AEBS-08 – Industry Input

AEB IWG 08 – Industry Input

Maximum required system performance
(GRVA-02-22e V. and VII. Proposal)

Does this mean whenever the 5 conditions are fulfilled, the system shall deliver maximum performance?

Trailer operation

Ambient Illumination

Driver Intervention

5.2.1.4. Speed reduction by braking demand

When the system is activated, the AEBS shall be able to achieve the maximum relative impact speed as shown in the following table:

– for collisions with constantly travelling or stationary targets;

– on dry roads;

– in laden and unladen conditions;

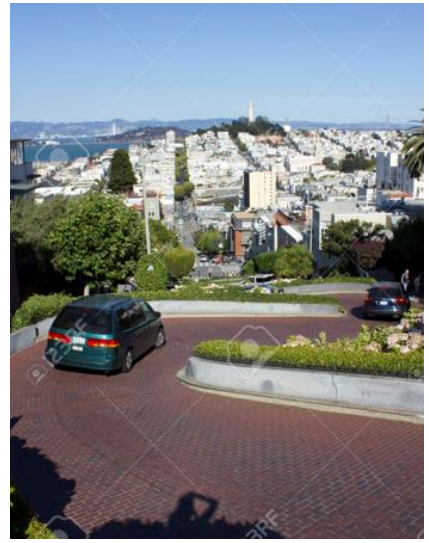
– in situations where the vehicle longitudinal centre planes are displaced by not more than 0.2 m; and/or

– in ambient illumination conditions of at least 1000 Lux.

It is recognised that the performances required in this table may not be fully achieved in other conditions than those listed above. However, the system shall not deactivate or drastically change the control strategy in these other conditions. This shall be demonstrated in accordance with Annex 3 of this Regulation.

Slope

Observation time



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Maximum required system performance
(GRVA-02-22e V. and VII. Proposal)

Condition	Criteria for Test Section	Criteria in the General Provisions
Road surface	Flat	-
	dry	dry
	Good adhesion (PBC of 0.9)	Implicitly by dry
	Consistent slope between level and 1%	-
Ambient Air temperature	Between 0-45°C	-
Horizontal visibility range	Allow the target to be observed throughout the test	-
Wind	No wind liable	-
Ambient illumination	Homogenous	-
	In excess of 1000lux (car2car) or 2000lux (car2ped)	In excess of 1000lux (car2car) or 2000lux (car2ped)
Test weight	Laden and unladen	Laden and unladen
	Load distributed according to manufacturers recommendation	-
Brake	A sequence of brake activations	-
Target	Specified, constantly travelling	Constantly travelling
Scenario (e.g. displacement of centerlines)	0,2m (car2car)	Displacement of max. 0,2m
Vehicle Speed	Constant	-
Oberservation Time	At least 4s TTC	-

A lot of conditions remain undefined in the requirements section, yet it requires maximum performance!

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Maximum required system performance
(GRVA-02-22e V. and VII. Proposal)

Alternative proposal for paragraph 5.2.1.4 (5.2.2.4 to be adapted accordingly)

5.2.1.4. Speed reduction by braking demand

When the system is activated, the AEBS shall be able to achieve the maximum relative impact speed as shown in the ~~following~~ table below.

~~- for collisions with constantly travelling or stationary targets;~~

~~- on dry roads;~~

~~- in laden and unladen conditions;~~

~~- in situations where the vehicle longitudinal centre planes are displaced by not more than 0.2 m; and/or~~

~~- in ambient illumination conditions of at least 1000 Lux.~~

It is recognised that the performances required in this table may not be fully achieved in case the conditions deviate from those described in the test procedure in paragraph 6 or in case other conditions [not mentioned in this regulation] affect the performance of the system (e.g. trailer hitched to the vehicle) ~~other conditions than those listed above~~.

However, the system shall not deactivate or ~~drastically~~ unreasonably change the control strategy in these other conditions. This shall be demonstrated in accordance with Annex 3 of this Regulation.

AEB IWG 08 – Industry Input

Justification for need of repetition of single tests
(GRVA-02-22e IX. Proposal)

What is the problem?

- **Goal:**

  Make sure that systems meeting minimum safety requirements pass homologation

- **Problem:**

  Mandating a large number of test cases that all need to be passed in a single test run to qualify for homologation might lead to problems for vehicles with otherwise good AEB systems.
  Due to the nature of systems relying on environment sensors the probability to pass a test is (slightly) slower than 100%.

- **Proposal:**

  Change the “all test cases need to be passed at only a single test run” rule into a “minimum two test runs of out three need to be passed” rule

AEB IWG 08 – Industry Input

Justification for need of repetition of single tests
(GRVA-02-22e IX. Proposal)

Single test per test case => 9,6% chance of homologation failure

- Mandating a large number of test cases that all need to be passed in a single test run to qualify for homologation might lead to problems for vehicles with otherwise good AEB systems.

- Let us assume the following parameters (example, not a real system):
- Probability p_{single} to pass a single test case $p_{single} = 99\%$
  even an otherwise good AEBS system might fail single tests, as this is a design constraint of systems based on environment sensors
- Total number of tests n needed for homologation $n = 10$

- Probability p_{fail} to fail homologation (with an otherwise good system)

$$\mathbf{p_{fail}} = 1 - p_{single}^{n} = 1 - 99\%^{10} = \mathbf{9{,}6\%}$$

=> Almost **one out of ten vehicles** (with an otherwise good system) **will fail homologation**!

AEB IWG 08 – Industry Input

Justification for need of repetition of single tests
(GRVA-02-22e IX. Proposal)

Two out of three per test case

- If you allow per test case a two out of three rule for tests to be passed:

- Using the same parameter:
- Probability p_{single} to pass a single test case $p_{single} = 99\%$
  even an otherwise good AEBS system might fail single tests, as this is a design constraint of systems based on environment sensors

- Test case is passed for:

Pass	Pass	Pass	in the three single tests
Pass	Pass	**Fail**	in the three single tests
Pass	**Fail**	Pass	in the three single tests
Fail	Pass	Pass	in the three single tests

AEB IWG 08 – Industry Input

Justification for need of repetition of single tests
(GRVA-02-22e IX. Proposal)

2 out of 3 per test case => 0,3% chance of homologation failure

- Probability p_{pass} to pass a test case:

$$\mathbf{p_{pass}} = p_{single}^{3} + 3 * p_{single}^{2} * (1 - p_{single}) = 97{,}03\% + 2{,}94\% = \mathbf{99{,}97\%}$$

(Pass*Pass*Pass + Pass*Pass*Fail + Pass*Fail*Pass + Fail*Pass*Pass)

- Probability p_{fail} to fail homologation (with the same system!)

$$\mathbf{p\_fail} = 1 - p_{pass}^{n} = 1 - 99{,}97\%^{10} = \mathbf{0{,}3\%}$$

=> Only three out of 1000 vehicles (with an otherwise good system) will fail homologation!

AEB IWG 08 – Industry Input

Justification for need of repetition of single tests
(GRVA-02-22e IX. Proposal)

Does this make AEB systems less effective?

- „Wait a minute! This means that the system will be quite bad, as it only needs to work for 66% of all tests!“
- Let’s do the same math with 66% for p_{single}: $p_{single} = 66\%$
- Probability p_{pass} to pass a single test case:

$$\mathbf{p_{pass}} = p_{single}^3 + 3 * p_{single}^2 * (1 - p_{single}) = 28{,}75\% + 43{,}12\% = \mathbf{71{,}87\%}$$

- Probability p_{fail} to fail homologation (with a system with only 66% probability to pass a single test):

$$\mathbf{p\_fail} = 1 - p_{pass}^n = 1 - 71{,}87\%^{10} = \mathbf{96{,}32\%}$$ **=> Almost all cars would fail homologation!**

Limiting the max. number of failed tests could address the concern, that this would otherwise allow systems with insufficient performance to the market.

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Justification for need of repetition of single tests
(GRVA-02-22e IX. Proposal)

Alternative Approaches could be:

- Specify that in case of a failed test it shall be agreed between the manufacturer and the Technical Service how many repetitions of this test are suitable.
- Define an overall percentage of tests that must be passed/may be failed.
- Define a different approval scheme (e.g. 3 out of 4 must be passed)