Informal Document No 19 .

WORKING PARTY ON PASSIVE SAFETY (GRSP)

30th SESSION, 3-6-December 2001.
Agenda Item 1.7.1 (Regulation 44 - ISOFIX)

United Kingdom Proposal to Amend Head Excursion Limits for ISOFIX Child Restraints Equipped with Top Tether.

Proposed text additions to informal document 15 (30th session of GRSP)

PROPOSAL

1) After paragraph 7.1.4.1.8 add the following new paragraph

'7.1.4.1.9 In the case of an ISOFix child restraint with a top tether, the dynamic tests shall be carried out under two conditions:

7.1.4.1.9.1 with the top tether strap attached, and

7.1.4.1.9.2 without the top tether strap attached'

2) In Figure 1 in paragraph 7.1.4.4.1.1, add the following footnote reference ' 5/ ' to the 550 dimension, and add a footnote as follows.

' 5/ . For the purpose of the test specified in paragraph 7.1.4.1.9.1, this dimension shall be 500mm. '

Renumber all subsequent footnotes accordingly.

3) After paragraph 8.1.3.7.7 add a new paragraph as follows:

'8.1.3.7.8 The test specified in paragraph 7.1.4.1.9.2 need only be carried out with the largest manikin for which the child restraint is designed. '

JUSTIFICATION

This proposal introduces tighter head excursion limits in the case of ISOFix child restraints where a top tether is fitted. The existing limits are retained for the purpose of an additional dynamic test carried out without the top tether attached, to simulate a misuse condition

The advantages of ISOFix child restraints, where the attachment of the child restraint to the vehicle structure is independent of the adult seatbelt, are widely accepted. Where the ISOFix child restraint is to be approved for universal use, the use of an additional anti rotation device, such as a leg or a top tether, is needed, since in universal applications the properties of the vehicle seat cushion are unknown. It is proposed, in Informal Document 15 (from France), that the anti rotation device for forward facing child seats should be a top tether.

In addition to permitting ISOFix CRS to be approved for universal use, the top tether confers the advantage of a much more direct and positive attachment to the vehicle structure than the attachment via the adult seatbelt. Since the restraint by this more direct attachment is more optimal, it is possible to reduce both the forward excursion of the child and the accelerations seen during impact.

<u>The need</u>
It would be possible to introduce a reduction in the forward excursion limit, or the chest acceleration limit or both. Accident studies in a number of countries have demonstrated that the body area which received the greatest frequency of injuries in accident for restrained children is the head and face, mainly through contact and all authors conclude that this is the principal area to be addressed. (Langwieder et al 99, Walsh et al 96, Kelleher 93, Gotschall C S et al.). Chest injuries are far less frequent and less serious. The most recent study of the occurrence of fatal injuries to restrained children (VSC Ltd), gives the following breakdown of injuries by body region for children who were killed in accidents while restrained in child seats.:

Body region with fatal or life-threatening injuries	**Number of fatalities**
Head	60
Neck	15
Chest	19
Abdomen	7
Burns (any region)	4
Drowned	3
Asphyxiated	1

It can be seen that injuries to the head are the overwhelming priority region.

When R44 was first being developed in 1974, a review of available space in some 39 cars by TNO (TNO 74) demonstrated that a 500mmm limit was appropriate and there was less space than this in only 15 of these cars (mainly those with a lower market share in the Netherlands. However, it was not practical to achieve this performance for child restraints of Group 3 or child seat of Group 2 restrained by adult seatbelts, so it was relaxed for practical reasons to 550mm.

Feasibility.

During the development of ISOFix, several different arrangements were tested, including the configuration of two lower ISOFix anchorages and a top tether. The table below shows some of the test results of these and with a production ISOFix CRS with a top tether, all using a P3 dummy;

CRS type	Head excursion (mm)	Chest acceleration (g) (3 msec)	Head acceleration (g) (3 msec)
Prototype 2-point + top tether	404	44	
	400	44	
	443	35	56
Production	458	42	51

It is clearly feasible to achieve well under 500mm head excursion for ISOFix CRS with top tether. Note that all of these exhibit chest accelerations well within the limits for R44.

Different requirements for different child restraint classes.

This proposal would set different limits for head excursion for different child restraint categories. However, ECE R44 already specifies several different limits for different categories of child restraint. e.g.

CRS type	**Excursion limit plane from Cr point**
Group 1 forward facing	550mm
Group 1 rearfacing, supported by dashboard	700mm
Group 0 not supported by dashboard	600mm.
Group 1 & 0+rearfacing not supported by dashboard	700mm

Misuse

It is recognised that one area of potential misuse is the non-use or slack use of the top tether. This is not currently found to be a problem in Australia where there has been considerable experience with child restraints with top tethers (Paine 2000) . Nevertheless, it would seem wise to assume some misuse might occur in Europe. In the earlier GRSP Ad-Hoc group on ISOFix, Prof. Langwieder recommended at certain higher performance requirement with top tether attached and the R44 limit with the top tether unattached as a backstop precaution to ensure that there would be some confidence in a minimum performance available in the event of such misuse.

It is important to realise that this does not mean that the performance is "acceptable" for *universal* use if the R44 requirements are met without the top tether. The issue of the wide range of seat cushion characteristics and dimensions is not resolved without the anti-rotation device. i.e. the less consistent performance over the wide range of car seats and rebound effect are not addressed. However, this proposal gives the confidence that the performance without top tether is not totally uncontrolled.

Proposal

It is proposed that the forward excursion limit during the test with top tether attached be a plane 500mm ahead of the Cr point. The chest acceleration shall not exceed 55g except for periods whose sum does not exceed 3 ms (no change).

It is proposed that, during the test without top tether attached, the manikin head should not pass beyond plane AB set 550mm ahead of the Cr point and the chest acceleration shall not exceed 55g except for periods whose sum does not exceed 3 ms. This last test need only be performed with the largest manikin for which the child restraint is designed.

References.

Gotschall C S et al. *Injury patterns associated with child restraint misuse.*. Child Occupant protection 2ns Symposium (P-316) 1997 SAE P973311

Kelleher B et al *Trauma to children in forward facing child seats* Child Occupant Protection (SP-986). 1993 SAE P933095

Langwieder, K et al. *Injury risks of children in cars depending on the type of restraint.* Proc Child Occupant Protection in Motor Vehicle Crashes, IRCOBI/AAAM/PSN, Sitges, 1999.

Paine M et al *Surveys of child restraint use in New South Wales.* PROC 17TH esv Conf, Amsterdam, June 2000

TNO 74. *Drawing 01-2-23008*. Unpublished

Walsh et al. *A study of motor vehicle accidents involving children.* Proc 40th Stapp Car Crash Conf.. 1996 SAE P962436.

VSC Ltd. *A retrospective study of child fatalities for the years 1990-1994*. Unpublished