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

Minimum requirements for safety-belts and Retractors						
Vehicle category	*Forward facing seating positions*				*Rearward-facing seating positions*	*Side-facing seating position*
	Outboard seating positions		*Centre seating position*			
	Front	*Other than front*	*Front*	*Other than front*		
M_1	Ar4m	Ar4m	Ar4m	Ar4m	B, Br3, Br4m	-
$M_2 < 3.5$ t	Ar4m, Ar4Nm	Ar4m, Ar4Nm	Ar4m, Ar4Nm	Ar4m, Ar4Nm	Br3, Br4m, Br4Nm	-
$M_2 > 3.5$ t	Br3, Br4m, Br4Nm, or Ar4m or Ar4Nm ●	Br3, Br4m, Br4Nm, or Ar4m or Ar4Nm ●	Br3, Br4m, Br4Nm or Ar4m or Ar4Nm ●	Br3, Br4m, Br4Nm or Ar4m or Ar4Nm ●	Br3, Br4m, Br4Nm	-
M_3	Br3, Br4m, Br4Nm, or Ar4m or Ar4Nm ● See para. 8.1.7. for conditions when a lap belt is permitted	Br3, Br4m, Br4Nm, or Ar4m or Ar4Nm ● See para. 8.1.7. for conditions when a lap belt is permitted	Br3, Br4m, Br4Nm or Ar4m or Ar4Nm ● See para. 8.1.7. for conditions when a lap belt is permitted	Br3, Br4m, Br4Nm or Ar4m or Ar4Nm ● See para. 8.1.7. for conditions when a lap belt is permitted	Br3, Br4m, Br4Nm	B, Br3, Br4m, Br4Nm

A: three-point (lap and diagonal) belt
3: automatically locking retractor
*: Refers to para. 8.1.6. of this Regulation [2]

B: 2-point (lap) belt
4: emergency locking retractor
Ø: Refers to para. 8.1.2.1. of this Regulation

r: retractor
N: higher response threshold
●: refers to para. 8.1.7. of this Regulation[2]

m: emergency locking retractor with multiple sensitivity (see UN Regulation No. 16, paras. 2.14.3. and 2.14.5.)

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

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.

Safety belt installation requirements for M2 & M3

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:

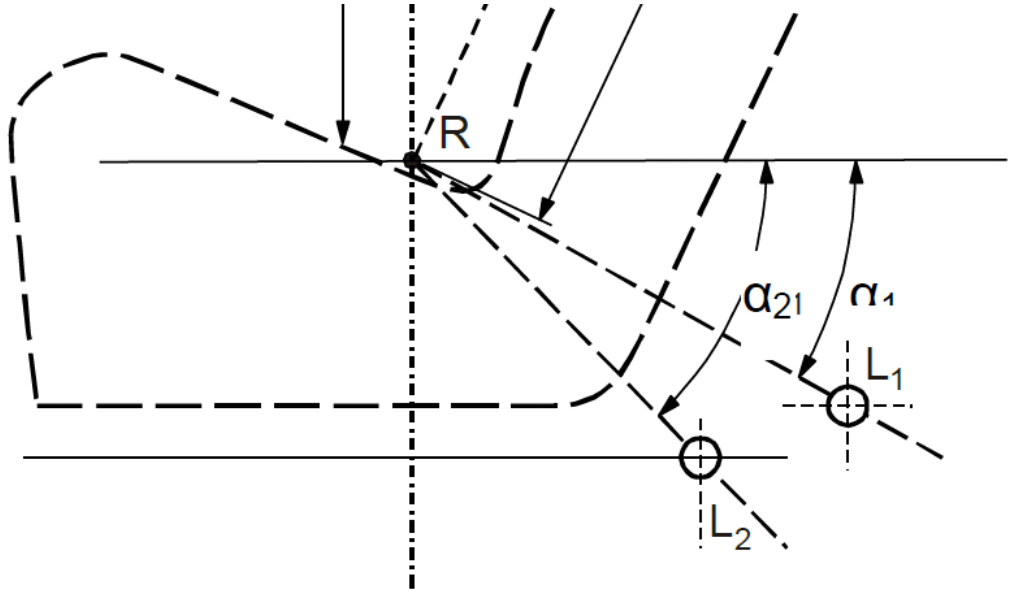
8.1.7.1 Dynamic test UN-R 80 pulse with 2-point safety belt buckled (B type).

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 M_1 the angles α_1 and α_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 M_2 and M_3, the angles α_1 and α_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 M_1 and N_1, the test load shall be 675 ± 20 daN, except that for M_3 and N_3 vehicles the test load shall be 450 ± 20 daN.

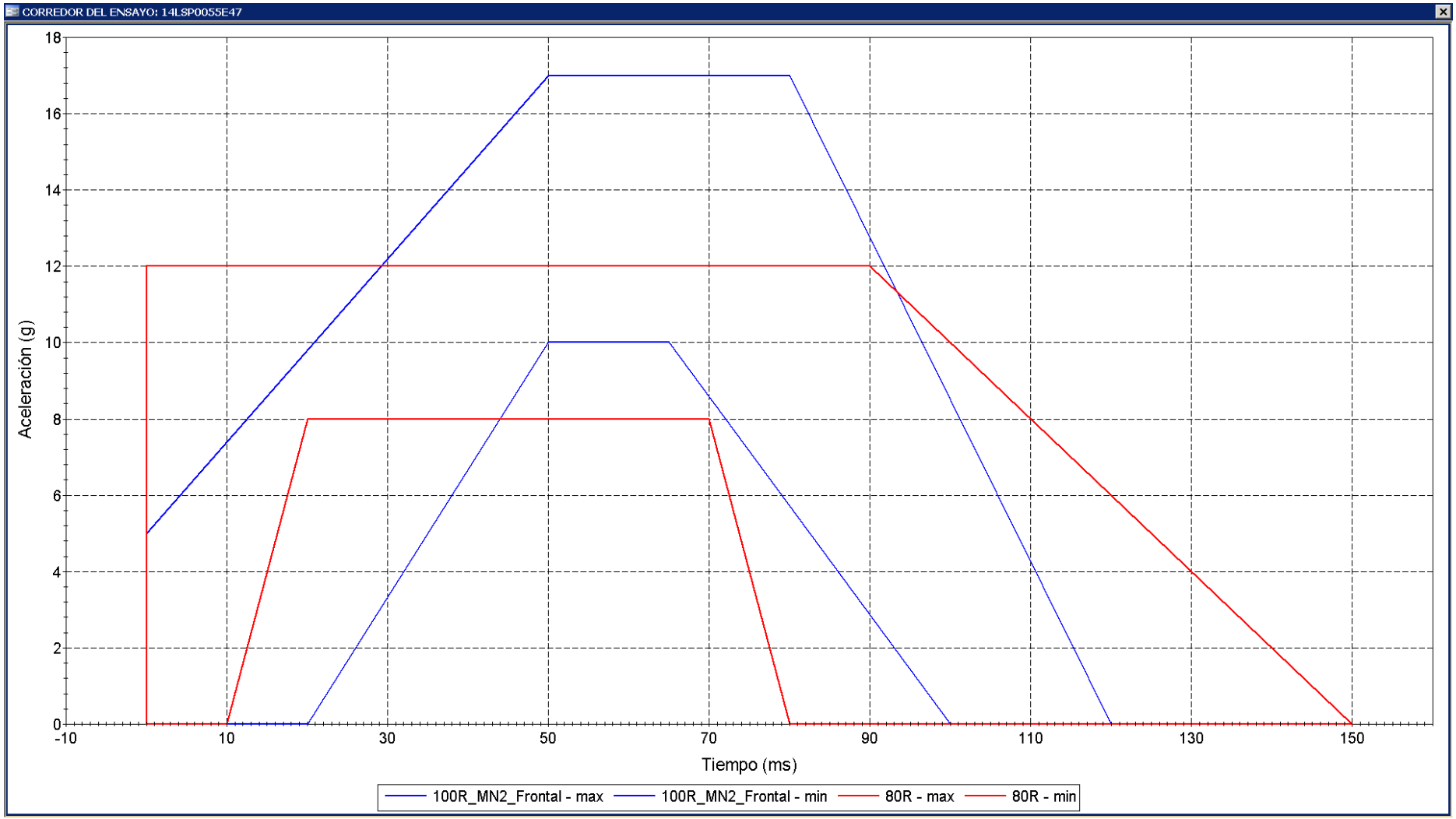
6.4.1.3. At the same time a tractive force of 1,350 daN ± 20 daN shall be applied to a traction device (see Annex 5, Figure 1) attached to the two lower belt anchorages. In the case of vehicles of categories other than M_1 and N_1, the test load shall be 675 ± 20 daN, except that for M_3 and N_3 vehicles 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

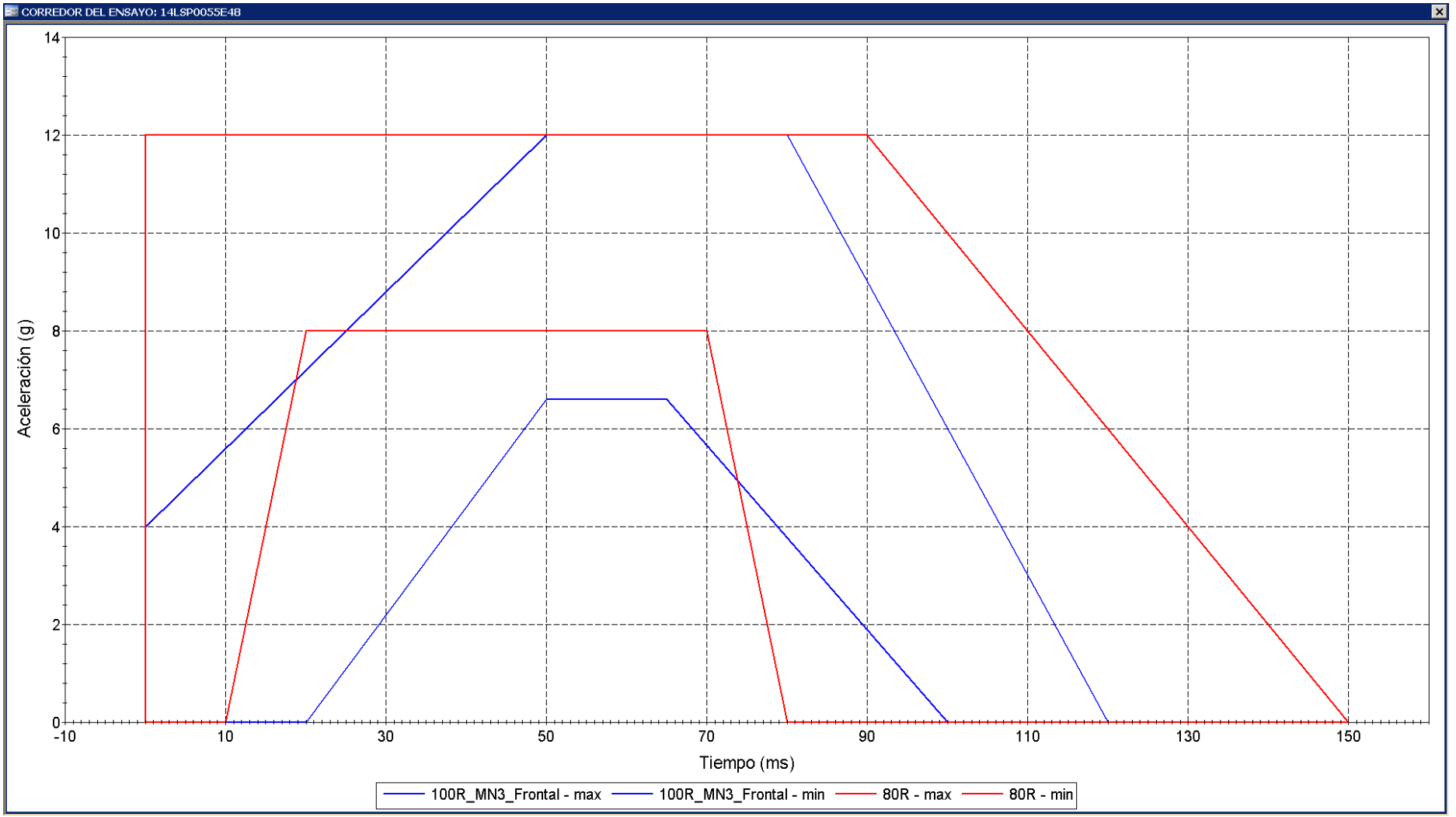
A test load of 2,225 daN ± 20 daN shall be applied to a traction device (see Annex 5, Figure 1) attached to the two lower belt anchorages. In the case of vehicles of categories other than M_1 and N_1, the test load shall be 1,110 ± 20 daN, except that for M_3 and N_3 vehicles the test load shall be 740 ± 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-R14 vs UN-R100 Force & Pulse comparison M1-M2-M3

UN-R 14, B type belt anchorage loads ratio:

$$\frac{M1}{M2} = \frac{2225\,daN}{1110\,daN} = 2.0 \qquad \frac{M1}{M3} = \frac{2225\,daN}{740\,daN} = 3.0 \qquad \frac{M2}{M3} = \frac{1110\,daN}{740\,daN} = 1.5$$

UN-R 100, Pulse maximum frontal acceleration:

$$\frac{M1}{M2} = \frac{28g}{17g} = 1.65 \qquad \frac{M1}{M3} = \frac{28g}{12g} = 2.33 \qquad \frac{M2}{M3} = \frac{17g}{12g} = 1.42$$

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.