Transmitted by the expert from GRSP Chairperson

Informal document No. **GRSP-42-34**
(42nd GRSP, 11-14 December 2007,
agenda item 3(b))

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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 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.

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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.
8-9 November 2007 in Basildon, United Kingdom.

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.

6. Representatives from European Association of Automotive Suppliers (CLEPA) and International Organization of Motor Vehicle Manufacturers (OICA) are also participants.

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. In December 2004, the United States of America 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. The gtr was developed per 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
Formal gtr to GRSP	May 2007
4th Progress Report to AC.3	June 2007
9th Informal working group Meeting	November 2007
Final Progress Report and formal gtr to GRSP	December 2007
Submittal of Final gtr to AC.3	March 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. Discussions and recommendations concerning the development of the gtr, which are not already addressed in the technical rational of the gtr, are reflected in this report.

A. Height of the head restraint

1. Front outboard

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 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 this measurement calculation 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. There are concerns that the method in which the height is measured may not reflect the effective height that would be needed to address the safety concerns of taller occupants. The have been some proposals put forth to improve the measurement method, but they were not yet fully developed for inclusion in the gtr (HR-10-2).

31. To resolve this issue the Working Party of Experts sought guidance from AC.3. AC.3 provided instruction through WP29-143-23 rev 1 to stated that the height requirement for the gtr would be 800 mm, and that the discussion on increasing the height requirement to 850 mm and/or revising the measurement method be continued in Phase 2 to this gtr.

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 with a minimum height of 700 mm. 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).

F. Seat set up and measuring procedure for static measurements

50. The method of measuring static measurements was discussed. Some recommended 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.

The Working Party of Experts had difficulty coming to consensus on this issue and sought guidance from AC.3. AC.3, per document WP29-143-23 rev1, instructed that all static measurements, except for backset, will use the R-point as the required reference point and that backset should be taken with the H-point as the required reference point, although some Contracting Parties may choose to allow backset to be measured with R-point as the required reference.

G. Backset

51. There is general consensus to recommend the regulation of backset, but 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 (GRSP-41-23), using the R-point as the 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 concerns of repeatability and reproducibility due to the seat production process and measurement method, when compared to the HRMD method.

The Working Group ofExperts had difficulty in finding consensus to choose one method over the other and sought guidance from AC.3. AC.3, per document WP29-143-23 rev 1, instructed that the gtr allow Contracting Parties and regional economic integration organizations the option of allowing manufacturers a choice between H-point and R-point, so that manufacturers which did not wish to market their vehicles in other countries would not have to incur potential expenses in retesting their head restraints to measure backset from the H-point.

H. Gaps

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

58. It was initially 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.

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. Additionally, 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. Further discussion of the Hybrid III option was suspended, as it is expected that research to develop a single dynamic test would supersede efforts to revise the Hybrid III dynamic option. However, if future information led to different conclusions used to develop the existing procedure and criteria (such as the trigger point or head-to-torso angle rotation), amendments could be made to this option.

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. But the Working Party of Experts is recommending that the option for a dynamic test using the BioRID II test dummy be recognized in this gtr. A section is reserved in the regulatory text to be use for the incorporation of amendments to include test procedures, performance criteria and associated corridors for the BioRID II dummy.

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.

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. The Working Party of Experts recommends and AC.3 agreed to initiate work for Phase 2 to the gtr which will comprise of the development of full system dynamic test procedures, injury criteria, and associated corridors for the BioRID II dummy.

81. Ultimately, it was agreed that for those Contracting Parties which would like to encourage the development of "active" head restraints, but are not comfortable with the dynamic options at this time, the Working Party of Experts is recommending that they be allowed to exempt "active" head restraints in their national legislation. The language of the exemption is purposefully left vague in the gtr to allow these parties to either fully or partially exempt these head restraints and/or to include conditions on the exemption as they deem appropriate in their country.

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
GRSP-41-3	(Japan) Head Restraint gtr - Backset Test Programme
GRSP-41-4	(Japan) Proposal to set up the head restraints gtr phase
GRSP-41-12	(USA) Head restraint gtr
GRSP-41-21	(OICA) Customer study - shingled head restraints
GRSP-41-20	(USA) Head restraint draft gtr
GRSP-41-22	(USA) Head restraint gtr - Backset limit
GRSP-41-23	(OICA) Gtr on head restraints: Backset measuring method - Analyses of H-point and R-point method
GRSP-41-26	(USA) Proposal for draft amendments to draft global technical regulation (gtr) on head restraints
GRSP-41-27	(OICA) Gtr on head restraints: Triggering of active systems in sled test
GRSP-41-34	(USA) Fifth progress report of the informal group on head restraints
GRSP-41-35	(OICA) OICA test programme on backset measurement

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: <u>Rear head restraint</u> 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	
