Submitted by the Experts of Germany and Japan

Informal Document - ACSF-11-03

Draft Proposal for category C requirements

I. Proposal

2.4.13 **A 'lane change procedure' starts when the direction indicator lamps are activated and ends when the lane change manoeuvre is completed and the direction indicator lamps are deactivated. It comprises three operations:**

- **Activation of direction indicator lamps**
- **Lane change manoeuvre**
- **Deactivation of direction indicator lamps**

2.4.14 **A 'lane change manoeuvre' is deemed**

- **to start when the outside of the tyre of the vehicle's front wheel closest to the lane markings has touched the inside edge of the visible lane marking to which the vehicle is being drifted.**
- **to end when the rear wheels of the vehicle have fully crossed the lane marking**

Insert a new paragraph 5.6.3, to read:

Reservation for ACSF of category B2.

Insert a new paragraph 5.6.4, to read:

5.6.4. **Special Provisions for ACSF of Category C**

Any system of Category C ACSF shall fulfill the following requirements.

5.6.4.1. **General**

5.6.4.1.1. **The vehicle shall be equipped with an ACSF of category B1 specified in paragraph 5.6.2.**

5.6.4.1.2. **The system shall be active (deliver automatic steering) only after a deliberate action of the driver and if all conditions for operation of the system are fulfilled.**

5.6.4.1.3. **The vehicle shall be equipped with a means for the driver to activate (standby mode) and deactivate (off mode) the system. It shall be possible to deactivate the system at any time by a single action of the driver. Following this action, the system shall only become active again as a result of a deliberate action by the driver.**

5.6.4.1.4. **It shall be technically ensured that the activation of a system of Category C is only possible on a road section which is not dedicated to pedestrians or cyclists and which has a physical or constructional separation of traffic moving in opposite directions and which has at least two lanes for the direction the vehicle is driving.**

5.6.4.1.5. **Accelerating, braking or steering operation by the driver shall take priority over a demand by the ACSF system.**

Steering by the driver shall override steering by the system. The steering control effort necessary to override the directional control provided by the system shall not exceed 50 N.

The system may remain active provided that priority is given to the driver during the overriding period. The means to override the ACSF shall be indicated in the system information data.

5.6.4.1.6. **The lateral acceleration induced by the system during the lane change manoeuvre shall not exceed [1 m/s²] in addition to the lateral acceleration generated by the lane curvature.**

However, the lateral acceleration of the vehicle shall not exceed the maximum values defined in the 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/s³.

The lane change manoeuvre shall be completed no later than

- **[5] s for M1, N1 vehicle categories,**
- **[10] s for M2, M3, N2, N3 vehicle categories.**

The direction indicator shall flash permanently during the lane change manoeuvre.

5.6.4.2. **ACSF of Category C operation**

5.6.4.2.1 **The activation of an ACSF of category C shall only be possible if an ACSF of category B1 is active.**

5.6.4.2.2. **Unless otherwise specified, the optical signals described in 5.6.4.2. shall all be different from each other (e.g. different symbol, colour, blinking, text).**

5.6.4.2.3. **If the system is active an optical signal shall be provided to the driver.**

5.6.4.2.4. **When the system is in standby mode, an optical warning signal shall be provided to the driver.**

5.6.4.2.5. **When the system reaches its boundary conditions set out in paragraph 5.6.4.3.1.1. of this Regulation (e.g. the specified maximum lateral acceleration ay_{smax}), the system shall continue to provide assistance and shall clearly inform the driver about this system status by an optical warning signal and additionally by an acoustic or haptic warning signal.**

5.6.4.2.6. **A system failure shall be signalled 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 signaled to the driver by an optical and an acoustic or haptic warning.

5.6.4.2.7. **During the lane change procedure and in the speed range between 10 km/h or V_{smin}, whichever is higher, and V_{smax}, it shall provide a means of detecting that the driver is holding the steering control.**

When the system detects that the driver is not holding the steering control, an optical warning signal shall be provided. This signal may be the same as the signal specified below in this paragraph.

The optical warning signal shall indicate to the driver to place their hands on the steering control. It shall consist of pictorial information showing hands and the steering control and may be accompanied by additional explanatory text or warning symbols.

If, after a period of no longer than 1 second the driver is not holding the steering control, at least the hands or steering control in the pictorial information provided as optical warning signal shall be shown in red and an acoustic warning signal shall be provided.

The warning signals shall be active until the driver is holding the steering control, or until the system is deactivated, either manually or automatically.

5.6.4.2.8. **Any lane change manoeuvre shall be completed, unless the system detects an imminent critical situation, is overridden by the driver or does not detect the lane markings anymore.**

5.6.4.2.9. **After the second deliberate action of driver according to 5.6.4.2.11.5.1., ACSF of category B1 lane keeping function shall be temporarily in stand by mode. Once the manoeuvre is completed, ACSF of category B1 shall automatically be activated again.**

5.6.4.2.10. **The vehicle with ACSF category C shall be tested in accordance with relevant vehicle test(s) specified in Annex 8 of this Regulation. In addition, in order to comply with 5.6.4.1. and 5.6.4.2., for the 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.**

5.6.4.2.11. **HMI requirements**

5.6.4.2.11.1 **The system status shall be default off at the initiation of each new ignition cycle. At the time of the first system activation, a disclaimer shall be provided to inform the driver of his duty to monitor the traffic and road conditions prior to initiating a lane change manoeuvre.**

5.6.4.2.11.2. **A lane change procedure shall not start if ACSF of category B1 has detected that the driver is hands-off the steering control.**

5.6.4.2.11.3. **The system shall inform the driver that the lane change procedure is ongoing.**

5.6.4.2.11.4. **Any single lane change manoeuvre shall be initiated only if commanded by two subsequent deliberate actions of the driver, within an interval of maximum [10s].**

5.6.4.2.11.4.1. **The first deliberate action of the driver to start the lane change procedure shall be the manual activation of the direction indicator lamps to the intended side for the lane change.**

5.6.4.2.11.5.1. **The second deliberate action of the driver to start the lane change manoeuvre shall be a manual steering input in the direction of the deliberate lane change with a required steering input to the driver of more than the steering control effort necessary to override the directional control provided by the corresponding ACSF of category B1**

5.6.4.2.11.6. **The lane change manoeuvre shall directly start upon the second deliberate action of the driver but shall not be initiated before 3 flashes of the direction indicator lamps.**

5.6.4.2.11.7. **The lane change manoeuvre shall not be initiated if the direction indicator lamps are deactivated.**

5.6.4.2.12. **Sensor requirements**

5.6.4.2.12.1. **The vehicle with ACSF category C shall be equipped with means to monitor the driving environment, to recognise other road users at the side and the rear of the vehicle. The vehicle shall not carry out a lane change if a collision with a vehicle at the side or at the rear of the vehicle is imminent. The vehicle shall abort an already started lane change manoeuvre and return to the initial lane if a collision with a vehicle at the side or at the rear of the vehicle is imminent.**

[A range of 8m to the side and 46m to the rear of the vehicle has to be monitored by the system.]

<< Please refer to the explanation of the Blind Spot Area in doc ACSF-11-04. After Discussion a sketch for the determination of the range shall be inserted into the test requirements.>>

The vehicle shall indicate to the driver if a vehicle is at the side or at the rear of the vehicle by an optical warning signal.

5.6.4.2.12.2. **The system has to ensure that under normal operating conditions neither the vehicle itself nor other road users at the side and at the rear of the vehicle will be negatively affected during the ACSF operation.**

5.6.4.2.12.3. **In case the system is not capable of recognizing other road users in the entire range of normal driving conditions, the system shall by itself adapt and restrict the boundaries for the selection of speed, accelerations and the execution of certain manoeuvres (e. g. lane change) depending on the presently prevailing conditions for operation (like e. g. weather conditions, actual range for monitoring the driving environment and the detection of obstacles, estimated adhesion, speed of other traffic, speed difference to other traffic).**

5.6.4.3. **System information data**

5.6.4.3.1. **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.**

5.6.4.3.1.1. **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;**

5.6.4.3.1.2. **Information about how the system detects that the driver is holding the steering control.**

5.6.4.3.1.3. **The means to override and to abort or cancel.**

5.6.4.3.1.4. **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.**

5.6.4.3.1.5. **Documentation about which system software version related ACSF performance is valid. This documentation shall be updated whenever a software version was amended.**

Insert a new paragraph 3.3 in Annex 8, to read:

Reservation for tests of ACSF Category B2 Systems.

Insert a new paragraph 3.4 in Annex 8, to read:

3.4. Tests for ACSF Category C Systems

<< Tests to be developed after the discussion of technical requirements >>

3.4.1. Lane change functional test

3.4.2. Abort of lane change test

3.4.3. Blind spot test