

Proposal for amendments to GRRF-84-02 Regulation No. 79 (steering equipment) Requirements applicable to ACSF of Category C1

I. Proposal

Amendment of paragraph from 5.6.4.7. to 5.6.4.8.1., to read:

5.6.4.7. Critical situation

A situation is deemed to be critical when, at the time a lane change manoeuvre starts, **an approaching vehicle is in the target lane within the distance to the rear (S_{rear})**. ~~an approaching vehicle in the target lane would have to decelerate at 3m/s^2 [0.0 or 1.2] seconds after the lane change manoeuvre has started, to ensure the distance between the two vehicles is never less than that the ACSF vehicle travels in [1] second.~~ **S_{rear} of the ACSF category [C1] system shall be calculated according to the following formula:**

$$S_{\text{rear}} = (v_{\text{app}} - v_{\text{ego}}) * t_{\text{B}} + (v_{\text{app}} - v_{\text{ego}})^2 / (2 * a) + v_{\text{app}} * t_{\text{G}}$$

Where:

v_{app} = the vehicle speed of approaching vehicle from behind [m/s]

v_{ego} = the vehicle speed of the ACSF vehicle [m/s]

a = 3 m/s² (Deceleration of the approaching vehicle)

t_{B} = [0.0 or 1.2]s (Time after the start of the manoeuvre at which the deceleration of the approaching vehicle starts)

t_{G} = [1]s (Remaining gap of the vehicles after the deceleration of the approaching vehicle)

~~an approaching vehicle in the target lane would have to decelerate at 3m/s^2 [0.0 or 1.2] seconds after the lane change manoeuvre has started, to ensure the distance between the two vehicles is never less than that the ACSF vehicle travels in [1] second.~~

For the purpose of this requirement, it is assumed that the maximum speed of the approaching vehicle ($V_{\text{app rear}}$) is 130km/h **or the maximum allowed speed of each Contracting Party**, and that the ACSF vehicle speed is constant. **In case of utilizing V_{app} other than 130km/h, the system shall recognize the maximum speed limit of each Contracting Party, and shall adjust the maximum speed of V_{app} for each Contracting Party accordingly.**

[5.6.4.8. Minimum sensor distance ~~and minimum operation speed~~

5.6.4.8.1. The ACSF of Category [C1] shall be able to detect vehicles approaching from the rear in an adjacent lane up to a **sensor** distance $S_{d_{rear}}$ as specified below:

The minimum **sensor** distance $S_{d_{rear}}$ shall be declared by the vehicle manufacturer. The declared value shall not be less than 55m. $S_{d_{rear}}$ shall be equal or larger than S_{rear} , and when the system cannot confirm that, a lane change procedure shall be prohibited.

The declared distance shall be tested according to the relevant test in Annex 8 using a two-wheeled motor vehicle of Category L3 as the approaching vehicle. ~~‡~~

~~The minimum operation speed V_{smin} , down to which the ACSF C is permitted to perform a lane change manoeuvre, shall be calculated with minimum distance S_{rear} using the following formula:~~

~~$$V_{smin} = a * (t_B - t_C) + v_{app} \sqrt{a^2 * (t_B - t_C)^2 - 2 * a * (v_{app} * t_C - S_{rear})}$$~~

~~Where:~~

~~S_{rear} = Minimum distance declared by the manufacturer in [m]~~

~~v_{app} = 36.1 m/s (Speed of the approaching vehicle = 130 km/h)~~

~~a = 3 m/s² (Deceleration of the approaching vehicle)~~

~~t_B = [0.0 or 1.2]s (Time after the start of the manoeuvre at which the deceleration of the approaching vehicle starts)~~

~~t_C = [1]s (Remaining gap of the vehicles after the deceleration of the approaching vehicle)~~

~~V_{smin} = x [m/s] Resulting minimum activation speed of the ACSF of Category C1~~

~~Notwithstanding the requirements above, the system may become active also at speeds lower than the calculated V_{smin} provided that the following conditions are met:~~

~~(a) The system has detected another vehicle in the adjacent lane into which the lane change is planned at a distance lower than S_{rear} and~~

~~(b) The situation is not deemed to be critical according to paragraph 5.6.5.7 (e.g. at low speed differences and $V_{app} < 130$ km/h)~~

~~(c) $[S_{rear} = (v_{app} - v_{smin}) * t_B + (v_{rear} - v_{smin})^2 / (2 * a) + v_{smin} * t_C]$~~

~~[Footnote:~~

~~‡ Until a uniform test target, having the radar cross section (res) characteristics of an appropriate L3 vehicle have been agreed, the motorcycle used for type approval shall have an engine capacity greater than 500cm³. The choice of the motorcycle shall be agreed with the Technical Service and the details recorded in the Test Report.]~~

Insert a new paragraph 3.5.x in Annex 8, to read:

"[3.5. Tests for ACSF of Category [C1] Systems

3.5.x. Test target of Category [C1] Systems

The target used for the tests shall be a two-wheeled motor vehicle of Category L3 as the approaching vehicle. */

Footnote:

*** Until a uniform test target, having the radar cross section (rcs) characteristics of an appropriate L3 vehicle have been agreed, the motorcycle used for type approval shall have an engine capacity greater than 500cm³. The choice of the motorcycle shall be agreed with the Technical Service and the details recorded in the Test Report.**

3.5.1. Lane change functional test

3.5.2. Suppression of lane change procedure test

3.5.3. Overriding test

3.5.4. Deactivation test

3.5.5. Sensor performance test

3.5.6. Sensor blindness test

3.5.7. "Engine start/run cycle test"]"

Remark: Details of the tests will be defined in 15th ACSF session (November 2017)

II. Justification

1. In paragraph 5.6.4.8.1. of GRRF-84-02, the distance which prohibits a lane change manoeuvre due to the critical situation and the minimum sensor distance are mixtured. The distance of the critical situation changes depending on the traffic environment in each Contracting Party, on the other hand, the minimum sensor distance should be used the same value in each Contracting Party. For this reason, in this amendment, both distances are distinguished. The critical situation should be specified based on the distance between the ACSF vehicle and the approaching vehicle (S_{rear}). S_{rear} is calculated by the formula, and it changes depending the speed differences between the ACSF vehicle and the approaching vehicle. On the other hand, Sd_{rear} is declared by the vehicle manufacturer. Reagrding the relation between S_{rear} and Sd_{rear} , Sd_{rear} shall be equal or larger than S_{rear} , and when the system cannot confirm that, a lane change procedure shall be prohibited.

2. The footnote means the requirement of the test target for Category C1 used in Annex 8. Therefore the footnote should be specified in Annex 8 in order to interpretate appropriately its subject for Technical Services as well as UN R131.
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