



**RDW**

Informal document **GRSP-51-23**  
(51st GRSP, 21–25 May 2012,  
agenda item 3)

# **Gtr7 measuring method for effective head restraint height**

**Update for GRSP, following  
the IWG on gtr No.7 in London March 2012**

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- Terms of reference of the informal group gtr No.7 - Head Restraints - Phase 2, part (a): how to define the effective height / concerns expressed in the rationale of gtr7
- Anthropometry / position of back-of-head in the 1980's
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- Tools for positioning of back-of-head of people nowadays
- Measuring procedure for effective head restraint height (step by step)

# Terms of reference of the informal group gtr No.7 Head Restraints Phase 2

Text from doc. GTR7-01-08 (ECE/TRANS/WP.29/2009/130):

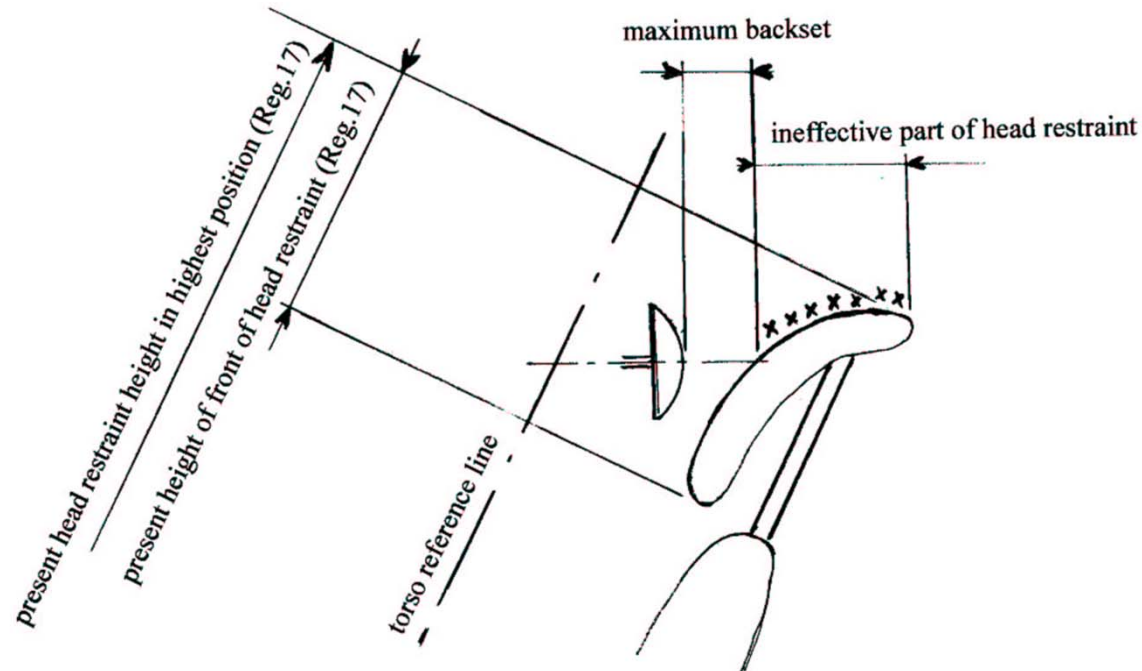
## “ III. SUBJECTS FOR REVIEW AND TASKS TO BE UNDERTAKEN

6. With regard to head restraint height, the informal group should decide:

- (a) How to define the effective height;
- (b) The height requirements ”



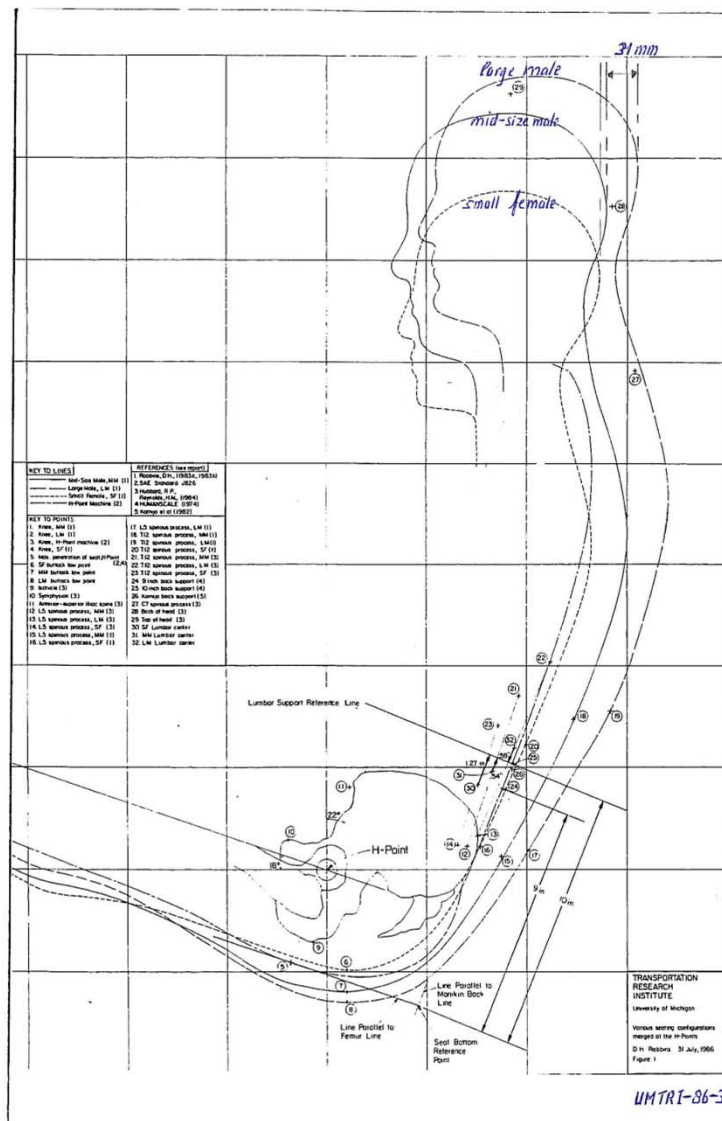
## Concerns expressed in the rationale of gtr No.7



- The measurement of the head restraint height taken as shown above does not address the effective height of the head restraint.
- In the case of extremely contoured head restraints, the height of the surface that the head would contact is less than the measured height.



# Anthropometry / position of back-of-head in the 1980's



UMTRI-86-39 study, merged H-points of the small female, mid-sized male and large male (known from the UMTRI-83-53-1).

It was found that the back-of-head of the large male, compared to the mid-sized male, is a “distance x” (being 31 mm) more rearward.

However this result is reached with:

- a chosen seatback angle,
- a large male dating from the 1980's, so not representing the nowadays large male car occupant.

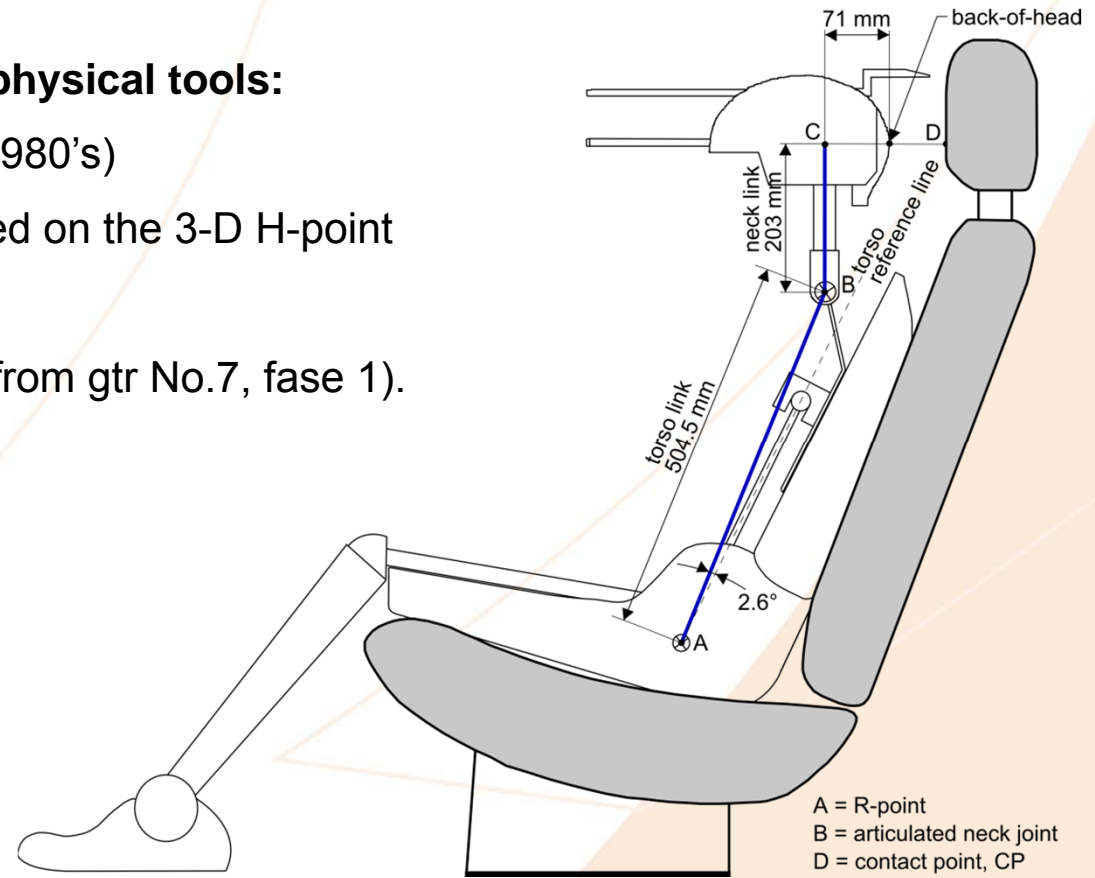


# Physical tools for positioning of back-of-head

**Combined in one picture two physical tools:**

(both for mid-sized male of the 1980's)

- the HRMD (from ICBC) mounted on the 3-D H-point machine,
- the Torso & Neck Link (known from gtr No.7, fase 1).



# Tools for positioning of back-of-head of people nowadays I

- The TNO study presented in Berlin (GTR7-04-03) made use of the posture from UMTRI-83-53-1 ( this study is used to create the HRMD) and combined this posture with the recent anthropometric database of CAESAR (**C**ivilian **A**merican and **E**uropean **S**urface **A**nthropometry **R**esource).
- The back-of-head of the 2004 NL large male is found to be 39 mm more rearwards than a mid-sized occupant (HRMD).
- Based on this the Torso & Neck Link (known from the gtr No.7 Phase 1) is supplemented with an upscaled version as follows:

	Torso & Neck Link, based on HRMD	Torso & Neck Link, based on large male (CAESAR NL 2004)
Torso link	504,5	593
Neck link	203	215
Head-overhang	71	76



# Tools for positioning of back-of-head of people nowadays II

- The original Torso & Neck Link together with the upscaled Torso & Neck Link can be expressed in goniometric formulas.
- With these formulas can be calculated the difference in back-of-head position between the mid-sized male (HRMD) and the nowadays large male (this difference is hereafter called “Distance x”).
- The design torso angle is the only parameter in the formulas. So the outcome of the calculations can also be expressed in a table (e.g. just like is done in Regulation No.125 on Forward Field of Vision of Drivers (Table IV)).
- Doing so, the measuring method for effective head restraint height does not need tools that are questionable.
- The so developed measuring method comprises the following 5 steps.





# Test procedure for effective head restraint height I

the Torso & Neck Link concept expressed in goniometric formulas

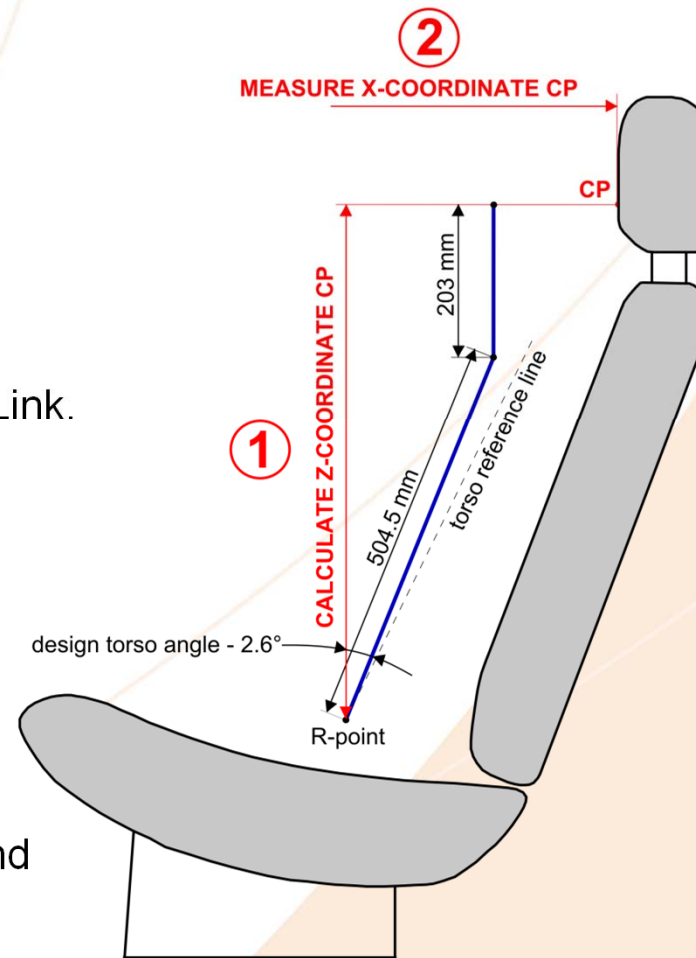
With head restraint set in mid-sized position,  
the measuring of Contact Point CP:

Available are:

- the coordinates of the R-point,
- the design torso angle, and
- the dimensions of the mid-sized Torso & Neck Link.

Needed actions:

- 1) calculate Z-coordinate CP =  
 $504.5 * \text{COS}(\text{design torso angle} - 2.6^\circ) + 203$   
(instead of calculation, a table will be provided),
- 2) mark this point on the head restraint surface and  
measure X-coordinate CP.



# Test procedure for effective head restraint height II

the Torso & Neck Link concept expressed in goniometric formulas

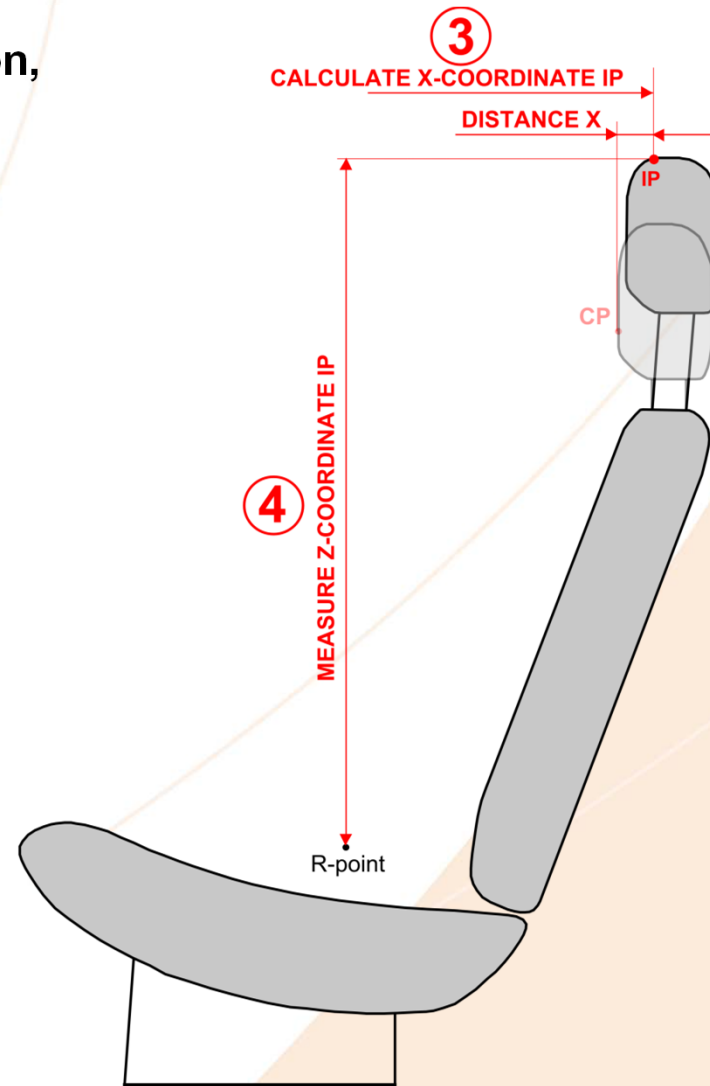
With head restraint set in its highest position,  
the measuring of Intersection Point IP:

Available are:

- the X-coordinate CP
- the table providing the “distance X” which depends of the design torso angle

Needed actions:

- 3) calculate X-coordinate IP =  
measured X-coordinate CP + “distance x”,
- 4) mark this point on the head restraint and  
measure Z-coordinate IP.



# Test procedure for effective head restraint height III

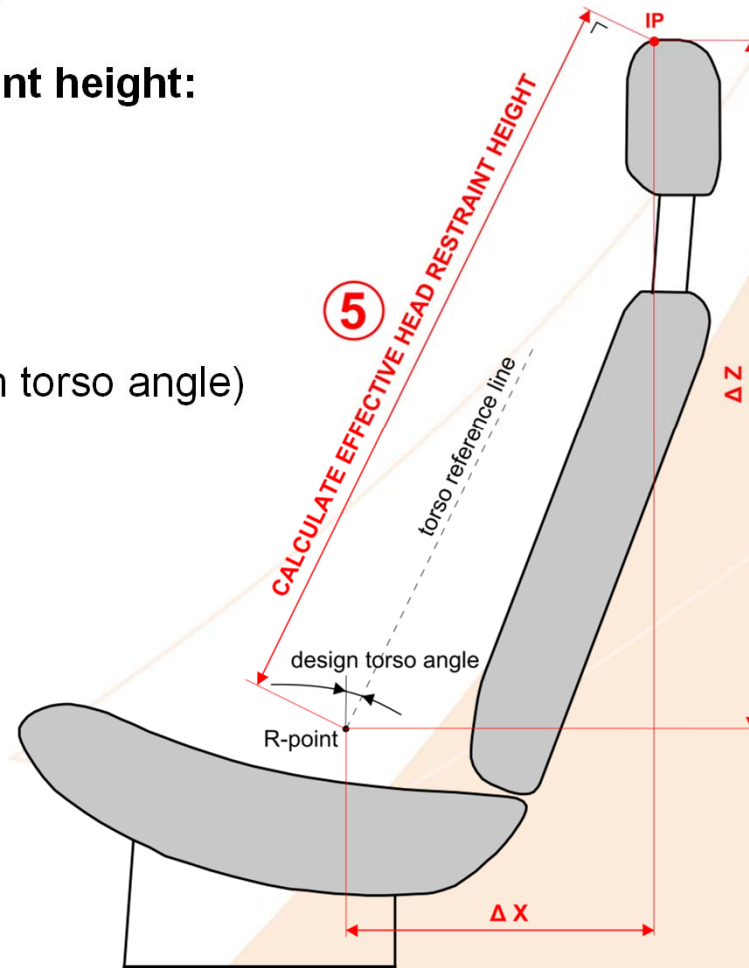
the Torso & Neck Link concept expressed in goniometric formulas

Calculation of the highest effective head restraint height:

Needed final action:

5) Calculate effective head restraint height =

$$\Delta X * \text{SIN}(\text{design torso angle}) + \Delta Z * \text{COS}(\text{design torso angle})$$



**Thank you for your attention**



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