Below some draft industry input to the skeleton document.

Identical text between R131 and the skeleton appears in green. / Yellow highlights proposals, comments, items for discussion

R131 (current)	AEBS-HDV-03-02 – V2	Comments (red text is extracted from AEBS-HDV-03-02)
Introduction The intention of this Regulation is to establish uniform provisions for Advanced Emergency Braking Systems (AEBS) fitted to motor vehicles of the categories M_2, M_3, N_2 and N_3[1] primarily used under monotonous highway driving conditions. While, in general, those vehicle categories will benefit from the fitment of an AEBS, there are sub-groups where the benefit is rather uncertain because they are primarily used in other conditions than highway conditions (e.g. buses with standing passengers i.e. Classes I, II and A[1], category G vehicles[1], construction vehicles, etc.). Regardless from the benefit, there are other sub-groups where the installation of AEBS would be technically difficult or not feasible (e.g. position of the sensor on vehicles of category G[1], construction vehicles mainly used in off-road areas and gravel tracks, special purpose vehicles and vehicles with front mounted equipment, etc.). In some cases there may be a possibility of false emergency braking events because of vehicle design constraints. In addition, systems intended for vehicles not equipped with a pneumatic rear-axle suspension require the integration of advanced sensor technology to take into account the variation of the pitch angle of the vehicle. The system shall automatically detect a potential forward collision, provide the driver with a warning and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating the severity of a collision in the event that the driver does not respond to the warning. The system shall only operate in driving situations where braking will avoid or mitigate the severity of an accident, and shall take no action in normal driving situations.	**Introduction (from R152)** The intention of this Regulation is to establish uniform provisions for Advanced Emergency Braking Systems (AEBS) fitted to motor vehicles of the Categories M_1 and N_1 primarily used within urban driving conditions. The system shall automatically detect a potential forward collision, provide the driver with an appropriate warning and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating the severity of a collision in the event that the driver does not respond to the warning. In the case of a failure in the system, the safe operation of the vehicle shall not be endangered. During any action taken by the system, the driver can, at any time through a conscious action, e.g. by a steering action or an accelerator kick-down, take control and override the system. This Regulation cannot cover all the traffic conditions and infrastructure features in the type-approval process; this Regulation recognises that the performances required in this Regulation cannot be achieved in all conditions (vehicle condition, road adhesion, weather conditions, deteriorated road infrastructure and traffic scenarios etc. may affect the system performances). Actual conditions and features in the real world should not result in false warnings or false braking to the extent that they encourage the driver to switch the system off. This Regulation is an "if-fitted" regulation. It shall not prevent contracting parties from mandating the fitting of AEBS approved in accordance to this Regulation.	New introduction to be developed.

In the case of a failure in the system, the safe operation of the vehicle shall not be endangered. The system shall provide as a minimum an acoustic or haptic warning, which may also be a sharp deceleration, so that an inattentive driver is made aware of a critical situation. During any action taken by the system (the warning and emergency braking phases), the driver can, at any time through a conscious action, e.g. by a steering action or an accelerator kick-down, take control and override the system. The Regulation cannot include all the traffic conditions and infrastructure features in the type-approval process. Actual conditions and features in the real world should not result in false warnings or false braking to the extent that they encourage the driver to switch the system off."		
1. Scope and purpose This Regulation applies to the approval of vehicles of category M_2, N_2, M_3 and N_3[1] with regard to an on-board system to avoid or mitigate the severity of a rear-end in lane collision.	**1. Scope** This Regulation applies to the approval of vehicles of Category M_2, M_3, N_2 and N_3[1] with regard to an on-board system to (a) Avoid or mitigate the severity of a rear-end in lane collision [with a passenger car] (b) Avoid or mitigate the severity of an impact with a pedestrian, (c) Avoid or mitigate the severity of an impact with a ~~bicycle~~ **cyclist**.	Overlapping of scope between R131 and R152. • N2 and M2 could be covered by both R131 and R52, to VM choice. • Justification: same AEBS on a N1 and a 'N2 derived from N1' should have the same requirements and be covered by the same regulation to avoid administrative burden. Is collision avoidance/mitigation with other vehicles (category M2/M3/N/O) than passage cars covered by this regulation?
2. Definitions 2.1. "*Advanced Emergency Braking System (AEBS)*" means a system which can automatically detect a potential forward collision and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating a collision.	**2. Definitions** For the purposes of this Regulation: 2.1. "*Advanced Emergency Braking System (AEBS)*" means a system which can automatically detect an imminent forward collision and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating a collision.	The definitions of Collision warning and emergency braking in R152 looks to be giving more flexibility for the design, compared to R131. The impact of the changes in the definitions should be reviewed once the requirements will be defined.

[1] As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.6, para. 2 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

2.8. "*Collision warning phase*" means the phase directly preceding the emergency braking phase, during which the AEBS warns the driver of a potential forward collision. 2.9. "*Emergency braking phase*" means the phase starting when the AEBS emits a braking demand for at least 4 m/s² deceleration to the service braking system of the vehicle.	2.2. "*Emergency Braking*" means a braking demand emitted by the AEBS to the service braking system of the vehicle. 2.3. "*Collision Warning* " means a warning emitted by the AEBS to the driver when the AEBS has detected an imminent forward collision.	

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.
	2.4. "*Vehicle Type with Regard to its Advanced Emergency Braking System*" means a category of vehicles which do not differ in such essential aspects as:
	
	(a) Vehicle features which significantly influence the performances of the Advanced Emergency Braking System;
	
	(b) The type and design of the Advanced Emergency Braking System.
		Discussion point:
		What are different types for heavy vehicles that are by themselves different?
		
		• Clarify the question from Chair.
		• Some first elements of potentially impacting vehicle characteristics on AEBS (while not necessarily changing "AEBS type")
		  ○ LCVs vs HCVs
		  ○ With / without O3/O4 trailer towing capabilities
		  ○ Hydraulic vs pneumatic braking
		  ○ Pneumatic vs leaf suspension
		
		Industry supports keeping the wording of (a) and (b) as proposed in the skeleton document.

2.3. "*Subject vehicle*" means the vehicle being tested. 2.7. "*Soft target*" means a target that will suffer minimum damage and cause minimum damage to the subject vehicle in the event of a collision. 2.4. "*Target*" means a high volume series production passenger car of category M_1 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. 2.5. "*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. 2.6. "*Stationary target*" means a target at standstill facing the same direction and positioned on the	2.5. "*Subject Vehicle*" means the vehicle being tested. 2.6. "*Soft Target"* means a target that will suffer minimum damage and cause minimum damage to the subject vehicle in the event of a collision. 2.7. "V*ehicle Target*" means a target that represents a vehicle. 2.8. "*Pedestrian Target*" means a soft target that represents a pedestrian 2.9. "*Bicycle Target*" means a soft target that represents a bicycle with cyclist	The new definitions looks ok.

	centre of the same test lane of travel as the subject vehicle.		
2.10.	"*Common space*" means an area on which two or more information functions (e.g. symbol) may be displayed, but not simultaneously.	2.10. "*Common Space*" means an area on which two or more information functions (e.g. symbol) may be displayed, but not simultaneously.	
2.11.	"*Self-check*" means an integrated function that checks for a system failure on a semi-continuous basis at least while the system is active.	2.11. "*Self-Check*" means an integrated function that checks for a system failure on a continuous basis at least while the system is active.	The word "continuous" is acceptable for electrically detectable failures, for the purpose of requirement in 5.1.4.1.1. Remark: the use of the word "continuous" is more questionable when it comes to other types of self-checks (e.g. a consistency check of wheel speed sensors values can only be done while the vehicle is driving, which makes the check not really "continuous", while being performed as soon as the conditions for the check are fulfilled…).
2.12.	"*Time to collision (TTC)*" means the value of time obtained by dividing the distance between the subject vehicle and the target by the relative speed of the subject vehicle and the target, at an instant in time.	2.12. "*Time To Collision (TTC)*" means the value of time obtained by dividing the longitudinal distance (in the direction of travel of the subject vehicle) between the subject vehicle and the target by the longitudinal relative speed of the subject vehicle and the target, at any instant in time.	Only clarifications, looks OK
		2.13. "*Dry road*" means a road with a nominal peak braking coefficient of 0.9 2.14. "*Peak braking coefficient (PBC)*": means the measure of tyre to road surface friction based on the maximum deceleration of a rolling tyre.	Dry road: • Why is a definition of "dry road" needed? • All "dry roads" does not provide 0.9… • The definition of "dry road" is only used in 5.2.1.4, 5.2.2.4 and 5.2.3.4 (b). These requirements specify the domain where the requirements shall be fulfilled. Does it mean that below 0.9, it would be acceptable to not fulfil the collision avoidance requirements (provided technically justified). • Isn't it sufficient to measure the adhesion at the time of testing? Do we need "Peak braking coefficient (PBC)" definitions in R131?

	2.15. "*Initialisation*" means the process of setting-up the operation of the system after switching ON the vehicle until it is fully functioning.	
	2.16. "*Mass of a vehicle in running order*" means the mass of an unladen vehicle with bodywork, including coolant, oils, at least 90 per cent of fuel, 100 per cent of other liquids, driver (75 kg) but except used waters, tools, spare wheel. 2.17. "*Maximum mass*" means the maximum mass stated by the vehicle manufacturer to be technically permissible (this mass may be higher than the "permissible maximum mass" laid down by the national administration).	We will update the conditions of mass for the categories of 2 and 3. • Are these definitions of the different "masses" compatible with WVTA or R13 definitions? • Mass of a vehicle in running order: ○ "Vehicle with bodywork"…? ○ We should not re-do R13 type approval test with the minimum possible vehicle mass… ○ The technical mass of a vehicle could be higher than the maximum homologated mass (e.g. construction vehicles may have a higher technical mass in construction areas, which is not considered for the AEBS approval) ○ We may have the following situation for a 6x4: ▪ 26t maximum on road ▪ 28t for the AEBS approval ▪ 32t for construction areas
5. Specifications 5.1. General 5.1.1. Any vehicle fitted with an AEBS complying with the definition of paragraph 2.1. above shall meet the performance requirements contained in paragraphs 5.1. to 5.6.2. of this Regulation and shall be equipped with an anti-lock braking function in accordance with the performance requirements of Annex 13 to Regulation No. 13.	**5. Specifications** 5.1. General requirements 5.1. General requirements 5.1.1. Any vehicle fitted with an AEBS complying with the definition of paragraph 2.1. above shall, when activated and operated within the prescribed speed ranges, meet the performance requirements: 5.1.1.1. of paragraphs 5.1. and paragraphs 5.3. to 5.6. of this Regulation for all vehicles; 5.1.1.2. of paragraph 5.2.1. of this Regulation for vehicles submitted to approval for Vehicle to car scenario; **(See 5.1.7)**	Meeting a requirement is an intrinsic characteristic of the vehicle with regard to the approved system (e.g. compliance to EMC R10, failure warning), it does not depend of the actual situation where the vehicle is.

No C2P requirements in R131	5.1.1.3. of paragraph 5.2.2. of this Regulation for vehicles submitted to approval for Vehicle to pedestrian scenario.	
No C2B requirements in R131	5.1.1.4. of paragraph 5.2.3. of this Regulation for vehicles submitted to approval for Vehicle to bicycle scenario.	
5.1.2. The effectiveness of AEBS shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by fulfilling the technical requirements and respecting the transitional provisions of Regulation No. 10 by applying: (a) The 03 series of amendments for vehicles without a coupling system for charging the Rechargeable Electric Energy Storage System (traction batteries); (b) The 04 series of amendments for vehicles with a coupling system for charging the Rechargeable Electric Energy Storage System (traction batteries).	5.1.2. The effectiveness of AEBS shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by fulfilling the technical requirements and respecting the transitional provisions of UN Regulation No. 10 05 series of amendments.	Cross reference to be checked.
5.1.3. Conformity with the safety aspects of complex electronic control systems shall be shown by meeting the requirements of Annex 4.	5.1.3. Conformity with the safety aspects of electronic control systems shall be shown by meeting the requirements of Annex 3.	
(paragraphs moved from their original position, for the best convenience of the comparison with the skeleton) 5.2.1.2. A failure warning when there is a failure in the AEBS that prevents the requirements of this Regulation of being met. The warning shall be as specified in paragraph 5.5.4. below. 5.2.1.2.1. There shall not be an appreciable time interval between each AEBS self-check, and subsequently there shall not be an appreciable delay in illuminating the warning signal, in the case of an electrically detectable failure.	5.1.4. Warnings **and information** In addition to the collision warnings described in paragraphs 5.2.1.1. and 5.2.2.1., the system shall provide the driver with appropriate warning(s) **and information** as below: 5.1.4.1. A failure warning when there is a failure in the AEBS that prevents the requirements of this Regulation of being met. The warning shall be as specified in paragraph 5.5.4. 5.1.4.1.1. There shall not be an appreciable time interval between each AEBS self-check, and subsequently there shall not be a delay in illuminating the warning signal, in the case of an electrically detectable failure.	Proposal to make one specific paragraph for warnings, distinct from a paragraph on "information to driver". If that proposal would be agreed, appropriate numbering and headlines should be updated accordingly.

	5.1.4.1.2. If the system has not been initialised after a cumulative driving time of [15] seconds above a speed of [10] km/h, information of this status shall be indicated to the driver. This information shall exist until the system has been successfully initialised. 5.1.4.1.3. Upon detection of any non-electrical failure condition (e.g. sensor blindness or sensor misalignment), the warning signal as defined in paragraph 5.1.4.1. shall be illuminated.	**Justification:** AEBS for M1 N1 is focussing on low speed / city driving, which probably justifies a threshold of 15 km/h, while AEBS for CVs is focussing on highway conditions, where the traffic and potential stationary targets may be less dense, thus giving less "opportunities" to check sensors.
(paragraphs moved from their original position, for the best convenience of the comparison with the skeleton) 5.2.1.3. A deactivation warning, if the vehicle is equipped with a means to manually deactivate the AEBS, shall be given when the system is deactivated. This shall be as specified in paragraph 5.4.2. below.	5.1.4.2. A deactivation warning, if the vehicle is equipped with a means to deactivate the AEBS, shall be given when the system is deactivated. This shall be as specified in paragraph 5.4.3.	• Why deleting "manually"? • Is it to cover cases where for example: o An ABS or an ESC failure would lead to disable AEBS…? o A sensor would be blocked by an external factor (i.e. the system gets disabled but this is not a system failure)? • Item linked with paragraph 5.4.2
See 5.2.2	5.1.5. Emergency braking Subject to the provisions of paragraphs 5.3.1. and 5.3.2., the system shall provide emergency braking interventions described in paragraphs 5.2.1.2., 5.2.2.2. and 5.2.3.2. having the purpose of significantly decreasing the speed of the subject vehicle.	
(paragraphs moved from their original position, for the best convenience of the comparison with the skeleton) 5.2.4. The system shall be designed to minimize the generation of collision warning signals and to avoid autonomous braking in situations where the driver would not recognize an impending forward collision. This shall be demonstrated in accordance with paragraph 6.8. of this Regulation.	5.1.6. False reaction avoidance The system shall be designed to minimise the generation of collision warning signals and to avoid advanced emergency braking in situations where there is no risk of an imminent collision. This shall be demonstrated in the assessment carried out under Annex 3, and this assessment shall include in particular scenarios listed in Appendix 2 of Annex 3.	False reaction scenarios: are R152 scenarios acceptable and/or need to be adapted?
See 5.1.1	5.1.7. Any vehicle fitted with an AEBS shall meet the performance requirements of UN Regulation No. 13 in its 11 series of amendments for vehicles of Category M_2, M_3, N_2, N_3 and shall be equipped with an anti-lock braking function in accordance with the performance	

	requirements of Annex 13 to UN Regulation No. 13 in its 11 series of amendments.	
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 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. above.	5.2. Specific Requirements 5.2.1. Car to car scenario 5.2.1.1. Collision warning When a collision with a preceding vehicle of Category M_1, in the same lane with a relative speed above that speed up to which the subject vehicle is able to avoid the collision, is imminent, a collision warning shall be provided as specified in paragraph 5.5.1., and shall be triggered at the latest 0.8 seconds before the start of emergency braking. However, in case the collision cannot be anticipated in time to give a collision warning 0.8 seconds ahead of an emergency braking a collision warning shall be provided as specified in paragraph 5.5.1. and shall be provided no later than the start of emergency braking intervention. **[Higher deceleration demand values than the minimum value prescribed at the start of the emergency braking are permissible for very short durations, e.g. as haptic warning to stimulate the driver's attention.]** The collision warning may be aborted if the conditions prevailing a collision are no longer present. This shall be tested according to paragraphs 6.4. and 6.5.	**Comments:** The warning strategy is broadly different from R131. A relaxing of the warning requirements is more than welcome to permit the manufacturer to implement its own technical solutions/strategies. However, this should be carefully analyzed, in relation with the collision avoidance / mitigation requirements. At high speed, there may still be a need to warn the driver "sufficiently" ahead of the EMB. A false positive with only a warning is indeed far less critical compared to one with an EMB, thus it seems of interest to in first place still try stimulating driver's reaction before to start an EMB. Consequently, if the required performance would increase in such a way that a much earlier start of EMB would be needed, the sensor range and the absolute distance to target may not be sufficient to build a sufficient level of confidence for starting a warning (an EMB?) phase. **Justification for proposal in [ ]:** Higher deceleration than 4m/s² (specified in 5.2.1.2) could be used during the warning phase, as haptic jerk. The proposed text is inspired from UN R157 on ALKS.
5.2.2. Subsequent to the warning(s) of paragraph 5.2.1.1. above, and subject to the provisions of paragraphs 5.3.1. to 5.3.3. below, there shall be an emergency braking phase having the purpose of significantly decreasing the speed of the subject vehicle. This shall be tested in accordance with paragraphs 6.4. and 6.5. of this Regulation.	5.2.1.2. Emergency braking When the system has detected the possibility of an imminent collision, there shall be a braking demand of at least ~~5.0 m/s²~~ **4 m/s²** to the service braking system of the vehicle. The emergency braking may be aborted **or the deceleration demand reduced below the threshold above (as relevant)** if the conditions prevailing a collision are no longer present **or the risk of a collision has decreased**.	Justification: Proposal to use the same value as in current R131 definition, which is also consistent with the "emergency braking signal" requirement in paragraph 5.2.1.31. of UN R13. Such a deceleration will be anyway perceived as an emergency braking by the driver, while providing more room for the system design (i.e. more freedom for the system to adapt the EMB demand to the actual situation). The second sub-paragraph enables aborting the EMB when the risk disappears. The proposed change adds (or only clarifies?) the possibility for

	This shall be tested in accordance with paragraphs 6.4. and 6.5. of this Regulation.	the system to reduce the deceleration demand (after an initial deceleration demand above [5m/s²]) in the case where the risk is only reduced, e.g. due to that the target moved ahead by 3m, the actual deceleration is higher than the minimum expected value which has been used for the design etc.
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, unless manually deactivated as per paragraph 5.4. below.	5.2.1.3. Speed **range** The system shall be active at least within the vehicle speed range between 10 km/h and 100 km/h for category M vehicle, 10 km/h and 90 km/h for category N vehicle and at all vehicle load conditions, unless deactivated as per paragraph 5.4. 5.2.1.4. Speed reduction by braking demand In absence of driver's input which would lead to interruption according to paragraph 5.3.2., the AEBS shall be able to achieve a relative impact speed that is less or equal to the maximum relative impact speed as shown in the ~~following~~ table**s specified in this paragraph**: (a) For collisions with unobstructed and constantly travelling or stationary targets; (b) On flat, horizontal and dry roads; (c) **No trailer is coupled to the motor vehicle and the mass of the motor vehicle is** Between maximum mass and mass in running order conditions; (d) In situations where the vehicle longitudinal centre planes are displaced by not more than 0.2 m; (e) In ambient illumination conditions of at least 1000 Lux without blinding of the sensors (e.g. direct blinding sunlight); (f) In absence of weather conditions affecting the dynamic performance **or the detection capabilities** of the vehicle (e.g. no storm, not below 0°C); (g) When driving straight with no curve, and not turning at an intersection	The requirement of V2C will be cover the high-speed range. b) Dry road means above 0.9 ? c) The maximum mass of the motor vehicle shall be considered, not the gross combination mass (since each vehicle is expected to brake its own mass). This regulation applies to the approval of single motor vehicles and not to combinations. AEBS performance cannot be expected with any kind of trailers (with overload, failing/unplugged ABS, poor braking, unadjusted response time etc.) d) note: R131 specifies an offset of not more than 0.5m (in the test section). But 0.2m is fine. 6.4.1. The subject vehicle shall approach the stationary target in a straight line for at least two seconds prior to the functional part of the test with a subject vehicle to target centreline offset of not more than 0.5 m. e) Lateral sunlight may also be a limiting factor (shadows on the road). f) weather conditions may not only affect the dynamic performance but also the detection capabilities The list from a) to g) can never be complete.

	It is recognised that the performances required in this table may not be fully achieved in other conditions than those listed above. **It is also recognized that some other conditions not named above may prevent the performances from being fully achieved (e.g. presence of overloaded trailer(s), failing motor vehicle or trailer ABS or ESC, high centre-of-gravity, moving loads, misleading lane markings, high brake temperature, specific surrounding environments affecting the detecting capabilities of the vehicle (e.g. tunnels or other "highly reflective environment")).** However, the system shall not deactivate or unreasonably switch the control strategy in these other conditions. This shall be demonstrated in accordance with Annex 3 of this Regulation.	We need clarity on the conditions which are not named in the list (a) to (g). The need and the content of this amendment is linked to the acceptance of other proposals above. Below is an example: At the end of a type-II test, R13 requires only 3.3m/s² for N3. In that case, AEBS won't prevent the collision as required in current 5.2.1.4. If this limitation is not explicit in the list of conditions (a) to (x), then it should be reflected in this paragraph.
	Maximum relative Impact Speed (km/h) for M_2 and M_3 vehicle* *Relative Speed (km/h)* / M_2 / M_3 / *Stationary/ Moving* / *Maximum mass* / *Mass in running order* 10 20 30 40 50 60 70 80 90 100 Discussion point: We can refer the calculation sheet proposed as GRVA-01-31. - Maximum deceleration (Max G) - Time to Max G - The value of LPS or LPB Confirmation of V2C scenario The requirement of R131 based on the difference of braking system. Same requirement for stationary/moving * For relative speeds between the listed values (e.g. [53] km/h), the maximum relative impact speed (i.e. [30/30] km/h) assigned to the next higher relative speed (i.e. [55] km/h) shall apply. For masses above the mass in running order, the maximum relative impact speed assigned to the maximum mass shall apply.	• The split of requirements does not correspond to current R131 Annex 3. The vehicle dynamics of LCVs is closer to M1 N1 (with regard to LPS / LPB) than to HCV combinations. Thus, they cannot have the same requirements. The split between row 1 and row 2 vehicles was based on actual tests which have been performed in Jeversen (Germany), see documents AEBS-LDWS-18-02 and 03. Additionally, CVs have different types of braking systems with fairly different response time for example: ○ N3 with pneumatic braking ○ M3 and LCVs may have pneumatic or hydraulic braking • Achieving requirements on the warning and the emergency phase up to 100kph is a challenge which is not feasible for current / mid-term sensor technology: warning 1.4s before EMB at 80km/h means a sensor range of ~80m, while it may mean 110/120m at 100km/h. The distance also increases sensitivity of the detection to the shape of the road (a slight curvature generates measurement errors). The risk is high to get too frequent false positives.

		This comment is maybe not valid with the new warning requirements in paragraph 5.2.1.1. However, we should be careful that the collision avoidance / mitigation performance requirements does not lead to so early warning that they cannot be given in time to stimulate driver reaction (to avoid false positive with EMB, an early warning may still be relevant). • **Same requirements for stationary and moving targets** is a big challenge given the higher difficulty to detect and classify stationary targets at high speed (now up to 100km/h, with a requirement to not "unreasonably switch the control strategy" at 110kph (for M3) or even 130kph for M2/N2). We have here a high risk to get frequent false positives, including EMB. A strategy based on "earlier warning and later braking" is maybe more relevant for stationary targets (compared to moving ones, where the detection is more robust). • **xxxxxxxxxxx**
	Maximum relative Impact Speed (km/h) for N_2 and N_3 vehicle* *Relative Speed (km/h)* / N_2 / N_3 / *Stationary/ Moving* / *Maximum mass* / *Mass in running order* 10 20 30 40 50 60 70 80 90 100 Discussion point: We can refer the calculation sheet proposed as GRVA-01-31. - Maximum deceleration (Max G) - Time to Max G - The value of LPS or LPB Confirmation of V2C scenario The requirement of R131 based on the difference of braking system. Same requirement for stationary/moving * For relative speeds between the listed values (e.g. [53] km/h), the maximum relative impact speed (i.e. [35/40/30/35] km/h) assigned to the next higher relative speed (i.e. [55] km/h) shall apply. For masses above the mass in running order, the maximum relative impact speed assigned to the maximum mass shall apply.	

No C2P requirements in R131	5.2.2. Vehicle to pedestrian scenario 5.2.2.1. Collision warning When the AEBS has detected the possibility of a collision with a pedestrian crossing the road at a constant speed of 5 km/h. a collision warning shall be provided as specified in paragraph 5.5.1. and shall be provided no later than the start of emergency braking intervention. [**Higher deceleration demand values than the minimum value prescribed at the start of the emergency braking are permissible for very short durations, e.g. as haptic warning to stimulate the driver's attention.]** The collision warning may be aborted if the conditions prevailing a collision are no longer present.	How could the system ensure the pedestrian is crossing the road at the exact speed of 5kph? Is it necessary to ensure that, or is the possibility of a collision with a pedestrian a sufficient criteria? (is no warning required if a pedestrian standing in the lane??).
	5.2.2.2. Emergency braking When the system has detected the possibility of an imminent collision. there shall be a braking demand of at least ~~5.0 m/s²~~ **4 m/s²** to the service braking system of the vehicle. The emergency braking may be aborted **or the deceleration demand reduced (as relevant)** if the conditions prevailing a collision are no longer present **or the risk of a collision has decreased**. This shall be tested in accordance with paragraph 6.6. of this Regulation. 5.2.2.3. Speed range The system shall be active at least within the vehicle speed range between 20 km/h and 60 km/h and at all vehicle load conditions., unless deactivated as per paragraph 5.4.	See justification in 5.2.1.2

	5.2.2.4. Speed reduction by braking demand In absence of driver's input which would lead to interruption according to paragraph 5.3.2., the AEBS shall be able to achieve an impact speed that is less or equal to the maximum relative impact speed as shown in the following table: (a) With unobstructed perpendicularly crossing pedestrians with a lateral speed component of not more than 5 km/h; (b) In unambiguous situations (e.g. not multiple pedestrians); (c) On flat, horizontal and dry roads; (d) Between maximum mass and mass in running order conditions; (e) In situations where the anticipated impact point is displaced by not more than 0.2 m compared to the vehicle longitudinal centre plane; (f) In ambient illumination conditions of at least 2000 Lux without blinding of the sensors (e.g. direct blinding sunlight). (g) In absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 0°C) and (h) When driving straight with no curve, and not turning at an intersection. It is recognised that the performances required in this table may not be fully achieved in other conditions than those listed above. However the system shall not deactivate or unreasonably switch the control strategy in these other conditions. This shall be demonstrated in accordance with Annex 3 of this Regulation.	See proposals in 5.2.1.4. e) What does an offset of 0.2m means against a pedestrian ??
	Maximum relative Impact Speed (km/h) for M_2 and M_3 vehicle*	See comments in 5.2.1.4.

Relative Speed (km/h)	M_2		M_3	
	Maximum mass	*Mass in running order*	*Maximum mass*	*Mass in running order*
20				
25				
30				
35				
40				
45				
50				
55				
60				

Discussion point:
We can refer the calculation sheet proposed as GRVA-01-31.
- Maximum deceleration (Max G)
- Time to Max G
- The value of LPS or LPB

Confirmation of V2P scenario
The requirement of R131 based on the difference of braking system.

All values in km/h

* For subject vehicle speeds between the listed values (e.g. [53] km/h), the maximum impact speed (i.e. [40/40] km/h) assigned to the next higher subject vehicle speed (i.e. [55] km/h) shall apply.
For masses above the mass in running order, the maximum relative impact speed assigned to the maximum mass shall apply.

Maximum relative Impact Speed (km/h) for N_2 and N_3 vehicle*

Relative Speed (km/h)	N_2		N_3	
	Maximum mass	*Mass in running order*	*Maximum mass*	*Mass in running order*
20				
25				
30				
35				
40				
45				
50				
55				
60				

Discussion point:
We can refer the calculation sheet proposed as GRVA-01-31.
- Maximum deceleration (Max G)
- Time to Max G
- The value of LPS or LPB

Confirmation of V2P scenario
The requirement of R131 based on the difference of braking system.

All values in km/h

* For subject vehicle speeds between the listed values (e.g. [53] km/h), the maximum impact speed (i.e. [40/45/40/45] km/h) assigned to the next higher subject vehicle speed (i.e. [55] km/h) shall apply.
For masses above the mass in running order, the maximum relative impact speed assigned to the maximum mass shall apply.

See comments in 5.2.1.4.

No C2B requirements in R131	5.2.3. Vehicle to bicycle scenario 5.2.3.1. Collision warning When the AEBS has detected the possibility of a collision with a bicycle crossing the road at a constant speed of 15 km/h. a collision warning shall be provided as specified in paragraph 5.5.1. and shall be provided no later than the start of emergency braking intervention. **[Higher deceleration demand values than the minimum value prescribed at the start of the emergency braking are permissible for very short durations, e.g. as haptic warning to stimulate the driver's attention.]** The collision warning may be aborted if the conditions prevailing a collision are no longer present.	
	5.2.3.2. Emergency braking When the system has detected the possibility of an imminent collision. there shall be a braking demand of at least ~~5.0 m/s²~~ **4 m/s²** to the service braking system of the vehicle. The emergency braking may be aborted **or the deceleration demand reduced (as relevant)** if the conditions prevailing a collision are no longer present **or the risk of a collision has decreased**. This shall be tested in accordance with paragraph 6.7. of this Regulation. 5.2.3.3. Speed range The system shall be active at least within the vehicle speed range between 20 km/h and 60 km/h and at all vehicle load conditions., unless deactivated as per paragraph 5.4.	See justification in 5.2.1.2

	5.2.3.4. Speed reduction by braking demand In absence of driver's input which would lead to interruption according to paragraph 5.3.2., the AEBS shall be able to achieve an impact speed that is less or equal to the maximum relative impact speed as shown in the following table: (a) With unobstructed perpendicularly crossing bicycles with constant speeds from 10 to 15 km/h; (b) In unambiguous situations (e.g. not multiple bicycles); (c) On flat, horizontal and dry roads; (d) Between maximum mass and mass in running order conditions; (e) In situations where the anticipated impact point of the crankshaft of the bicycle is displaced by not more than 0.2 m compared to the vehicle longitudinal centre plane; (f) In ambient illumination conditions of at least 2000 Lux without blinding of the sensors (e.g. direct blinding sunlight). (g) In absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 273.15K or 0°C) and (h) When driving straight with no curve, and not turning at an intersection. It is recognised that the performances required in this table may not be fully achieved in other conditions than those listed above. However the system shall not deactivate or unreasonably switch the control strategy in these other conditions. This shall be demonstrated in accordance with Annex 3 of this Regulation.	See proposals in 5.2.1.4. e) What does an offset of 0.2m means against a pedestrian ??
	Maximum relative Impact Speed (km/h) for M_2 and M_3 vehicle*	See comments in 5.2.1.4.

	<table><tr><th rowspan="2">*Relative Speed (km/h)*</th><th colspan="2">M_2</th><th colspan="2">M_3</th></tr><tr><th>*Maximum mass*</th><th>*Mass in running order*</th><th>*Maximum mass*</th><th>*Mass in running order*</th></tr><tr><td>20</td><td></td><td></td><td></td><td></td></tr><tr><td>25</td><td></td><td></td><td></td><td></td></tr><tr><td>30</td><td></td><td></td><td></td><td></td></tr><tr><td>35</td><td></td><td></td><td></td><td></td></tr><tr><td>40</td><td></td><td></td><td></td><td></td></tr><tr><td>45</td><td></td><td></td><td></td><td></td></tr><tr><td>50</td><td></td><td></td><td></td><td></td></tr><tr><td>55</td><td></td><td></td><td></td><td></td></tr><tr><td>60</td><td></td><td></td><td></td><td></td></tr></table> Discussion point: We can refer the calculation sheet proposed as GRVA-01-31. - Maximum deceleration (Max G) - Time to Max G - The value of LPS or LPB Confirmation of V2B scenario The requirement of R131 based on the difference of braking system. All values in km/h * For subject vehicle speeds between the listed values (e.g. [53] km/h), the maximum relative impact speed (i.e.[35/35] km/h) assigned to the next higher relative speed (i.e. [55] km/h) shall apply. For masses above the mass in running order, the maximum relative impact speed assigned to the maximum mass shall apply.	
	Maximum relative Impact Speed (km/h) for N_2 and N_3 vehicle* <table><tr><th rowspan="2">*Relative Speed (km/h)*</th><th colspan="2">N_2</th><th colspan="2">N_3</th></tr><tr><th>*Maximum mass*</th><th>*Maximum mass*</th><th>*Mass in running order*</th><th>*Mass in running order*</th></tr><tr><td>20</td><td></td><td></td><td></td><td></td></tr><tr><td>25</td><td></td><td></td><td></td><td></td></tr><tr><td>30</td><td></td><td></td><td></td><td></td></tr><tr><td>35</td><td></td><td></td><td></td><td></td></tr><tr><td>40</td><td></td><td></td><td></td><td></td></tr><tr><td>45</td><td></td><td></td><td></td><td></td></tr><tr><td>50</td><td></td><td></td><td></td><td></td></tr><tr><td>55</td><td></td><td></td><td></td><td></td></tr><tr><td>60</td><td></td><td></td><td></td><td></td></tr></table> Discussion point: We can refer the calculation sheet proposed as GRVA-01-31. - Maximum deceleration (Max G) - Time to Max G - The value of LPS or LPB Confirmation of V2B scenario The requirement of R131 based on the difference of braking system. All values in km/h * For subject vehicle speeds between the listed values (e.g. [53] km/h), the maximum relative impact speed (i.e.[40/35] km/h) assigned to the next higher relative speed (i.e. [55] km/h) shall apply. For masses above the mass in running order, the maximum relative impact speed assigned to the maximum mass shall apply.	See comments in 5.2.1.4.
5.3. Interruption by the driver 5.3.1. The AEBS may provide the means for the driver to interrupt the collision warning phase. However, when a vehicle braking system is	5.3. Interruption by the Driver	We don’t see the need for change. The recommendation is to keep R131 as it is.

used to provide a haptic warning, the system shall provide the driver with a means to interrupt the warning braking. 5.3.2. The AEBS shall provide the means for the driver to interrupt the emergency braking phase. 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 emergency situation. The vehicle manufacturer shall provide a list of these positive actions to the technical service at the time of type approval and it shall be annexed to the test report.	5.3.1. The AEBS shall provide the means for the driver to interrupt the collision warning and the emergency braking. 5.3.2. 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 emergency situation. The vehicle manufacturer shall provide a list of these positive actions to the technical service at the time of type approval and it shall be annexed to the test report.	
5.4. When a vehicle is equipped with a means to deactivate the AEBS function, the following conditions shall apply as appropriate: 5.4.1. The AEBS function shall be automatically reinstated at the initiation of each new ignition cycle.	5.4. Deactivation 5.4.1. When a vehicle is equipped with a means to manually deactivate the AEBS function. the following conditions shall apply as appropriate: 5.4.1.1 The AEBS function shall be automatically reinstated at the initiation of each new ignition cycle.	
	5.4.1.2. The AEBS control shall be designed a in such a way that manual deactivation shall not be possible with less than two deliberate actions.	
	5.4.1.3. The **location of** AEBS control shall ~~be installed so as to~~ comply with the relevant requirements and transitional provisions of UN Regulation No. 121 in its 01 series of amendments ~~or any later series of amendments~~.	Rather than the “installation of controls”, R121 is reading “the location and identification of hand controls, tell-tales and indicators”. “or any later series of amendments” is against the principle of static cross references adopted at GRRF in 2013. The requirements of R131 cannot be changed by a change in another regulation. Do we need this link at all?
	5.4.1.4. ~~It shall not be possible to manually deactivate the AEBS at a speed above 10 km/h.~~	The proposed requirement may be counter-productive: it may lead the driver to deactivate the system (maybe) 2 hours ahead of a critical situation (which creates a false positive reaction he/she knows about) instead of a couple of minutes before. Deactivation by driver at any speed is still needed.

	5.4.2. When the vehicle is equipped with a means to automatically deactivate the AEBS function, for instance in situations such as off-road use, being towed, being operated on a dynamometer, being operated in a washing plant, the following conditions shall apply as appropriate: 5.4.2.1. The vehicle manufacturer shall provide a list of situations and corresponding criteria where the AEBS function is automatically deactivated to the technical service at the time of type approval and it shall be annexed to the test report. 5.4.2.2. The AEBS function shall be automatically reactivated as soon as the conditions that led to the automatic deactivation are not present anymore. 5.4.2.3. Where automatic deactivation of the AEBS function is a consequence of the driver manually switching off the ESC function of the vehicle, this deactivation of the AEBS shall require at least two deliberate actions by the driver.	The text "in case of a non-detectable misalignment of sensors" has not been copied from R152. It was indeed weird to consider automatic deactivation in case of a non-detectable event ☺ Other examples: ○ Sensor blindness due to mud, dust, ice, snow ○ ABS or ESC failures ○ …
5.4.2. A constant optical warning signal shall inform the driver that the AEBS function has been deactivated. The yellow warning signal specified in paragraph 5.5.4. below may be used for this purpose.	5.4.3. A constant optical warning signal shall inform the driver that the AEBS function has been deactivated. The yellow warning signal specified in paragraph 5.5.4. below may be used for this purpose.	
	5.4.4. While automated driving functions are in longitudinal control of the vehicle (e.g. ALKS is active) the AEBS function may be suspended or its control strategies (i.e. braking demand, warning timing) adapted without indication to the driver, as long as it remains ensured that the vehicle provides at least the same collision avoidance capabilities as the AEBS function during manual operation.	Could it be confirmed that adding an ALKS on a vehicle type where an AEBS is approved should not lead to extra AEBS testing nor AEBS approval extension? In other words, could it be confirmed that "ensuring that the vehicle provides at least the same collision avoidance capabilities as the AEBS function during manual operation" is a task for the ALKS R157 approval (not for AEBS approval).
5.5. Warning indication 5.5.1. The collision warning referred to in paragraph 5.2.1.1. above shall be provided by at least two modes selected from acoustic, haptic or optical.	5.5. Warning Indication 5.5.1. The collision warning referred to in paragraphs 5.2.1.1., 5.2.2.1. and 5.2.3.1. shall be provided by at least two modes selected from acoustic, haptic or optical. **This requirement shall only be applied from the latest**	Justification: With regard to paragraph 5.2.2.1 (reminded below), the requirement to have two warning modes should only apply once the EMB has started. Before the EMB starts, the warning is

	point in time when the collision warning signal is required by paragraphs 5.2.1.1., 5.2.2.1. and 5.2.3.1.	optional, thus the manufacturer should be free to use only one mode (or two or three). 5.2.2.1. Collision warning When the AEBS has detected the possibility of a collision with a pedestrian crossing the road at a constant speed of 5 km/h. a collision warning shall be provided as specified in paragraph 5.5.1. and shall be provided no later than the start of emergency braking intervention.
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 6.4.2. and 6.5.2. of this Regulation		

5.5.2. A description of the warning indication and the sequence in which the collision warning signals are presented to the driver shall be provided by the vehicle manufacturer at the time of type-approval and recorded in the test report. 5.5.3. 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. below. 5.5.4. The failure warning referred to in paragraph 5.2.1.2. above shall be a constant yellow optical warning signal. 5.5.5. Each 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 (initial system (power-on)). This requirement does not apply to warning signals shown in a common space. 5.5.6. The optical warning signals shall be visible even by daylight; the satisfactory condition of the signals must be easily verifiable by the driver from the driver's seat. 5.5.7. When the driver is provided with an optical warning signal to indicate that the AEBS 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. above may be used for this purpose.	5.5.2. A description of the warning indication and the sequence in which the collision warning signals are presented to the driver shall be provided by the vehicle manufacturer at the time of type-approval and recorded in the test report. 5.5.3. 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. 5.5.4. The failure warning referred to in paragraph 5.1.4.1. shall be a constant yellow optical warning signal. 5.5.5. Each 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" position that is designated by the manufacturer as a check position (initial system (power-on)). This requirement does not apply to warning signals shown in a common space. 5.5.6. The optical warning signals shall be visible even by daylight; the satisfactory condition of the signals must be easily verifiable by the driver from the driver's seat. 5.5.7. When the driver is provided with an optical warning signal to indicate that the AEBS is temporarily not available, for example due to inclement weather conditions, the signal shall be constant. The failure warning signal specified in paragraph 5.5.4. above may be used for this purpose.	
5.6. Provisions for the periodic technical inspection 5.6.1. At a periodic technical inspection it shall be possible to confirm the correct operational status of the AEBS by a visible observation of the failure warning signal status, following a "power-ON" and any bulb check. In the case of the failure warning signal being in a common space, the common space must be	5.6. Provisions for the Periodic Technical Inspection 5.6.1. At a Periodic Technical Inspection, it shall be possible to confirm the correct operational status of the AEBS by a visible observation of the failure warning signal status. following a "power-ON" and any bulb check. 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.	

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 is available.	5.6.2. At the time of type approval, the means to protect against simple unauthorised 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 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 affording 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 the target to be observed throughout the test. 6.1.4 The tests shall be performed when there is no wind liable to affect the results.	**6. Test procedure** 6.1. Test Conditions 6.1.1. The test shall be performed on a flat. dry concrete or asphalt surface affording good adhesion. ~~6.1.1.1. The road test surface shall have a nominal2 peak braking coefficient (PBC) of 0.9. unless otherwise specified. when measured using either:~~ ~~6.1.1.2. The American Society for Testing and Materials (ASTM) E1136 standard reference test tyre. in accordance with ASTM Method E1337-90. at a speed of 40 mph; or~~ 6.1.1.3. The k-test method specified in Appendix 2 to Annex 13 of Regulation No. 13. 6.1.1.4. The test surface has a consistent slope between level and 1 per cent. 6.1.2. The ambient temperature shall be between 0°C and 45°C. 6.1.3. The horizontal visibility range shall allow the target to be observed throughout the test. 6.1.4 The tests shall be performed when there is no wind liable to affect the results. 6.1.5. Natural ambient illumination must be homogeneous in the test area and in excess of 1000 lux in the case of vehicle to car scenario as stipulated in paragraph 5.2.1. and of 2000 lux in the case of vehicle to pedestrian	Confirmation of ASTM method. 6.1.1.1 and 6.1.1.2 • What is the “minimum theoretical target value”?? • Why is there any need to specify a minimum value for the road adhesion? Is it a problem if the collision requirements are fulfilled on lower values of mu ?? • k-test method of R13 is sufficient

[2] The "nominal" value is understood as being the minimum theoretical target value.

	scenario as stipulated in paragraph 5.2.2. and of 2000 lux in the case of vehicle to bicycle scenario as stipulated in paragraph 5.2.3. It should be ensured that testing is not performed whilst driving towards, or away from the sun at a low angle. 6.1.6. At the request of the manufacturer and with the agreement of the Technical Service tests may be conducted under deviating test conditions (suboptimal conditions, e.g. on a not dry surface; below the specified minimum ambient temperature), whilst the performance requirements are still to be met.	
6.2. Vehicle conditions 6.2.1. 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.	6.2. Vehicle Conditions 6.2.1. Test mass The vehicle shall be tested: (a) At the mass in running order with an additional mass of maximum 125 kg where this additional mass includes the measuring equipment and a possible second person who is responsible for noting the results in order to demonstrate compliance with the requirements referring to the mass in running order, and (b) At the maximum mass The load distribution shall be according to the manufacturer's recommendation and be annexed to the test report. No alteration shall be made once the test procedure has begun. During the series of test runs, the fuel level may decrease but shall never fall below 50 %. 6.2.2. Pre-Test Conditioning 6.2.2.1. If requested by the vehicle manufacturer: (a) The vehicle can be driven a maximum of 100 km on a mixture of urban and rural roads with other traffic and roadside furniture to initialise the sensor system. (b) The vehicle can undergo a sequence of brake activations in order to ensure the service brake system is bedded in prior to the test.	We will update the conditions of mass for the categories of 2 and 3. Confirmation of pre-test method for the large vehicle. Current test definition in R131 is satisfactory. The weight should not be defined with too many details, to be able to cover the wide variety of truck variants. Suggestion to keep same text as today. Fuel capacity can differ a lot between truck variants. This parameter is not relevant. To be checked what R13 specifies. Brake temperature: R13 type 0 test specifies the following: "1.4.1.1. The brakes shall be cold; a brake is deemed to be cold when the temperature measured on the disc or on the outside of the drum is below 100 °C.". From a practical standpoint, a higher value could help.

	(c) The average temperature of the service brakes on the hottest axle of the vehicle, measured inside the brake linings or on the braking path of the disc or drum, is ~~between 65 and~~ **below** 100°C prior to each test run. 6.2.2.2. Details of the pre-test condition strategy requested by the vehicle manufacturer shall be identified and recorded in the vehicle type approval documentation. 6.2.3. The mounted tyres shall be identified and recorded in the vehicle type approval documentation.	
6.3. Test targets 6.3.1. The target used for the tests shall be a regular high volume series production passenger car of category M_1 AA saloon, or alternatively a "soft target" representative of such a vehicle in terms of its identification characteristics applicable to the sensor system of the AEBS under test.[3]	6.3. Test Targets 6.3.1. The target used for the vehicle detection tests shall be a regular high-volume series production passenger car of Category M_1 AA saloon. or alternatively a "soft target" representative of such a vehicle in terms of its identification characteristics applicable to the sensor system of the AEBS under test according to ISO 19206-3:2020. The reference point for the location of the vehicle shall be the most rearward point on the centreline of the vehicle.	
	6.3.2. The target used for the pedestrian detection tests shall be a child "articulated soft target" and be representative of the human attributes applicable to the sensor system of the AEBS under test according to ISO 19206-2:2018.	
6.3.2. Details that enable the target(s) to be specifically identified and reproduced shall be recorded in the vehicle type approval documentation.	6.3.3. The targets used for the bicycle detection tests shall be a "soft target" and be representative of the bicycle with an adult cyclist attributes applicable to the sensor system of the AEBS under test according to ISO 19206-4:2020.	
6.4. Warning and activation test with a stationary target	6.4. Warning and Activation Test with a Stationary Vehicle Target	Is the offset a performance or a test requirement ?

[3] The identification characteristics of the soft target shall be agreed upon between the Technical Service and the vehicle manufacturer as being equivalent to a passenger car of category M_1 AA saloon

6.4.1. The subject vehicle shall approach the stationary target in a straight line for at least two seconds prior to the functional part of the test with a subject vehicle to target centreline offset of not more than 0.5 m.

The functional part of the test shall start when the subject vehicle is travelling at a speed of 80 ± 2 km/h and is at a distance of at least 120 m from the target.

From the start of the functional part until the point of collision there shall be no adjustment to any control of the subject vehicle by the driver other than slight adjustments to the steering control to counteract any drifting.

6.4.2. The timing for the collision warning modes referred to in paragraph 5.5.1. above shall comply with the following:

6.4.2.1. At least one warning mode shall be provided no later than specified in Table I, Column B, of Annex 3.

In the case of the vehicles referred to in Table I, row 1, of Annex 3, the warning shall be haptic or acoustic.

In the case of the vehicles referred to in Table I, row 2, of Annex 3, the warning shall be haptic, acoustic or optical

6.4.2.2. At least two warning modes shall be provided no later than specified in Table I, Column C, of Annex 3.

6.4.2.3. Any speed reduction during the warning phase, shall not exceed either 15 km/h or 30 per cent of the total subject vehicle speed reduction, whichever is higher.

6.4.3. The collision warning phase shall be followed by the emergency braking phase.

6.4.4. The total speed reduction of the subject vehicle at the time of the impact with the stationary target shall be not less than the value specified in Table I, column D of Annex 3.

The subject vehicle shall approach the stationary target in a straight line for at least two seconds prior to the functional part of the test with a subject vehicle to target centreline offset of not more than 0.2 m.

Tests shall be conducted with a vehicle travelling at speeds shown in tables below for respectively M_2, M_3, N_2 and N_3 Categories. If this is deemed justified, the technical service may test any other speeds listed in the tables in paragraph 5.2.1.4. and within the prescribed speed range as defined in paragraph 5.2.1.3.

Subject vehicle test speed for M_2 and M_3 vehicle in stationary target scenario

M_2			*M_3*		
Maximum mass	*Mass in running order*	*Tolerance*	*Maximum mass*	*Mass in running order*	*Tolerance*

All values in km/h

Subject vehicle test speed for N2 and N3 vehicle in stationary target scenario

N_2			*N_3*		
Maximum mass	*Mass in running order*	*Tolerance*	*Maximum mass*	*Mass in running order*	*Tolerance*

All values in km/h

The functional part of the test shall start when the subject vehicle is travelling at a constant speed and is

Discussion point:

Table will be update based on the requirement table.

The test confirms the minimum speed, the maximum collision avoidance, the maximum speed in R152.

An offset of +/- 0.2m is fairly difficult to obtain with a truck or a coach, especially at the highest speed (90…100kph). Higher tolerance would be helpful. On the other hands this leads to more stringent requirements…

<table>
<tr>
<td>6.4.5. The emergency braking phase shall not start before a TTC equal to or less than 3.0 seconds.

Compliance shall be verified by either actual measurement during the test or using documentation provided by the vehicle manufacturer, as agreed between the Technical Service and the vehicle manufacturer.</td>
<td>at a distance corresponding to a Time To Collision (TTC) of at least 4 seconds from the target.

From the start of the functional part until the point of collision there shall be no adjustment to any control of the subject vehicle by the driver other than slight adjustments to the steering control to counteract any drifting.</td>
<td></td>
</tr>
<tr>
<td>6.5. Warning and activation test with a moving target

6.5.1. The subject vehicle and the moving target shall travel in a straight line, in the same direction, for at least two seconds prior to the functional part of the test, with a subject 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 speed of the value specified in Table I, column H of Annex 3, 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 there shall be no adjustment to any subject vehicle control by the driver other than slight steering adjustments to counteract any drifting.

6.5.2. The timing for the collision warning modes referred to in paragraph 5.5.1. above shall comply with the following:

6.5.2.1. At least one haptic or acoustic warning mode shall be provided no later than specified in Table I Column E of Annex 3.

6.5.2.2. At least two warning modes shall be provided no later than specified in Table I Column F of Annex 3.

6.5.2.3. Any speed reduction during the warning phase shall not exceed either 15 km/h or 30 per cent of the total subject vehicle speed reduction, whichever is higher.</td>
<td>6.5. Warning and Activation Test with a Moving Vehicle Target

The subject vehicle and the moving target shall travel in a straight line, in the same direction, for at least two seconds prior to the functional part of the test. with a subject vehicle to target centreline offset of not more than 0.2m.

Tests shall be conducted with a vehicle travelling at speeds shown in tables below for respectively M_2, M_3, N_2 and N_3 categories and target travelling at 20 km/h (with a tolerance of +0/-2 km/h for the target vehicles). If this is deemed justified, the Technical Service may test any other speeds for subject vehicle and target vehicle within the speed range as defined in paragraph 5.2.1.3.

Subject vehicle test speed for M_2 and M_3 vehicle in moving target scenario

<table><tr><td colspan="3">M_2</td><td colspan="3">M_3</td></tr><tr><td>Maximum mass</td><td>Mass in running order</td><td>Tolerance</td><td>Maximum mass</td><td>Mass in running order</td><td>Tolerance</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>All values in km/h

Subject vehicle test speed for N2 and N3 vehicle in moving target scenario

<table><tr><td colspan="3">N_2</td><td colspan="3">N_3</td></tr><tr><td>Maximum</td><td>Mass in running</td><td>Tolerance</td><td>Maximum</td><td>Mass in running</td><td>Tolerance</td></tr></table></td>
<td>Discussion point:

Table will be update based on the requirement table.

The test confirms the minimum speed, the maximum collision avoidance, the maximum speed in R152.</td>
</tr>
</table>

6.5.3. The emergency braking phase shall result in the subject vehicle not impacting the moving target. 6.5.4. The emergency braking phase shall not start before a TTC equal to or less than 3.0 seconds. Compliance shall be verified by either actual measurement during the test or using documentation provided by the vehicle manufacturer, as agreed between the Technical Service and the vehicle manufacturer.	<table><tr><th>mass</th><th>order</th><th></th><th>mass</th><th>order</th><th></th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> All values in km/h The functional part of the test shall start when the subject vehicle is travelling at a constant speed and is at a distance corresponding to a TTC of at least 4 seconds from the target. From the start of the functional part of the test until the subject vehicle comes to a speed equal to that of the target there shall be no adjustment to any subject vehicle control by the driver other than slight steering adjustments to counteract any drifting.	
No C2P requirements in R131	6.6. Warning and Activation Test with a Pedestrian Target 6.6.1. The subject vehicle shall approach the impact point with the pedestrian target in a straight line for at least two seconds prior to the functional part of the test with an anticipated subject vehicle to impact point centreline offset of not more than 0.1 m. The functional part of the test shall start when the subject vehicle is travelling at a constant speed and is at a distance corresponding to a TTC of at least 4 seconds from the collision point. The pedestrian target shall travel in a straight line perpendicular to the subject vehicle's direction of travel at a constant speed of 5 km/h +0/-0.4 km/h, starting not before the functional part of the test has started. The pedestrian target's positioning shall ... Tests shall be conducted with a vehicle travelling at speeds shown in tables below for respectively M_2, M_3, N_2 and N_3 categories. The technical service may test any other speeds listed in the table in paragraph 5.2.2.4. and within the prescribed speed range as defined in paragraphs 5.2.2.3. **Subject vehicle test speed for M2 and M3 vehicle in pedestrian target scenario**	

M_2			M_3		
Maximum mass	*Mass in running order*	*Tolerance*	*Maximum mass*	*Mass in running order*	*Tolerance*

All values in km/h

Subject vehicle test speed for N2 and N3 vehicle in pedestrian target scenario

N_2			N_3		
Maximum mass	*Mass in running order*	*Tolerance*	*Maximum mass*	*Mass in running order*	*Tolerance*

All values in km/h

From the start of the functional part until the subject vehicle has avoided the collision or the subject vehicle has passed the impact point with the pedestrian target there shall be no adjustment to any control of the subject vehicle by the driver other than slight adjustments to the steering control to counteract any drifting.

The test prescribed above shall be carried out with a child pedestrian "soft target" defined in 6.3.2.

6.6.2. The assessment of the impact speed shall be based on the actual contact point between the target and the vehicle, taking into account the vehicle shape.

No C2B requirements in R131	6.7. Warning and Activation Test with a Bicycle Target 6.7.1. The subject vehicle shall approach the impact point with the bicycle target in a straight line for at least two seconds prior to the functional part of the test with an anticipated subject vehicle to crankshaft of the bicycle impact point centreline offset of not more than 0.1 m.	Feasibility with a coach or a truck tbc

The functional part of the test shall start when the subject vehicle is travelling at a constant speed and is at a distance corresponding to a TTC of at least 4 seconds from the collision point.

The bicycle target shall travel in a straight line perpendicular to the subject vehicle's direction of travel at a constant speed of 15 km/h +0/-1 km/h, starting not before the functional part of the test has started. During the acceleration phase of the bicycle prior to the functional part of the test the bicycle target shall be obstructed. The bicycle target's positioning shall be coordinated with the subject vehicle in such a way that the impact point of the bicycle target on the front of the subject vehicle is on the longitudinal centreline of the subject vehicle, with a tolerance of not more than 0.1 m, if the subject vehicle would remain at the prescribed test speed throughout the functional part of the test and does not brake.

Tests shall be conducted with a vehicle travelling at speeds shown in tables below for respectively M_2, M_3, N_2 and N_3 Categories. The technical service may test any other speeds listed in the table in paragraph 5.2.3.4. and within the prescribed speed range as defined in paragraphs 5.2.3.3.

Subject vehicle test speed for M2 and M3 vehicle in bicycle target scenario

M_2			*M_3*		
Maximum mass	*Mass in running order*	*Tolerance*	*Maximum mass*	*Mass in running order*	*Tolerance*

All values in km/h

Subject vehicle test speed for N2 and N3 vehicle in bicycle target scenario

N_2	*N_3*

	<table><tr><th>Maximum mass</th><th>Mass in running order</th><th>Tolerance</th><th>Maximum mass</th><th>Mass in running order</th><th>Tolerance</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> All values in km/h From the start of the functional part until the subject vehicle has avoided the collision or the subject vehicle has passed the impact point with the bicycle target there shall be no adjustment to any control of the subject vehicle by the driver other than slight adjustments to the steering control to counteract any drifting. The test prescribed above shall be carried out with a bicycle "soft target" defined in 6.3.3. 6.7.2. The assessment of the impact speed shall be based on the actual contact point between the target and the vehicle, taking into account the vehicle shape.	
6.6. Failure detection test 6.6.1. Simulate an electrical failure, for example by disconnecting the power source to any AEBS component or disconnecting any electrical connection between AEBS components. When simulating an AEBS failure, neither the electrical connections for the driver warning signal of paragraph 5.5.4. above nor the optional manual AEBS deactivation control of paragraph 5.4. shall be disconnected. 6.6.2. The failure warning signal mentioned in paragraph 5.5.4. above shall be activated and remain activated not later than 10 seconds after the vehicle has been driven at a speed greater than 15 km/h and be reactivated immediately after a subsequent ignition "off" ignition "on" cycle with the vehicle stationary as long as the simulated failure exists.	6.8. Failure Detection Test 6.8.1 Simulate an electrical failure, for example, by disconnecting the power source to any AEBS component or disconnecting any electrical connection between AEBS components. When simulating an AEBS failure, neither the electrical connections for the driver warning signal of paragraph 5.5.4. above nor the optional manual AEBS deactivation control of paragraph 5.4.1. shall be disconnected. 6.8.2. The failure warning signal mentioned in paragraph 5.5.4. above shall be activated and remain activated not later than 10 s after the vehicle has been driven at a speed greater than 10 km/h and be reactivated immediately after a subsequent ignition "off" ignition "on" cycle with the vehicle stationary as long as the simulated failure exists.	
6.7. Deactivation test 6.7.1. For vehicles equipped with means to deactivate the AEBS, turn the ignition (start) switch to the "on" (run) position and deactivate	6.9. Deactivation Test 6.9.1. For vehicles equipped with means to manually deactivate the AEBS, turn the ignition (start) switch to the "on" (run) position and deactivate the AEBS. The	

the AEBS. The warning signal mentioned in paragraph 5.4.2. above 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 has been reinstated as specified in paragraph 5.4.1. above. If the ignition system is activated by means of a "key", the above requirement shall be fulfilled without removing the key.	warning signal mentioned in paragraph 5.4.3. above 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 has been reinstated as specified in paragraph 5.4.1. above. If the ignition system is activated by means of a "key", the above requirement shall be fulfilled without removing the key.	
6.8. False reaction test 6.8.1. Two stationary vehicles, of category M1 AA saloon, shall be positioned: (a) So as to face in the same direction of travel as the subject vehicle, (b) With a distance of 4.5 m between them , (c) With the rear of each vehicle aligned with the other. 6.8.2. The subject vehicle shall travel for a distance of at least 60 m, at a constant speed of 50 ± 2 km/h to pass centrally between the two stationary vehicles. During the test there shall be no adjustment of any subject vehicle control other than slight steering adjustments to counteract any drifting. 6.8.3. The AEBS shall not provide a collision warning and shall not initiate the emergency braking phase.	**Annex 3 - Appendix 2** **False Reaction scenarios**	
	6.10. Robustness of the system 6.10.1. Any of the above test scenarios, where a scenario describes one test setup at one subject vehicle speed at one load condition of one category (Vehicle to Car, Vehicle to Pedestrian, Vehicle to Bicycle), shall be performed two times. If one of the two test runs fails to meet the required performance, the test may be repeated once. A test scenario shall be accounted as passed if the required performance is met in two test runs. The number of failed tests runs within one category shall not exceed:	How many tests to check system robustness? Concern with regard to the number of test to cover a range (N2 LCV, N2 17”5 wheels, 19”5, N3 22”5, tractor / truck, cab height, long Haul/construction; axle configuration, M2, M3…) **Use of simulation…**

	(a) 10.0 per cent of the performed test runs for the Vehicle to Car tests; (b) 10.0 per cent of the performed test runs for the Vehicle to Pedestrian tests; and (c) 20.0 per cent of the performed test runs for the Vehicle to Bicycle tests. 6.10.2. The root cause of any failed test run shall be analyzed together with the Technical Service and annexed to the test report. If the root cause cannot be linked to a deviation in the test setup, the technical service may test any other speeds within the speed range as defined in paragraphs 5.2.1.3., 5.2.1.4., 5.2.2.3., 5.2.2.4., 5.2.3.3. or 5.2.3.4. as relevant. 6.10.3. During the assessment as per Annex 3, the manufacturer shall demonstrate, via appropriate documentation, that the system is capable of reliably delivering the required performances.	

Annex 1 **Communication**	**Annex 1** **Communication**	
Annex 2 **Arrangements of approval marks**	**Annex 2** **Arrangements of approval marks**	

Annex 3

Warning and activation test requirements – Pass/fail values

A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*Row*
	Stationary target			*Moving target*				
	Timing of warning modes		*Speed reduction (ref. paragraph 6.4.4.)*	*Timing of warning modes*		*Speed reduction (ref. paragraph 6.5.3.)*	*Target speed (ref. paragraph 6.5.1.)*	
	At least 1 (ref. paragraph 6.4.2.1.)	*At least 2 (ref. paragraph 6.4.2.2.)*		*At least 1 (ref. paragraph 6.5.2.1.)*	*At least 2 (ref. paragraph 6.5.2.2.)*			
M_3[1], $N_2 > 8$ t and N_3	Not later than 1.4 s. before the start of emergency braking phase	Not later than 0.8 s. before the start of emergency braking phase	Not less than 20 km/h	Not later than 1.4 s. before the start of emergency braking phase	Not later than 0.8 s. before the start of emergency braking phase	No impact	12 ± 2 km/h	1
$N_2 \leqq 8$ t [2, 4] and M_2 [2, 4]	Not later than 0.8 s before the start of the emergency braking phase	Before the start of the emergency braking phase [3]	Not less than 10 km/h	Not later than 0.8 s before the start of the emergency braking phase	Before the start of the emergency braking phase [3]	No impact	67 ± 2 km/h[5]	2

[1] Vehicles of category M_3 with hydraulic braking system are subject to the requirements of row 2.
[2] Vehicles with pneumatic braking systems are subject to the requirements of row 1.
[3] Values shall be specified by the vehicle manufacturer at the time of Type Approval (Annex 1, paragraph 15.).
[4] Manufacturers of vehicles covered by row 2 may elect to gain vehicle Type Approval to the values specified in row 1; in this instance compliance shall be demonstrated with all the values contained in row 1.
[5] The values for the target speed in cell H2 shall be reviewed before 1st November 2021.

Annex 4 **Special requirements to be applied to the safety aspects of complex electronic vehicle control systems**	**Annex 3** **Special requirements to be applied to the safety aspects of electronic control systems** **Annex 3 - Appendix 1** **Model assessment form for electronic systems**	
	Annex 3 - Appendix 2 **False Reaction scenarios**	Scenarios to be checked