Transmitted by
the GRSP Chairperson

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World Forum for Harmonization of Vehicle Regulations

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Items 5.4. and 18.1. of the provisional agenda

1998 AGREEMENT

Decisions by consensus vote on those elements of draft global technical regulations that have not been resolved by the Working Parties subsidiaries to the World Forum

~~Final~~ Fifth progress report of the informal working group on head restraints

Transmitted by the representative of the United States of America

The text reproduced below was prepared by the representative of the United States of America on behalf of the Working Party on Passive Safety (GRSP) informal working group on head restraints. This document is referring to the development of the draft gtr on head restraints (ECE/TRANS/WP.29/GRSP/2006/14) and complementing the previous reports (ECE/TRANS/WP.29/2006/93, ECE/TRANS/WP.29/2006/135, ECE/TRANS/WP.29/2006/140 and Amend. 1) by the informal group. It is submitted to the World Forum (WP.29) and Executive Committee of the 1998 Agreement (AC.3) for consideration.

GRSP Requests for Clarification
Summary

Dynamic Test/Evaluation of Non-Static Systems

Active/re-active head restraint systems, by the function of their design, reduce the backset only when needed for the protection of whiplash injuries in a rear impact crash. When not deployed, these systems may not meet the static backset requirements. Therefore, the working group desired a way to allow an alternative test method for these systems.

Four possible alternatives were considered. First, to specify that active/re-active head restraints should be measured in the deployed position. Second, to specify less severe backset requirements for active/re-active head restraints while measuring in the undeployed position. Neither of these alternatives is considered appropriate as there is no verification that the active/re-active head restraint will deploy when needed, and if it did not deploy the head restraint would offer less protection that the group had determined was appropriate.

Third, the group considered the alternative of specifying a dynamic test. The United States FMVSS No. 202 currently includes a dynamic test as an alternative method of certifying compliance with the standard. There was a great deal of concern expressed by some delegates and representatives to using this test. These concerns include:

- The insufficient biofidelity of the Hybrid III test dummy.
- The 12° rearwards rotation limit (7% injury risk). The industry proposed a 20° limit (10% injury risk).
- Trigger corridor.

The main impediment to resolution of this issue was the dummy. The BioRID II was suggested as an alternative; however, injury criteria still need to be developed for this dummy and it will not be ready for inclusion in a regulation in the near term. While some delegates suggested the US test (with the other two issues resolved) should therefore be included as a first step, with the intention including a more advanced test and dummy at a later date. Other delegates would not accept this.

The last proposal was to delete the alternative from the gtr completely. In this scenario, Contracting Parties would still be able to incorporate alternative requirements to facilitate the active/re-active head restraints. The United States indicated that it would retain the dynamic test in its standard, but there is no guarantee for industry that these devices could be certified in other countries.

Backset

No agreement has been reach on the measurement method for backset. There are two main issues to be resolved: H-point vs. R-point and the backset limit.

The H-point is an actual measurement on a real-world seat, and therefore production differences can result in variability from seat-to-seat that manufacturers find unacceptable. The R-point is a theoretical design point, and some delegates find this unacceptable because differences between

design and production could result in insufficient backset. The alternative of allowing the Contracting Party to select either the H-point or R-point has also been considered.

A number of backset limits have been considered. Using the H-point, backset limits of 70mm and 55mm are currently under consideration. Some delegates prefer 70mm citing consumer acceptability concerns with less backset and test variability. However, data presented show that large numbers of the current fleet could meet this requirement without change, resulting in zero benefits from a standard set at that level. Using the R-point, debate has centeredcentred on whether the limit should be identical to the H-point limit or not. Some delegates argue that the limits should be identical, again citing test variability concerns. However data has been presented that the R-point limit would have to be lower than the H-point limit to provide equivalent levels of protection and benefits. Differences as high as 15mm have been suggested, with the most recent data presented suggesting the appropriate number is 7mm or greater.

~~[Placeholder for Applicability pending discussion this week.]~~

Request for AC.3

In summary, GRSP requests guidance from AC.3 on the following issues:

- Whether to include an alternative for active/re-active head restraints.
  - If an alternative should be included, what alternative should be considered (static alternative measure, US dynamic or continue efforts to develop a new dynamic test and dummy).
    - If the US dynamic is recommended, how to resolve the angle rotation limit dispute.
- Whether to specify H-point, R-point or either for backset measurement.
  - How to set the backset limit for H-point, R-point, or both.

If the AC.3 can offer guidance on these issues, GRSP would request additional time to continue discussion of some minor technical issues, including:

- Trigger corridor.
- Front contact surface.
- [Applicability.]
- [Head Restraint Height.]
- Final editorial review of the text.

I. INTRODUCTION

1. During the one-hundred-twenty-sixth session of WP.29 of March 2002, the Executive Committee of the 1998 Agreement (AC.3) 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.A.) volunteered to lead the group's efforts and develop a document detailing the recommended requirements for the gtr. The United States of America 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).

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

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

(a) An examination of the merits of the proposal in detail, outlining the pros and cons of the proposal;
(b) Consideration of other regulations on the same subject, which are listed in the compendium;
(c) A determination that the proposal addresses a problem of sufficient magnitude to warrant the development of a regulation;
(d) An examination of whether the nature, extent and cause of the problem addressed by the proposal are correctly characterized;
(e) An examination of whether the proposal provides a sufficiently effective, performance oriented approach to address the problem;
(f) A determination that the approach identified in the proposal is appropriate to address the problem; and
(g) A description of needed additional information.

4. The informal working group met to discuss the development of a gtr on head restraints on:
1-2 February 2005 in Paris, France
11-13 April 2005 in Paris, France
13-15 June 2005 in Washington, D.C., United States of America
7-9 September 2005 in Paris, France
23-26 January 2006 in Cologne, Germany
19-21 April 2006 in London, United Kingdom
12-14 September 2006 in Montreal, Canada
7-8 December 2006 in Paris, France.

5. The Contracting Parties represented on the informal working group are the Netherlands, France, Canada, Japan, Germany, Korea, 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.

6. ~~The next meeting is tentatively planned after the completion of validation testing of the R-point method of measuring backset. This meeting should occur before the May 2007 GRSP session.~~No further meetings of the informal working group is planned pending direction from AC.3.

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

II. REQUEST TO PROCEED WITH THE DRAFTING OF A GTR

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

9. Due to the United States 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 informal 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.

10. The proposed gtr will combine elements from UNECE Regulations Nos. 17, 25, and newly upgraded United States Federal Motor Vehicle Safety Standard (FMVSS) No. 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 Informal working group Meeting	June 2005
Development of draft gtr begins	June 2005
4th Informal working group Meeting	September 2005
2nd Progress Report	December 2005
5th Informal working group Meeting	January 2006
2nd Progress Report to AC.3	March 2006
6th Informal working group Meeting	April 2006

3rd Progress Report and Draft gtr to GRSP	May 2006
3rd Progress Report to AC.3	June 2006
7th Informal working group Meeting	September 2006
8th Informal working group Meeting	December 2006
4th Progress Report/Draft gtr to GRSP	December 2006
4th Progress Report to AC.3	June 2007
9th Informal working group Meeting	TBD 2007
Final Progress Report and Draft gtr to GRSP	May 2007
Submittal of Final Draft gtr to AC.3	November 2007

III. EVALUATION OF THE SAFETY PROBLEM

11. In the United States of America, 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 United States of America and their new requirements in the upgraded FMVSS No. 202 can be reviewed in working paper No. HR-1-8 (HR-1-8).

12. In the European Community, there are over 1 million total whiplash injuries a year and the cost of these injuries in the EC is estimated to be €5 to €10 billion per annum and rising (Kroonenburg and Wismans, 1999). The estimated UK cost is approximately £800 million per annum (Batchelor, 2001) (this is equivalent to £30 of every motor insurance premium).

13. In Korea, rear end collisions account for 34 per cent of all car to car collisions and cause 31 per cent of fatalities and 37 per cent of injuries. Additionally, rear impact collisions caused 260,000 neck injuries in 2002 or 57 per cent of all neck injuries in car to car collisions.

14. In Japan, rear impacts account for 30 per cent of collisions resulting in bodily injury. Of these crashes, 90 per cent of the injuries or 309,939 are minor neck injuries. Among rear impact collisions resulting in bodily injury, 81.7 per cent of male and 88 per cent of female drivers of the impacted vehicles sustained minor neck injuries.

IV. REVIEW OF EXISTING INTERNATIONAL REGULATIONS

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

- UNECE Regulation No. 17 - Uniform provisions concerning the approval of vehicles with regard to the seats, their anchorages, and any head restraints
- UNECE Regulation No. 25 - Uniform provisions concerning the approval of head restraints (Head Rests), whether or not incorporated in vehicle seats

- European Union Directive 74/408/EEC (consolidated), relating to motor vehicles with regard to the seats, their anchorages and head restraints
- European Union Directive 78/932/EEC concerning head restraint of seats of motor vehicles
- United States 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
- Korea Safety Regulation for Road Vehicles Article 99 – Head Restraints

16. Additionally, research and activities being conducted by European Enhanced Vehicle Safety Committee (EEVC) Working Group 12, EEVC Working Group 20, EuroNCAP, and Korea NCAP are also being considered.

V. DISCUSSION OF ISSUES TO BE ADDRESSED BY A GTR

17. 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 Regulation No. 17 and United States FMVSS No. 202 is provided in the Appendix 1 of this document. ~~Appendix 2 has table noting the Status of Requirements as of the end of the December 2006 informal working group meeting.~~ Appendix ~~3~~2 has a table noting the gtr requirements if the U.S. dynamic test is recommended. The informal working group has started drafting the technical rational and regulatory text for the gtr. Discussions and recommendations are reflected in the text of this draft.

A. Applicability

18. The application of a head restraint gtr will, to the extent possible, use the revised vehicle classification and definitions of Special Resolution No. 1.

19. There has been extensive discussion of the applicability of this gtr. The application of United States FMVSS No. 202 is different from UNECE Regulation No. 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 Regulation No. 17 requires head restraints in all front outboard seating positions of vehicles of category M_1, in all front outboard seating positions of vehicles of category M_2 with a maximum mass not exceeding 3,500 kg, and all front outboard seating positions of vehicles of category N_1 1/ and allows for optional

1/ As defined in Annex 7 to the Consolidated Regulation on the Construction of Vehicles (R.E.3) (document TRANS/WP.29/78/Amend.2 at last amended by Amend. 4).

type approval of head restraints optionally installed in other seating positions, or in other vehicles. There is consensus to recommend that the gtr should recommend head restraints in all front outboard seating positions for category 1-1 vehicles and for category 1-2 vehicles with a gross vehicle mass of up to 3,500 kg. Vehicles of category 2 2/ need more discussion especially on the mass limit.

20. It was proposed that the gtr, as it pertains to front outboard seats, should apply to vehicles up to 4,536 kg. The United States of America presented justification (see working paper No. HR-4-4 of the informal group), 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 per cent) rear impacts involving vehicles with a gross vehicle mass over 3,500 kg that resulted in bodily injury (impacting or impacted vehicle occupants). Vehicles with GVW up to 3500 kg account for 97.5% of rear impacted vehicles in which occupants sustain neck injury.

21. There is strong support to limit the weight of category 2 vehicles to 3,500 kg. The United States of America continues to state that it will be difficult for them to limit application of the gtr to anything less than 4,500 kg. The United States of America was asked to provide justification for applying the gtr to vehicles in the 3,500 kg to 4,500 kg weight range, but based on the data collection methods used they were unable to subdivide the data to accurately determine the portion of the benefits that could be attributed to vehicles in the 3500 kg to 4500 kg range. ~~.~~

22. [Status of Applicability]
~~This discussion will continue upon receipt of the United States of America data.~~

B. Scope

23. 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".

24. 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 accepted for recommendation by the informal working group.

C. Height of the head restraint

1. Front outboard

2/ As defined in the Special Resolution No. 1 concerning the Common Definitions of Vehicle Categories, Masses and Dimensions (document TRANS/WP.29/1045).

25. Both UNECE Regulation No. 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 United States of America has increased over the last 10 years and a higher head restraint is needed to protect these occupants (see HR-3-6). Japan presented data (see HR-4-10) showing that Japanese females and males are smaller than the United States of America 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 (see HR-4-14 and HR-6-11) that showed although their population is not increasing in size, they are tall enough to need taller head restraints.

26. 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 (see HR-4-2). ~~This data was revised to include spine straightening and it still did not support raising the height to 850 mm.~~ This data was revised to include spine straightening and also compared with the method using erect sitting height (HR-4-16). It showed that making use of automotive sitting height a 95th percentile Netherlands male needs a height of 826 mm and making use of erect sitting height a 95th percentile Netherlands male needs 849 mm. The justification cited for using the method of automotive sitting height is that ~~There is support for~~ this measurement calculation ~~because it~~ incorporates the effect of backset and it measures occupants as they sit in a vehicle.

27. The Netherlands data was suggested 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 suggested that spine straightening might not be a factor when there is a reduced backset. Additionally, it was suggested that the spine straightening research of Kroonenberg, which showed a T1 z-displacement of 34 mm (SAE paper 983158), was conducted on a standard (cushioned) car seat, and a similar research of Ono (which showed similar effects) was conducted on a rigid board. It was discussed that this phenomenon would not be as pronounced in a cushioned automotive seat.

28. It was suggested by one representative that their head restraints are built with a compliance margin of 20 mm; therefore their head restraints are being built to 820 mm. If the height of the head restraint were required to be 850 mm, this representative would need to build their head restraints to 870 mm. This statement was countered by another representative who noted that some vehicles in the fleet only have heights in between 800 mm and 820 mm. It was noted that with an 800 mm 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 (see 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.

29. The Netherlands stated that taller men are also presented in the statistics and that whiplash is a real problem in the Netherlands (50 per cent insurance payments are to whiplash, there are problems with the hospitals, etc.). In Japan, females have a higher potential of whiplash injury (see HR-4-10).

30. The United States of America reviewed their cost benefits analysis for height and backset and found that there are no benefits to increasing the height to 850 mm (HR-7-11). The benefits calculated are solely influenced by the 55 mm backset. Benefits from height do not come into account until backset is very large.

31. Based on US and Japanese data, and other data presented at previous meetings, the gtr group decided to recommend a height of 800 mm in the gtr. If benefits for increasing the height are presented at a later date, this issue can be readdressed.

2. Rear outboard

32. It was proposed that optionally installed rear outboard head restraints have a minimum height of 750 m. Additionally it was proposed 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. The United States standard requires that optionally installed rear outboard head restraints must meet the requirements of the standard. The recommendation of the group is that these head restraints, if installed, must conform to the dimensional requirements, with a 750 mm height, and static requirements, excluding backset.

3. Front center/rear center

33. There was discussion on how front center head restraints are regulated under UNECE Regulation No. 17 and how to address these restraints in the gtr; in fact 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, United States of America regulations do not have the same capability as the UNECE Regulation. In general in the United States of America, if a manufacturer chooses to optionally install a piece of equipment, 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 No. 202.

34. Some experts 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 15 per cent.

35. The informal working group recommends that front center head restraints be included in the gtr and regulated in the same manner as rear outboard head restraints (i.e. optional, no backset requirement, 750 mm height, etc.). Requirements for rear center head restraints have also been included. These head restraints have the same requirements as front center head restraints, but they do not have a height requirement (to be called a head restraint, it must have a minimum height of 700 mm).

4. Clearance exemption

36. 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.

37. 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 (see 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.

38. 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 that reducing the height of a head restraint to less than approximately 780 mm would have an impact on the benefits.

39. After a review of the fleet, it was determined that the clearance exemption is not needed for front seats for folding positions and therefore it is recommended that this exemption only be applied in cases of interference with the roofline or backlight. This discussion will be re-opened if the height of the front head restraints is raised to 850 mm. This exemption is currently used for some folding rear seats, and therefore the exemption is still being considered in those cases.

40. With regard to the seat setup, it was ~~discussed~~recommended that this exemption be applied when the seat is in the lowest position and the head restraint is in the highest position, since this would be the position of the tallest occupant. ~~There is another recommendation that this clearance be applied when the seat is in design position. Evaluation of the proposed setup is still ongoing.~~ The group ~~does~~also recommends that the measurement be taken at any point of forward or aft adjustment.

41. It was also requested that the informal working group consider convertible roofs as they are retracted. Regulatory text will be added to apply an added exclusion for convertible roofs.

D. Adjustable front head restraints – front surface height

42. It has been proposed to include in the gtr the UNECE Regulation No. 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 Regulation No. 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.

43. The Netherlands has proposed a test procedure and provided rational for the inclusion of this requirement, but a full review of the proposal by the informal group is still needed.~~For inclusion in the gtr, this requirement needs to be justified and if the method of measurement is to be changed, an objective test procedure will need to be proposed.~~

E. Head restraint width

1. Front seats

(i) Single seats

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

(ii) Bench seats

45. 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.

46. 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.

47. At this time, it is difficult to justify this requirement. Unless justification is presented this requirement will not be included in the gtr and thus all head restraints would have a minimum width of 170 mm.

2. Rear seats

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

F. Seat set up and measuring procedure for height

49. 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 manufacturer's recommended seating position as detailed in UNECE Regulation No. 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 United States of America procedure allows for results of height and backset to be compared from vehicle to vehicle. The UNECE Regulation No. 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 United States of America

procedure would result in high variations at certification. UNECE Regulation No. 17 also takes into account the difference in seating positions for different vehicle types.

50. 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 and manufacturering variability.

G. Backset

51. There is general consensus to recommend the regulation of backset, but ~~there are still~~there was intense discussions on the measuring method and backset limit. One proposal is to measure backset, with a limit of 55 mm, using the Head Restraint Measuring Device (HRMD) attached to the three dimensional H-point machine. The other proposal is to measure backset from the R-point using a translation of the measurements of the HRMD, but not the physical HRMD itself.

52. Data has been presented with regard to concerns relating to repeatability/reproducibility issues with the HRMD and three dimensional h-point machine 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. Canada gave a presentation on using the H-point method to measure backset (HR-7-5). They found good repeatability and reproducibility of measurements when the H-point machine test with its HRMD is calibrated appropriately. This presentation also discussed the issues with calibrating the HRMD & SAE manikin system. The Insurance Industry working group has proposed the GLORIA Jig as a calibration system. Delegates were asked to review the draft calibration test procedure. Some delegates and representatives expressed concerns that the GLORIA is not readily accessible, and will add an extra cost to the regulation to purchase the GLORIA. There were also questions on who calibrates the calibration device. Canada indicated that completion of the new calibration system is expected to occur within a few months. Canada also explained that the plan is not for each HRMD/H-point user to have to purchase a calibrating jig and learn how to use it. Current plan is to have 3 or 4 GLORIA jigs, and HRMD owners would be offered calibration service. The calibration test procedure will be added to the gtr Annex with permission from the Insurance Industry working group.

53. It has also been noted that H-point scatter around R-point can vary in all directions but is limited by regulatory requirements. Build variability is one of the parameters that 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.

Data was presented suggesting that there is no correlation between the differences of the H-point and R-point locations and the associated measured backset (HR-6-12).

54. There has also been concern for the comfort of the occupant. Representatives are starting to see a large number of customer complaints on head restraints that were built to a 50 mm backset with the HRMD method. It was mentioned that if backset were regulated at 55 mm, then vehicles would have to be designed to 35-40 mm, potentially resulting in a large number of customer complaints and possible head restraint removal. A study was presented (see 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 per cent of the occupants. At a mean driver selected seat back angle at 22°, approximately 10 per cent of the occupants would have interference problems with the head restraint.

55. To alleviate some of the concerns with comfort on seats that have a very upright seat back design angle. The informal working group agreed to recommend that backset be measured at manufacturers' seat back design angle.

56. OICA presented a method to measure backset, with a limit of 55 mm, using the R-point as an initial reference point and the dimensions of the HRMD. This method has been incorporated into the regulatory text and is preferred by many delegates because it reduces the ~~It is suggested that this method will improve variability and have fewer problems with~~ concerns of repeatability and reproducibility due to the seat production process and measurement method, when compared to the HRMD method. ~~This method will be validated in the next couple of months and discussions will resume once testing is complete.~~

To ~~accomdate~~accommodate both positions, it was proposed that contracting parties be allowed to designated either or both measuring methods when they incorporate the gtr into their own national regulations. Since the H-point method and the R-point method use different measuring tools, a statistical analysis was used to determine the equivalency of the height and backset limits for the two methods (HR-7-12). Several vehicle seats were measured using both methods and an analysis was conducted comparing the two sets of measurements. It was estimated that the height as measured from the H-point is equivalent to the same height value when measured from the R-point. Conversely, the R-point backset was [15 mm] less than the equivalent H-point backset. Because of the large range and limited number of the measurements used in the analysis, concerns were expressed that this method could not provide enough confidence to ensure that a seat with an unaccepatably large backset could not be produced. Some representatives support a backset limit of 55 mm for both measurement methods based on the range of measurements.

Data was presented by the US (HR-7-11) showing the effect of backset limit on the potential benefits of the gtr. This data showed a 75% loss in benefits if the backset (as measured with the HRMD and H-point) is increased from 55mm to 65 mm and zero benefits if the backset limit is set at 70 mm.

The informal working group cannot find consensus on this issue and requests the guidance of AC.3 on which or both measuring methods should be incorporated into the gtr. Addition guidance is also requested on setting the backset limit to ensure acceptable benefits.

H. Gaps

1. Gaps within head restraint

57. It is recommended that all gaps with a head restraint are evaluated to ensure a minimum level of protection for the occupant and provide appropriate relief to address rearward visibility concerns. The proposed evaluation requires that if the gap is greater than 60 mm when measured using 165 mm sphere then the gap is tested using the displacement test with the headform applied at the center of the gap. This is an existing UNECE Regulation No. 17 requirement and is providing appropriate protection for the occupant.

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

58. It was initially ~~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 Regulation No. 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 Regulation No. 17 requirement or gaps that are extremely small.

59. It is recommended that gaps can be measured using either of the proposed methods. It recommended the for gaps between the bottom of the head restraint and the top of the seat back have either maximum dimension of 60 mm when measured using a 165 mm sphere or a maximum height of 25 mm when measured using the same method to measure overall height as described in UNECE Regulation No. 17, and the gap for non-vertically adjustable head restraints should have a maximum dimension of 60 mm.

I. Head restraint height adjustment retention devices (locks)

60. 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.

61. 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 was made to use the bottom of the head restraint as reference. New regulatory text and test procedures were drafted (HR-6-9) and included in the regulatory text.

J. Removability

62. There is consensus to recommend the ability for head restraint removal via a deliberate action distinct from any act necessary for adjustment as stated in UNECE Regulation No. 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. The informal working group has agreed on recommended language for the gtr to reflect this concept.

K. Non-use positions

1. Front seats

63. 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 or a human surrogate to evaluate these systems has been added to the gtr.

There is addition ongoing discussion to allow any validated method used to determine a non-use position in the rear seats, be allowed as a method to evaluate non-use in the front seats.

2. Rear seats

(i) Manually adjusted non-use positions

64. 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 (see HR-4-13).

65. A human factors study was conducted to evaluate the effectiveness of a 5º, 10º, and 15º torso angle degree change in causing an occupant to move the head restraint out of the non-use position

(HR-5-5). Based on the results of this study, the informal working group agreed to recommend the 10º torso angle change option as an alternative.

66. The use of labels to determine a non-use position was evaluated. Some representatives and delegates support the use of labels since these head restraints are optional, and a label in a non-use position is better than no label at all. Moreover, the need for labels was suggested because the use of the torso angle change method or discomfort metric may be incompatible with the installation on child restraints. Some delegates do not support the use of labels, because there are already too may labels in the vehicles and, based on the U.S.A. study, the labels were ineffective in causing the occupant to move the head restraint out of the non-use position, although 50 per cent of those questioned understood what the label meant, and an additional 30 per cent understood that the head restraint was adjustable. To accommodate all views, the working group recommends that ~~in the gtr~~ labels ~~will~~ be ~~recommended as~~ an optional method to be accepted by the Contracting Party. Based on the available data, Contacting Parties would be able to ~~can~~ choose the level of risk they are comfortable with.

67. Another proposal under consideration is a "discomfort metric" which defines the zone the head restraint is in when it is in the non-use position. This concept was accepted for recommendation by the working group, but the appropriate dimensional criteria needs to be determined. Two studies were conducted by OICA to evaluate the criteria. One study (HR-8-11) showed that the thickness of the head restraint is more important than the height of the lower edge of the head restraint in causing the occupant to move the head restraint from a non-use position to an in-use position. It also showed that when dimensions of the "discomfort metric" are such that they would produce a 10 degree torso angle change, the occupant responses are similar. The other study showed when the discomfort metric dimensions are the same as current seat designs, a large percentage of small females can recognize the head restraint is out of position.

68. The informal informal working group is reviewing the data presented at the last meeting and will evaluate the proposals for the next meeting.

(ii) Automatically adjusted non-use positions

69. 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 or a human surrogate to evaluate these systems has been added to the gtr.

L. Energy absorption

1. Impactor

70. 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 Regulation No. 17, except for the testing device and the requirement to rigidly fix the seat back during testing. Data was presented (see HR-4-8) showing that the free motion head form produces equivalent results as a pendulum impactor on rigidly supported head restraint foam. Additional testing was presented at the January 2006 meeting on the comparison of pendulum and linear impactor and the effect of rigidly fixing the seat back.

The informal working group agreed to recommend a test procedure that did not specify a type of impactor, but rather a required energy. This would allow the linear impactor, the free motion impactor, or the pendulum impactor to be used for testing. Additionally, the informal working group agreed to recommend running the test without fixing the seat back.

2. Radius of curvature

71. It has been proposed to incorporate the UNECE Regulation No. 17 requirement that 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 suggested for the post-test evaluation is that there could be interior breakage that would produce a sharp edge. There is concern for the protection of occupants from secondary impacts. It was suggested 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.

72. An objective test procedure was not developed to measure radius of curvature and the group recommends that the concerns for this evaluation be addressed in the technical rational of this gtr.

M. Displacement test procedures/adjustable backset locking test

73. A proposal was made to incorporate in the gtr a test procedure that combines the displacement test evaluation with an evaluation of adjustable backset locking systems. This test is similar to the displacement test in UNECE Regulation 17, but it requires specific measurements to be taken throughout the testing to insure an adjustable backset held in its forwardmost position of adjustment.

74. In the original proposal it was recommended that the testing be conducted when the seat back is rigidly fixed. The reason for the fixation was to address concerns about the variability in the return to an inital reference load. It was found that the test procedure was more repeatable when the seat back was braced. The UNECE Regulation No. 17 displacement test combines seat back and head restraint movement. From this perspective, it was suggested that fixing the seat back would be a much more severe test. However, it is unknown which is more stringent in terms of displacement. Therefore, it is recommended that the testing be conducted without rigidly fixing the seat back.

75. There had been considerable discussion on whether to include the backset retention requirements. Some believe that if an occupant adjusts their head restraint backset so that it is less than the requirement, then they should have some assurance that it will maintain that position when loaded. Some experts disagree with this concept stating that it would eliminate adjustable backsets and that the head restraint already has to meet the backset requirement. Other delegates support this requirement, but only for the required head restraints and not the optionally installed head restraints. It was suggested that there may be incompatibilities with non-use positions methods and the retention requirements. In this discussion it was noted that in the US test, on which theoriginal proposal was based, the evaluation of the adjustable retention requirement was performed on all head restraints, regardless of whether they were adjustable or not. It was suggested that, although a head restraint can be designed to pass the test, it will unnecessarily drive firmer head restraints. The gtr will be drafted so that the UNECE Regulation 17 test can be used for all seats and the Contacting Party can choose to apply the modified US test only when adjustable backsets are present.

N. Dynamic Test/Evaluation of Non-Static Systems

76. With the incorporation of a static backset requirement, it is important to provide an alternative way to evaluate active/re-active head restraint systems. These systems, by the function of their design, reduce the backset only when needed for the protection of whiplash injuries in a rear impact crash. When these systems are in their normal drivng position, they may have a larger static backset.

77. 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. Additionally, there was a discussion on the injury criteria. The U.S.A. recommended a 12 degree head-to-torso rotation limit. Many countries and representatives would suggest a 20 degree head-to-torso rotation criteria. US data shows that increasing the rotation limit would increase the risk of injury from 7 per cent to 10 per cent. A question was asked of all countries "…what is an acceptable risk?" Consensus was not reached on this issue. Furthermore, some representatives suggested that the envisaged dynamic test has an additional unsolved boundary conditions, such as triggering of the active/re-active head restraints in the sled test and the measurement procedure for the head-to-torso rotation.

78. It was suggested that the BioRID dummy is preferred for dynamic testing, but it was acknowledged that it was not ready for regulation. The informal working group considered using the BioRID dummy as a tool to activate the non-static systems under the same testing conditions as the U.S.A. dynamic test, but consensus could not be reached on injury criteria and their were still outstanding concerns on the reproducibility of the BioRID data.

79. A fully regulated dummy and a dynamic whiplash evaluation test are considered to be a longer term solution to the whiplash problem. To address the injuries quickly, it was suggested that the U.S.A. dynamic test could be an iterative step, and the gtr can be amended when a better dummy and test procedure are available. For some delegates, agreement to recommend the dynamic tests is dependent on a commitment from AC.3 to continue efforts to develop a better test and dummy. Unfortunately, the informal working group reached an impass concerning this proposal.

80. To resolve the issue of developing a regulation that would not hinder the production of active/re-active systems, it was suggested that these systems be measured staticly. A procedure to measure these systems in the activated/deployed position was considered, but concensus could not be reached on how to activate/deploy the system. This impass was similar to that above. Some delegates wanted to use the BioRID dummy, and other delegates could not accept this dummy because it is not regulated.

81. It was suggested that the non-static (active/re-active) systems be measured statically, but that they would be required to meet a less stringent backset requirement. To realize this suggestion a definition of either a static system or a non-static system is needed. Additonally, a justified proposal for a backset limit is needed. ~~For the group to fully support this direction, an action plan, with a timeline, for the development of a dynamic whiplash evaluation test and regulated dummy would~~

~~need to be discussed in the gtr Final Report and gtr technical rational. OICA has been tasked to develop a definition for either a static or non static system by the end of January 2007. Further discussion on this issue will continue after the proposed language is submitted.~~
This direction was determined to be unsatisfactory because there is no verification that the active/re-active head restraint will deploy when needed, and if it did not deploy the head restraint would offer less protection that the group had determined was appropriate.

Another proposal was to delete the alternative from the gtr completely. In this scenario, Contracting Parties would still be able to incorporate alternative requirements to facilitate the active/re-active head restraints. The United States indicated that it would retain the dynamic test in its standard, but there is no guarantee for industry that these devices could be certified in other countries.

82. The informal group could not find consenses on this issue and requests guidance from AC.3 on whether to include an alternative for active/re-active head restraints, and if an alternative should be included, what alternative should be considered (static alternative measure, US dynamic or continue efforts to develop a new dynamic test and dummy). If the US dynamic is recommended, the group also requests guidancehow to resolve the angle rotation limit dispute. ~~For the long term solution to reducing whiplash injuries, the informal working group recommends that research continue towards the development of a whiplash evaluation test and a whiplash dummy. The ongoing work in EEVC was acknowledged, but cooperation of countries outside of Europe was strongly encouraged. It was suggested that the GRSP would be an appropriate place for a centralized international cooperation.~~

VI. 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 UNECE Regulation No. 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) United States 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
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 gtrInput
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 United States FMVSS 202 to Light Trucks and Vans - Summary of HR-3-12 and HR-3-13
HR-4-5	(USA) United States 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 HeadRestraints 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 9 September 2005 (HR-4-17)
HR-4-18	(OICA) Head Restraint Definition
HR-5-1	Meeting Agenda
HR-5-2	Draft GTR regulatory text
HR-5-3	(OICA) Non-Use Position proposal
HR-5-4	US Measurement Variability Presentation
HR-5-5	US Non-Use Position Study
HR-5-6	US Energy Absorption Test
HR-5-7	(OICA) Head Restraint Height Clearance
HR-5-8	(UK) Rear Impact Dummy Research
HR-5-9	(OICA) Backset Complaint Data
HR-5-10	US Measurement Variability Comparison
HR-5-11	(OICA) Dummy Performance Comparison
HR-5-12	(CLEPA) Dynamic tests with control yielding seats
HR-5-13	(OICA) Head Restraint Applicability data
HR-5-14	(Canada) Head Restraint Comparison Methods
HR-5-15	Status of Euro NCAP
HR-5-16	ESV Paper: The Role of Seatback and Head Restraint Design Parameters on Rear Impact Occupant Dynamics
HR-5-17	US Energy Absorption Test report
HR-5-18	(Japan) Presentation on Accident Data
HR-5-19	(Japan) Presentation on Reproducibility of Dummy Data
HR-5-20	Meeting Minutes – January 2006
HR-5-21	Gtr regulatory text at end of meeting 1/27/06
HR-5-22	Draft gtr regulatory text for Height Retention of Head Restraints
HR-5-23	US Head Restraint Non-Use Position Report
HR-6-1	Meeting Agenda
HR-6-2	Draft gtr regulatory text - April 14, 2006
HR-6-3	(OICA) Test procedure for backset measurement from R-point
HR-6-4	Draft gtr regulatory text - April 21, 2006
HR-6-5	(Japan) Hybrid III T1G for whiplash evaluation in a dynamic test
HR-6-6	(OICA) Dimensional drawings for document HR-6-3
HR-6-7	(France) Consideration for measuring active head restraints

HR-6-8	(CLEPA) Test Procedures for Energy Dissipation Test
HR-6-9	(CLEPA) Foam Influence on height retention
HR-6-10	(Japan) Example of Gap greater than 60 mm
HR-6-11	(UK) Head Restraint Height Calculations
HR-7-1	Agenda for 7th Head Restraint Informal Meeting
HR-7-2	Head Restraint gtr regulatory text –Sept 12, 2006
HR-7-3	Head Restraint gtr regulatory text - Sept 14, 2006
HR-7-4	Alliance/OICA Head Restraint Backset Measurement Study
HR-7-5	Canada – Measuring Backset with HRMD
HR-7-6	The Current Status of Head Restraint Regulation in Korea
HR-7-7	JMLIT Comment to the New French Dynamic Backset Proposal
HR-7-8	OICA - Trigger point in dynamic test procedure
HR-7-9	JMLIT Comment for Height on Head Restraint gtr
HR-7-10	JMLIT Comment for New Backset Measurement Procedure
HR-7-11	US Height & Backset Benefits
HR-7-12	US Benefits calculation – H-point vs R-point
HR-8-1	Agenda Meeting - December 2006
HR-8-2	Gtr regulatory text
HR-8-3	Technical rational for gtr
HR-8-4	US Dynamic Testing of Active Head Restraints
HR-8-5	Revised gtr regulatory text - US and Canada comments
HR-8-6	Gtr regulatory text Biorid - France
HR-8-7	Annex 8_Biorid spec - France
HR-8-9	Biorid_Fx
HR-8-10	OICA_PC-HR Test Method
HR-8-11	Alliance-NHTSA HR presentation –FINAL
HR-8-12	NL RDW Comparison of Methods

Note: All the documents of the informal group on head restraints are available at: http://www.unece.org/trans/main/welcwp29.htm

Appendix 1

Comparison of head restraint regulations UNECE Regulation No. 17 / FMVSS No. 202
(Current U.S.A: standard, U.S.A. final rule, and UNECE Regulation No. 17)

Head Restraint Component	US – FMVSS No. 202 (current)	US - FMVSS No.202 Final Rule (FR)	UNECE Regulation No 17	Comments
A. Application 1. Vehicles				
	Front outboard seating positions in passenger cars, MPVs and trucks with a GVWR ≤ 4,536 kg	Front outboard and rear outboard (optional) seating positions in passenger cars, MPVs and trucks with a GVWR ≤ 4,536 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 M_1 and N_1, and of vehicles of categories M_2 up to 3,500 kg (paras. 5.3.1. to 5.3.2)	-If head restraints (HR) present in rear seat, UNECE Regulation No. 17 and 202 Final Rule regulates. -UNECE Regulation No. 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	US – FMVSS 202 (current)	US - FMVSS 202 Final Rule	UNECE Regulation No. 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	US – FMVSS 202 (current)	US - FMVSS 202 Final Rule	UNECE Regulation No. 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.	United States 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 Regulation Nos. 17 and 25 does not specify load placed on the sphere to measure gap. UNECE Regulation Nos. 17 and 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	US – FMVSS 202 (current)	US - FMVSS 202 Final Rule	UNECE Regulation No. 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 Regulation No. 17, para. 5.1.1). No downward test required.	UNECE has no downward testing requirement.
2. Backset	Not specified	Under applied rearward moment, while adjusted to 800 mm for front and 750 mm 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	US – 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 700 mm 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".	United States rule defines "clearly recognizable" as being rotated forward or rearward 60°.
j. Radius of Curvature				
	Not specified	In NPRM, requirement was same as UNECE Regulation No. 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	US – FMVSS 202 (current)	US - FMVSS 202 Final Rule	UNECE Regulation No. 17	Comments
k. Energy Absorption				
	Not specified	Front of HR impacted with head form at v=24.1 km/h. 3 ms deceleration of head form must not exceed 80 gs. 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. 95th male dummy used, max rotation 45°.	New corridor based on scaled version 208 sled test. Target pulse the same as 202. 50th male dummy used in any seat, HR adjusted midway between lowest and highest position and any backset position. 12° max rotation.	Not specified	

Appendix 2: Head Restraint gtr – Status of Requirements (December 2006)
Front outboard: mandatory installation; Rear outboard and front centre: optional, but if fitted, they must meet

Dimensional Requirements

Seating Position	Height (5.1.1)	Width (5.1.2)	Gaps within HR (5.1.3)	Gaps between HR and seat back top (5.1.4)	Backset (5.1.5)
Front outboard (static system)	*Minimum of 800 mm in at least 1 position. *Minimum of 750 in any use position. *Exemption if roof contact	Minimum of 170 mm	Gaps > 60 mm must meet max 102 mm rearward displacement. Procedure: 165 mm sphere	*Not adjustable: max 60 mm. *Adjustable: max 25 mm when measured with linear ruler or max 60 mm when measured with 165 mm sphere	*[55-70] mm. Procedure: HRMD -or- *[40-55] mm. Procedure: R-point and FARO arm
Front outboard (non-static system) - Same as front outboard static system, except for backset	Same as above	Same as above	Same as above	Same as above	*[80] mm. Procedure: HRMD -or- *[80] mm. Procedure: R-point and FARO arm
Front centre	*Minimum of 750 mm in any use position. *Exemption if roof contact	Same as above	Same as above	Same as above	- No requirement
Rear outboard	Same as above	Same as above	Same as above	Same as above	- No requirement
Rear centre	No height requirement (not regulated as a head restraint if height is less than 700 mm)	Same as above	Same as above	Same as above	- No requirement

Static Requirements

Seating Position	Energy absorption front surface (5.2)	Adjustable height retention (5.2)	Displacement Test & Backset retention (5.2)	HR strength (5.2)	Non-use positions (5.4)	Removability (5.5)
Front outboard (static system)	Max 80g/3ms. Procedure: 165 mm sphere impact	Downward movement max 25 mm. Procedure: cylinder with 500N downward force	Max 102 mm rearward displacement. Procedure: see Reg. No. 17 ——— Adjustable backset: Contracting Party Option to test in rearmost (see above) or in any adjustment (see above procedure with additional displacement evaluation)	Resist load of 890 N	(Front passenger only) - Automatic return	Allowed when accompanied with a distinct action other than upward adjustment.
Front outboard (non-static system)	Same as above	Same as above	Max 102 mm rearward displacement. Procedure: see Reg. No. 17	Same as above	(Front passenger only) - Automatic return	Same as above
Front centre Rear centre Rear outboard	Same as above	Same as above	Max 102 mm rearward displacement. Procedure: see Reg. No. 17 ——— Adjustable backset: Contracting Party Option to test in rearmost (see above) or in any adjustment (see above procedure with additional displacement evaluation)	Same as above	Contracting Party Option: Either Automatic return, 10° torso angle change, 60° rotation, or discomfort metric Or all of the above or labels	Same as above

*Numbers in parenthesis in title row correspond to text in HR-8-2 **Definition required for either "static system" or "non-static system"

Appendix 23: Head Restraint gtr – If U.S.A. Dynamic Test is recommended
Front outboard: mandatory installation; Rear outboard and front centre: optional, but if fitted, they must meet

Dimensional Requirements

Seating Position	Height (5.1.1)	Width (5.1.2)	Gaps within HR (5.1.3)	Gaps between HR and seat back top (5.1.4)	Backset (5.1.5)
Front outboard (static system)	*Minimum of 800 mm in at least 1 position. *Minimum of 750 in any use position. *Exemption if roof contact	Minimum of 170 mm	Gaps > 60 mm must meet max 102 mm rearward displacement. Procedure: 165 mm sphere	*Not adjustable: max 60 mm. *Adjustable: max 25 mm when measured with linear ruler or max 60 mm when measured with 165 mm sphere	*[55-70] mm. Procedure: HRMD -or- *[40-55] mm. Procedure: R point and FARO arm
Front outboard (Dynamic system)	Same as above	Same as above	Same as above	Same as above	-No requirement
Front centre (Static or Dyanmic)	*Minimum of 750 mm in any use position. *Exemption if roof contact	Same as above	Same as above	Same as above	-No requirement
Rear outboard (Static or Dynamic)	*Minimum of 750 mm in any use position. *Exemption if roof contact	Same as above	Same as above	Same as above	-No requirement
Rear centre (Static or Dynamic)	No height requirement (not regulated as a head restraint if height is less than 700 mm)	Same as above	Same as above	Same as above	-No requirement

Static Requirements

Seating Position	Energy absorption front surface (5.2)	Adjustable height retention (5.2)	Displacement Test & Backset retention (5.2)	HR strength (5.2)	Non-use positions (5.4)	Removability (5.5)
Front outboard (static system)	Max 80g/3ms. Procedure: 165 mm sphere impact	Downward movement max 25 mm. Procedure: cylinder with 500N downward force	Max 102 mm rearward displacement. Procedure: see Reg. No. 17 _____ Adjustable backset: Contracting Party Option to test in rearmost (see above) or in any adjustment (see above procedure with additional displacement evaluation)	Resist load of 890 N	(Front passenger only) -Automatic return	Allowed when accompanied with a distinct action other than upward adjustment.
Front outboard (dynamic)	-no requirement	-no requirement	-no requirement	-no requirement	(Front passenger only) -Automatic return	Allowed when accompanied with a distinct action other than upward adjustment.
Front Centre Rear Outboard (static)	Max 80g/3ms. Procedure: 165 mm sphere impact	Downward movement max 25 mm. Procedure: cylinder with 500N downward force	Max 102 mm rearward displacement. Procedure: see Reg. No. 17 _____ Adjustable backset: Contracting Party Option to test in rearmost (see above) or in any adjustment (see above procedure with additional displacement evaluation)	Resist load of 890 N	Contracting Party Option: Either Automatic return, 10° torso angle change, 60° rotation, or discomfort metric Or all of the above or labels	Allowed when accompanied with a distinct action other than upward adjustment.

Static Requirements

Seating Position	Energy absorption front surface (5.2)	Adjustable height retention (5.2)	Displacement Test & Backset retention (5.2)	HR strength (5.2)	Non-use positions (5.4)	Removability (5.5)
Front Centre Rear Outboard (dynamic) (5.3)	No requirement	No requirement	No requirement	No requirement	Contracting Party Option: Either Automatic return, 10° torso angle change, 60° rotation, or discomfort metric Or all of the above or labels	Allowed when accompanied with a distinct action other than upward adjustment.
Rear centre (static)	Max 80g/3ms. Procedure: 165 mm sphere impact	Downward movement max 25 mm. Procedure: cylinder with 500N downward force	No requirement	Resist load of 890 N	Contracting Party Option: Either Automatic return, 10° torso angle change, 60° rotation, or discomfort metric Or all of the above or labels	Allowed when accompanied with a distinct action other than upward adjustment.
Rear Centre (dynamic) (5.3)	No requirement	No requirement	No requirement	No requirement	Contracting Party Option: Either Automatic return, 10° torso angle change, 60° rotation, or discomfort metric Or all of the above or labels	Allowed when accompanied with a distinct action other than upward adjustment.

*Numbers in parenthesis in title row correspond to text in HR-8-2

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