

18 December 2023

Agreement

Concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations*

(Revision 3, including the amendments which entered into force on 14 September 2017)

Addendum 151 – UN Regulation No. 152

Revision 2 – Amendment 3

Supplement 3 to the 02 series of amendments – Date of entry into force: 24 September 2023.

Uniform provisions concerning the approval of motor vehicles with regard to the Advanced Emergency Braking System (AEBS) for M₁ and N₁ vehicles

This document is meant purely as documentation tool. The authentic and legal binding text is: ECE/TRANS/WP.29/2023/16 (as amended by paragraph 90 of the report ECE/TRANS/WP.29/1171) .



UNITED NATIONS

* Former titles of the Agreement:

Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958 (original version); Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, done at Geneva on 5 October 1995 (Revision 2).

Paragraph 1., amend to read (addition of an asterisk):

"1. Scope

This 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.

* 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."

Paragraph 2.13., amend to read:

"2.13. *"Sufficient nominal Peak Braking Coefficient (PBC)"*: means a road surface friction coefficient of:

- (a) 0.9, when measured using the American Society for Testing and Materials (ASTM) of E1136-19 standard reference test tyre in accordance with ASTM Method E1337-19 at a speed of 40 mph;
- (b) 1.017, when measured using either:
 - (i) The American Society for Testing and Materials (ASTM) of F2493-20 standard reference test tyre in accordance with ASTM Method E1337-19 at a speed of 40 mph; or
 - (ii) The k-test method specified in Appendix 2 to Annex 6 of UN Regulation No. 13-H.
- (c) The required value to permit the design maximum deceleration of the relevant vehicle, when measured using the k-test method in Appendix 2 to Annex 13 of UN Regulation No. 13."

Paragraph 5.1.4., the title, amend to read:

"5.1.4. Warnings and information"

Paragraph 5.2.1.1., amend to read:

"5.2.1.1. Collision warning

When 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 paragraph 5.2.1.4.), 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..."

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 - <https://unece.org/transport/standards/transport/vehicle-regulations-wp29/resolutions>

Paragraph 5.2.1.2., amend to read:

"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 to the service braking system of the vehicle. This does not prohibit higher deceleration demand values than 5 m/s² during the collision warning for very short durations, e.g. as haptic warning to stimulate the driver's attention.

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."

Paragraph 5.2.1.4., amend to read:

"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) 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 by the manufacturer in accordance with Annex 3 of this Regulation and, if deemed justified, may be followed by testing by the Technical Service in conditions deviating from those listed above or those in paragraph 6. The rationale for and the results of this verification testing shall be appended to the test report.

..."

Paragraph 5.2.2.1., amend to read:

"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 (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."

Paragraph 5.2.2.2., amend to read:

"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 to the service braking system of the vehicle. This does not prohibit higher deceleration demand values than 5 m/s² during the collision warning for very short durations, e.g. as haptic warning to stimulate the driver's attention.

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."

Paragraph 5.2.2.4., amend to read:

"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) 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 by the manufacturer in accordance with Annex 3 of this Regulation and, if deemed justified, may be followed by testing by the Technical Service in conditions deviating from those listed above or those in paragraph 6. The rationale for and the results of this verification testing shall be appended to the test report.

..."

Paragraph 5.2.3.1., 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."

Paragraph 5.2.3.2., amend to read:

"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 to the service braking system of the vehicle. This does not prohibit higher deceleration demand values than 5 m/s² during the collision warning for very short durations, e.g. as haptic warning to stimulate the driver's attention.

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."

Paragraph 5.2.2.4., amend to read:

"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) 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 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 by the manufacturer in accordance with Annex 3 of this Regulation and, if deemed justified, may be followed by testing by the Technical Service in conditions deviating from those listed above or those in paragraph 6. The rationale for and the results of this verification testing shall be appended to the test report.

..."

Paragraph 5.4.1.1., amend to read:

"5.4.1.1 The AEBS function shall be automatically reinstated at the initiation of each new engine start (or run cycle, as relevant).

This requirement does not apply when a new engine start (or run cycle, as relevant) is performed automatically, e.g. the operation of a stop/start system."

Insert a new paragraph 6.2.4., to read:

"6.2.4. The vehicle may be fitted with protective equipment that does not affect the results of the tests."

Paragraph 6.4., amend to read:

"6.4. Warning and Activation Test ...

...

The functional part of the test shall start with:

- (a) The subject vehicle travelling at the required test speed within the tolerances and within the lateral offset prescribed in this paragraph, and
- (b) A distance corresponding to a Time To Collision (TTC) of at least 4 seconds from the target.

The tolerances shall be respected between the start of the functional part of the test and the system intervention."

Paragraph 6.5., amend to read:

"6.5. Warning and Activation Test ...

...

The functional part of the test shall start with:

- (a) The subject vehicle travelling at the required test speed within the tolerances and within the lateral offset prescribed in this paragraph, and
- (b) A distance corresponding to a TTC of at least 4 seconds from the target.

The tolerances shall be respected between the start of the functional part of the test and the system intervention."

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 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 with:

- (a) The subject vehicle travelling at the required test speed within the tolerances and within the lateral offset prescribed in this paragraph, and
- (b) A distance corresponding to a Time To Collision (TTC) of at least 4 seconds from the target.

The tolerances shall be respected between the start of the functional part of the test and the system intervention.

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 \pm 0.2 km/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 0.1 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 the 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

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

Paragraph 6.6.2., amend to read:

"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 without additional protective equipment as permitted per paragraph 6.2.4."

Paragraph 6.7.1., amend to read:

"6.7. Warning and Activation Test with a Bicycle Target

6.7.1. The subject vehicle ...

...

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 5.2.3.4. and within the prescribed speed range as defined in paragraph 5.2.3.3.

...

The functional part of the test shall start with

- (a) The subject vehicle travelling at the required test speed within the tolerances and within the lateral offset prescribed in this paragraph,
- (b) The bicycle target travelling at the required test speed within the tolerances specified in this paragraph and
- (c) A distance corresponding to a TTC of at least 4 seconds from the target.

The tolerances shall be respected between the start of the functional part of the test and the system intervention."
