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# **KATRI Round Robin Tests Using the Flex-GTR-Prototype (SN03)**

**Dec. 1–2, 2009**

**Ministry of Land, Transport and Maritime Affairs (MLTM)  
Korea Automobile Testing and Research Institute (KATRI)**



**MLTM**  
Ministry of Land,  
Transport and Maritime Affairs

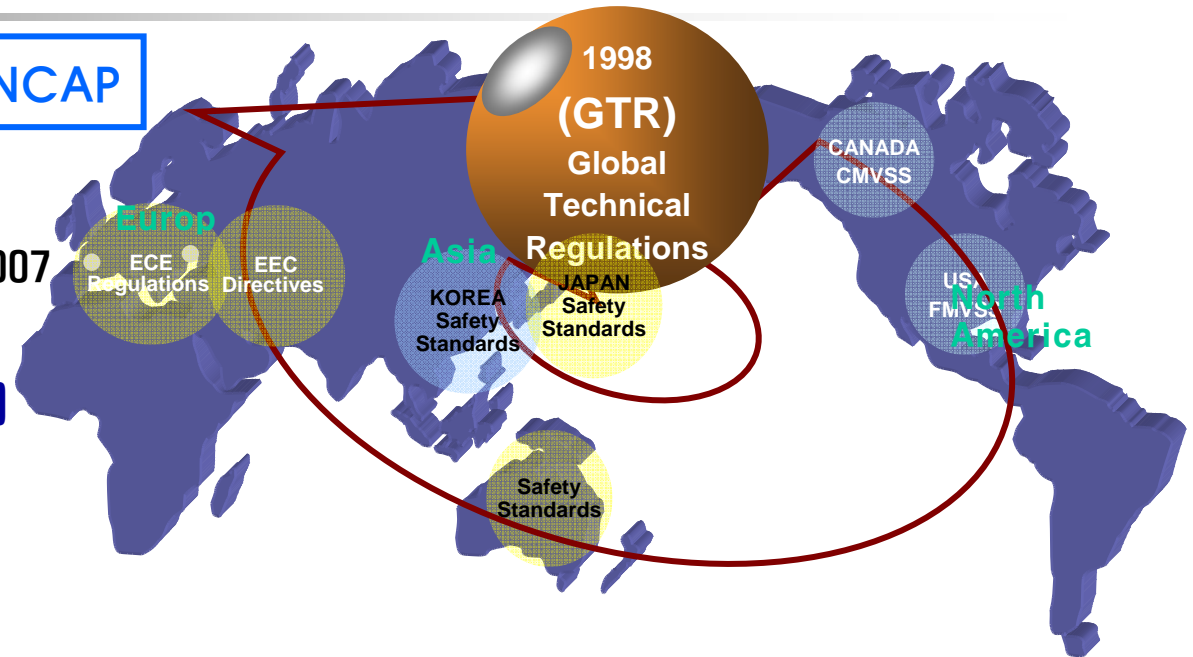


**TS**  
Korea Transportation  
Safety Authority

# Background

## Introduction of Regulation & K-NCAP

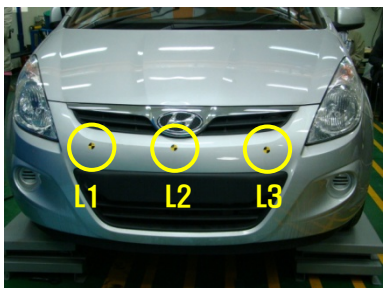
- **Pedestrian protection (K-NCAP)**
  - ✓ Headform test had been Started since 2007
  - ✓ Legform test was added since 2008
- **Pedestrian protection (Regulation)**
  - ✓ Published Year : 2008. 12
  - ✓ Application : New vehicle (2013)  
Old vehicle (2018)



## KATRI Round Robin Test Using the Flex-GTR-Prototype

- Tests were part of the round robin testing with Flex-GTR-Prototype no3
- Tests were conducted by KATRI from late September to early October
- The purpose of test is check for repeatability, usability and durability of Flex-PLI by real vehicle impact

# Introduction of Test Vehicle and Test Method



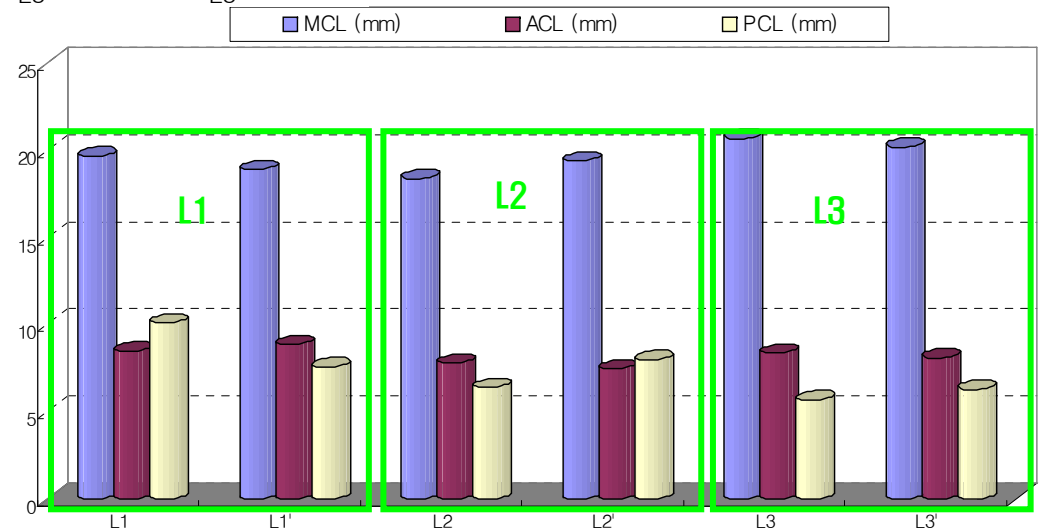
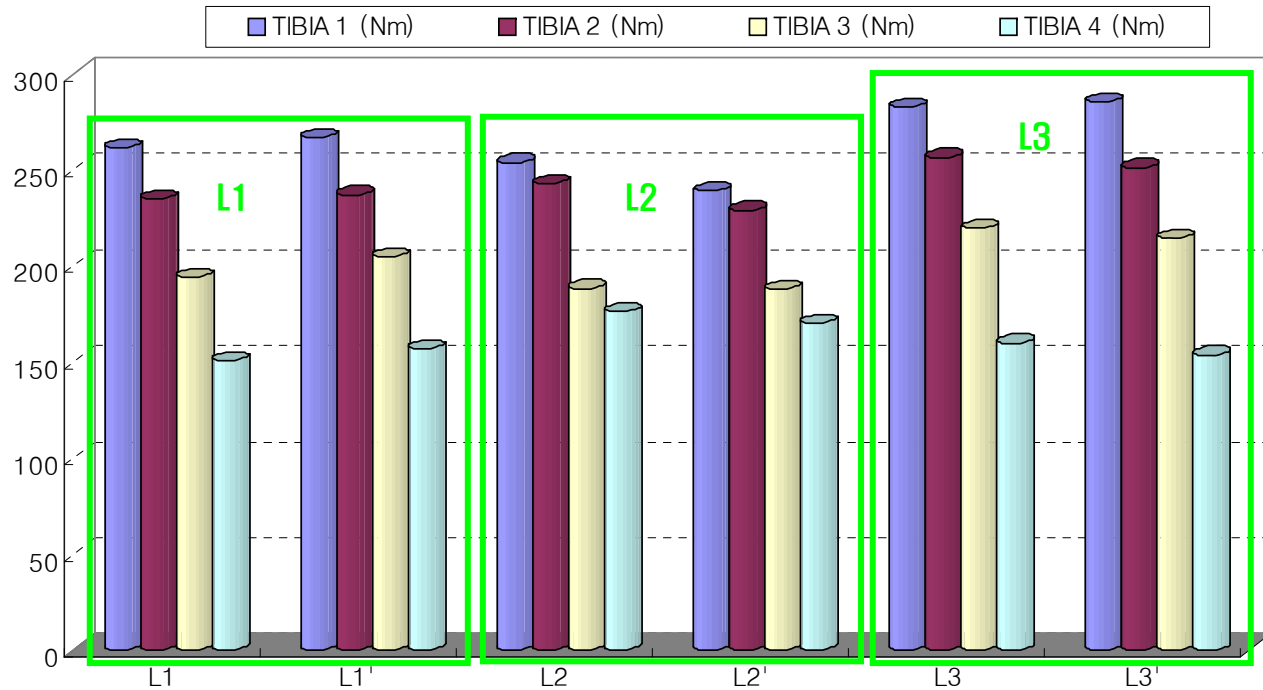
## Test Vehicle

- Vehicle meets the criteria of the TRL-LFI to test according to existing legislation
- Vehicle was rated completely **green** in the TRL-LFI to tests of Euro-NCAP
- Vehicle is considered to be pedestrian friendly in this area

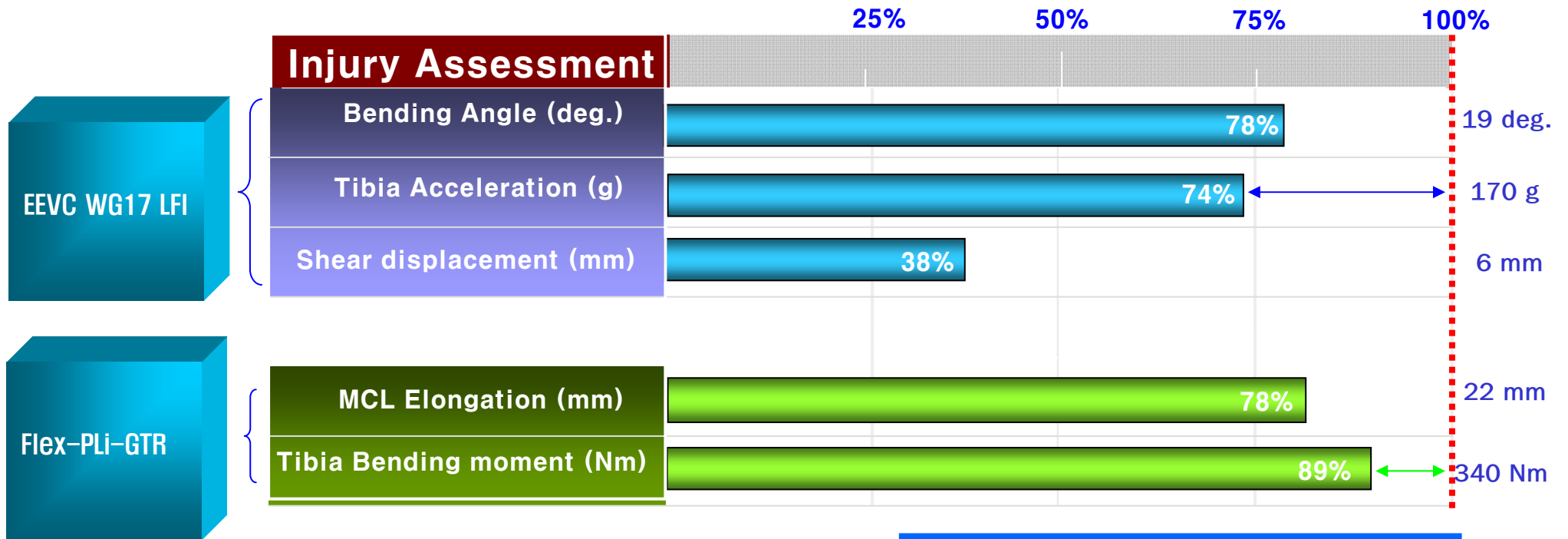
## Test Method

Impactor type	<b>Flex-PLi-GTR Prototype</b>
Impact velocity	<b>11.1 ± 0.2m/s</b>
Impact zone	<b>EEVC WG17 LFI by EURO NCAP (Green zone)</b>
Impact point	<b>Same point 2 Same vehicles</b>
Impact times	<b>3 Impact per 1 Vehicle</b>
Impact Height	<b>75mm (From ground level)</b>

# Test Result of Flex-PLI Prototype for the vehicle



# Comparison between EEVC WG17 LFI and Flex-PLI-GTR



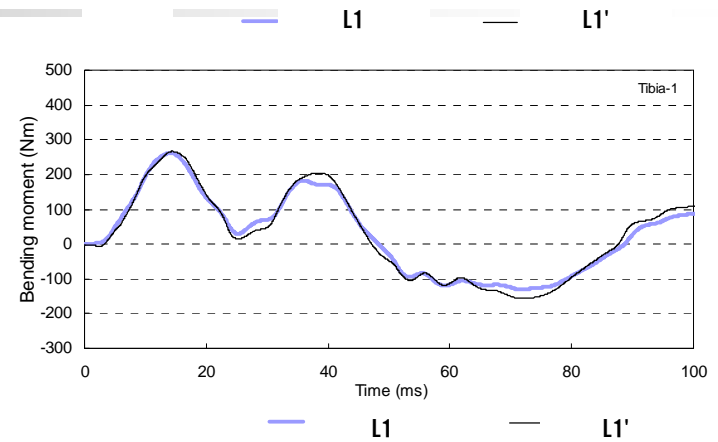
- Bending limitation of 19 deg.  
→ MCL Elongation : 22mm
- Tibia Acceleration limitation of 170g  
→ Tibia Bending moment : 340Nm

- Shear displacement limitation of 6mm  
→ ACL/PCL Elongation : 13mm

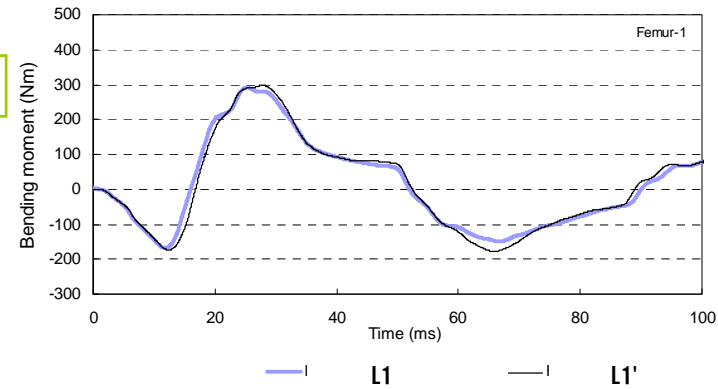
# Repeatability for Flex-PLI Prototype



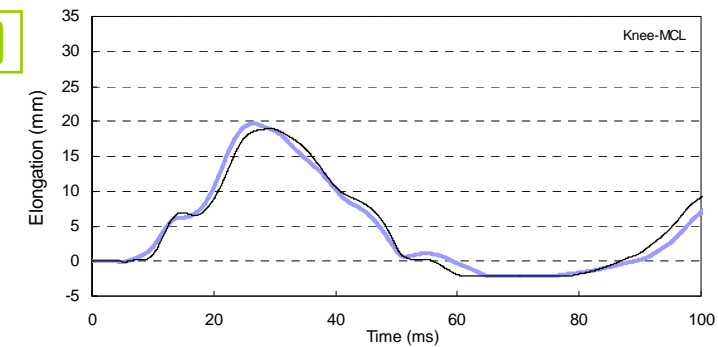
**Tibia (Nm)**



**Femur (Nm)**



**Knee (mm)**



# Repeatability for Flex-PLi Prototype

		TIBIA 1 (Nm)	TIBIA 2 (Nm)	TIBIA 3 (Nm)	TIBIA 4 (Nm)	MCL (mm)	ACL (mm)	PCL (mm)
<b>L1</b>	L1	261.4	234.9	194.1	150.5	19.7	8.5	10.1
	L1'	266.7	237	204.7	156.9	18.9	8.9	7.6
	MEAN	264.05	235.95	199.4	153.7	19.3	8.7	8.85
	ST.DEV	3.7477	1.4849	7.4953	4.5255	0.5657	0.2828	1.7678
	C.V	0.0142	0.0063	0.0376	0.0294	0.0293	0.0325	0.1997
	<b>C.V(%)</b>	<b>1.42</b>	<b>0.63</b>	<b>3.76</b>	<b>2.94</b>	<b>2.93</b>	<b>3.25</b>	<b>19.97</b>
<b>L2</b>		TIBIA 1 (Nm)	TIBIA 2 (Nm)	TIBIA 3 (Nm)	TIBIA 4 (Nm)	MCL (mm)	ACL (mm)	PCL (mm)
	L2	253.6	242.7	188.1	175.9	18.4	7.8	6.4
	L2'	239	228.8	187.9	170.2	19.4	7.5	8
	MEAN	246.3	235.75	188	173.05	18.9	7.65	7.2
	ST.DEV	10.324	9.8288	0.1414	4.0305	0.7071	0.2121	1.1314
	C.V	0.0419	0.0417	0.0008	0.0233	0.0374	0.0277	0.1571
	<b>C.V(%)</b>	<b>4.19</b>	<b>4.17</b>	<b>0.08</b>	<b>2.33</b>	<b>3.74</b>	<b>2.77</b>	<b>15.71</b>
<b>L3</b>		TIBIA 1 (Nm)	TIBIA 2 (Nm)	TIBIA 3 (Nm)	TIBIA 4 (Nm)	MCL (mm)	ACL (mm)	PCL (mm)
	L3	282.6	256.4	219.4	159.7	20.7	8.4	5.7
	L3'	285.4	251.1	214.3	153.4	20.2	8.1	6.3
	MEAN	284	253.75	216.85	156.55	20.45	8.25	6
	ST.DEV	1.9799	3.7477	3.6062	4.4548	0.3536	0.2121	0.4243
	C.V	0.007	0.0148	0.0166	0.0285	0.0173	0.0257	0.0707
	<b>C.V(%)</b>	<b>0.70</b>	<b>1.48</b>	<b>1.66</b>	<b>2.85</b>	<b>1.73</b>	<b>2.57</b>	<b>7.07</b>

CV = 3%	3% < CV = 7%	7% < CV = 10%	CV > 10
good	acceptable	marginal	not acceptable



# Conclusion

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**KATRI have conducted the round robin test for Flex-PLi-GTR and as the result,**

- **Comparison between EEVC WG17 LFI and Flex-PLi-GTR for same vehicle**
  - ✓ Vehicle meets the criteria of EEVC WG17 LFI is also to meet Flex-PLi-GTR
  - ✓ In spite of meeting regulation, The margin of Flex-PLi is shorter than EEVC WG17 LFI
  - ✓ This result should not apply for every vehicle, it is only applicable to our tested vehicle
- **Repeatability**
  - ✓ Almost Good(62%) and Acceptable(24%) but some happened not acceptable level(9%)
- **Durability and Usability**
  - ✓ No serious issues on the durability and usability
- **Some improvements are needed**
  - ✓ As for Design and Durability : No sharp edges and No fracture especially zipper
  - ✓ As for Usability : More convenient and automatic control program
  - ✓ As for stability : Better data download and electrical ground connection
  - ※ More consideration is necessary to unexpected and without-control rebound phenomenon