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agenda item B.1.7.)

PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 44
(Child restraints)

Transmitted by the expert from France on behalf of the ad hoc group

Note: The text reproduced below was prepared by an ad hoc group in order to authorize the use of an acceleration test device for validation of the dynamic behaviour of a child restraint system.

New text is **bolded and underlined**, and existing text to be deleted is ~~crossed through~~.

Note: This document is distributed to the Experts on Passive Safety only.

A. PROPOSAL

CONTENTS, Annex 7, amend to read.

"Annex 7 - Curve of trolley's deceleration **or acceleration** as a function of time
Annex 7 – Appendix 1 - Curve of trolley's deceleration **or acceleration** as a function of time. Frontal Impact
Annex 7 – Appendix 2 - Curve of trolley's deceleration **or acceleration** as a function of time. Rear Impact"

THE TEXT OF THE REGULATION,

Paragraph 8.1.3.1.1.2., amend to read:

"8.1.3.1.1.2. The trolley shall remain horizontal throughout deceleration **or acceleration.**"

Paragraph 8.1.3.1.1.3., amend to read:

"8.1.3.1.1.3. **Deceleration or acceleration devices**

The applicant shall choose to use one of the two following devices:

8.1.3.1.1.3.1. Deceleration test device

The deceleration of the trolley shall be achieved by using the apparatus prescribed in annex 6 to this regulation or any other device giving equivalent results. This apparatus shall be capable of the performance specified in paragraph 8. 1. 3. 4. and **hereafter specified:**

The deceleration curve of the trolley weighted with inert masses to produce a total mass of 455 ± 20 kg in the case of child restraint tests performed in accordance with paragraph 8. 1. 3. 1. of this Regulation, and of 910 ± 40 kg in the case of child restraint tests performed in accordance with paragraph 8. 1. 3. 2. of this Regulation, where the nominal mass of the trolley and vehicle structure is 800 kg, must remain, in the case of frontal impact, within the hatched area **of the graph in annex 7 appendix 1 of this regulation** ~~to this annex~~, and, in the case of rear impact, within the hatched area **of the graph in annex 7 appendix 2 of this regulation** ~~to this annex~~.

If necessary, the nominal mass of the trolley and attached vehicle structure may be increased for each increment of 200 kg by an additional inert mass of 28 kg. In no case shall the total mass of the trolley and the vehicle structure and inert masses differ from the nominal value for calibration tests by more than ± 40 kg. During calibration of the stopping device, the stopping distance shall be 650 ± 30 mm for frontal impact, and 275 ± 20 mm for rear impact.

The trolley shall be so propelled that at the moment of impact its free running speed and its stopping distance are according to paragraph 8.1.3.4 of this Regulation and the manikin remains stable.

8.1.3.1.1.3.2. Acceleration test device

For frontal impact, the trolley shall be so propelled that, during the test, its total velocity change ΔV is $[50 \text{ km/h } \begin{smallmatrix} +2 \\ -0 \end{smallmatrix} \text{ km/h}]$ and its acceleration curve is within the hatched area of the graph in annex 7 appendix 1 and stay above the segment defined by the coordinates $[5g, 10ms]$ and $[9g, 20ms]$. The distance to achieve the first $[49 \text{ km/h } \begin{smallmatrix} +1 \\ -0 \end{smallmatrix} \text{ km/h}]$ of the velocity change of the trolley shall be of $[650 \text{ mm} \pm 50 \text{ mm}]$. The start of the impact (T0) is defined, according to ISO DIS 17 373 for a level of acceleration of 0.5 g.

For rear impact, the trolley shall be so propelled that, during the test, its total velocity change ΔV is $[32 \text{ km/h } \begin{smallmatrix} +2 \\ -0 \end{smallmatrix} \text{ km/h}]$ and its acceleration curve is within the hatched area of the graph in annex 7 appendix 2 and stay above the segment defined by the coordinates $[5g, 5ms]$ and $[10g, 10ms]$. The distance to achieve the first $[31 \text{ km/h } \begin{smallmatrix} +1 \\ -0 \end{smallmatrix} \text{ km/h}]$ of the velocity change of the trolley shall be of $[275 \text{ mm} \pm 25 \text{ mm}]$. The start of the impact (T0) is defined, according to ISO DIS 17 373 for a level of acceleration of 0.5 g.

Despite the fulfilment of the above requirements, the technical service shall use a mass of trolley (equipped with its seat), as specified in paragraph 1 of annex 6, superior to 380 kg."

Paragraph 8.1.3.1.1.4., amend to read:

8. 1. 3. 1. 1. 4. The following measurements shall be made:
 8. 1. 3. 1. 1. 4. 1. the trolley speed immediately before impact(only for deceleration sleds, needed for stopping distance calculation).
 8. 1. 3. 1. 1. 4. 2. ~~the stopping distance~~ the distance to achieve the first $[49 \text{ km/h } \begin{smallmatrix} +1 \\ -0 \end{smallmatrix} \text{ km/h}]$ of the velocity change of the trolley for frontal impact and to achieve the first $[31 \text{ km/h } \begin{smallmatrix} +1 \\ -0 \end{smallmatrix} \text{ km/h}]$ of the velocity change of the trolley for rear impact may be calculated by double integration of the recorded sled acceleration or deceleration.
 8. 1. 3. 1. 1. 4. 3. the displacement of the manikin' s head in the vertical and horizontal planes for groups I, II and III and for group 0 and 0+ the displacement of the manikin without considering its limb.
 8. 1. 3. 1. 1. 4. 4. the chest **d**eceleration in three mutually perpendicular directions; except for new-born manikin.
 8. 1. 3. 1. 1. 4. 5. any visible signs of penetration of the modelling clay in the abdomen (see paragraph 7. 1. 4. 3. 1.); except for new-born manikin.

8.1.3.1.1.4.6. the trolley acceleration or deceleration for at least the first 300ms."

Paragraph 8.1.3.1.2.3., amend to read:

"8.1.3.1.2.3. The deceleration conditions shall satisfy the requirements of paragraph 8.1.3.4. below: **8.1.3.1.3.1.**
The acceleration conditions shall satisfy the requirements of paragraph 8.1.3.1.3.2."

Paragraph 8.1.3.1.2.4., amend to read:

"8.1.3.1.2.4. The measurements to be made shall be similar to those listed in paragraphs 8.1.3.1.4. to 8.1.3.1.4. **6.** above."

Paragraph 8.1.3.2.1.5., amend to read:

"8.1.3.2.1.5. The deceleration conditions shall satisfy the requirements of paragraph 8.1.3.4. below: **8.1.3.1.3.1.**
The acceleration conditions shall satisfy the requirements of paragraph 8.1.3.1.3.2."

Paragraph 8.1.3.2.1.6., amend to read:

"8.1.3.2.1.6. The following measurements shall be made:

8.1.3.2.1.6.1. the trolley speed immediately before impact (**only for deceleration sleds, needed for stopping distance calculation.**)"

8.1.3.2.1.6.2. ~~the stopping distance~~ **the distance to achieve the first [49 km/h⁺¹₋₀ km/h] of the velocity change of the trolley for frontal impact and to achieve the first [31 km/h⁺¹₋₀ km/h] of the velocity change of the trolley for rear impact may be calculated by double integration of the recorded sled acceleration or deceleration.**

8.1.3.2.1.6.3. any contact of the manikin's head with the interior of the vehicle body shell;

8.1.3.2.1.6.4. the chest deceleration in three mutually perpendicular directions; except for new-born manikin

8.1.3.2.1.6.5. any visible signs of penetration of the modelling clay in the abdomen (see paragraph 7.1.4.3.1.) except for new-born manikin.

8.1.3.2.1.6.6. the trolley and vehicle body shell acceleration or deceleration for at least the first 300ms."

Paragraph 9.1., amend to read:

"9.1. The test report shall record the results of all tests and measurements including the **following test data:**

- a) **the type of device used for the test (acceleration or deceleration device),**
- b) **the total velocity change,**
- c) the trolley speed **immediately before impact only for deceleration sleds,**
- d) **the acceleration or deceleration curve during all the velocity change of the trolley and at least 300ms,**
- e) the time (in msec) when the head of the manikin reaches its maximum displacement during the performance of the dynamic test,
- f) the place occupied by the buckle during the tests, if it can be varied,
- g) and any failure or breakage."

Annex 1, insert a new item 9. to read:

"9. Type of device: deceleration/acceleration

Items 9. to 16. (former), renumber as **10. to 17.**"

Annex 7, amend to read:

"Annex 7

CURVE OF TROLLEY' S, DECELERATION **OR ACCELERATION,**
AS FUNCTION OF TIME
(~~Curve for testing stopping devices~~)

In **all** cases the calibration and measuring procedures shall correspond to those defined in the International Standard ISO 6487 (1980); the measuring equipment shall correspond to the specification of a data channel with a channel frequency class (CFC) 60.

Annex 7 – Appendix 1

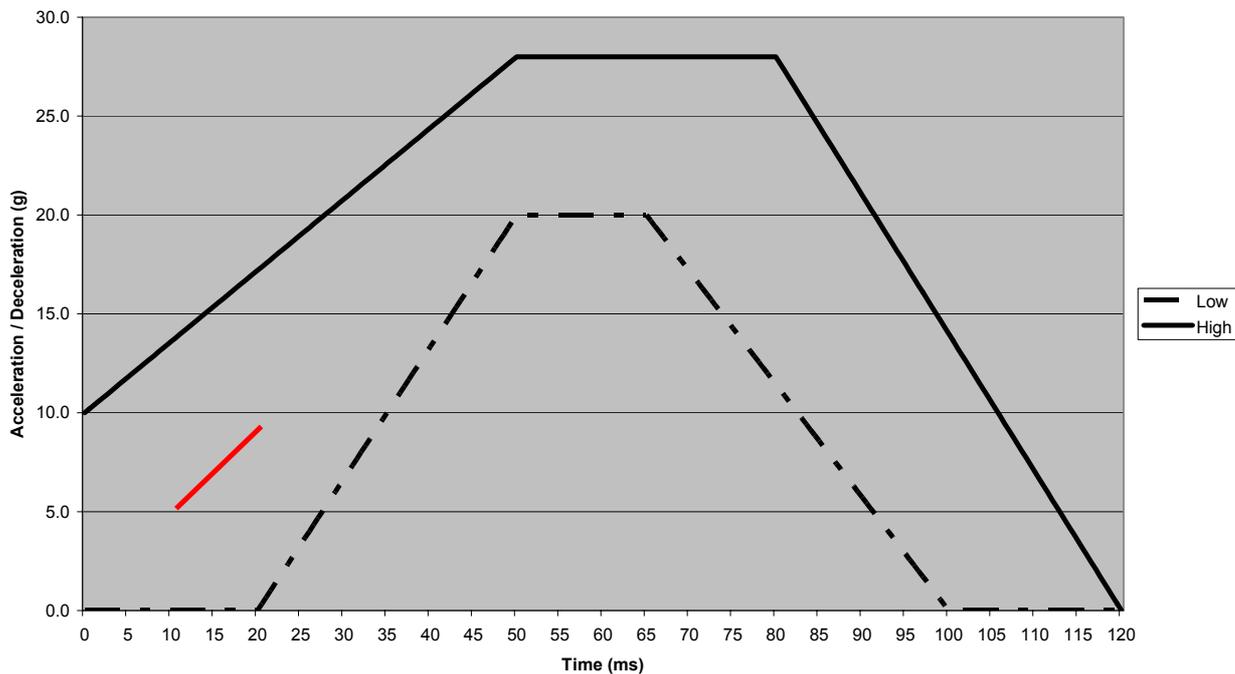
**CURVE OF TROLLEY' S, DECELERATION OR ACCELERATION,
AS FUNCTION OF TIME
(Curve for testing stopping devices)
FRONTAL IMPACT**

Test Speed: 50 (+0 ; -2) km/h
Stopping distance: 650 ± 30mm

Definition of the different curves

Time (ms)	Acceleration (g) Low corridor	Acceleration (g) High corridor
0	-	10
20	0	-
50	20	28
65	20	-
80	-	28
100	0	-
120	-	0

R44 Frontal impact



Annex 7 – Appendix 2

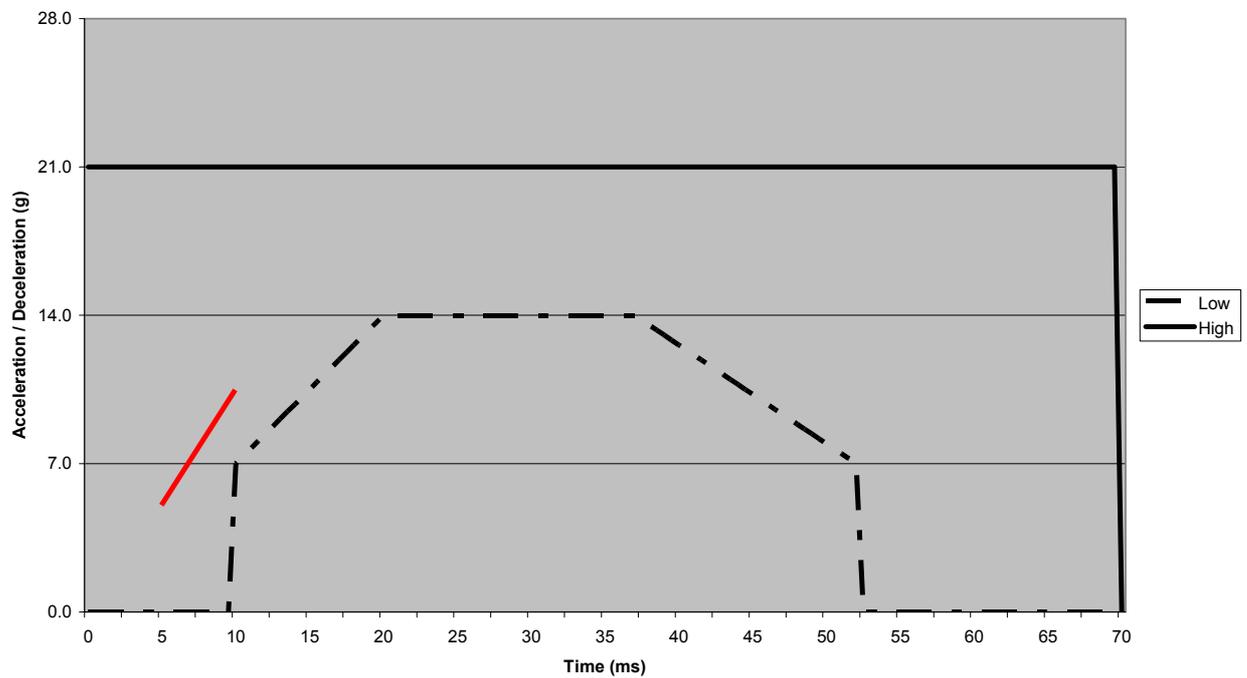
**CURVES OF TROLLEY' S, DECELERATION OR ACCELERATION,
AS FUNCTION OF TIME
(Curve for testing stopping devices)
REAR IMPACT**

~~Test Speed: 30 (+2 ; -0) km/h~~
~~Stopping distance: 275 ± 20mm~~

Definition of the different curves

Time (ms)	Acceleration (g) Low corridor	Acceleration (g) High corridor
0	-	21
10	0	
10	7	-
20	14	-
37	14	-
52	7	-
52	0	
70	-	21
70	-	0

R44 Rear impact



* * *

B. JUSTIFICATION

General:

The acceleration test device (called Hyge sled) is precise test equipment capable of reproducing with a very good repeatability the invert acceleration of a deceleration crash pulse.

It was shown by previous studies that even if the two test devices cannot be considered as totally equivalent, the Hyge sled can be used as alternative test equipment.

An ad hoc group has been set up to propose to GRSP an alternative test method to be included in ECE R44. As a first step, and to be in line with the current level of severity applied to child restraint systems, in European or Japanese Technical Services, the total velocity change was set to 50 km/h for frontal impact and to 32 km/h for rear impact, and a better definition of T0, initial slope of acceleration curve and equivalent stopping distance were included.

Re. Paragraphs 8.1.3.1.1.2. to 8.1.3.2.1.6.:

The current definition of the trolley and the calibration method remain for the deceleration test device.

An alternative definition of the acceleration test device has been added. The principle of such equipment needs more precise definitions in terms of speed variation and nominal g level instead of impact speed, stopping distance and deceleration pulse corridor.

Re. Paragraphs 9.1. and Annex 1:

Inclusion in the test report and in the communication, of the type of device (acceleration or deceleration) used during type approval test.

The proposed complement authorizes the use of and acceleration test device for type approval of child restraint systems.

Re. Annex 7:

Parts of annex 7 have been put in paragraph 8.1.3.1.1.2., in order to use the same annex 7 for the two test devices (acceleration and deceleration).

As it can be seen in the tables below, the actual pulse corridor permits a wide range of velocity change if there is no defined impact speed.

It is for that reason that a velocity change of 50 km/h for frontal impact and of 32 km/h for rear impact has been defined for the acceleration test device. This variation of speed corresponds to the actual variation of speed on deceleration test devices including impact speed plus rebound speed.

Calculation of velocities

FRONTAL IMPACT

Curve	Velocity (km/h)
Low corridor	33.55
High corridor	82.99
Nominal curve	56.15

REAR IMPACT

Curve	Velocity (km/h)
Low corridor	17.67
High corridor	51.91
Nominal curve	32.29
