

## **Proposal for the 03 series of amendments to UN Regulation No. 127 (Pedestrian Safety)**

### **Submitted by the expert from the European Commission on behalf of the drafting Task Force \***

The text reproduced below was prepared by the experts of the drafting Task Force to replace ECE/TRANS/WP.29/GRSP/2020/9. The proposal aims to introduce specific provisions in the UN Regulation that are aligned with the new provisions set out in the revised General Safety Regulation (EU) 2019/2144 that will apply in the European Union in accordance with the proposed transitional provisions. It also covers a specific provision on optional monitoring of headform contact with A-pillars, windscreen header and cowl. The proposed test also makes a few minor adaptations and clarifications to the existing requirements. The modifications to the current text of the UN Regulation are marked in bold for new or strikethrough for deleted characters.

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\* In accordance with the programme of work of the Inland Transport Committee for 2021 as outlined in proposed programme budget for 2021 (A/75/6 (Sect.20), para 20.51), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.



## I. Proposal

Paragraph 2.1., amend to read:

"2.1. **"Adult headform bonnet top test area"** is an area on the outer surfaces of the front structure. The area is bounded:

- (a) In the front, by a wrap around distance (WAD) of 1,700 or a line 82.5 mm rearward of the bonnet leading edge reference line, whichever is most rearward at a given lateral position;
- (b) At the rear, by a WAD ~~{2,500<sup>1</sup>}~~ or a line 82.5 mm forward of the bonnet rear reference line, whichever is most forward at a given lateral position, and
- (c) At each side, by a line 82.5 mm inside the side reference line.

The distance of 82.5 mm is to be set with a flexible tape held tautly along the outer surface of the vehicle."

Paragraph 2.10., amend to read:

"2.10. **"Bonnet top test area"** is composed of the child headform **bonnet top** test area and the adult headform **bonnet top** test area as defined in paragraphs 2.1. and 2.16. respectively."

Paragraph 2.16., amend to read:

"2.16. **"Child headform bonnet top test area"** is an area on the outer surfaces of the front structure. The area is bounded:

- (a) In the front, by a WAD 1,000 or a line 82.5 mm rearward of the bonnet leading edge reference line, whichever is most rearward at a given lateral position,
- (b) At the rear, by a WAD 1,700 or a line 82.5 mm forward of the bonnet rear reference line, whichever is most forward at a given lateral position, and
- (c) At each side, by a line 82.5 mm inside the side reference line.

The distance of 82.5 mm is to be set with a flexible tape held tautly along the outer surface of the vehicle."

Insert new paragraphs 2.44. to 2.48., to read:

"2.44. **"Windscreen test area"** is an area on the outer surface of the windscreen. It is bound:

- (a) **In the front, by a line 100 mm rearward to the opaque obscuration of the windscreen. In case of absence of the opaque obscuration, the line is measured from the front visible edge of the windscreen material.**
- (b) **In the rear, by a WAD 2,500 or a line 130 mm forward to the rear visible edge of the windscreen material, whichever is more forward at a given lateral position.**
- (c) **At each side, by a line 100 mm inside the opaque obscuration of the windscreen. In case of absence of the opaque obscuration, the line is measured from the side visible edge of the windscreen material.**

**For (a) and (c): the distances of 100 mm are to be measured with a flexible tape held tautly along the outer surface of the vehicle at an angle of 90° to the tangent line to the opaque obscuration limit.**

<sup>1</sup> or WAD 2,100 in accordance with paragraphs 11.9 and 11.10.

For (b): the distances of 130 mm is to be measured with a flexible tape held tautly along the outer surface of the vehicle at an angle of 90 ° to the tangent line to the rear edge of the windscreen.

Tests assigned to any measuring points located in the windscreen area forward of and including WAD 1,700 are performed with the child headform impactor. Tests assigned to any measuring points located in the windscreen area rearward of WAD 1,700 are performed with the adult headform impactor.

- 2.45. "Cowl monitoring area" is generally located near the rear of the bonnet test area and the front of the windscreen test area.

For the adult head tests, if any, this area is bound:

- (a) In the front, by the forward most boundary of the adult headform bonnet top test area as defined in paragraph 2.1 or a line 82.5 mm forward of the bonnet rear reference line, whichever is most rearward at a given lateral position; and
- (b) At the rear, by a WAD [2,500<sup>2</sup>] or the front of the windscreen test area, whichever is most forward at a given lateral position.

For the child head tests, this area is bound:

- (a) In the front, by the forward most boundary of the child headform bonnet top test area as defined in paragraph 2.16 or a line 82.5 mm forward of the bonnet rear reference line, whichever is most rearward at a given lateral position; and
- (b) At the rear, by a WAD 1,700 or the front of the windscreen test area, whichever is most forward at a given lateral position.

- 2.46. "Opaque obscuration" means any area of the glazing preventing light transmission, including any solid black windscreen-printed area, but excluding any shade band, dot-printed area, text or graphics.

- 2.47. "Shade band" means any area of the glazing with a reduced light transmittance, excluding any opaque obscuration.

- 2.48. "Atypical windscreen fracture behaviour" is where the headform to windscreen impact results in at least one of the following cases:

- (a) The absolute value of the minimum value of the derivation of the headform acceleration versus time is below 180 g/ms for the first 4 ms after the initial contact of the headform to the windscreen; or
- (b) The minimum value of the acceleration below 300 m/s<sup>2</sup> between the initial peak and 10 milliseconds is reached later than 4 ms in the time/acceleration plot, or glass breaking which expands to whole windshield is not visibly observed."

Paragraph 5.2.1., amend to read:

- "5.2.1. Child and adult headform tests:

When tested in accordance with Annex 5, paragraphs 3., 4., and 5., the HIC recorded shall not exceed 1,000 over two thirds of the **combined** bonnet top test area **and the windscreen test area. Furthermore, the HIC recorded shall not exceed 1,000 over two-thirds of the bonnet top test area.** The HIC for the remaining test areas shall not exceed 1,700 for both headforms. **Measuring points located in the cowl monitoring area shall not be taken into consideration to assess the performance requirements stated in this**

<sup>2</sup> from WAD 2,100 front boundary, if applicable, in accordance with paragraphs 11.9 and 11.10.

**paragraph. The respective test results are used for monitoring purposes only and do not contribute to the one-third and two-third area calculation.**

In case there is only a child headform test area, the HIC recorded shall not exceed 1,000 over two thirds of the test area. For the remaining area the HIC shall not exceed 1,700."

*Insert new paragraphs 11.5. to 11.10~~1~~, to read:*

- "11.5. As from the official date of entry into force of the 03 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept type approvals under this Regulation as amended by the 03 series of amendments.
- 11.6. As from 7 July 2024, Contracting Parties applying this Regulation shall not be obliged to accept type approvals to the preceding series of amendments, first issued after 7 July 2024.
- 11.7. Until 7 July 2026, Contracting Parties applying this Regulation shall accept type approvals to the preceding series of amendments, first issued before 7 July 2024.
- 11.8. As from 7 July 2026, Contracting Parties applying this Regulation shall not be obliged to accept type approvals issued to the preceding series of amendments to this Regulation.
- 11.9. ~~As from~~Until 1 September 2028, Contracting Parties applying this Regulation shall no longer permit can continue to grant type approvals using the specific provisions related to atypical windscreen fracture behaviour (see Annex 5 paragraphs 4.8. and 5.8.) and [WAD 2,100 monitoring front boundary (see paragraphs 2.1. and 2.45.)~~] for the purpose of granting type approval.~~
- 11.10. As from 1 September 2029, Contracting Parties applying this Regulation shall not be obliged to accept type approvals issued for a vehicle with a cowl monitoring area WAD 2,100 front boundary on the bonnet top (see paragraphs 2.1. and 2.45.)
- 11.10. Contracting Parties applying this Regulation shall not refuse to grant type approvals according to any preceding series of amendments to this Regulation or extensions thereof."

*Annex 1, Part 2, insert new items 16. to 16.3., to read:*

**"16. Monitoring results**

**16.1. Cowl Monitoring area:**

<i>point</i>	<i>WAD</i>	<i>Y-coordinate<sup>3</sup></i>	<i>Impact speed</i>	<i>HIC value</i>
1.				
2.				
...				

<sup>3</sup> Coordinate system as defined by appendix 2 to Annex 1 of the Consolidated Resolution on the Construction of Vehicles (R.E.3).

**16.2. Area incorporating pedestrian or bicyclist head injury mitigation features, e.g. external airbag, deployable structure, energy absorption elements (if applicable)**

<i>A-pillar</i>	<i>WAD</i>	<i>Y-coordinate</i>	<i>Impact speed</i>	<i>HIC value</i>
1.				
2.				
...				
<b>Windscreen header</b>				
(3.)				
(4.)				
...				
<b>Cowl</b>				
(5.)				
(6.)				
...				

**16.3. Manufacturer-requested impact points on innovative solutions (if applicable)**

<i>A-pillar</i>	<i>WAD</i>	<i>Y-coordinate</i>	<i>Impact speed</i>	<i>HIC value</i>
1.				
2.				
...				
<b>Windscreen header</b>				
(3.)				
(4.)				
...				
<b>Cowl</b>				
(5.)				
(6.)				
...				

Annex 5,

Paragraphs 3.4.1. to 3.4.4., amend to read:

- "3.4.1. The manufacturer shall identify the zones of the bonnet top test area **and of the windscreen test area** where the HIC shall not exceed 1,000 (HIC1000 zone) or 1,700 (HIC1700 zone) (see Figure 5).
- 3.4.2. Marking of the "bonnet top" test area, **marking of the windscreen test area** as well as "HIC1000 zone" and "HIC1700 zone" will be based on a drawing supplied by the manufacturer, when viewed from a horizontal plane above the vehicle that is parallel to the vehicle horizontal zero plane. A sufficient number of x and y co-ordinates shall be supplied by the manufacturer to mark up the areas on the actual vehicle while considering the vehicle outer contour in the z direction. **The cowl monitoring area is not considered for the marking of the "HIC1000 zone" and "HIC1700 zone".**
- 3.4.3. The areas of "HIC1000 zone" and "HIC1700 zone" may consist of several parts, with the number of these parts not being limited. The determination of the impacted zone is done by the measuring point.

- 3.4.4. The calculation of the surface of the bonnet top test area **and the calculation of the surface of the windscreen test area** as well as the surface areas of "HIC1000 zone" and "HIC1700 zone" shall be done on the basis of a projected bonnet **and windscreen** when viewed from a horizontal plane parallel to the horizontal zero plane above the vehicle, on the basis of the drawing data supplied by the manufacturer."

*Paragraphs 4.1. to 4.3., amend to read:*

- "4.1. Tests shall be made to the front structure within the boundaries as defined in paragraph 2.16. of this Regulation. **Test shall also be made to the windscreen within the boundaries as defined in paragraph 2.44.** For tests on the rear area of the bonnet top, the headform impactor shall not contact the windscreen or A-pillar before impacting the bonnet top. **For tests on the windscreen, the headform impactor shall not directly contact the A-pillars, windscreen header and cowl, except in the case of monitoring testing.**

- 4.2. A minimum of nine tests shall be carried out with the child headform impactor **over the areas prescribed by the child bonnet top test area and the child windscreen test area together, with** three tests each to the middle and the outer thirds of the child/small adult ~~bonnet top~~ test areas, at positions judged to be the most likely to cause injury. **Where possible, at least one of these nine tests shall be carried out on the windscreen test area. Furthermore, and at the discretion of the technical service, one of these nine tests may be conducted (in any third) in the cowl monitoring area.**

**For each test on the windscreen an undamaged and untested windscreen shall be used.**

Tests shall be to different types of structure, where these vary throughout the area to be assessed and at positions judged to be the most likely to cause injury. **Taking into account any symmetry of the windscreen and relevant structures, the number of tests on the windscreen test area may be reduced at the discretion of the Technical Service.**

- 4.3. The selected measuring points for the child/small adult headform impactor shall be a minimum of 165 mm apart and within the child headform test areas as defined in paragraphs 2.16. **and 2.44.** of this UN Regulation.

These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle."

*Annex 5,*

*Paragraph 4.5., amend to read:*

- "4.5. For the child headform testing, a longitudinal and transversal impact tolerance of  $\pm 10$  mm shall apply. This tolerance is measured along the surface of the bonnet **or the windscreen.** The test laboratory may verify at a sufficient number of measuring points that this condition can be met and the tests are thus being conducted with the necessary accuracy."

*Insert new paragraphs 4.8. and 4.9., to read:*

- "4.8. **Tests may be repeated in case of atypical windscreen fracture. The repetition of the test is at manufacturer's request where the HIC value exceeds or is equal to the respective limit of the head impact zone. The maximum number of repetitions on a measuring point is 3 (i.e. 4 tests total) in this case. On request of the technical service the tests may be repeated where the HIC value is below the limit of the head impact zone, for instance in case of underlying structures within 100 mm of the measuring point.**

**Tests with atypical windscreen fracture shall be duly recorded in the test report.**

- 4.9. **If the A-pillars and/or windscreen header incorporate pedestrian or bicyclist head injury mitigation features, which shall be declared by the manufacturer (e.g. external airbag, deployable structure, energy absorption elements) additional monitoring tests shall be carried out on such structure. Contracting parties may indicate that monitoring results are not required for the approval to be recognised and accepted by such contracting party.**

**In such case the measuring points on the A-pillars, windscreen header and/or cowl shall be selected as agreed between the technical service and the manufacturer so that the effectiveness of the protection can be scientifically assessed. For that purpose, it is not required to observe the prescribed clearance distances or exclusion areas.**

**The vehicle manufacturer may also voluntarily request for monitoring tests to be carried out in case of any other innovative solutions that reduce head injury levels in case of head contact with A-pillars and/or windscreen header.**

**The monitoring results shall be detailed in point 16 of the type-approval communication form.**

**A detailed description of the protective system, the selected measuring points and the results of the assessment shall also be included in the information document."**

*Paragraphs 5.1. to 5.3., amend to read:*

- "5.1. Tests shall be made to the front structure within the boundaries as defined in paragraph 2.1. of this UN Regulation. **Test shall also be made to the windscreen within the boundaries as defined in paragraph 2.44.** For tests at the rear of the bonnet top, the headform impactor shall not contact the windscreen or A-pillar before impacting the bonnet top. **For the tests on the windscreen, the headform impactor shall not directly contact the A-pillars, windscreen header and cowl, except in the case of monitoring testing.**
- 5.2. A minimum of nine tests shall be carried out with the adult headform impactor, **over the adult areas prescribed by the adult bonnet top test area and the adult windscreen test area together, with three tests each to the middle and the outer thirds of the adult test areas, at positions judged to be the most likely to cause injury. Where possible, at least one of these nine tests shall be carried out on the windscreen test area. Furthermore, and at the discretion of the technical service, one of these nine tests may be conducted (in any third) in the cowl monitoring area.**
- For each test on the windscreen an undamaged and untested windscreen shall be used.**
- Tests shall be to different types of structure, where these vary throughout the area to be assessed and at positions judged to be the most likely to cause injury.
- Taking into account any symmetry of the windscreen and relevant structures, the number of tests on the windscreen test area may be reduced at the discretion of the Technical Service.**
- 5.3. The selected measuring points for the adult headform impactor shall be a minimum of 165 mm apart and within the adult headform test areas defined in paragraphs 2.1. **and 2.44.** of this UN Regulation.
- These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle."

*Paragraph 5.5.*, amend to read:

- "5.5. For the adult headform testing, a longitudinal and transversal impact tolerance of  $\pm 10$  mm shall apply. This tolerance is measured along the surface of the bonnet **or the windscreen**. The test laboratory may verify at a sufficient number of measuring points that this condition can be met and the tests are thus being conducted with the necessary accuracy."

*Insert new paragraphs 5.8. and 5.9.*, to read:

- "5.8. Tests may be repeated in case of atypical windscreen fracture. The repetition of the test is at manufacturer's request where the HIC value exceeds or is equal to the respective limit of the head impact zone. The maximum number of repetitions on a measuring point is 3 (i.e. 4 tests total) in this case. On request of the technical service the tests may be repeated where the HIC value is below the limit of the head impact zone, for instance in case of underlying structures within 100 mm of the measuring point.**

**Tests with atypical windscreen fracture shall be duly recorded in the test report.**

- 5.9. If the A-pillars and/or windscreen header incorporate pedestrian or bicyclist head injury mitigation features, which shall be declared by the manufacturer (e.g. external airbag, deployable structure, energy absorption elements) additional monitoring tests shall be carried out on such structure. Contracting parties may indicate that monitoring results are not required for the approval to be recognised and accepted by such contracting party.**

**In such case the measuring points on the A-pillars, windscreen header and/or cowl shall be selected as agreed between the technical service and the manufacturer so that the effectiveness of the protection can be scientifically assessed. For that purpose, it is not required to observe the prescribed clearance distances or exclusion areas.**

**The vehicle manufacturer may also voluntarily request for monitoring tests to be carried out in case of any other innovative solutions that reduce head injury levels in case of head contact with A-pillars and/or windscreen header.**

**The monitoring results shall be detailed in point 16 of the type-approval communication form.**

**A detailed description of the protective system, the selected measuring points and the results of the assessment shall also be included in the information document."**

## **II. Justification**

1. This proposal will allow Contracting Parties to the 1958 Agreement to apply an enlarged head impact zone for regulatory compliance testing.
2. The extended head impact zone is requested due to the entry into force of the revised General Safety Regulation (EU) 2019/2144 that will apply as from 7 July 2024 for new types of vehicle and 7 July 2026 for all new vehicles.
3. Various Task Force meetings, attended by interested stakeholders and Contracting Parties, were organized to discuss the proposal. In addition, practical application (workshops) to validate and support the proposal were arranged as in addition to face-to-face and web meetings.
4. Following the above meetings and the obligations laid down in the revised General Safety Regulation, a methodology was agreed that would enlarge the head impact zone, while

excluding or monitoring head form contact with the A-pillars and windscreen header and monitoring the cowl area.

5. The issue of untypical breakage of mineral glass with late fracturing and (very) high deceleration values has been addressed by a temporary provision allowing retesting and providing the respective industries sufficient lead time to finalise the process of improving these properties of windscreen glazing.

6. Atypical windscreen fracture has been addressed by introducing an objective definition alongside temporary provisions allowing retesting. During windscreen tests, it could be observed that Head Injury Criteria (HIC) values generated in conjunction with typical glass fracture were lower than those with atypical glass fracture. Simultaneously meeting the HIC performance criteria as well as the jerk criterion for a retest thus leads to the conclusion, that in any repeat of a test with atypical glass fracture, an increase of the result with typical glass fracture would not be expected. Therefore, any repetition of tests meeting the HIC criteria is indispensable only in a case where any underlying structure is in reach of the head form impactor.

7. In very rare cases, the envisioned enlarged windscreen head impact zone actually falls on the rear part of the bonnet, which was unforeseen. It is however reasonable to include this area to protect notably bicyclists, but an appropriate transitional provision in line with that for atypical windscreen glass breakage is deemed necessary to permit the necessary structural changes to be incorporated in the relevant structural bonnet designs.

8. Special provisions have been added to request monitoring testing of any areas currently not covered by the defined enlarged head form test zone, e.g. external airbags.

9. The 100 mm criterion of paragraph 5.8. of Annex 5 is meant to give a guidance whether to repeat a test, or not, in case of an atypical fracture with low HIC value. This 100 mm minimum distance in impact direction is used within the Euro New Car Assessment Programme testing protocol as a prerequisite for compliance judgement, because it ensures that no underlying structure will be contacted during the test, i.e. that in case of sufficient distance the calculated HIC value solely results from the performance of the windscreen, without being influenced by any underlying structure. If the minimum distance between windscreen and, e.g. dashboard is less than 100 mm, a contact between the head impactor and this structure may occur in a repeated test with a more typical fracture behaviour. Therefore, the recommendation is given to repeat a test in case of low HIC but with an atypical windscreen fracture.

10. The proposal also makes minor adaptations and clarifications to the existing provisions.

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