GRSP Informal Working Group on Safer Transport of Children in Buses and Coaches

2nd meeting

M2 & M3 Key Requirements for seats and safety belts

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# Safety belt installation requirements for M2 & M3

<table>
<thead>
<tr>
<th>Vehicle category</th>
<th>Minimum requirements for safety-belts and Retractors</th>
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<tbody>
<tr>
<td></td>
<td>Forward facing seating positions</td>
</tr>
<tr>
<td></td>
<td>Outboard seating positions</td>
</tr>
<tr>
<td>M₁</td>
<td>Ar₄m</td>
</tr>
<tr>
<td>M₂ &lt; 3.5 t</td>
<td>Ar₄m, Ar₄Nm</td>
</tr>
<tr>
<td>M₂ &gt; 3.5 t</td>
<td>Br₃, Br₄m, Br₄Nm, or Ar₄m or Ar₄Nm</td>
</tr>
<tr>
<td>M₃</td>
<td>Br₃, Br₄m, Br₄Nm, or Ar₄m or Ar₄Nm</td>
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A: three-point (lap and diagonal) belt
B: 2-point (lap) belt

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1. Erratum to Supplement 12 to the 04 series of amendments, applicable "ab initio."
2. Erratum to Revision 4, applicable "ab initio."

There are minimum requirements for safety belts and restraints in vehicles. The table above outlines the specific requirements for M2 and M3 categories based on their vehicle category. The requirements vary depending on the seating position and whether the seat is forward-facing or rearward-facing. Side-facing seating positions are also specified, and the table includes codes indicating different types of safety belts and restraints, such as lap belts, diagonal belts, and emergency locking retractor units with multiple sensitivity features.
8.1.7. Every seating position in Annex 16 marked with the symbol ●, three-point belts of a type specified in Annex 16 shall be provided unless one of the following conditions is fulfilled, in which case two-point belts of a type specified in Annex 16 may be provided.

8.1.7.1. There is a seat or other vehicle parts conforming to paragraph 3.5. of Appendix 1 to UN Regulation No. 80 directly in front; or

8.1.7.2. No part of the vehicle is in or, when the vehicle is in motion, capable of being in the reference zone; or

8.1.7.3. Parts of the vehicle within the said reference zone comply with the energy absorbing requirements set out in Appendix 6 of UN Regulation No. 80.

Remarks to paragraph:
8.1.7.1 Dynamic test UN-R 80 pulse with 2-point safety belt buckled (B type).
8.1.7.3 Energy absorbing of reference zone (2.21 UN-R 80, 400mm wide with 3-D H-point machine 840-736mm), tested according Annex 4 of UN-R 21, sphere 6.8 kg at 24 km/h.
Safety belts anchorage geometric requirements for M2 & M3

In motor vehicles of category M₁ the angles \( \alpha_1 \) and \( \alpha_2 \) shall be within the range of 30 to 80 degrees for all rear seats. If rear seats are adjustable the above angles shall be valid for all normal travelling positions.

In the case of seats, other than front seats, of vehicles in categories M₂ and M₃, the angles \( \alpha_1 \) and \( \alpha_2 \) shall be between 45 and 90 degrees for all normal positions of use.
Safety belts anchorage point load requirements for M2 & M3

**Testing forces for A belts (3-point-belts)**

6.4.1.2. A test load of 1,350 daN ± 20 daN shall be applied to a traction device (see Annex 5, Figure 2) attached to the belt anchorages of the same belt, by means of a device reproducing the geometry of the upper torso strap of such a safety-belt. In the case of vehicles of categories other than M₁ and N₁, the test load shall be 675 ± 20 daN, except that for M₃ and N₃ vehicles the test load shall be 450 ± 20 daN.

6.4.1.3. At the same time a tractive force of 1,350 daN ± 20 daN shall be applied to a traction device (see Annex 5, Figure 1) attached to the two lower belt anchorages. In the case of vehicles of categories other than M₁ and N₁, the test load shall be 675 ± 20 daN, except that for M₃ and N₃ vehicles the test load shall be 450 ± 20 daN.

**Testing forces for B belts (2-point-belts)**

6.4.3. Test in configuration of a lap belt

A test load of 2,225 daN ± 20 daN shall be applied to a traction device (see Annex 5, Figure 1) attached to the two lower belt anchorages. In the case of vehicles of categories other than M₁ and N₁, the test load shall be 1,110 ± 20 daN, except that for M₃ and N₃ vehicles the test load shall be 740 ± 20 daN.
UN-R 80 vs UN-R 100 Frontal Dynamic Test Pulse for M2

UN-R 100, also defines corridors for lateral impact.
UN-R 80 vs UN-R 100 Frontal Dynamic Test Pulse for M3
UN-R 14, B type belt anchorage loads ratio:

\[
\frac{M_1}{M_2} = \frac{2225 \text{ daN}}{1110 \text{ daN}} = 2.0 \quad \frac{M_1}{M_3} = \frac{2225 \text{ daN}}{740 \text{ daN}} = 3.0 \quad \frac{M_2}{M_3} = \frac{1110 \text{ daN}}{740 \text{ daN}} = 1.5
\]

UN-R 100, Pulse maximum frontal acceleration:

\[
\frac{M_1}{M_2} = \frac{28g}{17g} = 1.65 \quad \frac{M_1}{M_3} = \frac{28g}{12g} = 2.33 \quad \frac{M_2}{M_3} = \frac{17g}{12g} = 1.42
\]

Conclusions:
In case that only one dynamic test configuration will be adopted, the M2 pulse for frontal impact guaranties resistance for both types of vehicles.

UN-R 100 does not define: initial speed and stopping distance for the corridors, further definitions will be necessary.