

MEETING MINUTES
6TH GTR-7 MEETING, BRUSSELS
28 FEBRUARY AND 1 MARCH, 2011

Mr Frost and Mr Broertjes welcomed all participants to the 5th meeting of the GTR-7 Phase 2 Informal Group (IG).

1 Adoption of the Agenda

The draft agenda (GTR7-06-01) was adopted with the following changes:

- Item 7 pushed back to a later time on day 2 to help some webex attendees
- Item 11 (Test pulse) to be covered under item 7
- Item 11 now head restraint height

2 Review of the Minutes from the Berlin (4th) and Geneva (5th) Meetings

DH presented a brief overview of the main agenda points from the previous meetings, and reviewed the actions and decisions in detail.

The draft minutes of the 4th meeting were approved with one change – JARI was changed to Japan in the decisions. The Action list was updated with the progress on each item and the Decisions were ratified.

There was a brief discussion on the use of the term ‘injury criteria’ within GTR-7 discussions, and whether an alternative such as ‘seat performance criteria’ should be used. **Decision:** it was agreed that ‘injury criteria’ will be used as a working title, and it was acknowledged that this may need to be updated at a later date.

The draft minutes of the 5th meeting were approved without changes. The Action list was updated with the progress on each item and the Decisions were ratified.

3 Review the Latest ToR and Progress Report for March WP29

Presentation from Asada-san, Japan on the ToR and the progress report transmitted by Japan, UK and USA.

Mr Frost noted that the updated ToR will be presented to WP29 week beginning 7 March. Mr Frost summarised the changes to ToR last December: 1) Identify best pulse to replicate the conditions under which AIS 1 injury takes place. 2) Single pulse, not several. 3) Main ambition is to address short-term injury, but if there is an opportunity to address long-term injury at the same time this will be taken.

Mr Frost noted that this means a intensive period for the IG over the next 18 months so. If WP.29 adopt the proposal in June 2013, it could become legislation in approximately Jan 2014.

Japan proposed to adopt Phase 2 in UNECE Regulation 17 without any intermediate steps being adopted in Reg 17. Mr Frost summarised that this means that regulators in the meeting are working to a single update in a single timescale, which will be based on the work of this IG and the TEG.

OICA asked if the US is going to implement Phase 1, or wait for Phase 2. The US noted that Phase 1 is very close to FMVSS 202a so would be relatively straightforward to implement, but waiting for Phase 2 could be considered.

4 Discuss Resolution for Dummy Information

Presentation from Mr Frost (GTR7-06-12).

Mr Frost gave an overview of the background to the proposal for a Resolution on Dummy Information. The GRSP Secretariat proposed to introduce a new Resolution which deals specifically with test tools (which could therefore have a wider significance than just dummies). There would be a number of Annexes under the Resolution, each of which would refer to a particular test tool. There would be a high-level Annex number for all documents relating to each test tool. Each Annex may have several Appendices, e.g. for a PADI, drawing package, certification. Mr Frost noted that this is on the WP.29/AC3 agenda next week, and AC3 has noted that this has implications for other GR groups and that these groups should be notified of any proposals.

It was noted that tools would be unlikely to be included under the Resolution if there is no intention to use them in regulation, and that any tool included in a regulation could be included under the Resolution.

Mr Frost noted that there may be a divergence between the tool used in regulation and that used in research. It is not necessarily the case that regulators would want to make incremental updates, but rather would expect to keep a constant specification for the tool unless measurement accuracy or some other benefit would be delivered. Before a specification change could be introduced in the Resolution the Contracting Parties would need to be content that any modifications would not adversely affect the tool's regulatory use. Updates will require the approval of WP.29.

Decision: GTR7-06-12 (Proposal on a Special Resolution for Test Tools) was approved without changes for presentation to WP.29/AC3 by Mr Frost.

5 Review of the Regulation Text Amendment Proposal

Presentation from Asada-san, Japan (GTR7-06-10).

Mr Frost reminded the Group that the purpose of the review was to identify those parts of the draft text that need further work or discussion, not to work on the content at this stage.

Asada-san presented the document and updated the highlighting as discussed by the Group (red text identifies areas that need further discussion).

Decision: No decisions were made on the document, just discussion of which areas need to be flagged for review.

Action All to propose any other parts of the regulation text amendment proposal document from Japan that may need to be changed or discussed.

Decision: it was agreed to footnote the technical rationale for any decisions in regulation text amendment proposal document from Japan as we go along, so that the rationale is captured.

6 Head Restraint Height

Presentation from Mr Horn, OICA on the joint work with NL (GTR7-06-11).

A simple, pragmatic approach to effective height measurement was evaluated, and possible issues regarding the interaction of Child Restraint Systems (CRS) and head restraints were also considered. It was summarised that the effective height could be improved for current head restraints using this approach without actually raising the head restraint because the profile of the HR would not curve away from the occupant.

It was noted that in some cases the CRS requirements overlap (and are therefore mutually exclusive) with the head restraint requirements. This means that the rear head restraint can push the CRS forward.

It was also noted that the proposal from NL and OICA is regarding the head restraint in an in-use position, not in a non-use position as defined in Phase 1.

There will be a further meeting between OICA and NL in May to discuss the results of the OICA evaluations of the new method and agree a direction to propose to the IG.

7 Report of the TEG Activity

Presentation from Mr Lorenz, TEG Chair (GTR7-06-05):

The new certification procedure without head restraint is now in use and data are being collected which will allow the certification corridors need to be tightened (although more data is required in order to do this).

The PADI has been sent for inclusion on the GRSP web site, but it is not there. It will be transmitted again. The PADI includes the design and maintenance checklists. **Action Mr Lorenz** to resend the PADI to the GRSP Secretariat for inclusion on the GRSP web site.

First experience with the new no-HR test seems very promising. Some safety concerns were raised at the last TEG regarding the very high mass pendulum used for the with-HR certification test (See 8.3.). This is being reviewed.

Humanetics have been testing the effect of different neck pin specifications to find out if these are a source of reproducibility issues.

It was noted that the new jacket test has identified jackets with outlying performance, and one new jacket has been replaced as a result of this test. Data are being collected in order to determine the jacket specification, after which the jacket production process will be tuned. Currently this test is only being run at regional Humanetics facilities, but dummies can be shipped to these for testing.

8 Review of the BioRID II PADI and New Certification Study Status

8.1 Jacket Test

Presentation from Mr Depinet, Humanetics on the jacket test (**GTR7-06-15**):

The jacket test uses a Hybrid III 5th female certification impactor, but with tighter tolerance on the radii of the impact surface (all jacket test probes can be used with the Hybrid, but not necessarily the reverse). Preliminary response corridors have been proposed based on a small number of jackets; these will be updated as more data becomes available.

Humanetics Heidelberg recently undertook testing on several jackets and found one jacket that was outlying (the jacket was softer than others). All three dummies passed the no-HR certification, which is part of the reason for wanting to make the corridors narrower. If the jacket fails, it has to be replaced because the jacket cannot be modified.

Mr Hynd asked how much the jacket stiffness could affect R&R testing with very rigid seats – could the reproducibility appear worse than it would be with a standard seat? Also any biofidelity tests with rigid seats may need to be repeated. One of the EEVC biofidelity requirements uses a rigid seat. Mr Depinet presented data from two dummies with soft and stiff jackets in the rigid rally-style seats that were used in the PDB R&R study that was reported previously. Notable differences in upper neck Fx, Fz, My; T1 X-acceleration; and lower neck Fx, Fz, My shape or magnitude were shown.

It was noted that Humanetics have issued a Technical Bulletin to customers recommending that they no longer run the old certification tests; instead they should run the no-HR test for certification (which will also provide data for making the corridors narrower); plus run the with-HR test and jacket test for information. All dummies sent to Humanetics OH and Heidelberg are getting the jacket test and the certification tests as per the draft certification document.

Asked if there was an ageing problem with the jacket Mr Depinet advised that the material would be expected to harden slightly overtime, which is why an annual check has been recommended in the TEG. There should be no problem due to the number of tests that the jacket is used for, provided that it is not torn.

A pin-fit study has been undertaken to evaluate the effect of neck pin interference fit, normal fit, or loose fit in certification tests. The loose pins were ~0.05 mm smaller diameter than standard. The loose fit had less effect than the over-tight fit. It was proposed to use a 'no-go' pin test to check for worn holes (giving a loose pin). Also, should be able to insert the pin by hand with no tools, which ensures fit is not too tight. These guidelines will be added to the maintenance checklist located in the user manual. It is recommended that all users check this.

8.2 R&R Study with new BioRID II Calibration Method

Presentation from Asada-san, Japan (GTR7-06-06):

New study with three BioRID IIg dummies, compared with previous study with two dummies. New sled (no-HR test) had a smoother sled response visually. A comparison of sled pulse and dummy measurements with the old and new sleds was presented. The oldest of the three dummies (with new jacket) used with the new sled showed some differences compared to the two newer dummies. In the future seat tests will be undertaken to determine whether this gives a difference in seat tests.

The new no-HR certification test was compared with seat tests to compare the kinematics. The shape of the neck was reported to be different at time of peak pot values, with the neck much straighter in seat tests, largely due to the head restraint limiting rearward motion of the head. Therefore, use of the head restraint certification tests was recommended.

It is not known what caused the difference between dummy 095 and dummies 102 and 115. Dummies 095 and 102 are JARI dummies that have both been used in many seat tests; dummy 115 is brand new and has therefore not been used for seat testing. The two older dummies had previously been maintained using the old sled test. It was noted that only dummy 115 is definitely fully compliant with the design and maintenance checklists, but 095 and 102 should be compliant with the significant amendments. **Action Asada-san** to check dummies 095 and 102 against the design and maintenance checklists.

8.3 Head Restraint Certification Test Development

Presentation from Mr Depinet, Humanetics on the HR certification test (**GTR7-06-14**):

The rationale for the development of the with-HR test was presented. The biggest dummy-to-dummy reproducibility issues were observed to be during head restraint contact, e.g. in PDB test programme. The test equipment and procedure have been updated several times in response to feedback from the TEG and IG. The impactor probe has been changed to a higher mass (188 kg) with a longer, profiled Energy Transfer Device (ETD), to give a 16 km/h 10 g pulse with similar duration to car seat tests. The head restraint also has a foam covering, which has been tuned to give a head restraint contact duration similar to car seats. These give similar upper neck Fx and My magnitude and shapes to JASIC tests, but a bit different to the rigid rally seats in the PDB tests. Upper neck Fz was more similar to the PDB tests. Similar lower neck Fx and Fz to seat tests from German manufacturers (well within the range of the different seats tested).

A tool has been developed to allow the head restraint to be adjusted to a nominal 70 mm backset. The head restraint foam has been sealed to prevent humidity problems (as with the ETD). The heavier pendulum requires updated suspension cables and possibly an updated winch to pull it back. Humanetics have developed a cart to support the impactors so that they never have to be lifted manually. A video was shown demonstrating correct handling of the impactor probe using the cart.

The high mass of the new impactor probe was discussed, particularly with respect to potential health and safety issues from handling and deploying a heavy probe, and the time taken to swap the probes

between with-HR and no-HR tests. It is possible that the with-HR test could be performed regularly, with periodic no-HR certification if the dummy is rebuilt, or buffers changed.

Decision: It was agreed to continue with the heavy impactor at this time. Further work will then proceed to check whether the test identifies differences between dummies that result in differences in seat tests.

Mr Frost asked the IG to identify dummies with known different performance in sled tests. Mr Hartleib noted that PDB have two dummies with outlying performance, one of which has been updated and one is unchanged from the previous tests. **Action Mr Hartlieb** to check whether PDB can do some additional tests (and to notify the IG by end March if this can be done). **Action Humanetics** to perform certification tests with-HR and with light and heavy impactors in early April. **Action Mr Lorenz** to arrange a TEG meeting for the end of April to discuss the results of these tests. **Action Mr Lorenz** to run tests with two dummies, one of which previously had outlying performance, and then they can be provided to Humanetics for certification in April. Also to consider running seat tests with the PDB dummies if PDB cannot test. **Action Humanetics** to consider running some light and heavy impactor with-HR certification tests with the dummies deliberately modified to have performance changes to see which set-up better highlights these changes. It should be noted that it is not known whether these changes result in differences in seat tests.

9 Review the Dummy Seating Procedure Study Status

9.1 BioRID Seating Trial #5

Presentation from Asada-san, Japan (GTR7-06-13):

Two seats each tested three times at different torso angles. One seat was standard and one included a reactive head restraint. It was reported that there was no consistent change in dummy measures when changing from 20° torso angle to 25° torso angle. It was therefore recommended that the design torso angle should be used. No further work is planned on this subject.

The relative merits of fixed (25°) and design torso angles were discussed. PDB reported that the effect of e.g. 20° and 25° torso angles depends on whether the backset is kept constant, or allowed to change with torso angle. It was noted that the design angle is intended to reflect the typical use of the seat for a particular type of vehicle; if one then tests at a more reclined seating position, manufacturers may have to move the head restraint forward, which can be too close (touching) in the normal use position. All other impact tests in UNECE use the design torso angle as do most FMVSS impact tests, however, 202a uses a fixed torso angle of 25°.

Action Mr Frost to include torso angle as a specific discussion point on future agendas.

9.2 BioRID IIg Response to Varying Seat Designs

Presentation from Lear Corporation (GTR7-06-07):

All tests to the IIWPG test protocol using the BioRID IIg.

A study was undertaken to identify the influence of seat comfort features on the IIWPG rating, whether the BioRID is repeatable enough to distinguish between different seat features, and provide comment on the criteria and thresholds proposed by Japan. The same seat cushion and adjuster assembly was used for all tests, with a different seat back for all tests. The same seat frame, foam, trim and head restraint were used in all tests. A spring-damper recliner system was used to give 7, 10 and 15 degree recline angles in the tests.

It was reported that acceleration values were very repeatable (CV<5%); NIC repeatable (CV<10%); but neck loads were marginal (although it was noted that CVs were calculated from two tests, and with very small values for some of the parameters, which exaggerates the CV). It was also reported that the BioRID IIg was able to distinguish between the various stiffness's of comfort features used in the

tests, and was able to identify mechanical failures in the seat back features. The BioRID response generally increased with an increase in seatback rotation (reduced frame stiffness).

9.3 Evaluation of Seat Performance Criteria for Rear-end Impact Testing

Presentation from Mr Davidsson on behalf of EEVC (GTR7-06-09).

Progress update on a study to investigate the correlation between rear impact seat test results and Folksam insurance data for a range of vehicle models. Insurance data from 1995 to 2008 were used. Two risk measures were assessed:

- symptoms > 1 month, and
- risk of permanent medical impairment (it takes up to three years to establish this, so no data more recent than 2008 in the study).

Seat test data were from existing databases using BioRID II e and g, with two different H-point tools.

Results were reported for groups of seats from different vehicles in which the seat design was about the same. NIC, upper neck shear force (Fx, head rearward), and head-to-T1 angle gave the best correlation with risk of permanent injury in these preliminary results. It was noted that some seats show an opposite trend for some individual criteria, even for seats with markedly reduced risk. This was taken to show the need for multiple criteria.

It was noted that the analysis will be repeated later this year, when it is expected that there will be three times as many data available. Occupant gender will be controlled in the updated study(there should be enough data to do this). This study looks at the ability of a test with BioRID to discriminate between seats with different risk in the field [where drivers are of different size, gender, seating position, posture etc.]. **Action Mr Davidsson** to complete the study by the end of 2011, and to compare the results with the recommendations on criteria coming from biomechanical studies. Also to contact Dr Ono and discuss collaboration.

It was noted that R^2 would not be expected to equal 1, as noted in the slide, but a low R^2 still indicates that the parameter is a poor predictor of permanent injury. Also it is not clear that using several parameters with poor R^2 will give a better overall prediction. Mr Frost noted that these issues will have to be discussed in future meetings.

It was noted that Nkm was recommended, in preference to the individual forces and moments because the individual forces and moments gave very low correlations. It was hypothesised that the variations in these individual parameters is masked when they are combined in the Nkm calculation.

10 Review the Research Status for Dummy and Dynamic Evaluation Method

10.1 NHTSA Rear Impact Biofidelity Study

Presentation from Mr Moorhouse, US (GTR7-06-03):

Biofidelity tests were undertaken at two pulses: 17 km/h 8.5 g, 202a type pulse, and scaled up to 24 km/h 10.5 g. No so much difference in kinematics at the lower pulse, but some at the moderate pulse the PMHS ramped up a lot, H-III not at all, and BioRID and RID-3D somewhere in between. Detailed results for all three dummies were reviewed.

The PMHS responses were phase aligned to get a more representative typical response for biofidelity comparison and the results assessed using the BioRank method for external, internal and total biofidelity. It was reported that the BioRID had either the best biofidelity (low-speed external and total biofidelity, moderate-speed internal biofidelity) or joint best biofidelity with RID^{3D} (low-speed internal, moderate-speed external and total biofidelity). BioRID II therefore had the best overall

biofidelity. BioRID also had the best overall repeatability, although all three dummies were acceptable.

It noted that volunteers typically tense somewhat and may therefore have reduced motions compared with PMHS. Mr Moorhouse noted that this effect may affect the low-speed pulse data, but that the high speed is sufficiently high that occupant tensing or bracing would not be significant.

10.2 VRTC Rear Impact Sled Testing Status

Presentation from Mr Moorhouse, US (GTR7-06-04):

Comparison of BioRID IIg and Hybrid III in 202a and Euro NCAP / Annex 9 pulse using the same seat used in the PMHS tests.

Both dummies discriminated between the pulses using the criteria defined for each dummy. NHTSA plan to repeat the tests with OEM seats, modified so that the backset can be adjusted to give a range of backsets.

10.3 Euro NCAP Medium-severity Pulse

Presentation from Mr Ellway, Euro NCAP (GTR7-06-08):

Mr Ellway presented the Euro NCAP medium-severity whiplash pulse definition, including a detailed review of the development of the current, narrow corridors. The medium-severity pulse definition started with the IIWPG definition, which had three 'gates' at the start, peak and end of the pulse. Euro NCAP defined a pulse to fit these requirements in terms of a mathematical expression for the rising and falling acceleration, plus a delta-v requirement. No corridor is set on the down-slope, because it was not thought necessary if the pulse meets the rise-slope and delta-v. It was noted that it took some time for all of the labs to understand how to meet the pulse specification, e.g. using a dummy on the sled for pulse tests to account for the partially coupled mass. Once each lab has adjusted the sled and can get the pulse, they do so quite consistently. It was noted that the labs found that the best way to minimise the effect of the partially coupled dummy mass was to increase sled mass to 2000 kg (from a typical mass of 1000 kg). It was also noted that all but one of the Euro NCAP labs have been able to meet the pulse specification for some time, although it is known that some OEMs have found that they cannot modify their sleds to be able to meet the pulse

Mr Frost asked what evaluation was made regarding how the tightening of the corridor affected the assessment, or whether it was simply trying to get a good compromise between tight corridor and achievability. Mr Ellway replied that it was the latter.

10.4 Update on Investigations into BioRID Response Variations

Presentation from Mr Depinet, Humanetics (GTR7-06-16):

A schedule for all outstanding work on certification testing and evaluating the effect of possible differences between dummies, and for tightening the corridors, was presented. Volunteers were sought for testing identified different dummies with OEM seats. Corridors will be tightened by excluding dummies with known issues. Humanetics will then evaluate how to retune the outlying (failed) dummies such that they meet the certification requirements. Certification test R&R will also be evaluated. The programme will take at least one year from now, but requires a decision to finalise the with-HR test.

It was noted that a target of 50 dummies would be good to certify over a six month period, in order to have confidence that the less common sources of variation are identified. This should be achievable though the routine certification that will now include the new certification tests.

Action All to comment on the test programme and schedule presented by Humanetics.

11 Review the H-Point Machine SAE Study Status

No new information was forthcoming.

12 Any Other Business

Mrs Meyerson noted that the Euro NCAP pulse is slightly lower severity than 202a, but JNCAP is as severe in terms of delta-v. It was noted that JNCAP will increase their pulse to about 17.6 km/h delta-v, with the same shape. Should this be used? Mr Frost noted that the group ultimately choose a pulse related to injury risk, but we already have an idea of the range this would be in, so it makes sense to move to this higher delta-v.

Decision: It was agreed that the NHTSA tests could be at a delta-v of 17.6 km/h.

13 Future Meetings

Mr Frost proposed that the IG should meet Thursday and Friday 9-10 June or Thursday and Friday 16-17 June, which is immediately before or after ESV. **Action All** to email Mr Frost with preferred dates by the end of next week (11 March).

14 Decisions

Decision: it was agreed that 'injury criteria' will be used as a working title, and it was acknowledged that this may need to be updated at a later date.

Decision: GTR7-06-12 (Proposal on a Special Resolution for Test Tools) was approved without changes for presentation to WP.29 by Mr Frost next week.

Decision: it was agreed to footnote the technical rationale for any decisions in regulation text amendment proposal document from Japan as we go along, so that the rationale is captured.

Decision: It was agreed to continue with the heavy impactor at this time. Further work will then proceed to check whether the test identifies differences between dummies that result in differences in seat tests.

Decision: It was agreed that the NHTSA tests could be at a delta-v of 17.6 km/h.

15 Actions

Action All to propose any other parts of the regulation text amendment proposal document from Japan that may need to be changed or discussed. **Decision:** No decisions were made on the document, just discussion of which areas need to be flagged for review.

Action Mr Lorenz to resent the PADI to the GRSP Secretariat for inclusion on the GRSP web site.

Action Asada-san to check dummies 095 and 102 against the design and maintenance checklists.

Action Mr Hartlieb to check whether PDB can do some additional tests (and to notify the IG by end March if this can be done).

Action Humanetics to perform certification tests with-HR and with light and heavy impactors in early April.

Action Mr Lorenz to arrange a TEG meeting for the end of April to discuss the results of these tests.

Action Mr Lorenz to run tests with two dummies, one of which previously had outlying performance, and then they can be provided to Humanetics for certification in April. Also to consider running seat tests with the PDB dummies if PDB cannot test.

Action Humanetics to consider running some light and heavy impactor with-HR certification tests with the dummies deliberately modified to have performance changes to see which set-up better highlights these changes. It should be noted that it is not known whether these changes result in differences in seat tests.

Action Mr Frost to include torso angle as a specific discussion point on future agendas.

Action Mr Davidsson to complete the study by the end of 2011, and to compare the results with the recommendations on criteria coming from biomechanical studies. Also to contact Dr Ono and discuss collaborating on the criteria.

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Action All to email Mr Frost with preferred dates for the next meeting (Thursday and Friday 9-10 June or Thursday and Friday 16-17 June) by the end of next week (11 March).