

Notes from the Secretariat :

The Secretariat respected the following principles when drafting the document:

- TF02 recommendation adopted by IG03: text in normal characters.
- Wording newly appeared at IG03: text in bold characters
- Paragraphs will be re-numbered subsequently, in order to avoid creating confusion with some changes to the current cross-references

For ease of document management, the notes and action points are collected in tables below the relevant paragraphs.

AEBS/LDWS-02-02-Rev.1
100108

E/ECE/324
E/ECE/TRANS/505

Rev.2/Add.AEBS

30 January 20XX

AGREEMENT

AGREEMENT ON UNIFORM TECHNICAL PRESCRIPTIONS FOR MOTOR VEHICLE EQUIPMENT AND PARTS WHICH CAN BE FITTED TO CERTAIN CATEGORIES OF MOTOR VEHICLES AND THE CONDITIONS FOR RECIPROCAL RECOGNITION OF APPROVALS GRANTED ON THE BASIS OF THESE PRESCRIPTIONS */

(Revision 2, including the amendments which entered into force on 16 October 1995)

Addendum AEBS: Regulation No. AEBS+1

Date of entry into force: XXX

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF MOTOR VEHICLES WITH REGARD TO THE ADVANCED 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.

GE.11-

Regulation No. AEBS

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF MOTOR VEHICLES
WITH REGARD TO THE ADVANCED EMERGENCY BRAKING SYSTEM

CONTENTS

REGULATION	<u>Page</u>
1. Scope	
2. Definitions	
3. Application for approval	
4. Approval	
5. Specifications	
6. Test procedure	
7. Modification of vehicle type and extension of approval	
8. Conformity of production	
9. Penalties for non-conformity of production	
10. Production definitely discontinued	
11. Names and addresses of Technical Services responsible for conducting approval tests, and of Administrative Departments	

AEBS/LDWS-TF02-03-Rev.2

12 Introductory provisions

ANNEXES

Annex 1: Communication concerning the approval or extension or refusal or withdrawal of approval or production definitely discontinued of a type of vehicle with regard to the lane departure warning system pursuant to Regulation No. AEBS

Annex 2: Arrangements of approval marks

Annex 3:

1. SCOPE AND PURPOSE

1.1. This Regulation applies to the advanced emergency braking system of vehicles of category M₂, N₂, M₃ and N₃^{1/}.

TF02 recommendation	Justification	Notes from TF02	IG03 discussion
<p>1.2. Contracting Parties may mandate the fitment of AEBS to specific category among M2, M3, N2 and N3 in their territory. In this case, at the time of application of this Regulation, Contracting Parties shall notify to the Secretary-General of the United Nations that they intend to mandate the fitment of AEBS specified in this regulation in their territory for which vehicle.</p>	<p>Proposal 1 by Japan (AEBS/LDWS-TF02-07): Since the traffic accident situation in each country may differ, any Contracting Party may prefer mandating the fitment of AEBS specified by the technical requirement of this regulation to the specific vehicle. To achieving this demand under the mutual recognition under 1958 agreement, if Contracting Party want to require to install AEBS to the specific vehicle, it is necessary to declare it to other Contracting Party beforehand. This amendment proposal is based on ECE116 and the document ECE/TRANS/WP.29/2009/129.</p>	<p><i>Industry concern about how such new provision can function in the frame of the 1958 Agreement. In particular, concerns about the communication delays and quality between the different UN and national institutions. Industry indeed needs to get information well in time to adapt their production.</i></p>	<p>CLEPA repeated their concern about applicability of the proposed system. Chair: suggested to request guidance from GRRF. Conclusion:</p> <ul style="list-style-type: none"> • All parties to check applicability of the proposal • Request for advice to GRRF-67 • Clarification of the wording might be necessary
GRRF-67			


^{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).

AEBS/LDWS-TF02-03-Rev.2

Current proposal	Action point from TF01	TF03/IG04
<p>1.3. Contracting Parties shall issue or accept approvals with respect to vehicles equipped with AEBS detecting both moving and stationary targets unless they notify to the Secretary-General of the United Nations their option to issue or accept approvals with respect to vehicles equipped with AEBS detecting moving targets only. Such notification shall have effect in accordance with the time scales laid down in Article 1, paragraphs 6. and 7. of the 1958 Agreement (E/ECE/TRANS/505/Rev.2).</p>	<p><i>Japan to consider, for the purpose of developing a draft regulatory text for an AEBS for "moving targets", the possibility of accepting higher decelerations than the ones proposed in document AEBS/LDWS-02-10 (page 12, paragraph 5.2.1.2.1.5.).</i></p>	<p>(No IG03 discussion)</p>

2.

DEFINITIONS

Current proposal	Notes from TF02
Order of the definitions	<p><i>Following a discussion as to whether definitions should serve for the purpose of the performance requirements and/or for the test procedures, the chair proposed to consider to re-arrange the order of the definitions as per document AEBS/LDWS-TF02-11</i></p>  <p>AEBS-LDWS-TF02-11 AEBS definitions chair</p>
<p>(No IG-03 discussion): (Note also document AEBS/LDWS-03-03) TF03/IG04:</p>	

For the purposes of this Regulation:

- 2.1. "Approval of a vehicle type" means the full procedure whereby a Contracting Party to the Agreement certifies that a vehicle type meets the technical requirements of this Regulation;
- 2.2. "Vehicle type with regard to its Advanced Emergency Braking System" 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,
 - (c) the type and design of the Advanced Emergency Braking System.

AEBS/LDWS-TF02-03-Rev.2

Current proposal	TF02 recommendation
2.3. " <u>Advanced Emergency Braking System (AEBS)</u> " 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.	" <u>Advanced Emergency Braking System (AEBS)</u> " means a system which can automatically detect a potentially potential forward collision and automatically activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating a collision.
(No IG-03 discussion): (Note also document AEBS/LDWS-03-03) TF03/IG04:	

Current proposal	Justification	Notes from TF02
2.4. " <u>Time to collision</u> " means the delay remaining between the instant 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.	Was considered by the Secretariat, at the time of drafting the 1 st version of the skeleton paper, as the simplest way to define a reference point throughout the test procedure.	<i>Definition to be kept or deleted subject to decision about the main parameters.</i> <i>If kept, definition to read as follows: "<u>Time to collision</u>" 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 direction during that delay.</i>
(No IG-03 discussion) TF03/IG04:		

Current proposal	Notes from TF02
2.5. “ <u>Remaining reaction time</u> ” 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 .	<i>Definition to be kept or deleted subject to decision about the main parameters. Numbering to be revised accordingly.</i>
(No IG-03 discussion) TF03/IG04:	

OICA proposal	Justifications	Notes from TF02
2.XX. “ <u>Emergency braking</u> ” means the maximum braking demand of the AEBS system in purpose of avoiding or mitigating an accident.” 5.1.3. The AEBS shall provide the warning referred to in para. 5.5.1. in any case before the emergency braking phase as defined in 2.XX.”	The AEBS functions in a cascade of 2 successive phases: warning phase and emergency braking phase. OICA believes that the AEBS should provide the warning referred to in para. 5.5.1. in any case BEFORE the emergency braking phase. This implies the addition of a new definition for “emergency braking”. Quantitative requirements should however remain in the test procedure section (same philosophy as in braking regulations).	<ul style="list-style-type: none"> • <i>Japan to propose improved definition</i> • <i>OICA to propose definitions for warning and braking phases.</i> • <i>All to consider timing for latest warning using the same reference point</i> • <i>Warning mandatory only in “normal conditions” (high μ, sufficient time)</i>
IG-03 discussion: Following a presentation by Japan on their proposals in AEBS/LDWS-03-05 a brainstorming on the main principles for the warning and emergency braking phases resulted in a preliminary agreement on the need to specify a braking demand or deceleration value for the automatic emergency braking phase and to specify a limit for vehicle speed reduction during the warning phase, as well as a minimum warning time before the automatic emergency braking is activated. (See also detailed notes under point 6.6 below). OICA proposed the following definitions: “ <u>Collision warning phase</u> ” means the phase directly preceding the emergency braking phase, during which the AEBS warns the driver of a potential forward collision.		

AEBS/LDWS-TF02-03-Rev.2

OICA proposal	Justifications	Notes from TF02
<p>“<u>Emergency braking phase</u>” means the phase during which the AEBS emits its maximum braking demand to the service braking system of the vehicle.</p> <p>“<u>Maximum braking demand</u>” means the maximum deceleration the AEBS requests from the service brakes.</p> <p>TF03/IG04:</p>		

Current proposal	TF02 recommendation	Justification and TF02 recollection
2.5. “ <u>Subject vehicle</u> ” means the vehicle being subject to testing.	2.5. “ <u>Subject vehicle</u> ” means the vehicle being tested .	Editorial proposal by CLEPA (AEBS/LDWS-03-03)
<p>(No IG-03 discussion)</p> <p>TF03/IG04:</p>		

Current proposal	TF02 recommendation	Notes from TF02
2.6. “ <u>Target vehicle</u> ” or “ <u>target</u> ” means a target simulating the bulk and the radar cross section of a regular passenger car of category M1 AA saloon <u>1/</u>	<p>“<u>Target vehicle</u>” or “<u>target</u>” means a target simulating the bulk and the radar cross section of a regular passenger car of category M1 AA saloon <u>1/</u> a high volume series production [passenger car / vehicle] of category M1 AA saloon <u>1/</u> or an object representative of such a vehicle in terms of its detection characteristics applicable to the sensor system of the AEBS under test.</p>	<p><i>Proposal by CLEPA (AEBS/LDWS-TF02-06)</i></p> <ul style="list-style-type: none"> • <i>UK: concern that a vehicle could comply with one target but not with another, both meeting the definition</i> • <i>OICA: supports UK, study reservation</i>

Current proposal	TF02 recommendation	Notes from TF02
(No IG-03 discussion) TF03/IG04:		

Current proposal	TF02 recommendation
2.7. “ <u>Stationary target</u> ” means a target fixed on the ground on the axis of the test course.	2.7. “ <u>Stationary target</u> ” means a target fixed on the ground on the axis of the test course on the centre of the test lane at standstill throughout the test.
(No IG-03 discussion): (Note also document AEBS/LDWS-03-03) TF03/IG04:	

Current proposal	TF02 recommendation	Notes from TF02
2.8. “ <u>Moving target</u> ” means a target having a speed of at least 15 km/h along the axis of the test course and in the same direction as the subject vehicle.	2.8. “ <u>Moving target</u> ” means a target having travelling at a speed of at least [10/15] km/h along the axis of the test course and in the same direction and [along the centre of the test lane /in the same lane] as the subject vehicle [and which may subsequently slow to a halt].	<ul style="list-style-type: none"> • <i>OICA: 10/15 kph considered as more appropriate</i> • <i>J, CLEPA: keen that the minimum speed be 15 km/h</i>

AEBS/LDWS-TF02-03-Rev.2

Current proposal	TF02 recommendation	Notes from TF02
(No IG-03 discussion): (Note also document AEBS/LDWS-03-03) TF03/IG04:		

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

(No IG-03 discussion): (Note also document AEBS/LDWS-03-03) TF03/IG04:
--

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.

(No IG-03 discussion): (Note also document AEBS/LDWS-03-03) TF03/IG04:
--

- 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.

(No IG-03 discussion): (Note also document AEBS/LDWS-03-03)

TF03/IG04:

3. APPLICATION FOR APPROVAL

- 3.1. The application for approval of a vehicle type with regard to the advanced emergency braking system 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 and include the following particulars:
- 3.2.1. a description of the vehicle type with regard to the items mentioned in paragraph 2 above, together with dimensional drawings and a documentation package which gives access to the basic design of the AEBS 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
- 3.2.2. particulars of the primary reference marks in sufficient detail to enable them to be readily identified and the position of each in relation to the others and to the "R" point verified.
- 3.3. A vehicle representative of the vehicle type to be approved shall be submitted to the Technical Service conducting the approval tests.

AEBS/LDWS-TF02-03-Rev.2

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, 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 photographs and/or plans 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.
- 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;

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

- 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.

AEBS/LDWS-TF02-03-Rev.2

5. SPECIFICATIONS

5.1. General

Current proposal	Notes from TF02
5.1.1. [Subject to the requirements of paragraph 12,] any vehicle fitted with a AEBS complying with the definition of paragraph 2.3 shall meet the performance requirements contained in paragraphs 5.1 to 5.5.4. of this regulation and shall be equipped with an anti-lock device.	<ul style="list-style-type: none"> • <i>Introductory provisions might be rejected by WP29. Discussions about introductory provisions to be raised at GRRF/WP29</i> • <i>OICA keen to introduce a reference to EVSC equipment, as per document AEBS/LDWS-TF02-05 for safety purposes.</i> • <i>Japan supports OICA, favouring ABS fitment</i>
(No IG-03 discussion) TF03/IG04:	

Current proposal	TF02 recollection
5.1.2. Any AEBS fitted on a vehicle shall comply with the requirements of Regulation No. 10 on electromagnetic interferences.	CLEPA / OICA to provide improved wording aligned with LDWS document ABS fitment
IG-03 discussion: CLEPA: no common CLEPA position for the moment. Suggested to postpone to next meeting, possibly with an alignment on R13. All Electronic systems associated to the braking system are approved according to R13 wording Conclusion: CLEPA will propose a wording at TF03/IG04, taking into account alignment on R13. TF03/IG04:	

Current proposal	TF02 recommendation	Justification
-	5.1.3. Conformity with the safety aspects of complex electronic control systems shall be shown by meeting the requirements of Annex 3.	CLEPA proposal. All current systems are approved to the CEL Annex.
(No IG-03 discussion) TF03/IG04:		

AEBS/LDWS-TF02-03-Rev.2

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 driver with the warning specified in paragraph 5.5.1. when tested in accordance with the provisions of paragraph 6.6. (reaction time warning test);

OICA proposal	Justifications	Notes from TF02
<p>2.XX. “<u>Emergency braking</u>” means the maximum braking demand of the AEBS system in purpose of avoiding or mitigating an accident.”</p> <p>5.1.3. The AEBS shall provide the warning referred to in para. 5.5.1. in any case before the emergency braking phase as defined in 2.XX.”</p>	<p>The AEBS functions in a cascade of 2 successive phases: warning phase and emergency braking phase. OICA believes that the AEBS should provide the warning referred to in para. 5.5.1. in any case BEFORE the emergency braking phase. This implies the addition of a new definition for “emergency braking”.</p> <p>Quantitative requirements should however remain in the test procedure section (same philosophy as in braking regulations).</p>	<ul style="list-style-type: none"> • <i>Japan to propose improved definition</i> • <i>OICA to propose definitions for warning and braking phases.</i> • <i>All to consider timing for latest warning using the same reference point</i> • <i>Warning mandatory only in “normal conditions” (high μ, sufficient time)</i>
<p>IG-03 discussion: see page 8 above on the same subject TF03/IG04:</p>		

5.2.1.2. activate the subject vehicle service braking system when tested in accordance with the provisions of paragraph 6.7. (braking system activation test) and

(No IG-03 discussion): (Note also proposal 5 in document AEBS/LDWS-TF02-07)
TF03/IG04:

5.2.1.3. provide the driver with the warning specified in paragraph 5.5.2. when tested in accordance with the provisions of paragraph 6.8. (malfunction detection test).

5.2.2. The AEBS shall be active at least within the vehicle speed range of 15 km/h to 90 km/h, unless manually de-activated as per paragraph 5.4. below.

Current proposal	OICA proposal	Notes from TF02
<p>5.2.2. The AEBS shall be active at least within the vehicle speed range of 15 km/h to 90 km/h, unless manually de-activated as per paragraph 5.4. below.</p>	<p>5.2.2. The AEBS shall be active at least between 15 km/h and 100 km/h</p> <p>Justifications:</p> <ul style="list-style-type: none"> • 15 km/h is a current technical limit • 100 km/h: Difficult to develop the system for higher speeds without violating the road code • 100 km/h is a value recommended by ISO 	<ul style="list-style-type: none"> • <i>UK: OICA proposal addresses only M3N3 categories.</i> • <i>Need for correct wording reflecting that the system must remain active when arriving to a stop.</i> • <i>CLEPA: wording should address the markets where there is no speed limit</i> <p><i>Conclusion: OICA to table an improved proposal at the 3rd meeting of the informal group.</i></p>

AEBS/LDWS-TF02-03-Rev.2

Current proposal	OICA proposal	Notes from TF02
(No IG-03 discussion): (Note also new proposal 2 in document AEBS/LDWS-03-06) TF03/IG04:		

Current proposal	IG02 proposal and action point	CLEPA proposal
<p>5.3. The driver shall always have the capability of overriding the AEBS.</p>	<p><u>Proposal:</u> 5.3. The driver shall at all times be able to override the operation of the advanced emergency braking system. This override may be initiated by any reaction that indicates that the driver is aware of the pending situation.</p> <p><u>Action point:</u> OICA and UK to provide a draft text covering the overriding capabilities</p>	<p><u>(AEBS/LDWS-TF02-06):</u></p> <p>5.3.The driver shall always have the capability of overriding the AEBS until the moment of collision.</p>
IG03		
<p>Note proposal 6 in document AEBS/LDWS-TF02-07 OICA presented the following proposal (not discussed): “5.3. Interruption by the driver 5.3.1. The AEBS may provide the means for the driver to interrupt the warning. 5.3.2. The AEBS shall provide the means for the driver to interrupt the emergency braking. 5.3.3. In both cases above, 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 pending situation. The vehicle manufacturer shall state these positive actions to the technical service at the time of type approval.”</p> <p>Justifications: The necessity to interrupt the warning may depend on the warning strategy and the vehicle category. For this reason, the interruption of the warning should not be mandatory.”</p>		
TF03/IG04:		

AEBS/LDWS-TF02-03-Rev.2

Current proposal	CLEPA proposal (<i>AEBS/LDWS-TF02-06</i>)
5.4. When a vehicle is equipped with a means to disable the AEBS function, the following conditions shall apply as appropriate:	5.4. When a vehicle is equipped with a manual means to disable the AEBS function, the following conditions shall apply as appropriate:
(No IG-03 discussion) TF03/IG04:	

Current proposal	CLEPA proposal (<i>AEBS/LDWS-TF02-06</i>)
5.4.1. The AEBS function shall be automatically reinstated at the initiation of each new ignition cycle.	5.4.1. The AEBS function shall be automatically reinstated at the initiation of each new ignition “ on ” (run) cycle.
(No IG-03 discussion) TF03/IG04:	

Current proposal	CLEPA proposal (<i>AEBS/LDWS-TF02-06</i>)
5.4.2. A constant optical warning signal shall inform the driver that the AEBS function has been disabled. The yellow warning signal specified in paragraph 5.5.2. below may be used for this purpose.	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.

Current proposal	CLEPA proposal (<i>AEBS/LDWS-TF02-06</i>)
(No IG-03 discussion) TF03/IG04:	

Proposal 7 by Japan (<i>AEBS/LDWS-TF02-07</i>)	Justification
5.4.3 The mean to disable the AEBS function shall have a structure which prevent the driver in the driver's seat operating the mean easily. e.g. Locating the mean not to be reached easily by the driver in the driver's seat or having the cover on the means.	Off switch should be used only when a trouble like sensor installation deformation. Easy usage by the driver should be eliminated by some means.
(No IG-03 discussion) TF03/IG04:	

AEBS/LDWS-TF02-03-Rev.2

5.5. Warning requirements

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

Current proposal	Proposal 8 by Japan <i>(AEBS/LDWS-TF02-07)</i>	OICA proposal	CLEPA proposal <i>(AEBS/LDWS-TF02-06)</i>
<p>The remaining reaction time warning referred to in paragraph 6.6. shall be by means of an optical, audible or haptic warning signal, or any combination thereof.</p>	<p>The remaining reaction time collision warning referred to in paragraph 6.65.2.1.1. shall use at least two means among audible, haptic and optical warning signals be by means of an optical, audible or haptic warning signal, or any combination thereof.</p>	<p>The remaining reaction time warning referred to in paragraph 6.6. shall be by means of an optical, audible or haptic warning signal, or any combination thereof. When an optical signal is used as a collision warning, the flashing of the malfunction warning signal specified in paragraph 5.5.2. below may be used.</p>	<p>The remaining reaction time warning referred to in paragraph 6.65.2.1. 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.</p>
<p>(No IG-03 discussion) TF03/IG04:</p>			

5.5.2. The malfunction warning referred to in paragraph 6.8. shall be by means of a yellow optical warning signal.

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)
5.5.2. The malfunction warning referred to in paragraph 6.8. shall be by means of a yellow optical warning signal.	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.
(No IG-03 discussion) TF03/IG04:	

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal
-	5.5.3. In the case that the AEBS has the ability to shut itself 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.	“... temporarily unavailable. The warning signal shall be a flashing yellow optical warning signal. The warning signal defined in paragraph 5.5.2. may be used for this purpose. A description of the non-failures that lead to loss of functionality ...
(No IG-03 discussion) TF03/IG04:		

AEBS/LDWS-TF02-03-Rev.2

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

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)
<p>5.5.3. 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). This requirement does not apply to tell-tales shown in a common space.</p>	<p>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.</p>
<p>(No IG-03 discussion) TF03/IG04:</p>	

5.5.4. The optical warning signals shall be visible even by daylight; the satisfactory condition of the signal must be easily verifiable by the driver from the driver's seat.

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)
5.5.4. The optical warning signals shall be visible even by daylight; the satisfactory condition of the signal must be easily verifiable by the driver from the driver's seat.	5.5.4.5. 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.
(No IG-03 discussion) TF03/IG04:	

Proposal 9 by Japan (AEBS/LDWS-TF02-07)	Justification
5.6. Prevention of over reliance of the driver	To avoid the driver's over reliance following points are necessary. 1) to give the feeling of discomfort (5.6.1.1. and 5.6.1.2.) 2) to give the feeling of fear (5.6.1.3.) 3) to make the driver understand that he should take the driving responsibility (5.6.1.4.)
5.6.1. When the collision is avoided by the activation of the service braking system:	
5.6.1.1. maximum deceleration during the activation of the service braking system shall be 6m/s² or more.	
5.6.1.2. the jerk of the subject vehicle shall be 12m/s³ or more.	
5.6.1.3. the subject vehicle shall get closer to the target until the distance is 1m or less.	
5.6.1.4. if the subject vehicle comes to the stop, the service brake shall be released at the latest 3sec after the stop.	
5.6.1.3. the subject vehicle shall get closer to the target until the distance is 1m or less.	(No IG-03 discussion) TF03/IG04:

AEBS/LDWS-TF02-03-Rev.2
 6. TEST PROCEDURE

Current proposal		OICA proposal	
6.1.	Test conditions	6.1.	Test conditions
6.1.1.	The test shall be performed on a flat surface affording good adhesion.	6.1.1.	The test shall be performed on a flat, dry concrete or asphalt surface affording good adhesion.
6.1.2.	The ambient temperature shall be between 0° C and 45° C.	6.1.2.	The ambient temperature shall be between 0° C -15° C and 45° C.
6.1.3.	The horizontal visibility range shall be greater than 1 km.	6.1.3.	The horizontal visibility range shall be greater than 1 km should allow observing the target at the test course during all states of the test.
(No IG-03 discussion) TF03/IG04:			

Current proposal		CLEPA proposal	
-		6.1.4	The tests shall be performed when there is no wind liable to affect the results.
(No IG-03 discussion) TF03/IG04:			

6.2. Accuracy of measurements

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)
6.2.1. Distances shall be measured with an accuracy of +/- 5%.	6.2.1. Distances shall be measured with an accuracy of +/- 5%.
6.2.2. Speeds 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%.	6.2.3. 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.
(No IG-03 discussion) TF03/IG04:	

AEBS/LDWS-TF02-03-Rev.2

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.

Action point from TF01	Notes from TF02
<p><i>All Contracting Parties are kindly invited to verify their proving ground capabilities in terms of testing the systems performance on curved roads. As a reminder, 2 km can be considered a standard highway radius of curvature, and 250 m is considered the radius of curvature of a tight curve on motorways.</i></p>	<ul style="list-style-type: none"> • <i>J and F have no capability of testing on curved highway roads, UK will provide information at the 3rd plenary informal group meeting.</i> • <i>TF recommends addition of a general requirement in paragraph 5. about functionality in the highway conditions, and testing on straight roads only</i> • <i>Mr. Jennison (CLEPA) commits to provide and circulate a draft text before the 3rd meeting</i>
<p>(No IG-03 discussion) TF03/IG04:</p>	

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)	Dr. Trost proposal
<p>6.3. Test course</p> <p>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.</p>	<p>6.3. Test course</p> <p>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.</p>	<p>6.3. Test course</p> <p>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. The test course may not include the roadway that is necessary to accelerate the subject vehicle to test speed. The lane width should be in between 2.8m and 3.5m.</p>
<p>(No IG-03 discussion) TF03/IG04:</p>		

AEBS/LDWS-TF02-03-Rev.2

6.4. Vehicle conditions

6.4.1. 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.

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)	Dr. Trost proposal
<p>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.</p>	<p>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.</p>	<p>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.</p>
<p>(No IG-03 discussion) TF03/IG04:</p>		

Current proposal	Japan proposal (AEBS/LDWS-TF02-07):	CLEPA proposal (AEBS/LDWS-TF02-06):	Proposal from Dr. Trost
6.5. Target vehicle	6.5. Target vehicle obstacle	6.5. Target vehicle	6.5. Target vehicle
6.5.1. The target used for the test shall have the bulk of a regular passenger car of category M1 AA saloon and a total radar cross section (RCS) of at least 2 m ² +/- 1 %.	6.5.1. The target used for the test shall have the bulk of a regular passenger car of category M1 AA saloon and/or a radar reflector(s) total radar cross section (RCS) of at least 2 m² +/- 1%.	6.5.1. 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.	6.5.1. The target vehicle should be any regular M1 vehicle provided by the OEM.
(No IG-03 discussion) TF03/IG04:			

AEBS/LDWS-TF02-03-Rev.2

Current proposal	Japan proposal (AEBS/LDWS-TF02-07):	CLEPA proposal (AEBS/LDWS-TF02-06):	Proposal from Dr. Trost
			6.5.2. The target vehicle shall be moving on the axis of the test course at a constant speed required below
(No IG-03 discussion) TF03/IG04:			

Current proposal	Japan proposal (AEBS/LDWS-TF02-07):	CLEPA proposal (AEBS/LDWS-TF02-06):
6.5.2. When the target carries radar reflector(s),	6.5.2. When the target carries radar reflector(s),	6.5.2. When the soft target carries radar reflector(s) the total radar cross section shall be 2 m² +/- 1%.
6.5.2.1.the reflector(s) shall be oriented toward the subject vehicle;	6.5.2.1. the reflector(s) shall be oriented toward the subject vehicle;	6.5.2.1.the reflector(s) shall be oriented toward the subject vehicle;
(No IG-03 discussion) TF03/IG04:		

Current proposal	Japan proposal (AEBS/LDWS-TF02-07):
	6.5.2.2. The target used for the test shall be made of two reflectors. Radar Cross Section (RCS) of each reflector is until 15 dBsm. If a radar reflectivity is smaller than two reflectors with each radar cross section (RCS) of 15 dBsm, the test may use the different target obstacle.
	6.5.2.3. The reflectors shall be placed on a horizontal line perpendicular to the axis of the test course, distant 1.7m from each other, and symmetrically to the axis of the test course, oriented toward the subject vehicle.
(No IG-03 discussion) TF03/IG04:	

Current proposal	Japan proposal (AEBS/LDWS-TF02-07):	CLEPA proposal (AEBS/LDWS-TF02-06):
6.5.2.2. the reflectors shall be placed between 0.09 m to 1.00 m height; and	6.5.2.24. the reflectors shall be placed between 0.09 m to 1.00 m height. However, if the height of the forward obstacle sensor of the test vehicle exceeds 1 m, the height of the reflector may be raised to the height of the sensor.; and	6.5.2.2. the reflectors shall be placed between 0.09 m to 1.00 m height; and
(No IG-03 discussion) TF03/IG04:		

AEBS/LDWS-TF02-03-Rev.2

Current proposal	Japan proposal (AEBS/LDWS-TF02-07):	CLEPA proposal (AEBS/LDWS-TF02-06):
6.5.2.3. the structure supporting the reflector(s) on the target shall not reflect radio waves emitted by the subject vehicle AEBS.	6.5.2.3.5. the structure supporting the reflector(s) on the target shall not reflect radio waves emitted by the subject vehicle AEBS	6.5.2.3. the any structure supporting the reflector(s) on the target shall not reflect radio waves emitted by the subject vehicle AEBS.
(No IG-03 discussion) TF03/IG04:		

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal
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.	6.5.3. 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.	6.5.3. 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.
(No IG-03 discussion) TF03/IG04:		

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal
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.	6.5.4. 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.	6.5.4. Moving target The moving target shall be moving on the axis centre of the test course at a constant speed comprised between 5 km/h and 70 km/h of [10/15] km/h.
(No IG-03 discussion) TF03/IG04:		

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal
6.5.5. Details that enable the target vehicle to be specifically identified shall be recorded in the vehicle type-approval documentation	6.5.5. Details that enable the targets vehiele to be specifically identified shall be recorded in the vehicle type-approval documentation	
(No IG-03 discussion) TF03/IG04:		

AEBS/LDWS-TF02-03-Rev.2

Current proposal	Japan proposal (AEBS/LDWS-TF02-07)	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal	Dr. Trost proposal
<p>Structure: 6.6. Remaining reaction time test 6.6.1. bulb check 6.6.2. Warning test with stationary target 6.6.3. Warning test with moving target 6.7. braking system activation test 6.7.1. bulb check 6.7.2. braking activation with stationary target 6.7.3. braking activation with moving target 6.8. Malfunction detection</p>	<p>Structure: 6.6. test 6.6.1. bulb check 6.6.2. performance with stationary target (warning + braking activation) 6.6.3. performance with moving target (warning + braking activation) 6.6.4. Test of deactivation of service braking to the obstacles outside the lane</p>	<p>Structure: 6.5. test 6.5.1. bulb check 6.5.2. Warning test with stationary target (including system overriding) 6.5.3. Warning test with moving target (including system overriding) 6.5.4. Braking system activation with stationary target 6.5.5. braking system activation with moving target 6.5.6. braking system activation with moving target slowing to a stop 6.5.7. Adjacent vehicle curve test (false warning test) 6.5.8. Overtaking manoeuvre test (false warning test) 6.5.9. Alley way test (false warning test) 6.5.10. Non-failure loss of functionality test 6.5.11. Manual disablement test 6.5.12. Failure warning test</p>	<p>Structure: The AEBS functions in a cascade of 2 successive phases: warning phase and emergency braking phase. OICA believes that the AEBS should provide the warning referred to in para. 5.5.1. in any case BEFORE the emergency braking phase. This implies the addition of a new definition for “emergency braking”. Quantitative requirements should however remain in the test procedure section (same philosophy as in braking regulations).</p>	<p>Structure: 6.6. AEBS test 6.6.1. Lamp check test 6.6.2. Functional test (warning + braking activation) 6.8. malfunction detection test 6.9 AEBS disable test</p>
<p>(No IG-03 discussion) TF03/IG04:</p>				

Current proposal	Japan proposal (AEBS/LDWS-TF02-07)	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal	Dr. Trost proposal
6.6. Remaining reaction time warning test	6.6. Remaining reaction time warning Test	6.6. Remaining reaction time warning test Tests		
	6.6.1. Bulb check function test	6.6.1. Optical warning signal verification test		
6.6.1. With the subject vehicle stationary and the ignition locking system in the "Lock" or "Off" position, activate the ignition locking system to the "On" or "Run" 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.	6.6.1.1. With the subject 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.	6.6.1.1. With the subject 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 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.		

AEBS/LDWS-TF02-03-Rev.2

Current proposal	Japan proposal (AEBS/LDWS-TF02-07)	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal	Dr. Trost proposal												
6.6.2. Warning test with stationary target	6.6.2. Performance test with stationary target	6.6.2. Warning test with stationary target														
6.6.2.1. Drive the vehicle, enter the vehicle the test course and smoothly track the lane so that the posture of the vehicle is stable. Perform three trials at the respective constant speeds of 20 km/h, 40 km/h and 80 km/h	6.6.2.1. Drive the vehicle, enter the vehicle the test course and smoothly track the lane so that the posture of the vehicle is stable. Perform three trials at the respective constant speeds of 20 km/h, 40 km/h and 80 km/h	6.6.2.1. 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 two tests at the respective constant speeds of 20 km/h, 40 km/h and 80 km/h.														
6.6.2.2. 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.	6.6.2.2. 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.	6.6.2.2. 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:														
		<table border="1"> <thead> <tr> <th data-bbox="959 1205 1079 1269">V_{Ego} (km/h)</th> <th data-bbox="1079 1205 1178 1269">V_{co} (km/h)</th> <th data-bbox="1178 1205 1281 1269">Time to collision (s)</th> <th data-bbox="1281 1205 1457 1269">Latest Warning (m)</th> </tr> </thead> <tbody> <tr> <td data-bbox="959 1269 1079 1341">80</td> <td data-bbox="1079 1269 1178 1341">0</td> <td data-bbox="1178 1269 1281 1341">1.9</td> <td data-bbox="1281 1269 1457 1341">41</td> </tr> <tr> <td data-bbox="959 1341 1079 1427">40</td> <td data-bbox="1079 1341 1178 1427">0</td> <td data-bbox="1178 1341 1281 1427">0.9</td> <td data-bbox="1281 1341 1457 1427">10</td> </tr> </tbody> </table>			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
		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													

Current proposal	Japan proposal (AEBS/LDWS-TF02-07)	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal	Dr. Trost proposal						
<p>6.6.2.3.If the AEBS did not warn the driver as mentioned in paragraph 6.6.2.2. above, discontinue the test.</p>	<p>6.6.2.3.If the AEBS did not warn the driver as mentioned in paragraph 6.6.2.2. above, discontinue the test. The AEBS shall activate the service braking system and reduce the subject vehicle speed as shown on the table XX. Table XX</p> <table border="1" data-bbox="415 699 953 927"> <thead> <tr> <th data-bbox="415 699 680 802">Subject vehicle speed</th> <th data-bbox="680 699 953 802">Minimum subject vehicle speed reduction</th> </tr> </thead> <tbody> <tr> <td data-bbox="415 802 680 873">40km/h</td> <td data-bbox="680 802 953 873">6km/h</td> </tr> <tr> <td data-bbox="415 873 680 927">80km/h</td> <td data-bbox="680 873 953 927">10km/h</td> </tr> </tbody> </table>	Subject vehicle speed	Minimum subject vehicle speed reduction	40km/h	6km/h	80km/h	10km/h	<p>6.6.2.3. If the AEBS did not warn the driver as mentioned in paragraph 6.6.2.2. above, discontinue the test.</p>		
Subject vehicle speed	Minimum subject vehicle speed reduction									
40km/h	6km/h									
80km/h	10km/h									
<p>6.6.3. Warning test with moving target</p>	<p>6.6.3. Performance test with moving target</p>	<p>6.6.3. Warning test with moving target</p>								
<p>6.6.3.1.Drive the moving target as in paragraph 6.5.4.</p>	<p>6.6.3.1. 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. Perform three trials at the respective relative speeds between the subject vehicle and the target equalling to 40 km/h and 60 km/h.</p>	<p>6.6.3.1. 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</p>								

AEBS/LDWS-TF02-03-Rev.2

Current proposal	Japan proposal (AEBS/LDWS-TF02-07)	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal	Dr. Trost proposal
		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.	6.6.3.2. The AEBS shall warn the driver as mentioned in paragraph 5.2.1.1. (See new proposal by Japan in document AEBS/LDWS-03-06 and notes on the IG03 discussion below))	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.	6.6.3.2. Increase the subject vehicle speed and perform three two trials at the relative speed between the subject vehicle speed and the target equalling to 20 km/h, 40 km/h and 60 km/h and 80 km/h.	

<p>6.6.3.3. 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.</p>	<p>6.6.3.3. The AEBS shall activate the service braking system and reduce the relative speed as shown on the table YY.</p> <p style="text-align: center;">Table YY</p> <table border="1" style="width: 100%;"> <thead> <tr> <th data-bbox="415 558 684 732">Relative speed</th> <th data-bbox="684 558 953 732">Minimum relative speed reduction</th> </tr> </thead> <tbody> <tr> <td data-bbox="415 732 684 870">40km/h</td> <td data-bbox="684 732 953 870">[14]km/h (heavy duty trucks with GVW of 20t or more)</td> </tr> <tr> <td data-bbox="415 870 684 1081">60km/h</td> <td data-bbox="684 870 953 1081">[18]km/h (heavy duty trucks with GVW of 20t or more)</td> </tr> </tbody> </table>	Relative speed	Minimum relative speed reduction	40km/h	[14]km/h (heavy duty trucks with GVW of 20t or more)	60km/h	[18]km/h (heavy duty trucks with GVW of 20t or more)	<p>6.6.3.3. 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:</p> <table border="1" style="width: 100%;"> <thead> <tr> <th data-bbox="953 558 1115 696">VEgo (km/h)</th> <th data-bbox="1115 558 1226 696">Vco (km/h)</th> <th data-bbox="1226 558 1337 696">Time to collision (s)</th> <th data-bbox="1337 558 1465 696">Latest Warning (m)</th> </tr> </thead> <tbody> <tr> <td data-bbox="953 696 1115 732">80</td> <td data-bbox="1115 696 1226 732">20</td> <td data-bbox="1226 696 1337 732">2.3</td> <td data-bbox="1337 696 1465 732">39</td> </tr> <tr> <td data-bbox="953 732 1115 818">60</td> <td data-bbox="1115 732 1226 818">20</td> <td data-bbox="1226 732 1337 818">1.9</td> <td data-bbox="1337 732 1465 818">21</td> </tr> <tr> <td data-bbox="953 818 1115 1081">80</td> <td data-bbox="1115 818 1226 1081">20</td> <td data-bbox="1226 818 1337 1081">2.3</td> <td data-bbox="1337 818 1465 1081">39</td> </tr> </tbody> </table>	VEgo (km/h)	Vco (km/h)	Time to collision (s)	Latest Warning (m)	80	20	2.3	39	60	20	1.9	21	80	20	2.3	39	<p>6.6.3.3. The AEBS shall warn the driver as mentioned in paragraph 5.2.1.1. 5.5.1. at the latest when the remaining reaction time has fallen below 1,5 s. [0.8 / 2.0] seconds before the emergency braking phase as defined in paragraph 2.XX.</p>	
Relative speed	Minimum relative speed reduction																									
40km/h	[14]km/h (heavy duty trucks with GVW of 20t or more)																									
60km/h	[18]km/h (heavy duty trucks with GVW of 20t or more)																									
VEgo (km/h)	Vco (km/h)	Time to collision (s)	Latest Warning (m)																							
80	20	2.3	39																							
60	20	1.9	21																							
80	20	2.3	39																							
<p>6.6.3.4. If the AEBS did not warn the driver as mentioned in paragraph 6.6.3.3. above, discontinue the test.</p>		<p>6.6.3.4. If the AEBS did not warn the driver as mentioned in paragraph 6.6.3.3. above, discontinue the test.</p>																								
		<p>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</p>																								

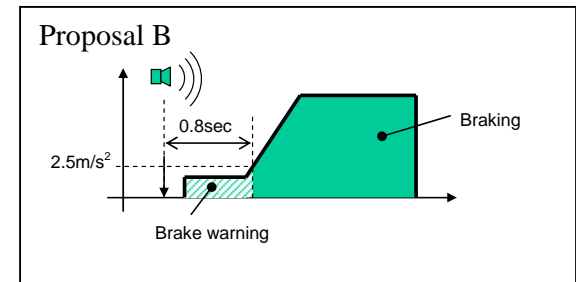
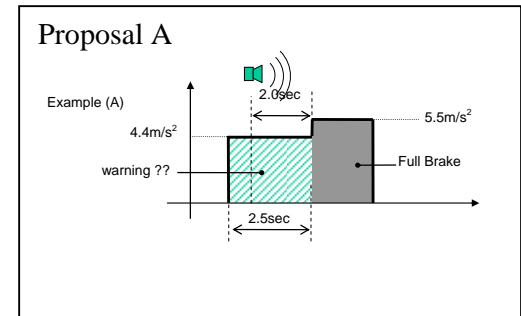
AEBS/LDWS-TF02-03-Rev.2

**position of the accelerator pedal or
 brake pedal, shall result in the AEBS
 actions being overridden.**

IG03

Consideration of document AEBS/LDWS-03-05 (J):

- **Proposal A** (“6.6.3.3. ... provide warning at latest 2sec. before full braking”):
 - OICA / CLEPA: the example given can indeed be designed according to the current text of the skeleton paper, yet no manufacturer would offer such system contradictory to the spirit of safety. In addition, no regulation can prevent a manufacturer to design not appropriate systems. A regulation has rather the task of ensuring that the system is fitted, and that it functions.
 - CLEPA:
 - 4.4 m/s² cannot be considered as a haptic warning, hence this shows that some limits must be found.
 - Timing is a parameter easy to catch from the CAN bus, as AEBS is a “Complex System”.
 - OICA:
 - A high deceleration cannot be considered as a “haptic warning”, should have “small speed reduction” as a criterion.
 - As CAN interface is common practice between AEBS and braking system, suggestion to define 3 phases, and use the time of start of emergency braking, and speed reduction as reference parameters. Can be easily checked at the time of approval by reading the print-out of the the CAN signals after having performed the test.
- **Proposal B** (“6.6.3.3. ... provide warning at latest 0.8 sec prior to the activation of service brake system.” Brake warning is not included as activation of service brake system, It is permitted to warn the driver simultaneously of service brake application when the emergency situation such as when the system detects the sudden cut-in of a vehicle.
 - OICA:
 - As the group agreed to separate the general requirements from the test requirements, there is no need to consider the case of a vehicle in all real situations
 - There is indeed the need for a deceleration threshold
 - Value of 2.5 m/s² is questionable: ACC operation could mask the haptic warning.



- CLEPA: concerning the last OICA comment: the test procedure assumes that ACC is not in operation; matter of CEL annex.
- **Proposal C** (“6.6.3.3. ...Provide warning at latest 1 sec prior to deceleration, which is automatically applied by AEBS, reaches 4.0m/s²)
 - OICA: questioned the value of 1.0 second
 - CLEPA: concerned that the provisions would forbid emergency braking below 4 m/s².

Chair summary:

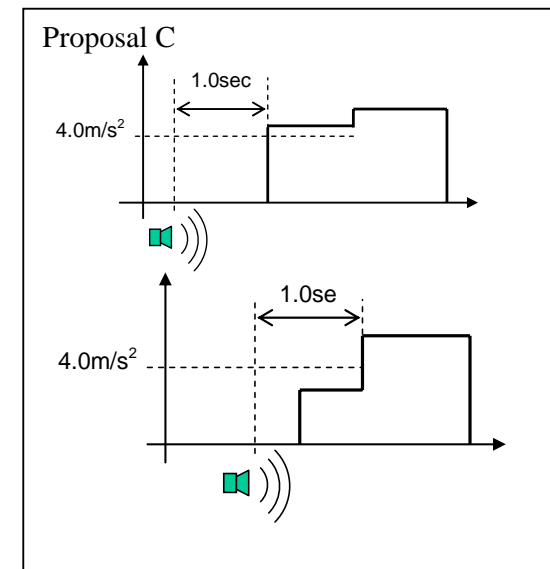
- Emergency braking phase is crucial phase
- Need to agree on a reference point (between emergency braking phase and preceding phases) from which other parameters (such as timing for warning) can be defined
- Criteria for any warning braking preceding the emergency braking phase may need to be specified
- Performance criterion for the emergency braking phase: either speed reduction or deceleration value.
- To maintain flexibility for the OEM to develop his haptic warning strategy, the performance requirements on haptic warning during the warning should be generic, e.g. by specifying a limit for the average speed reduction during the warning phase.

Some **informal discussions** led to the consideration of the situations that can be found in the logic schemes on page 45 (cases A to F).

- Start of emergency braking taken as the reference point
- Warning by braking to be defined as being
 - below the emergency braking deceleration
 - above a certain minimum deceleration
 - before a certain delay to the reference point
 - of a longer duration than a certain minimum value.
- This implies defining a maximum speed reduction value and defining the shape of the shaded green surface in the logic schemes.
- Japan reluctant to generate the Emergency Stop Signal at the time of the warning; however recognizes the safety merits of early emergency stop lamp activation.

Definition of emergency braking:

- CLEPA: key parameter is the full braking : “2.5.“Emergency braking phase” means the phase during which the AEBS requests full



AEBS/LDWS-TF02-03-Rev.2

braking of the service braking system.”

- OICA: key parameter is the system maximum braking demand:

“2.5. “Emergency braking phase” means the phase during which the AEBS emits its maximum braking demand to the service braking system of the vehicle.

2.6. “Maximum braking demand” means the maximum deceleration the AEBS requests from the service brakes.”

Action points:

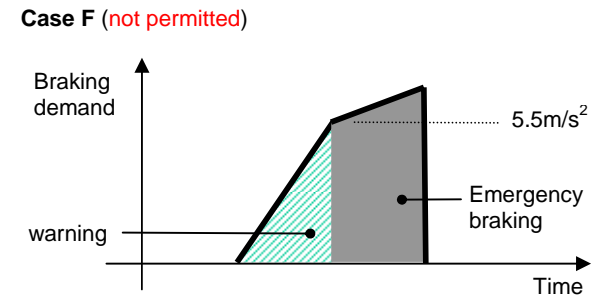
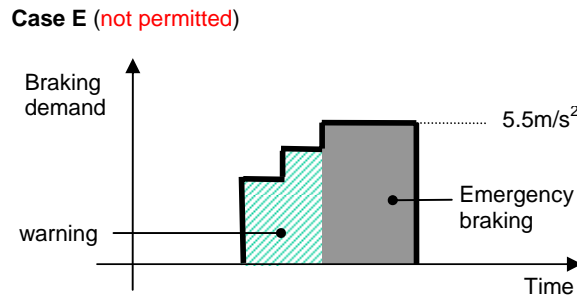
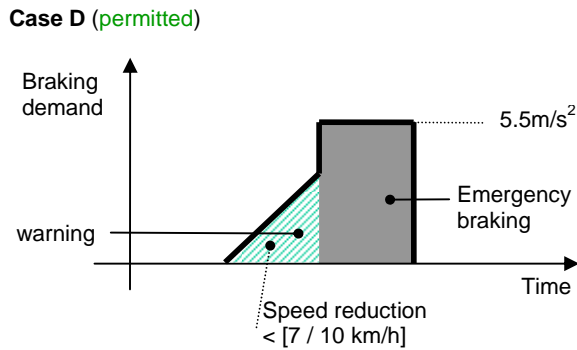
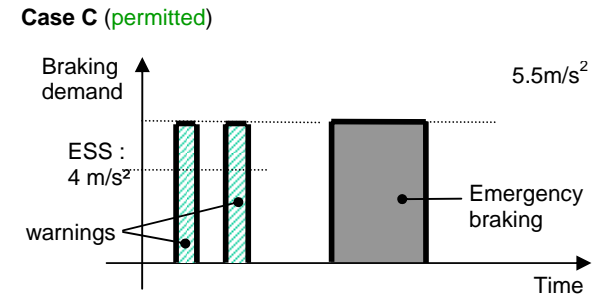
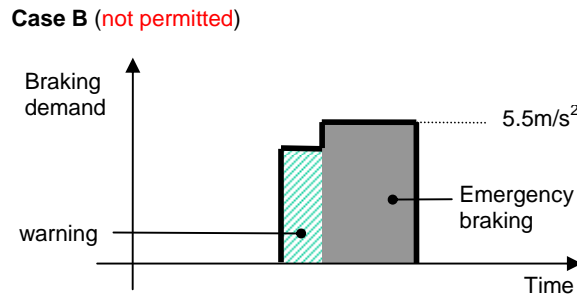
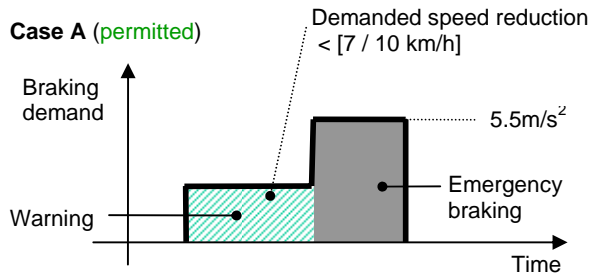
- OICA to provide information about the means to capture the CAN signals (feasibility of recording the braking demand), or any other logic signal commanding the ancillary systems (warning, braking, etc.) with the purpose of defining an approval procedure .
- All parties to build up a position toward the proposal :
“6.6.3.3. The AEBS shall warn the driver as mentioned in paragraph 5.5.1. at the latest [0.8 / 2.0] seconds before the emergency braking phase as defined in paragraph 2.XX. *If during this phase the AEBS applies the service braking, the speed reduction shall not exceed [7 / 10] km/h and the braking demand shall be [lower than in the emergency phase / below 4 m/s²]. [wording to avoid ESS activation]*”
- Japan to justify why to avoid the ESS generation during the warning phase.

Conclusion: (see also notes on page 8 relating to item 2.

Agreement on:

- The braking phase
- The reference point
- The need to define requirements for the braking warning

TF03/IG04



AEBS/LDWS-TF02-03-Rev.2

Japan proposal (AEBS/LDWS-TF02-07)	Justification	(No IG-03 discussion) TF03/IG04:
6.6.4. Test of deactivation of service braking to the obstacles outside the lane	The verification test of deactivation of braking control to obstacle outside the test lane is added. This deactivation test of AEBS is proposed as a minimum requirement. Please refer to AEBS/LDW-01-06 on page 34	
6.6.4.1. Test course		
6.6.4.1.1 Tests course shall be flat and have a straight lane for the subject vehicle with the width of 3.5m and the space beside the lane for the obstacles outside the lane as appropriate.		
6.6.4.2. Obstacles outside the lane		
6.6.4.2.1. The obstacles outside lane shall be two vehicles in the same direction as the subject vehicle put in the both right and left adjacent space symmetrically to the lane for the subject vehicle with the distance of 0.5m each from the edge of the lane to the near side of the vehicle.		
6.6.4.3. Test		
6.6.4.3.1. Drive from more than 60m behind the obstacles outside the lane and trace the centre of the lane at the constant speed of 40km/h, until passing over the obstacles outside the lane. Repeat the same test three times.		

Japan proposal (AEBS/LDWS-TF02-07)	Justification	AEBS/LDWS-TF02-03-Rev.2 (No IG-03 discussion) TF03/IG04:
6.6.4.3.2. Not to operate the braking system which may cause any affect on the AEBS operation.		
6.6.4.3.3. The AEBS shall not activate the service braking system except the warning brake.		

6.7. Braking system activation test

Current proposal	Japan proposal (AEBS/LDWS-TF02-07)	CLEPA proposal (AEBS/LDWS-TF02-06)
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.	See proposed paragraphs 6.6.2. and 6.6.3.	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		6.7.2. Braking system activation with stationary target
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. Perform three trials at the respective constant speeds of 20 km/h, 40 km/h and 80 km/h.		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. Perform three trials at the respective constant speeds of 20 km/h, 40 km/h and 80 km/h. 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.

AEBS/LDWS-TF02-03-Rev.2

Current proposal	Japan proposal (AEBS/LDWS-TF02-07)	CLEPA proposal (AEBS/LDWS-TF02-06)
		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:		6.7.2.2. The AEBS shall:
6.7.2.2.1. activate the service braking system as mentioned in paragraph 5.2.1.2. at the latest at a time to collision equalling 0,8 s, and		6.7.2.2.1. activate the service braking system as mentioned in paragraph 5.2.1.2. at the latest at a time to collision equalling 0,8 s, and provide a driver warning as in paragraph 6.5.2.
6.7.2.2.1. activate the service braking system as mentioned in paragraph 5.2.1.2. at the latest at a time to collision equalling 0,8 s, and		6.7.2.2.1. activate the service braking system as mentioned in paragraph 5.2.1.2. at the latest at a time to collision equalling 0,8 s, and 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/s ² .		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.		6.7.2.3. 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. Braking system activation with moving target		6.7.3. 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.		6.7.3.1. 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. The subject vehicle shall travel in a straight line for a

Current proposal	Japan proposal (AEBS/LDWS-TF02-07)	CLEPA proposal (AEBS/LDWS-TF02-06)
		<p>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.</p> <p>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.</p>
<p>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.</p>		<p>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.</p>
<p>6.7.3.3. The AEBS shall:</p>		<p>6.7.3.3. The AEBS shall:</p>
<p>6.7.3.3.1. activate the service braking system as mentioned in paragraph 5.2.1.2. at a time to collision equalling 0,8 s, and</p>		<p>6.7.3.3.1. activate the service braking system as mentioned in paragraph 5.2.1.2. at a time to collision equalling 0,8 s, and provide a driver warning as in paragraph 6.5.3.</p>
		<p>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</p>
<p>6.7.3.3.2. provoke an average deceleration of at least 3,3 m/s².</p>		<p>6.7.3.3.2. provoke an average deceleration of at least 3,3 m/s². initiate a full brake application.</p>
<p>6.7.3.4. If the AEBS did not activate the service braking system as mentioned in</p>		<p>6.7.3.4. If the AEBS did not activate the service braking system as mentioned in paragraph 6.7.3.3. above,</p>

AEBS/LDWS-TF02-03-Rev.2

Current proposal	Japan proposal (AEBS/LDWS-TF02-07)	CLEPA proposal (AEBS/LDWS-TF02-06)
paragraph 6.7.3.3. above, discontinue the test.		discontinue the test.

CLEPA proposal (AEBS/LDWS-TF02-06)	(No IG-03 discussion) TF03/IG04:
Adjacent vehicle curve test (false warning test)	
Overtaking manoeuvre test (false warning test)	
Alley way test (false warning test)	
Non-failure loss of functionality test	
Manual disablement test	

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal
6.8. Malfunction detection	6.8. Malfunction detection Failure warning test	6.8. Malfunction detection
6.8.1. Simulate a AEBS malfunction, 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, the electrical connections for the telltale lamps shall not be disconnected.	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.	6.8.1. Simulate a AEBS malfunction, 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, the electrical connections for the telltale lamps shall not be disconnected.
6.8.2. Drive the vehicle for up to 60	Drive the vehicle for up to 60 minutes	6.8.2. Drive the vehicle for up to 60

Current proposal	CLEPA proposal (AEBS/LDWS-TF02-06)	OICA proposal
minutes along any portion of the test course.	along any portion of the test course.	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.	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. 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.	6.8.3. 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.
6.8.4. If the AEBS malfunction indicator did not illuminate in accordance with paragraph 5.5.2. as required, discontinue the test.	6.8.4. If the AEBS malfunction indicator did not illuminate in accordance with paragraph 5.5.2. as required, discontinue the test.	6.8.4. If the AEBS malfunction indicator did not illuminate in accordance with paragraph 5.5.2. as required, discontinue the test.
(No IG-03 discussion) TF03/IG04:		

7. MODIFICATION OF VEHICLE TYPE AND EXTENSION OF APPROVAL

7.1. Every modification of the vehicle type as defined in paragraph 2.2. 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;

AEBS/LDWS-TF02-03-Rev.2

- 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.

12. INTRODUCTORY PROVISIONS

12.1. As from the date of entry into force of this Regulation, Contracting Parties applying this Regulation shall not:

(a) Refuse to grant ECE approval for a type of vehicle under this Regulation; or

(b) Prohibit the sale or entry into service of a vehicle

if the vehicle falls within the scope of this Regulation and complies with the requirements of this Regulation.

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 lane departure warning system pursuant to Regulation No. AEBS

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 reference point "R" of the seating position designated for the driver in relation to the primary reference marks:
.....
7. Identification, place and relative positions of the primary reference marks:
8. Date of submission of vehicle for approval:
9. Technical Service performing the approval tests:

10. Date of report issued by that service:
11. Number of report issued by that service:
12. Approval with regard to the AEBS is granted/refused: 2/
13. Place:
14. Date:
15. Signature:
16. Annexed to this communication are the following documents, bearing the approval number indicated above:

..... dimensional drawings

..... exploded view or photograph of the passenger compartment
17. Any remarks:

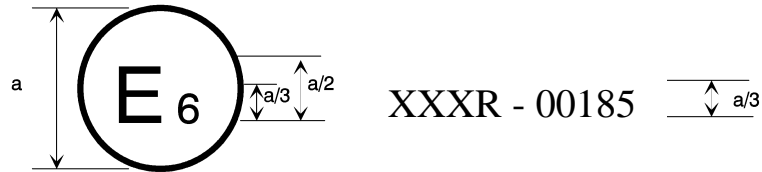
1/ Distinguishing number of the country which has granted/extended/refused/withdrawn an approval (see approval provisions in the Regulation).

2/ Delete what does not apply.

Annex 2

ARRANGEMENTS OF APPROVAL MARKS

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



$a = 8 \text{ mm min}$

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 pursuant to Regulation No. AEBS. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of Regulation No. XXX 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 cooperate 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.]
