PROPOSAL for DRAFT AMENDMENTS to the FUTURE REG.17 on HEAD RESTRAINTS

Transmitted by the expert from the Netherlands

Note: The text reproduced below was prepared by the expert from the Netherlands in order to create a new definition for a Front Contact Surface.
For this purpose gained testing experience has been taken on board. This updated version of the protocol provides a simplified approach compared to the previous version, presented as HR-10-02.

ENCOUNTERED PROBLEM

The present definitions of minimum required head restraint height and minimum height of the front of a head restraint seem to be insufficient because certain head restraint shapes are such that a part of the head restraint will not properly function in limiting the rearward displacement of the seated occupant's head. This is clearly demonstrated by the section indicated with crosses on the head restraint in the figure below.
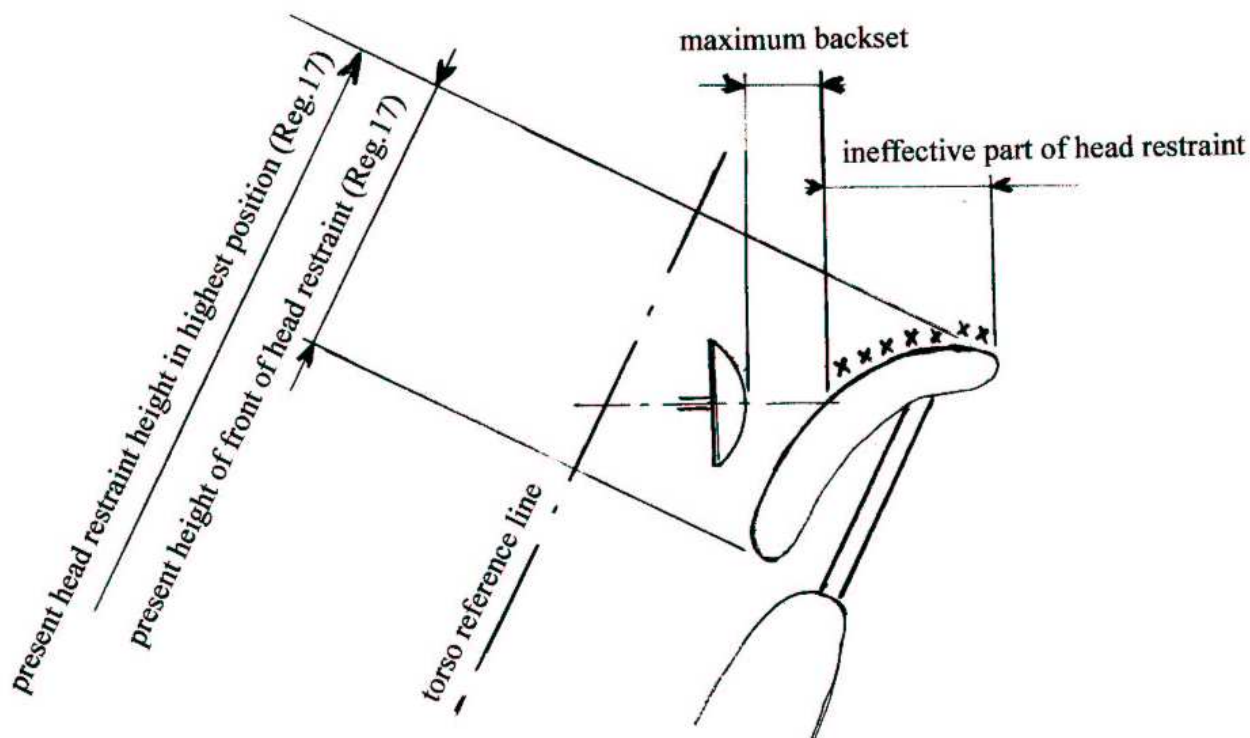

Figure – Demonstrating the ineffective part of head restraint

This problem can be solved in two steps, being:
Step 1:
Define a "Front Contact Surface" of a head restraint having minimum outer dimensions that are based on requirements for width and height that already exist (resp. 5.6.1. and 5.10. of Reg.17) .
Step2:
Define a "Centreline of the head restraint" that, where situated within the "Front Contact Surface", will have to fulfil the backset requirements.

This concept leads to the following proposal
(which is put in a framework that takes account of the Commission proposal to update Reg.17 being ECE/TRANS/WP.29/GRSP/2008/11)

PROPOSAL

in Definitions, add the following two new definitions:

2.x.   Front Contact Surface of a head restraint means the front surface of the head restraint which is intended to catch the head of the seated occupant in order to limit rearward displacement of the head relative to the torso during a rear impact to the vehicle.

2.x+1   Centreline of a head restraint means the trace of the centre plane of the occupant (paragraph 2.10. of Commission proposal ECE/TRANS/WP.29/GRSP/2008/11) over the front surface of the head restraint.

in Performance requirements, add requirements to these new definitions:

5.5.x.   Minimum area and location of a Front Contact Surface.
          When measured in accordance with Annex "New":
5.5.x.1   a Front Contact Surface shall have at least a minimum area with borders that coincide with the intersections of the following planes with the head restraint:
          -     two vertical longitudinal planes set at 85 mm on either side of the centreline of the head restraint,
          -     two planes perpendicular to the torso line, 100 mm apart.
5.5.x.2   the top border of the Front Contact Surface shall reach to at least the minimum required height above the R-point that counts for the designated seating position.
5.5.x.3   the centreline of the head restaint within the Front Contact Surface shall fulfil the backset requirements.

The so-called Annex "New" will replace Annex 1 (minimum height measurement test procedure), Annex 2 (minimum width measurement test procedure) and part of Annex 4 (this concerns the second part under No.3 "backset measurement using the R-point as backset reference point"; furthermore one could question whether Europe would need to adopt the first part (under No.2) of this Annex 4, being a backset measurement procedure using the 3-D H machine with the HRMD):

<div align="center">

Annex "New"
Test Procedure for Verifying the Front Contact Surface

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1.   Purpose. The procedure described in this Annex is used to verify whether the Front Contact Surface encloses the minimum area and is located as required in paragraph 5.1.6.
2.   Tools and use. For the measurements a CMM (Coordinate Measuring Machine) in combination with a probe simulating the back of the head is used. The probe is fixed in a portal construction such that it can be shifted horizontally (X-direction) and can be displaced vertically (Z-direction).
       The probe shall be positioned in the centre plane of the occupant and during determination of the X-coordinate of the head restraint surface a 10N force is applied to the probe to ensure that any trim covering material is in contact with the underlying foams, or that the separation of trim material will not provide artificially favourable measurements.
3.   Procedure. The seat shall be adjusted such that its H-point coincides with the R-point and the

seat back is set at the design seat back angle (if it is adjustable), taking into account the requirements of paragraph 4 of this Annex.

The head restraint shall be adjusted to the highest position of use. The head restraint shall, if adjustable in X-direction, be adjusted to the most rearward position.

3.1. The initial position of the probe that is derived from the UMTRI mid-sized male (report nr. UMTRI-83-53-1, can be calculated taking into account Annex "New" , Appendix 1.

3.2. The centre plane of the occupant in seating position shall be located and/or drawn on the head restraint; this will be considered as the centreline of the head restraint.

3.3. Establish on the centreline of the head restraint the minimum required height above the R-point that accounts for the designated seating position. This point must fulfil the backset requirements.

3.4. A plane through this established point, perpendicular to the torso reference line, shall be used to locate and/or draw the level of the top border of the front contact surface.

3.5. Two vertical longitudinal planes set at 85 mm on either side of the centreline of the head restraint shall be used to locate and/or draw the vertical borders of the Front Contact Surface.

3.6. A plane parallel to the one used to locate the upper border and situated 100 mm below that upper border measured along the torso reference line (see figure 12-1), shall be used to locate and/or draw the lower border of the Front Contact Surface.

3.7. The quadrangle determined following paragraphs 3.4. to 3.6. is the minimum area of the Front Contact Surface as required in paragraph 5.5.x. and must be able to support the seated occupant's head to limit rearward displacement.

3.8. Moreover, the part of the centreline within the minimum area of the Front Contact Surface has to fulfil the backset requirements as required in paragraph 5.5.x.3. This shall be checked by measuring the backset on all points that can be considered to result in a less good backset than the upper border of the Front Contact Surface.
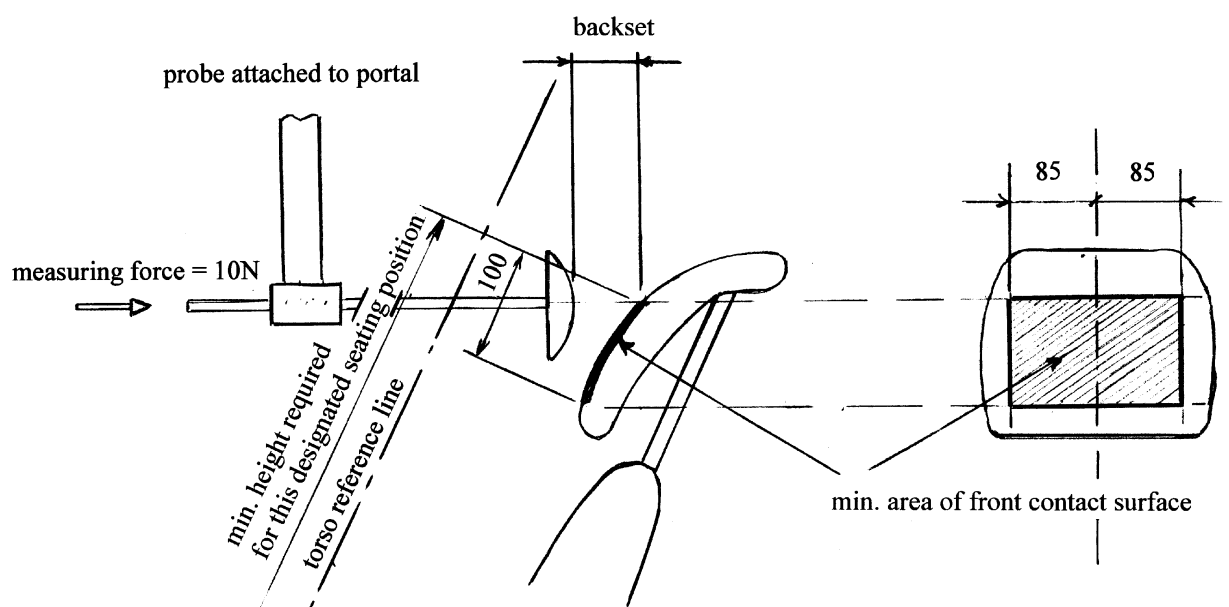

Figure 12-1:   Check of Front Contact Surface on minimum area and location

4. <u>Relationship between the H-point and the R-point</u> .

4.1. When the seat is positioned in accordance to the manufacturer's specifications, the H-point, as defined by its co-ordinates, shall lie within a square of 50 mm side length with horizontal and vertical sides whose diagonals intersect at the R-point, and the actual torso angle shall be within 2.5 degree of the design torso angle.

4.2 If these conditions are met, the R-point and the design torso angle shall be used to demonstrate compliance with the provisions of this Annex.

4.3. If the H-point or the actual torso angle does not satisfy the requirements of paragraph 4.1., the H-point and the actual torso angle shall be determined twice more (three times in all). If the results of two of these three operations satisfy the requirements, the conditions of paragraph 4.2. shall apply.

4.4. If the results of at least two of the three operations described in paragraph 4.1. do not satisfy the requirements of paragraph 4., or if the verification cannot take place because the vehicle manufacturer has failed to supply information regarding the position of the R-point or regarding the design torso angle, the centroid of the three measured points or the average of the three measured angles shall be used and be regarded as applicable in all cases where the R-point or the design torso angle is referred to in this Annex.

Annex "New" – Appendix 1

RELATIONSHIP BETWEEN PORTAL APPARATUS EQUIPPED WITH A PROBE AND 3-D H MACHINE EQUIPPED WITH A HRMD-PROBE AND THE UMTRI MID-SIZED MALE

The HRMD-probe mounted on the 3-D H machine is the simulation of the back of the occupant's head (see figure 12-2 below).
This initial position of the HRMD-probe is derived from the UMTRI mid-sized male (report nr. UMTRI-83-53-1, Dec.'83, see figure 12-3 on next page).
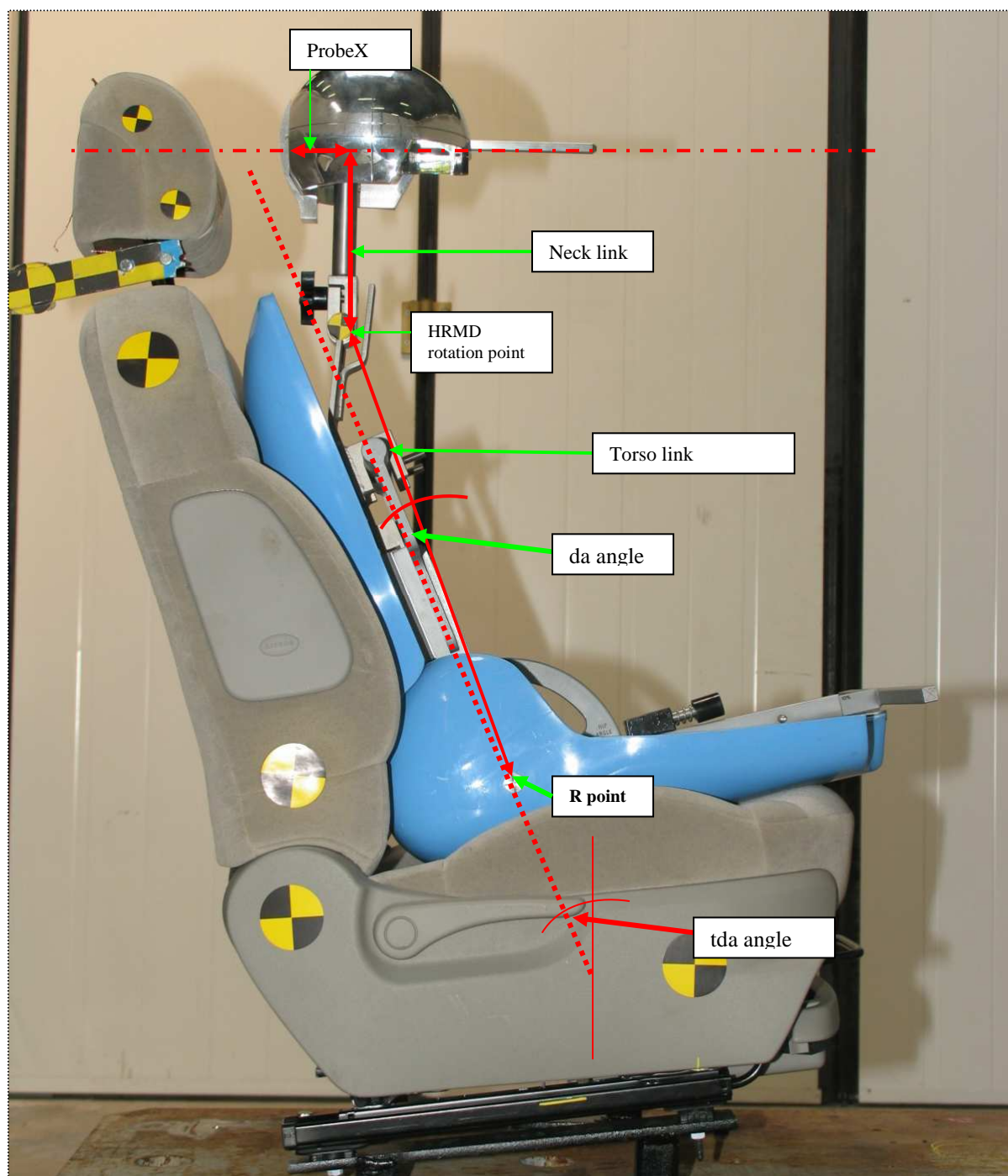

Figure 12-2 HRMD-probe on 3-D H machine with further explanation
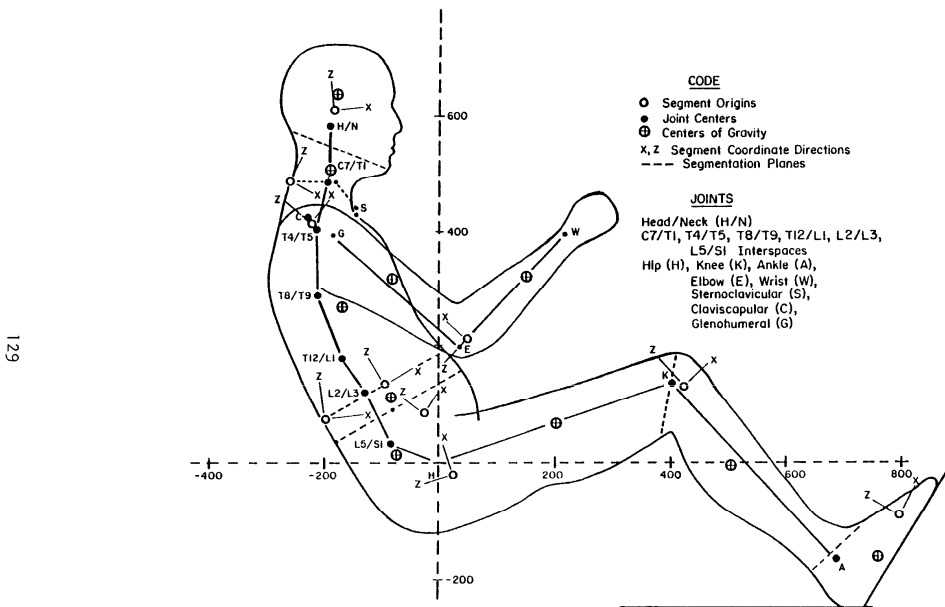
Figure 12-3 UMTRI mid-sized male

FIGURE 5-1. Anthropometric specifications for mid-sized male dummy.

This same initial position of the HRMD-probe (or a semi-spherical headform probe 165 mm in diameter, which is a better representation of the human head) can also be reached by means of a portal construction equiped with this probe.
The advantage is that non-biofidelic interaction caused by the 3-D H machine is excluded.

Figure 12-4 below shows the still the HRMD-probe in a portal construction; coordinates will be checked by means of a Coordinate measuring machine.

So, the spherical side of the probe in its initial position simulates the back of the head of the UMTRI mid-size male sitting in an automotive posture. This initial position (which is called backset reference point in the earlier mentioned Commission proposal) will be calculated, its initial X-coordinate is dependent upon the design angle of the seat (see below).

The difference between the probe in its initial position and the measured position with the probe shifted against the head restraint will give the backset.

<u>Calculation of the X-coordinate of spherical side of the probe in its initial position:</u>

Constant values:
Torso Link length   = 504.5 mm, is the connecting link between R-point and HRMD-point
Neck Link length   = 203 mm, is the vertical link between HRMD-point and centre of head
da angle   = 2.6 degrees, is the angle between Torso Link and design torso line
Backset reference point= 71 mm further away from point R than the X-coordinate of the neck link (neck link is always vertical)

Values depending of manufacturer's specifications:
R-point   = accepted from manufacturer taking account of paragraph 4 of Annex "New"
tda angle   = design torso angle accepted from manufacturer taking account of paragraph 4 of Annex "New"

Formula for X-coordinate of spherical side of the probe in its initial position:

$$X\ coordinate = 504.5 * \left| SIN\ (torso\ design\ angle - 2.6) \right| + 71$$