

Draft Proposal for category [C1] requirements

Based on document ACSF-12-03 (Draft Proposal for category C requirements)

I. Proposal

- 2.4.13. A 'lane change procedure' in case of Category [C1] starts when the direction indicator lamps are activated with deliberate action of the driver and ends when the direction indicator lamps are deactivated. It comprises four operations:
1. Activation of direction indicator lamps with a deliberate action of the driver
 2. Starting driving towards the lane
 3. Lane change manoeuvre
 4. **Deactivation of direction indicator lamps and resume the lane keeping function by CAT B1**
- 2.4.14. A 'lane change manoeuvre' is deemed
5. **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.**
 6. **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 5.6.5, to read:

5.6.5. Special Provisions for ACSF of Category [C1]

Any system of Category [C1] ACSF shall fulfill the following requirements.

5.6.5.1. General

5.6.5.1.1. Any vehicle equipped with an ACSF CAT [C1] shall also be equipped with an ACSF of category B1 specified in paragraph 5.6.2.

5.6.5.1.2. The system shall be active only after a deliberate action of the driver and if all conditions for operation of the system are fulfilled.

5.6.5.1.3. 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 CAT B1 may be used. 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.

5.6.5.1.4. **The system** shall ensure that the activation of a system of Category [C1] is only possible on roads where pedestrians and cyclists are prohibited and which are equipped normally 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. [This may be achieved with the use of e.g. navigation map data or road sign recognition.]

5.6.5.1.5. **Notwithstanding the requirements of paragraph 5.6.5.1.4 it shall be possible [for the type approval authority] to perform the corresponding tests in Annex 8 on test tracks which are specified by the vehicle manufacturer for the purpose of type approval and surveillance of conformity of production.**

5.6.5.1.56. 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.

Manual deactivation of the direction indicator lamps shall be possible for the driver at any time and stop the lane change procedure.

5.6.5.1.67. 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, and
- 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/s³.

The lane change manoeuvre shall be completed in less than

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

5.6.5.1.78 The direction indicator shall be deactivated by the system after the completion of the lane change manoeuvre.

5.6.5.2. ACSF of Category [C1] operation

5.6.5.2.1 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.

5.6.5.2.2. Unless otherwise specified, the optical signals described in 5.6.5.2. shall all be different from each other (e.g. different symbol, colour, blinking, text).

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

5.6.5.2.4. When the system reaches its boundary conditions set out in paragraph 5.6.5.3.1.1. of this Regulation (e.g. the specified maximum lateral acceleration $a_{y_{\max}}$), 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.

5.6.5.2.5. A system failure which prevents the function to perform a lane change manoeuvre of Category [C1] 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.

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

While executing the lane change procedure/manoeuvre, the means of detecting that the driver is holding the steering control of the ACSF of category B1 described in 5.6.2.2.5. shall remain active. This includes also the warning signals.

If, at the start of the lane change manoeuvre the driver is not holding the steering control, the lane change shall be canceled.]

5.6.5.2.7. 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.

The lane change manoeuvre shall be aborted if at least one of the following situations is detected:

- the system detects an imminent critical situation (as described by the manufacturer in the system information data),
- the system is overridden **or switched off** by the driver
- the system reaches its boundaries (e.g. lane markings are not detected)

5.6.5.2.8. 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. Once the manoeuvre is completed, ACSF of category B1 shall automatically resume.

5.6.5.2.9. The vehicle with ACSF category [C1] shall be tested in accordance with relevant vehicle test(s) specified in Annex 8 of this Regulation. Compliance with 5.6.5.1. and 5.6.5.2., 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.

5.6.5.2.10. HMI requirements

5.6.5.2.10.1 The system status shall be default off at the initiation of each new engine start/run cycle performed by the driver.

At the time of the first system activation after a new engine start, 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.

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

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

5.6.5.2.10.4. Any single lane change procedure shall be initiated only if commanded by a deliberate action of the driver. The 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.

5.6.5.2.10.5. The lane change procedure shall start upon the deliberate action of the driver but the lane change manoeuvre shall not be initiated before a period of 3s of flashing of the direction indicator lamps.

The system may delay initiation of the manoeuvre for a period not exceeding [6/10?] seconds after the deliberate action of the driver to

confirm the traffic condition specified in paragraph 5.6.5.2.12.4. In this case the system shall inform the status to the driver. If the manoeuvre has not begun with this [6/10] seconds the execution of the procedure shall be cancelled.

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

5.6.5.2.11. Sensor requirements

5.6.5.2.11.1. The vehicle with ACSF category [C1] shall not carry out any lane change manoeuvre or shall abort an already started manoeuvre if an overtaking vehicle is within the safety distance defined under 5.6.5.2.11.2. and 5.6.5.2.11.3. In both cases the system shall clearly inform the driver about the system status by an optical warning signal and additionally by an acoustic or haptic warning signal.

These sensor requirements are deemed to be satisfied if the tests for Category [C1] as specified in Annex 8 are met.

5.6.5.2.11.2. The minimal distance to detect vehicles to the rear (s_{Rear}) of the ACSF category [C1] system shall be calculated according to the following formula:

$$1) s_{Rear} = (\Delta v_{max}) * (3.5) \quad (3.5 = TTC \text{ of } 3.5 \text{ s})$$

where:

Δv_{max} = initial speed difference between the minimum design speed of category [C1] and [130 km/h] as the maximum speed of approaching vehicle from behind, measured in m/s.

2) In case of Δv_{max} is less than 50 km/h, Δv_{max} deems to be 50 km/h.

5.6.5.2.11.3. The minimal detection range to the left and to the right (side) of the ACSF category [C1] system shall be at least 6 m measured from the medium longitudinal centerline of the vehicle equipped with ACSF of category [C1]

5.6.5.2.11.4. In case the system is not fulfilling the requirement of paragraph 5.6.5.2.11.2. and 5.6.5.2.11.3, under any driving conditions, the system shall indicate this to the driver by an optical warning signal and shall not perform any lane change manoeuvre.

5.6.5.3. System information data

5.6.5.3.1. 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.

5.6.5.3.1.1. 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 a_{ysmax} for every speed range as mentioned in the table of paragraph 5.6.2.1.3. of this Regulation;

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

5.6.5.3.1.3. The means to override and to abort or cancel.

[5.6.5.3.1.4. 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.]

- 5.6.5.3.1.5. 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 3.5 in Annex 8, to read:

3.5. Tests for ACSF Category [C1] Systems

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

- 3.5.1. Lane change functional test (Respecting also ay-requirements)**
 - 3.5.1.1. Overtaking test (similar FU3?)**
 - 3.5.1.2. Returning to the “old” lane**
- 3.5.2. Abort of lane change test (similar FU2?)**
- 3.5.3. Overriding test**
- 3.5.4. Deactivation test**
- 3.5.5. Sensor performance test (L3-vehicle)**