMI) concept with the vehicle occupants/operator/remote operator (if any) when ODD limits are approached and then reached shall be explained including the list of types of situations in which the ADS will generate a support request to the operator/remote operator, the way the request is performed, the procedure that handles a failed request, the Minimum Risk Manoeuvre. Signals and information given to the operator/remote operator, occupants and other road users in each of the above aspects shall also be described.

3.3. System layout and schematics

3.3.1. Inventory of components.

A list shall be provided, collating all the units of "The ADS" and mentioning the other vehicle systems which are needed to achieve the automated driving function in question.

An outline schematic showing these units in combination, shall be provided with both the equipment distribution and the interconnections made clear.

This outline shall include:

(a) Perception and objects detection including mapping and positioning

(b) Characterization of Decision-making

(c) Remote supervision and remote assistance

(d) The data recorder for ADS).

3.3.2. Functions of the units

The function of each unit of "The ADS" shall be outlined and the signals linking it with other units or with other vehicle systems shall be shown. This may be provided by a labelled block diagram or other schematic, or by a description aided by such a diagram.

3.3.3.	Interconnections within "The ADS" shall be shown by a circuit diagram for the electric transmission links, by a piping diagram for pneumatic or hydraulic transmission equipment and by a simplified diagrammatic layout for mechanical linkages. The transmission links both to and from other systems shall also be shown.

3.3.4.	There shall be a clear correspondence between transmission links and the signals carried between Units. Priorities of signals on multiplexed data paths shall be stated wherever priority may be an issue affecting performance or safety.

3.3.5.	Identification of units

Each unit shall be clearly and unambiguously identifiable (e.g. by marking for hardware, and by marking or software output for software content) to provide corresponding hardware and documentation association. Where software version can be changed without requiring replacement of the marking or component, the software identification must be by software output only.

Where functions are combined within a single unit or indeed within a single computer, but shown in multiple blocks in the block diagram for clarity and ease of explanation, only a single hardware identification marking shall be used. The manufacturer shall, by the use of this identification, affirm that the equipment supplied conforms to the corresponding document.

3.3.5.1.	The identification defines the hardware and software version and, where the latter changes such as to alter the function of the unit as far as this Regulation is concerned, this identification shall also be changed.

3.3.6.	Installation of sensing system components

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 ADS'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.

3.4.	Safety concept of the manufacturer

3.4.1.	The manufacturer shall provide a statement which affirms that the "ADS" is free from unreasonable risks for the vehicle occupants and other road users.

3.4.2.	In respect of software employed in "The ADS", the outline architecture shall be explained and the design methods and tools used shall be identified (see 3.5.1). The manufacturer shall show evidence of the means by which they determined the realization of the ADS logic, during the design and development process.

Commented [VS(173)]: JAMA: We believe since it is only necessary to satisfy the vehicle performance requirements, it is not necessary to describe the sensor mounting in detail.

Commented [LA(174)]: DE: To be discussed whether "only notified" is enough and no additional approval (extention) is required.

Commented [G(175R174)]: JRC: the Auhtority will then decide on a case-by-case basis

Commented [VS(176)]: NAVYA: Why we are talking about driver IN L4?
We provide documentation that proves we achieve functional safety with ISO 26262 for our systems to be compliant to the different safety goals specified (Risk are controlled)

Commented [G(177R176)]: JRC: functional safety is not enough

3.4.3.   The manufacturer shall provide the Type Approval Authority with an explanation of the design provisions built into "The ADS" so as to ensure functional and operational safety. Possible design provisions in "The ADS" are for example:

(a)   Fall-back to operation using a partial system.

(b)   Redundancy with a separate system.

(c)   Diversity of systems performing the same function

(d)   Removal of the automated driving function(s).

3.4.3.1.   If the chosen design provision selects a partial performance mode of operation under certain fault conditions (e.g. in case of severe failures), then these conditions shall be stated (e.g. type of failure) and the resulting limits of effectiveness defined (e.g. initiation of a minimum risk manoeuvre immediately) as well as the warning strategy to the operator/remote operator, occupants and other road users (when applicable).

3.4.3.2.   If the chosen design provision selects a second (back-up) or diverse means to realise the performance affected by the fault , the principles of the change-over mechanism, the logic and level of redundancy and any built-in checking features shall be explained and the resulting limits of effectiveness defined.

3.4.3.3.   If the chosen design provision selects the removal of the automated driving function, this shall be done in compliance with the relevant provisions of this regulation. All the corresponding output control signals associated with this function shall be inhibited.

3.4.4.   The documentation shall be supported, by an analysis which shows , how the ADS will behave to mitigate or avoid hazards which can have a bearing on the safety of vehicle occupants and other road users.

The chosen analytical approach(es) shall be established and maintained by the manufacturer and shall be made open for inspection by the Type Approval Authority at the time of the type approval and afterwards.

The Type Approval Authority shall perform an assessment of the application of the analytical approach(es):

(a)   Inspection of the safety approach at the concept (vehicle) level.

This approach shall be based on a Hazard / Risk analysis appropriate to system safety.

(b)   Inspection of the safety approach at the ADS level including a top down (from possible hazard to design) and bottom up approach (from design to possible hazards). The safety approach may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) and a System-Theoretic Process Analysis (STPA) or any similar process appropriate to system functional and operational safety.

(c)   Inspection of the validation/verification plans and results including

appropriate acceptance criteria. This shall include validation testing appropriate for validation, for example, Hardware in the Loop (HIL) testing, vehicle on-road operational testing, testing with real end users, or any other testing appropriate for validation/verification. Results of validation and verification may be assessed by analysing coverage of the different tests and setting coverage minimal thresholds for various metrics.

The inspection shall confirm that at least each of the following items is covered where applicable under (a)-(c):

(i)   Issues linked to interactions with other vehicle systems (e.g. braking, steering);

(ii)   Failures of the automated driving system and system risk mitigation reactions;

(iii)   Situations within the ODD when a system may create unreasonable safety risks for the vehicle occupants and other road users due to operational disturbances (e.g. lack of or wrong comprehension of the vehicle environment, lack of understanding of the reaction from the operator/remote operator, vehicle occupants or other road users, inadequate control, challenging scenarios)

(iv)   Identification of the relevant scenarios within the boundary conditions and management method used to select scenarios and validation tool chosen.

(v)   Decision making process resulting in the performance of the dynamic driving tasks (e.g. emergency manoeuvres), for the interaction with other road users and in compliance with national traffic rules

(vi)   Reasonably foreseeable misuse by the vehicle occupants/other road users (, mistakes or misunderstanding by the operator/remote operator/occupants/other road users (e.g. unintentional override) and intentional tampering of the ADS.

(viii)   Cybersecurity threats having an impact on the safety of the vehicle (can be done through the analysis done under the UN Regulation No 155 on Cyber Security and Cyber Security Management System).

The assessment by the approval authority shall consist of spot checks to establish that argumentation supporting the safety concept is understandable and logical and implemented in the different functions of the ADSs. The assessment shall also check that validation plans are robust enough to demonstrate safety (e.g. reasonable coverage of chosen scenarios testing by the validation tool chosen) and have been properly completed.

It shall demonstrate that the vehicle is free from unreasonable risks for the vehicle occupants and other road users in the operational design domain, i.e. through:

(a)   an overall validation target (i.e., validation acceptance criteria) supported by validation results, demonstrating that the entry into service of the automated driving system "the ADS" will overall not increase the level of risk for the vehicle occupants and other road users compared to a manually driven vehicles; and

(b)   A scenario specific approach showing that the ADS will overall not increase the level of risk for the vehicle occupants and other road users compared to a manually driven vehicles for each of the safety relevant scenarios; and

The Type Approval Authority shall perform or shall require performing tests as specified in paragraph 4. of this Annex to verify the safety concept.

3.4.4.1. This documentation shall itemize the parameters being monitored and shall set out, for each failure condition of the type defined in paragraph 3.4.4. of this annex, the warning signal to be given to the operator/remote operator/vehicle occupants/other road users and/or to service/technical inspection personnel.

3.4.4.2. This documentation shall also describe the measures in place to ensure the "The ADS" is free from unreasonable risks for the vehicle occupants, and other road users when the performance of "The ADS" is affected by environmental conditions e.g. climatic, temperature, dust ingress, water ingress, ice packing, inclement weather.

3.5. Safety management system (Process Audit)

3.5.1. In respect of "The ADS", the manufacturer shall demonstrate to the type approval authority in terms of a safety management system (SMS) that effective processes, methodologies and tools are in place, up to date and being followed within the organization to manage the safety and continued compliance throughout the product lifecycle (design, development, production, operation including respect of traffic rules, and decommissioning).

3.5.2. The design and development process shall be established including safety management system, requirements management, requirements' implementation, testing, failure tracking, remedy and release

3.5.3. The manufacturer shall institute and maintain effective communication channels between manufacturer departments responsible for functional/operational safety, cybersecurity and any other relevant disciplines related to the achievement of vehicle safety.

3.5.4. The manufacturer shall have processes to monitor and analyse safety-relevant incidents/accidents caused by the engaged automated driving system and a process to manage potential safety-relevant gaps post-registration (closed loop of field monitoring) and to update the vehicles. The manufacturer shall immediately report critical incidents (e.g. collision with another road users and potential safety-relevant gaps) to the type-approval authorities

3.5.4.x The following events will have to be reported by the manufacturer every six months:

1. Interventions by the operator/remote operator,

2. In conflict scenarios, especially in accidents and near-accident scenarios,

3. In the event of unplanned lane changes or swerving,

4. In the event of malfunctions in the operating process.

3.5.5. The manufacturer shall demonstrate that periodic independent internal process audits are carried out to ensure that the processes established in accordance with paragraphs 3.5.1 to 3.5.4. are implemented consistently.

3.5.6.   Manufacturers shall put in place suitable arrangements (e.g. contractual arrangements, clear interfaces, quality management system) with suppliers to ensure that the supplier safety management system comply with the requirements of paragraphs 3.5.1. (except for vehicle related aspects like "operation" and "decommissioning"), 3.5.2, 3.5.3 and 3.5.5.

3.6.   Certificate of Compliance for Safety Management System

Commented [G(196)]: JRC: from R155

3.6.1.   Member States shall appoint an Approval Authority to carry out the assessment of the manufacturer and to issue a Certificate of Compliance for SMS.

3.6.2.   An application for a Certificate of Compliance for Safety Management System shall be submitted by the vehicle manufacturer or by their duly accredited representative.

3.6.3.   It shall be accompanied by the undermentioned documents in triplicate, and by the following particular:

(a) Documents describing the Safety Management System.

(b) A signed Declaration of Compliance of the SMS with all the requirements for safety management according to this Regulation, using the model as defined in Appendix 2 to this Annex.

3.6.4.   When this assessment has been satisfactorily completed and in receipt of a signed declaration from the manufacturer according to the model as defined in Appendix 2, a certificate named Certificate of Compliance for SMS as described in Appendix 3 (hereinafter the Certificate of Compliance for SMS) shall be granted to the manufacturer.

3.6.5.   The Certificate of Compliance for SMS shall remain valid for a maximum of three years from the date of deliverance of the certificate unless it is withdrawn.

3.6.6.   The Approval Authority may at any time verify that the requirements for the Certificate of Compliance for SMS continue to be met. The Approval Authority shall withdraw the Certificate of Compliance for SMS if major non-conformities in the compliance with the requirements laid down in this Regulation are discovered and not immediately addressed.

3.6.7.   The manufacturer shall inform the Approval Authority or its Technical Service of any change that will affect the relevance of the Certificate of Compliance for SMS. After consultation with the manufacturer, the Approval Authority or its Technical Service shall decide whether new checks are necessary.

3.6.8.   In due time, the manufacturer shall apply for a new or for the extension of the existing Certificate of Compliance for SMS. The Approval Authority shall, subject to a positive assessment, issue a new Certificate of Compliance for SMS or extend

its validity for a further period of three years. The Approval Authority shall verify that the SMS continue to comply with the requirements of this Regulation. The Approval Authority shall issue a new certificate in cases where changes have been brought to the attention of the Approval Authority or its Technical Service and the changes have been positively re-assessed.

3.6.9.   The expiry or withdrawal of the manufacturer's Certificate of Compliance for SMS shall be considered, with regard to the vehicle types to which the SMS concerned was relevant, as modification of approval, which may include the withdrawal of the approval if the conditions for granting the approval are not met anymore.

4.   Verification and tests

Considering the results of the analysis of the manufacturer's documentation package referred to in paragraph 3, the Type Approval Authority shall request the tests to be performed or witnessed by the Technical Service to check specific points arisen from the assessment of "the ADS" and the safety concept of the manufacturer.

4.1.   The functional operation of "The ADS", as laid out in the documents required in paragraph 3., shall be tested as follows:

4.1.1.   Verification of the function of "The ADS"

The Type approval authority shall verify "The ADS" under non-failure conditions by testing on a track a number of selected functions, as deemed necessary by the type approval authority, from those described by the manufacturer in paragraph 3.2. above, and by checking the overall behaviour of the ADS in real driving conditions including the compliance with traffic rules.

These tests shall include scenarios whereby the ADS is overridden by the supervision centre.

These tests can be based on scenarios listed in Part 2 and/or on additional scenarios not covered by part 2.

4.1.1.1. The test results shall correspond with the description, including the control strategies, provided by the manufacturer in paragraph 3.2. and shall comply with the performance requirements of this regulation.

4.1.2.   Verification of the safety concept of paragraph 3.4.

The reaction of "The ADS" shall be checked under the influence of a faults in any individual unit by applying corresponding output signals to electrical units or mechanical elements in order to simulate the effects of internal failure within the unit. The Type approval Authority shall conduct or witness this check for at least one individual unit, but shall not check the reaction of "The ADS" to multiple simultaneous failures of individual units.

The Type Approval Authority shall verify that these tests include aspects that may have an impact on vehicle controllability and user information (HMI aspects e.g. interaction with the operator/remote operator).

4.1.2.1. The Type Approval Authorities shall also check a number of scenarios that are critical for the Object and Event Detection and Response (OEDR) and characterization of the decision-making and HMI functions of the ADS (e.g. object difficult to detect, when the ADS reaches the ODD boundaries, traffic disturbance scenarios) as defined in this regulation.

4.1.2.2. The verification results shall correspond with the documented summary of the hazard analysis, to a level of overall effect such that the safety concept and execution are confirmed as being adequate and in compliance with the requirements of this regulation.

4.2. Simulation tool and mathematical models for verification of the safety concept may be used in accordance with Annex VIII to Regulation (EU) 858/2018 8, in particular for scenarios that are difficult on a test track or in real driving conditions. ADS Manufacturers shall provide demonstration of the scope of the simulation tool, its validity for the scenario concerned as well as the validation performed for the simulation tool chain (correlation of the outcome with physical tests). Simulation shall not be a substitute for physical tests in Part 2 of this Annex.

4.3 Taking into account the results of the analysis of the manufacturer's documentation package referred to in paragraph 3, the Type Approval Authority shall audit specific points from the management system of the manufacturer..

5. Reporting provision

The reporting of the assessment of the vehicle functional operation and safety concept of the ADS ("the ADS") as well as the audit of the safety management system of the manufacturer shall be performed in such a manner that allows traceability, e.g. versions of documents inspected are coded and listed in the records of the Technical Service.

An example of a possible layout for the assessment form of the assessment of the vehicle functional operation and safety concept of the ADS from the Technical Service to the Type Approval Authority is given in Appendix 1 to this Annex III. The listed items in this Appendix are outlined as minimum set of items which need to be covered. [**Layout for the safety management system??**]

The Authority shall issue a safety assessment report based on the Final Information Document received by the applicant (paragraph 3.1.1.c) and on the outcomes of the verification and test campaigns performed according to paragraph 4. and Annex 5 of this Regulation.
The safety assessment report shall provide evaluations and statements as to whether the vehicle meets the safety targets set by the present Regulation or not. The safety assessment report will be the basis for the granting of a type approval. An example of a possible layout for the assessment form from the Technical Service to the Type Approval Authority is given in Appendix 4

6 Communication to other Type Approval Authorities

The authority shall provide information to other Type Approval Authorities containing:

(a) The Information Document supplied by the applicant, with the exception of

section [7] "Verification and Validation by the Manufacturer" (which includes the analyses and simulations as per paragraph 3.4.4.).

(b) The safety assessment report issued by the Authority together with the assessment forms provided by the Techncial Service (paragraph 5.).on the test results during the verification process.

(c) Certificate of Compliance for SMS.

Confidential information (identified by the applicant as per paragraph 3.1.1.), analyses and simulations (as per paragraph 3.4.4.) shall be made available at least at the applicant's premises for inspection of other Type Approval Authorities.

7. Competence of the auditors/assessors

The assessments under this Annex III shall only be conducted by auditors/assessors with the technical and administrative knowledge necessary for such purposes. They shall in particular be competent as auditor/assessor for ISO 26262-2018 (Functional Safety - Road Vehicles), and ISO/PAS 21448 (Safety of the Intended Functionality of road vehicles); and shall be able to make the necessary link with cybersecurity aspects in accordance with UN Regulation No 155 and ISO/SAE 21434). This competence should be demonstrated by appropriate qualifications or other equivalent training records.

Commented [LA(219)]: CITA: The assessment shall be conducted by personnel competent with appropriate knowledge and skills in Functional Safety, Safety of the Intended Functionality of road vehicles and whole vehicle type approvals, having the ability to make the necessary links with cyber security and the UN-R 157. Particular competence regarding the ISO 2626-2018 and ISO 21448 shall be demonstrated.

In general, the requirements for the qualification shall always be decided on the commissions and authority side. Relaying on external qualifications according to the ISO standards which are not created by the commission shall be avoided as this would weaken the commissions position.

Commented [G(220R219)]: JRC: auditors should be competent in SMS; assessors should be safety experts

Appendix 1

Model assessment form for Automated Driving system

Test report No:

1.   Identification.

1.1.   Vehicle make:

1.2   Vehicle Type

1.3   Means of identification of vehicle type if marked on the vehicle:

1.4.   Location of that marking:

1.5.   Manufacturer's name and address:

1.6.   If applicable, name and address of manufacturer's representative:

1.7.   Manufacturer's formal documentation package:

              Documentation reference No:

              Date of original issue:

              Date of latest update:

2.   Test vehicle(s)/system(s) description

2.1.   General description:

2.2.   Description of all the control functions of "The ADS", and methods of operation:

2.3.   Description of the components and diagrams of the interconnections within "The ADS":

2.4.   General description:

2.5.   Description of all the control functions of "The ADS", and methods of operation:

2.6.   Description of the components and diagrams of the interconnections within "The ADS

3.   Manufacturer's safety concept

3.1.   Description of signal flow and operating data and their priorities:

3.2.   Manufacturer's declaration:

The manufacturer(s) .... affirm(s) that the strategy chosen to achieve "The ADS" is free of unreasonable safety risks to the vehicle occupants and other road users.

3.3.   Software outline architecture and the design methods and tools used:

3.4.   Explanation of design provisions built into "The ADS" under fault conditions:

3.5.   Documented analyses of the behaviour of "The ADS" under individual hazard or fault conditions:

3.6.   Description of the measures in place for environmental conditions:

3.7.   Provisions for the periodic roadworthiness test of "The ADS":

3.8.   Results of "The ADS" verification test, referred to in point 4.1.1. of Annex III Part I to Regulation (EU) …/…(¹) *[PO: this Regulation]*.

3.9.   Results of safety concept verification test, referred to in point 4.1.2. of Annex III Part I to Regulation (EU) …/…(¹) *[PO: this Regulation]*.

3.10   Results of the audit of the Safety management system (appended to this test report)

3.11.   Date of assessment/audit

3.12.   This test has been carried out and the results reported in accordance with Commission Implementing Regulation (EU) …/…(¹) *[PO: this Regulation]*, as last amended by Regulation (EU) … /….

         Technical Service carrying out the test
         Signed: ....   Date: ....

3.13.   Comments:

_____
(¹) [PO: insert full title and OJ reference.]

Appendix 2

Model of Manufacturer's Declaration of Compliance for SMS

Manufacturer's declaration of compliance with the requirements for the Safety Management System

Manufacturer Name:

Manufacturer Address:

…………………..(*Manufacturer Name*) attests that the necessary processes to comply with the requirements for the Safety Management System laid down in paragraph 3.5 of UN Regulation 157 are installed and will be maintained.

Done at: …………………… (*place*)

Date:

Name of the signatory:

Function of the signatory:

(*Stamp and signature of the manufacturer's representative*)

Appendix 3

Model of Certificate of Compliance for SMS

**Certificate of Compliance for
Safety Management System**

With UN Regulation No. [*This Regulation*]

Certificate Number [*Reference number*]

[……. *Approval Authority*]

Certifies that

Manufacturer: ....

Address of the manufacturer:

complies with the provisions of paragraph 3.5 of Regulation No. 157

Checks have been performed on:

by (name and address of the Approval Authority or Technical Service):

Number of report:.........................

The certificate is valid until […..*Date*]

Done at [……*Place*]

On […….*Date*]

[………….*Signature*]

Attachments: description of the Safety Management System by the manufacturer.

Appendix 4

Review Report for ADS to be prepared by the Type Approval Authority

PART 2: Tests

1.   General provisions

Test cases created to assess vehicle safety shall be based on the requirements set out in Annex II. The requirements are defined in such a way that the pass/fail criteria can be derived not only for a specific set of test parameters, but also for all safety-relevant combinations of parameters that may occur in the operating conditions covered by the type approval and the specified operating range (e.g., Speed range, longitudinal and transverse acceleration range, radii of curvature, brightness, number of lanes).

These tests shall confirm the functionality of the ADS and the safety concept of the manufacturer as described in Part I of this Annex as well as the minimum performance requirements described in Annex II.

2   Test site

The test site shall comprise characteristics (example: friction value) that correspond to the specified ODD of the ADS. The intended operational area may act as a test site itself provided that tests can be carried out safely and without any risk to other road users and in accordance with the applicable law of the Member State granting the type-approval.

3.   Environmental conditions

Tests shall be carried out under different environmental conditions, within the limits of the defined ODD for the ADS. For environmental conditions not tested that may occur within the defined operating range of the vehicle (ODD), the vehicle manufacturer shall demonstrate as part of the audit in Part I to the satisfaction of the technical service that the vehicle is safely controlled.

In order to test the requirements for failure of functions, self-testing of the ADS and initiation and implementation of a manoeuvre to reach a minimal risk condition faults may be artificially induced and the vehicle may be artificially brought into situations when operating autonomously and exposed to environmental conditions where it reaches the limits of the defined operating range.

4.   System modifications for testing purposes

If ADS modifications are required in order to allow testing, e.g. road type assessment criteria or road type information (map data), it shall be ensured that these modifications don't have an effect on the test results. These modifications shall in principle be documented and annexed to the test report. The description and the evidence of influence (if any) of these modifications shall be documented and annexed to the test report.

5.   Vehicle conditions

5.1.   Test mass

The subject vehicle shall be tested with any permissible vehicle load. No load alteration shall be made once the test procedure has begun. The vehicle manufacturer shall demonstrate, through the use of documentation, that "the ADS"

Commented [VS(221)]: DE comment

Commented [VS(222)]: NAVYA: This requirement is too opened, example for the speed range, this should be done each X km and X m/s². Proposal to replace by appropriate combinations of parameters ranges

Commented [VS(223R222)]: JRC: Concerning the variety of functions that are planned here, I don't think it is wise to define parameter ranges and intervals for the different tests. A robotaxi might need completely different test cases than a shuttle in confined area.

Commented [VS(224)]: DE comment

Commented [VS(225)]: JAMA comment

Commented [LA(226)]: DE: Based on what criteria such as worst case or other considerations?

Commented [VS(227R226)]: JRC: It is really up to the vehicle type. A HDV in confined area is a different case than a robotaxi. I think it should not be defined here.

works at all load conditions to the subject vehicle type applicable.

5.2. The subject vehicle shall be tested at the tyre pressure recommended by the vehicle manufacturer.

6. Test tools

In addition to real vehicles, state-of-the-art test tools may be used to carry out the tests, replacing real vehicles and other road users (e.g., Soft targets, mobile platforms).The replacement test tools shall comply with the characteristics relevant for sensory performance assessment, real vehicles and other traffic participants. Tests shall not be carried out in such a way as to endanger experimental personnel.

7 Test parameter variation

As part of the type-approval tests and the verification of compliance with the requirements of the approval, tests may be designed as necessary and the number of tests may be increased as long as they remain within the limits of the defined range of operation of the vehicle to be tested. The selected test cases shall provide sufficient test coverage for all scenarios, test parameters and environmental influences. Adequate robustness of the perceptions systems for the automated driving function against input/sensor data malfunction and adverse environmental conditions shall be demonstrated.

8. Tests scenarios to assess the performance of the ADS on a test track with regard to the dynamic driving task.

The scenarios included in the following paragraphs have to be considered a minimum set of conditions under which the vehicle shall be tested. Under the request of the relevant authority, additional scenarios in the ODD of the ADS representative of situations that the vehicle might be reasonably confronted with can be executed. If a scenario described in paragraph 8 of this annex does not belong to the ODD of the vehicle under test, it should not be taken into consideration.

Depending on the intended operating range (corresponding to an Operational Design Domain (ODD)), test scenarios shall be selected as part of the type approval test. The selection of the test scenarios shall be made on the basis of a scenario catalogue based on the scenarios listen in this section. Type approval testing may be carried out on the basis of simulations, manoeuvres on the test track and driving tests on real road traffic. However, it may not be based solely on computer simulations.

8.1. Lane keeping

The test shall demonstrate that the vehicle with an ADS does not leave its lane unintentionally and maintains a stable motion inside its lane across the speed range and different curvatures within its system boundaries.

8.1.1 The test shall be based on the ODD of "The ADS" and shall be executed at least :

a) With a minimum test duration of 5 minutes;
b) With a passenger car target as well as a Power Two Wheler (PTW) target as

the other vehicle;

    c) With a lead vehicle swerving in the lane; and

    d) With another vehicle driving close beside in the adjacent lane.

8.2.   Lane changing manoeuvre (LCM)

The tests shall demonstrate that the vehicles with an ADS does not cause an unreasonable risk to safety of the vehicle occupants and other road users during a Lane Change Procedure, and that the ADS is able to assess the criticality of the situation before starting the Lane Change Manoeuvre (LCM) throughout the entire operational speed range. These tests are only required if the vehicle equipped with an ADS is capable of performing lane changes either during a Minimal Risk Manoeuvre or during regular operation.

8.2.1.   The following tests shall be executed:

    a) With the vehicle with an ADS performing lane change to the adjacent (target) lane;

    b) Merging at lane end;

    c) Merging into an occupied lane.

8.2.2.   The tests shall be executed at least:

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

    b) In a scenario where a lane changing manoeuvre in regular operation is possible to be executed;

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

    d) With an equally fast vehicle following behind in the adjacent lane, preventing a lane change;

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

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

    g) In a scenario where a LCM shall be terminated due to a sudden change in the surrounding conditions, such as, for example, an approaching vehicle in the target lane suddenly accelerating, or a leading vehicle in the target lane suddenly decelerating, or the lane change of another vehicle or another road user into the target lane before the LCM is terminated.

8.3.   ~~Detect and r~~Response to different road geometries

These tests shall ensure, that the vehicle with an ADS detects and adapts to a variation of different road geometries which can occur within the intended ODD across its whole speed range.

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

    a) T-junctions (3-way intersections) with and without traffic lights, with different rights of way;

    b) Crossroads (4 or more way intersections) with and without traffic lights, with different rights of way;

Commented [VS(248)]: JAMA: These behaviour are feature dependent.
Should not be mandated for the lane keeping.

Commented [VS(249R248)]: JRC: Suggestion: "but based on the ODD of the system."

Commented [VS(250)]: DE comment

Commented [VS(251)]: DE comments

Commented [VS(252)]: JAMA: The purpose of requirement should not be "detection" (it is enough to keep road safety by responding various situation, since just road safety in total should be required.)

Commented [VS(253R252)]: JRC: "detect" deleted here and below

c) Roundabouts.

8.3.2. Each test shall be executed at least:

    a) Without a lead vehicle;

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

    d) Without and with incoming vehicles.

8.4. ~~Detect and r~~Response to national traffic rules and road infrastructure

These tests shall ensure that the vehicle equipped with an ADS complies with national traffic rules as well as ~~detects and~~ adapts to a variation of permanent and temporary changes of the road infrastructure (e.g. road construction sites) in the entire speed range.

8.4.1. The tests shall be executed at least with the list of scenarios below based on the ODD of the given system:

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

    b) Signal lights and/or human traffic controller with situations of going straight, turning left and right;

    c) Pedestrian crossings with and without pedestrians approaching / on the road.

    d) Temporary modifications: e.g., road maintenance operations indicated by traffic signs, cones and other signalization, access restrictions.

8.4.2. Each test shall be executed at least:

    a) Without a lead vehicle;

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

8.5. Collision avoidance: Avoid a collision with road users or objects blocking the lane

The test shall demonstrate that the vehicle equipped with an ADS avoids a collision with a stationary vehicle, road user or fully or partially blocked lane up to the maximum specified speed of the ADS.

8.5.1. This test shall be executed at least:

    a) With a stationary passenger car target;

    b) With a stationary PTW target;

    c) With a stationary pedestrian target;

    d) With a pedestrian target crossing the lane with a speed of [5] km/h, also in the presence of other objects (e.g. a ball, a shopping bag, etc.);

    e) With a pedestrian target moving within and partially occupying the lane of the ADS and following the same or the opposite direction of the ADS with a speed of up to [10] km/h;

    f) With a pedestrian target swerving in the same lane of the ADS;

    g) With a target representing a blocked lane;

    h) With a target partially within the lane;

i) With one or more different types of unpassable objects (e.g., a dustbin, a fallen bicycle or scooter, a fallen traffic sign, a stationary or moving ball, etc.);

j) With multiple consecutive obstacles blocking the lane (e.g., in the following order: ego-vehicle -motorcycle - car);

k) On a curved section of road.

8.6.   Avoid unnecessarily braking and maintain a stable motion with a passable object in the lane

a) The test shall demonstrate that vehicle with an ADS is not braking without a reason and is able to maintain a stable motion in the presence of a passable object in the lane (e.g., a manhole lid or a small branch) up to the maximum specified speed of the ADS.

8.6.1.   The test shall be executed at least:

a) Without a lead vehicle;

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

8.7.   Following a lead vehicle

The test shall demonstrate that the vehicle equipped with an ADS is able to maintain and restore a stable motion and the required safety distance to a vehicle in front and is able to avoid a collision with a lead vehicle which decelerates up to its maximum deceleration.

8.7.1.   This test shall be executed at least:

a) Across the entire speed range of the vehicle with an ADS;

b) Using a passenger car target as well as a PTW target as lead vehicle, provided standardized PTW targets suitable to safely perform the test are available;

c) For constant and varying lead vehicle velocities (e.g. following a realistic speed profile from existing driving database);

d) For straight and curved sections of road;

e) For different lateral positions of lead vehicle in the lane;

f) With a deceleration of the lead vehicle of at least 6 m/s^2 mean fully developed deceleration until standstill.

8.8.   Lane change of another vehicle into lane (cut-in)

The test shall demonstrate that the vehicle with an ADS is capable of avoiding a collision with a vehicle or other road user cutting into the lane of the vehicle equipped with an ADS up to a certain criticality of the cut-in manoeuvre.

8.8.1.   The criticality of the cut-in manoeuvre shall be determined according to the provisions introduced in paragraph x.x.x. and depending on the distance between the rear-most point of the cutting in vehicle and front-most point of the vehicle with an ADS, the lateral velocity of the cutting-in vehicle and the longitudinal movement of the cutting-in vehicle, as defined in paragraph X.Y.Z. of this

Commented [VS(265)]: JAMA: Contents of e.g. may not be unpassable for some vehicle types.

Commented [VS(266R265)]: JRC: Only ODD-specific case need to be tested.

Commented [LA(267)]: CLEPA: Recommended to change "not hard braking"

Commented [VS(268R267)]: In this case hard braking should be defined?

Commented [LA(269)]: DE: What are the pass-fail-requirements?

Commented [VS(270R269)]: Shall we put in the stable motion definition from ALKS amendment?

Commented [LA(271)]: DE: To be discussed: What is the definition of the "required safety distance and whether it should be mentioned here more precisely.

Commented [LA(272)]: DE: To be discussed: What is the assumption for the maximum breaking performance and whether it should be mentioned here more precisely.

Commented [LA(273)]: CLEPA: Need to add pedestrian+cyclist to align with requirement section

Commented [VS(274R273)]: JRC: "Or other road user" added

Regulation.

8.8.2. This test shall be executed taking into consideration at least the following conditions:

a) For different TTC, distance and relative velocity values of the cut-in manoeuvre, covering types of cut-in scenarios in which a collision can be avoided and those in which a collision cannot be avoided;
b) For cutting-in vehicles travelling at constant longitudinal speed, accelerating and decelerating;
c) For different lateral velocities, lateral accelerations of the cut-in vehicle;
d) For passenger car as well as PTW targets as the cutting-in vehicle, provided standardized PTW targets suitable to safely perform the test are available.

8.9. Stationary obstacle after lane change of the lead vehicle (cut-out)

The test shall demonstrate that the vehicle equipped with an ADS is capable of avoiding a collision with a stationary vehicle, road user or blocked lane that becomes visible after a preceding vehicle avoided a collision by an evasive manoeuvre.

8.9.1. The test shall be executed at least:

a) With a stationary passenger car target centred in lane;
b) With a powered two-wheeler target centred in lane;
c) With a stationary pedestrian target centred in lane;
d) With a target representing a blocked lane centred in lane;
e) With multiple consecutive obstacles blocking the lane (e.g. in the following order: ego-vehicle – lane change vehicle – motorcycle – car).

8.10. Parking

The test shall demonstrate that the vehicle equipped with ADS is able to park to different parking spaces and parking layouts under different conditions; and during the parking manoeuvre it is not causing damage to the surrounding objects, road users and itself.

8.10.1. This test shall be executed at least:

a) With parking spaces parallel and perpendicular to the road;
b) On even and slant surfaces;
c) With other vehicles in the surrounding parking spaces, including PTWs and bicycles;
d) Parking to parking spaces with different geometrical dimensions;
e) On different road slope angles;
With another vehicle cutting in to the parking space during the parking manoeuvre.

Commented [LA(275)]: DE: Should be added to chapter 1 Definitions.

Commented [VS(276R275)]: JRC: "TTC" defined in par. 1.

Commented [VS(277)]: NAVYA: need to define the test protocol especially for the requirement "becomes visible after a preceding vehicle"

Commented [VS(278)]: JRC: Added this long pending scenario.

EU TYPE-APPROVAL CERTIFICATE (VEHICLE SYSTEM)

Communication concerning *granting* / *extension* / *refusal* / *withdrawal* (^{1}) of type-approval of a type of vehicle with regard to its automated driving system (ADS) in accordance with the requirements laid down in Commission Implementing Regulation (EU) …/…(^{2}) *[PO: this Regulation]*, as last amended by Regulation (EU) No …/…

Number of the EU type-approval certificate:

Reason for *extension* / *refusal* / *withdrawal* (^{1}):

SECTION I

0.1. Make (trade name of manufacturer):

0.2. Type:

0.2.1. Commercial name(s) (if available):

0.3. Means of identification of type, if marked on the vehicle:

0.3.1. Location of that marking:

0.4. Category of vehicle:

0.5. Name and address of manufacturer:

0.8. Name(s) and address(es) of assembly plant(s):

0.9. Name and address of the manufacturer's representative (if any):

SECTION II

1. Additional information (where applicable): see Addendum.

2. Technical service responsible for carrying out the tests:

3. Date of test report:

4. Number of test report:

5. Remarks (if any): see Addendum.

6. Place:

7. Date:

8. Signature:

_____

(^{1}) Delete where not applicable.

Addendum
to EU type-approval certificate number

6.   Description and/or drawing of the ads including:

6.1.   Specified maximum speed of the ADS declared by the manufacturer:

6.2   Sensing system (incl. components):

6.3.   Installation of the ADS sensing system:

6.4.   Software Identification of the ADS(if applicable):

> **Commented [LA(280):** To be discussed whether this should be made mandatory.

7.   Written description and/or drawing of the ADS Human supervision/assistance system

> **Commented [LA(281):** To be discussed whether items 7 to 7.4 should be made optional.

7.1.   Remote supervision and remote assistance

7.2.   Means to activate, deactivate and override the ADS

7.3.   Monitoring in the inside of the vehicle

7.4.   Any system limitations due to environmental or road conditions

8.   Written description and/or drawing of the information given to vehicle occupants and other road users

8.1.   System status:

8.2.   Request to the operator/remote operator:

.3.   Minimum Risk Manoeuvre:

8.4.   Emergency Manoeuvre:

9.   Data Storage System for Automated Driving (DSSAD):

9.1.   DSSAD performance verified after the tests performed according to Annex 5:

9.2.   DSSAD documentation concerning data retrievability, data integrity self-check and protection against manipulation of stored data verified: yes/no

10.   Cyber Security and Software updates

10.1.   Cyber Security Type Approval Number (if applicable):

> **Commented [LA(282):** CITA: if applicable

10.2.   Software Update Type approval number (if applicable):

11.   Assessment of the functionality of the automated driving system and the safety concept of the ADS as well as audit of the safety management system of the manufacturer (Annex III-)

12.   Annexes

Addendum 1: Information document for automated driving systems (refer to Annex I-Appendix 1 of <mark>Regulation XX</mark>)."

NAVYA: Why do you add this paragraph? The compliance to the R155 and R156 will be mandatory as asked by the 2019/2144, so this paragraph will be redundant with the part III (ex: we don't ask information regarding the compliance to R13, or R79 it's directly defined in the part III)

UITP: Data recorder only inside the vehicle?

What about data provided by external elements of the

vehicles (control centre, connected infrastructure...)

what about incidents that happens inside the vehicle for the shared vehicle?

DE: To be discussed whether missing or not:

- Interactions with human supervision