

Draft Minutes

GTR No. 7 / BioRID TEG

2nd Group of Experts Whiplash Injury Criteria Meeting (WebEx)

Date & Timing: Thursday 27th August 2015, 14:00-16:30 (CET)

Location: WebEx

Minutes drafted by: Bernd Lorenz (BAST/EEVC)

Participants: Johan Davidsson (Chalmers); Annette Irwin (SAE/ISO/GM); Yun-Seok Kang (Ohio State Uni); Agnes Kim (Ford); Bernd Lorenz (BAST/EEVC); Kevin Moorhouse (VRTC); Koshiro Ono (JARI); Philippe Petit (LAB); Hans Ammerlaan (RDW), Paul Lemmon (Humanetics), Paul Depinet (Humanetics), Siwoo Kim (KATRI)

Apologies: Bernie Frost (DfT)

Documents: documents of the meeting are uploaded to the UNECE website under the BioRID TEG (<WCWID-2-xy>)

1. Welcome / Roll Call / Introduction

Bernd Lorenz (BL) welcomed the participants.

He explained that it is the task of the group to propose recommendations for whiplash injury criteria and limits based on the outcome of the Munich 2015 meeting. This group has given recommendations on injury criteria candidates in September 2014 (see minutes from September 2014 meeting <WCWID-1-10>). However, NDCrot shall now be replaced by upper and lower neck My for flexion and extension. The discussion should focus on the use of criteria (JNCAP or EEVC or ...?) and depending on the use of criteria also give recommendations on the limits to the GTR7 group.

BL explained that the recommendations of this group shall be put forward to the IWG GTR No. 7 meeting in London 7th / 8th September and that the chair of the IWG wants to provide a draft GTR text to the GRSP meeting in December this year. So the whole issue is under time pressure.

2. Approval of the Agenda

The draft agenda was approved with additions (see <WCWID-2-01>):

- Presentation from Johan Davidsson (JD) on a new approach how to derive injury criteria from insurance data (<WCWID-2-05>)
- Presentation from BL on seat performance/injury criteria for regulatory purposes (<WCWID-1-04>)

3. Summary of discussion of 1st Group of Experts Meeting September 2014 based on meeting minutes

At the September 2014 meeting it was agreed that the following criteria should be recommended for the purpose of regulation (<WCWID-1-10>):

- NIC
- NDCrot for both flexion and extension, using appropriately specified angular rate sensors.
- Fx upper and lower neck.

It was also agreed to delete My upper and lower neck provided that NDCrot has requirements for both flexion and extension.

At the September 2014 meeting no limits for the criteria have been discussed or proposed.

4. Summary of discussion of July 2015 Munich meeting

At the Munich meeting NHTSA/VRTC gave an update on its correlation study on BioRID injury criteria measures to PMHS injury (<WCWID-2-06>).

The BioRID seems adequately repeatable and reproducible based on Gen-X tests and production seat sled tests. However, the BioRID appears to exhibit poor biofidelity in flexion so that there is only a poor correlation between BioRID measures and PMHS flexion injuries. One reason is that the BioRID was initially designed and tuned to match extension kinematics (of volunteers).

This does not mean that the BioRID is not a suitable tool for advancing safety in rear impact. The use of seat performance criteria (e.g. EuroNCAP/JNCAP/IIHS) may be capable of reducing whiplash injuries even though the criteria may not be directly linked to the injury mechanism.

NHTSA/VRTC is proposing a design change at the BioRID to perform more biofidelic with regard to flexion. The range of motion of BioRID cervical vertebrae in flexion shall be

expanded. This would take a while and sled tests with the modified BioRID would need to be re-conducted and in a longer term more PMHS tests would be needed to strengthen correlations.

This work would take a much longer time than the schedule agreed by WP.29.

So an alternative way shall be explored.

5. Information / Discussion on Whiplash Injury Criteria for Regulation

5.a. Aim of this meeting

Based on the outcome of the Munich meeting one way could be to replace NDCrot by upper and lower neck My for flexion and extension. The discussion should focus on the use of criteria (JNCAP/EEVC/Euro NCAP/IIWPG ...) and depending on the use of criteria also give recommendations on the limits to the GTR7 group for its London meeting.

5.b. Proposal from Japan

Dr. Koshiro Ono gave two presentations (<WCWID-2-02>, <WCWID-2-03>) explaining the background research and the justification for the limits proposed by Japan.

Injury Criteria		WAD2+
		82.9% Value
		(IV-NIC=1.1)
NIC Max		23
Upper Neck	FX (Backward)	640
	MY(Flx/Ext)	34
Lower Neck	FX (Backward)	640
	MY(Flx/Ext)	34

Units:
Force (N)
Moment (Nm)

IV-NIC=1.1 is correlated with AIS1+=50% and WAD2+=82.9%. This is how the proposed limits for NIC, upper and lower neck forces and moments were derived.

BL raised a concern with regard to the 82.9% risk of WAD2+ neck injuries. If the group shall bring the proposal to GRSP one of the contracting parties may ask why we accept a risk of approx 83% for an injury. For someone who is not familiar with the group's discussion this risk might sound very high. This could lead to the question how the proposed criteria would

correlate with a 50% WAD2+ risk or even lower. He said that the group needs to be prepared for such type of discussion within GRSP or even WP.29.

It might be better to relate the proposed limits for the criteria to something where the risk “sounds” lower (e.g. PMI or something else). This could avoid discussion.

However, Japan showed data (from Anders Kulgren) which showed that there is a reduction of claims about 63% for “Whiplash Seats” (mainly Volvo WHIPS). He also showed that from JNCAP data that there is no good correlation between backset and score (rating). This is not surprising as this is highly depending on seat design. However, it might be of importance for discussions about having a dynamic test as an option if the geometric requirements are passed (as it is in the current GTR).

It was also shown that HIII is not an acceptable tool for whiplash testing (e.g. inverse flexion).

KO was also presenting JNCAP data from the 17.6 kph and 20 kph pulse. The results have improved over time even when the seats are exposed to higher energy. This is also an experience from Euro NCAP.

5.c. New Approach by Chalmers

Dr. Johan Davidsson showed a new approach (<WCWID-2-05>) on how to develop injury criteria risk functions based on the data he presented in former meetings.

The risk functions will be generated in following way:

- a) Generate risk functions for the 17 groups included in the Davidsson and Kullgren IRCOBI 2013 paper will be generated. Data will be turned into binomial data by groping the data into better or worse than a state of the art.
- b) Each accident that is included in the Folksam data base and for which there is accident reconstruction data available will be included in a large volume regression analysis. The main disadvantage is that the crash severity is unknown (a generic pulse and seating position is used in the reconstructions) and risk curves will be to some degree influenced by the generic pulse used in the accident reconstructions.

This approach can be used not only for NIC but also for Forces and Moments.

JD is aiming to provide this data for the London meeting.

5.d. On Candidate Seat Performance / Injury Criteria for Regulatory Purposes

BL showed a summary of experience from Euro NCAP tests from the last years (<WCWID-2-04>). Most of the European (standard) seats have no problems with the proposed criteria.

Out of 152 models tested between 2011 and 2014 only 4 vehicles had a whiplash pulse score capped (mainly due to rebound velocity). No capping was applied for one of the candidate injury criteria NIC and Upper Neck Fx. The other candidate criteria like My are measured but not assessed.

However, it should be noted that only the seats of the best selling version are tested at Euro NCAP. In general no special sports seats or high sophisticated luxury seats are tested within the Euro NCAP programme.

Euro NCAP whiplash tests are currently performed in 7 European labs which received „Euro NCAP accreditation“. Different BioRIDs are used which are certified according to the „old“ procedure.

Based on the data and by a comparison of the different proposals BL recommends the following limits for further discussion within the GTR 7 group:

- NIC 23
- Upper and Lower Neck Fx 360 N
- Upper and Lower Neck My 30 Nm

BL said that a status was reached where the group could also define something as “good practice” or based on the experience of JNCAP and Euro NCAP (may be IIWPG) set limits for some criteria to set a minimum standard and to sort out very cheap and bad seats (which could have a good geometry).

6. Recommendations to the GTR-7 Informal Group

6.a. Whiplash injury criteria candidate(s) and draft limits

As there is still some more data needed and due to the limited time no clear recommendations can be given to the GTR 7 informal group.

On the one hand guidance is needed on the level of risk related to what kind of injury (AIS1+, WAD2+, PMI) which is acceptable for the contracting parties.

On the other hand the correlation work on BioRID injury criteria measures to PMHS injuries is not completed and there might be a longer time frame needed to fulfil this work.

However, there are other approaches to set limits for seat performance criteria that should be considered by the contracting parties:

- a) New approach on how to develop injury criteria risk functions based on insurance data as proposed by Dr. Johan Davidson. This approach seems to be promising at this stage and might be possible for NIC and upper and lower neck forces and My.
- b) The criteria and limits proposed from Japan are backed by extensive simulation work and JNCAP data and are partially well correlated to the work of NHTSA/VRTC.
- c) Based on the experience of Euro NCAP whiplash seat testing and assessment of over 200 different seat models limits can be proposed following a kind of good practice approach. In the last years no rating of the seats has been capped due to one of the proposed criteria. This means the so called “black” limits are not too demanding for modern seat design.

5.b. Further Recommendations

None.

6. AoB

None

7. Summary of the Meeting

The BioRID seems adequately repeatable and reproducible based on Gen-X tests and production seat sled tests. However, the BioRID appears to exhibit poor biofidelity in flexion so that there is only a poor correlation between BioRID measures and PMHS flexion injuries. One reason is that the BioRID was initially designed and tuned to match extension kinematics (of volunteers).

However, this does not mean that the BioRID is not a suitable tool for advancing safety in rear impact. Japan and EEVC have shown that HIII is not an acceptable tool for whiplash testing (e.g. inverse flexion).

The use of seat performance criteria (e.g. EuroNCAP/JNCAP/IIHS) may be capable of reducing whiplash injuries even though the criteria may not be directly linked to the injury mechanism.

The group discussed several proposals on how to set limits for the proposed seat performance / injury criteria.

Guidance is needed by the contracting parties which level of risk related to what kind of injury (AIS1+, WAD2+, PMI) is acceptable.

The correlation work on BioRID injury criteria measures to PMHS injuries is not completed and there might be a longer time frame needed to fulfil this work than the schedule agreed by WP.29.

However, there are other approaches to set limits for seat performance criteria that should be considered by the contracting parties:

- a) A promising new approach on how to develop injury criteria risk functions based on insurance data
- b) The criteria and limits proposed from Japan are backed by extensive simulation work and JNCAP data and are partially well correlated to the work of NHTSA/VRTC.
- c) Based on the experience of Euro NCAP whiplash seat testing and assessment of over 200 different seat models limits can be proposed following a kind of good practice approach.