

UN ECE GRRF AEBS and LDWS Informal Working Group

CLEPA proposed amendments to AEBS “skeleton” document AEBS-LDWS-02-02e with regard to technical requirements

PROPOSAL 29-10-2009

Black text: original skeleton document text

Red “~~strikethrough~~” text: deleted original skeleton document text

Blue text: proposed amendments/additions to skeleton document

Green text: not considered necessary – can support on an optional basis

2. DEFINITIONS

For the purposes of this Regulation:

- 2.1. “Approval of a vehicle type” means
- 2.2. “Vehicle type with regard to its Advanced Emergency Braking System” means
- 2.3. “Advanced Emergency Braking System (AEBS)” means a system which can ~~automatically~~ detect ~~[a potentially potential forward collision /an emergency situation]~~ and ~~automatically~~ activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating a collision.
- 2.4. “Time to collision” means the delay remaining between the instant ~~being~~ considered and the time of the collision between the subject vehicle and the target vehicle, notwithstanding any alteration of speeds and directions during that delay.
- 2.5. “Remaining reaction time” means the particular time to collision when the instant considered is defined by the vehicle manufacturer as permitting the driver to undertake an action successfully avoiding the collision.
- 2.5. “Subject vehicle” means the vehicle being ~~subject to testing~~ tested.
- 2.6. “Target vehicle” or “target” means a ~~target simulating the bulk and the radar cross section of a regular~~ high volume series production passenger car of category M1 AA saloon 1/ or an object representative of such a vehicle in terms of its identification characteristics applicable to the sensor system of the AEBS under test.
- 2.7. “Soft target” means a target that will suffer minimum damage or cause damage to the subject vehicle in the event of a collision.

2.78. “Stationary target” means a target ~~fixed on the ground on the axis of the test course~~ that the AEBS has never identified as a moving target.

2.89. “Moving target” means a target ~~having~~ travelling at a speed of at least ~~15~~ 20 km/h ~~along the axis of the test course and~~ in the same direction and in the same lane as the subject vehicle ~~which may subsequently slow to a halt.~~

~~2.9. “Radar cross section (RCS)” means a measure of how detectable an object is with a radar.~~

~~2.10. “Collision mitigation” means the actions taken by the system, such as the detection of a stationary obstacle, the computing of the relevant data and the activation of the service brakes, for significantly decreasing the impact speed.~~

~~2.11. “Collision avoidance” means the actions taken by the system, such as the obstacle detection, the computing of the relevant data and the activation of the service brakes, for slowing down the subject vehicle to a speed equal to or lower than the target vehicle speed.~~

3. APPLICATION FOR APPROVAL

3.1.

4. APPROVAL

4.1.

5. SPECIFICATIONS

5.1. General

5.1.1. Subject to the requirements of paragraph 12, any vehicle fitted with an AEBS ~~complying with the definition of~~ as defined in paragraph 2.3 shall ~~meet the performance requirements contained in paragraphs 5.1 to 5.5.4.~~ comply with the provisions of this regulation and shall be equipped with an anti-lock ~~device~~ system meeting the requirements of Regulation No. 13 Annex 13.

5.1.2. Any AEBS fitted on a vehicle, shall ~~comply~~ not be adversely affected by magnetic or electrical fields. (This shall be demonstrated by compliance with the requirements of Regulation No. 10, 02 series of amendments) ~~on electromagnetic interferences.~~

5.1.3. Conformity with the safety aspects of complex electronic control systems shall be shown by meeting the requirements of Annex 3.

5.2. Performance requirements

~~5.2.1. When tested in the conditions of paragraphs 6.1. to 6.5., the AEBS shall:~~

- 5.2.1.1. ~~provide the~~ The driver shall be provided with the warning specified in paragraph 5.5.1. when tested in accordance with the provisions of paragraphs ~~6.6.~~ 6.5.2. and 6.5.3. (reaction time warning tests);
- 5.2.1.2. ~~activate the~~ The subject vehicle service braking system shall be automatically activated when tested in accordance with the provisions of paragraphs ~~6.7.~~ 6.5.4., 6.5.5, and 6.5.6. (braking system activation tests) ~~and~~.
- 5.2.3. The driver shall be provided no visual, acoustic or haptic warning signals when tested in accordance with the provisions of paragraphs 6.5.7., 6.5.8., and 6.5.9. (false warning tests)
- 5.2.4. The driver shall be provided with the warning specified in paragraph 5.5.3. when tested in accordance with the provisions of paragraph ~~6.8.~~ 6.5.10. (non-failure loss of functionality warning test).
- 5.2.5. The driver shall be provided with the warning specified in paragraph 5.4.2. when tested in accordance with the provisions of paragraph ~~6.8.~~ 6.5.11. (manual disablement warning test).
- 5.2.1.36. ~~provide the~~ The driver shall be provided with the warning specified in paragraph 5.5.2. when tested in accordance with the provisions of paragraph ~~6.8.~~ 6.5.12. (~~malfunction detection~~ failure warning test).
- 5.2.27. The AEBS shall be active at least within the vehicle speed range of ~~15~~ 20 km/h to ~~90~~ 120 km/h, unless manually or automatically de-activated as per paragraph 5.4. or paragraph 5.5.3. below.
- 5.3. The driver shall always have the capability of overriding the AEBS until the moment of collision.
- 5.4. When a vehicle is equipped with a manual means to disable the AEBS function, the following conditions shall apply as appropriate:
- 5.4.1. The AEBS function shall be automatically reinstated at the initiation of each new ignition “on” (run) cycle.
- 5.4.2. A ~~constant~~ flashing optical warning signal shall inform the driver that the AEBS function has been disabled. The yellow warning signal specified in paragraph 5.5.23. below may be used for this purpose.

5.5. Warning requirements

- 5.5.1. The remaining reaction time warning referred to in paragraph ~~6.6.~~ 5.2.1. shall be by means of an ~~optical, audible~~ visual, acoustic or haptic warning signal, or any combination thereof.

In the case of a haptic warning, if a brake application is made it shall not exceed a duration of 0.8 seconds or result in a vehicle speed reduction greater than 5 km/h.

A description of the warning signal(s), and the sequence in which they are presented to the driver if there is more than one, shall be provided by the vehicle manufacturer at the time of type-approval.

- 5.5.2. The ~~malfunction~~ failure warning referred to in paragraph ~~6.8.~~ 6.5.13. shall be by means of a constant yellow optical warning signal.

The warning signal shall remain displayed as long as the failure or defect persists and the ignition (start) switch is in the 'on' (run) position.

- 5.5.3. In the case that the AEBS has the ability to shut its-self down due to a non-failure loss of functionality, e.g. temporary sensor blindness, the driver shall be provided with a warning signal indicating that the system is temporarily unavailable.

The warning signal shall be a flashing yellow optical warning signal.

A description of the non-failures that lead to loss of functionality shut down shall be provided by the vehicle manufacturer at the time of type-approval.

- 5.5.34. Any AEBS optical warning signal shall be activated either when the ignition (start) switch is turned to the "on" (run) position or when the ignition (start) switch is in a position between the "on" (run) and "start" that is designated by the manufacturer as a check position (bulb check).

In the case of activation in the "on" (run) position the warning signal(s) shall be deactivated after a short period of time, as defined by the vehicle manufacturer, unless there is a failure or defect present in the system.

This requirement does not apply to tell-tales shown in a common space.

- 5.5.45. The optical warning signals shall be clearly visible even by daylight; and the satisfactory condition of the signal ~~must be~~ easily verifiable, by the driver from the driver's seat.

6. TEST PROCEDURE

6.1. Test conditions

- 6.1.1. The tests shall be performed on a flat surface affording good adhesion.

- 6.1.2. The ambient temperature shall be between 0° C and 45° C.

- 6.1.43. The horizontal visibility range shall be greater than 1 km.
- 6.1.4. The tests shall be performed when there is no wind liable to affect the results.

6.2. Accuracy of measurements

- 6.2.1. Distances shall be measured with an accuracy of +/- 5%.
- 6.2.2. Speeds shall be measured with an accuracy of +/- ~~5%~~ 3 km/h.
- 6.2.3. Time ~~and delays~~ shall be measured with an accuracy of +/- 1%.
- 6.2.4. Decelerations shall be measured with an accuracy of +/- 0.1 m/s².

~~6.3. Test course~~

~~The course shall be a segment of straight road of sufficient length in order to maintain the subject vehicle speeds required below and to allow detecting a target vehicle moving at a minimum speed of 15 km/h and braking the subject vehicle up to collision avoidance.~~

6.43. Vehicle conditions

6.43.1. Test weight

The vehicle shall be tested in the unladen conditions of the Type-0 test as described in Annex 4 to Regulation N° 13. No alteration shall be made once the test procedure has begun.

~~6.4.2. The AEBS shall be configured in accordance with the instructions provided by the vehicle manufacturer. In the case where the AEBS is equipped with a user-adjustable warning threshold, each test shall be performed twice: once with the warning threshold set at its earliest setting, and once with the warning threshold set at its latest setting. No alteration shall be made once the test procedure has begun.~~

6.54. Target vehicle

6.54.1. The target used for the tests shall be either ~~have the bulk of~~ a regular high volume series production passenger car of category M1 AA saloon ~~and a total radar cross section (RCS) of at least 2 m² +/- 1%~~ or a “soft target” representative of such a vehicle in terms of its identification characteristics applicable to the sensor system of the AEBS under test.

6.54.2. When the soft target carries radar reflector(s) the total radar cross section shall be 2 m² +/- 1%,

6.54.2.1. the reflector(s) shall be oriented toward the subject vehicle;

6.54.2.2. the reflectors shall be placed between 0.09 m to 1.00 m height; and

6.54.2.3. ~~the any~~ structure supporting the reflector(s) on the target shall not reflect radio waves emitted by the subject vehicle AEBS.

~~6.5.3. Stationary target~~

~~The stationary target shall be positioned such that its component nearest to the subject vehicle is positioned at the collision point on the axis of the test course.~~

~~6.5.4. Moving target~~

~~The moving target shall be moving on the axis of the test course at a constant speed comprised between 5 km/h and 70 km/h.~~

6.54.3. Details that enable the targets ~~vehicle~~ to be specifically identified shall be recorded in the vehicle type-approval documentation.

6.65. ~~Remaining reaction time warning test~~ Tests

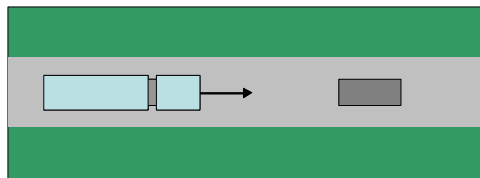
6.65.1. Optical warning signal verification test

6.5.1.1. With the subject vehicle stationary check that the optical warning signal(s) are activated when the ignition (start) switch is turned to the "on" (run) position or when the ignition (start) switch is in a position between the "on" (run) and "start" that is designated by the manufacturer as a check position.

The warning signal(s) shall then be automatically deactivated when ignition (start) switch is moved to the "on" (run) position or after a period of time as identified by the vehicle manufacturer in the case where the signal activation occurs in the "on" (run) position.

~~and the ignition locking system in the "Lock" or "Off" position, activate the ignition locking system to the "On" or "Run" position. The AEBS shall perform a check of lamp function as specified in paragraph 5.5.3. of this Regulation.~~

6.65.2. Warning test with stationary target



6.65.2.1. ~~Drive the vehicle, enter the vehicle the test course and smoothly track the lane so that the posture of the vehicle is stable.~~

The subject vehicle shall travel in a straight line for a minimum distance of 50m towards the standing target vehicle with a vehicle centreline offset of not more than 0.5m. The target vehicle shall be a 'soft target' representative of a M1 AA saloon category vehicle.

Perform ~~three trials~~ 2 tests at the respective constant speeds of ~~20 km/h~~, 40 km/h and 80 km/h.

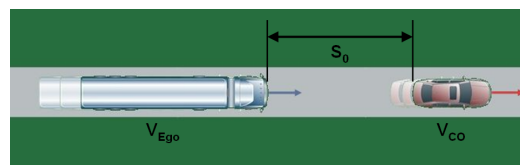
6.65.2.2. The AEBS shall warn the driver as mentioned in paragraph 5.2.1.1. ~~at the latest when the remaining reaction time has fallen below 1,5 s.~~ as specified below:

V_{Ego} (km/h)	V_{CO} (km/h)	Time to collision (s)	Latest Warning (m)
80	0	1.9	41
40	0	0.9	10

~~6.6.2.3. If the AEBS did not warn the driver as mentioned in paragraph 6.6.2.2. above, discontinue the test.~~

6.5.2.3. Subsequent to the warning(s) a movement of any driver control that indicates that the driver is aware of the pending collision, e.g. operation of the turn indicator, change in position of the accelerator pedal or brake pedal, shall result in the AEBS actions being overridden.

6.65.3. Warning test with moving target



6.65.3.1. ~~Drive the moving target as in paragraph 6.5.4.~~ The subject vehicle and the moving target vehicle shall travel in a straight line for a minimum distance of 50m, in the same direction, with a vehicle centreline offset of not more than 0.5m. The target vehicle shall be a ‘soft target’ representative of a M1 AA saloon category vehicle.

Perform 2 tests with the subject vehicle travelling at a constant speed of 60 km/h and 80 km/h and the target vehicle travelling at a speed of 20 km/h in both cases (closing speeds of 40 km/h and 60 km/h respectively).

~~6.6.3.2. Increase the subject vehicle speed and perform three trials at the relative speed between the subject vehicle and the target equalling to 20 km/h, 40 km/h and 60 km/h.~~

6.65.3.32. The AEBS shall warn the driver as mentioned in paragraph 5.2.1.1. ~~at the latest when the remaining reaction time has fallen below 1,5 s.~~ as specified below:

V_{Ego} (km/h)	V_{CO} (km/h)	Time to collision (s)	Latest Warning (m)
80	20	2.3	39
60	20	1.9	21

~~6.6.3.4. If the AEBS did not warn the driver as mentioned in paragraph 6.6.3.3. above, discontinue the test.~~

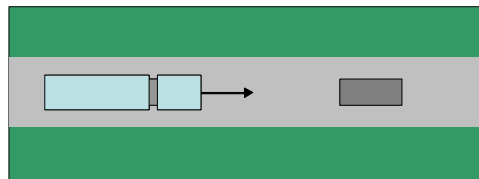
6.5.3.3. Subsequent to the warning(s) a movement of any driver control that indicates that the driver is aware of the pending collision, e.g. operation of the turn indicator, change in position of the accelerator pedal or brake pedal, shall result in the AEBS actions being overridden.

~~6.7. Braking system activation test~~

~~6.7.1. With the vehicle stationary and the ignition locking system in the "Lock" or "Off" position, activate the ignition locking system to the "On" or "Run" position. The AEBS shall perform a check of lamp function as specified in paragraph 5.5.3. of this Regulation.~~

~~6.7.2. Braking system activation with stationary target~~

6.5.4.



~~6.7.2.1. Drive the vehicle, enter the vehicle the test course and smoothly track the lane so that the posture of the vehicle is stable.~~

6.5.4.1. The subject vehicle shall travel in a straight line for a minimum distance of 50m towards the standing target vehicle with a vehicle centreline offset of not more than 0.5m. The target vehicle shall be a 'soft target' representative of a M1 AA saloon category vehicle.

Perform a test at a speed of 80 km/h. The speed shall be maintained constant until the (initial) AEBS driver warning signal, after which there shall be no adjustment of any vehicle control by the driver.

~~6.7.2.2. The AEBS shall:~~

6.5.4.2.

6.5.4.2.1. provide a driver warning as in paragraph 6.5.2.

~~6.7.2.2.1.~~

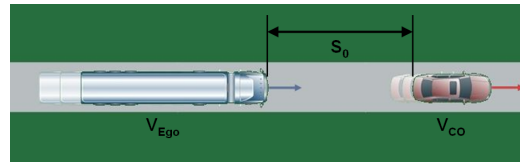
6.5.4.2.2 activate the service braking system as mentioned in paragraph 5.2.2. to level as set by the vehicle manufacturer at a time to collision equalling 0,8 s at the latest.

~~6.7.2.2.2. provoke an average deceleration of at least 3,3 m/s²~~

~~6.7.2.3. If the AEBS did not activate the service braking system as mentioned in paragraph 6.7.2.2. above, discontinue the test.~~

~~6.7.3.~~

6.5.5. Braking system activation with moving target



~~6.7.3.1. Drive the moving target as in paragraph 6.5.4. and drive the subject vehicle, enter it the test course and smoothly track the lane so that the posture of the vehicle is stable.~~

6.5.5.1. The subject vehicle shall travel in a straight line for a minimum distance of 50m towards the moving target vehicle with a vehicle centreline offset of not more than 0.5m. The target vehicle shall be a 'soft target' representative of a M1 AA saloon category vehicle.

Perform 2 tests with the subject vehicle travelling at a constant speed of 60 km/h and 80 km/h and the target vehicle travelling at a speed of 20 km/h in both cases (closing speeds of 40 km/h and 60 km/h respectively). The speed shall be maintained constant until the (initial) AEBS driver warning signal, after which there shall be no adjustment of any vehicle control by the driver.

~~6.7.3.2. Perform three trials at the relative speed between the subject vehicle and the target equalling to 20 km/h, 40 km/h and 60 km/h.~~

~~6.7.3.3. The AEBS shall:~~

6.5.5.2.

6.5.5.2.1. provide a driver warning as in paragraph 6.5.3.

~~6.7.3.3.1.~~

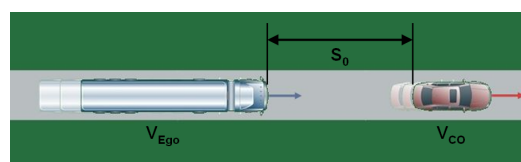
6.5.5.2.2. activate the service braking system as mentioned in paragraph 5.2.1-2. at a time to collision equalling 0,8 s at the latest, and

~~6.7.3.3.2.~~

6.5.5.2.3. ~~provoke an average deceleration of at least 3,3 m/s².~~ initiate a full brake application.

~~6.7.3.4. If the AEBS did not activate the service braking system as mentioned in paragraph 6.7.3.3. above, discontinue the test.~~

6.5.6. Braking system activation with moving target slowing to a stop



6.5.6.1. The subject vehicle and the target vehicle shall travel in the same direction in a straight line for a minimum distance of 50m with a separating distance of 70m and a vehicle centreline offset of not more than 0.5m. The target vehicle shall be a 'soft target' representative of a M1 AA saloon category vehicle.

Perform a test at a speed of 60 km/h. The speed of the subject vehicle shall be maintained constant until the (initial) AEBS driver warning signal, after which there shall be no adjustment of any vehicle control by the driver. The target shall decelerate at 5m/s^2 to a standstill.

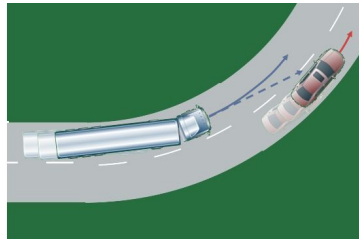
6.5.6.2. The AEBS shall:

6.5.6.2.1. provide a driver warning as in paragraph 6.5.3.

6.5.6.2.2. activate the service braking system as mentioned in paragraph 5.2.2. at a time to collision equalling 0,8 s, and

6.5.6.2.3. initiate a full brake application.

6.5.7. Adjacent vehicle curve test (false warning test)

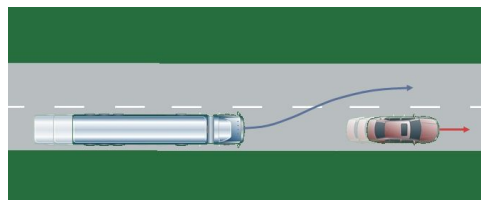


6.5.7.1. The subject vehicle shall approach and pass the target vehicle at a closing speed of 10 km/h when both vehicles are travelling in the centre of adjacent lanes, each 3.5m wide, with the inner marking of the inside lane having a 125m radius of curvature. The target vehicle shall travel at a constant speed of 40 km/h.

The test shall be conducted twice, once with a right hand curve and once with a left hand curve.

6.5.7.2. There shall be no action from the AEBS.

6.5.8. Overtaking manoeuvre test (false warning test)

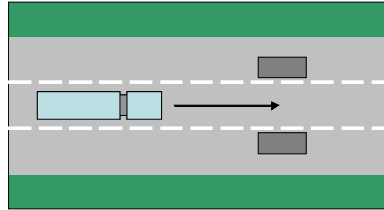


6.5.8.1. With both the subject vehicle and the target vehicles travelling initially in the centre of the same lane, the subject vehicle shall approach and overtake the target vehicle, using an adjacent lane, at a closing speed of 10 km/h. Each lane shall be straight and 3.5m wide. The target vehicle shall travel at a constant speed of 40 km/h.

The subject vehicle shall start the overtaking manoeuvre at a distance of less than 15m from the target vehicle.

6.5.8.2. There shall be no action from the AEBS.

6.5.9. Alley way test (false warning test)



6.5.9.1. The subject vehicle shall approach and pass between 2 target vehicles travelling in the same direction in adjacent lanes. The three lanes shall be straight with the centre lane being 3.5m wide.

The target vehicles shall travel at the outer edge of the centre lane markings at a constant speed of 20 km/h, with their off-set to each other being not more than 1.5m.

The subject vehicle shall have a constant speed of 50 km/h.

6.5.9.2. There shall be no action from the AEBS.

6.5.10. Non-failure loss of functionality test

6.5.10.1. If the AEBS has a non-failure loss of functionality function(s), a loss of function chosen from those identified by the vehicle manufacturer shall be simulated.

6.5.10.2. The appropriate warning signal shall be activated and deactivated when the loss of functionality is simulated and regained.

6.5.11. Manual disablement test

6.5.11.1. If the vehicle is fitted with a means by which the driver can disable the AEBS, it shall be checked that its operation activates the appropriate signal and that the AEBS is automatically reinstated when the ignition start switch is in the “on” (run) position.

~~6.8.~~ ~~Malfunction detection~~ Failure warning test

6.5.12.

~~6.8.1.~~

6.5.12.1. Simulate a an AEBS ~~malfunction~~ failure, for example by disconnecting the power source to any AEBS component, disconnecting any electrical connection between AEBS components, or misaiming the sensor(s). When simulating an AEBS

~~malfunction failure~~, the electrical connections for the ~~telltale lamps~~ driver warning signal and optional manual off-switch shall not be disconnected.

~~6.8.2. Drive the vehicle for up to 60 minutes along any portion of the test course.~~

~~6.8.3. The sum of the total cumulative drive time under paragraph 6.8.2. shall be the lesser of 60 minutes or the time at which the AEBS malfunction telltale illuminates in accordance with paragraph 5.5.2.~~

6.5.12.2. The AEBS failure warning signal shall be activated without delay and remain activated while the vehicle is being driven and is re-activated after a subsequent ignition “off” ignition “on” cycle.

~~6.8.4. If the AEBS malfunction indicator did not illuminate in accordance with paragraph 5.5.2. as required, discontinue the test.~~

7. MODIFICATION OF VEHICLE TYPE AND EXTENSION OF APPROVAL

7.1.

8. CONFORMITY OF PRODUCTION

8.1.

9. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

9.1.

10. PRODUCTION DEFINITELY DISCONTINUED

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11. NAMES AND ADDRESSES OF THE TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS AND OF ADMINISTRATIVE DEPARTMENTS

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12. INTRODUCTORY PROVISIONS

12.1.

Annex 3

SPECIAL REQUIREMENTS TO BE APPLIED TO THE SAFETY ASPECTS OF COMPLEX ELECTRONIC VEHICLE CONTROL SYSTEMS

1. GENERAL

This Annex defines the special requirements for