Submitted by the the experts of OICA and CLEPA

Informal Document - ACSF-13-12

Draft Proposal for category [C1] requirements

Industry homework for ACSF-13

Red: justifications
Red bold: changes to the current proposal

I. Proposal

2.4.13.1 **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 five 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**
5. **Resume the lane keeping function by CAT B1**

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.**

Homework: **UK to rework text including "CAT B1"**

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.**

(Remark: should be reviewed before finalazing the document)

Industry note:
What is meant here by "a deliberate action of the driver":

- *Activate the direction indicator stalk to start the lane change procedure?*
  Or
- *Press a button to "switch on" the system (i.e. means the same as to "activate (standby mode) and deactivate (off mode) the system" in paragraph 5.6.5.1.3?*

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.**

Industry note:
Is the aim of this paragraph to request a means to implement the "deliberate action" defined in 5.6.5.1.2.?

5.6.5.1.4. **It shall ~~be designed to~~ ensure that the activation of a system of Category [C1] is only possible on roads where pedestrians and cyclists are prohibited and are equipped normally with a physical separation ~~or continuous solid lane marking~~ that divides the traffic moving in opposite directions and which have at least two lanes in the direction the vehicles are driving.~~at least two lanes for the direction the vehicles are travelling in the same direction~~. This may be achieved with the use of e.g. navigation ~~digital~~ map data or road sign recognition.**

(Remark: A 100% detection of this condition is by the system seems not to be possible (Road constructions, re-routing of highway…))

Homework: OICA to provide a new wording

Industry note:
It is a fact that the navigation map data may not be up-to-date in the vehicle, and that a road sign may be missing or hidden (e.g. "end of highway"). As a consequence, the detection cannot be 100% reliable, even if the risk is low.

5.6.5.1.5. **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.

Industry note:
50N should be reviewed in a second step, considering all different ACSF categories and use cases. Current values on the market are probably conservative.

5.6.5.1.6. **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, 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.**

Homework: D to check 130 km/h as Vmax?

Homework: OICA extension of 5s necessary? **Not needed**

5.6.5.1.7 **The direction indicator shall be deactivated no earlier than one second after the start of the lane change manoeuvre ~~on completion of the lane change manoeuvre~~.**

Homework : D+J to consider the chronological order (…Resume the lane keeping function by CAT B1)

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).**~~

(Remark: Should be considered when finalizing the document)

Justification: moved to the HMI section

~~**5.6.5.2.3. If the system is in the lane change procedure an optical signal shall be provided to the driver.**~~

Justification: redundant with paragraph 5.6.5.2.11.3.

~~**5.6.5.2.4. When the system is in standby mode, an optical signal shall be provided to the driver.**~~

Justification: moved to the HMI section

~~**5.6.5.2.5. 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 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.**~~

Justification: already covered by paragraph 5.6.5.2.8. And addition of a new paragraph in the HMI section

5.6.5.2.6. 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.

Proposal to copy/paste from B1 requirements:

A system failure shall be indicated to the driver with an optical warning signal. However, when the system is manually deactivated, 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.

5.6.5.2.7. [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.

While executing the lane change procedure/manoeuve, 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.]

Homework: UK to rework

5.6.5.2.8. ~~**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.**~~

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

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

Justification:

- *The deleted subparagraph above is redundant with the second.*
- *the requirement that the LC must be completed is covered by the requirement of 5s for the LC completion*

~~**either – or ???**~~

5.6.5.2.9. **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.**

5.6.5.2.10. **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 ~~5.6.4.1.~~ 5.6.5.1. and ~~5.6.4.2.~~ 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.**

Justification: numbering to be updated

5.6.5.2.11. HMI requirements

5.6.5.2.11.1 **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/run cycle performed by the driver, 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.]**~~

Justification: the system is default-off, there is no need for a disclaimer.

(Remark: Language of the market shall be considered in the final version)

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

Note: to be considered with para 5.6.5.2.7.

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

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

5.6.5.2.11.x. **Unless otherwise specified, the optical signals described in 5.6.5.2.11 shall all be different from each other (e.g. different symbol, colour, blinking, text).**
(Remark: Should be considered when finalizing the document)

5.6.5.2.11.x. **When a lane change is aborted, the system shall clearly inform the driver by an optical warning signal and additionally by an acoustic or haptic warning signal**

Homework OICA: check, what is necessary to define with regard to hirarchie of the status and warning signals.

5.6.5.2.11.4. 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.

A manual deactivation of the direction indicator lamps shall stop the lane change procedure

Homework: J to check, whether there is a conflict with Regulation 48

Homework: D+J to rework and add the deactivation (considering 5.6.5.2.11.6.)

~~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.~~

5.6.5.2.11.5. 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 the initiation of the manoeuvre for a further period not exceeding [3/10] seconds to confirm the traffic condition specified in para. 5.6.5.2.12.4. In this case the system shall inform the status to the driver. If the manoeuvre has not begun within this [3/10] seconds the execution of the procedure shall be canceled.

Homework: D+J to rework an make a proposal for the […]

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

Homework: D+J to rework considering 5.6.5.1.7

5.6.5.2.12. Sensor requirements

5.6.5.2.12.1. ~~The vehicle with ACSF category [C1] 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 manoeuvre if a collision with a vehicle at the side or at the rear of the vehicle is imminent, and 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. 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.~~

~~EC Proposal:~~

~~The vehicle with ACSF category [C1] shall not carry out a lane change manoeuvre or shall abort an already started manoeuvre if an overtaking vehicle is within the safety distance defined under 5.6.5.2.12.2 and~~

~~5.6.5.2.12.3 . 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.~~

The Lane Change maneuver shall only be initiated if all the following safety criteria are met:

- **No vehicle detected with a TTC lower than [3,0s] in the intended adjacent lane, within the range defined in paragraph 5.6.5.1.12.5 (*sensor requirements – sensor range*)**
- **No vehicle closer than [12m] in the intended adjacent lane**

The system shall automatically abort the Lane Change Manoeuver if another vehicle in the intended adjacent lane violates the safety criteria mentioned above unless the front wheel closest to the intended adjacent lane has entirely crossed the lane marking.

The abortion may consist in stopping the maneuver or in driving back into the original lane.

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

~~5.6.5.2.12.2. The minimal distance to detect vehicles detection range to the rear (s_{Rear}) of the ACSF category [C1] system shall be calculated according to the following formula:~~

~~1) $s_{Rear} = [(\Delta v_{max})*(2.5+1)]$~~

~~*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 Avmax is less than 50 km/h, Avmax deems to be 50km/h.~~

Homework: OICA to check the minimum distance at low speed difference

Define safety range, Sensor range and cut off area (values).

How can it be ensured, that the sensor performance is not reduced below the minimum requirement?

Homework: CPs to check acceptable minimum safety distances

5.6.5.2.12.3. **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]**

Homework: OICA to check which percentage can be covered (including a sketch, which will be included in the regulation)

5.6.5.2.12.4. **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.**

5.6.5.2.12.5. ~~**In case the system does is not fulfill the requirement of paragraph 5.6.5.2.12.2. and 5.6.5.2.12.3, 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.**~~

5.6.5.2.12.5. **After each vehicle power-on performed by the driver, the ACSF CAT C function shall remain prevented from performing a lane change maneuver until the system has once detected an object at a distance above 48m.**

5.6.5.2.12.6. **The ACSF CAT C shall be able to detect blindness of the sensor (e.g due to accumulation of dirt, ice or snow). The ACSF C shall be prevented, upon detection of blindness, from performing a lane change maneuver. The status of the system shall be signaled to the driver not later than on the initiation of the lane change maneuver. The same warning as the one specified in paragraph 5.6.5.2.6. (*system failure warning*) may be used.**

5.6.5.2.12.7. **At the time of type approval the manufacturer shall provide a documentation package with pertinent 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 fulfillment of paragraph 5.6.5.2.12.2. and 5.6.5.2.12.3. of this regulation.**

5.6.5.2.12.8. **For the purpose of type approval, the ACSF-C shall be able to detect a vehicle of category M1 approaching from the rear on the adjacent lane at a distance of at least 63 m.**

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 ay_{smax} 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.]**

Homework: CITA to check which data are necessary

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

Homework: D to check, whether it is necessary to include requirements for market surveillance (not PTI)

3.5.1. Lane change functional test (Respecting also ay-requirements)

3.5.1.1 Overtaking test

3.5.1.2 Returning to the "old" lane

3.5.2. Abort of lane change test

[3.5.3. Blind spot test]

3.5.4 Overriding test

3.5.5 Deactivation test

3.5.6 Sensor performance test (L3-vehicle)

Homework: OICA to

- **prepare a document for 13th session for all tests**
- **Define sensor performance tests**
  - **"63"m under good conditions**
  - **Necessary also with a truck behind the "Ego-vehicle"?**
  - **"Cut OFF" or "deactivation" test (Remark: Currently unknown how to perform this test),**