Preliminary ACEA comments to the papers presented during the 3rd Flex-TEG meeting at BASt on 24. April 2006.

Papers:

1. Information on the Flexible Pedestrian Legform Impactor GT Alpha (Flex-GTa)
2. Evaluation Activities on Injury Assessment Ability of the Flexible Pedestrian Legform Impactor GT Alpha (Flex-GTa)

ACEA welcomes the improvements of the Flex-PLI since the Flex-GTa appears to be usable at a test speed of 40km/h (see part 1 of paper 2). Nevertheless there are still some remaining comments and questions collected so far. The subject of the evaluation of the injury assessment ability is a very difficult issue. The studies done so far in paper 2 can be seen as a valuable first step to address this highly complicated aspect.

In June 2006 the ACEA experts will meet for a detailed discussion on the state of the Flex-PLI assessment. ACEA vehicle tests are scheduled for autumn 2006 and will give additional information and more experience to evaluate the Flex-GTa more precisely particularly with regard to industrial use and to car design process.

Due to the delay of the vehicle tests ACEA believes that the final assessment of the Flex-GTR until end of 2006 is very optimistic.

Reference charts in "*italics*"

Paper 1:

Generally:
The comparison of the injury assessment ability should be done between the Flex-GTa and the TRL-LFI.

"*Length, C.G. Location, and Mass*"
The table indicates that some of the dimensions and properties of the Flex-GTa are less biofidelic when compared to the 50% human leg and the Flex-G. However, the final conclusion of better injury assessment ability of the Flex-GTa needs to be drawn to the TRL legform and not necessarily to Flex-G which only is a development step.

"*Long Bones, Materials*"
There are many changes in the various materials. More explanation of the reasons is needed. Which problem is linked to the lighter bones, i.e. to the use of different materials?

"*Long Bones, Sectional dimensions of bone core*"
An explanation is needed for the smaller bending stiffness and the link to the conclusion.

"*Long Bone, Bone core binding method*"
The wording "just tight enough" needs to be more precise. Also the use of screws for shear force reaction should be reconsidered.

In addition, looking at the drawings and photographs of the bone design a detailed assessment seems necessary for the ability of the Flex-PLI to also bend sideward in case of an impact closer to the edges of the impact area. (The bending obviously is only possible in vehicle longitudinal direction!)

"*Long Bones Bending characteristics (Leg)*"
It shows no significant difference of the bending behaviour of the Flex-G and the Flex-GTa. Why is the leg core changed so drastically then?

"*Knee, size and design*" and "*Knee, knee ligaments*"
The slides show the sophisticated design of the Flex-GTa knee joint. For a detailed assessment ACEA requests JARI to provide a comparison of the Flex-GTa and the TRL-LFI regarding the following items:

- Number of parts of both tools
- Consequences on costs related to purchase and maintenance
- Failure probability of both tools
- Frequency of checks and (re)certification compared to number of vehicle tests
- Difficulties of periodic tests for both tools
- List of spare parts for the two tools

"*Flesh*" and "*Measurements*"
For these part ACEA requests for a comparison of the Flex-GTa and the TRL-LFI regarding

- Number of parts, costs and frequency of replacements
- Reliability of measurements (e.g.: the more cables the higher the possibility of failure measurement)
- Consequences of the above comparisons on industrial testing (and car design process) for the two tools
- The possible influence of "wrapping mistakes" for the different "flesh" layers

"*Thigh (3-point bending)*", "*Leg (3-point bending)*", "*Knee (3-point bending)*"
ACEA requests for a comparison of the Flex-GTa and the TRL-LFI regarding

- Frequency of calibration for both tools
- Difficulties / easiness of the calibration
- Difficulties / easiness to find causes for a possible non compliance
- Consequences of the above comparisons on industrial testing (and car design process) for the two tools

"*Results Leg-1 (maximum value)*" to "*Results Leg-4 (maximum value)*"
There are 6 outliers (Flex-GTa-T06a, -T06b, -T09a, -T09b, -T12a and T12b). An explanation is needed for TEG.

Paper 2:

Part 1:
"*Test Conditions*"
What was the reason for choosing this vehicle (Sedan 1, 2004 year model)?

"Simulation Conditions"

Why was the simulation performed using a 2001 model instead of the 2004 model? The facts that the front shapes are slightly different (independent of how big or small the differences are) and that the centre of the knee is at a different height could completely change the overall behaviour of the leg.
In addition, an indication is necessary which simulation model has been used to assess possible limitations of the respective FE model (e.g. as a kind of FMEA) and to allow double-checking of the results.

"*Comparison*"
The values of the knee bending angles should be given under the pictures for the tests and the simulation.
Nevertheless, final conclusions should not be drawn without further investigations.

"Test Results"
Are there results from the simulation with the human FE leg model which are comparable to the test results?

Part 2:
"*PMHS Test Data*"
For the discussion in the informal group the details (make, model, model year etc.) need to be made available.

"*Tentative Thresholds*"
An indication is necessary why those data were specifically chosen.

"*Reconstruction Test Results (Car: C1)*"
It is only stated that the measured tibia bending moment is above the fracture level. Tibia fractures are observed in real world PMHS tests. But in addition the Flex-GTa also measures MCL elongations at the respective knee injury level and very high thigh bending moments and thus a high risk of knee and thigh injuries were indicated by the impactor which was not observed in the PMHS tests. A conclusion of good injury assessment ability should be drawn very carefully.

"*Reconstruction Test Results (Car: C3)*"
Although the Flex-GTa indicates a high risk of thigh, tibia and knee injuries the real PMHS leg suffers only tibia/fibula fractures (see also comment above).

Part 3:
Generally
The Flex-GTa is designed to represent a 50th percentile human leg. The masses of the real injured pedestrians in part 3 of paper 2 are 45kg and 48kg. Those masses indicate more or less a 5th percentile human being. Which vehicles are C2 and C3?

"*Reconstruction Test Results (Car: Car3)*"
The Flex-GTa indicates high risks of thigh, tibia and knee injuries although only tibia fractures are observed in the real world accident (see also comments above).

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