

**Minutes of the 2<sup>nd</sup> meeting of the Informal Group on Global Technical Regulation No. 9 - Phase 2 (IG GTR9-PH2)**

Venue	RIHGA Royal Hotel Osaka, 5-3-68 Nakanoshima Kita, 530-0005 Osaka, Japan  <b>Please note:</b> It is planned to provide WebEx access to the meeting, details will be shared in due time before the meeting.
Date	28 March 2012, 10 a.m. – 5:30 p.m. and 29 March 2012, 9:00 a.m. – 4:30 p.m.
<b>Status: <span style="color: red;">Draft</span></b>	

**A) List of Attendees**

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Ms. Chaka as well as Messrs. Bambach, Beebe, Bilku, Borde, Corwin, Davis, Edwards, Frost, Gehring, Hardy, Kolb, Otubushin, Pingston, Tedesco, Uikey and Zander attended the meeting via telephone and/or WebEx.

## B) List of Actions

ID	Action Item	Responsibility	Due
A-2-01	Check EEVC information on statistics regarding knee injuries that were provided during development of EEVC legform impactor	U.K. DfT	3 <sup>rd</sup> meeting
A-2-02	Check boundary conditions of Nagoya University study mentioned in the presentations; update and combine the respective presentations if needed	JASIC	3 <sup>rd</sup> meeting
A-2-03	Provide more details / the final document from the research project with Autoliv on pedestrian injuries	NHTSA	4 <sup>th</sup> meeting
A-2-04	Provide more detailed information regarding the concerns mentioned during the discussion on the cost/benefit assessment of the FlexPLI	OICA	3 <sup>rd</sup> meeting
A-2-05	Provide raw data of inverse certification tests to TF-RUCC members to allow them a better assessment of the impact conditions	Humanetics	Before the 3 <sup>rd</sup> meeting

A-2-06	Organize the uploading of TF-RUCC documents to the IG GTR9-PH2 website	TF-RUCC chair	Before the 3 <sup>rd</sup> meeting
A-2-07	Provide raw data of certification as well as of vehicle tests presented during the work of IG GTR9-PH2, if possible	NHTSA, JARI, OICA	3 <sup>rd</sup> meeting and afterwards
A-2-08	Provide drawings of the FlexPLI, for the time being with disclaimer that they must not be used for commercial purposes	Humanetics	3 <sup>rd</sup> meeting
A-2-09	Provide certification test results for the different FlexPLI's used for the tests presented in document GTR9-2-10, add the respective information to the presentation	OICA	3 <sup>rd</sup> meeting
A-2-10	Provide clearer specification of the vehicle size as well as build levels of cars and parts used for the tests presented in document GTR9-2-10, add the respective information to the presentation	OICA	3 <sup>rd</sup> meeting
A-2-11	Provide information on further test / certification results with the impactors used for the tests in document GTR9-2-10 as well as on the impactors' build levels	BASt	3 <sup>rd</sup> meeting
A-2-12	Update manual with visual inspection parameters	Humanetics	3 <sup>rd</sup> meeting
A-2-13	Establish a Task Force "Bumper Test Area" (TF-BTA) discussing the possible changes to the bumper test area	European Commission	Before the 4 <sup>th</sup> meeting
A-2-14	Provide information on the rational why Euro NCAP changed the bumper test area	European Commission	Before the 1 <sup>st</sup> TF-BTA meeting
A-2-15	Submit draft progress report of 2 <sup>nd</sup> meeting to GRSP	Chair, Vice-Chair, Secretary	51 <sup>st</sup> GRSP
A-2-16	Provide draft proposal of a vehicle test matrix	Chair, Vice-Chair, Secretary, BASt	3 <sup>rd</sup> meeting

**C) List of Meeting Documents**

GTR9-1-02	(Chair/Secretary) Minutes of the 1st meeting of the Informal Group on Global Technical Regulation No. 9 – Phase 2 (IG GTR9-PH2) - Draft
GTR9-1-02r1	(Chair/Secretary) Minutes of the 1st meeting of the Informal Group on Global Technical Regulation No. 9 – Phase 2 (IG GTR9-PH2) - Final
GTR9-1-05r1	(JASIC) Technical Discussion – Biofidelity (Revision)
GTR9-2-01	(Chair/Secretary) Agenda for the 2nd meeting of the Informal Group on Global Technical Regulation No. 9 - Phase 2 (IG GTR9-PH2) – Draft
GTR9-2-01r1	(Chair/Secretary) Agenda for the 2nd meeting of the Informal Group on Global Technical Regulation No. 9 - Phase 2 (IG GTR9-PH2) – Final
GTR9-2-02	(Reserved for the minutes/this document)
GTR9-2-03	(BAST) Proposal for a Modification of the Bumper Test Area for Lower and Upper Legform to Bumper Tests
GTR9-2-04	(BAST) Robustness of SN02 prototype test results
GTR9-2-05	(BAST) Comparison of Filter Classes for FlexPLI
GTR9-2-06	(OICA) Technical Specification and PADI
GTR9-2-07	(JASIC) Technical Discussion – Benefit; Updated Version of Document GTR9-1-07r1 ( <b>Note:</b> The document was not presented since a revision 1 of the document was already available for the meeting)
GTR9-2-07r1	(JASIC) Technical Discussion – Benefit; Updated Version of Document GTR9-1-07r1
GTR9-2-08	(Humanetics) Flex PLI GTR meeting actions
GTR9-2-09	(Humanetics) FLEX PLI GTR –FE v2.0IG FLEX GTR9-PH2
GTR9-2-10	(OICA) FlexPLI Comparison (Impactors: SN02, SN04, IND-Impactor - Test experiences)
GTR9-2-11	(Chair) Informal document <b>WP.29-156-11</b> : First progress report of the informal group on Phase 2 of gtr No. 9
GTR9-2-12	(JASIC) Re-examination of Number of Pedestrians by Injury Severity
GTR9-2-13	(Humanetics) FLEX PLI Update for Alliance of Automobile Manufacturers
GTR9-2-14	(JARI) Updated Japan Progress Report: Review and Update Certification Test Corridors and Test Methods (added pendulum Test data)
TF-RUCC-2-03	(BAST) FlexPLI Inverse Certification Corridors-Further Test Results
TF-RUCC-2-04	(ACEA) Comments on Inverse Certification Test Procedure

- TF-RUCC-2-05 (Humanetics) Humanetics Inverse and Round Robin Leg Preparation
- TF-RUCC-2-06 (BGS Boehme & Gehring) Status of the FlexPLI – Inverse Certification
- TF-RUCC-2-07r1 (TF-RUCC chair) Japan Progress Report: Review and Update Certification Test Corridors and Test Methods

## **D) Summary of Meeting**

### **1. Welcome (chair, Mr. Kubota (J-MLIT))**

The chair Mr. Damm (German Ministry of Transport) welcomed the attendees in Osaka.

Mr. Kubota (Japanese Ministry of Land, Infrastructure and Transport) also welcomed the attendees on behalf of the J-MLIT and gave a short overview about the city and the area of Osaka.

### **2. Roll call of participants**

The attendees (see above) introduced themselves.

### **3. Adoption of the agenda**

The chair introduced a slightly revised agenda where the documents handed-in in advance were already mentioned at the specific agenda items. This revised agenda was adopted as document GTR9-2-01r1. However, it was agreed to adapt the running order to the needs especially of those people calling in from overseas. In addition, a presentation from the United States on injury data was added under agenda item 6 and, on request of the chair, a report from the U.K. on the UNECE test tool depository was added to be given under agenda item 9.

### **4. Review of the Minutes of the 1st Meeting (document GTR9-1-02\_Rev)**

Comments to the minutes of the first meeting had been received. These comments were reviewed in detail.

On request of Mr. Bilkhu (OICA) it was specifically stated that the cost/benefit discussion will be continued and that this had not yet been finished. The chair added that the concerns raised by the Alliance (or OICA respectively) will be reflected in the 2<sup>nd</sup> progress report, pending further information to be submitted by OICA for the 3<sup>rd</sup> meeting.

The other changes were adopted without further discussion.

**5. Review of information provided to GRSP during their 50<sup>th</sup> session in December 2011 and progress report given to WP.29/AC.3 in March 2012 (document WP.29-156-11/GTR9-2-11)**

Mr. Damm presented the 1<sup>st</sup> progress report given to the December 2011 GRSP session and handed-in as an informal document to WP.29 and AC.3 for their March 2012 session. He pointed out that he did some slight editorial corrections to the document in between. The document was well received and is expected to be adopted by WP.29 and AC.3 in their June 2012 session.

**6. Review of accident data, especially related to lower leg injuries (action items A-1-11 and A-1-12 of the 1<sup>st</sup> meeting's "List of Actions") (Chair, NHTSA, All) (document GTR9-2-07)**

Mr. Takahashi (JASIC) presented document GTR9-2-07 in a version that had been already revised (see document GTR9-2-07r1). He mentioned that some of the information had already been presented during the 1<sup>st</sup> meeting of the IG GTR9-PH2.

Mr. Takahashi explained that the biofidelity of the FlexPLI has improved significantly. Mr. Bilkhu felt that the presentation here is not fully correct: Data are mainly based on simulation data and it seems impossible with this to prove that the biofidelity has really improved. All models may have different correlations. Dr. Otubushin (OICA) suggested to clearly state that the performance of the two impactors' FE models was compared with the human body model which should address the concerns of the Alliance. Dr. Konosu stated that those FE models are validated by comparing with actual impactor responses or PMHS responses. No concerns regarding validity therefore exist with those FE models. Mr. Takahashi wondered whether he needs then to change the former presentation since the slides under discussion were just copied from the other document. Also, he pointed out that the time where the earlier presentation had been shown no comments on this had been made. Finally it was suggested to modify the presentation accordingly but to go through the presentation here to assure that the information is shared.

During the ongoing presentation, Ms. Chaka (OICA) explained that the data from the U.S. may need to be processed in another way. Classification of injury severities from accident data (AIS coding) refers to vehicle occupants but not to pedestrians. In addition, data are not nationwide. Finally, it should be defined how the terms fatal, severe and minor were used for the injuries.

Mr. Bilkhu added that legform injuries usually are not fatally (max. AIS 3) and that therefore the approach for establishing the costs may be misleading and needs to be changed. The Alliance sees some difficulties in agreeing on the way JASIC performed the analyses. After some intense discussion on this it was finally clarified by the chair that the information represents the approach of JASIC. The chair therefore suggested that the Alliance may hand in their comments and concerns via OICA. A constructive document proposing alternative methods would be very much appreciated.

Afterwards, Mr. Takahashi presented again document GTR9-1-05r1 of the 1<sup>st</sup> meeting since the Alliance questions referred to this. The presentation explains in detail the methodology of JASIC to prove the biofidelity of the FlexPLI. Mr. Bilkhu again mentioned that some of the slides need to clearly state that the impactors are compared with a human body model. Mr. Takahashi replied that the presentation reflects JASIC's findings and that the Alliance should hand in their comments for discussion.

Mr. Frost (U.K. DfT) wondered whether the knee stiffness is acceptable. The EEVC LFI clearly has its limitations but seems to good represent the knee injuries. In contradiction, the presentation of Mr. Takahashi shows that knee injuries are underrepresented. Dr. Konosu (JARI) replied that the FlexPLI covers both, knee as well as tibia injuries. Due to this, compromises had to be found and main priority was given to tibia fractures based on the relevance according to accident studies. However, Mr. Frost stated that he is concerned with the decreasing ability to assess knee injuries. Dr. Konosu therefore explained that knee injuries are rare in accident statistics. He wondered whether more statistics on this are available from the United Kingdom or EEVC. Mr. Frost promised to check this.

Dr. Otubushin asked the group to not only consider the detailed scientific comparisons between the EEVC legform impactor and the FlexPLI: It may be the case that also differences in the operational area of testing are relevant. For example, in slide 16 of the JASIC presentation, at the level of 340 Nm the difference in displacement between FlexPLI and EEVC LFI is only approximately 10 mm whereas consideration of the whole range of responses including the rebound phase as presented in this slide would lead to drastically different conclusions. The group should therefore always ask themselves if the differences

between the impactors in the operational area specified in the GTR are relevant in the real world.

Mr. Hardy (TRL) asked why the bending moment at the knee is zero at the knee joint since the joint itself also can withstand certain loads. Mr. Takahashi explained that he does not know the boundary conditions of this study that was done by experts from the Nagoya University. It was agreed that JASIC will come back to this.

On behalf of NHTSA Mr. Nguyen presented details from a research project of NHTSA and Autoliv. Mr. Nguyen apologized that this is preliminary information from this study but promised to deliver the final results at one of the next meetings. Sources of the data used are the Pedestrian Crash Data Study (PCDS) and the German In-Depth Accident Study (GIDAS). The analyses only cover AIS 3-6 injuries, looking at disabling injuries according to the Functional Capacity Index (FCI) based on AIS. According to both studies, bumper-caused injuries represent up to 40% of all pedestrian injuries. Despite there are notable differences between the two sources regarding the number of injuries to the different body regions the number of injuries to lower extremities caused by the bumper is in both cases close to 100% (94% for PCDS and 99% for GIDAS). The presentation also showed the ranking of injured body regions for serious and disabling injuries.

Mr. Edwards (OICA) asked when the final study will be available. Mr. Nguyen responded that he does not have this information right now.

On request of the Mr. Bilkhu Mr. Nguyen clarified that only injuries of people above 18 years were considered. Ms. Chaka wondered how PCDS data were used to represent nationwide data. Mr. Nguyen explained that the PCDS data set was weighted using the data of the General Estimates System (GES) of the National Automotive Sampling System (NASS). However, it was again promised to come back to the details as soon as the study is finally published.

Mr. Takahashi presented document GTR9-2-12 representing a reexamination of the data of document GTR9-2-07r1 and which addresses the concerns raised by Mr. Bilkhu and Ms. Chaka mentioned before. He admitted that indeed the data of the PCDS had counted MAIS1+ injuries as severe injuries in some cases and MAIS2+ injuries as minor injuries. Considering and correcting these mistakes Mr. Takahashi found that the number of severe injuries rises while the number of minor injuries decreases.

It was finally concluded that the discussion on these items is expected to go on during the



next meeting.

**7. Review of activities of the “Task Force Review and Update of Certification Corridors”/TF-RUCC (action item A-1-09) (TF-RUCC chair) (Report expected)**

Dr. Konosu, who also serves as a chair of the TF-RUCC, explained that the last audio conference of the task force had taken place some days before the meeting of the informal group. Unfortunately, the TF was struggling with WebEX problems (some of TF members were not able to talk with other members via WebEX) so that not all information could be shared in a way as it is wished for. He therefore requested the TF members to shortly present their documents to the informal group.

Mr. Kinsky (OICA), who also is pilot of the pedestrian safety experts’ group of the European manufacturers, presented the document on the comparison of inverse certification tests in two different labs (document TF-RUCC-2-04). He concluded that currently the labs are still struggling to conduct the tests in a way that allows repeatable results so that a discussion on the inverse certification corridors seems to be premature.

Mr. Zander (BASt) presented the BASt document (document TF-RUCC-2-03) that is based on the same data as the document of European manufacturers. However, he concluded that specifically the Humanetics test lab may have difficulties to conduct the inverse tests. Dr. Konosu added that he sees the responsibility at Humanetics to improve the way how they conduct the tests. Moreover, Dr. Konosu stated generally that the lab to lab differences regarding the inverse certification test seem to be high. Tips to obtain comparable test results among different labs therefore shall be worked out by BASt/BGS and ACEA (proposers of inverse certification test) and then shall be shared with Humanetics as well as with IG GTR9-PH2 members.

Mr. Gehring (BGS/BASt) presented a proposal to modify the hanger for the legform (which is used before the legform is hit by the honeycomb structure) in a way that the vertical hanging of the impactor is guaranteed (document TF-RUCC-2-06). He pointed out that the main intention is not to have a modification as proposed in the presentation but to assure that the impactor is hanging vertically. Mr. Zander added that the gtr No 9 describes some tolerances for the movement during the free-flight of the FlexPLI and that this also should be guaranteed during the certification. Mr. Burleigh (Humanetics) was wondering whether this has any influence on the test results and offered to conduct some comparison tests on this. This will be done within the task force’s activities.

The activities of Humanetics for the TF-RUCC were presented by Mr. Burleigh (document TF-RUCC-2-05). First, Humanetics had investigated the influence of the rubber length. (As a reminder: The certification corridors had been agreed based on test data with the three prototype legforms; these prototype legforms had short rubber sheets in front of the tibia.) Mr. Burleigh stated that obviously the length of the rubber has some influence on the test results. Second, the modifications of Humanetics test rig were presented addressing the issues that were mentioned in the presentations of Messrs. Kinsky and Zander (TF-RUCC-2-04 and TF-RUCC-2-03). However, these modifications did not provide the necessary progress in the test results. Finally, Mr. Burleigh explained the Humanetics' activities preparing the round robin tests planned within the task force.

Mr. Hess (OICA) wondered whether the tests with the different rubber lengths were conducted with the same test equipment as the tests that were shown earlier by BAST and European manufacturers. This was confirmed and Mr. Hess concluded that therefore the test results may be questionable. Mr. Gehring added that he also sees difficulties with the speed measurement: Since the test equipment obviously is not fully stable during the test slight deviations in the speed measurement equipment may lead to large differences in the recorded test speed. Mr. Burleigh promised that Humanetics will pay special attention to this, Mr. Gehring recommended in addition to use an external speed measurement device.

Mr. Matsuoka (OICA) wondered whether the impactor had moved vertically during the test but Mr. Burleigh could not say anything on this. Mr. Zander suggested that Humanetics shares the raw data which may allow a better assessment of the test details and Mr. Burleigh promised to do so.

The TF-RUCC presentations were concluded by Dr. Konosu showing a revised version of the progress report of the TF's activities (document TF-RUCC-2-07r1). JARI had spent several efforts to assure that the bone cores selected for the round robin tests with three different legforms are of a reliable quality and are certified on component level. In addition, tibia and femur assemblies as well as knee assemblies were certified on sub-system level. It is then planned to conduct inverse and pendulum certification tests at JARI followed by tests at BAST. Mr. Burleigh added that also Bertrandt in Germany and Ford in the US are interested in supporting the test series and that therefore the legform should be given to Bertrandt after BAST finished their testing. Humanetics itself may not be able to test since the problems with their test rig as described above have not yet been finally solved.

Mr. Damm thanked the chair of the task force and all members of the group for their intense work and concluded that the TF-RUCC input for the work of the informal group therefore is expected for the 3<sup>rd</sup> meeting of the IG GTR9-PH2 in May.

Later during the meeting Dr. Konosu presented further data regarding pendulum test results which were conducted at JARI during the 2<sup>nd</sup> IG GTR9-PH2 meeting with the prototype legforms SN-01, SN-03 and the so-called “engineering legform” that was produced by Humanetics for development purposes (document GTR9-2-14). The pendulum test results were compared to the data produced in 2009 (FlexPLI’s which did not have brand-new knees were used at that time) and it can be seen that there are tendencies of the test results to move within the corridors. Mr. Burleigh confirmed that this also fits the experiences of Humanetics. It is concluded that the details will be discussed in the Task Force on Review and Update of Certification Corridors (TF-RUCC).

On request of Mr. Pingston (OICA) it was clarified that the legforms mentioned above all were updated with vinylester bone core material. Also, it was mentioned that at least one production legform is available that meets both, the pendulum as well as the inverse certification corridor (see documents TF-RUCC-2-03 and TF-RUCC-2-04).

Dr. Konosu again invited all people interested in the details of the work of the task force to attend the respective meetings or audio conferences respectively. The documents will also be uploaded to the UN website where the documents of the informal group are stored.

**8. Update on the FlexPLI build levels of individual impactors (action item A-1-03) (Humanetics) (document GTR9-2-08)**

Mr. Burleigh presented the document GTR9-2-08 that covers several items. It was agreed in advance that the discussion on items not belonging to this agenda item will be discussed later under the respective items in the agenda.

The presentation firstly covers the details of the build levels of different impactor generations. Changes were brought-in in different phases that were explained in detail. Mr. Gehring wondered whether the appropriateness of the modifications was just confirmed by pendulum tests. This was confirmed by Mr. Burleigh.

Mr. Nguyen (NHTSA) asked how the documents of the new impactor will be dealt with, especially where data will be stored. The chair responded that this discussion had already started in Geneva and Humanetics is aware of the fact that the documentation needs to be stored in a public area.

Also, Mr. Nguyen was wondering whether the detailed measurement data can be shared. Dr. Ries (OICA) asked if the question refers to the raw data which was confirmed. Dr. Konosu confirmed that JARI is willing to provide their certification test data obtained at JARI. The chair asked whether industry can also share the detailed data of the vehicle tests. OICA will check this. Mr. Nguyen promised that NHTSA also will share their detailed data since this then allows a good comparison of the overall performance of the impactors.

In the second part, the presentation explains how the changes of the legforms' build levels are recorded to assure that they can be tracked.

The third part of the document compares the effects of filtering test results with filter classes CFC 180 with those with using CFC 600 filters. Mr. Burleigh stated that the use of the different filter classes does not influence the test results significantly in general but obviously has an influence on the acceleration.

Mr. Hess asked what the numbering of the bone batches means. Mr. Burleigh responded that the bone core material is received from the manufacturer of the material in different batches. However, the detailed differences are not known but the bone core manufacturer confirmed that there are differences. Humanetics therefore conducts fine-tuning regarding the bone core bending stiffnesses one by one in the process of reducing bone core thickness from original one.

**9. Update of the users' manual for the FlexPLI (action item A-1-08) (Humanetics) (documents GTR9-2-06 and GTR9-2-08)**

The current status had been presented under agenda item 8. It was again explained that version C of the owner's manual is available. On request it is agreed that the document will be shared as official document GTR9-2-13 of the documents of this meeting.

Dr. Ries presented document GTR9-2-06 requesting more transparency of the respective activities. Making the respective documentation available may encourage other manufacturers to e.g. supply spare parts or even complete impactors. Mr. Burleigh confirmed that all documentation will be available as soon as the FlexPLI will be part of legislation. This had already been agreed. However, Humanetics of course would not like to see other manufacturers to produce spare parts etc. but could not prevent this. However, he also promised that for example the delivery of spare parts will improve soon.

Mr. Frost added that in WP.29 it was already agreed that engineering drawings of dummies and dummy parts will be shared but not manufacturing drawings. So, competitors will have to invest on their own to deliver parts having the same performance. The current proposal foresees that drawings will be made available during the discussion period only for information purposes covering a disclaimer that it may not be used for commercial purposes. After dummies and dummy parts will have been finally agreed the disclaimers on the drawings will be removed and the engineering drawings will be made available. Also, there was the question on how to work with parts or technology that are protected by patents. For this, no final solution is available by now. Several dummies have been developed using funding from governments etc. If parts are protected by patents it is unclear whether this has to be respected by governments. Several governments are still trying to solve this issue together with Humanetics. However, WP.29 already agreed to have a Special Resolution No. 2 in the future that will form a kind of library for dummies and other test devices. The U.K. and the U.S. are currently preparing the wording of such a resolution. The idea is to differentiate between information that is needed for test laboratories only, which should be put into the S.R.2, and information that is needed for the test procedure, which should be put into the respective piece of legislation.

On request Mr. Frost confirmed that the intention is to not limit the S.R.2 to the 1958 or the 1998 agreement and that the idea is to draft it in a way that allows the use for both legislation frameworks.

Mr. Gehring pointed out that the question whether there are patents on the FlexPLI had not been answered. Dr. Konosu confirmed that JARI holds a general patent on the FlexPLI but that JARI will not be against the use of the impactor as soon as the discussion has been finalised. In addition, JARI will no longer pay the patent fees so that the patent will expire once the amendments including the FlexPLI specifications and requirements for the gtr 9 as well as the UN Regulation are accepted by WP.29. Mr. Burleigh added that he is not aware of further patents hold by Humanetics.

Mr. Frost in addition explained on request that the drawings will carry Humanetics' name as long as the impactor is still in the development phase but that it probably will be removed after finalisation. However, it will also be a learning process on how to work with this in the future.

The chair thanked Mr. Frost for this excursion to the current discussion of WP.29 on setting up a depository for test tools in future. Also, the chair noted that this will be very beneficial not only for the Flexible Pedestrian Legform Impactor but for other test tools waiting in the wings as well.

## 10. Experiences from testing with the FlexPLI

### 10.1. Data from testing with the FlexPLI (action item A-1-14) (NHTSA, OICA, All) (document GTR9-2-10)

Mr. Hess (OICA) presented document GTR9-2-10 reporting about the experiences of an OEM with three different impactors of the FlexPLI (2 prototype impactors and one production legform). Three different vehicle types were tested: a sedan type vehicle, a sports car as well as an SUV. Mr. Hess pointed out that, despite the test results are already promising for all legforms, the divergences for the legforms are quite high in some cases with different peak values of well above 20%.

Mr. Edwards wondered which divergence would be acceptable and Mr. Hess replied that 10% should be a target considering that some of the divergences may be caused by the vehicles.

Mr. Zander wondered what the build levels of the legforms were. It was replied that SN-04 and the production leg had vinyl ester bone cores; SN-02 had polyester bones. All legforms were already equipped long rubbers in front of the tibia at the time of the testing.

Dr. Konosu highlighted that obviously the design of vehicles towards compliance with the FlexPLI requirements is already possible. Also, he mentioned that the divergences may also be caused by the use of different vehicle parts. Mr. Hess agreed that this may be the case but noted that only production parts were used that usually have limited differences in their performance and their material composition. However, he promised to also deliver the certification test results at a later meeting.

Mr. Gehring noted that the time difference between the tests - SN-04 was tested in 2009 and the other impactors in 2011 - may also have an influence. Dr. Otubushin replied that the time must not be an issue for an impactor. However, it was clarified that not the time difference itself was meant but that SN-04 was tested at a time where limited experiences were available and the impactor itself was still at an early stage of the impactor development. However, it would be interesting to have test results produced at the same period of time under the same conditions. Such information may be available later during the work of the informal group.

The Alliance requested to add the information on the build levels and Mr. Hess promised to do so as soon as possible. Mr. Thedinga wondered whether the type of vehicles can be better specified: For SUV and sports car a clear understanding exists but for a sedan type vehicle it may be of interest which size the vehicle is. Mr. Hess promised to deliver this information.

**10.2. Possible changes of performance over time due to wearing (action item A-1-04)  
(BAST, Bertrandt, All) (document GTR9-2-04)**

Mr. Zander presented the experiences of three years of inverse certification testing with the prototype legform SN-02 (see document GTR9-2-04).

Dr. Otubushin asked whether BAST has an explanation for the decay of the test results in the 2<sup>nd</sup> test reported. Mr. Zander replied that they do not have such an explanation. Dr. Otubushin also wondered what the reasons for the large scatter in the rebound phase of the impactor may be: while the test results show good repeatability for the first peak the scatter becomes up to 50% during the rebound phase and seems to be uncontrollable. Dr. Otubushin added that this should not be seen as criticism against the legform but that needs to be considered for the assessment of the vehicle results.

Ms. Chaka asked for clarification of the changes to the impactor in between the tests. Mr. Zander replied that only very limited changes were done, only the string pots were replaced and it needs to be added that the length of the rubber has changed some when during the tests. Mr. Pingston added that this is a good study but due to the fact that SN-02 still has polyester bone core material it may be outdated. Mr. Zander and Mr. Gehring offered to do a similar assessment for SN-04 provided that all certification data will be made available by the owners of the data. Messrs. Zander and Gehring will try to get the respective approvals.

Dr. Ries wondered why some of the early tests results are shown as non-compliant despite the data produced with this legform were also used for the definition of the certification corridors. Mr. Zander confirmed that some of the test results were not considered since they were considered to be outliers of a larger number of test results.

The chair added that following the long-time experiences reported by OICA during the past meeting Humanetics proposed to add screw holes to tighten some screws that were found to be loose (see one section in document GTR9-2-08). Mr. Burleigh highlighted that this will work for the femur section but will not work to the tibia section due to a wire that is fitted there. Dr. Konosu recommended to not apply this change but to recommend in the PADI that this should be inspected in defined intervals and how this can be done. This was finally

agreed.

**10.3. Differences in test data when using different filter classes during the data recording (action item A-1-07) (BAST, OICA, Bertrandt, Humanetics) (documents GTR9-2-05 and GTR9-2-08)**

The chair remembered the group that during the meeting in Geneva Mr. Martin (DTS) had placed a request to follow the SAE J211 convention that foresees CFC600 for the filtering of the data instead of CFC 180 as it is used for the FlexPLI (and nearly all other impactors used in the pedestrian safety tests). Mr. Zander presented BAST's comparison (see document GTR9-2-05) on the effects of the use of different CFC's. He noted that in general differences were found to be very small and that no notable influence can be seen except for the accelerations. However, as the acceleration signal is already quite noisy with the filter class CFC 180 BAST proposed to keep the filter classes for all signals unchanged.

Humanetics had also done an assessment on this (see one section in document GTR9-2-08). Mr. Burleigh also agreed that very small differences can be seen and only for the accelerometer there are larger differences. On behalf of Mr. Knotz (Concept Technologies, who could unfortunately not attend the meeting and handed in some comments in advance) the secretary mentioned that Concept had done tests with one of the very first versions of the FlexPLI and that already at that time the accelerometer signal was found to be very instable. The instabilities were obviously caused by the noise of the signal which was by itself was influenced by the position of the accelerometer. Therefore, already at that time it had been agreed to not use the accelerometer signal for any assessment. It was noted that the design of the impactor has not changed in the respective area.

The group agreed to keep the filter classes as they are. These have to be clearly mentioned in the gtr.

**10.4. Further information, if available (All)**

OICA informed participants that further vehicle test data will be submitted during one of the next meetings. However, details cannot yet be shared since tests are planned and conducted by individual manufacturers.

**11. Modification to the legform test procedure (action items A-1-05 and A-1-06) (European Commission, BAST, All) (document GTR9-2-03)**



Document GTR9-2-03 was presented by Mr. Zander. He noted, that the bumper corners today are defined via 60° planes but early documents of EEVC were talking about 45° planes to be used. However, even in EEVC it was felt necessary to have more research on this. Latest designs of some manufacturers use design features to clearly decrease the bumper test areas which concerns of the European Commission and therefore was proposed to be discussed in this informal group. BAST introduced two proposals to avoid that pure design features are used to limit the test area:

- either the whole vehicle front is tested, defining the front just via the vehicle's width and excluding the mirrors only,
- or the definition used in Euro NCAP could be used where the wider of the two areas, formed either by the 60° planes or by the width of the structure lying behind the surface, is used for testing.

For the time being, Mr. Zander proposed to test the whole width of the vehicle since this covers the accident risk for a pedestrian, as long as no accident data analysis is available showing the specific impact zones related to lower legform impacts.

Mr. Broertjes informed the attendees that there already was a pre-meeting on this subject the day before this meeting. The meeting was kindly hosted by TUV Rheinland Japan and a high number of attendees showed the interest in this subject. Mr. Broertjes explained that, while it is understandable and welcomed to have a stable definition of the test area, design features must not be used to decrease the test areas. NHTSA's presentation also had shown the importance of the legform tests. Taking over the Euro NCAP procedure would probably be the easiest way but Mr. Broertjes noted that focussing on the bumper beam may not be sufficient. He mentioned that e.g. the headlamps can also be very rigid and there may be a need to include them into the areas to be tested. Mr. Broertjes mentioned that an action list was developed for the next steps and that the respective work will be done in a task force. The respective activities will be reported to the informal group.

Mr. Damm thanked the Commission for their efforts and added that, depending on the progress of the group, it may be needed to separate the discussion on this subject from the discussion on the FlexPLI. However, currently the discussion will be part of this group but it will finally not delay any decision on the main subject of the group, the introduction of the new legform impactor.

Mr. Edwards wondered whether these activities should be part of this group since the informal group is more related to discussion on biomechanical and impactor issues. The

chair responded that clearly the subject is part of the ToR of this group and that it was brought in on request of OICA. The reply that this nevertheless is seen as an issue of European legislation was answered by Mr. Broertjes who explained that the EU has already acceded to the new UN Regulation on Pedestrian Safety and with this the starting point of all discussions needs to be in Geneva.

Mr. Nguyen asked whether there are experiences with the use of the impactor at angled surfaces and whether there are data on the possible risk of headlamps. The secretary pointed out that a list of documents of the former Technical Evaluation Group was shared with document GTR9—C-08 and that there is also a report mentioned on test parameter variations with the FlexPLI. This report, document TEG-142, also covers the subject of impacts with a partially turned impactor. Mr. Zander added that he does not see an issue with this since the impactor may rotate when being used at an angled surface but this in principle will reduce test results. In addition, BASt proposed to not test areas where the test does not make sense.

Coming back to the history of the EEVC test procedure Mr. Hardy explained that according to his understanding the 60° planes came from the compatibility with other regulations such as UN Regulation R42 and Canadian bumper requirements. Also, issues may occur with high bumper vehicles.

Mr. Edwards asked whether the proposed change of the test procedure is supported by facts and data and the chair replied that it is his understanding that this will be delivered by the Commission.

Dr. Ries went back to the proposal of Mr. Zander to not test where a test does not make sense: This would lead to an unclear test procedure that cannot be wished for by industry. The chair pointed out that the target is a very clear test procedure and that the comment of course will be considered. Mr. Broertjes added that the Commission noted extremely protruding design features to artificially reduce the test areas and that the Commission is still looking for an improvement of the definition of the test area that makes such things impossible. Dr. Otubushin pleaded for an understanding of the roots of the problem before fundamentally changing the test procedure or the definitions: If the design features mentioned by Mr. Broertjes do not create any additional risks there may not be a need for amendments.

Mr. Nguyen again pointed out that there should be a clear prove where the problems e.g. with the headlamps come from. According to his knowledge, usually headlamps are out of

the test area and therefore he was wondering whether they indeed create issues. Mr. Broertjes added that there were good reasons for Euro NCAP to amend their test procedure. Therefore, the respective information should be available. The chair also requested the group and the task force to study accident data specifically on this subject.

## **12. Information on FlexPLI FE models (action item A-1-13) (All) (document GTR9-2-09)**

During the last meeting discussion had taken place on the simulation models. Mr. Burleigh consequently informed the group about updates of Humanetics' simulation model (see document GTR9-2-09). Several improvements could be made and the performance is considered to be acceptable. Version 2.0 of the simulation model is now available through the Humanetics network but the consortium doing the development wishes to proceed as soon as the final version of the hardware impactor is available. The purpose is to of course guarantee that the model represents the latest hardware status. In addition, the consortium wishes to validate the model against new test data since by now the validation only was done using generic structures.

Dr. Ries added that unfortunately the progress seems not to be the same for all model codes. Mr. Burleigh promised to check this. Mr. Hess pointed out that consequently OEM's wish to use the FlexPLI simulation model with their vehicle data of real vehicles so further experiences will be available later.

On request of the chair Dr. Konosu added that there are some models in use in Japan as already mentioned during the last meeting. However, there is no intention to use these models for commercial purposes.

The secretary also mentioned that comments on this subject were handed in by Mr. Knotz in advance: The basic data also for the simulation model are based on simulation data with a non-validated impactor model of JARI. Therefore, additional validation steps seem necessary using physical test data to validate the model again. This needs to be considered for future activities. Dr. Konosu replied that all validation of JARI-used simulation models was done on component and sub-system level and with this it is the understanding of JARI that the whole model should be understood to be validated.

Also, Mr. Knotz was wondering whether the validation data presented by Humanetics are generally valid. The data are shown to be produced by Porsche and therefore may not represent the whole vehicle fleet. However, it was noted by the informal group that several parameters such as impact height and load paths were modified and it needs to be double-

checked whether this specific comment is valid.

The chair concluded that with this information the discussion on the simulation models seems to be nearly finished. Therefore, there may not be a need to re-discuss this during the next meetings as long as no new information is available.

### **13. Consideration of activity list, work plan and identification of further open issues**

The chair informed the participants about the plan to perform vehicle tests with the three impactors used for the certification test activities of the TF-RUCC after the finalization of its work hopefully for the 3<sup>rd</sup> meeting. Therefore, a draft proposal for a test matrix will be provided for the 3<sup>rd</sup> meeting of the informal group. If further impactors shall be used for this testing as well, the corridors resulting from the TF-RUCC activities have to be fulfilled first.

A detailed action list was developed following the discussion during the meeting.

### **14. Consideration of schedule**

Currently the schedule is kept unchanged, but it may be necessary to re-discuss it at the May meeting depending of the progress of the TF-RUCC.

### **15. Next meetings (already planned: 29 – 30 May 2012, Paris, OICA offices)**

The meeting in Paris will be held at OICA offices, Rue de Berri 4, 75008 Paris. It is planned to start on 29 May 2012 at 13:00 and to be finished on 30 May 2012 at 17:00 the latest.

The meeting after this meeting is planned for 18 – 19 September 2012 in Washington D.C. and will be hosted by NHTSA. This will be confirmed during the Paris meeting. Members of the IG GTR9-PH2 are kindly requested to reserve these times in their schedules.

### **16. A. O. B.**

The chair informed the group that GRSP requested the informal group to supply acronyms used in regulations. Mr. Broertjes added that for the UN Regulations the European Commission and OICA are reviewing the GRSP related regulations. For gtr No 9 the chair will provide the European Commission with the needed information.

Mr. Burleigh shared a presentation that had been prepared for a meeting of Humanetics with the Alliance (see document GTR9-2-13). It was explained that currently Humanetics optimizes the FlexPLI's according to the wishes of their customers and therefore delivers a P version (optimized towards the pendulum certification test) and an I version (optimized towards the inverse certification test). Also, some details like the shimming of the impactor are explained in detail and Humanetics shows the test rig in use at their lab. Finally, the work of the TF-RUCC is mentioned.

Mr. Gehring pointed out that, following the concerns shared in the TF-RUCC (see document TF-RUCC-2-03) the test rig should be designed in a way that separates the propelling system from the hanger of the impactor. Mr. Burleigh confirmed that activities on this are currently already done.

The chair added that it is clearly not wished for to have two different impactors as it may be understood from the presentation. Mr. Burleigh agreed that the impactors themselves should be identical and just some fine-tuning is done in that direction. On request of Mr. Edwards Mr. Burleigh also confirmed again that the problems with the two different impactor versions may be caused by issues with Humanetics' test rig but that BAST has confirmed to have impactors tested that met both corridors with the same impactor.

The chair closed the meeting and thanked all attendees for their contributions. In addition, the chair specifically thanked the Japanese colleagues for kindly hosting the meeting and for the very good organization.