E/ECE/324 Rev.2/Add.AEBS-A
E/ECE/TRANS/505

30 January 20XX

CLEPA proposed amendments highlight in yellow (bold or lined through) with justification in blue text, 02-12-2010.

AGREEMENT

CONCERNING THE ADOPTION OF UNIFORM TECHNICAL PRESCRIPTIONS FOR WHEELED VEHICLES, EQUIPMENT AND PARTS WHICH CAN BE FITTED AND/OR BE USED ON WHEELED VEHICLES AND THE CONDITIONS FOR RECIPROCAL RECOGNITION OF APPROVALS GRANTED ON THE BASIS OF THESE PRESCRIPTIONS */

Addendum: Regulation No. Collision Avoidance+1

Date of entry into force: XXX

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF MOTOR VEHICLES WITH REGARD TO A COLLISION AVOIDANCE EMERGENCY BRAKING SYSTEM

UNITED NATIONS

*/ Former title of the Agreement:
Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

AEBS/LDWS-TF02-03-Rev.2
091116

AEBS/LDWS-09-02

Regulation No.

[UNIFORM PROVISIONS CONCERNING THE APPROVAL OF MOTOR VEHICLES WITH REGARD TO A COLLISION AVOIDANCE EMERGENCY BRAKING SYSTEM]

CONTENTS

1. SCOPE AND PURPOSE

This Regulation applies to vehicles of category M_2, N_2, M_3 and N_3[1/] with regard to an on-board system to avoid a rear-end in lane collision.

2. DEFINITIONS

2.1. "Advanced Emergency Braking System (AEBS)" means a system which can automatically detect a potentially forward collision and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating a collision.

Justification:
Grammar improvement.

2.1.1. "Advanced Emergency Braking System Mitigation (AEBS-M)" means a system which can automatically detect a potentially forward collision and activate the vehicle braking system to decelerate the vehicle with the purpose of mitigating a collision.

Justification:
As paragraph 2.1.

2.1.2. "Advanced Emergency Braking System Avoidance (AEBS-A)" means a system which can automatically detect a potentially forward collision and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding a collision.

Justification:
As paragraph 2.1.

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

2.3. "Vehicle type with regard to its Advanced Emergency Braking System for Collision Avoidance" means a category of vehicles which do not differ in such essential respects as:

(a) the manufacturer's trade name or mark,

(b) vehicle features which significantly influence the performances of the Advanced Emergency Braking System for Collision Avoidance,

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1/ As defined in Annex 7 to the Consolidated Resolution on the Construction of Vehicles (R.E.3) (document TRANS/WP.29/78/Rev.1/Amend.2, as last amended by Amend.4).

(c) the type and design of the Advanced Emergency Braking System.

2.4. "Subject vehicle" means the vehicle being tested

2.5. "Target vehicle" or "target" means a high volume series production passenger car of category M1 AA saloon 1/ or **in the case of a soft target** an object representative of such a vehicle in terms of its detection characteristics applicable to the sensor system of the AEBS under test.

Justification:

The basis requirement should be for the target to be an actual vehicle. As alternative to prevent or minimise damage to the subject vehicle or the target, an equivalent object can be used. See also paragraph 6.5.1.

2.6. "Moving target" means a target travelling at a constant speed in the same direction and in the centre of the same lane of travel as the subject vehicle.

2.7. "Soft target" means target that will suffer minimum damage and cause minimum damage to the subject vehicle in the event of a collision.

2.8. "Radar Cross Section" means a measure of how detectable an object is with a radar.

2.9. "Collision warning phase" means the phase directly preceding the emergency braking phase, during which the AEBS warns the driver of a potential forward collision.

2.10. ["Emergency braking phase" means the phase starting when the AEBS emits the maximum braking demand or a braking demand for at least **4 5** m/s² deceleration to the service braking system of the vehicle.]

Justification:

Full use should be made of the capability of the vehicle service braking system to avoid or mitigate the severity of the collision. For type-approval purposes to ECE R13 the service braking system must achieve a deceleration of at least 5m/s². Therefore, if a value is to be specified, rather than the term "full braking" (typically vehicles achieve >6m/s²), then 5m/s² is appropriate.

Notes of the Secretariat:
Germany commits to present, at the 10th meeting of the informal group, a draft introductory paragraph, providing background information about the parameters used for defining the emergency braking phase, with the help of relevant explanatory drawings, with the aim of removing the value for a braking demand to a location more appropriate than the definition paragraph.

2.11. "Maximum braking demand" means the maximum deceleration the AEBS requests from the service braking system necessary to significantly decrease the speed of the vehicle at the time of the collision.

2.12. "Common space" means an area on which two or more information functions (e.g. symbol) may be displayed, but not simultaneously.

2.13. "Self-check" means an integrated function that checks for a system failure on a semi-continuous basis at least while the system is active.

3. APPLICATION FOR APPROVAL

3.1. The application for approval of a vehicle type with regard to Advanced Emergency Braking System - Avoidance shall be submitted by the vehicle manufacturer or by his authorized representative.

3.2. It shall be accompanied by the documents mentioned below in triplicate:

3.2.1. a description of the vehicle type with regard to the items mentioned in paragraph 2.4. above, together with a documentation package which gives access to the basic design of the AEBS-A and the means by which it is linked to other vehicle systems or by which it directly controls output variables. The numbers and/or symbols identifying the vehicle type shall be specified; and

3.3. A vehicle representative of the vehicle type to be approved shall be submitted to the Technical Service conducting the approval tests.

4. APPROVAL

4.1. If the vehicle type submitted for approval pursuant to this Regulation meets the requirements of paragraph 5. below, approval of that vehicle shall be granted.

4.2. An approval number shall be assigned to each type approved; its first two digits (00 for the Regulation in its initial form) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same number to the same vehicle type equipped with another type of AEBS-A, or to another vehicle type.

4.3. Notice of approval or of refusal or withdrawal of approval pursuant to this Regulation shall be communicated to the Parties to the Agreement which apply this Regulation by means of a form conforming to the model in Annex 1 and documentation supplied by the applicant being in a format not exceeding A4 (210 x 297 mm), or folded to that format, and on an appropriate scale or electronic format.

4.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation, an international approval mark conforming to the model described in Annex 2, consisting of:

4.4.1 a circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval 2/;

4.4.2. the number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in paragraph 4.4.1. above.

4.5. If the vehicle conforms to a vehicle type approved under one or more other Regulations, annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 4.4.1. need not be repeated; in such a case, the Regulation and approval numbers and the additional symbols shall be placed in vertical columns to the right of the symbol prescribed in paragraph 4.4.1. above.

4.6. The approval mark shall be clearly legible and be indelible.

4.7. The approval mark shall be placed close to or on the vehicle data plate.

5. SPECIFICATIONS

2/ 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Serbia, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for the Russian Federation, 23 for Greece, 24 for Ireland, 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30 (vacant), 31 for Bosnia and Herzegovina, 32 for Latvia, 33 (vacant), 34 for Bulgaria, 35 (vacant), 36 for Lithuania, 37 for Turkey, 38 (vacant), 39 for Azerbaijan, 40 for The former Yugoslav Republic of Macedonia, 41 (vacant), 42 for the European Community (Approvals are granted by its Member States using their respective ECE symbol), 43 for Japan, 44 (vacant), 45 for Australia, 46 for Ukraine, 47 for South Africa, 48 for New Zealand, 49 for Cyprus, 50 for Malta, 51 for the Republic of Korea, 52 for Malaysia, 53 for Thailand, 54 and 55 (vacant) and 56 for Montenegro. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.

5.1. General

5.1.1. Any vehicle fitted with an AEBS-A complying with the definition of paragraph 2.1.2. shall meet the performance requirements contained in paragraphs 5.1 to 5.6.2. of this Regulation ~~[~~when used in highway **(urban, inter-urban, inter-city)** conditions~~]~~ and shall be equipped with ~~an anti-lock braking function [in accordance with Annex 13 of Regulation N°13] [and~~ a Vehicle Stability Function~~]~~ ~~[~~in accordance with Annex 21 of Regulation N°13~~]~~.

Justification:

It is appropriate to define the operating environment in terms of road type for which the AEBS-A is to operate. However, "highway" is not sufficiently precise and "urban, inter-urban, inter-city" is included to provide clarification.

As a result of AEBS action in adverse weather conditions, a vehicle stability function could be more beneficial than an anti-lock braking system as the vehicle stability function would assist the driver in any avoiding manoeuvre while the anti-lock braking system would only be effective in the braking phase. Therefore, as a vehicle stability function also includes an anti-lock braking function, a vehicle stability function is preferred.

If a vehicle stability function (or an anti-lock braking system) is to be specified, then reference should be made to the appropriate ECE Regulation and Annex. This would then establish the performance level of the function/system as is currently the case with EMC (following paragraph).

5.1.2. The effectiveness of the AEBS-A shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by compliance with Regulation No. 10, 03 Series of Amendments

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. The system shall provide the driver with appropriate warning(s) as below:

5.2.1.1. A collision warning when the AEBS-A has detected the possibility of a collision with a preceding vehicle of category M, N or O in the same lane which is travelling at a slower speed, has slowed to a halt or is stationary having not being identified as moving. The warning shall be as specified in paragraph 5.5.1.

5.2.1.2. A failure warning when there is a failure in the AEBS-A that prevents the requirements of this Regulation of being met. The warning shall be as specified in paragraph 5.5.4.

5.2.1.2.1. There shall not be an appreciable time interval between each AEBS-A self-check, or an appreciable delay in illuminating the warning signal in the case of an electrical detectable failure.

5.2.1.3. A deactivation warning, if the vehicle is equipped with a means to manually deactivate the AEBS-A, **which is given** when the system is deactivated. The warning shall be as specified in paragraph 5.4.2.

Justification:

Clarification improvement.

5.2.2. Subsequent to the start of the warning(s) of paragraph 5.2.1.1., and subject to the provisions of paragraphs 5.3.1. to 5.3.3., the system shall autonomously activate the ~~subject~~ vehicle service braking system for slowing down the subject vehicle to a speed equal to or lower than the target vehicle speed. This shall be tested in accordance with paragraph 6.6.3.

Justification:

Not necessary.

5.2.3. The system shall be active at least within the vehicle speed range of 15 km/h up to the maximum design speed of the vehicle, and at all vehicle load conditions between laden and unladen, unless manually deactivated as per paragraph 5.4. In the case of a semi-trailer tractor, the unladen condition is with an unladen semi-trailer attached.

~~[~~5.2.4. The system should not react in terms of warning signal generation or autonomous braking in situations where the driver would not recognise a pending danger, e.g. oncoming vehicles either to the right or left, vehicles in adjacent lanes either right or left or simultaneously both right and left, when carrying-out an overtaking manoeuvre to the right or left, or when overtaking in a right or left hand curve.~~]~~

Justification:

With the driver having a manual off-switch, the benefits only arise if it has zero/minimal use. Therefore, to discourage use of the off-switch, false warnings should be at a minimal level. So that there is a common understanding of that constitutes a false warning (annoyance) it is important to have this paragraph or similar wording (same message) somewhere in the regulation.

Notes of the Secretariat:

Germany commits to present, at the 10th meeting of the informal group, a draft introductory paragraph, providing background provisions about the situations where the AEBS should not initiate nuisance reactions (warnings and brakings).

5.3. Interruption by the driver

5.3.1. The AEBS-A ~~[may /~~ shall~~]~~ provide the means for the driver to interrupt the collision warning phase.

Justification:

A warning that the driver understands, but can not cancel through a normal control movement will lead to annoyance, which in turn encourages use of the off-switch. Therefore, it should be mandated that the driver is able to interrupt the warning.

5.3.2. The AEBS-A shall provide the means for the driver to interrupt the emergency braking phase.

5.3.3. In both cases above, a clear movement of a driver control that indicates that the driver is aware of the impending collision shall result in the AEBS-A actions being overridden. This interruption may be initiated by any positive action (e.g. kick-down, operating the direction indicator control) that indicates that the driver is aware of the emergency situation. The vehicle manufacturer shall state these positive actions to the technical service at the time of type approval ~~[~~and they shall be listed in the test report~~/Annex 3]~~.

Justification:

The override actions are part of the normal operating conditions of the system and, therefore, it is not appropriate for them to be included in Annex 3. Annex 3 is concerned with fault strategy and how one complex electronic control system interfaces with other complex electronic systems regarding safety related functions.

5.4. When a vehicle is equipped with a means to deactivate the AEBS-A, the following conditions shall apply as appropriate:

5.4.1. The AEBS-A function shall be automatically reinstated at the initiation of each new ignition cycle.

5.4.2. A constant optical warning signal shall inform the driver that the AEBS-A function has been deactivated. The yellow warning signal specified in paragraph 5.5.4. below may be used for this purpose.

~~[5.4.3. AEBS off control switch shall have measures which discourage the driver to operate the switch easily.]~~

AEBS/LDWS-09-02

Justification:

To enable the Technical Services to apply a common standard, the "measures which discourage" require to be specified in detail, but in specifying them in detail they become design restrictive. It can be imagined that to provide an off-switch and then make it difficult to operate will create a negative feeling in the driver and could increase (create a new!) driver distraction danger. Therefore, if an off-switch is to be provided, its positioning/design should be so that it is easy to use (at the discretion of the vehicle manufacturer). Over use of the off-switch should be address by requiring a low level of false warnings – not allowing a lot of false warnings and then positioning/designing the off-switch so that the driver can not use it while driving.

5.5. Warning indication

5.5.1. The **collision** warning referred to in paragraph 5.2.1.1. shall be provided by at least 2 modes **selected** from acoustic, haptic or optical.

Justification:

The inclusion of the word "collision" provides easy identification of the warning and aligns with paragraph 5.5.4. – failure warning. Addition of "selected" is a grammar improvement.

5.5.1.1. Where the warning signals are provided in a cascade, an acoustic or haptic mode shall be provided as the first mode.

5.5.1.2. The timing of the warning signals shall be such that they provide the possibility for the driver to react to the risk of collision and take control of the situation, and shall also avoid nuisance for the driver by too early or too frequent warnings. This shall be tested in accordance with the provisions of paragraphs 6.6.2.1. and 6.6.2.2.

5.5.~~3.~~**1.3.** Where an optical means is used as part of the collision warning, the optical signal may be the flashing of the failure warning signal specified in paragraph 5.5.4.

Justification:

Paragraph 5.5.3. is specific to paragraph 5.5.1. and is covered by the requirements of paragraph 5.5.2. Therefore, it is appropriate to position it before paragraph 5.5.2.

5.5.~~2.~~**1.4.** A description of the warning signals and the sequence in which they are presented to the driver shall be provided by the vehicle manufacturer at the time of type-approval and recorded in the test report.

Justification:

The requirement of paragraph 5.5.2. is specific to paragraph 5.5.1., but there is no indication of this. Therefore, it and the preceding requirements specific to paragraph 5.5.1. should become sub-paragraphs of 5.5.1.

5.5.4. The failure warning referred to in paragraph 5.2.1.2. shall be a constant yellow optical warning signal.

5.5.5. ~~Except as provided in paragraph 5.5.4.,~~ **E**ach AEBS-A optical warning signal~~s~~ 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 (initial system (power-on)).

In the case of an AEBS failure, it is not necessary for the warning signal referred to in paragraph 5.5.4. to be switched off before being switched on again to indicate the failure.

This requirement does not apply to warning signals shown in a common space.

Justification:

The bulb check is equally applicable to the failure warning. If the bulb/circuit is defective there is no possibility to later warn the driver of a failure.

5.5.6. The optical warning signals shall be clearly visible even by daylight and the satisfactory condition of the signal easily verifiable by the driver from the driver's seat.

~~[~~5.5.7. ~~The~~ **A**coustic collision warning signals shall be clearly audible by the driver from his driving seat, even when the vehicle is ~~in movement.]~~ **travelling at its maximum design speed.**

Justification:

An acoustic warning signal is not mandatory. Therefore “The” is not appropriate. “In movement” could be a speed of 1 km/h and a signal at this speed may not be audible at 100 km/h.

5.5.8. When the driver is provided with an optical warning signal to indicate that the AEBS-A is temporarily not available, for example due to inclement weather conditions, the signal shall be constant **and yellow in colour**. The failure warning signal specified in paragraph 5.5.4. may be used ~~to indicate that AEBS-A is temporarily not available~~.

Justification:

The colour should be specified so that the same warning colour is used when the failure warning signal is not used. The wording at the end of the last sentence is superfluous.

5.6. Provisions for the periodic technical inspection

5.6.1. At a periodic technical inspection the AEBS-A shall pass/fail as a result of a visible observation of the failure warning signal status, following a “power-ON” and the bulb check (off – system OK, on – system fault present).

In the case of the failure warning signal being in a common space, the common space must be observed to be functional prior to the failure warning signal status check.

5.6.2. At the time of type-approval, the means to protect against simple unauthorized modification of the operation of the failure warning signal chosen by the manufacturer shall be confidentially outlined.

Alternatively, this protection requirement is fulfilled when a secondary means of checking the correct operational status of the AEBS-A is available.

6. Test procedure

6.1. Test conditions

6.1.1. The test shall be performed on a flat, dry concrete or asphalt surface **providing good adhesion**.

Justification:
To achieve a high (emergency) deceleration it is necessary to conduct the tests on a surface providing good adhesion.

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

6.1.3. The horizontal visibility range shall allow ~~observing~~ the target **to be observed throughout** ~~at the test course during all states of~~ the test.

Justification:
Grammar improvement.

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 3 km/h.~~

~~6.2.3. Time shall be measured with an accuracy of +/- 1%.~~

~~6.2.4. Decelerations shall be measured with an accuracy of +/- 0.1 m/s².]~~

Justification:

As an approved laboratory it is for the Technical Service to use measuring equipment of an appropriate standard. Where a tolerance is necessary for conducting the tests, values should be given in the appropriate test paragraph.

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~~ **the detection of** a target vehicle and **the** braking **of** the subject vehicle up to collision avoidance

Justification:

Grammar improvement.

6.4. Vehicle conditions

6.4.1. Test weight

The vehicle shall be tested in a condition of load to be agreed between the manufacturer and the Technical Service. No alteration shall be made once the test procedure has begun.

~~[~~6.5.1. The target used for the tests shall be ~~either of the bulk of~~ a regular high volume series production passenger car of category M1 AA saloon , ~~[an equivalent soft target having a total radar cross section (RCS) of at least 10 m² +/- 10 % / two reflectors each with a radar cross section of less than 15 dBsm],~~ or **alternatively** a "soft target" representative of such a vehicle in terms of its identification characteristics applicable to the sensor system of the AEBS-A under test. **1/** ~~]~~

1/ The identification characteristics of the soft target shall be agreed between the Technical Service and the vehicle manufacturer as being equivalent, e.g. 2 reflectors each of <15 dBsm in the case of a 77 GHz radar.

Justification:

The basic requirement should be that the target is an actual vehicle - a typical passenger car (high volume and AA saloon = typical). Target characteristic that are representative of the vehicle and are applicable to the senor system, e.g. radar reflectability, are then permitted as an alternative. The target requirements should only be given in general terms, and not be design specific (e.g. 2 reflectors) as this is design restrictive.

Note of the Secretariat:

AEBS/LDWS-09-02

UK committed to investigate proposing a list of possible targets, to be presented at the 10th meeting of the informal group.

6.5.4. Details that enable the target(s) to be specifically identified shall be recorded in the vehicle type-approval documentation.

6.6. Warning and activation test with moving target

[6.6.1. The subject vehicle and the moving target shall travel in a straight line, in the same direction, for at least 2 seconds prior to the functional part of the test, with a vehicle **to target** centreline offset of not more than 0.5m.

The functional part of the test shall start with the subject vehicle travelling at a speed of 80 ± 2 km/h, the moving target at a speed of [15 ± 1] km/h and a separation distance of at least 120 m between them.

From the start of the functional part of the test until the subject vehicle comes to a speed equal to that of the target vehicle/soft target or a standstill there shall be no adjustment to any subject vehicle control by the driver **other than slight steering adjustments to counteract any drifting**.] /

~~[6.6.1. The subject vehicle shall travel at a speed of 80±2km/h in a straight line for a distance of 120m towards the moving target travelling in the same direction, with a vehicle centreline offset of not more than 0.5m.]~~

Justification:

The testing sequence starts with a "setting-up" phase in which the relative positioning of the subject vehicle and the moving target is established (first paragraph). A functional phase (second paragraph) follows the setting-up phase, in which the warnings are provided and the emergency braking occurs. The speed of the subject vehicle and the speed of the moving target are specified, together with a minimum separation distance. The minimum separation distance is to ensure that the sensor(s) have sufficient time in which to register the target. The third paragraph specifies the allowable driver action during the functional phase.

[6.6.2. The timing ~~for~~ **of** the two **or more** collision warning modes referred to in Paragraph 5.5.1. shall comply with the following:

Justification:

Paragraph 5.5.1.2 only requires 2 warning modes as a minimum. Therefore, more than 2 could be used.

6.6.2.1. Where the warning signals are provided in a cascade,

– the first of the ~~2~~ warning modes shall be provided no later than ~~[2.0 / 1.4 / 0.8]~~ **1.5** s ~~[and shall occur not earlier than [2.5] s]~~, and
– the last of the ~~2~~ warning modes shall be provided no later than ~~[~~0.8~~]~~s

before the start of the Emergency Braking phase.

Justification:

As there can be more than 2 warning modes the specifying of 2 is not appropriate.

1.5 seconds is the minimum time which allows a inattentive driver to react and take control of the situation.

It is important to minimizing the number of warnings when the driver sees no reason for the warning. Driver annoyance should be reduced to a minimum so that he/she is not encouraged to switch the system off or disable it.

However, as support is limited for an "not earlier than" requirement, this requirement (as proposed by CLEPA) is withdrawn on the basis of including a no false warning requirement in the proposed no false braking test (paragraph 6.10).

It is considered that the specifying of a "no later than" time for the last warning is unnecessary. However, if the consensus of the Contracting Parties is that it is necessary, a time of 0.8 seconds can be supported.

6.6.2.2. Where the warning signals are not provided in a cascade, the ~~2~~ warning modes shall be provided no later than ~~[2.0 / 1.4 / 0.8]~~ **1.5** s ~~[and shall occur not earlier than [2.5] s]~~ before the start of the Emergency Braking phase.

Justification:

As 6.6.2.1. above.

6.6.2.3. When the AEBS-A applies the service braking during the warning phase, the speed reduction demanded by the AEBS-A shall not exceed ~~[7 /~~ 10~~]~~ km/h.]

Justification:

An action to warn an inattentive driver so that he/she can take control of the situation should not result in the creation of an undue hazard for other road uses. A high speed reduction, as a warning, for a situation that is not yet critical could create an over reaction from a following driver which results in an accident. Therefore, a maximum speed reduction should be specified and while CLEPA proposes a 10 km/h value, 7 km/h can be accepted. The difference of 3 km/h is considered useful in terms of energy dissipation without significantly increasing the risk for a following driver.

~~[~~6.6.3. The **emergency braking phase shall result in the** subject vehicle **having a mean fully developed deceleration of at least 5 m/s² and it** shall not impact the moving target.~~]~~

Justification:

It is necessary to specify a minimum deceleration requirement otherwise low deceleration rates could be used with correspondingly long braking periods. The result of a long braking period, would be a warning so early that the driver does not understand the need for the warning and is encouraged to switch the system off.

The situation under consideration in this regulation is an "emergency" situation and in these situations full use should be made of the vehicles service braking performance to avoid the collision or obtain the maximum energy reduction in the case of collision occurring.

For type-approval purposes to ECE R13, the service braking system must achieve a deceleration of at least 5m/s². Therefore, if a value is to be specified, rather than the term "full braking" (typically vehicles achieve >6m/s²), then 5m/s² is appropriate.

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NOTE: M_2 and N_2 vehicles

The weight range for N_2 vehicles is from 3.5t to 12.0t and in Europe the type of braking system changes from hydraulic at 3.5t, via air-over-hydraulic, to full air at 12.0t. While there is no difference in the braking system and vehicle characteristics between an 11.5t N_2 and a 12.5t N_3 there are very significant differences in the braking system and vehicle dynamic behaviour of a 3.5t N_2.

Therefore, while the values in paragraph 6.6. (M_3 and N_3 vehicles with full air braking systems) can be applied to some M_2 and N_2 vehicles they can not be applied to all M_2 and N_2 vehicles.

As a result, performance requirements should be braking system based, i.e. full air and hydraulic/air-over-hydraulic, and not vehicle category based.

Currently there are no M_2 or N_2 vehicles with hydraulic or air-over-hydraulic braking systems and AEBS in series production and, therefore, no in-service experience on which to draw.

Using the experience of AEBS in heavy cars and extrapolating it to M_2/N_2 the following values can be suggested for a moving target test with regard to hydraulic/air-over-hydraulic braked vehicles:

- Subject vehicle speed: 40 km/h
- Moving target speed: 15 km/h

- Earliest warning: no later than 1.5 seconds
- Latest warning: no later than 0.8 second
- Minimum deceleration in braking phase: 5 m/s²

X.x. Warning and activation test with a stationary target

X.x.1. The subject vehicle shall approach the stationary target in a straight line for at least 2 seconds prior to the functional phase of the test with a vehicle to target centreline offset of not more than 0.5m. The target shall be representative of a M1 AA saloon category vehicle and may be a "soft target".

The functional phase shall start when subject vehicle is travelling at a speed of 20 ± 2 km/h and is a distance of at least 120 m from the target.

From the start of the functional phase until the subject vehicle comes to a halt there shall be no adjustment to any subject vehicle control by the driver other than slight steering adjustments to counteract any drifting.

X.x.2. The timing of the two or more collision warning modes referred to in Paragraph 5.5.1. shall comply with the following:

X.x.2.1. Where the warning signals are provided in a cascade,

- **the first of the warning modes shall be provided no later than 1.5 s, and**
- **the last of the warning modes shall be provided no later than 0.8 s**

before the start of the Emergency Braking phase.

X.x.2.2. Where the warning signals are not provided in a cascade, the warning modes shall be provided no later than 1.5 s before the start of the Emergency Braking phase.

X.x.2.3. When the AEBS-A applies the service braking during the warning phase, the speed reduction demanded by the AEBS-A shall not exceed 10 km/h.

X.x.3. The emergency braking phase shall result in the subject vehicle having a mean fully developed deceleration of at least 5 m/s² and it shall not impact the target.

Justification:

Stationary vehicles in the subject vehicle lane that would never be seen by the AEBS "as moving" are a reality and as there are systems in series production that can identify such stationary vehicles, they should be included in the regulation.

The proposed requirements are relatively low, but establish an initial standard for collision avoidance with regard to a "not seen moving stationary vehicle".

6.7. Failure detection test

6.7.1. Simulate an electrical failure, for example by disconnecting the power source to any AEBS-A component, disconnecting any electrical connection between AEBS-A components. When simulating an AEBS-A failure, neither the electrical connections for the driver warning signal of paragraph 5.5.4. or the optional manual AEBS-A deactivation control of paragraph 5.4. shall ~~not~~ be disconnected.

Justification:

Correction – no change in requirement. The electrical connections for the driver warning signal and deactivation control shall not be disconnected. However by using the word “neither” in the sentence, the use of the word “not” is incorrect.

6.7.2. The failure warning signal mentioned in paragraph 5.5.4. shall be activated and remain activated not later than 10 seconds after the vehicle has being driven at a speed greater than 15 km/h and be reactivated after a subsequent ignition “off” ignition “on” cycle with the vehicle stationary as long as the simulated failure exists.

6.8. Deactivation test

6.8.1. For vehicles equipped with means to deactivate the AEBS-A, turn the ignition (start) switch to the "on" (run) position and deactivate the AEBS-A. The warning signal mentioned in paragraph 5.4.2. shall be activated. Turn the ignition (start) switch to the "off" position. Again, turn the ignition (start) switch to the "on" (run) position and verify that the previously activated warning signal is not reactivated, thereby indicating that the AEBS-A has been reinstated as specified in paragraph 5.4.1. If the ignition system is activated by means of a “key”, the above requirement shall be fulfilled without removing the key.

[6.9. ~~Test of deactivation of service brakes of AEBS-A to the obstacles outside the lane~~

False warning and false braking test

Justification:

Important to have a false warning test in addition to a false braking test so as to signify the importance of minimizing the number of warnings when there is no driver perceived reason, so that the driver is not encouraged to switch the system off or disable it.

A simple title is sufficient. Details are given in following sub-paragraphs.

6.9.1. ~~Stationary obstacles~~

6.9.1.1. ~~The obstacles outside lane shall be the two stationary vehicles of category M1 AA saloon in the same direction in both right and left lanes. The width of a lane is 3.5m, each vehicle is located on the centre of the lane.~~

Two stationary vehicles, of category M1 AA saloon, shall be positioned;

- **with the vehicle centre line in the centre of a lane to the right and left of the subject vehicle lane,**
- **so as to face in the same direction of travel as the subject vehicle,**
- **with the rear of each vehicle aligned with the other,**

where all three lanes are 3.5m wide.

Justification:

Clarification of requirements – no change of objective.

6.9.1.2. ~~Drive from more than 60m behind the obstacles outside the lane and trace the centre of the lane at the constant speed of 50+/- 2km/h, until passing over the obstacles outside the lane.~~

The subject vehicle shall travel for a distance of at least 60m, at a constant speed of 50 km/h, in a straight line, in the centre of the centre lane before passing between the 2 stationary vehicles.

During the test there shall be no adjustment of any subject vehicle control other than slight steering adjustments to counteract any drifting.

Justification:

Clarification of requirements – no change of objective.

6.9.1.3. The AEBS-A shall not **provide a warning or** initiate the emergency braking phase.

Justification:

Minimize driver annoyance.

~~6.9.2. Moving obstacles~~

~~6.9.2.1. The obstacles outside lane shall be two vehicles of category M1 AA saloon in the same direction as the subject vehicle travelling in both right and left lanes. The velocity of each vehicle is 30+/- 2km/h. The width of a lane is 3.5m, each vehicle shall be driven on the centre of the lane.~~

~~6.9.2.2. Drive from more than 60m behind the obstacles outside the lane and trace the centre of the lane at the constant speed of 50+/- 2km/h, until passing over the obstacles outside the lane.~~

~~6.9.2.3. The AEBS-A shall not initiate the emergency braking phase.]~~

Justification:

Moving test brings no additional benefit – stationary test is more severe.

7. MODIFICATION OF VEHICLE TYPE AND EXTENSION OF APPROVAL

7.1. Every modification of the vehicle type as defined in paragraph 2.3. above shall be notified to the Administrative Department which approved the vehicle type. The department may then either:

7.1.1. consider that the modifications made do not have an adverse effect on the conditions of the granting of the approval and grant an extension of approval;

7.1.2. consider that the modifications made affect the conditions of the granting of the approval and require further tests or additional checks before granting an extension of approval.

7.2. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph 4.3. above to the Contracting Parties to the Agreement which apply this Regulation.

7.3. The Competent Authority shall inform the other Contracting Parties of the extension by means of the communication form which appears in Annex 2 to this Regulation. It shall assign a serial number to each extension, to be known as the extension number.

8. CONFORMITY OF PRODUCTION

8.1. Procedures concerning conformity of production shall conform to the general provisions defined in Appendix 2 to the Agreement (E/ECE/324-E/ECE/TRANS/505/Rev.2) and meet the following requirements:

8.2. A vehicle approved pursuant to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements of paragraph 5. above;

8.3. The Competent Authority which has granted approval may at any time verify the conformity of control methods applicable to each production unit. The normal frequency of such inspections shall be once every two years.

9. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

9.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 8. above are not complied with.

9.2. If a Contracting Party withdraws an approval it had previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation by sending them a communication form conforming to the model in Annex 1 to this Regulation.

10. PRODUCTION DEFINITELY DISCONTINUED

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he shall so inform the authority which granted the approval, which in turn shall forthwith inform the other Contracting Parties to the Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

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

The Contracting Parties to the Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Administrative Departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval are to be sent.

Annex 1

COMMUNICATION

(Maximum format: A4 (210 x 297 mm))

issued by : Name of administration:
.....
.....
.....

concerning: 2/ APPROVAL GRANTED
APPROVAL EXTENDED
APPROVAL REFUSED
APPROVAL WITHDRAWN
PRODUCTION DEFINITELY DISCONTINUED

of a type of vehicle with regard to the collision avoidance emergency braking system pursuant to Regulation No.

Approval No.: .....Extension No.: .....

1. Trademark: .....

2. Type and trade name(s): .....

3. Name and address of manufacturer: .....

4. If applicable, name and address of manufacturer's representative: .....
.....

5. Brief description of vehicle: .....

6. Data to enable the identification of the type of AEBS-A: .....
.....

7. Date of submission of vehicle for approval: .....

8. Technical Service performing the approval tests: .....

9. Date of report issued by that service: .....

10. Number of report issued by that service: .....

11. Approval with regard to the AEBS-A is granted/refused: 2/ .....

12. Place: .....

13. Date: .....

14. Signature: .....

15. Annexed to this communication are the following documents, bearing the approval number indicated above:

..... List of the positive actions enabling the driver to interrupt the braking phase
..... Description of the AEBS-A warning strategy
.....Details which enable the targets to be specifically identified

17. Any remarks: .....

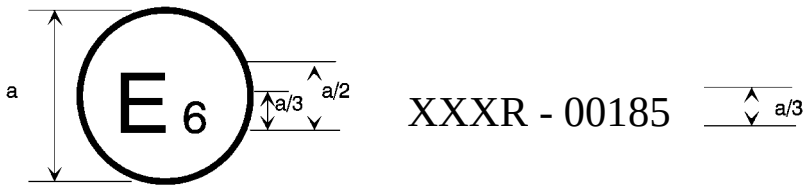
1/ Distinguishing number of the country which has granted/extended/refused/withdrawn an approval (see approval provisions in the Regulation).

2/ Delete what does not apply.

Annex 2

ARRANGEMENTS OF APPROVAL MARKS

(see paragraphs 4.4. to 4.4.2. of this Regulation)



a = 8 mm min

The above approval mark affixed to a vehicle shows that the vehicle type concerned has been approved in Belgium (E6) with regard to the AEBS-A pursuant to Regulation No. . The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of Regulation No. in its original form.

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 documentation, fault strategy and verification with respect to the safety aspects of Complex Electronic Vehicle Control Systems (definition 2.3. below) as far as this Regulation is concerned.

This annex may also be called, by special paragraphs in this Regulation, for safety related functions which are controlled by electronic system(s).

This annex does not specify the performance criteria for "The System" but covers the methodology applied to the design process and the information which must be disclosed to the Technical Service, for Type Approval purposes.

This information shall show that "The System" respects, under normal and fault conditions, all the appropriate performance requirements specified elsewhere in this Regulation.

2. DEFINITIONS

For the purposes of this annex,

2.1. "Safety concept" is a description of the measures designed into the system, for example within the electronic units, so as to address system integrity and thereby ensure safe operation even in the event of an electrical failure.

The possibility of a fall-back to partial operation or even to a back-up system for vital vehicle functions may be a part of the safety concept.

2.2. "Electronic control system" means a combination of units, designed to co-operate in the production of the stated vehicle control function by electronic data processing.

Such systems, often controlled by software, are built from discrete functional components such as sensors, electronic control units and actuators and connected by transmission links. They may include mechanical, electro-pneumatic or electro-hydraulic elements.

"The System", referred to herein, is the one for which type approval is being sought.

2.3. "Complex electronic vehicle control systems" are those electronic control systems which are subject to a hierarchy of control in which a controlled function may be over-ridden by a higher level electronic control system/function.

A function which is over-ridden becomes part of the complex system.

2.4. "Higher-level control" systems/functions are those which employ additional processing and/or sensing provisions to modify vehicle behaviour by commanding variations in the normal function(s) of the vehicle control system.

This allows complex systems to automatically change their objectives with a priority which depends on the sensed circumstances.

2.5. "Units" are the smallest divisions of system components which will be considered in this annex, since these combinations of components will be treated as single entities for purposes of identification, analysis or replacement.

2.6 "Transmission links" are the means used for inter-connecting distributed units for the purpose of conveying signals, operating data or an energy supply.

This equipment is generally electrical but may, in some part, be mechanical, pneumatic, hydraulic or optical.

2.7. "Range of control" refers to an output variable and defines the range over which the system is likely to exercise control.

2.8. "Boundary of functional operation" defines the boundaries of the external physical limits within which the system is able to maintain control.

3. DOCUMENTATION

3.1. Requirements

The manufacturer shall provide a documentation package which gives access to the basic design of "The System" and the means by which it is linked to other vehicle systems or by which it directly controls output variables.

The function(s) of "The System" and the safety concept, as laid down by the manufacturer, shall be explained.

Documentation shall be brief, yet provide evidence that the design and development has had the benefit of expertise from all the system fields which are involved.

For periodic technical inspections, the documentation shall describe how the current operational status of "The System" can be checked.

3.1.1. Documentation shall be made available in 2 parts:

(a)The formal documentation package for the approval, containing the material listed in Section 3 (with the exception of that of paragraph 3.4.4.) which shall be supplied to the technical service at the time of submission of the type approval application. This will be taken as the basic reference for the verification process set out in paragraph 4. of this annex.

(b)Additional material and analysis data of paragraph 3.4.4., which shall be retained by the manufacturer, but made open for inspection at the time of type approval.

Description of the functions of "The System"

A description shall be provided which gives a simple explanation of all the control functions of "The System" and the methods employed to achieve the objectives, including a statement of the mechanism(s) by which control is exercised.

3.2.1. A list of all input and sensed variables shall be provided and the working range of these defined.

3.2.2. A list of all output variables which are controlled by "The System" shall be provided and an indication given, in each case, of whether the control is direct or via another vehicle system. The range of control (paragraph 2.7.) exercised on each such variable shall be defined.

3.2.3. Limits defining the boundaries of functional operation (paragraph 2.8.) shall be stated where appropriate to system performance.

3.3. System layout and schematics

3.3.1. Inventory of components

A list shall be provided, collating all the units of "The System" and mentioning the other vehicle systems which are needed to achieve the control function in question.

An outline schematic showing these units in combination, shall be provided with both the equipment distribution and the interconnections made clear.

3.3.2. Functions of the units

The function of each unit of "The System" shall be outlined and the signals linking it with other Units or with other vehicle systems shall be shown. This may be provided by a labelled block diagram or other schematic, or by a description aided by such a diagram.

3.3.3. Interconnections

Interconnections within "The System" shall be shown by a circuit diagram for the electric transmission links, by an optical-fiber diagram for optical links, by a piping diagram for pneumatic or hydraulic transmission equipment and by a simplified diagrammatic layout for mechanical linkages.

3.3.4. Signal flow and priorities

There shall be a clear correspondence between these transmission links and the signals carried between units.

Priorities of signals on multiplexed data paths shall be stated, wherever priority may be an issue affecting performance or safety as far as this Regulation is concerned.

3.3.5. Identification of units

Each unit shall be clearly and unambiguously identifiable (e.g. by marking for hardware and marking or software output for software content) to provide corresponding hardware and documentation association.

Where functions are combined within a single Unit or indeed within a single computer, but shown in multiple blocks in the block diagram for clarity and ease of explanation, only a single hardware identification marking shall be used.

The Manufacturer shall, by the use of this identification, affirm that the equipment supplied conforms to the corresponding document.

3.3.5.1. The identification defines the hardware and software version and, where the latter changes such as to alter the function of the unit as far as this Regulation is concerned, this identification shall also be changed.

3.4. Safety concept of the manufacturer

3.4.1. The Manufacturer shall provide a statement which affirms that the strategy chosen to achieve "The System" objectives will not, under non-fault conditions, prejudice the safe operation of systems which are subject to the prescriptions of this Regulation.

3.4.2. In respect of software employed in "The System", the outline architecture shall be explained and the design methods and tools used shall be identified. The Manufacturer shall be prepared, if required, to show some evidence of the means by which they determined the realisation of the system logic, during the design and development process.

3.4.3. The Manufacturer shall provide the technical authorities with an explanation of the design provisions built into "The System" so as to generate safe operation under fault conditions. Possible design provisions for failure in "The System" are for example:

(a)Fall-back to operation using a partial system.
(b)Change-over to a separate back-up system.
(c)Removal of the high level function.

In case of a failure, the driver shall be warned for example by warning signal or message display. When the system is not deactivated by the driver, e.g. by turning the Ignition (run) switch to "off", or by switching off that particular function if a special switch is provided for that purpose, the warning shall be present as long as the fault condition persists.

3.4.3.1. If the chosen provision selects a partial performance mode of operation under certain fault conditions, then these conditions shall be stated and the resulting limits of effectiveness defined.

3.4.3.2. If the chosen provision selects a second (back-up) means to realise the vehicle control system objective, the principles of the change-over mechanism, the logic and level of redundancy and any built in back-up checking features shall be explained and the resulting limits of back-up effectiveness defined.

3.4.3.3. If the chosen provision selects the removal of the higher level function, all the corresponding output control signals associated with this function shall be inhibited, and in such a manner as to limit the transition disturbance.

3.4.4. The documentation shall be supported, by an analysis which shows, in overall terms, how the system will behave on the occurrence of any one of those specified faults which will have a bearing on vehicle control performance or safety.

This may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) or any similar process appropriate to system safety considerations.

The chosen analytical approach(es) shall be established and maintained by the manufacturer and shall be made open for inspection by the technical service at the time of the type approval.

3.4.4.1. This documentation shall itemise the parameters being monitored and shall set out, for each fault condition of the type defined in paragraph 3.4.4. above, the warning signal to be given to the driver and/or to service/technical inspection personnel.

4. VERIFICATION AND TEST

4.1. The functional operation of "The System", as laid out in the documents required in paragraph 3., shall be tested as follows:

4.1.1. Verification of the function of "The System"

As the means of establishing the normal operational levels, verification of the performance of the vehicle system under non-fault conditions shall be conducted against the manufacturer's basic benchmark specification unless this is subject to a specified performance test as part of the approval procedure of this or another Regulation.

4.1.2. Verification of the safety concept of paragraph 3.4.

The reaction of "The System" shall, at the discretion of the type approval authority, be checked under the influence of a failure in any individual unit by applying corresponding output signals to electrical units or mechanical elements in order to simulate the effects of internal faults within the unit.

The verification results shall correspond with the documented summary of the failure analysis, to a level of overall effect such that the safety concept and execution are confirmed as being adequate.
