



ACSF-06-05

What's new with regard to Cat E? Proposals and additional ideas to be discussed

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Normal Operation Conditions

"Normal operating conditions" mean that the ACSF system is active and does neither carry out a transition procedure nor a Minimal Risk Manoeuvre nor an Emergency Manoeuvre.

Defined in order to clarify that the values V_{smax} , V_{smin} and ay_{smax} only describe the system boundaries under normal conditions but can be overcut or undercut in other situations



PTI

5.5.2 In the case of an ACSF system it shall be possible to confirm the valid software version of the system via the use of an electronic communication interface.

And additional system information data with regard to PTI:

5.6.1.3.1.8 Information about how the failure warning signal status and the confirmation of the valid software version can be checked via the use of an electronic communication interface.

5.6.1.3.1.9 Documentation about which system software version is valid. This documentation shall be updated whenever a software version was amended.



“Handbook”

5.6. Information about the transition procedure and the consequences of delayed or omitted take over of the steering shall be provided to the users of the vehicle.

“Override”

5.6.1.1.3. Steering by the driver shall override steering by the system. Braking or accelerating by the driver shall override speed selection by the system or initiate a transition demand.



Inducing accelerations (into others)

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

(this § was redundant with § 5.6.1.1.5.)

For discussion see also U.K. proposal ACSF-06-03:

“...any traffic identified by this equipment will not collide with the vehicle or be forced to slow down or deviate from its path”



Direction indicators

Current wording:

- 5.6.1.2.2. If a lane change manoeuvre is carried out, the correspondent direction indicator lamps shall be automatically activated minimum 3 s
- a) prior to the ~~steering operation~~ start of the lane change manoeuvre or
 - b) prior the vehicle has touched the lane markings

Possible solution

additional idea

5.6.1.2.2. If a lane change manoeuvre is carried out, the correspondent direction indicator lamps shall automatically flash minimum 3 times prior 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.

For comparison R 130 wording: "The LDWS shall provide the lane departure warning indication mentioned in paragraph 5.4.1. above at the latest when the outside of the tyre of the vehicle's front wheel closest to the lane markings crosses a line 0.3 m beyond the outside edge of the visible lane marking to which the vehicle is being drifted."



Seatbelt unfastened (unintended use)

5.6.1.2.5. The system shall detect if the driver's seatbelt is unfastened. When the driver's seatbelt is detected to be unfastened a transition demand shall be initiated according to 5.6.1.4.4.

Introduced to have a requirement for the TR3 test.

But could as well be included in 5.6.1.2.6. “Driver availability recognition system” (possible solution see next slides)



Driver availability recognition system

5.6.1.2.6. Driver availability recognition system

The system shall comprise a driver availability recognition system that is active whenever the ACSF system is active.

The driver availability recognition system shall detect that the seatbelt is fastened and that the driver is present in the driver seat and that he is available to take over the steering.

In the subparagraphs there is now for clarification issues a separation between presence, (seatbelt) and availability



Driver availability recognition system

5.6.1.2.6.1. Driver not present in the driver seat

When the driver is not present in the driver seat the system shall provide a distinctive warning until the driver is detected to be back in the driver seat or until a transition demand is initiated.

When the driver is not back in the driver seat during the distinctive warning with a max. duration of [15 s] a transition demand shall be initiated according to 5.6.1.4.3.



Driver availability recognition system

- 5.6.1.2.6.2. Driver not available to take over the steering**
The system shall check if the driver is available to take over the steering by permanently evaluating driver's activity. The means to detect driver's activity [(e.g. head and/or eye movement and/or input to any control element of the vehicle)] shall be selected by the manufacturer.
When the driver does not show any activity for a time span of maximum [15] min ~~When the driver is not available~~ the system shall provide a distinctive warning until appropriate actions of the driver are detected (e.g. the driver resumes manual control) or until a transition demand is initiated.
When the system does not detect appropriate actions from the driver during the distinctive warning with a max. duration of [15 s] a transition demand shall be initiated according to 5.6.1.4.3.



Driver availability recognition system

additional idea

5.6.1.2.6.1.x Seatbelt unfastened

When the seatbelt is unfastened the system shall provide a distinctive warning until the seatbelt is fastened or until a transition demand is initiated.

When the seatbelt is not fastened during the distinctive warning with a max. duration of [15 s] a transition demand shall be initiated according to 5.6.1.4.3.



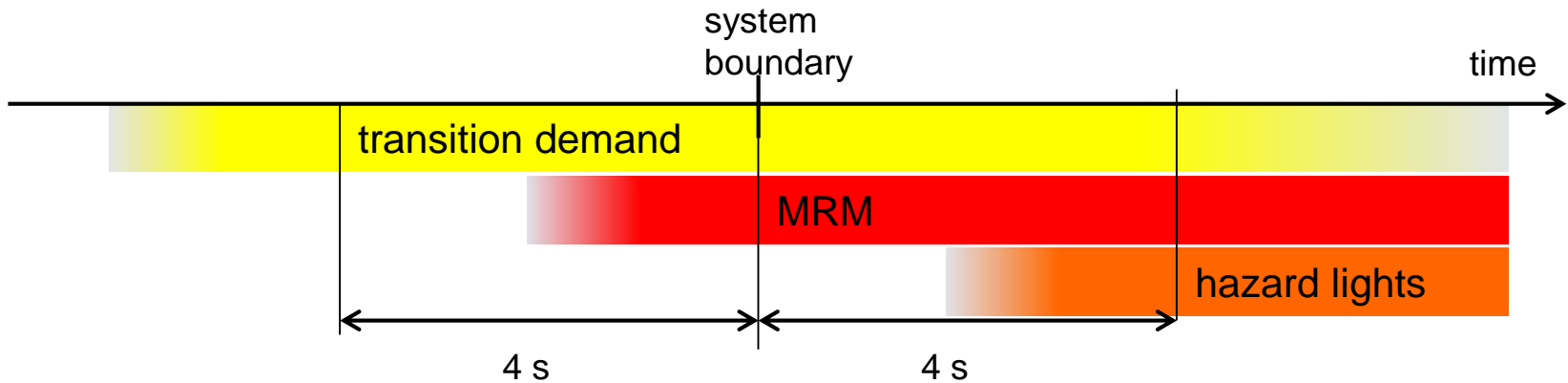
System information data for driver availability recognition system

5.6.1.3.1.7 Information about **how** the driver availability recognition system:

- **how it detects the presence of the driver in the seat and**
- **how it detects driver availability to take over the steering and**
- **how it evaluates driver's activity and**
- **how it detects appropriate driver activities after a distinctive warning**

Transition procedure

Normal operating conditions (forseeable system boundary)



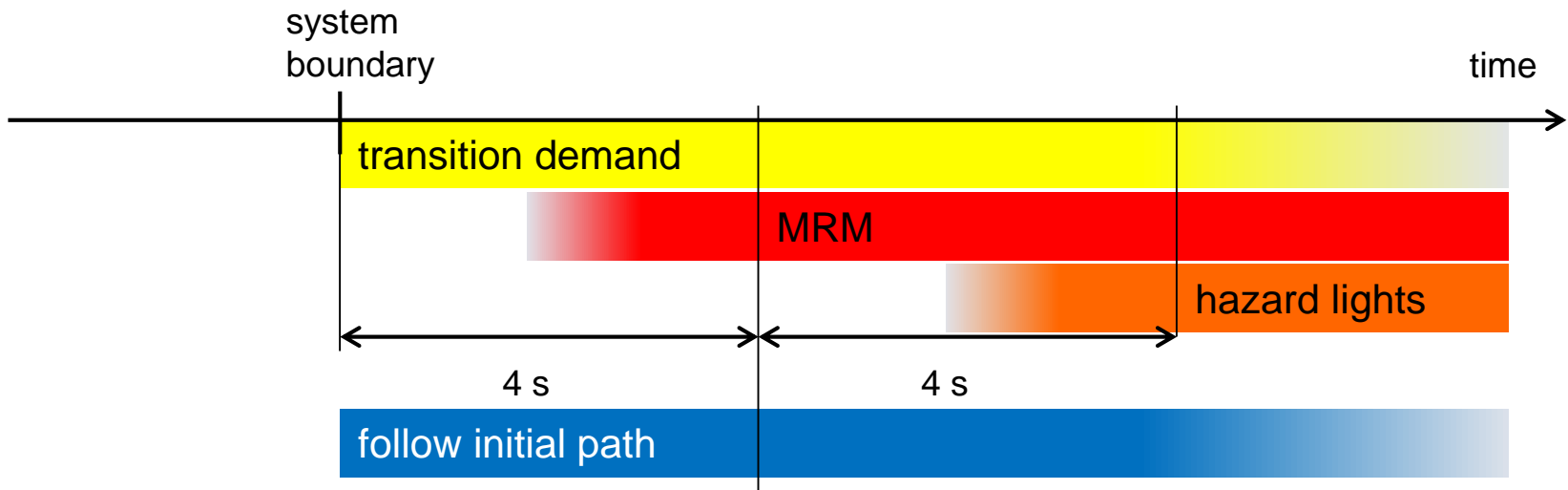
e. g. in case of:

- exit
- end of motorway
- system boundary known because of chosen route and internal map of the vehicle

Avoids excessive
flashing of hazard lights

Transition procedure

Sudden unexpected event without danger of collision

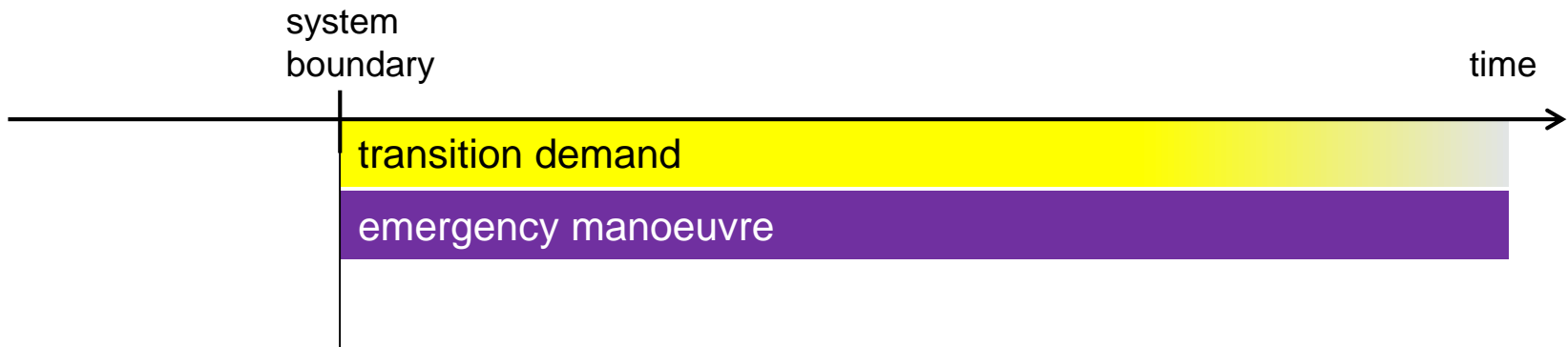


For the following cases:

- Lateral acceleration or longitudinal speed exceeded
- Lane marking missing
- Single sensor failure
- Seatbelt unfastened
- Driver inactive in spite of warning

Transition procedure

Sudden unexpected event with danger of collision



e. g. in case of:

- Obstacle on the road

In case of other than single sensor failure:

Transition demand plus fail safe strategy of the manufacturer according to Annex 6



Longitudinal Control

5.6.1.6. Emergency Manoeuvre

5.6.1.6.1. If the activated ACSF detects that due to a sudden unexpected event the vehicle is in imminent danger to collide with another road user ahead or beside the vehicle 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 and/or by steering).

5.6.1.7. Longitudinal control and ~~protective~~ ~~braking~~ deceleration

5.6.1.7.1. Any vehicle equipped with an ACSF of category E shall be able to control the longitudinal speed of the vehicle ~~meet the following requirements for protective braking.~~

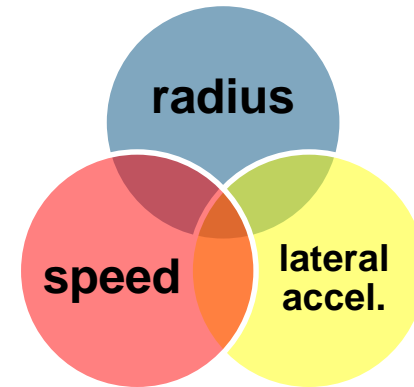
5.6.1.7.1.1. If the activated system detects that the distance to other road users in front is less or will shortly be less than the foreseen safety distance a protective ~~braking~~ deceleration shall be carried out until the foreseen safety distance is reached again.

5.6.1.7.1.2. If the activated system detects that due to a sudden unexpected event the vehicle is in imminent danger to collide with another road user in front and that the time for a safe transition procedure is too short, a protective ~~braking~~ deceleration as emergency manoeuvre shall be carried out. Only in case a lane change can be carried out safely, alternatively a lane change manoeuvre can be carried out to prevent the collision.

5.6.1.7.1.3. The protective ~~braking~~ deceleration must be able to deliver full braking force of the vehicle in order to achieve a maximum deceleration.



Test FU 1: Test for lane keeping



- radius is defined by proving ground
- 2 lateral accelerations shall be defined by the Technical Service
- so that the speed remains in the range between v_{smin} and v_{smax}

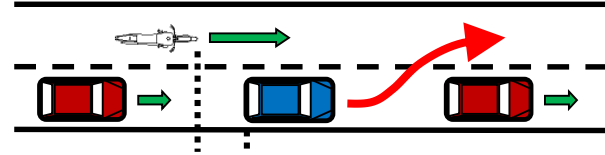
3.1.1. Functionality Test 1 (FU1): Test for lane keeping

3.1.1.1 Drive the vehicle with activated ACSF on a track with curves with road markings at each side of the lane at 2 different lateral accelerations between 0.5 m/s^2 and 90 % of ay_{smax} selected by the technical service. Repeat each test case. The lateral accelerations shall be selected such that the vehicle speed remains in the range from v_{smin} up to v_{smax} .

3.1.1.2 Data for the whole lateral acceleration range

Technical service shall require to manufacturer to deliver data about fulfilling test for lane keeping capabilities for the whole lateral acceleration range.

(J/D text of Bonn coffee brake)



Test FU 2: Test for the abort of lane change

- Use distance between motorcycle and vehicle equipped with ACSF instead of TTC (more intuitive)
- Use formula of 5.6.1.1.8 for the calculation:

$$S_{rear} = d_{reaction, rear} + d_{brake, rear} + d_{safety, rear}$$

$$\begin{aligned}d_{reaction, rear} &= (v_{rear} - v_{ACSF}) * t_{reaction} \\d_{brake, rear} &= (v_{rear} - v_{ACSF})^2 / (2 a_{brake}) \\d_{safety, rear} &= v_{ACSF} * t_d\end{aligned}$$

$$v_{rear} - v_{ACSF} = 50 \text{ km/h}$$

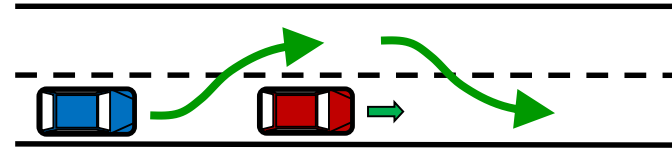
$$v_{ACSF} = 70 \text{ km/h}$$

$$t_{reaction} = 1.2 \text{ s}$$

$$t_d = 1 \text{ s}$$

$$a_{brake} = 3 \text{ m/s}^2$$

$$\Rightarrow S_{rear} = 68 \text{ m}$$



Test FU 3: Test for lane change

After the completion of lane change manoeuvre, vehicle shall be back to the initial lane with a time gap of $1.9 \text{ s} \pm 0.1 \text{ s}$ to the vehicle behind.



TR Tests

The requirements of the test are fulfilled in case transition demand initiated during test if

- the transition demand was given not later than “the event” and
- the vehicle does not cross any lane marking for 4 s after the transition demand and
- the minimal risk manoeuvre as specified by the vehicle manufacturer was initiated not later than 4 s after the transition demand and
- the hazard lights are activated not later than 4 s after the start of the minimal risk manoeuvre.

-> wording: not later than

-> no excessive flashing of hazard lights



Test EM 1

3.3.1 Emergency Test 1 (EM1): Protective deceleration braking with moving target

3.3.1.1. Drive the vehicle with activated ACSF behind a target vehicle. The vehicle and the target vehicle shall drive within the lane markings on a track with road markings at each side of the lane at a speed of 70 km/h or ($V_{\text{smax}} - 20$ km/h) whatever is lower. The time gap between the test vehicle and the target vehicle shall be selected by the vehicle itself but shall not be more than 2.4 s ~~± 0.05 s~~. Then the target vehicle shall decelerate with $6 \text{ m/s}^2 \pm 0.25 \text{ m/s}^2$ and with a mean brake jerk of $6 \text{ m/s}^3 \pm 0.25 \text{ m/s}^3$ in the first second of braking. The vehicle shall not carry out a lane change to avoid a collision. Thus any other lane adjacent to the lane the vehicle is driving in shall be blocked e. g. by other vehicles.

3.3.1.2. The requirements of the test (3.3.1.1.) are fulfilled if the vehicle does not collide with the target vehicle.



Test EM 2

3.3.2. Emergency Test 2 (EM2): Protective deceleration braking with stationary target

3.3.2.1. Drive the vehicle with activated ACSF at least 1 min on a track with road markings at each side of the lane at a test speed 10 km/h below V_{smax} . The vehicle shall approach a target vehicle being at standstill and being placed in the center of the lane. The vehicle shall not carry out a lane change to avoid a collision. Thus any other lane adjacent to the lane the vehicle is driving in shall be blocked e. g. by other vehicles next to the target vehicle.

3.3.2.2. The requirements of the test are fulfilled if the vehicle does not collide with the target vehicle.



Backup: Split B into B1 and B2

B1 defined in order to integrate the LKAS work.

B2 can be then regarded as category E ACSF without lane change.

2.3.4.1.2. ACSF Category B1 means a function which is initiated/activated by the driver and which continuously assists the driver in keeping the vehicle within the chosen lane, by influencing the lateral movement of the vehicle.

2.3.4.1.3. “ACSF Category B2 means a function which is initiated/activated by the driver and which continuously keeps the vehicle within its lane by influencing the lateral movement of the vehicle for extended periods without further driver command/confirmation.

additional idea