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Progress on the development of new gtrs and of amendments to established gtrs – Gtr No. 7 (Head restraints)

Fourth progress report of the Informal Working Group on Phase 2 of gtr No. 7 (Head restraints)

Submitted by the representative of the United Kingdom *

The text reproduced below was prepared by the representative of the United Kingdom. It is based on informal document WP.29-163-23, distributed at the 163rd session (ECE/TRANS/WP.29/1110, para. 94). This document, if adopted, shall be appended to the gtr in accordance with the provisions of paras. 6.3.4.2., 6.3.7. and 6.4. of the 1998 Agreement.

* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

Fourth progress report of the Informal Working Group on Phase 2 of gtr No. 7 (Head restraints)

I. Background

1. 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 global technical regulation (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 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 associated corridors for the Biofidelic Rear Impact Dummy II (BioRID II).

2. At its twenty-seventh 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 and of the United States of America. This approach considers whether the BioRID II can effectively address injuries occurring in low speed rear impact crashes. The focus on reducing injuries in higher speed rear impact crashes will be considered as a further step.

3. At the twenty-eight session of the Executive Committee (AC.3) of the 1998 Agreement in November 2009, Japan submitted a proposal for developing amendments to the gtr, prepared jointly with the United Kingdom and the United States of America (USA), and the revised timetable. AC.3 agreed to develop the amendment to the gtr.

4. The first interim report of this activity was provided to the 152nd session of WP.29/AC.3 in November 2010 (ECE/TRANS/WP.29/2010/136). The second interim report was provided to the 154th session of WP.29/AC.3 in June 2011 (ECE/TRANS/WP.29/2011/86).

II. Status of the progress of work

5. The informal working group (IWG) held its seventh meeting in Washington DC on 10 June 2011. Participants were both from industry and government from Asia Pacific, Europe and North America.

6. The IWG addressed the head restraint height issue in two parts:

(a) The first part addressed the review of the procedure for measuring the height of the head restraint and in particular to determine the effective height rather than the physical height of the device.

(b) The second part addressed recommendations for the height requirement. It was agreed that this would be discussed following agreement on the measurement procedure.

7. Concerning the certification activity of BioRID II, significant progress was made concerning evaluation of repeatability and reproducibility. However, the IWG noted that while most evaluations indicated good performance on repeatability, on reproducibility there were on-going research activities to address concerns.

8. A round robin programme, using the BioRID specimens that had exhibited variance, was agreed upon at the meeting. The European dummies were shipped to the USA where General Motors and the National Highway Traffic Safety Administration (NHTSA) conducted tests. It was intended that the dummies would then be used to complete the programme funded by the European Commission. However, the dummies did not complete the round robin test programme because they were recalled by their owners. Nevertheless, the European programme continued, although with alternative dummies.
9. Injury criteria were evaluated by NHTSA and by Japan Automobile Research Institute (JARI). NHTSA completed its work but the studies conducted in Japan were delayed as a result of the tsunami at the beginning of 2011. JARI expected to provide results of analysis for consideration of the IWG by the first quarter of 2012.
10. The IWG continued to provide recommendations to GRSP at its 2012 sessions, although the additional testing programme and the unforeseeable delays on development of injury criteria had caused delays in the programme. The Chair of the IWG informed AC.3 at its March 2012 session on the impact of these delays on the completion of the programme of work.
11. The ninth meeting of the IWG was held in London on 19-20 March 2012 (immediately after the 156th session of WP.29) in conjunction with the IWGs on WorldSID and Pole Side Impact.
12. NHTSA reported on preliminary Post-Mortem Human Subjects (PHMS) test analysis that showed the Intervertebral-Neck Injury Criterion (rotation) (IV-NICrot) as a potential injury criteria. NHTSA stated that the Neck Displacement Criterion (rotation) (NDCr) and Neck Displacement Criterion (shear displacement) (NDCx) were possible criterion. Japan reported on the progress of Finite Element Method (FEM) study that indicated a good correlation between IV-NICrot, (flexion side) and Neck strain/strain-rate. NHTSA indicated that more PHMS test data were needed and introduced its future test plan with different seat performance configurations.
13. Transport Research Laboratory (TRL) reported on the outcome of a European Commission project study, evaluating the dummy reproducibility and repeatability by using a sled test. The results indicated that some specific channels of the dummy did not provide adequate reproducibility (measured as Coefficient of Variation - C.V). The dummy response was sensitive to the jacket and spine bumper change which suggested that improved certification test and better control of material properties might be needed. It was agreed that the spine bumper material and jacket /pelvis flesh would be examined and dummies would be refurbished.
14. During the May 2012 session of GRSP, the expert from the Netherlands introduced a proposal to increase head restraint height (GRSP-51-24). The expert from OICA stated that the discussion should 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 possible proposal on draft gtr No. 7 Phase 2 that might be submitted by the IWG. A small subgroup coordinated by the Netherlands, including experts from the manufacturers, established recommendations for a revised procedure to establish the height of a head restraint and, in particular, to address the newly agreed definition for effective height.
15. At the June 2012 session of AC.3, the representative of the United Kingdom, on behalf of the Chair of the IWG, reported on the work progress of the IWG and on the difficulties to define injury criteria. AC.3 gave its consent to extend the mandate of the IWG until December 2013.

16. At the November 2012 session of WP.29, a proposal was considered for a protocol to manage drawings, calibration and maintenance procedures associated with test tools referenced by Regulations and gtrs in the framework of the 1958 and 1998 Agreements (ECE/TRANS/WP.29/2012/124 and WP.29-158-19). The World Forum WP.29 adopted ECE/TRANS/WP.29/2012/124, as amended by WP.29-158-19.

17. In the framework of activities of the IWG, Japan introduced the IV-NIC (Rotation/Flex) risk curve proposal. From this proposal two IV-NIC risk curves were derived. One of these was from human model FEM simulation, based on 20 cases of real world accidents. The second one, based on previous NHTSA PHMS test results, correlated Abbreviated Injury Scale (AIS) to a Whiplash Associated Disorder (WAD) index hypothesis.

18. NHTSA reported on the progress of injury criteria development by PHMS tests. NHTSA stated the Potential "global" injury criteria as follows:

(a) USA: Intervertebral Neck Injury Criterion (rotation) – (IV-NICrot), Neck Displacement Criterion (rotation) – NDCr, Neck Displacement Criterion (shear displacement) – (NDCx), Neck Injury Criterion (NIC);

(b) Japan: IV-NICrot, NIC, Upper Neck Force – x-plane (UNFx), Upper Neck Moment – y-plane (UNMy), Lower Neck Force – x-plane (LNFx), Lower Neck Moment – y-plane (LNMy).

However, the IWG agreed that BioRID injury criteria should be discussed following further PMHS tests by NHTSA and test data analysis by JARI (Japan).

19. The dummy manufacturer expert (Humanetics) reported the sled test result using the refurbished dummies. The results indicated better reproducibility with C.V values but data analysis were still needed. The Chair of the Technical Evaluation Group (TEG) proposed an additional sled test series with the European Commission project seat and the hard bucket seat from the Partnership for Dummy Technology and Biomechanics (PDB). The test results were discussed during the meeting of the IWG in February 2013.

20. At the workshop held by BASt (Germany) in March 2013, experts of the IWG examined the effective head restraint height measurement procedure using an actual vehicle. The work shop findings were reproduced in the draft revised text of Annex 1 to gtr No. 7. As a result of the workshop, experts agreed that the use of the Head Restraint Measuring Device (HRMD) was no longer needed for the backset measurement.

21. At the June 2013 session of AC.3, the representative of the United Kingdom, on behalf of the Chair of the IWG on gtr No. 7 Phase 2, reported on the work progress of the IWG, and sought guidance of AC.3 on whether the IWG should proceed in a two-step approach:

Step 1 - the measurement of height of head restraint and,

Step 2 - the dynamic test.

AC.3 preferred to proceed in 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 mandate of the IWG until the end of 2015.

22. At the workshop held by BASt on 16 July 2013, experts examined backset measurement and dummy seating procedure. The workshop concluded that backset and also BioRID reference point (back of head) could be measured by coordinate measuring apparatus without HRMD usage. However, it was agreed that the procedure for installation of BioRID should continue to be examined.

23. At the 14th meeting of the IWG in Gothenburg, the experts from Chalmers University, JARI and NHTSA reported their research progress and discussed on recommended injury criteria.

NHTSA reported that the best PMHS injury predictor (and potential BioRID injury criteria) is IV-NICrot with 50 per cent probability of AIS 1+ injury while Japan reported tentative BioRID injury criteria from the WAD risk curve that corresponds to IV-NICrot. The representative of Chalmers University stated that according to his research the correlation between real world insurance claims and specified model sled test performance could provide an indication of BioRID injury criteria. However, it was agreed to resume discussion on additional PHMS data and sled test results by using refurbished dummies provided by the Vehicle Research and Test Center (VRTC) of NHTSA.

24. During the 14th meeting the PDB representative reported on the good progress on a review of the dummy drawings and specifications to be incorporate into an addendum to the Mutual Resolution No. 1 (M.R.1). The IWG agreed to prepare a draft proposal of Addendum 1, also including five certification and inspection tests, to be submitted at the fifty-fourth session of GRSP (GRSP-54-05).

25. GRSP at its fifty-fourth session discussed a proposal (ECE/TRANS/WP.29/GRSP/2013/17), introduced at the previous session and submitted by the experts from Germany, the Netherlands and the United Kingdom on head restraint height requirement to cover taller occupants. The proposal received comments from the experts of the USA and OICA. GRSP agreed to resume consideration of this agenda item on the basis of final proposals submitted by the IWG and of further justification concerning ECE/TRANS/WP.29/GRSP/2013/17 and to keep GRSP-54-18-Rev.1 and GRSP-54-23 as references.

26. During the February 2014 meeting of the IWG, the experts from Humanetics reported on the dummy certification update. He informed the IWG, about the aging effect of bumper spine material of the BioRID (Urethane rubber). Moreover, during the WebEX meeting in June 2014, they reported that the update and replacement of bumper material required three to four months before being delivered for testing to VRTC.

27. During the May 2014 session of GRSP, the expert from the United Kingdom, on behalf of the Chair of the IWG, reported on the work progress of the group that expected to deliver recommended injury criteria to the December 2014 session of GRSP and a draft gtr No. 7 Phase 2 for the May 2015 session of GRSP.

28. The small working group on injury criteria planned a meeting on 8-9 September 2014 in Berlin in conjunction with IRCOBI 2014 meeting. Moreover, IWG and other TEG (WebEX) meetings had been planned between September and the December 2014 session of GRSP to prepare the recommended injury criteria.
