

First progress report of the informal group on Phase 2 of gtr No. 9  
(IG GTR9 - PH2)

The text reproduced below was submitted by the Chairman of the informal group on phase 2 of gtr No. 9 and proposes the first progress report on the activities and work of this informal group (ECE/TRANS/WP.29/AC.3/24).

## **I. Objective of this proposal**

1. The representatives of Japan and Germany proposed the development of Phase 2 of gtr No. 9. The main objective is the development of a draft proposal to amend the UN global technical regulation No. 9 - Phase 2 on pedestrian safety by introducing the flexible pedestrian legform impactor (FlexPLI) as a single harmonized test tool in order to enhance the level of protection for lower legs of pedestrians.

The work of the informal group shall not be limited to draft proposals to amend Gtr No. 9, but shall cover the development of a complementary draft proposal to amend the draft UN Regulation on pedestrian safety.

The group may also review proposals to improve and / or clarify aspects of the legform test procedure.

## **II. Background**

2. At the 154th session of the World Forum for Harmonization of Vehicle Regulations and the 32nd session of the Executive Committee of the 1998 Agreement it was agreed to set up an informal group to solve the pending issues for the incorporation of the FlexPLI in Phase 2 of the UN Gtr No. 9 and in the draft UN Regulation on pedestrian safety, subject to the submission to WP.29 and to AC.3 of appropriate terms of references (document ECE/TRANS/WP.29/1091, paras. 36 and 100).

Japan and Germany have informed the World Forum for Harmonization of Vehicle Regulations and the Executive Committee of the 1998 Agreement that this informal group named IG GTR9 - Phase 2 will be co-sponsored by Japan and Germany.

3. The informal group has started its work on 03 November 2011 with a Constitutional Meeting in Bonn, Germany, to draft a document on the terms of references, the operating principles, the schedule and the work plan. At this occasion the participants agreed to the proposal of Japan and Germany that the informal group will be managed by Germany (chair), Japan (vice-chair) and OICA (secretary).

4. At the 155th session of the World Forum for Harmonization of Vehicle Regulations and the 33rd session of the Executive Committee of the 1998 Agreement Japan and Germany have informed delegates about the ongoing activities of the informal group on UN Gtr No. 9 Phase 2 (document WP.29-155-35). The delegates were informed about the constitutional meeting and the management of the group. The information was given that the first meeting was planned for 01 and 02 December 2011 to start the technical discussion and to finalize the draft terms of references as well as the work plan for submission to GRSP in December 2011.

5. The first meeting of the informal group was held on 01 and 02 December 2011 in Geneva, Switzerland. The technical discussion was started and the draft document on the terms of references, the operating principles, the schedule and the work plan for submission to GRSP in December 2011 was finalised. This document and the first progress report are planned to be submitted to the World Forum for Harmonization of Vehicle Regulations for the 156th session and to the Executive Committee of the 1998 Agreement for its 34th session in March 2012.

### **III. Subjects for review and tasks to be undertaken (terms of reference)**

6. The informal group has set up an activity list to address remaining items for the introduction of the FlexPLI:

1. Review and consideration of remaining items
  - a) Review of Flex-TEG activities → to reach common understanding
  - b) Assessment of biofidelity (comparison of FlexPLI and EEVC lower legform impactor)
  - c) Assessment of benefit and costs (injury reduction, additional benefit compared to EEVC lower legform impactor)
  - d) Technical specifications (drawings) and PADI (user manual)
  - e) Evaluation of durability
  - f) Test procedure (rebound phase, best practice, velocity measurement etc.)
  - g) Certification tests
  - h) Review and exchange of test results
  - i) Evaluation of reproducibility and repeatability
  - j) Evaluate and decide on performance / injury criteria and threshold values
  - k) Evaluation of vehicle countermeasures (assessment of technical feasibility)
2. Develop a draft proposal to amend UN Gtr No. 9 - Phase 2
3. Develop a complementary draft proposal to amend draft UN Regulation on Pedestrian Safety (including a recommendation for transitional provisions based on item 1).

### **IV History of the discussions**

7. At the constitutional meeting the informal group drafted the objectives of the group, terms of references, a work plan and schedule. The objectives of the group were discussed extensively. It was finally agreed that the main objective of the group should be the amendment of the UN Gtr No. 9 while the work of the group shall not only be limited to this task, but shall cover the development of a complementary draft proposal on amending the draft UN Regulation on pedestrian safety. It was also agreed, that the group should review proposals to improve the test procedure with the lower legform impactor.

The informal group has set up an activity list to review and discuss remaining items. The schedule of work was discussed and agreed.

8. During the constitutional meeting the participants have been informed about the past activities of the technical evaluation group (TEG) to improve the FlexPLI. A document matrix was prepared by the secretary to ease the work for experts when reviewing the TEG documents. It was also agreed to install a task force on reviewing and updating the certification corridors (TF-RUCC) for the calibration procedure for the FlexPLI. This task force is chaired by Japan.

9. At the first meeting of the informal group the draft terms of references were finalised for submission to GRSP. The technical discussion was started on several items.

#### 10. Status of FlexPLI

The company Humanetics gave an update on the current status of the FlexPLI development. Information was provided on the number of legs produced up to now. The representative informed the participants about the activities to resolve open issues on the certification corridors. Especially for the inverse testing further investigations have to be undertaken. These will be mainly covered by the TF-RUCC. Experts requested a description of the build level of the different legform impactors including a clear documentation. Humanetics was asked to provide such information for discussion in the informal group.

#### 11. Durability

OICA has presented information on the long-term durability of the FlexPLI. Several items were mentioned, of which the durability of the bone core material led to extensive discussions. The bone core material is suffering during the testing resulting in small cracks of the material. While several experts mentioned that the performance is still ok with these minor damages, information was given by the company Bertrandt that deviations in the performance may be seen during calibration of the legform impactor. Experts will further investigate this issue and present further information on the long-term performance of the leg at the 2<sup>nd</sup> meeting of the informal group.

The representative of the United States presented further information on the durability of the FlexPLI. During the comparison tests of the earlier and the current version of the FlexPLI, it was found that the durability was improved for the current version of the impactor and therefore is not a major issue at the moment.

#### 12. Benefit and costs

JASIC introduced detailed information on the possible benefit related to tibia injuries that can be expected with the introduction of the FlexPLI. Based on accident data, it was presumed that tibia fractures mainly occur due to indirect loading (approx. 80 %). Only in a minor number of cases the fracture of the tibia occurs due to direct loading of the bumper. It was also shown that the most significant improvement can be achieved by mitigation of leg fractures.

It was concluded that the FlexPLI can provide improved biofidelity for the tibia and the knee. Relative to the currently used legform impactor the cost savings due to mitigation of tibia fractures were estimated to be \$100m for the United States and \$50m for Japan based on calculation models using the annual medical costs for such types of injuries.

#### 13. Biofidelity

Another presentation from JASIC highlighted the improved biofidelity of the FlexPLI compared to the legform impactor currently used in Gtr No. 9. The superior biofidelity was shown at component and assembly level using both, testing and simulation tools. Especially the improvements in the knee and tibia area were presented. For the performance limits a comparison study of the FlexPLI and PMHS test data was done, showing that the FlexPLI is behaving more human-like with regard to the injury mechanism of the tibia.

#### 14. Performance / injury criteria

JASIC introduced information on the performance and injury criteria for the FlexPLI. The validation of criteria for the tibia fracture and the MCL and ACL failure was presented in detail and compared to the legform impactor currently used in Gtr No.9. The results are mainly based on data coming from different sources of testing of specimens. From this data a probability function for the injury risk was developed. Performance limits for the tibia bending moment, the criteria ACL and MCL were presented to participants.

The expert from the United States raised some concerns regarding the injury thresholds that were chosen for the FlexPLI in relation to the EEVC legform impactor. With the ability of the flexible impactor it may be possible to achieve better protection with more stringent criteria. The US does not see a necessity to just achieve a protection level that is comparable to the EEVC legform impactor. NHTSA will investigate this in more detail.

#### 15. TF-RUCC (certification procedures)

Japan gave a status report of the activities of the task force reviewing and updating the certification corridors. It is currently planned to perform tests with several legforms in a limited number of labs to check the performance of the flexible pedestrian legform impactors. The schedule is aiming at finalising the task to update the certification corridors, if necessary, till the 2<sup>nd</sup> meeting of the informal group. The task force will prepare a recommendation for the informal group on the certification procedures and the corridors to be used for the calibration of the FlexPLI.

#### 16. Drawings and specifications

Experts were informed that the drawings and specifications of the FlexPLI will be needed before the regulatory text can be approved by GRSP and adopted by WP.29 and AC.3. Humanetics confirmed that this is well known and such information will be submitted to the informal group accordingly.

#### 17. Accident analysis

Participants were asked to provide accident data at one of the next meetings. This request will also be raised at the 50<sup>th</sup> session of GRSP by the chair of the informal group. The expert of the United States has informed the group that they are investigating if information on accidents with pedestrians can be supplied for discussion.

#### 18. Finite element models

Faurecia requested information on the development of finite element models for the FlexPLI. It was decided that the informal group will not develop such models but will serve as a platform to have an exchange of information on this subject regularly. This task will be started at the second meeting of the informal group and participants were invited to submit information accordingly.

#### 19. User manual / PADI

Several items were raised in relation to the user manual for the FlexPLI. Humanetics will provide the group with an updated user manual incorporating the proposals that were raised during the meeting.

## V. Work schedule

### 20. Work schedule

#### Overall Schedule

P.R.: Progress Report

Year	2011			2012												2013										
Month	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
WP29		Report	○		P.R. & ToR	○			P.R.	○			P.R.	○		P.R.	○			P.R. & DRAFT (Informal)	○			DRAFT (Formal)	○	
GRSP			○		P.R. & ToR				P.R.	○			P.R. & DRAFT (Informal)	○		DRAFT (Formal)	○			Input if needed (Informal)	○					
IG-GTR9-PH2		○ const.	○ 1st			○ 2nd			○ 3rd				○ 4th			○ 5th				○ 6th						

May 2011	Proposal of Draft ToR to GRSP (informal document)
June 2011	GRSP to seek consent of WP.29 and AC.3 to mandate new informal group on pedestrian protection
03 November 2011 (Bonn, DE)	Constitutional meeting of the IG GTR9-PH2
November 2011	Report to WP.29 on activities of IG
01/02 December 2011 (Geneva, CH)	First meeting of the IG GTR9-PH2
December 2011	Progress-Report to GRSP, submission of Draft ToR to WP.29
March 2012	Progress-Report to WP.29 and adoption of ToR by WP.29 / AC.3
28 and 29 March 2012 (Osaka, JP)	Second meeting of the IG GTR9-PH2
May 2012	Progress-Report to GRSP
29 and 30 May 2012 (Paris, FR)	Third meeting of the IG GTR9-PH2
September 2012	Fourth meeting of the IG GTR9-PH2
November 2012	Progress-Report to WP.29
December 2012	Fifth meeting of the IG GTR9-PH2
December 2012	Progress report and submission of informal draft documents to GRSP
March 2013	Sixth meeting of the IG GTR9-PH2
May 2013	Submit formal proposal to GRSP, adoption by GRSP, submit formal proposal to WP.29
November 2013	Adoption by WP.29

## VI. Documents

### 21. Documents for the meetings

ECE/TRANS/WP.29/ GRSP/2011/13	Japan	Proposal for Amendment 2 to global technical regulation No. 9 (Pedestrian safety)
GRSP-49-38	Japan and Germany	Draft terms of reference for the informal group on pedestrian safety phase 2 (IG PS2)

ECE/TRANS/WP.29/1091		Reports of the World Forum for Harmonization of Vehicle Regulations on its 154th session, Administrative Committee of the 1958 Agreement on its forty-eighth session, Executive Committee of the 1998 Agreement on its thirty-second session, Administrative Committee of the 1997 Agreement on its eighth session
GTR9-C-01	Chair	Agenda for the constitutional meeting of the Informal Group on Pedestrian Safety Phase 2 (IG PS2)
GTR9-C-01r1	Chair	Agenda for the constitutional meeting of the Informal Group on Pedestrian Safety Phase 2 (IG PS2)
GTR9-C-02	Chair/Secretary	Minutes of the Constitutional Meeting of the Informal Group on Global Technical Regulation No. 9 – Phase 2 (IG GTR9-PH2)
GTR9-C-02r1	Chair/Secretary	Minutes of the Constitutional Meeting of the Informal Group on Global Technical Regulation No. 9 – Phase 2 (IG GTR9-PH2)
GTR9-C-03	Japan/Germany	Informal document GRSP-49-38: Draft Terms of Reference for the Informal Group on Pedestrian Safety Phase 2 (IG PS2)
GTR9-C-04	Japan	History of Development of the FlexPLI
GTR9-C-05	Japan	Review of the FlexPLI TEG Activities
GTR9-C-06	OICA	Comments on the Draft Terms of Reference for the Informal Group on Pedestrian Safety Phase 2 (28/10/2011)
GTR9-C-07	Chair	Final Operating Principles and Terms of Reference for the IG GTR9-PH2
GTR9-C-07r1	Chair	Final Operating Principles and Terms of Reference for the IG GTR9-PH2
GTR9-C-08	Secretary	TEG document matrix
GTR9-1-01	Chair/ Secretary	Agenda for the 1st meeting of the Informal Group on Global Technical Regulation No. 9 - Phase 2 (IG GTR9-PH2)
GTR9-1-01r1	Chair/Secretary	Agenda for the 1st meeting of the Informal Group on Global Technical Regulation No. 9 - Phase 2 (IG GTR9-PH2)
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)
GTR9-1-03	Japan	Work plan of Task Force Review and Update of Certification Corridors (TF-RUCC)
GTR9-1-03r1	Japan	Work plan of Task Force Review and Update of Certification Corridors (TF-RUCC)
GTR9-1-04	OICA	FlexPLI Version GTR Prototype SN-02 - Durability Assessment
GTR9-1-05	JASIC	Technical Discussion - Biofidelity
GTR9-1-05r1	JASIC	Technical Discussion – Biofidelity (revised)
GTR9-1-06	JASIC	Technical Discussion - Injury Criteria
GTR9-1-06r1	JASIC	Technical Discussion - Injury Criteria (revised)
GTR9-1-07	JASIC	Technical Discussion - Benefit
GTR9-1-07r1	JASIC	Technical Discussion – Benefit (revised)
GTR9-1-08	Humanetics	FlexPLI GTR status 1 / 2 December 2011
GTR9-1-08r1	Humanetics	FlexPLI GTR status 1 / 2 December 2011
GTR9-1-09	Japan/ Germany	Informal document WP.29-155-35: Report to the November session of WP.29 on the activities of the IG GTR9-PH2
GTR9-1-10c1	Humanetics	Flex-GTR changes list since prototype built, status 02 Dec. 2010 (corrected)
GTR9-1-11	Bertrandt	Pendulum Test Scatter
GTR9-1-12	United States	Informal document GRSP-49-23: Update on Pedestrian Leg Testing