United Nations ECE/TRANS/WP.29/2020/86

# Economic and Social Council

Distr.: General
7 April 2020

Original: English

## Economic Commission for Europe

Inland Transport Committee

### World Forum for Harmonization of Vehicle Regulations

**181st session**
Geneva, 23-25 June 2020
Item 14.6. of the provisional agenda
**Consideration and vote by AC.3 of draft UN GTRs and/or draft amendments to established UN GTRs**
**Proposal for amendments to a UN GTR, if any:**
**Proposal for Amendment 1 to UN GTR No. 7 (Head restraints)**

# Final progress report of the informal working group on Phase II of UN GTR No. 7

### Submitted by the Working Party on Passive Safety *

The text reproduced below was adopted by the Working Party on Passive Safety (GRSP) at its sixty-fifth session (ECE/TRANS/WP.29/GRSP/66, para. 5). It is based on ECE/TRANS/WP.29/GRSP/2019/21. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Executive Committee of the 1998 Agreement (AC.3) for consideration at their June 2020 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2020 as outlined in proposed programme budget for 2020 (A/74/6 (part V sect. 20) para 20.37), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

# I. Objective of this proposal

1. The representative of Japan proposed the development of Phase 2 of UN GTR No. 7 at the twenty-seventh session of the Executive Committee (AC.3) of the 1998 Agreement. Additional amendments proposed by the United States of America were incorporated, [1] as well as the establishment of an informal working group for developing Phase 2. IWG was mandated to discuss appropriate methods for testing and evaluating injuries due to rear-impact crashes.

# II. Background

2 At its 143rd session in November 2007, the World Forum for Harmonization of Vehicle Regulations (WP.29) agreed to provide guidance to GRSP on developing the draft UN GTR on head restraints (ECE/TRANS/WP.29/1064, para. 81) and decided that Phase 2 of the UN GTR should consider (WP.29-143-23-Rev.1):

(a) The head restraint height of 850 mm;

(b) The appropriate dynamic test, including the test procedure, injury criteria and the associated corridors for the Biofidelic Rear Impact Dummy II (BioRID II).

3. At its 148th session in June 2009, the Executive Committee of the 1998 Agreement (AC.3) agreed to the two-step approach suggested by the representatives of the United Kingdom of Great Britain and Northern Ireland and of the United States of America. This approach considers whether BioRID II can more effectively address injuries occurring in low-speed, rear-impact crashes and focuses on reducing injuries in higher speed, rear-impact crashes as a second step. At its 149th session, in November 2009, Japan submitted to AC.3 a proposal for developing amendments to the UN GTR, prepared jointly with the United Kingdom and the United States of America, and a revised timetable. AC.3 agreed to the development. As a first step, the amendment work would develop a low-speed dynamic test using the BioRID II dummy. The first issue was defining the effective height of the head restraint. Detailed discussions on dummies would be conducted by a Technical Evaluation Group (TEG), which was to be established under the auspices of the informal group. Drawings detailing the uniform specification of the test tools would be developed and provided to the secretariat as reference material.

4. To address minor neck injuries (Maximum Abbreviated Injury Scale 1 (MAIS)) that occur in low-speed and rear-impact crashes, insurance industry groups – such as the International Insurance Whiplash Prevention Group (IIWPG), Insurance Institute for Highway Safety (IIHS) and Thatcham – conducted dynamic evaluations of seats. The European New Car Assessment Programme (EuroNCAP) introduced dynamic evaluations of seats in 2008, and the Japanese New Car Assessment Programme (JNCAP) introduced dynamic evaluations of seats in 2009. Testing and evaluation methods varied from one programme to another. Additionally, the European Enhanced Vehicle-safety Committee (EEVC) Working Group 12 had investigated which appropriate dynamic test to address minor injuries in low-speed crashes, including the test procedure, injury criteria and the associated corridors for the BioRID II dummy.

5. Another review of the initial data of the United States of America showed that while a number of AIS 2 and AIS 3 injuries occur in rear impact crashes over 18 km/h, most of the neck injuries – which are the focus of this UN GTR and which can be evaluated on a rear impact dummy – are AIS 1. For AIS 1 injuries, approximately an equal number of crashes occur below or above 18 km/h. Research from Japan showed similar trends, with a significant number of long-term minor neck injuries occurring in 16 – 25 km/h range (www.unece.org/trans/doc/2010/WP.29grsp/GTR7-02-16e.pdf). An evaluation of research, entitled "Recommendations for a Low-speed Rear Impact Sled Test Pulse", conducted by EEVC concluded that most long-term, minor neck injuries (longer than one month) are sustained at speeds between 16 km/h and 25 km/h (www.eevc.org/publicdocs/EEVC_WG20_

[1] ECE/TRANS/WP.29/2008/115, ECE/TRANS/WP.29/2009/47 and ECE/TRANS/WP.29/2009/48

Pulse_Recommendations_Sept_2007.pdf). The United States of America in 2019 evaluated several dummies and compared them to cadaver testing at 24 km/h. Results can be used to help address the long-term minor neck injuries.

6. Although previous discussions differentiated between "low speed" and "high speed", all the research being conducted is at speeds that could be considered "low speed" when considering short-term and long-term minor neck injuries. Instead of focusing on test speed, IWG should take a comprehensive approach to determine the most appropriate test pulse or test pulses to mitigate minor neck injuries and provide a comparable level of benefits as in the existing UN GTR No.7 requirements. The group may consider options which would provide additional benefits for focusing long-term injuries in the time frame of the work schedule, but if this work was not completed, any discussion of further work in this area would take place at a future date.

7. At the 153rd session of the WP.29, an amendment proposal to ToR to the effect that the dynamic evaluation method under study should focus on reducing injuries that occur in low-speed, rear-impact crashes was submitted jointly by Japan, the United Kingdom and the United States of America. The amended ToR was adopted by GRSP in December 2012 and approved by WP.29 in June 2013.

8. At the 154th session of the WP.29, the possibility of a delay in the injury criteria work of Japan and the United States of America that could hinder the satisfactory conclusion of the work was reported on. The United States of America also questioned whether the dummy drawing package and other dummy info should be incorporated into a separate UN GTR. It was decided to develop a resolution linking the 1958 and 1998 Agreements, and WP.29 was suggested to discuss this further.

9. At the 157th session of the WP.29, the representative of the United Kingdom, on behalf of the Chair of the IWG, reported on the difficulty of finalizing the work on replacing the Hybrid III with BioRID II within the timeframe, and that the current projected delivery of injury criteria would require a 12-month extension of the mandate. AC.3 consented to an extension until December 2013.

10. At the 158th session of the WP.29, a protocol was proposed to manage drawings, calibration and maintenance procedures associated with test tools referenced by UN Regulations and UN Global Technical Regulations in the framework of the 1958 and 1998 Agreements (ECE/TRANS/WP.29/2012/124 and WP.29-158-19). WP.29 adopted ECE/TRANS/WP.29/2012/124 as amended by WP.29-158-19.

11. At the 160th session of WP.29, the representative of the United Kingdom, on behalf of the Chair of the IWG on UN GTR No. 7, Phase 2, reported on the progress. AC.3 discussed the method to proceed on:

(a) The measurement of height of the head restraint; and

(b) The dynamic test.

AC.3 preferred a one-step approach – to consider a complete proposal – including a draft Addendum to the Mutual Resolution No. 1 (M.R.1), and agreed to extend the IWG mandate until the end of 2015.

12. At the 166th session of WP.29, the representative of Japan reported that IWG would propose the injury criteria and the pass/fail criteria to the GRSP session of December 2015 and would finalise a proposal for GRSP session of May 2016. AC.3 agreed to extend the IWG mandate until December 2016.

13. At the 167th session of WP.29, the representative of Japan reported that IWG was waiting for output from the Post Mortem Human Subjects (PMHS) study conducted by the National Highway Traffic Safety Administration (NHTSA). The output was expected to help establish pass/fail criteria. Though the study provided good data on the reproducibility and repeatability of the Bio Rear Impact Dummy (BioRID), it had not been possible to determine a correlation between the dummy and PMHS. Further work was needed to establish statistical significance. The representative of Japan also informed AC.3 that IWG had transmitted an updated draft amendment to the UN GTR to GRSP for discussion at its session in December 2015 and that the details of the proposal would be refined before December 2015. He added

that he expected a final proposal in May 2016 for UN GTR No. 7 and M.R.1, and that these would be brought to WP.29 in November 2016.

14. At the 168th session of WP.29, the representative of the United Kingdom (Chair of AC.3) reported that IWG expected to submit a more advanced proposal to the GRSP session of May 2016 on the UN GTR No. 7 and on the Addendum 1 to M.R.1 that would incorporate BioRID specifications. AC.3 endorsed his request for an extension of mandate of the IWG until March 2017.

15. At the 170th session of WP.29, the representative of Japan reported that since the meeting of IWG in September 2015, studies on PMHS by NHTSA had not been sufficient to establish suitable injury criteria. IWG was waiting for further study results from NHTSA by the spring of 2017; these results should help to fully incorporate BioRID into the UN GTR and would avoid the adoption of empirical values. He added that IWG would provide an update on the progress at the March 2017 session of AC.3 and seek consent for a revised timetable for delivering the proposed amendment to UN GTR No. 7.

16. At the 171st session of WP.29, the Chair of IWG on UN GTR No.7, Phase 2 reminded WP.29 that the work to establish injury criteria, based on biomechanical data, had been inconclusive and that the work of the group had now been suspended for approximately 18 months. It appeared that new data would not be available before the end of 2017 and that a different approach might be necessary. AC.3 extended the mandate of the IWG until June 2018.

17. At the 172nd session of WP.29, the representative of the United Kingdom, on behalf of the Chair of IWG, reported that IWG had been unable to establish injury criteria directly from PMHS testing, but IWG had developed an understanding based on empirical data. He added that the expert of the United States of America had agreed to explore their ability to provide further PMHS data, but it seemed likely that they would be unable to complete any related work before the end of 2017. Accordingly, AC.3 agreed to extend the mandate to allow IWG to finalise its work using an empirical approach, if PMHS data could not be obtained.

18. At the 175th session of WP.29, the Chair of the IWG informed WP.29 that the group had been unable to establish a correlation between PMHS and BioRID response. Developing injury criteria directly from PMHS testing would still require further research. He explained that IWG intended to restart its activity to submit an official proposal of amendment to the UN GTR based on empirical data at the December 2018 session of GRSP. The proposed amendments would also be introduced as a revision to UN Regulation No. 17, as:

(a) An informal document to introduce the latest developments of IWG on injury criteria;

(b) The final status report of IWG; and

(c) A proposal for Addendum 1 to M.R.1 to incorporate the drawings and specifications of BioRID.

He expected finalization of this work within one year of activity and therefore requested an extension of the mandate. AC.3 agreed to extend the mandate until June 2019.

19. At the 176th session of WP.29, the representative of Japan, as technical sponsor, recalled that at the 175th session of WP.29, the Chair of IWG had informed AC.3 of his intention to restart activity. He also recalled that a working document on the activities for UN GTR No.7, Phase 2 had been submitted to the sixty-fourth session of GRSP. He explained that GRSP had discussed the remaining items and that IWG would consider the remaining points in square brackets in the preparations for the sixty-fifth session of GRSP session in May 2019.

20. At the 177th session of WP.29, the representative of Japan and technical sponsor, reported that the Chair of IWG had informed AC.3 of his intention to restart activity at the 2018 June session of WP.29. He recalled that a working document on UN GTR No.7, Phase 2 activity had been submitted to the GRSP session in December 2018. He further noted that an informal document on a proposal to remove the square brackets that remained in that working document had been jointly prepared by Germany, Japan and the Netherlands. The

representative of Japan explained that, in parallel, a proposal to amend UN Regulation No. 17 to align it with UN GTR No.7, Phase 2 had been jointly prepared by Japan and the European Commission. The expert from the European Association of Automotive Suppliers (CLEPA) had also submitted proposals for injury criteria and for the static test method. He added that GRSP had discussed the remaining items, in square brackets, and would to continue discussions until the next GRSP session in May 2019.

21. The representative of Japan highlighted that a working document for the next GRSP in May 2019, taking the comments from CLEPA into consideration, had already been prepared, and which still retained the square brackets on the injury criteria intended for discussion at the IWG. IWG, at its next meeting, would prepare another informal document on a proposal for injury criteria that had support from the group, and would remove the square brackets that remained in the working documents.

22. At the 178th session of WP.29, the representative of Japan and technical sponsor, reported that at the May 2019 session of GRSP, IWG had submitted the advanced proposal with several square brackets removed and, therefore, had resolved the main issues. He added that the draft amendment would introduce injury criteria focusing on Neck Injury Criteria (NIC), i.e. upper and lower neck flexion and extension, and introduce the procedure for establishing the height of the head restraint based on head contact. He also said that the proposal would be further discussed at the December 2019 session of GRSP and complemented by the final status report. He proposed an extension of the mandate of the IWG for one year. AC.3 endorsed the extension until June 2020.

# III. Subjects for review and tasks (Terms of Reference)

23. The informal group on head restraint height should decide on:

(a) How to define the effective height;

(b) The height requirements.

24. To mitigate long-term and short-term minor neck injuries in a dynamic test, the informal group should:

(a) Define test conditions that reflect accidents in the real world, including the performance of seat backs and head restraints as a system:

(i) Tests conducted on the whole vehicle as available on the market, and/or on production seats mounted on sleds;

(ii) Number and conditions of sled pulses.

(b) Work within the accepted knowledge on the mechanism of minor neck injury and other rear impact injuries, and identify parameters that may be used to advance developments in occupant protection through, for example:

(i) Analysing accidents;

(ii) Performing volunteer tests (low speed only) and simulations with human body Finite Elements (FE) models.

(c) Evaluate dummies that reflect the above mechanism with high fidelity to the human body and which demonstrate an acceptable level of perfection as a measuring instrument:

(i) In particular, the dummy evaluations should include an assessment of their biofidelity in the critical areas associated with the safety technology under review, their repeatability and their reproducibility;

(ii) Define the dummy’s sitting conditions to minimize variation in test results;

(iii) Harmonize the test dummy and calibration test.

(d) Evaluate indicators of human body injury that reflect the minor neck and other rear-impact injury mechanisms:

(i) e.g. measure the relative movement between the upper and lower parts of the neck and the forces applied to each of these parts;

(ii) Define reference values which should be based on the results of injury risk analysis and feasibility studies.

25. The informal group should evaluate the effects on reducing injury and the cost-effectiveness of the proposals.

# IV. History of the discussions

## A. Head Restraint Height

26. The Netherlands proposed to measure the height in combination with the backset to ensure the effectiveness of head restraints for tall occupants. At the second informal group meeting, the Netherlands pointed out that the backset was not considered under the methods of the current UN Regulation No. 17, Euro NCAP and IIWPG, and proposed a new evaluation method that combines the height and backset. This evaluation method performed measurements at the centre only and would require the height to be raised by about 40 mm. Some methodological issues pointed out other uncertainties, reproducibility/repeatability, and hindrance to rear visibility. At the fourth informal group meeting, the Netherlands explained their recent considerations of the head restraint height which would be considered by measuring the backset based on the 95th percentile Head Restraint Measurement Device **(**HRMD) template proposed by the Netherlands. Evaluations of effectiveness were available in the accident analysis by EEVC (HR-10-6). Japan pointed out that the evaluation method for active head restraints was necessary and that timing of delivery was important. The Chair noted that this topic could run in parallel to the principle issue of developing a procedure for the BioRid dummy. He encouraged the Netherlands to define their proposal as soon as possible and asked that they consider the effect of the most recent changes to regulatory requirements on taller occupants. He also welcomed the cooperation between the Netherlands and the International Organization of Motor Vehicle Manufacturers (OICA) to collect data on the head position according to the RAMSIS system by June 2011.

27. At the sixth informal meeting, a proposal on "a simple, pragmatic approach to effective height measurement" was submitted by a task force that was led by Netherlands and included members of OICA. It was decided that the task force would study the new method further and the report on the results in June 2011.

28. At the seventh informal meeting, the head restraint height task force reported on its new measurement method, and explained the measurement of the backset and effective height of head restraints for $50^{th}$ percentile and $95^{th}$ percentile occupants, and the problem of possible interference between CRS and rear head restraint. A new method for measuring the head restraint width was also proposed. The task force reported that, to further improve the measurement method, it would continue to study different head restraint designs as well as issues related to UN Regulation No. 16 that are part of the CRS-interference problem. The SAE HADD [2] Committee had commented on the head restraint height measurement method, and the Chair noted that SAE would be welcome to contribute to the work. It was also agreed that the task force would make available to NHTSA the data obtained from this work.

29. At the eighth informal meeting, Netherlands presented the proposed effective height measurement method and the proposal on the text of the regulation. "Annex 1" from paragraph 2.3.3. on determination of the highest head restraint height states:

(a) The head restraint height is the distance from the R-point, parallel to the torso reference line and limited by a line perpendicular to the torso reference line intersecting IP;

[2] Society of Automotive Engineers (SAE) Human Accommodations and Design Devices (HADD)

(b) After the coordinates of IP are determined, the highest head restraint height can be calculated by its longitudinal (ΔX) and vertical (ΔZ) distance from the R-point, as follows:

Head restraint height = ΔX SIN(design torso angle) + ΔZ COS(design torso angle)

IWG discussed the proposed method of head restraint height measurement and noted some issues concerning certain head restraint shapes and the measuring device. The task force would consider these issues that would be further discussed by the informal working members at the next meeting.

30. At the fifty-first GRSP meeting, the Netherlands introduced a proposal to increase head restraint height (GRSP-51-24). The expert from OICA asked that the discussion focus first on the definition of the measurement method and then on the height thresholds. GRSP agreed to resume discussion at its December 2012 session on the basis of a draft proposal on draft UN GTR No. 7, Phase 2 that may be submitted by IWG.

31. At a workshop held in mid-March 2013 at the Federal Highway Research Institute of Germany (BAST), the effective head rest height measurement procedure was examined by using an actual vehicle. The workshop findings are summarised in the draft Annex 1 of Amendment 1 to UN Global Technical regulation No. 7. The workshop also concluded that the backset can be measured without HRMD.

32. At the fifty-third GRSP meeting, the Netherlands proposed head restraint height requirements in GRSP-53-15, and GRSP agreed to resume discussion at their December 2013 session on the basis of a working document by submitted by Germany, the Netherlands and the United Kingdom.

33. At the fifty-fourth GRSP meeting, the expert from the United States of America questioned (GRSP-54-23) the rationale for both proposed height values. The expert from OICA observed (GRSP-54-18-Rev.1) that the new measurement procedure would reduce the measured height. GRSP agreed to resume consideration of this agenda item on the basis of final proposals submitted by IWG and of further justification concerning ECE/TRANS/WP.29/GRSP/2013/17.

34. At the fifty-eighth GRSP meeting, the Netherlands informed the members that further improvements to the height measurement procedure of head restraint would be possible, and withdrew the document ECE/TRANS/WP.29/GRSP/2013/17. The proposals were reproduced in ECE/TRANS/WP.29/GRSP/2015/34. Australia, China, Denmark, France, Germany, Hungary, Japan, Netherlands, Republic of Korea, Russian Federation, Spain, Sweden, United Kingdom, United States of America and European Commission supported the proposal of head restraint height requirement of 830 and 720mm as proposed by Germany, the Netherland and the United Kingdom after reference to the 2007 EEVC study report. India could agree provided that the footnote, allowing contracting parties to restrict the requirements nationally, is retained. Italy could also agree with India for the higher height of head restraint. GRSP adopted the proposal of OICA to revise this footnote to read,

> "A contracting party may opt for a lower value in its domestic legislation if it decides that such value is appropriate."

35. GRSP concluded that the head restraint heights of 830 mm and 720 mm respectively could be finalized. The informal group would take this guidance onboard and review the proposal to adapt the height requirements. For the rear centre seat, the a height of 700 mm would be retained.

## B. Dynamic evaluation method

36. The number and conditions of sled pulses for the low-speed dynamic test was evaluated.

37. A study on accident analysis and accident simulation tests conducted by Japan, indicated that, for reducing permanent disabilities, it is appropriate to set the sled pulse at the medium waveform of Euro NCAP which is between ΔV = 16 km/h and 25 km/h. However,

Japan found that in the repeatability tests at 20 km/h, the results showed large variations due mainly to variations in the seat deformation. In the future studies, improvements in reproducibility and repeatability would use a new dummy calibration method.

38. A discussion of evaluation indicators and of appropriate test speeds to evaluate protection against long-term and short-term injuries was held at the fourth informal group meeting. While some countries preferred to set the speeds now, other countries argued that it was difficult to set the test speed until a decision was made on the evaluation indicators. A benefits analysis was considered useful.

39. The sixth informal meeting began with the development of the Euro NCAP medium-severity pulse definition (delta-v of 16 km/h). The United States of America noted that since delta-v of the Euro NCAP pulse is lower than that of federal motor vehicle safety standard (FMVSS) 202a, the JNCAP pulse, whose delta-v will be 17.6 km/h with the same shape as the Euro NCAP pulse, would be more desirable. It was agreed that the sled test waveform would be studied using the JNCAP pulse with the same delta-v as in Phase 1 (17.6 km/h) as the standard pulse.

40. At the seventh informal meeting, NHTSA reported on the Injury Criteria Analysis Plan, which includes cadaver sled tests as well as Computed Tomography scans (CT scans) of the cervical vertebrae and reproduction of tests using cervical vertebrae simulation models. Specific investigations were on the output values of sensors installed in the cadaver neck and the injuries after the test. NHTSA would assess if there was correlation between the injuries and Inter Vertebral Neck Injury Criterion (IV-NIC) in injury evaluations and whether they can be correlated to the existing injury criteria.

41. The future tasks would be:

(a) to summarize the test results calculations of quantitative parameters, i.e. the IV-NIC shear and axial forces;

(b) to create injury risk curves based on the PHMS test results; and

(c) to define the Injury Assessment Reference Value (IARV).

42. A study plan in which, eventually, the risk curve/ IARV calculations would be performed using BioRid was introduced.

43. The injury criteria work was jointly done by Japan and the United States of America, and its schedule was reported on by NHTSA.

44. At the eighth informal meeting, Japan reported on the preliminary study results of FEM simulation. The findings indicate that the correlation among IV-NIC (rotation, compression, sliding), rotation (flexion side), compression (compression side), and strain/strain-rate trends may be obtained, however, the simulation study is in limited cases (n=3).

45. NHTSA also reported on preliminary PHMS injury risk curves and potential IARVs for UN GTR. The results indicated that the potential injury criteria are Neck Displacement Criterion rotation (NDCr) rate and product; Neck Displacement Criterion in x direction (NDCx) rate and product. Their latest study of rear impact sled test on BioRid II versus Hybrid III and FMVSS202a versus Modified Annex 9 pulse with OEM seats observed that:

(a) T1 Acceleration is a poor criterion for both dummies;

(b) BioRid is more biofidelic than the Hybrid III.

46. At the ninth informal meeting, Japan reported that the FEM simulation had indicated that three is a good correlation between IV-NIC rotation (IV-NICrot), (flexion side) and Neck strain/strain-rate. NHTSA reported that preliminary PHMS test analysis indicated that IV-NICrot, and that NDCr, NDCx are potential criteria of injury. However, NHTSA would need more PHMS test data, and introduced the intended test plan with various seat performance conditions.

47. At the eleventh informal meeting, Japan reported on the derivation of two IV-NIC (Rotation/Flex) risk curves: one from Human model FEM simulation base on 20 cases of real world accidents, and one based on previous PHMS test results from NHTSA which translated

AIS to WAD (Whiplash Associated Disorder) index with a hypothesis. IWG would continue discussions at the next meeting and develop injury criteria with more PHMS data, BioRid assessment values and a benefit analysis.

48. At the twelfth informal meeting, NHTSA reported on the injury criteria development using PHMS tests. Potential "global" injury criteria had been evaluated from:

(a) Japan: IV-NICrot, Neck Injury Criterion (NIC), Upper Neck Shear Force in X direction (UNFx), Upper Neck Bending Moment (UNMy), Lower Neck Shear Force in X direction (LNFx) and Lower Neck Bending Moment (LNMy).

(b) United States of America: IV-NICrot, NDCr, NDCx and NIC.

Furthermore, BioRiD measures should be discussed in conjunction with further PMHS tests by NHTSA and data analysis by Japan Automobile Research Institute(JARI).

49. At the thirteenth informal meeting, NHTSA spoke about progress in the PMHS test, and the time needed to develop appropriate injury criteria.

50. At the fourteenth informal meeting, reports on research were from:

(a) NHTSA: the best PMHS injury predictor is IV-NICrot with a 50 per cent chance of AIS 1+ injury, and BioRID injury criteria is best predictor of PMHS injury, perhaps in the order of the following values:

(i) IV Rotation = 6.4 deg. (flexion) PMHS, 3.7 deg. BioRID (flexion);

(ii) NDCrot = 32.5 deg. (flexion) PMHS, 12.2 deg. (flexion) BioRID.

(b) JARI: tentative BioRID injury criteria from a WAD risk curve that corresponds to IV-NICrot is as follows:

(i) NDCrot=12°, NDCx=30.5mm;

(ii) NIC=23.2;

(iii) Upper Neck, Fx=636.5, Fz=979.2, My=33.5(Flexion, Extension);

(iv) Lower Neck, Fx=636.5, Fz=1135.9, My=33.5(Flexion, Extension).

(c) Chalmers University: the correlation between real world insurance claims and specified model sled test performance indicates BioRID injury criteria as follows:

(i) NIC 25 $m^2/s^2$;

(ii) L1 x-acceleration 120 $m/s^2$;

(iii) Occipital Condyle x-displacement 22 mm.

51. A working group met in Berlin during IRCOBI 2014 to discuss potential injury criteria. The group agreed that the candidate list of injury criteria for the purposes of a regulation could be reduced to the following:

(a) NIC;

(b) NDCrot for both flexion and extension, (using appropriately specified angular rate Sensors);

(c) Fx upper and lower neck.

52. At an informal WebEx meeting in mid-November 2014, the Vehicle Research and Testing Centre (VRTC) of NHTSA discussed the plan of BioRID injury criteria sled tests from December 2014 to January 2015. Two recently, certified "matched" dummies would be used to correlate PMHS and BioRID responses. The plan included injury criteria number refinement, reproducibility, neck extension criteria development and BioRID/Hybrid small-scale fleet assessment.

53. At the seventeenth informal meeting in September 2015 in London, IWG concluded that a more empirical approach was now necessary to pursue the definition of injury criteria. UN GTR No. 7 would also require a further development phase and that, following additional PMHS studies, new injury criteria could be introduced at a later date. IWG transmitted their

working document ECE/TRANS/WP.29/GRSP/2015/34, with the recommendation for an empirical approach for injury criteria to GRSP for first consideration during their December 2015 session.

54. "At the fifty-eighth GRSP December 2015 session two approaches for BioRID injury criteria were proposed: one proposal by Germany is based on empirical data from Euro NCAP. The second proposal by Japan is based on a 50% risk of AIS1+injuries and 82.9% risk of WAD2+ injuries (IV-NIC=1.1). Germany rather strongly insisted on more severe limits, and informed that more than 95% of front seats tested by Euro NCAP would meet the thresholds of proposal by Germany. Japan supported the higher limits since these are based on sound technical rationale. GRSP agreed to resume discussions at the next meeting, on the basis of GRSP-58-26, reproducing the amendments made to GRSP/2015/34 during the meeting.

55. A group of experts from Germany, Japan and the Netherland reviewed the BioRID injury criteria for the sixty-fourth GRSP session in December 2018. Japan agreed with the proposal by Germany.

56. CLEPA expressed concerns on the repeatability and the reproducibility of BioRID test results, and suggested taking this variation into consideration when defining limits for injury criteria. The GRSP experts were invited to provide comments to the proposed amendment from Japan by the end of January 2019.

57. It was also agreed that IWG would organize a WebEx meeting to allow Japan to submit a formal proposal of amendments that incorporated the concerns of CLEPA by 15 February 2019.

58. At the eighteenth informal meeting in April 2019 (Bergisch Gladbach,Germany), IWG discussed injury criteria. Germany responded to the concerns expressed by CLEPA on lower neck Fx. The proposed limit for lower neck Fx appeared demanding based on the existing data from consumer testing by Euro NCAP. It was stated that Euro NCAP was not evaluating lower neck Fx. Germany proposed to evaluate flexion and extension. CLEPA requested a safety margin equivalent to the test tolerance of BioRID. In particular, a NIC compromise was required. Finally, IWG agreed to propose the following:

*Injury criteria*

| | *NIC max* | *25 $m^2/s^2$* |
|---|---|---|
| Upper Neck | Fx | 360N |
| | My (Flexion/Extension) | 30Nm |
| Lower Neck | Fx | Monitor |
| | My (Flexion/Extension) | 30Nm |

Note: The injury criteria shall be calculated excluding rebound movement of the head. For the injury criteria of upper and lower neck, both the positive and negative values shall be assessed.

59. Germany proposed to review these criteria following three years of new research results.

## C. Accident analysis

60. In Japan, all accident macro analyses show that rear impact crashes account for 31 per cent of all traffic collisions, and that 92 per cent of these result in minor neck injuries. About 60 per cent accidents are at a crash speed of ΔV=15 km/h or below. Even at ΔV=20km/h and above, AIS2+ neck injuries account for only 2 per cent, and most of the resulting injuries (60 per cent or more) are AIS1 neck injuries. In recent years, the number of permanent disabilities increased, and occur most frequently at ΔV=16–22 km/h, however, these ΔV analyses are based on small numbers of accident micro analysis.

61. Japan had presented the evaluation indicator and the reference value at the "meeting of interested experts" before the informal group was established. Past studies on neck injuries and volunteer tests had shown correlations between neck strain rates and occurrence of injuries. Risk curves for each case were derived from the results of accident analysis and simulation. Injury indicators that have high correlations with strain rates and that are measurable using dummies were extracted. Relationships between strain rates and NIC, and between neck strain and neck force (Upper & Lower Fx, Fz, My) were shown. Japan proposed that risk curves derived from these relationships be used as the basis for injury criteria. For some indicators, risk curve could not be derived and other alternative indicators were used.

62. EEVC had also presented evaluation indicators on "dynamic backset" for the discussions on Phase 1 of UN GTR No. 7.

63. At the fourth informal group meeting, Partnership for Dummy (PDB) Technology and Biomechanics reported on the evaluation of reproducibility on eight dummies: this was first presented to an ESV conference in 2009. The reproducibility was poor in the neck force (Fx, Fz, My), while acceptable in acceleration (but cv>10 per cent for NIC) and kinematic behaviour (cv<10 per cent for dynamic backset). However, the standard evaluation method for dynamic backset should be prescribed since variability is inherent in video analysis.

64. At the sixth informal meeting, EEVC reported that a study investigating the correlation between traffic accidents recorded in insurance data and the injury criteria had shown high correlation between NIC and UNFx with risk of long-term, permanent injury.

65. At the eighth informal meeting, Japan provided their latest rear collision analysis for the UN GTR test method. They concluded that for each injury criteria, the rate of neck injury tends to increase with the injury values which Japan had proposed for UN GTR No. 7.

## D. Dummies

66. Discussions on dummies had been held as part of the Global BioRID Users Meetings (GBUM) activities up to the first informal meeting. From the second meeting, GBUM activities were incorporated into activities of the informal group's TEG which held web meetings approximately once a month.

## E. Biofidelity

67. At a meeting of interested experts, the status of the study by the EEVC Working Groups 12 (WG12) and 29 (WG20), and the results of studies on the biofidelity of Hybrid III, RID3D, and BioRID II were discussed. The biofidelity in volunteer tests at 7–9 km/h was verified using qualitative procedures and quantitative core methods. BioRID II presented the best results.

68. The United States of America reported on its studies on the biofidelity of dummies and injury mechanisms for evaluating AIS3+ injuries in mid- and high-speed rear impact crashes. From the results, a seat for sled tests was developed. Biofidelity was also compared with data from PMHS, BioRID, RID3D and Hybrid III experiments to determine the most appropriate dummy. The injury mechanisms were also examined to determine and verify the instrumentation to the spine and to define the injury behaviour.

69. At the fourth informal group meeting, NHTSA reported on the results of repeatability/reproducibility and biofidelity research. NHTSA had conducted dynamic tests at 17.6 km/h and 24 km/h. Tests were also conducted comparing PMHS with Hybrid III, BioRID, and RID3D. The dummies showed different biofidelity in head displacement and rotation during tests for reproducibility, repeatability and biofidelity. The ramping-up behaviour was quite different between PMHS and dummies. The evaluation of biofidelity and of repeatability would be completed by the end of October 2010 and of December 2010, respectively. NHTSA also conducted tests to compare the sensitivity and reproducibility between dummies. Results were compared using BioRID II and Hybrid III in seats with large and small backset, and waveforms specified in FMVSS 202a, and UN Regulation No. 17

proposes to incorporate BioRID (Annex 9) to evaluate if the tests rank the severity of backset in the same manner. The testing would be completed in November 2010 and the results would be presented in February 2011. OICA had requested biofidelity assessment, over the range of potential seatback angles, of the rear impact dummy chosen for UN GTR No. 7.

70. One of the original IWG tasks was to develop a low-speed dynamic test, including the test procedure, compliance criteria and the associated corridors for BioRID II. Later, depending upon WP.29, the group would consider the possibility of a higher-speed dynamic test.

71. At the fourth meeting, the Chair recalled that IWG would report to WP.29 at its 152nd session (November 2010) and, particular, to confirm the timetable for the delivery of a proposal to adopt the BioRID II dummy into UN GTR No. 7. He suggested recommending to WP.29 that Phase 2 be considered for approximately 2 years, adoption be aimed for at GRSP in December 2012, and a proposal be submitted to WP.29 in June 2013. This was based on the understanding that the research conducted by Japan and the United States of America that was scheduled for completion by the end of 2011, would succeed in establishing suitable injury criteria for evaluation in a regulatory test procedure.

72. Japan commented that BioRID II should be added to UN GTR No. 7 in May 2011 as specified in the original ToR since neck injury is a serious problem necessitating regulation immediately. Options were proposed:

(a) Option 1: A proposal to amend UN GTR No. 7 would be submitted to GRSP in May 2011 to specify dynamic backset evaluations using either Hybrid III or BioRID II, as an option for contracting parties. In a second step, harmonization of the dummy, evaluation of upright postures, tests at higher- and mid-speed would be considered from 2014.

(b) Option 2: Extend the work schedule of the informal group to require that a proposal to amend UN GTR No. 7 be submitted to GRSP in December 2012, in anticipation that a harmonized dynamic backset evaluation proposal be made based on the injury criteria using BioRID II only. In a second step, harmonization of the dummy, evaluation of upright postures, tests at higher- and mid-speed would be considered from 2014.

73. OICA expressed strong concerns that both options result in a UN GTR with contracting party options.

74. At the 152nd session of WP.29, Japan proposed a revised ToR to AC.3 to establish the IWG timeline until 2012. The schedule allowed completion of the injury criteria analysis, but in case of incompletion, a detailed BioRID II test would be added to UN GTR No. 7 as an alternative to the existing test (the option already existed as a placeholder). The United States of America presented an alternative ToR proposal to allow a comprehensive approach to address both long-term and short-term minor neck injuries. AC.3 returned the proposals to GRSP on the note that it anticipated a revised proposal to revise the ToR at the 153rd session.

75. At the fifth meeting of the information group, it was confirmed that the preference was to deliver a new proposal that could be adopted into UN GTR No. 7 as a single procedure to assess the protection against neck injury. The group also agreed with the recommendation of the United States of America that the injury criteria that emerge from the ongoing research efforts in Japan and the United States of America should guide the development of the final procedure.

76. Japan had associated lower speed tests with injuries at AIS1 level and was concerned that any change to address more severe injury levels would extend the timeline beyond December 2012. It was agreed that AIS1 injuries remain on focus but that, if possible, consideration be given to long-term as well as short term injuries.

77. As a result, the group recommended that GRSP propose amending the ToR to specify that the primary focus of the informal group should be the development of a proposal for the BioRID II that would provide benefits equal to or better than the benefits provided by the existing option in UN GTR No. 7. Any additional benefits from the group within the specified time frame would be permitted, but if this work was not completed, any discussion of further work in this area would take place at a future date.

78. At the sixth informal meeting of the information group, the United States of America reported that BioRID II had shown the best biofidelity and reproducibility. Japan and the United States of America were scheduled to conduct a joint study of the injury criteria before the end of 2011.

79. At the seventh informal meeting of the information group, PDB reported that the shoulder of the BioRID II may interact with the seat back of a hard bucket seat, depending on the shape of the seat back, with a load through the T2 jacket bolt/shoulder plate. PDB also presented the simulation and sled test results which affect the upper neck Fx and My.

80. At the sixteenth informal meeting, NHTSA reported flexion in PHMS studies is significance and, that like HybridIII, the BioRID neck does not fully replicate this movement.

## F. New Drawing of the Head Restraint Measurement Device

81. The current H-point machine is defined in SAE J826, and HRMD was developed in the 1990s. For both machines, the variations are large in products available on the market, and resulted in variations in the backset measurements.

82. At the second informal meeting of UN GTR No.7, the results of research by the German manufacturer's association (VDA) were introduced. VDA had developed a new H-point machine and the “Dilemma” testing jig, by harmonizing the average of many H-point machines with the SAE standard. For this, it was scheduled to issue the VDA specifications in February 2010 and to propose it to SAE as a revision to the standard.

83. At the fourth informal group meeting, it was reported that the draft of 3D CAD data of the SAE HADD J826 H-Point manikin had been proposed at an SAE meeting on 20 October 2010. When SAE agreed with the proposal, it would be possible to release 3D CAD to the public. The measurement method with HRMD was in consideration and would be suggested by March 2011.

84. At the eighth informal meeting, the Chair presented the current status of HRMD and of the three-dimensional H-point (3DH) selection and calibration. SAE had indicated their interest in the activities on UN GTR No. 7, but advised that their workload prevented them contributing to development of HRMD and 3DH device specifications. The Chair noted that as the group was aware of the variation in these devices, a solution should be found. IWG would discuss this further.

85. At the workshop held in mid-July at BASt, the backset measurement and dummy seating procedure were examined. The workshop concluded that backset and also the BioRID reference point (back of head) can be measured by coordinate measuring apparatus (without HRMD usage).

## G. Dummy drawings (2D and 3D)

86. The first and second informal meetings reported on the harmonization of drawings by Denton and First Technology Safety Systems (FTSS). The 2D drawing (PDF form), 3D drawing (STEP form) and user's manual were scheduled for joint development by two manufacturers.

87. At the fourth informal group meeting, Humanetics, which was formed by the merger of FTSS and Denton, reported that the drawings had been posted on the GRSP website. 3D data was also ready, but PADI was being revised: a list was being prepared to be included in PADI for checking the most recent dummy. The Chair pointed out that a method to clarify the appropriateness of the build level of BioRID II was necessary. The group agreed to the suggestion of Japan to have PADI and the drawings on the same website.

88. At the 153rd session of WP.29, the Chair of IWG introduced a proposal for a protocol to manage drawings, manuals, etc. at the United Nations. A basic principle was agreed on.

89. At the eighth informal meeting, the Chair reported on the status of the register of technical specification. WP.29 had directed that, as a first step, data would be incorporated

into the Consolidated Resolution on the Construction of Vehicles (R.E.3). The amendment to R.E.3 would also be used for other ATDs.

90. At the 158th session of WP.29, AC.3 agreed to M.R.1 of the 1958 and 1998 Agreements on the description and performance of test tools and devices.

91. At the fourteenth informal meeting, PDB reported that the dummy drawings were nearly ready for incorporation into Addendum 1 of M.R.1.

92. At the 178th session of WP.29, the representative from the United Kingdom explained that a proposal to amend M.R.1 would incorporate drawings and specifications of the Biofidelic Rear Impact Dummy. However, he indicated that the major challenge was the legal issue of copyright infringement concerning the above paragraph 91 mentioned specifications and consequent limitation to public usage. He announced that the work would continue in close cooperation with the secretariat and with the dummy manufacturer to draft a disclaimer, that would be removed from the drawings, once the amendment was adopted by WP.29 and AC.3.

93. At the eighteenth TEG meeting in August 2019, Humanetics stated that ECE was allowed to use the drawings and PADI of the BioRID for rulemaking purposes within the framework of M.R.1.

## H. Certification procedures

94. At the "meeting of interested experts", the history and summary of discussions on the new certification test at GBUM were presented. New certification tests had been completed in Japan, the Republic of Korea, the United States of America and Europe. The sled waveform had become flatter, showing good reproducibility. At the second informal meeting, a change was proposed to the calibration waveform so that it would match that of the Euro NCAP medium pulse and dummy input. However, the Chair commented that since the ToR of the informal group stipulated that our objective was to specify the uniform method for evaluating low-speed impacts and that the low speed was defined as V18 km/h or below, we should aim for a sled waveform at around 16–18 km/h and discuss the calibration waveform based on the current proposal (GBUM2009).

95. At the third meeting, BioRID TEG reported that development of the new certification test method with the head restraint was heading in the right direction, though concerns were that the head-to-head restraint contact time was somewhat short (10–20 ms). Humanetics would draft a detailed method of the presence of head restraint in the new sled which would be evaluated by Japan, Ford, General Motors (GM) and PDB.

96. At the fifth and sixth informal meetings, the calibration method without head restraints was agreed on. It was decided that a study on calibration with head restraints would be based on the weight probe (119 kg) that was better correlated with input pulses of evaluation tests.

97. Jacket impact assessment was adopted as another improvement to dummy performance, while pelvis impact assessment was not considered to affect the dummy's effectiveness. The optional Skull CAP switch would be included in the drawing package.

98. At the seventh informal meeting, Humanetics reported that neither of the certification tests using the standard probe or the heavy probe were noted to offer clear benefit over the other: the reduced burdens of the standard probe were performed better in laboratories. On the other hand, concerns were about the safety of handling such a heavy tool.

99. At the eighth informal meeting, Japan reported on the results of the calibration test of the standard versus the heavy probe. The peak value and variation by calibration test of the heavy probe had become more apparent.

100. At the fourteenth informal meeting, Humanetics reported on recommended certification tests:

(a) Spine quasi-static setup;

(b) Mini-sled without head restraint;

(c) Mini-sled with seat back and head restraint;

(d) Jacket only impact;

(e) Pelvis only impact (bottom only).

And on recommended inspection tests:

(a) Spine bumper stiffness;

(b) Pelvis shape check.

101. At the informal meeting by WebEx in mid-November 2014, Humanetics discussed progress in the dummy certification work and confirmed the ability of the new "Gen-X" test to discriminate dummy responses. The draft of Addendum I to the M.R.1. had also progressed: United Nations numbered drawings, and detailed text to describe the new "Gen-X" certification test.

102. At the eighteenth informal meeting in April 2019, Humanetics said that work had stopped on the "Gen-X" test, and instead Humanetics recommended the regular replacement of all bumpers throughout the dummy to cover bumper change/ageing over time, and the additional pelvis and jacket test. A description of the tests would be included in the documentation for the addendum to M.R.1 on BioRID.

103. At the seventeenth TEG meeting in May 2019 by WebEx, Humanetics explained that the parts replacement management method is simpler and more advantageous than the "Gen-X" test. The properties of the bumpers were checked by a special compression test. Humanetcis also informed TEG about the some stakeholder’s concerns on the POT-A certification test corridor. They invited delegates to provide test data for POT-A corridor correction. The Chair of TEG suggested collecting data by mid-June 2019 and confirming progress at the next TEG meeting.

104. At the eighteenth TEG meeting in August 2019, Humanetics reported on an analysis of certification data from 89 different dummies. The data comprised 1,164 tests from six laboratories with the aim to review the certification test corridor, especially POT-A. However, TEG could make final conclusions during this meeting. The Chair of TEG asked Humanetics for an updated analysis at the next meeting.

105. At the nineteenth TEG meeting in September 2019, Humanetics presented the results of an updated analysis. Members of TEG discussed the corridors and proposed minimal, appropriate changes. The Chair of TEG concluded that all certification corridors should kept as they were in the current manual with the exception of Pot-A and to:

(a) Adjust Pot-A corridor to the mean and keep the same corridor width;

(b) Keep jacket and pelvis compression for monitoring purposes only (no pass/fail criteria);

(c) Review all certification criteria after 3 years;

(d) Remove the C4 accelerometer mount.

## I. Repeatability and reproducibility

106. At the first informal group meeting in Dec 2009, Korea reported evaluation result of BioRIDII, they informed good repeatability was obtained during testing if the same dummy is used. However, some problems were associated with reproducibility using different dummies. Work to establish a common build level for the BioRID II, together with dummy improvements and revised certification tests was being discussed to improve repeatability and reproducibility.

107. At the third informal group meeting in May 2010, Japan reported the results of the new dummy calibration methods and sled tests. The same variations in lower Fz that had been seen in the new certification test method with the simulated head restraint were also observed in the sled tests. Thus, it is considered effective to use the head restraint in the certification test, especially to minimize variations around the contact time. However, there

are differences in absolute values between certification and sled tests which would be discussed further in September 2010.

108. At the fourth meeting, a quite large difference between sled types when one seat was tested for evaluating the reproducibility using acceleration and deceleration sleds was reported. It was difficult to keep the pulse within the corridor when using the deceleration sled. It was also pointed out that the backset changed due to the movement of dummy's head during approach. These issues are kept as items to be monitored.

109. At the seventh informal meeting, the Korea Automobile Testing and Research Institute (KATRI) reported on the results of dummy reproducibility in sled tests (with delta-v at 16 km/h and 20 km/h). Comparison of the Values (C.V) between the two sled speeds showed that, in general, C.V was larger at 16 km/h than at 20 km/h, but it was also seen that the tendency was not the same for different evaluation areas. Since the injury values were not very reproducible, it was decided to check the dummy specifications (2009–2010), to collect the latest findings and information obtained at this meeting, and to continue studying reproducibility and repeatability. PDB readjusted the BioRID II that it had long used in testing, performed certification tests with the head restraint using the standard and heavy probes, and verification tests with the accompanying hard bucket seat, and reported the results of these tests. It concluded that although the reproducibility/repeatability for accelerations was acceptable, the values were not adequate for use as injury criteria in forces or moments. Even though the dummy satisfied testing with a hard bucket seat, poor reproducibility was shown for some data channels. It was thus agreed that round-robin tests be performed between the United States of America and Europe using the dummy used in PDB testing.

110. At the eighth informal meeting, Humanetics reported on the round-robin test results from Occupant Safety Research Partnership (OSRP) and Vehicle Research and Testing (VRTC). Sled tests did not recreate the results recorded at PDB, but OSRP did identify some reproducibility concerns. However, analysis of the results was incomplete. IWG would continue to investigate dummy reproducibility. The TEG Chair proposed a WebEx meeting to schedule future work. Japan reported BioRid response differentiation between 095G and other 102G/115 in the calibration test. By swapping the dummy jacket between 012G and 095, the waveform shifted to correspond with the original dummy jacket's waveform. Japan would evaluate the jacket's stiffness using the new procedures developed by Humanetics. The Republic of Korea reported on their latest study of test procedure on the variation of dummy response by using the FEM model and sled test. The Republic of Korea noted that the current low level of confidence in repeatability and reproducibility of real tests may be due to a high tolerance of some factor of the dummy, and had considered reconsidering the current tolerance for BioRid II setting for establishing the test procedure in UN GTR No. 7, Phase 2.

111. At the ninth informal meeting in the UK, the Transport Research Laboratory (TRL) reported on the outcome of an EC study that had evaluated the dummy reproducibility and repeatability using the sled test. The results indicated that some specific channels do not provide adequate reproducibility (C.V). The dummy's response was sensitive to the change, which suggested that the certification test and better control of material properties might be needed. The spine bumper, jacket and pelvis would be fresh and examined the dummies refurbished. The refurbished dummies would be evaluated using the same sled test condition in a timely manner.

112. At the eleventh informal meeting, Humanetics reported that the result of the sled test using the refurbished dummies had indicated better reproducibility with C.V but still need data analysis. The TEG Chair proposed an additional sled test series with an EC project rig seat and a PDB hard bucket seat. The test results would be discussed at the informal meeting in mid-February 2013.

113. At the informal BioRID TEG meeting, Chrysler reported that the repeatability and reproducibility results from an EC project of dummy analysis had shown some good and some poor channels. The dummy components, i.e. jacket, pelvis and bumper had since been updated through validation tests, and analysis had shown that dummy reproducibility had improved. (Series1, Series2)

114. At the fifteenth informal meeting, Humanetics further reported that the stiffness of the candidate replacement materials for the spine bumper (Urethane rubber) in BioRID had proven unstable with ageing. They confirmed that all current testing used matched and stable material – and new materials, when available – would be benchmarked against the original.

115. At the informal meeting by WebEx in mid-November 2014, Humanetics reported that the dummy quality had improved as a result of the new procedures: repeatability, reproducibility and C.V values were reported for several dummies. Matched dummies were identified for delivery to NHTSA(VRTC).

116. At the sixteenth informal meeting, NHTSA provided positive data on the repeatability and reproducibility of BioRID based on their latest sled test series.

117. At the seventeenth TEG meeting by WebEx, Humanetics informed delegates about the investigation of R&R by the bumper compression force test. Japan had agreed to provide the data of bumper compression force test for investigation of R&R.. Humanetics would report on the conclusion of R&R by the bumper compression force test at the next TEG meeting.

118. At the eighteenth TEG meeting, Japan showed research on the influence of the hardness of ARA-220 bumpers to Pot A corridor.

119. At the nineteenth TEG meeting, Humanetics said the bumper compression values had been added to the bumper drawings.

## J. Dummy seating conditions

120. At the first informal meeting "meeting of interested experts", Japan proposed the seating procedures of IWPG and Euro NCAP:

(a) Design reference torso angle;

(b) Reduction of backset tolerance; and

(c) Special adjustment in the case of smaller torso angle (more upright) seats typically used in small $N_1$ vehicles (especially those with forward control), and explained the reasons for the proposals (GTR7-01-09e).

121. At the second informal meeting, Japan reported that in general, the torso angle is about 15° in trucks and vans, and it proposed to specify an optional spine angle to accommodate these upright seats. Denton, Inc. (a manufacturer of BioRID) presented a new spine comb to set the dummy to a more erect, seating posture. The appropriateness of the dummy when set to this posture was being evaluated.

122. At the third informal meeting, basic agreement was reached on adopting the design reference angle of the standard seating posture proposed by Japan. Japan reported on the influence of different seating postures at design torso angle and 25° on evaluation: no specific tendency was seen in the difference between two same seats with the conditions of JNCAP (design angle, 20°–25°) or IIHS (25°).

123. Japan reported the results of tests that it had conducted on the new tool for upright postures using a smaller torso angle (10°) for commercial vehicles. While the dummy spine could be set to the revised posture when the dummy was equipped with its jacket, its upright posture would tilt largely forward, and so, it was unable to keep its head fully horizontal. For this reason, it was decided that, for applying the upright posture tool, development of the jacket, etc. will be undertaken as a second step.

124. Japan and OICA reported the ratio of seats with an upright torso angle on the market.

(a) In Japan, such seats account for 45 per cent of all seats in market and pointed out the necessity of the static backset option, until the dummy representing upright posture was developed.

(b) OICA reported that the overall worldwide ratio (including the Japanese data) of seats with upright torso angle is 12 per cent.

125. It was agreed that work to define procedures to assess more upright seats would not be pursued as a priority at this time, but that the static evaluation procedure would be kept as an option for these seats until the dynamic evaluation is shown to be suitable for all seat angles.

126. At the workshop held in the mid-July 2013 at BASt, the BioRID seating procedure was examined with different torso angle conditions. However, the dummy spine flexibility may lead to set position variations. The seating procedure continued to be investigated by OICA, and seating procedure and appropriate dummy positioning tolerances would be suggested in the near future.

127. At the fifteenth informal meeting, JAMA reported that the study of dummy seating procedure for the dynamic test had indicated that it is better to set the pelvis angle at 26.5±2.5°and hip point tolerance (z) at 0±10m min in dynamic tests using production seats. JAMA indicated that their work continued.

128. Japan, Germany and the Netherland had determined to adjust the pelvis angle to the actual torso angle +1.5±2.5°" before the sixty-fourth GRSP in December 2018.

## K. Dummy durability

129. The neck damper had only shown damaged in the Republic of Korea, when the new calibration test procedures were performed. Ford pointed out the necessity to add a body block to the calibration sled to prevent damage to dummies.

130. At the fourth informal group meeting, it was agreed that the issue experienced by the Republic of Korea had not been seen elsewhere and it was not considered to be a problem.

# V. Work schedule

131. First step (under the chairmanship of the United Kingdom and with the technical sponsorship of Japan):

| *Working Groups* | *Dates* | *Venue* |
|---|---|---|
| "meeting of interested experts" | 6 November 2009 | Washington D.C. |
| 1st informal meeting | 8 December 2009 | Geneva, Switzerland |
| 2nd informal meeting | 2–3 February 2010 | Tokyo |
| 3rd informal meeting | 17 May 2010 | Geneva, Switzerland |
| 4th informal meeting | 21–22 September 2010 | Germany |
| 5th informal meeting | 6 December 2010 | Geneva, Switzerland |
| 6th informal meeting | February 2011 | Brussels |
| 7th informal meeting | June 2011 | Washington, D.C. |
| 8th informal meeting | December 2011 | Geneva, Switzerland |
| 9th informal meeting | March 2012 | London |
| 10th informal meeting | June 2012 | Munich, Germany |
| 11th informal meeting | December 2012 | Geneva, Switzerland |
| 12th informal meeting | February 2013 | Brussels |
| 13th informal meeting | April 2013 | Paris |

| *Working Groups* | *Dates* | *Venue* |
|---|---|---|
| 14th informal meeting | September 2013 | Gothenburg, Sweden |
| 15th informal meeting | February 2014 | Brussels |
| 16th informal meeting | July2015 | Munich, Germany |
| 17th informal meeting | September 2015 | London |
| 18th informal meeting | April 2019 | Bergisch Gladbach, Germany |

132. Step 1

| *Tasks* | *Dates* |
|---|---|
| At the 145th session of WP.29, Japan officially proposed to set up Phase 2 of the Head Restraint UN GTR | June 2008 |
| At WP.29/AC.3, it was proposed to establish the informal group | June 2009 |
| At WP.29/AC.3, ToR were approved | Nov. 2009 |
| 1st progress report to GRSP | May 2010 |
| 1st progress report to WP.29/AC.3 | June. 2010 |
| 2nd progress report to GRSP | Dec. 2010 |
| 2nd progress report to WP.29/AC.3 | June 2011 |
| 3rd progress report to GRSP informal proposal requirements submitted | Dec. 2011 |
| 3rd progress report to WP.29/AC.3 | March 2012 |
| 4th progress report to GRSP | Dec. 2012 |
| 4th progress report to WP.29/AC.3 | March 2013 |
| 5th progress report to GRSP | Dec. 2013 |
| 6th progress report to GRSP | Dec. 2014 |
| 7th progress report to GRSP | Dec. 2015 |
| 8th progress report to GRSP | Dec. 2018 |
| 9th progress report to GRSP | May 2019 |
| Final progress report and official proposal for low-speed requirements submitted to GRSP | Dec. 2019 |
| Proposal for final progress report and requirements adopted at WP.29/AC.3 | June 2019 |

# Annex

[English only]

## Documentation

| | |
|---|---|
| WM-0-1 | First Dummy TEG Attendance list |
| WM-0-2 | EEVC presentation |
| WM-0-3 | (JASIC/Japan) BioRID seating position |
| WM-0-4 | (Denton) BioRID II user's meeting |
| WM-0-5 | (First technology) Whiplash updates |
| WM-0-6 | (Japan) Neck injury criteria risk |
| WM-0-7 | (NHTSA) VRTC rear impact |
| WM-0-8 | Rear impact task definition |
| GTR7-01-02 | (JASIC/Japan) Proposal for Bio RIID II dummy standardization activity for UN GTR No.7 – Phase 2 |
| GTR7-01-03 | (The Netherlands) Front contact surface |
| GTR7-01-04 | Comparisons for different Spine adjustment |
| GTR7-01-05 | (Japan) Schedule of Head Restraint UN GTR No. 7 – Phase 2 Informal Working Group |
| GTR7-01-06 | (Denton) Global BioRID-II User's Meeting |
| GTR7-01-07 | (Republic of Korea) UN GTR No.7 – Phase 2 Research Results |
| GTR7-01-08 | Terms of reference of the informal group on Head Restraints – Phase 2 |
| GTR7-01-09 | (JASIC/Japan) BioRID II seating proposal |
| GTR7-01-10 | Draft minutes of the first Informal Working Group Meeting for UN GTR No. 7 – Head Restraints Phase 2 |
| GTR7-02-01 | Draft agenda of the second Informal Working Group Meeting for UN GTR No. 7 – Head Restraints – Phase 2 |
| GTR7-02-02 | (LEAR) HPM Variations |
| GTR7-02-03 | (LEAR) HRMD Variations |
| GTR7-02-04 | (AUDI) New HPM and HRMD Standards |
| GTR7-02-05 | (VDA) Certification of the H-Pt. and Backset measuring equipment and its calibration |
| GTR7-02-06 | (First technology) Global BioRID-II User's Meeting |
| GTR7-02-07 | (First technology) Seat/Head Restraint Test Sled Pulse Summary |
| GTR7-02-08 | (NHTSA) Rear Impact Dummy Biofidelity |
| GTR7-02-09 | (First technology) BioRID II Drawing Harmonization |
| GTR7-02-10 | (First technology) Seat/Head Restraint Test Sled Pulse Summary |
| GTR7-02-11 | (Chalmers) BioRID new certification procedure |
| GTR7-02-12 | (Denton) Background of GBUM certification test |
| GTR7-02-13 | (Denton) Pulse feasibility investigation |
| GTR7-02-14 | (Denton) New dummy head |

| | |
|---|---|
| GTR7-02-15 | (The Netherlands) Head Restraints Static Height and Backset Measurement |
| GTR7-02-16 | (JASIC/Japan) Crash pulse research status based on Japan accident research and vehicle rear impact test |
| GTR7-02-17 | (JASIC/Japan) Japan research activities for new BIORID II calibration method in the UN GTR No. 7 – Phase 2 IWG |
| GTR7-02-18 | (The Netherlands) Head Restraints Static Height and Backset Measurement |
| GTR7-03-01/Rev.1 | Minutes of the meeting |
| GTR7-03-02 | BioRID II Smaller Design Torso Angle seat seating trial |
| GTR7-03-03 | (Japan) Repeatability and Reproducibility study with new BioRID II calibration method |
| GTR7-03-04 | Third Meeting of the IWG UN GTR No. 7 - Draft Status Report of the BioRID TEG |
| GTR7-03-05 | UN GTR No. 7 IWG Meeting 3 – Summary of Decisions and Actions |
| GTR7-04-01 | BioRID II Drawing package - 23 July 2010 version |
| GTR7-04-02/Rev.1 | Agenda of the meeting |
| GTR7-04-03 | (The Netherlands) Head Restraints - Static Height Requirements |
| GTR7-04-04 | (Japan) UN GTR No.7 – Phase 2 Dynamic Evaluate Condition and Criteria Proposal |
| GTR7-04-05 | (JARI) Influence on Cervical Vertebral Motion of the Interaction between Occupant and Head Restraint/Seat, based on the Reconstruction of Rear-End Collision Using Finite Element Human Model |
| GTR7-04-06 | (PDB) Summary of the BioRID III Test Programme |
| GTR7-04-07 | (Faurecia) Whiplash Criteria Repeatability with different dummies & sleds |
| GTR7-04-08 | (Humanetics) Drawing and PADI status and a Checklist for Evaluating Dummy Acceptability for Use |
| GTR7-04-09 | (Humanetics) Results of the latest test series on the effect of lateral tilt on the headrest test results |
| GTR7-04-10 | (Humanetics) A Summary of Current Known Sources of Dummy to Dummy Variation |
| GTR7-04-11 | (Humantics) Review and Approval of Recommended Certification Tests for BioRID II |
| GTR7-04-12 | (Humanetics) BioRid II design evaluation checklist - Draft 21 September 2010 |
| GTR7-04-13 | (Humanetics) BioRid II design evaluation checklist - Draft 21 September 2010 |
| GTR7-04-14 | (USA) BioRID II Preliminary Repeatability Assessment & Biofidelity Assessment |
| GTR7-04-15 | (USA) Compatibility Between Two Rear Impact Dummies and Two Rear Impact Pulses |
| GTR7-04-16/Rev.1 | (Japan) Japan Research Activities in the UN GTR No.7 – Phase 2 amendment BioRID II seating proposal 4 |
| GTR7-04-17 | (OICA) UN GTR head restraints Torso angle ranges Distribution in vehicle categories |
| GTR7-04-18 | (SAE) SAE HADD J826 3D CAD H-Point Manikin UN GTR No. 7 Update |
| GTR7-04-19 | (Japan) UN GTR No.7 Regulation Flow Chart Proposal |

| | |
|---|---|
| GTR7-04-20 | Draft Minutes fourth UN GTR No. 7 Rear Impact Meeting, September 2010, Berlin |
| GTR7-05-01 | Draft Agenda UN GTR No. 7 (Phase 2) Informal Group Meeting 6 December 2010 |
| GTR7-05-02 | (Japan and UK) Amendments to the proposal to develop Phase 2 of UN GTR No. 7 and to establish an informal group for its development |
| GTR7-05-03 | (USA) Amendments to the proposal to develop Phase 2 of UN GTR No. 7 and to establish an informal group for its development |
| GTR7-05-04 | (Japan) 2nd progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints UN GTR Phase 2) |
| GTR7-6-01 | GTR7-06-01 - Draft Agenda GTR 7 (Phase II) Informal Group Meeting, 28 February–1 March 2011 |
| GTR7-06-02 | UN GTR and Regulation No. 17 amendment plan draft |
| GTR7-06-03 | (NHTSA) Rear Impact Dummy Biofidelity |
| GTR7-06-04 | (NHTSA) VRTC Rear Impact Sled Testing Status |
| GTR7-06-05 | 6th Meeting of the IWG GTR No. 7 Draft Status Report of the BioRID TEG |
| GTR7-06-06 | (JASIC) Japan Research Activities in the **UN** GTR-7 Phase 2 IWG Repeatability and Reproducibility study with new Bio RID II calibration method |
| GTR7-06-07 | (Lear) BioRID IIg response to varying comfort feature stiffness and varying seatback rotational stiffness (tests conducted under IIWPG protocol) GTR7-06-08 Euro NCAP |
| GTR7-06-09 | (EEVC) Evaluation of Seat Performance Criteria for Rear-end Impact Testing |
| GTR7-06-10 | (Japan) Review of Regulatory Text |
| GTR7-06-11 | GTR head restraints height of head restraints discussion of new measurement method |
| GTR7-06-12 | DRAFT proposal for a protocol to manage drawings, calibration and maintenance procedures associated with test tools referenced by UNECE Regulations |
| GTR7-06-13 | (Japan) Research Activities in the GTR-7 Phase 2 amendment BioRID II seating proposal No. 5 |
| GTR7-06-14 | (Humanetics) BioRIDII Head Restraint Certification Test Development |
| GTR7-06-15 | (Humanetics) Latest Investigations into BioRIDII Dummy Variation |
| GTR7-06-16 | Dummy Variability Reduction Timeline |
| GTR7-06-17 | Meeting minutes 6th GTR-7 meeting, 28 February–1 March 2011, Brussels |
| GTR7-07-01 | Draft agenda of the 7th meeting |
| GTR7-07-02 | (PDB) Evaluation of the proposed certification test procedures |
| GTR7-07-03 | (PDB) BioRID – Dummy Artefacts T2 Jacket Bolts / Shoulder Plates |
| GTR7-07-04 | (Humanetics) Update to BioRID II GTR/TEG |
| GTR7-07-05 | (NHTSA) BioRID vs. HIII Revised Buck |
| GTR7-07-06 | (NHTSA) Injury Criteria Analysis Plan |
| GTR7-07-07 | (JARI/JAMA) Study on impact response (injury value variation factors for BioRID II dummies |
| GTR7-07-08 | (MLTM/TS) BioRIDII Repeatability on Production Seat |

| | |
|---|---|
| GTR7-07-09 | GTR Head Restraints-Discussion of Height Measurement Method-Task Force by RDW, BASt, OICA |
| GTR7-07-10 | (Humanetics) BioRID Task List discussions |
| GTR7-07-11 | Meeting Notes 7th GTR-7 Informal Group Meeting, 10 June 2011, Washington, D.C, |
| GTR7-08-01-Rev.1 | Agenda of the 8th meeting |
| GTR7-08-02 | (Netherlands) Proposal of height for head restraints |
| GTR7-08-03 | (Netherlands) Effective head restraint height |
| GTR7-08-04 | (Japan) Neck Injury Parameters based on PMHS Tests |
| GTR7-08-05 | (NHTSA) Risk Curves and Injury Criteria - Injury Analysis Geneva |
| GTR7-08-06 | (Humanetics) PDB dummy investigation |
| GTR7-08-07 | (OSRP) Sled Tests with PDB Dummies |
| GTR7-08-08 | (Humanetics) VRTC sled testing |
| GTR7-08-09 | (Jasic) Validation of Neck Injury Criteria |
| GTR7-08-10 | (NHTSA) Rear Impact Sled Testing Summary |
| GTR7-08-12 | (JASIC) Results of Calibration Test with a heavy probe impactor for BioRID II |
| GTR7-08-13 | (JASIC) Verification for the difference in the waveform configuration |
| GTR7-08-14 | (ADSEAT) project overview Faurecia |
| GTR7-08-15 | (KATRI) 2nd simulation results of the Republic of Korea |
| GTR7-08-16 | (PDB) Post-Testing of OSRP BioRID II |
| GTR7-09-01 | Draft agenda of the 9th meeting |
| GTR7-09-02 | (PDB) New measurement method for effective height, March 2012, London |
| GTR7-09-03 | (NHTSA) Height Method comparison |
| GTR7-09-04 | (Tokyo Institute of Technology) Evaluation Methods Minor Neck Injuries TUV |
| GTR7-09-05 | (MLIT/JASIC/Japan) Neck Injury Parameters |
| GTR7-09-06 | (NHTSA) Injury Analysis, 2012, London |
| GTR7-09-07 | (Faurecia) GTR No. 7, Phase II Backset measurement variations |
| GTR7-09-08 | (CLEPA/OICA) Backset measurment test procedure using HRMD method |
| GTR7-09-09 | (BASt) 9th Meeting of the IWG GTR No. 7, Draft Status Report of the BioRID TEG |
| GTR7-09-10 | (TRL/EC) Presentation, 20 March 2012 |
| GTR7-09-11 | (Humanetics) BioRID Spine QA Stiffness Test Initial Trial |
| GTR7-09-12 | (Jasic) Verification for the difference in the waveform configuration on the 095G |
| GTR7-10-01 | Agenda of the 10th Meeting |
| GTR7-10-02 | (EC) Use of BioRID in Reg. No. 17 |
| GTR7-10-03 | (EC) Assessment of BioRID |
| GTR7-10-04 | (EC) Assessment of BioRID – Appendices |
| GTR7-10-05 | (OICA) Static backset measurement |
| GTR7-10-06 | (OICA) Head Restraint Height Context |
| GTR7-10-07 | (JARI) Injury Risk Curve Accident Simulation |

| | |
|---|---|
| GTR7-10-08 | (PDB) Status of BioRID Evaluation |
| GTR7-10-09 | (SAE) OICA VDA backset measure development |
| GTR7-10-10 | (SAE) Provisional comments on GTR7-06-10 Rev.2 |
| GTR7-10-11 | (TEG Chair) Proposition for Injury Assessment |
| GTR7-10-12 | (Japan) Effective height – interpretation |
| GTR7-11-01 | (Humanetics) BioRID RR evaluation series |
| GTR7-11-02 | (JARI) Injury Criteria |
| GTR7-12-01 | Agenda |
| GTR7-12-02 | (UK/Germany) Draft guidelines for M.R.1 v1 |
| GTR7-12-03 | (Chrysler) BioRID II R&R – TRL Baseline Tests |
| GTR7-12-04 | (Chalmers) Injury Criteria - Black Box Approach |
| GTR7-12-05 | (NHTSA) Preliminary injury criteria |
| GTR7-12-06 | (Jasic/JARI) Injury criteria |
| GTR7-12-07 | (OICA) Body in white definition |
| GTR7-12-08 | Draft minutes- meeting 12 |
| GTR7-13-01 | Draft agenda |
| GTR7-13-02 | (Chair) Working document-Dual pane regulatory text |
| GTR7-13-02 | Re-issued in word 2007 format-save in this format only |
| GTR7-13-03 | (TEG Chair) TEG Status Report |
| GTR7-13-04 | (Humanetics) Certification test update |
| GTR7-13-05 | Minutes |
| GTR7-14-01 | Agenda |
| GTR7-14-02 | (Chalmers) Seat evaluation study |
| GTR7-14-03 | (NHTSA) Preliminary BioRID II injury criteria |
| GTR7-14-04 | (Japan) Injury criteria progress report |
| GTR7-14-05 | (Japan) Tentative injury criteria proposal |
| GTR7-14-06 | (BASt) Report: Seating procedure work shop, July 2013 |
| GTR7-14-07 | (JASIC) JNCAP seating observation |
| GTR7-14-08 | (Humanetics) HIS certification test update |
| GTR7-14-09 | (Humanetics) HIS BioRID Pelvis and Jacket development |
| GTR7-15-01 | Agenda - Meeting 15 |
| GTR7-15-02 | (Humanetics) Certification Test Development |
| GTR7-15-03 | (NHTSA) Injury Criteria Update |
| GTR7-15-04 | (Humanetics) HIS update |
| GTR7-15-05 | (OICA) Commentary on Draft amendment |
| GTR7-15-06 | (OICA) Head restraint position |
| GTR7-15-07 | (JAMA) BioRID seating position |
| GTR7-16-01 | Agenda - Meeting 16 |
| GTR7-16-02 | (Humanetics) HIS update |
| GTR7-16-03 | (NHTSA) correlation study BioRID injury criteria |
| GTR7-17-xx | Agenda - Meeting 17 |
| GTR7-18-xx | Agenda - Meeting 18 |
| GTR7-18-xx | (CLEPA) Study impact of pulse |
| GTR7-18-xx | (OICA) BioRID criteria LAB CCFA |

| | |
|---|---|
| GTR7-18-xx | (BASt) Seat performance criteria for GTR7 |
| GTR7-18-xx | (JASIC) Explain for draft proposal amendment GTR7 |
| GTR7-18-xx | (JASIC) Proposal of backset |
| GTR7-18-xx | (JASIC) Consider of proposal from CLEPA |
| GTR7-18-xx | (JASIC) Injury criteria GTR |
| GTR7-18-xx | (Humanetics) Progress report of BioRID certification |
| TEGID-01 | (First Technology) Seat/Head Restraint Test Sled Pulse Summary |
| TEGID-02 | (Denton) Global BioRID-II User's Meeting |
| TEGID-03 | (Denton) Welcome to TEG BioRID Meeting, 15 March 2010 |
| TEGID-04 | (First Technology) FTSS Harmonized BioRID Sled |
| TEGID-05 | (PDB) BioRID Comparison upright vs. normal spine adjustment |
| TEGID-06 | Second WebEx Meeting of the BioRID TEG Draft Agenda |
| TEGID-07 | (Ford) BioRIDII New Sled Evaluation |
| TEGID-08 | (Denton) Denton ATD Update to BioRID II TEG |
| TEGID-09 | Third Meeting of the IWG UN GTR No. 7 – Draft Status Report of the BioRID TEG |
| TEGID-10 | (GM) GM BioRID Fx Data Issue Final Results - Report to GTR/TEG |
| TEGID-11 | Fourth WebEx Meeting of the BioRID TEG |
| TEGID-12 | UN GTR No. 7 (Phase 2) Informal Group Meeting, 21–22 September 2010 |
| TEGID-13 | Draft Minutes of third WebEx Meeting of the BioRID TEG on 13 July 2010 |
| TEGID-14 | (Katri) BioRID II Neck Bumper |
| TEGID-15 | (PDB) Possible causes for the poor reproducibility of neck forces and moments of the BioRID II First findings |
| TEGID-16 | (PDB) Possible causes for the poor reproducibility of neck forces and moments of the BioRID II First findings |
| TEGID-17 | (Humanetics) update to BioRID II UN GTR No. 7/TEG |
| TEGID-18 | (Faurecia) Influence of BioRID hip joint adjustment on BioRID results |
| TEGID-19 | (Humanetics) Jaw / C4 Contact Issue |
| TEGID-20 | (Humanetics) BioRID II Head/Neck Storage and Lifting Enhancement Kit |
| TEGID-21 | Draft agenda of fifth WebEx Meeting of the BioRID TEG |
| TEGID-22 | Certification Procedures for the BioRID II Crash Test Dummy |
| TEGID-23 | Procedures for Assembly, Disassembly, and Inspection (PADI) of the BioRID II Rear Impact Crash Test Dummy November |
| Since June 2012 | |
| TEGID-6-01 | Draft Agenda of 6th WebEx Meeting of the BioRID TEG, 7 February 2011 |
| TEGID-6-02 | Minutes of 6th WebEx Meeting, 7 February 2011 |
| TEGID-6-03 | ID for HR UN GTR phase 2 TOR change at 153rd WP.29 |
| TEGID-6-04 | Humanetics BioRID Update 2 July 2012 |
| TEGID-6-05 | Draft Status Report BioRID TEG, 6 December 2010 |

| | |
|---|---|
| TEGID-7-01 | Draft Agenda of 7th WebEx Meeting of the BioRID TEG, 14 April 2011 |
| TEGID-7-02 | (Humanetics) Plan for Comparing Head Restraint Probes |
| TEGID-8-01 | Draft Agenda of 8th WebEx Meeting of the BioRID TEG, 1 June 2011 |
| TEGID-8-02 | (Humanetics) Humanetics Update to BioRID II GTR/TEG |
| TEGID-8-03 | (Humanetics) Certification Testing PDB Tests |
| TEGID-8-04 | (PDB) Evaluation of the New Certification Test Procedures |
| TEGID-9-01 | Draft Agenda of 9th WebEx Meeting of the BioRID TEG, 14 December 2011 |
| TEGID-10-0 | Draft Agenda of 10th WebEx Meeting of BioRID TEG, 31 January 2012 |
| TEGID-10-02 | (TRL/EC) TRL-EC Presentation, 31 January 2012 |
| TEGID-11-01 | Draft Agenda Face to Face and 11th WebEx Meeting of BioRID TEG, 23 February 2012 |
| TEGID-11-02 | Attendance List Face to Face, 23 February 2012, Bergisch Gladbach |
| TEGID-11-03 | Minutes Face to Face and 11th WebEx, Bergisch Gladbach |
| TEGID-11-04 | TRL-EC Presentation, 23 February 2012 |
| TEGID-11-05 | (Humanetics) HIS Test Plan, 23 February 2012 |
| TEGID-11-06 | (Humanetics) HIS Spine Stiffness Test 1 |
| TEGID-11-07 | (JARI/JASIC) Jacket Test Quick Report from Japan to BioRID TEG |
| TEGID-12-01 | Draft Agenda of the 12th WebEx Meeting of the BioRID TEG, 14 March 2012 |
| TEGID-12-02 | (NHTSA) Injury Criteria Analysis Plan, Washington, D.C. |
| TEGID-12-03 | (NHTSA) Preliminary PMHS Injury Risk Curves |
| TEGID-12-04 | Collaboration Works (USA & JAPAN) Neck Injury Parameters based on PMHS Tests (J-MLIT/JASIC/JARI) |
| TEGID-12-05 | (JASIC) Evaluation Test Methods for UN GTR 7 - Accident Analysis (Validation of Neck Injury Criteria) (JASIC) |
| TEGID-12-06 | (JASIC) Evaluation Test Methods for UN GTR 7 - Verification for the Difference in the Waveform Configuration on the 095G Dummy |
| TEGID-12-07 | (JASIC) Evaluation Test Methods for UN GTR 7 - Results of Calibration Test with a Heavy Probe Impactor for BioRID II |
| TEGID-13-01 | Draft Agenda of 13th WebEx Meeting of the BioRID TEG, 3 July 2012 |
| TEGID-13-02 | (NHTSA) Shaw Probst Donelly Evaluation of the 95th Percentile HIII Large Male Dummy ESV 2007 |
| TEGID-14-01 | (Chair) Agenda 14th WebEx, 18 April 2013 |
| TEGID-14-02 | (Chair) Short report GTR No. 7 Workshop, 26 March 2012, BASt |
| TEGID-14-03 | (Humanetics) BioRID R&R evaluation series, 10 December 2012 |
| TEGID-14-04-1 | (Chrysler) BioRID II R&R – Series 2 - No Plots |
| TEGID-14-04-2 | (Chrysler) BioRID II R&R – Series 2 –Plots |
| TEGID-14-04-3 | (Chrysler) BioRID II R&R – Series 2 vs Series 1- No Plots |
| TEGID-14-04-4 | (Chrysler) BioRID II R&R – Series 2 vs Series 1- Plots Neck |
| TEGID-14-04-5 | (Chrysler) BioRID II R&R – Series 2 vs Series 1- Plots Head |

| | |
|---|---|
| TEGID-14-04-6 | (Chrysler) BioRID II R&R – Series 2 vs Series 1- Plots Thorax |
| TEGID-14-04-7 | (Chrysler) BioRID II R&R – Series 2 vs Series 1- Plots Lumbar |
| TEGID-14-04-8 | (Chrysler) BioRID II R&R – Series 2 vs Series 1- Plots Pelvis |
| TEGID-15-05-1 | (Humanetics) H-III50M R&R TRL seat, 18 April 2013 |
| TEGID-15-05-2 | (Humanetics) H-III50M R&R TRL seat – graphs, 18 April 2013 |
| TEGID-14-06 | (Humanetics)Certification Test Update to GTR7/TEG |
| TEGID-16-01 | Agenda 16th BioRID TEG WebEx |
| TEGID-16-02 | HIS certification test update, 29 January 2014 |
| TEGID-16-03 | Draft BioRID Certification Test Procedure, 27 January 2014 |
| TEGID-16-04 | Draft Minutes 16th WebEx, 16 January 2014 |
| TEGID-17-01 | Draft Agenda 17th BioRID TEG WebEx |
| TEGID-17-02 | (Germany) Introduction 17th BioRID TEG WebEx, 6 May 2019 |
| TEGID-17-03 | (Humanetics) HIS BioRID Corridors to TEG, 5 July 2019 |
| TEGID-17-04 | (JAMA/JARI) Summary BioRID II Certification Test Results |
| TEGID-18-01 | (Chair) Draft Agenda 18th BioRID TEG Meeting, 27 August 2019 |
| TEGID-18-02 | (JAMA) Proposal for BioRID II |
| TEGID-18-03 | (Humanetics) Corridor Analysis for UN GTR7 |
| TEGID-19-01 | (Chair) Draft Agenda 19th BioRID TEG Meeting, 12 September 2019 |
| TEGID-19-02 | (Chair) Draft Report BioRID TEG 18th WebEx, 29 August 2019 |
| TEGID-19-03 | (Humanetics) Corridor Analysis for UNGTR7 TEG Meeting, 12 September 2019 |
| TEGID-19-04 | (JAMA) JAMA opinion to BioRID II Corridor, 12 September 2019 |
| TEGID-19-05 | (Humanetics) C4 issue for UN GTR7 TEG Meeting, 12 September 2019 |
| TEGID-19-06 | (BASt) Dummy shoes for UN GTR No.7 |
| TEGID-19-07 | (JASIC) Confirmation of shoes wt to each dummy |
| TEGID-19-08 | (Humanetics) Shoe summary HIS, 8 September 2015 |
| TEGID-19-09 | (Chair) Draft report BioRID TEG TEG19th WebEx, 12 September 2019 |
| WCWID-1-01 | Agenda Whiplash Injury Criteria Workshop, September 2014, Berlin |
| WCWID-1-02 | Gothenburg List used for Whiplash Injury Criteria Workshop, Berlin |
| WCWID-1-03 | Seat Evaluation Study by Johan Davidsson and Anders Kullgrenm, 09-10b 2013 |
| WCWID-1-04 | Seat Evaluation Addition Davidsson Rev. 1 |
| WCWID-1-05 | JARI Review on Injury Parameters and Injury Criteria for Minor Neck Injuries during Rear-end Impacts |
| WCWID-1-06 | NHTSA OSU Preliminary PMHS Injury Risk Curves & Potential Injury Criteria in Rear Impact |
| WCWID-1-07 | TNO Whiplash Injury Criteria |

| | |
|---|---|
| WCWID-1-08 | Participant List Whiplash Injury Criteria Workshop, September 2014, Berlin |
| WCWID-1-09 | EEVC WG12 Evaluation of seat performance criteria |
| WCWID-1-10 | Minutes Whiplash Injury Criteria Workshop, Berlin |
| WCWID-2-01 | Agenda 2nd Group of Experts Injury Criteria Meeting, (WebEx) August 2015 |
| WCWID-2-02 | (Japan) Brief Summary of the Process on the Selection/Determination of Neck Injury Parameter |
| WCWID-02-03 | (Japan) Questions/Discussion with respect to Japan's Proposal |
| WCWID-02-04 | On Candidate Seat Performance/Injury Criteria for Regulatory Purpose |
| WCWID-02-05 | (Chalmers University) Johan Davidsson GTR7 meeting WebEx |
| WCWID-02-06 | GTR7 update July 2015 R&R and Injury Criteria Correlation (NHTSA/VRTC) BioRID II Drawing package, 23 July 2010 version |
| GRSP-47-16/Rev.1 | (Japan) First progress report of the informal working group on UN GTR No.7 (Head Restraint) Phase 2 |
| GRSP-47-17/Rev1 | (Japan) Head restraint UN GTR Phase 2 Status and Open issues |
| GRSP-48-11 | (Japan and United Kingdom) Amendments to the proposal to develop Phase II of UN GTR No. 7 (Head restraints) and to establish an informal group for its development |
| GRSP-48-12 | (United States of America) Amendments to the proposal to develop Phase II of UN GTR No. 7 and to establish an informal group for its development |
| GRSP-48-33 | (Japan) 2nd progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints UN GTR Phase 2) |
| GRSP-50-31 | (Japan) Draft 3rd progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints UN GTR Phase2) |
| GRSP-51-31 | (Germany) The status report of Chair of the BioRID Technical Evaluation Group (TEG) |
| GRSP-52-18 | (Chair of IWG on UN GTR No. 7, Phase 2) Status report of the informal working group |
| GRSP-52-23 | (Japan) Draft 4th progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints UN GTR Phase 2) |
| GRSP-53-06 | (Chair of the Informal Working Group on UN GTR No. 7 - Phase 2) Draft UN Global Technical Regulation No. 7 (Head restraints) |
| GRSP-53-14 | (Chair of the Informal Working Group on UN GTR No. 7 - Phase 2) Status report of the Informal Working Group on UN GTR7 Phase 2 |
| GRSP-53-15 | (The Netherlands) Increase of the absolute height of head restraints |
| GRSP-53-16 | (The Netherlands) UN GTR7 measuring method for effective head restraint height |
| GRSP-53-17 | (The Netherlands) Proposal on actual needed height of head restraints |
| GRSP-54-05 | (IWG GTR7 PH2) Draft Addendum 1 - Specifications for the Construction, Preparation and Certification of the 50th percentile male Biofidelic Rear Impact Dummy, (BioRID II) anthropometric test device |
| GRSP-54-18-Rev.1 | (OICA) Global Technical Regulation No. 7 (Head restraints) OICA position on head restraint height |

GRSP-54-23 (USA) Comments from the United States on ECE/TRANS/WP.29/GRSP/2013/17

GRSP-54-30 (Japan) Draft 5th progress report of the informal group on phase 2 of UN GTR No.7 (Head restraint UN GTR Phase2)

ECE/TRANS/WP.29/GRSP/2013/24 (IWG on UN GTR No. 7, Phase 2) Draft amendment 1 Phase 2 of the global technical regulation No. 7 (Head restraints)

GRSP-56-05 (Japan) Draft 6th progress report of the informal group on phase 2 of UN GTR No.7 (Head restraint UN GTR phase 2)

ECE/TRANS/WP.29/GRSP/2015/34 (IWG on UN GTR No. 7, Phase 2) Draft amendment 1 (Phase 2 of the global technical Regulation)

ECE/TRANS/WP.29/2010/136 (Japan and UK) First progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints)

WP.29-152-13 (Japan and UK) Amendments to the proposal to develop Phase 2 of UN GTR No. 7 (Head restraints) and to establish an informal group for its development

WP.29-152-16 (USA) Amendments to the proposal to develop Phase 2 of UN GTR No. 7 (Head restraints) and to establish an informal group for its development

WP.29-153-28 (Japan, UK and USA) Amendments to the proposal to develop Phase II of UN GTR No. 7 and to establish an informal group for its development

WP.29-153-29 (Japan) 2nd progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints UN GTR Phase 2)

ECE/TRANS/WP.29/2011/86 (Japan) 2nd progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints UN GTR Phase 2)

ECE/TRANS/WP.29/2012/34 (Chair of IWG on UN GTR No. 7, Phase 2) Third progress report for Phase 2 of UN GTR No. 7 (Head restraints)

ECE/TRANS/WP.29/AC.3/25/Rev.1 (Japan) Revised authorization to develop amendments to GRT No. 7 concerning head restraints

WP.29-161-19 (Japan) Status report of the informal group on Phase 2 of UN GTR No. 7 (IWG GTR No. 7, PH2)

WP.29-163-23 (Chair of IWG on UN GTR No. 7, Phase 2) Draft 4th progress report of the informal group on Phase 2 of UN GTR No. 7

ECE/TRANS/WP.29/2014/86 (United Kingdom) Fourth progress report of the Informal Working Group on Phase 2 of UN GTR No. 7 (Head restraints)

ECE/TRANS/WP.29/GRSP/2013/17 (Germany, Netherlands and United Kingdom) Proposal for Amendment 1 to Global Technical Regulation No. 7 (Head restraints)

GRSP-58-18 (Germany) Introduction to Revision of UN GTR No. 7 - Official document ECE/TRANS/WP.29/GRSP/2015/34

GRSP-58-19-Rev.2 (Japan) Draft 7th progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints UN GTR Phase 2)

GRSP-58-26 (Chair of GRSP) Draft amendment 1 (Phase 2 of the global technical Regulation) - Superseding ECE/TRANS/WP.29/GRSP/2015/34

ECE/TRANS/WP.29/GRSP/2018/27 (IWG on UN GTR No. 7, Phase 2) Proposal for Amendment 1 (Phase 2 of the global technical Regulation)

GRSP-64-38 (Germany) Introduction to Revision of UN GTR No. 7 - Formal document ECE/TRANS/WP.29/GRSP/2018/27

GRSP-64-39-Rev.1 (Japan, Germany and Netherlands) Proposal for Amendment 1 Phase 2 of the UN GTR No. 7

GRSP-64-40 (Japan) Draft 8th progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints UN GTR Phase 2)

GRSP-64-44 (CLEPA) Dynamic criteria BioRID.

ECE/TRANS/WP.29/GRSP/2019/5 (IWG on UN GTR No. 7, Phase 2) Proposal for Amendment 1 of Phase 2 of UN GTR No. 7 (Head restraints)

ECE/TRANS/WP.29/GRSP/2019/8 (CLEPA) Proposal for Amendment 1 (Phase 2) to UN Global Technical Regulation No. 7 (Head Restraints)

ECE/TRANS/WP.29/GRSP/2019/10 (CLEPA) Proposal for Amendment 1 (Phase 2) to UN Global Technical Regulation No. 7 (Head Restraints)

GRSP-65-24 (IWG on UN GTR No. 7, Phase 2) Proposal for Amendment 1 (Phase 2 of the global technical Regulation)

GRSP-65-32 (Germany) Introduction to Revision of UN GTR No. 7 - Formal document ECE/TRANS/WP.29/GRSP/2019/05 and GRSP-65-24.

GRSP-65-31 (Japan) Draft 9th progress report of the informal group on Phase 2 of UN GTR No. 7 (Head restraints UN GTR Phase2)

ECE/TRANS/WP.29/GRSP/2019/26 (IWG on UN GTR No. 7, Phase 2) Proposal for Amendment 1 of Phase 2 of UN Global Technical Regulation No. 7 (Head restraints)

ECE/TRANS/WP.29/GRSP/2019/21 (Japan) progress report of the informal group on Phase 2 of UN GTR No.7 (Head restraints)