

DRAFT 4th Flex-PLI Technical Evaluation Group
(Flex-TEG) Meeting Minutes

Date: 2nd April, 2007 (10:30 - 16:00)

Place: BASt (<http://www.bast.de/>) – Bergisch, Germany

Attendance lists :

- A. Konosu (Flex-TEG chairperson/J-MLIT/JARI)
- B. Been (Flex-TEG secretariat/FTSS)
- H. Inomata (J-MLIT/JASIC)
- D. Cesari (INRETS/EEVC),
- O. Zander, B. Lorenz (BASt/EEVC)
- D. Gehring, P. Lesmann (BGS)
- R. Fleischhacker (Porsche/ACEA)
- T. Kinsky, M. Zeugner, M. Ergiaber (GM-E/ACEA)
- O. Ries (VW/ACEA)
- A. Sipido, J. Ni (Ford)
- H. Suzuki, I. Imaizumi (HONDA R&D/JAMA)
- K. Wolff (SRS)
- F. Minne (UTAC)
- L. Thompson (TRL)
- W. Liebers (TUV)
- P. Haug (GE Plastics)
- M. Burleigh (FTSS-UK)
- T. Issiki (JARI)

Total 24 persons

1. Opening and Welcome

- The chairman expressed his appreciation to the participants as well as to BASt, which provided the conference room.

2. Adoption on the draft agenda of 4th Flex-TEG meeting, TEG-029

- Discussions on the agenda for the 4th Flex-TEG conference (TEG-029).
- Several items were added, and then finalized the agenda (TEG-029-R1).

3. Adoption on the draft minutes for 3rd Flex-TEG meeting, TEG-026

- The draft minutes of the 3rd Flex-TEG conference (TEG-026) were reviewed.

- There were no additions or corrections to the draft minutes. The draft minutes is accepted by changing just its title from “draft” to “final” (TEG-026-R1).

4. Confirmation of Status of Action Items, TEG-030

- The statuses of action items were reported by the chairman and related persons.
- Basic understanding was obtained in general, and then these actions are closed.
- With regard to ACTION-011, JAMA stated, “Under JAMA rules, the names of vehicles used for experiments cannot be published. TEG members can share information on the proposition not to publish vehicle names.” In response, ACEA stated, “Although we respect JAMA’s opinion, we basically consider it better to publish the names of vehicles.”

5. Flex-GT Information and Discussions

5.1. Computer simulation analysis

5.1.1. Development of an FE Biofidelic Flexible Pedestrian Legform Impactor Model (FLEX-GT-prototype Model), TEG-031

- The chairman introduced the finite-element model of the Flex-GT-prototype used for finalizing the specifications for Flex-GT.
- Mr. Ries (VW/ACEA) asked how to measure knee bending moment in the test set up.
- The chairman answered that the forces are measured with load cells used under supports and bending moments are derived by calculation from the support distances.
- Mr. Been (FTSS) asked “what kind of FE code is applied for the model”.
- The chairman answered “PAM crash code is applied”.

5.1.2. Development of a Biofidelic Flexible Pedestrian Legform Impactor Type GT (FLEX-GT), TEG-032

- The chairman reported the results of the computer simulation for finalizing the specifications for Flex-GT.
- Mr. Zander (BASt/EEVC) asked “Could I confirm the impact heights of Human FE and Flex-GT prototype FE model ?”.
- The chairman answered “The impact height is basically 25 mm above from the ground (base). As for the Flex-GT prototype FE model, as a parameter study, 1) base, 2) base + 50 mm, and 3) base +75 mm is used.”
- Mr. Ries asked what tibia result is plotted in the presentation?
- The chairman answered that the maximum bending moment of tibia is plotted.

5.2. Specifications

5.2.1. Information on Flexible Pedestrian Legform Impactor Type GT (FLEX-GT), TEG-033

- The chairman reported the final specifications for Flex-GT as well as the impact height to the

vehicle (base + 50mm).

- Mr. Gehring (BGS) asked “The femur moments are used for injury assessment?”
- The chairman answered “The femur moments does not use for injury assessment because when we assess femur injury correctly, upper part of body effects should be considered. The measurements are used only for checking femur damage.
- Mr. Gehring (BGS) asked what to do we do with LCL elongation as on the impact side no elongation would be expected.
- The chairman answered “Basically, LCL elongation is negative, so do not measure. To measure LCL elongation is possible, so if a vehicle design clearly show that it has a chance to generate positive elongation of LCL, e.g. the impact on a ‘Bull Bar’, LCL measurement would be useful”.
- Mr. Kinsky (ACEA/GM-E) asked, ”What are the differences in test results due to differences in the specifications between Flex-Gt and the Flex-GT prototype?”
- The chairman stated, “We have only one Flex-GT prototype, and it is currently leased to BAsT/BGS, so it is difficult to compare them in Japan.”
- BAsT/BGS commented, “We are planning to upgrade the Flex-GT prototype that is now leased from Japan to Flex-GT in a few days, so it is possible to compare these impactors output soon.”

[ACTION-018]

- **BAsT/BGS shall conduct a comparison test on Flex-GT and the Flex-GT prototype and shall report the results to TEG members.**

5.3. Test results

5.3.1. Flexible Pedestrian Legform Impactor Type GT (FLEX-GT) Evaluation Test Results, TEG-034

- The chairman reported the results of an investigation into the repeatability and reproducibility of each part (femur, tibia, and knee) as implemented by J-MLIT/NTSEL. The assembled impactor (Femur, Tibia, and Knee connected) of the Flex-GT as implemented by J-MLIT/NTSEL were also reported by the chairman.
- The report indicated good repeatability and reproducibility of each part and the assembled Flex-GT.
- Mr. Zander (BAsT/EEVC) asked, “The car test results are obtained from car-centre position?”
- The chairman answered, “Car-center tests are conducted. It was the intension to have highly repeatable test condition.”
- Mr. Ries (ACEA/VW) commented, “In this report, the repeatability and reproducibility of each part of the impactor (femur, tibia, and knee) are evaluated through the relationship between the bending moment (external force) applied to the impactor and the displacement that occurred on the impactor. However, evaluation based on the value measured by the impactor itself is also necessary.”
- The chairman answered, “The measurements by the impactor itself were also obtained. So, the

repeatability and reproducibility of each part of the impactor based on those values is possible.”

[ACTION-019]

- **Japan will evaluate and analyze the repeatability and reproducibility of each part of the impactor based on the measurements of the impactor itself and will report the result to TEG members.**

5.3.2. Flexible Pedestrian Legform Impactor Type GT (FLEX-GT) Car Test Results, TEG-035

- The chairman reported the results of the experiments conducted by JAMA on Flex-GT and TRL-LFI.
- It was reported that there was no particular conclusion at present because amount of the number of experiment is small; it was planned to collect additional data in the future.
- Mr. Ries asked, “How did it come the threshold values of Flex-GT?”
- The chairman answered, “Convert human threshold values using correlation between FE human and FE Flex-GT prototype model.”

5.3.3. Flex-GT-alpha BAST Tests, TEG-036

- Mr. Zander (BAST) reported the results of Flex-GT-alpha (another name for the Flex-GT prototype) experiments conducted by BAST using actual vehicles. Those experiments evaluated the reproducibility of the test results on Flex-GT-alpha based on the coefficient of variation (CV (%)).
- It was reported that while the reproducibility of the measurements in the Tibia and MCL is good or acceptable level (< 10%), the measurements in the ACL and PCL were somewhat widely dispersed (>=10%).
- The chairman commented, “During tests using actual vehicles, variation in test conditions (variation in testing speed, height of collision, impact attitude, etc.) may affect the test results. In particular, ACL and PCL, which have small output values (on the level of several millimeters), tend to be easily influenced by variation in test conditions. Therefore, the dispersion of test conditions should also be considered.”
- Mr. Gehring (BGS) answered, “The height of the impactor collision with the vehicle is checked by laser and is within the range of target height +/- 10mm and usually on the level of +/- 5mm.”
- The chairman commented, “Even with a deviation of around 10mm, the knee behavior varies largely depending on whether the articulating position of the knee joint of the impactor is above or below the top of the bumper. For example, the knee joint exhibits a combination of shearing and bending when the articulating position is above the top of the bumper but exhibits primarily bending when the articulating position is below the top of the bumper. ACL and PCL, in particular, which have low outputs (on the level of several millimeters), tend to be influenced by variation in test conditions easily, and so analysis results should consider these variations.”

5.2.4. Handling and Usage (Flex-GT-alpha), TEG-037

- Mr. Gehring (BGS) explained the methods for handling and using Flex-GT-alpha (Flex-GT prototype) that had been acquired during the test in BAST/BGS.
- Together with explanations of the methods for handling and using the Flex-GT prototype, proposals for resolving minor problems in the impactor (the hanging roller, cable routing, etc.) were presented.
- The chairman expressed his appreciation to Mr. Gehring (BGS) for his proposed improvements with reporting that the hanging roller had already been improved.

5.3.5. Certification Histories (Flex-GT-alpha), TEG-038

- The results of dynamic assembly calibration tests (a total of 52 cycles) that were conducted during the tests using Flex-GT-alpha (Flex-GT prototype) (a total of 70 cycles 40 km/h tests) were reported by Mr. Gehring (BAST).
- Mr. Gehring's report covered the following.
 - 1) The bending moments of the tibia and femur are relatively stable.
 - 2) Dispersion can be observed in the bending moments of the ACL and PCL (possibly due to the play in the connecting section gap between the impactor and calibration test equipment), but they are generally stable.
 - 3) The MCL output is slightly increasing.
- The chairman commented, "The tightening force of the spring in the knee section may not be being checked as specified in the manual. The tightening force of the spring in the knee section of Flex-GT-alpha must be checked" (After this meeting, a subsequent investigation by Mr. Isshiki of JARI confirmed that the spring in the knee section was not tightened sufficiently).

5.3.6. Flex-GT-alpha ACEA Tests at BAST / BGS March 2007, TEG-039

- Mr. Ries (ACEA/VW) reported the results of the experiment on Flex-GT-alpha (Flex-GT-prototype) conducted by ACEA at the BAST/BGS testing facility.
- In that experiment, the following tests were implemented, and the output of the impactor was measured.
 - 1) A test in which a ram collides with a suspended impactor "Inverse test".
 - 2) A test to launch the impactor so that it collides with a simplified vehicle "Test on a simplified vehicle".
 - 3) A test to launch the impactor so that it collides with an actual vehicle "Tests on actual vehicle".
- However, it was reported that these tests had just been started and would be completed by the end of April 2007.
- The chairman asked, "There were some measurement errors during the test. What caused them?"

- Mr. Gehring (BGS) responded, “During the rebound after the test, the measurement cable was occasionally damaged by hitting the ground or shooting face, resulting in measurement errors. The test could be continued after the damaged cable was repaired. There was only one case in knee ligament measurement was impossible because the measurement cable was disconnected from the potentiometer, but the test could be continued when the measurement cable was re-connected.”

5.4. Demonstration of the Flex-GT-alpha test (13:30h)

- With the cooperation of BAST, BGS, and ACEA, we inspected the test on Flex-GT-alpha (Flex-GT prototype) conducted by ACEA in the BAST-BGS testing facility and were able to physically observe the experiment.

5.5. Others

- No particular comments.

6. Future action plans (round-robin tests, etc.)

- As a result of discussions, it was agreed to conduct round-robin tests by autumn of 2007 with checking action items ACTION-018 and ACTION-019 results.
- It was planned to hold the next Flex-TEG conference in the autumn of 2007 when the results of the round-robin tests would be available.

7. Discussion on the contents of Flex-TEG status report for the 41st GRSP

- As a result of discussions, it was decided that the chairman should prepare a general abstract of the 4th Flex-TEG conference and report the activities of Flex-TEG based on that data at the 41st GRSP conference. Such data will first be checked by TEG members.
- Furthermore, it was decided that an actual Flex-GT should be displayed in the UN conference room during the 41st GRSP conference to promote the activities of Flex-TEG.

8. AOB

- No particular comments.

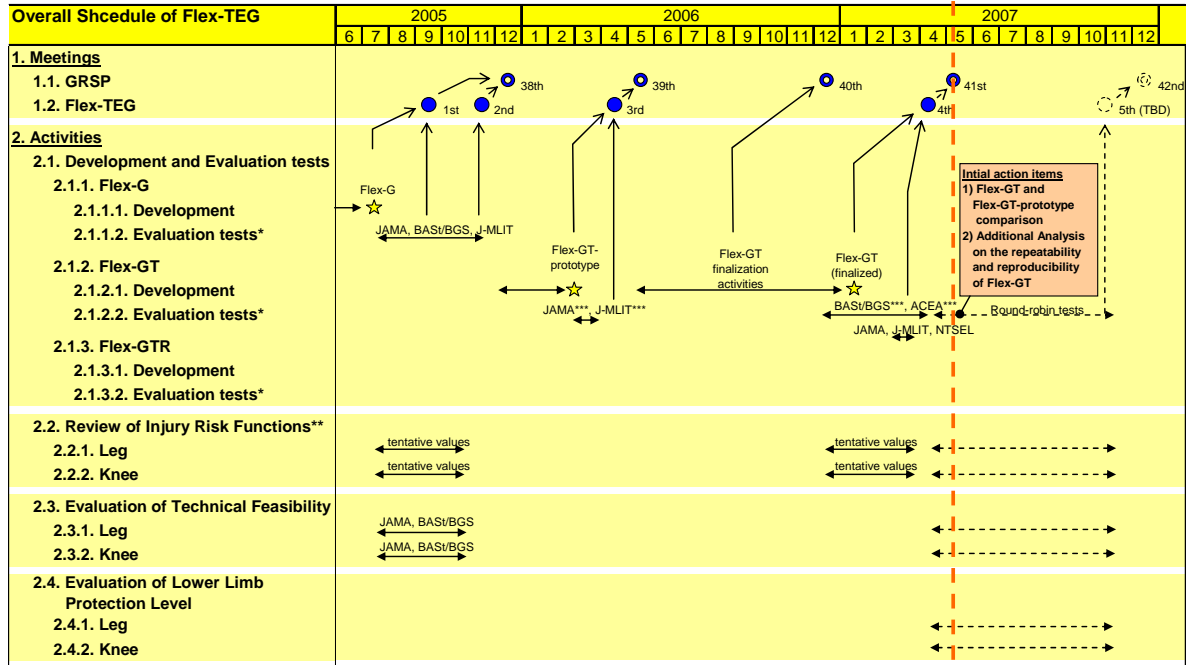
9. Closing

- The chairman thanked the participants as well as BAST, which provided the conference room and expressed his wishes to meet again at the next conference.

Annex 1: Schedule

Flex-TEG Overall Schedule, May 2007

41st GRSP



* Usability, Repeatability, Reproducibility, Durability, and Comparison of those issues between the Flex-PLI and the TRL-LFI.

** Review and propose threshold values for Flex-PLI

*** Flex-GT-prototype tests

Annex 2: List of documents

Document number	Document name	Dated [dd/mm/y]
TEG-001	Agenda for 1st Meeting of Flex PLI Technical Evaluation Group.doc	1/Sep./2005
TEG-002	Flex-G_General_Information_050904.pdf	5/Sep./2005
TEG-003	Flex-G_Preparation_Manual_050904.pdf	5/Sep./2005
TEG-004	2005.09.02 - BASt Flex-G Test Programme.pdf	2/Sep./2005
TEG-005	Revised Agenda for 1st Flex-G_MT.pdf	6/Sep./2005
TEG-006	2005_06_ESV_JAMA-Flex.pdf	21/April/2005
TEG-007	2005_06_ESV_JMLIT-Flex.pdf	21/April/2005
TEG-008	2005_06_ESV_NHTSA_TRL-Flex.pdf	10/Mar./2005
TEG-009	Attendance list 1 st Flex-PLI Meeting	6/Sep./2005
TEG-010	DRAFT Minutes 1st Flex PLI meeting_051011.pdf	11/Oct./2005
TEG-010-R1	Modified_Minutes 1st Flex PLI meeting_051122.pdf	22/ Nov./2005
TEG-011	Agenda for 2nd Meeting of Flex-TEG.pdf	22/ Nov./2005
TEG-011-R1	Modified_Agenda for 2nd Meeting of Flex-TEG.pdf	22/ Nov./2005
TEG-012	Flex-G_Minor_Modifications_onto_SN01_051122.pdf	22/ Nov./2005
TEG-013	Flex Repeatability and Reproducibility for Thigh Leg Knee.pdf	22/ Nov./2005
TEG-014	Flex_Assembly_Test_Results_and_Tentative_Corridors_051122.pdf	22/ Nov./2005
TEG-015	Report_on_Flex-G_Car_Test_Results_051122_final.pdf	22/ Nov./2005
TEG-016	Flex-TEG_Schedule_051115.pdf	22/ Nov./2005
TEG-016-R1	Flex-TEG_Schedule_051122.pdf	22/ Nov./2005
TEG-017	Attendance list 2nd Flex-PLI .pdf	22/Nov./2005
TEG-018	DRAFT Minutes 2nd Flex-TEG_060228.pdf	28/Feb./2006
TEG-018-R1	FINAL Minutes 2nd Flex-TEG_060424.pdf	24/ April /2006
TEG-019	Draft Agenda for 3rd Meeting of Flex-TEG_060327.pdf	24/ April /2006
TEG-020	Status Report on Action Items_060424.pdf	24/ April /2006
TEG-021	Flex-GT-alpha_General_Information_060424.pdf	24/ April /2006
TEG-022	Flex-GT-alpha_Injury_Assessment_Ability_060424.pdf	24/ April /2006
TEG-023	TRL-LFI_Retry_Test_060424.pdf	24/ April /2006
TEG-024	Flex-GT-alpha_Typical_Dynamic_Assembly_Calibration_Test_Result_060424.xls	24/ April /2006

TEG-025	Attendance list 3rd Flex-TEG_060424.pdf	24/April/2006
TEG-026	DRAFT Minutes 3rd Flex-TEG	24/April/2006
TEG-026-R1	Final_Minutes_3rd_Flex-TEG_MT_070402.pdf	2/April/2007
TEG-027	ACEA_draft_comments_Flex-GT-alpha_060530.pdf	30/May/2006
TEG-028	Chairperson_Answer_on_the_ACEA_draft_comments_Flex-GT-alpha_060606.pdf	6/June/2006
TEG-029	Draft_Agenda_on_4th_Flex-TEG_Meeting_070316.pdf	16/Mar./2007
TEG-029-R1	Final_Agenda_on_4th_Flex-TEG_Meeting_070402.pdf	2/April/2007
TEG-030	Status_Report_on_Action_Items_070402.pdf	2/April/2007
TEG-031	Development of an FE Biofidelic Flexible Pedestrian Legform Impactor Model (FLEX-GT-prototype Model)	16/Mar./2007
TEG-032	Development of a Biofidelic Flexible Pedestrian Legform Impactor Type GT (FLEX-GT)	16/Mar./2007
TEG-033	Information on Flexible Pedestrian Legform Impactor Type GT (FLEX-GT)	29/Mar./2007
TEG-034	Flexible Pedestrian Legform Impactor Type GT (FLEX-GT) Evaluation Test Results	29/Mar./2007
TEG-035	Flexible Pedestrian Legform Impactor Type GT (FLEX-GT) Car Test Results	29/Mar./2007
TEG-036	Flex-GT-alpha BAST/ACEA Tests	30/Mar./2007
TEG-037	Handling and Usage (Flex-GT-alpha)	2/April/2007
TEG-038	Certification Histories (Flex-GT-alpha)	2/April/2007
TEG-039	ACEA Preliminary Test Results with FlexPLI-alpha	March/2007
TEG-040	Attendance list of 4 th Flex-TEG meeting	2/April/2007
TEG-041	Draft minutes of 4 th Flex-TEG meeting	26/July/2007

http://www.unece.org/trans/main/wp29/wp29wgs/wp29grsp/pedestrian_FlexPLI.html

Annex 3: List of Actions

Action number	Action	Dated [dd/mm/y]
ACTION-001	The chairman will verify the representatives of the organizations that did not attend this Flex-TEG Meeting.	06/ Sep./2005 (Reported. 2 nd TEG)
ACTION-002	The chairman will obtain approval for the added tasks at the next GRSP meeting.	06/ Sep./2005 (Reported. 2 nd and 3 rd TEG)
ACTION-003	The chairman would check with Autoliv (Sweden) and Korea on their experiment contents and schedules.	06/ Sep./2005 (Reported. 2 nd and 3 rd TEG)
ACTION-004	Mr. Tanahashi to inform the group if manufacture will allow disclosure of detailed model information per test shown in ESV paper 05-0106.	06/ Sep./2005 (Reported. 2 nd TEG)
ACTION-005	The chairman would confirm the parental body of the Flex-TEG Meeting at the next GRSP and other meetings.	06/ Sep./2005 (Reported. 2 nd and 3 rd TEG)
ACTION-006	The chairman would present at the GRSP meeting a proposal for releasing Flex-TEG information material to the public through the GRSP website.	06/Sep./2005 (Reported. 3 rd TEG)
ACTION-007	The Chairman will send the properties of the materials of the pads used in the assembly dynamic calibration tests to the Flex-TEG members.	22/Nov./2005 (Reported. 3 rd TEG)
ACTION-008	The Chairman will disclose waveform data of typical assembly calibration tests (digital data) to the Flex-TEG members.	22/ Nov./2005 (Reported. 3 rd TEG)
ACTION-009	Japan: will make improvements to movable range of knee of Flex-G.	22/ Nov./2005 (Reported. 3 rd TEG)
ACTION-010	BASt/BGS: will run confirmation tests on repeatability and reproducibility of Flex-G in assembly state.	22/Nov./2005 (Reported. 3 rd TEG)
ACTION-011	Mr Imaizumi will recheck the position of JAMA members on Mr Kinsky's request to disclose the	24/ April /2006 (Reported. 4 th TEG)

	model names of test vehicles.	
ACTION-012	Mr Imaizumi agreed to confirm if JAMA members would be willing to use TRL-LFI as well as Flex in future vehicle tests by JAMA.	24/ April /2006 (Reported. 4 th TEG)
ACTION-013	Each TEG member should review the presentation given at the current (3rd) Flex-TEG Meeting and transmit their comments to other members by the end of May 2006.	24/ April /2006 (Reported. ACEA: 30 May 2006, Chairperson: 6 June 2006)
ACTION-014	Japan should transmit the results of its future tests to TEG members at least one week prior to the coming Flex-TEG Meeting.	24/ April /2006 (Reported. 4 th TEG)
ACTION-015	The chairperson should check with HONDA if TEG members can share the human FE model and the Flex-GT FE model using for the finalization of Flex-GT specifications.	24/ April /2006 (Reported. 4 th TEG)
ACTION-016	Japan should proceed with its development of Flex-GT according to the above schedule.	24/ April /2006 (Reported. 4 th TEG)
ACTION-017	Mr Been will provide new sentences for Tasks 3 and 4 by the next Flex-TEG Meeting.	24/April/2006 (Reported. 4 th TEG)
ACTION-018	BASt/BGS shall conduct a comparison test on Flex-GT and the Flex-GT prototype and shall report the results to TEG members.	2/April/2007
ACTION-019	Japan will evaluate and analyze the repeatability and reproducibility of each part of the impactor based on the measurements of the impactor itself and will report the result to TEG members.	2/April/2007