

Emergency Steering Function (ESF)

Industry proposal

Based on ACSF-12-11 (Consolidated document after 12th session)

Red: justifications

Red bold: changes to the current proposal

Draft Proposal:

Paragraph 2.3.4., amend to read:

2.3.4. "Advanced Driver Assistance Steering System" means a system, additional to the main steering system, that provides assistance to the driver in steering the vehicle but in which the driver remains at all times in primary control of the vehicle. It comprises one or ~~both~~ **more** of the following functions:

2.3.4.1. "Automatically commanded steering function (ACSF)" means [...]

2.3.4.2. "Corrective steering function (CSF)" means [...]

Insert a new paragraph 2.3.4.3. to read:

2.3.4.3 "Emergency Steering Function (ESF)" means a control function which can automatically detect a potential collision and **automatically** activate the vehicle steering system for a limited duration, to steer the vehicle with the purpose of avoiding or mitigating a collision ~~=~~, with:

- i. another vehicle driving/* in an adjacent lane,
 - a. drifting towards the path of the subject vehicle and/or,
 - b. into which path the subject vehicle is drifting and/or,
 - c. into which lane the driver initiates a lane change manoeuvre.
- ii. an obstacle obstructing the path of the subject vehicle or when the obstruction of the subject vehicle's path is deemed imminent.

ESF shall cover one or **more several** use cases from the list above.

/* the vehicle may be driving in the same or the opposite direction as the subject vehicle.

Insert a new paragraph 5.1.6.3. to read:

5.1.6.3 Provisions for ESF

Any ESF shall fulfil the following requirements.

5.1.6.3.1. ESF shall only start an intervention in case a risk of a collision is detected.

5.1.6.3.2. **An automatic avoidance manoeuvre initiated by an ESF shall not steer the vehicle out of the lane of travel lead the vehicle to cross a lane marking, unless the target is to come back into the original lane for avoiding a collision.** However, if the intervention starts during a lane change manoeuvre performed by the driver or during an unintentional drift into the adjacent lane, the system may steer the vehicle back into its original lane of travel.

In case of absence of lane markings, the ESF intervention shall not lead to a lateral offset of more than 0.75 m.

Any vehicle fitted with ESF shall be equipped with means to detect lane markings and to monitor the driving environment. The system shall monitor the driving environment at any time the ESF is active. The manufacturer shall demonstrate during type approval, to the satisfaction of the technical service, which means to detect lane markings and to monitor the driving environment, are fitted to the vehicle to satisfy these provisions.

JUSTIFICATION:

The requirements itself contains implicitly the presence of means to detect the position of the own vehicle within the lane. The requirement above does the same for potential other vehicles or obstacles.

Due to the manifold of system performance variations (e.g speed, means of detection, range of detection, etc) a manufacturer may implement an ESF function in a different way, however the principles stated above are to be fulfilled.

A manufacturer may fit sensors with a wider view around the vehicle, while another may fit sensors (e. g. ultrasound) to the sides. Both implementations are valid as they aim at reducing the risk of collision using ESF, however they have different detection ranges.

~~5.1.6.3.3. **Any intervention of ESF shall be indicated to the driver with an optical and an acoustic warning.**~~

5.1.6.3.4. ~~**When a risk of collision has been detected by the system, an optical and an acoustic warning shall be provided at the latest when the intervention starts. The same warning(s) as in paragraph 5.1.6.3.3 may be used.**~~

Any intervention of an ESF shall be indicated to the driver with an optical and with an acoustic warning signal to be provided at the latest with the start of the ESF intervention.

For this purpose signals used by other vehicle systems to indicate the presence of a vehicle in the blind spot and / or to indicate a potential collision are deemed to be sufficient.

JUSTIFICATION:

In order not to confuse the driver with various different warnings blind spot indication and / or Forward Collision Warnings should be enough.

The driver gets a haptic feedback on the steering wheel in addition

5.1.6.3.5. **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.**

Once suppressed, the indication of a failure shall be kept in the vehicle as long as the failure exist in order to satisfy the provisions of Paragraph 5.5. of this Regulation.

JUSTIFICATION:

The proposed text is now in line with the corresponding paragraph from Category B1 (5.6.2.2.4). From B1: 5.6.2.2.4. 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 the failure may be suppressed.

The PTI provisions are covered by the current paragraph 5.5.2. in UN R79.

5.1.6.3.6. The steering control effort necessary to override the directional control provided by the system shall not exceed [50 N].

JUSTIFICATION

In ACSF 07 meeting in London a value of 150N (up to 250N for some categories) was originally proposed. Industry suggested reducing this value down to 50 N.

Industry is of the opinion the 50 N is relevant for emergency steering functions. The value may be re-visited later considering all categories and use cases.

5.1.6.3.7 The ESF shall be subject to the requirements of Annex 6.

5.1.6.3.8 The vehicle shall be tested in accordance with the relevant vehicle tests specified in Annex 8 of this Regulation.

5.1.6.3.9. System information data

The 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:

- **Use case(s) where ESF is designed to operate (among the use cases i.a, i.b, i.c and ii. specified in the ESF definition);**
- **The conditions under which the system is active, e.g. the vehicle speed range V_{smax} , V_{smin} .**
- **How ESF detects a risk of a collision.**
- **[How to deactivate/reactivate the function]**

Tests to be added into Annex 8

The vehicle shall be driven with activated ESF on a road with lane markings on each side, positioned in the centre of the lane.

The test conditions and the vehicle speed shall be within the operating range of the system as declared by the manufacturer.

Test for ESF Type i:

A target vehicle shall approach the vehicle under test and one of the vehicles shall minimize their lateral distance.

Test for ESF Type ii.:

The vehicle under test shall approach an object positioned in the lane such that the ESF intervention can be performed according to the specification of the manufacturer. The object shall be of such size and positioned in a way that the system can pass the object without crossing the lane marking.

The tests requirements are fulfilled if:

- (a) the warnings are provided no later than the ESF intervention starts, and
- (b) the ESF intervention does not lead the vehicle to leave its lane.

In case the systems works in absence of any lane markings the above tests need to be repeated on a test track without lane markings.

These tests are fulfilled if,

- (c) the lateral offset during the manouvre is 0,75 m at maximum

In addition, the manufacturer shall demonstrate to the satisfaction of the Technical Service that the requirements defined in paragraph 5.1.6.3.1 to 6. are fulfilled in the whole range of the ESF operation range (specified by the OEM)

Justification:

ESF aims at reducing the risk of collisions. Implementations of ESF will vary regarding means of detection, range of detection and speed range. Therefore, it is difficult to define a concise test for each and every implementation. As a baseline, the tests above offer the Technical Service the opportunity to verify the ESF capability by taking into consideration within the specification of the OEM.

A test for the overriding force once the ESF maneuver has started does not seem feasible, since the driver of the ESF vehicle would have to oversteer in the opposite direction of the intervention leading to the collision itself. or ADAS a steering torque of 5 Nm is engineered for M1 and N1 vehicles (for controllability reasons regarding functional safety). Supposing the case when the driver has to oversteer with a torque of 5 Nm and taking into account a typical steering wheel radius of 0.170 m, the resulting force yields 30 N. The driver typically applies the forces on the steering wheel with both hands, thus a 15 N force needs to be applied by the driver using each hand.