

The Range of Anthropometric Measurements for Asian Populations - SAE J317

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The Range of Anthropometric Measurements For Asian Populations

SAE Information Report

Report of the Construction and Industrial Machinery Technical Committee approved November 1967

SCOPE

This report provides data on the body dimensions of Turkish and Vietnamese military personnel. These groups represent the extremes in body size of the entire Asian population and the potential operators of the industrial and construction equipment.

Included with the data is information concerning the influence of body dimensions on: the fixed limits of the vehicle cab, the operator's seat, levers and controls, visibility, and the dashboard and instrument panel.

The scope is confined to body dimensions (static anthropometrics). Data are not provided on the range of body movement and strength (dynamic anthropometrics) or other operator capabilities and limitations, such as visual acuity and reaction time. Insufficient useful data on Asians are available in these areas.

PURPOSE

This report is intended to help eliminate many design-related costs by providing relevant Asian body dimension data at an early stage of equipment development. This information is intended to serve as a guideline for the design of efficiently operating equipment and is not meant to be an exhaustive checklist of operator-related design considerations.

Body dimensions greatly influence the design of seats, the positioning of controls, and the dimensions and position of various vehicle control area features (for example, windshields and panels). The use of body dimensions as a design guideline will help provide an effective work place and a much safer, more comfortable, and healthy operator environment.

If body dimensions and information concerning operator limitations and capabilities are integrated with operational requirements during early conceptualization and design stages, significant improvements in system operation can be achieved with minimum cost. Errors concerning the design of certain vehicle features which affect operator effectiveness will be avoided. Redesign costs will be reduced.

NECESSITY OF ASIAN ANTHROPOMETRIC DATA

The employment of body dimensions as an integral part of equipment design requires data on the intended user population. This specific information is necessary because a large difference in body size may exist among groups of people.

Exemplifying this difference, the 50th percentile value for stature of Vietnamese military personnel is equivalent to the 2nd percentile for United States soldiers. The 50th

percentile for weight of Vietnamese is less than the 1st percentile value for United States soldiers. The average Vietnamese is 5 in. shorter and 43 lb lighter than the average United States soldier.

A large portion of the Vietnamese would have difficulty operating a vehicle designed for United States personnel. The visibility of a large portion of the Vietnamese operators would be restricted by a low seat. Control of the steering wheel or foot pedals might be limited by a seat that could not be moved forward far enough. In order to avoid these and other operator-related problems, it is necessary to design equipment using data which include most of the potential users.

SAMPLE

Turks and Vietnamese possess, respectively, the largest and smallest body dimensions of Asian population. A sample consisting of male military personnel was selected from each of these nations as the source of the dimensions. This military sample was selected because the only Asian body measurement data available are on the armed forces.

DATA SELECTION

There exists within each of these samples a wide range of values for the selected measures. In order to obtain an overall range for each measure across all the Asian populations, the greatest values of the larger individuals, Turks, and the smallest values of the smallest individuals, Vietnamese, were selected. The values, based on percentiles, include the 95th and 99th percentiles for Turkey and the 1st and 5th for Vietnam. These data are presented in Table 1* with a median value for each group on all the measures. This method includes approximately 98% of all Asians.

Data on a representative United States sample are presented in Table 2*. These data provide the reader with a better frame of reference for determining the variation among the populations.

SAMPLE COMPOSITION

The Turkish and Vietnamese samples are composed of individuals in all branches of the service. The United States sample, which is more a reference point than a direct com-

* The data on Air Force personnel are provided so that the reader can see the general range of difference between various Asian populations and a U. S. population. The Air Force data were used because the data consisted of nearly all the dimensions presented for Asian populations.

Table 1 - Percentiles of Anthropometric Measures, Vietnam and Turkey

	Vietnam*						Turkey**					
	1st		5th		50th		50th		95th		99th	
	cm	in.	cm	in.	cm	in.	cm	in.	cm	in.	cm	in.
1. Stature	148.1	58.3	151.6	59.7	160.4	63.2	169.0	66.5	172.0	67.7	182.4	71.8
2. Shoulder Height	120.4	47.4	123.1	48.5	131.2	51.6	137.4	54.1	146.8	57.8	150.3	59.2
3. Kneecap Height	40.8	16.1	42.4	16.7	46.3	18.2	49.1	19.3	53.4	21.0	55.8	22.0
4. Crotch Height	65.0	25.6	67.1	26.4	73.8	29.6	78.7	31.0	85.2	33.5	87.4	34.4
5. Functional Reach	69.4	27.3	71.4	28.1	73.3	28.9	75.3	29.6	81.8	32.2	85.2	33.5
6. Hip Breadth	26.0	10.2	26.8	10.6	29.0	11.4	32.7	12.9	35.7	14.1	37.1	14.6
7. Sitting Height	77.5	30.5	79.6	31.3	85.0	33.5	89.6	35.3	95.1	37.4	97.3	38.3
8. Eye Height	65.7	25.9	67.8	26.7	73.1	28.8	77.5	30.5	82.6	32.5	84.9	33.4
9. Shoulder Height	49.7	19.6	51.5	20.3	56.2	22.1	57.5	22.6	64.3	25.3	67.2	26.5
10. Shoulder-Elbow	30.2	11.9	31.3	12.3	33.8	13.3	35.1	13.8	37.9	14.9	39.0	15.4
11. Forearm-Hand	40.2	15.8	41.3	16.3	44.5	17.5	46.3	18.2	49.9	19.7	51.2	20.2
12. Buttock-Knee	46.3	18.2	48.4	19.1	52.7	20.8	56.9	22.4	61.1	24.1	62.9	24.8
13. Buttock-Popliteal	38.7	15.2	40.3	15.9	44.2	17.4	47.4	18.7	51.7	20.4	54.0	21.3
14. Popliteal Height	36.8	14.5	38.2	15.0	41.3	16.3	41.1	16.2	44.9	17.7	46.6	18.4
15. Shoulder Breadth	36.4	14.3	37.6	14.8	40.8	16.1	45.0	17.7	49.2	19.4	51.2	20.2
16. Hip Breadth												
Seated	26.2	10.3	27.2	10.7	30.1	11.8	34.0	13.4	37.1	14.6	38.6	15.2
17. Shoulder												
Circumference	91.1	35.9	93.6	36.9	100.6	39.6	109.4	43.1	119.7	47.1	124.4	49.0
18. Chest												
Circumference	72.2	28.4	74.5	29.3	80.8	31.8	90.7	35.7	100.1	39.4	105.0	41.3
19. Waist												
Circumference	58.1	22.9	60.7	23.9	67.1	26.4	78.4	30.9	92.3	36.3	100.1	39.4
20. Hip												
Circumference	74.5	29.3	76.7	30.2	82.6	32.5	91.4	36.0	100.8	39.7	104.6	41.2
21. Calf												
Circumference	27.8	10.9	29.2	11.5	32.4	12.8	35.5	14.0	39.5	15.6	40.8	16.1
22. Interscye Breadth	30.5	12.0	32.2	12.7	36.0	14.2	38.1	15.0	42.9	16.9	45.2	17.8
23. Hand Length	15.6	6.1	16.2	6.4	17.5	6.9	18.8	7.4	20.3	8.0	20.8	8.2
24. Palm Length	8.9	3.5	9.2	3.6	10.1	4.0	10.7	4.2	11.6	4.6	11.9	4.7
25. Hand Breadth	7.0	2.8	7.3	2.9	8.0	3.2	8.6	3.4	9.4	3.7	9.7	3.8
26. Foot Length	21.3	8.4	21.9	8.6	23.6	9.3	26.2	10.3	28.0	11.0	28.9	11.4
27. Foot Breadth	8.0	3.2	8.4	3.3	9.3	3.7	10.1	4.0	11.1	4.4	11.6	4.6
Weight	39.8 kg	87.7 lb	42.4 kg	93.5 lb	50.5 kg	111.3 lb	63.8 kg	140.6 lb	79.2 kg	174.6 lb	87.6 kg	193.1 lb
Age, yr	19		20		25		22.4		35.9		39.8	

* Ref. 8.

** Ref. 3.

parison, consists of Air Force personnel in various flight categories.*

The number of individuals in each sample are: Vietnamese, 2129; Turks, 915; and American, 4000. Samples of this large provide an accurate appraisal of the full range of body measurement within the population.

DESCRIPTION OF MEASURES

Twenty-eight static measurements were selected from available anthropometric data. These measurements are

*The data provided are for nude operators.

for both seated and standing operators and range from large dimensions, such as stature, to hand length and foot breadth. Figs. 1-4 indicate graphically the nature of these dimensions. (The drawings and descriptions are from Ref. 8.) The dimensions were obtained in the following manner:

In Fig. 1, with the subject standing erect:

1. Stature: Measured as distance from floor to top of head (vertex).

2. Shoulder height: Measured as distance from floor to outer point of right shoulder (acromiale).

3. Kneecap height: Measured as distance from floor to top of right kneecap.