

Transmitted by the expert from Japan (Technical sponsor)

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Draft 3rd progress report of the informal group on Phase 2 of gtr No. 7
(Head restraints gtr Phase2)

Note:

The text reproduced below was submitted by the representative of Japan and proposes amendments to the 2nd progress report of the informal group on Phase 2 of gtr No.7 (ECE/TRANS/WP.29/2011/86). The proposed amendments are marked in bold and in strikethrough characters.

I. Objective of this proposal

1. The representative of Japan proposed developing Phase 2 of gtr No. 7. Additional amendments proposed by the United States of America were incorporated in the proposal.¹ He also proposed establishing an informal group for the development of this Phase. The informal group received the mandate 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 the Working Party on Passive Safety (GRSP) for the development of the draft gtr on head restraints (ECE/TRANS/WP.29/1064, para. 81) and that Phase 2 of the gtr should consider, as indicated in informal document No. WP.29-143-23-Rev.1, the following issues:

- (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 on the two-step approach suggested by the representative 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 focus 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 gtr, prepared jointly with the United Kingdom and the United States of America, and the revised timetable. AC.3 agreed to develop the amendment to the gtr. As a first step, the amendment work will focus on developing a low speed dynamic test using the BioRID II dummy. Regarding the head restraint height, as a first step the procedures for defining the effective height will be considered. Detailed discussions on dummies will be conducted by a Technical Evaluation Group (TEG), which is to be established under the auspices of the informal group. Drawings detailing the uniform specification of the test tools will 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 rear impact crashes, insurance industry groups, such as the International Insurance Whiplash Prevention Group (IIWPG), Insurance Institute for Highway Safety (IIHS) and Thatcham, have been conducting 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. However, the testing and evaluation methods vary from one programme to another. Additionally, the European Enhanced Vehicle-safety Committee (EEVC) Working Group 12 has been investigating the 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.

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

5. A deeper review of United States of America's initial data shows that while there are a number of AIS 2 and AIS 3 injuries occurring in rear impact crashes greater than 18 km/h, most of the neck injuries, which are the focus of this gtr and which can be evaluated by a rear impact dummy, are AIS 1. For AIS 1 injuries, there are approximately an equal number of occurrences below 18 km/h as there are above 18 km/h. Research from Japan shows similar trends, with a significant number of long term minor neck injuries occurring in the range of 16 – 25 km/h (www.unece.org/trans/doc/2010/wp29grsp/GTR7-02-16e.pdf). An evaluation of research titled "Recommendations for a Low-speed Rear Impact Sled Test Pulse" conducted by the EEVC concluded that most long term minor neck injuries (greater than one month) are sustained at speeds between 16 km/h and 25 km/h (www.eevc.org/publicdocs/EEVC_WG20_Pulse_Recommendations_Sept_2007.pdf). The USA is currently evaluating several dummies and comparing them to cadaver testing at 24 km/h which can be used to help address these long term minor neck injuries.

6. Although previous discussions have differentiated between "low speed" and "high speed", all the research being conducted is at speeds that could be considered to "low speed" with respect to short-term and long-term minor neck injuries. Instead of focusing on test speed, the informal working group should take a comprehensive approach to determining the most appropriate test pulse or test pulses to mitigate minor neck injuries and provide a comparable level of benefits as in the existing gtr No.7 requirements. The group may consider options which would provide additional benefits for focussing long term injuries during 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, a proposal to amend the ToR to the effect that the dynamic evaluation method being studied 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, with the goal to have the amended ToR adopted by GRSP in December 2012 and approved by WP.29 in June 2013. The proposal was approved.

8. At the 154th session of the WP.29, the possibility of a delay in the progress of the injury criteria work by the United States of America and Japan that may hinder the satisfactory conclusion of the work was reported. In addition, about handling of the dummy drawing package and other dummy info, the United States of America questioned whether it should be incorporated into a separate gtr. It was decided the development of a common resolution between the 1958 and 1998 agreements and suggested that WP.29 would discuss this further.

III. Subjects for review and tasks to be undertaken (Terms of Reference)

~~7.9.~~ With regard to head restraint height, the informal group should decide:

- (a) How to define the effective height;
- (b) The height requirements.

~~8.10.~~ With regard to mitigating long-term and short-term minor neck injuries with 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) Working within the accepted knowledge concerning the mechanism of minor neck injury and other rear impact injuries, identify parameters that may be used to advance developments in occupant protection through, for example:
 - (i) Analyzing 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 shall 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 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) ~~For example, e.g.~~ measure the relative movement between the upper and lower parts of the neck and the forces applied to each of these parts.
- (e) (ii) Define reference values which should be based on the results of injury risk analysis and feasibility studies.

~~9.11. With regard to evaluation, the~~ The informal group should evaluate the effects on ~~reduction~~ ~~reducing~~ of injury and the cost-effectiveness of the proposals.

IV History of the discussions

A. Head Restraint Height

~~10.12.~~ The Netherlands proposed measuring the height by combining it 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 is not considered under the methods of the current Regulation No. 17, EuroNCAP, and IIWPG and proposed a new evaluation method that combines the height and backset. In this evaluation method, measurements are performed at the center only. Measurements according to this evaluation method would require the height to be raised by about 40 mm. Some methodological issues were pointed out, such as remaining uncertainties, reproducibility/repeatability, and hindrance to rear visibility. At the fourth informal group meeting, the Netherlands explained the status of their consideration of new head restraint height requirements. The head restraint height will be considered by measuring the backset based on the 95 percentile HRMD template proposed by the Netherlands. The evaluation of effectiveness had been reported in the accident analysis by EEVC (HR-10-6). Japan pointed out that the evaluation method for active head restraints is necessary and that the timing of its delivery was

important. The Chair noted that this topic could run in parallel to the principal 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 that the most recent changes to regulatory requirements had regarding taller occupants. He also welcomed the cooperation between International Organization of Motor Vehicle Manufacturers (OICA) and the Netherlands to collect data on the head position according to the RAMSIS system by June 2011.

13. At the 6th informal meeting, a proposal on “a simple, pragmatic approach to effective height measurement” was submitted by a task force led by Netherlands and includes member of OICA. It was decided that the task force will study the new method further and the result of the study will be reported in June 2011.

14. At the 7th informal meeting, the head restraint height task force reported its proposed new height measurement method and explained measurement of the backset and effective height of head restraints for 50th percentile and 95th 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 ECE R16 that are part of the CRS-interference problem.

The SAE HADD committee had some comments on the head restraint height measurement method, and the Chair noted that the 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.

15. At the 8th informal meeting, Netherlands presented the proposed effective height measurement method with proposal of text of the regulation. The “Annex1” described at paragraph 2.3.3 Determination of the highest head restraint height as follows:

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.

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 =

$$\Delta X \cdot \sin(\text{design torso angle}) + \Delta Z \cdot \cos(\text{design torso angle})$$

The informal working group discussed the proposal method of head restraint height measurement and noted that there are still some issues concerning certain head restraint shapes and the measuring device. The task force will consider these issues and the informal working member will discuss this further at the next meeting.

B. Dynamic Evaluation Method

~~11.16.~~ Number and conditions of sled pulses for the low speed dynamic test

~~12.17.~~ A study on accident analysis and accident simulation tests, conducted by Japan, indicates that, for reducing permanent disabilities, it is appropriate to set the sled pulse at EuroNCAP's medium waveform between $\Delta V = 16$ 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, improvements in reproducibility and repeatability will be studied using a new dummy calibration method.

13-18. A discussion of appropriate test speeds to evaluate protection against both long-term and short-term injuries was held at the fourth informal group meeting. Evaluation indicators were also discussed. 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 and a benefits analysis could be conducted.

19. At the 6th informal meeting, the development of the Euro NCAP medium-severity pulse definition (delta-v of 16 km/h) was presented. However, the United States of America noted that since delta-v of the Euro NCAP pulse is lower than that of 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.

20. At the 7th informal meeting, NHTSA reported the Injury Criteria Analysis Plan, which includes cadaver sled tests as well as CT scans of the cervical vertebrae and reproduction of tests using cervical vertebrae simulation models. Specifically, the output values of sensors installed in the cadaver neck and the injuries after the test were investigated. NHTSA noted that it would make assessments to see if there is correlation between the injuries and the IV-NIC in injury evaluations and whether they can be correlated to the existing injury criteria. The future tasks are to summarize the test results such as calculations of quantitative parameters, i.e., the IV-NIC shear and axial forces, to create injury risk curves based on the PHMS test results, and to define the IARV.

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

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

21. At the 8th informal meeting, Japan reported the preliminary study result regarding FEM simulation. The findings indicate states 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 limited cases (n=3).

NHTSA reported preliminary PHMS injury risk curves and potential IVRAs for grt. The analysis results indicated that the potential injury criteria are NDCr rate and product and NDCx rate and product.

NHTSA also reported their latest study of rear impact sled test on BioRid II vs. Hybrid III and FMVSS202a vs. Modified Annex 9 pulse with OEM seats. The major observations from test results are:

>T1 acceleration is a poor criterion for both dummies.

>BioRid is more biofidelic than the Hybrid III.

C. Accident analysis

14-22. In Japan, rear impact crashes account for 31 per cent of all traffic collisions, and 92 percent of these result in minor neck injuries based on all accident macro analyses. The accidents occur most frequently (about 60 percent) at a crash speed of $\Delta V=15$ km/h and below. Even at $\Delta V=20$ km/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 has increased, and they occur most frequently at

$\Delta V=16-22$ km/h, however, these ΔV analyses are based on small accident numbers micro analyses.

~~15-23.~~ Evaluation Indicator and Reference Value

(a) Japan gave a presentation at the "meeting of interested experts" held before establishing the informal group. Past studies on neck injuries and volunteer tests have shown correlations between neck strains/strain rates and occurrences of injuries. Risk curves for each case were created based on the results of accident analysis and simulations. Injury indicators that have high correlations with strain rates and can be measured using dummies were extracted. As a result, relationships between strain rates and NIC and between neck strain and neck force (Upper & Lower Fx, Fz, My) were shown, and their risk curves were created. Japan proposes that these be used as the basis for injury criteria. For some indicators, no risk curve could be drawn and other alternative indicators were used.

(b) In addition to the Japanese proposal, EEVC presented another proposal for evaluation indicators on "Dynamic backset", that was submitted during the discussions for Phase 1 of gtr No. 7.

~~16-24.~~ At the fourth informal group meeting, Partnership for Dummy (PDB) reported on the evaluation of reproducibility of eight dummies, first presented to the ESV conference in 2009. The reproducibility was poor in the neck force (Fx, Fz, My), while acceptable in acceleration (but $cv>10\%$ for NIC) and kinematic behaviour ($cv<10\%$ for dynamic backset). However, standard evaluation method for dynamic backset should be prescribed since variability is inherent in video analysis.

25. At the 6th informal meeting, EEVC reported that, in a study to investigate the correlation between traffic accidents recorded in insurance data and the injury criteria, a high correlation was found between NIC and Upper Neck shear force(Fx) with risk of long-term (permanent) injury.

26. At the 8th informal meeting, Japan reported their latest rear collision analysis to evaluate the gtr test method. The findings from their analysis that in each injury criteria, the rate of neck injuries tend to increase with the injury values which Japan had proposed for UN/ECE/WP.29/GRSP/gtr7.

D. Dummies

~~17-27.~~ Discussions on dummies had been conducted as part of the Global BioRID Users Meetings (GBUM) activities up to the first informal meeting. However, starting with the second meeting, the GBUM activities were incorporated into those of the Informal Group's TEG (Technical Evaluation Group) who hold web meetings approximately once a month.

E. Biofidelity

~~18-28.~~ At the "meeting of interested experts", the current status of the study by EEVC Working Group 12 (WG12) and WG20 and results of studies on the biofidelity of Hybrid III, RID3D, and BioRID II were reported on. The biofidelity in volunteer tests at 7-9 km/h was verified using qualitative procedures and quantitative core method, and BioRID II presented the best results.

~~19-29.~~ The United States of America reported on the progress of its studies on the biofidelity of dummies and injury mechanisms for the evaluation of AIS3+ injuries in mid-

and high-speed rear impact crashes. Based on their results, a seat for sled tests was created. In addition, the biofidelity was compared with data from post-mortem human surrogate (PMHS) experiments, BioRID, RID3D and Hybrid III 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.

~~20.30.~~ At the fourth informal group meeting, NHTSA reported on the results of repeatability/reproducibility and biofidelity research. NHTSA conducted dynamic tests at 17.6 km/h and 24 km/h. They also conducted tests comparing PMHS with Hybrid III, BioRID, and RID3D. Those 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 repeatability will be completed by the end of October and December of 2010 respectively. NHTSA is also conducting tests to compare the sensitivity and reproducibility among dummies. They are comparing results using BioRID II and Hybrid III in seats with large and small backset and waveforms specified in FMVSS 202a and Regulation No. 17 proposal to incorporate a BioRID (Annex 9) to evaluate if the tests rank the severity of backset in the same manner. The testing will be completed in November 2010 and the results will be presented in February 2011. OICA has requested that a biofidelity assessment be done on the rear impact dummy chosen for this gtr, over the range of potential seatback angles.

~~21.31.~~ One of the original tasks of the informal group was to develop a low-speed dynamic test, including the test procedure, compliance criteria and the associated corridors for the biofidelic rear impact dummy (BioRID II). As a possible later phase, depending upon the direction of WP.29, the group would consider the possibility of a higher-speed dynamic test.

~~22.32.~~ At the fourth meeting, the Chair recalled that the Informal Group was tasked with reporting to WP.29 at its 152nd session (November 2010) and, in particular, to confirm the timetable for the delivery of a proposal for the adoption of the BioRID II dummy into gtr No. 7. He suggested recommending to WP.29 that the period of Phase 2 consideration would be approximately 2 years, aiming for adoption at GRSP in December 2012, with a proposal to WP.29 in June 2013. The suggestion was based on the understanding that research being conducted by Japan and the United States, and scheduled to be completed by the end of 2011, would be successful in establishing injury criteria suitable for evaluation in a regulatory test procedure.

~~23.33.~~ Japan commented that BioRID II should be added to the gtr in May 2011 as specified in the original Terms of Reference (ToR), since neck injury is a serious problem needing to be addressed in the regulation immediately. Two options were proposed:

(a) Option 1: A proposal to amend gtr No. 7 will be submitted to GRSP in May 2011 to specify dynamic backset evaluations using either Hybrid III or BioRID II, as a Contracting Party option. Then, as a second step, harmonization of dummy, evaluation of upright postures, tests at higher speed and mid speed will be considered in 2014 and later.

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

~~24.34.~~ OICA expressed strong concerns that both of these options would result in a gtr with Contracting Party options.

~~25~~-35. At the 152nd session of WP.29, Japan presented a proposed revision of the ToR to AC.3 to establish the timeline of the group until 2012. This schedule should allow the completion of the injury criteria analysis, but pointed out that if the work was not complete, a detailed BioRID II test would be added to the gtr as an alternative to the existing test (the option already exists as a placeholder). The United States presented an alternative proposal to revise the ToR to allow the group to take a comprehensive approach to address both long-term and short-term minor neck injuries. AC.3 returned the proposals to GRSP, noting that it anticipated a revised proposal to revise the ToR at the 153rd session.

~~26~~-36. 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 the gtr as a single procedure to assess the protection against neck injury. The group also agreed with the recommendation of the United States that the injury criteria that emerge from the ongoing research effort in the US and Japan should guide the development of the final procedure.

~~27~~-37. Japan had associated lower speed tests with injuries at AIS1 level and expressed concerns that any change to address more severe injury levels would take longer than December 2012. It was agreed that AIS1 injuries remain the focus but that, if possible, consideration be given to long term as well as short term injuries.

~~28~~-38. As a result, the group is recommending 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 equivalent or better than the benefits provided by the existing option in gtr No. 7. If the group was able to provide additional benefits within the specified time frame it would be permitted to do so, but if this work was not completed, any discussion of further work in this area would take place at a future date.

39. At the 6th informal meeting, the United States of America reported that BioRID II has the best biofidelity and reproducibility. Japan and the United States of America are scheduled to conduct an appropriate, joint study of the injury criteria by the end of 2011.

40. At the 7th informal meeting, PDB reported that the shoulder of the BioRID II interacts with the seat back of the hard bucket seat depending on the seat back shape, with a load path via the T2 jacket bolt/shoulder plate, and PDB also presented the simulation and sled test results that affect the upper neck Fx and My.

F. New Head Restraint Measurement Device (HRMD) drawing

~~29~~-41 The current H-point machine is defined in Society of Automotive Engineers (SAE) SAE J826, and the HRMD was developed in the 1990s. For either machine, there are large variations in products available on the market, resulting in variations in the backset measurements.

~~30~~-42. At the second informal meeting, the result of research conducted by the German manufacturer's association (VDA) was introduced. VDA developed a new H-point machine and a testing jig called Dilemma by taking the average of many H-point machines and harmonizing it with the SAE standard. For this, it is scheduled to issue the VDA specifications in February 2010 and to propose it to the SAE as a revision to the standard.

~~34~~-43. At the fourth informal group meeting, it was reported that the draft of 3D CAD data of SAE HADD J826 H-Point manikin was proposed at SAE meeting on October 20. When this proposal will be agreed to at a SAE conference, it will be possible to release 3D CAD to the public. The measuring method with HRMD is under consideration and will be suggested by March 2011.

44. At the 8th informal meeting, the chair stated the current status of HRMD and 3DH selection and calibration. The SAE had indicated their interest in the gtr activity but also advised that their workload prevented them making a contribution to development of HRMD and 3DH devices specification. The chairman noted that as the group was aware of the variation in these devices or solution should be found. The informal working group will discuss this further.

G. Dummy drawings (2D & 3D)

~~32~~45. At the first and second informal meetings, the progress of the drawing harmonization by Denton and First Technology Safety Systems (FTSS) was reported on. The 2D drawing (PDF form), 3D drawing (STEP form) and user's manual are scheduled to be created jointly between the two manufacturers.

~~33~~46. At the fourth informal group meeting, Humanetics (a company formed by the merger of FTSS and Denton) reported that the drawings had been posted on GRSP website. They also reported that 3D data is ready, but PADI is under revision. They are preparing the list to be included in PADI for checking most recent dummy. The Chair pointed out that a method to clarify the appropriateness of the build level of BioRID II is necessary. The suggestion from Japan to provide PADI along with drawings in a same website was agreed.

47. At the 153rd session of WP.29, the chair of the informal group introduced a proposal for a protocol to manage drawings, manuals, etc. at the United Nations. The basic principle was agreed.

48. At the 8th informal meeting, the chair reported status of register of technical specification. WP29 has directed that, as a first step, data shall be incorporated into the Consolidated Resolution on the Construction of Vehicles(R.E.3). The amendment to R.E.3 will be used also for other ATDs.

H. Certification procedures

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

~~35~~50. At the third meeting, the BioRID TEG reported on the new certification test method with the head restraint. While the development is heading in the right direction, there are concerns that the head to head restraint contact time is a little too short (10-20 ms). Regarding the presence of head restraint in the new sled, Humanetics will develop a draft of detailed method. It will be evaluated by PDB, Japan, Ford and General Motors (GM).

51. At the 5th and 6th informal meetings, the calibration method without head restraints was agreed. As regards calibration with head restraints, it was decided that the study would be based on the weight probe (119 kg) with a better correlation with input pulses of evaluation tests.

~~36.52.~~ 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 is to be included in the drawing package.

53. At the 7th informal meeting, Humanetics reported the results of certification tests using the standard probe and the heavy probe. They noted that neither one offered or clear benefit over the others, while the standard probe is better in terms of reduced burdens in handling in laboratories. On the other hand, a safety concern exists about handling such heavy tool.

45. At the 8th informal meeting, Japan reported Standard vs. Heavy probe calibration test results that noted the heavy probe with in which the peak value and variation by calibration test has become more apparent.

I. Repeatability and reproducibility

~~37.54.~~ In testing, good repeatability is obtained if the same dummy is used. However, there are problems with reproducibility among different dummies. Work to establish a common build level for the BioRIDIIg, together with dummy improvements and revised certification tests are being discussed to improve their repeatability and reproducibility.

~~38.55.~~ At the third meeting, Japan reported the results of the new dummy calibration methods and sled tests. The same variations in LowerFz that had been seen in the new certification test method with the simulated head restraint were also observed in the sled tests. Accordingly, it is considered effective to use the head restraint in the certification test, especially to minimise variations around the contact time. However, there are differences in absolute values between certification and sled tests, so will be discussed further September 2010.

~~39.56.~~ At the fourth informal group meeting, it was reported that there was a quite large difference between sled types when one seat was tested for evaluating the reproducibility using acceleration and deceleration sleds. 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 head during approach. These issues are kept as items to be monitored.

57. At the 7th informal meeting, KATRI reported the results of dummy reproducibility in sled tests (with delta-v of 16 km/h and 20 km/h).

Comparison of the CV values between the two sled speeds shows that, in general, the CV 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.

As regards the injury values, since they 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 the study on the reproducibility and repeatability.

PDB re-adjusted the BioRID II that it had long used in testing, performed certification tests with the head restraint using the standard and heavy probes as well as verification tests with the accompanying hard bucket seat, and reported the results of these tests.

As a result, it concluded that although the reproducibility/repeatability for accelerations was acceptable, the values were not adequate to be used as injury criteria for forces or moments. Even though the dummy satisfies testing with a hard bucket seat has shown poor reproducibility for some data channels. It was thus agreed that round-robin tests be performed between Europe and the United States of American using the dummy used in the PDB testing.

58. At the 8th informal meeting, Humanetics reported the round robin test status. The results from OSRP and VRTC sled tests did not recreate the results recorded at PDB but OSRP did identify some reproducibility concerns. However analysis of the results is not complete. The working group will continue to investigate dummy reproducibility. TEG chair proposed WebEX meeting as soon as possible, to schedule future work.

Japan reported BioRid response differentiation between 095G and other 102G/115 on calibration test. By swapping the dummy jacket between 012G and 095, the waveform was shifted to correspond with the original dummy jacket's waveform.

Japan will evaluate the jacket stiffness using the new procedures developed by Humanetics.

Korea reported their latest study of test procedure on the variation of dummy response by using FEM model and sled test. Korea noted that current low level of confidence in repeatability and reproducibility of real tests may be due to high tolerance of some factor of the dummy and considered that the current tolerance for BioRid II setting should be reconsidered in establishing test procedure in Gtr 7 Phase 2.

J. Dummy seating conditions

40-59. At the "meeting of interested experts" and at the first informal meeting, regarding the seating procedures of IWPG and EuroNCAP, Japan made proposals on:

- (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 N₁ vehicles (especially those with forward control), and explained the reasons for the proposals (GTR7-01-09e).

41-60. At the second informal meeting, Japan reported that in general the torso angle is at 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 for a more erect seating posture. The appropriateness of the dummy when set to this condition is being evaluated.

42-61. At the third meeting, regarding the standard seating posture, basic agreement was reached on adopting the design reference angle proposed by Japan.

43-62. Japan reported the influence of the difference of seating postures at design torso angle and 25 degrees on evaluation. They reported that there was no specific tendency in the difference between two same seat with conditions of JNCAP (design angle, 20 to 25 degrees) or IIHS (25 degrees).

44-63. Japan reported the results of tests that it had conducted to study the new tool for upright postures using a smaller torso angle (10°) for commercial vehicles. It was found that while the dummy spine could be set to the revised posture when the dummy is equipped with its jacket, its upright posture will tilt forward largely and it is 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.

45-64. Japan and OICA reported the ratio of seats with upright torso angle in the market. Japan reported that such seats account for 45 per cent of all seats in the Japanese market and pointed out the necessity of static backset option until the dummy representing upright posture is developed.

46-65. OICA reported that the overall world wide ratio (which includes the Japanese data) of seats with upright torso angle is 12 per cent.

47-66. 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 is kept as an option for these seats until the dynamic evaluation is shown to be suitable for all seat angles.

K. Dummy Durability

48-67. The neck damper was only damaged in the Republic of Korea, when the new calibration test procedures were performed. Ford pointed out that it is necessary to add a body block to the calibration sled to prevent damage to dummies.

49-68. 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

50-69. First step (under the chairmanship of the United Kingdom and with the technical sponsorship of Japan)

Working Groups	Dates	Venue
"meeting of interested experts"	6/11/2009	Washington D.C.
1 st informal meeting	8/12/2009	Geneva, Switzerland
2 nd informal meeting	2-3/2/2010	Tokyo, Japan
3 rd informal meeting	17/5/2010	Geneva, Switzerland
4 th informal meeting	21-22/9/2010	Germany
5 th informal meeting	6/12/2010	Geneva, Switzerland
6 th informal meeting	2/2011	Brussels, Belgium
7 th informal meeting	6/2011	Geneva, Switzerland Washington DC, United state of America
8 th informal meeting	6 12/2011	Washington DC Geneva, Switzerland
9 th informal meeting	3/2012	London, United Kingdom
10 th informal meeting	12/2011	Geneva, Switzerland
11 th informal meeting	5/2012	Geneva, Switzerland
[12 th informal meeting	2012]
[13 th informal meeting	12/2012	Geneva, Switzerland]

Step 1

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

VI. Documents for the meetings

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 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 gtr No. 7 – Phase 2 Informal Working Group
GTR7-01-06	(Denton) Global BioRID-II User's Meeting
GTR7-01-07	(Republic of Korea) 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 gtr No. 7 – Head Restraints Phase 2
GTR7-02-01	Draft agenda of the second Informal Working Group Meeting for 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 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 gtr No. 7 - Draft Status Report of the BioRID TEG
GTR7-03-05	Gtr No. 7 IWG Meeting 3 – Summary of Decisions and Actions
GTR7-04-01	BioRID II Drawing package - 7/23/10 version
GTR7-04-02/Rev.1	Agenda of the meeting
GTR7-04-03	(The Netherlands) Head Restraints - Static Height Requirements
GTR7-04-04	(Japan) 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 Program
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	(Humanetics) Review and Approval of Recommended Certification Tests for BioRID II
GTR7-04-12	(Humanetics) BIORID II design evaluation checklist - Draft 9/21/2010
GTR7-04-13	(Humanetics) BIORID II design evaluation checklist - Draft 9/21/2010
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 gtr No.7 – Phase 2 amendment BioRID II seating proposal 4
GTR7-04-17	(OICA) Gtr head restraints Torso angle ranges Distribution in vehicle categories
GTR7-04-18	(SAE) SAE HADD J826 3D CAD H-Point Manikin gtr No. 7 Update
GTR7-04-19	(Japan) gtr No.7 Regulation Flow Chart Proposal
GTR7-04-20	Draft Minutes fourth gtr No. 7 Rear Impact Meeting, Berlin September, 2010
GTR7-05-01	Draft Agenda 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 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 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 gtr No. 7 (Head restraints 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	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 GTR-7 Phase 2 IWG Repeatability and Reproducibility study with new Bio RID II calibration method
GTR7-06-07	(Lear) Bio RID 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 Bio RID II seating proposal No. 5

GTR7-06-14	(Humanetics) BioRID-II Head Restraint Certification Test Development
GTR7-06-15	(Humanetics) Latest Investigations into BioRID-II Dummy Variation
GTR7-06-16	Dummy Variability Reduction Timeline
GTR7-06-17	Meeting minutes 6th GTR-7 meeting, Brussels 28 February 1 March, 2011
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, Washington 10 June, 2011
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 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	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 13th of 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 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
BioRID II Drawing package 7/23/10 version	
GRSP-47-16/Rev.1	(Japan) First progress report of the informal working group on gtr No.7 (Head Restraint) Phase 2
GRSP-47-17/Rev1	(Japan) Head restraint gtr Phase 2 Status and Open issues
GRSP-48-11	(Japan/United Kingdom) Amendments to the proposal to develop Phase II of 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 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 gtr No. 7 (Head restraints gtr Phase2)
ECE/TRANS/WP29/2010/136 (Japan and UK) First progress report of the informal group on Phase 2 of gtr No. 7 (Head restraints)	
WP29-152-13	(Japan & UK) Amendments to the proposal to develop Phase 2 of gtr No. 7 (Head restraints) and to establish an informal group for its development
WP29-152-16	(USA) Amendments to the proposal to develop Phase 2 of gtr No. 7 (Head restraints) and to establish an informal group for its development
WP29-153-28	(UK/Japan and USA) Amendments to the proposal to develop Phase II of gtr No. 7 and to establish an informal group for its development

WP29-153-29 (Japan) 2nd progress report of the informal group on Phase 2 of gtr No. 7 (Head restraints gtr Phase2)

ECE/TRANS/WP.29/2011/86 (Japan) 2nd progress report of the informal group on Phase 2 of gtr No. 7 (Head restraints gtr Phase2)

ECE/TRANS/WP.29/AC.3/24 (Japan) Proposal to develop Amendments to Global Technical Regulation No. 9 concerning Pedestrian Safety

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