

6.3 House Form - Capital Region.

6.3.1 Social & Economic Influences.

The ^{traditional administrative and} merchant communities, ~~with their~~ have in the past been responsible for the construction of the substantial town houses of Muscat and Mutrah. Muscat's wealthy families' houses are generally freestanding, while ~~in~~ Mutrah being more of a middle class merchant settlement has houses ~~group~~ protectively grouped into ethnic and tribal clusters (neighbourhoods). The Mutrah town house tends therefore not to be free standing but physically and socially connected to the neighbourhood structure. In most cases in both Muscat and Mutrah the courtyard house is the predominant form of indigenous housing. Often in ~~more~~ wealthy houses more than one courtyard is incorporated.

In recent years the economy ^{and the physical face} of the ~~community~~ area has undergone changes. With the introduction of large scale construction projects particularly in Mutrah (ie the ~~construction~~ building of the new harbour & the construction of the Cornish) ~~areas of~~ areas of existing town have come under the threat of redevelopment. In the case of many of the inhabitants of this area, new ^{projects} ~~plans~~ mean the demolition of their houses. When this area was surveyed

by the 'research group' it became apparent immediately that this threat was foremost in many of the inhabitants minds. ~~As the~~ ~~consequence~~ this feeling of lack of security in tenure has had physical consequences in that owners are no longer willing to invest in the maintenance of their properties. ~~Therefore~~ For this reason as well as ~~for~~ ^{for} other ~~new~~ external pressures such as increased population pressure and new sanitation problems introduced by the building of the Cornish (discussed in previous section) ^{houses in} the area ~~is~~ ^{are} ~~experiencing~~ ~~struggling~~ experiencing deterioration.

Due to ~~the changing economy~~ ^{the changing economy} ~~new population pressures~~

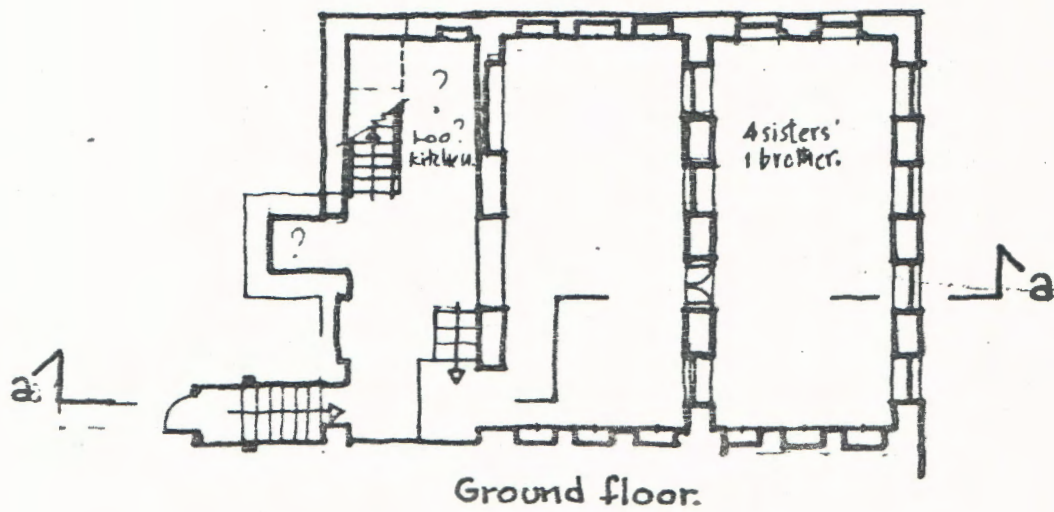
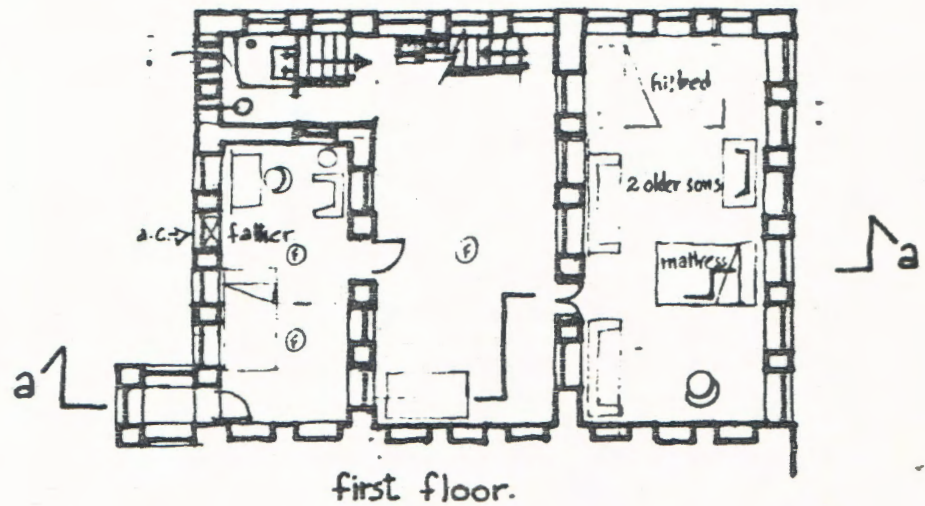
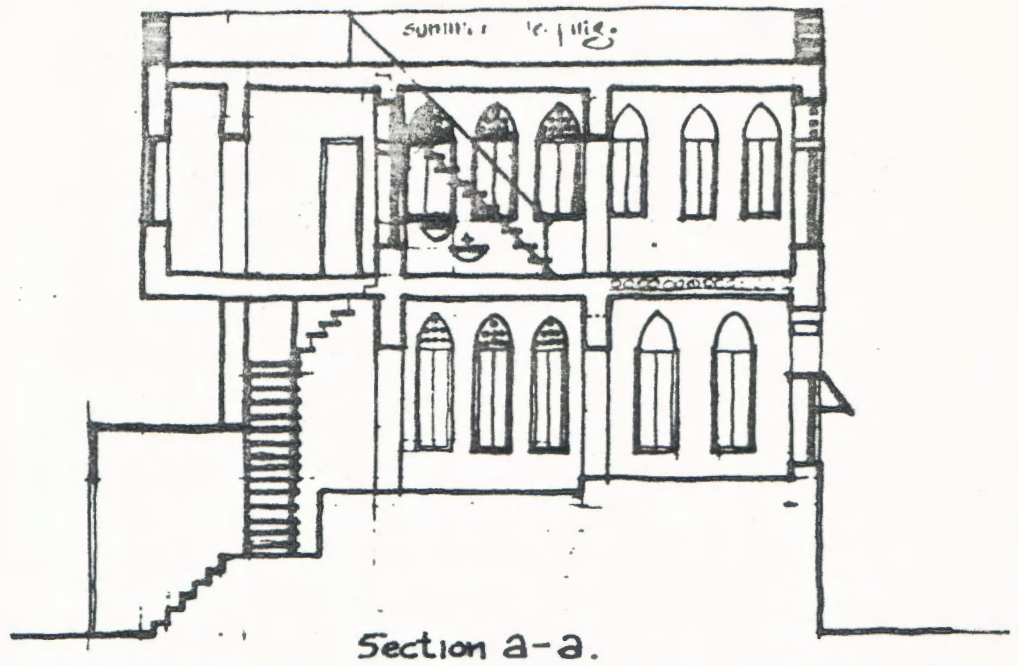
and ~~the changing economy~~ and new population pressures recently the form of ^{many of} the recently built habitations in the capital region are unlike the traditional town house. ^{the} New squatter housing behind the expanding harbour ^{though unplanned} can also be said to be 'indigenous forms' ~~of some~~ for they are unplanned and respond to pressures is a response to the pressures of the changing region. Accommodation is needed for the influx of predominantly male Omanis who have left rural areas and Pakistani & Indian workers who have ~~in~~ come to the capital region to find employment in the construction projects or with government departments. Families in most cases have been left behind so these

stay as being temporary and ~~again~~ show little interest in investing time and money in maintaining their physical surroundings.

In consequence ~~this area~~ houses in this area are of a low physical standard. Inhabitants are generally tenants ~~who~~ in some cases are faced to pay ~~quite~~ high rents for substandard overcrowded ~~dwellings~~ accommodation.

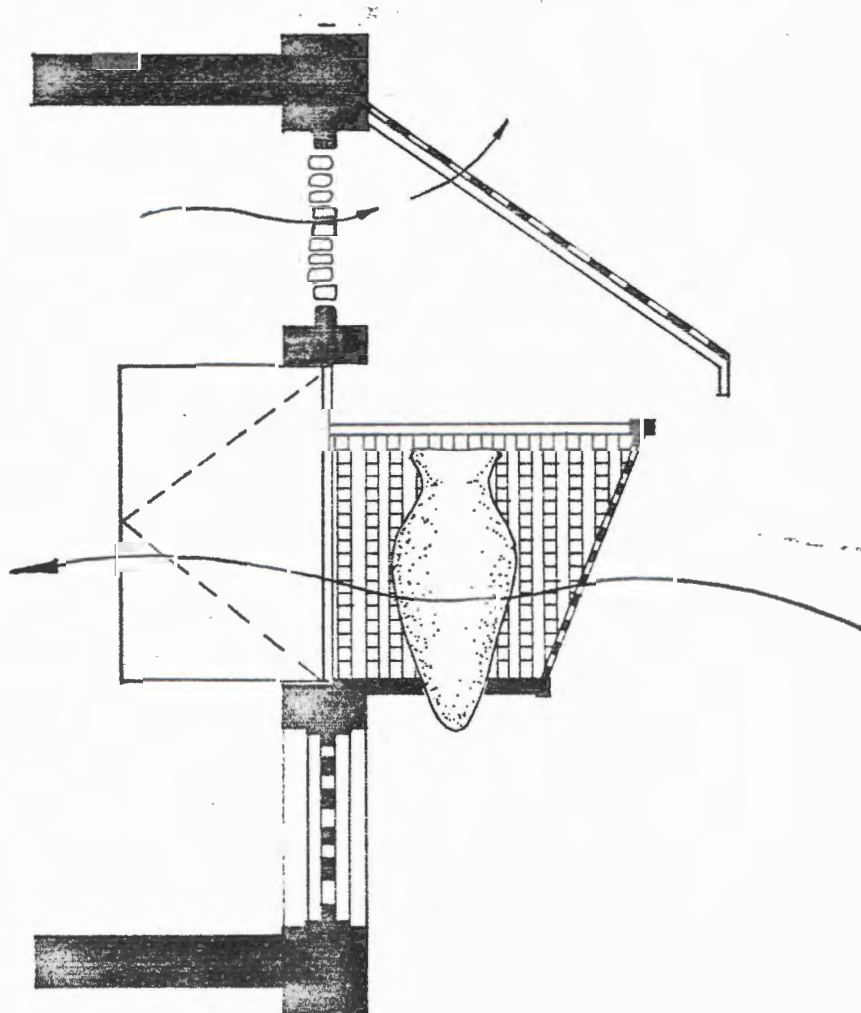
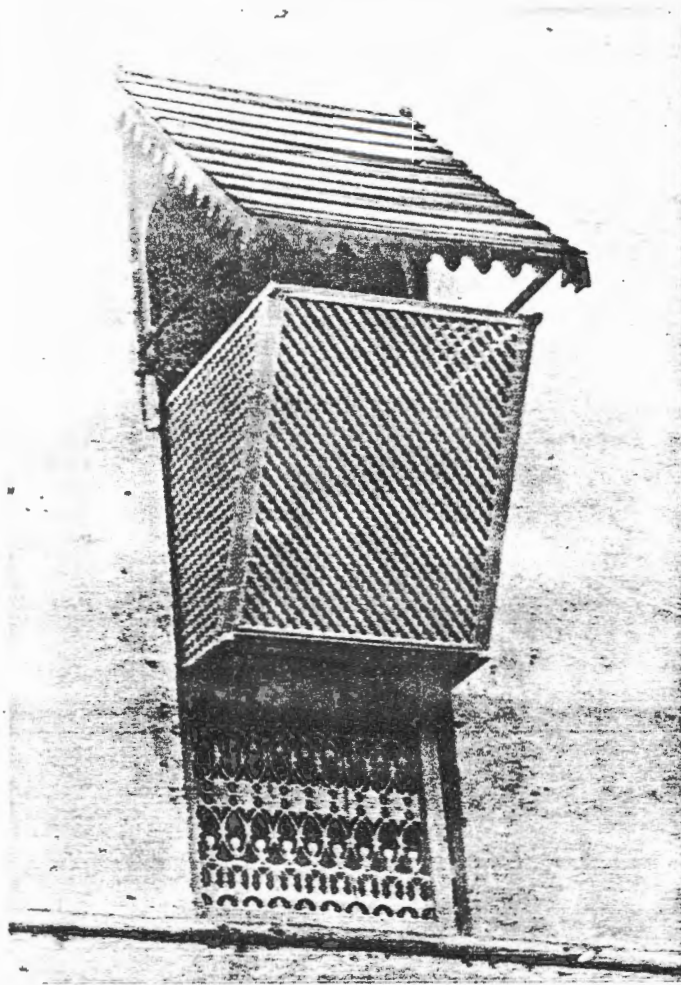
New Page

6.3.2 Climatic Influence on House form.



House of Haji Ali Najmehi
Molrah (boy's room)

N



3 Towns Mus, Mat, Rei represent ~~spaces~~
different examples of how a town can
change through development pressure.

Muscat:

New development is limited to
replacement of individual bld. that
~~have~~ are no longer economically viable
or that are physically in poor shape &
replacement with new buildings is gov't
dept or commercial establishment & ~~Patron~~
The over all settlement pattern has not
and will not likely be drastically
altered. Rich families own individual
plots and houses and are not likely to
cooperate in comprehensive development?

Infrastructure is roads & water supply
though improved will not likely change
pattern & must be adapted.

Matrah

Plan has been overlaid on
existing settlement and therefore has
altered economic & social function
ie example of harbour. (compare Sur)

roads, trees, shelters - seasonal labour / shanty's, yrs. + gov't officials:
Rei New comprehensive development area - verges site

CAPITAL REGION

CASE BOOK:

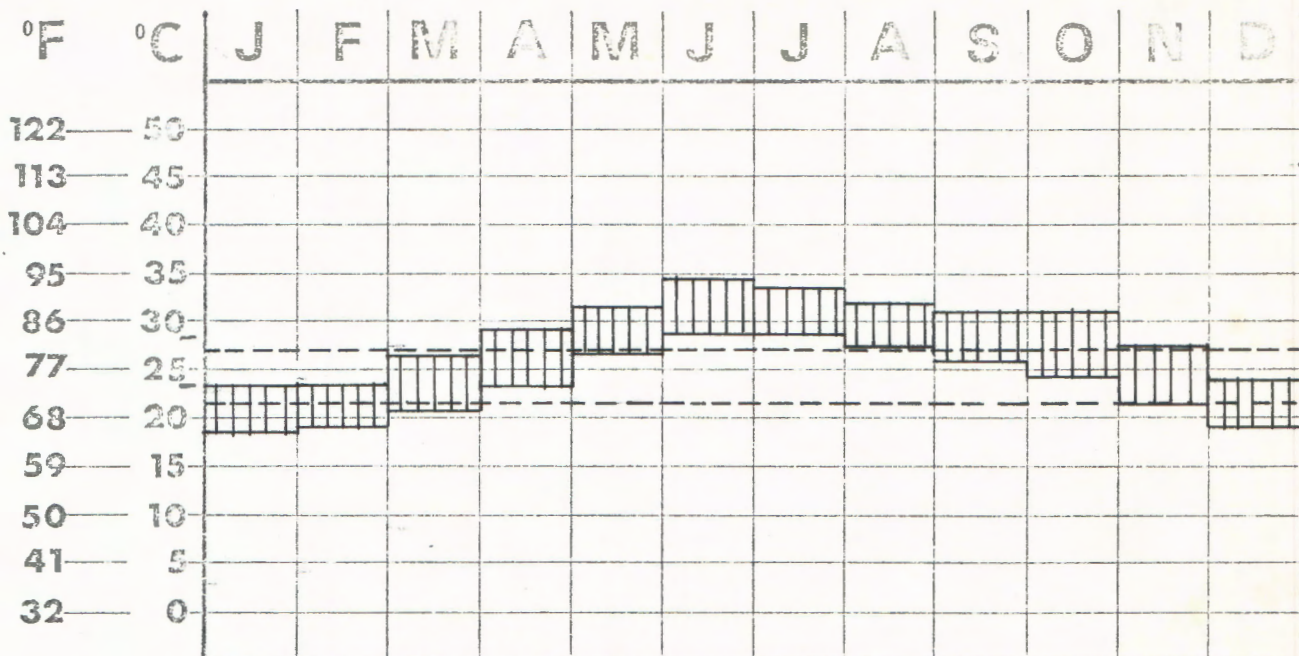
PROGRAMME:

(CORRECTED) EFFECTIVE TEMPERATURE

LOCATION MUSCAT LONG 58°35' LAT 23°37' ALT 5 m

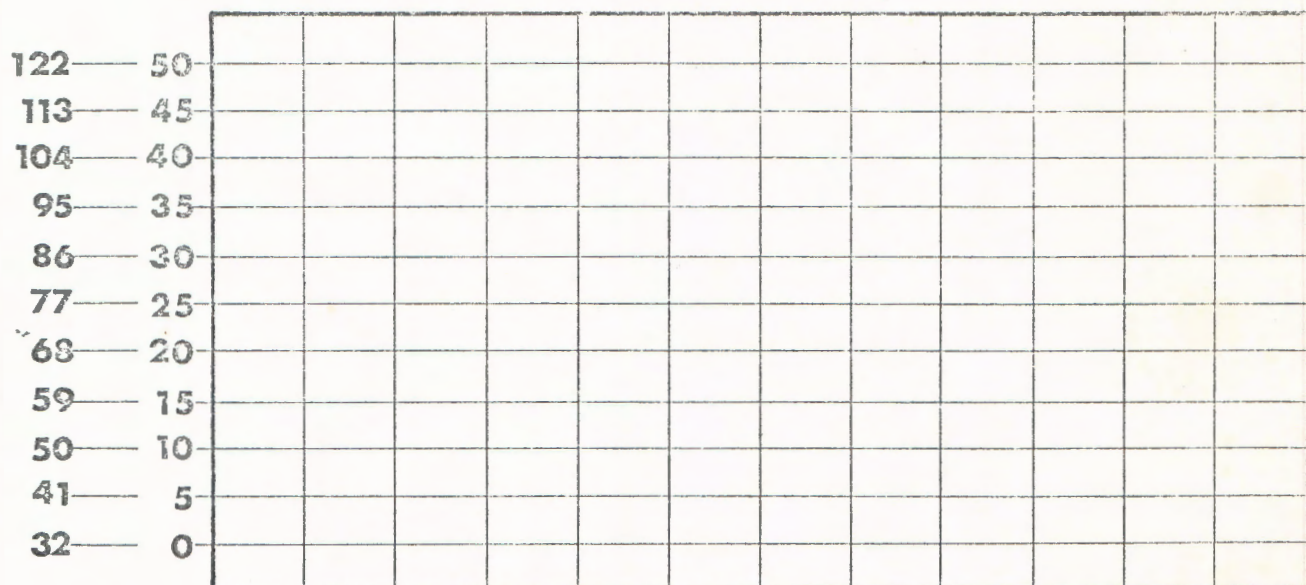
1

WIND SPEED 5m/min



2

WIND SPEED.....



3

CRITICAL MONTH(S):-

SOURCE:

DATE:

NAME:

CASE BOOK:

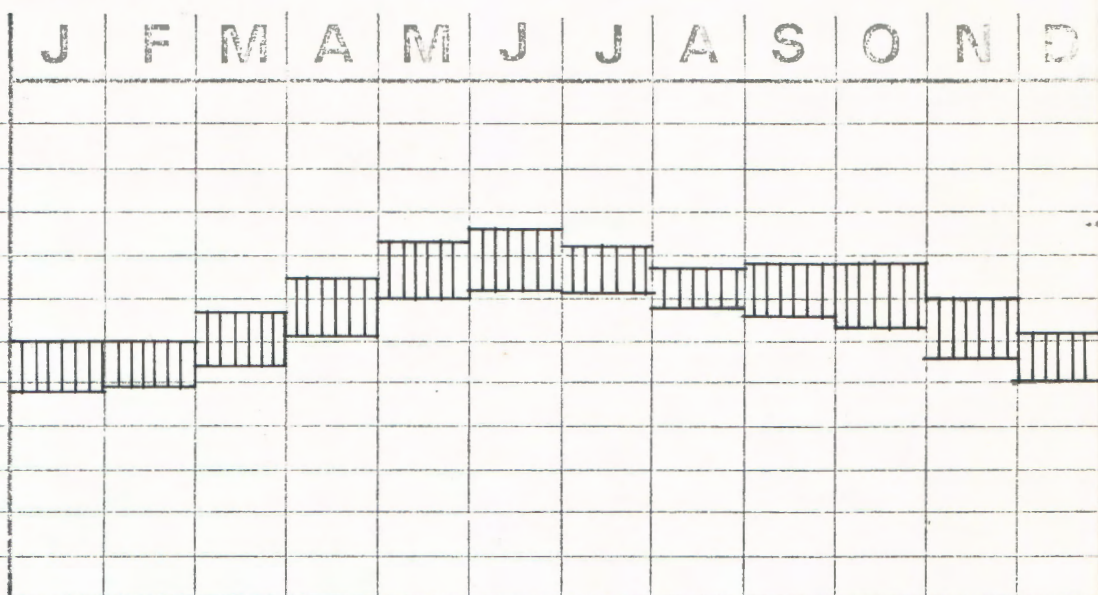
PROGRAMME:

CLIMATIC DATA 1

LOCATION MUSCAT LONG..... LAT..... ALT....

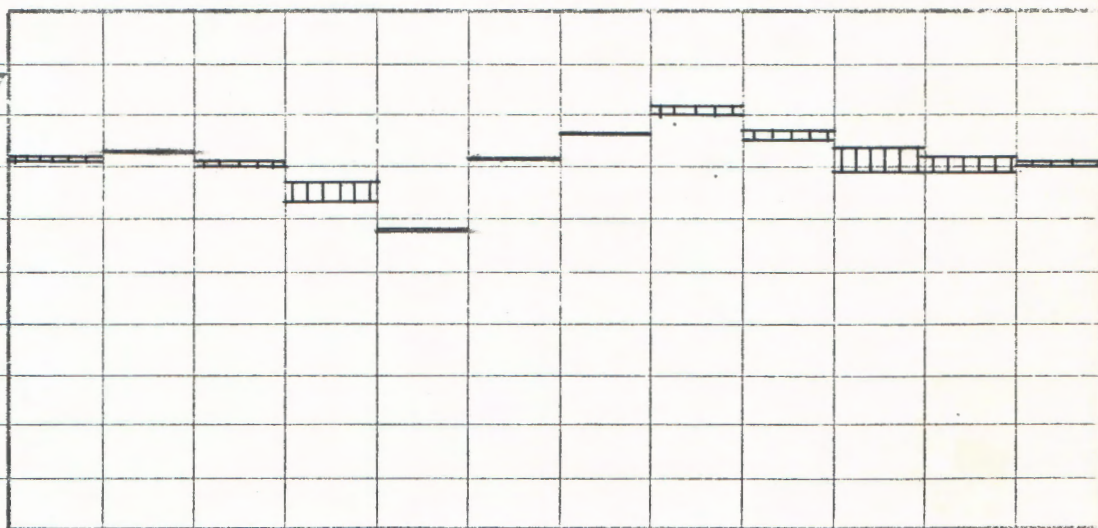
1 AIR TEMP.

113 — 45
104 — 40
95 — 35
86 — 30
77 — 25
68 — 20
59 — 15
50 — 10
41 — 5
F° 32 C° 0



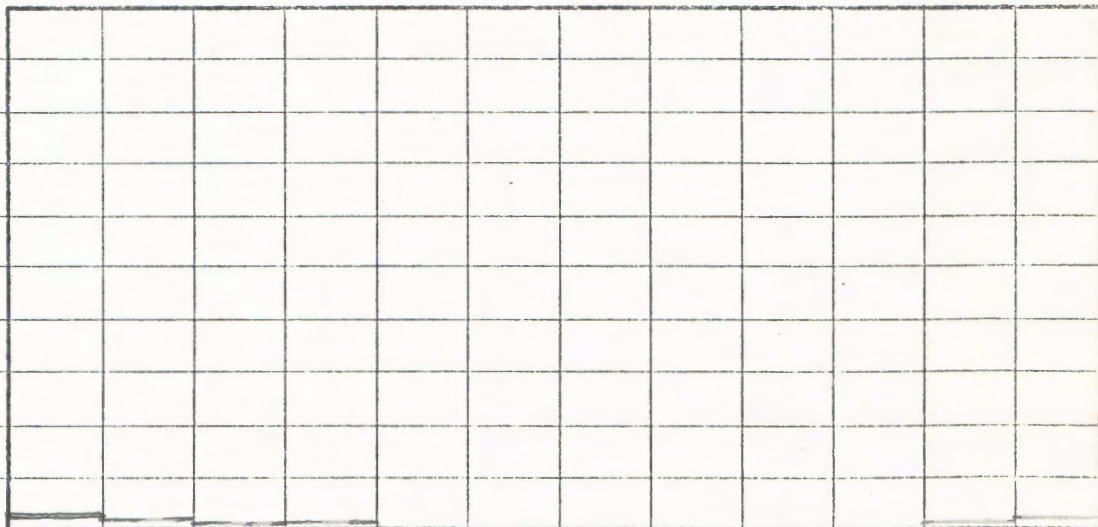
2 REL. HUMIDITY

70
60
50
40
30
20
10
PER CENT



3 RAINFALL

32 — 80
28 — 70
24 — 60
20 — 50
16 — 40
12 — 30
8 — 20
4 — 10
INCHES mm

SOURCE: W.M.H.

DATE:

NAME: MUSCAT

PERIOD:

TO FIND [CORRECTED] EFFECTIVE TEMPERATURE (C.E.T.)
MUSCAT, OMAN. (at Wind speed (W.S.) = 5 m/min)

	D.B.T.		R.H.		W.B.T.		C.E.T.	
	max.	min.	max. %	min. %	max.	min.	max.	min.
							@ W.S. = 5 m/min.	
JAN.	25	19	72	71	21	16	23	18
FEB.	25	19.5	73	73	21	16	23	18.5
MARCH	28.5	22	71	70	24.5	18	26	20.5
APRIL	32.5	25.5	68	64	28.5	21.5	28.5	23.5
MAY	36.5	30	60	58	29.5	24	31.5	26.5
JUNE	38	31	72	72	33	26.5	34	28
JULY	36	30.5	77	77	32.5	27	33	28
AUG.	33.5	29	82	80	30.5	26	32	27.5
SEPT.	34	28	77	75	30.5	25	31	26
OCT	34	26.5	74	69	29	22.5	31	24.5
NOV.	30	23	72	69	25.5	19.5	27.3	21.3
DEC.	26	20	71	70	22	16.5	24	18.5

1. First find Wet bulb Temperature (W.B.T.)
 To find W.B.T. ←
 a. Max. Dry Bulb Temperature [D.B.T.] = Average Daily max. air temperature as given in meteorological charts] with min. Relative Humidity (R.H.) read off PSYCHOMETRIC CHART. (Appendix #) = max. W.B.T.
 b. min D.B.T. with max. R.H. off Psychometric Chart = min W.B.T.
2. a. max. ^DW.B.T. with max. W.B.T. read off [CORRECTED] EFFECTIVE TEMP. SCALE (Appendix #) = max. C.E.T.
 b. min D.B.T. with min. W.B.T. read off C.E.T. scale = min. C.E.T.

TO FIND COMFORT ZONE.MUSCAT. OMAN:

1. First calculate Annual Mean D.B.T. ($T_{a.m.}$)
 $T_{a.m.} = \frac{\text{av. highest dry bulb temp} + \text{av. lowest dry bulb temp}}{2}$
 ~~$T_{a.m.} = \frac{\text{mean highest D.B.T.} + \text{mean lowest D.B.T.}}{2}$~~

2.

$$= \frac{44 + 16}{2} \text{ (from meteorological charts)}$$

$$= 30.2.30^{\circ}\text{C}$$

2. then calculate $\%$ of comfort zone (T_{ec})

$$T_{ec} = \frac{T_{a.m.}}{4} + 17.2 \text{ (constant for tropics)}$$

$$= \frac{30}{4} + 17.2$$

$$= 30.2.24.6^{\circ}\text{C}$$

3. calculate Annual D.B.T. range

$$\text{Annual D.B.T. range} = \text{Av. highest dry bulb temp} - \text{Av. lowest dry bulb temp}$$

$$= 44 - 16 = 28^{\circ}\text{C}$$

4. Read off corresponding comfort zone Range (from table appendix #)

$$= 5.0.$$

5. $\therefore$ The COMFORT ZONE IS BETWEEN

$$\text{22.5}^{\circ} - 27.5^{\circ} \text{ } 23^{\circ}\text{C} - 28^{\circ}\text{C}$$

TO RECORD AVERAGE HOURLY G.E.T.
MUSCAT, OMAN. (for SOLAR CHARTS)

	6	7	8	9	10	11	12	1	2	3	4	5	6.
JAN.		18	20	21	22	22.3	22.8	23	23	23	22.5	22	
FEB.		18.5	20.3	21	22	22.5	23	23	23.2	23	22.5	22	
MARCH	20.5	22	23	24	25	25.5	26	26.5	26.5	26.5	26	25.5	25
APRIL	23.2	24.5	25.5	26.5	27.5	28	28.5	28.8	29	29	28.5	28	27.5
MAY	26.5	27.5	28.5	29.5	30	30.5	31	31.3	31.5	31.5	31	30.5	30
JUNE	28.8	30	31	32	32.8	33.5	34	34.5	34.5	34.3	34.0	33.5	32.5
JULY	28.5	29.8	30.8	31.5	32	32.5	33	33.5	33.5	33.2	33	32.5	32
AUG.	27.5	28.8	29.5	30	30.5	31	31.5	32	32	32	31.8	31.2	30.5
SEPT.	26	27	27.5	28.5	29.5	30	30.5	30.8	31	31	30.5	30	29.5
OCT.	24	25	26.5	27.5	29	30	30.5	31	31	31	30.5	29.8	
NOV.		21.5	23.5	24.8	25.5	26.5	27	27.3	27.3	27.3	27	26	
DEC		18.8	20	21.3	22	22.8	23.3	23.8	24	24	23.5	22.5	

I. LOCATION, LAND AND CLIMATE

Location

Between latitudes 16° 40' N and 26° 20' N and longitudes 51° 50' E and 59° 40' E.

Coastline

1,700 kilometers. 1,060 miles.

Major Offshore Islands

Al Masirah and the Kuria Muria Islands.

Neighbouring Countries

Union of Arab Emirates, Saudi Arabia, Peoples Democratic Republic of Yemen.

Land

Land Area	Square Kilometers	Square Miles
Total	300,000	120,000
of which: regions		
Dhofar	100,000	40,000
Musandam	2,000	800
and: type of land		
Mountains (= + 450 m)	45,000	18,000
Coastal plains, inhabited	9,000	3,600
Wadi and desert areas (= - 450 m)	246,000	98,400

Estimated from maps series 1: 500,000

CLIMATE

Monthly Average Rainfall

Month	mm				
	Sohar	Mina al Fahal	Muscat	Nizwa	Salalah
January	11.7	16.0	20	10.9	0.9
February	20.1	29.6	10	33.5	0.8
March	1.8	4.2	10	2.0	7.4
April	—	3.7	16	19.0	4.9
May	—	1.0	9	18.3	15.9
June	—	—	3	0.8	4.3
July	—	0.3	9	36.1	29.9
August	—	14.3	—	21.8	25.5
September	—	—	—	15.2	3.5
October	—	—	—	—	7.0
November	—	1.4	8	3.6	10.4
December	3.6	7.7	22	10.7	4.4

Monthly Maximum and Minimum Temperature

°C

Month	Azaiba		Muscat		Salalah	
	Max.	Min.	Max.	Min.	Max.	Min.
January	24.9	14.7	27.2	16.6	27.2	17.9
February	27.3	16.6	29.8	17.0	27.9	18.5
March	30.2	18.3	32.5	19.5	29.6	20.5
April	33.3	21.6	36.4	22.0	31.3	22.7
May	39.1	26.3	39.5	25.2	32.3	25.0
June	39.9	28.0	41.0	28.4	31.8	26.1
July	38.9	28.5	40.5	27.3	28.0	24.2
August	37.1	26.7	36.8	26.7	26.9	23.2
September	36.4	24.5	36.1	25.5	29.0	23.4
October	35.4	22.4	34.7	23.8	30.4	21.1
November	29.7	18.3	30.8	20.2	30.2	20.4
December	25.7	14.6	28.2	17.8	28.4	18.9

1

ZONE 3C (contd.)

MUSCAT 23°37'N, 58°35'E 15 ft

Period 1893-1929 1935-1944 Biblio- graphy 1 4	Temperature				Relative humidity		Precipitation		
	Average daily Max. Min.	Average of highest each month	Average of lowest each month	Absolute Max. Min.	Average of observations at		Average monthly fall	Maximum fall in 24 h	Average No. of days with 0.01 in or more
					0800 1600				
	degrees Fahrenheit				per cent		inches		
January	25 77	66 89	83	87 51	72 71	72	1.1	3.1	2
February	25 77	67 91	84	90 53	73 73	73	0.7	2.2	1
March	26 83	72 92	93	107 62	71 70	71	0.4	1.7	1
April	32 90	78 105	100	105 66	54 68	54	0.4	2.0	1
May	36 98	86 108	108	112 75	58 60	58	<0.1	0.2	<0.1
June	38 100	88 110	110	116 78	72 72	72	0.1	2.4	<0.1
July	36 97	87 105	108	113 77	77 77	77	<0.1	0.2	<0.1
August	33 92	84 103	103	108 75	82 80	82	<0.1	0.4	<0.1
September	34 93	83 101	101	107 73	75 77	75	0.0	0.0	0
October	34 93	80 100	100	105 69	69 74	69	0.1	1.5	<0.1
November	30 86	73 93	93	96 62	69 72	69	0.4	2.1	1
December	26 79	68 86	86	92 60	70 71	70	0.7	2.2	2
Year	89 78	111	59	116 51	71 72	71	3.9	3.1	8
No. of years	24 23	24	23	24 23	7 7	7	38	38	38

PASNI 25°16'N, 63°29'E 10 ft

Period 1911-1942 Biblio- graphy 76 78	Temperature				Relative humidity		Precipitation		
	Average daily Max. Min.	Average of highest each month	Average of lowest each month	Absolute	Average of observations at		Average monthly fall	Maximum fall in 24 h	Average No. of days with 0.1 in or more
					0800 1600				
	degrees Fahrenheit				per cent		inches		
January	75 55	81	47	89 39	76	53	2.0	5.9	2
February	77 56	86	45	95 31	78	59	1.1	3.2	1
March	85 62	95	53	102 47	74	50	0.6	3.4	1
April	90 68	100	61	107 50	75	65	0.3	1.4	0.4
May	94 74	106	68	110 56	77	67	<0.1	0.3	<0.1
June	94 78	104	73	115 61	79	71	0.4	5.0	0.3
July	91 78	98	74	107 65	82	72	0.4	2.8	1
August	89 76	94	72	105 63	82	71	0.2	1.7	1
September	90 72	100	67	105 57	82	71	<0.1	<0.1	<0.1
October	91 67	99	59	105 51	75	61	<0.1	<0.1	<0.1
November	85 60	93	51	100 37	65	53	0.2	2.0	0.3
December	78 56	85	47	90 40	70	58	1.0	2.6	2
Year	87 67	108	44	115 31	76	63	6.2	5.9	8
No. of years	20 20	20	20	20 20	26	4	20	20	20

QUETTA 30°10'N, 67°01'E 5490 ft

Period 1881-1943 Biblio- graphy 2 7	Temperature				Relative humidity		Precipitation		
	Average daily Max. Min.	Average of highest each month	Average of lowest each month	Absolute Max. Min.	Average of observations at		Average monthly fall	Maximum fall in 24 h	Average No. of days with 0.1 in or more
					0800	1600			
	degrees Fahrenheit				per cent		inches		
January	50 27	63	17	75 6	80	49	1.9	1.9	5
February	54 30	68	19	80 8	76	43	2.0	1.6	5
March	64 38	76	26	84 19	67	34	1.7	6.0	5
April	74 45	84	35	91 25	58	30	1.0	1.4	3
May	84 52	93	43	98 35	48	25	0.4	1.0	1
June	93 59	99	49	103 44	48	23	0.2	2.2	0.4
July	95 65	101	56	104 47	59	27	0.5	1.4	1
August	93 62	98	52	103 45	60	23	0.3	1.2	1
September	87 50	93	40	98 33	51	18	<0.1	0.5	0.1
October	77 39	85	30	91 22	51	19	0.1	0.9	0.3
November	65 31	74	23	81 12	63	23	0.3	0.8	1
December	55 27	67	17	74 - 3	78	38	1.0	1.5	3
Year	74 44	101	13	104 - 3	61	29	9.4	6.0	25
No. of years	30 30	30	30	30 30	30	11	60	30	60

Land-LOCKED BAYS.

Ex. Muscat. Mutrah.

The towns of Muscat and Mutrah lie ~~in a~~ locked between the sea to the North and hills to the South.

This geographical location ~~has~~ concentrates the major climatic influences on the towns. The ^{influence} ~~cooling~~

~~effect of the sea is intensified. Land and sea breezes ^{are strengthened as they work} combine with the valley wind effect, (described in the uplands)~~

Land and sea breezes are strengthened by the valley wind effect (described in the uplands.) which complement their direction. ~~Thus~~ the cooling effect is

^{however} counteracted by the solar radiation reflected ^{from} the hills and the built-up area.

Summer temperatures are cooler with a July max. of 38°C . and winter temp. warmer with a Jan. min. of 19°C . R.H. is higher ^{80%} thruout the year, max. in August. There is little fluctuation in diurnal or annual temp. or R.H. ranges.

The cooling effect is however somewhat counteracted by solar radiation from the hills and the built-up town environment making both Muscat & Mutrah v. hot and humid.

ZONE.	LAND-LOCKED BAYS.
PLACES.	Muscat.* & Mutrah.
SEASONS. Dry Bulb Temp.	Two ~~distinct~~ Seasons: 1. HOT: May - Oct. Critical Month. June: 31°C - 38°C. 2. COOL: Nov. - April. Critical Month: 20°C - 25°C. Low Diurnal and Annual Range. D.R: 5° - 7°C. A.R. 5 - 10°C.
R. H.	High. 70% - 80% . ~~constant~~ . Constant.
RAINFALL.	very little: in winter. occasionally in Aug.
Air Movem.	Daytime: Northerly Sea-Breeze + Upslope valley wind. Nighttime: Southerly land-Breeze + Down-slope Valley Wind.
COMFORT & DESIGN IMPLICATIONS.	HOT. HUMID.

* climatic data.

Muscat

Air cooling window unit
using porous unglazed water jar. as wind
blows across jar's surface water evaporates
& cools the air by evaporation. ...

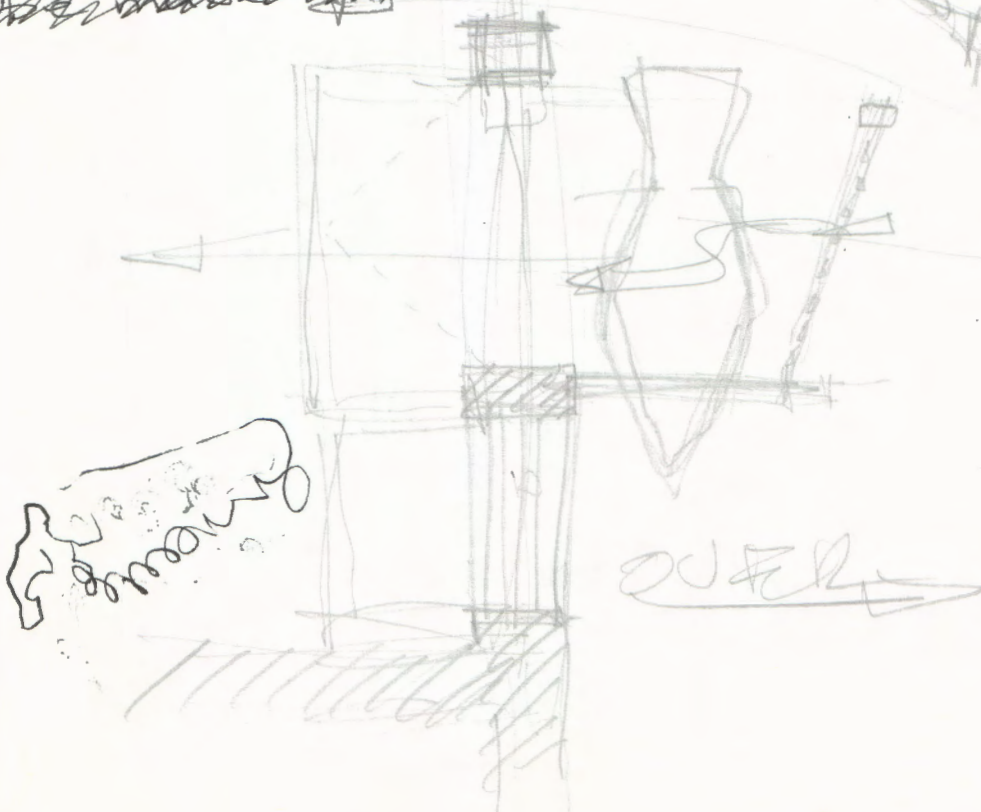
~~This same ^{evaporative cooling} ~~is a system~~ principal was used by Hassan Fathy in
a design for windcatchers (using water jars)
in his design of a school in Gourna.~~

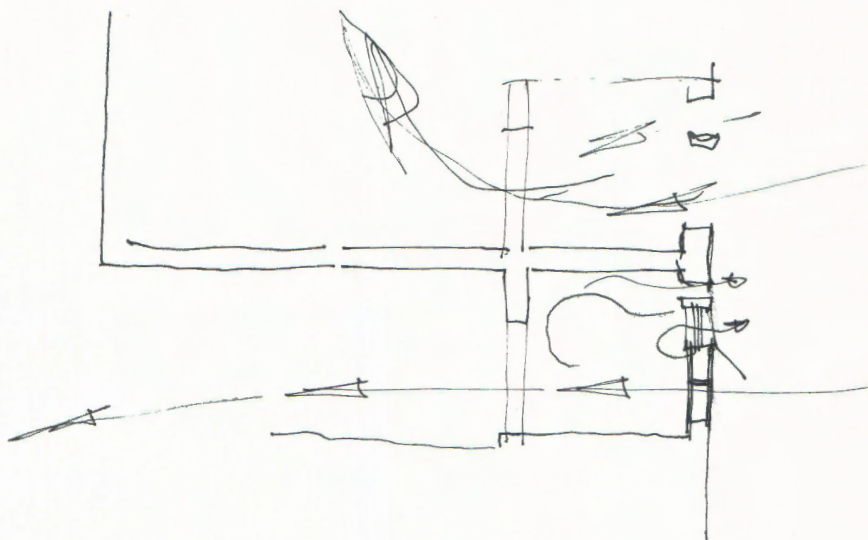
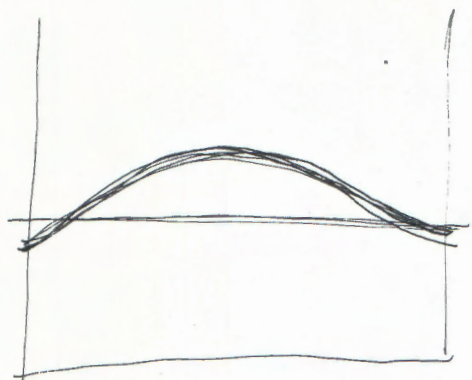
This same evaporative cooling system (using
porous water jars) can be found incorporated
into ~~the~~ the windcatchers of some buildings
in Pakistan. A more sophisticated windcatch^(using trays of wet charcoal)
designed by Hassan Fathy for one of his
schools in Gourna "produced a drop in temperature
of 10 °C. *

* Ref pg 115 - Gourna a Tale of Two Villages

This ~~high~~ high rate of evaporative cooling
could not be expected in Muscat because
the humidity is much higher than in Upper
Egypt, & a high rate of evaporation depends
on relatively dry air. A certain amount
of cooling will occur though. ~~Tests should~~
~~be made~~

also refer
to our Gourna
water jar
tests.





The three towns can be seen as a natural progression.
NCT was built on before new dev. was available.

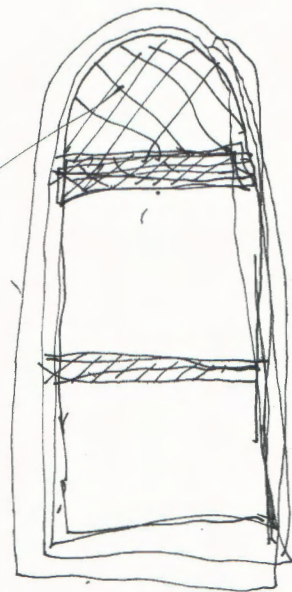
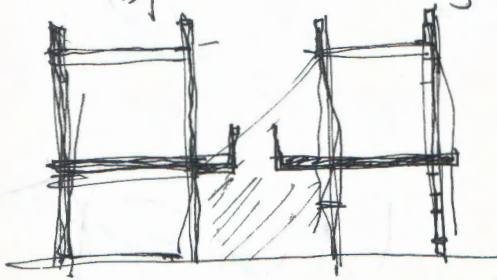
Old. Middle - New.



Mumbai - more room for expansion.

6.3.2 Climatic Influence on House Form.

Courtyard
for ventilation
& providing shade



Mushrabeya type lattice over windows.
Reverse of the way mushrabeya is
used in hot dry areas where the light
reflected from the ground is far more
intense than the sky. In the case of
Mushrabeya etc. the humidity in the air is
high meaning that water vapour in the
atmosphere reflecting the light will make
the sky bright.

Lattice used for ventilation.

	6	7	8	9	10	11	12	1	2	3	4	5	6
J	~~18~~	~~20~~	20	21	22	22.3	22.8	23	23	23	23	22.5	22
F		18.5	20.3	21	22	22.5	23	23	23.2	23	22.5	22	
M	20.5	22	23	24	25	25.5	26	26.5	26.5	26.5	26	25.5	25
A	23.2	24.5	25.5	26.5	27.5	28	28.5	28.8	29	29	28.5	28	27.5
M	26.5	27.5	28.5	29.5	30	30.5	31	31.3	31.5	31.5	31	30.5	30
J	28.8	30	31	32	32.8	33.5	34	34.5	34.5	34.3	34	33.5	32.5
J	28.5	29.8	30.8	31.5	32	32.5	33	33.5	33.5	33.2	33	32.5	32
A	27.5	28.8	29.5	30	30.5	31	31.5	32	32	32	31.8	31.2	30.5
S	26	27	27.5	28.5	29.5	30	30.5	30.8	31	31	30.5	30	29.5
O	24.0	25	26.5	27.5	29	30	30.5	31	31	31	30.5	29.8	
N	~~21.5~~	~~23.5~~	~~24.8~~	~~25.5~~	~~26.5~~	~~27~~	27.3	27.3	27.3	27	26		
D	18.8	20	21.3	22	22.8	23.3	23.8	24	24	23.5	22.5		

Muscat - Daily Ranges

CASE BOOK:

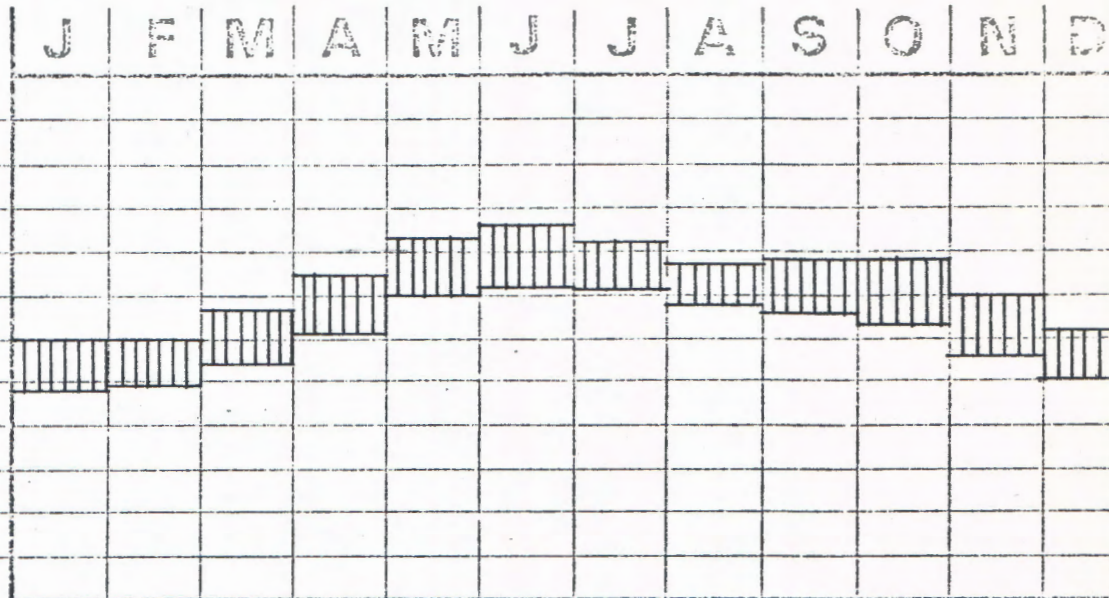
PROGRAMME:

CLIMATIC DATA 1

LOCATION MILKAT LONG..... LAT..... ALT.....

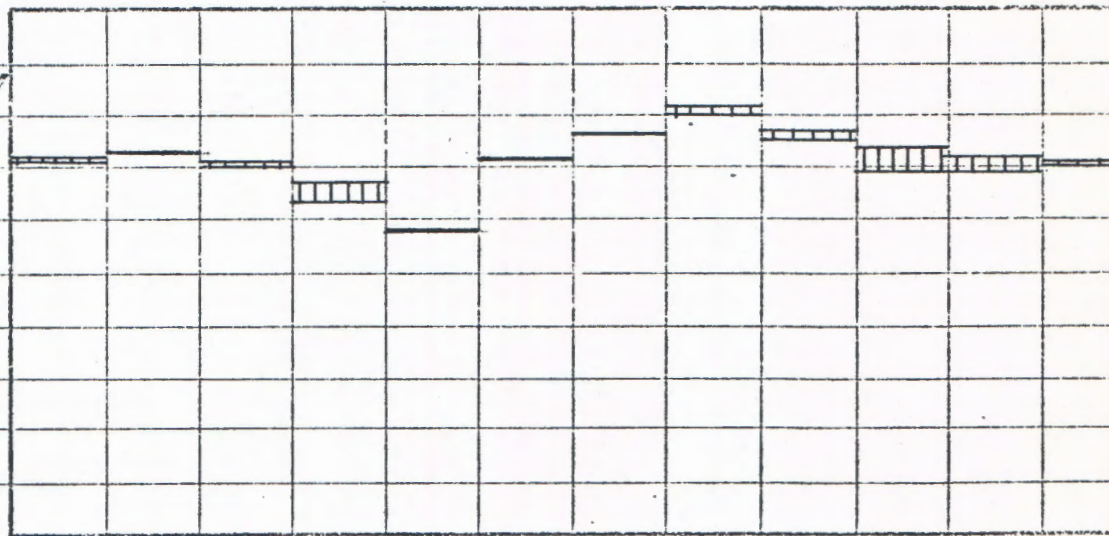
1 AIR TEMP.

113 — 45
104 — 40
95 — 35
86 — 30
77 — 25
68 — 20
59 — 15
50 — 10
41 — 5
F° 32 C° 0



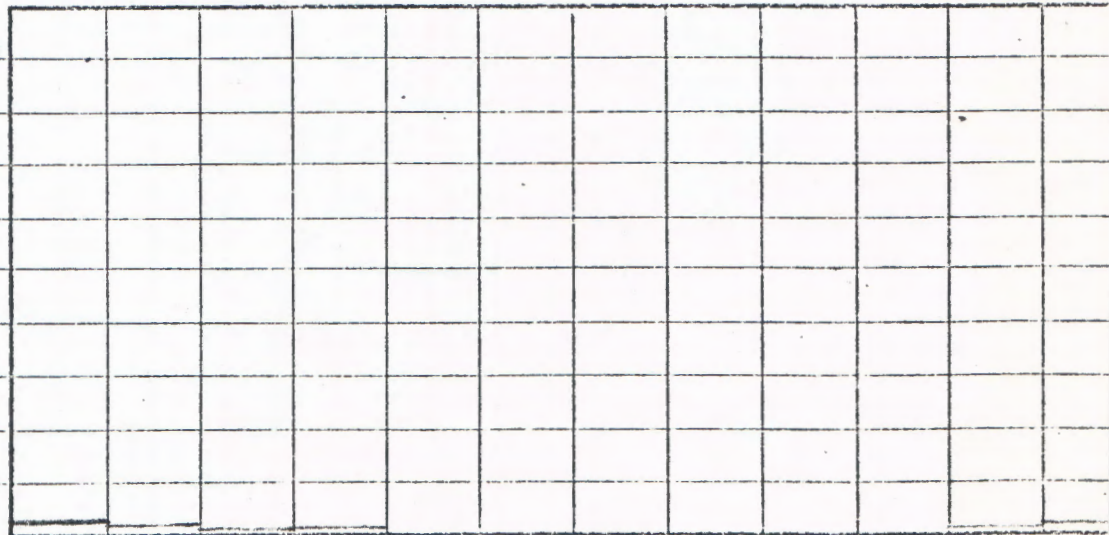
2 REL. HUMIDITY

70
60
50
40
30
20
10
PER CENT



3 RAINFALL

32 — 80
28 — 70
24 — 60
20 — 50
16 — 40
12 — 30
8 — 20
4 — 10
INCHES mm



SOURCE: W. D. H.

NAME: MILKAT

DATE:

PERIOD:

24

CASE BOOK:

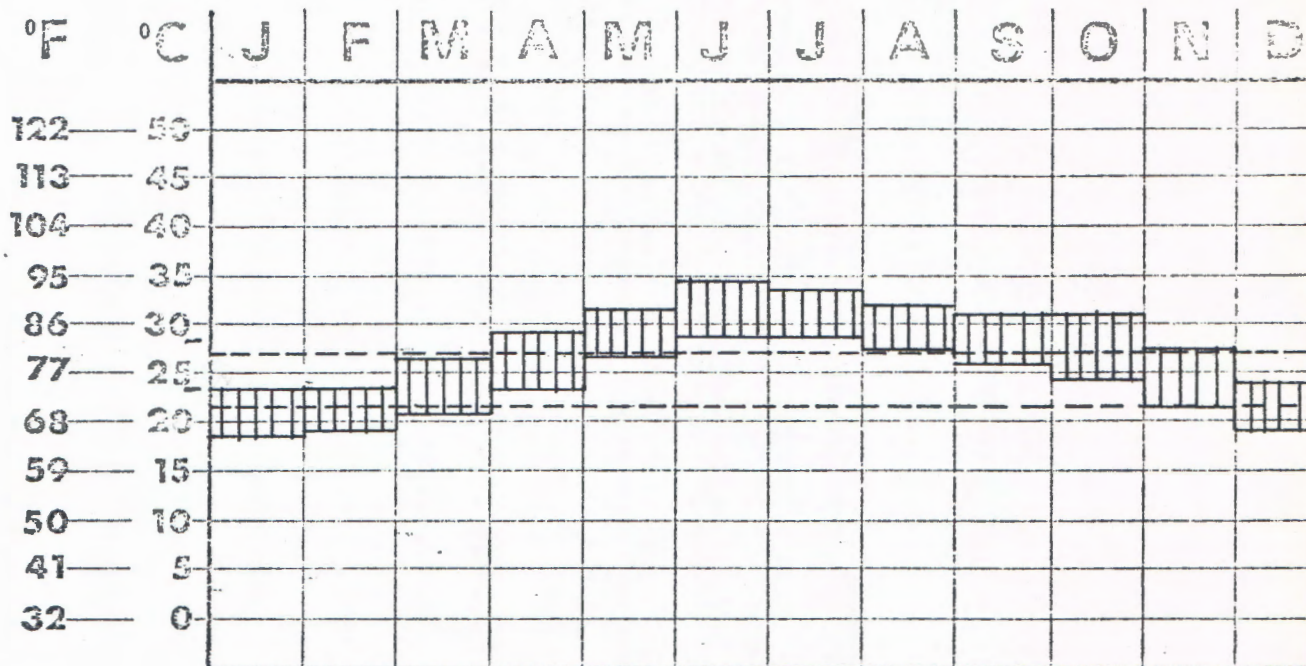
PROGRAMME:

(CORRECTED) EFFECTIVE TEMPERATURE

LOCATION: MUSCAT LONG. 53° 35' LAT. 23° 37' ALT. 5 m.

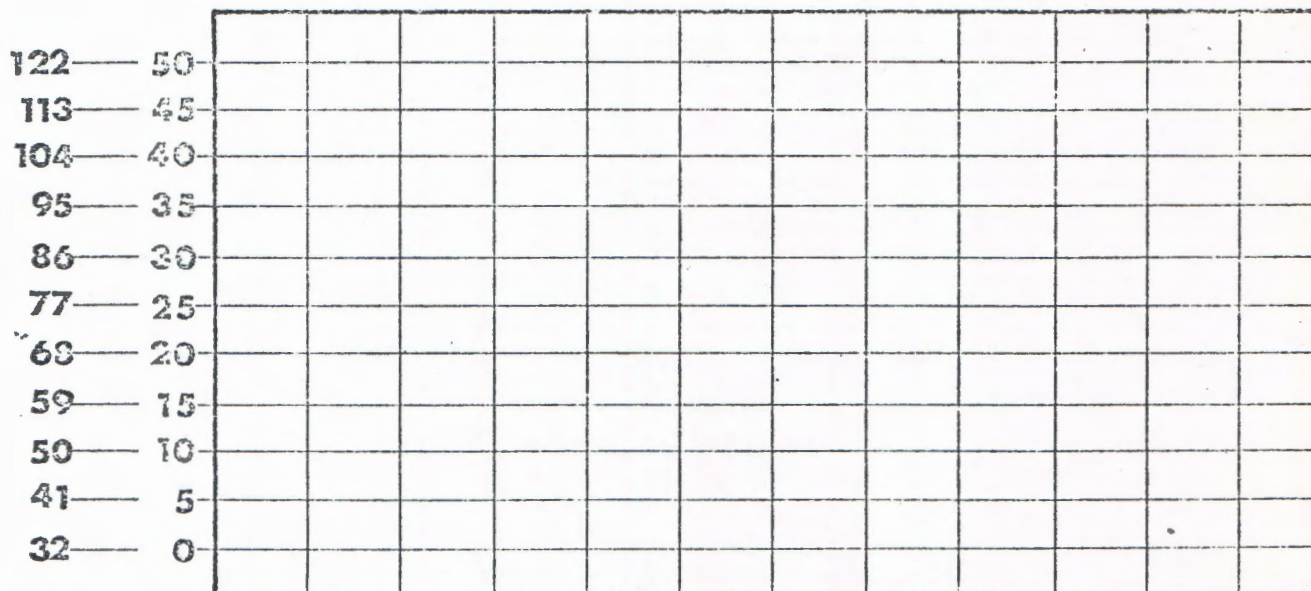
1

WIND SPEED 5m/min



2

WIND SPEED.....



3

CRITICAL MONTH(S):-

SOURCE:

NAME:

DATE:

	Temp		RH		ET	
	Am	Pm	Am	Pm	Am	Pm
J	19	25	72	71	18	23
F	19.5	25	73	73	18.5	23.2
M	22	28.5	71	70	20.5	26.5
A	25.5	32.5	64	68	23.0	29
M	30	36.5	58	60	26.3	31.5
J	31	38	72	72	28.5	34.5
J	30.5	36	77	77	28.5	33.5
A	29	33.5	82	80	27.5	32
S	28	34	75	77	26	31
O	26.5	34	69	74	24.5	31
N	23	30	69	72	21.3	27.3
D	20	26	70	71	18.5	24

Muscat - Oman

Comfort Zone

Annual Mean =
DB Temp

29.5

15.9

$$\frac{1.4 + 15}{2} =$$

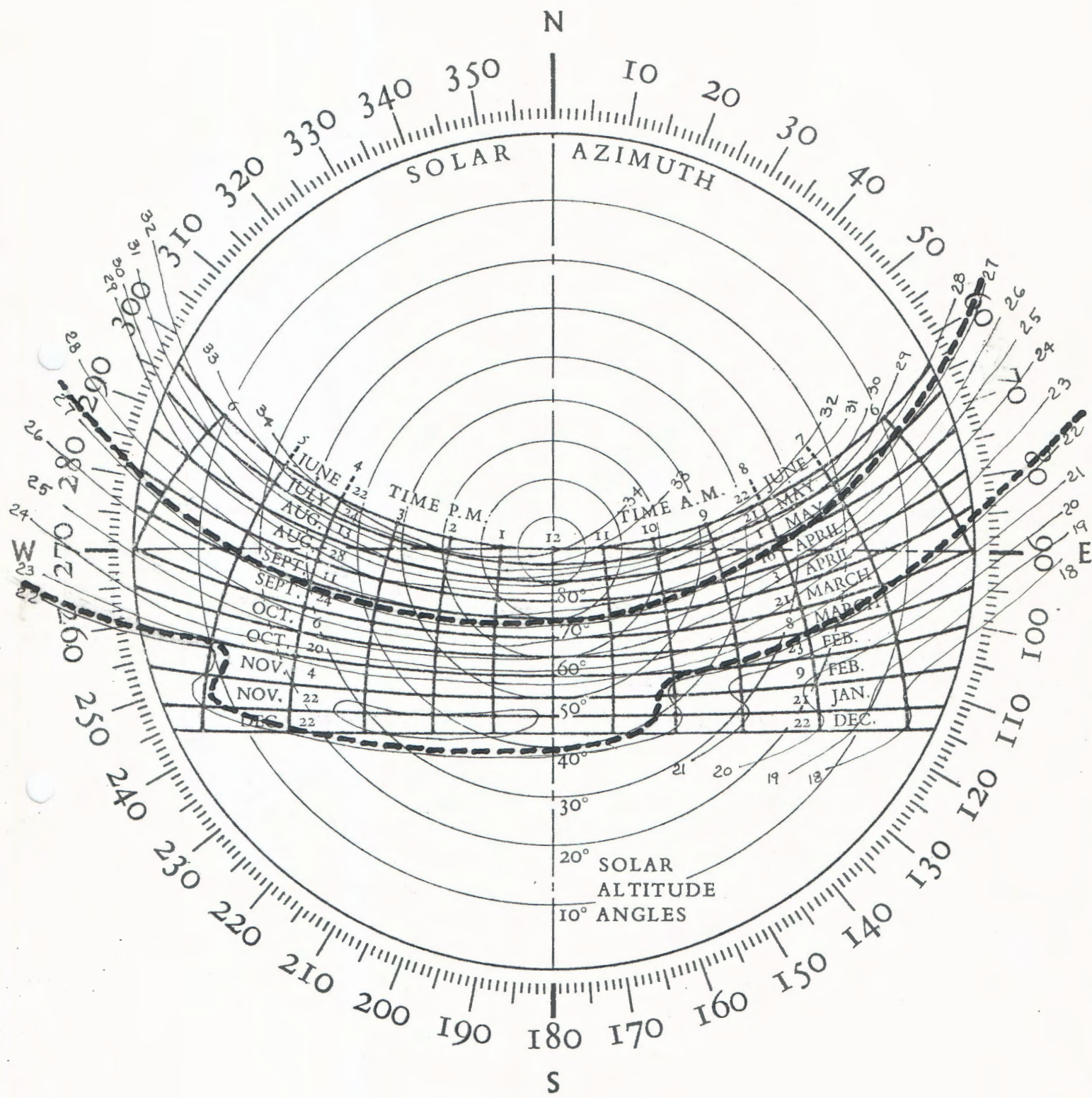
$$\begin{array}{r} 29.5 \\ + 14.5 \\ \hline 44 \\ \hline 22 \\ \hline 7.4 \end{array}$$

$$T_{cc} = \frac{14.5}{4} + 17.2 = 24.6$$

Comfort Zone

$$27.1 \leftarrow 22.1$$

25

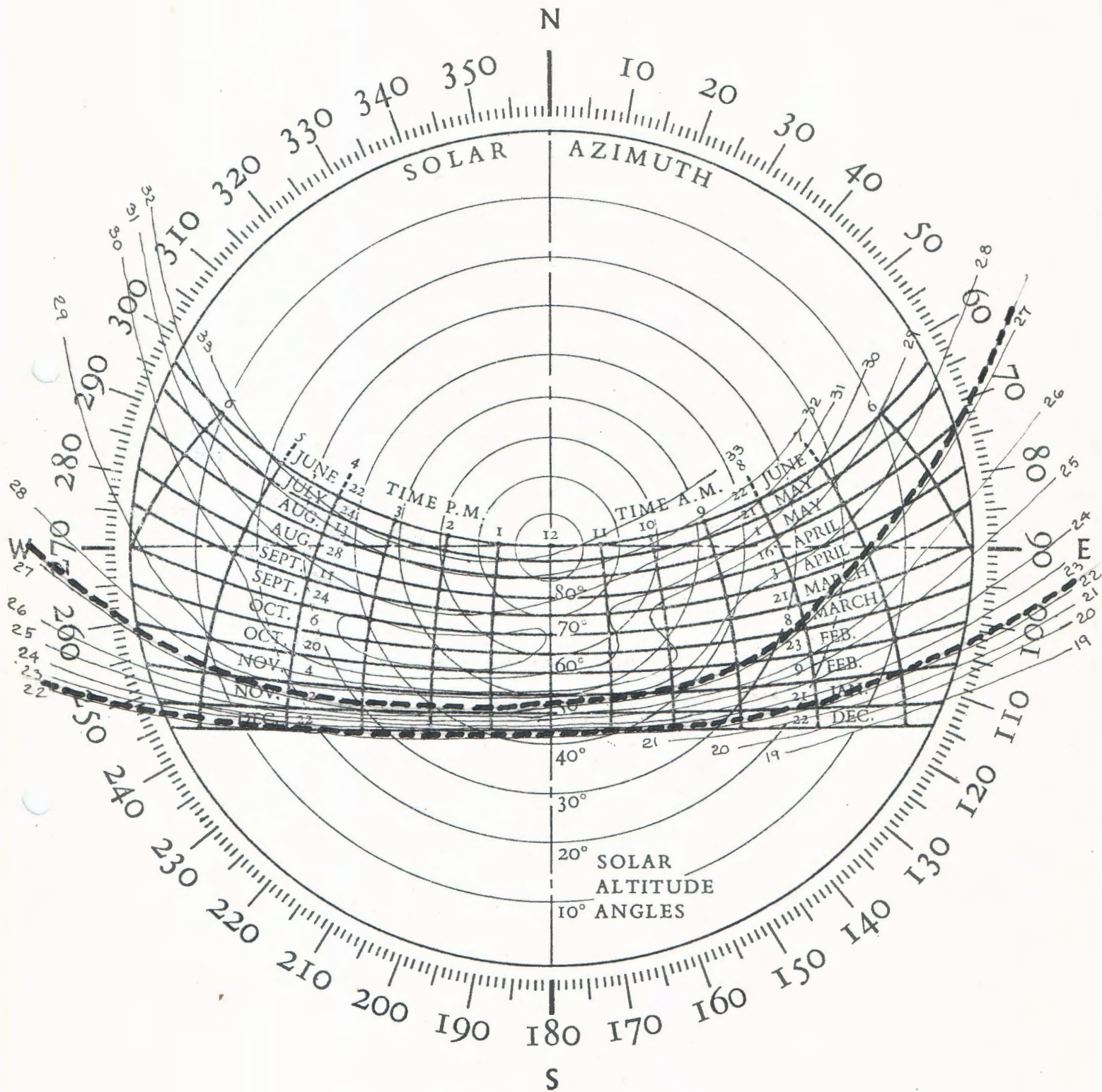


LATITUDE 24° NORTH

Figure XXXII. Solar charts (continued)

Muscat - Oman

January - June



LATITUDE 24° NORTH

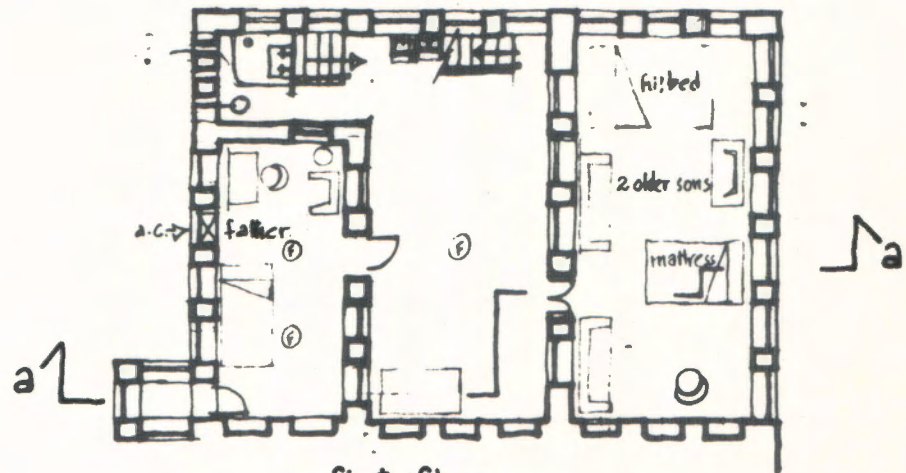
Figure XXXII. Solar charts (continued)

Muscat - Oman

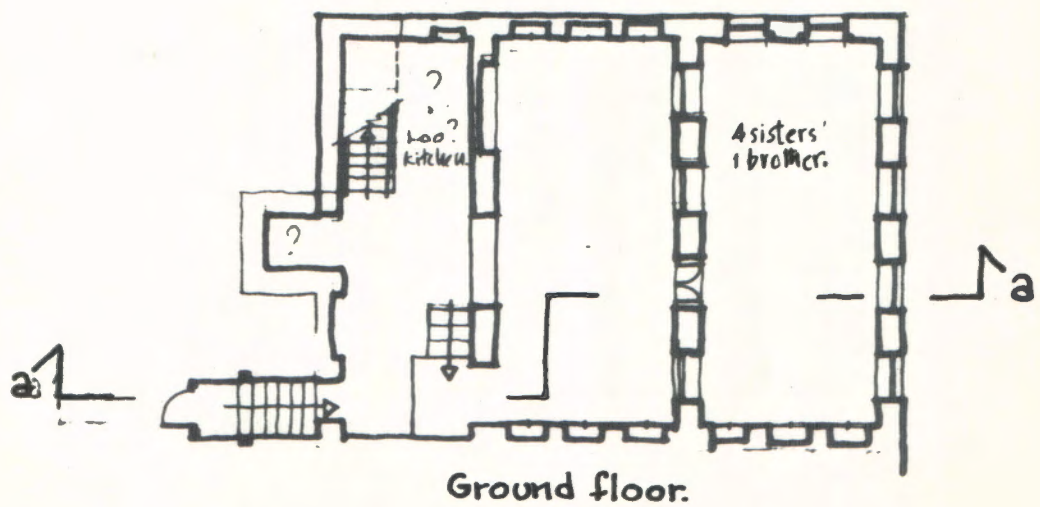
July - December



Section a-a.



first floor.



Ground floor.

House of Haji Ali Najmani
Molah (boy friend)

N