

Proposal for amendments to Regulation No. 79 (steering equipment) Requirements applicable to ACSF of Category C1

I. Proposal

Insert a new paragraph 2.4.16. and 2.4.17., to read:

- "2.4.16. A 'lane change procedure' in the case of ACSF of Category [C1] starts when the direction indicator lamps are activated by a deliberate action of the driver and ends when the direction indicator lamps are deactivated. It comprises the following operations:**
- (a) Activation of the direction indicator lamps by a deliberate action of the driver**
 - (b) Lateral movement of the vehicle towards the lane boundary**
 - (c) Lane change manoeuvre**
 - (d) Resumption of the lane keeping function**
 - (e) Deactivation of direction indicator lamps**
- 2.4.17. A "lane change manoeuvre" is part of the lane change procedure and,**
- (a) Starts when the outside edge of the tyre tread of the vehicle's front wheel closest to the lane markings touches the inside edge of the lane marking to which the vehicle is being manoeuvred,**
 - (b) Ends when the rear wheels of the vehicle have fully crossed the lane marking."**

Insert a new paragraph 5.6.3, to read:

"(Reserved for ACSF of category B2.)"

Insert a new paragraph 5.6.4, to read:

- "5.6.4. Special Provisions for ACSF of Category [C1]**
- Any ACSF system of Category [C1] shall fulfil the following requirements.**
- 5.6.4.1. General**
- 5.6.4.1.1. A vehicle equipped with an ACSF of Category [C1] shall also be equipped with an ACSF of Category B1 complying with the requirements of this Regulation.**
- 5.6.4.2. Activation/deactivation of the ACSF of Category [C1] system**
- 5.6.4.2.1. The default status of the system shall be off at the initiation of each new engine start/run cycle.**
- [At the time of the first system activation] after a new engine start/run cycle, a disclaimer shall be provided to inform the driver of their duty to monitor the traffic and road conditions prior to and throughout the lane change procedure.**

This requirement does not apply when a new engine start/run cycle is performed automatically, e.g. the operation of a stop/start system.

5.6.4.2.2. The vehicle shall be equipped with a means for the driver to activate (standby mode) and deactivate (off mode) the system. The same means as for an ACSF of Category B1 may be used.

5.6.4.2.3. The system shall only be activated (standby mode) after a deliberate action by the driver.

Activation by the driver shall only be possible on roads where pedestrians and cyclists are prohibited and which, by design, are equipped with a physical separation that divides the traffic moving in opposite directions and which have at least two lanes in the direction the vehicles are driving. These conditions shall be ensured by the use of at least two independent means.

In the case of a transition from a road type with a classification permitting an ACSF of Category [C1], to a type of road where an ACSF of Category [C1] is not permitted, the system shall be deactivated automatically.

5.6.4.2.4. It shall be possible to deactivate the system (off mode) at any time by a single action of the driver. Following this action, the system shall only be able to be reactivated (standby mode) by a deliberate action of the driver.

5.6.4.2.5. Notwithstanding the requirements above it shall be possible to perform the corresponding tests in Annex 8 of this Regulation on a test track.

5.6.4.3. **Overriding**

A steering input by the driver shall override the steering action of the system. The steering control effort necessary to override the directional control provided by the system shall not exceed [30 or 50] N.

The system may remain activated (standby mode) provided that priority is given to the driver during the overriding period.

5.6.4.4. **Lateral acceleration**

The lateral acceleration induced by the system during the lane change manoeuvre:

(a) Shall not exceed 1 m/s^2 in addition to the lateral acceleration generated by the lane curvature, and

(b) Shall not cause the total vehicle lateral acceleration to exceed the maximum values indicated in tables of paragraph 5.6.2.1.3.

[The moving average over half a second of the lateral jerk generated by the system shall not exceed 5 m/s^3 .]

5.6.4.5. **Human Machine Interface (HMI)**

5.6.4.5.1. Unless otherwise specified, the optical signals identified in paragraph 5.6.4.5. shall be easily distinguishable from each other (e.g. different symbol, colour, blinking, text).

5.6.4.5.2. When the system is in standby mode (i.e. ready to intervene), an optical signal shall be provided to the driver.

5.6.4.5.3. When the lane change procedure is ongoing an optical signal shall be provided to the driver.

- 5.6.4.5.4.** When the lane change procedure is suppressed, in accordance with paragraph 5.6.4.6.8., the system shall clearly inform the driver about this system status by an optical warning signal and additionally by an acoustic or haptic warning signal. In case the suppression is initiated by the driver, an optical warning is sufficient.
- 5.6.4.5.5.** A system failure shall be signalled immediately to the driver by an optical warning signal. However, when the system is manually deactivated by the driver, the indication of failure mode may be suppressed.
- If a system failure occurs during a lane change manoeuvre, the failure shall be signalled to the driver by an optical, and an acoustic or haptic warning.
- 5.6.4.5.6.** The system shall provide a means of detecting that the driver is holding the steering control and shall warn the driver in accordance with the warning strategy below:
- If, after a period of no longer than 3 seconds after the initiation of the lane change procedure, the driver is not holding the steering control, an optical warning signal shall be provided. This signal shall be the same as the signal specified in paragraph 5.6.2.2.5.
- The warning signal shall be active until the driver is holding the steering control, or until the system is deactivated, either manually or automatically.
- 5.6.4.6.** Lane change procedure
- 5.6.4.6.1.** The initiation of a lane change procedure of an ACSF of Category [C1] shall only be possible if an ACSF of Category B1 is already active.
- 5.6.4.6.2.** The lane change procedure requires, and shall start immediately after, a manual activation by the driver of the direction indicator to the intended side for the lane change.
- 5.6.4.6.3.** When the lane change procedure starts, the ACSF of Category B1 shall be suspended, and the ACSF of Category [C1] shall carry on the lane keeping function of ACSF of category B1, until the lane change manoeuvre starts.
- 5.6.4.6.4.** The lane change manoeuvre shall not be initiated before a period of 3.0 s and not later than 5.0 s after the deliberate action of the driver described in paragraph 5.6.4.6.2.
- 5.6.4.6.5.** The lane change manoeuvre shall be completed in less than:
- (a) 5 s for M₁, N₁ vehicle categories,
 - (b) 10 s for M₂, M₃, N₂, N₃ vehicle categories.
- 5.6.4.6.6.** Once the lane change manoeuvre has completed, ACSF of Category B1 lane keeping function shall resume automatically.
- 5.6.4.6.7.** The direction indicator shall remain active throughout the whole period of the lane change manoeuvre and shall be deactivated by the system no later than 0.5 seconds after the resumption of ACSF of Category B1 lane keeping function as described in paragraph 5.6.4.6.6.
- 5.6.4.6.8.** Suppression of the lane change procedure

5.6.4.6.8.1. The lane change procedure shall be suppressed automatically by the system when at least one of the following situations occurs before the lane change manoeuvre has started:

- (a) The system detects a critical situation (as defined in para. 5.6.4.7),
- (b) The system is overridden or switched off by the driver,
- (c) The system reaches its boundaries (e.g. lane markings are no longer detected)
- (d) The system has detected that the driver is not holding the steering control at the start of the lane change manoeuvre,
- (e) The direction indicator lamps are manually deactivated by the driver,
- (f) The lane change manoeuvre has not commenced within 5.0 s following the deliberate action of the driver described in para. 5.6.4.6.2.

5.6.4.6.8.2. Manual deactivation of the lane change procedure, using the manual control of the direction indicator, shall be possible for the driver at any time.

5.6.4.7. Critical situation

A situation is deemed to be critical when, at the time a lane change manoeuvre starts, an approaching vehicle in the target lane would have to decelerate at 3m/s^2 [0.0 or 1.2] seconds after the lane change manoeuvre has started, to ensure the distance between the two vehicles is never less than that the ACSF vehicle travels in [1] second.

For the purpose of this requirement, it is assumed that the maximum speed of the approaching vehicle (V_{rear}) is 130km/h, and that the ACSF vehicle speed is constant.

[5.6.4.8. Minimum distance and minimum operation speed

5.6.4.8.1. The ACSF of Category [C1] shall be able to detect vehicles approaching from the rear in an adjacent lane up to a distance S_{rear} as specified below:

The minimum distance S_{rear} shall be declared by the vehicle manufacturer. The declared value shall not be less than 55m.

The declared distance shall be tested according to the relevant test in Annex 8 using a two-wheeled motor vehicle of Category L3 as the approaching vehicle. */

The minimum operation speed V_{smin} , down to which the ACSF C is permitted to perform a lane change manoeuvre, shall be calculated with minimum distance S_{rear} using the following formula:

$$V_{S_{\text{min}}} = a * (t_B - t_G) + v_{\text{app}} - \sqrt{a^2 * (t_B - t_G)^2 - 2 * a * (v_{\text{app}} * t_G - S_{\text{rear}})}$$

Where:

- S_{rear} = Minimum distance declared by the manufacturer in [m]
- v_{app} = 36.1 m/s (Speed of the approaching vehicle = 130 km/h)
- a = 3 m/s² (Deceleration of the approaching vehicle)

- $t_B = [0.0 \text{ or } 1.2]s$ (Time after the start of the manoeuvre at which the deceleration of the approaching vehicle starts)
- $t_G = [1]s$ (Remaining gap of the vehicles after the deceleration of the approaching vehicle)
- $V_{\text{min}} = x \text{ [m/s]}$ Resulting minimum activation speed of the ACSF of Category C1

Notwithstanding the requirements above, the system may become active also at speeds lower than the calculated V_{min} provided that the following conditions are met:

- (a) The system has detected another vehicle in the adjacent lane into which the lane change is planned at a distance lower than S_{rear} and
- (b) The situation is not deemed to be critical according to paragraph 5.6.5.7 (e.g. at low speed differences and $V_{\text{app}} < 130 \text{ km/h}$)
- (c) $[S_{\text{rear}} = (v_{\text{app}} - v_{\text{Smin}}) * t_B + (v_{\text{rear}} - v_{\text{Smin}})^2 / (2 * a) + v_{\text{Smin}} * t_G]$

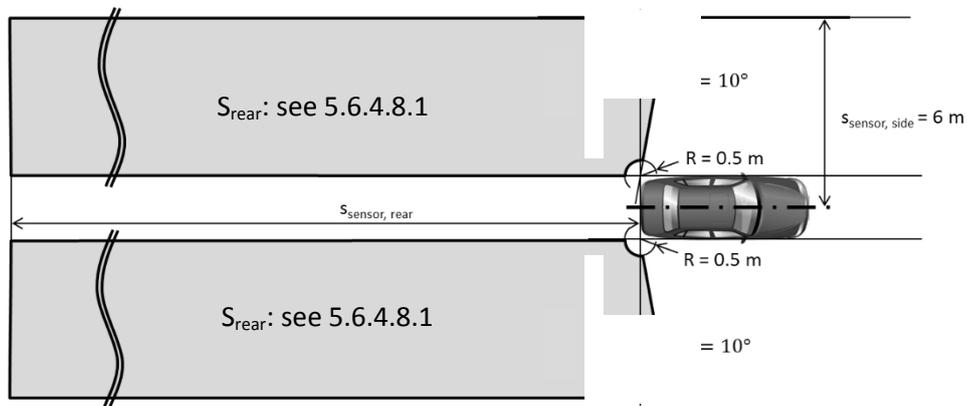
[Footnote:

* Until a uniform test target, having the radar cross section (rcs) characteristics of an appropriate L3 vehicle have been agreed, the motorcycle used for type approval shall have an engine capacity greater than 500cm^3 . The choice of the motorcycle shall be agreed with the Technical Service and the details recorded in the Test Report.]

5.6.4.8.2. The vehicle system detection area on ground level shall be at minimum as shown in the figure below.

Fig. 1

Figure Minimum detection area



5.6.4.8.3. After each vehicle new engine start/run cycle (other than when performed automatically, e.g. the operation of a stop/start systems), the ACSF of Category [C1] function shall be prevented from performing a lane change manoeuvre until the system has detected, at least once, a moving object at a distance greater than $[x] \text{ m}$.

5.6.4.8.4. The ACSF of Category [C1] shall be able to detect blindness of the sensor (e.g. due to accumulation of dirt, ice or snow). The ACSF of Category [C1] shall be prevented, upon detection of blindness, from performing the lane change manoeuvre procedure. The status of the

system shall be signalled to the driver no later than on the initiation of the lane change manoeuvre. The same warning as the one specified in paragraph 5.6.4.5.5. (*system failure warning*) may be used.

- 5.6.4.9. System information data
- 5.6.4.9.1. Following data shall be provided together with the documentation package required in Annex 6 of this regulation to the Technical Service at the time of type approval.
 - 5.6.4.9.1.1. The conditions under which the system can be activated and the boundaries for operation (boundary conditions). The vehicle manufacturer shall provide values for V_{smax} , V_{smin} and ay_{smax} for every speed range as mentioned in the table of paragraph 5.6.2.1.3. of this Regulation.
 - 5.6.4.9.1.2. Information about how the system detects that the driver is holding the steering control.
 - 5.6.4.9.1.3. The means to override and to suppress or cancel.
 - [5.6.4.9.1.4. Information about how the failure warning signal status and the confirmation of the valid software version related ACSF performance can be checked via the use of an electronic communication interface.]
 - [5.6.4.9.1.5. Documentation about which system software version related ACSF performance is valid. This documentation shall be updated whenever a software version was amended.]
 - 5.6.4.9.1.6. Information on the sensor range over lifetime. The sensor range shall be specified such way that any influence on deterioration of the sensor shall not affect the fulfilment of paragraph 5.6.4.8.3. and 5.6.4.8.4. of this regulation.
- 5.6.4.10. The vehicle with ACSF of Category [C1] shall be tested in accordance with relevant vehicle test(s) specified in Annex 8 of this Regulation. [For driving situations not covered by the tests of Annex 8, the safe operation of the ACSF shall be demonstrated by the vehicle manufacturer on the base of Annex 6 of this Regulation.]

Insert a new paragraph 3.5 in Annex 8, to read:

- "[3.5. Tests for ACSF of Category [C1] Systems
- 3.5.1. Lane change functional test
- 3.5.2. Suppression of lane change procedure test
- 3.5.3. Overriding test
- 3.5.4. Deactivation test
- 3.5.5. Sensor performance test
- 3.5.6. Sensor blindness test
- 3.5.7. "Engine start/run cycle test"]"

Remark: Details of the tests will be defined in 15th ACSF session (November 2017)
