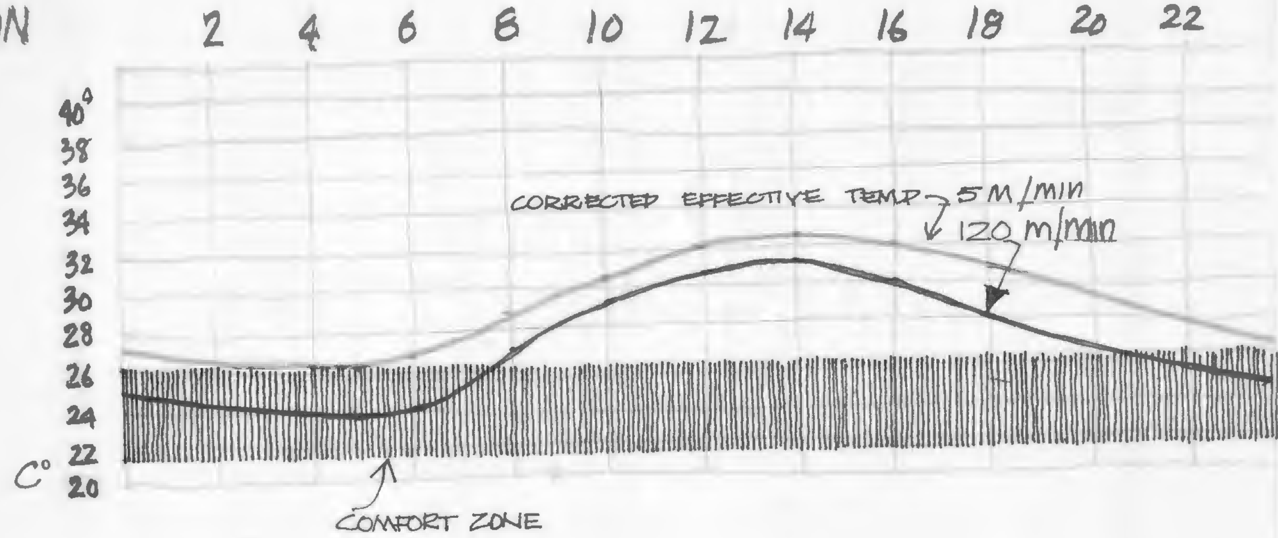
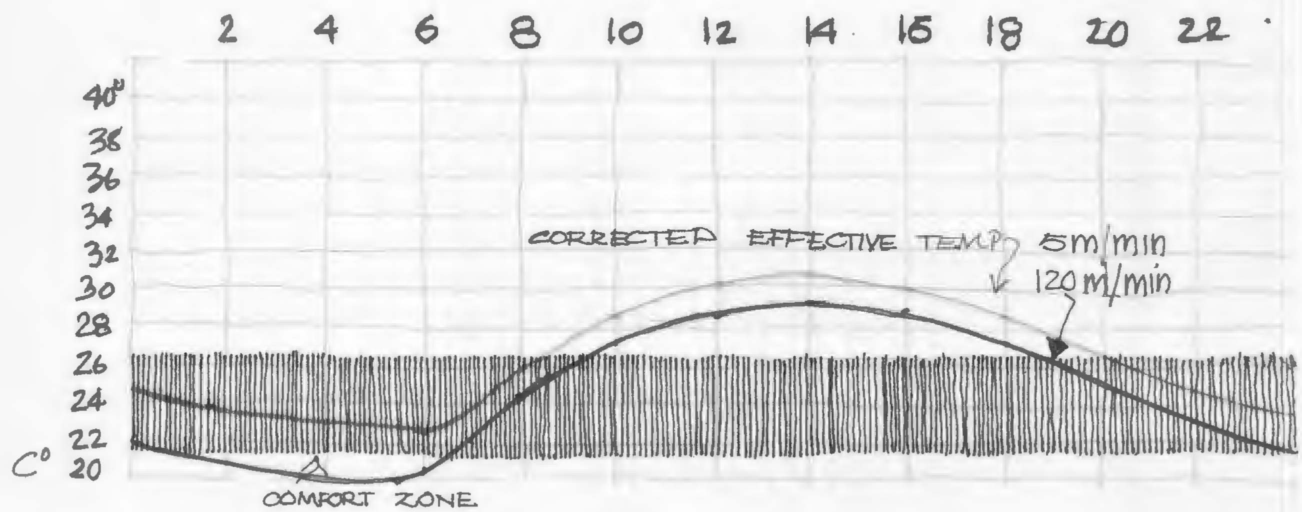
DIURNAL VARIATION

AZAIBA

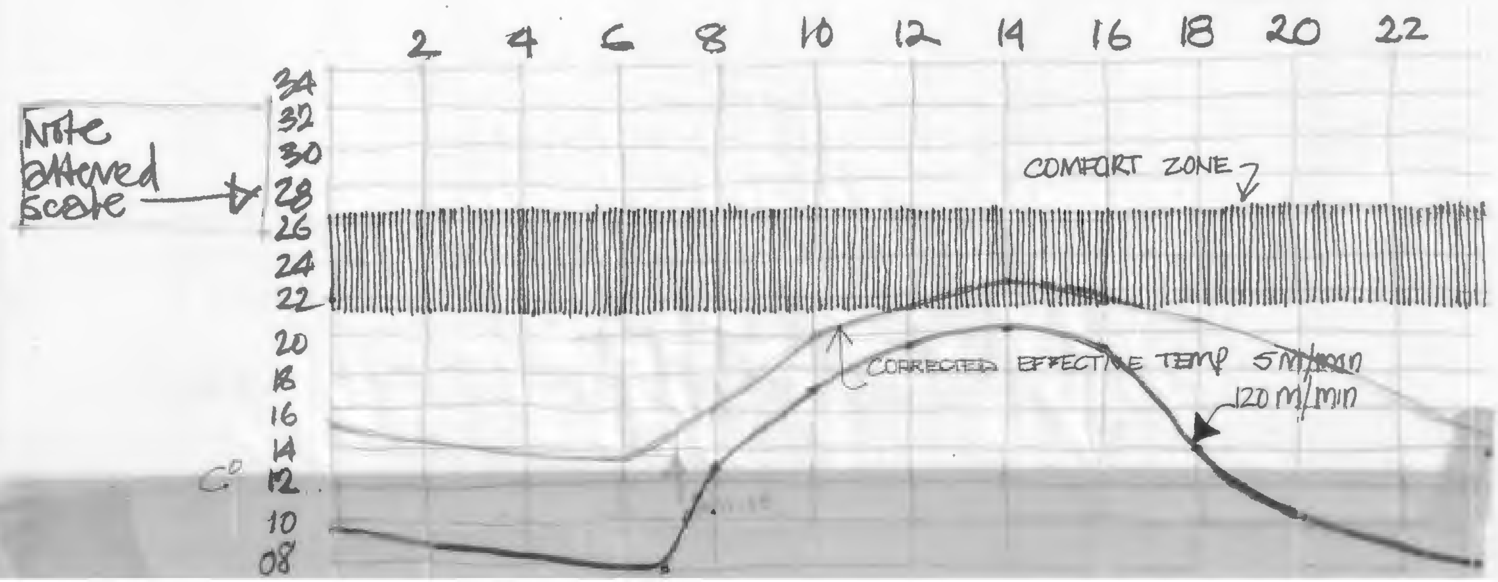
CRIT MONTH JULY



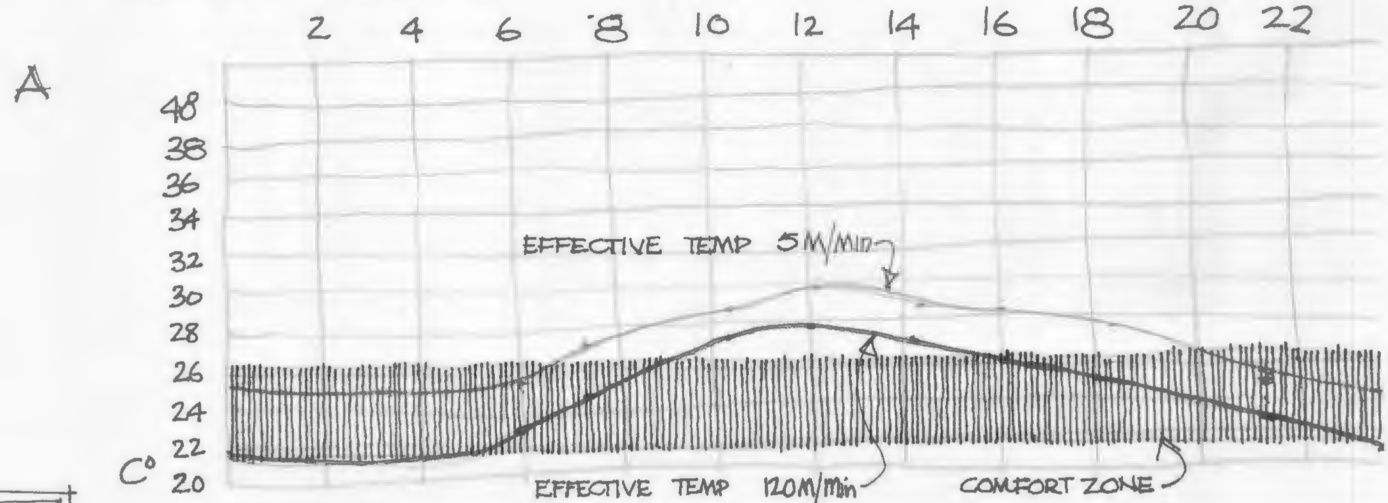
SEPTEMBER.



DECEMBER

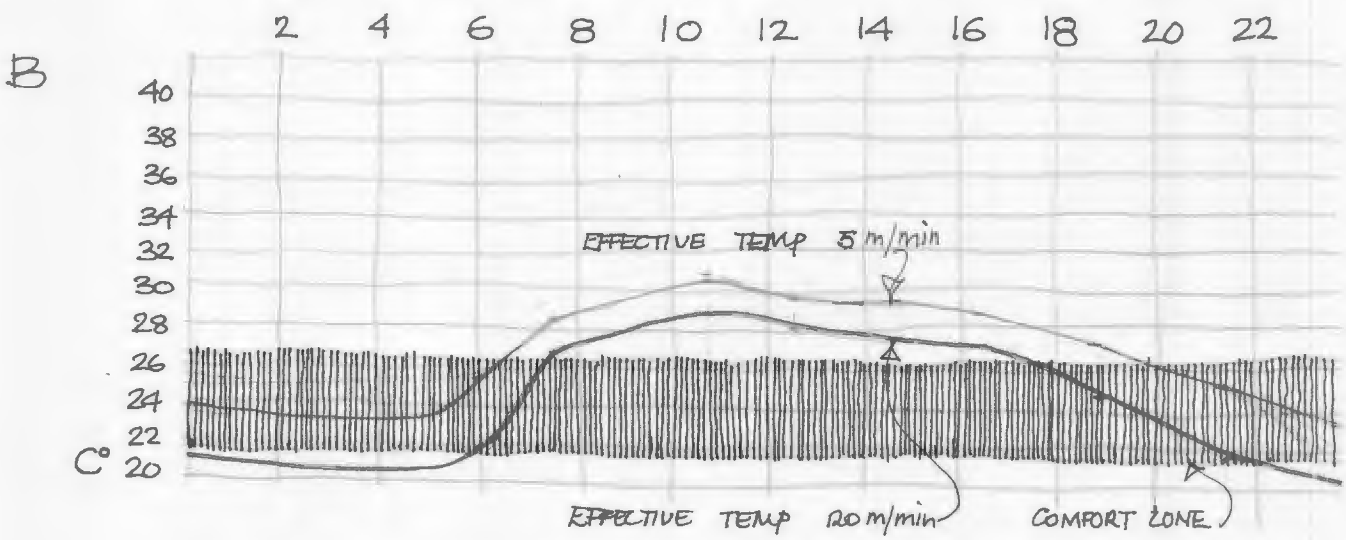


SOHAR BEACH

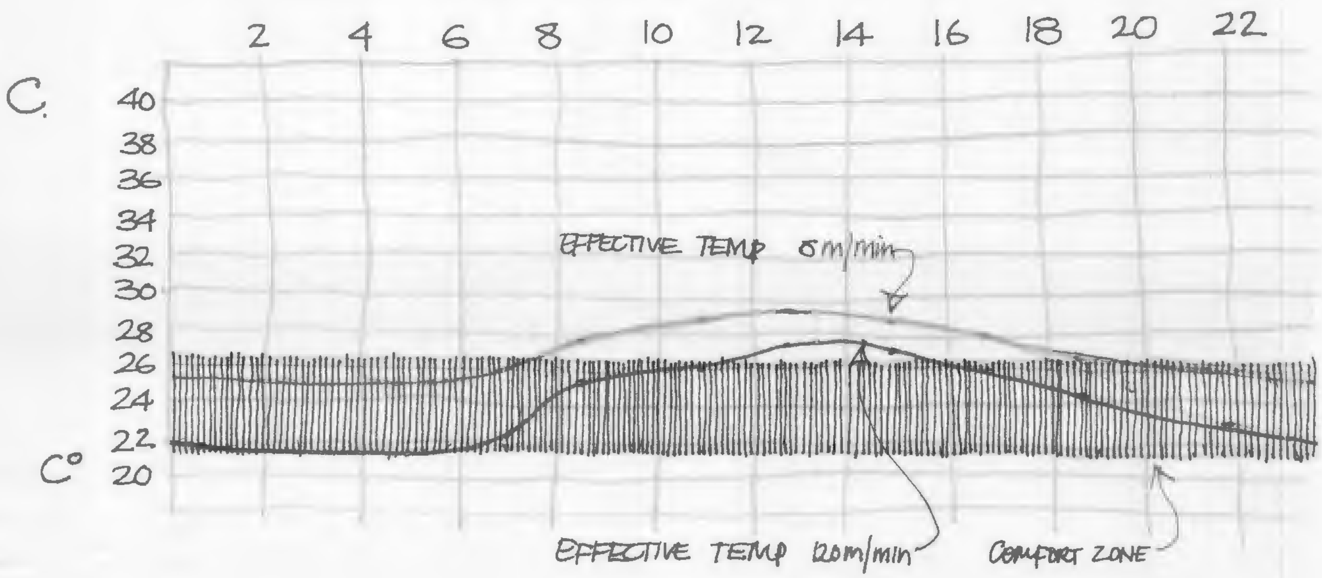


22/9/73

PALM GROVE BELT



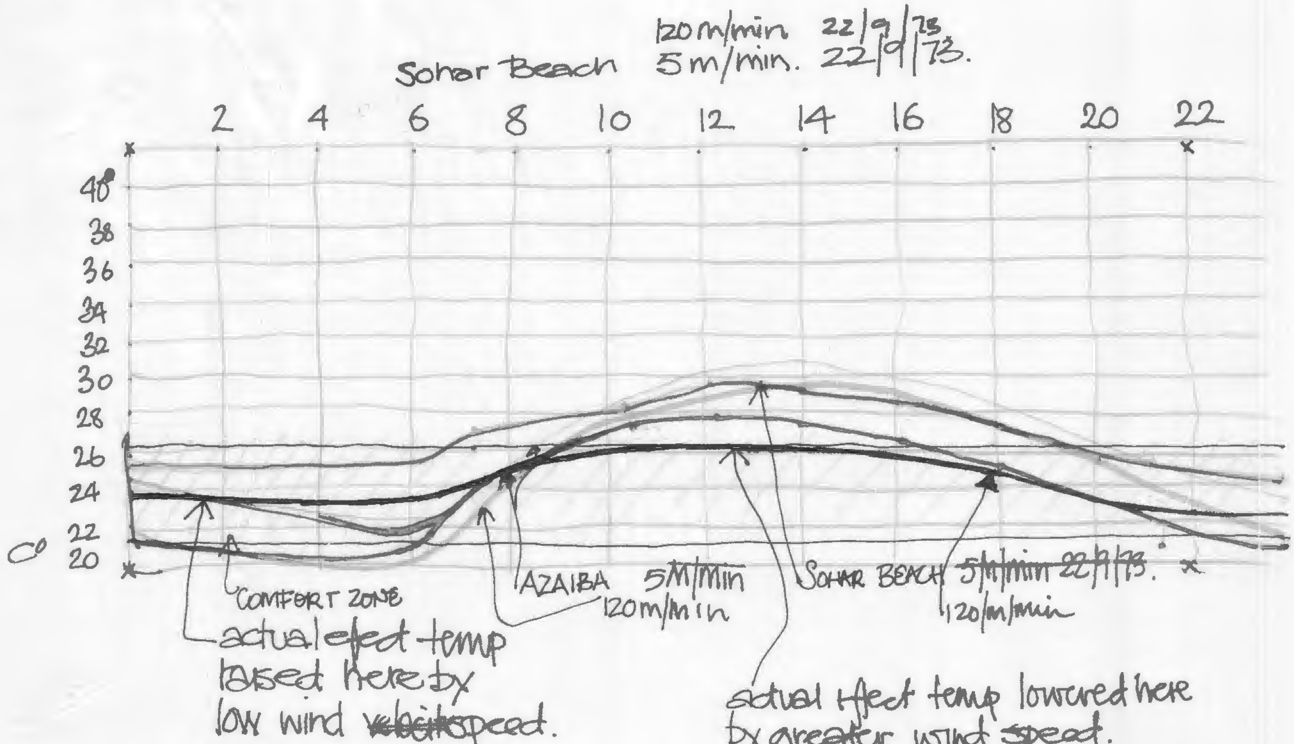
INLAND OF ASPHALT ROAD.



SOHAR.

DIURNAL VARIATION

SOHAR.



Stage Two.

sheets No 1–6 Take two houses at Om El Boche + plot internal + external contact temperatures for all surfaces. Internal + External Air temp.

House (a) was conc. block.

sheets No 7–15 (b) Barasti.

Both houses were studied the day after the Sohar climate study was done, so ~~bare~~ climatically there is a close relationship between these readings and the general conditions already shown.

The plotting of these figures is the first stage in analysing the thermal performance of the two building materials in question. Notably in the case of the Barasti house Salem Ben Abdullah.

Contact temperature gives a direct relationship between internal and external surface temperatures but these temperatures are a result of a combination of factors. The problem is then to distinguish the factors and the role that they play.

[17 gives velocity away from building] Below the contact temperature chart for each surface is another chart for wind velocity against the external surface. This is aimed at ascertaining the cooling effect of the air movement over the material.

18 The Solair chart is used in the same context. Solair is the equivlent to the

20-22 maximum that the external surface could heat up to. [Note that for Solair here certain figures have been extrapolated from Globe thermometer readings and is accordingly a bit higher than it should be. Correction will be done in the lab]

Solair should be calculated for each surface when all accurate figures are available.

Comparing solair to external contact temperature you can see how much potential heat has been lost through air movement, ~~reflectance~~ shading etc.

23 I have done an approximate calculation for the U value of a solid peice of barasti, giving a value of 1·75 m² deg^c/W. This is fairly accurate and enough to show that it is a good insulator. The contact temperature curves belie this. See

25-28 sheets 25 – 28.

16. Interior room air temperatures related to external

[19 is for 9 days later] air temperatures outline the problem, showing whether the materials create a microclimate

OMAN

STAGE ONE.

Establish climatic profile for Azaiba. [site of old Seeb Airport].
Official figures available. Rainfall taken for Mina al Fahal a few miles down the coast.

Sheet 1 shows air temp. Relative humidity and rainfall for the whole year.

Sheet 2. shows effective temp for Azaiba, calculated at Wind speed of 5m/min, + related to comfort zone.

Sheet 3. + 4 plots the times of the day during which the Effective temp is within the comfort zone. for the months January to June and July to December respectively.,

Sheet 5. takes two critical months. July + December, and the month for which work was done in Sohar, September, and plots the diurnal range of the effective temperature, for wind speeds of 5m/min [in red] and 120m/min [in blue]
Again related to comfort zone.

Sheet 6 plots the figures taken over a 24 hour period [22/23/9/73] for Sohar on
A. The BEACH.
B. In the Palm tree Belt
C. Inland ~~of~~ of the Asphalt Road [scrub/desert]
again effective temp at 5m/min and 120m/min.

These figures can thus be compared to september in Azaiba, and therefore one can see how close Azaiba is to the climate of Sohar ~ eg - Does it represent a good example of the Batinah coast climate.

Slight variations occur - partly due to the fact that detailed analysis of the Azaiba climate becomes theoretical - time of max/min etc. Whilst Sohar figs show an exact pattern for one day, with the alterations ~~shown~~ caused by air movement etc.

Sheet 7. Relates Sohar Beach to Azaiba. Black line indicates roughly how the wind speed will lower or raise the effective temp.

Giving greater idea of what the climate for that day actually was.

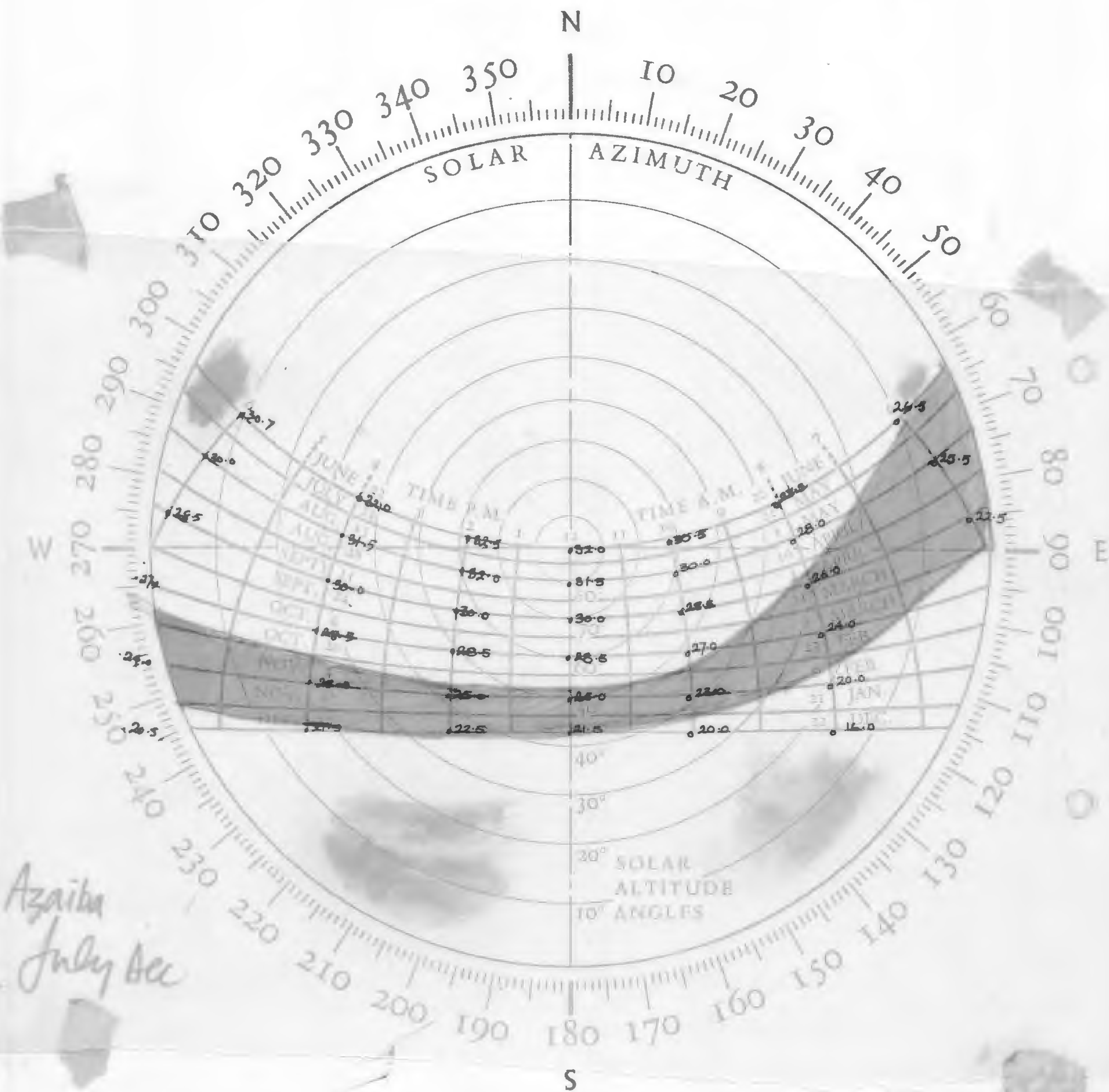
Azaiba readings probably relate closer to either palm tree belt or scrub belt.

23°36'N

ZONE.	(Northern) COASTAL PLAIN
PLACES.	(On coast) Azaiba.* Massanah. Sohar: (On Plain) Mallada. Falaj el Qabael.
SEASONS. Dry Bulb Temp.	TWO DISTINCT SEASONS. 1. HOT: MAY–OCT: Critical Month: May: 27°c. – 40°c. 2. COOL: NOV: – APRIL. DEC. JAN: 15°c. – 25°c. Moderate diurnal and annual range. D.R:– 10°c. A.R:– 25°c.
R.H.	High in Summer & Winter:– ~~Jan~~ Aug. & Jan: 75%. Moderate in Spring and Autumn. average 50%
Rainfall.	75 m.m. p. annum. LOW. Dec. – Feb: occasionally in Aug.
Air Movement.	Daytime Northerly ~~land~~ sea Breeze. strongest in summer and autumn. Nightime. Southerly land-breeze. light.
COMFORT & DESIGN IMPLICATIONS.	

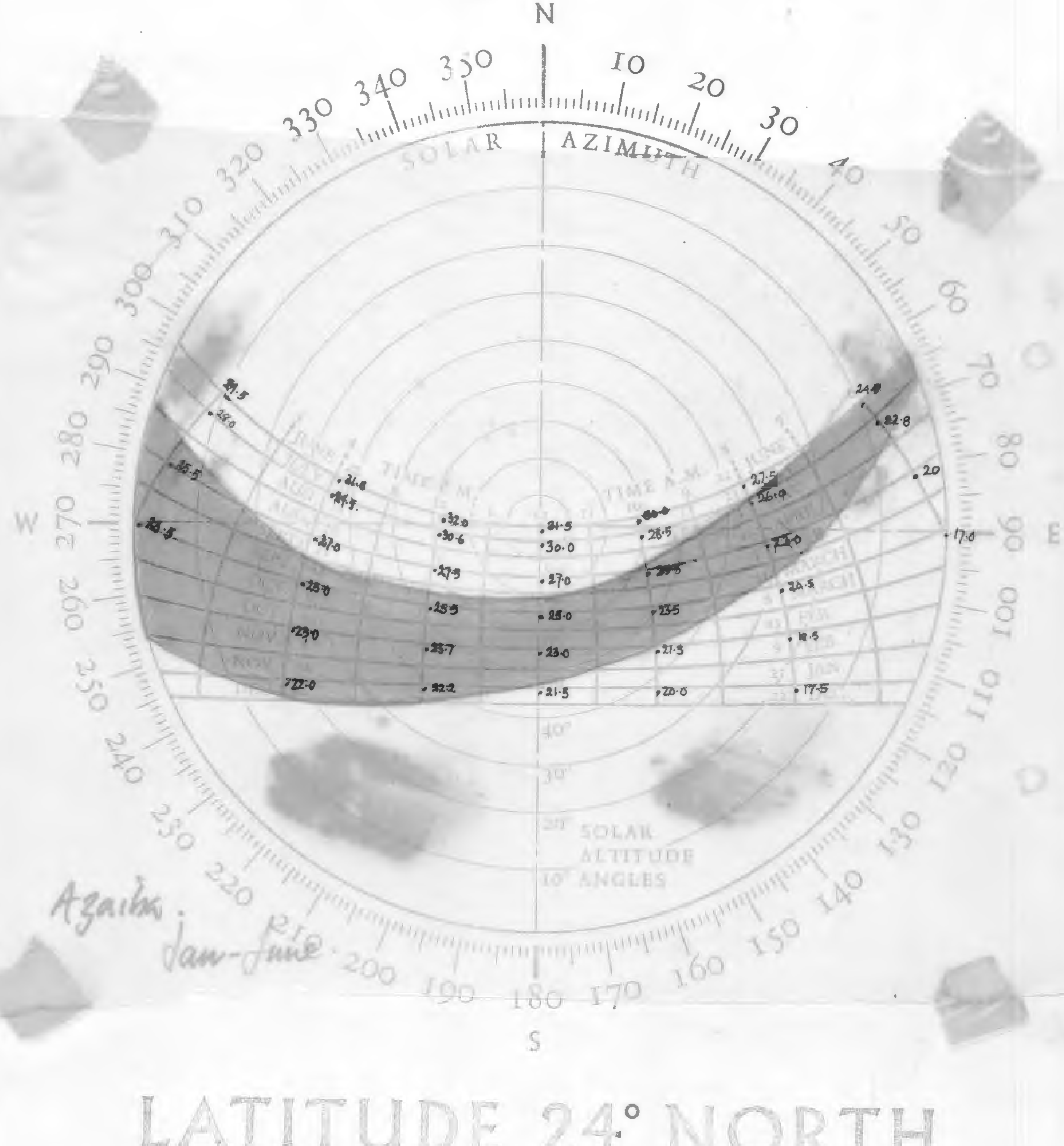
* Climatic data derived from Met. office in Azaiba

SOLAR CHARTS



LATITUDE 24° NORTH

SOLAR CHARTS



LATITUDE 24° NORTH

Heat Transfer Barasti/Mud - Salala

(October) ← Radiation →

	Air Temp	N	E	S	W	Roof	N	E	S	W	Roof
6	23	0	0	0	0	0	23	23	23	23	23
8	25	0	525	240	0	250	~~28~~ 25	38	31	25	31.25
10	28	0	400	400	0	640	28	38	38	28	44
12	29	0	0	440	0	760	29	29	40	29	48
14	30	0	0	400	400	640	30	30	40	40	46
16	29	0	0	240	525	250	29	29	35	42	35.25
18	26.5	0	0	0	0	0	26.5	26.5	26.5	26.5	26.5

Sol. Air. Temp = $A\,I\,r_o + t_o$

$= (.5)\,I\,(.05) + t_o$

Absorptivity = .50
(Mud Plaster)

(January)

	Air Temp	N	E	S	W	Roof	N	E	S	W	Roof
6	17	0	0	0	0	0	17	17	17	17	17
8	19	0	430	270	0	180	19	29.75	25.75	19	23.5
10	22	0	380	460	0	500	22	31.5	33.5	22	34.5
12	22.5	0	0	550	0	650	22.5	22.5	35.75	22.6	38.75
14	23.5	0	0	460	380	500	23.5	23.5	35	33	37
16	23	0	0	270	430	180	23	23	29.75	33.75	27.5
18	20.5	0	0	0	0	0	20.5	20.5	20.5	20.5	20.5

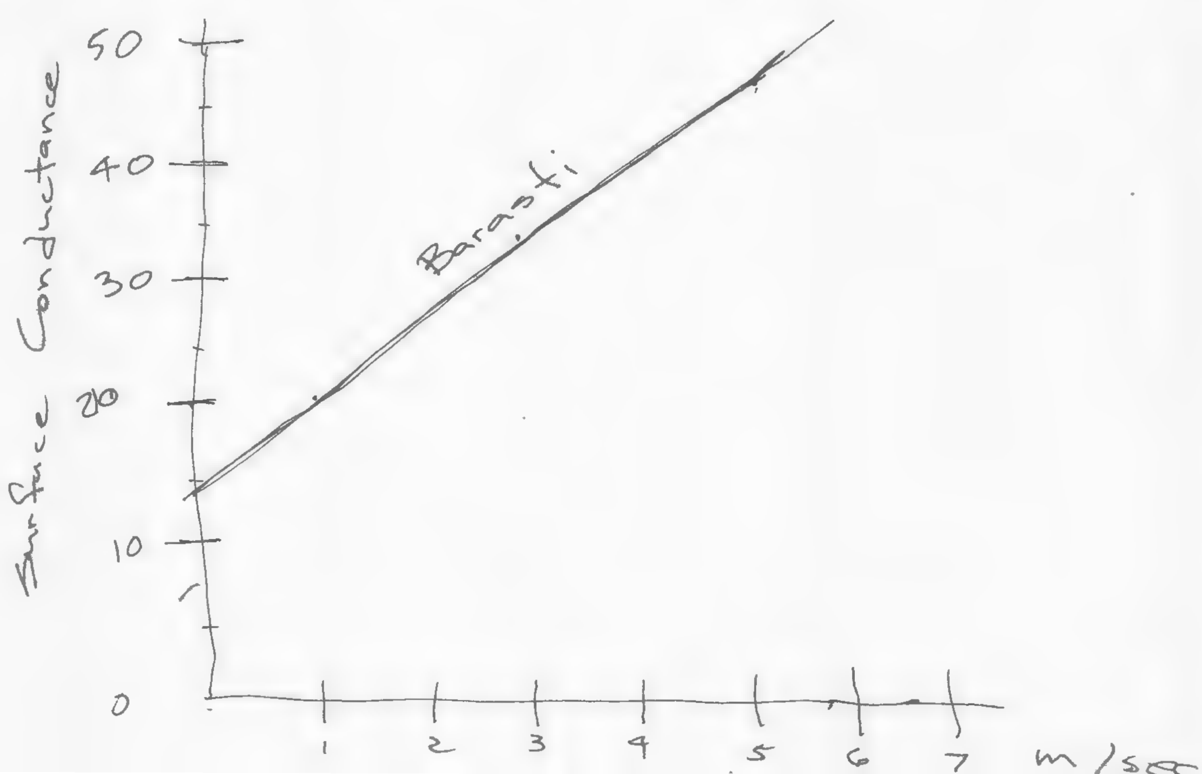
Barasti – Sohar Sept. 73.

Radiation. $r_0 = .05$

	Air Temp.	N.E.	S.E.	S.W.	N.W.	Roof	N.E.	SE	SW	NW	Roof	Velocity
7	26.5	150	300	0	0	80		37.5				
9	29.5	225	590	0	0	475		51.6				
10	31	75	550	0	0	650		51.6				
12	33.0	0	340	340	0	775		45.05				
14	32	0	0	550	75	650						
15	31.5	0	0	590	225	475						
17	30	0	0	300	150	80						

Velocity across surface & corresponding surface conductance

	N.E	sc	S.E.	sc	S.W	sc	NW	sc	Roof	sc	r_0 SE	Temp
7	0.8	18	1.8	27	0.2		1.8		1.9		.037	34.8
9	1.3	22	2.0	28	0.3		2.0		2.1		.0357	45.3
10	1.4	25	2.2	29	0.4		2.2		2.2		.0345	45
12	1.6	26	2.4	30	0.4		2.4		2.4		.033	40.1
14	1.8	27	2.9	34	0.5		2.9		2.9		.0294	
15	1.9	28	3.1	37	0.5		3.1		3.0		.027	
17	1.9	28	3.0	36	0.4		3.1		3.0		.028	



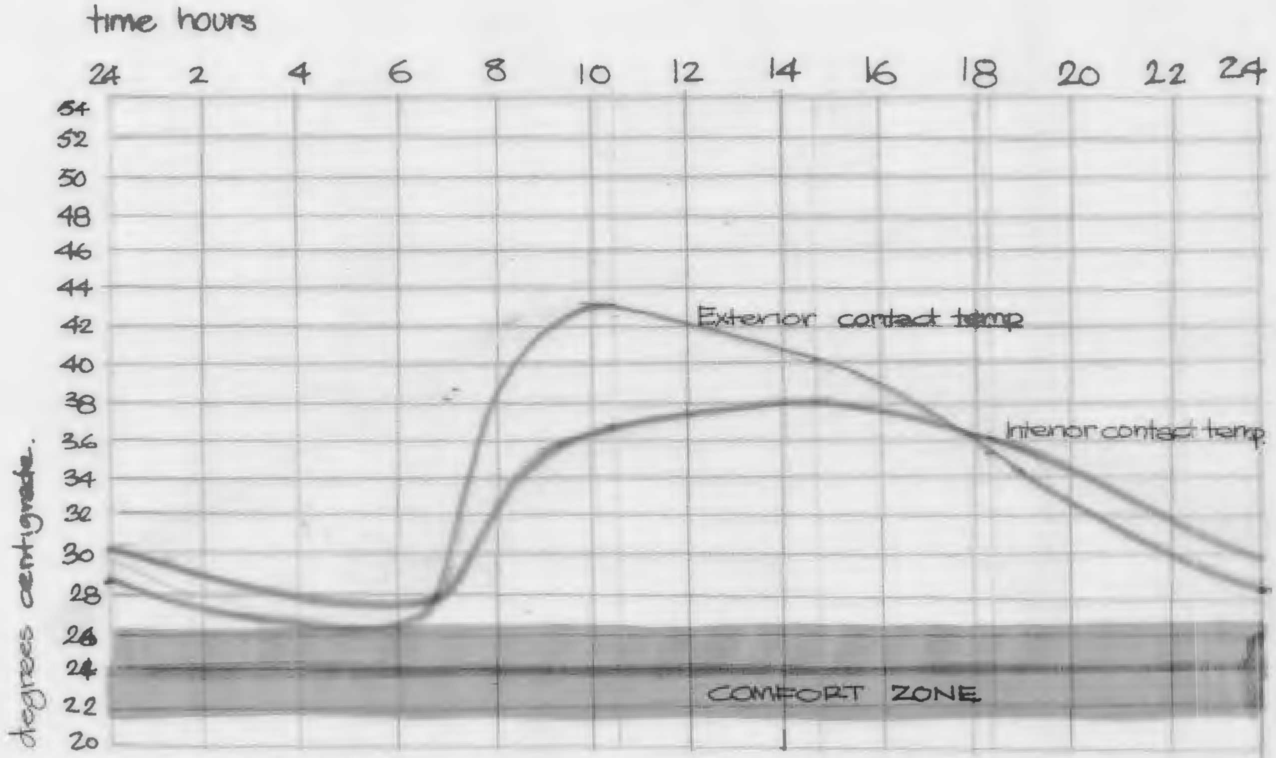
Corrected Effective Temp Diurnal Range - hourly Agaiba

14.0 | 17.5 | 20.0 | 21.5

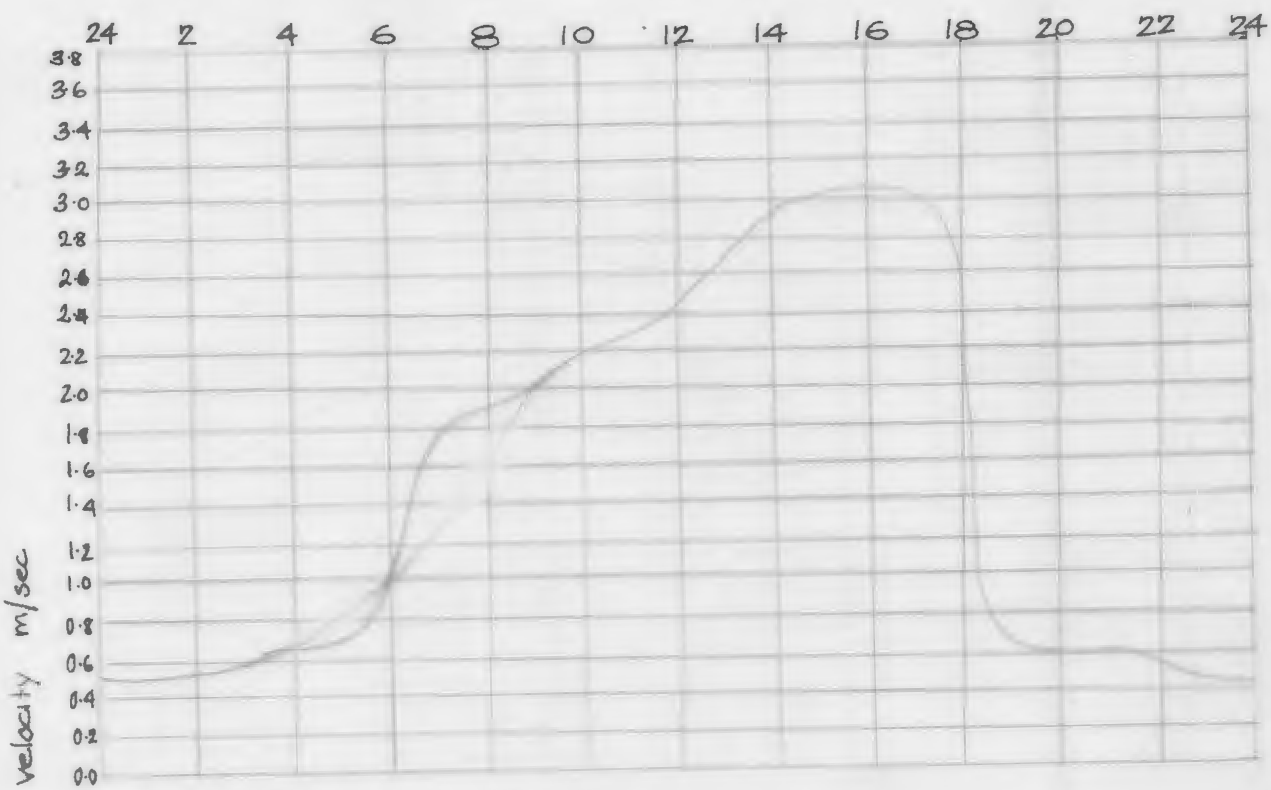
	5.0	6.00	8.00	10.00	12.00	14.00	16.00	18.00
Jan		12.3	14.5	17.0	21.5	22.2	22.0	20.0
Feb		15.5	18.5	21.5	23.0	23.7	23.0	21.5
Mar		17.0	20.5	23.5	25.0	25.5	25.0	23.5
April		20.0	23.0	25.5	27.0	27.5	27.0	25.5
May	22.5	22.8	26.0	28.5	30.0	30.6	29.5	28.0
June	24.0	24.5	27.5	30.0	31.5	32.0	31.5	29.5
July	26.0	26.5	28.5	30.5	32.0	32.5	32.0	30.7
Aug.	25.0	25.5	28.0	30.0	31.8	32.0	31.5	30.0
Sept		22.5	26.0	28.5	30.0	30.5	30.0	28.5
Oct		20.3	24.0	27.0	28.5	29.0	28.5	27.0
Nov		17.5	20.0	23.0	25.0	25.6	25.0	24.0
Dec.		13.5	16.0	20.0	21.5	22.5	21.5	20.5

calculation for charts 3+4.

House of Salem Ben Abdullah



South Wall. 'C'
same as 'B'



Wind Velocity in contact with surface

Surface
Conductance
for Parasti

A r_0 F t

A = .75
I
r_0 .05

.028
36) 100
72
280
288

.027
37) 100
74
260
259

.0294
34) 100
68
320
306
140

m / sec

.033
30) 1.00
90

.037
27) 1.00
81
190
189

.0357
28) 1.00
84
160
140
200
196

.0345
29) 1.00
87
130
116
140
145

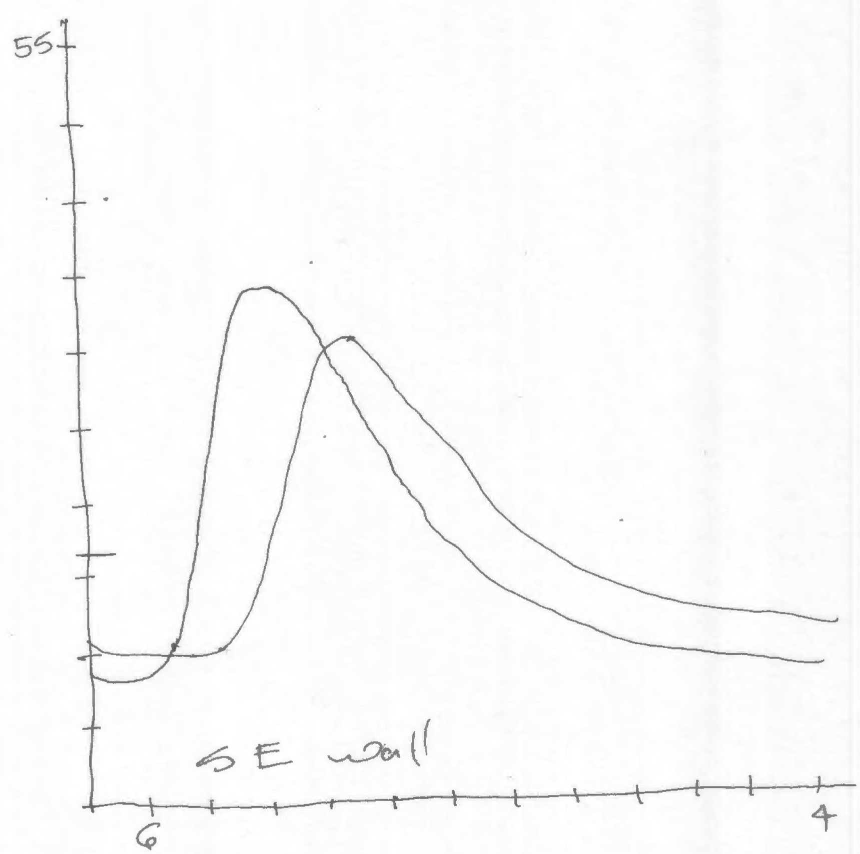
30
25
20 40
15 30
10 20
5 10

velocity

75 590
.05 .0375
.0375 2950
300 4130
11.2500 1770
226.5 22.1250
37.75 29.5
51.6

.0375
550
18750
1873
206250
31

.0375
340
15000
1125
12.7500
33
4575



55
SE wall
6
4

raising of the temperature of the interior wall surface. The time that it takes for heat to pass through the wall is called time lag and depends on the thickness of the wall & the termal properties & density of its materials, The proportion of heat which reaches the interior surface (compared to the temp. of the exterior wall) is dependent on the decrement factor of the material of the wall.

Barasti

$r_o = 0.03$

	NE	SE	SW	NW	Roof	Air
7	29.8	33.25	26.5	26.5	28.3	26.5
9	34.5	42.75	29.5	29.5	40.1	29.5
10	32.6	43.4	31	31	45.6.	31
12	33	40.7	40.7	33	50.4	33
14	32	32	44.4	33.6	46.6	32
15	31.5	31.5	44.75	36.5	42.1	31.5
17	30	30	36.75	33.4	31.8.	30

Sohar

Using $r_o = 0.05$
or
outside surface conductance = 20

	Air Temp.	NE	SE	SW	NW	Roof	NE	SE	SW	NW	
7	26.5	150	300	0	0	80	32	37.75	26.5	26.5	29.5
9	29.5	225	590	0	0	475	38	51.5	29.5	29.5	47.3
10	31	75	550	0	0	650	34	51.5	31	31	55.4
12	33.0	0	340	340	0	775	33	45.75	45.75	33	62.1
14	32	0	0	550	75	650	32	32	52.5	35	56.4
15	31.5	0	0	590	225	475	31	31.5	53.5	40	49.3
17	30	0	0	300	150	80	30	30	41.25	35.5	33

$AI r_o + t_o$

A = absorbtivity averaged from calculated values on site using mini-lux
= .75

I = table

$R_o = .05$

Sohar ~~Craft~~ Critical Month December.

	Dec. Air temp	N.E.	S.E.	S.W.	N.W.	Roof	NE	SE	SW	NW	Roof
6	13.5	0	0	0	0	0	13.5	13.5	13.5	13.5	13.5
8	15	80	400	0	0	125 ~~260~~	17.0	25	15	15	18
10	19	0	650	120	0	440 ~~520~~	19	35.25	22	19	30
12	22.2	0	420	420	0	550 ~~610~~	22.2	32.7	32.7	22.2	36
14	22.5	0	120	650	0	440 ~~520~~	22.5	26.5	38.75	22.5	33.5
16	21	0	0	400	80	125 ~~260~~	21	21	31	23.0	24
18	18.5	0	0	0	0	0	18.5	18.5	18.5	18.5	18.5

$$\text{Sol. Air. Temp} = A I r_o + t_o$$
$$= (.5) I (.05) + t_o$$

420 × .025 = 2100 + 840 = 10.5

650 × .02

650 × .025 = 3250 + 1300 = 16.250

400 × .025 = ~~800~~ 2000 + 800 = 10.0

120 × .025 = 600 + 240 = 3.000

440 × .025 = 2200 + 880 = 11.000

125 × .025 = 625 + 250 = 3.125

550 × .025 = 2750 + 1100 = 13.750

Relationship of Air movement to Wall surface Temperature

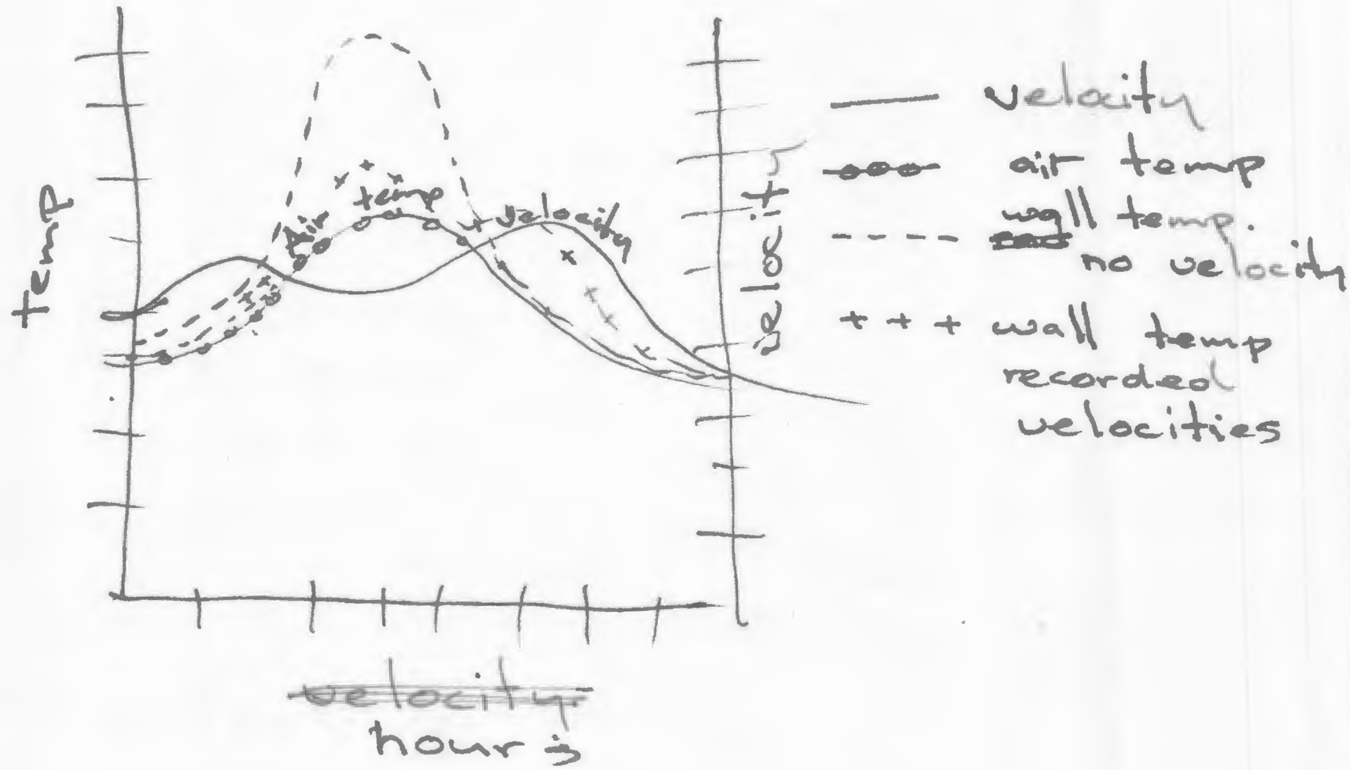
The exterior exposed surface wall temperature depends on the air temperature & the heating effect of the sun's radiation. & the effect of air movement across the surface.

The radiation of the sun (esp. ~~infra~~ red end of spectrum) when reaching the surface of the wall are either reflected or absorded, the degree depending on the absorbtivity of the surface, principally the collour. Heat energy is generated on the surface, a proportion of which is lost to the atmosphere by direct conduction[1] to the molecules of air. This is generally small because the layer of still air on the walls surface acts as an insulator, between wall temp. & air temp. As the wind velocity is increased, turbulence occurs on the surface, disturbing the insulation layer of air. As the air temperature is lower than the wall temperature, this turbulence causes new molecules of air to continually come in contact with the wall surface, thus draw off more heat [illegible]

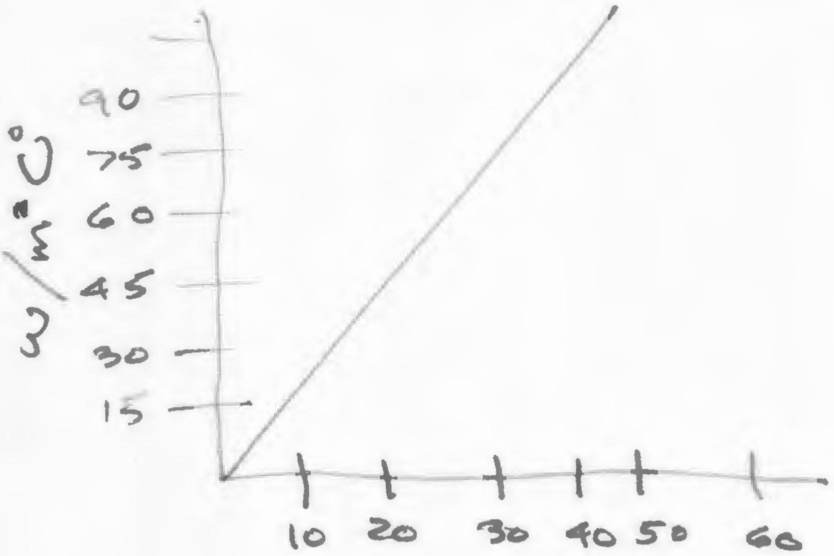
[1] (The amount depends on the amount of water vapour in the air)

the wall's surface falls.

The surface texture of the wall effects this phenomina, the rougher the surface the greater the turbulence on the surface when there is air movement.



Note: "Surface Conductance" is the term used to describe the (thermal) action of the air layer on the surface of the wall. The higher the conductance the greater heat loss there is between wall and the air. The greater the wind velocity the greater the conductence, thus ~~the greater the~~ more heat given off from the wall surface to the air, ∴ lowering of wall surface temperature



note.
extrapolation from available data for ~~barasti~~ wall

* if wall can be made smoother by ie. rendering, the conductance can be lowered (show DPU graph.

Heat Transfer:

A proportion of this heat built up on the surface of the wall ~~due~~ to solar iradiation is lost to the air and the remainder of the heat results in the raising in temp. of the wall surface. Heat is transfered into the wall itself (from the surface) by direct conduction of ~~heat~~ from molecule to molecule of the wall material. A portion of this

Solair. hourly dist.

At Ro + to =

.055

A = Absorbtivity = ·75

·75

80

I

ro = ·05

·75 72
8 64
68̶00 ·05
3̶4̶0̶0̶ ·3·200

At 7 ∅sa = ·75 × 80 × ·05 + 26·5
= ~~26·8~~ oc 29·~~5~~ oc

750
640 150

26 8
29·7

·75
·05
·0375

9. ∅sa = ·75 × 475 × ·05 + 29·5.
= 47·3 oc

475
75
475
·0375
2375
33250
142500
17·8125
295
47·3125

10. ∅sa. ·75 × 650 × ·05 + 31.
55·4 oc

650
0375
750

12 ∅sa ·75 × 775 × ·05 + 33.
62·1 oc.

·0375
650
18750
225000
24·3750
31
55·4

475
·0375
2375
33250
142500
025
17·7925
29·5
47·2925

14 ∅sa. ·0375 × 650 + 32
= 56·4 oc

15 ∅sa ·0375 × 475 + 31·5
= 49·3 oc

·0375
775
1875
26250
262500
290625
33
62·1

75

17 ∅sa = ·0375 × 80 + 30
= 33 oc.

·0375 5
80 5
3·0000 24
29·5.

7. ·0225
80
1·8000

475
·0225
2375
9500
95000
1·06875

·75
·03

950

7. = 28.3
9 = 40·1
16 = 45·6
12 = 50·4.
14 = 46·6
15 = 42·1
17 = 31·8

340·1

31
4

650
·0225
3250
13000
130000
14·6250
31
45·6

1300

32
46

775
·0225
3875
15500
155000
17·4375
33
50·4

1550

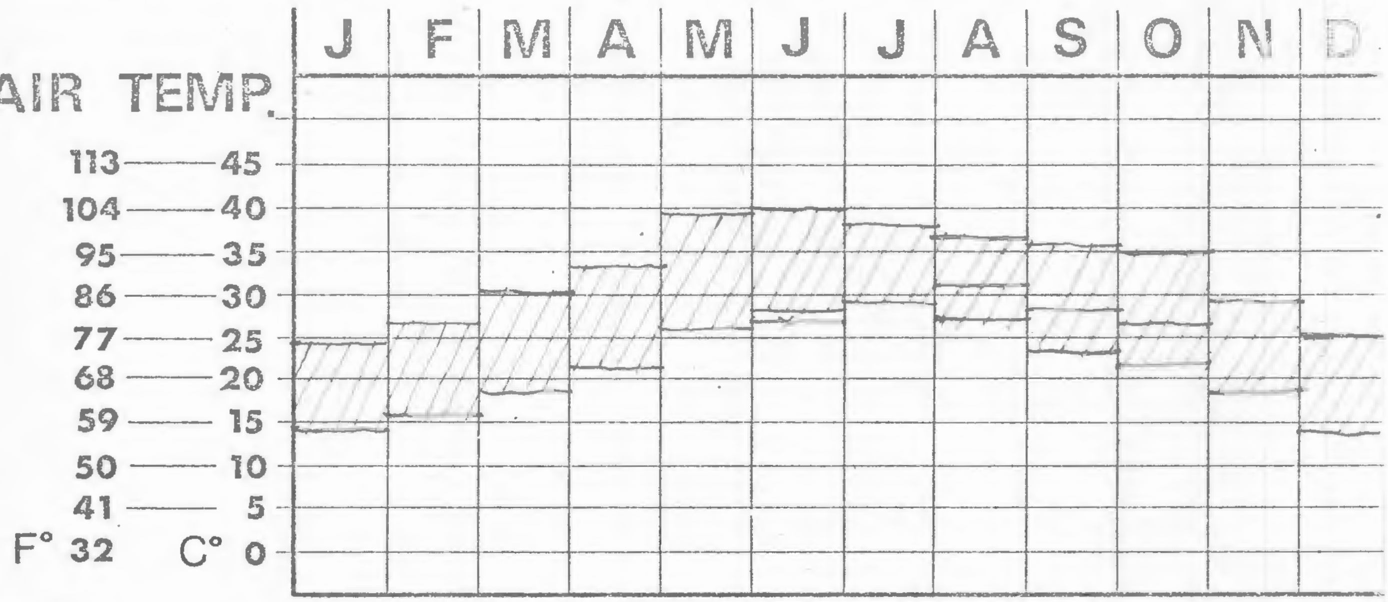
DEVELOPMENT PLANNING UNIT U.C.L.

CASE BOOK: PROGRAMME:

CLIMATIC DATA 1

LOCATION AZAIBA (OMAN) LONG...... LAT...... ALT....

1 AIR TEMP.



2 REL. HUMIDITY

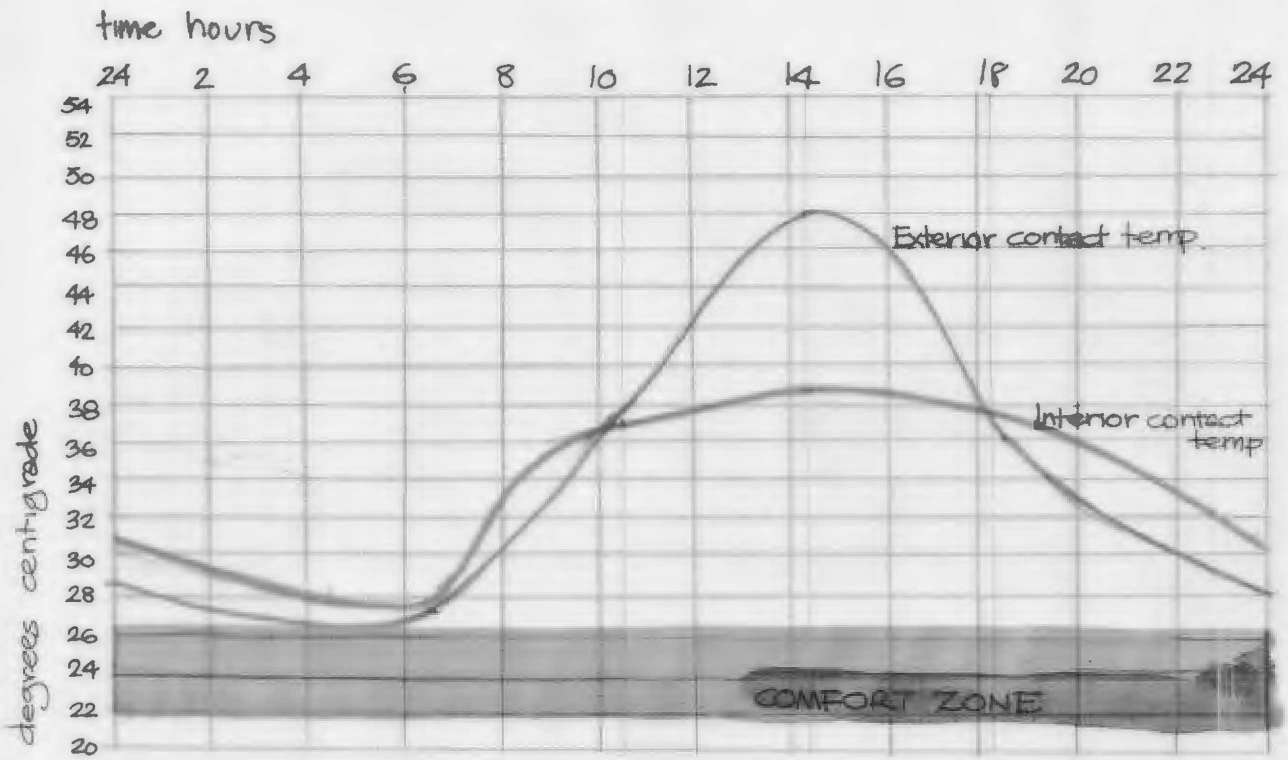
PER CENT: 70, 60, 50, 40, 30, 20, 10

3 RAINFALL

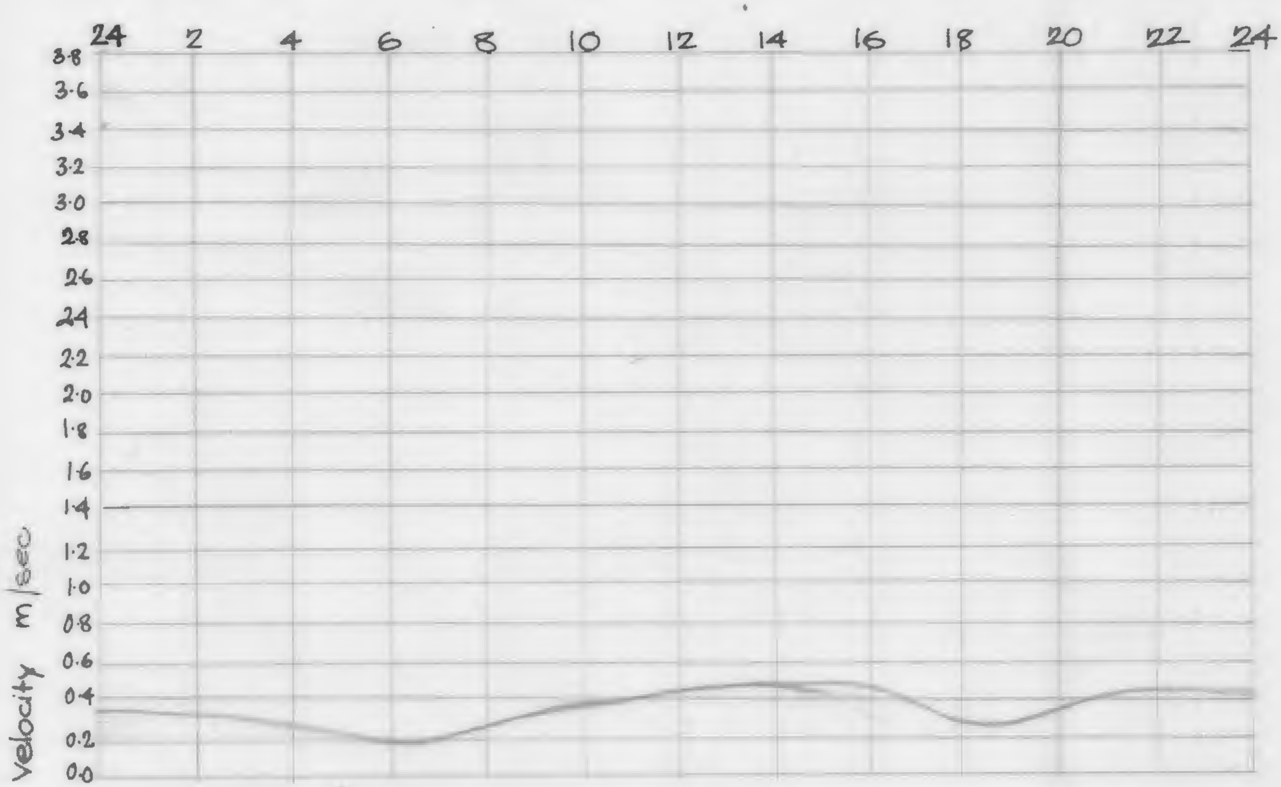
INCHES / mm: 32 — 80, 28 — 70, 24 — 60, 20 — 50, 16 — 40, 12 — 30, 8 — 20, 4 — 10

SOURCE: OMAN – Dept. of Information. Muscat. 1972. DATE:

House of Salem Ben Abdullah.

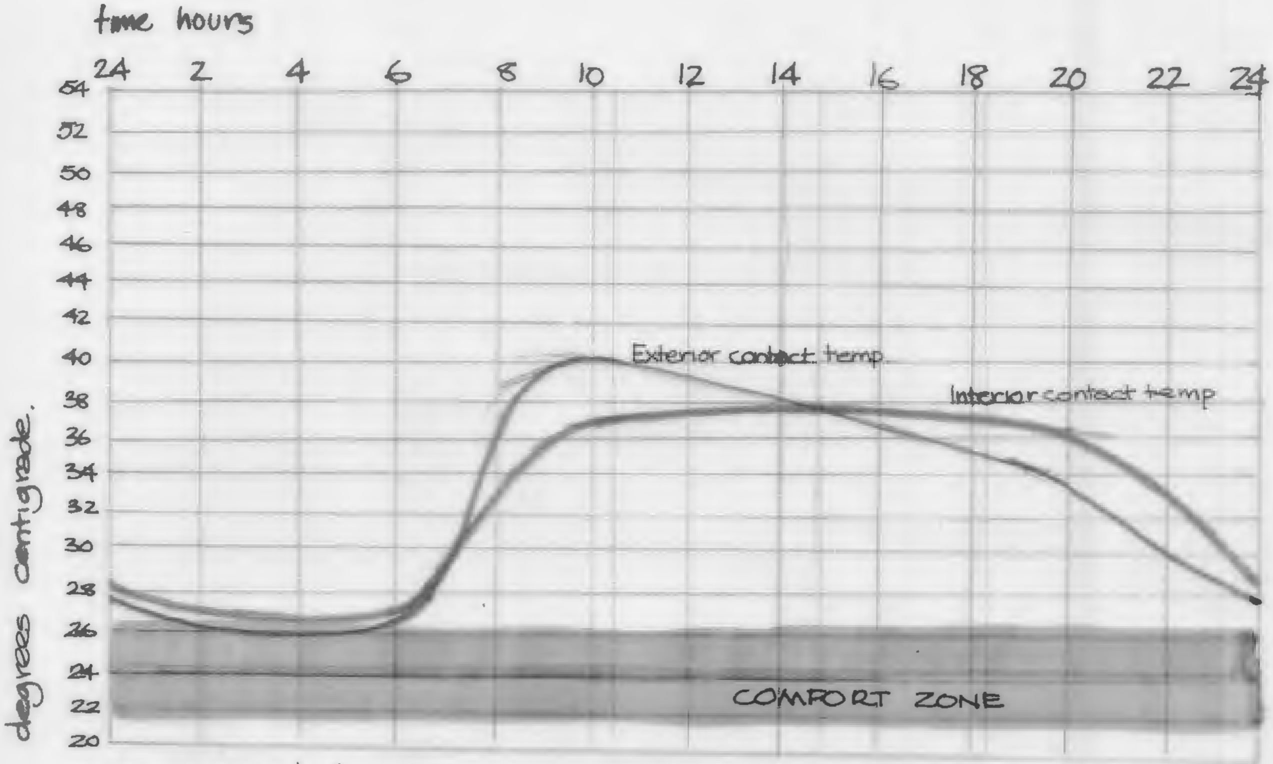


West Wall 'D'
Same as 'B'

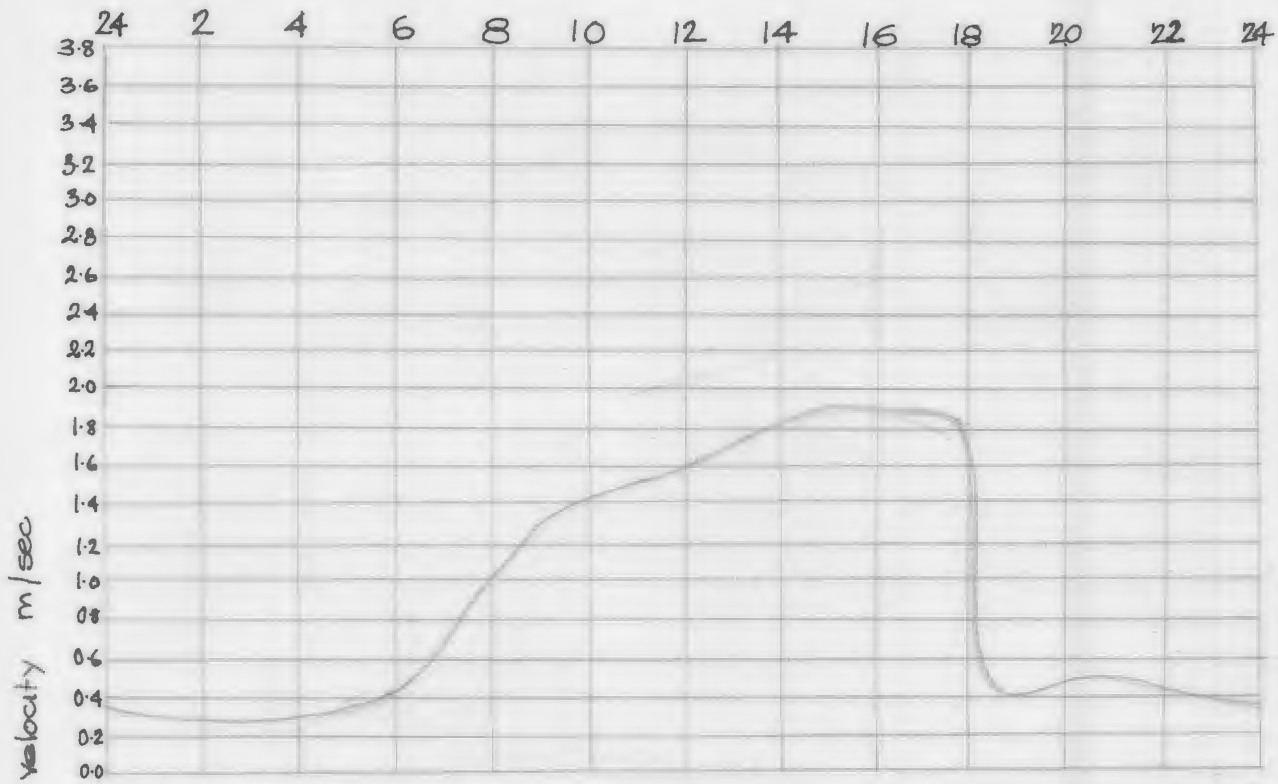


Wind velocity in contact with surface

House of Salem Ben Abdullah.

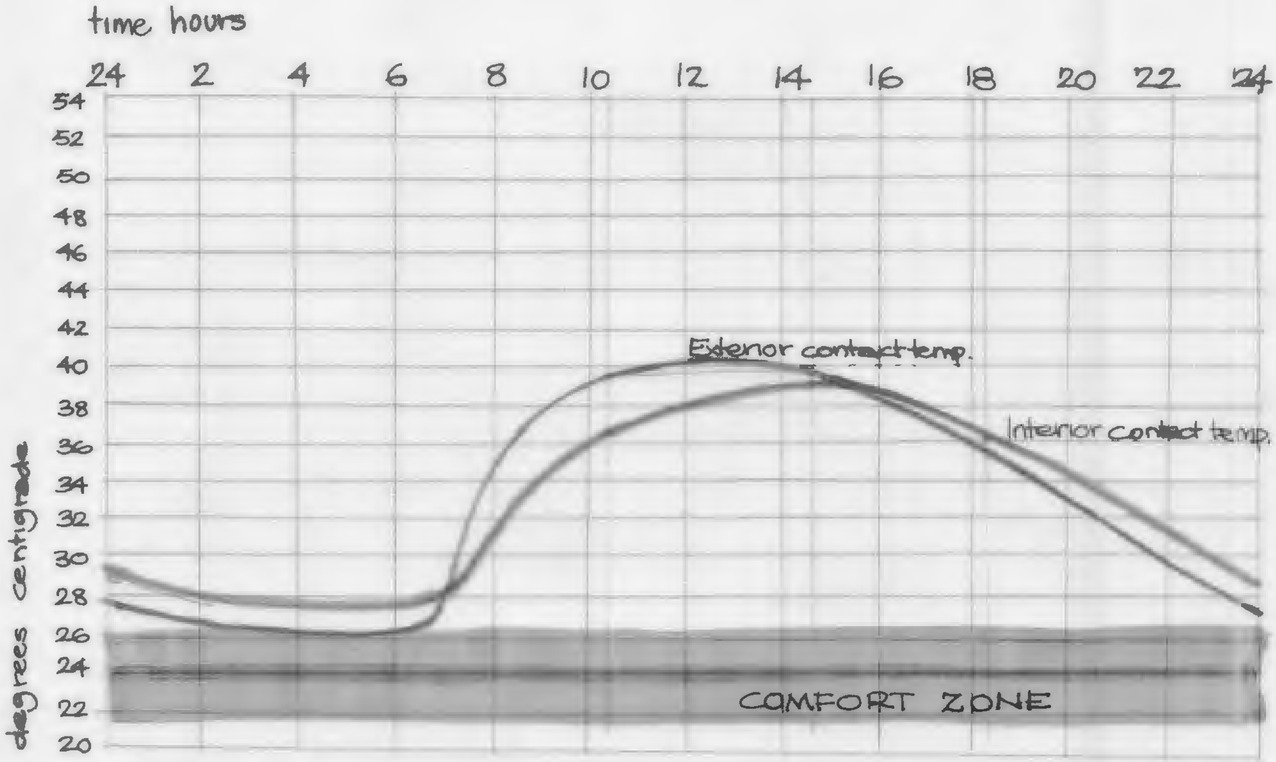


East Wall. 'H'.
Plain Barasti. No leaves. 7mm spacing.

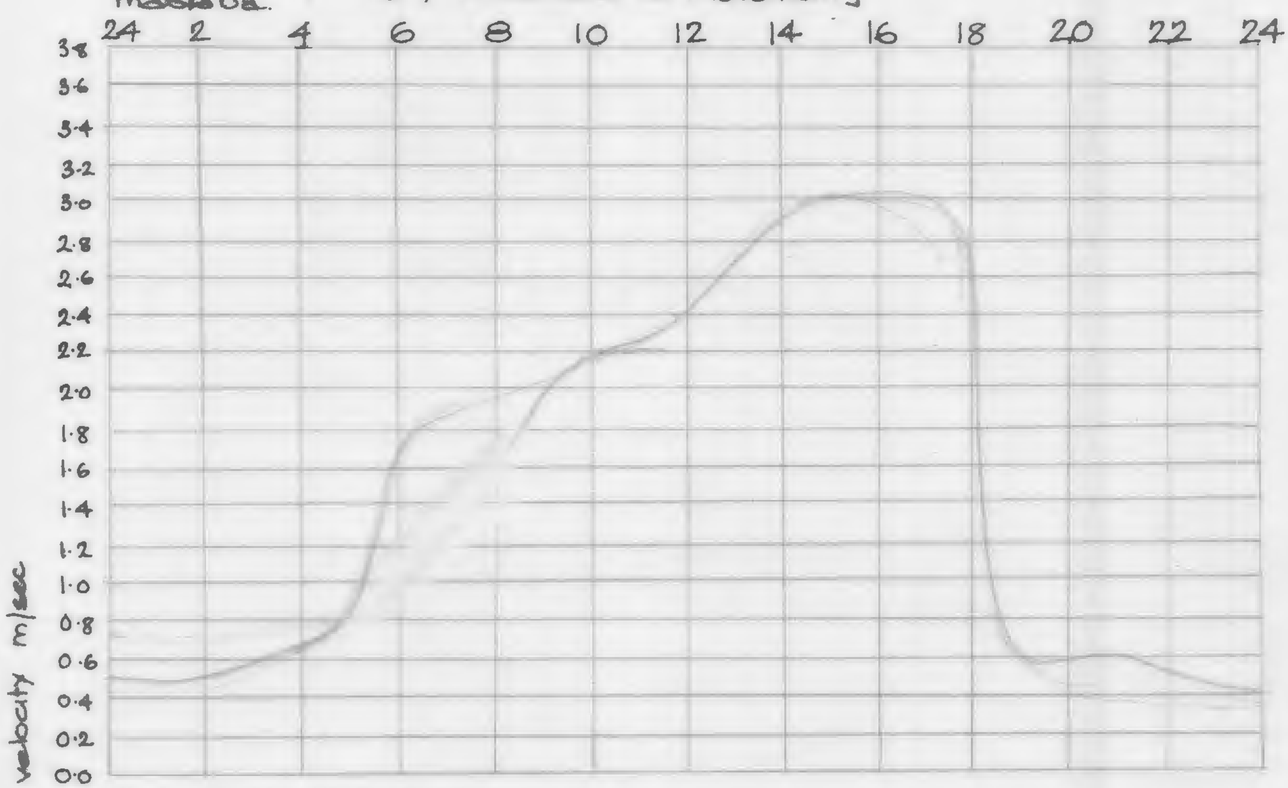


Wind Velocity in contact with surface.

House of Salem Ben Abdullah

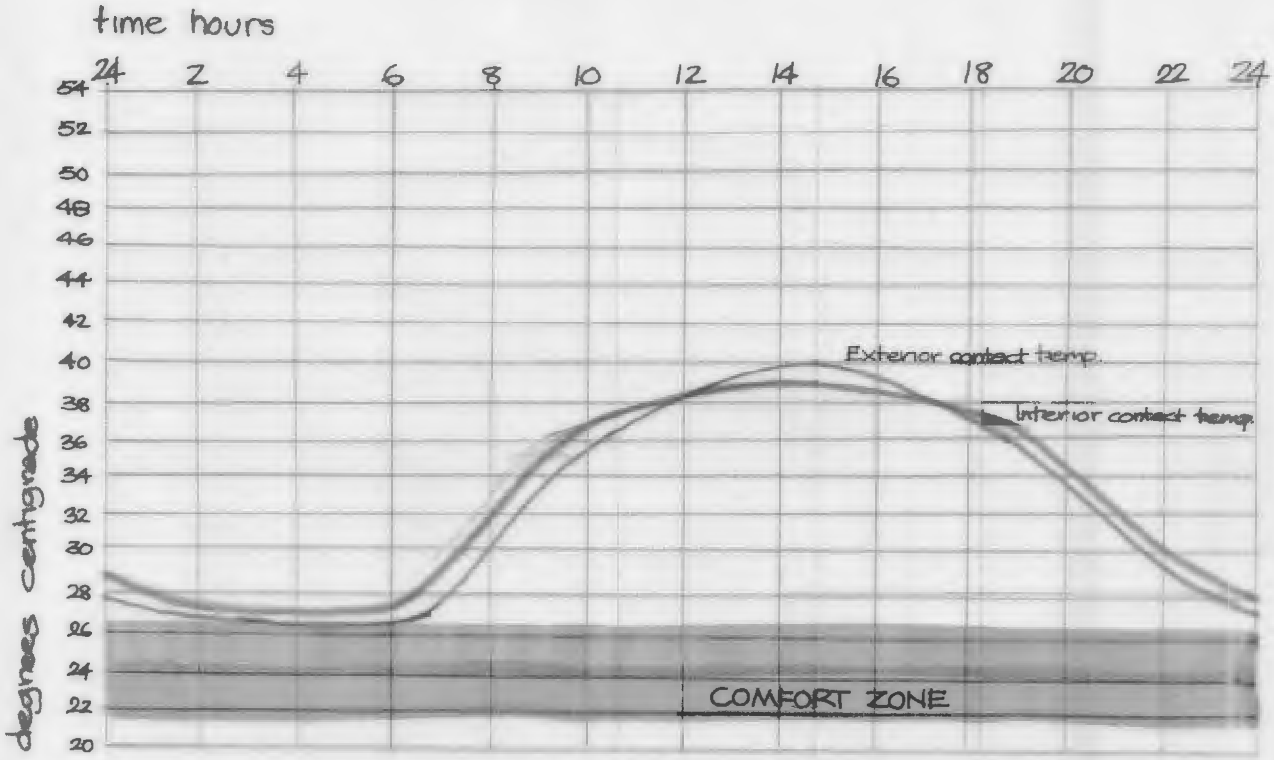


Roof. 'E'
Thick leaves out.
Roof over open [~~fully~~ unrestricted air movement]
mastaba.

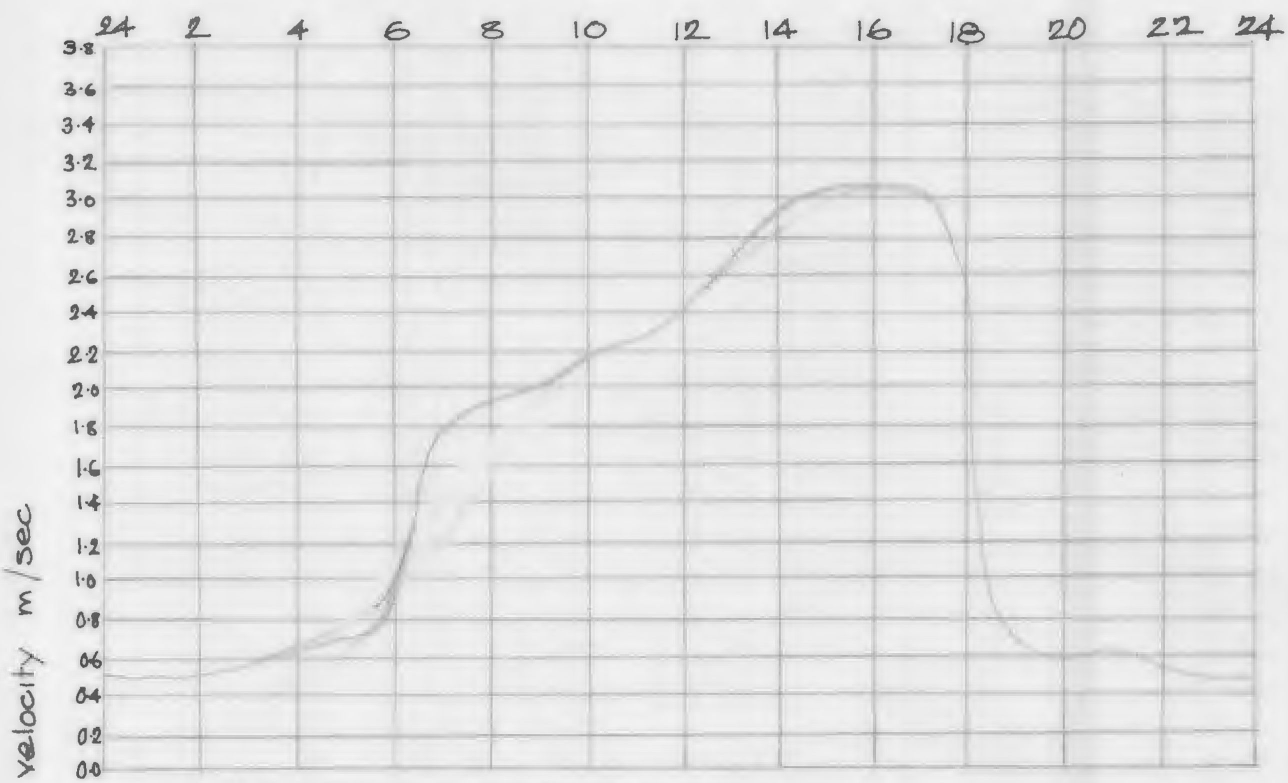


Wind Velocity in contact with surface.

House of Salem Ben Abdullah

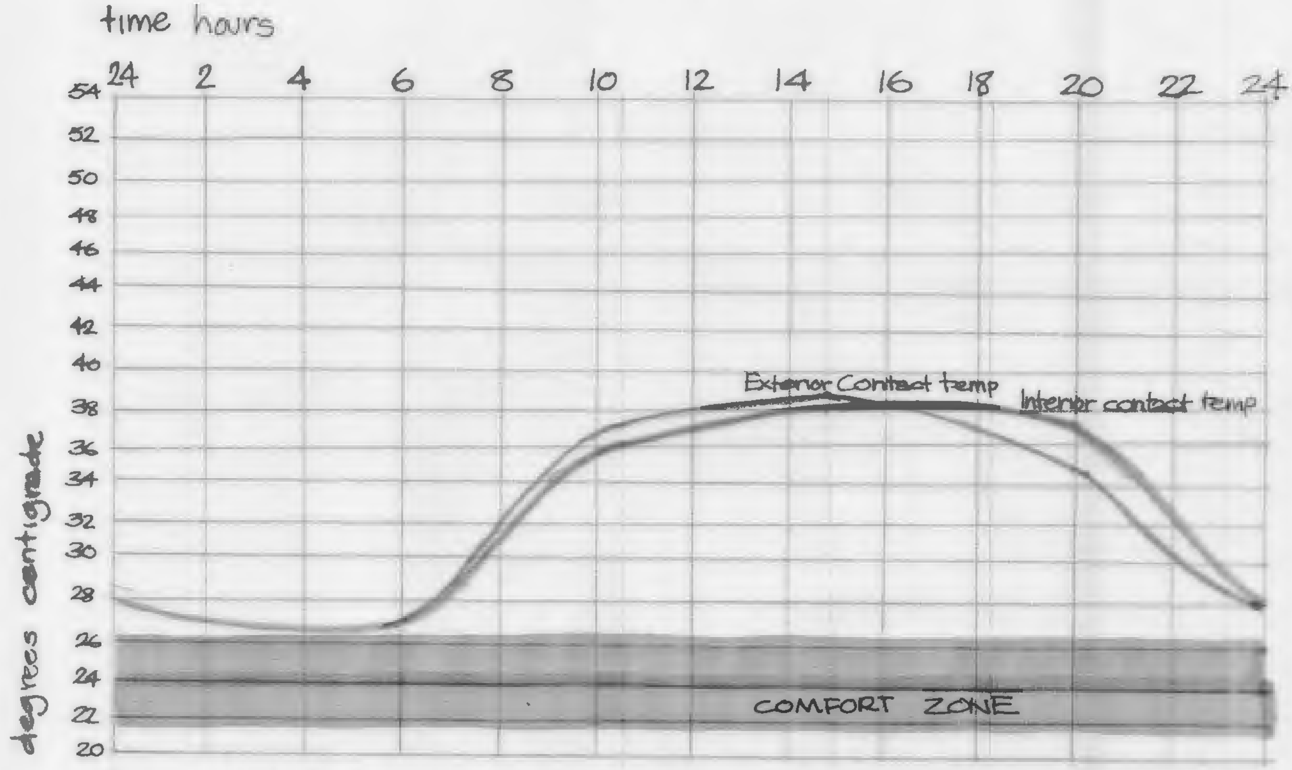


North Wall 'F'
Double thickness as 'B'

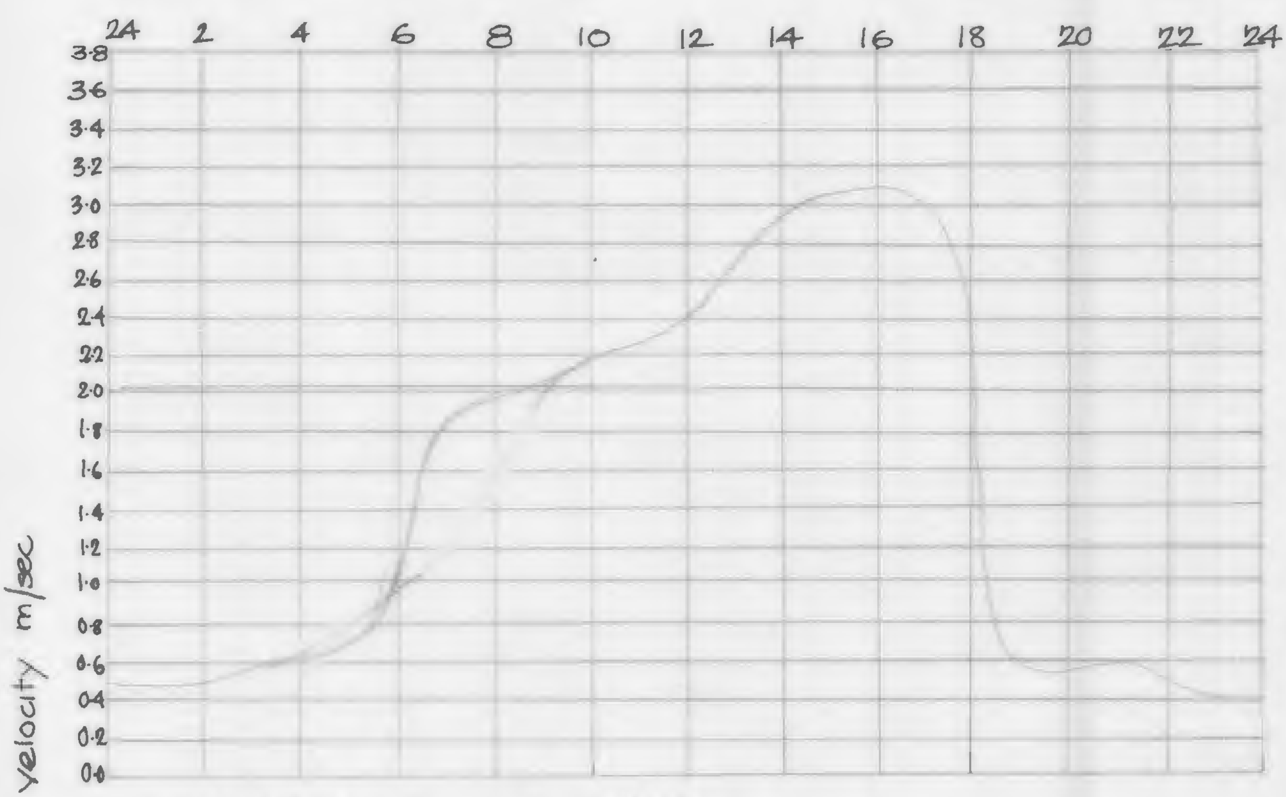


Wind velocity in contact with surface

House of Salem Ben Abdullah

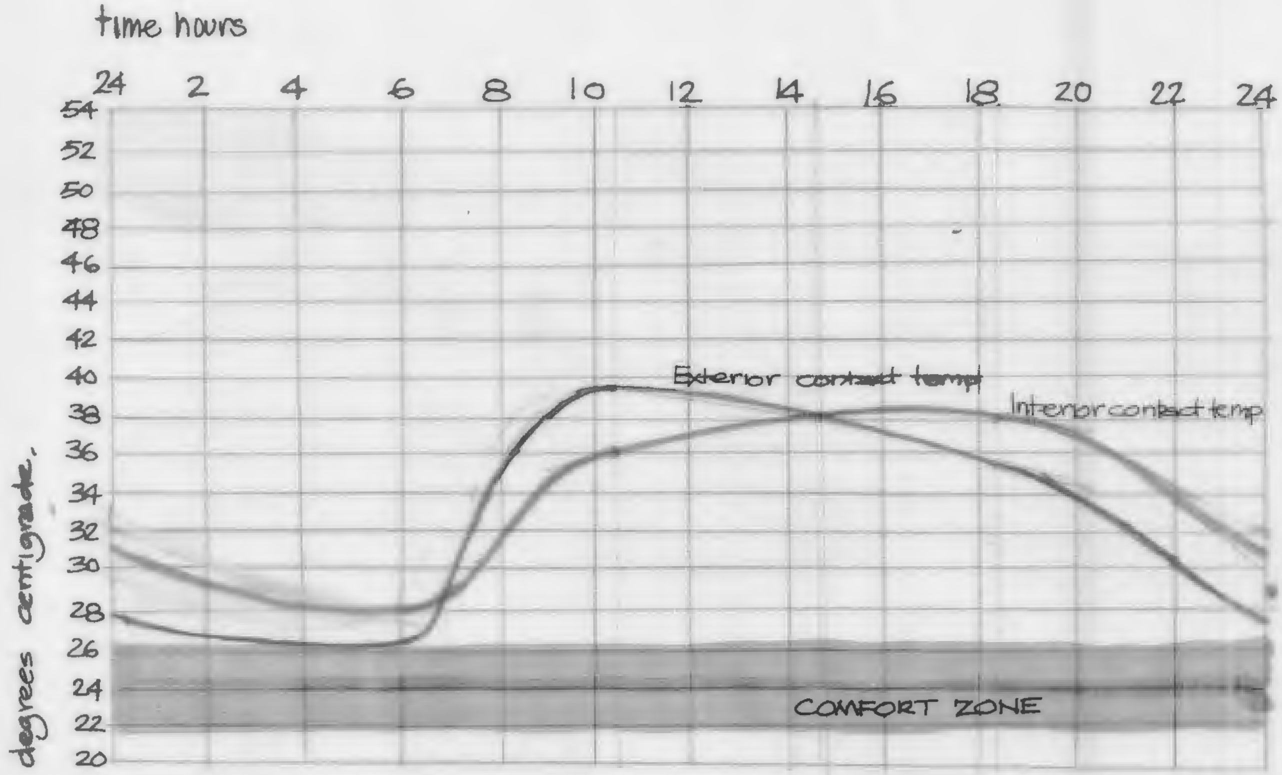


North Wall. 'G'
Single leaves in.

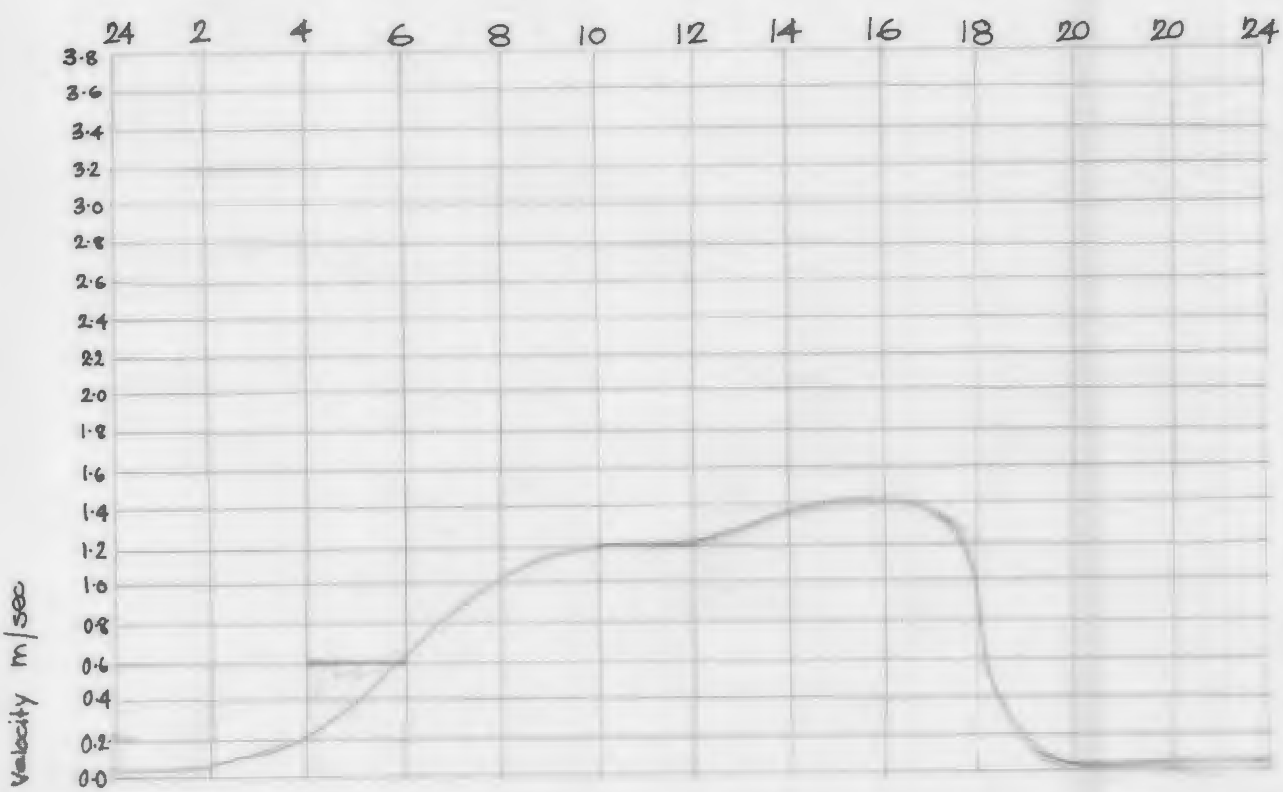


Wind velocity in contact with surface

House of Salem Ben Abdullah.

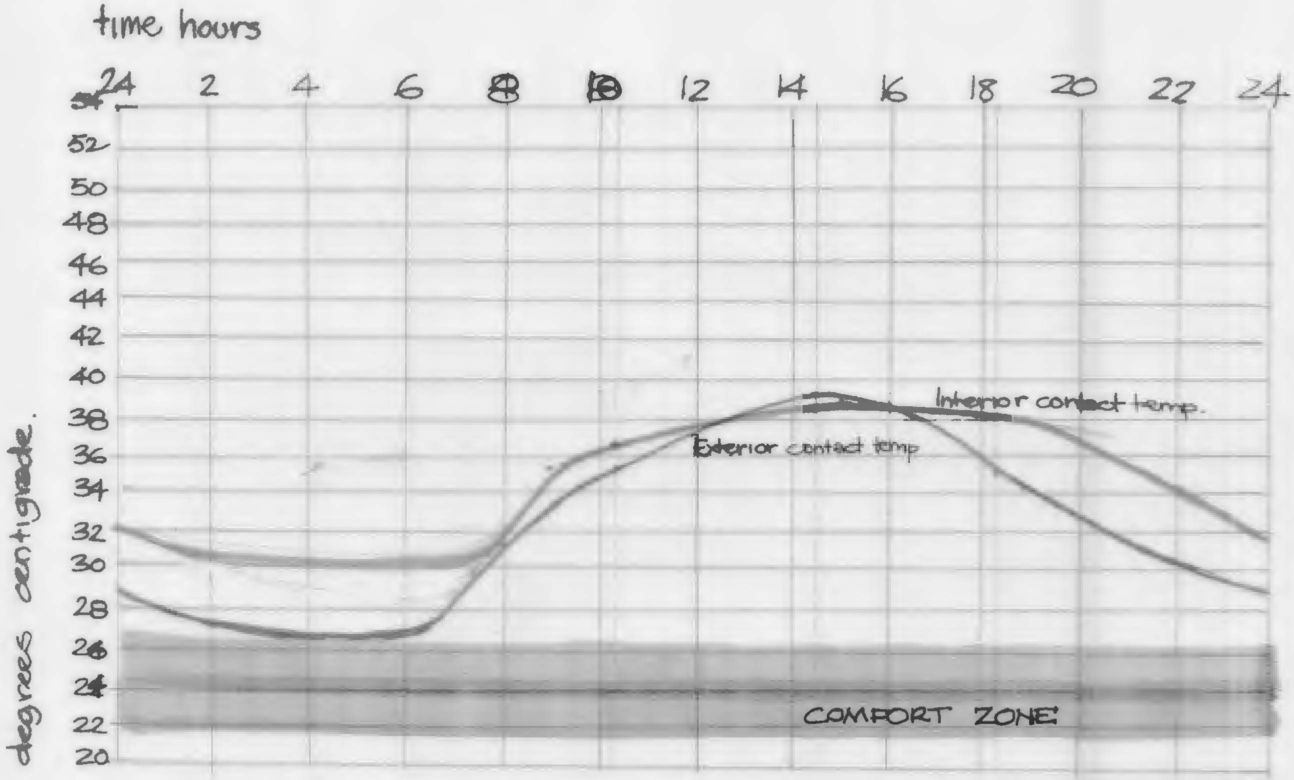


East Wall 'B'
Double Thickness. Leaves both layers facing into each other.

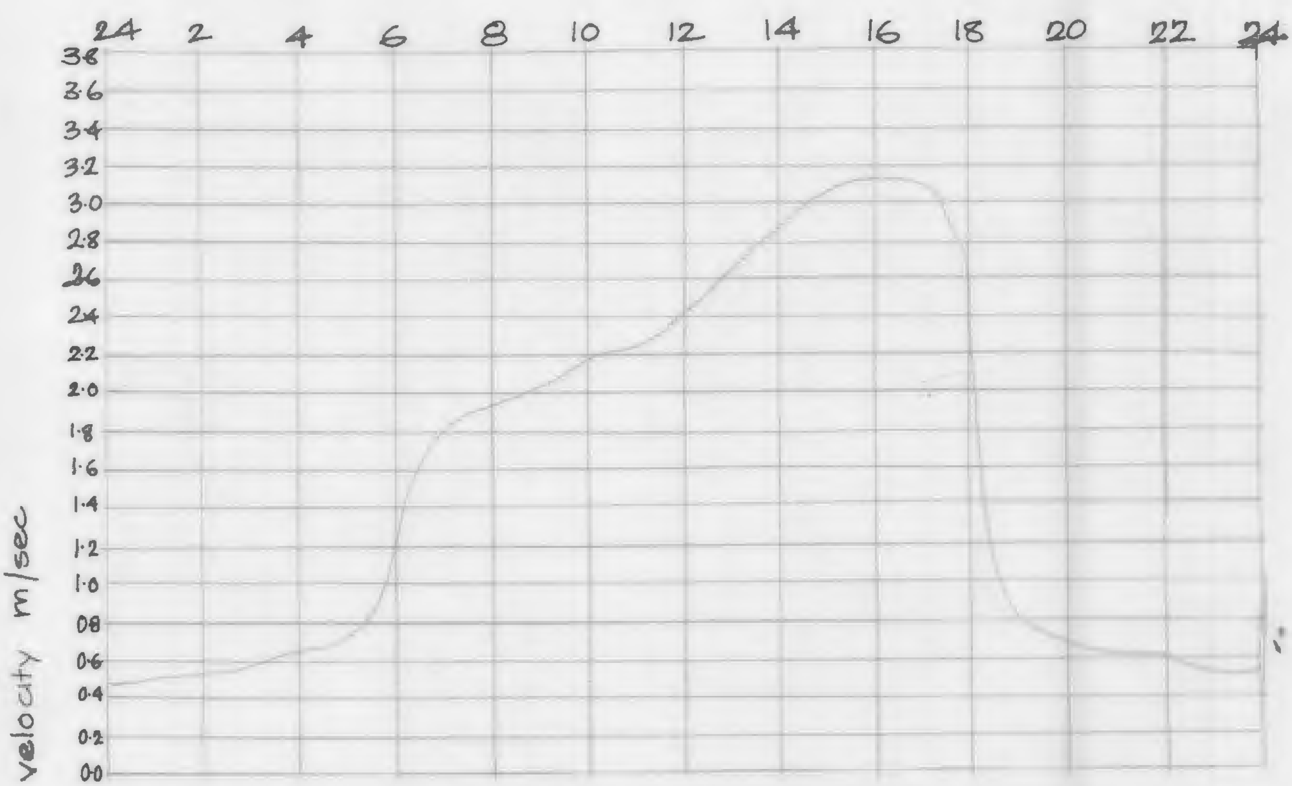


Wind velocity in contact with surface

House of Salem Ben Abdullah.



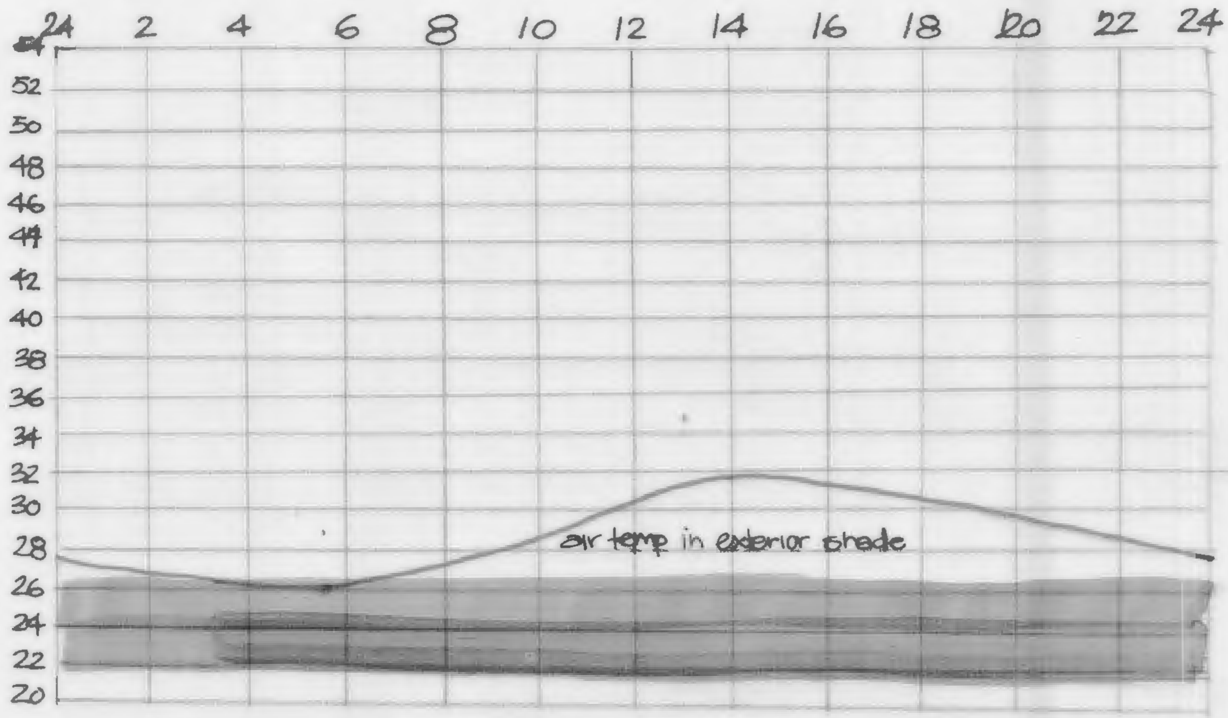
North Wall. 'A'
Single Thickness Barasti. Leaves out. Medium Spacing.



Wind Velocity in contact with surface

House of El Said & Rachid Mohd Ben Said.

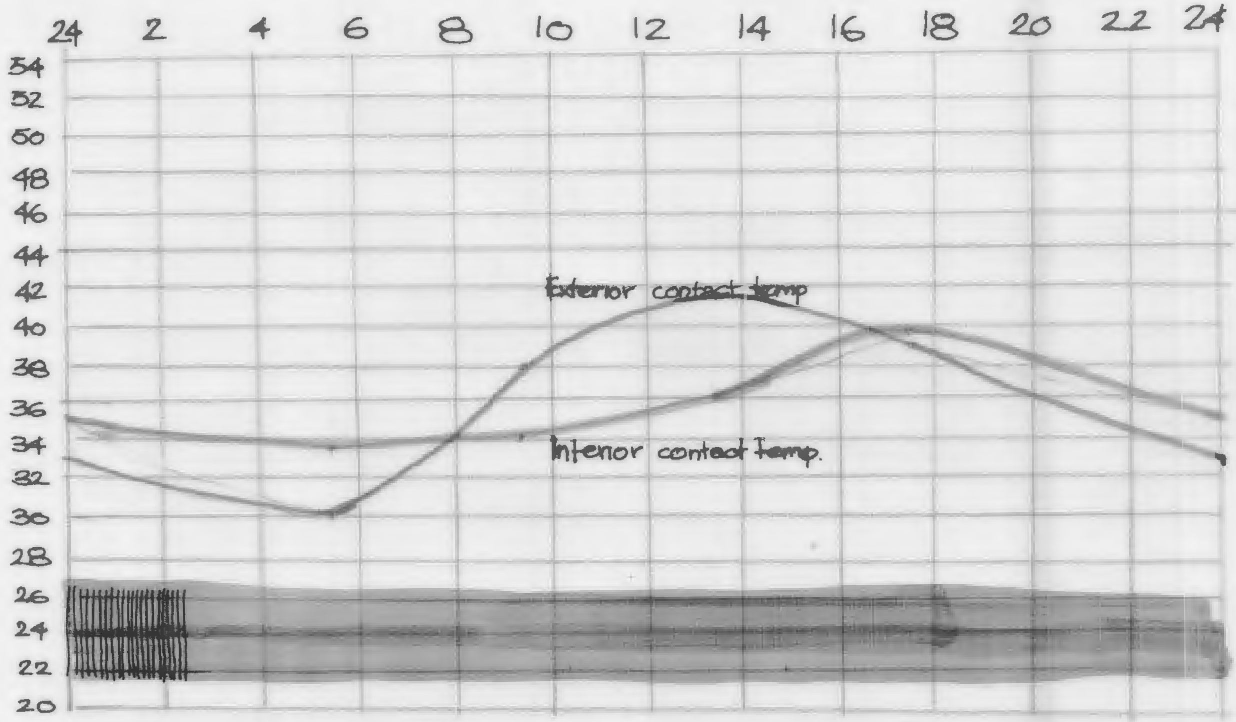
MAGLISSE



* require thermohygrograph chart for completion.

House of El Said & Rachid Mohd Ben Said

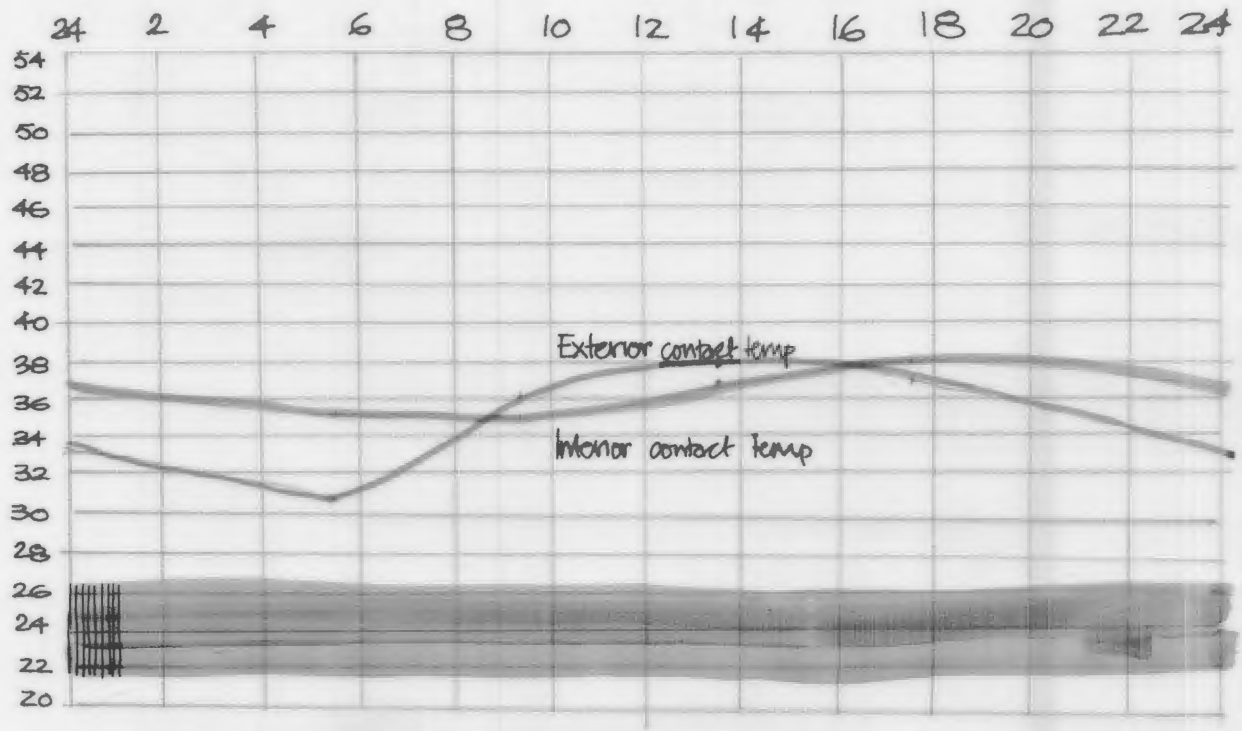
MAGLISSE



Roof:

House of El Said & Rachid Mohd Ben Said

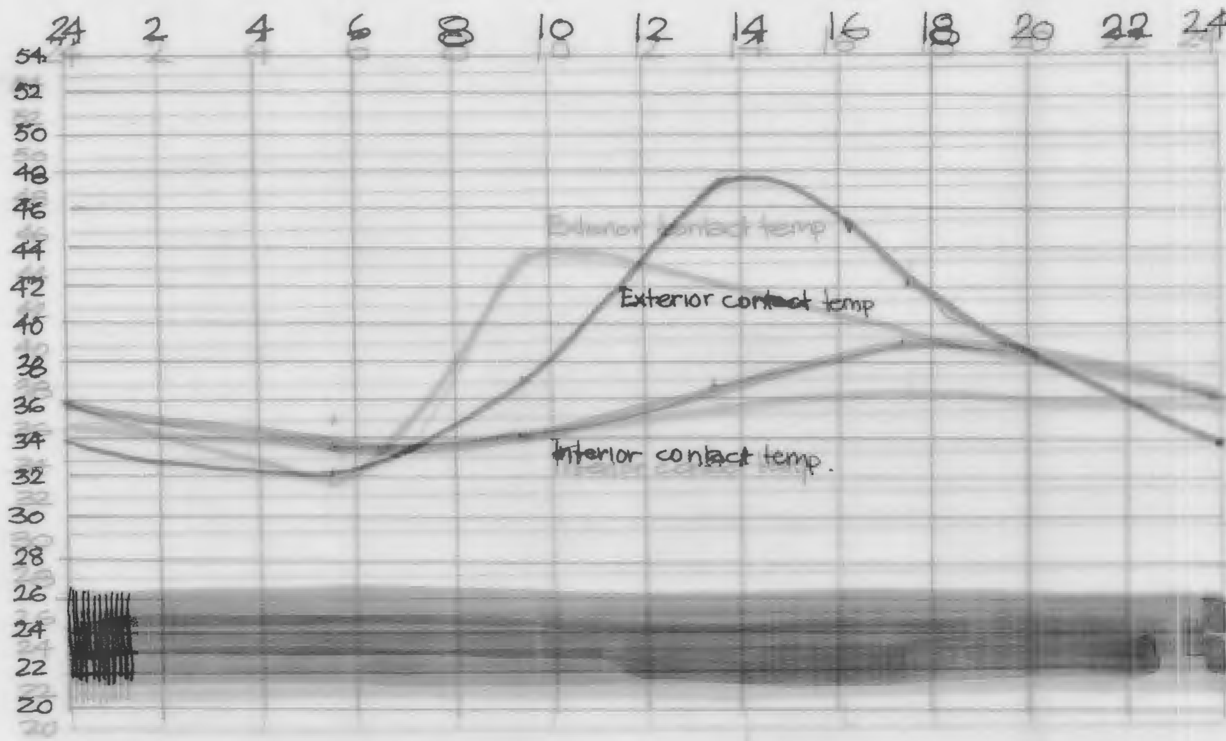
MAGLISSE



North Wall

House of El Said & Rachid Mohd Ben Said

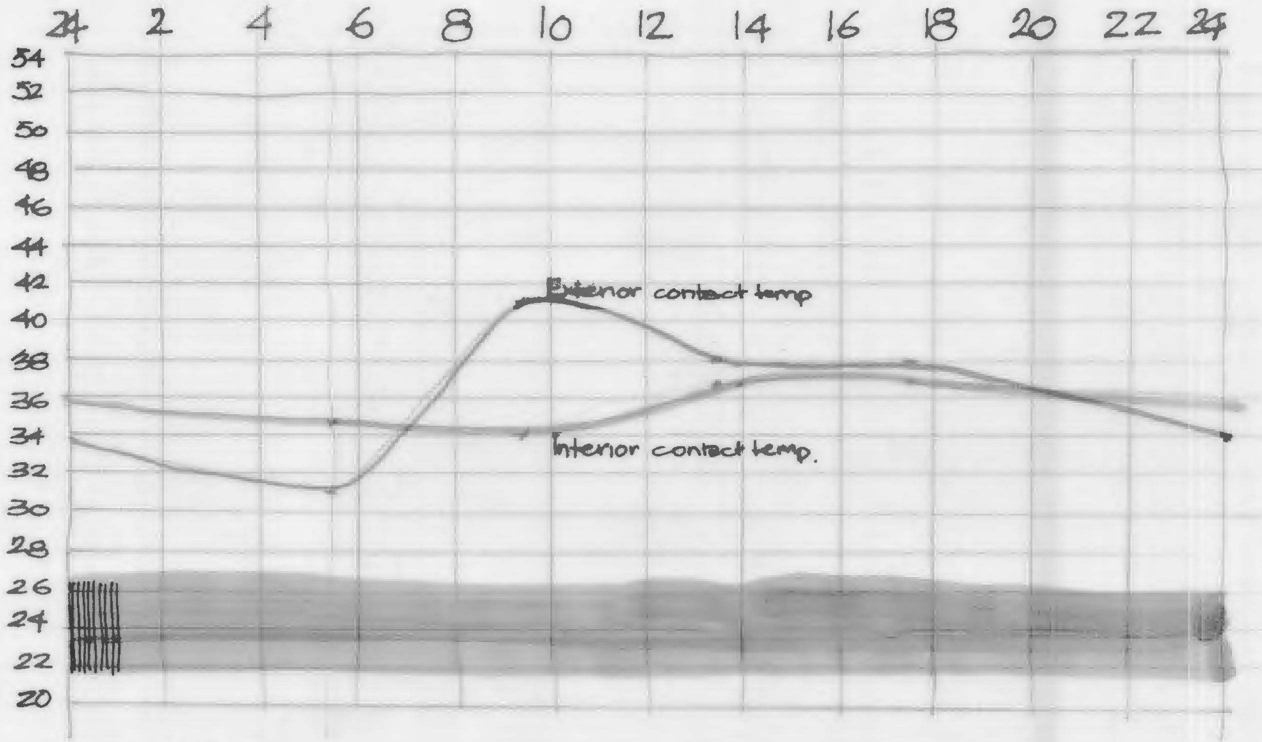
MAGLISSE



West Wall

House of El Said & Rachid Mohd Ben Said

MAGLISSE



East Wall.

South Wall.

Sol air temp. midday. = 51.0 where θ

Absorbtivity = .75. α

I [vertical intensity of radiation] = 292.5 [for midday] I

dry bulb temp = 30.5

in the equation

$$f_0 = \frac{\alpha \times I}{\theta} + dbt$$

$$f_0 = \frac{.75 \times 292.5}{51.0} + 30.5$$

$$f_0 = 34.8$$ = outside surface conductance.

The irregular surface of the material would alter the absorbtivity at different times

West Wall

Sol air temp. = 51.0

Absorbtivity = .75

I = 180

$$f_0 = \frac{.75 \times 180.0}{51.0} + 30.5$$

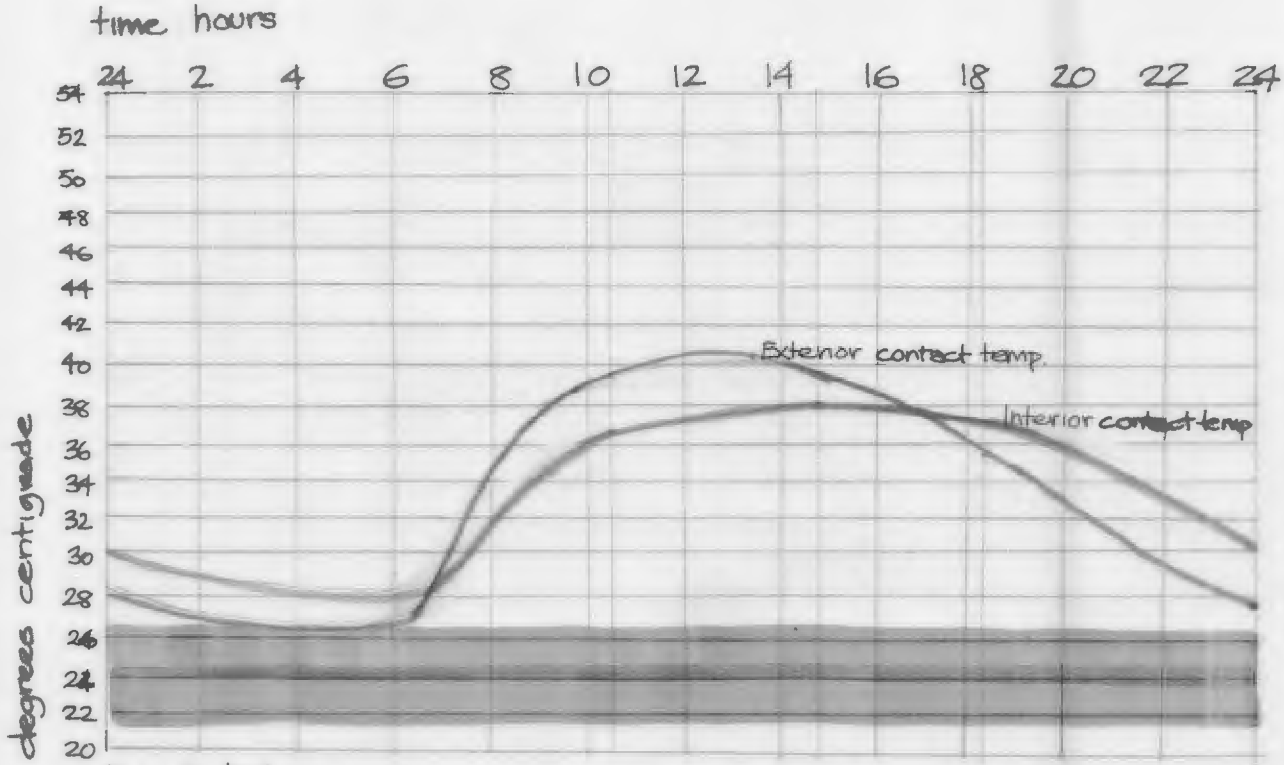
180
.75
900
12600
135.

51) 135 = 002.6
100
330

f_0 = 32.6 outside surface conductance.

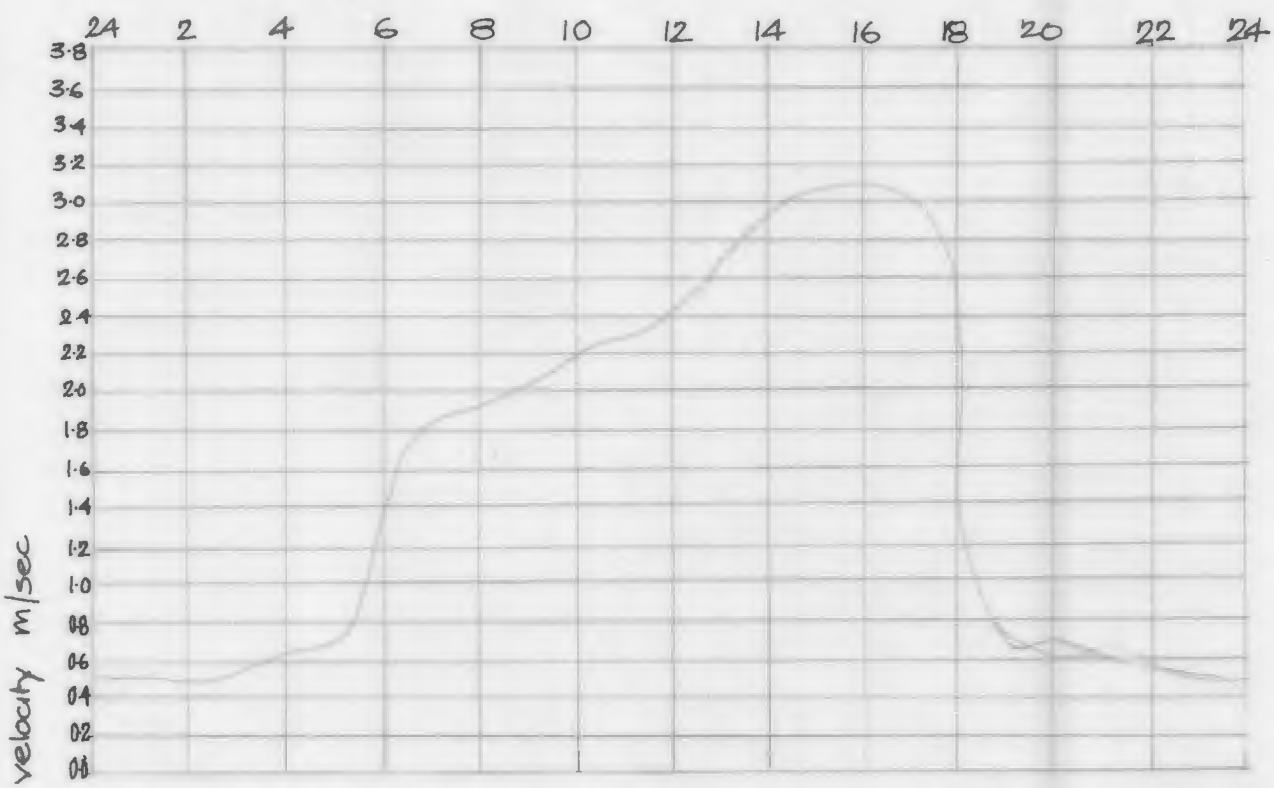
West Wall

House of Salem Ben Abdullah



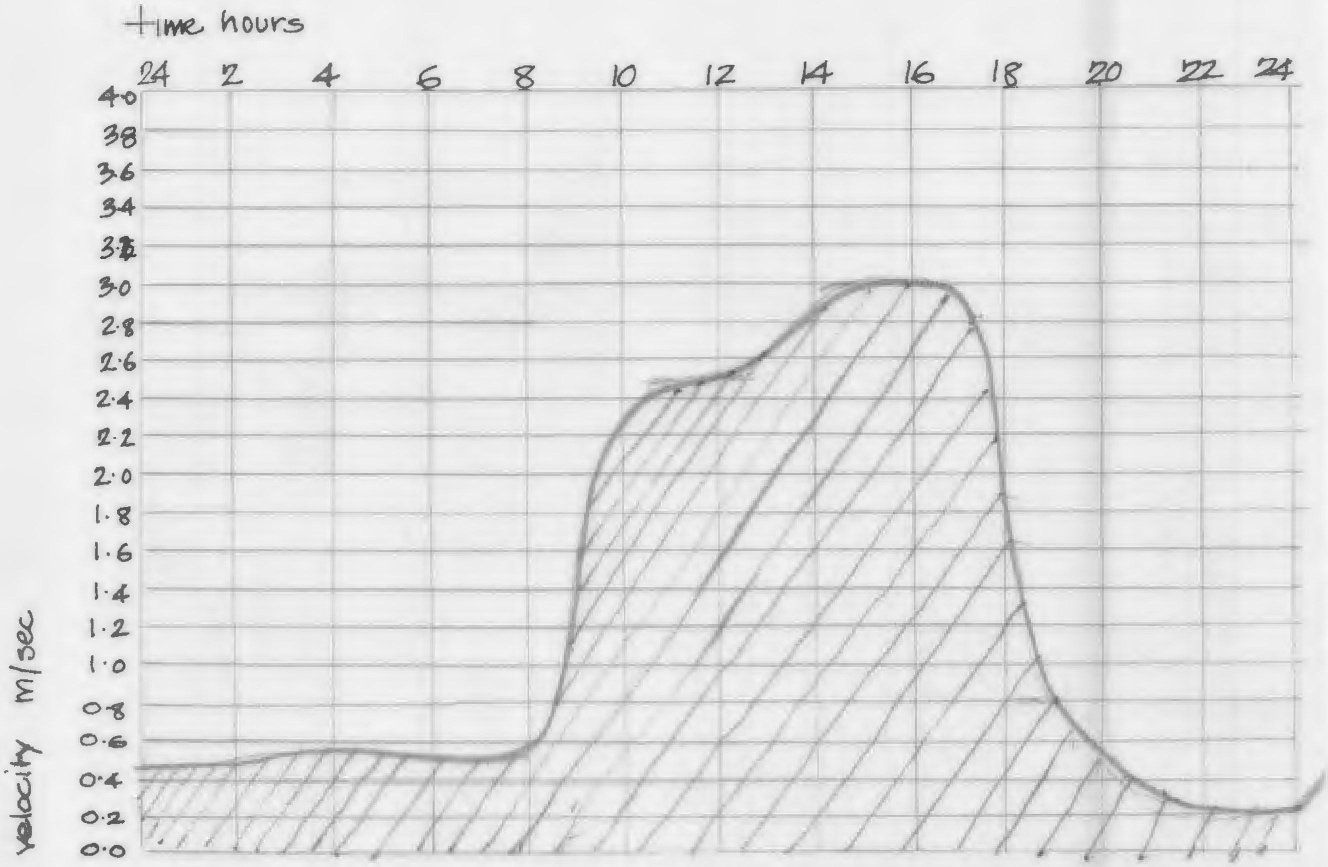
Roof. 'J'

Single Barasti. Leaves out.
Thicker spacing than 'E'.



Wind Velocity in contact with surface

Wind Velocity m/sec planted belt. 22/9/73



Wind direction

type : single thickness with leaves on.

location. A.E.G.J.

Characteristics

Appear to be used as basic screens, [da'an's are bought in this form] Barasti walls as used in this house to provide privacy, define spaces and provide basic shelter. Some spaces enclosed by single thickness barasti had no roof, [see kitchen area], other uses were for providing well ventilated but sheltered areas. Main characteristic is shelter from direct sunlight. Used for flat roofs as well as screening rooms. Provides a basic baffle to air movement and as winter comes on extra screens are put up. [see photographs]

Because these walls are used in areas where there is free air movement, eg. the side walls to covered mastaba area, the interior / shaded side of the barasti panel is recieving the full benefit of the passage of air of the relevant surface, The fact that the leaves are used 'loose' does help to decrease the amount of heat that can be transferred. [Increase shaded surface area.]

Barasti   House of Salem Ben Abdullah.   Om El Boche

type one : double thickness leaves facing into each other.
locations. B. C. D. F.
Characteristics

Tightness of actual material prevented any movement of air through the walls into the interior, [none recordable]. Air changes did take place. [there was a small percentage of air movement out of the door, caused by the passage of air past this opening creating a suction effect. Vacuum created by this could be filled by air movement through joints / gaps in the ~~envelop~~ walls and ceiling]

Air movement helps to cool down the exterior surfaces which in turn reduces the amount of heat transferred to the interior surface.

The interior surfaces heat up at almost the same time as the external surfaces. There is no evidence of any noticeable time lag, but at the same time, individual surfaces take on the overall characteristics of the room, so that contact temperatures reflect the micro climate of the room. Peaks occurring on the outside contact temperatures are not transferred to the interior as increases in temperature of the same magnitude. My conclusion from this is that each particular surface heats up in relation to its adjacent micro climate. Warming up of air space in the structure of the wall allows heat gains from the outside to be ~~transformed~~ transferred to the interior, but actual time lag of the solid palm frond is negated because of sharp drop in temp at sunset and rise at ~~sunrise~~ dawn. Surfaces heat up quickly. It follows that the tighter the fabric of the wall is, the more insulation will be provided. The problem in this instance is to reduce the air space within the wall.

Barasti | House of Salem Ben Abdullah | Om El Beche

type : single thickness barasti. no leaves. 10mm spacing
location . H.

Characteristics

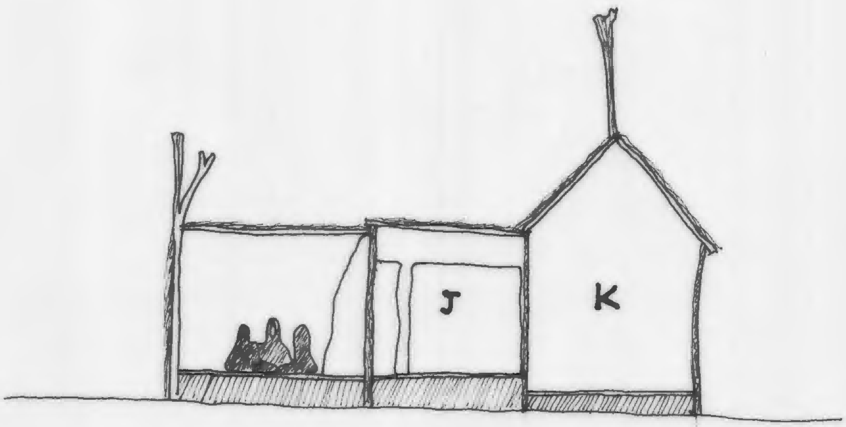
Made purposely to allow air movement into the room, also giving privacy. [operating in same way as Mushrabiya, and as such represents one of the best features of barasti]
Barasti was studied with even more sensitive use of spacing for air movement control and lighting [see house of Mohd Abdullah Salem ~ Beach Sohar]
Drawback in lack of accoustic privacy. Not a quality occurring in any of the Barasti houses [this factor may come to play and important part as indigenous family patterns change with the influence of Western Colonization]
In the graph for contact temperatures similarity with other temp curves emphasises importance of air movement and air cooling. The interior temp was lower than contact temps for the other east walls with the same orientation, but exterior contact temp was higher - relate heat buildup of a plain surface to surface with leaves on.

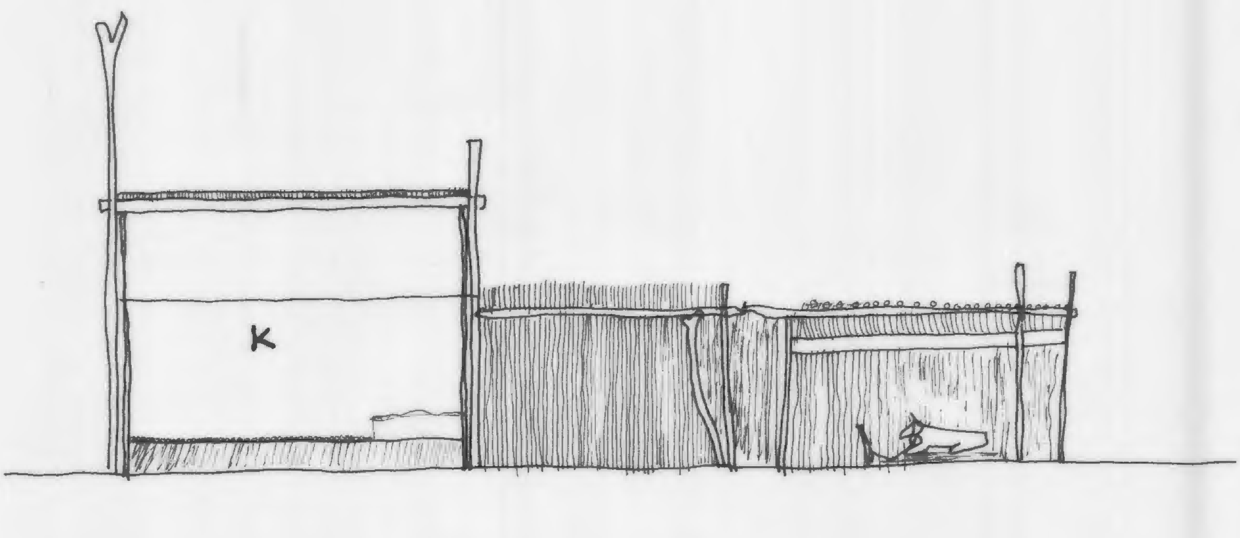
Properties of timber:

Good thermal insulation prevents a marked rise in temperature on side remote from heat source.
~~For average~~ softwood U value is 1.19 $W/m^2 deg^c$ / 102 mm thickness
Timber is a good insulator.

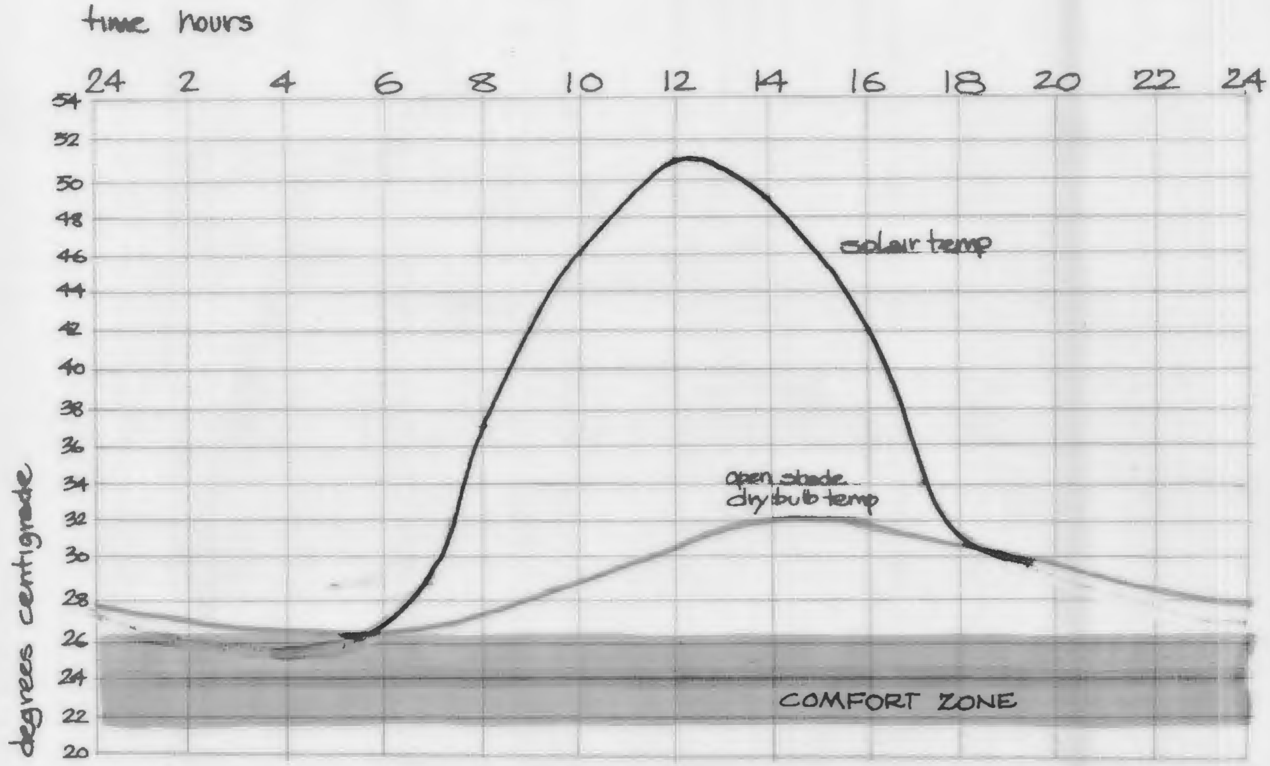
Barasti:

Actual heat transfer rate through solid material very low.
Heat effect passed from outer surface to inner surface by air movement. Peaks of exterior contact temp not transmitted through to the interior contact temp, but surface has raised temperature through air movement effect, and general rise in air temperature. Lack of air movement in interior allows for the build up of heat, but when air temp drops the interior temp drops as well, overriding time lag effect on barasti itself.
Heat transfer is not of prime importance and insulation is not one of the outstanding qualities of barasti, because of the porous nature of the material when used in walls + roofs - lots of air spaces which ~~can~~ + warm up + cool down in relationship to local temperature changes.
Use of double skin barasti is an attempt to provide insulation in the winter when temp drops. Even so the walls still allow the passage of air, but at such a low speed that there is no noticeable cooling effect.
In periods of heat spaces with better ventilation are used, where the air has a free passage of air through the structure - see use of plain barasti - no leaves.


J
K

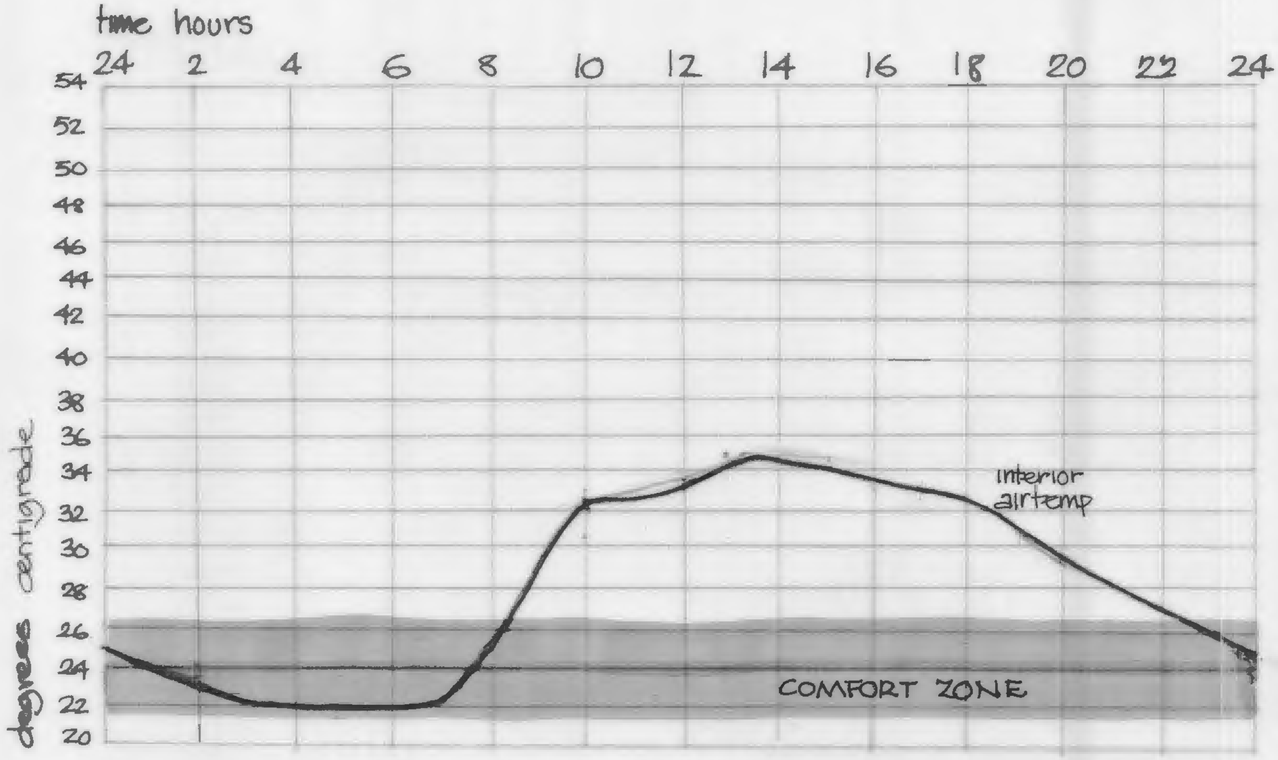

K

House of Salem Ben Abdullah.



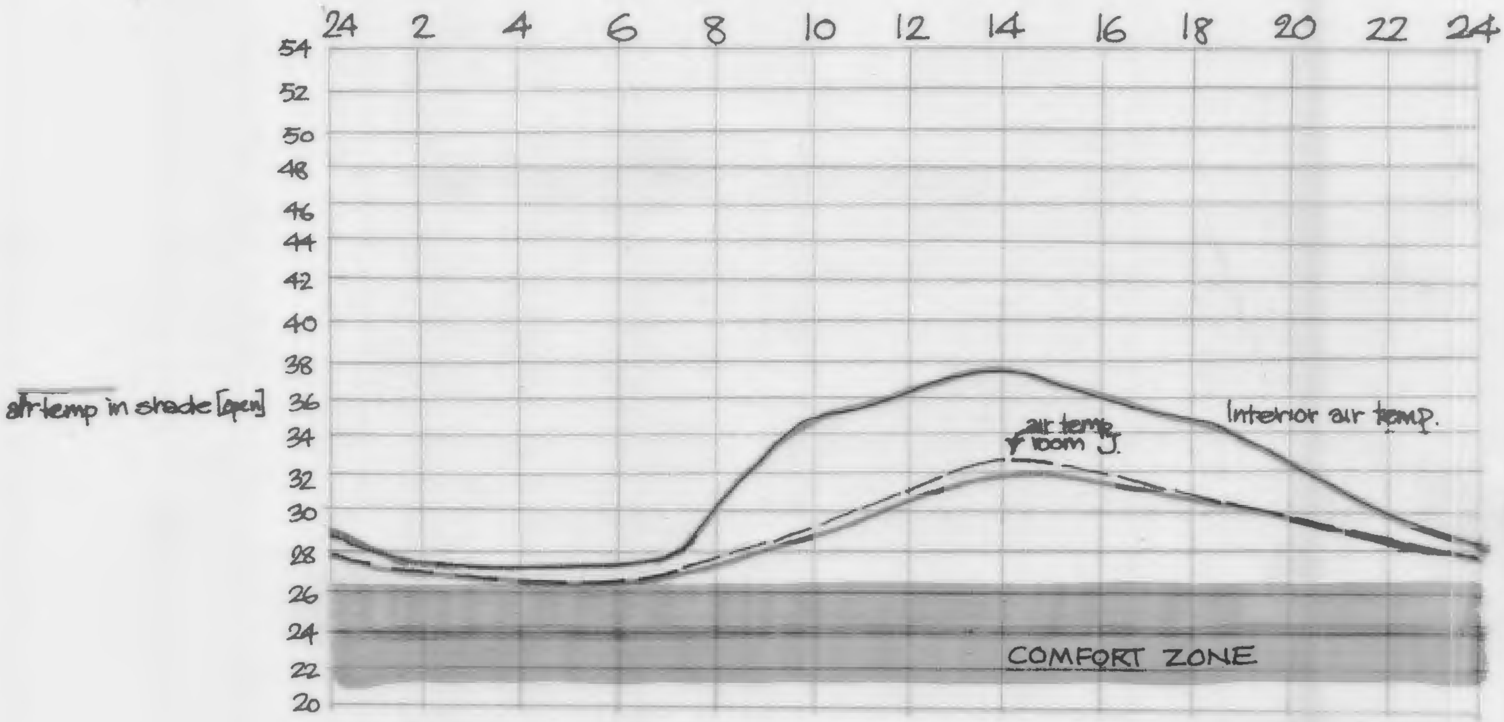
House of Salem Ben Abdullah.

Reading 30/9/73 – 1/10/73. Room 'K'

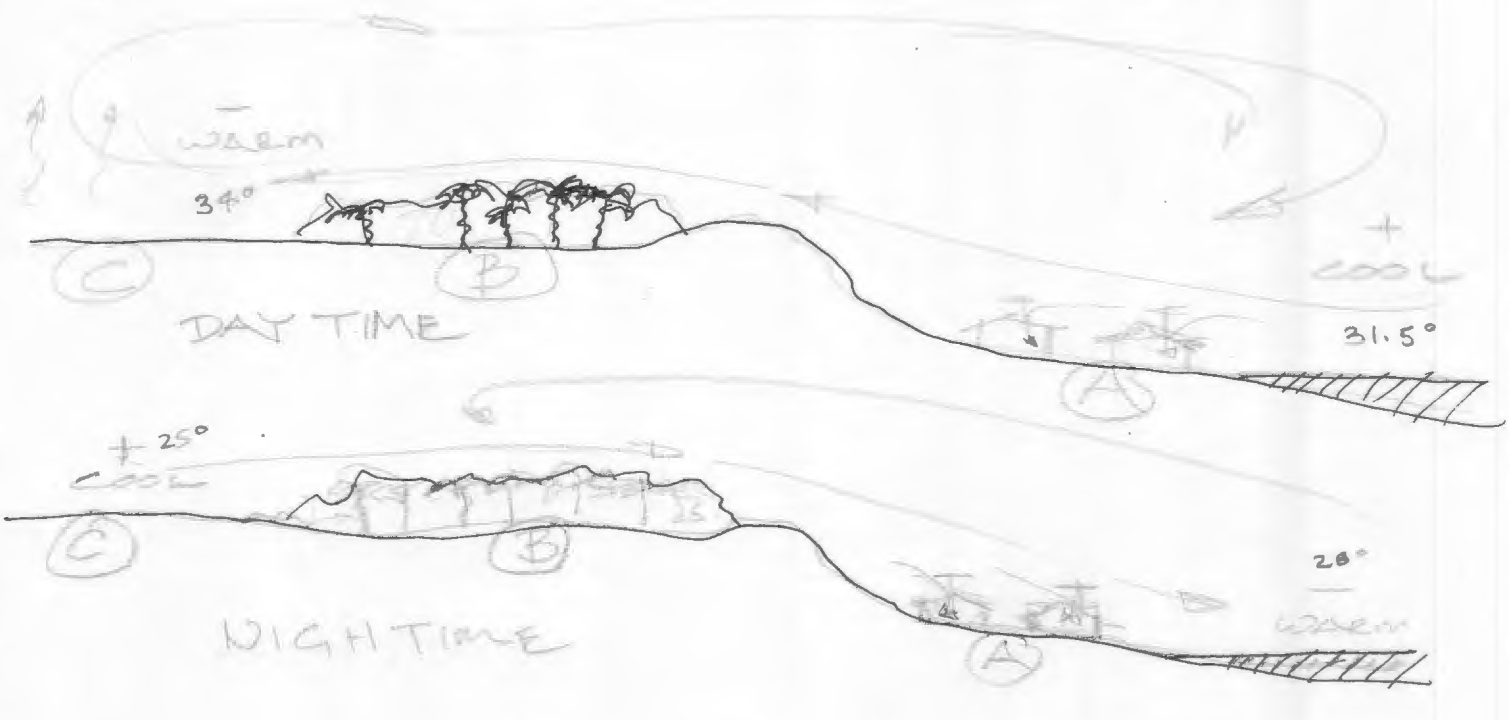


House of Salem Ben Abdullah.

Reading 24/25/9/73. Max Min Only Room K & J.

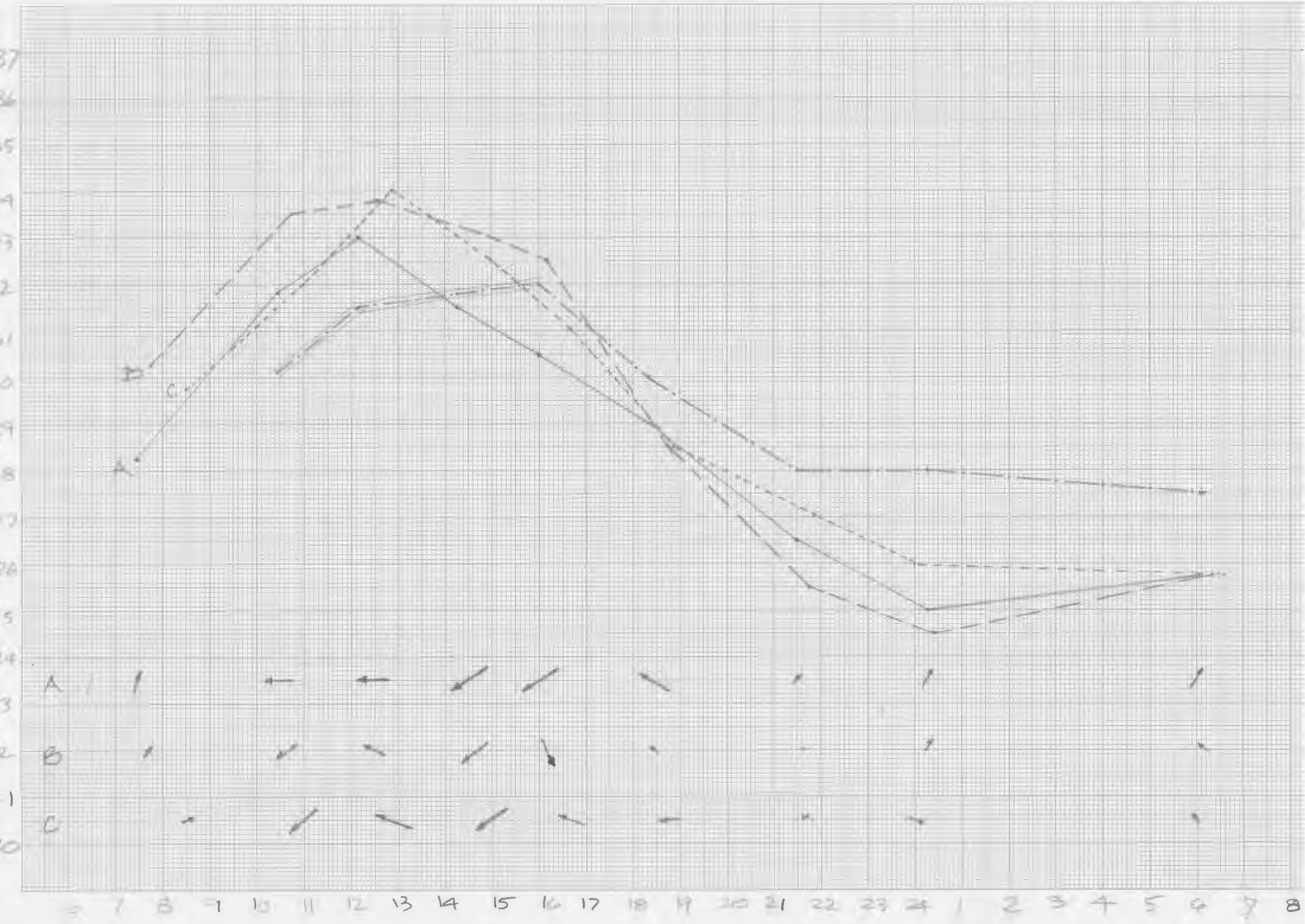


A
B
C
Section



warm
34°
+
cool
31.5°
C
B
A
DAY TIME
+ 25°
cool
28°
warm
C
B
A
NIGHT TIME

Section


A
B
C
D
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 1 2 3 4 5 6 7 8

Specific Heat

Polystyrene	1250	J/kg deg C
Hardboard	1250	J/kg deg C
Insulating Fiberboard	1400	
Timber	1500	

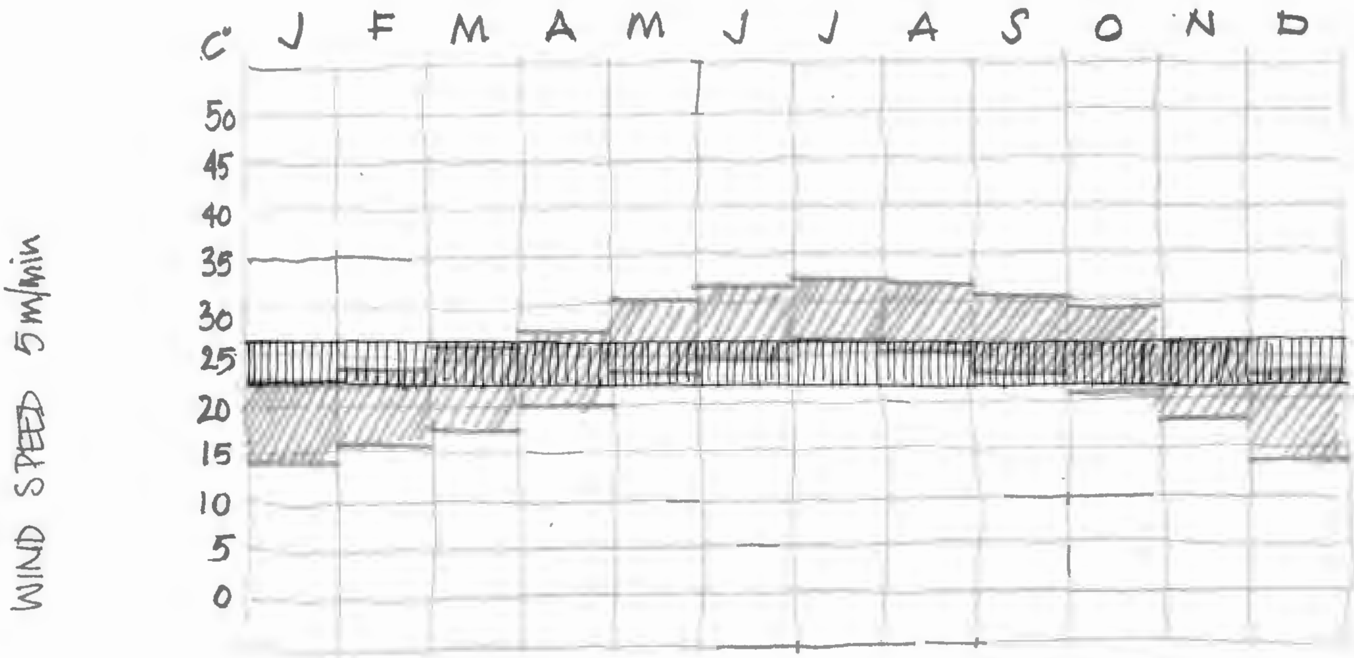
Assume barasti ⟶ 1400

Density - Wood Soft - 320
Average - 450
Cork — 160

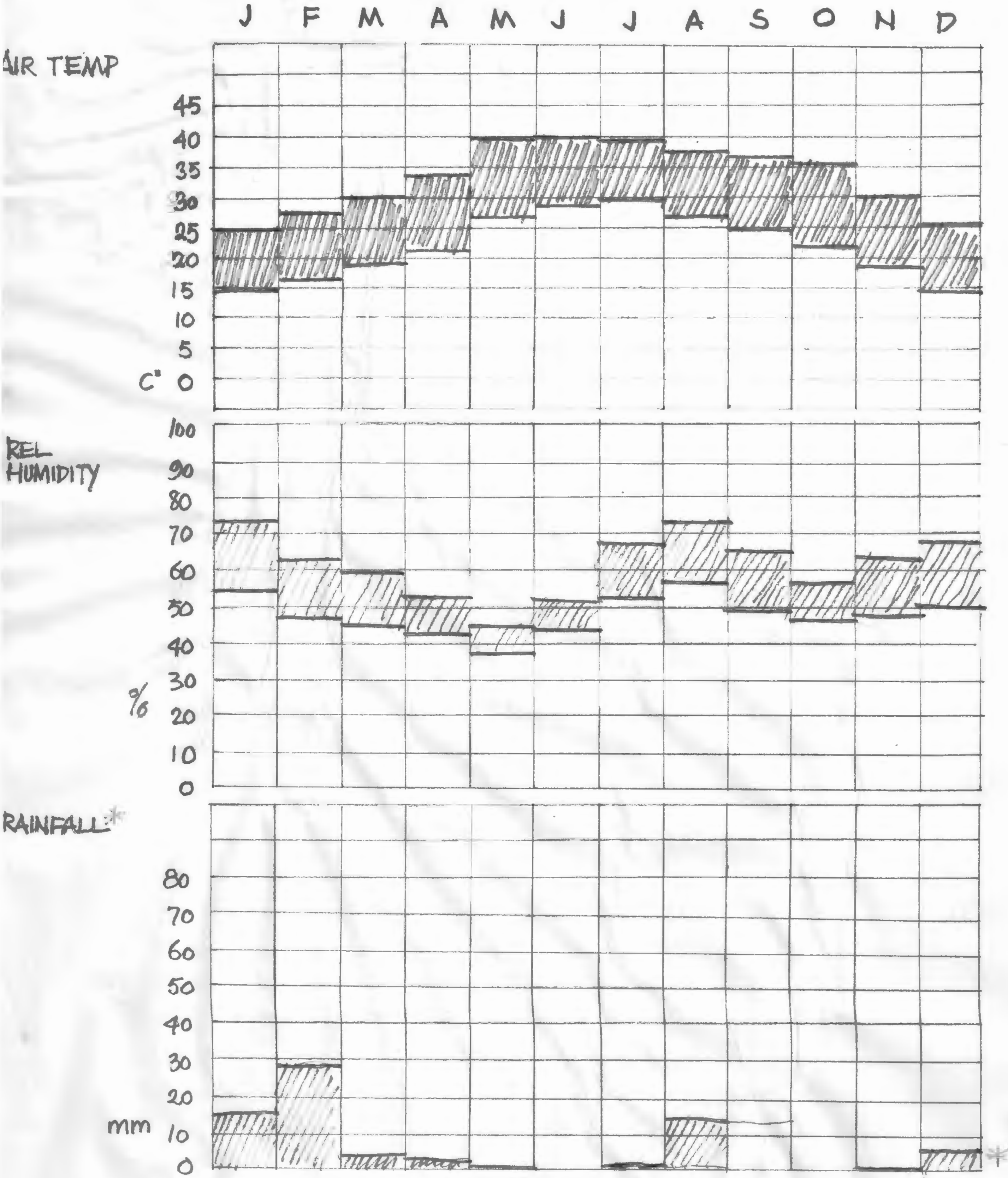
Barasti ⟶ 250 kg/m³

Thermal Conductivity

AZAIBA



AZAIBA - OMAN. 58°20'E 23°36'N



* mina-al-Fahal figures. (5 miles east.)