GTR HR

Head positions, summary of UMTRI study & vehicle examples

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Anthropometry basis of UMTRI study

- Mean male/female head size:

- Basis: ANSUR data (US 1989)
Anthropometry basis of UMTRI study

- Eye ellipses of occupants in seats with fixed seat back angle

- Basis: posture study (up to 120 drivers in 22 vehicles) & NHANES III (US) anthropometry

- NHANES III: male stature (5th: 1636, 50th: 1755, 95th: 1880mm)
  female stature (5th: 1504, 50th: 1618, 95th: 1730mm)

The position of the eye ellipse is varying with a change of the torso angle, but the form remains identical.
Anthropometry basis of UMTRI study

- Combining eye ellipse & mean head size = ellipse of back of head (occiput)

Eye ellipse is only translated and head size variations are not taken into account in UMTRI model.

According UMTRI:
Standard deviation of forehead after driver head position is 35.3mm & male head length is 7mm & correlation between stature & head length is 0.35

95th cut-off ellipse
Anthropometry basis of UMTRI study

- Superposition with HRMD at 25° fixed torso angle

A backset of 50mm in respect to HRMD will slightly cut the back-of-head ellipse

HRMD pivot point when installed on SAE mannequin
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Vehicle influence

minimal Field of vision

Steering wheel

Seat adjustments

Pedals

Roof

Upper limit

Lower limit

Upper limit

Lower limit

Technical perfection, automotive passion.
Exemple of typical postures:

Smaller persons use mainly steeper torso angles to assure sufficient visibility.
Anthropometry basis of UMTRI study

- In reality every occupant adjusts its torso angle and the percentage of occupants which are in interference with the head restraint depends on the mean driver selected seat back angle:

This curves have been calculated with a 50mm backset at 25° torso angle.
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Conclusions

Need to enlarge requested backset of 55mm to accommodate persons in vehicles where the design torso angle is smaller than 25°.

References: MODELING VEHICLE OCCUPANT HEAD AND HEAD RESTRAINT POSITIONS, UMTRI, M.P. Reed et al., 2001