

Proposal for amendments to UN R 152

The text reproduced below was prepared by the experts from the Informal Working Group on Advanced Emergency Braking Systems of Heavy Duty Vehicles for Supplements to the original text of UN R152, to UN R152.01 and to UN R152.02. The modifications to the respective texts of the current regulation are marked in strikethrough characters for deleted text and in bold characters for added text.

I. Proposal

FOR ALL SERIES OF AMENDMENDS

Paragraph 1., insert a new footnote to read (current Footnote 1 remains unchanged):

"1. Scope

This UN Regulation applies to the approval of vehicles of Category M₁ and N₁¹ * 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.

* This Regulation also offers an alternative set of requirements for vehicles of Category M₂, and for those of Categories M₃/N₂ with a maximum weight below or equal to 8 tons, equipped with hydraulic braking, to those contained in UN Regulation No. 131.

For the vehicles described above, Contracting Parties that apply both UN Regulation No. 131 and this Regulation recognise approvals to either regulation as equally valid."

PROPOSAL FOR THE 00, 01 AND 02 SERIES OF AMENDMENTS

Subparagraphs of paragraph 5.2., amend to read:

- "5.2. Specific Requirements
- 5.2.1. Car to Car Scenario
- 5.2.1.1. Collision Warning

When ~~a~~ an imminent collision with a preceding vehicle of Category M₁, in the same lane ~~is detected~~ with a relative speed above that speed up to which the subject vehicle is able to avoid the collision (~~within the conditions specified in paragraphs 5.2.1.4~~), ~~is imminent~~, a collision warning shall be provided as specified in Paragraph 5.5.1., and shall be triggered at the latest 0.8s before the start of emergency braking.

However, in case the collision cannot be anticipated in time to give a collision warning 0.8s 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.

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

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.

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/s^2 to the service braking system of the vehicle.

The emergency braking may be aborted **or the deceleration demand may be 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**.

This shall be tested in accordance with Paragraphs 6.4. and 6.5. of this Regulation.”

...

“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, **provided**:

- (a) ~~For collisions with unobstructed and constantly travelling or stationary targets;~~
- (b) ~~On flat, horizontal and dry roads;~~
- (c) ~~In maximum mass and mass in running order conditions;~~
- (d) ~~In situations where the vehicle longitudinal centre planes are displaced by not more than 0.2m;~~
- (e) ~~In ambient illumination conditions of at least 1,000Lux without blinding of the sensors (e.g. direct blinding sunlight);~~
- (f) ~~In absence of weather conditions affecting the dynamic performance of the vehicle (e.g. no storm, not below 0°C);~~
- (g) ~~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.~~

- (a) **Vehicle external influences allow for the required deceleration, i.e.:**
 - (i) **The road is flat, horizontal and dry affording good adhesion;**
 - (ii) **The weather conditions do not affect the dynamic performance of the vehicle (e.g. no storm, not below 0°C);**
- (b) **The vehicle state itself allows for the required deceleration, e.g.:**
 - (i) **The tyres are in an appropriate state and properly inflated;**
 - (ii) **The brakes are properly operational (brake temperature, pads condition etc.);**
 - (iii) **There is no severe uneven load distribution;**
 - (iv) **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;**
- (c) **There are no external influences affecting the physical sensing capabilities, i.e.:**

- (i) The ambient illumination conditions are at least 1000 Lux and there is no extreme blinding of the sensors (e.g. direct blinding sunlight, highly RADAR-reflective environment);
 - (ii) The target vehicle is not extreme with regard to the Radar Cross Section (RCS) or the shape/silhouette (e.g. below fifth percentile of RCS of all M₁ vehicles)
 - (iii) There are no significant weather conditions affecting the sensing capabilities of the vehicle (e.g. heavy rain, dense fog, snow, dirt);
 - (iv) There are no overhead obstructions close to the vehicle;
- (d) The situation is unambiguous, i.e.:
- (i) The preceding vehicle belongs to Category M₁, is unobstructed, clearly separated from other objects in the driving lane and constantly travelling or stationary;
 - (ii) The vehicle longitudinal centre planes are displaced by not more than 0.2 m;
 - (iii) The direction of travel is straight with no curve, and the vehicle is not turning at an intersection and following its lane.

When conditions deviate from those listed above, the system shall not deactivate or unreasonably switch the control strategy. This shall be demonstrated in accordance with [paragraph 6 and] Annex 3 of this Regulation.”

...

“5.2.2 Car 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 5km/h (**within the conditions specified in paragraph 5.2.2.4.**) 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 collision warning may be aborted if the conditions prevailing a collision are no longer present.

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 5.0m/s² to the service braking system of the vehicle.

The emergency braking may be aborted **or the deceleration demand may be 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**.

This shall be tested in accordance with Paragraph 6.6. of this Regulation.”

...

“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, **provided**:

- (a) With unobstructed perpendicularly crossing pedestrians with a lateral speed component of not more than 5km/h;

- (b) In unambiguous situations (e.g. not multiple pedestrians);
- (c) On flat, horizontal and dry roads;
- (d) In maximum mass and mass in running order conditions;
- (e) In situations where the anticipated impact point is displaced by not more than 0.2m compared to the vehicle longitudinal centre plane;
- (f) In ambient illumination conditions of at least 2,000 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.

- (a) Pedestrians are unobstructed and perpendicularly crossing with a lateral speed component of not more than 5 km/h;
- (b) Vehicle external influences allow for the required deceleration, i.e.:
 - (i) The road is flat, horizontal and dry affording good adhesion;
 - (ii) The weather conditions do not affect the dynamic performance of the vehicle (e.g. no storm, not below 0°C);
- (c) The vehicle state itself allows for the required deceleration, e.g.:
 - (i) The tyres in an appropriate state and properly inflated;
 - (ii) The brakes are properly operational (brake temperature, pads condition etc.);
 - (iii) There is no severe uneven load distribution;
 - (iv) 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) There are no external influences affecting the physical sensing capabilities, i.e.:
 - (i) The ambient illumination conditions are at least 2000 Lux and there is no extreme blinding of the sensors (e.g. direct blinding sunlight, highly RADAR-reflective environment);
 - (ii) There are no significant weather conditions affecting the sensing capabilities of the vehicle (e.g. heavy rain, dense fog, snow, dirt);
 - (iii) There are no overhead obstructions close to the vehicle;
- (e) The situation is unambiguous, i.e.:
 - (i) There are not multiple pedestrians crossing in front of the vehicle.
 - (ii) The silhouette of the pedestrian and the type of movement relate to a human being.
 - (iii) The anticipated impact point is displaced by not more than 0.2 m compared to the vehicle longitudinal centre plane.
 - (iv) The direction of travel is straight with no curve, and the vehicle is not turning at an intersection and following its lane.

- (v) There are no multiple objects close by to the pedestrian and an unambiguous object separation is given.

When conditions deviate from those listed above, the system shall not deactivate or unreasonably switch the control strategy. This shall be demonstrated in accordance with [paragraph 6 and] Annex 3 of this Regulation.”

...

Paragraph 6.6.1., amend to read:

- “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 2s prior to the functional part of the test with an anticipated subject vehicle to impact point centreline offset of not more than 0.1m.

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 4s 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 5km/h +0/-0.4km/h, starting not before the functional part of the test has started. The pedestrian target’s positioning shall be coordinated with the subject vehicle in such a way that the impact point of the pedestrian target on the front of the subject vehicle is on the longitudinal centreline of the subject vehicle, with a tolerance of not more than 0.1m, 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 M1 and N1 Categories. **If this is deemed justified, 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 Paragraph 5.2.2.3.**

Subject vehicle test speed for M₁ category in pedestrian target scenario

<i>Maximum mass</i>	<i>Mass in running order</i>	<i>Tolerance</i>
20	20	+2/-0
40	42	+0/-2
60	60	+0/-2

All values in km/h

Subject vehicle test speed for N₁ category in pedestrian target scenario

<i>Maximum mass</i>	<i>Mass in running order</i>	<i>Tolerance</i>
20	20	+2/-0
38	42	+0/-2
60	60	+0/-2

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."

PROPOSAL FOR THE 02 SERIES OF AMENDMENTS

Subparagraphs of paragraph 5.2.3., amend to read:

“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 (**within the conditions specified in paragraph 5.2.3.4.)** 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 collision warning may be aborted if the conditions prevailing a collision are no longer present.

5.2.3.2. When the system has detected the possibility of an imminent collision there shall be a braking demand of at least 5.0m/s² to the service braking system of the vehicle.

The emergency braking may be aborted **or the deceleration demand may be 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**.

This shall be tested in accordance with Paragraph 6.7. of this Regulation.

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, **provided**:

- (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) ~~In 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.~~

- (a) Cyclists are unobstructed and perpendicularly crossing with constant speeds between 10 and 15 km/h;
- (b) Vehicle external influences allow for the required deceleration, i.e.:
 - (i) The road is flat, horizontal and dry affording good adhesion;
 - (ii) The weather conditions do not affect the dynamic performance of the vehicle (e.g. no storm, not below 0°C);
- (c) The vehicle state itself allows for the required deceleration, e.g.:
 - (i) The tyres are in an appropriate state and properly inflated;
 - (ii) The brakes are properly operational (brake temperature, pads condition etc.);
 - (iii) There is no severe uneven load distribution;
 - (iv) 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) There are no external influences affecting the physical sensing capabilities, i.e.:
 - (i) The ambient illumination conditions are at least 2000 Lux and there is no extreme blinding of the sensors (e.g. direct blinding sunlight, highly RADAR-reflective environment);
 - (ii) There are no significant weather conditions affecting the sensing capabilities of the vehicle (e.g. heavy rain, dense fog, snow, dirt);
 - (iii) There are no overhead obstructions close to the vehicle;
- (e) The situation is unambiguous, i.e.:
 - (i) There are not multiple cyclists crossing in front of the vehicle.
 - (ii) The silhouette of the cyclist and the type of movement relate to a human being.
 - (iii) 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.
 - (iv) The direction of travel is straight with no curve, and the vehicle is not turning at an intersection and following its lane.
 - (v) There are no multiple objects close to the cyclist and an unambiguous object separation is given.

When conditions deviate from those listed above, the system shall not deactivate or unreasonably switch the control strategy. This shall be demonstrated in accordance with [paragraph 6 and] Annex 3 of this Regulation.”

Paragraph 6.7., amend to read:

- “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 2s 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 0.1m.

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 4s 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 15km/h +0/-1km/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 0.1m, 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 M₁ and N₁ Categories. **If this is deemed justified, the** 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 M₁ category in bicycle target scenario

Maximum mass	Mass in running order	Tolerance
20	20	+2/-0
38	40	+0/-2
60	60	+0/-2

All values in km/h

Subject vehicle test speed for N₁ category in bicycle target scenario

Maximum mass	Mass in running order	Tolerance
20	20	+2/-0
36	40	+0/-2
60	60	+0/-2

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 Paragraph 6.3.3."

II. JUSTIFICATIONS

1. The Informal Working Group on Advanced Emergency Braking Systems of Heavy-Duty Vehicles adapted the performance requirements of UN R131 to technical progress and took the opportunity of this revision to improve the quality of the provisions. GRVA at its 12th session endorsed the outcomes of the IWG and adopted the document GRVA-12-50-Rev.1 (became document WP.29/2022/76). GRVA in addition requested the IWG to transfer the improvements to UN R152, as indicated in the revised terms of reference per document GRVA-12-10, item 8. The main purpose of the present document is to fulfil this mandate from GRVA.

2. Paragraph 1: the insertion of a new footnote is necessary to open the possibility for the manufacturers to approve some vehicles to UN R152 as an alternative to UN R131. It is a way to streamline the approval process for some vehicles derived from light vehicles already under the scope of UN R152. There are only safety benefits in this proposal since the requirements of UN R152 are more complete than those of UN R131 (e.g. vehicle-to-bicycle performance requirements).
3. Collision warning and speed reduction (paragraphs 5.2.1., 5.2.2. and 5.2.3.):
 - a. Some of the wording elaborated in the IWG on AEBS-HDV was recognized by the experts of both GRVA and IWG AEBSM1N1 as of better quality than that of the current text of UN R152. The proposal is hence to transfer this clearer and more accurate text into UN R152. In particular the list of conditions under which the AEBS must generate a speed reduction is close to exhaustive; this helps the manufacturers and the Technical Services to determine the outlines of the performance requirements.
 - b. The reference to paragraph 6 in the last sentence of the new proposed text did not reach consensus within the IWG: on the one hand some parties see an interest in adding this reference, on the other hand this reference faces no unanimity within the IWG and the proposal seems to go beyond the mandate given by GRVA to the IWG. The IWG requests guidance from GRVA on this item.
4. Paragraph 6.6.1. and 6.7.1.: this wording seems having been missed in the current text of UN R152. It is re-introduced for the sake of consistency with their respective reference paragraphs 6.4. and 6.5.