

Draft Proposal for Category C requirements

Consolidated document (including homework) after the 13th session

(Text (neutral) was agreed by the delegates in the 13th session, text highlighted in yellow, is still tbd.)

OICA-CLEPA homework in Blue **This document is based on ACSF-13-16**

I.Proposal

Insert a new paragraph 2.4.13. ~~and~~ to 2.4.145., to read:

- 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 the following operations:
- 1. Activation of direction indicator lamps with a deliberate action of the driver**
 - 2. Lateral movement towards the lane boundary**
 - 3. Lane change manoeuvre**
 - 4. Resumption of the lane keeping function**
 - 5. Deactivation of direction indicator lamps**

JUSTIFICATION:

Item 4 and 5 are inverted, because 5.6.5.6.3 requires the resumption of B1 right after the end of the manoeuvre. Furthermore, 5.6.5.6.7 requires the direction indicator to flash throughout the whole period of the manoeuvre, and shall be deactivated no later than 0.5s after Resumption of ACSF of category B1.

- 2.4.14.** A ‘lane change procedure’ in case of Category C2 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 the following operations:
- 1. Activation of direction indicator lamps with a deliberate action of the driver**
 - 2. Deliberate action on the steering wheel by the driver to drift the vehicle towards the lane boundary.**
 - 3. Lane change manoeuvre**
 - 4. Resumption of the lane keeping function**
 - 5. Deactivation of direction indicator lamps**

JUSTIFICATION:

See document: [ACSF-14-xx - \(OICA-CLEPA\) - ACSF C2 - v4.PPTX](#)

- Philosophy, page 3
- Sensor comparison, page 4&5
- Blind spot, page 6&7
- Mode confusion, page 9&10

- 2.4.145.** A ‘lane change manoeuvre’ is deemed
- 1. 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 manoeuvred,**
 - 2. 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. A vehicle equipped with an ACSF Category [C1] shall also be equipped with an ACSF of Category B1 complying with the requirements of this regulation.

Reminder: Cat B2 could be added as alternative to B1, once defined.

5.6.5.2. Activation/deactivation of the ACSF Category [C1] system

5.6.5.2.1. 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.

5.6.5.2.2. 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 Category B1 may be used.

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

~~[Activation by the driver shall only be 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.]~~

~~[In the case of road section classification change from a road where Category [C1] use was permitted before, to a type of road where Category [C1] is [not/no longer] allowed, the system shall be switched off, as soon as the system has detected this]~~

It shall be technically ensured that the initiation of a lane change is only possible on a road section where pedestrians or cyclists are prohibited and which normally has a physical separation of traffic moving in opposite directions and which has at least two lanes for in the direction which the vehicle is driving. The use of navigation map data and/or road section recognition by on board sensors is deemed sufficient to fulfil the above requirement.

JUSTIFICATION:

The technical capabilities of on board sensors and map data are deemed sufficient to fulfil this requirement.

‘road sign recognition’ is changed to ‘road section recognition by on board sensors’ to ensure the regulation is technology neutral.

5.6.5.2.4. 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.

~~**5.6.5.2.5. Notwithstanding the requirements above it shall be possible to perform the corresponding tests in Annex 8 on a test track.**~~

JUSTIFICATION: it is up to the OEM to reach an agreement with the Type Approval authority on the way to test the vehicle.

5.6.5.3. Overriding

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 ~~[30/50]~~ N.

JUSTIFICATION: proposal is to keep the 50N. see industry specific document: [ACSF-14-xx - \(OICA-CLEPA\) - Bench Study - Overriding Force of 50N - v2.pptx](#)

~~The system may remain activated (standby mode) 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.~~

JUSTIFICATION:

Already required in section about system information data

5.6.5.4. Lateral acceleration

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.

5.6.5.5. HMI

5.6.5.5.1. Unless otherwise specified, the optical signals described in 5.6.5.5. shall all be different from each other (e.g. different symbol, colour, blinking, text).

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

5.6.5.5.3. ~~The system shall inform the driver after the deliberate action that the lane change procedure is on-going.~~

5.6.5.5.4. ~~The system shall inform the driver if the lane change manoeuvre is delayed, as defined in 5.6.5.6.5.~~

JUSTIFICATION:

Moved from section 5.6.5.6 (LC procedure) to section 5.6.5.5 (HMI) for consistency

5.6.5.5.3.5. When the lane change is aborted, in accordance with 5.6.5.6.8., 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 abortion is initiated by the driver, an optical warning is sufficient.

5.6.5.5.46. 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 signalled to the driver by an optical, and an acoustic or haptic warning.

JUSTIFICATION:

Optical always needed. Acoustic or haptic are two alternatives in addition to optical.

5.6.5.5.57. 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 set out for Category B1.

5.6.5.6. Lane change procedure

5.6.5.6.1 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.

5.6.5.6.2. ~~The lane change procedure shall start immediately after the manual activation by the driver of the direction indicator to the intended side for the lane change. The lane change procedure can only start by the deliberate action by the driver.~~

The lane change procedure shall only be initiated with a deliberate action of the driver to activate the direction indicator lamps.

JUSTIFICATION: Improves wording.

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

JUSTIFICATION: Paragraph moved from the bottom of 5.6.5.6. for chronological order of the lane change procedure requirements.

5.6.5.6.4. ~~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.

JUSTIFICATION: redundant text with 5.6.5.6.2 is deleted

5.6.5.6.5 ~~The system may delay initiation of the lane change manoeuvre for a period not exceeding [10] seconds after the deliberate action of the driver. to confirm the traffic condition specified in paragraph 5.6.5.2.12.4. This delay shall be indicated to the driver. In this case the system shall inform the status to the driver. If the manoeuvre has not begun with this [10] seconds the execution of the procedure shall be cancelled.]~~

JUSTIFICATION:

Reference to 5.6.5.2.12.4 is deleted. No added value as already covered by critical distance requirements below.

Requirement starting with “This delay...” is moved to HMI requirements.

Requirement starting with “In this case ...” is covered by paragraph 5.6.5.6.8. on abortion.

~~When the lane change procedure starts, the vehicle shall keep its lane until the lane change manoeuvre starts and the direction indicator lamps shall flash between 3 and 10s before the lane change manoeuvre can start.~~

JUSTIFICATION: now covered by 5.6.5.6.3

5.6.5.6.6. 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.

5.6.5.6.7. 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 Category B1 control as described in paragraph 5.6.5.6.3.

JUSTIFICATION: correction of the cross reference

~~5.6.5.6.8. [The lane change procedure shall be aborted at least when one of the following situation occurs:~~

~~the system detects an imminent critical situation (vehicles within the safety distance),~~

~~the system is overridden or switched off by the driver~~

~~the system reaches its boundaries (e.g. lane markings are not detected)~~

~~The system has detected, that the driver is not holding the steering control (If, at the start of the lane change manoeuvre the driver is not holding the steering control, the lane change shall be canceled),~~

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

~~the lane change manoeuvre has not begun within the [10] s of flashing of the direction indicator lamps.]~~

5.6.5.6.8. Aborting

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

- the system detects a critical situation (as defined in 5.6.5.7),
- the system is overridden or switched off by the driver,
- the system reaches its boundaries (e.g. lane markings are no longer detected)
- the system has detected that the driver is not holding the steering control at the start of the lane change manoeuvre,
- the direction indicator lamps are manually deactivated by the driver,
- the lane change manoeuvre has not begun within the [10] s of flashing of the direction indicator lamps.

5.6.5.6.8.2. Manual deactivation of the direction indicator lamps shall be possible for the driver at any time by using the manual control of the direction indicator.

~~5.6.5.7. Safety distance requirements~~

~~5.6.5.7.1. 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 critical distance to the rear ($S_{Cd_{rear}}$) and the safety distance to the left and to the right (side). 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.~~

~~5.6.5.7.2. The safety distance to the rear ($S_{d_{rear}}$) of the ACSF Category [C1] system shall be calculated according to the following formula:~~

~~t *ibid.* Delegates prefer a dynamic formula reflecting ΔV t~~

5.6.5.7. Critical situation

The vehicle with ACSF Category [C1] shall abort a lane change procedure either if another vehicle is detected in the lane that the driver intends to move into, and has a time to collision of less than [3.5] seconds or if the distance to the rear to the other vehicle is less than 15m both measured at the time the lane change manoeuvre starts.

JUSTIFICATION:

The first sentence of 5.6.5.7.1 is proposed to be changed as above, to define what the critical situation is:

- With a sensor range of 55m, a TTC of 3.5s at the time the lane change manoeuvre starts implies a minimum operational speed equal to 73 km/h.
- The 15m is taken from EC proposal in document ACSF-13-09.
- The 3.5s TTC is taken from D+J proposal in ACSF-12-03 and EC proposal in ACSF-13-09.
- See industry document [ACSF-14-xx - \(OICA-CLEPA\) - Sensor range and critical situation - v6.pptx](#)

The second sentence of 5.6.5.7.1 (starting with “in both cases...”) is covered in HMI requirements.

No need for a formula, a fixed value is simpler to use.

5.6.5.8. Sensor requirements

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

~~[tbd. Delegates prefer a dynamic formula reflecting ΔV]~~

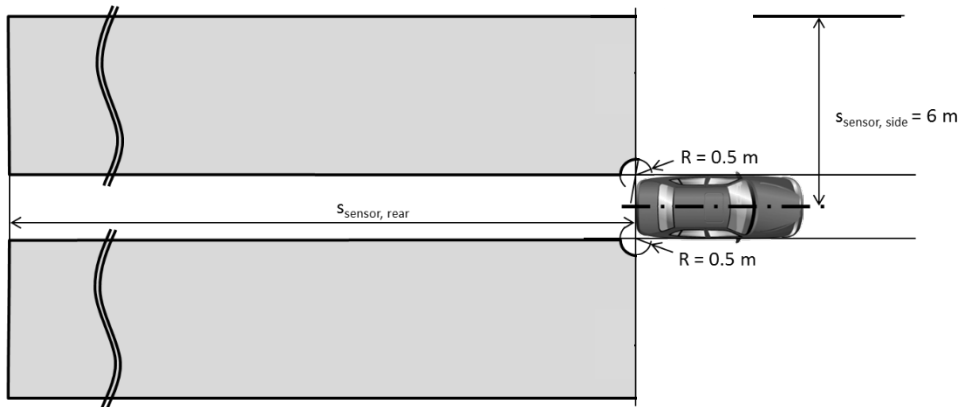
The ACSF Category [C1] shall be able to detect vehicles approaching from the rear in an adjacent lane up to a distance as specified below:

- 63m for a regular high volume series production passenger car of category M1 AA saloon,
- 55m for a regular high volume series production vehicle of category L3, **other than sub-category L3-A1.**

JUSTIFICATION: See ACSF-13-15

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

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



1 Figure Minimum detection area

†

5.6.5.2.12.5.8.3 After each vehicle new engine start/run cycle performed by the driver, the ACSF Category [C1] function shall be prevented from performing a lane change maneuver until the system has detected, at least once, a moving object at a distance greater than [x] m.

5.6.5.2.12.6.8.4 The ACSF Category [C1] shall be able to detect blindness of the sensor (e.g. due to accumulation of dirt, ice or snow). The ACSF Category [C1] shall be prevented, upon detection of blindness, from performing the lane change ~~maneuver~~ procedure. The status of the system shall be signalled to the driver ~~no later than on the initiation of the lane change maneuver~~. The same warning as the one specified in paragraph 5.6.5.2.6.5.5.6. (system failure warning) may be used.

5.6.5.9. System information data

5.6.5.9.1. 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.

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

Homework D to propose new wording

Comment: a_{ysmax} and the table of paragraph 5.6.2.1.3 are irrelevant for cat C.

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

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

5.6.5.9.1.3.1. The strategy after the abortion has been initiated.

~~**5.6.5.9.1.4. 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.**~~

JUSTIFICATION:

Already covered by paragraph 5.5.2 on PTI.

Proposals from CS&OTA TF are expected. No need for interim solutions.

~~**5.6.5.9.1.5. Documentation about which system software version related ACSF performance is valid. This documentation shall be updated whenever a software version was amended.**~~

JUSTIFICATION:

Already covered by Annex 6, paragraph 3.3.5 "identification of units".

Proposals from CS&OTA TF are expected. No need for interim solutions.

5.6.5.9.1.6 [Documentation 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 fulfilment of paragraph [5.6.5.2.12.28.3]. and [5.6.5.2.12.3.8.4.] of this regulation.]

5.6.5.10. The vehicle with ACSF 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.]

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

JUSTIFICATION:

See document ACSF-14-xx - (OICA-CLEPA) - Presentation of ACSF C Tests - v2.pptx

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~~

3.5.1.1. The test vehicle shall be driven with an activated ACSF C1 (stand-by mode) within the left lane of a straight track that has at least two lanes with road markings on each side of the lane.

A lane change to the adjacent lane shall then be commanded by the driver (as defined in 5.6.5.6.2. of this Regulation).

The lateral acceleration and the lateral jerk shall be recorded during the test.

3.5.1.2. The requirements of the test are fulfilled if:

- the lane change manoeuvre is completed,
- the recorded lateral acceleration does not exceed 1m/s^2 ,
- the moving average over half a second of the lateral jerk does not exceed 5 m/s^3 ,
- the measured time between the start of the first flashing and the start of the lane change manoeuvre is not less than 3s,
- The system provides an information to the driver to indicate the lane change procedure is on-going,
- the lane change manoeuvre is completed in less than 5s for M1 N1 vehicle categories and less than 10s for M2 M3 N2 N3 vehicle categories,
- ACSF B1 automatically resumes after the lane change procedure is completed, and
- The direction indicator is deactivated not before the end of the Lane Change Manoeuvre and no later than 0.5s after B1 has resumed.

3.5.1.3 The test specified in 3.5.1.1 shall be repeated with a lane change to the right lane.

3.5.2. Abort of lane change procedure test (~~similar FU2?~~)

3.5.2.1. The test vehicle shall be driven with an activated ACSF C1 (stand-by mode) within either of the lanes of a straight track that has at least two lanes with road markings on each side of the lane.

Another vehicle shall be driven in the adjacent lane, with same speed, within the critical distance defined in paragraph 5.6.5.7. of this regulation. A regular high volume series production passenger car of category M1 AA saloon shall be used.

A lane change shall then be commanded by the driver.

3.5.2.2. The requirements of the test are fulfilled if:

The lane change procedure does not start, or

The lane change procedure starts, the lane change manoeuvre is not performed and the lane change procedure is cancelled no later than [10s] after the deliberate action of the driver, as specified in paragraph 5.6.5.6.5. of this Regulation. The system informs the driver that the lane change manoeuvre is delayed, as specified in 5.6.5.5.4.

3.5.3. Overriding test

3.5.3.1. The test vehicle shall be driven with an activated ACSF C1 (stand-by mode) within either of the lanes of a straight track that has at least two lanes with road markings on each side of the lane.

A lane change shall then be commanded by the driver.

The steering shall firmly be maintained in the straight direction.

The force applied by the driver on the steering control during the overriding manoeuvre shall be recorded.

3.5.3.2. The test requirements are fulfilled if the force applied by the driver on the steering control to override the intervention does not exceed 50 N, as specified in 5.6.5.3.

3.5.4. Deactivation test

3.5.4.1. The test vehicle shall be driven with an activated ACSF C1 (stand-by mode) within either of the lanes of a straight track that has at least two lanes with road markings on each side of the lane.

A lane change shall then be commanded by the driver.

No later than 3s after the lane change procedure has started, the driver shall deactivate the direction indicator, as specified in paragraph 5.6.5.6.8. of this Regulation.

3.5.4.2. The requirements of the test are fulfilled if the lane change procedure is aborted.

3.5.5. Sensor performance test (~~L3-vehicle~~)

3.5.5.1 The vehicle manufacturer shall provide a method to determine when the system detects the rear coming vehicle.

The test shall be performed on a test track with at least two lanes with road markings at each side of the lane.

The test vehicle shall be driven with an activated ACSF C1 (stand-by mode) within either of the lanes of a straight track that has at least two lanes with road markings on each side of the lane.

Another vehicle shall approach from the rear on the adjacent lane, with a differential speed [between 10 and 50km/h], but with an absolute speed no greater than 130km/h.

The approaching vehicle shall be a regular high volume series production passenger car of category M1 AA saloon. The identification characteristics of the approaching vehicle shall be agreed upon between the Technical Service and the vehicle manufacturer.

The distance between the two vehicles shall be measured (e.g. with a differential GPS).

3.5.5.2. The requirements of the test are fulfilled if the system detects the approaching vehicle latest at a distance of 63m, as specified in 5.6.5.8.1., between the rear end of the test vehicle and the front end of the approaching vehicle.

3.5.5.3. The test above shall be repeated with a vehicle of category L3, **other than sub-category L3-A1**. The identification characteristics of the approaching vehicle shall be agreed upon between the Technical Service and the vehicle manufacturer.

The requirements of the test are fulfilled if the system detects the approaching vehicle latest at a distance of 55m, as specified in 5.6.5.8.1., between the rear end of the test vehicle and the front end of the approaching vehicle.

3.5.6 Sensor blindness test

3.5.6.1. The test vehicle shall be driven with an activated ACSF C1 (stand-by mode) within either of the lanes of a straight track that has at least two lanes with road markings on each side of the lane.

The rear sensor(s) shall be made blind, with a means specified by the vehicle manufacturer and agreed with the Technical Services.

Once the system has detected the sensor blindness, a lane change shall be commanded by the driver.

3.5.6.2. The requirements of the test are fulfilled if the system detects the sensor blindness, provides a warning to the driver as defined in 5.6.5.8.4. and is prevented from performing the lane change procedure.

3.5.7.2 “engine start/run cycle test”

The test is divided in 3 phases as specified below.

3.5.7.1. Phase 1

3.5.7.1.1. Following a new engine start /run cycle performed by the driver, the test vehicle shall be driven within either of the lanes of a straight track that has at least two lanes with road markings on each side of the lane, at a test speed higher than V_{min} and lower than V_{max} .

A lane change shall then be commanded by the driver.

3.5.7.1.2. The requirements of the test phase 1 are fulfilled if the lane change procedure is not initiated, as the precondition (i.e. default off) defined in 5.6.5.2.1. is not fulfilled.

3.4.7.2. Phase 2

3.5.7.2.1. Following the completion of the test phase 1, the ACSF C shall be manually activated (standby mode).

The test vehicle shall be driven with an activated ACSF C1 (stand-by mode) within either of the lanes of a straight track that has at least two lanes with road markings on each side of the lane.

A lane change shall then be commanded by the driver.

3.5.7.2.2. The requirements of the test phase 2 are fulfilled if the lane change procedure is not initiated, as the pre-condition specified in 5.6.5.8.3. is not fulfilled.

3.5.7.3. Phase 3

3.5.7.3.1. Another vehicle shall approach from the rear of the adjacent lane, with a differential speed [between 10 and 50km/h], but with an absolute speed no greater than 130km/h.

The approaching vehicle shall be a regular high volume series production passenger car of category M1 AA saloon.

The distance between the two vehicles shall be measured (e.g. with a differential GPS).

After the rear coming vehicle has entirely passed the vehicle under test, a lane change shall be commanded by the driver.

3.5.7.3.2. The requirements of the test phase 3 are fulfilled if the lane change manoeuvre is executed, provided the distance between the rear end of the test vehicle and the front end of the approaching vehicle, at the time the system has detected the rear coming vehicle, is greater than [x m].

3.5.8 Tests for ACSF Category [C2] Systems

To be defined once C2 requirements will be agreed.