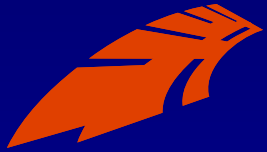


Status report

Head Restraints - Static Height Requirements

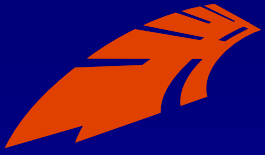
Hans Ammerlaan

3rd meeting of IWG gtr No.7 Phase2



Contents

- Main conclusions from presentation GTR7-02-015
- NL proposal GTR7-01-03 and reactions
- NL study by TNO – set up
- NL study by TNO - outcome
- Rear of head in dependence of the occupant's height
- Conclusions

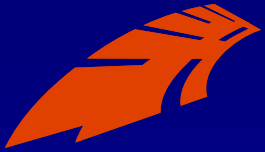


Main conclusions from presentation

GTR7-02-015

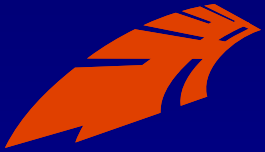
I

- The present UNECE Reg.17 static height measurement method (which is also in GTR-7) simply measures this height to the top of the head restraint, without relating this measurement to the fact whether this height is too far backwards or not.
- The backset (proposal GTR-7) is only measured at a single height, derived from UMTRI-1983 mid-sized male. However this corresponds now to the NL 2004 20th % male and the USA 2000 35th % male (CAESAR study).
- The option of using the 3-D-H machine equipped with the HRMD-probe (derived from the UMTRI mid-sized male) causes difficulties.



Main conclusions from presentation GTR7-02-015 II

- Therefore the NL doc. GTR7-01-03 initially proposed to link the following three measurements:
 - the measurement of head restraint height (above the R-point)
 - the measurement of backset
 - the measurement of the height of the front contact surface of the head restraint (measured on the median longitudinal plane) in order to provide an appropriate catching zone



NL presentation GTR7-01-03 and reactions

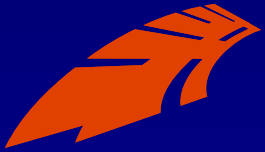
I

NL received on GTR7-01-03 the following OICA comment:

OICA comment:

- How is the height adjustment of the HRMD head done? Only in vertical (Z) direction? Or parallel to the torso line? When moved only in vertical direction, the backset will increase more than in reality for a taller occupant. A taller occupant has a longer torso, which is longer parallel to the torso line. On the other hand the head also will be horizontal.

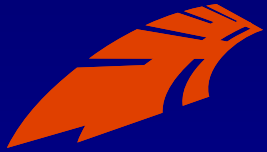
Detailed definition of the HRMD position in dependence of the occupant's height is needed.



NL presentation GTR7-01-03 and reactions II

NL reaction on previous OICA comment:

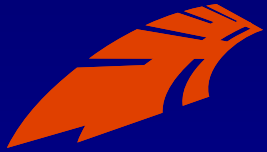
- A more detailed definition of the HRMD position in dependence of the occupant's height should be taken on board.
- Therefore the department Human Factors of TNO was asked to provide data of the head in automotive posture of the NL 5th % male up to the 95th % male using the anthropometric CAESAR 2004 data.



NL study by TNO set up I

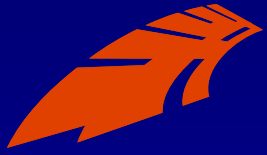
Work approach:

- Three different human head and neck positions were measured using DELMIA software (version 5.19, Dassault Systèmes), namely:
 - the back of the head (BH),
 - centre of gravity (COG) of the head, and
 - the position between the cervical 7 spine (C7) and the thoracic 1 spine (T1) were measured.



NL study by TNO – set up II

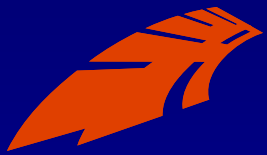
- The male manikins were created using the Netherlands' anthropometric CAESAR 2004 database. The positions were determined for the 1st, 5th, 10th, 20th, 25th, 30th, 40th, 50th, 60th, 70th, 75th, 80th, 90th, 95th and 99th percentile.



NL study by TNO - set up III

All the manikins were created and positioned as follows:

- 1. The model was positioned on to the H-point (HRP) used as referential origin;
- 2. Adjusting body length percentile;
- 3. Adjusting bodyweight percentile;
- 4. Adjusting sitting height percentile (figure 1);
- 5. Adjusting distance from Menton to top of head percentile (figure 2) (to adjust face length);



NL study by TNO – set up IV

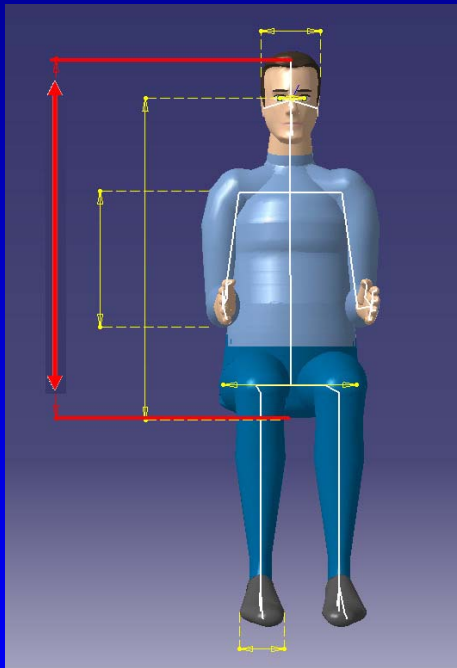


Figure 1 Sitting height

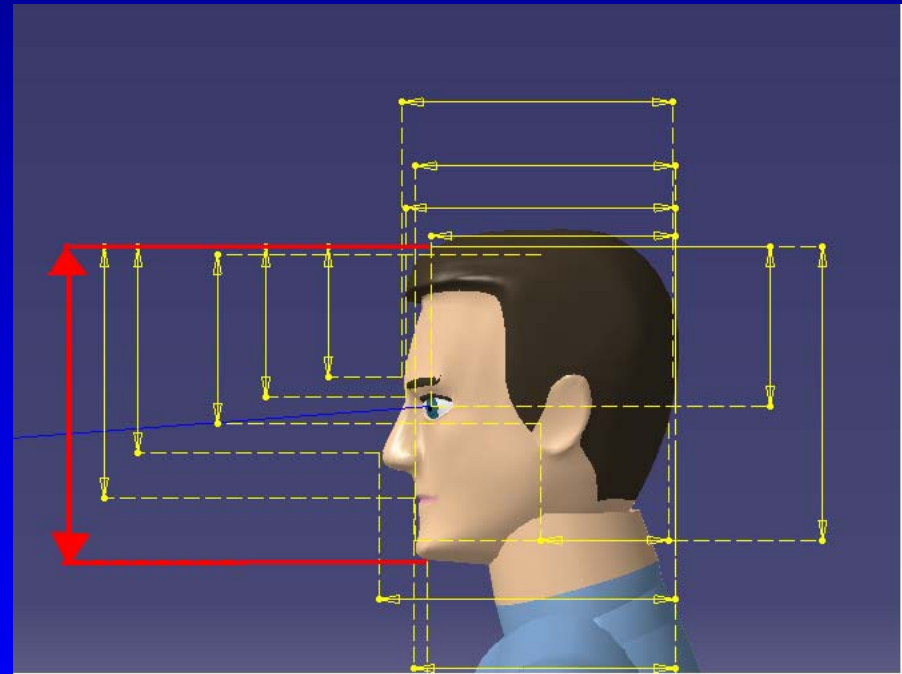
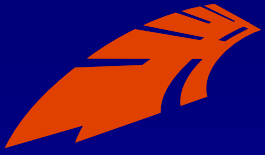


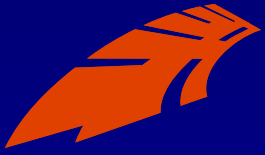
Figure 2 Menton to top of head



NL study by TNO - set up

V

- 6. Adjusting backseat angle to 25 degrees (reference to vertical axis);
- 7. Slumped position on base of the UMTRI model;
- 8. Adjusting line of sight to 5-10 degree (reference to horizontal axis). Resulting in the body position as shown in figure 3.

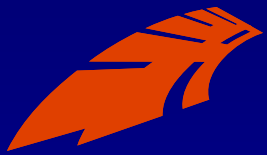


NL study by TNO - set up VI

- Back of the head (BH) is a static anthropometrical point, which corresponds with the landmarks used in DELMIA.
- COG is calculated, proceeding from the top of the head (using formula B from document HR-03-06 (see blow)).

$$HRPtoCOG \%ile = ErectSittingHeight \%ile - 93 \left(\frac{FaceLength}{FaceLengthUMTRI} \right) - 67 \left(\frac{SittingHeight}{SittingHeightUMTRI} \right)$$

- The positions of COG, BH and C7-T1 are clarified in figure 4.



NL study by TNO – set up VII

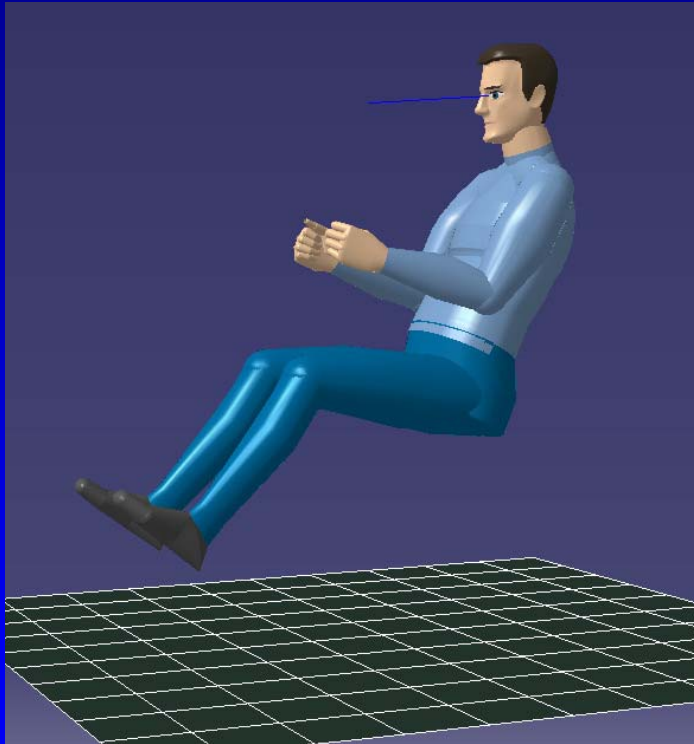


Figure 3 Resulting body position

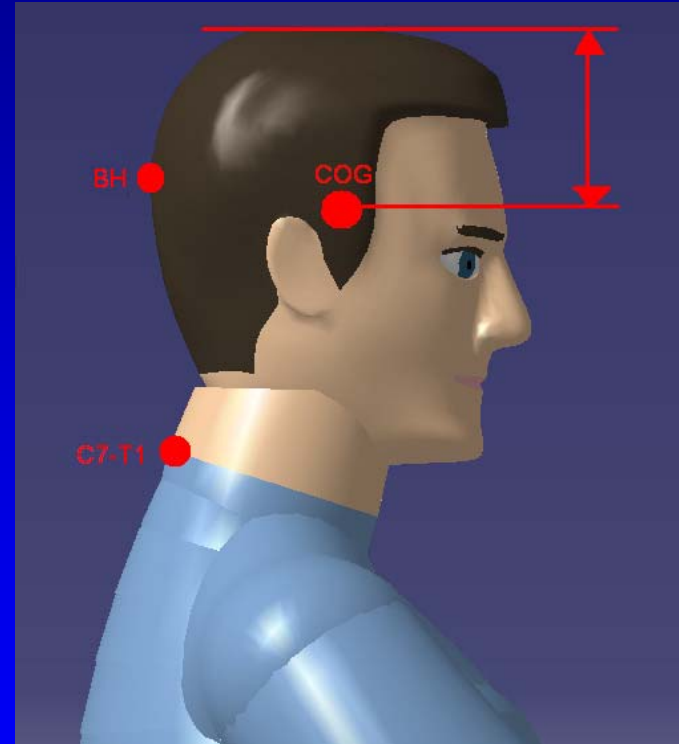
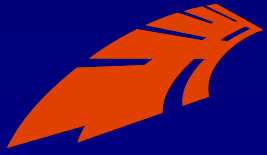


Figure 4 Projection BH /COG /C7 T1

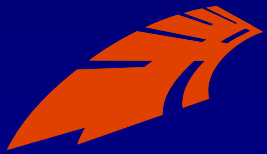


NL study by TNO - outcome

Accompanying remarks with measurements data in next table.

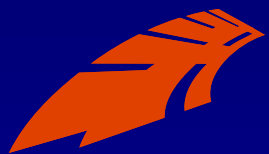
It is elementary to use the data with a certain error margin. The error margin indicates that persons do not assume the same seated position on repeated occasions and consequently there are always slight differences in measurement results e.g. different joint angles.

The expected error margin was considered as +/- 7 mm (Oudenhuijzen et al., 2010: On the creation of 3D libraries for F-16 pilots in their crew station: Method development, library creation and validation, TNO Report P001)



NL study by TNO - outcome

	25° SBA		2004 NL male from CAESAR database in automotive posture			
					1	1
	Back head		COG		C7/TH1 (spine)	
	x	z	x	z	x	z
p1	-227	623	-128	575	-226	507
p5	-248	640	-137	605	-238	528
p10	-261	665	-153	633	-247	556
p20	-262	675	-156	642	-249	561
p25	-267	681	-157	647	-253	567
p30	-269	690	-159	656	-254	574
p40	-273	707	-164	673	-259	590
p50	-278	719	-167	684	-263	604
p60	-283	725	-172	696	-267	615
p70	-277	752	-175	709	-271	627
p75	-288	752	-176	716	-273	633
p80	-289	760	-179	739	-277	651
p90	-297	782	-185	746	-284	656
p95	-302	801	-189	763	-290	670
p99	-316	841	-199	802	-303	710



Defining rear of head at the height of its COG

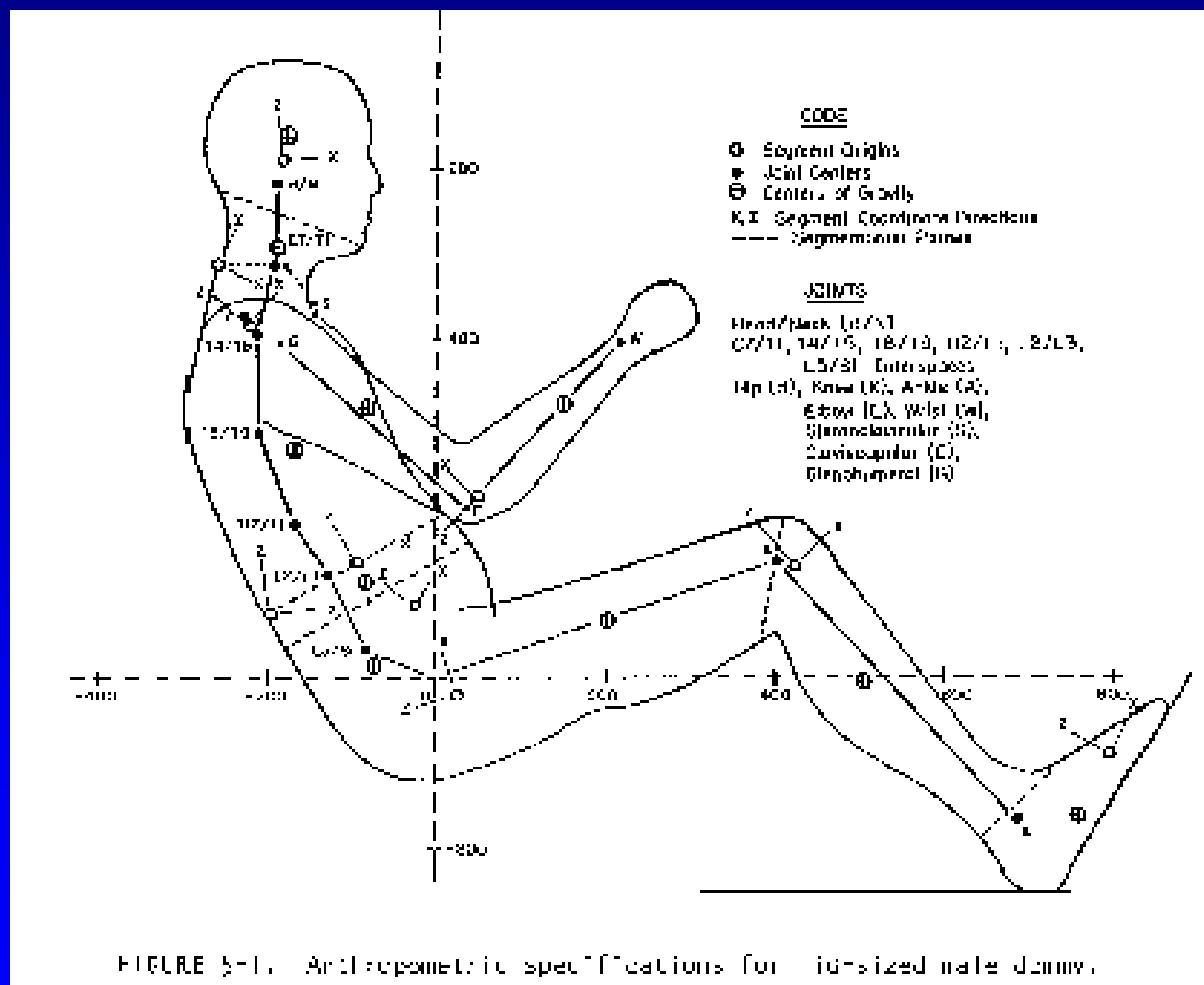
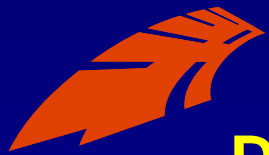
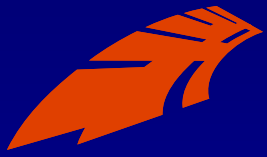


FIGURE 5-1. Anthropometric specifications for 50th-sized male dummy.

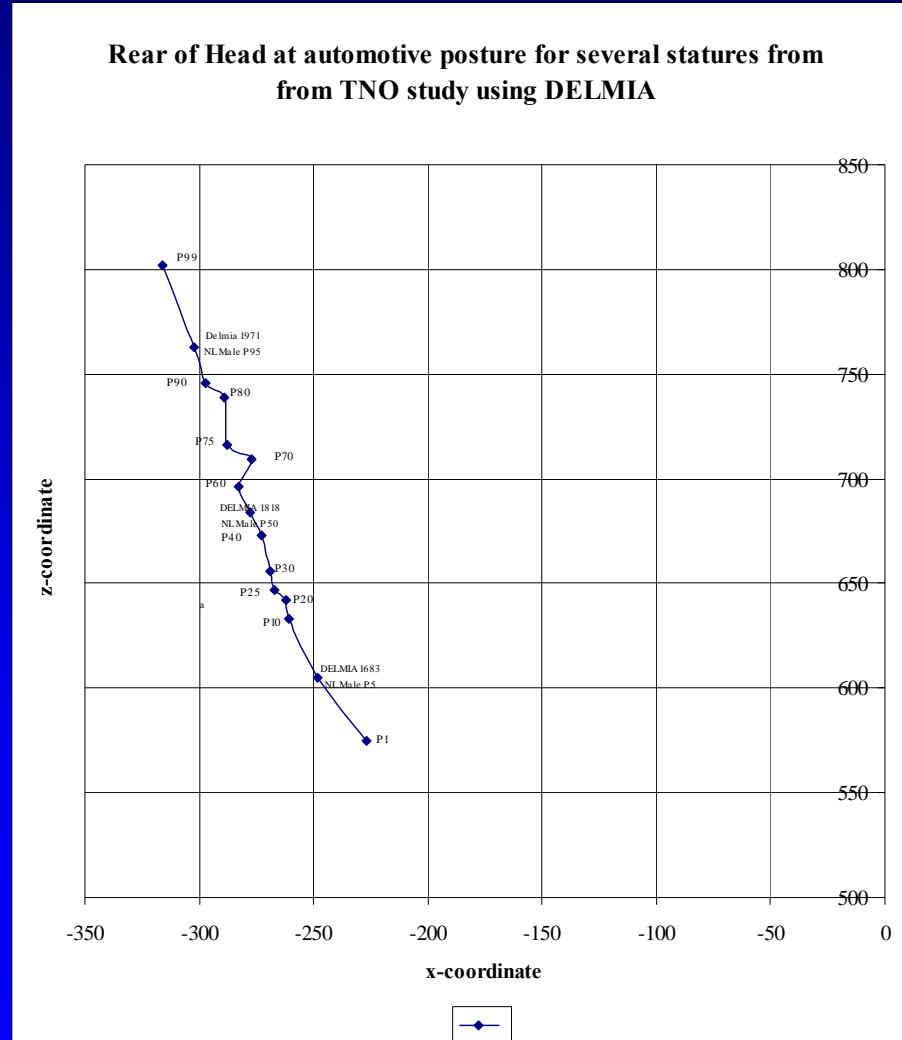


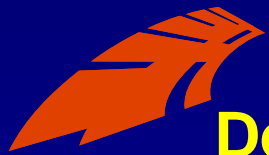
Defining rear of NL head at the height of its COG

2004 NL male from CAESAR in automotive posture	Stature (mm)	X-coordinate of rear of head (mm)	Z-coordinate of rear of head at the height of its COG (mm)
p1 Delmia (version 5.19)		-227	575
p5 Delmia (version 5.19)	1683	-248	605
p10 Delmia (version 5.19)		-261	633
p20 Delmia (version 5.19)		-262	642
p25 Delmia (version 5.19)		-267	647
p30 Delmia (version 5.19)		-269	656
p40 Delmia (version 5.19)		-273	673
p50 Delmia (version 5.19)	1818	-278	684
p60 Delmia (version 5.19)		-283	696
p70 Delmia (version 5.19)		-277	709
p75 Delmia (version 5.19)		-288	716
p80 Delmia (version 5.19)		-289	739
p90 Delmia (version 5.19)		-297	746
p95 Delmia (version 5.19)	1971	-302	763
p99Delmia (version 5.19)		-316	802



Rear of head for NL male P1 up to P99



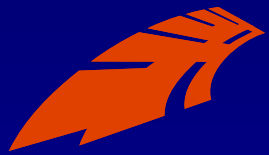


Defining rear of heads from other data sets

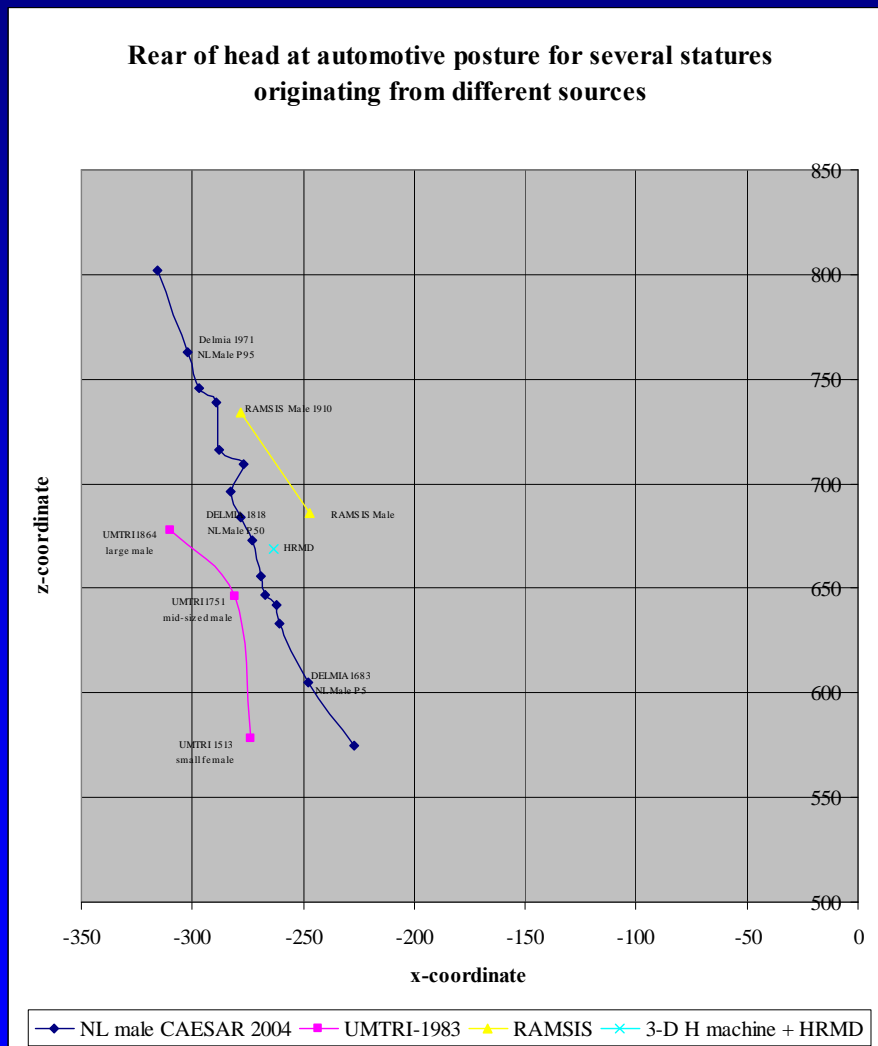
The UMTRI values for the small female, mid-sized male and large male originate from report UMTRI-83-53-1 (Dec 1983)

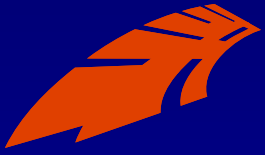
- Table 5.9 on page 160 provides centres of gravity
- Appendix I, page I-2,I-10 and I-18 provide anthropometric statistics
- The UMTRI drawings provide a mix of the previous two

Human in Automotive Posture at 25° SBA unless indicated	Stature (mm)	X-coordinate of rear of head (mm)	Z-coordinate of rear of head at the height of its COG (mm)
UMTRI-1983			
UMTRI-1983 small female	1513	-273,5	578
UMTRI-1983 mid-sized male	1751	-280,5	646
UMTRI-1983 large male	1864	-310	678
RAMSIS			
RAMSIS 50th male (24°)	1790	-247	686
RAMSIS 95th male (24°)	1910	-278	734
3-DH machine + HRMD (GTR-7)		-263	669



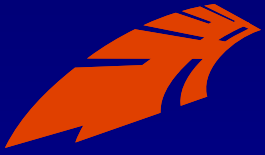
Rear of head – several data sets together





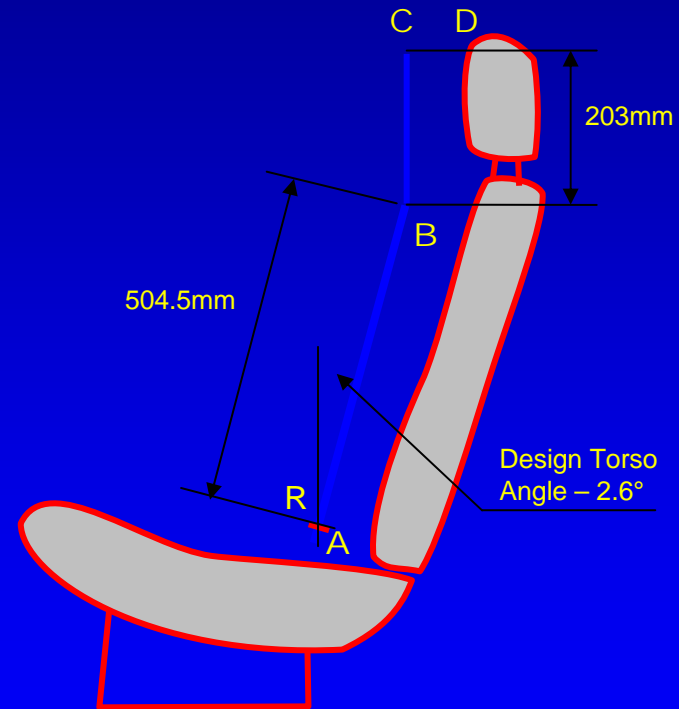
First conclusions

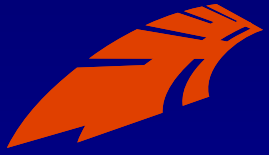
- As OICA requested now information is available offering more “Detailed definition of the HRMD position in dependence of the occupant’s height”
- From this study can be concluded (comparing coordinates, -263/669 with -302/763) that the NL 95th % male will be 39 mm more rearward and also 94 mm higher than the HRMD position (both in automotive posture, seat back angle of 25 degrees); this could be used as guidance
- Effects of spine straightening and ramping up are not on board, so the height item should be handled with caution



First conclusions

- Getting the outcome of this study settled into the originally proposed measuring method GTR7-01-03 could lead to a complicated method
- However an adaptation of the measuring method proposed in GTR-7 (see figure) such that the NL 95th % can be measured is not considered complicated.
- The Netherlands is still reviewing its original proposal





Thank you