

## Final Minutes

### The 5<sup>th</sup> Flex-PLI Technical Evaluation Group (Flex-TEG) Meeting

Date: 7 December 2007 (start 1030, end 1730)

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

#### Attendance list

- A. Konosu (Flex-TEG chairperson/J-MLIT/JARI)
- B. Been (Flex-TEG secretariat/FTSS)
- H. Inomata (J-MLIT/JASIC-Geneva)
- O. Zander (BAST)
- J. W. Lee (Korean Gov.(KOTSA)/KATRI)
- T. Kinsky, M. Zeugner, B. Buenger (ACEA/GM-E)
- O. Ries (ACEA/VW)
- R. Fleischhacker (ACEA/Porsche)
- H. Suzuki (JAMA/HONDA R&D)
- D. Gehring (BGS)
- K. Wolff (SRS)
- J. Manning (TRL)
- W. Liebers (TUV)
- P. Becker (ACTS)
- M. Burleigh (FTSS-UK)

Total: 17 persons

#### 1. Opening and Welcome

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

#### 2. Adoption: Draft Agenda of the 5<sup>th</sup> Flex-TEG Meeting, TEG-044-Rev. 1

- The draft agenda for the 5th Flex-TEG conference (TEG-044-Rev.1) was discussed.
- Agenda point 5.2 was added: 5.2. BAST/ACEA Joint Project Preliminary Report on Repeatability and Reproducibility Results of Flex-GT Certification and inverse tests.
- Agenda point 5.7 was added: FTSS report Design Review of Flex-GT and Flex-GTR

Development project, TEG-052.

- Participants agreed the modifications, and then finalized the agenda (TEG-044-Rev. 2).

### **3. Adoption: Draft Minutes of the 4<sup>th</sup> Flex-TEG Meeting, TEG-041**

- The draft minutes of the 4th Flex-TEG meeting were adopted by changing just its title from ‘draft’ to ‘final’. (TEG-041-Rev.1)

### **4. Confirmation: Status of the Action Items, TEG-050**

- The Status Report of the Action Items (TEG-050) was reported by chairperson.
- The subject of the action result sentence for the Action Item 018 was changed from “BGS report” to “Joint Project ACEA/BAS<sub>t</sub> report”, and then finalized the report (TEG-050-Rev. 1). Action 18 was closed. Action 19 was closed.

### **5. Report of the Flex-GT Technical Evaluation Results and Discussions**

#### **5.1. ACEA/BAS<sub>t</sub> Joint Project Report on Tests with the Flexible Pedestrian Legform Impactors Flex GT alpha and Flex GT, TEG-043**

- Mr. Gehring, BGS, presented the report (TEG-043).
- Mr. Buenger, GM-E, asked about the replacement method for the damaged strain gauge in the bone section of Flex-GT.
- The chairperson replied, “When a strain gauge is damaged, it is usually replaced together with the bone core section. However, because the strain gauge can be used repeatedly and two strain gauges are installed on the same position (on the collision side and non-collision side), the test can be continued using the remaining strain gauge when just one strain gauge is damaged.”
- Mr. Buenger, GM-E, asked, “Does the coefficient of transformation for the strain and bending moment differ between the strain gauge on the collision side and that on the non-collision side?”
- The chairperson responded, “The coefficient of transformation differs between the strain gauges on the collision side and that on the non-collision side. It is so designed that the strain gauge on the collision side and that on the non-collision side have equal values of bending moment by the use of different coefficients of transformation.”
- Mr Buenger: ‘Strain gauges are glued on the bone. How to calibrate and repair them?’

- The chairperson responded that calibration procedures will be explained under agenda item 5.6.
- Mr. Zander, BAST, asked after how many tests should the bone core be replaced?
- Chairperson responded: The service life of the bone core is dependent on the severity of the tests throughout the life time and is hard to predict. The bone core should be replaced if it does not meet its calibration corridor.
- The chairperson commented, “Although the page 75 slide states that “the whole bone section must be disassembled when multiple measurement cables are disconnected,” it is really not necessary. The first, when multiple measurement cables have disconnected, reconnect cables without regard to sensor assignment. Next, conduct a dynamic assembly calibration test to determine which cables are connected to which sensors based on the waveform and maximum value output from each cable because the waveform and maximum value is unique for each sensor.”
- Mr. Gehring, BGS, responded, “When multiple measurement cables disconnected during our test, we wholly disassembled the bone section to check which cables are connected to which sensors because we had not been informed of this repair method. We request that this repair method be included in a user’s manual.”
- The chairperson replied, “I apologize that. We could not prepare a proper user’s manual when the tests are done because we spent most of our time developing the impactor itself. To avoid misunderstanding, we would like to prepare a TEG document including this repair method.”

#### **ACTION-020**

- The chairperson will submit a TEG document stating the repair method when multiple measurement cables have been disconnected.

#### **5.2. BAST/ACEA Joint Project Preliminary Report on Flex-GT Repeatability and Reproducibility of Assembly Certification and inverse test results (TEG-051)**

- Mr. Zander, BAST, explained a preliminary report on the Flex-GT repeatability and reproducibility performance under assembly certification and inverse tests, which is implemented under a joint project between BAST and ACEA (TEG-051). The report showed good repeatability and reproducibility of Flex-GT under the certification and

inverse tests conditions except for the output of ACL in the knee section during the inverse test on Flex-GT.

- Mr. Zander, BAST, commented, “It is necessary to confirm the reproducibility continuously by conducting tests on objects equivalent to actual vehicles and tests involving a larger number of impactors. These test are scheduled in our future test plans”
- The chairperson commented, “The inverse test was only conducted with a ramming impact applied to Flex-GT just below the knee. Therefore, a slight deviation of the position of impact (whether the top end of the Ram overlaps the knee joint or not) may lead to a large difference in the output of ACL, so the inverse test should be conducted carefully, and/or be conducted under other impacting positions (not only just below the knee impact).”
- The chairperson further commented, “Although the repeatability and reproducibility are evaluated in CV (%), when the absolute output value becomes small, a very small difference in output may be indicated as a large percentage, over emphasizing the difference in test results. The ACL in the knee section, in particular, has a small output (on the level of a few millimeters), so it is highly probable that a small difference in output is expressed as a large difference in percentage.
- Mr. Been commented that the ACL output is very low and that we are looking at relatively small variation to a small absolute number and that the effect seen may be insignificant.
- The chairperson proposed, “Therefore, if the output during the test is below the injury criteria, for example, we should compensate the difference or adopt a method of multiplying the CV value by the weighting factor (e.g. average output value /injury threshold value).”

### **5.3. J-MLIT Flex-GT Simplified Car Test Results (Repeatability Check), TEG-045**

- The chairperson introduced the result of checking the repeatability of Flex-GT during the test on objects equivalent to actual vehicles that was conducted by the Ministry of Land, Infrastructure and Transport of Japan (J-MLIT). The tests demonstrated high repeatability for Flex-GT, generally well below 5% and qualified as ‘good’.
- Mr. Oliver, BAST, asked, “Can be the simplified car model used in the test deformed?”

- The chairperson answered, “Yes, the bonnet leading edge, bumper, and spoiler section are all made of steel plate for automobiles, high spec steel material with well controlled material properties, and can be deformed.”
- Mr. Gehring, BGS, asked; were all elements replaced after the each test? The chairperson confirmed the all elements were replaced after the each test.
- Mr. Kinsky, GM-E, questioned, “Is it possible to add some photos that show these deformations in the presentation?”
- The chairperson responded, “I believe it is possible. It will be implemented later on.”
- Mr. Ries, VW, asked, “A relatively higher repeatability including the output of the ACL in the knee section is shown than in the test result of BAST/BGS. How is such high repeatability achieved in the test result in Japan?”
- The chairperson answered, “This may be because the test condition used in Japan simulates more actual vehicle impact situation. (neither calibrated test conditions nor a single ram hits the impactor).”
- The chairperson continued, saying, “Let’s take a headform impactor case as an example. In our previous research, two headform impactor models were developed, one that passes the drop calibration test at the upper limit and one that passes the lower limit (average +/-20%) of the drop calibration test. However, when each impactor model was struck by the same actual vehicle model, the difference between the test results (HIC) was only about +/-3%. The flesh section alone was deformed during the drop calibration test. On the other hand, both the flesh section and the vehicle parts deformed during an actual vehicle impact test. It means that the difference of the headform impactor model is neglected by the vehicle deformation. We believe that the same thing can be applied to the legform impactor, so it will be possible to obtain a more stable test result by making the test condition closer to an actual vehicle impact condition.” The chairperson continued, “Of course, to pay high attention to achieve a high reproducible test conditions is also very important”.

#### **ACTION-021**

- The chairperson will add photos that show the deformation of the simplified car to the TEG-045.

#### **5.4. ACEA comments on the current development stage of Flex-PLI, TEG-042**

#### **5.5. Response to ACEA comments on the current development stage of Flex-PLI, TEG-046**

- Agenda items 5.4 and 5.5 were deliberated concurrently using the data of TEG-046, which gave an overview of the comment from ACEA on the tool and answered by JAMA-JARI.
- Mr. Ries, VW, questioned, “It is stated that improvement of measurement cables will be examined in the process of developing Flex-GTR. What is the concept for improvement?”
- The chairperson responded, “In developing Flex-GTR, we will carefully consider how to prevent cables from being exposed to the outside. Besides, temperature compensation for the strain gauge will be considered. Furthermore, we also plan to provide a built-in Data Acquisition System (DAS) as an option. These Flex-GTR development plans will be reported by FTSS in the Agenda 5.7”
- Mr. Ries, VW, asked, “It is stated that the impact height will be maintained at 75mm as is currently proposed. Do you intend to propose 75mm also at GRSP?”
- The chairperson answered, “An analysis, ESV 20<sup>th</sup> Paper No. 07-0178, indicates that a good correlation with the human body can be obtained by setting the impact height to 75mm (consider upper body effect of pedestrian). Based on this analysis, we will propose a impact height of 75mm at GRSP.”
- Mr. Ries, VW, questioned, “It is stated that the training courses and user’s manuals for the handling the flexible legform impactor will be enriched in the Flex-GTR development. Is this true?”
- The chairperson responded, “We plan to furnish complete training courses and user’s manuals in the process of developing Flex-GTR.”
- Mr. Ries, VW, asked, “It is stated that to avoid/reduce the twisting motion of the knee will improve the repeatability especially for the outputs of ACL and PCL. What practical measures will be taken?”
- The chairperson answered, “In practical terms, we plan to make the knee section a symmetrical structure by adding two cross ligaments to the knee section so as to reduce the twisting motion there. Incidentally, although the number of cross ligaments in the knee section will be doubled, we plan to maintain the overall knee bending characteristics by using half stiffness of current springs. This also will be reported by

FTSS in the Agenda 5.7” The chairperson continued, “Making the structure of the knee section symmetrical as above also will improve the difference between the test results at symmetrically lateral positions on the bumper.”

- Mr. Ries, VW, commented, “There is some question about the risks of injury of “green” of Euro-NCAP. Some risks are contained in the EEVC WG17 report 1998 version, but not all. However, I believe it difficult to compare them directly with the results of Flex because constructions are very different between them.”
- Mr. Ries, VW, commented, “The sensing timing of a bumper for the popup bonnet with Flex may differ from that of the conventional TRL legform impactor. However, such sensing timing must also be examined in other impact cases (child impact, etc.), so I believe it needs not to be discussed in here.”
- Mr. Ries, VW, asked, “Is it true that the CAE model will be developed by dummy manufacturers and/or software producers in the near future?”
- The chairperson answered, “We are examining the possibility of developing computer models in parallel with Flex-GTR. I believe that kind of plans will be reported by FTSS in the Agenda 5.7”
- Mr. Buenger, GM-E, commented that the bending stopper cable nuts should be a self locking nut to reduce maintenance.
- The chairperson answered, “The self locking nut idea is good under the normal use condition. However, when the stopper cable works after severe loading test (around 350 Nm over), it is better to check the stopper cable stretch, and then it is better to do maintenance the nuts positions.”
- Dr.Ries mentioned the concern of tool performance on less well developed (yellow or red in the Euro-NCAP rating) vehicles. ACEA have planned to perform a ‘poor’ vehicle test and asked if the FLEX-PLI can sustain high loads.
- The Chairperson responded, “Basically, it is difficult to say, because these responses of TRL leg and Flex leg are very different, but the Flex-GT can be used up to the current PS-GTR requirements level (TRL legform impactor: 19deg. 170-250G, 6mm) ”

#### **5.6. Flex-GT Full Calibration Test Procedures, TEG-047**

- The chairperson explained the method for the full calibration test of the Flex-GT (TEG-047).

- Mr. Ries, VW, asked, “Isn’t it necessary to check the output from the strain gauge in the Step 1(b)?”
- The chairperson responded, “No problem has occurred without any checking so far in the Step 1(b). However, the check itself is possible, so, if necessary, the checking procedure can be added in the calibration protocol.”
- Mr. Buenger, GM-E, inquired, “In the Step 1(a), the coefficient of transformation for the strain gauge and bending moment is obtained using an assumption that the output of the strain gauge is constantly linear. Is it no problem?”
- The chairperson responded, “No problem has occurred in the use of this method so far. However, it is possible to obtain the coefficient of transformations for the strain gauge and bending moment by conducting a loading test on each strain gauge. So, if necessary, such a method can be adopted.”
- Mr. Oliver, BAST, questioned, “How developed the calibration test corridors?”
- The chairperson answered, “The test corridors are obtained based on average experiment data with a width corresponding to approximately +/-5% of the average of maximum outputs. If any better method exists, it can be adopted.”
- Mr. Gehring, BGS, inquired, “Are end users required to conduct Steps 1 and 2?”
- The chairperson responded, “Normally, end users are required to conduct Step 4. Only when the bone core materials, strain gages, and/or knee cables are damaged Step1 and/or Step 2 will be required”
- Mr. Gehring, BGS, asked, “Isn’t it better to conduct Steps 1 and 2 once a year or so even if no part is damaged?”
- Mr. Been, FTSS, commented, “Usually, a standard test/measurement tool is required a full calibration once a year or so. I believe such a rule may be established for the legform impactors as well. I will propose improved calibration methods for the Flex-PLI”

#### **ACTION-022**

- Mr. Been will propose improved calibration methods for the Flex-PLI.

#### **5.7. FTSS Report on Flex-GT Technical Review and Flex-GTR Development, TEG-052**



- The chairperson commented, “So far, development of flexible legform impactors has been implemented by JAMA-JARI. However, we decided to implement development of Flex-GTR in collaboration with FTSS. The reason is that JAMA-JARI is not a manufacturer specialized in developing dummies, and we judged it is better to utilize the ability of a manufacturer specialized in development of dummies for developing Flex-GTR as the final stage of a regulatory tool.”
- Mr. Been, FTSS, introduced the result of a technical review on Flex-GT that FTSS has implemented as well as a draft design for developing Flex-GTR (TEG-052). He reported that, in developing Flex-GTR, the knee section would be made symmetrical to avoid/reduce knee twist motion, the layout of measurement cables would be refined, and a built-in DAS (optional) would be provided while maintaining the basic specifications for Flex-GT (mass, length, and bending deformation characteristics). Furthermore, he offered that a computer model of Flex-GTR would also be developed in parallel with development of Flex-GTR itself in a co-operation if there would be sufficient demand.
- The chairperson commented, “We would like to fix the design for Flex-GTR by Mar. 2008, so we request TEG members to review the data presented by FTSS at this time and give us your opinions. We would like to have the next (6<sup>th</sup>) Flex-TEG conference in Mar. 2008 in order to fix the Flex-GTR design.”
- Mr. Kinsky, GM-E, commented, “We will promptly examine the FTSS report within ACEA members. Furthermore, we need to know a final draft of the Flex-GTR design two to four weeks before the next (6<sup>th</sup>) Flex-TEG meeting.
- The chairperson responded, “I agree to circulate a final draft of the Flex-GTR design two to four weeks before the next Flex-TEG meeting.”

### **ACTION-023**

- The chairperson will circulate a final draft of the Flex-GTR design two to four weeks before the next (6<sup>th</sup>) Flex-TEG meeting.

## **6. Direction of the Flex-GTR based on the Flex-GT Technical Evaluation Results**

### **6.1. Specifications (Mass, Length, and Bending Characteristics)**

#### **6.2. Usability**

#### **6.3. Durability**

#### **6.4. Repeatability**

#### **6.5. Reproducibility**

#### **6.6. Measurements**

- The chairperson stated, “Based on the Flex-GT technical evaluation results, we would like to make the knee section as symmetrical to avoid/reduce knee twist motion, refine the layout of measurement cables, and provide a built-in DAS (optional) in the Flex-GTR development while maintaining the basic specifications for Flex-GT (mass, length, and bending deformation characteristics)”
- The chairperson asked “Do you agree with this development policy?”, and then TEG members agreed the development policy.
- The chair person continued to stated, “Technical evaluation of Flex-GTR will be done by developers at first in their development phase, and then after technical evaluations will be done by main Flex-TEG member.”

### **7. Discussion for the Injury threshold values for the Flex-PLI**

#### **7.1. Review of Injury Criteria and Injury Thresholds for Flex-PLI, TEG-048**

- The chairperson explained the injury criteria used in JAMA-JARI’s study (bending moment of the tibia, elongation of MCL) as well as the method for calculating each injury threshold values (TEG-048). The chairperson also stated, “The ACL alone is damaged in only 3% of the total number of accidents, so we imagine that the ACL will be protected automatically by implementing measures to protect the MCL in the knee section.”
- The chairperson stated, “When establishing the injury criteria for the bending moment of the tibia, we should use the injury risk curve obtained by Kerrigan et al. (page 4) rather than using the data obtained by Nyquist et al. from experiments on cadavers (page 5) directly.” As the reason, he explained, “Maximum values are not clear in the data obtained by Nyquist et al., and then they just 10 % increased the unclear data in the page 5. On the other hand, maximum values are clear in the data obtained by Kerrigan et al., and also they processed the Nyquist et al. data using a certain statistical method, so the injury risk curve described in page 4 is more reliable to use.”
- The chairperson further stated, “For bending of the knee section, we should use the injury risk curve calculated by Ivarson et al. based on the bending angle of the knee section alone (page 6) rather than using the injury risk curve calculated by Konosu based

on the bending angle of the whole leg (page 7).” He then explained, “The injury risk curve calculated by Konosu includes the bending angle of the long bones. On the other hand, the injury risk curve calculated by Ivarson et al. based on the bending angle of the knee section alone, therefore, more suitable to use.”

- The chairperson commented, “There is no urgent need for reaching a conclusion on this agenda, but we request that Flex-TEG members conduct examinations continuously based on this data.”
- Mr.Kinsky, GM-E, stated, “We would like to do double check the risk curves by our in house experts.”
- Mr.Been, FTSS, stated, “I would like to ask EEVC/ WG12 to review the current injury thresholds for FLEX-PLI.”

#### **ACTION-024**

- Mr.Kinsky will do double check the injury risk curves by their in house experts.

#### **ACTION-025**

- Mr.Been will ask EEVC/ WG12 to review the current injury thresholds for FLEX-PLI.

### **8. Evaluation of Pedestrian Lower Extremity Protection Level Provided by the Flex-PLI**

#### **8.1. Evaluation of Pedestrian Lower Extremity Protection Level Provided by Flex-PLI (for discussion), TEG-049**

- The chairperson explained the lower extremity injury reducing effect of the regulations that use flexible legform impactors (TEG-049). The reduction effect was calculated based on the calculation method of NHTSA (TRANS/WP.29/GRSP/ 2006/7).
- Mr. Zander, BAST, questioned, “Which country pedestrian accidents data was used in calculation?”
- The chairperson responded, “It was used the U.S. pedestrian accident database (PCDS) data.”
- Mr. Kinsky, GM-E, commented, “I suppose it is possible to calculate the injury reduction level in various countries using this method.”

- Mr. Been, FTSS, commented, “I suppose the IHRA pedestrian accident database can be utilized.”
- The chairperson responded, “IHRA is now suspending its activities, so I think it is difficult to obtain valid data from it now.”

## 9. Future action plans

- The chairperson proposed the following activity plans.
- Dec. 2007 to Mar. 2008: Conduct additional evaluation tests on Flex-GT and fixing of design for Flex-GTR.
- Apr. to Oct. 2008: Manufacture and conduct technical evaluation on Flex-GTR by the developer.
- Nov. 2008 to Apr. 2009: Conduct initial technical evaluation on Flex-GTR by principal Flex-TEG members.
- May 2009 onward: Final technical evaluation on Flex-GTR by principal Flex-TEG members.
- Injury Criteria and Threshold values will be discussed and finalized by the end of Flex-TEG activities.
- Evaluation of Pedestrian Lower Extremity Protection Level provided by the Flex-PLI will be discussed and finalized by the end of Flex-TEG activities.
- Documentation Activities (Preamble and Test Method making) will be addressed as a New Work Item of the Flex-TEG.
- Regarding the overall timeline of the Flex-TEG, several comments were made that the schedule is too tight and therefore should be expanded to the end of 2009 / mid of 2010
- The chairperson answered, “At least, initial technical evaluation on Flex-GTR by principal Flex-TEG members can be done by Apr. 2009. The Flex-TEG schedule, after Apr. 2009, can be re-discussed on that time.
- Mr. Kinsky, GM-E, commented, “I have no objection to the planned activities, but how will you promote evaluation activities in those GTR member countries that are not yet participating in Flex-TEG activities?”
- The chairperson answered, “Indeed, it will take much more time to complete all evaluation activities involving those GTR member countries that are not yet participating in Flex-TEG activities. Basically, however, we intend to divide evaluation activities as two phases. In the 1<sup>st</sup> phase, implement and complete the technical evaluation by the

current principal Flex-TEG members. Then after, if needed, we will consider evaluation activities in those GTR member countries that are not yet participating in Flex-TEG activities“

- Mr. Been, FTSS, asked, “The EC FP7 Cooperation Work Programme is currently calling proposals of study projects for protection of pedestrians (deadline for proposals is May 2008). We intend to propose research activities that support and promote part of Flex-TEG activities”
- The chairperson stated, “If its time line and contents of activity is matched with Flex-TEG activities, we have not reason to reject. So, at first, could you make a draft proposal on the EC FP7 project? We would like to evaluate the contents.”

#### **ACTION-026**

- Mr. Been will make a draft proposal on EC FP7 project regarding FLEX-PLI, and then Flex-TEG member will evaluate the contents.

#### **10. Discussion on Flex-TEG Status report for the 42nd GRSP Meeting**

- The chairperson stated, “I will make a draft Flex-TEG status report for the 42<sup>nd</sup> GRSP meeting containing a summary of this meeting by this weekend (Dec. 8, 9), and then distribute it to Flex-TEG members. I have to report it at GRSP on Dec. 11 or 12, so I would like to request your comments on that material by the night of Dec. 10.”
- Flex-TEG members: Agreed.

#### **ACTION-027**

- The chairperson will make a draft Flex-TEG status report for the 42nd GRSP meeting containing a summary of this meeting by this weekend (Dec. 8, 9), and then distribute it to Flex-TEG members.

#### **11. AOB**

- Mr. Manning, TRL, announced, “Although not directly related to this conference, we are developing a “sensor leg” to check the bumper sensor for the popup bonnet. Anybody interested in this tool should contact me.”

- Mr. Gehring, BGS, commented "I did not expect that the Flex-GTR development includes changes of such an extent. This may influence the additional evaluation test program using Flex-GT. An amendment to the Flex-GTR development report seems to be necessary. This amendment should compare the designs of Flex GT and Flex GTR and indicate any influence of the design changes to the performance of the legform."
- The chairperson commented, "Basically, we would like to share the information about Flex-GTR development with Flex-TEG committee members ASAP to promote this activity. Therefore, we asked to FTSS to report the contents of the Flex-GTR development at this conference. Indeed, it may influence the additional evaluation test program using Flex-GT hereafter. However, we believe the additional evaluation test results will become valuable evaluation data. Therefore, we kindly ask that you continue additional evaluation tests using Flex-GT."
- Information: the ACEA/BAS<sub>t</sub> test programme that was originally planned has been cancelled due to the design changes from the GT to the GTR version and replaced by a smaller test series after this meeting.

## 12. Closing

- The chairperson again expressed his appreciation to Flex-TEG members for participating in this meeting as well as to BAS<sub>t</sub> for providing the conference room.
- Members were invited to meet again at the next (6<sup>th</sup>) Flex-TEG conference.

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## **Annex 1: Flex-TEG Schedule (After December 2007)**

- **December 2007 – March 2008: Conducts additional Flex-GT evaluation tests and will fix the Flex-GTR Design.**
- **April 2008 April – October 2008 : Manufacturing and Technical Evaluation of Flex-GTR by Developer.**
- **November 2008 – April 2009: Conducts Flex-GTR Initial Evaluation Tests by Main Flex-TEG members.**
- **After May 2009: Final Technical Evaluation by Main Flex-TEG members.**
- **Injury Criteria and Threshold values will be discussed and finalized by the end of Flex-TEG activities.**
- **Evaluation of Pedestrian Lower Extremity Protection Level provided by the Flex-PLI will be discussed and finalized by the end of Flex-TEG activities.**
- **Documentation Activities (Preamble and Test Method making) will be addressed as an New Work Item of the Flex-TEG.**

## Annex 2: List of documents

<b>Document number</b>	<b>Document name</b>	<b>Dated</b> [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 <sup>st</sup> 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)	29/Mar./2007



	Car Test Results	
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 <sup>th</sup> Flex-TEG meeting	2/April/2007
TEG-041	Draft minutes of 4 <sup>th</sup> Flex-TEG meeting	26/July/2007
TEG-041-Rev.1	Finalized_the_4th_Flex-TEG_Meeting_Minutes_071207	7/Dec./2007
TEG-042	FlexPLI Comments ACEA 20070808 TFP approved	12/Sep/2007
TEG-043	ACEA/BAST Joint Project Report on Tests with the Flexible Pedestrian Legform Impactors Flex GT alpha and Flex GT	7/Nov./2007
TEG-044	5th_Flex-TEG_Meeting_DRAFT_Agenda	20/Nov./2007
TEG-044-Rev.1	Revised 5 <sup>th</sup> Flex-TEG Meeting DRAFT Agenda_071204	4/Dec./2007
TEG-044-Rev.2	Finalized 5 <sup>th</sup> Flex-TEG Meeting Agenda 071207	7/Dec./2007
TEG-045	J-MLIT Flex-GT Simplified Car Test Results 071129	29/Nov./2007
TEG-046	JAMA-JARI Answer for the ACEA Comments Sep 2007 071129	29/Nov./2007
TEG-047	Flex-GT Full Calibration Test Procedures 071129	29/Nov./2007
TEG-048	Review of Injury Criteria and Thresholds for Flex 071129	29/Nov./2007
TEG-049	Evaluation of Protection Level Provided by Flex-PLI 071129	29/Nov./2007
TEG-050	Status of Action Items 071130	30/Nov./2007
TEG-051	BAST/ACEA Joint Project Preliminary Report on Flex-GT Repeatability and Reproducibility of Assembly Certification and inverse test results	7/Dec./2007
TEG-052	FTSS Design Review of Flex-GT and FLEX-GTR Development dec14-07	7/Dec./2007 (14/Dec./2007 updated)
TEG-053	Draft Minutes of the 5th Flex-TEG Meeting, 080124	24/Jan./2008

[http://www.unece.org/trans/main/wp29/wp29wgs/wp29grsp/pedestrian\\_FlexPLI.html](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 <sup>nd</sup> TEG) Closed.
ACTION-002	The chairman will obtain approval for the added tasks at the next GRSP meeting.	06/ Sep./2005 (Reported. 2 <sup>nd</sup> and 3 <sup>rd</sup> TEG) Closed.
ACTION-003	The chairman would check with Autoliv (Sweden) and Korea on their experiment contents and schedules.	06/ Sep./2005 (Reported. 2 <sup>nd</sup> and 3 <sup>rd</sup> 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 <sup>nd</sup> TEG) Closed.
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 <sup>nd</sup> and 3 <sup>rd</sup> TEG) Closed.
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 <sup>rd</sup> TEG) Closed.
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 <sup>rd</sup> TEG) Closed.
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 <sup>rd</sup> TEG) Closed.
ACTION-009	Japan: will make improvements to movable range of knee of Flex-G.	22/ Nov./2005 (Reported. 3 <sup>rd</sup> TEG) Closed.
ACTION-010	BASt/BGS: will run confirmation tests on repeatability and reproducibility of Flex-G in assembly state.	22/Nov./2005 (Reported. 3 <sup>rd</sup> TEG) Closed.
ACTION-011	Mr Imaizumi will recheck the position of JAMA members on Mr Kinsky's request to disclose the model names of test vehicles.	24/ April /2006 (Reported. 4 <sup>th</sup> TEG) Closed.
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 <sup>th</sup> TEG) Closed.
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) Closed.
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 <sup>th</sup> TEG) Closed.
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 <sup>th</sup> TEG) Closed.
ACTION-016	Japan should proceed with its development of	24/ April /2006

	Flex-GT according to the above schedule.	(Reported, 4 <sup>th</sup> TEG) Closed.
ACTION-017	Mr Been will provide new sentences for Tasks 3 and 4 by the next Flex-TEG Meeting.	24/April/2006 (Reported, 4 <sup>th</sup> TEG) Closed.
ACTION-018	BASSt/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 (Joint Project ACEA/BASSt report (TEG-043) which is related on this topic is submitted to the TEG members on 7 Nov. 2007.) Closed.
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 (Japan report (TEG-034-Rev.1) which is related on this topic is submitted to the TEG members on 6 Aug. 2007.) Closed.
ACTION-020	The chairperson will submit a TEG document stating the repair method when multiple measurement cables have been disconnected.	7/December/2007
ACTION-021	The chairperson will add photos that show the deformation of the simplified car to the TEG-045.	7/December/2007
ACTION-022	Mr. Been will propose improved calibration methods for the Flex-PLI.	7/December/2007
ACTION-023	The chairperson will circulate a final draft of the Flex-GTR design two to four weeks before the next (6 <sup>th</sup> ) Flex-TEG meeting.	7/December/2007
ACTION-024	Mr.Kinsky will do double check the injury risk curves by their in house experts.	7/December/2007
ACTION-025	Mr.Been will ask EEVC/ WG12 to review the current injury thresholds for FLEX-PLI.	7/December/2007
ACTION-026	Mr.Been will make a draft proposal on EC FP7 project regarding FLEX-PLI, and then Flex-TEG member will evaluate the contents.	7/December/2007
ACTION-027	The chairperson will make a draft Flex-TEG status report for the 42nd GRSP meeting containing a summary of this meeting by this weekend (Dec. 8, 9), and then distribute it to Flex-TEG members.	7/December/2007