Proposal for amendments to the 03 and 04 series of amendments to UN Regulation No. 79

(to be agreed and submitted to GRVA by TF-FADS)

This document is based on FADS-21-06.

*Notes:*

Modifications to the existing text of the Regulation indicated in **red bold** for new characters and ~~red strikethrough~~ for deleted characters.

Issues that the task force has agreed require further discussion following FADS-21 are highlighted in yellow.

Changes compared to document FADS-21-06 are highlighted in blue. Changes made in-session are highlighted in green. Rev 3 incorporates the content of FADS-22-06 (EC).

 I. Proposal

*Delete paragraph 1.2.4*:

1.2. This Regulation does not apply to:

…

~~1.2.4. Vehicles of categories M and N which are not equipped with manual steering controls intended for use during normal operation.~~

*Amend paragraph 2.3. to read:*

2.3. "Steering equipment" means all the equipment the purpose of which is to determine the direction of movement of the vehicle.

The steering equipment consists of:

The steering control **(if any)**,

The steering transmission,

The steered wheels,

The energy supply, if any.

*Amend paragraph 2.3.2. to read:*

2.3.2. "Steering transmission" means all components which form a functional link between the steering control **and/or ADS (as applicable),** and the road wheels.

The transmission is…

*Amend paragraph 2.3.4. to read:*

2.3.4. "Advanced Driver Assistance Steering System" means a system, additional to the main steering system, that provides assistance to ~~the~~ **a** driver in steering the vehicle but in which the driver remains at all times in primary control of the vehicle. It comprises one or both of the following functions

*Insert new paragraph 3.2.4.:*

**3.2.4. In the case of vehicles equipped with an ADS, an overview of the transmission links between the ADS and the steering equipment.**

*Amend paragraph 5.1.1. to read:*

5.1.1. The steering system shall ensure easy and safe handling of the vehicle up to its maximum design speed or in case of a trailer up to its technically permitted maximum speed. ~~There shall be a tendency to self-centre when tested in accordance with paragraph 6.2. with the intact steering equipment.~~  The vehicle shall meet the requirements of paragraph 6.2. in the case of motor vehicles and of paragraph 6.3. in the case of trailers. If a vehicle is fitted with an auxiliary steering system, it shall also meet the requirements of Annex 4. Trailers equipped with hydraulic steering transmissions shall comply also with Annex 5.

*Insert new paragraphs 5.1.1.1. to 5.1.1.3.:*

**5.1.1.1. Except in the case of vehicles of category X or Y, there shall be a tendency to self-centre when tested in accordance with paragraph 6.2. with intact steering equipment.**

**5.1.1.2. Steering controls of vehicles of category X or Y, if fitted, and their associated transmission are only required to comply with this regulation insofar as:**

**5.1.1.2.1. The direction of operation of the steering control shall correspond to the intended change of direction of the vehicle.**

**5.1.1.2.2. Paragraphs 5.1.5 and 5.1.11 shall apply.**

**5.1.1.2.3. Paragraph 5.3.1.3 shall apply whilst the steering controls are in use.**

**5.1.1.3. It shall be ensured through technical means that the speed of vehicles of category X or Y cannot exceed 6 km/h whilst the vehicle is being manually driven.**

*Amend paragraph 5.1.2. to read:*

5.1.2. It shall be possible to travel along a straight section of road without unusual steering correction by the driver **or ADS** and without unusual vibration in the steering system at the maximum design speed of the vehicle.

*Amend paragraph 5.1.5. to read:*

5.1.5. The effectiveness of the steering equipment, including the electrical control lines, shall not be adversely affected by magnetic or electric fields. This shall be demonstrated by fulfilling the technical requirements and respecting the transitional provisions of Regulation No. 10 by applying **the following series of amendments (or later), as applicable**:

(a) The 03 series of amendments for vehicles without a coupling system for charging the Rechargeable Electric Energy Storage System (traction batteries);

(b) The 04 series of amendments for vehicles with a coupling system for charging the Rechargeable Electric Energy Storage System (traction batteries)**;**~~.~~

**(c) The 07 series of amendments for vehicles equipped with an ADS.**

*~~Amend paragraph 5.1.9. to read:~~*

~~5.1.9. Steered wheels~~

 ~~The steered wheels shall not be solely the rear wheels. This requirement does not apply to semi-trailers~~ **~~or to vehicles of category X or Y.~~**

*Amend paragraphs 5.3.3. to 5.3.3.5. to read:*

5.3.3. Full power steering systems

5.3.3.1. The system shall be designed such that the vehicle cannot **drive or** be driven indefinitely at speeds above 10 km/h where there is any fault which requires operation of the warning signal referred to in paragraph 5.4.2.1.1.

5.3.3.2. In case of a failure within the control transmission, with the exception of those parts listed in paragraph 5.1.4., it shall still be possible to steer with the performance laid down in paragraph 6. for the intact steering system.

5.3.3.3. In the event of a failure of the energy source of the control transmission, it shall be possible to carry out at least 24 "figure of eight" manoeuvres, where each loop of the figure is 40 m diameter at 10 km/h speed and at the performance level given for an intact system in paragraph 6. The test manoeuvres shall begin at an energy storage level given in paragraph 5.3.3.5.

5.3.3.4. In the event of a failure within the energy transmission, with the exception of those parts listed in paragraph 5.3.1.1., there shall not be any immediate changes in steering angle. As long as the vehicle is capable of **driving or** being driven at a speed greater than 10 km/h the requirements of paragraph 6. for the system with a failure shall be met after the completion of at least 25 "figure of eight" manoeuvres at 10 km/h minimum speed, where each loop of the figure is 40 m diameter.

 The test manoeuvres shall begin at an energy storage level given in paragraph 5.3.3.5.

5.3.3.5. The energy level to be used for the tests referred to in paragraphs 5.3.3.3. and 5.3.3.4. shall be the energy storage level at which a failure **warning is given** ~~is indicated to the driver~~.

 In the case of electrically powered systems subject to Annex 6, this level shall be the worst case situation outlined by the manufacturer in the documentation submitted in connection with Annex 6 and shall take into account the effects of e.g. temperature and ageing on battery performance.

*Amend paragraph 5.4. to read:*

5.4. WARNING SIGNALS

**The requirements of this section related to warning signals to the driver do not apply whilst [an ADS feature/ an ADS feature which does not require a fallback user / an ADS feature of Type 2] is active. Requirements of paragraph 5.8.3. shall apply instead.**

*Insert new paragraph 5.5.3.:*

**5.5.3. For vehicles of category X or Y, suitable means shall be provided (e.g. a test mode, manual controls) to enable the performance of the necessary physical checks described in paragraph 5.5.1.**

*Amend paragraph 5.8. to read:*

5.8. Special Provisions for vehicles equipped with an Automated Driving System

 The steering equipment of any vehicle equipped with an Automated Driving System~~, other than Automated Lane Keeping Systems as defined in UN Regulation No. 157,~~ shall fulfil the following requirements.

*Amend paragraph 5.8.3. to read:*

5.8.3. Whilst ~~the~~ an ADS feature is active, ~~detected faults~~ **warning signals** **(e.g. failure status)** as described in paragraph 5.4. **and/or Annex 6** ~~of this UN Regulation~~ shall be transmitted to the ADS. **~~Warning signals related to faults detected while the ADS is not active shall either be transmitted to the ADS or shall be stored and transmitted to the ADS the next time it is activated, as appropriate.~~**

**The means by which it is ensured that existing detected faults are transmitted to the ADS before an ADS feature becomes active (e.g. previously detected faults which remain present) shall be documented by the manufacturer and demonstrated in accordance with Annex 6.**

For reference:

5.8.3.1. Notwithstanding paragraph 5.4.1.1, faults which impair the steering function and which can under manual driving conditions be detected by a driver due to vibration in the steering system or an increase in the steering force, shall be detected by the steering system and transmitted to the ADS unless the ADS itself is capable of detecting or sensing the presence of these faults.

*Insert new paragraph 5.8.4.:*

**5.8.4. Without prejudice to the requirements of other applicable regulations, the transmission links between the steering control and steering equipment and/or the steering control itself may be disabled or disconnected whilst an ADS feature is active.**

*Insert new paragraph 5.8.5.:*

**5.8.5. Notwithstanding the provisions of sections 5.1.6 and 5.6, Advanced Driver Assistance Steering Systems shall not be active, or be able to be activated, whilst an ADS feature is active.**

*Amend paragraph 6.1.4. to read:*

6.1.4. In the case of any systems that use electrical energy for part or all of the energy supply, all performance tests shall be carried out under conditions of actual or simulated electrical load of all essential systems or system~~s~~ components which share the same energy supply. Essential systems shall comprise **at least the following, where fitted:** lighting systems, windscreen wipers, ~~engine~~ **powertrain** management **systems**, ~~and~~ braking systems **and automated driving systems**.

*Open issue:* Testing provisions.

**OPTION 1 – EC proposal from FADS-22-06, with minor changes by UK:**

*Amend paragraph 6.2. to read:*

6.2. PROVISIONS FOR MOTOR VEHICLES

**Paragraph 6.2.1 applies to all motor vehicles, both whilst being manually driven and whilst any ADS feature is active.**

**Paragraphs 6.2.2 to 6.2.5 do not apply to vehicles of category X or Y, or to other vehicles whilst an ADS feature is active.**

**Paragraphs 6.2.6 and 6.2.7 apply only whilst an ADS feature is active.**

*Insert new paragraphs 6.2.6 to 6.2.7.2:*

**6.2.6. The measurement of steering time of vehicles equipped with an ADS, with intact steering equipment, whilst the ADS is active.**

**6.2.6.1. The vehicle shall be driven from straight ahead into a spiral at a speed of 10 km/h. The time shall be measured from the start of steering motion until the position of the steered wheels corresponds to a turning radius of 12 m (or full lock if not attainable for M3 and N3 vehicles). One steering movement shall be made to the right and one to the left.**

**6.2.6.2. The maximum permitted steering time with intact steering equipment is 4s.**

**6.2.7. The measurement of steering time of vehicles equipped with an ADS, with a failure in the steering equipment, whilst the ADS is active.**

**6.2.7.1. The test described in paragraph 6.2.6. shall be repeated with a failure in the steering equipment. The steering time shall be measured from the start of steering motion until the position of the steered wheels corresponds to the turning radius of 20 m.**

**6.2.7.2. The maximum permitted steering time with a failure in the steering equipment is 4s, except for categories M3 and N3 where the maximum steering time is 6s.**

**OPTION 2 – Industry proposal from FADS-22-06, with changes / comments by EC:**

*Renumber existing paragraph 6.2.1 as 6.2.1.1 and insert new paragraph 6.2.1.2:*

 **6.2.1.2. For vehicles [of categories X and Y / equipped with an ADS, whilst an ADS is active]**

 **It shall be possible to leave or enter a curve with a radius of [50] meters from a tangent, without unusual vibration, with a speed of x km/h. The speed x shall be agreed between the manufacturer and the Type Approval Authority, whereby the resulting lateral acceleration of the test shall be at least 4 m/s2.**

*Open issue:*

12. Transitional provisions

*Annex 1, insert new items 5.6.1. and 5.6.2:*

5.6. Vehicle is equipped with an ADS: yes/no”

**5.6.1. Description of the disconnection or disablement of steering controls while ~~the~~ an ADS feature is active, if applicable:**

**5.6.2. In the case of vehicles of category X or Y, description of the operation of manual steering controls, if fitted:**

*Open issue:*

 Annex 3 - BRAKING PERFORMANCE FOR VEHICLES USING THE SAME ENERGY SOURCE TO SUPPLY STEERING EQUIPMENT AND BRAKING DEVICE

…

2. If an energy source failure occurs, service braking performance on the first brake application shall achieve the values given in the table below.



3. After any failure in the steering equipment, or the energy supply, it shall be possible after eight full stroke actuations of the service brake control, to achieve at the ninth application, at least the performance prescribed for the secondary (emergency) braking system (see table below).

 In the case where secondary performance requiring the use of stored energy is achieved by a separate control, it shall still be possible after eight full stroke actuations of the service brake control to achieve at the ninth application, the residual performance (see table below).

…

*Annex 4, amend paragraph 2.3.1. to read:*

2.3.1. Except for parts of ASE not considered susceptible to breakdown as specified in paragraph 5.3.1.1. of this Regulation, the following failure of ASE shall be clearly brought to the attention of the driver **or transmitted to the ADS, as applicable:**~~.~~

*Annex 7, amend paragraphs 2.1.2 and 3.5. to read:*

2.1.2. The ~~driver’s~~  **[vehicle / operation / operator / user]** manualshall include information to advise the ~~driver~~ **user** on the electrical energy available for the trailer steering system and that the electrical interface shall not be connected when the current requirement marked on the trailer exceeds that which can be supplied by the towing vehicle.

3.5. Failure warning:

Failures within the electric control transmission of the steering system shall be directly displayed to the driver **or transmitted to the ADS, as applicable**.

 II. Justification

**Items proposed for amendment.**

1.2.4.

The amendment introduced into the scope when R79 was previously amended to cover ADS vehicle with full manual driving capability is no longer needed, as this proposal expands the scope to include ADS vehicles both with and without manual driving capability.

2.3.

Definition of steering equipment is amended to clarify that not all vehicles will have a ‘steering control’.

2.3.2.

Definition of steering transmission amended to account for ADS vehicles potentially not having a steering control.

2.3.4.

Definition of ADASS amended from ‘the driver’ to ‘a driver’ to clarify that a driver is not necessarily present. Subsequent uses of ‘the driver’ do not need amending.

5.1.1. to 5.1.1.1.

Self-centring requirement removed from this paragraph, and re-inserted as new paragraph 5.1.1.1. which does not apply to vehicles of Category X or Y.

5.1.1.2. to 5.1.1.3.

Allowance for steering controls in vehicles of category X and Y (i.e. controls that can only be used below 6 km/h) to be exempted from the majority of requirements of R79 (e.g. those related to steering effort and safe handling), since these requirements are not justified when operating at such low speeds. Requirements that do apply to these controls are:

* The direction of control operation shall match the direction of the vehicle movement - part of 5.1.3 for conventional vehicles.
* Electromagnetic compatibility - 5.1.5.
* Safety aspects of electronic control systems - 5.1.11 (and by reference Annex 6).
* Fault / failure warnings to the driver - 5.3.1.3 (and by reference 5.4).
* The vehicle should be prevented from exceeding 6 km/h whilst such controls are in use.

5.1.2.

Adding ADS here to ensure that ‘unusual steering correction’ is also not required of an ADS. This requirement is not intended to prevent the ADS making continuous micro-corrections to the steering angle - this should be deemed normal behaviour of a closed-loop control system. Rather, it is intended to ensure that there are not fundamental deficiencies in the steering (for example excessive play in joints, or excessive latency in transmission of control signals) that require the driver or ADS to make corrections.

5.1.5.

Update the reference to R10 because the new 07 series specifically covers ADS vehicles.

~~5.1.9.~~

~~Allows the use of rear-wheel steering for category X and Y vehicles. The use of rear wheels only is a potential problem for handling, but this is not an issue at the very low manual driving speed for category X / Y.~~

5.3.3. to 5.3.3.5.

Linguistic amendments to clarify that the vehicle might drive itself, rather than be ‘driven’.

5.4

Clarify that warning signals do not need to be given in vehicles of category X or Y, except when manual controls are in use.

5.5.3.

Provisions to ensure vehicles have facilities to enable PTI to be carried out (for example, a means of turning the steering in each direction to inspect components for wear).

5.8.

Justification TBC.

5.8.3.

Clarification on how to handle detected faults / failures while an ADS feature is active (i.e. when the ADS is performing the DDT). The situation should be transmitted to the ADS, and the ADS is expected to manage this information in accordance with the safety / operation concept and the requirements of the UN Regulation on ADS.

5.8.4.

It is necessary to clarify that the manual steering controls are not required to operate the steering when an ADS ~~is engaged~~ feature is active. It is expected that this will be regulated with in the HMI provisions of the UN Regulation on ADS, so a permissive provision is sufficient here.

5.8.5

Advanced Driver Assistance Steering Systems as defined in 2.3.4 are systems that ‘provide assistance to the driver’. This includes the functions ACSF-A to -E, CSF, ESF, RCM and RMF. The ADS is not a ‘driver’, and should not require such assistance, therefore it is appropriate to prohibit the activation of such systems while an ADS is active in order to avoid ambiguous states of control.

The ADS may provide functionalities similar to these functions (e.g. lane-keeping, lane changing, minimum risk manoeuvres), however these are functions of the ADS itself to be regulated and assessed accordingly.

6.1.4.

Update the list of ‘essential system’ that draw energy to include the ADS. Paragraph further amended for clarity.

6.2

Justification TBC.

Annex 4 paragraph 2.3.1. and Annex 7 paragraph 3.5

Fault transmission to ADS as relevant.

Annex 7 paragraph 2.1.2.

Replace “driver’s manual” with “vehicle manual”, as the person who needs this information might not be a driver in the case of an ADS vehicle.

**Items discussed by TF-FADS but not proposed for amendment.**

2.2. (type definition)

TF-FADS agreed that the type definition does not need to change, because ‘steering control’ is already included as an aspect within the type definition.

2.5.3.1. and 2.5.3.2. (front- / rear-wheel steering equipment).

TF-FADS agreed, in consultation with other screening task forces and the mandate from WP.29, that bi-directional vehicles would be covered in a future phase of amendments.

5.1.6. (ADAS systems)

TF-FADS agreed that no changes are needed to R79, because the state of ADAS relating to transitions of control is expected to be covered by the UN Regulation on ADS. See ADS-04-15 paragraph 5.3.2.3.8.

Annexes 9 and 10 (Communication with trailers for ACSF functions)

Since these annexes specifically relates to ACSF, they are deemed not applicable for ADS. If an ADS can operate with the vehicle in combination, it will be important that any communication with the trailer is assured. However, this should be addressed by requirements for the ADS.