Japan Research Activities in the GTR-7 Phase 2 amendment

Bio RID II seating proposal #2

JASIC/Japan

Nov. 6. 2009

1. Seating Condition Proposal

2. Seating Procedure Proposal based on variation study

3. Seating Procedure Proposal for smaller torso angle seat.

Seating Condition Proposal

The dummy seating procedure should be modified from the IIWPG procedure as follows, as the actual seating angle is closer to the design torso angle. In addition, the dummy outputs are very sensitive to the static backset according to the simulation and test results.

① Seat torso angle:
Design torso angle ⇦ 25 degrees

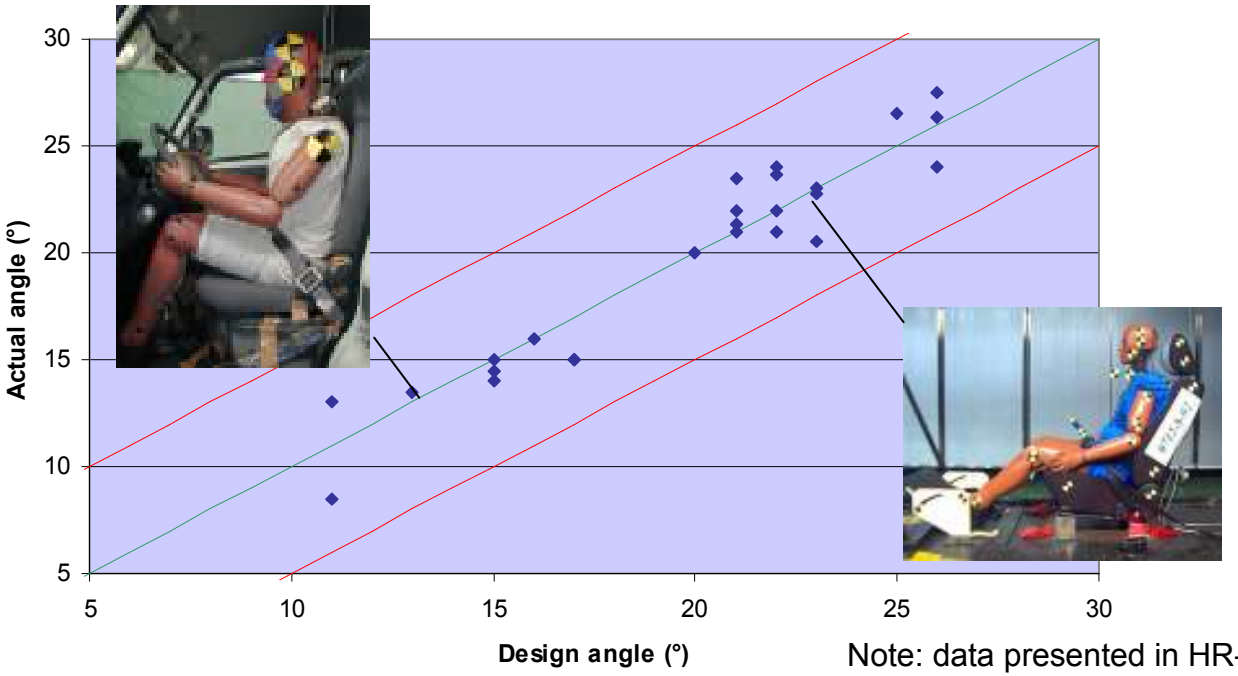
② Backset tolerance:
+/-2 mm ⇦ +/- 5 mm.

③ Special adjustment in the case of smaller torso angle seat

① Background of Design Torso Angle Proposal

Note: presented in HR-6-13

Range of design torso angles used in different vehicle types



Note: data presented in HR-4-13

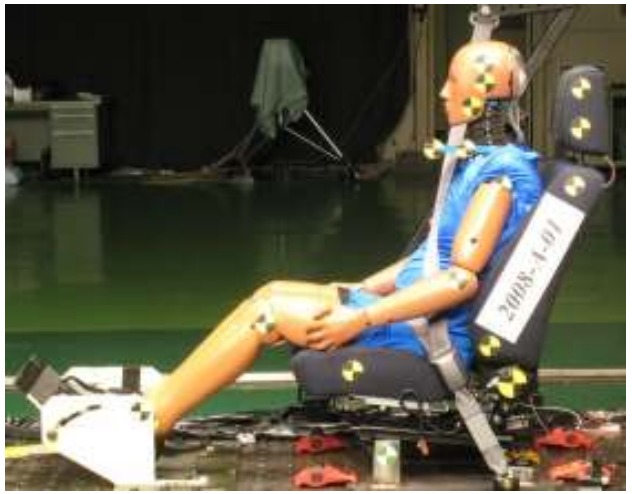
- Design torso angle is specified by typical driving posture for each type of vehicle and seating height. It is varied from 10° to 30°.
  - For certain seat designs, 25° bears no relation to the real world seating position and in some cases may not even be physically achievable
  - Advise the use of the procedure specified in ECE17 Annex 3
- All other safety tests, including vehicle crash tests, are conducted with the design torso angle.

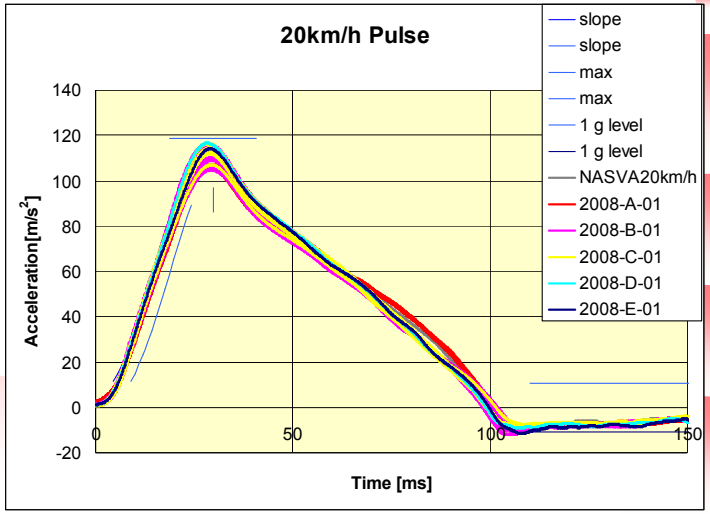
② Seating procedure variation effect study

JARI has conducted the following tests to confirm the effects of seating variation.

- Back set : ＋5mm ＋10mm
- H-point ＋5mm ＋10mm
- Pelvis angle: ＋2.5° －2.5°

Crash Pulse : Delta V 20km/h
Seat : Passive-type seat





Seating procedure variation effect study

Variation effect summary

Test No.	HRCT	Hx Acc.	T1 Acc.	Upper FX	Upper FZ	Upper MY-Flx.	Upper MY-Ext.	Lower FX	Lower FZ	Lower MY-Flx.	Lower MY-Ext.	NIC	OC-T1
2008-B-01～05（**(Ave.)**	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2008-B-06（BS +5mm）	103.1	107.7	98.7	123.5	111.9	104.7	100.0	111.9	121.9	124.6	114.4	118.2	104.7
2008-B-07（BS +10mm）	105.8	114.8	97.6	146.7	123.0	109.2	100.0	123.5	143.2	147.0	128.4	135.5	109.8
2008-B-08（HP +5mm）	100.9	101.9	96.0	111.6	99.2	104.2	100.0	101.4	102.1	105.7	105.0	103.4	99.8
2008-B-09（HP +10mm）	101.9	103.8	92.3	123.3	98.8	108.2	100.0	103.0	104.2	109.7	110.0	107.6	99.5
2008-B-10（PA +2.5°）	97.7	100.2	89.8	106.5	101.7	103.3	100.0	102.7	105.4	103.2	102.8	89.6	96.3
2008-B-11（PA -2.5°）	103.7	102.7	110.7	100.7	100.4	95.6	100.0	98.2	97.2	107.2	102.3	117.7	106.9

単位：% ±5 ±10 ±20 ±21～

Conclusion

- Back set variation produces the greatest effect on all indicators.
- H-point variation is the second effect on all indicators.

③ Smaller Design Torso Angle seat seating trial

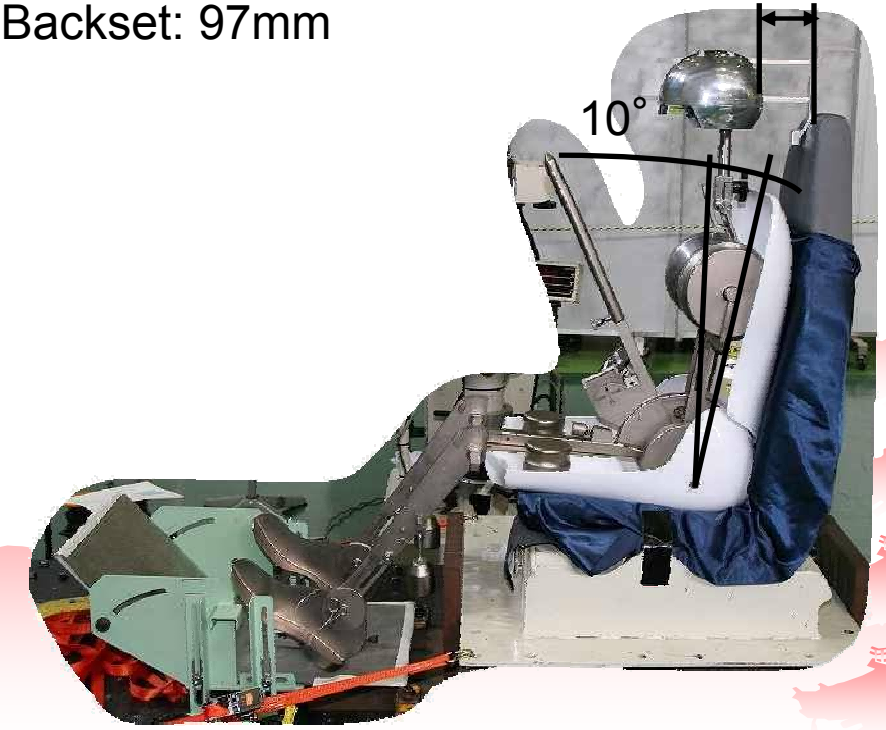
Purpose:

- To discover problems with the Bio RID II seating procedure. If the design torso angle seat is less than 20 degree.
- To study route cause and to propose countermeasures.

Sample seat

Small van

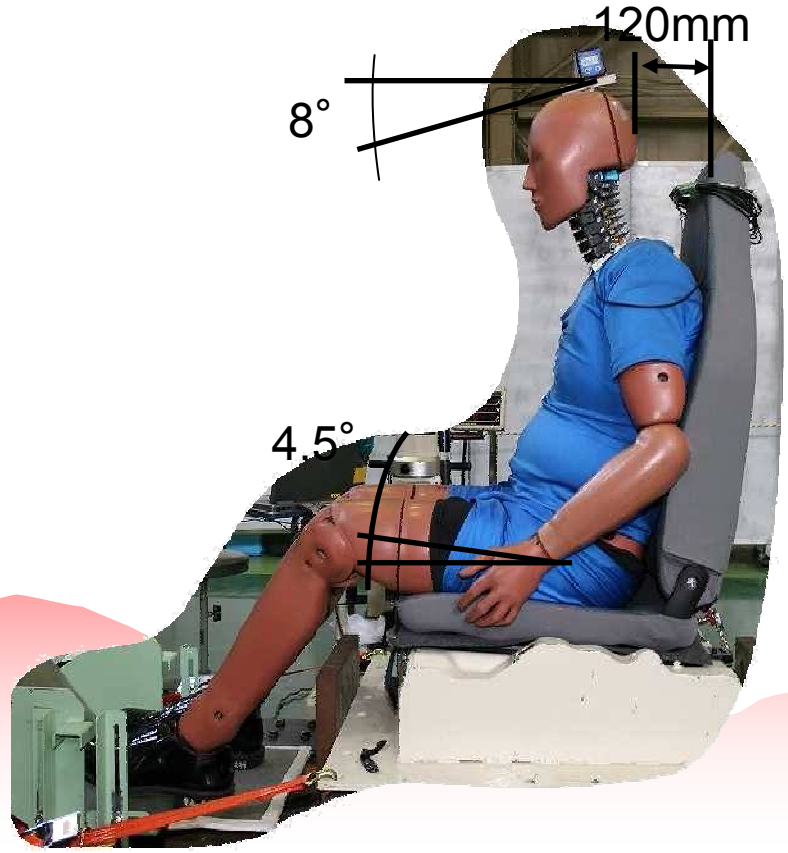
13 degree design torso angle seat
- Actual torso angle : 10 degree
- Backset: 97mm



Smaller Design Torso Angle seat seating trial

Problem:

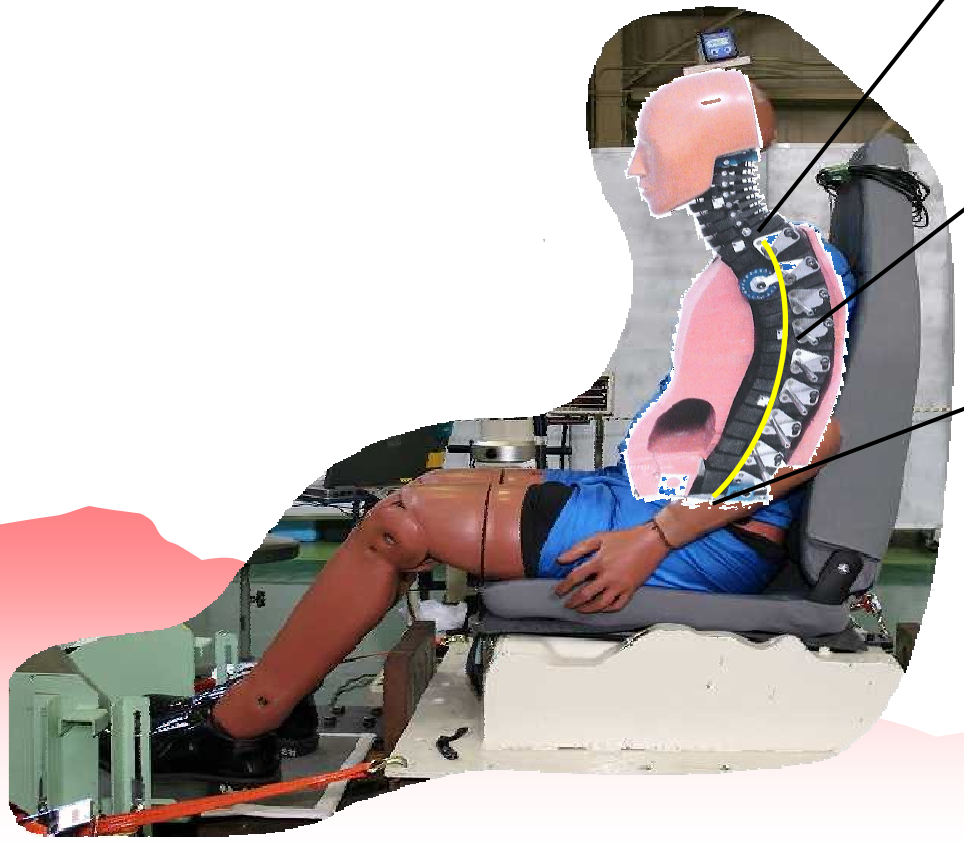
- Head can not remain **laterally level.**
- Distance between head and head restraint is greter than backset+15mm (112mm).
- Pelvis angle can not maintain torso angle + 1.5 degree.



Smaller Design Torso Angle seat seating trial

Route cause study

- •Spine curvature allows less flexibility due to the design for 25 degree seating posture.
- •There is no adjustment capability at neck joint and/or pelvis joint.



No adjustment at neck joint

Spine curvature is too rigid

No adjustment at pelvis joint

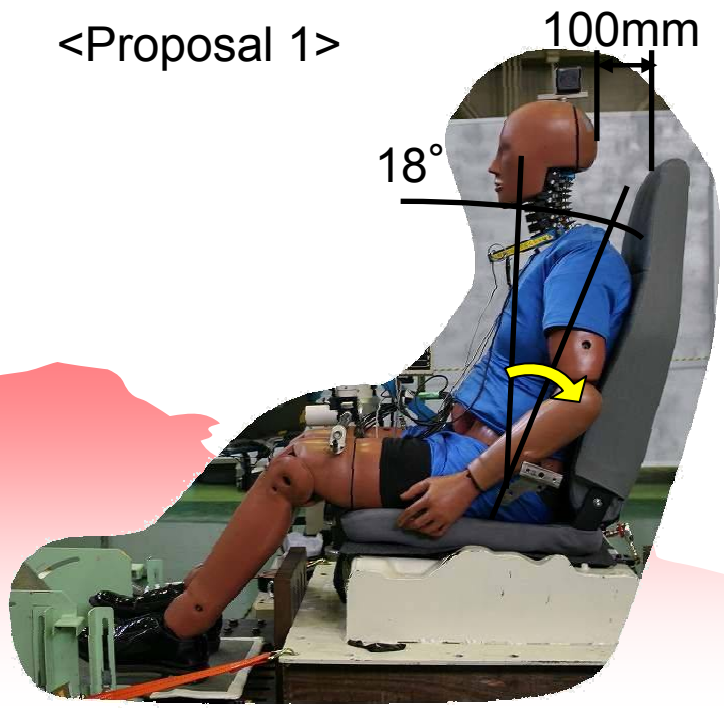
Smaller Design Torso Angle seat seating trial

Countermeasure proposal

- Proposal 1: Recline the Seat Back until the head can remain laterally level.
  - ➲ Seating posture can not represent actual driving posture.

- Proposal 2: Move the dummy Hip until the head can remain laterally level.
  - ➲ Seating posture more closely resembles actual driving posture. The gap between head and head restraint is smaller than Backset +15mm. The effect of the gap between hip and seat back on dynamic behavior and reactive head restraint performance is unclear.

<Proposal 1>



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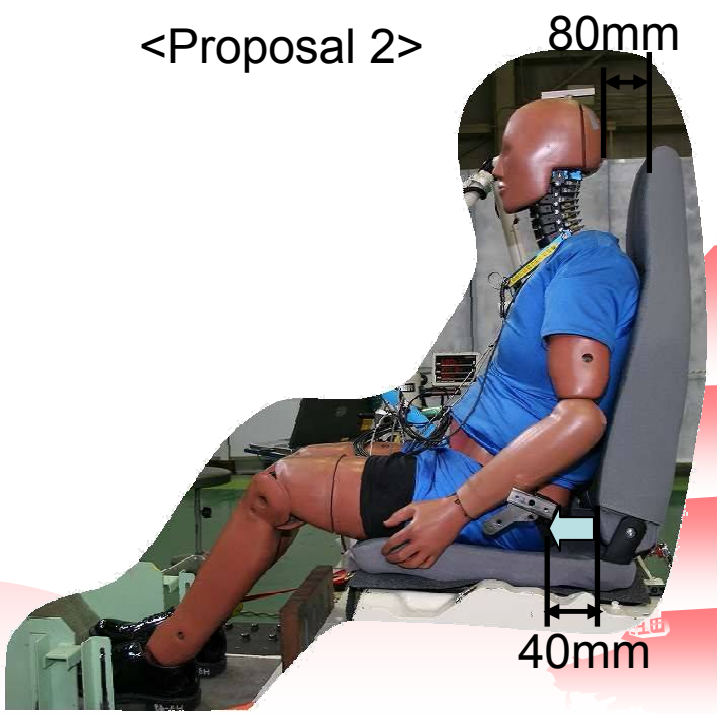
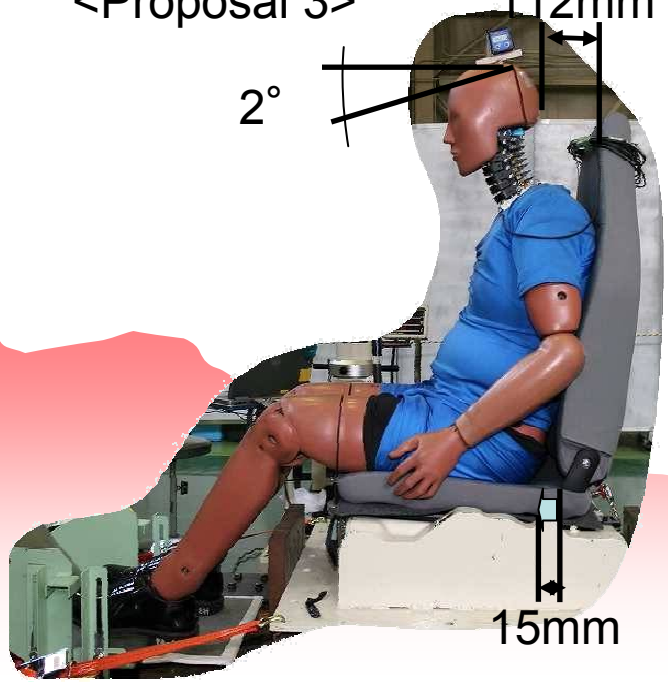


Smaller Design Torso Angle seat seating trial

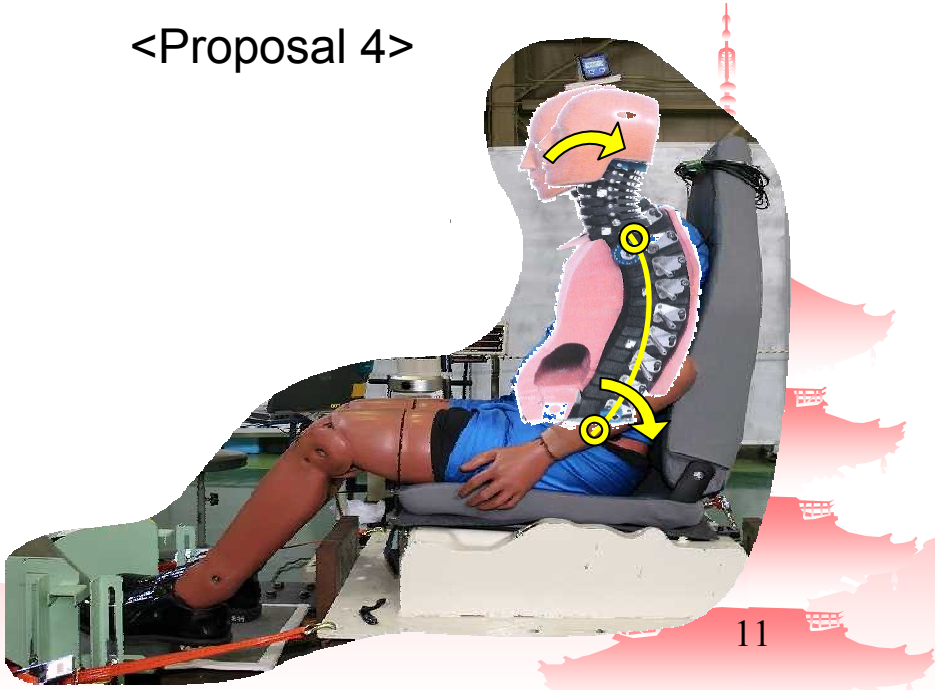
Countermeasure proposal

- Proposal 3: Move the dummy Hip until the gap between head and head restraint becomes Backset +15mm.
  - ➲ Seating posture more closely resembles actual driving posture. The effect of the gap between hip and seat back on dynamic behavior and reactive head restraint performance is unclear.
- Proposal 4: Add neck and/or pelvis angle adjust feature to Bio RID II dummy.
  - ➲ Seating posture more closely resembles actual driving posture. Dummy modification capability is unclear.

<Proposal 3>



<Proposal 4>



Smaller Design Torso Angle seat seating trial

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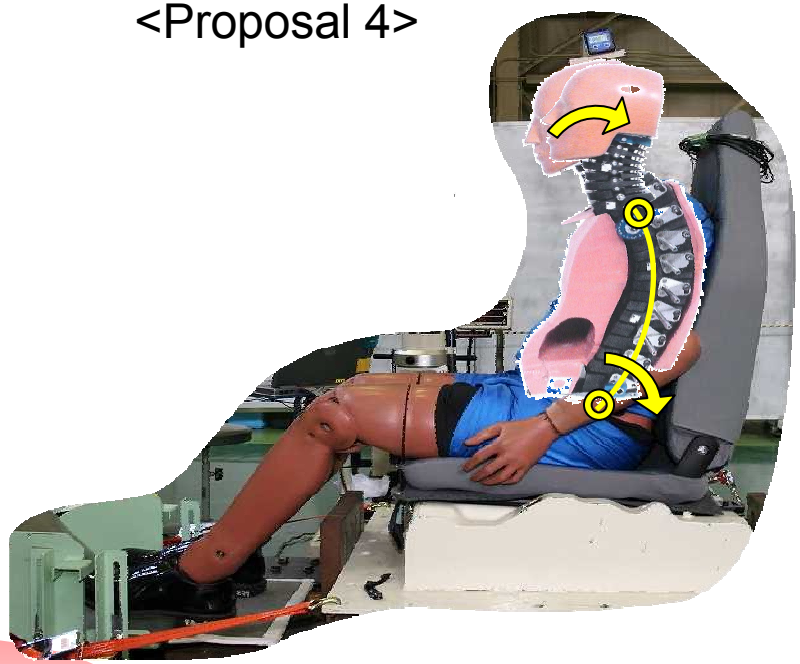
Recommendation

✓Proposal 4:

- This proposal is feasible as a permanent solution.
- A tentative solution may need to be considered depending on the difficulty of modification.

<Proposal 4>

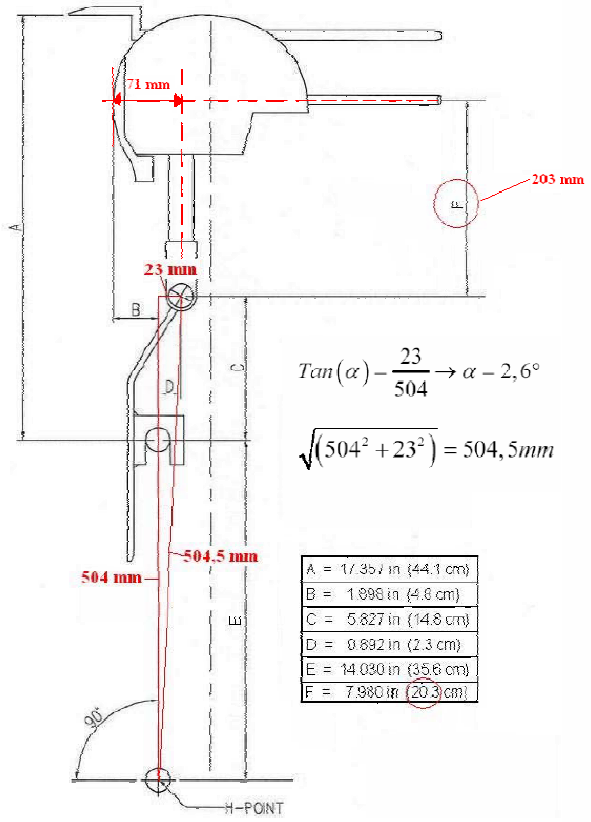


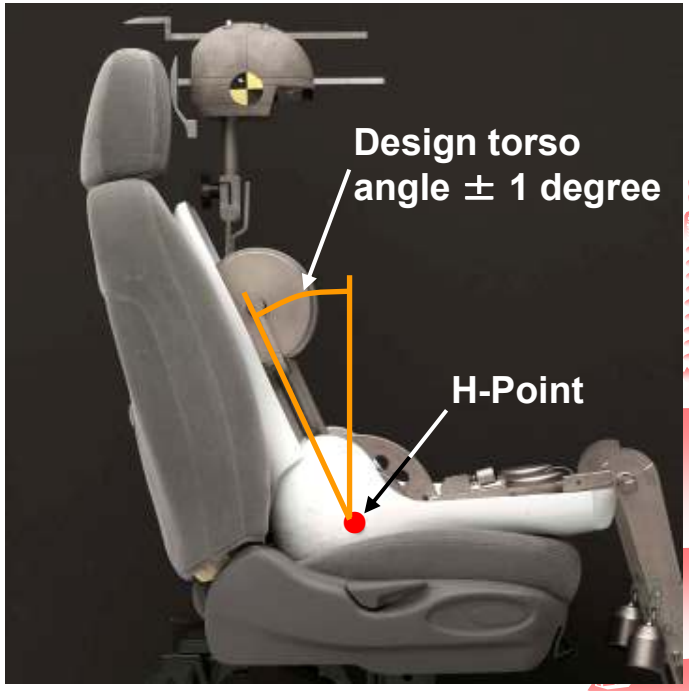
Japan Automobile Standards Internationalization Center

Thank you for your attention！

(Reference) Seating procedure proposal

4.4.1 **The seat shall have already been set to give the design torso angle ± 1 degree measured on the H-Point machine fitted with HRMD (see Annex 5).**





Head Restraint Measuring Device (HRMD)

(Reference) Seating procedure proposal

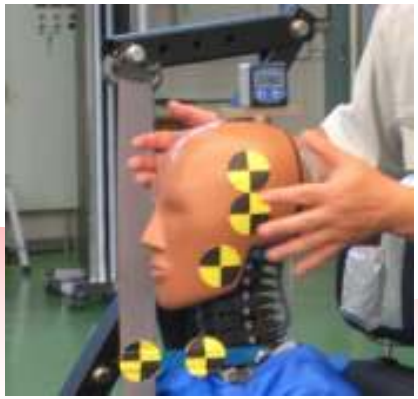
Place the test dummy in the seating position equipped with a head restraint after allowing the seat to recover for 15 minutes with nothing in it.

4.4.2. **Place the seat belt across the dummy and lock as normal.**

(Reference) Seating procedure proposal

4.4.3. **Align the test dummy's midsagittal plane with the centerline of the seat.**

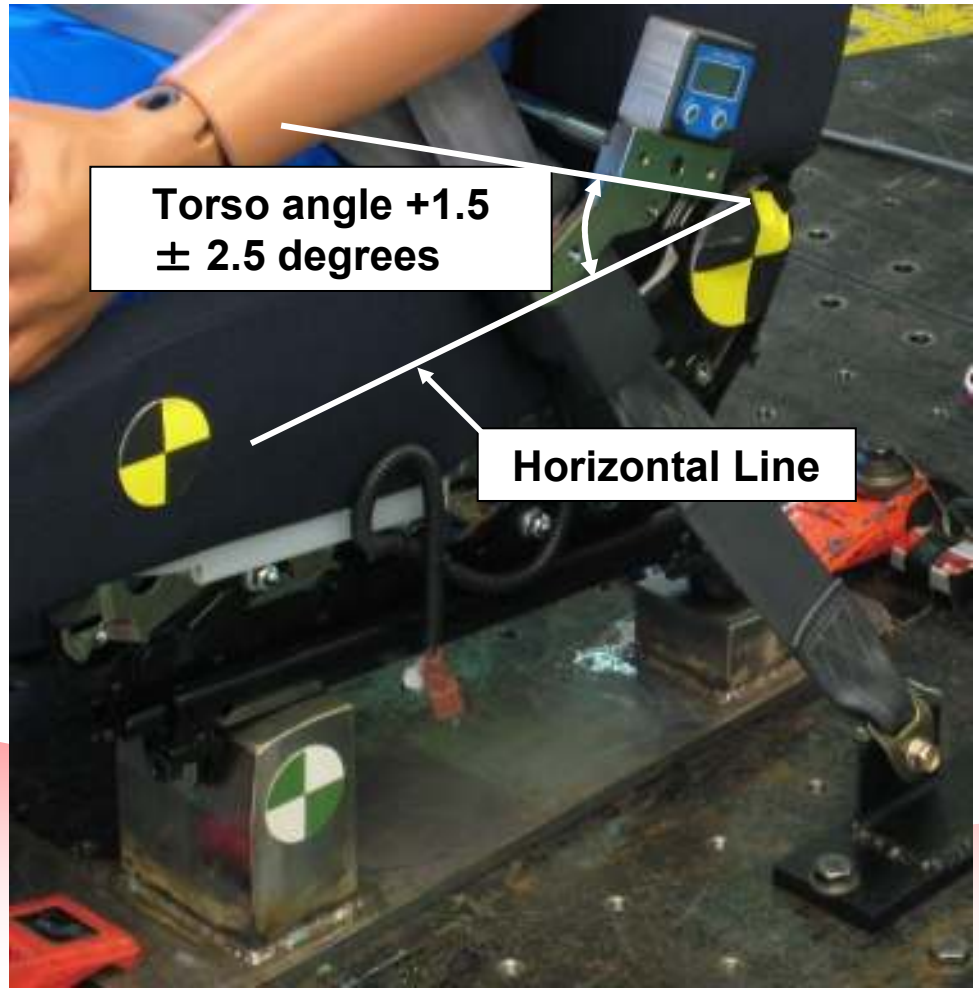
4.4.4. **Adjust the test dummy's midsagittal plane to be vertical; the instrumentation platform in the head shall be laterally level.**



(Reference) Seating procedure proposal

4.4.5. Adjust the pelvis angle to the actual torso angle recorded by the procedure specified in paragraph 4.4.1 plus 1.5 ± 2.5 degrees.

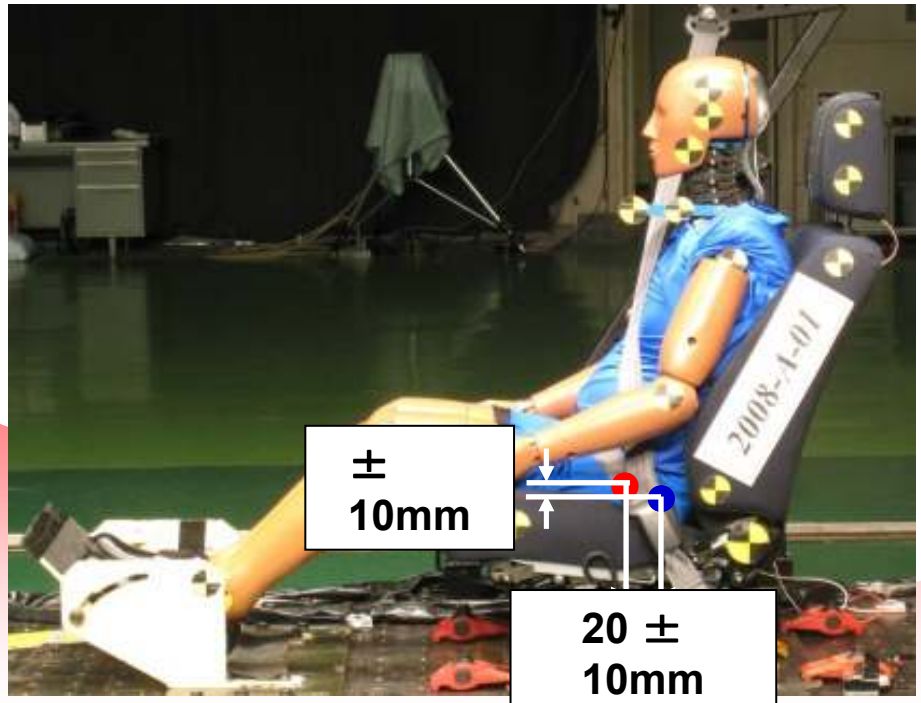
Rev.1



(Reference) Seating procedure proposal

4.4.6. **Position the test dummy's H-Point 20 ± 10 mm forward and 0 ± 10 mm vertically of the H-Point location measured under the condition specified in paragraph 2.12 of Annex 4, while keeping the pelvis angle within the range specified in paragraph 4.4.5 .**

Rev.1

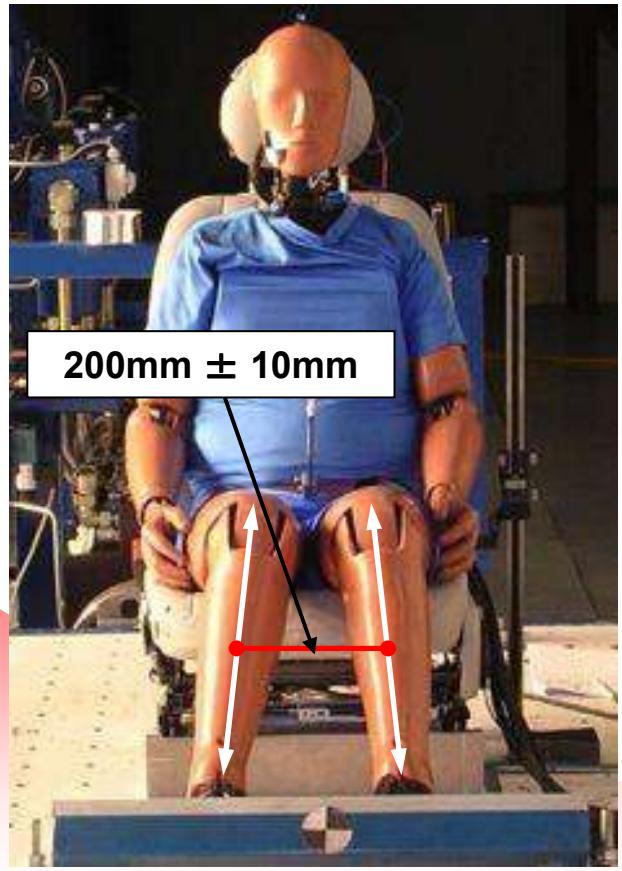


● : Test dummy's H-Point

● : H-Point location measured under the condition specified in paragraph 2.12 of Annex 4

(Reference) Seating procedure proposal

4.4.7. **Adjust the spacing of the legs so that the centreline of the knees and ankles is 200 mm(±10 mm) apart and ensure that the knees are level.**



(Reference) Seating procedure proposal

4.4.8. **Adjust the test dummy's feet and/or the horizontal position of the adjustable toe board so that the heel of the test dummy's shoe is resting on the heel surface. The tip of the shoe shall rest on the toe pan between 230mm and 270mm from the intersection of the heel surface and toe board, as measured along the surface of the toe board (see Figure 9-2).**

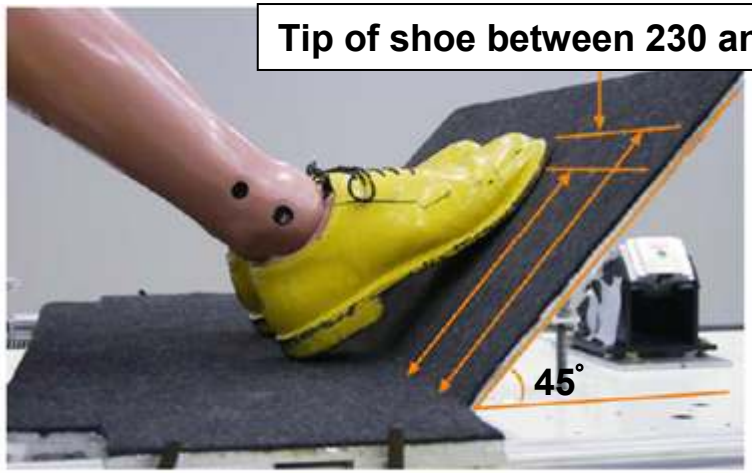
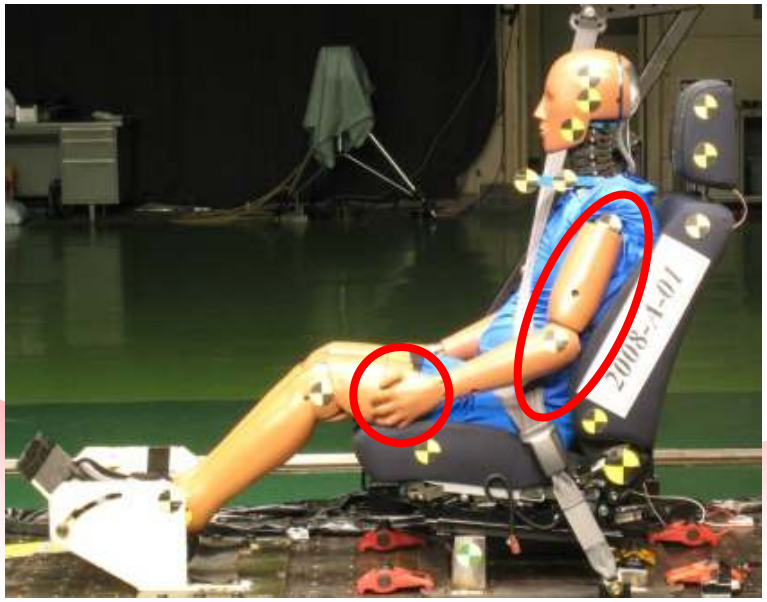


Figure 9-2 Proper positioning of the test dummy's feet.

(Reference) Seating procedure proposal

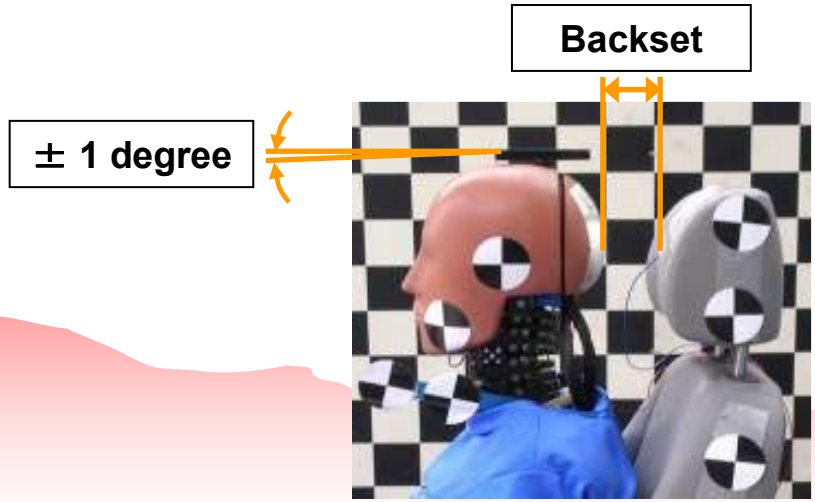
4.4.9. **Position the test dummy's arms so that the upper arms are as close to the torso sides as possible. The rear of the upper arms shall contact the seatback, and the elbows shall be bent so that the small fingers of both hands are in contact with the top of the vehicle seat cushion with the palms facing the dummy's thighs.**



(Reference) Seating procedure proposal

4.4.10. **Level the instrumentation plane of the head (front/rear and left/right directions) to within ± 1 degree.**

4.4.11. **Measure the test dummy reference backset, which is the horizontal distance between the rearmost point on the head and the same identifiable location on the head restraint. Compare the test dummy reference backset with the HRMD backset obtained by the procedure specified in paragraph 2.12 of Annex 4.**



(Reference) Seating procedure proposal

4.4.11.1. **If the test dummy reference backset is different more than ±2mm from the HRMD backset, obtained by the procedure specified in paragraph 2.12 of Annex 4, plus 15mm, then do the following:**

Rev.1

4.4.11.1.2.If the backset cannot be brought closer to the test dummy reference backset plus ±2mm by paragraph 4.7.10.1.1 of this Annex, adjust the pelvis angle and H-point position within their respective tolerance bands giving priority to use the pelvis angle tolerance. In this case begin at paragraph 4.7.4 of this Annex and adjust the test dummy position accordingly.

Backset	± 2 mm from HRMD backset