

## Chapter 13: Solution

### Review questions

1.

Major demographic variables:

Gender

Age

Ethnicity

Years of education

2.

Three principles:

Design for extreme individuals: Design for maximum population value is recommended strategy if a high value of design feature is given. Design for minimum population value is appropriate strategy if a low value of some design feature is given

Design for adjustable range: In the design features of equipment or facilities the provision for adjustment should be there for individuals who use them. EG: Automobile seats, chair, desk height etc.

Design for the average: There is average individual and a person may be average on one or two dimensions. Designers often design for the average as a compromise as they do not have to deal with anthropometric data.

3.

Research on horizontal work surface area:

Barnes (1963) and Farley (1955):

Normal Area: area conveniently reached by forearm (while upper arm hangs in natural position)

Maximum Area: area reached by extending the arm from the shoulder

Squires (1956): suggests "optimal area": takes into account dynamic interaction of forearm movement as the elbow is also moving

Squires (optimal) area vs. Farley area (normal-max.)

Squires area more shallow but covers more area

Squires area requires less forearm extension  $\Rightarrow$  minimal stress on elbow joint

4.

#### Seated Work-Surface: Height

Design here for max, min, average, and adjustable?

Non-adjustable height work surface

ANSI: 26.2 in (66.5 cm) as min. ht. of bottom

Small users

Raise seat so elbows are at 90° to work surface

⇒ feet don't touch floor

⇒ foot rest is needed to support feet

or use adjustable-height work surface

#### General Principles for Seated Work Surfaces:

Best to find work surfaces with adjustable height (e.g. adjustable computer tables)

Best if work surface is such that elbow height = working height

Work surface should provide enough clearance for people with thick thighs

#### Work-Surface Height: 2. Standing

Factors governing standing work-surface ht

-Elbow height

-Type of work

Type of work vs. elbow height:

Light and heavy work: work-surface height: below elbow height

Precision work:

Work-surface height: slightly above elbow height

- Reason: to support elbow while performing work
- But recommended: sitting down for precision work
- Fixed vs. adjustable standing work surface height
- Fixed: designed for max. (i.e. tallest) users
- Shorter users: Either use a platform to account for height difference or use adjustable ht. (e.g. electric, manual, hydraulic)

Other recommendations:

Work height: too high ⇒ shoulders & upper limbs raised ⇒ fatigue, strain on shoulder muscles

Work height: too low ⇒ trunk, neck, head: inclined forward ⇒ stress on spine

Recommended hts. for different tasks: below for fixed vs. adjustable ht (and for male, female)

5.

General Principles of Seat Design:

- ☒ Promote Lumbar Lordosis
- ☒ Minimize Disc Pressure
- ☒ Minimize Static Loading of the Back Muscles
- ☒ Reduce Postural Fixity
- ☒ Provide for Easy Adjustability

### **Project 13**

#### **Part A**

Yes

Pen holder was outside the recommended area by squires. But it was not too far away as it was well under Maximum area. Task lighting was also outside the proposed area by squires. It was about 2 inches further from the farthest point of the area proposed by squires, rest of the things was under recommended area.

#### **Part B**

Q.1

1. 28 in
2. 27-28.5
3. yes

2.

1. 25 in
2. 23-28 in (human factor society) or 24-32 in (lueder 1986a)
3. yes

3.

1. 40 degree
2. 0-60 degree
3. yes

### Part C.

- Foot rest
- Task Lighting
- Document holder
- Keyboard drawer
- Pen holder
- Paper Weight
- papers

### PART D

Actual	Recommended	Acceptable
17 in	16	yes
22 in	20.5	no
0 deg	ANSI (0-10 deg backward) Mandal (10-15 deg forward)	yes
16 in	15-17 in	yes
18.5 in	18.2 in	yes
2.2 in	1.5 – 2 in	yes
24 in	minimum 19.5 in	yes
15.5 in	minimum 12 in	yes
100 deg	90-105 deg	yes
2.2 in	2 in ( from back of the seat)	yes

8 in                      6-9 in                      yes

#### PART E

OK    -   -   OK

OK    -   -   OK

OK    -   -   -

OK    -   -   -

OK    -   -   OK

-       -   -   -

OK    -   -   OK

OK    -       -    OK

OK    -       -    -

#### PART F

Based on above observations present workstation and seating being evaluated follows most of the norms of standards. Proper adjustable seating height and angle count as some of the major strengths. Easy access to desk items, less stress on shoulder and knee, properly aligned seating and height arrangements with respect to desktop makes it pleasant to work for long uncomfortable hours. Un adjustable seat pan angle is one of the flaws for this arrangement. Adjustable and easy to access tilt makes it easy to adjust the workstation and seating arrangement according to task requirement. Different postures are favoured while doing different tasks like reading, writing, typing or data entry. So adjustable tilt for different tasks is helpful and increases efficiency and mind cool, which can be added in this work station. Adjustable desk can also be very effective. Adjusting work surface angle helps while doing different separate tasks.

## PART G

Addition of adjustable seat pan and back rest angle. Improving ease of adjustability of various features. Instant feedback while adjust parameters can be introduced using cutting edge technology and designs. Introduce adjustability of work surface angle for different tasks. Ease of adjustability can be provided by intruding different modes of seating arrangement for different tasks, for example certain different ranges of adjustable features may be fixed and made known to the user, for example different tilt angle height seat pan tilt for reading and watching and different for writing, typing or data entry. Feet may be used for adjustment of height instead of hands, this may provide instant feedback if proper mechanism is used.