

Development of JAMA-JARI Pedestrian Child and Adult Head-Form Impactors

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4: Jasti Co., Ltd.

BACKGROUND

Car-Pedestrian Impact

Head injuries are the most common cause of pedestrian death.



ISO, IHRA-PS and Japan MLIT

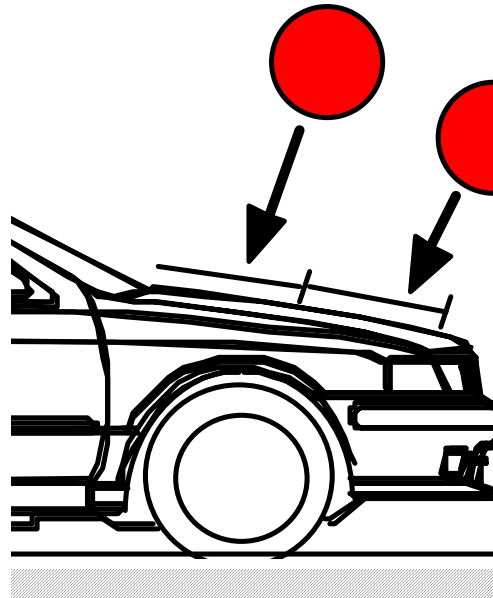
proposed subsystem test to evaluate car front safety performance (bonnet area).

Adult head-form impactor

(4.5 kg: effective mass of 50% adult head)

Child head-form impactor

(3.5 kg: effective mass of 6 year child head)



V = 30 - 50 km/h

Angle = 20 - 78 degrees

Parameters of head-form impactors required by ISO, IHRA and Japan MLIT

World top level technical knowledge

- Mass
- Diameter
- Biofidelity (drop test) : stiffness of skin
- Distance between center of gravity and geometric center
- 1st natural frequency
- Moment of inertia
- Distance between seismic mass location of accelerometer
and geometric center

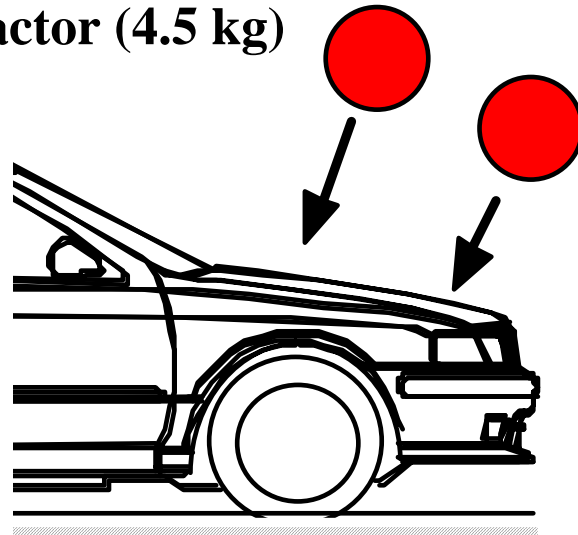
However, **no impactors** fulfill the requirements of **ISO, IHRA and Japan MLIT** have been developed so far.

OBJECTIVE

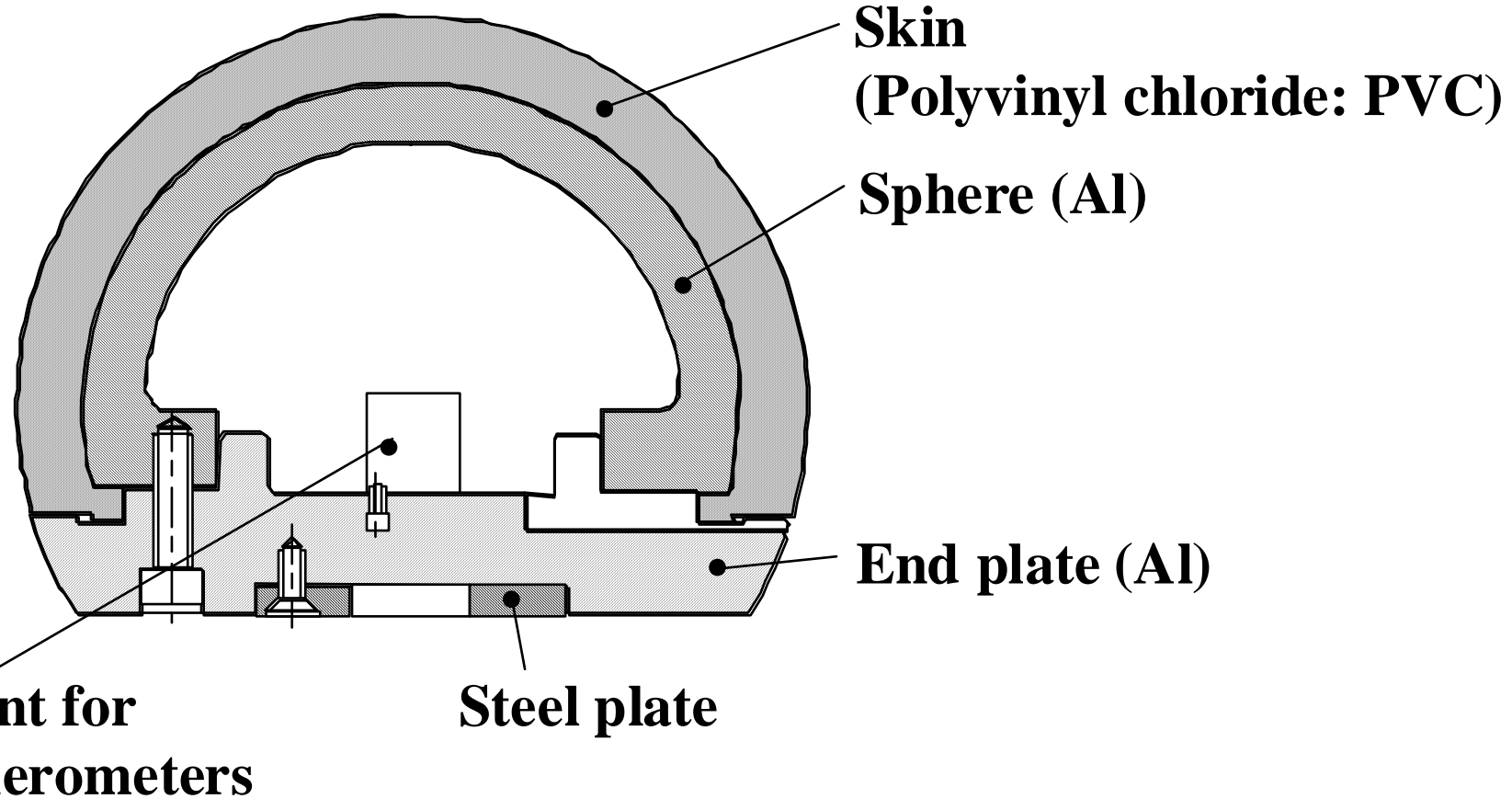
To develop new child and adult head-form impactors specifically to meet the requirements of ISO, IHRA/Japan MLIT proposals.

**Adult head-form
impactor (4.5 kg)**

**Child head-form
impactor (3.5 kg)**



Design of JARI head-form impactors



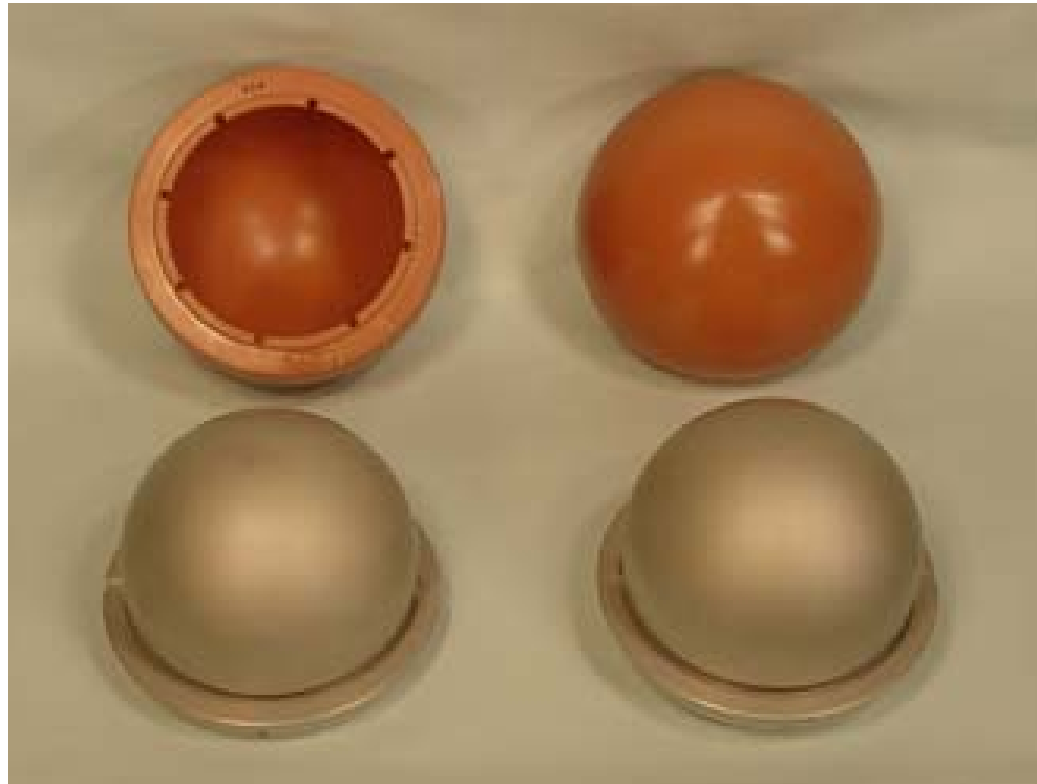
JARI head-form impactors (assembled)



Child head-form

Adult head-form

Disassembled head-form impactors



**Skin
(PVC)**

**Core part
(Al)**

Child head-form

Adult head-form

Result of physical values measured by JARI child head-form impactor

Parameter	IHRA/ Japan MLIT	Newly developed JARI child head	
1) Mass	3.5 ± 0.07 kg	3.504 kg	✓
2) Diameter	165 ± 1 mm	164.5 mm	✓
3) Drop test corridor	245 - 300 G	Ave. 282 G	✓
4) Distance between C.G and Ge.C.	± 2 mm	0.4 mm	✓
5) 1st natural frequency	Over 5000 Hz	7424 Hz	✓
6) Moment of inertia	0.0075 to 0.0200 kgm ²	0.0089 kgm ²	✓
7) Distance between S.M.L. and Ge.C.	± 10 mm	Max. 8.5 mm	✓
	± 1 mm	0.4 mm	✓

Result of physical values measured by JARI adult head-form impactor

Parameter	IHRA/ Japan MLIT	Newly developed JARI adult head	
1) Mass	4.5 \pm 0.10 kg	4.494 kg	✓
2) Diameter	165 \pm 1 mm	164.5 mm	✓
3) Drop test corridor	225 - 275 G	Ave. 255 G	✓
4) Distance between C.G and Ge.C.	\pm 2 mm	0.4 mm	✓
5) 1st natural frequency	Over 5000 Hz	8496 Hz	✓
6) Moment of inertia	0.0075 to 0.0200 kgm ²	0.0115 kgm ²	✓
7) Distance between S.M.L. and Ge.C.	\pm 10 mm	Max. 8.5 mm	✓
	\pm 1 mm	0.4 mm	✓

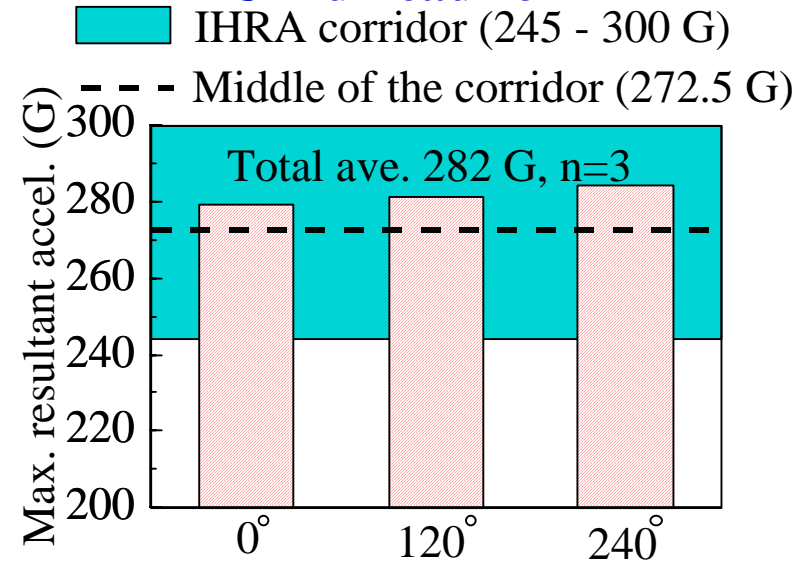
3) Biofidelity (Drop Test): Stiffness of skin

Material component of skin

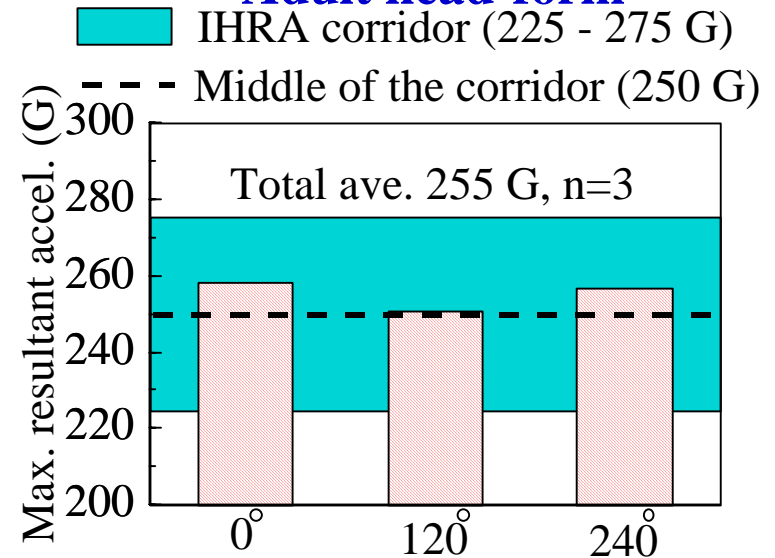
- Polymer
- Plasticizer
- Stabilizer
- Vinyl toner color



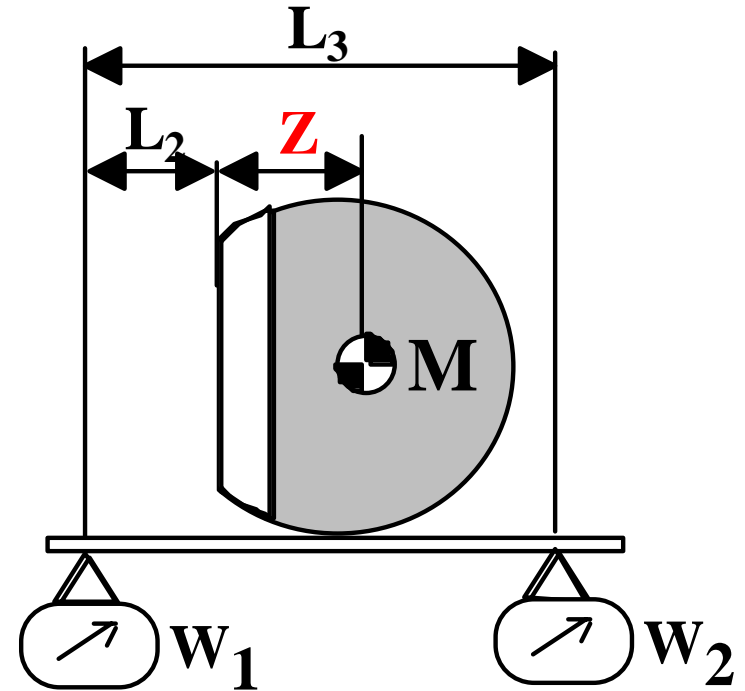
Child head-form



Adult head-form

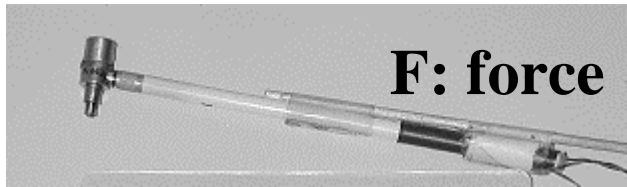


4) Distance between Center of Gravity and Geometric Center

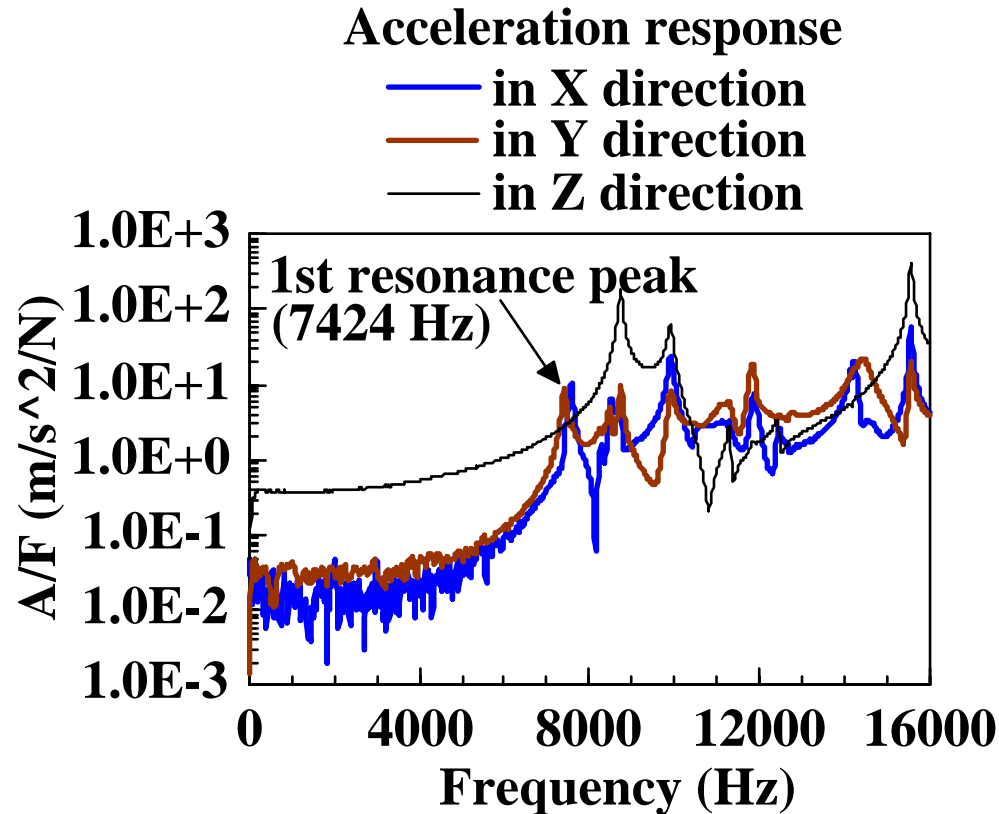
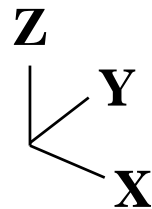


$$(L_2 + Z) \times M = L_3 \times W_2$$

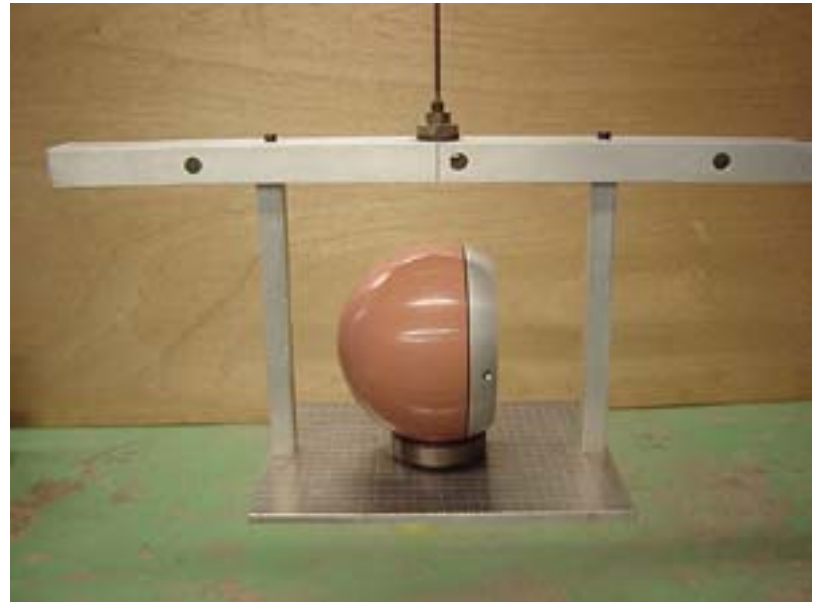
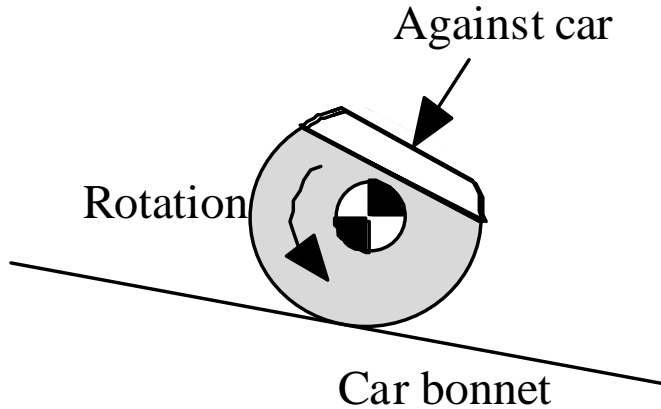
5) First Natural Frequency



A: acceleration



6) Moment of Inertia



I: moment of inertia

C: stiffness of torsion spring

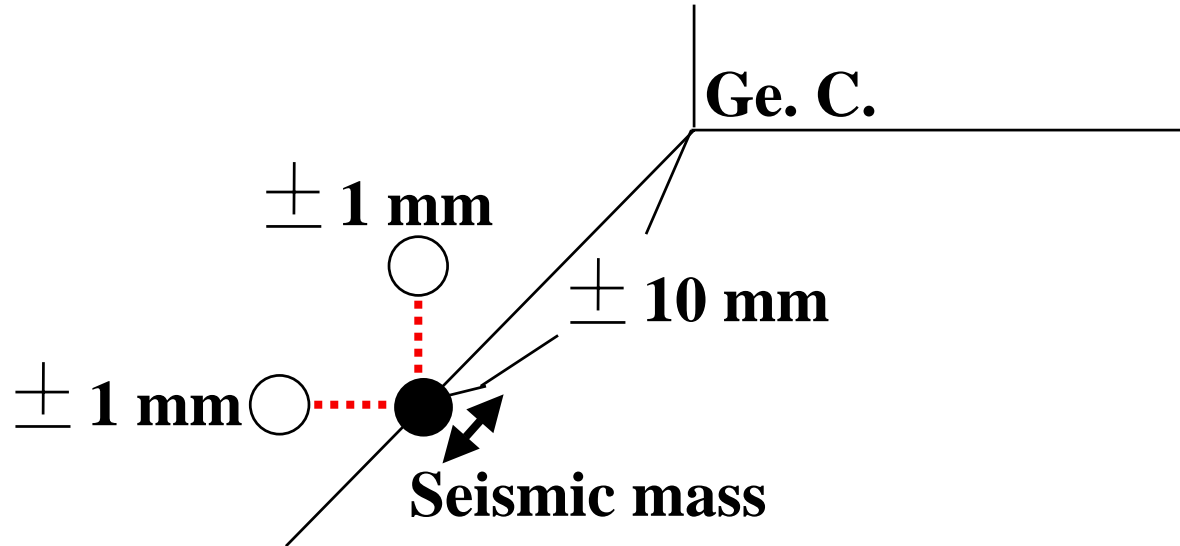
t: vibration period

$$I = C \times (t/2 \quad)$$

known

Should be measured

7) Distance between seismic mass location of accelerometer and Geometric Center (Ge.C.)



The location of seismic mass:

± 10 mm from Ge. C. in the direction of measurement axis

± 1 mm from Ge. C.

in the direction perpendicular to the measurement axis

FURTHER INFORMATION

- Cores are available from: **S●Tech Co., Lit., Japan**



[Http//www.s-technic.co.jp](http://www.s-technic.co.jp)
info@s-technic.co.jp

- Skin is available from: **Jasti Co., Lit., Japan**



[Http//www.jasti.co.jp](http://www.jasti.co.jp)
info@jasti.co.jp

CONCLUSIONS

- **The technical specification of the prototype JARI child and adult head-form impactors fulfilled both the ISO and IHRA/Japan MLIT requirement.**
- **The compliance with the detailed specifications of the ISO and IHRA/Japan MLIT is technically feasible.**