8th TEG FlexPLI Meeting
on 19.05.2009
Offices of TÜV Rheinland, Cologne

Summary of ACEA Tests

ACEA Comments

Content:

- ACEA previous and latest test series
- Problems related to Flex-GTα and Flex-GTR
- Observations of ACEA members during Round Robin Tests
- ACEA remarks
- Conclusions and recommendations

ACEA previous test series

When:	**2005, August**
Who:	**Tests at BASt/BGS**
Test object:	**Real world „green“ *) vehicles, modified vehicles**
Impactor:	**Flex-G, 2004 version**
Main results:	**FlexG not suitable for impact speed above 25 kph further investigation required**
Reference:	**TEG-004 presented on TEG kick-off meeting on 04.09.2005**

***) „green“ = pedestrian friendly based on EuroNCAP results**

ACEA previous test series

When:	**2007, January**
Who:	**Tests at BASt/BGS**
Test object:	**Real world „green“ vehicles, Functional (inverse) tests**
Impactor:	**Flex-GTα**
Main results:	**Repeatability, Reproducibility appears to be acceptable Problems on robustness observed Calibration problems Asymmetric knee behavior**
Reference:	**TEG-043, presented on 5. TEG meeting, 07.12.2007 TEG-046, presented on 5. TEG meeting, 07.12.2007 TEG-037, presented on 4. TEG meeting, 02.04.2007**

ACEA previous test series

When:	**2008, January**
Who:	**Tests at BASt/BGS**
Test object:	**Real world „green“ vehicles**
	Oblique tests ±30°
	Test on modified bumper (exemption zone)
Impactor:	**Flex-GTα**
Main results:	**Repeatability & reproducibility in inverse tests at least acceptable except for ACL and PCL**
	Knee response not symmetrical at ±30° (Knee tends to torque only in one direction)
	No obvious damage observed
Reference:	**no TEG paper so far**

ACEA latest test series

When:	**2009, January**
Who:	**Tests at BASt/BGS**
Test object:	**Real world „green“ vehicles** **Round robin tests performed by manufacturers**
Impactor:	**3 Flex-GTR (prototypes) with/without onboard DAS**
Expectation:	**Scheduled to be finalized by end of April 2009** **to be ready by May 2009**
Problems:	**Technical problems on DAS equipments of Flex-GTRs** **Discussion on solutions (BGS, JARI, DAS-supplier)** **One Flex-GTR returned to Japan by end of January 2009** **-> Delay of scheduled test program** **No round robin tests possible within scheduled time**

ACEA latest test series

Main results:

- Tibia A3 signal scatter due to impact on edge of the rubber sheet (neoprene skin)
- Knee behavior still asymmetric despite symmetric design
- Reproducibility in vehicle tests marginal
- Flex-GTR test results 10% to 15% higher than Flex-GTα´s
- Acceleration device to be optimized (vibrations before contact)
- More details see BGS report …

Reference: BGS report presented on 8. TEG meeting, 19.05.2009 (TEG-089)

Problems related to Flex-GTα and Flex-GTR

List of problems of the Flex-GTα and Flex-GTR
References:

TEG-037	Flex-GTα handling usage	4.TEG, 02.04.2007
TEG-042	ACEA comments Sept.2008	5.TEG, 07.12.2007
TEG-046	JARI answer to TEG-042	5.TEG, 07.12.2007
TEG-052	FTSS-Flex-GTR-development	5.TEG, 07.12.2007
TEG-089	BGS report on 2009 ACEA tests	8.TEG, 19.05.2009

Color code:

- incomplete, solution in sight
- solution accepted
- problem, no solution available
- not applicable

Problems related to Flex-GTα and Flex-GTR

no	observations before, during and after testing	Flex-GTα	Flex-GTR	comment
1	definition of certification / calibration procedures			component calibration (TEG-056), assembly certification (TEG-075), corridors to be proposed in 8. TEG meeting
2	function of a "marginal" performing vehicle to be checked			checked in 2008 ACEA test program
3	asymmetrical knee measurement			improved, but still differences in oblique tests ±30°, open issue, to be discussed in 8.TEG
4	bending moment measurements - full bridge configuration			improved
5	DAS calibration problems / no procedures available			DAS calibration procedures along specifications
6	generally higher measurement of Flex-GTR			no reason found so far, open issue, to be discussed in 8.TEG
7	availablility of a robust, well calibrated FE model			FE activities started in Nov.2008, in progress, in time so far, BUT: mesh to be improved, simulation time appears to be too long
8	complete disassembling when cable is damaged			easy exchange, no problem with onboard DAS
9	cable guiding near sharp edges / angles			cable routing improved
10	potentiometer string crimping poor			damage of crimp connection, solution available, to be discussed in 8.TEG

Problems related to Flex-GTα and Flex-GTR

no	observations before, during and after testing	Flex-GTα	Flex-GTR	comment
11	channel order different in three GTR legforms			solution by ISO codes, but to be confirmed in 8. TEG meeting
12	support of complete impactor hight during acceleration to avoid vibration			additional support of knee, solution to be discussed in 8.TEG
13	roller guidance allows rotation around z-axis during acceleration			rotation minimized
14	cable influence during free flight			no problem with onboard DAS, BUT: for impactor with cables damage is very likely
15	impact accuracy detection by paint spots is difficult			improved due to one piece outer skin, no difference to WG17 impactor
16	edged shape of impactor surface causes z-rotation during impact			no further observation, but further investigstions recommended
17	tibia neoprene length too short (scatter of tibia-A3)			solution available: neoprene skin which covers the whole length, to be discussed in 8.TEG
18	tibia surface plate damage			not observed in Flex-GTR tests
19	separation of lowest segment impact face			still possible, appears to be no problem during impact, to be discussed in 8.TEG
20	skin damage by sharpe edges			not observed in Flex-GTR tests

Problems related to Flex-GTα and Flex-GTR

no	observations before, during and after testing	Flex-GTα	Flex-GTR	comment
21	neoprene skin zippers very sensitive			zippers improved but still sensitive
22	robustness of cable, possible damage in rebound			no damage with onboard-DAS, damage still likely on cable impactor
23	check of 8 knee screws			recommended after three tests
24	check of 20 knee spring ends			not needed after each test, recommended during certification test
25	check of 4 upper bending stopper cable ends			not needed after each test, recommended during certification test
26	check of 4 lower bending stopper cable ends			not needed after each test, recommended during certification test
27	check of cable clearance (tool)			see item 25 and 26
28	check of distortion of knee parts			not needed due to improved symmetry
29	change and re-change of mounting device (roller to joint) for certication test			not needed for inverse certification test, only needed for pendulum test, to be discussed in 8.TEG
30	cable / wiring			significantly improved

Problems related to Flex-GTα and Flex-GTR

Overview of the color codes for 30 identified items

	Flex-GTα	Flex-GTR	
	7	0	
	7	1	no reason found, open issue
	16	9	to be worked out and checked
	0	20	improvements

Observations of ACEA members during Round Robin Tests

By now: Round Robin tests are performed by only a few ACEA members in 2007 with Flex-GTα, some tests in March 2009 with Flex-GTR

Round Robin tests not yet finished due to impactor unavailability caused by technical problems in the beginning of the ACEA 2009 tests

Further tests are scheduled with Flex-GTR more time for careful assessment and evaluation needed

First experiences and observations with Flex-GTR:

- **repeatability poor - results in vehicle tests vary too much**
- **test results much higher than with the previous legform version**
- **current vehicle designs don´t necessarily comply with draft criteria**
- **long time experiences are necessary**
- **manuals need to be improved**
- **knee cross section alignment to be checked before test (may reduce scatter)**

ACEA remarks

Generally:

Onboard DAS: at first realized in Flex-GTR prototype (FTSS commercial design)

Availability: at first by December 2008 (FTSS Flex-GTR prototype)
(originally expected by September 2008)

In Europe: availability of 3 Flex-GTR prototypes by January 2009

Experience: no experience of Flex-GTR testing for ACEA before December 2008

Intention: faultless 2009 evaluation test program planned by ACEA

BUT: problems delay start of 2009 tests at BASt/BGS

Round Robin tests: are to be finalized and assessed

ACEA remarks

Repeatability and reproducibility acceptable based on inverse tests

Repeatability and reproducibility need to be reviewed for vehicle tests

Durability improved, long time experience is missing

Handling improved

Feasibility depends on criteria which are in question up to now

Open issues:

- **criteria issue**
- **choice of certification test - inverse test vs pendulum test**
- **higher vehicle test results of Flex-GTR compared to Flex-GTα to be clarified, also linked to feasibility issue**
- **pink & red colored items of the Flex-GTR (see list of problems)**
- **review of meeting the TEG terms of reference**

ACEA remarks

Conclusions and recommendations:

- Development process of the Flex-GTR is very promising
- Open questions left to be solved
- All outstanding Round Robin tests should be awaited & assessed
- Evaluation of the Flex-GTR as a regulatory tool is very important
- Evaluation should be done very carefully

- Avoid an overhasty introduction of Flex-GTR into a regulatory frame
- By now, an amendment of the Flex-GTR in the GTR-9 is too premature
- Elimination of problems is more difficult and time consuming
  after acceptance of the Flex-GTR as a legal tool

- ACEA´s recommendation:
  careful review of open issues – fixation of next TEG activities
  clarification Flex-GTR criteria and feasibility on vehicle design
  review of TOR
  decision on Flex-GTR availability for Round Robin tests