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Draft Regulation on pedestrian safety

Proposal for Supplement 1 to the draft Regulation

Submitted by the experts from Germany and the International Organization of Motor Vehicle Manufacturers *

This proposal was prepared by the experts from Germany and from the International Organization of Motor Vehicle Manufacturers (OICA) to align the text of the draft Regulation (ECE/TRANS/WP.29/2010/127) with the current text of the gtr and to clarify provisions of the headform test. It is based on two documents without a symbol (GRSP-49-12 and GRSP-49-26) distributed during the forty-ninth session of the Working Party on Passive Safety (GRSP) (see ECE/TRANS/GRSP/49, para. 38). The modifications to the current text of the draft Regulation on pedestrian safety (ECE/TRANS/WP.29/2010/127) are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/2010/8, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

Paragraph 1, footnote ¹, amend to read:

"¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.2, para. 2."

Paragraph 2.1., amend to read:

"2.1. "Adult headform test area" is an area on the outer surfaces of the front structure. The area is bounded ~~in the front by a wrap-around distance:(WAD) of 1,700 mm and, at the rear, by the rear reference line for adult headform and, at each side, by the side reference line.:~~

- (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 2,100 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 2.13., amend to read:

"2.13. "Child headform test area" is an area on the outer surfaces of the front structure. The area is bounded, ~~in the front, by the front reference line for child headform, and, at the rear, by the WAD1700 line, and by the side reference lines.:~~

- (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."

Paragraph 2.22., amend to read:

"2.22. "~~Impact~~ **First contact point**" means the point on the vehicle where initial contact by the test impactor occurs. The proximity of this point to the target point is dependent upon both the angle of travel by the test impactor and the contour of the vehicle surface (see point C B in Figure 7B and Figure 7C)."

[The first contact point is sometimes also referred to as "impact point" in respective regular texts for pedestrian protection.]"

Figure 7, shall be deleted

Insert new Figures 7A to 7C, to read:

Figure 7A
Geometry of a headform to bonnet impact

Measuring and target point

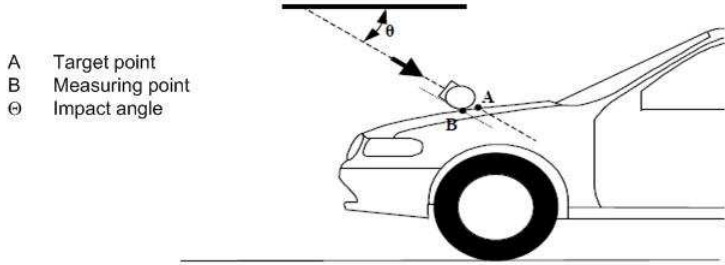
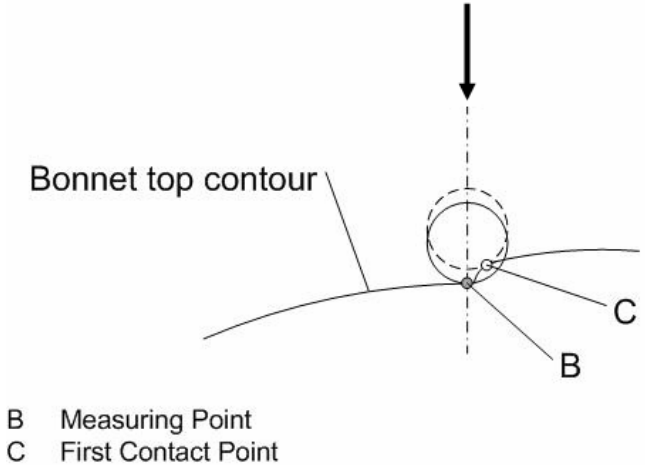
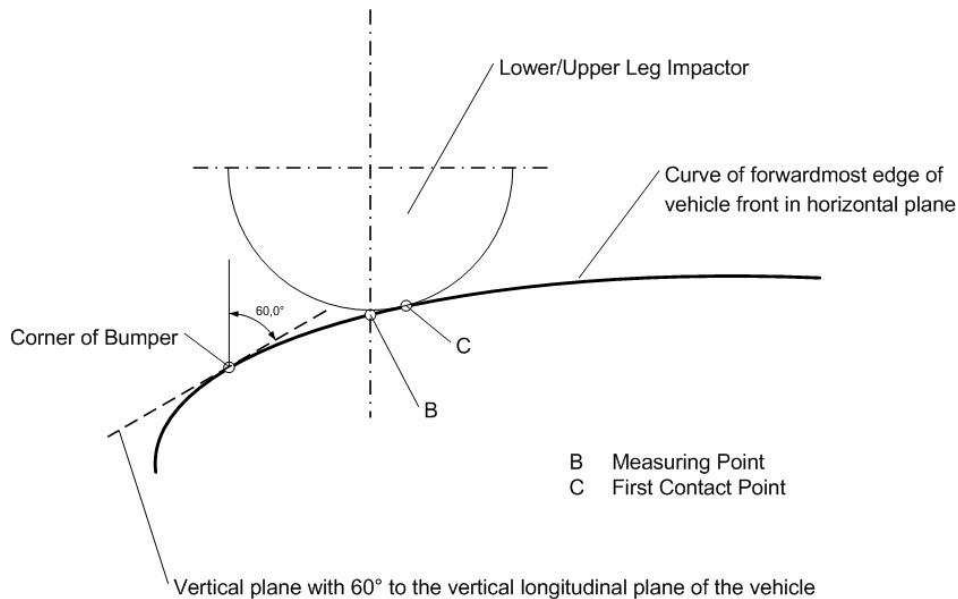


Figure 7B
Measuring and first contact point (schematic front view) ²



² Remark: due to the spatial geometry of the bonnet top, the first contact point C does, in most cases, not lie in the same vertical longitudinal or transverse plane which contains measuring point B.

Figure 7C
Geometry of a Lower/Upper legform to bumper impact



Insert new paragraph 2.26., to read:

"2.26 "Primary reference marks" means holes, surfaces, marks and identification signs on the vehicle body. The type of reference mark used and the vertical (Z) position of each mark relative to the ground shall be specified by the vehicle manufacturer according to the running conditions specified in paragraph 2.27. These marks shall be selected such as to be able to easily check the vehicle front and rear ride heights and vehicle attitude.

If the primary reference marks are found to be within ± 25 mm of the design position in the vertical (Z) axis, then the design position shall be considered to be the normal ride height. If this condition is met, either the vehicle shall be adjusted to the design position, or all further measurements shall be adjusted, and tests performed, to simulate the vehicle being at the design position."

Paragraphs 2.26 to 2.28., renumber as paragraphs 2.27. to 2.29.

Paragraph 2.29.(former), renumber as paragraph 2.30 and amend to read:

"2.30. "Target point" means the intersection of the projection of the headform longitudinal axis with the front surface of the vehicle (see point A in Figure 7A).

[The target point is sometimes also referred to as "aiming point" in respective regular texts for pedestrian protection.]"

Paragraph 2.30.(former), shall be deleted

Paragraph 2.31., amend to read:

- "2.31. "Third of the bonnet top" means the geometric trace of the area between **the side boundaries of the bonnet top test area**, measured with a flexible tape following the outer contour of the bonnet top on any transverse section, divided in three equal parts."

Paragraph 2.32., amend to read:

- "2.32. "Third of the bumper" means the geometric trace between **the side boundaries of the bumper test area**, measured with a flexible tape following the outer contour of the bumper, divided in three equal parts."

Insert new paragraphs 2.41. to 2.43., to read:

- "2.41. **The measuring point for the headform test is a point in the vertical longitudinal plane of the vehicle, containing the centre of the impactor. In this plane, it is the point at which the impactor nominally first contacts the bonnet top (see point B in Figure 7A and 7B). The first contact point may differ from the measuring point as a result of the geometry of the bonnet top.**
- [The measuring point is sometimes referred to as "test point" or "selected impact point" in respective regulatory texts for pedestrian protection.]
- 2.42. **The measuring point for the lower legform to bumper test and upper legform to bumper test lies in a vertical longitudinal plane containing the central axis of the impactor. The first contact point may differ from the measuring point as a result of the geometry of the vehicle front.**
- 2.43. **"Bonnet top test area" is composed of the child headform test area and the adult headform test area as defined in Paragraph 2.1. and 2.13. respectively."**

Paragraph 4.4.1., the reference to footnote ² and footnote ² renumber as footnote ³ and amend to read:

- ² **The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to Consolidated Resolution on the Construction of Vehicles (R.E.3), document TRANS/WP.29/78/Rev.2."**

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 **bonnet top combined child and adult headform** test areas. The HIC for the remaining areas shall not exceed 1,700 for both headforms.
- 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."

Annex 5

Paragraphs 1.4. and 1.5., amend to read:

- "1.4. The selected **measuring target** points shall be in the bumper test area.

- 1.5. A minimum of three lower legform to bumper tests shall be carried out, one each to the middle and the outer thirds of the bumper at positions judged to be the most likely to cause injury. Tests shall be to different types of structure, where they vary throughout the area to be assessed. The selected **measuring test** points shall be a minimum of 132 mm apart, and a minimum of 66 mm inside the defined corners of the bumper. These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle. The positions tested by the laboratories shall be indicated in the test report."

Paragraph 1.10., amend to read:

- "1.10. ~~At the time of first contact the centre line of the impactor shall be within a ± 10 mm tolerance to the selected impact location.~~ **For lower leg testing, an impact tolerance of ± 10 mm shall apply.**"

Paragraphs 2.4. to 2.6., amend to read:

- "2.4. The selected **measuring target** points shall be in the bumper test area as defined in paragraph 2.11.
- 2.5. A minimum of three **upper lower** legform to bumper tests shall be carried out, one each to the middle and the outer thirds of the bumper at positions judged to be the most likely to cause injury. Tests shall be to different types of structure, where they vary throughout the area to be assessed. The selected **measuring test** points shall be a minimum of 132 mm apart, and a minimum of 66 mm inside the defined corners of the bumper. These minimum distances are to be set with a flexible tape held taut along the outer surface of the vehicle. The positions tested by the laboratories shall be indicated in the test report.
- 2.6. The direction of impact shall be parallel to the longitudinal axis of the vehicle, with the axis of the upper legform vertical at the time of first contact. The tolerance to this direction is $\pm 2^\circ$.

At the time of first contact the impactor centre line shall be vertically midway between the upper bumper reference line and the lower bumper reference line with a ± 10 mm tolerance and the impactor vertical centre line shall be positioned laterally with a tolerance of ± 10 mm."

Paragraph 3.3.1., amend to read:

- "3.3.1. The acceleration time histories shall be recorded, and HIC shall be calculated. The first **contact** point ~~of contact~~ on the front structure of the vehicle shall be recorded. Recording of test results shall be in accordance with ISO 6487:2002."

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** where the HIC must not exceed 1,000 (HIC1000 zone) or 1,700 (HIC1700 zone) (see Figure 3).
- 3.4.2. Marking of the "bonnet top **test impact** 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.

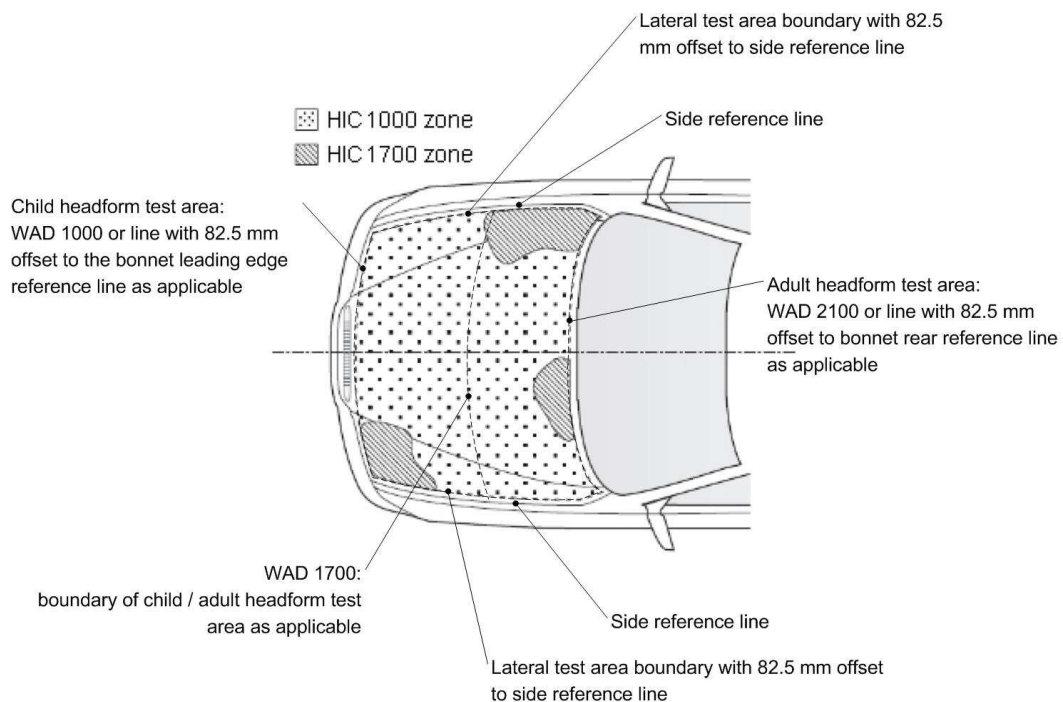
- 3.4.3. The areas of "HIC1000 zone" and "HIC1700 zone" may consist of several parts, with the number of these parts not being limited. The determination of the impacted zone is done by the **measuring point, irrespective of the position of the first contact point of the headform** with the bonnet top.
- 3.4.4. The calculation of the surface of the **bonnet top test impact** area as well as the surface areas of "HIC1000 zone" and "HIC1700 zone" shall be done on the basis of a projected bonnet 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."

Figure 3, shall be deleted

Insert a new Figure 3, to read:

Figure 3

Example of marking of HIC1000 zone and HIC1700 zone



Paragraph 3.5., amend to read:

- "3.5. ~~Impact test points~~ **Measuring point selection** – Particular specifications

Paragraphs 4.2. to 4.5., amend to read:

- "4.2. A minimum of nine tests shall be carried out with the child headform impactor, 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.
- 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."

- 4.3 The selected **measuring** points for the child/~~small adult~~ headform impactor shall be ~~at the time of first contact~~:
- (a) A minimum of 165 mm apart, and
 - ~~(b) A minimum of 82.5 mm inside the defined side reference lines, and;~~
 - ~~(c) Forward of the WAD1700 line or a minimum of 82.5 mm forward of the bonnet rear reference line, whichever is most forward at the point of measurement, and~~
 - ~~(d) Rearward of the WAD1000 line, or a minimum of 82.5 mm rearward of the bonnet leading edge reference line, whichever is most rearward at the point of measurement.~~
- (b) within the child headform test area as defined in 2.13.**
- These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle.
- 4.4. No ~~impact~~ **measuring** point shall be located so that the impactor will impact the test area with a glancing blow resulting in a more severe second impact outside the test area.
- 4.5. ~~The point of first contact point of the headform impactor shall be within a ±10 mm tolerance to the selected impact point.~~ **For head impact testing, an impact tolerance of ± 10 mm shall apply."**

Paragraphs 5.3. to 5.5., amend to read:

- "5.3. ~~The S~~selected **measuring** ~~impact~~ points on the bonnet for the adult headform impactor shall be ~~at the time of first contact~~:
- (a) A minimum of 165 mm apart, and
 - ~~(b) A minimum of 82.5 mm inside the defined side reference lines, and;~~
 - ~~(c) Forward of the WAD2100 line or a minimum of 82.5 mm forward of the bonnet rear reference line, whichever is most forward at the point of measurement, and~~
 - ~~(d) Rearward of the WAD1700 line, or a minimum of 82.5 mm rearward of the bonnet leading edge reference line, whichever is most rearward at the point of measurement.~~
- (b) within the adult headform test area as defined in 2.1.**
- These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle.
- 5.4. No ~~impact~~ **measuring** point shall be located so that the impactor will impact the test area with a glancing blow resulting in a more severe second impact outside the test area.
- 5.5. ~~The point of first contact point of the headform impactor shall be within a ± 10 mm tolerance to the selected impact point.~~ **For head impact testing, an impact tolerance of ± 10 mm shall apply."**

II. Justification

1. Given the differences between type approval and self certification systems, it is recommended in Part A (Technical Rationale and Justification, paras. 61 and 62) of gtr No. 9 that Contracting Parties to the 1998 Agreement take this into account upon national implementation of the gtr. As guidance to Contracting Parties gtr No. 9 provides paragraphs 61 and 62 of Part A of the gtr, which can be used in this case.

2. This proposal aims at incorporating the text proposed in paragraphs 61. and 62. of Part A of the gtr, provides clear guidelines and definitions for performing type approval tests of vehicles.

The text of gtr No. 9 relevant for this proposal is given below:

3. Part A, Chapt. 5., (e) Vehicle design position:

"61. As vehicles come in many variants and modifications, the ride height may vary greatly. Taking into account the differences between type approval and self certification, it is recommended that Contracting Parties take this into account upon national implementation of the gtr. As guidance to Contracting Parties, the EU addresses this issue by defining the concept of "primary reference marks". This definition (paragraph 2.2 of EU Commission Decision of 23 December 2003) reads:

"Primary reference marks" means holes, surfaces, marks and identification signs on the vehicle body. The type of reference mark used and the vertical (Z) position of each mark relative to the ground shall be specified by the vehicle manufacturer according to the running conditions specified in paragraph 2.3. These marks shall be selected such as to be able to easily check the vehicle front and rear ride heights and vehicle attitude.

62. If the primary reference marks are found to be within ± 25 mm of the design position in the vertical (Z) axis, then the design position shall be considered to be the normal ride height. If this condition is met, either the vehicle shall be adjusted to the design position, or all further measurements shall be adjusted, and tests performed, to simulate the vehicle being at the design position."

4. The expert from OICA in informal document GRSP-48-27, explained that from Industry's point of view there is an issue with the current wording used in gtr No. 9 and in the draft Regulation is unclear. This especially concerns the use of the first contact point as the main reference point for testing. Especially the latest, Corrigendum No. 2 to gtr No. 9, made this more obvious for the future application of gtr No. 9 by the Contracting Party to the 1998 Agreement as well as the draft Regulation by the Contracting Parties to the 1958 Agreement.

5. GRSP considered GRSP-48-27 and agreed, at its December 2010 session, that OICA may propose necessary changes to make the test procedure clearer.

6. From the experiences collected during the application of existing pedestrian safety legislation in Japan and Europe it had been noted that the first contact point may not be appropriate as the main reference point for testing. It is true that a first contact will always be achieved. However, there are points on the bonnet surface that may be identified as being of interest (due to underlying structures, hard points, etc.) but where a direct first contact of this point is impossible due to the bonnet design. Assuming that the main impact energy is transferred in the centre-plane of the impactor that also contains the centre of gravity of the impactor, it will nevertheless be possible to test such points, to achieve first contacts in the surrounding area and to allocate test results to such points. Industry feels that this procedure is clearer since it can be used for every point within the borderlines of

the test area on the bonnet surface, independent of whether a point can be contacted by the headform during a test or not. Furthermore, the procedure allows a well defined positioning of the impactor while a first contact may be achieved with different points of the impactor's surface. Finally, the procedure will guarantee that vehicles of the same widths have an identical width of the test area.

7. This proposal contains the necessary changes to the texts of the gtr No. 9 and of the draft UN Regulation considering the headform test as a three-dimensional system of:

(a) a measuring point (the point being closest to an underlying structure, to hard points etc.; this point sometimes is also referred to as test point or impact point),

(b) a target point (the point the propelling device targets to; sometimes also referred to as aiming point),

(c) a first contact point (the point where the initial contact of the impactor with the bonnet surface occurs; sometimes also referred to as impact point).

8. In this spatial geometry, the measuring point as well as the target point are always in the centre-plane of the impactor that is aligned to the vertical longitudinal plane of the vehicle. The test result achieved (i.e. an HIC value) shall always be allocated to the measuring point, independent of where the first contact occurred.

9. In addition to the three-dimensional definition of the point to be tested, OICA noted a discrepancy in the definition of the headform test area: According to the current test procedure described in gtr No. 9 and the draft Regulation on pedestrian safety can occur only within the child and/or adult headform test area excluding an offset of 1/2 headform diameter. The calculation of the HIC 1000 or the HIC 1700 zones respectively is nevertheless done for the whole area between the side reference lines. In practice, this could create a situation of possible misinterpretation when assigning the HIC zones to the bonnet surface since it may be possible to assign the less challenging criterion to areas that cannot be tested. The wording proposed in this document provides a clear procedure, i.e. the HIC value is to be calculated only for the area to be tested. Consequently this leads to a smaller HIC 1700 area in total which will contribute to increased safety for pedestrians.

10. This proposal also clarifies the same approach for the legform impactor test geometry of aligning the impactor's centre-plane with the measuring point as described above for the headform impactor.

11. Again, the expert from OICA wishes to point out that the changes to the procedures as described above are based on the experiences collected since gtr No. 9 was discussed in the Informal Group on Pedestrian Safety (INF GR PS). In the meantime, several experiences could be collected when testing vehicles to comply with legislation in Japan and Europe as well as with consumer requirements around the world. The procedures represent common practice in regulatory use. The proposed changes will contribute to the clearness of future worldwide pedestrian protection regulations in order to minimize the room for interpretations when the gtr No. 9 or the draft Regulation will enter into force in national legislation of the Contracting Parties.

12. The expert from OICA therefore would appreciate if the changes were accepted by GRSP and WP.29 respectively, as soon as possible to have consistent test procedures around the world.