

Meeting Notes

7th GTR-7 Informal Group Meeting, Washington

10 June, 2011

Welcome

Mr Frost welcomed the attendees to the 7th GTR-7 Informal Group meeting, and thanked NHTSA for hosting the meeting. Mr Frost also welcomed Mr Kadotani, who has replaced Mr Asada as the expert for Japan.

The informal group noted with sadness the passing of Mr Yonezawa, and recognised the contribution that he had made to the UNECE discussions to advance vehicle safety. They extended their condolences to his family and colleagues.

1 Approval of the Agenda

The draft agenda was approved with additional presentations and with item 1 moved to the end.

2 Minutes of the 7th Meeting, Brussels

Mr Hynd reviewed the minutes of the previous meeting, with particular reference to the actions and decisions.

The minutes were adopted with minor revisions. Updates to the actions were recorded.

3 Report from WP.29 and GRSP

Oral update from Mr Frost.

Timescale: The informal group will report to WP.29 at the November 2012 session, with a view to it being adopted at the June 2013 session. WP29 acknowledged that this timeline is contingent upon the satisfactory conclusion of the injury criteria work from US and Japan by the end of 2011. If progress on this point is delayed Mr Frost will report back to WP29 at their November 2011 session and seek their agreement to a revised schedule.

Drawing package and other dummy info: The proposal for a "Resolution" approach, as agreed at the 6th meeting of the informal group (Brussels), was discussed. The need to maintain a structured record of the documentation associated with test tools was agreed as was the general structure and content that had been proposed. However, the US questioned whether it was appropriate to hold the document outside of regulations, or whether it should be brought forward as a GTR. WP.29 will discuss this further.

The report from WP.29 and GRSP was accepted by the attendees.

4 Activity Report and Discussion

4.1 Evaluation of the Proposed Certification Procedures

Presentation from Mr Bortenschlager, PDB (GTR7-07-02):

Mr Bortenschlager presented an update to the repeatability and reproducibility work presented at ESV 2009 (09-0492). Dummy D006 and D007 from that work were identified as being outliers for reproducibility when used in the hard bucket seat with the SRA-16 (Euro NCAP low) pulse. A test matrix including repeated certification and sled testing was presented. All dummy measurements were reportedly similar for both dummies, except upper neck My and lower neck Fz. Upper neck My performance shifted with dummy adjustment, but the magnitude of variation between the dummies was unchanged. The lower neck Fz difference between dummies was unchanged with dummy adjustments.

It was confirmed that all of the data presented were from the most recent test series (not from the original programme). The data will be made available for interested parties.

The certification test results for both dummies at each stage of the test programme were presented. It was noted that there was no significant difference in dummy certification performance after adjustment to the latest criteria, which led to the conclusion that the certification tests did not identify a difference between the two dummies, although a difference was apparent in SRA-16 hard bucket seat tests.

Mr Bortenschlager had observed that skull cap friction has a large effect on neck moments, and that jacket stiffness also affects the moment. It was noted that there was very thin padding on the head restraint of the hard bucket seat.

An open question is how to adjust the dummy if a difference is noted in the certification tests. In this programme, different combinations of certification test were performed at each stage of the programme, so it is not known whether the heavy impactor with-HR test would identify dummy differences.

There was some discussion about the difference between the SRA-16 and Euro NCAP mid pulse (the one proposed for GTR-7). It was noted that the upper neck moments are very low with the SRA-16 pulse and that CV tends to accentuate differences for low values. Humanetics suggested that the dummy seems to perform better when exposed to higher pulses and it was felt that it would be interesting to check these dummies with the Euro NCAP mid-pulse.

Action PDB to distribute pictures of the hard bucket seat test set-up for clarification.

4.2 Load Path Through the Shoulder

Presentation from Mr Bortenschlager, PDB (GTR7-07-03):

Mr Bortenschlager gave a presentation regarding the interaction of the shoulder of the BioRID dummy with the seat back/wings of the hard bucket seat used in the test programme presented above. It was indicated that both simulation and the test work presented showed a load path from the shoulder, via the T2 jacket bolt, that was larger in the hard bucket seat than a standard seat. This load path is not controlled by the certification tests. In dummy tests the upper neck Fx and My results changed markedly when the T2 bolt was removed, but with very little change in NIC.

The shape of the seat back on the hard bucket seat and the standard seat was shown. The dummy spine did not appear to be in contact with the bucket seat, just the shoulders.

The presentation concluded by asking whether this load path is biofidelic, and is the curvature of the seat back in the shoulder region responsible for WAD protection?

4.3 Study on Impact Response (Injury Value) Variation Factors for BioRID-II Dummies

Presentation from Nakajima-san (GTR7-07-07):

The focus of the study is to compare certification performance and seat test performance by Madymo simulations. A parameter study was undertaken to tune the model to meet the certification requirements, using a real certification sled pulse as an input to a model of the old “no-HR” certification sled. The model was tuned by modifying the characteristics of the C1-C2, C7-T1 and T1-T12 joints. The pot B characteristics correlated with greater variation in dummy model measurements. This was also true for seat simulations.

The results indicate that large variations in certification tests match with large variations in sled tests, and low variation in certification matches low variation in seat tests.

It was reported that the upper neck My is markedly different in both magnitude and timing for “no-HR” certification tests and seat tests. Lower neck loads were not assessed.

It was concluded that if variations are induced in injury metrics in certification tests, the same injury value variations are seen in seat tests. It will be possible to reduce seat test variation by reducing certification test variations. A certification test that is closer to seat tests than the “no-HR” test may be required.

It was noted that the earlier presentations identified differences in seat tests that may not have been identified in certification tests, whereas this presentation indicates that the certification test can predict differences in seat tests. Humanetics noted that many differences in seat tests have been associated with differences in certification performance, but PDB have identified one condition that does not seem to be identified during certification.

It was felt that the influence of pin fit seems to correlate well with the type of adjustments made in the simulation study. Dr Ono noted that the simulation study focused on the internal factors that influence the dummy, whereas the PDB study may reveal more about the external interaction with the seat back.

The data will be shared with Humanetics and, together with the PDB information, it may help prioritise which parts of the dummy to focus on.

Mr Lorenz noted that the TEG is collecting data with the intention to tighten the certification corridors. This simulation study indicates that this will be very important.

4.4 BioRID-II Repeatability of a Production Seat

Presentation by Mr Bon-Hwan Koo on behalf of Mr Jongsoo Kim (GTR7-07-08):

The results of seat tests at 16 and 20 km/h, using KNCAP protocol, performed in 2009-2010 were presented. The 20 km/h pulse had the peak scaled up, but had the same duration as the 16 km/h pulse.

It was reported that the CV for head and T1 accelerations was <7; there was a high CV for upper neck Fx, lower Fz and upper neck My at 20 km/h, and for lower neck My at both pulses. Other outputs had a CV <10. Upper neck Fz and lower neck Fx were acceptable as were the kinematics.

The study concluded that, in general, the CV was larger at 16 km/h than at 20 km/h, and that head rotation angle, T1 x and Head x accelerations seem appropriate for a GTR. It was reported that other seat models will be tested. Tests will be run with Hybrid III to try and correlate the Hybrid III 12 degree criterion with BioRID measurements.

The data from this study are available for the informal group.

It was noted that the tests were performed in 2009-2010, and it was asked whether the dummy has been checked against the latest checklists to determine whether the dummy was up the current specification. Mr Koo indicated that Mr Kim would be able to advise on this point.

Action all to email questions to Mr Kim at KATRI:

- The neck shear forces were negative, as per the NHTSA tests with a high seat back rotation angle, whereas they were positive in the PDB tests. What was the seat recline angle in the tests?
- Was the repeatability of T1 angle assessed when setting up the dummy?
- A description of the seat back contour would be useful, similar to that in the PDB presentation.

4.5 Humanetics Update on Certification Tests

Presentation from Mr Depinet, Humanetics (GTR7-07-04):

Check list:

The definition of the tolerances for the vertebra pins will be updated, along with pin-fit check tests using a standard check-pin.

Heavy vs Light HR impactor:

Seven dummies have been tested with both impactors; the impactors give very different responses but both show differences between dummies, however, there is no clear indication that one highlights differences better than the other. Given this, Humanetics would like the informal group to decide which impactor to use going forward:

- Light impactor involves no changes or handling issues between tests and there is only one energy transfer device (ETD) to certify
- Heavy impactor gives a pulse more like a typical seat test and gives similar upper neck moments to a seat test.

Mr Frost recalled that the decision in Brussels was to continue with the heavy impactor, while also collecting light impactor data. He questioned whether seven tests was sufficient to make the decision, or to know what is important when seat tests are undertaken. Humanetics commented that they have shown that they can detect differences with both tests, but that running both tests is taking time away from other investigations. Humanetics would prefer to investigate the issues raised by PDB. It was noted that it was not known whether the dummy differences seen in the two certification tests correlated with different responses in seat tests.

There was considerable discussion regarding the pros and cons of running both “with-HR” certification tests. It was noted that it would be useful if seat tests could be performed with the dummy(ies) that were outlying in the recent certification tests, to see if this corresponds with differences seen in certification. This would also help to establish what is needed to control reproducibility in seat tests.

It was recalled that there was previously some discussion of adjusting the position of the head restraint in the “with-HR” certification test and it was asked whether there are any data that might demonstrate the influence of the backset?

Humanetics commented that data are being collected – the position the HR is set to, and how much it has to be changed in order to get the defined backset for the dummy.

It was also noted that, ultimately, not all dummy channels may be required for regulatory assessment and that the informal group will get more guidance on this point from the ongoing injury criteria work in the US and Japan. Mr Lorenz noted that the TEG urgently needs this information so that it can focus on the relevant areas of the dummy. It was noted that Japan had already indicated some preliminary assessment parameters at the formative meeting for the group (Washington 2009 – Meeting “0”) but that the joint programme of NHTSA and JARI would provide further guidance to the informal group.

4.6 Certification Development Plan

Presentation from Mr Depinet, Humanetics (GTR7-07-04):

Certification tests

- Collect 50+ dummies in 5+ labs
- MUST do checklists – this is part of the certification
- Certification using both “no-HR” and “with-HR” sleds
- Sled weight package verification tests
- Jacket tests
- Head restraint foam verification tests

Investigation of PDB dummy differences

- Testing with half-arms during certification tests to load the shoulders – this gave different results with the two dummies during head restraint contact, but this had not been evident in retests
- No back support to exercise full spine motion
- May try a full rigid back plate with load cells

Humanetics will continue to look at other variables as previously identified. A timeline for the certification development work was presented, finishing in May 2012.

It was noted that the dummy was removed from the certification sled between sets of “with-arm” tests. Doing this “without-arms” gave repeatable results, but this was not the case when using arms, at least with this preliminary data. 12 more tests will be done.

It was noted that the extra arm mass will have the opposite effect of the seat loading in the PDB seat, but it may expose a difference in the stiffness of the shoulders. The differences seen in the first “with-arm” tests were of similar magnitude to the variations in the PDB data. Mr Frost noted that this is the sort of technical detail that should be referred to the TEG, but it is useful for the informal group to have some oversight of the information.

4.7 Humanetics Update

Presentation from Mr Beebe, Humanetics (GTR7-07-10):

Following earlier discussions in the meeting, a proposal for further investigation of the PDB dummies was developed and presented to the informal group:

- June 2011 – arm cert testing at Humanetics Europe. The PDB dummies (D006 and D007) and seats would then be shipped to Humanetics Ohio.
- July 2011 – review PDB dummies at Humanetics Ohio; conduct baseline certification tests; perform PDB type sled tests using the PDB dummies and seats (pressure map the seats, add accelerometers and rate sensors to the spine). OSRP agreed to see if they could run these tests in July. The dummies would then be shipped back to Europe.
- August 2011 – Perform additional sleds; PDB requested another volunteer to run some tests. Chrysler may be able to run some tests before the dummies are shipped to Europe.

Action Mr Lorenz to schedule a TEG for the end of July / beginning of August to go through the data from the tests in June and July. Mr Bortenschlager noted that PDB have to confirm the dummy availability, but he believed that it should be possible.

Action OSRP to determine whether they can contribute sled tests to the PDB evaluation programme.

Decision: it was agreed to conduct the proposed test programme with the PDB seats and dummies.

Action NHTSA to run some tests with the PDB seats and their own dummies.

It was noted that different dummies have different connectors and that this will need to be resolved for inter-laboratory use.

Action PDB to provide a detailed test description so that other labs can replicate the tests accurately. Mr Hynd noted that TRL/European Commission may be able to contribute to testing the PDB/dummies and seats, or similar work with a wider range of seats/dummies.

Action Mike Beebe to include Mr Hynd, cc Mr Broertjes, on the information for this programme.

It was noted that it would be useful to try the Annex 9 (Euro NCAP mid) pulse as well, to see if the same issue is seen with that pulse.

Decision: it was agreed to hold a meeting in the week beginning 20 June to finalise the plan for the test programme.

4.8 NHTSA Status Update

Presentation from Mr Donnelly, NHTSA (GTR7-07-05):

NHTSA is developing a new side-by-side buck, using 2011 Chevrolet Cruze seats, rated 'Good' in Euro NCAP and IIHS, for tests with BioRID and Hybrid III. Backset will be adjusted to create a 'poor' seat as well (44 mm backset for good, 82 mm for poor). The Annex 9 (Euro NCAP mid) pulse will be used.

Injury risk collaboration with JARI. Preliminary NHTSA injury risk functions will be available by the end of October 2011. JARI is also modelling real-world crashes. A combined

recommendation on risk functions will be available by the end of Feb 2012. JARI will also try to model the effect of the instrumentation mass on the PMHS tests by end April 2012.

Mr Frost reminded the informal group has to report to WP.29 at the end of 2011 and indicate whether the work is on schedule. Hopefully the couple of extra months indicated in the above schedule won't be a problem for this.

4.9 Injury Criteria Analysis Plan

Presentation from Mr Moorhouse, NHTSA (GTR7-07-06):

The biofidelity programme is complete and was presented at the Brussels meeting. The work programme was now focussed on investigating the mechanism of injury and selecting appropriate injury criteria.

Neck kinematics have been measured in 8 PMHS, and the injuries have been assessed by MRI scans and necropsies and fully documented, including disc fracture, disc ruptures and soft-tissue tears. Most of the injuries were subluxations, which are minor AIS 1, but other more severe injuries occurred and have been documented. It was noted that some of the injuries were more severe than those normally associated with whiplash.

The IC-NIC (Panjabi, 2005) for each joint was compared qualitatively with the injury level. The physiological range of motion was set conservatively, based on mean \pm one standard deviation from the Panjabi results. The IV-NIC only evaluates intervertebral rotation, so NHTSA have calculated analogous parameters for shear and axial displacements. These, and combinations of these, will also be assessed, along with strain and strain rate. These will then be correlated with the dummy measurements that were taken in the same test conditions. This will give injury risk curves for the PMHS, and for the dummy. It was noted that the method to correlate the PMHS to dummy IRC is not decided yet.

Mr Donnelly noted that NHTSA would like to run PMHS tests in a standard car seat, with the same PMHS instrumentation set-up, if budget allows.

5 Head Restraint Height

5.1 Measurement of Effective Height

Presentation from Mr Pott on behalf of the task force (RDW, OICA, and BAST) (GTR7-07-09):

Mr Pott presented an overview of progress with the definition of a test procedure to measure the effective height of head restraints for 50th percentile and 95th percentile male occupants.

The proposed effective height measurement was compared with the current UNECE Regulation 17 (R17) height measurements for selected head restraints. Some rear head restraints were identified with curved front faces that meant that the R17 method includes an area of the head restraint that is unlikely to be effective. For front HR the difference between the two methods was 15-25 mm for the seats assessed, and for rear seats was 5-60 mm.

The task force proposed that an effective height of 780 mm was equivalent to an R17 height of 800 mm, based on an average difference of 20 mm.

Mr Pott confirmed that the task force is continuing discussion regarding an allowance for a lower height if it prevents egress from rear seats of two-door vehicles. The task force felt that height limits could be reduced for low roof lines as is currently done in Regulation 17. They

felt that consideration could also be given to assuming a lower height for e.g. 3rd row occupants, for instance if taller occupants cannot fit in this row.

The task force will consider further:

- Consequences for head restraint design
- Refinement of the proposal
- Evaluation of possible interference between CRS and (rear) HR, and options for preventing conflict between rear HR and CRS requirements
- Recommendation of necessary effective height for the text, e.g. allowing for the difference between the R17 and new proposed method

It was noted that the SAE HADD committee had some comments on the test method. Mr Frost noted that the informal group is open and that the SAE would be welcome to contribute to the evaluation of the effective height method, or any other part of the work.

Mr Ammerlaan noted that the task force had also evaluated the method based on the H-point, using the H-point machine.

Action Effective Height Task Force to make this comparison data available to NHTSA.

It was noted that the difference between the two methods would be larger for more traditional HR shapes than the one shown in the presentation.

6 Update from SAE HADD Committee

An update was promised for the last meeting and this meeting, but no information has been forthcoming.

Action BF to contact Dr Smythe to enquire about progress.

7 Status of Review for GTR Regulatory Text

(GTR-06-10 Rev.1)

A preamble has been added to the GTR text to explain why reference to the Hybrid III has been removed, i.e. because the focus is in on a single dummy acceptable to all parties. It was agreed that, should the informal group be unable to agree on a single dummy for inclusion within the GTR, the proposed text would have to be redrafted to retain Hybrid III and the alternative dummy. The preamble was reviewed and approved.

Decision: the preamble to the GTR text was approved.

Decision: It was agreed that the text will held as a Meeting 6 document, with revision numbers to track the changes.

Action BL and MB to prepare a TEG status report for distribution to the informal group in two weeks.

8 AoB

Action the Chairs of the WorldSID, PSI and GTR-7 informal groups to make a proposal for the dates of the next meetings by end June.

Action BF, SM and RH to email attendees of the three IGs to identify dates such as the Stapp conference in late October and early November that need to be avoided and/or provide an opportunity for streamlining travel arrangements.

No other business was raised.

9 Actions and Decisions

Action PDB to distribute pictures of the hard bucket seat test set-up for clarification.

Action all to email questions to Mr Kim at KATRI.

Decision: it was agreed to conduct the proposed test programme with the PDB seats and dummies.

- **Action Mr Lorenz** to schedule a TEG for the end of July / beginning of August to go through the data from the tests in June and July.
- **Action OSRP** to determine whether they can contribute sled tests to the PDB evaluation programme.
- **Action NHTSA** to run some tests with the PDB seats and their own dummies.
- **Action PDB** to provide a detailed test description so that other labs can replicate the PDB tests accurately.
- **Decision:** it was agreed to hold a meeting in the week beginning 20 June to finalise the plan for the test programme, possibly including Annex 9 pulse tests as well.
- Mr Hynd noted that TRL/EC may be able to contribute to testing the PDB/dummies and seats, or similar work with a wider range of seats/dummies. **Action MB** to include Mr Hynd, cc Mr Broertjes, on the information for this programme.

Action Effective Height Task Force to make the H-point and R-point based effective height comparison data available to NHTSA.

Action BF to contact Dr Smythe to enquire about progress from the SAE HADD Committee.

Decision: the preamble to the GTR text was approved.

Decision: It was agreed that the text will held as a Meeting 6 document, with revision numbers to track the changes.

Action BL and MB to prepare a TEG status report for distribution to the INFORMAL GROUP in two weeks.

Action the Chairs of the WorldSID, PSI and GTR-7 IGs to make a proposal for the dates of the next meetings by end June.

Action BF, SM and RH to email attendees of the three informal groups to identify dates such as the Stapp conference in late October and early November that need to be avoided and/or provide an opportunity for streamlining travel arrangements.