

## Technical Evaluation Tests for the Flex-GTR-prototype

Comparability of the Flex-GTR-proto output under the symmetric right and left bumper corner impact

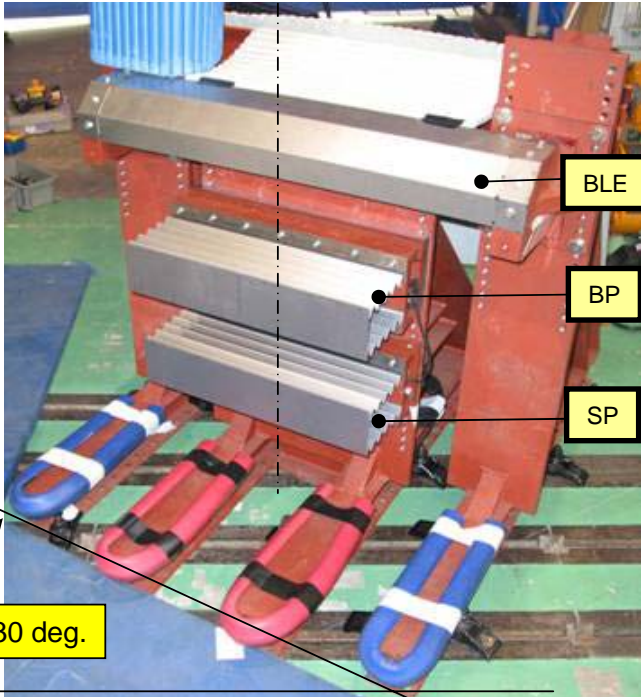
# Back Grounds

- In the Flex-GT tests, incomparable test results were obtained under the symmetric right and left bumper corner impact because of the asymmetric structure of the knee joint.
- In the Flex-GTR-prototype development, knee joint was developed by having symmetric structure.
- JAMA/JARI therefore conducted symmetric right and left bumper corner impact tests using the Flex-GTR-prototype in order to check the comparability of the test results.

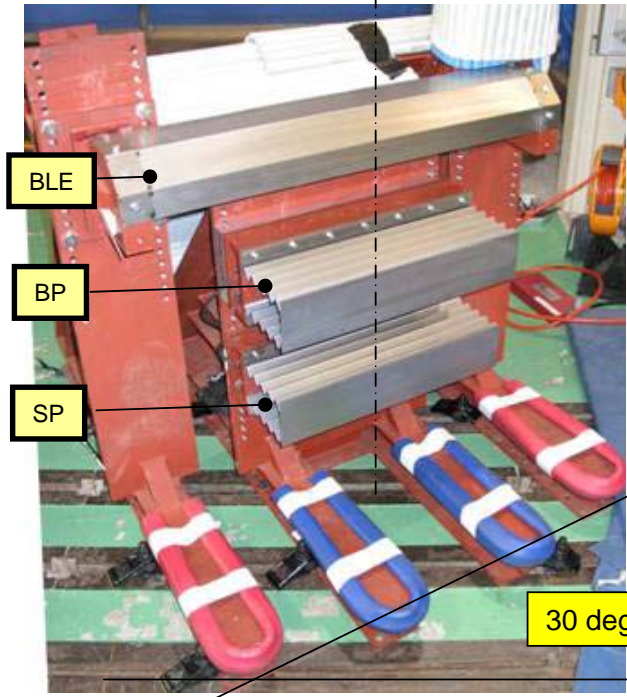
# Test Rigs

## Simplified Car: Type 2 (Photo: Overview)

Type 2-R  
Right bumper corner



Type 2-L  
Left bumper corner

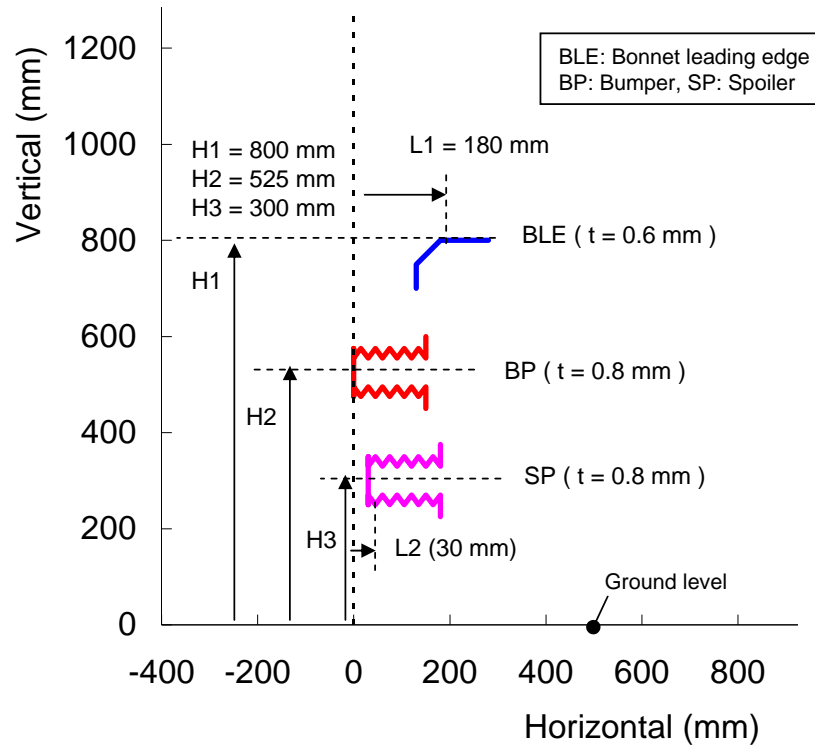


BLE: Bonnet leading edge  
BP: Bumper  
SP: Spoiler

# Test Rigs, contd.

## Simplified Car: Type 2

Cross Sectional Dimensions align with the Car Center Line

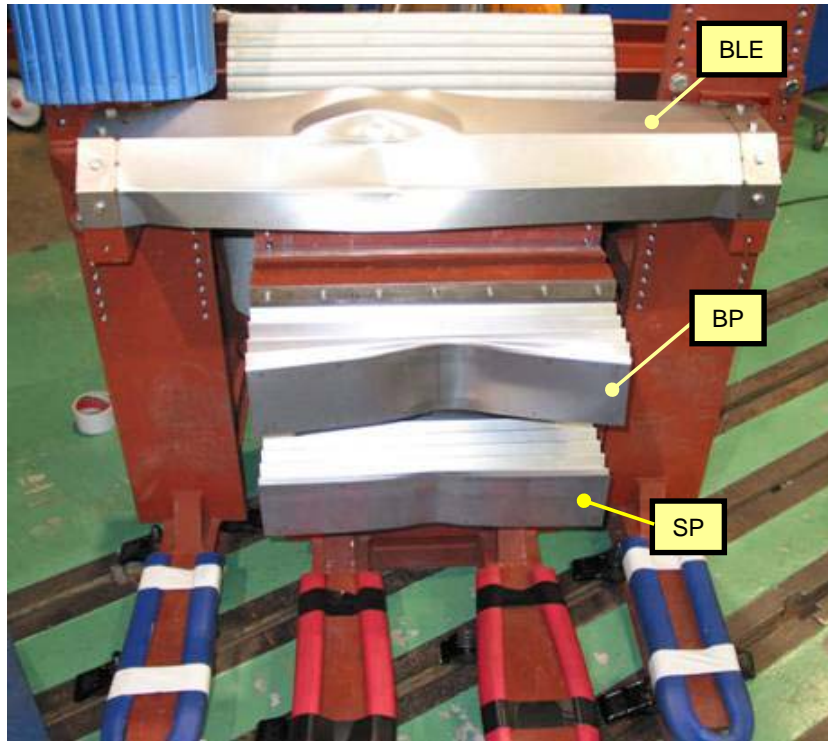


# Test Rigs, contd.

## Simplified Car: Type 2 (Photo: After test)

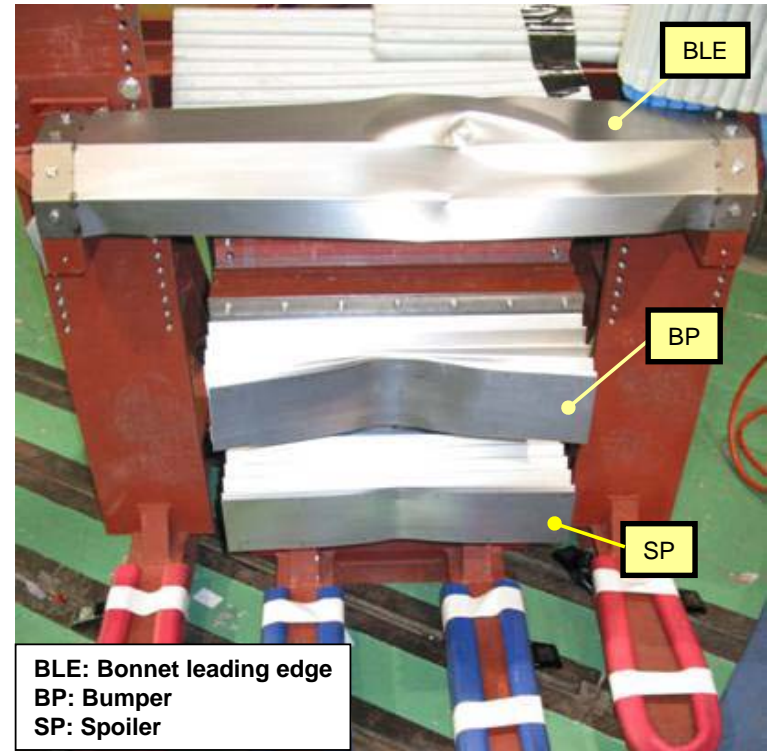
### Type 2-R

Right bumper corner

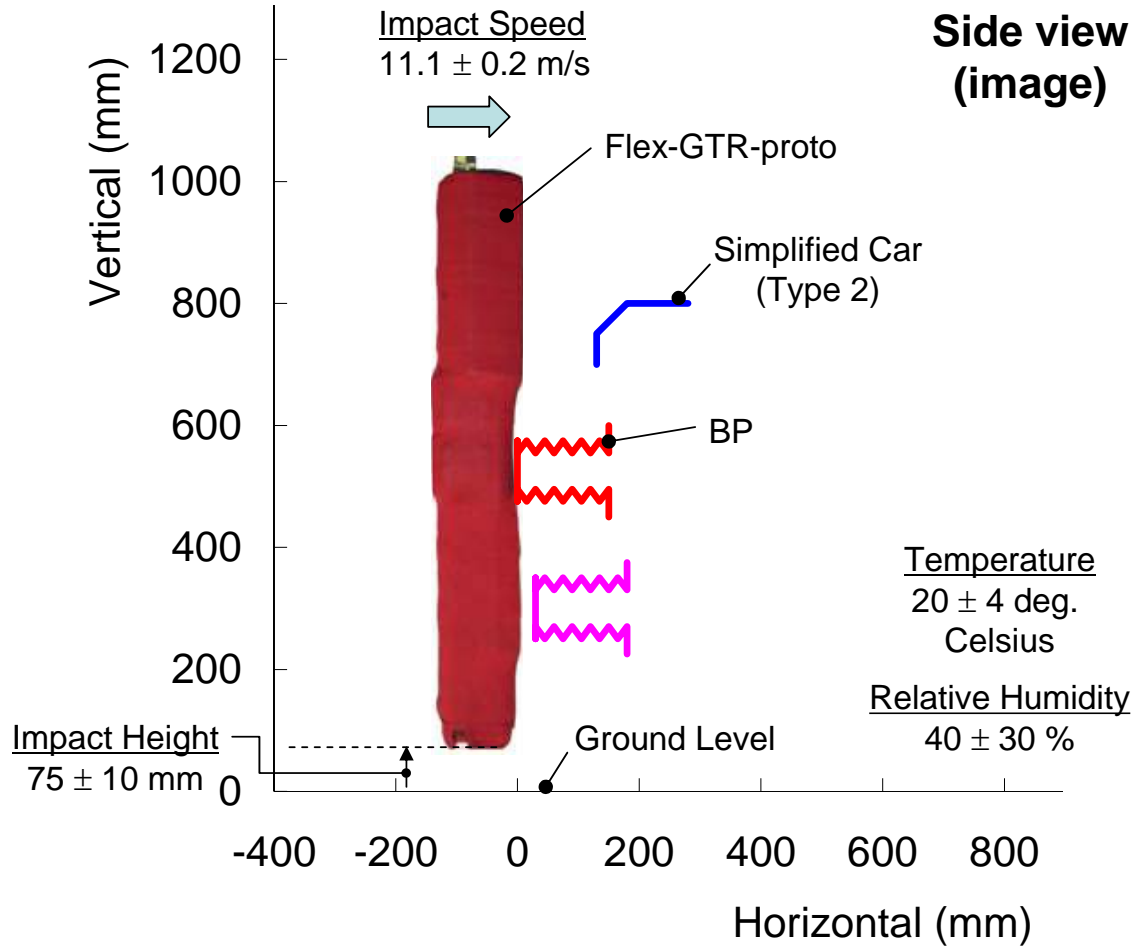


### Type 2-L

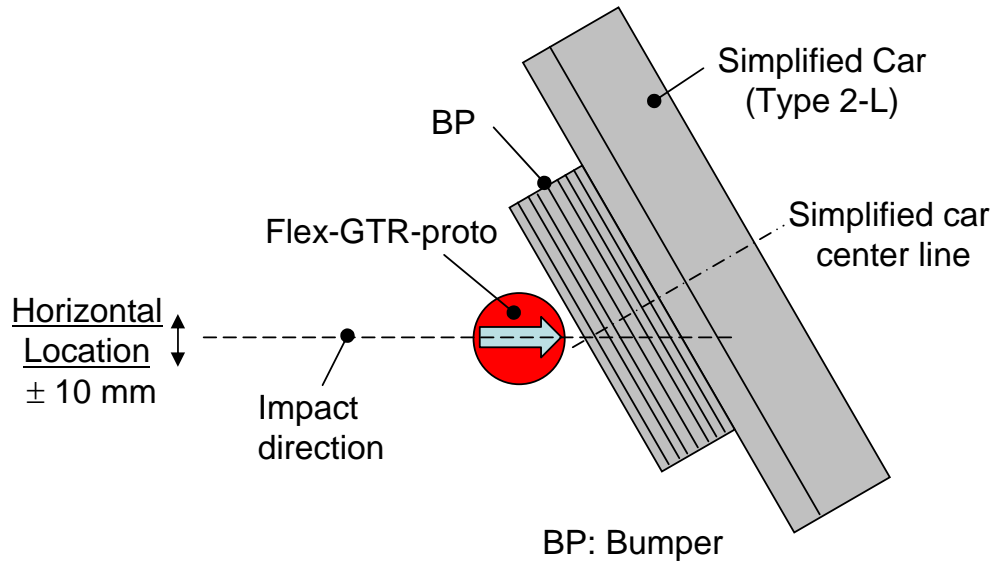
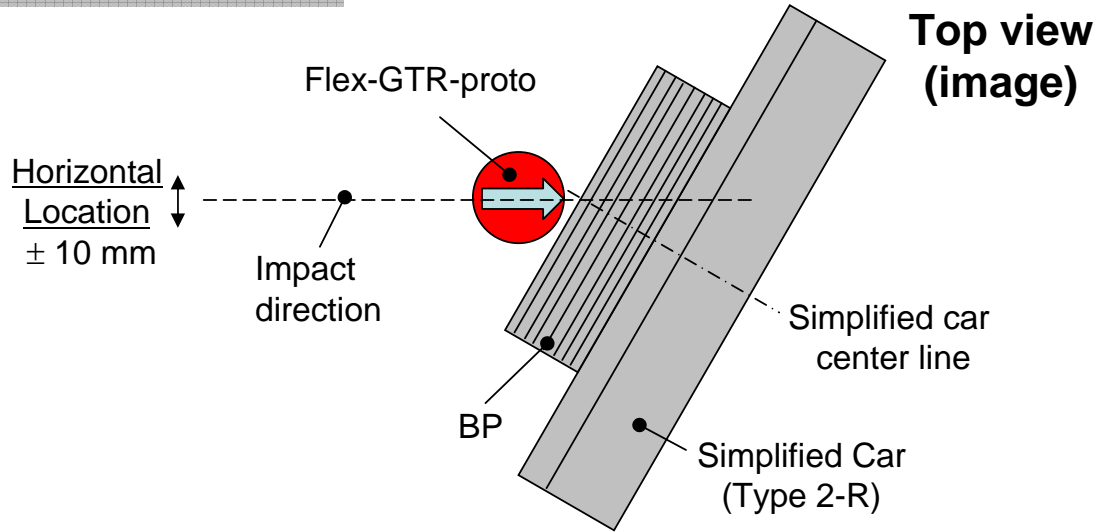
Left bumper corner



# Impact Condition



# Impact Condition, contd.



## Test Matrix

Test ID	Impactor		DAS	Simplified Car
	Type	SN		Type
S8	Flex-GTR-proto	SN03	SLICE	Type 2-L
S9				
S10				Type 2-R
S11				

Comparability of the Flex-GTR-proto output under the symmetric right and left bumper corner impact



## Test Results

# Kinematics

(Flex-GTR-prototype, L and R Bumper Corner Impact)

Simplified Car  
Type 2-L

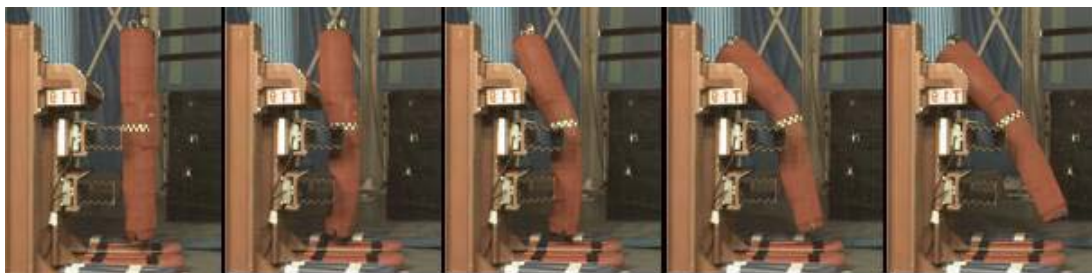
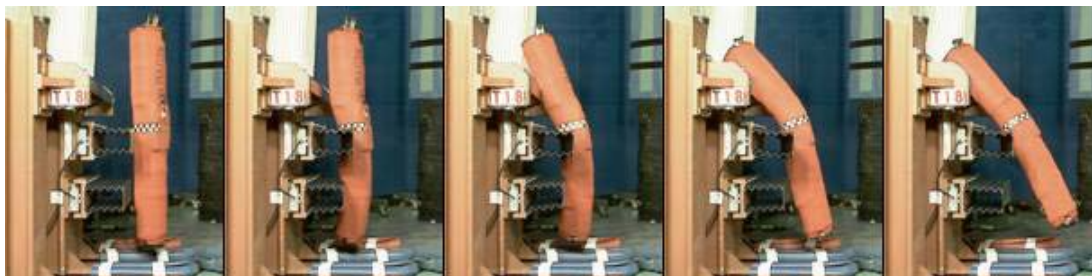
Flex-GTR-proto. (SN03), S8  
Simplified Car (Type 2-L)

Flex-GTR-proto. (SN03), S9  
Simplified Car (Type 2-L)

Simplified Car  
Type 2-R

Flex-GTR-proto. (SN03), S10  
Simplified Car (Type 2-R)  
Inversed Images

Flex-GTR-proto. (SN03), S11  
Simplified Car (Type 2-R)  
Inversed Images



0 ms

10 ms

20 ms

30 ms

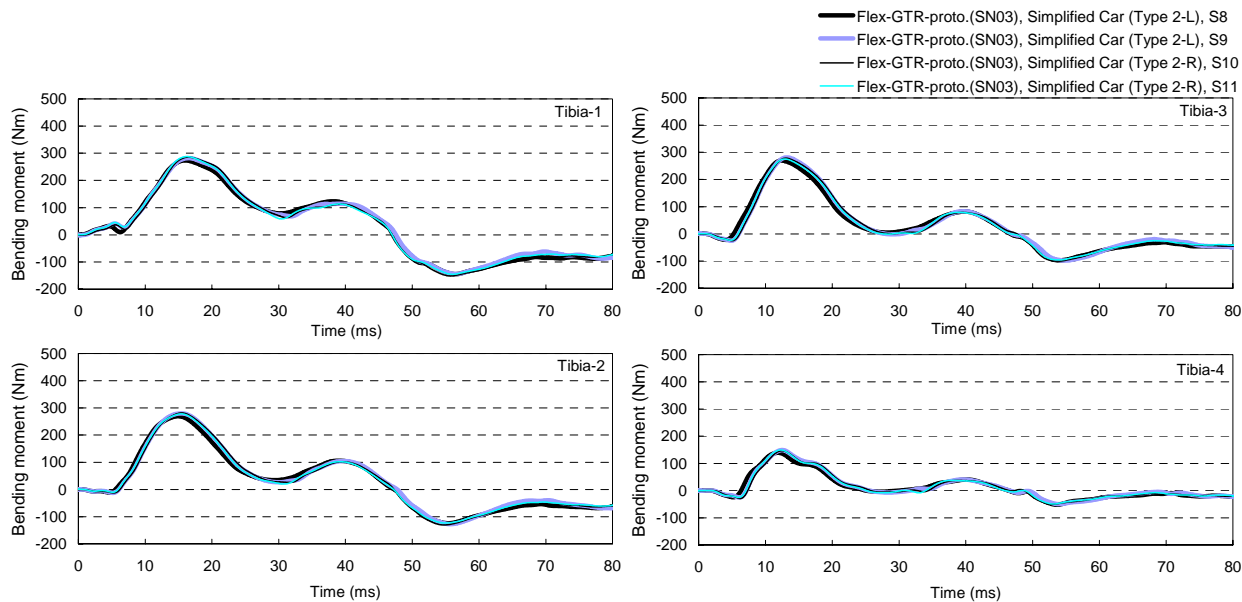
40 ms

10

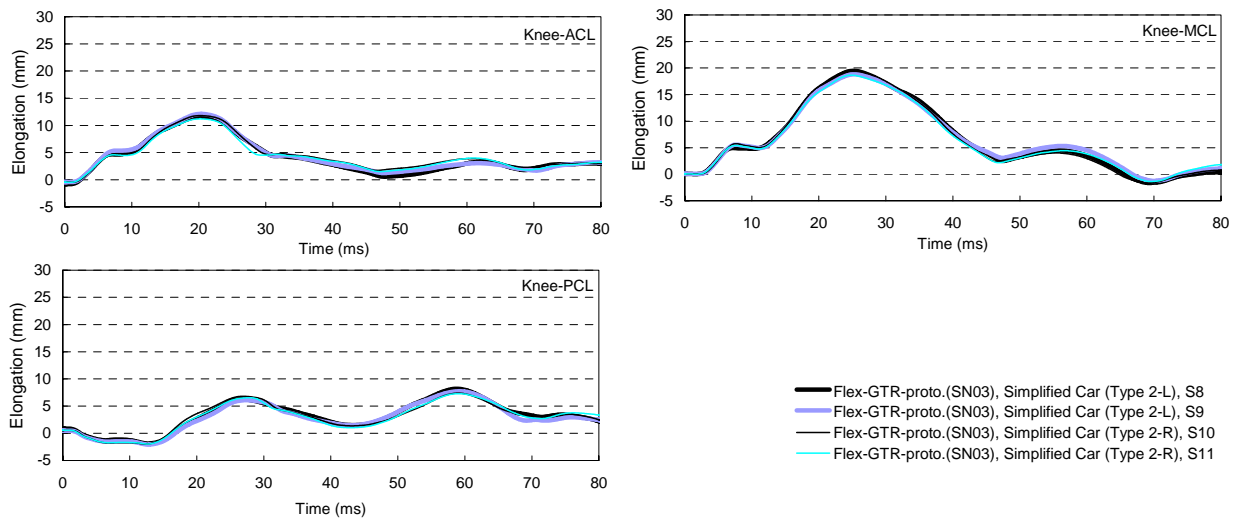
# Waveforms

(Flex-GTR-prototype, L and R Bumper Corner Impact)

- Tibia-1
- Tibia-2
- Tibia-3
- Tibia-4



- Knee-ACL
- Knee-PCL
- Knee-MCL



# Maximum Values

(Flex-GTR-prototype, L and R Bumper Corner Impact)

## Comparability Check for Flex-GTR-prototype (SN03) Under Right and Left Bumper Corner Impact

Test Method: Subsystem (Free fright)

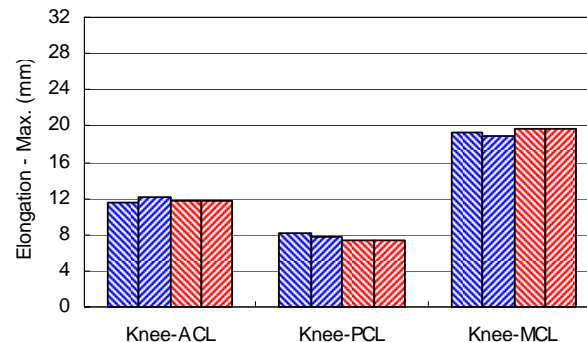
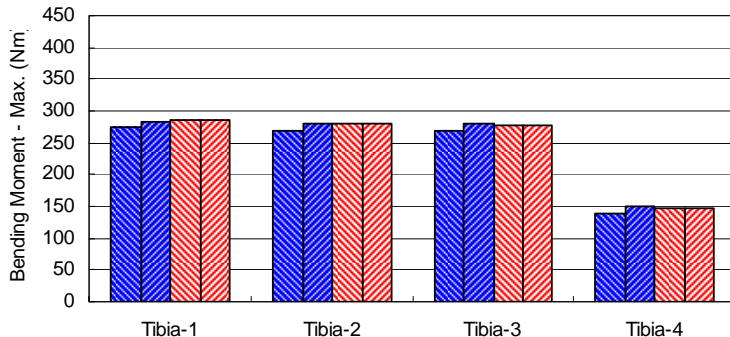
Test Rig: Simplified Car

	Max. values**						
	Tibia-1 (Nm)	Tibia-2 (Nm)	Tibia-3 (Nm)	Tibia-4 (Nm)	Knee-ACL (mm)	Knee-PCL (mm)	Knee-MCL (mm)
<b>Simplified Car (Type 2-L)</b>							
Flex-GTR-prot. (SN03), S8	273.7	269.6	269.8	139.5	11.61	8.18	19.3
Flex-GTR-prot. (SN03), S9	282.1	280.0	281.1	149.2	12.11	7.72	18.8
avg.	277.9	274.8	275.5	144.3	11.9	8.0	19.1
<b>Simplified Car (Type 2-R)</b>							
Flex-GTR-prot. (SN03), S10	285.6	281.5	278.7	146.5	11.81	7.38	19.8
Flex-GTR-prot. (SN03), S11	285.6	281.5	278.7	146.5	11.81	7.38	19.8
avg.	285.6	281.5	278.7	146.5	11.8	7.4	19.8



Simplified Car (Type 2-L) ■ Flex-GTR-prot. (SN03), S8 ■ Flex-GTR-prot. (SN03), S9

Simplified Car (Type 2-R) ■ Flex-GTR-prot. (SN03), S10 ■ Flex-GTR-prot. (SN03), S11



# Maximum Values

(Flex-GTR-prototype, L and R Bumper Corner Impact)

## Comparability Check for Flex-GTR-prototype (SN03) Under Right and Left Bumper Corner Impact

Test Method: Subsystem (Free fright)

Test Rig: Simplified Car

	Max. values**						
	Tibia-1 (Nm)	Tibia-2 (Nm)	Tibia-3 (Nm)	Tibia-4 (Nm)	Knee-ACL (mm)	Knee-PCL (mm)	Knee-MCL (mm)
Simplified Car (Type 2-L), Avg.	277.9	274.8	275.5	144.3	11.86	7.95	19.1
Simplified Car (Type 2-R), Avg	285.6	281.5	278.7	146.5	11.81	7.38	19.8
Avg.	281.8	278.1	277.1	145.4	11.84	7.67	19.42
St. Dev.	5.42	4.77	2.30	1.55	0.04	0.40	0.49
CV (%)	1.92	1.72	0.83	1.06	0.30	5.26	2.51
Judgement	Good	Good	Good	Good	Good	Acceptable	Good
t-IARV*	318	318	318	318	12.7	12.7	20.0
St.Dev./t-IARV (%)	1.70	1.50	0.72	0.49	0.28	3.17	2.44
Judgement	Good	Good	Good	Good	Good	Acceptable	Good

\* t-IARV: Tentative Injury Assessment Reference Values

\*\* Injury assesement items and monitoring items were evaluated.

### Judgements

Good: < 3%
Acceptable: 3% ≤ and < 7%
Marginal: 7% ≤ and < 10%
Not Acceptable: > 10%

Injury  
Assessment  
Items

Monitoring  
Items

# Conclusions

- JAMA/JARI conducted symmetric right and left bumper corner impact tests using the Flex-GTR-prototype.
- As a results, we observed comparable test results of the Flex-GTR prototype under the symmetric right and left bumper corner impact.
- This results means, no concerns of the Flex-GTR-prototype for to use the symmetric right and left bumper corner impact tests.