

Head Restraint Static Height Requirements

6th GTR Head Restraint Informal Working Group

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19-21 April 2006

Contents

- UK population stature 1993-2003;
- UK anthropometric data;
- UK calculations of required head restraint height; and
- Conclusions

UK population stature 1993-2003

Stature of UK population - 1

- Data from the “Health Survey for England 2003”, published on 17th Dec 2004 by Department of Health;
- Key trends ...
 - There was a significant increase in men's mean height between the year 2000 and 2002, but no systematic change in mean height over the whole period.
 - There was no systematic variation in mean height among women between 1993 and 2003.
 - There was no marked pattern of height variation for men and women in any age band.

Stature of UK population - 2

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Year	MEN		AGE						
	Mean	SE	16-24	25-34	35-44	45-54	55-64	65-74	75+
1993	174.4	0.08	176.6	176.4	175.9	174.5	173.1	170.5	168.6
1994	174.6	0.09	176.6	176.7	176.2	174.8	173.1	170.9	168.7
1995	174.5	0.09	176.8	176.6	175.8	174.7	173.2	170.9	168.2
1996	174.4	0.09	176.3	176.6	175.7	174.4	173.2	170.9	168.0
1997	174.5	0.12	176.7	176.4	175.8	174.7	172.9	170.9	168.5
1998	174.4	0.09	176.6	176.6	175.6	174.8	173.1	171.2	168.4
1999	174.4	0.13	176.8	177.0	175.1	174.6	173.2	171.3	168.8
2000	174.4	0.13	176.4	176.9	175.8	174.3	173.0	171.4	168.2
2001	174.6	0.09	176.9	176.7	176.2	174.9	173.1	171.9	168.2
2002	174.8	0.13	177.0	176.6	176.1	175.0	173.6	171.5	169.3
2003	175.0	0.11	177.2	176.9	175.9	175.0	173.5	171.5	169.6

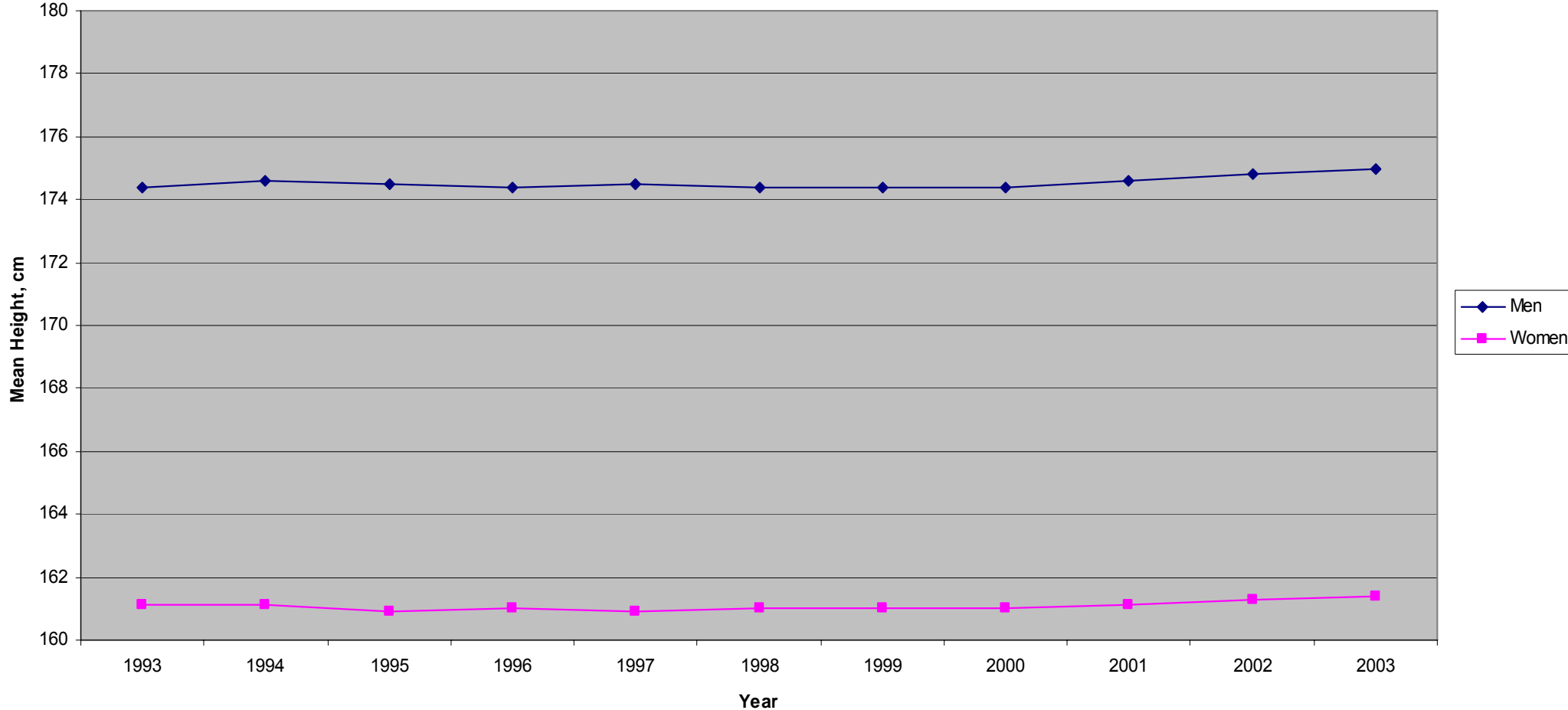
Stature of UK population - 3

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Year	WOMEN		AGE						
	Mean	SE	16-24	25-34	35-44	45-54	55-64	65-74	75+
1993	161.1	0.07	163.1	163.0	162.4	161.7	160.2	158.1	154.3
1994	161.1	0.08	163.0	163.3	162.3	161.9	160.4	158.4	154.6
1995	160.9	0.07	163.1	162.8	162.1	161.3	159.9	158.1	154.6
1996	161.0	0.07	163.1	163.2	162.2	161.4	159.9	157.8	154.7
1997	160.9	0.10	162.9	163.1	162.4	161.4	159.4	158.2	154.3
1998	161.0	0.07	163.4	163.0	162.5	161.4	160.2	157.8	154.7
1999	161.0	0.11	163.6	162.6	162.2	161.3	159.8	158.2	154.7
2000	161.0	0.11	162.8	162.9	162.8	161.5	160.1	157.9	154.4
2001	161.1	0.08	163.5	163.2	162.3	161.5	160.6	158.2	154.5
2002	161.3	0.11	163.3	163.1	162.6	161.8	160.4	158.6	155.4
2003	161.4	0.09	163.7	163.1	162.7	161.7	160.3	158.5	155.4

Stature of UK population - 4

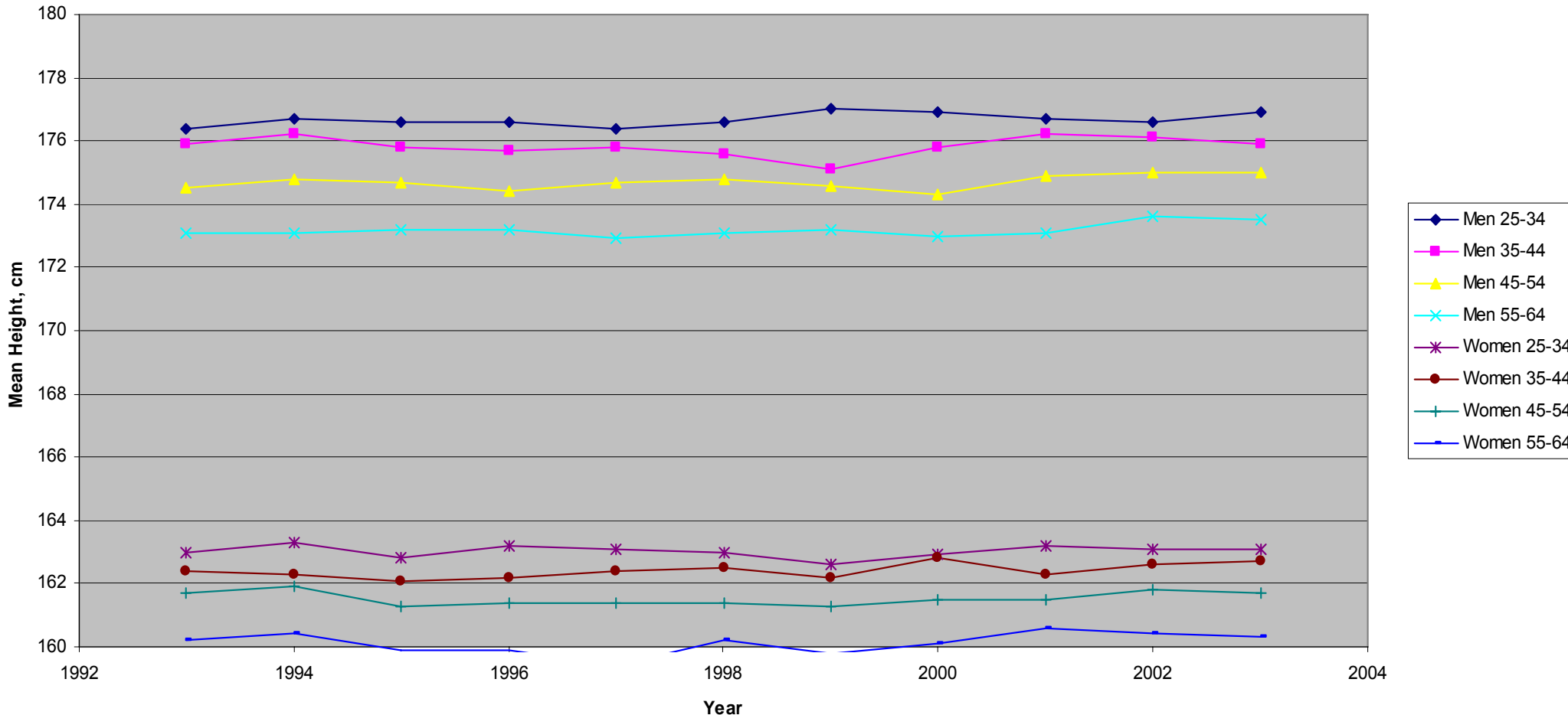
UK Population Mean Height (cm) by year



Stature of UK population - 5



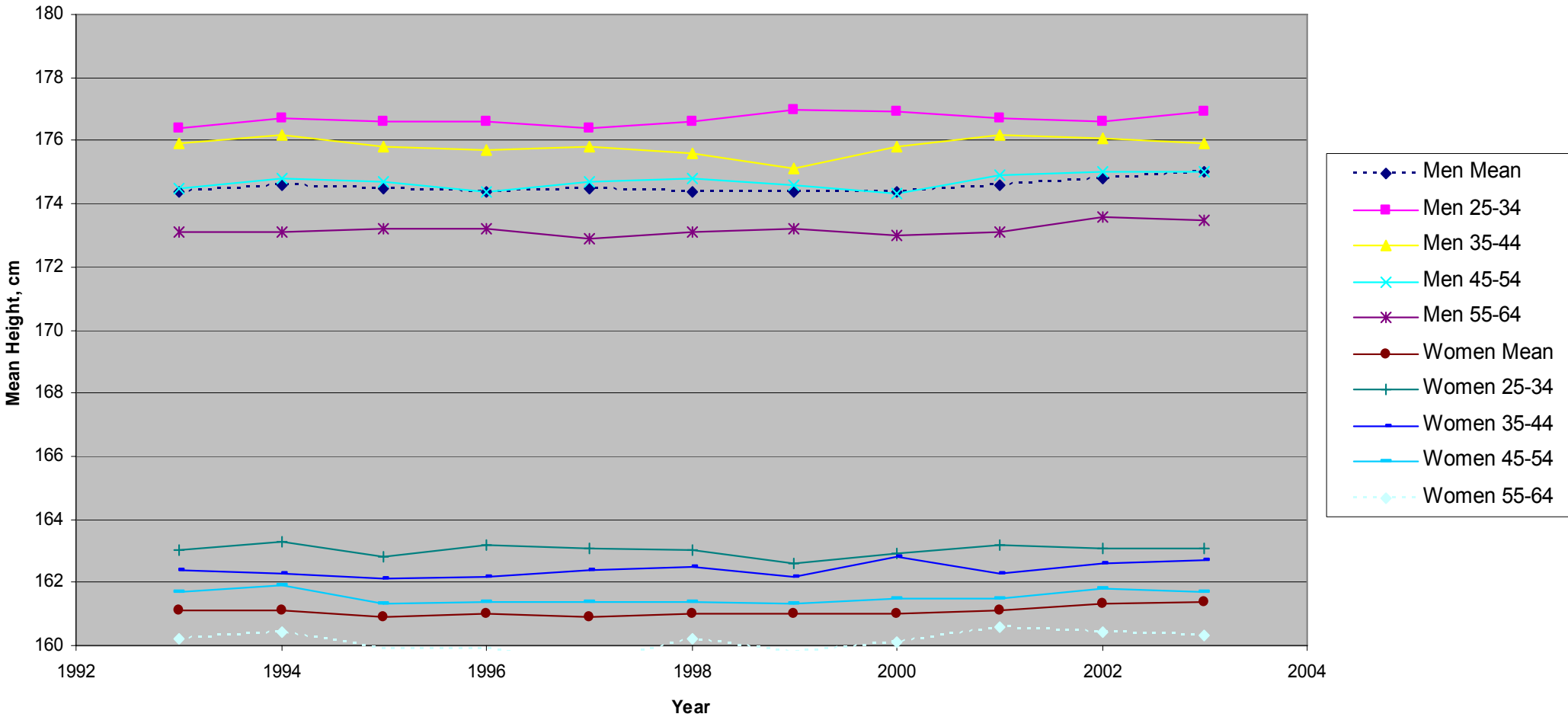
UK Population Mean Height (cm) by year and age



Stature of UK population - 6



UK Population Mean Height (cm) by year and age



Summary

- The UK population has seen no systematic change in **mean height** over the period 1993 to 2003.
- The UK population has no pattern of varying **mean height** and age.
- UK population mean height continues to be very much above average for Europe, as it has been for +15 years.

UK anthropometric data 1998

Anthropometric Data - 1

- ADULTDATA - The Handbook of Adult Anthropometric and Strength Measurements – Data for Design Safety. Department of Trade and Industry, London. ISBN 0 9522571 3 0. May 1998.
- Government Consumer Safety Research
- Utilises 'PeopleSize' anthropometry database, which brings together data from Department for Health (UK), National Center for Health Statistics (US) and the Human Measurement and Research Group (HUMAG) at Loughborough University (UK);
- <http://www.openorg.com/psz.htm>

Anthropometric Data¹ - 2



	Male			Female		
	5th%ile	50th%ile	95th%ile	5th%ile	50th%ile	95th%ile
Stature	1641.0	1755.1	1869.2	1514.4	1620.0	1725.6
Erect Sitting Height	860.4	920.2	980.0	803.4	857.6	911.8
Head Circumference	547.3	575.0	602.7	521.7	547.4	573.0
Face Length	105.9	118.8	131.7	95.3	105.9	116.5

1 ADULTDATA - The handbook of adult anthropometric and strength measurements. Department of Trade and Industry, London. ISBN 0 9522571 3 0. May 1998.

UK calculations of required head restraint height

Anthropometric Data¹ - UK

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	Male			Female		
	5th%ile	50th%ile	95th%ile	5th%ile	50th%ile	95th%ile
Stature	1641.0	1755.1	1869.2	1514.4	1620.0	1725.6
Erect Sitting Height	860.4	920.2	980.0	803.4	857.6	911.8
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UK calculation of required head restraint height - Method NL

- Based upon HR-03-06e / HR-02-14e;
- Using UMTRI 1983 data as reference;
- Height measured as per UN-ECE Regulation 17; height measured in a plane as near to 25° as possible from vertical normal line of the manikin torso ref. line, unless otherwise specified by manufacturer; and
- NL adds a '**conservative**' 15mm to account for torso 'ramping' and 'spine straightening' effect.

UK calculation of required head restraint height - Method NL

$$HRHeight\%ile = (SittingHeight\%ile) - 93 \left(\frac{FaceLength}{FaceLengthUMTRI} \right) - 67 \left(\frac{SittingHeight}{SittingHeightUMTRI} \right) + SittingEffect$$

UMTRI [UMTR-83-53-1, Dec 1983]

- Erect sitting height 50th%ile male = 911 mm
- Distance crown to CoG head = 93 mm
- Distance H-point to lowest buttocks = 67 mm
- Face length UMTRI equivalent = 117 mm [HR-02-14]
- Sitting height UMTRI equivalent = 912 mm [HR-02-14]

“**SittingEffect**” as described in SAE Paper 983158; Human Head Neck Response During Low-Speed Rear End Impact (1998); Kroonenberg, A van den *et al.*

“**SittingEffect**” = Ramping + Spine Straightening => Add Height Req. + 15 mm ► + 34 mm

UK calculation of required head restraint height - Method NL

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Transport

- 50thile Male UK - 1998
 - Head Restraint Height required = 758 mm + 15 = 773 mm
 - Head Restraint Height required = 758 mm + 34 = **792** mm
- 95thile Male UK - 1998
 - Head Restraint Height required = 803 mm + 15 = 818 mm
 - Head Restraint Height required = 803 mm + 34 = **837** mm

Conclusions

- UK supports the NL proposal for a minimum head restraint height of **850 mm** for the proposed GTR [UNECE R17 methods].
- It is an appropriate height to offer protection to the population of vehicle occupants in the UK.
- It is an appropriate height to offer protection to the population of vehicle occupants globally, most of whom who are increasing in stature.
- Cost-benefit analysis / regulatory impact assessment.

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