Document 500: Draft minutes

Call Conference Meeting EEVC WG12-WG18

On the Effect of Q-dummies and Criteria on the EEVC Test Database Results

July 4th, 2007 (16:00: 17:50 CEST)

<u>Attendees:</u>

David Hynd, (DH), TRL. WG12.
Philippe Lesire, (PL), LAB. WG18.
Luis Martinez, (LM), UPM-INSIA. WG12.
Britta Schnottale, (BS), BASt. WG18.
Gonçal Tejera, (GT), Applus IDIADA. WG18.
Thomas Turbell, (TT), VTI. WG18.
Xavier Trosseille, (XT), LAB. WG12.
Michiel van Ratingen, (MvR), FTSS. WG12.
Kees Waagmeester, (KW), FTSS.

LM started the meeting thanking all for joining the call conference and asking MvR to proceed and present the work in "Injury Criteria for Q Dummies in Frontal Impact", prepared by KW (presentation sent around to all WG12 and WG18 partners for review and main topic of the meeting).

MvR presents the content of the presentation, divided into two parts: one dealing with the development of the injury criteria and calculation of injury assessment reference values (IARV) for the Q dummies (slides 3-20) and the other part applying these to the current CRS test database (slides 21-46).

The development of the injury criteria has been based on two approaches:

1) Scaling down ECE R94 adult criteria using Mertz scaling techniques.

2) Using real world accidents from CREST and CHILD EC funded project as input together with their validated accident reconstructions to obtain first Q3 IARVs and then scale these to the different dummy sizes. With these data, Certainty method (CM) and Logistic Regression method (LR) are used to derive injury risk functions for the HIC, Head acceleration 3ms, neck F_z (tension) and M_y (flexion) and chest deflection.

GT commented that in ECE R94, M_y in flexion is not limited but it is in extension, so this criterion needs to be checked (**Action 481 XT: verify M_y criterion**).

DH expressed his concern on how the scaling between the dummy sizes were done applying scaling factors, hence not taking into account the actual performance of the various dummies with respect to their respective biofidelity corridors. MvR explains that differences in size and material properties have been taken into account to obtain the scaling factors but he commented that differences in the same dummy versions have currently not been considered.

The injury risk curves obtained from both methods together with the IARV derived from them for the 20% and 50% AIS3+ injuries and the one scaled from the ECE R94 are summarized for the different criteria, being analysed five sets of IARV:

- AIS3+ scaled ECE R94.
- AIS3+ 20%CM.

- AIS3+ 20% LR.
- AIS3+ 50%CM.
- AIS3+ 50% LR.

In all cases but for the chest deflection, the IARVs obtained via LR method and CM show good agreement for both risk percentages. However, in the case of the chest deflection, for the 20%, LR<<CM but for 50%, LR>>CM, which may indicate that the data in which the predictions are based for the LR is not sufficient. XT commented that the CM in case should be preferred.

DH said that UK's position with respect to the appropriateness of the CM has not changed and that the effect of the statistical method selected needs to be taken into account. TRL has contacted some statistics experts to give more detailed feedback on this issue (**Action 482 DH: share feedback on CM versus LR method**).

XT added that ECE R94 IARV are not based always in the same injury risk (the head and neck is based on a 20% and the chest is based on a 50% risk of AIS3+) and a coherent approach needs to be taken with the same injury risk level in all the body regions (**Action 483 XT with KW: develop recommended injury risk level and apply to data**).

LM commented pointed out an apparent inconsistency on the summary of injury criteria (slide 20) since for the head, Q0 injury risk values are over the ones for Q1, but for the neck this is the contrary. XT replied that the calculation of the scaling factors takes into account the different injury mechanisms and the material properties of the body region but the effect of the latter is different in head and neck and therefore, it can lead to these results.

LM also highlighted that the deflection values for chest deflection in Q3 are higher to the ones from Q6 and even some seems to be unrealistic (slide 14), one Q6 AIS3 injury appears with very low chest deformation. XT agreed and was asked to check the values of chest deflection used (to confirm also that only validated cases were used) (**Action 484 XT: check the values of chest deflection used**). DH highlighted the previous comment by XT about the lack of data for chest deflection, and therefore, in his view this discussion is no longer useful if no more data are included to allow a proper injury risk derivation.

MvR continued the presentation with the injury criteria evaluation done with the 152 ECE R44 test performed with Q dummy in the WG12-18 test programme. In this part of the presentation, focus was put on the evaluation of the different CRS with the new injury criteria proposed for the Q dummies.

First, a global overview was presented, taken into account all tested CRS, in which the five presented IARVs are evaluated. The worst test per CRS is considered to set if the CRS fail or pass the criteria. This pass/fail process is based only on Q dummy responses and does not take into account possible failures in the CRS during the tests (clarification requested by PL). TT answered that this is not necessary for the purpose of the current analysis and the CRS failure will be still covered in R44. In this case, considering the 20% of risk or the scaled ECE R94, less than the 20% of the current CRS would meet the requirements. If 50% of risk is considered, 30-40% of the CRS would meet the requirements.

Further analyses were performed in the different injury criteria for the AIS3+ 20% IARV, in this case considering the best results obtained by the CRS in each of the two

tests. These analyses showed that HIC, Fz and chest deflection are the most critical criteria to be met.

PL commented that 50% risk is preferable to 20% since in that sense, some CRS are meeting the requirements and the rest of manufacturers may see that the requirements are not impossible to be met. PL added that regarding the neck tension, the incidence in real accidents is seen to be low but as R44 configuration is different, the importance can also be different.

Cross plot between the HIC and the upper neck Fz and HIC and chest deflection is presented considering the different IARV boxes. The former it to consider head kinematics, and it seems that increasing HIC leads to increasing upper neck Fz. The latter is to analyse if an aggressive restrain in the dummy chest may be related with the head kinematics (KW).

Next, detailed analyses per CRS group was presented (groups 0+, I, II) showing that:

- There is not significant correlation between current ECE R44 criteria and the new parameters; therefore, MvR suggested that both sets of criteria can be somehow complementary to continue taking into account the overall kinematics of the child dummy.

- The new injury criteria provides significant design challenge, specially in groups I and II, since, for group 0+, 6/7 CRS pass the new IARV (in the 20% CM and the 50 % CM risk cases), while in group I (2/20 pass for 20% CM and 8/20 pass for 50% CM) and group II (0/10 pass for 20% CM and 3/10 pass for 50% CM) the results are rather poorer. GT suggested that some guidelines should be included in the document to somehow guide CRS manufacturers to approach this design challenge (**Action 485 all: develop guidelines for CRS improvement to be included in the final report**).

PL commented that he was not surprised of group 0+ behaves better than the other groups since in group II most of the CRS uses the seatbelts from the car. KW replies that the CRS have been tested in working positions at R44 bench, therefore, perhaps load limiters needs to be considered.

Jean-Philippe Lepetre, although not present in the conference, sent by email his comments. In line with PL, he expressed his surprise in the poor results of group I for the 20% CM (2/20) and he wonders if the CRS are really so bad or if the criteria used is too stringent.

BS commented that she was surprised, especially in group I for Romer Duo, which was tested by ADAC showing very good results in frontal crashes (even more severe than ECE R44) and with the new criteria, it is rather far to meet the requirements. KW replied that perhaps it could be because the ECE R44 requirements are more qualitative and the new criteria are more quantitative. *See additional note at the end of these minutes.*

PL also expressed his concern regarding that ISOFIX CRS are over the limits and that booster CRS may result in better results with the new criteria, but, he added that if other body assessments were done (i.e. abdomen measurements) the picture may be different. MvR replied that the current dummy measurement capabilities have been used and that if more body regions are assessed they may lead to different problems. He agrees that kinematics needs still to be assessed, especially supported by the low correlation of the

new criteria with the current ECE R44 measurements, which may indicate that they can be complementary.

Note: It could be interesting to analyse further every CRS failures with three different criteria: the current ECE R44 pass/fail criteria with P dummies, the current ECE R44 criteria applied to Q dummies and the presented analysis (new Q dummies criteria). These three analyses may lead to clarify more objectively the large number of CRS rejected.

(Action 486 KW: perform this analysis)

TT said that the study is very completed and asked for the future steps to finalise it, especially taken into account that it could be very interesting for the incipient GRSP ad hoc group for the revision of ECE R44. MvR replied that EEVC WG12 will finish the document and send it to the EEVC SC. For that, WG12 will need the support on their conclusions and recommendations from the WG18 partners. Then the EEVC SC is responsible of the dissemination of this document but once in the final version, it will be made available to the GRSP ad hoc group for ECE R44 revision.

Regarding the time frame, MvR asked KW to finalise the document by end of August to be discussed in WG12 meeting in early September, where WG18 partners needs to be involved in this discussion even the WG18 activities are currently frozen.

MvR finished the conference at 17:50h, thanking all for his participation and asking LM to circulate the minutes of the meeting.

Additional Note:

The fact that some CRS seem to perform less or better than what would be expected based on published test results by ADAC and others, may in some cases be attributed to an incomplete data set. For instance, the score of the Team Tex Basic CRS is relatively high, but only 6 out of 10 parameters were reliably measured by EEVC. In this specific case, critical criteria Fz and Dchest were missing and therefore the CRS could not fail on the basis of these parameters. An attempt will be made to take this effect better into account in the presentation of end results in the final report (**Action 487 KW**)