

ECE/TRANS/WP.29/GRSP/2012/21

Item 15 of the provisional Agenda

Regulation 44

Proposal for Supplement 7 to the 04 series of amendments

Submitted by the expert from France

Geneva, 11 December 2012

Objectives

- Clarify lap-strap interaction with the dummy
- How to assess that interaction
- Improving the overturning test

Paragraph 2.8.1., amend to read:

2.8.1. "*lap strap*" means a strap which, either in the form of a complete belt or in the form of a component of such a belt, passes across the front of, and restrains, **directly or not**, the child's ~~pelvic region~~ **pelvis**;

*A more precise wording to define the lap strap
role in restraining the pelvis of the dummy*

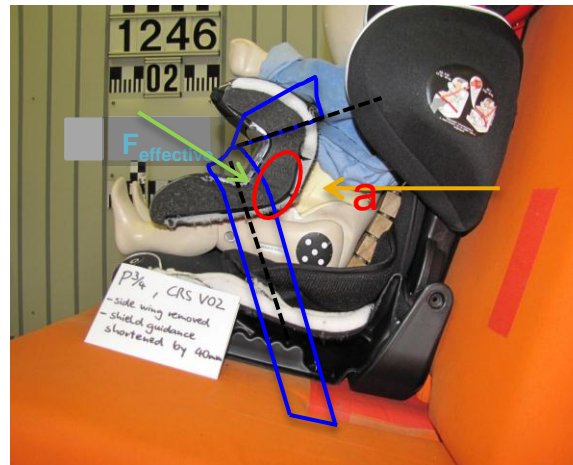
Paragraph 6.2.1.5., amend to read:

"6.2.1.5. **For all forward-facing group I restraints incorporating an integral harness belt system** to prevent submarining, either by impact or through restlessness, a crotch strap shall be required. ~~on all forward-facing group I restraints incorporating an integral harness belt system. With the crotch strap attached, and in its longest position if adjustable, it shall not be possible to adjust the lap strap to lie above the pelvis in either the 9 kg or the 15 kg dummy.~~"

Simplification of 6 2 1 5

Paragraph 6.2.2., amend to read:

"6.2.2. For groups I, II and III, all restraint devices utilizing a "lap strap" must positively guide the "lap strap" to ensure that the loads transmitted by the "lap strap" are transmitted through the pelvis. **The assembly shall not subject weak parts of the child's body (abdomen, crotch, etc.) to excessive stresses.**"



Insert new paragraphs 6.2.2.1. and 6.2.2.2., to read:

- "6.2.2.1. With the crotch strap attached, and in its longest position if adjustable, it shall not be possible to adjust the lap strap to lie above the pelvis of both the smallest and largest dummy within the mass groups covered by the approval. For all forward-facing restraints, it shall not be possible to adjust the lap strap to lie above the pelvis of both the smallest and largest dummy within the mass groups covered by the approval."
- 6.2.2.2. During the dynamic test, as prescribed in paragraph 8.1.3., the lap belt shall not wholly pass beyond or move over the pelvic structure of the dummy, during the period prior to maximum horizontal head excursion. Assessment shall be carried out using high speed camera."

6 2 2 1 : ensure
the lap strap
geometry relative
to the pelvis

6 2 2 2 : Dynamic
assessment

Paragraph 6.2.4., amend to read:

"6.2.4. ~~The assembly shall not subject weak parts of the child's body (abdomen, crotch, etc.) to excessive stresses.~~ The design shall be such that compression loads shall not be imposed on the crown of the child's head in the event of a collision."

Overturning Test according to ECE R44

7.1.3. Overturning

7.1.3.1. The child restraint shall be tested as prescribed in paragraph 8.1.2.; **the manikin shall not fall out of the device** and, when the test seat is **in the upside down position the manikin's head shall not move more than 300 mm** from its original position in a vertical direction **relative to the test seat**.

8.1.2. Overturning

8.1.2.1. The manikin shall be placed in the restraints installed in accordance with this Regulation and taking into account the manufacturer's instructions and **with the standard slack** as specified in paragraph 8.1.3.6. below.

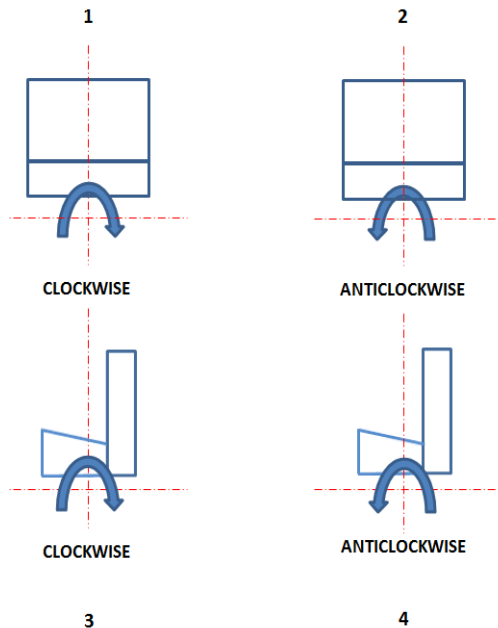
8.1.2.2. The restraint shall be fastened to the test seat or vehicle seat. The whole seat shall be **rotated around a horizontal axis** contained in the median longitudinal plane of the seat through an angle of **360°** at a speed of **2-5 degrees/second**. For the purposes of this test, devices intended for use in specific cars may be attached to the test seat described in Annex 6.

8.1.2.3. This test shall be carried out again rotating in the reverse direction after having replaced, if necessary, the manikin in its initial position. With the rotational axis in the horizontal plane and at 90° to that of the two earlier tests, the procedure shall be repeated in the two directions of rotation.

8.1.2.4. These tests shall be carried out using both the **smallest** and the **largest appropriate manikin** of the group or groups for which the restraining device is intended.

Test Description, overturning test today

- Today, the overturning test is a simple rotation (360°) of the dummy in the test seat as shown on the pictures.
- Criteria: The manikin shall not fall out of the device and, when the test seat is in the upside down position. The manikin's head shall not move more than 300 mm from its original position in a vertical direction relative to the test seat.



UTAC Roll Over Tests – Test 1

- Small size vehicle
- 47 km/h initial speed
- Shield system G I



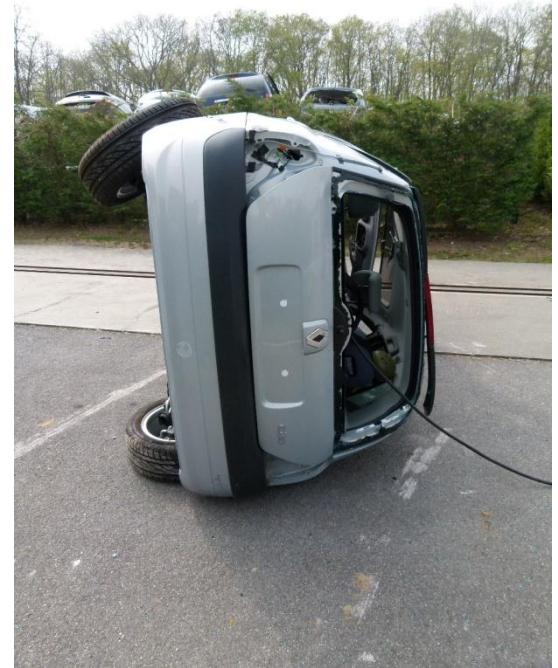
Rollover Tests – Test 1



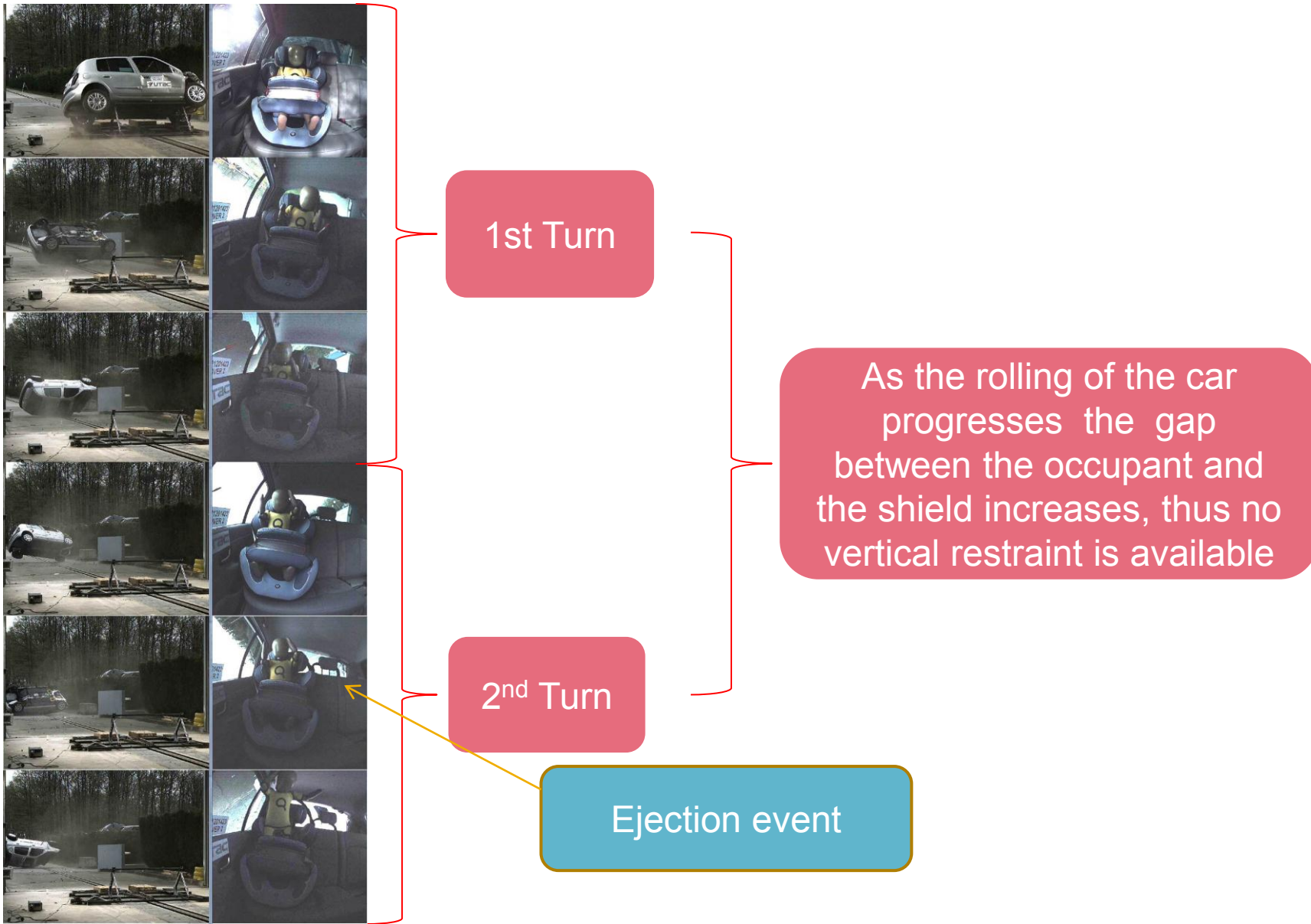
Before



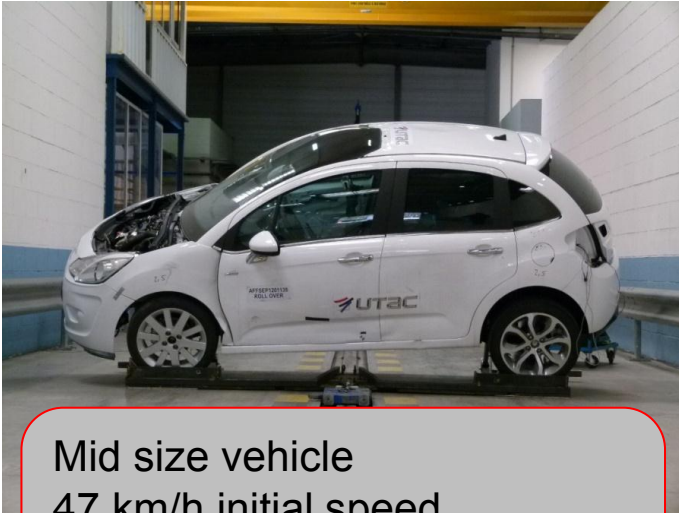
After the rollover



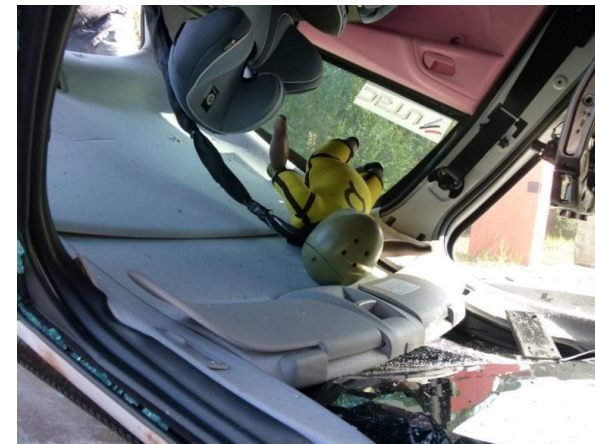
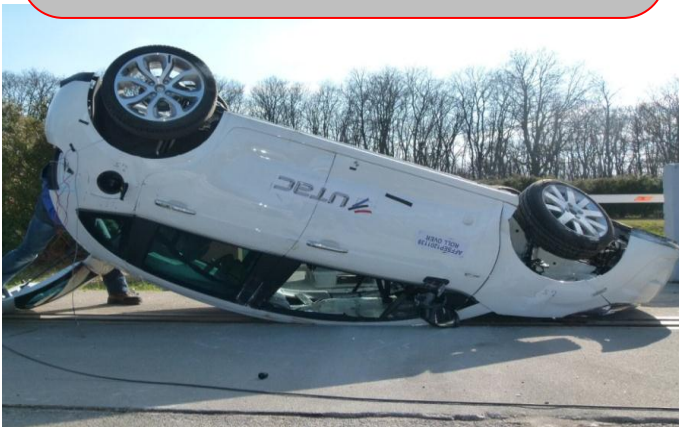
Test 1 – Motion sequence of the ejection



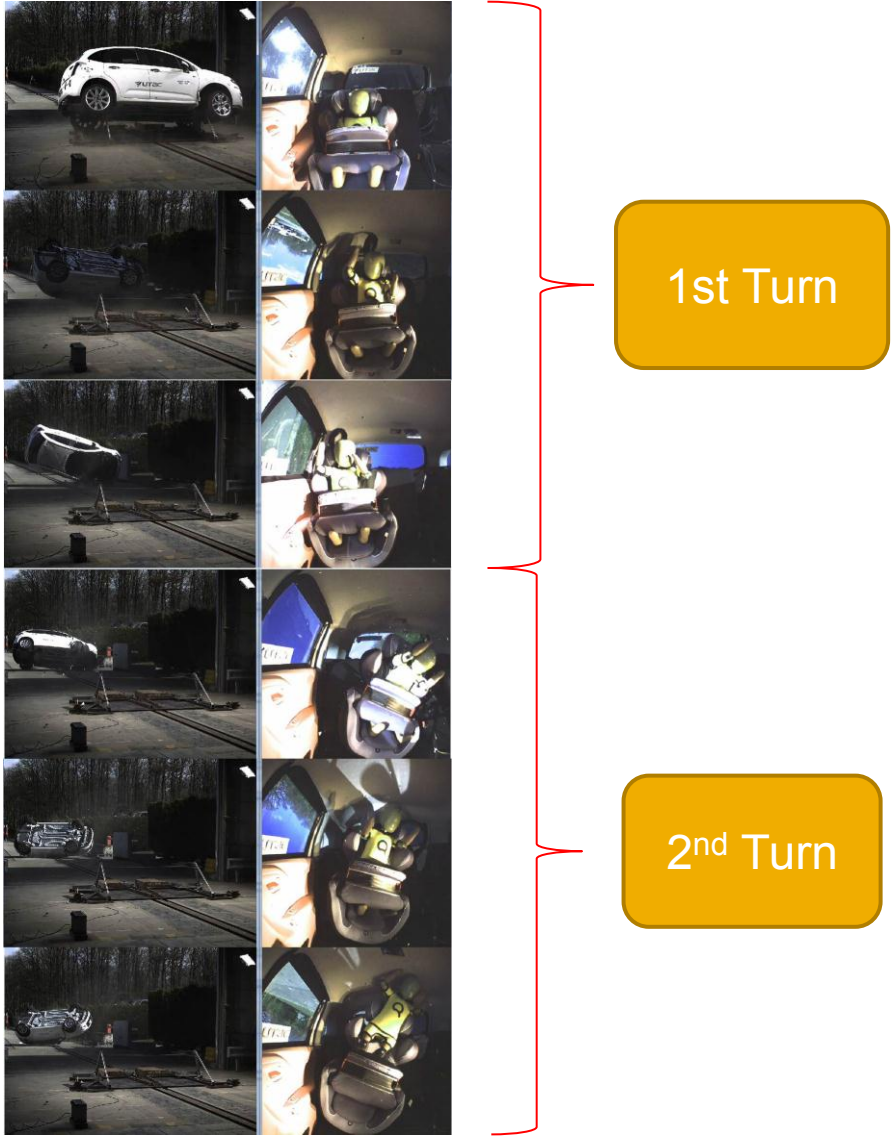
UTAC Rollover Tests – Test 2



Mid size vehicle
47 km/h initial speed
Same Shield System as 1st
Test



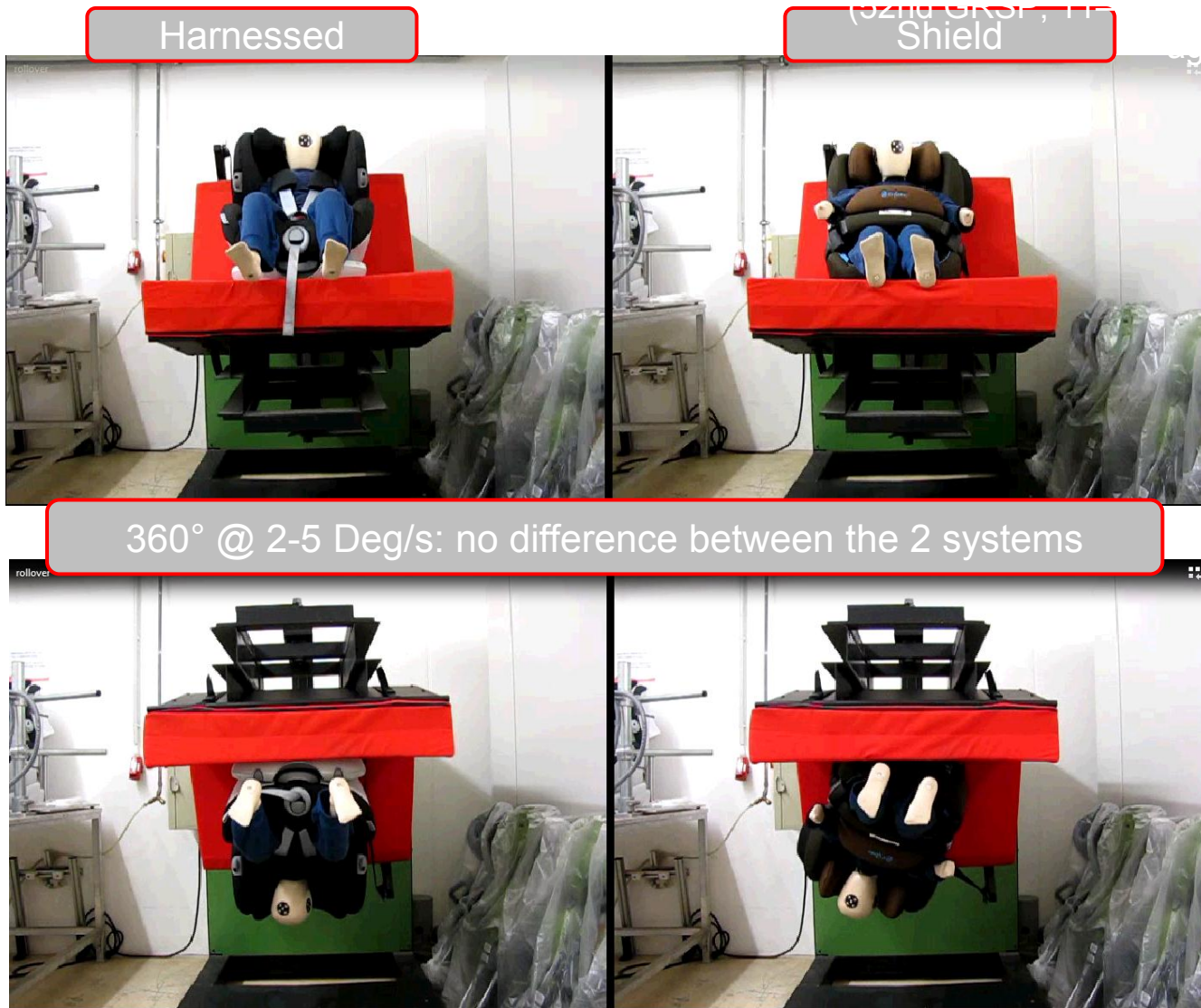
Test 2 - Motion sequence



What do these tests mean?

- This may pose a safety problem in real world
- Not only in rollover but in other collisions where absence of shoulder restraint may be critical to control occupant containment
- Need to adopt a conservative measure to reduce risk of ejection

Overturning Test according to ECE R44- Comparing Shield & Harnesses Seat



Review of § 7 3 1 – Overturning test

7 3 1 does not reflect loading of the CRS and the occupant during an accident



Need for a revision of 7 3 1

Paragraph 7.1.3.1., amend to read:

"7.1.3.1. The child restraint shall be tested as prescribed in paragraph 8.1.2.; the manikin shall not fall out of the device **during the whole test** and, when the test seat is in the upside down position the manikin's head shall not move more than 300 mm from its original position in a vertical direction relative to the test seat."

Make sure complete test phases are covered

Paragraph 8.1.2.2., amend to read:

"8.1.2.2. The restraint shall be fastened to the test seat or vehicle seat. The whole seat shall be rotated around a horizontal axis, contained in the median longitudinal plane of the seat through an angle of ~~360~~ **540° +/- 5°** at a speed of 2-5 degrees/second **and stopped in this position.** For the purposes of this test, devices intended for use in specific cars may be attached to the test seat described in Annex 6."

540° rotation corresponds to 1 and ½ turn

Insert new paragraphs 8.1.2.3. to 8.1.2.5., to read:

- "8.1.2.3. At this static inverted position a total mass equivalent to [5] times that of the dummy shall be applied vertically downwards in a plane perpendicular to the axis of rotation to the dummy utilizing the load application device described in Annex 23. The load shall be applied at a rate not exceeding [400 mm/min]. Maintain the prescribed maximum load for a duration of [30 -0/+5] seconds.
- 8.1.2.4. Remove the load at a rate not exceeding [400] mm/min and measure displacement.
- 8.1.2.5. Rotate the whole seat for 180° to return to the starting position."

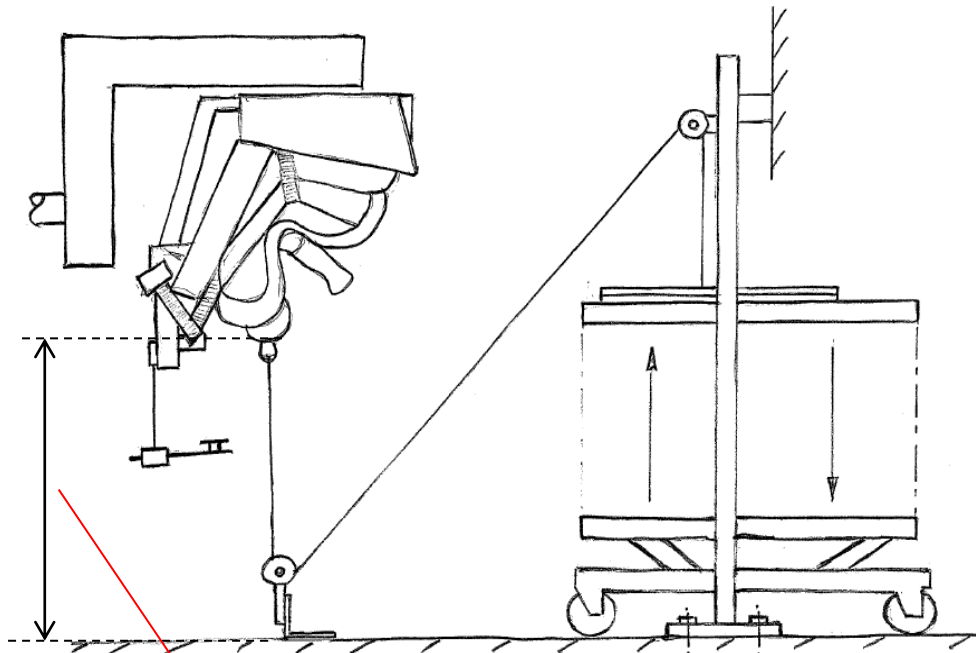
Paragraph 8.1.2.3.and 8.1.2.4.(former), renumber as paragraphs 8.1.2.6. and 8.1.2.7. and amend to read:

- "8.1.2.36. This test **cycle** shall be carried out again rotating in the reverse direction. ~~after having replaced, if necessary, the manikin in its initial position.~~ With the rotational axis in the horizontal plane and at 90° to that of the two earlier tests, the procedure shall be repeated in the two directions of rotation.
- 8.1.2.47. These tests shall be carried out using both the smallest and the largest appropriate manikin of the group or groups for which the restraining device is intended.
- Any adjustment of the dummy or child restraint systems during the complete test cycle is not allowed."**

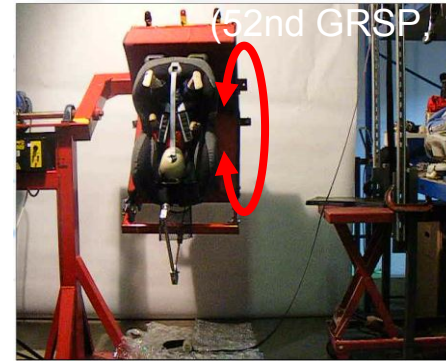
Test Description, overturning test tomorrow (proposal)

- The rotation angle will be increased to 540° , so that test seat and dummy stop in the upside down position.
- In this position a weight is applied as shown and described on the following slide
- Criteria remains unchanged

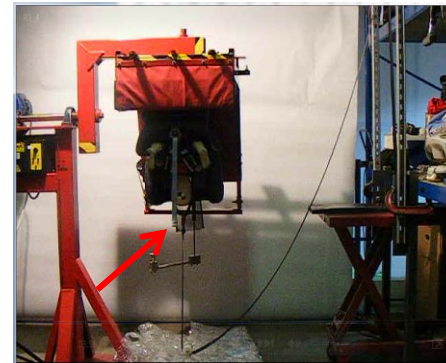
Test Procedure Description



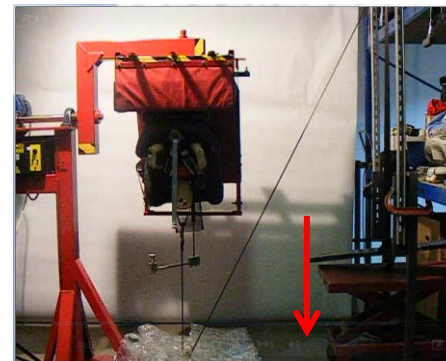
For proper working and testing: Approx. 800mm distance needed between dummy head and floor!



1.) 540° rollover test



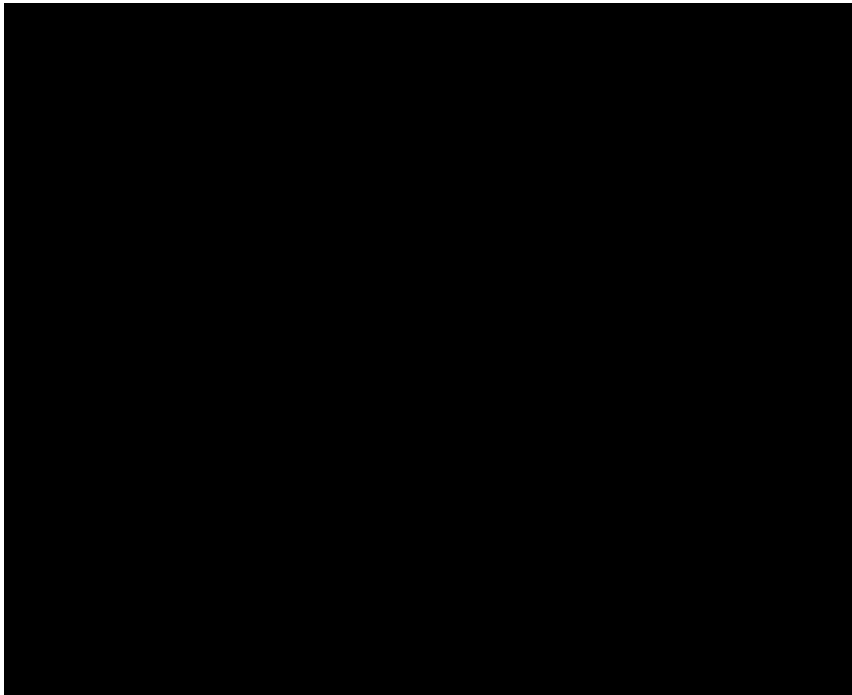
2.) Attachment of additional weight (4 times dummy mass)



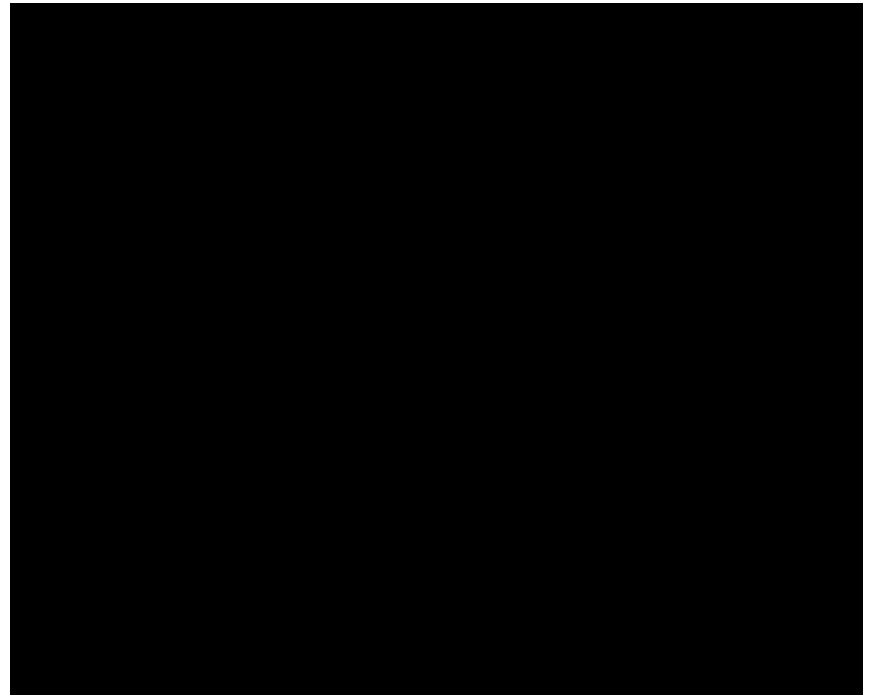
3.) Load applied at less than 400mm/min for 30 s – check of max head displacement

Test Procedure - Videos

Overturning Test with Shield System

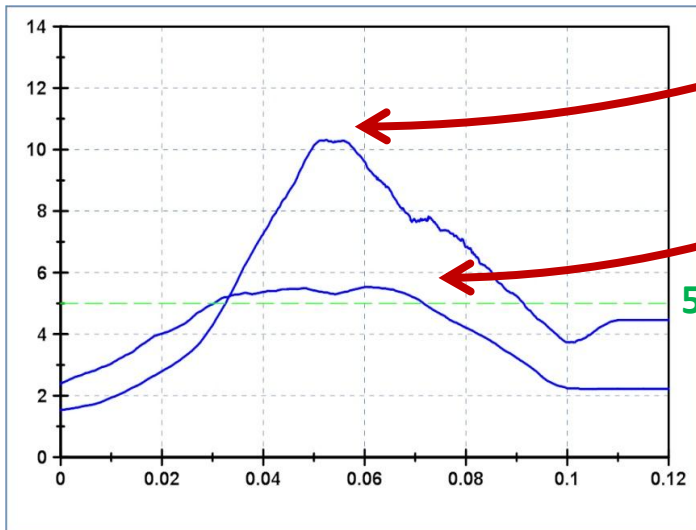
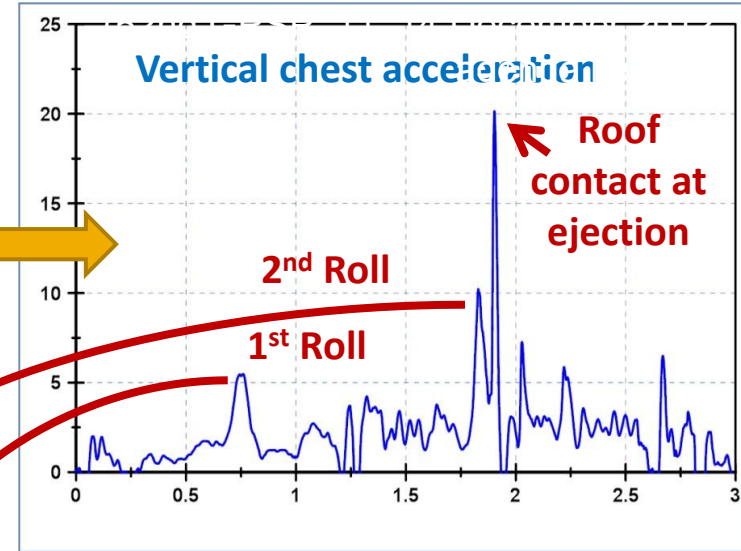
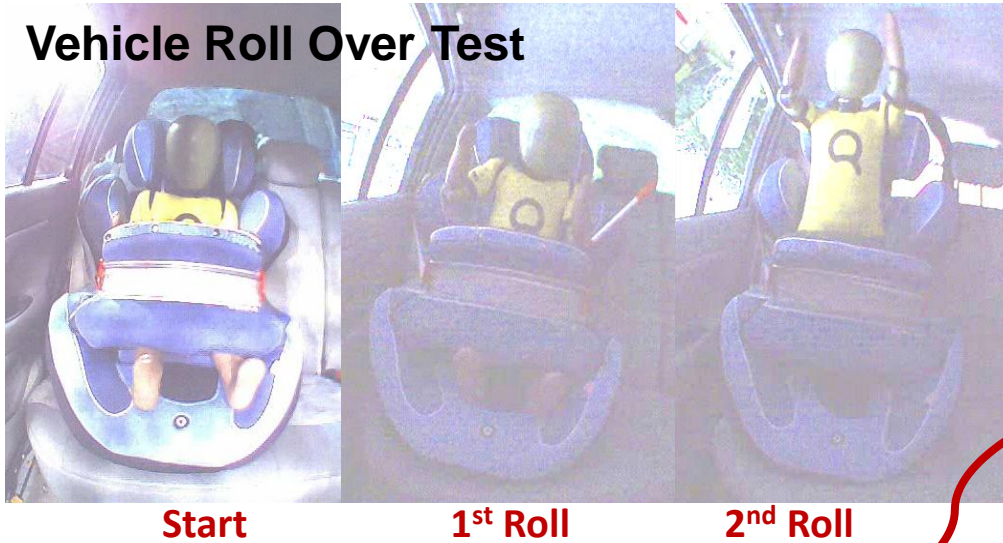


Overturning Test with 5-PT-Harness System

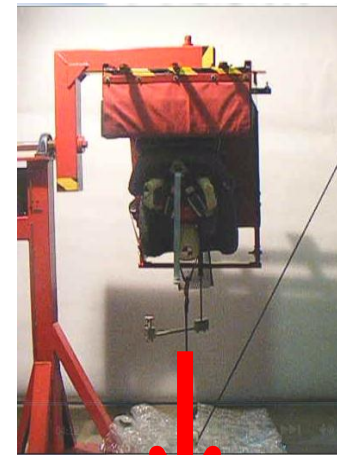


Justification of Overturning Pull Force

Vehicle Roll Over Test



ECE R44 Overturning Test

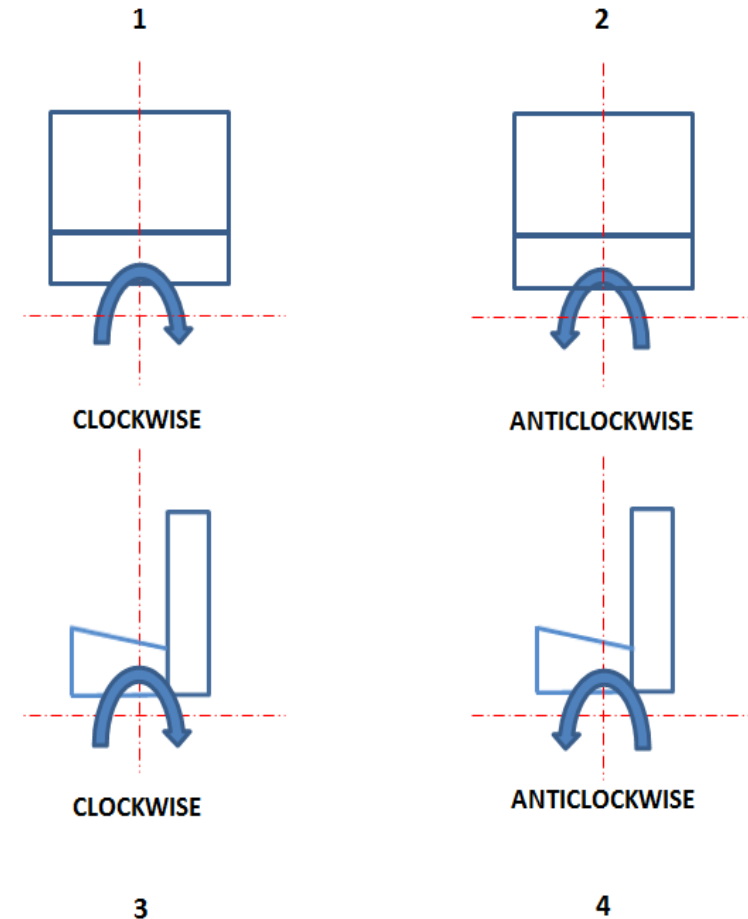


Pull force = 4 times dummy mass + origin dummy mass \triangleq 5g applied to restraint device

Several different shield, as well as integrated harness child restraint systems were tested following the new protocol. Below shown test results are representative and applicable for any CRS model.

Test Report

CRS	DUMMY	ORIENTATION	RESULT
Shield	P3	1	Pass - 250mm max displacement
Shield	P3	2	
Shield	P3	3	
Shield	P3	4	
Shield	P3/4	1	Fail - dummy ejection
Shield	P3/4	2	
Shield	P3/4	3	
Shield	P3/4	4	
Harness	P3	1	Pass - 25mm max displacement
Harness	P3	2	
Harness	P3	3	
Harness	P3	4	
Harness	P3/4	1	Pass - 30mm max displacement
Harness	P3/4	2	
Harness	P3/4	3	
Harness	P3/4	4	



Test Description – Interpretation/Clarification

7.1.3. Overtuning

7.1.3.1. The child restraint shall be tested as prescribed in paragraph 8.1.2.; the manikin shall not fall out of the device **during the whole test** and, when the test seat is in the upside down position the manikin's head shall not move more than 300 mm from its original position in a vertical direction relative to the test seat.

8.1.2. Overtuning

8.1.2.1. The manikin shall be equipped with the load application device as described in Annex 23 and placed in the restraints installed in accordance with this Regulation and taking into account the manufacturer's instructions and **with the standard slack as specified in paragraph 8.1.3.6. below.**

8.1.2.2. The restraint shall be fastened to the test seat or vehicle seat. The whole seat shall be rotated around a horizontal axis, contained in the median longitudinal plane of the seat through an angle of ~~360~~ **540°** +/- 5° at a speed of 2-5 degrees/second **and stopped in this position.** For the purposes of this test, devices intended for use in specific cars may be attached to the test seat described in Annex 6.

8.1.2.3. **At this static inverted position a total mass equivalent to [5] times that of the dummy shall be applied vertically downwards in a plane perpendicular to the axis of rotation to the dummy utilising the load application device described in Annex 23. The load shall be applied at a rate not exceeding [400 mm/min] . Maintain the prescribed maximum load for a duration of [30 -0 +5] seconds.**

8.1.2.4. Remove the load at a rate not exceeding [400] mm/min and measure displacement.

8.1.2.5. Rotate the whole seat for 180° to return to the starting position.

8.1.2.36. This test cycle shall be carried out again rotating in the reverse direction. ~~after having replaced, if necessary, the manikin in its initial position.~~ With the rotational axis in the horizontal plane and at 90° to that of the two earlier tests, the procedure shall be repeated in the two directions of rotation.

8.1.2.47. These tests shall be carried out using both the smallest and the largest appropriate manikin of the group or groups for which the restraining device is intended. **Any adjustment of the dummy or CRS during the complete test cycle is not allowed.**

- should be changed

...with the standard slack as specified in paragraph 8.1.3.6 below, **applied for all systems identically.**

...a **total** mass equivalent to **4** times that of the dummy shall be applied vertically downwards.....rotation **in addition** to the dummy.....

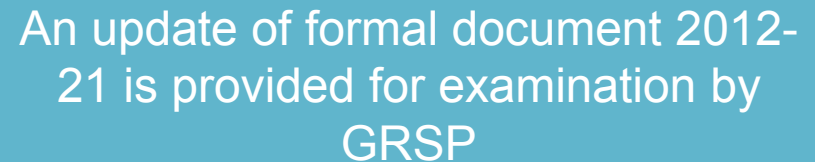
...applied **in a gradual controlled manner** at a rate not exceeding **[400 mm/min] gravitational acceleration or 400mm/min.....**

- comment

...The test will have been deemed a failure and therefore stopped if the 300 mm displacement has been exceeded at any stage of the test cycle.

Summary for improvement of the overturning test

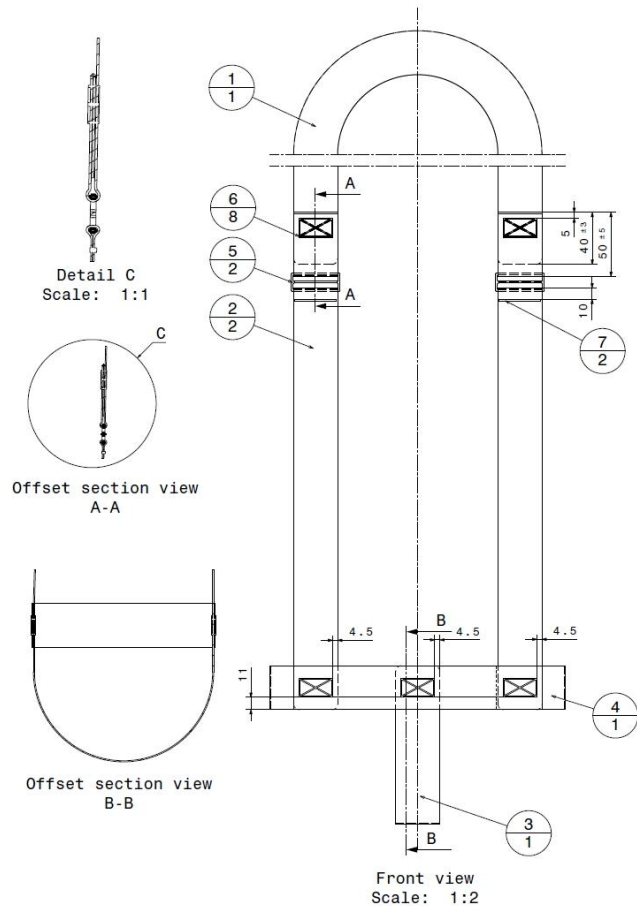
- Understanding and application of test procedure confirmed by two test labs.
- Test procedure applied to already existing ECE R44 Roll Over test rig.
- Test procedure sufficient to recognize poor performing systems in respect to risk of occupant ejection
- Minor editorial work to be done on the text, as well as adding a slight geometrical improvement to the load application device, based on feedback from test labs



An update of formal document 2012-21 is provided for examination by GRSP

Insert a new Annex 23, to read:

Load application device for Group 0/0+

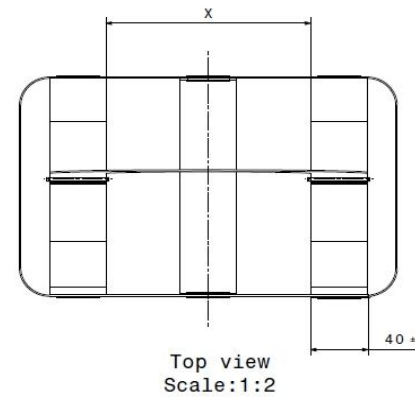


No.	Name	Information	Quantity
1	head belt - 39mm	-	1
2	shoulder belt lh/rh - 39mm	-	2
3	crotch belt - 39mm	-	1
4	hip belt - 39mm	-	1
5	stitch pattern (30x17)	stich: 77, thread: 30	8
6	plastic buckle	-	2
7	stitch pattern (2x37)	stich: 77, thread: 30	2

stretch length (+/-5mm)	P/O					
	Dummy P/O 0	Dummy P/O 1	P/O 1, 2	P/O 3	P/O 6	P/O 10
head belt	1000mm	1000mm	1000mm	1200mm	1200mm	1200mm
shoulder belt	750mm	850mm	850mm	1000mm	1100mm	1300mm
crotch belt	300mm	350mm	400mm	400mm	450mm	0/0mm
hip belt	400mm	400mm	550mm	600mm	700mm	800mm
dimension X	120mm	130mm	140mm	140mm	150mm	160mm

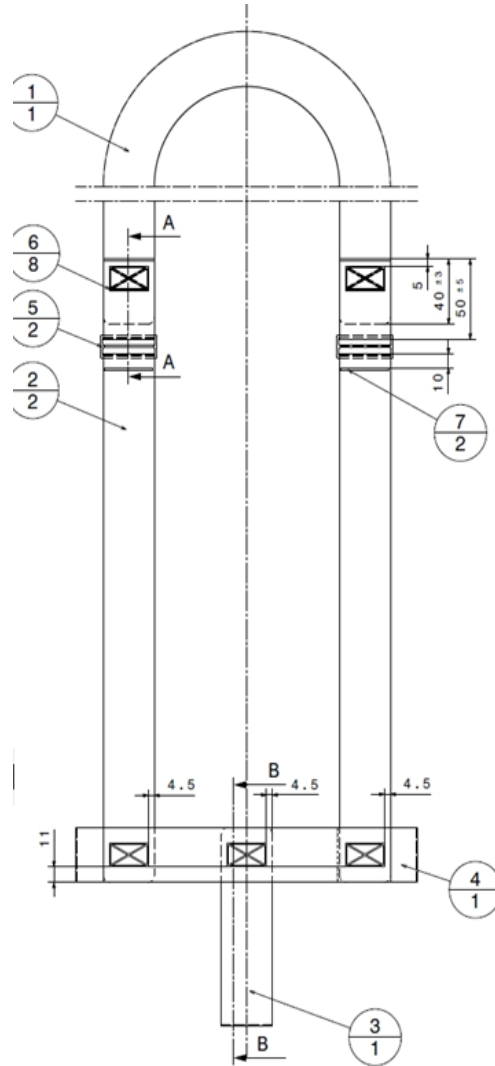
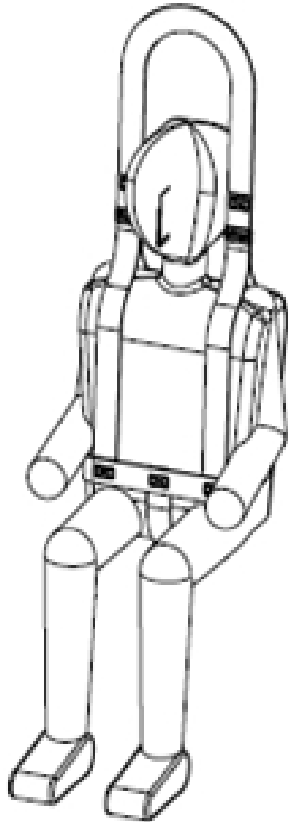
stitch pattern	min. required force
12x12mm	3,5 kN
12x12mm	5,3 kN
12x17mm	5,3 kN
12x20mm	7,0 kN

all belt radius = 5mm



Isometric view
Scale: 1:10

Test Description – Interpretation/Clarification (Group 0/0+)

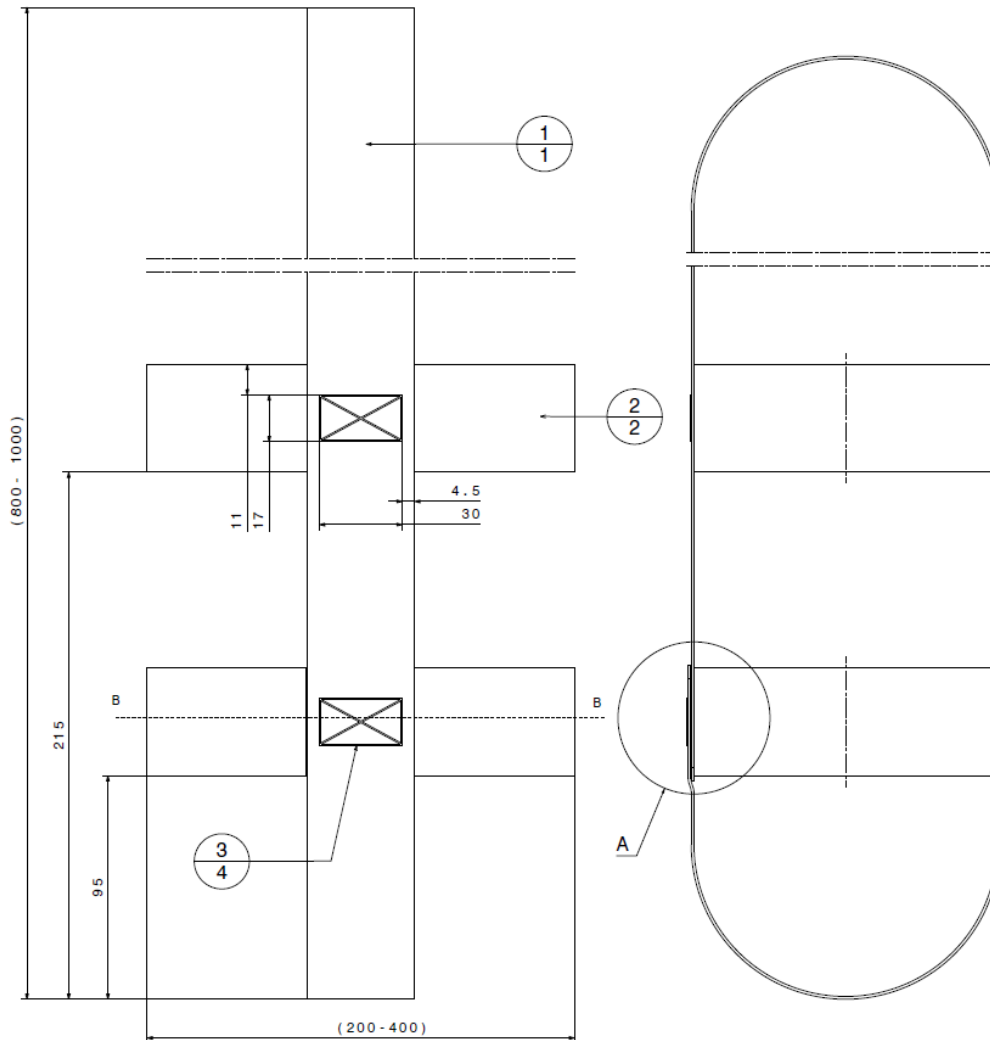


Front view
Scale: 1:2



Insert a new Annex 23, to read:

Load application device for Group 1

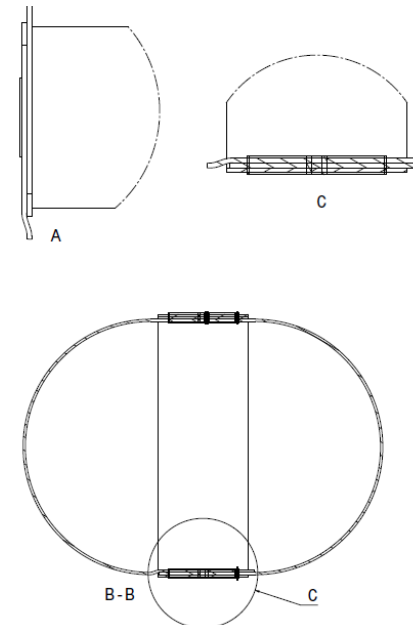


No.	Name	Information	Quantity
1	main belt - 39mm	-	1
2	hip belt (upper/lower) - 39mm	-	2
3	stitch pattern (30x17)	stich: 77, thread: 30	4

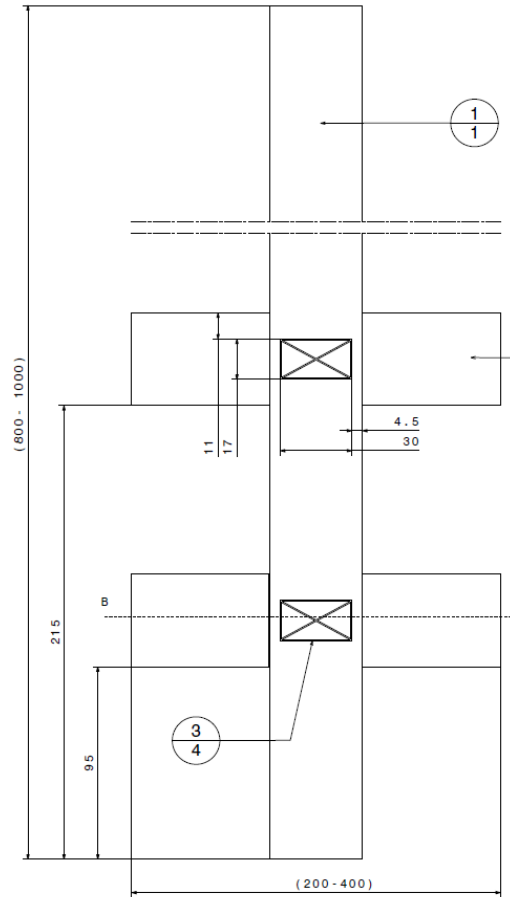
stretch length	(+/-5mm)					
	Dummy P/Q 0	Dummy P/3/4	P/Q 1,5	P/Q 3	P/Q 6	P/Q 10
main belt	1600mm	1600mm	1600mm	2000mm	2000mm	2000mm
hip belt	440mm	540	640mm	740mm	740mm	840mm

stitch pattern	min. required force
12x12mm	3,5 kN
30x12mm	5,3 kN
30x17mm	5,3 kN
30x30mm	7,0 kN

all belt radius = 5mm



Test Description – Interpretation/Clarification (Group 1)



Justification

1. *Paragraph 2.8.1.*: Consistency with paragraph 6.2.2 and clarification of the meaning of "lap strap" in relation to devices used to restrain the child and ensure loading through the pelvis.
2. *Paragraph 6.2.1.5.*: Deals with submarining, while the second part of the paragraph covers requirement of lap strap position which is considered more relevant to paragraph 6.2.2. Assessment test method has been also clarified.
3. *Paragraph 6.2.2.*: Deals with effective lap belt positioning. Requirements about this item have been removed from 6.2.1.5 and 6.2.4 and collected in one paragraph. Due to complexity of the verification assessment, two subparagraphs have been prepared: 6.2.2.1 provides guidance for the static assessment of lap strap positioning, while 6.2.2.2 deals with dynamic assessment. Consequently also 6.2.4 has been modified.
4. *Paragraphs 7.1.3. to 8.1.2.7. and Annex 23*: The present test procedure does not adequately reflect the circumstances of real world rollover crashes. The procedure has been improved to reduce the existing differences between the test procedure and real accidents. A vertical quasi-static load is applied to simulate the dynamic behaviour of the child restraint systems and the dummy.