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Working Party on Passive Safety

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Item 16 of the provisional agenda

Regulation No. 80 (Strength of seats and their anchorages (buses))**Proposal for Supplement 1 to the 02 series of amendments to
Regulation No. 80****Submitted by the experts from Belgium and Germany***

The text reproduced below was prepared by the experts from Belgium and Germany in order to introduce prescriptions for side-facing seats in vehicles of category M₃ (Class II, III and B). This proposal supersedes GRSP-46-19, distributed during the forty-sixth session of the Working Party on Passive Safety (GRSP). The modifications to the current text of the Regulation, including draft 02 series of amendments to Regulation No. 80 (ECE/TRANS/WP.29/2010/61), are marked in bold or strikethrough characters.

* In accordance with the programme of work of the Inland Transport Committee for 2006–2010 (ECE/TRANS/166/Add.1, 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

Contents,

Insert a new Appendix 7, to read:

“... ”

Appendix 7 Requirements for the safeguarding of passengers in side-facing seats according to paragraph 7.4.”

Paragraph 1.4., amend to read:

“1.4. The installation of side-facing seats shall be prohibited in vehicles of categories M₂ (of class **II, III and B**) and M₃ (of class **II, III and B**).”

Paragraph 1.5., amend to read:

“1.5. **Paragraph 1.4. shall not apply to vehicles of category M₃ (of class II, III and B) of a technically permissible maximum laden mass exceeding 10 tonnes with side-facing seats provided the requirements of paragraph 7.4. are met.**”

Paragraph 2.5.3., amend to read:

“2.5.3. **“Side-facing seat”** means a seat which ~~with regard to its alignment with the vertical plane of symmetry of the vehicle, does not meet either of the definitions given in paragraphs 2.5.1. or 2.5.2. above~~ **can be used whilst the vehicle is in motion and which faces towards the side of the vehicle in such a manner that the vertical plane of symmetry of the seat forms an angle of 90° (± 10°) with the vertical plane of symmetry of the vehicle;**”

Paragraph 2.20., amend to read:

“2.20. **“Manikin”**, a manikin corresponding to the specifications for HYBRID II or III ~~2/ for forward-facing seats; or a manikin corresponding to the specifications for side impact dummy according to Regulation No. 95, Annex 6 for side facing seats;~~”

Paragraph 5.1., amend to read:

“5.1. Each type of **forward-facing** seat shall be subject to the test requirements of either Appendix 1 (dynamic test) or Appendices 5 (static test) and 6 at the request of the manufacturer.”

Paragraph 7.2.1., amend to read:

“7.2.1. Test 1 shall not apply where the rear of the seat cannot be struck by an unrestrained passenger (i.e. there is no forward **or side-facing** seat directly behind the seat to be tested).”

Paragraph 7.2.2.2., amend to read:

“7.2.2.2. if the seat behind is **a forward-facing seat** fitted with a 3-point belt with anchorages that comply fully with Regulation No. 14 (without derogation); or”

Paragraph 7.3.1., amend to read:

“7.3.1. The test of Appendix 5 shall not apply if the rear of the seat cannot be struck by an unrestrained passenger (i.e. there is no forward **or side-facing** seat directly behind the seat to be tested).”

Paragraph 7.3.2.2., amend to read:

“7.3.2.2. if the seat behind is a **forward-facing seat** fitted with a 3-point belt with anchorages that comply fully with Regulation No. 14 (without derogation).”

Insert new paragraphs 7.4. to 7.4.4., to read:

- 7.4. The installation of side-facing seats shall be subject to the following conditions:**
- 7.4.1. the seat shall have a reference height of at least 1 m; and**
- 7.4.2. the plane through the H-points of adjacent side-facing seats shall be parallel to the reference plane;**
- 7.4.3. the horizontal distance between the H-point line between two adjacent side facing seats shall not exceed 725 mm and shall not be less than 450 mm, measured horizontally between the vertical longitudinal planes passing through the centres of these seating positions, (see Appendix 7, figure 1); and**
- 7.4.4. the passengers in side-facing seats shall be safeguarded by a vehicle part (e.g. partition, wall or seat back of a forward-facing seat) forward of the foremost side-facing seat. This vehicle part shall meet the requirements of Appendix 7.”**

Appendix 1,

The title, amend to read:

“Appendix 1

TEST PROCEDURES FOR SEATS ACCORDING TO PARAGRAPH 5 AND/OR ANCHORAGES ACCORDING TO PARAGRAPH 6.1.2. AND/OR THE INSTALLATION OF SIDE-FACING SEATS ACCORDING TO PARAGRAPH 3 OF APPENDIX 7.”

Insert a new paragraph 1.1.2.2., to read:

“**1.1.2.2. For a manikin in an auxiliary forward-facing seat the following biomechanical acceptability criteria have to be met:**”

Paragraphs 1.1.2.1.1. to 1.1.2.1.3. (former), renumber as paragraphs 1.1.2.2.1. to 1.1.2.2.3.

Insert new paragraphs 1.1.2.3. to 1.1.2.3.4., to read:

- 1.1.2.3. For a manikin in an auxiliary side-facing seat the following biomechanical acceptability criteria have to be met:**
- 1.1.2.3.1. the head acceptability criterion HIC is less than 500;**
- 1.1.2.3.2. the thorax acceptability criteria:**
- (a) **Rib Deflection Criterion (RDC) less than or equal to 42 mm;**
- (b) **Soft Tissue Criterion (VC) less or equal to 1.0 m/sec;**
- 1.1.2.3.3. the pelvis acceptability criterion:**
- Pubic Symphysis Peak Force (PSPF) less than or equal to 6 kN;**
- 1.1.2.3.4. the abdomen acceptability criterion:**
- Abdominal Peak Force (APF) less than or equal to 2.5 kN internal force (equivalent to external force of 4.5 kN).”**

Paragraph 3.3.2., amend to read:

“3.3.2. ~~“The manikin's hands shall rest on its thighs with the elbows touching the seat back; the legs shall be extended to the maximum and shall, if possible, be parallel; the heels shall touch the floor. Irrespective of the seating position of the dummy, the angle between the upper arm and the torso arm reference line on each side shall be $40^{\circ} \pm 5^{\circ}$. The torso arm reference line is defined as the intersection of the plane tangential to the front surface of the ribs and the longitudinal vertical plane of the dummy containing the arm. The legs shall be extended to the maximum and shall, if possible, be parallel; the heels shall touch the floor.”~~

Paragraph 3.3.3.3.2., amend to read:

“3.3.3.3.2. without the torso moving, the head shall be placed in a position such that the platform supporting the measuring instruments contained in the head is horizontal and that the median sagittal plane of the head is parallel to that of the vehicle (for side-facing seats, the median saggital plane of the head shall be parallel to the vertical median plane of the seat).

Insert a new paragraph 3.5.3., to read

“3.5.3. **Test 2 may also be applied to vehicle parts other than a seat, as referred to in paragraph 8.1.7. of Regulation No. 16 and paragraph 5.3.5. of Regulation No. 14.”**

Paragraph 3.5.3 (former), renumber as paragraph 3.5.4.

Insert a new paragraph 3.5.5., to read:

“3.5.5. **Test 2 may also be applied to side-facing seats. In this case the auxiliary seat as mentioned in paragraph 3.2. shall be a side-facing seat and shall be located as specified in Appendix 7.”**

Appendix 3,

Paragraph 2.2.2., amend to read:

“2.2.2. Measurements in the thorax of the manikin.

The resultant acceleration at the centre of gravity shall be measured with a CFC of 180. **The deflection of the ribs and the viscous criterion (VC) shall be measured with a CFC of 180.”**

Insert new paragraphs 2.2.4 to 2.2.5., to read:

“2.2.4. **Measurements in the abdomen of the manikin.**

The abdominal forces shall be measured with a CFC of 600.

2.2.5. **Measurements in the pelvis of the manikin.**

The pubic force shall be measured with a CFC of 600.”

Appendix 4, amend to read:

“Appendix 4

DETERMINATION OF ACCEPTABILITY CRITERIA

1. **Frontal Impact (forward-facing seat)**

1.1. **Head acceptability criterion (HIC)**

- 1.1.1. This injury criterion (HIC) is calculated on the basis of the resultant triaxial acceleration measured according to Appendix 3, paragraph 2.2.1. by the following expression:

$$\text{HIC} = (t_2 - t_1) \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} g_r dt \right]^{2.5}$$

in which t1 and t2 are any values of time during the test, HIC being maximum value for and interval t1, t2. The values of t1 and t2 are expressed in seconds.

- 1.2. Thorax acceptability criterion (ThAC)

- 1.2.1. This criterion is determined by the absolute value of resultant acceleration, expressed in g and measured according to Appendix 3, paragraph 2.2.2, and by the acceleration period, expressed in ms.

- 1.3. Femur acceptability criterion (FAC)

This criterion is determined by the compression load expressed in kN, transmitted axially on each femur of the manikin and measured according to appendix 3, paragraph 2.2.3., and by the duration of the compression load, expressed in ms.

2. Side impact (side-facing seat)

- 2.1. Head acceptability criterion (HIC) see Appendix 4, paragraph 1.1.

- 2.1. Thorax acceptability criterion

- 2.1.1. Chest deflection: the peak chest deflection is the maximum value of deflection on any rib as determined by the thorax displacement transducers.

- 2.1.1. Viscous criterion (VC):

the peak viscous response is the maximum value of VC on any rib which is calculated from the instantaneous product of the relative thorax compression related to the half thorax and the velocity of compression derived by differentiation of the compression. For the purposes of this calculation the standard width of the half thorax rib cage is 140 mm.

$$\text{VC} = \max \left[\frac{D}{0.14} \times \frac{dD}{dt} \right]$$

where D (metres) = rib deflection

The calculation algorithm to be used is set out in Regulation No. 95, Annex 4, Appendix 2.

- 2.2. Abdomen acceptability criterion The peak abdominal force is the maximum value of the sum of the three forces measured by transducers mounted 39 mm below the surface on the crash side.

- 2.3. Pelvis acceptability criterion

The pubic symphysis peak force (PSPF) is the maximum force measured by a load cell at the pubic symphysis of the pelvis.”

Appendix 6,

Insert a new paragraph 3., to read:

“3. This test may be applied to parts of a vehicle other than a seat (paragraph 3.5.3. of Appendix 1 and paragraph 2.3. of Appendix 7).”

Insert a new Appendix 7, to read:

“Appendix 7

REQUIREMENTS FOR THE SAFEGUARDING OF PASSENGERS IN SIDE-FACING SEATS ACCORDING TO PARAGRAPH 7.4.4.

1. The distance between the foremost side-facing seat and the vehicle part forward of this foremost side-facing seat shall not exceed 450 mm. All measurements are to be taken 1000 mm above the foot contact area of the foremost side-facing seat (see Figure 1).

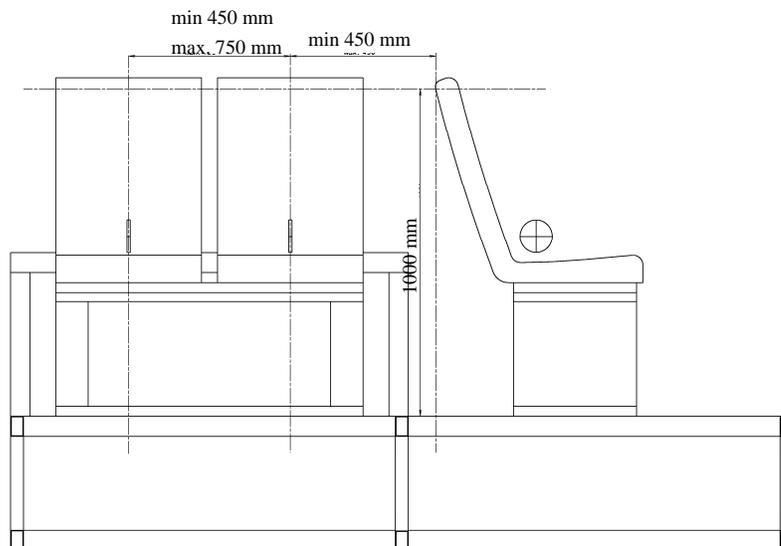
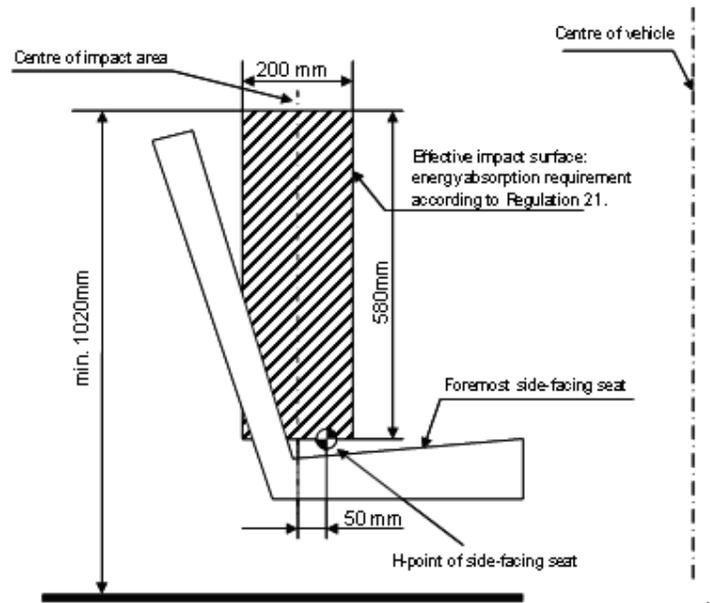


Figure 1: Positioning requirements for side-facing seats

2. The vehicle part (e.g. partition, wall or seat back of a forward facing seat) in front of the foremost side-facing seat shall fulfil the following requirements in order to safeguard the passenger in that foremost side-facing seat (see figure 2):
 - 2.1. The height of the vehicle part, based on the foot contact area of the foremost side-facing seat, must not be less than 1,020 mm; and
 - 2.2. the effective impact surface of the vehicle part has a width of 200 mm and a height of 580 mm. This surface shall be positioned so that the vertical centre-line is located 50 mm behind the H-point of the foremost side-facing seat; and
 - 2.3. the corresponding surface of the vehicle part in place projected onto a vertical plane through this H-point, shall cover at least 95 per cent of the

effective impact surface. This vehicle part shall fulfil the energy absorption requirement by Appendix 6.

- 2.3.1. If there is a gap in the corresponding surface (typically two forward-facing seats with a gap in between) a distance shall be determined for each gap by means of a sphere having a diameter of 165 mm. The sphere shall be put into contact with the gap in a point of the gap area which allows the maximum sphere intrusion, considering no load is to be applied. The distance between the two points of contact of the sphere must be less than 60 mm;
3. At the manufacturers' choice, a test according to Appendix 1 with the appropriate manikin for side-facing seats may be conducted.



II. Justification

The proposal introduces the necessary requirements to take into account the installation of side-facing seats under certain conditions.