Informal document No. **GRSP-35-2**
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agenda item B.1.2.)

PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 17 (Strength of Seats)

Transmitted by the Expert from Consumers' International

1. Introduction

At the 34th session of GRSP in Dec.2003 it was agreed to reconsider the 'TEST PROCEDURE FOR DEVICES INTENDED TO PROTECT THE OCCUPANTS BETTER AGAINST DISPLACEMENT OF LUGGAGE' (informal document No.**GRSP-34-1**).

The Representative of Consumers' International presented test results that were carried out by ANEC (the European Association for the co-ordination of consumer representation in standardization).

These tests highlighted the differences between the mild legislative requirements and more realistic accident situations.

On the basis of this informal document Consumers International proposed to address the shortcomings in Regulation No. 17, annex 9, that were revealed at the 34th session of GRSP.

CI agreed to present a more detailed proposal for modifications.
This paper can be considered as a first step to come to improvements of the rear seat back strength test and requirements.

2. Nature of problem

Accident studies have identified that restrained occupants, subjected to additional loading by seat backs that have been distorted by luggage loading, can suffer otherwise avoidable severe injuries. These injuries are either a consequence of increased seat belt loading or a result of contacts made during increased forward excursion within the restraint.

The TRL paper entitled "THE INFLUENCE OF REAR LOADING ON THE PROTECTION OF CHILD CAR OCCUPANTS IN CHILD RESTRAINTS" by M. Le Claire and C. Visvikis, published at the 17th International Technical Conference on the Enhanced Safety of Vehicles in Amsterdam in 2001, provides some examples of accident experience and illustrates the influence of luggage loading on children in a variety of child restraints by means of a series of sled tests with controlled additional loading from the displaced seat back (cases described in appendix I). It is notable that the sled test severity and the seat back displacements used are

as specified in the latest version of Regulation No. 17. Whilst this revised legislation improves the situation somewhat from earlier versions, the results clearly demonstrate that even at this relatively low severity compared with for instance Euro NCAP's typical pulses, the permitted seat displacement in legislation does not protect children, particularly those in booster seats or cushions, from harmful additional loading.

In March 2003, ANEC, the European Association for the co-ordination of consumer representation in standardization, published results of their sled tests examining the dynamic rear seat strength of some current models. These tests included pulses of Euro NCAP severity. They illustrated that realistic luggage loading on the rear seats could result in major seat displacement and consequent additional loading on restrained rear occupants. They asked GRSP to improve this area of design. The full technical description of the work is contained in a report entitled "Testing of Rear Seat Strength in Cars" published by ANEC under reference ANEC2003/TRAF/005.

3 PROPOSAL

CI proposes to agree on the following concepts for modification to improve Regulation No.17, annex 9 (see page 55 cont.). A final proposal, containing detailed amendments, and taking on board the outcome of the discussions within GRSP's 35th meeting, will be made available for the 36th session.

Concept 1

Sled pulse: A new more demanding pulse must be defined. Shape and severity of the crash must acknowledge the state of the art. A generic pulse can be derived from existing data of REG94 crashes or, preferably, EuroNCAP tests. The velocity change (delta v) for the sled should be at least as large as that in the Reg94 or Euro NCAP frontal impact test.

Concept 2

Luggage simulation: The luggage blocks should be split both in vertical and horizontal planes, to allow for realistic loading of seats. The horizontal split will prevent artificial countermeasures, such as ledges on the car floor at the base of the seat back, being used to restrain luggage blocks, as can occur when using the blocks specified in Regulation 17. It is suggested that the horizontal split occurs at the mid height of the luggage simulation blocks. The final dimensions of the blocks need to be agreed, but their total height should be such that loading is applied towards the top of a typical folding rear seat back, simulating the situation when the luggage area is filled up. The split in the vertical plane allows realistic loading of the separate parts of a split folding rear seat. This vertical split could be arranged as in the legislative test i.e. the blocks symmetrically placed about the centre line of the vehicle, spaced 50 mm apart

The mass of the luggage simulation should be higher than that used in legislation, as 36 kg is too small a mass to reflect the full luggage load, even in small cars. It is proposed that a luggage mass of [70 kg] be used, as this load can be carried by most vehicles, together with a full compliment of adult occupants, without exceeding the recommended maximum Gross Vehicle Weight.

Concept 3

Spacing of luggage simulation from rear seat back and its relationship to car size: The test should acknowledge that cars with larger luggage compartments require stronger seats than vehicles with smaller luggage capacities. This aim could be met either by having different mass luggage simulations for different sized luggage compartments, or, perhaps more simply, by adjusting the back set of the luggage simulation from the car seat back according to the size of the luggage compartment. The detail of the size of luggage blocks and their back set from the seat back should be worked up, once the basic principles have been agreed within GRSP.

Concept 4

Assessment criteria: The cheapest solution would be to have a simple geometric criterion. The paper by Le Claire and Visvikis illustrates that displacement of the seat back as far as a vertical plane through the R point already increases load on the seat belt for children in booster type products. To pass the test no part of the seat passes through a vertical plane [0-50 mm] rearwards of the R point.

An alternative or additional set of criteria could be based on data generated with dummies in the sled test. The dummies would have to be the smallest that could be accommodated within booster type products. It is suggested that a simple booster seat type is chosen for testing. Dummy choice could be the [P1.5]. Measured criteria should be forward movement, chest acceleration, and seat belt tension. The advantage of using dummies would be that the protocol would acknowledge any design features within the restraint system that reduce the influence of luggage loading. Thus load limiters on rear seat belts would be acknowledged in a way that was not possible with the simple geometric criteria. If dummies were used, they could be placed in all designated rear seating positions. With split rear seats, the center rear occupant is often exposed to the greatest additional loading.

APPENDIX

Accident Investigation (excerpt from paper 147, 2001 ESV conference, M. Le Claire, C. Visvikis; Amsterdam)

A TRL study has been carried out of serious injuries to restrained children. Within a sample of 230 there have been some instances of serious injuries, attributed to loading through a distorted vehicle seatback.

Some examples:

- The car involved had a frontal impact with another car. It was a 12 o'clock direction of force with three quarters overlap. A 6 year old girl was restrained in a booster seat by the three point adult belt in the rear right side seat. She was seriously injured with head and chest injuries. A 3-year-old boy was restrained in a child seat on the rear left side and he suffered serious head injuries. The injuries to both children were attributed to loading from the seatback.

- The car involved had a frontal impact with another car. It was an 11 o'clock direction of force with a half overlap on left side. The 50/50 split rear seat back failed due to luggage loading. A 6-year-old boy was restrained in the rear left position. He suffered a fatal fracture dislocation of the upper cervical spine and a ruptured spleen. A 2-year-old girl was restrained in the centre rear position. She was fatally injured with asphyxia due to crushing of the chest. A 4-year-old girl was restrained in the rear right position and suffered serious head injuries.

- A frontal impact into the side of another car. It was a 12 o'clock direction of force with a full overlap. The luggage distorted the lower section of the rear seat back. The adult belt in the rear seat restrained an 11-year-old girl. She was seriously injured with a torn liver and spleen.

- In this case the car was involved in a sideswipe with a Transit van. The latch failed on the split rear seat back. A 2-year-old boy was restrained in a child seat in the rear right position of the car. He suffered fatal injuries to the head. The seat back loaded the child seat causing it to translate forwards and the child's head struck the deformed B pillar.