

Submitted by France

Informal Document: **ACSF-04-03**

Proposal based on ACSF-03-16

Proposal for amendments to Regulation No. 79 to include ACSF > 10 km/h

The modifications ~~to the Regulation~~ are marked in bold and strikethrough red characters.

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French comments: The aim of the R79 is to approve the steering function and the systems considered as lateral support. Thus in this viewpoint the current regulation should only include provisions relative to the lateral movement independently of any other automated driver support. If the involved systems are combined with these other automated systems, for example systems acting on speed, on brakes or using rearview vision, these systems must be type approved as combined systems fulfilling the requirements of new independent regulations based on each use case.

Do we need to regulate the automated rearview function in regulation R 46?

Do we need to regulate the forward automated braking function in regulation R 131?

Do we need to regulate the rearward automated braking function in a regulation (park assist)?

We have tried to separate in the document requirements linked only to lateral support system which could stay in regulation R79 and those which should be inserted in new regulations based on use cases (identified by [1]).

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Amend paragraph 2.3.4.1. to read:

2.3.4.1. "Automatically commanded steering function" (ACSF) means the function within a complex electronic control system where actuation of the steering system can result from automatic evaluation of signals initiated on-board the vehicle, possibly in conjunction with passive infrastructure features, to generate continuous control action in order to assist the driver ~~in following a particular path, in low speed manoeuvring or parking operations.~~ **in lateral support.**

2.3.4.1.1. Category A ACSF means, a function that operates at a speed no greater than 10 km/h to assist the driver, on demand, in low speed **lateral** manoeuvring ~~or parking operations.~~

Comments: Parking assistance could be split at least in two categories:

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- With longitudinal management by the driver (could stay in R79)

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- With automated longitudinal management (must be considered as a combined system)

2.3.4.1.2. [~~“ACSF~~ Category B ~~ACSF~~ means a function which is initiated/activated by the driver and which keeps the vehicle within its lane by influencing the lateral movement of the vehicle.]

[2.3.4.1.3. Category C ACSF means, a function which can perform a single lateral manoeuver (e.g. lane change) when commanded by the driver.

2.3.4.1.4. Category D ACSF means, a function which can indicate the possibility of a single lateral manoeuvre (e.g. lane change) but performs that function only following a confirmation by the driver.

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2.3.4.1.5. Category E ACSF means, a function which is [initiated/activated] by the driver and which can continuously determine the possibility of ~~a lateral manoeuvres~~ (e.g. lane changes) and complete these manoeuvres for extended periods without further driver command/confirmation.]

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Rem: (F) intend to delete “manoeuvre” and replace it by “lane change” (Cat C, D, E)

Insert new paragraph 2.4.8. to read

2.4.8. For Automatically commanded steering functions

[2.4.8.1 ~~“Motorway Multi lane, one way” means, a road section, dedicated exclusively to motor vehicles, having [a speed limit of more than 100 km/h and]~~ at least two traffic lanes for ~~the each~~ direction of travel and having a physical separation of traffic moving in opposite directions.]

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Comments: Traffic rules can not be included in a technical regulation for vehicles.

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2.4.8.2 “Lane” means one of the longitudinal strips into which a roadway is divided.

2.4.8.3 “Visible Lane markings” means delineators intentionally placed on the borderline of the lane that are directly visible by the driver while driving (e.g. not covered by snow, etc.).

2.4.8.4 “Lead vehicle” means a vehicle driving in front of the vehicle equipped with ACSF.

2.4.8.5 “Lane change manoeuvre” means a manoeuvre in which the vehicle changes from its initial lane to an adjacent lane

2.4.8.6 “Specified maximum speed V_{smax} ” means the maximum speed up to which an ACSF is designed to work.

2.4.8.7 “Specified minimum speed V_{smin} ” means the minimum speed up to which an ACSF is designed to work.

- 2.4.8.8 **"Transition demand "** means an instruction from the ACSF they have to take over manual control of the steering task again.
- 2.4.8.9 **"Transition procedure"** means the sequence of providing a transition demand by the system, taking over manual steering control by the driver and deactivation of the ACSF.
- [2.4.8.10 **"Conditions for safe operation"** mean all circumstances like traffic situation, road category, quality of lane markings, vehicle speed, curvature of the road, lighting, sensor capabilities etc. specified by the vehicle manufacturer that have to be fulfilled when an ACSF shall be able to be activated by a driver.] (put it in the requirements? ***No, but mandatory both in the owner's manual and in the type approval technical file***)
- [2.4.8.11 **"System boundaries"** mean all circumstances from which on the conditions for safe operation are not fulfilled anymore, that cannot be dealt with by an activated ACSF anymore and thus request a take-over of manual steering control by the driver.
- Comments: Do we need to require minimum conditions (curvatures, type of lane markings, ...) to type approve an ACSF?***
- 2.4.8.12 **"ACSF status"** means any distinct operational mode of the ACSF like "switched off" "switched on", "available to be activated", "activated" etc.
- 2.4.8.13 **"Driver recognition [system/function]"** means a function able to assess driver's physical availability to respond to a transition demand from an ACSF system, based e.g. on the monitoring of driver activity, presence in driver's seat etc.
- 2.4.8.14 **"Minimum risk manoeuvre"** means a procedure to reach a **safeguard** status with as little risk as possible in the given traffic situation, when the driver fails to respond to the takeover demand.
- 2.4.8.15 **"Emergency Manoeuvre"** is a manoeuvre performed by the system in case of a sudden unexpected event in which the vehicle is in imminent danger to collide with another object, in order to avoid or mitigate a collision.]

Rem: all definitions have to be reviewed, when the requirements have been finalized.

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Amend paragraph 5.1.6.1. to read:

5.1.6.1. Whenever ~~the an~~ Automatically Commanded Steering function **becomes operational**, this shall be indicated to the driver. ~~and the control action shall be automatically disabled if the vehicle speed exceeds the set limit of 10 km/h by more than 20 per cent or the signals to be evaluated are no longer being received.~~ Any termination of control shall produce a ~~short but distinctive driver warning in accordance with the requirements of paragraph 5.4.3. by a visual signal and either an acoustic signal or by imposing a tactile warning signal on the steering control.~~

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Comments; Becomes operational: Does it mean "ready to act"?

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Insert new paragraph 5.4.3. Renumber paragraph 5.4.3. as 5.4.4.

5.4.3. Special Warning Provisions for Automatically Commanded Steering Functions

5.4.3.1 Any termination of control other than in 5.4.3.2 or a transition demand (acc. to 5.6.1.5) shall produce a distinctive driver warning by a [yellow or red] visual signal and either an acoustic signal or by imposing a haptic warning signal. This warning shall be provided before the system (function) becomes in-operational, if the termination is not intended by the driver. If the driver does not take over manual control the warning shall be escalating with time in terms of enlarging the intensity of the warning and/or in terms of adding and/or changing the warning means.

5.4.3.2. Any sudden termination of control caused by a failure of the system physical or functional failure shall produce immediately a distinctive driver warning by a [red] visual signal and either an acoustic signal that shall remain operational until the driver has resumed control.

Insert new paragraph 5.6

5.6 Special Provisions for Automatically Commanded Steering Functions

5.6.1. Special Provisions for **Category E** ACSF

5.6.1.1. General

Marker for 130 km/h

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5.6.1.1.1. The system shall be active (deliver automatic steering) only after a deliberate action of the driver ~~when and if the conditions for safe operation of the system are~~ **is** ~~fulfilled available to be activated (all associated functions – e.g. brakes, accelerator, steering, camera/radar/lidar etc. are working proper).~~

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5.6.1.1.2. The vehicle shall be equipped with a means for the driver to activate and deactivate ~~the system~~. The deactivation shall be possible at any time.

5.6.1.1.3. If the driver is steering manually, ACSF shall be deactivated automatically.

Comments: What means "steering manually" (Torque, angular speed, ...)?

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5.6.1.1.4. The system shall not induce in normal driving situations a lateral acceleration of more than 3 m/s².

5.6.1.1.5. The system shall **may** comprise an ~~attentiveness ??~~ driver recognition system that is active whenever the system is active.
Rem: Minimum requirements tbd.

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5.6.1.1.6. The activated system shall at any time control the lateral movements of the vehicle in such a way that the vehicle does not induce any safety critical situations and that the lateral movements of the vehicle is clear to other road users.

5.6.1.1.7. The system shall at any time give a noticeable and distinctive signalization to the driver about the system status. This signalization shall be at least a visual signal. Any change in system status shall be indicated by an optical and [, if not initiated by the driver,] either an acoustic or haptic signal.

5.6.1.2. Operation of ACSF

5.6.1.2.1. Any lane change manoeuvre shall be initiated only if:

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- the vehicle is travelling on a multi lane one way motorway as defined in paragraph 2.4.8. and

- any traffic that can affect the safe manoeuvre shall be identified by equipment installed on the vehicle and
- the vehicle equipment can analyze speed and distance of the identified traffic to ensure a safe manoeuvre (e.g. does not cause a deviation to the flow or direction of other traffic).

to perform lane changes through monitoring the surrounding, road traffic situation etc.]

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5.6.1.2.2. If a lane change manoeuvre is carried out, the correspondent direction indicator lamps shall be ~~manually automatically~~ **or automatically activated** minimum [3s] prior to the steering operation.

5.6.1.2.3. The lane change manoeuvre shall be completed, except] the system detects an imminent critical situation [or] the system is overridden by the driver].

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5.6.1.2.4. The activated system shall at any time ensure a safe lateral distance to other road users. The vehicle manufacturer shall provide documentation about how such a safe distance is achieved to the technical service.

5.6.1.2.5. If the activated ACSF detects that due to a sudden unexpected event the vehicle is in imminent danger to collide with another road user and that the time for a safe transition procedure is too short, an emergency manoeuvre shall be carried out (e.g. by braking the vehicle).]

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5.6.1.2.6. [If the attention recognition system **if fitted** detects that the driver is inattentive, it shall give a warning to restore attentiveness again. The manufacturer shall provide information to the technical service how the attention recognition systems detects inattentiveness of the driver.]

5.6.1.3. System information data

5.6.1.3.1. 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

5.6.1.3.1.1. The values for V_{smax} and V_{smin} .

5.6.1.3.1.2. The conditions under which the system can be activated, i. e. when the conditions for safe operation of the system are fulfilled.

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5.6.1.3.1.3. Information about system boundaries at which the activated system shall issue a transition demand.

5.6.1.3.1.4. The specific values for time intervals acc. to 5.6.1.5.2 which are foreseen for safe transition to manual steering under different circumstances.

5.6.1.3.1.5. Documentation about the chosen strategies regarding the minimum risk manoeuvre which is foreseen depending on the given traffic situation.

5.6.1.3.1.6. Documentation about the chosen strategies regarding the emergency manoeuvre which is foreseen in different sudden critical events.

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5.6.1.4. Transition demand

5.6.1.4.1. If the system detects that its boundaries are reached or will be reached shortly or in case of a system failure it shall provide a transition demand.

5.6.1.4.2. The timing of the transition demand shall be such that sufficient time is provided for a safe transition to manual steering.

5.6.1.4.3. If the speed of the vehicle with activated ACSF exceeds v_{smax} a transition demand shall be given.

5.6.1.4.4. If the vehicle reaches a lateral acceleration of more than 3 m/s^2 a transition demand shall be given.

5.6.1.4.5. If an attention recognition system detects the driver to be inattentive although a warning to restore attentiveness was provided to the driver a transition demand shall be given.

5.6.1.4.6. The system shall provide a transition demand if the driver's seatbelt is unfastened and/or if the driver's seat is left by the driver.

5.6.1.4.7. The transition demand shall be provided by a [yellow] visual signal and either an acoustic signal or by imposing a haptic warning signal.

5.6.1.5. Minimum Risk Manoeuvre

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5.6.1.5.1. If the system detects that after a transition demand the driver does not take over manual control of the steering again the vehicle shall carry out a minimum risk manoeuvre.

5.6.1.3.1.5. Documentation about the chosen strategies regarding the minimum risk manoeuvre which is foreseen depending on the given traffic situation.

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5.6.2. Special Provisions for ACSF of Category D

- to be developed based on the requirements for a Category 5 system-

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5.6.3. Special Provisions for ACSF of Category C

- to be developed based on the requirements for a Category 5 system-

5.6.4. Special Provisions for ACSF of Category B

- to be developed based on the requirements for a Category 5 system-

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5.6.5. Special Provisions for ACSF of Category A

- to be developed based on the requirements for a Category 5 system-

Insert new Annex 7

Annex 7

Text requirements for automatically commanded steering functions

1. General Provisions

Vehicles fitted with ACSF shall fulfill the tests requirements of this annex according to the corresponding category of ACSF specified in Table 1.

2. Test conditions

2.1. The test shall be performed on [a flat,] dry asphalt or concrete surface delivering good adhesion. The ambient temperature shall be between 0° C and 45° C.

2.2. Lane markings

The lane markings and the width of the lane used in the tests shall be those of one of the Contracting Parties, with the markings being in good condition and of a material conforming to the standard for visible lane markings of that Contracting Party. The lane marking layout used for the testing shall be recorded.

The test shall be performed under visibility conditions that allow safe driving at the required test speed.

2.3 Lead vehicle

The lead vehicle shall be a high volume series production passenger car of category M1 AA saloon or in the case of a soft target an object representative of such a vehicle in terms of its detection characteristics. A soft target is a target that will suffer minimum damage and cause minimum damage to the subject vehicle in the event of a collision.

2.4 Motorcycle Target (L3)

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A two-wheeled vehicle with an engine cylinder capacity in the case of a thermic engine exceeding 50 cm³ or whatever the means of propulsion a maximum design speed exceeding 50 km/h.

3. Tests

Table 1 specifies which tests have to be fulfilled by each ASCF category.

Test \ ASCF category	A1	B2	3-C	[4D & E]
FU1 lane keeping test				X
FU2 lane change test				X
TR1 tight curve				X
TR2 missing lane marking				X
EM1 braking behind lead vehicle				X
EM2 braking behind motorcycle				X

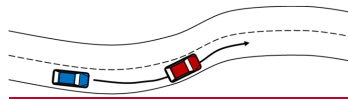
Table 1

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3.1. Functionality Tests

3.1.1. Functionality Test 1 (FU1)



Formatiert: Zentriert

Drive the vehicle with activated ACSF at least 5 min on a track with various curvatures with road markings at each side of the lane at various speeds up to v_{smax} and down to v_{smin} . The usage of a lead vehicle is optional. If a lead vehicle is used ~~and the time gap is not selected by the system,~~ the vehicle shall drive between [2 s] and [3 s] behind the lead vehicle except if the time gap is selected by the system. The lead vehicle shall drive within the lane markings. The speed of the lead vehicle shall be selected such that the lateral acceleration is not more than 1 m/s².

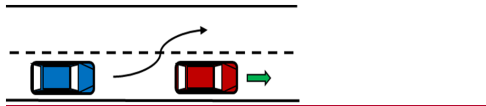
The requirements of the test are fulfilled if the vehicle does not cross any lane marking.

Comments: What happens when the lead vehicle leaves the lane markings?

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3.1.1 bis. Functionality Test 1 bis (FU1 bis)

To check only the lane change with or without a lead vehicle.

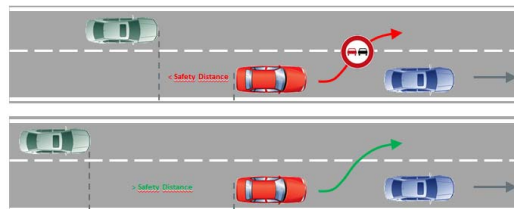


To be confirmed

Formatiert: Zentriert

3.1.2. Functionality Test 2 (FU2)

New test t.b.d. by OICA



Drive the red vehicle with activated ACSF at least 1 min on a track with road markings at each side of the lane where ACSF can be activated with a speed of [30 km/h] below v_{smax} or at v_{smin} , whatever is higher. In front of the red vehicle drives the blue vehicle with the same speed. To the same time the green vehicle is driving with the same speed as the other vehicles on the adjacent lane. The time gap between the "green" vehicle and the red vehicle should be 1s.

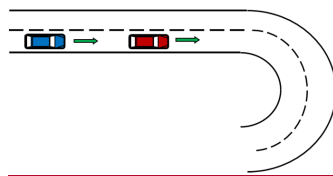
The driver in the red vehicle shall increase the set speed for the ACSF-system by [20 km/h].

Nevertheless the red vehicle should not perform the lane change manoeuvre, because of the short safety distance to the green vehicle.

After at least 1 min of driving, the green vehicle shall reduce the speed by [5 km/h]. In consequence the distance to the red vehicle will increase. The distance/time gap between the green and the red vehicle shall be recorded at that time, when the red vehicle starts the lane change manoeuvre. (Alternatively, the distance between green and red car could be increased stepwise, until the red car is able to start the lane change manoeuvre).

3.2. Transition Tests

3.2.1 Transition Test 1 (TR1)



Drive the vehicle with activated ACSF [at least 1 min] on a track with road markings at each side of the lane at a speed of 10 km/h below v_{smax} . The usage of a lead vehicle is optional. If a lead vehicle is used ~~and the time gap is not selected by the system,~~ the vehicle shall drive between [2 s] and [3 s] behind the lead vehicle except if the time gap is selected by the system. The lead vehicle shall drive within the lane markings. After a straight section of at

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least 200 m the vehicle shall enter a curve of more than 90° that demands a lateral vehicle acceleration of more than 3 m/s². The test driver of the vehicle shall not take over manual steering control again until the minimum risk maneuver is finished.

The requirements of the test are fulfilled if the transition demand was given at least when the lateral acceleration exceeds [3] m/s² and the minimum risk manoeuvre as specified by the manufacturer was initiated. The vehicle shall not cross any lane marking before the minimum risk manoeuvre was initiated.

Comments:

Left and right curvatures ?

Use of the formula V^2/R possible ?

1' at 120km/h represents 2 km

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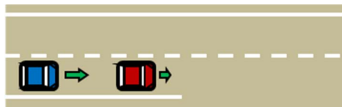
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3.2.2. Transition Test 2 (TR2)



Formatiert: Zentriert

Drive the vehicle with activated ACSF [at least 1 min] on a track with road markings at each side of the lane at a speed of 10 km/h below v_{smax} . The usage of a lead vehicle is optional. If a lead vehicle is used and if the time gap is not selected by the system, the vehicle shall drive between [2 s] and [3 s] behind the lead vehicle except if the time gap is selected by the system. The lead vehicle shall drive within the lane markings. After a straight section of at least 200 m the vehicle shall approach a section with a length of 200 m with only one lane marking at the driver's side. The test driver of the vehicle shall not take over manual steering control again.

The requirements of the test are fulfilled if:

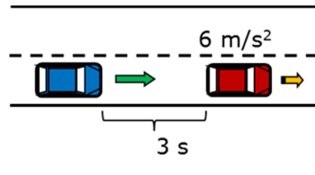
- the vehicle is following the initial path for the complete section with missing lane marking without crossing the lane marking, or
- the transition demand is given before the vehicle is entering the section with missing lane markings and the vehicle shall follow the initial path without crossing the lane marking for at least [5] seconds after the transition demand. If the driver does not take over the driving task, a minimum risk manoeuvre as specified by the manufacturer is initiated.

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3.3. Emergency Tests

3.3.1 Emergency Test 1 (EM1)

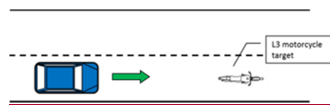


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Drive the vehicle with activated ACSF at least 1 min behind a lead vehicle. If the time gap is not selected by the system, the vehicle shall drive at a gap of 3 s behind the lead vehicle. The lead vehicle shall drive within the lane markings on a track with road markings at each side of the lane at a speed 10 km/h below v_{max} . Then the lead vehicle decelerates with 6 m/s^2 and with a mean brake jerk of 6 m/s^3 in the first second of braking. The requirements of the test are fulfilled if the vehicle does not collide with the lead vehicle.

3.3.2. Emergency Test 2 (EM2)



Formatiert: Zentriert

Drive the vehicle with activated ACSF at least 1 min on a track with road markings at each side of the lane at a speed 10 km/h below v_{max} . The vehicle shall approach a stationary motorcycle Target (L3) target being placed in the center of the lane. The requirements of the test are fulfilled if the vehicle does not collide with the motorcycle Target (L3) target.

The Test is not applicable for systems which are not able to follow the lane without a lead vehicle.

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