RDW

An effective head restraint height

a brief sketch of the milestones towards

an improved test procedure

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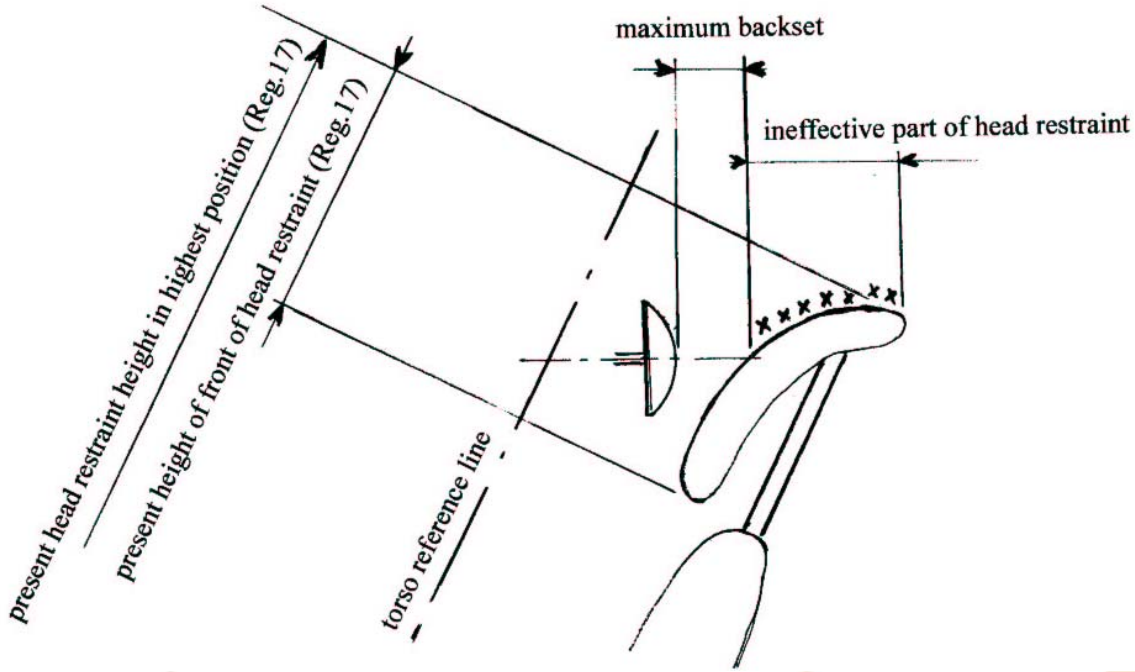
Concerns expressed in the rationale of gtr No.7



• 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.

Points of departure

• In order to prevent that head restraints for taller occupants (taller than the HRMD) offer ineffective height, the head position of different occupant sizes has been considered.

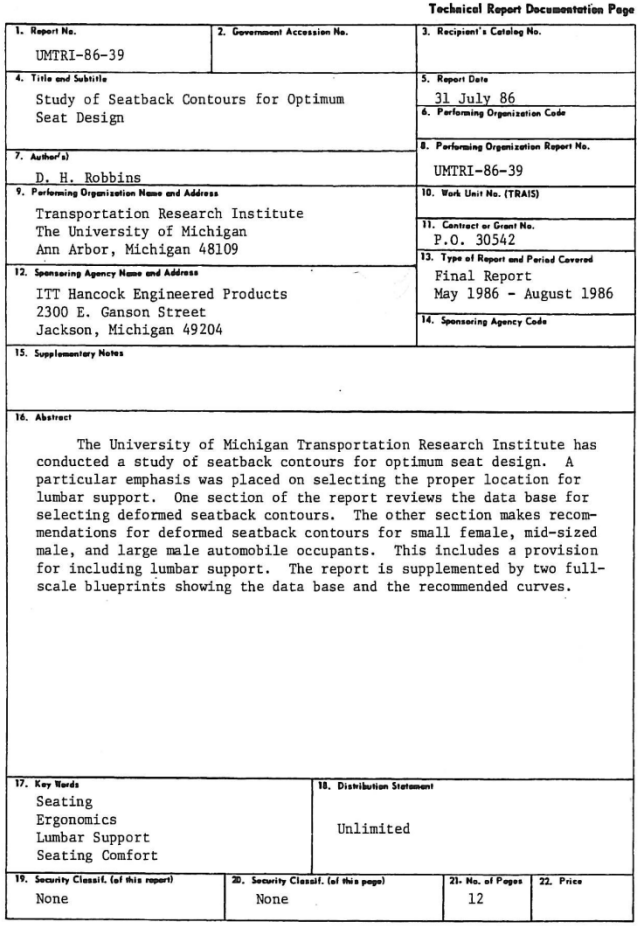
• For the HRMD the well known UMTRI mid-sized male served as model (UMTRI-83-53-1, Dec. 1983).

• Therefore this study and a related study have been considered first:

  • UMTRI-83-53-1, Dec. 1983 delivered anthropometric specifications for a small female, a mid-sized male and a large male, and these data were used for the constitution of an adult-dummy family and later also used for the HRMD.

  • UMTRI-86-39, Aug. 1986, that provided a graphic comparison of contours for occupants of the above mentioned sizes.

Position of back-of-head in the 1980's I



Technical Report Documentation Page

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16. Abstract

The University of Michigan Transportation Research Institute has conducted a study of seatback contours for optimum seat design. A particular emphasis was placed on selecting the proper location for lumbar support. One section of the report reviews the data base for selecting deformed seatback contours. The other section makes recommendations for deformed seatback contours for small female, mid-sized male, and large male automobile occupants. This includes a provision for including lumbar support. The report is supplemented by two full-scale blueprints showing the data base and the recommended curves.

17. Key Words	18. Distribution Statement
Seating Ergonomics Lumbar Support Seating Comfort	Unlimited

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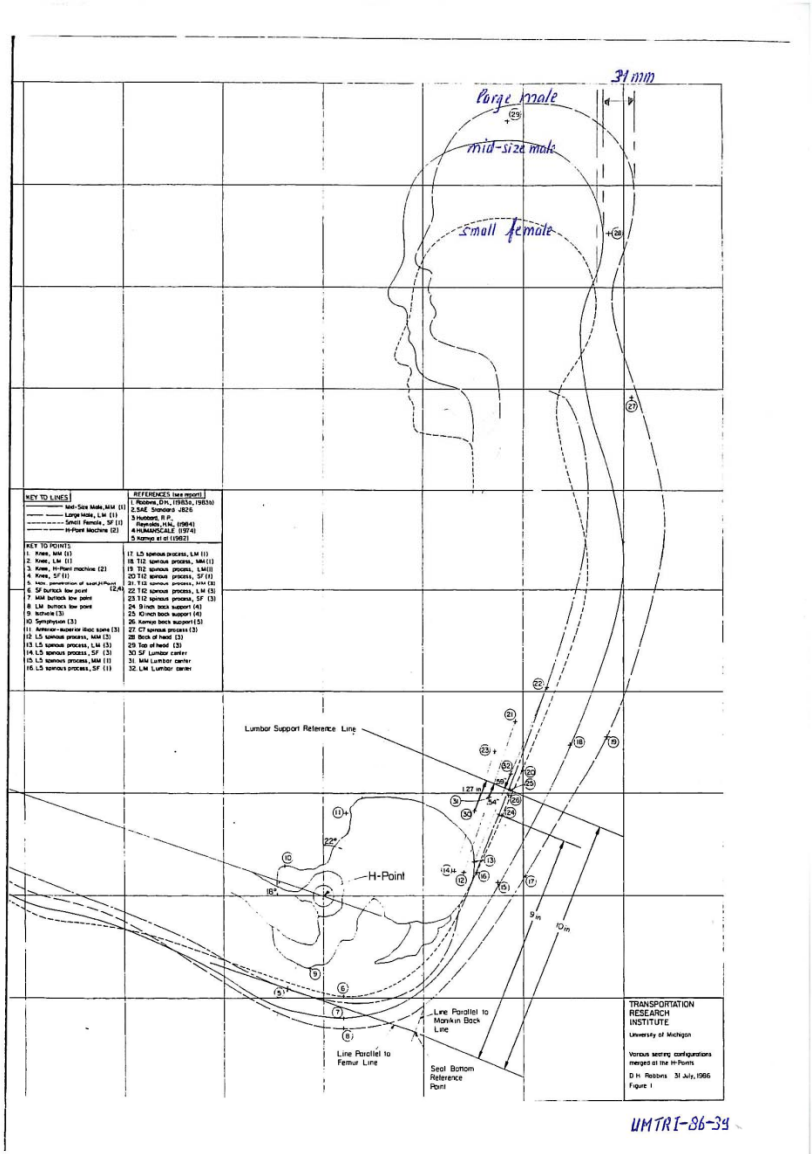
UMTRI-86-39, Aug. 1986

This study merged the H-points of the small female, mid-sized male and large male, all three known from UMTRI-83-53-1, Dec. 1983.

(http://deepblue.lib.umich.edu/)

Position of back-of-head in the 1980's II



Based on this UMTRI-86-39 study, the position of the back-of-head of the large male, compared to the mid-sized male, is found here on a "distance x" which is 31mm more rearwards.

However this result is reached with:

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

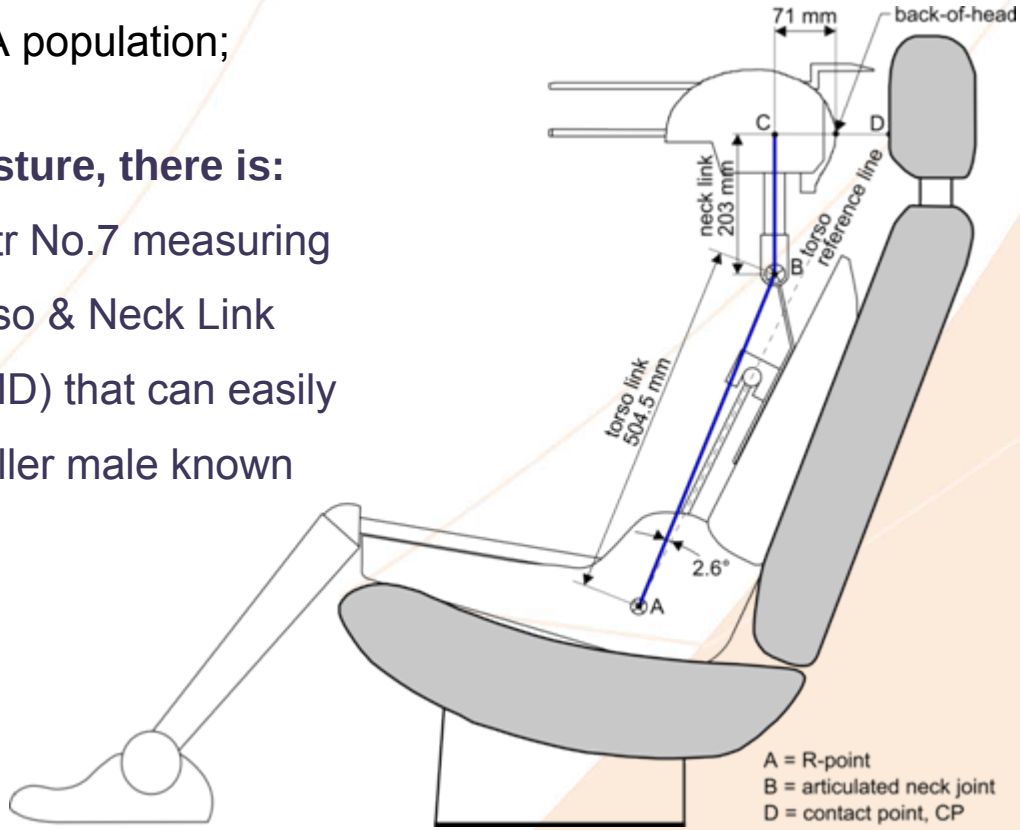
Position of back-of-head of people nowadays

With regard to research concerning nowadays' people, there is:

• the CAESAR (Civilian American and European Surface Anthropometry Resource) research (1998 -2000) resulted in an up-to-date database of the Dutch and USA population;

With regard to posture, there is:

• in particular the gtr No.7 measuring principle of the Torso & Neck Link (based on the HRMD) that can easily be upscaled to a taller male known from CAESAR.



Upscaling of the Torso & Neck Link I

• the TNO study GTR-04-03 took the males of the Netherlands' CAESAR 2004 database and put them in the slumped position known from the UMTRI mid-sized male (Berlin meeting of Sept. 21-22, 2010), and

• from this study the Netherlands' 95th % male has been used to create the upscaled Torso & Neck Link representing a nowadays large male (Caesar NL).

Upscaling of the Torso & Neck Link II

• the gtr no.7 Torso & Neck Link (shown in its Annex 5 and also slide 7) is now supplemented with an upscaled Torso & Neck Link as follows:

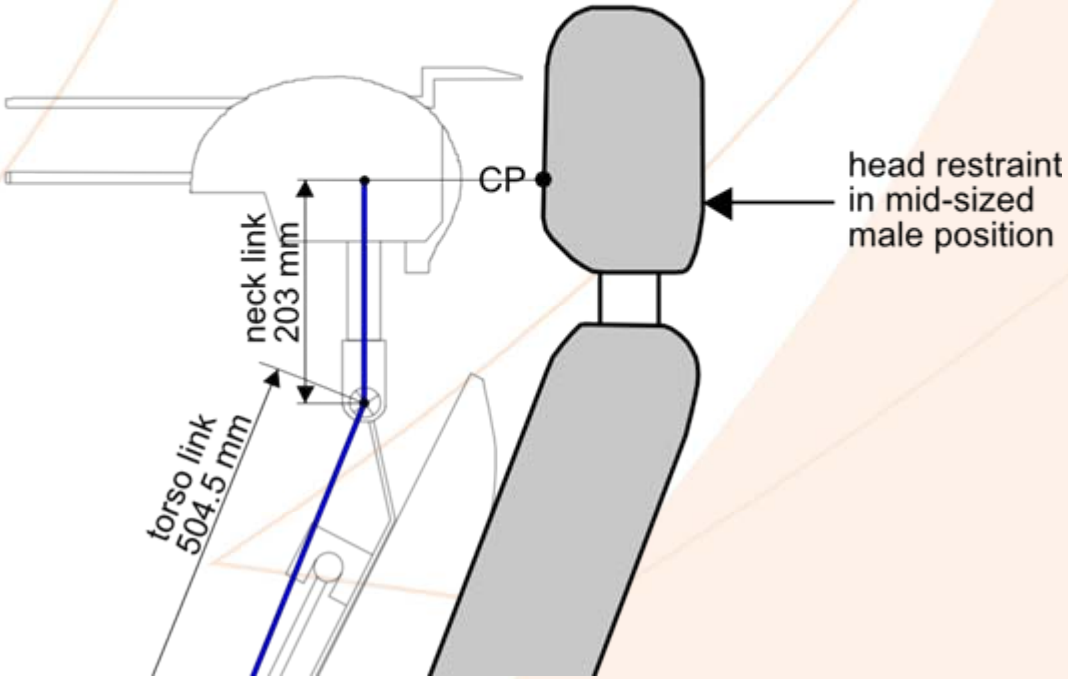
	Torso & Neck Link, based on HRMD	Torso & Neck Link, based on large male (CAESAR NL 2004)
Torso link	504,5	593
Neck link	203	215
Head-overhang	71	76

• based on this, the position of the back-of-head of the upscaled large male, compared to the mid-sized male as represented by the HRMD, is found on a “distance x” which is now 39 mm more rearwards (when measured at a design torso angle of 25 degrees).

Concept for measuring of effective head restraint height I

With the head restraint in its mid-position,

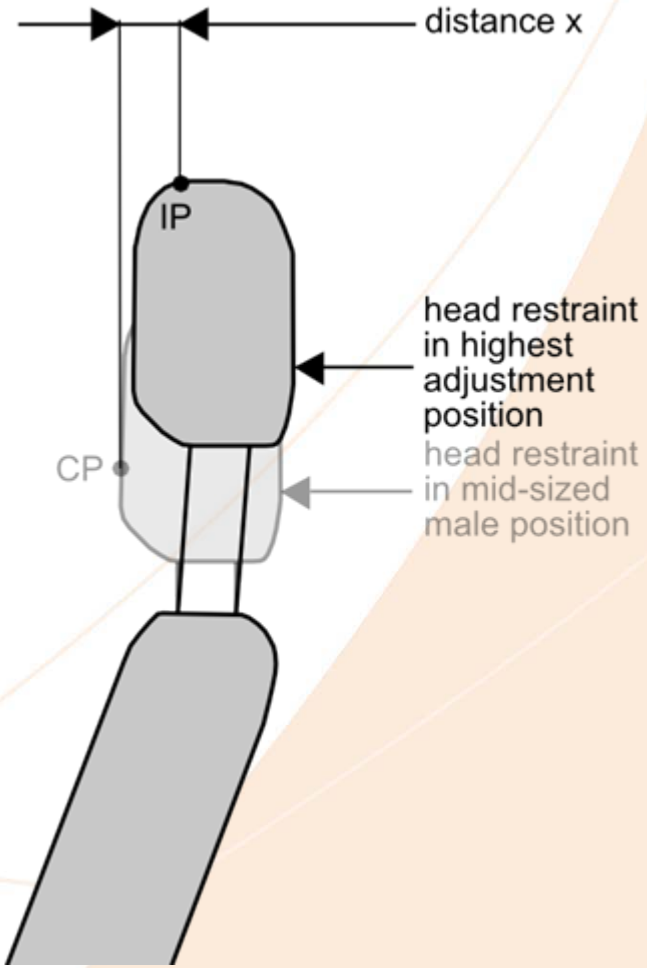
CP is the contact point from the horizontal line through the top of the Neck Link with the front surface of the head restraint (the top of the Neck Link is on the height of the centre-of-gravity of the HRMD).



Concept for measuring of effective head restraint height II

With the head restraint in its highest position,

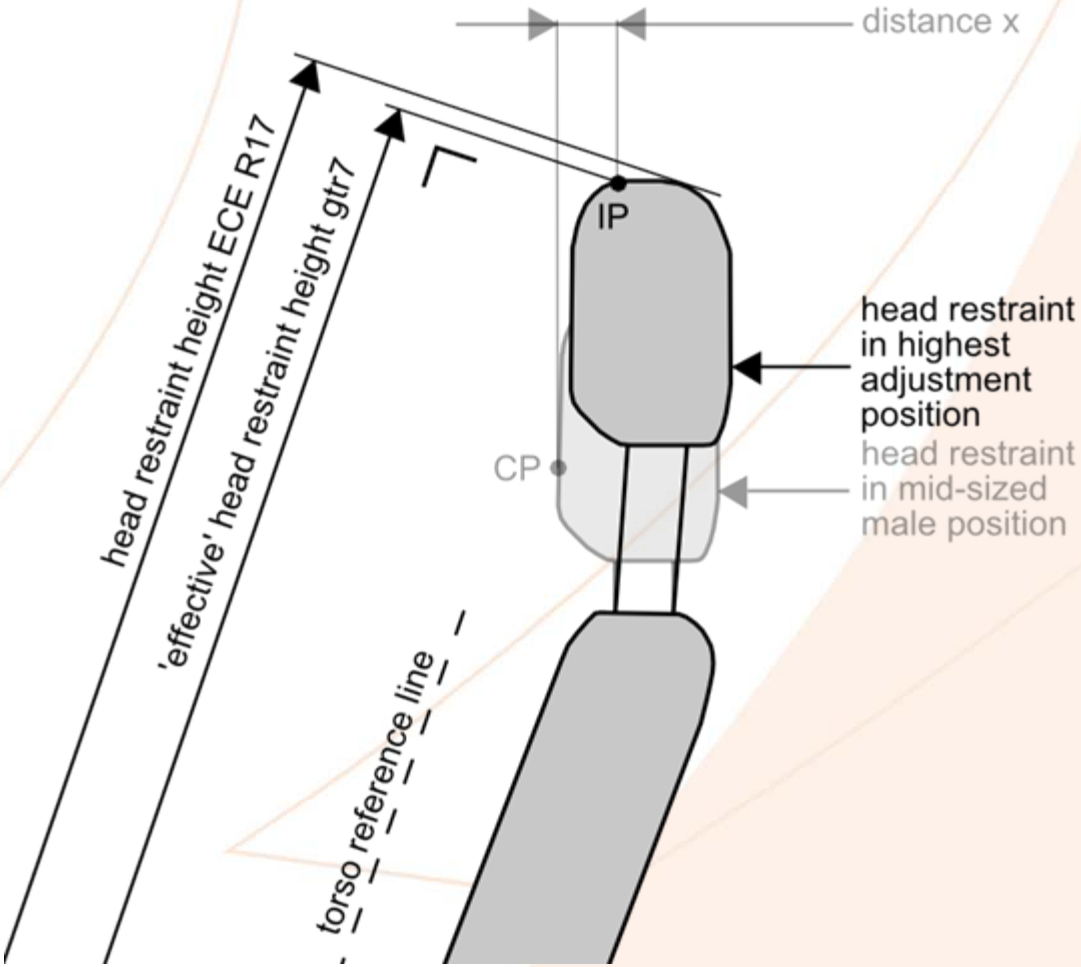
An intersection point IP is to be determined on the front surface of the head restraint on a “distance x” more rearwards
(this coincides with the more rearwards x-coordinate of the back-of-head of the large male).



Concept for measuring of effective head restraint height III

Finding the effective height,

the highest head restraint height will now be limited by the line perpendicular to the torso reference line and intersecting IP.



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,
- A design torso angle, and
- dimensions of a mid-sized Torso & Neck Link.

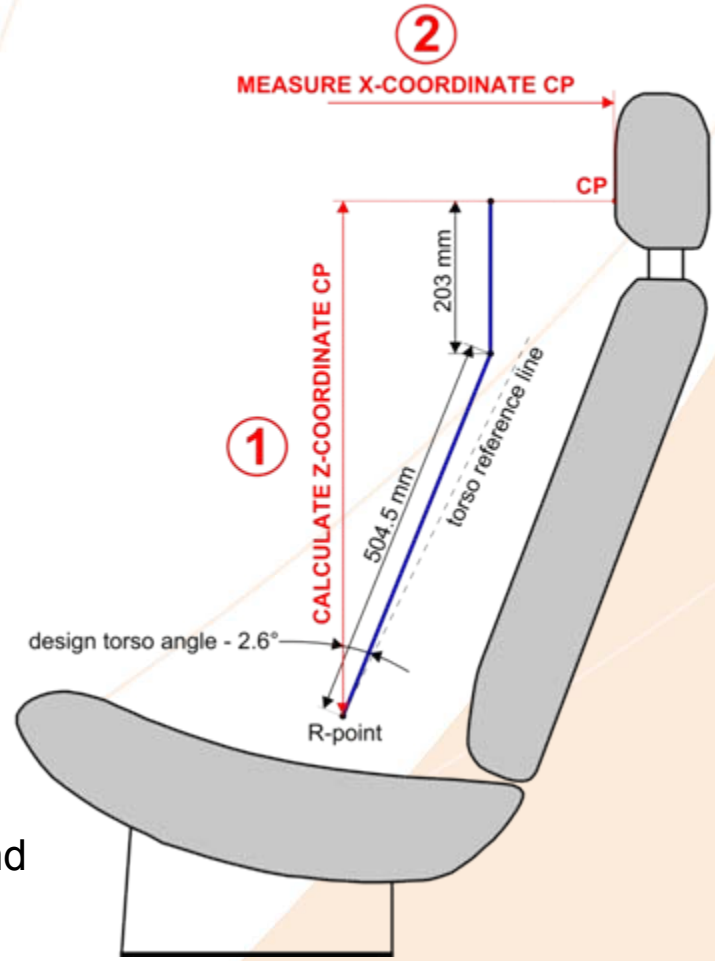
Needed actions:

1) calculate Z-coordinate CP =

504.5 * COS(design torso angle – 2.6º) + 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:

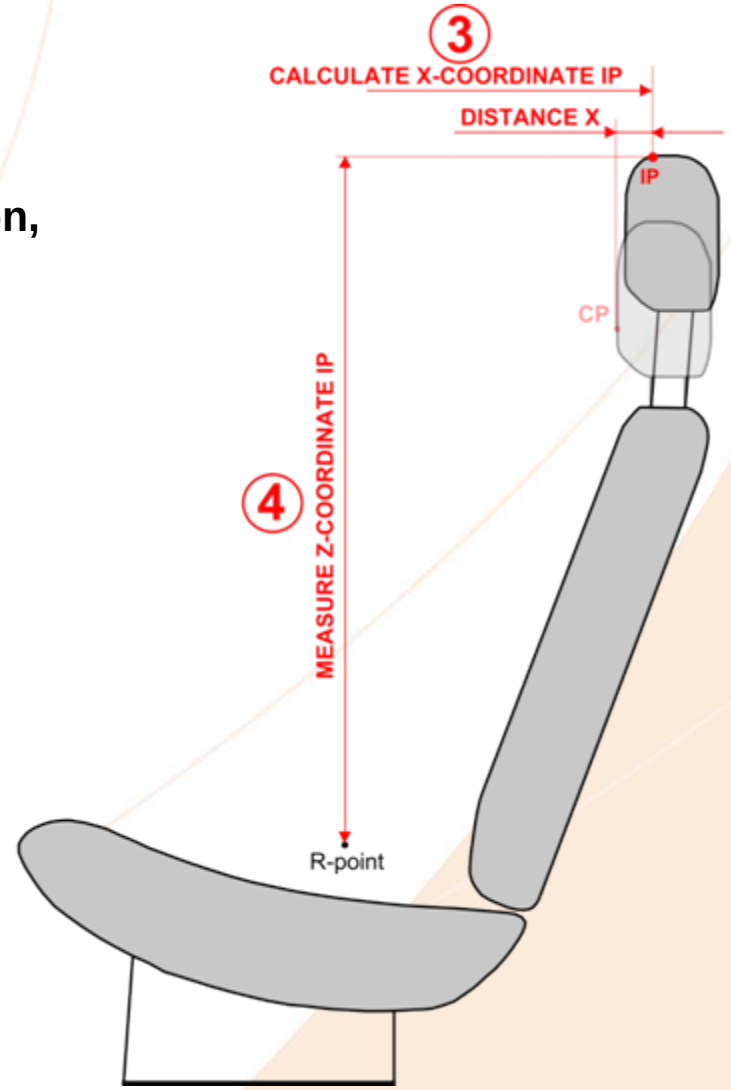
➢The table providing also “distance X”

Needed actions:

3) calculate X-coordinate IP =

Measured X-coordinate CP + “distance x”,

4) mark this point on the HR and measure Z-coordinate IP.



Test procedure for effective head restraint height III

the Torso & Neck Link concept expressed in goniometric formulas

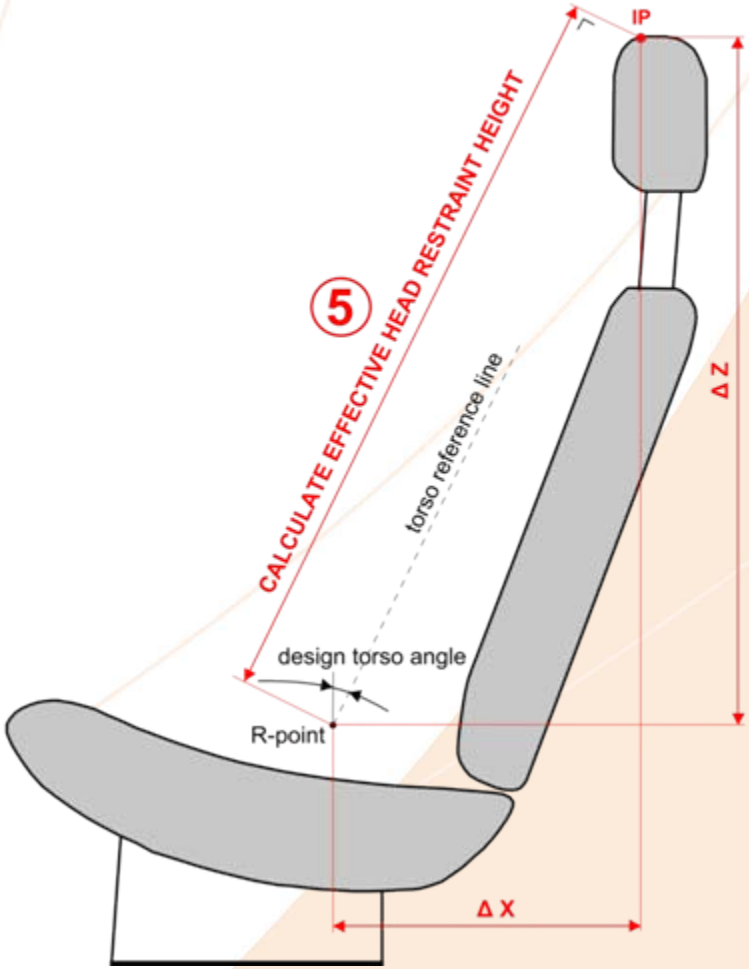
Calculation highest effective head restaint height:

Needed final action:

5) Calculate HR height =

Δ X * SIN(design torso angle) +

Δ Z * COS(design torso angle)



Thank you for your attendance