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UN/ECE/WP.29/GRSP
INFORMAL WORKING GROUP
ON
HEAD RESTRAINTS

2ND PROGRESS REPORT
(PRESENTED BY MRS. SUSAN MEYERSON, CHAIR OF THE INFORMAL WORKING GROUP)

DRAFT

1. INTRODUCTION

During the 126th session of WP.29 of March 2002, the Executive Committee of the 1998 Global Agreement (1998 Agreement) adopted a Program of Work, which includes the development of a global technical regulation (gtr) to address neck injuries in crashes. The United States of America (U.S.) volunteered to lead the group's efforts and develop a document detailing the recommended requirements for the gtr. The U.S. presented an informal document (WP.29-134-12) in November 2004 proposing the work and highlighting the relevant issues to be addressed in the gtr. This proposal was adopted at the March 2005 session of WP.29 (TRANS/WP.29/AC.3/13).

At the November 2004 WP.29 session, the Executive Committee charged the Working Party on Passive Safety (GRSP) to form an informal working group (working group) to discuss and evaluate relevant issues concerning requirements for head restraints to make recommendations regarding a potential gtr.

Under the guidelines governing the development of a gtr, the working group is to first evaluate the merits of the proposal. This evaluation should include:

1. An examination of the merits of the proposal in detail, outlining the pros and cons of the proposal;
2. Consideration of other regulations on the same subject, which are listed in the compendium;
3. A determination that the proposal addresses a problem of sufficient magnitude to warrant the development of a regulation;
4. An examination of whether the nature, extent and cause of the problem addressed by the proposal are correctly characterized;
5. An examination of whether the proposal provides a sufficiently effective, performance oriented approach to address the problem;
6. A determination that the approach identified in the proposal is appropriate to address the problem; and
7. A description of needed additional information.

The working group met to discuss the development of a gtr on head restraints on:

- February 1 – 2, 2005 in Paris, France
- April 11-13, 2005 in Paris, France
- June 13-15, 2005 in Washington, D.C., USA
- September 7-9, 2005 in Paris, France.

At the request of GRSP Chairman, the meeting scheduled for December 5-6, 2005 in Geneva, Switzerland was canceled to allow the Pedestrian gtr informal working group, which was experiencing difficulties setting up a meeting, to meet at that time. The next meeting is scheduled for January 23-26, 2006 in Cologne, Germany. A proposed schedule of efforts is outlined in Section 2 of this document.

The Contracting Parties represented on the working group are the Netherlands, France, Canada, Japan, Germany, Spain, United Kingdom, United States of America, and the European Commission. Representatives from European Association of Automotive Suppliers (CLEPA) and International Organization of Motor Vehicle Manufacturers (OICA) are also participants.

This report summarizes the main issues discussed by the working party in evaluating the proposal to develop a draft global regulation on head restraints.

2. REQUEST TO PROCEED WITH THE DRAFTING OF A GTR

The U. S. recently upgraded its head restraint standard to provide more stringent requirements. In 1982, the U.S. assessed the performance of head restraints installed pursuant to the current standard and reported that integral head restraints are 17 percent effective at reducing neck injuries in rear impacts and adjustable head restraints are only 10 percent effective. The UNECE regulations on head restraints were considerably more stringent than the old U.S. regulation, and were used as a baseline in developing the new upgraded U.S. head restraint regulation.

Due to the U.S. regulatory upgrade effort, this is an excellent opportunity for the international community to develop and establish a gtr in this area. It is the belief of the working group that everyone could benefit from harmonization and new technology based improvements of head restraints. The benefits to the governments would be the improved safety of the head restraints, leveraging of resources, and the harmonization of requirements. Manufacturers would benefit from reduction of the cost of development, testing, and fabrication process of new models. Finally, the consumers would benefit by having a choice of vehicles built to higher, globally recognized standards, providing a better level of safety at a lower price.

The proposed gtr will combine elements from UNECE Regulations Nos.17, 25, and newly upgraded U.S. Federal Motor Vehicle Safety Standard (FMVSS) 202. While not all issues that would be addressed by a gtr have been resolved, no issues are sufficiently problematic to prevent the development of a draft regulation. It is proposed that a draft gtr could be prepared for discussion at the next GRSP meeting pursuant to the following schedule:

Tasks	Dates
1st Progress Report to GRSP	May 2005
1st Progress Report to AC.3	June 2005
3rd Working Group Meeting	June 2005
Development of draft gtr begins	June 2005
4th Working Group Meeting	September 2005
2nd Progress Report/Draft gtr to GRSP	December 2005
5th Working Group Meeting	January 2006
2nd Progress Report to AC.3	March 2006
3rd Progress Report/Adoption of Final Draft gtr by GRSP	May 2006
3rd Progress Report to AC.3	June 2006
Submittal of Final Draft gtr to AC.3	November 2006

3. EVALUATION OF THE SAFETY PROBLEM

In the United States, between 1988 and 1996, 805,581 whiplash injuries (non-contact Abbreviated Injury Scale (AIS 1) neck) occurred annually in all crashes of passenger cars and LTVs (light trucks, multipurpose passenger vehicles and vans). 272,464 of these whiplash injuries occurred as a result of rear impacts. For rear impact crashes, the average cost of

whiplash injuries in 2002 dollars is $9,994 (which includes $6,843 in economic costs and $3,151 in quality of life impacts, but not property damage), resulting in a total annual cost of approximately $2.7 billion. Although the front outboard seat occupants sustain most of these injuries, whiplash is an issue for rear seat passengers as well. During the same time frame, an estimated 5,440 whiplash injuries were reported annually for occupants of rear outboard seating positions.

A more detailed discussion of the safety problem in the U.S. and their new requirements in the upgraded FMVSS 202 can be reviewed in Informal Document HR-1-8.

4. REVIEW OF EXISTING INTERNATIONAL REGULATIONS

The following existing regulations, directives, and standards pertain to head restraints:

- UNECE Regulation 17 - Uniform Provisions concerning the Approval of Vehicles with regard to the Seats, their Anchorages, and any Head Restraints
- UNECE Regulation 25 - Uniform Provisions Concerning the Approval of Head Restraints (Head Rests), whether or not Incorporated in Vehicle Seats
- EU Directive 74/408, concerning interior fittings of motor vehicles
- EU Directive 96/037, adapting to technical progress Council Directive 74/408/EEC relating to the interior fittings of motor vehicles (strength of seats and of their anchorages)
- EU Directive 78/932/EEC, concerning head restraints of seats of motor vehicles
- U.S. Code of Federal Regulations (CFR) Title 49: Transportation; Part 571.202: Head Restraints
- Australian Design Rule 3/00, Seats and Seat Anchorages
- Australian Design Rule 22/00, Head Restraints
- Japan Safety Regulation for Road Vehicles Article 22 – Seat
- Japan Safety Regulation for Road Vehicles Article 22-4 – Head Restraints, etc.
- Canada Motor Vehicle Safety Regulation No. 202 – Head Restraints
- International Voluntary Standards --SAE J211/1 revised March 1995 – Instrumentation for Impact Test – Part 1 – Electronic

Additionally, research and activities being conducted by EEVC Working Group 12, EEVC Working Group 20, and EuroNCAP are also being considered.

5. DISCUSSION OF ISSUES TO BE ADDRESSED BY A GTR

The following discussions reflect the working group's identification of specific issues, as well as the group's evaluation of those issues. A draft comparison of the requirements of UNECE 17 and US FMVSS No. 202 is provided in the Appendix of this document.

5.1. Applicability

The application of a head restraint gtr will, to the extent possible, use the revised vehicle classification and definitions of Special Resolution 1.

There has been limited discussion of the applicability of this gtr. The application of US FMVSS No. 202 is different than UNECE 17. FMVSS No. 202 requires head restraints in all front

outboard seating positions and regulates head restraints optionally installed in the rear outboard seating positions for vehicles up to 4,536 kg. UNECE 17 requires head restraints in all front outboard seating positions of vehicles of category M1, vehicles of category M2 up to 3500 kg and vehicles of category N1 and regulates head restraints optionally installed in all seating positions, in all vehicles. There is consensus to recommend that the gtr should recommend head restraints in all front outboard seating positions for Category 1-1 vehicles. Vehicles of category 1-2 and 2 need more discussion especially on the weight limit.

It was proposed that the gtr, as it pertains to front outboard seats, should apply to vehicles up to 4,536 kg. The US presented justification (HR-4-4), developed in 1989, when the applicability of their regulation was increased to 4,536 kg. By extending the applicability from passenger cars to include trucks, buses, and multipurpose passenger vehicles, there was an estimated reduction of 510 to 870 injuries at an average cost of $29.45 per vehicle (1989 dollars). Japan presented data (HR-4-10) showing the breakdown, by vehicle weight, of crashes resulting in whiplash injuries. They show 1,540 (0.7%) rear impacts involving vehicles with a GVW over 3,500 kg that resulted in bodily injury. All delegates and representatives were requested to provide data for whiplash rates and fleet composition for vehicles that fall in the 3,500-4,500 kg weight range.

This discussion will continue at the January 2006 meeting.

5.2. Scope

At the April meeting, scope language was proposed: "This GTR specifies requirements for head restraints to reduce the frequency and severity of [neck injury] in rear end [and other collisions.]" At the June meeting, it was proposed to replace "neck injury" with "whiplash associated disorder".

There was concern about defining the scope using the injuries and the type of accidents in which those injuries occur. New text was proposed for the scope that addresses these issues: “This gtr specifies requirements for head restraints to reduce the frequency and severity of injuries caused by rearward displacement of the head.” This text comes from the definition of head restraints and was well received by the informal working group. It was decided to review the proposed language change and discuss it at the next meeting.

5.3. Height of the Head Restraint

5.3.1. Front Outboard

Both UNECE 17 and the FMVSS No. 202 Final Rule require front outboard head restraints with a minimum height of 800 mm above the R-point/H-point, respectively. A proposal was made to recommend a minimum height of 850 mm, to accommodate the taller citizens of some countries.

Data was provided showing that the average sitting height for adults in Netherlands and the US has increased over the last 10 years and a higher head restraint is needed to protect these occupants (HR-3-6). Japan presented data (HR-4-10) showing that Japanese females and males are smaller than the US population. They stated that the current height requirement of 800 mm is appropriate and do not want to raise it to 850 mm. The United Kingdom also submitted data (HR-4-14) that showed their population is not increasing in size, and therefore a head restraint height of 800 mm is sufficient.

Using the Netherlands and University of Michigan Transportation Research Institute (UMTRI) data for automotive sitting height, it was calculated that a 800 mm height of head restraints is sufficient to protect up to almost a 95th percentile Netherlands male (HR-4-2). The Netherlands data was stated to be more robust because it measures erect sitting height and does not need to take in account spine straightening. Some representatives questioned the necessity of taking into account spine straightening. It was stated that spine straightening may not be a factor when there is a reduced backset. It was also noted that the spine straightening research was conducted on a rigid board and this phenomena would not be as pronounced in a cushioned automotive seat.

It was stated that head restraints are built with a compliance margin of 20 mm, therefore head restraints are being built to 820 mm. If the height of the head restraint is required to be 850 mm, manufacturers would need to build their head restraints to 870 mm. It was noted that with an 800 m head restraint, it is starting to become a challenge to be able to install seats in the vehicle, and a larger head restraint can also restrict occupant visibility (blocking vision rearward and to the side) (see HR-3-5). Additional data was presented (HR-3- 4) that showed that in small cars (smaller than mini), 850 mm head restraints could severely restrict rearward vision in the rearview mirror.

One delegate referred to the EEVC study that found that whiplash is mainly a problem with smaller females. The Netherlands stated that taller men are presented in the statistics and that this is a real problem in the Netherlands (50% insurance payments are to whiplash, there are problems with the hospitals, etc.). In Japan, females have a higher potential of whiplash injury (HR-4-10).

The US reviewed their cost benefits analysis for height and backset and found that there are no benefits to increasing the height to 850 mm. The benefits calculated are solely influenced by the 55 mm backset. Benefits from height do to come into account until backset is very large.

In addition, there were concerns expressed over measuring active head restraint systems using the same methods to measure passive systems.

Discussion on these issues will continue at the next meeting.

5.3.2. Rear Outboard

There was general consensus to recommend that optionally installed rear outboard head restraints be required to meet a minimum set of requirements. If a vehicle has rear outboard head restraints, it is recommended that they meet the requirements and have a minimum height of 750 mm. One proposal was made to define a rear head restraint as any seat structure 700 mm above the H-point. Current practice in UNECE is allowing the manufacturer designating what is and is not a head restraint. Further discussion is needed to clarify this requirement. Additionally, the application of this requirement to all vehicles is still under discussion.

5.3.3. Front Center/Rear Center

It has been proposed to include in the gtr the UNECE 17 requirement to regulate optionally installed head restraints in all seating positions, including front and rear center seats.

There was discussion on how front center head restraints are regulated under UNECE 17 and how to address these restraints in the gtr. Under UNECE 17, the manufacturer has the option to approve center head restraints to the requirements; meaning that the installation of a center head restraint does not necessarily mean it has been approved to the requirements. In this sense, US regulations do not have the same capability as the ECE regulation. In general in the US, if a manufacturer chooses to optionally install a piece of equipment, than that piece of equipment must meet the regulation. For example, manufacturers have the option to install rear outboard head restraints, but if they are installed, they must meet the requirements outlined in FMVSS 202.

Some delegates are concerned with the ability to justify regulating front center head restraints due to low occupancy rates. There is also concern that front center head restraints may impede visibility. It was stated that in Europe there is a UNECE requirement that limits obscurity of rearward visibility to 51%.

It was requested that we continue to evaluate adding front center head restraint requirements to gtr. An alternative suggestion was to add a discussion in the preamble to not regulate center head restraints in the gtr, but acknowledge that center head restraints will remain in UNECE 17 for the option of type approval.

This item is still under discussion.

5.3.4. Clearance Exemption

There is consensus to recommend, in the measurement of height, the allowance of a 25 mm clearance exemption for the "roofline or backlight." There is additional discussion on where this measurement is taken and the seat set-up when the measurement is taken.

There are two proposals being considered. One allows 25 mm of clearance between the head restraint and the roofline or rear window when the head restraint is in the lowest position, the seat is in the lowest position, and the seat back angle measures 25 degrees. This is based on the safety concern for maintaining the 800 mm height of the head restraint.

Another proposal was put forth to allow the clearance exemption be applied when the seat is in any position of adjustment. (HR-4-15) It was stated that this exemption was needed to allow the rear seat passengers to exit the vehicle in emergency. Without the clearance, the seat could contact the vehicle structure and slow down the egress process.

Several questions were raised concerning this exemption:

- What is the real world implication?
- Are there vehicles that apply this clearance exemption now?
- What is the head restraint height of the vehicle that uses this exemption?
- Are there cost effective engineering solutions to avoiding head restraint contact or adjusting the head restraint lower when the seat is flipped forward? On some current vehicles, the head restraint moves out of the way when the seat-back flips forward to prevent contact with vehicle structure.

Some delegates do not believe that emergency egress is an issue. There is also concern that the clearance exemption could be applied when the seat is in the highest position, thereby allowing head restraints as short as 700 mm. It was stated the reducing the height of a head restraint to less than approximately 780 mm will have an impact on the benefits.

In addition to the clearance exemption, it was also suggested to incorporate the UNECE R.17 requirement for a minimum height of the rear seat. It was also requested that the working group consider convertible roofs as they are retracted. Further discussion on this issue will continue at the next meeting.

5.4. Adjustable Front Head Restraints – Front Surface Height

It has been proposed to include in the gtr the UNECE 17 requirement that the height of the head restraint face be a minimum of 100 mm to ensure sufficient surface for the occupant's head to contact. The UNECE 17 requirement is measured in the same manner as the overall height of the head restraint. There have been concerns expressed that the measurement taken in this manner does not address the effective height of the restraint. In the case of extremely contoured head restraints, the height of the surface that the head would contact is less than the measured height. It has been proposed that the 100 mm requirement be applied to this effective height of the head restraint. This proposal was countered by some as not necessary because the shape of the head restraint is governed by the displacement test, energy absorption test, and other requirements. This issue is still under discussion.

5.5. Head Restraint Width

5.5.1. Front Seats

5.5.1.1. Single Seats

There is consensus to recommend that single front outboard seats have a minimum head restraint width of 170 mm.

5.5.1.2. Bench Seats

There is a proposal to recommend that head restraints have a minimum width of 254 mm when installed in the front outboard positions on bench seats. The need for this requirement has been argued because a bench seat can cause the occupant to sit off-center from the head restraint (especially if unbelted), therefore a wider head restraint is needed.

There was concern for regulating the wider head restraints because the gtr would be regulating misuse. Others stated this requirement is no longer necessary, because the vehicle bench seat of today is considerably different from the vehicle bench seat of 40 years ago. There is also a concern that wider head restraints could impact visibility.

Further justification has been requested for this proposal. The discussion will continue at the next meeting.

5.5.2. Rear Seats

There was consensus to recommend that rear outboard seats, if installed, have a minimum head restraint width of 170 mm.

5.6. Seat Set Up and Measuring Procedure for Height

There are two proposals under discussions concerning the set-up of the seat for measurement and the measurement procedure. One proposal is to use the manufacturers recommended seating position as detailed in UNECE 17. The other is to use the procedure that is outlined in the recently adopted FMVSS No. 202, which positions the seat in the highest position of adjustment and sets the seat back angle at a fixed 25 degrees. The U.S. procedure allows for results of height and backset to be compared from vehicle to vehicle. The UNECE 17 procedure allows the seat to be measured at the same seat back angle that is used to determine other occupant design requirements, such as sight angles and has proved to be very repeatable and reproducible; concerns have been raised that the US procedure would result in high variations at certification. UNECE 17 also takes into account the difference in seating positions for different vehicle types.

In addition to the set-up of the seat, the method of measuring height is under discussion. Some recommend taking all measurements from the R-point. Another proposal is to use the J826 manikin as the primary measurement tool. The use of the R-point allows measurements to be verified to known design points on the vehicle thus improving repeatability. The use of the J826 manikin allows the seat H-point to be measured as it exists in the vehicle and when it is under load. It was argued that options in seat materials and manikin set up can produce recordable differences from one seat to another. UNECE experience shows that the use of the R-point allows measurements to be easily verified on a drawing and is also very repeatable and reproducible when verified in a car. The use of H-point can address differences in measurements caused by seat materials.

Studies are being conducted to determine the effect of H-point variability on the height measurement. They are also looking at the range in height that is measured on a seat with an independently adjusted lower seat cushion, when the seat cushion is in the lowest position and at the manufacturers recommended position. The results of these studies will be presented at the next meeting.

5.7. Backset

It was proposed to recommend a maximum backset of 55 mm for front outboard head restraints, using the Head Restraint Measuring Device (HRMD), as a measuring tool. There is general consensus to recommend the regulation of backset, but there was concern that the 55 mm requirement is too stringent.

Data has been presented with regard to concerns relating to repeatability/reproducibility issues with the test device and with using different technicians to measure the backset. It has been shown that for each degree of torso angle change, there is approximately 4.3 mm backset change and a 5 mm deviation in H-point could cause a 20 mm variability on backset. It has also been noted that H-point scatter around R-point can vary in all directions and that build variability can translate into significant variability in backset. Another study showed that vehicle orientation can impact backset variation and it has been recommended to use the design seating position to reduce variability. Other representatives acknowledged their desire to use the design seat back angle in measuring backset, noting that this would be the same angle that is used in other testing, like frontal impact. Additional studies to evaluate measurement variability will be presented at the January meeting.

There has also been concern for the comfort of the occupant. Representatives are starting to see customer complaints on head restraints that were built to a 50 mm backset. It was mentioned that if backset were regulated at 55 mm, then vehicles would be designed to 35-40 mm. A study was presented (HR-4-7) based on eye-ellipse data from UMTRI in which interference between the head restraint and head when the backset is 50 mm was calculated. In a seat that was designed for a 50 mm backset at 25° torso angle, with a mean driver selected seat back angle of 20°, there would be interference problem with about 35 to 40% of the occupants. At a mean driver selected seat back angle at 22°, approximately 10% of the occupants would have interference problems with the head restraint.

There has also been concern for measuring active head restraint systems using the same methods to measure passive systems. A study has been introduced using BioRID to determine loads needed to activate an active head restraint in a dynamic test, and then using those loads a test procedure would be developed to activate an active head restraint and measure the backset statically. The status of this study will be presented at the January meeting.

Discussion on this issue continues.

5.8. Gaps

5.8.1. Gaps within Head Restraint

It has been proposed that all gaps within the head restraint have a maximum dimension of 60 mm when measured using a 165 mm sphere. There is general consensus to recommend the sphere measurement requirement.

In addition to this requirement, it has also been proposed to allow gaps larger than 60 mm if the displacement tests requirements can be met when the load is applied at the gap. A concern for safety has been expressed on allowing gaps that are too large. It has been suggested that some of these concerns are addressed by the backset requirement, but limitations on the HRMD do not allow for a full evaluation of the gap and the backset requirement does not apply to the rear seats. It was also stated that the displacement test accounts the density of the foam of the head restraint.

The proposal to use the displacement test to test the gaps is still under discussion. Justification was requested to show how the displacement test addresses the safety concern of large gaps.

5.8.2. Gaps between bottom of head restraint and top of seat back

It has been proposed that gaps between the bottom of the head restraint and the top of the seat back have maximum dimension of 60 mm when measured using a 165 mm sphere. There has been an alternative proposal to allow a maximum height of 25 mm when measured using the same method to measure overall height as described in UNECE 17. It was also stated the 25 mm gap requirement is to prevent a gap that is too large. Requiring a minimum gap was established to prevent an occupant from contacting the head restraint posts or other structure when the head restraint is in the lowest position. It was noted that because of seat contours, there was concern that using the sphere to measure this gap could result in failure of gaps that would normally pass the UNECE 17 requirement or gaps that are extremely small.

This issue is still being discussed.

5.9. Head Restraint Adjustment Retention Devices (Locks)

There is general consensus to recommend that if a device is adjustable for height, then it should hold its position when loaded in the downward direction. It has been proposed that downward force of 500 N be applied to the top of an adjustable head restraint to ensure the integrity of the height retention device. Concern was expressed that this load was overly severe, the forces were being applied in the wrong direction, and that such a requirement might negatively affect active head restraint system design. Data from Hybrid III dummies was provided on the representativeness of the force levels. It was stated that if there is still a concern with the 500 N load, than justified alternatives would be considered.

It was also questioned if the measurement taken at the top of the head restraint is the correct method as it does not take into account the foam hysteresis. An alternative suggestion is to use the bottom of the head restraint as reference. Test procedures are being drafted based on this suggestion and will be reviewed at the next meeting.

5.10. Removability

There is general consensus to recommend the ability for head restraint removal via a deliberate action distinct from any act necessary for adjustment as stated in UNECE 17. There is discussion on the meaning of "a deliberate action distinct from any act necessary for adjustment." It has been proposed to allow for removal via a deliberate action distinct from any act necessary for upward adjustment. This issue is still under discussion.

5.11. Non-use Positions

5.11.1. Front Seats

It has been proposed to allow non-use positions in the front seat, as long as they automatically return to the proper position when the seat is occupied. A test procedure using the 5th percentile female Hybrid III dummy to evaluate these systems is being reviewed.

5.11.2. Rear Seats

5.11.2.1 Manually adjusted non-use positions

There is consensus to recommend regulation of non-use positions in the rear seats, as long as the position is "clearly recognizable to the occupant." There is discussion on how to objectively evaluate this requirement. One proposal is to define "clearly recognizable" as a head restraint that rotates a minimum of 60 degrees forward or aft. There was concern that this definition is too design restrictive as the sole method and additional methods have been proposed (HR-4-13). One proposal is to use a "discomfort metric" which defines the zone the head restraint is in when it is in the non-use position. Another method uses an evaluation based on the torso angle change. Other proposals were for pop-up indicators or flags.

A human factors study is being conducted to evaluate non-use position proposals, including torso angle change and indicators/flags. Data will be presented at the January meeting.

5.11.2.1. Automatically adjusted non-use positions

There is consensus, for the rear seats, to recommend regulation of non-use positions that automatically return to the proper position when the seat is occupied. A test procedure using the 5th percentile female Hybrid III dummy to evaluate these systems is being reviewed.

5.12. Energy Absorption

5.12.1 Impactor

It has been proposed to recommend the energy absorption test defined in FMVSS No. 202. This test is similar to the test defined in UNECE 17, except for the testing device and the requirement to rigidly fix the seat back during testing. Data was presented (HR-4-8) showing that the free motion head form produces equivalent results as a pendulum impactor on rigidly supported head restraint form. Addition testing will be presented at the January meeting on the comparison of pendulum and linear impactor and the effect of rigidly fixing the seat back.

5.12.1. Radius of Curvature

It has been proposed to incorporate the UNECE Regulation 17 requirement designated parts of the front of the head restraint shall not exhibit areas with a radius of curvature less than 5 mm pre- and post-test. Justification for the post-test evaluation is that there could be interior breakage that would produce a sharp edge. There is concern for the protection occupants from secondary impacts. It was stated that the pre-test requirement is very difficult to conduct under self-certification. Applying this to the rear of the head restraint is not within the scope of the gtr.

This issue is still under discussion.

5.13. Displacement Test Procedures/Adjustable Backset Locking Test

A proposal was made to incorporate into the gtr the displacement test defined in FMVSS No. 202. This test adapted the displacement test procedure in UNECE 17 to incorporate an objective evaluation of adjustable backset locking systems.

The US varies from the UNECE requirement in that the US rigidly braces the seat back, and then applies the loading. The test is conducted as follows:

- A 37 Nm load is used to establish a reference position.
- This is increased to 373 Nm, and a limit of 102 mm of displacement is applied (as in UNECE 17).
- The load is backed off to 37 Nm. The delta between initial reference load position and the current load position cannot be more than 13 mm.
- At this point, the displacement part of the test is completed.
- The fixation is removed.
- The ultimate load test is conducted. (i.e. nothing can break).

It was noted that the reason for the fixation was that the there were concerns about the variability in the return to the reference load. It was found that the test procedure was more repeatable when the seat back was braced.

The UNECE17 displacement test combines seat back and head restraint movement. From this perspective, it was suggested that this would be a much more severe test. However, it is unknown which is more stringent in terms of displacement.

Testing is being conducted to evaluate concerns and results will be discussed at the January meeting.

5.14. Dynamic Test

A proposal was made to recommend incorporation of the optional dynamic test defined in FMVSS No. 202 into the gtr as an option to the static requirements. Data was presented positively correlating the dynamic test to real-world data. There was a great deal of concern expressed by some delegates and representatives with respect to using the Hybrid III dummy in a dynamic test because the spine is not human like and the dummy does not have humanlike motion in a dynamic test. It was stated that the BioRID dummy is preferred in Europe for dynamic testing, but it was acknowledged that it was not ready for regulation. There are additional concerns about the repeatability and reproducibility of the Hybrid III in rear impacts. Data will be presented at the January meeting on this issue.

There is limited support for a dynamic test using the Hybrid III dummy, but there are no alternatives for the dynamic test to evaluate active head restraints. It was suggested that a dynamic test could be an iterative step, and the gtr can be amended when a better dummy and test procedure are available. There is also some discussion that the dynamic test be a second step to the gtr drafting process.

Discussion of this issue will continue at the next meeting.

6. List of Informal Working Group Documents

HR-1-1	Attendance List, Paris, 1-2 February 2005
HR-1-2	(USA) Final Rule
HR-1-3	(USA) Final Regulatory Impact Analysis - FMVSS No. 202 Head Restraints for Passenger Vehicles
HR-1-4	(USA) Comparison of Head Restraint Regulations FMVSS 202 (Current standard, Final Rule, and ECE 17)
HR-1-5	{Blank}
HR-1-6	Head Restraints for Rear Seating Positions
HR-1-7	(OICA) Abstract from ACEA Whiplash Test Series on Repeatability and Reproducibility of Proposed Test Procedures
HR-1-8	(USA) U.S. FMVSS No. 202 Final Rule
HR-1-9	GRSP informal group on head restraints 1st Meeting, Paris, 1-2 February 2005 Draft Summary Report
HR-1-9-Rev.1	GRSP informal group on head restraints 1st Meeting, Paris, 1-2 February 2005 Draft Summary Report
HR-2-1	(USA) The Displacement Test as an Alternative to the 60 mm Gap Requirement
HR-2-2	Head Restraint Informal Working Group Meeting - Agenda 11-13 April 2005, OICA Offices, Paris, France

HR-2-3	(Netherlands) Static geometric measurements on head restraints
HR-2-4	(USA) Justification for 254 mm width of Head Restraints on Bench Seats
HR-2-5	(Japan) Japan's Comments on Backset Requirements of FMVSS 202aS – Final Rule - Study of Variations in Backset Measurements
HR-2-6	(USA) Head Restraint Height Measurement - H-point vs. R-point
HR-2-7	(USA) Correlation of Dynamic Test - Procedure to Field Performance
HR-2-8	(USA) Justification for Load Values - FMVSS No. 202 Final Rule – Backset and Height Retention Testing
HR-2-9	BioRID ATD - Part of a Presentation from Matthew Avery / Thatcham for an EEVC WG12/20 joint meeting
HR-2-10	Neck Injuries - Real World Data - Male/Female Comparison - Raimondo Sferco/Bernd Lorenz - Ford Motor Company/BASt
HR-2-11	(Germany) Current Status of the Euro NCAP Whiplash Subgroup Bundesanstalt für Straßenwesen - Federal Highway Research Institute
HR-2-12	(Germany) Current Status of the EEVC WG 20 "Rear Impact test procedure(s) and the mitigation of neck injury" Bundesanstalt für Straßenwesen - Federal Highway Research Institute
HR-2-13	(OICA) Comment for Non Use Position of Non Use Position of Head Restraint GTR Head Restraint GTR
HR-2-14	(Netherlands) Needed Height for Head Restraints
HR-2-15	Attendance List - GRSP Informal Group Meeting on Head Restraints Paris, 11-13 April 2005
HR-3-1	Head Restraint Informal Working Group Meeting - Agenda, 13-15 June 2005, NHTSA Office, Washington, D.C., USA
HR-3-2	Japan's Comments on Draft Action Items for June 2005 - Head Restraints GTR Meeting
HR-3-3	Japan's Comments on Backset Requirements of FMVSS 202aS - Final Rule
HR-3-4	Japan's Comments on Head Restraint Height Proposal from the Netherlands
HR-3-5	Height of Head Restraint - Impact of increased height threshold of head restraints
HR-3-6	(Netherlands) Calculation needed head restraint height
HR-3-7	(Japan) Biomechanical Responses of HY-III and BioRID II (Part 1)
HR-3-8	(Japan) Biomechanical Responses of HY-III and BioRID II (Part 2)
HR-3-9	(USA) Laboratory Test Procedure for FMVSS 202aS - Head Restraints – Static Requirements
HR-3-10	(OICA) Alliance of Automobile Manufacturers - Head Restraint GTR Input
HR-3-11	Attendance List - GRSP Informal Group Meeting on Head Restraint – Washington, D.C., 13-15 June 2005
HR-3-12	(USA) Final Rule
HR-3-13	(USA) Final Regulatory Evaluation: Extension of Head Restraint Requirements to Light Trucks, Buses, and Multipurpose Passenger Vehicles with Gross Vehicle Weight Rating of 10.000 pounds or Less (FMVSS 202)

HR-3-14	(USA) An Evaluation of Head Restraints Federal Motor Vehicle Safety Standard 202, February 1982
HR-4-1	Agenda of the Head Restraint Informal Working Group Meeting - 7-9 September 2005, OICA Office, Paris, France
HR-4-2	(USA) United States' Analysis of the Need to Raise the Head Restraint Height to 850 mm
HR-4-3	(Japan) Japanese Backset Raw Data Revision B
HR-4-4	(USA) Extending the Applicability of U.S. FMVSS 202 to Light Trucks and Vans - Summary of HR-3-12 and HR-3-13
HR-4-5	(USA) U.S. Justification for "Other Collisions" in the Proposed Scope
HR-4-6	Draft Global Technical Regulation on Head Restraints
HR-4-7	(CLEPA) Head Positions, Summary of UMTRI Study and Vehicle Examples
HR-4-8	(CLEPA) Comparison between the Pendulum and the Free Motion Headform (FMH) energy dissipation test
HR-4-9	(Japan) Japan's Comments on Backset Requirements of FMVSS 202aS – Final Rule
HR-4-10	(Japan) Japan Accident Analyses for Application and Height on Head Restraints GTR
HR-4-11	(Japan) Japan Research Status for Bio-RID II Injury Parameters on Head Restraints GTR
HR-4-12	(Japan) Japan Research Status for Bio-RID II Dummy Repeatability and Reproducibility on Head Restraints GTR
HR-4-13	(OICA) Head Restraint GTR Informal Working Group - OICA Data Submission, 7-9 September 2005
HR-4-14	(UK) UK Population Stature 1993-2003
HR-4-15	(OICA) Draft Proposal on Roof Clearance for Tip Forward Seat Backs
HR-4-16	(Netherlands) Netherlands' Comparison of Two Different Calculations of "Needed Head Restraint Height".
HR-4-17	HR-4-6 (202 Draft GTR) revised as of Sept 9 2005 (HR-4-17)
HR-4-18	(OICA) Head Restraint Definition

APPENDIX

Comparison of Head Restraint Regulations
UNECE 17/FMVSS 202

Comparison of Head Restraint Regulations UNECE 17/FMVSS 202
(Current US standard, US Final Rule, and UNECE 17)

Head Restraint Component	**U.S. – FMVSS 202 (current)**	**US FMVSS 202 Final Rule**	**UNECE 17**	**Comments**
A. Application ***1. Vehicles***				
	Front outboard seating positions in passenger cars, MPVs and trucks with a GVWR ≤ 4536 kg	Front outboard and rear outboard (optional) seating positions in passenger cars, MPVs and trucks with a GVWR ≤ 4536 kg, with added exclusion for seating position adjacent to aisle on buses (more than 10 seats)	Front outboard and rear (optional) seating positions in vehicles of categories M1 and N, and of vehicles of categories M2 and M3, not covered by Regulation No. 80	-If HR present in rear seat, UNECE 17 and 202 Final Rule regulates. -UNECE 17 regulates rear center head restraints if available.
2. Requirements				
a. Height				
1. Front outboard				
A. Fixed	At least 700 mm above H-point as measured parallel to the torso reference line.	Increased to 800 mm above H-point and measured with a SAE J826 manikin. Seat back angle set at 25 degrees. Seat cushion at highest position.	Same height as FR, but measured from R-point. Seat back angle is 25 degrees or manufacturer specified. Seat cushion at lowest position	Different seat set-up and measuring techniques used.
B. Adjustable	Same as 202-fixed	Must achieve a height of 800 mm and cannot be adjusted below 750 mm. Measured with a SAE J826 manikin. Seat back angle set at 25 degrees. Seat cushion in highest position.	Same height as FR, but measured from R-point and at manufacturer's suggested angle or 25 degrees. Seat cushion in highest position.	Different seat set-up and measuring techniques used.

Head Restraint Component	U.S. – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE 17	Comments
a. Height (cont.) 2. Rear outboard	*(202 Final Rule: Rear head restraint means a rear seat back, or any independently adjustable seat component attached to or adjacent to a seat back, that has a height equal or greater than 700 mm, in any position of backset and height adjustment.)*			
A. Fixed	Not specified	If provided, minimum height of 750 mm above H-point. Measured with SAE J826 Manikin.	If provided, same height as FR, but measured from R-Point	Different seat set-up and measuring techniques used.
B. Adjustable	Not specified	If provided, no adjustment below 750 mm from H-point. Measured with SAE J826 Manikin.	If provided, same as FR, but measured from R-Point	Different seat set-up and measuring techniques used.
3. Rear Center				
	Not specified	Not specified	If provided, minimum height of 700 mm above R-point	
b. Backset				
1. Front outboard positions	Not specified	Backset limited to a maximum 55 mm as measured with HRMD. Head restraint in at any height adjustment between 750 and 800 mm, inclusive. Seat back angle set at 25 degrees. Seat cushion at highest position.	No backset specified, but there is a general requirement for the seat back angle to be set at manufacturer's suggested angle or 25 degrees and the seat cushion to be in the lowest position.	Different seat set-up and measuring techniques used.

Head Restraint Component	U.S. – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE 17	Comments
c. Width				
1. Front outboard	Minimum of 171 mm on single seats and 254 mm on bench seats	Minimum of 170 mm on single seats (outboard seats with no seat in between) and 254 mm on bench seats (outboard seats with seat in between).	Minimum of 170 mm for all seat types.	US requires wider HRs on front outboard seats with a center seat between them.
2. Rear outboard	Not specified	If provided, minimum of 170 mm for all seat types	If provided, minimum of 170 mm.	
d. Height of adjustable head restraint front surface				
	Not specified	Not specified	Minimum height of 100 mm	
e. Gaps				
1. All outboard positions	Not specified	In all positions, gap between HR and seat back and within the HR is ≤ 60 mm. A 165 mm sphere is pressed against the gap with a load no more than 5 N	-In lowest position, gap is ≤ 25, with no reference to backset adjustment. Measured along straight line between HR and seat back. -In other positions the gap ≤ 60 mm as measured with 165 mm dia. sphere. -Gaps larger than 60 mm are allowed if they pass the energy absorption test.	-UNECE 17/25 does not specify load placed on the sphere to measure gap. -UNECE 17/25 measures the gap between the HR in the lowest position and seat back differently from the gaps in the HR. -Larger gaps allowed by UNECE, but must be tested.

Head Restraint Component	U.S. – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE 17	Comments
f. HR Adjustment Retention Devices (locks)				
1. Height	Not specified	Must maintain height in highest position and at 800 mm and 750 mm for front and rear seats (if HR provided), respectively, while a downward force is applied. Seat back is rigidly constrained.	If adjustable, requires automatic locking system (UNECE 17, 5.1.1). No downward test required.	UNECE has no downward testing requirement.
2. Backset	Not specified	Under applied rearward moment, while adjusted to 800mm for front and 750mm for rear (if provided), HR must maintain any position of backset adjustment. Seat back is rigidly constrained.	Not specified.	
g. Removability				
1. Front	Not specified	Can be removed with deliberate action distinct from any act necessary for adjustment.	Same as 202 FR	
2. Rear	Not specified	Can be removed with deliberate action distinct from any act necessary for adjustment.	Same as 202 FR	

Head Restraint Component	U.S. – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE 17	Comments
h. Clearance				
	Not specified	25 mm clear space allowed where rear HRs, when seat is occupied, interfere with *roofline or rear window*.	If HR provided, 25 mm clear space allowed where interference with *vehicle structure*. Seat does not need to be occupied. Minimum height of 700mm must be maintained.	-In UNECE the 25 mm gap is measured from any vehicle structure, not just roofline or rear window as in FR. -UNECE requires a minimum seat height if HR is present. FR defines a rear HR as having a height greater than 700 mm
i. Non-use positions				
1. Front	Not specified	Not allowed	Allowed, provided HR automatically returns to proper position when seat is occupied.	
2. Rear	Not specified	Allowed, provided HR automatically returns to proper position when seat is occupied or the HR is rotated a minimum of 60° forward or rearward.	Allowed as long as non-use position is "clearly recognizable to the occupant".	US rule defines "clearly recognizable" as being rotated forward or rearward 60°.
j. Radius of Curvature				
	Not specified	In NPRM, requirement was same as UNECE 17. Requirement was deleted in final rule.	Parts of front and rear of HR shall not exhibit a radius of curvature less than 5 mm.	Deleted in FR because enforcement outweighs benefits. No commenter had info to support reg.

Head Restraint Component	U.S. – FMVSS 202 (current)	US FMVSS 202 Final Rule	UNECE 17	Comments
k. Energy Absorption				
	Not specified	Front of HR impacted with head form at v=24.1 km/h. 3ms deceleration of head form must not exceed 80gs . Impactor is linear head form with mass of 6.8 kg.	Similar to FR: Uses pendulum impactor with same weight and velocity as linear impactor. Front and rear of HR tested.	Tests in UNECE and FR are functionally equivalent. Except FR does not test rear of HR.
l. Displacement Test Procedures				
	Load is applied to back pan of seat, load is applied to head restraint after seat load is removed. 102 mm of displacement allowed with 373 Nm moment. Load is increased until 890N or seat back fails. Use spherical or cylindrical form to apply load.	Test procedure modified from 202. Seat back and HR loaded together. Moments and displacements same. Maximum load the same, seat back cannot fail. Use spherical form to apply load	Same load and displacement requirements as FR.	FR provides a detailed test procedure, including load hold times.
m. Dynamic sled test (optional)				
	Seat accelerated so the pulse falls in a corridor defined by 2-½ sine waves with amplitudes of 78 m/s^2 and 86 m/s^2. Corridor cannot be met. 95^{th} male dummy used, max rotation 45°.	New corridor based on scaled version 208 sled test. Target pulse the same as 202. 50^{th} male dummy used in any seat, HR adjusted midway between lowest and highest position and any backset position. 12° max rotation.	Not specified	