

1. Research and development of the Indigenous building methods, materials, local skills and resources.

- a) Oman
- b) Selseleh, Luristan, Iran
- c) Caspian Region, Iran

by

John Norton

April 1980

Research and Development of the indigenous building methods, materials, local skills and resources.

a. Oman

b. Iran: Luristan, Caspian.

These three case studies are each summaries of research programmes conducted in each area. In the cases of the latter two, they were directly linked to follow up practical work. Equally, the Oman and Caspian researches were aimed to inform policy makers about the potentials and problems of indigenous methods in their own countries.

The case studies outline a methodology for assessing the problems and potentials of indigenous building methods, and in each area point out how these can be used and developed to meet contemporary shelter needs and how problems that exist can be overcome, without necessitating a departure to new, imported or expensive solutions which are often beyond the financial range of the individuals in developing countries and are also frequently socially, culturally and environmentally inappropriate.

In each case it is pointed out that the indigenous solutions are well attuned to local conditions and that much can be learnt by developing a proper understanding of the way in which they work.

1. Research and development of the Indigenous building methods, materials, local skills and resources.

a) Oman

by

John Norton

April 1980

1a OMAN

Sections/Contents

	Page
A Oman	1
1. Background	1
2. Programme	3
3. The Northern Coastal Plain (Batinah Coast)	5
3.1 Introduction	5
3.2 Beach front house	7
3.3 Houses in the date gardens	10
3.4 Inland of the planted belt	13
3.5 Conclusion	13
3.6 Materials	15
4. The Northern Uplands	
4.1 Introduction	16
4.2 House form	16
4.3 Conclusion.	18
5. Desert Oasis - Buraimi	
5.1 Introduction	21
5.2 House form and materials	21
5.3 Conclusion	23
6. The Capital Region - Muscat, Mutrah, Ruwi	
6.1 Introduction	24
6.2 House form	26
6.3 Conclusion	26
7. Sur	
7.1 Introduction	28
7.2 House form	30
7.3 Conclusion	32
8. Dhofar Coast (Salala)	
8.1 Introduction	33
8.2 Settlement pattern	35
8.3 House form and materials	35
8.4 Conclusion	38
9. Overall Conclusion	40

Illustrations

Fig. A.1	Map of Oman	Page 2
A.2	Falaj. Water supply system	6
A.3	Azaiba climate chart	8
A.4	Micro climatic comparison	9
A.5	External view of palm frond screen	11
A.6	Hessian windcatch	11
A.7	House with summer and winter halves	12
A.8	House in Om el Boche	14
A.9	Izki climate chart	17
A.10	Town house in Nizwa	19
A.11	Comparison between thermal properties of mud and concrete	19
A.12	Buraimi climate chart	22
A.13	Muscat climate chart	25
A.14	Window details	27
A.15	Sur climate chart	29
A.16	House of three brothers, Sur	31
A.17	Air movement	31
A.18	Salala climatic chart	34
A.19	Air flow around buildings in Salala Old Town centre	36
A.20	Evolution of courtyard house Salala	39

1.A RESEARCH AND DEVELOPMENT OF INDIGENOUS BUILDING METHODS, MATERIALS, LOCAL SKILLS AND RESOURCES.

A OMAN

This case study is a brief resumé of a major study carried out between September and November 1973, dealing with the problems and potentials of the Indigenous built environment of Oman.*¹

The aim of the study was to identify, whilst the opportunity still existed, to what extent the indigenous building methods and materials that Oman possesses are capable of meeting the country's contemporary shelter needs. The study also aimed to identify what improvements were needed.

1 BACKGROUND

Prior to 1970 Oman had been isolated from the rest of the world. Before H.M. Sultan Qaboos took power in 1970 the country's development had been at a virtual standstill, to the extent that repairs to existing buildings were discouraged. Since 1970, there has been a general opening up in the development of the country. In 1973, at the time of this study, 2 characteristics were clear in the way that the country's built environment was being developed. Revenue from oil exports had made it possible for the Government to take an extremely westernised approach to building, and at the same time the indigenous building methods and materials were being discarded in favour of new, more prestigious materials and techniques. A statement made in the Whitehead Consulting Group's Economic survey of Oman 1972 *² illustrates the direction

*¹ CAIN, A; AFSHAR, F; NORTON, J. OMAN, The problems and potentials of the indigenous built environment in a developing country. London, by authors. 1975

*² Whitehead Consulting Group. Economic Survey of Oman 1972 Muscat, Oman. Section 4. i.e. Environmental Sanitation.

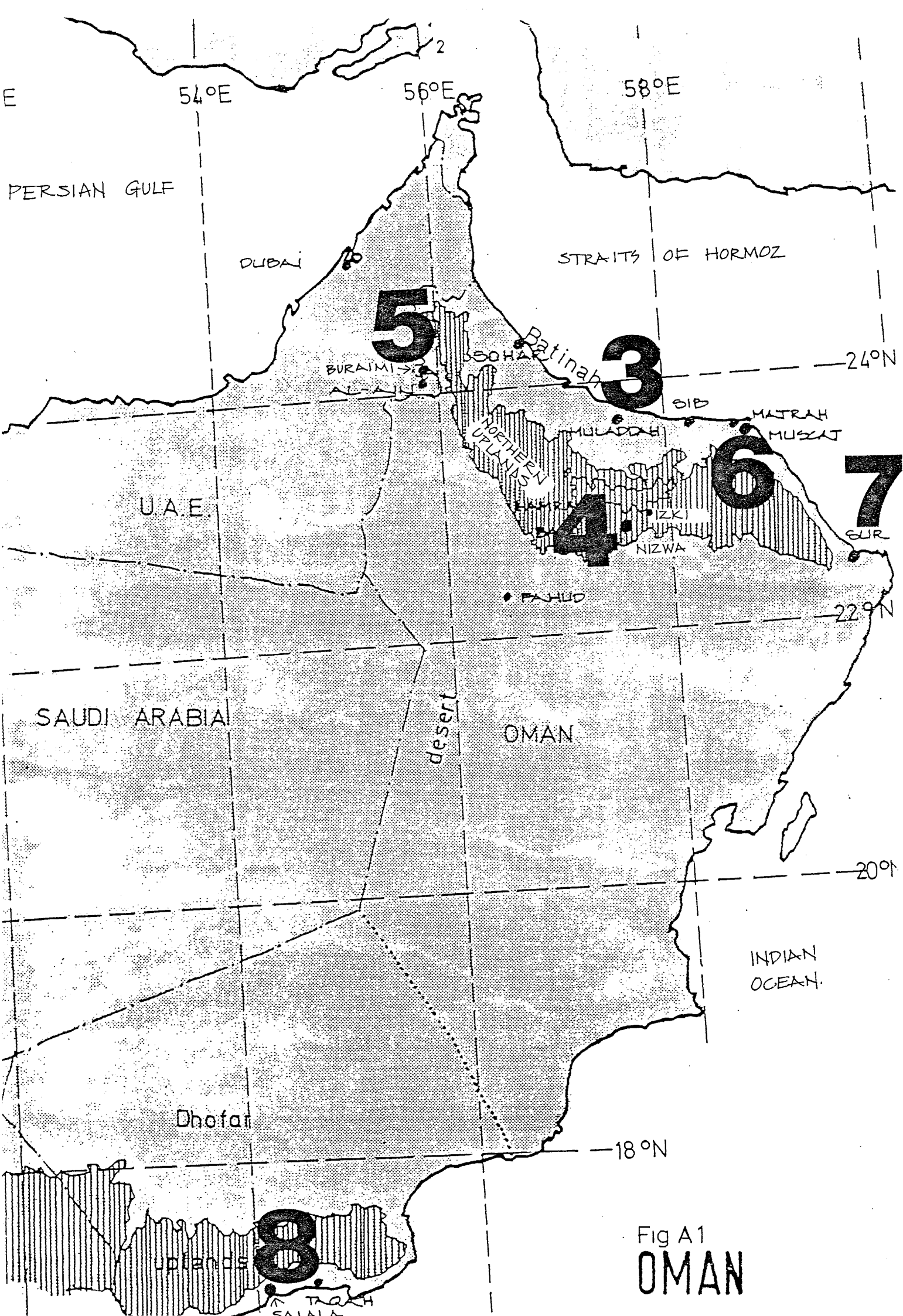


Fig A1
OMAN

that housing policy was taking. "Housing should provide protection against extremes of weather as well as privacy and facilities for a healthy way of life. This is certainly not provided by barasti and mud houses and to impose such standards here would be unrealistic."

Barasti (Palm frond stems) and mud were the two major building materials of the country, and the majority of Omanis lived in houses using these materials. It was felt by the study team that since the majority of Omanis live in these barasti and mud houses such a dismissal of their environment and its potentials was unfortunate, especially when no obvious alternative was economically or physically practical in the foreseeable future. No study had been undertaken to ascertain exactly how these materials functioned, nor to what extent they "provided protection against extremes of weather as well as privacy and facilities for a healthy way of life". *2

A focal point of the study was therefore to assess the performance of the indigenous built environment, and to compare it with the alternative materials and techniques being introduced as replacements.

It was hoped that through the report on Oman's indigenous built environment, an approach to the shelter needs of the country could be developed which would more readily meet the social, economic, environmental and cultural needs of the country. To make the best use of the country's resources it was necessary for policy makers to understand the potentials and problems that existed.

2 PROGRAMME

Whilst in Oman we visited and stayed in some 20 towns and villages in six of the eight major regions of the country.

We did not visit the Dhofar Hills because of unstable conditions prevailing at that time, nor the central desert where there were very few settlements.

The areas studied were:

3. The Northern Coastal Plain (Batinah Coast).
4. The Northern Uplands (Nizwa, Bahla, Izki).
5. The Buraimi Oasis.
6. The Capital Region (Muscat, Mutrah, Ruwi).
7. Sur (On the North East corner of Oman).
8. The Dhofar Coastal Plain (Salala).

Fig. A.1.

Prior to starting the field work, as much documented material as possible was collected, covering two major items: any previously recorded information concerning the built environment; detailed information and statistics for the climate in all the areas to be visited.

The climatic data available was limited and in many cases the figures had been collected for a short period only, consequently reducing the accuracy of the overall averages. In every settlement visited, descriptions of the local climate, including any abnormalities which existed, were collected from villagers. To further supplement this information, readings were taken for temperature, relative humidity and wind speed and direction, using portable equipment. These readings were essential for gaining an understanding of the micro climate which affects individual settlements and buildings. This is extremely important since the climatic performance of a building, especially in situations with unfavourable climates, is inseparable from the provision of protection against extremes of weather and facilities for a healthy way of life. An understanding of the local climate enables one to see in what way the building must

respond to provide an internal climate within the comfort zone. *1

During the field work the team spent an average of two weeks in each area. (The Buraimi Oasis study was conducted over a period of 24 hours, because of difficulties in travelling to the oasis from the Capital Region). In each place visited, discussions were held with the local inhabitants and especially local builders. Through these discussions we gathered information about the way that buildings were used and how they responded to local needs and the climate. At the same time settlements and individual buildings were surveyed, to be drawn up later, and samples of local and imported building materials were collected for analysis. Most of the problems faced by the local population became apparent through these processes, as well as the advantages and disadvantages of the different types of buildings.

The following sections will deal briefly with each of the six areas visited.

3 THE NORTHERN COASTAL PLAIN (BATINAH COAST)

3.1 Introduction

This is a strip of coastal plain facing the straits of Hormoz. It averages between 10 to 30 kms wide and stretches from the frontier with the United Arab Emirates in the North West, down to Azaiba, 270 kms to the South East. Along the coast is a 3 km wide strip of date palm gardens and cultivation, and most settlement occurs either at the

*1 The Comfort zone is a range of effective temperatures within which the human body performs most efficiently and comfortably.

edge or within this belt, inland of which is mostly scrub-land with scattered acacia trees. In 1973 the local economy was still based upon two main items; dates and fish, with the majority of the population living near their place of occupation. The water supply, important in maintaining settlements in this area, comes from 2 sources, wells, which nowadays supply most of the water, and Falaj a system of underground and surface water channels which tap the water table up in the foothills and transport water by gravity down to the date gardens and settlements.*¹ (Fig. A.2)

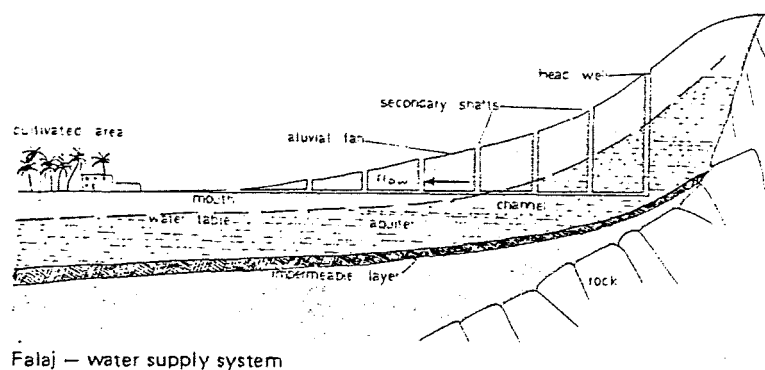


Fig A2

*¹ A system almost certainly introduced from Iran, where they are known as Qanat () and have supplied the water for settlements throughout central Iran for centuries, and have been a major factor in the location of villages and towns.

The Batinah coast has a climate directly affected by its proximity to the sea. The high humidity and the sea's steady temperature have a moderating affect upon the temperature pattern, with an annual range of only 15°C and a diurnal range of 10°C. (Fig. A.3)

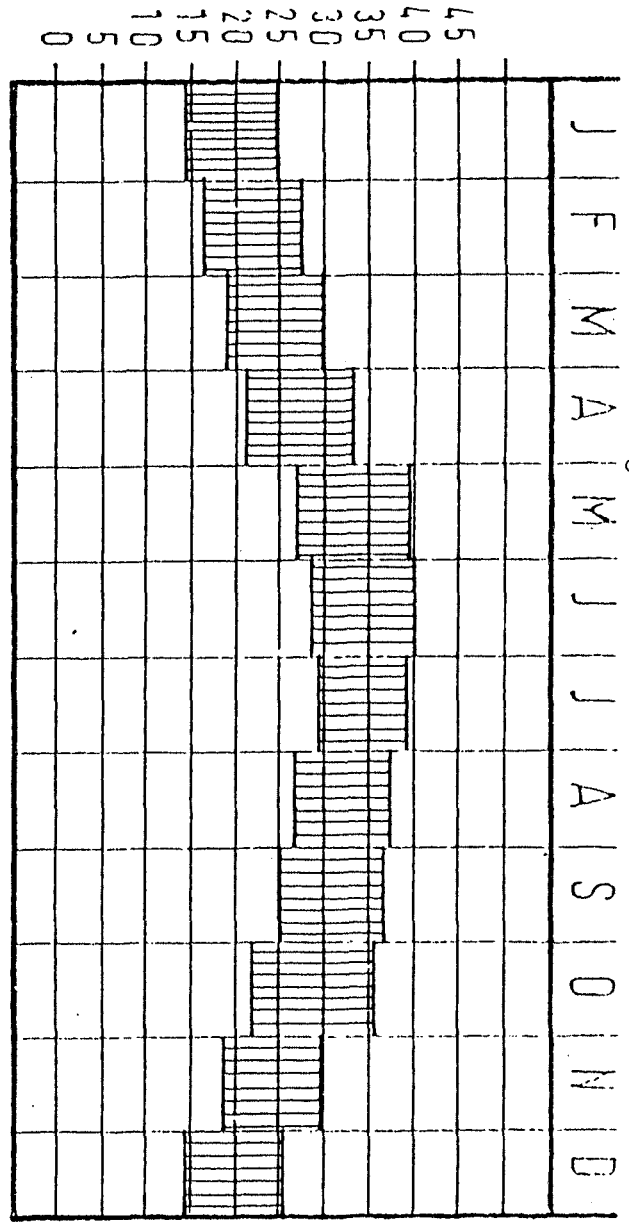
These ranges increase with distance from the sea as humidity drops. In general conditions are uncomfortably hot from May to September and uncomfortably cool between December and February. This pattern has a distinct influence upon the house forms of the area and the materials that they use.

A micro climatic comparison in Sohar, conducted over a 24 hour period (22 - 23 September 1973) shows the differences that exist between the beach front, a location in the date gardens and a location inland of the date garden. The built form and materials showed a clear response to this, especially when seen in terms of the range of climate over the year. The three locations are characteristic for the Batinah Coast. (Fig. A.4)

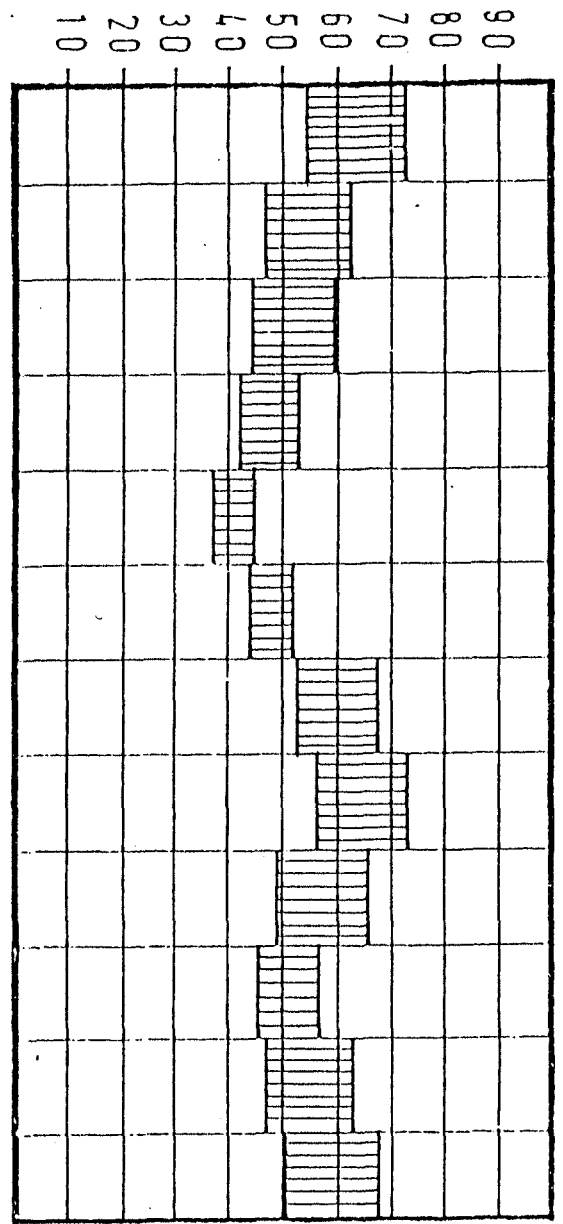
3.2 Beach Front house

High relative humidity and temperatures, with a low diurnal range make the introduction of air movement through the beach front buildings essential for comfort during the summer. Summer rooms are built facing the sea, hence orientated to make maximum use of onshore/offshore sea breezes. These rooms have walls made up as panels of palm frond stems with the leaves removed, supported by a timber, or more recently concrete framework. These screens perform various functions. a) They allow air to pass unrestricted through them: essential for comfort. b) They provide privacy: the darker interior cannot be looked into from bright conditions outside, and one focusses naturally upon the external surface of the screen.

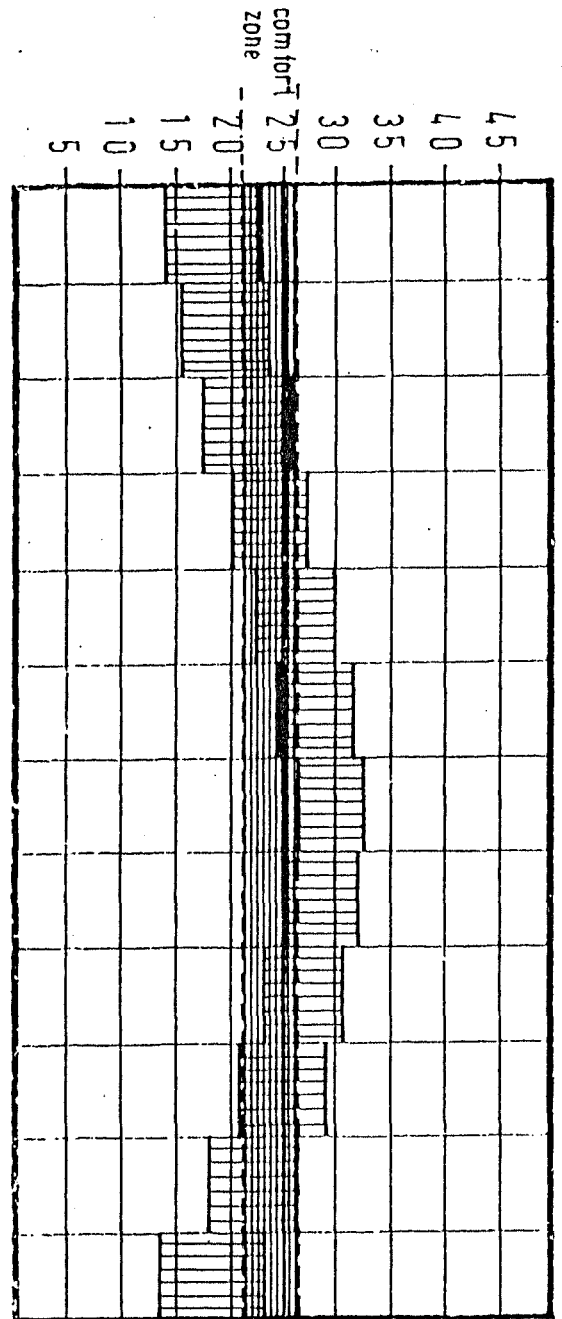
AIR TEMPERATURE °C



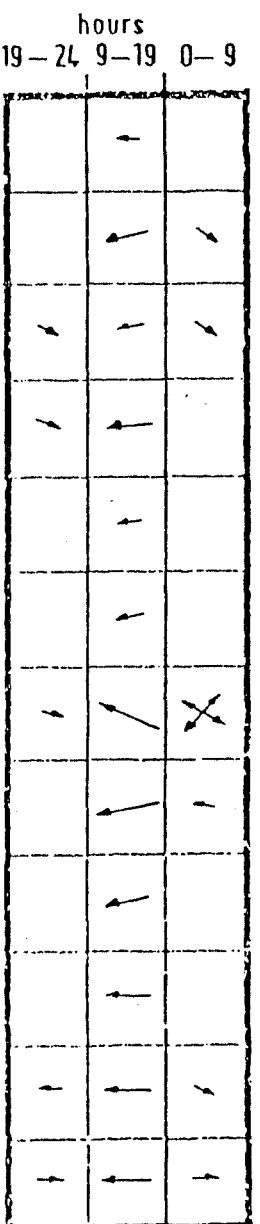
RELATIVE HUMIDITY %



EFFECTIVE TEMPERATURE °C



WIND
Direction and
Relative Velocity



RAIN
mm.

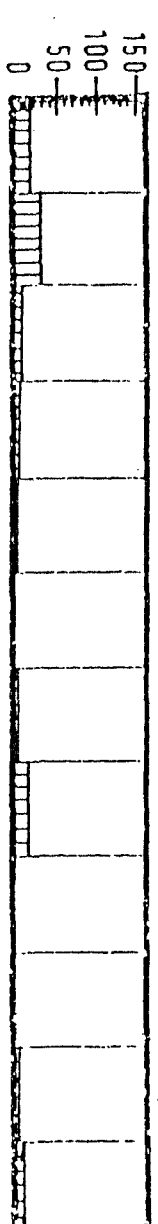
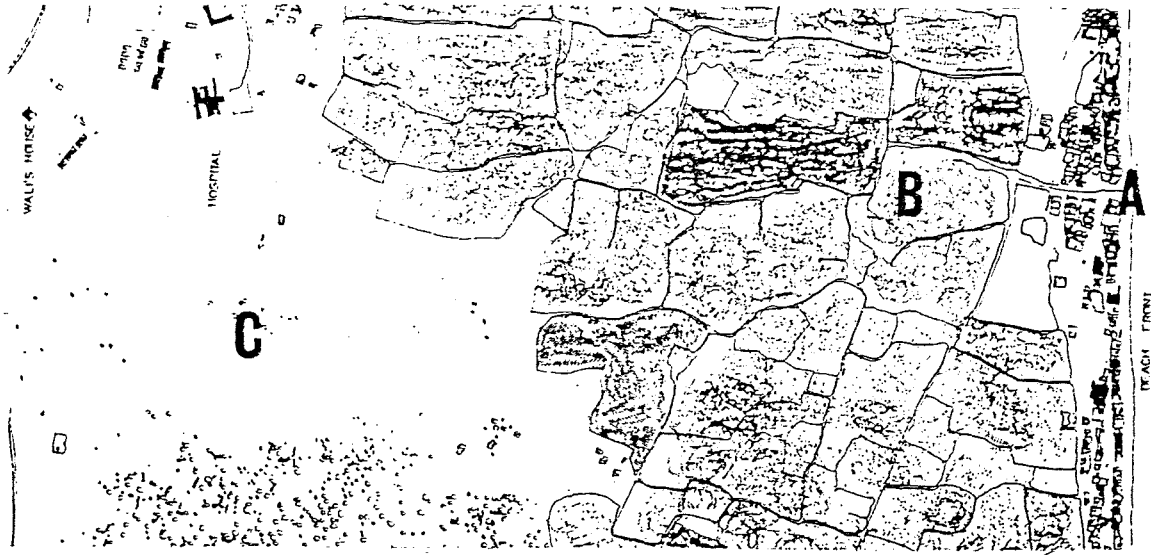
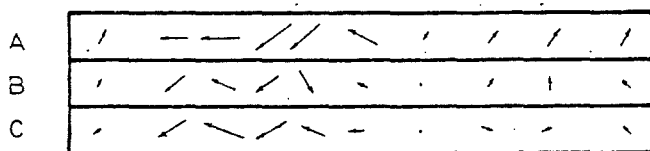
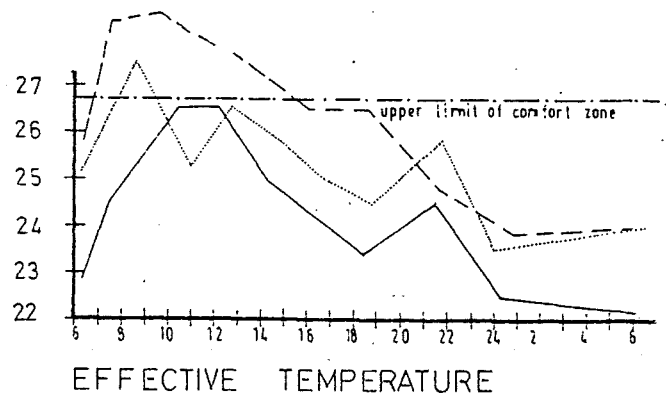
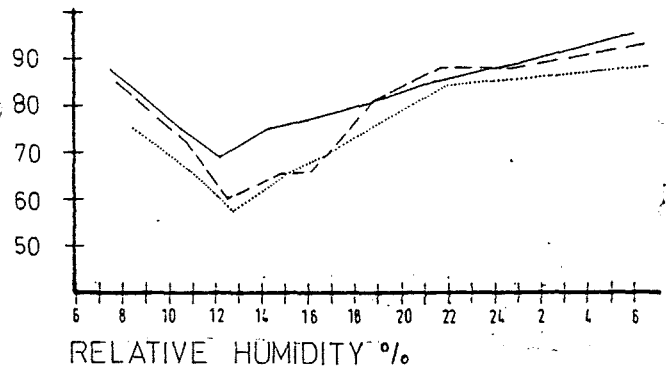
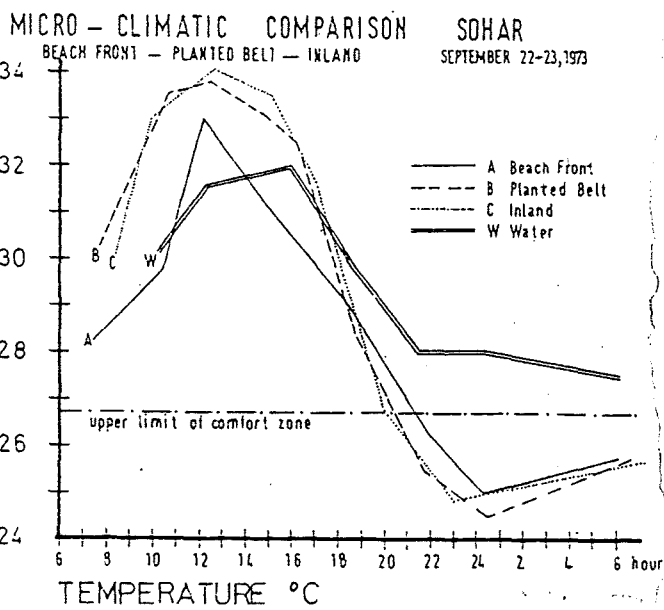
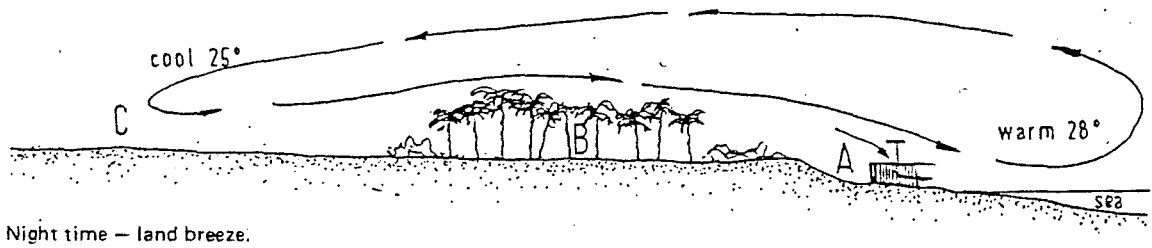
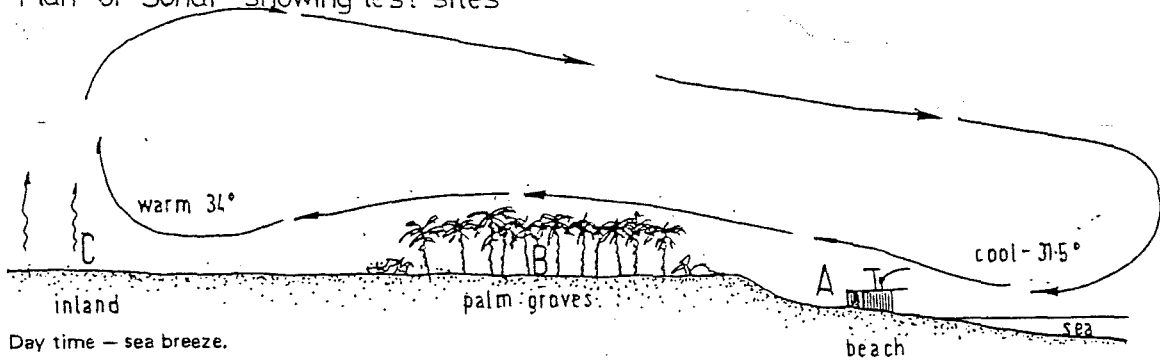


Fig A4 MICRO CLIMATIC COMPARISON ⁹



Plan of Sohar showing test sites



WIND

c) They provide security, to possessions. d) They control the amount and quality of light entering the room. During the daytime, when external light is bright and the level of glare is high, one's focus falls naturally upon the screen; to look outside would be uncomfortable. As the lighting level drops outside (early morning and evening) the external light becomes more comfortable and one can look through the screen to the outside.

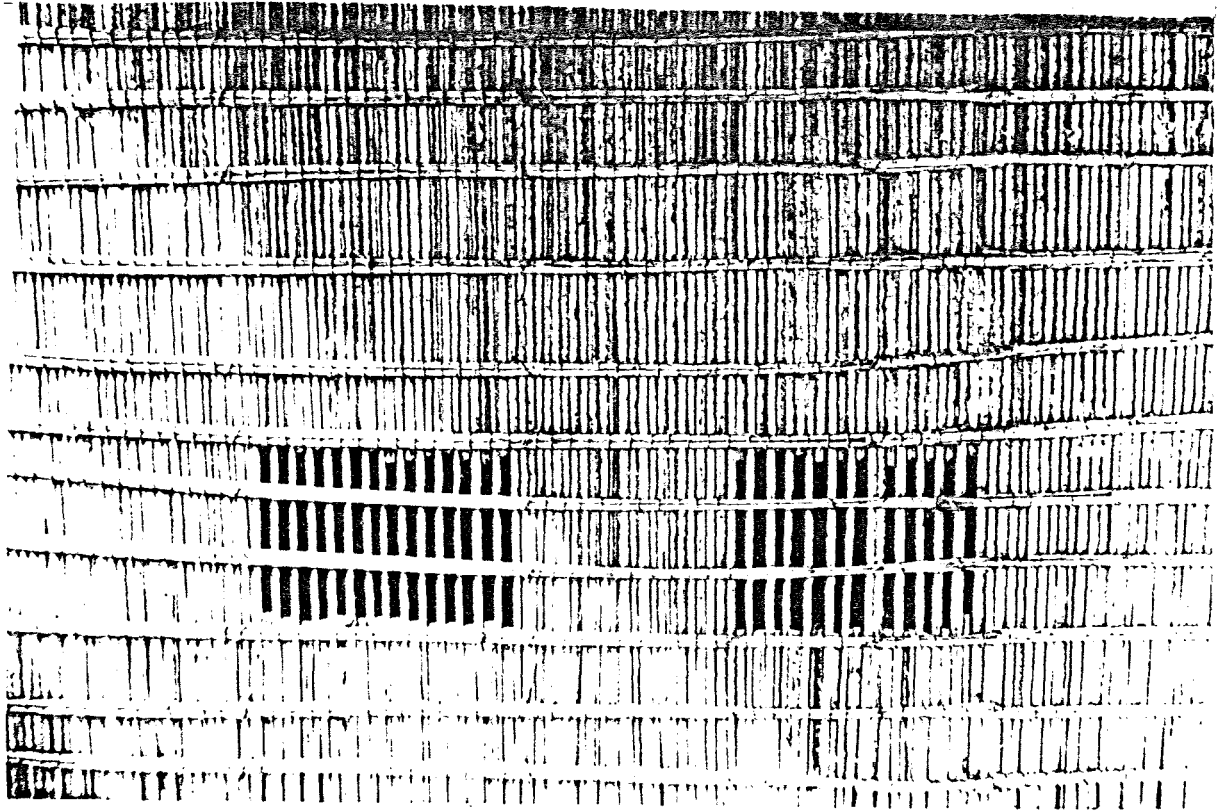
These screens combine the functions of window, wall and air conditioner in a way that is cheap and simple but effective. (Fig. A.5)

Many of the houses also make use of windcatchers to induce more air movement into rooms below. (Fig. A.6) On the Batinah Coast these are made with a wooden framework, supporting panels of hessian sackcloth. When the temperature is cool enough for additional air movement to be unnecessary, the hessian is removed and the opening to the room closed off.

In winter, temperatures are cool, and most beach front houses have a winter half to match the summer quarters. The winter half has rooms made of mud brick, which keeps air movement out, (unwanted in winter) and by its thermal mass, retains warmth which is radiated to the interior. (Fig. A.7)

3.3 Houses in the date gardens.

The range of temperature between night and day is greater here than on the beach, but houses still need air movement, particularly in the daytime for comfort. Walls and roofs are usually made of palm frond stem screens, but there are a variety of types, different ones used in different spaces to meet the specific requirements of each room.



FigA5 EXTERNAL VIEW OF PALM FROND SCREEN

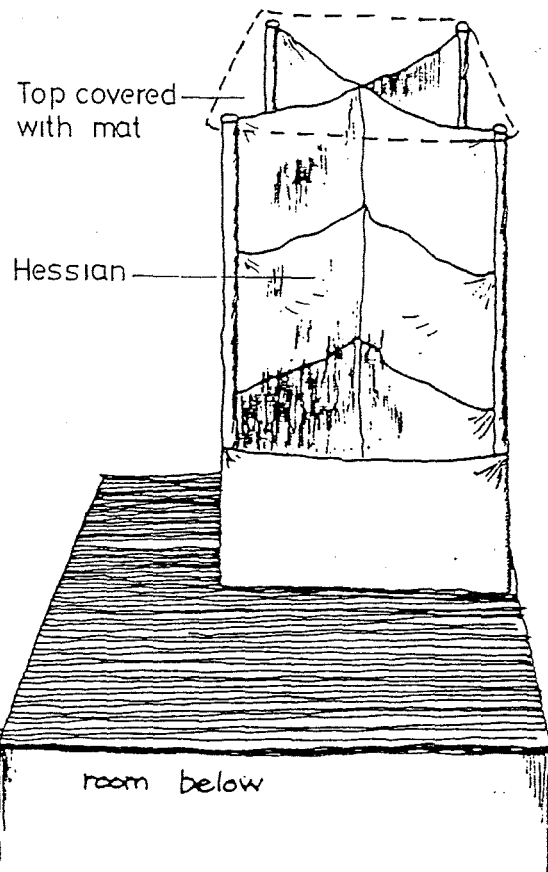
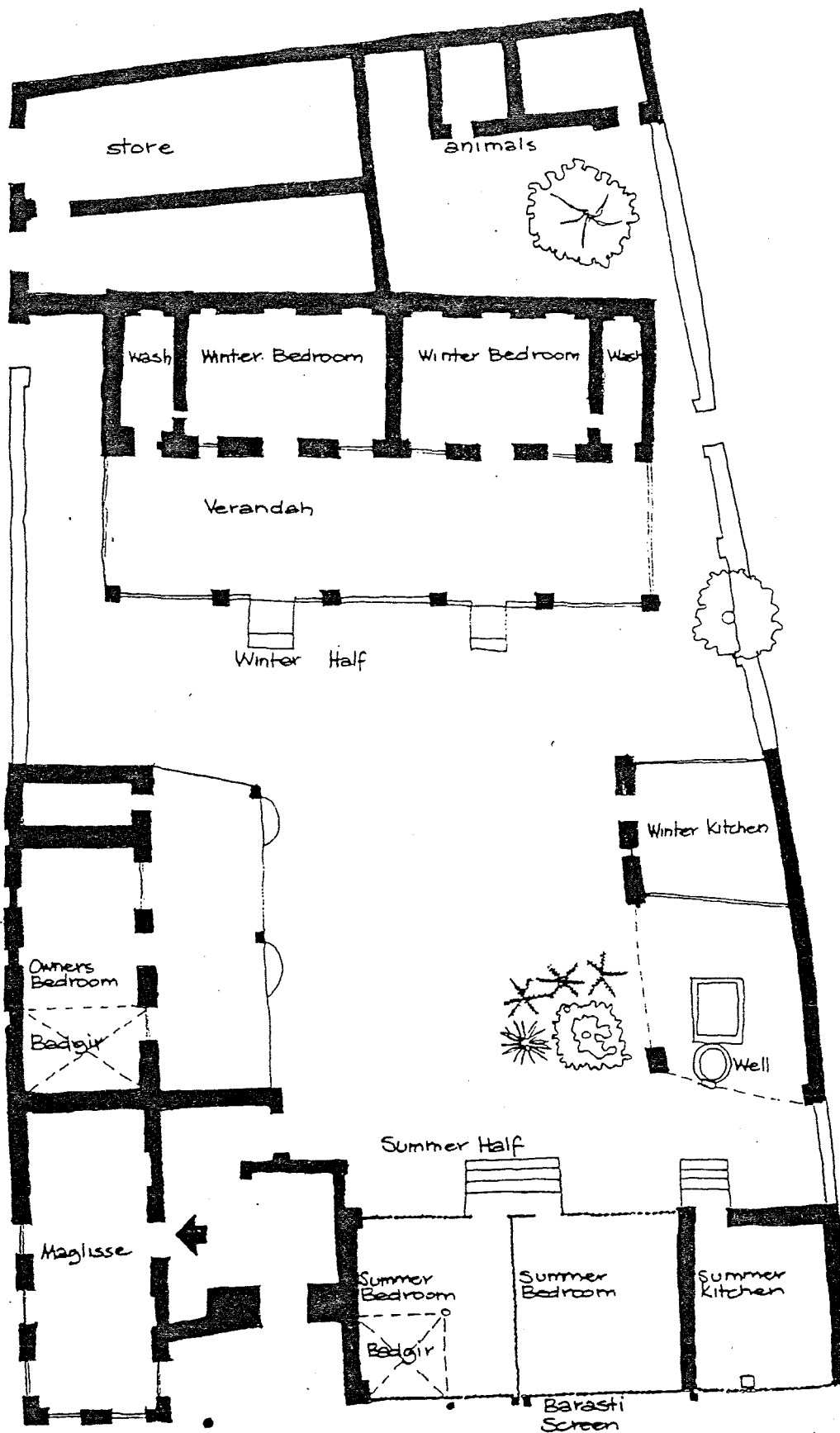


Fig A6 HESSIAN WINDCATCH



Beach Front
0 1 2 3 4 5 metres

HOUSE OF MOH'D SHERIF ABDULLAH
BEACH-SOHAR

Fig A7

Summer daytime spaces often have no walls facing the prevailing breeze, but are shaded and protected at the side. The positioning of screens allows for privacy. Screens are also added or removed according to seasonal variation of climate. Screens used in bedrooms are made of palm frond stems with the leaves retained, to provide insulation, and in many houses a double layer of stems is used to form a sandwich panel with leaves compressed in the middle, particularly for autumn and winter sleeping rooms. A room will often have different panels on each wall, one to let in light and air movement during the day, another to protect the room from wind blowing at night, which comes from inland. (Fig. A.8)

Wind catches are not used in this belt.

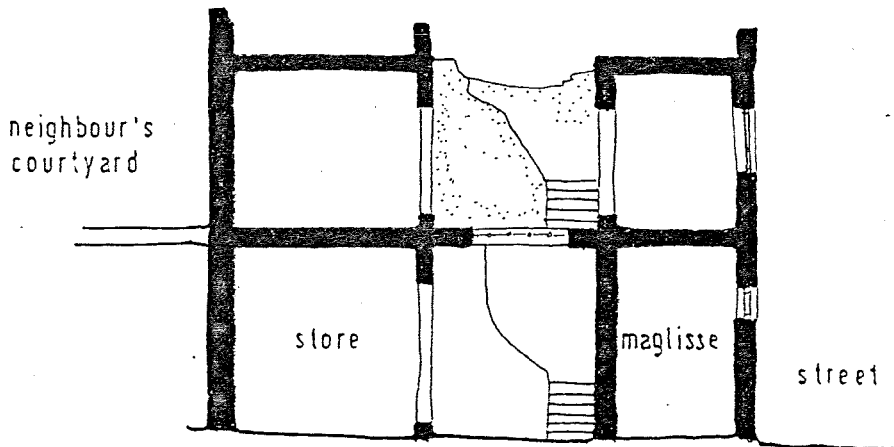
3.4 Inland of the planted belt.

Here the daily and seasonal range of temperature is much greater and the relative humidity less. Air movement through the building is less desirable; instead, a material which will balance the extremes of daytime heat and nighttime coolness is required. Most of the houses here are built of mud/mud brick, which has the ability to store daytime heat and transmit it to the interior during the night. The interior rooms remain at a constant temperature.

Because many of the people living here work during the summer in the date gardens, some of the inland settlements are used only in the winter, with migration into the date gardens to houses built with palm frond stems during the summer.

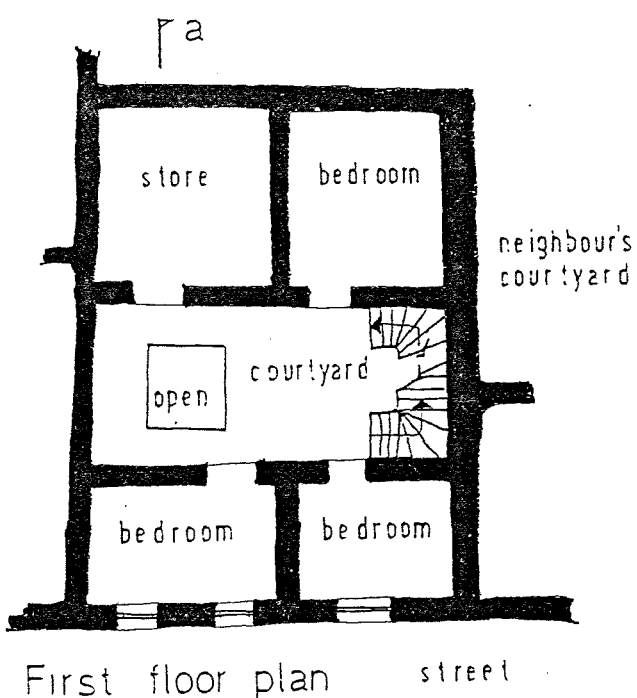
3.5 Conclusion

Each location has a particular micro climate, any single solution will be unsuitable for all three locations. The

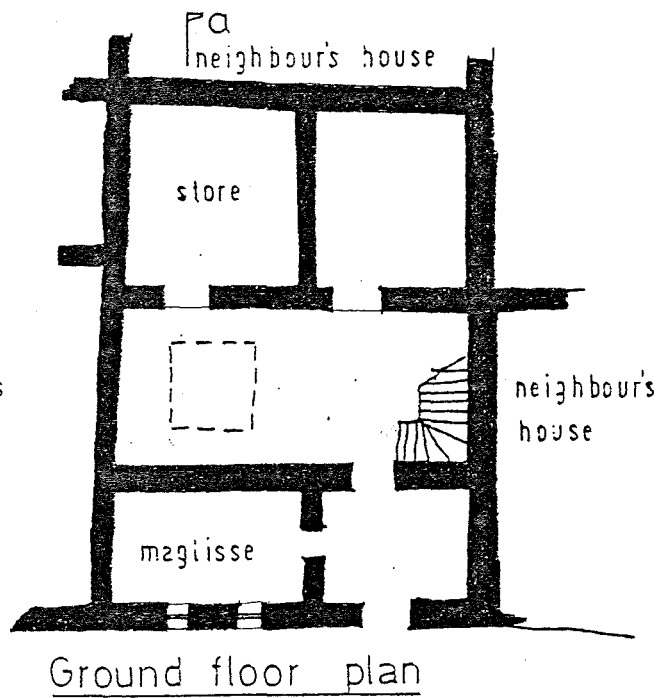


Section a a

Fig A10
TOWN HOUSE IN NIZWA

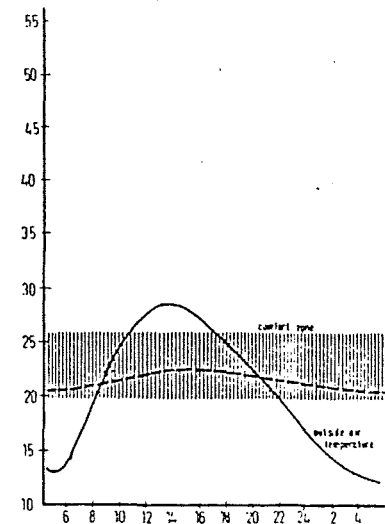


First floor plan

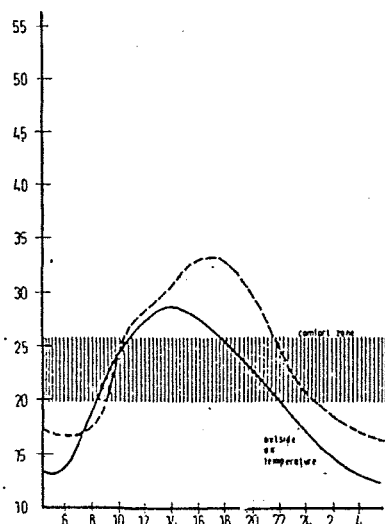


Ground floor plan

Fig A11
COMPARISON
BETWEEN
THERMAL
PROPERTIES OF
MUD & CONCRETE



Mud brick room.
Interior air temperature - - -



Prefab concrete room.
Interior air temperature - - -

high parapet walls are put up where there might be a view overlooking a neighbour. The courtyard also acts as a temperature regulator, storing heavy cool night-time air at the bottom of the courtyard, which then helps to keep the building cool during the hot daytime. Lowest rooms are often used for storage, with lighter and airier rooms higher up the building. As with the Batinah Coast, certain rooms are set aside for use at different times of the year. Windows are larger at the top and small or non-existent near the ground. One room, essential to all houses in the area, occurs at the ground floor. This is the room for entertaining guests (the Maglisse) and is a feature also found on the Northern Coast. In the Northern Uplands this room is also used as a workshop, and is often the only room with an outward looking aspect in houses which are almost entirely inward looking, especially at lower levels. (Fig. A.10)

Recent changes have introduced concrete as a building material, which is extremely expensive by comparison to mud. Its thermal performance can be compared to mud brick in (Fig. A.11), which shows that the concrete wall transfers extremes of temperature quickly to the interior. A change to more outwardlooking housing set apart from neighbouring houses has also increased the amount of direct solar gain on walls and through windows.

4.3 Conclusion

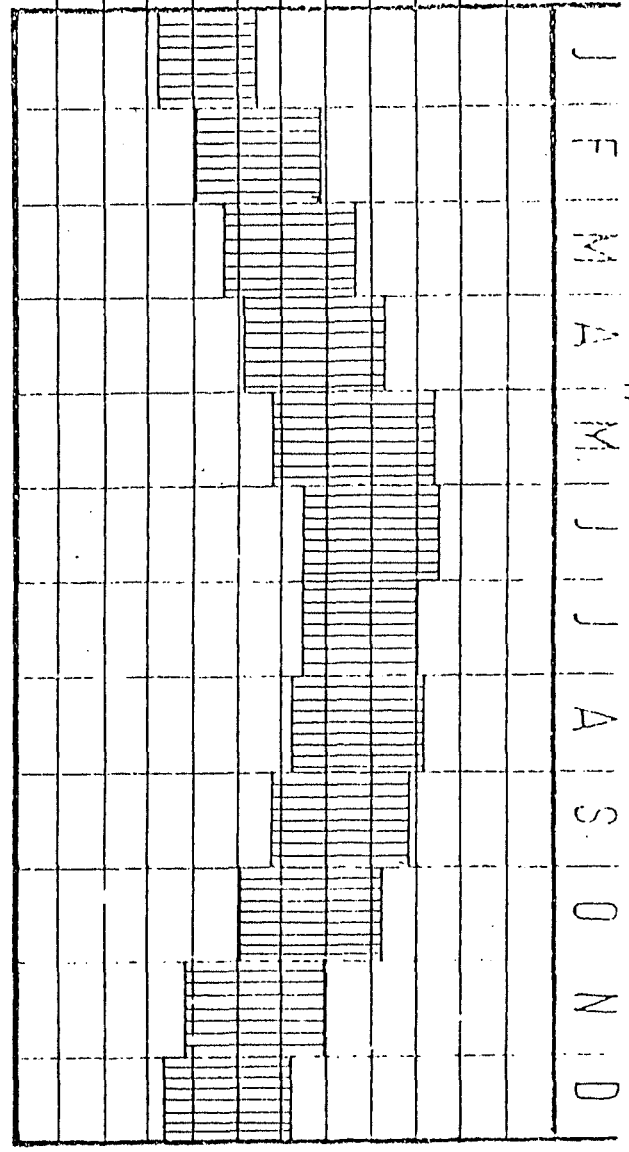
The indigenous courtyard house is climatically and socially well suited to the local conditions. Mud brick is also climatically and economically appropriate. Its main drawbacks are the need for periodic maintenance and the increasing attitude that is inferior as a material to concrete block. A new house in Izki, completed in 1973 had been built entirely with concrete, but in exactly the

12KI
Fig A9

J J F M A M J J A S O N D

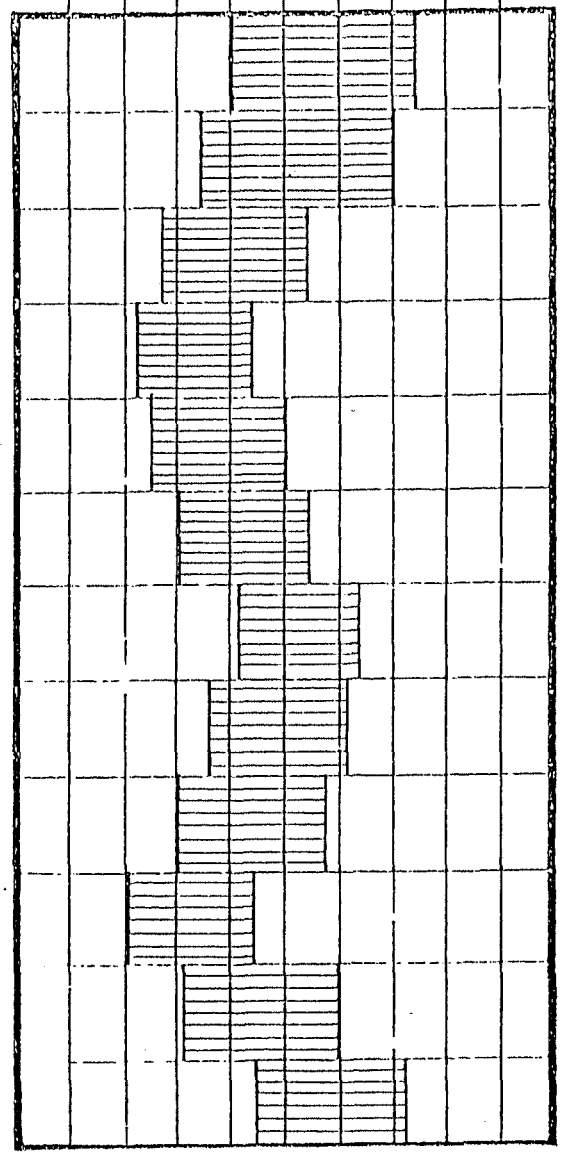
AIR TEMPERATURE °C

45
40
35
30
25
20
15
10
5
0



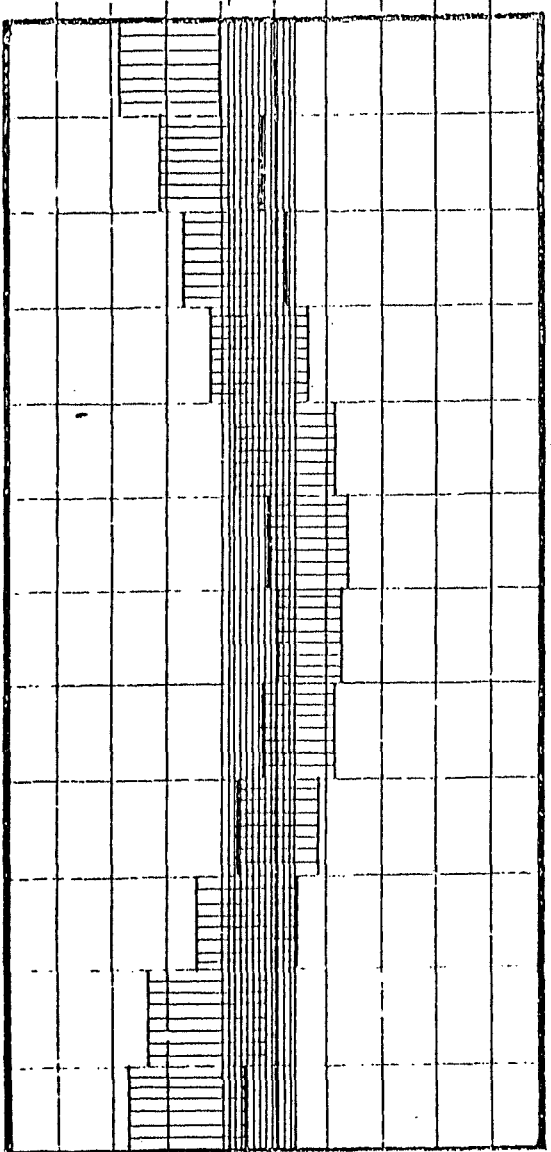
RELATIVE HUMIDITY %

90
80
70
60
50
40
30
20
10



EFFECTIVE TEMPERATURE °C

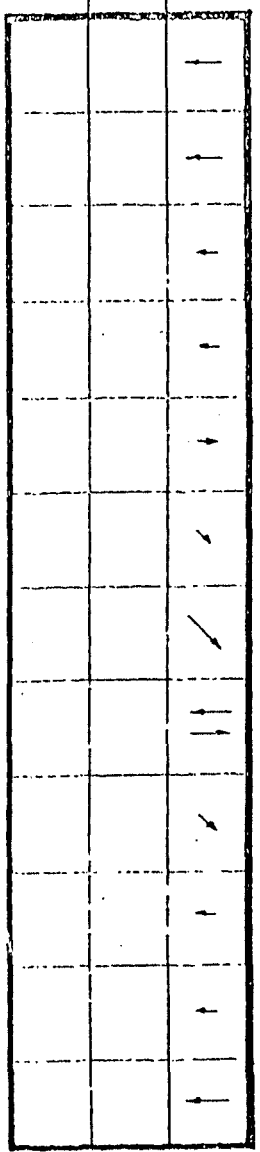
comfort zone
45
40
35
30
25
20
15
10
5



WIND

direction and
relative direction

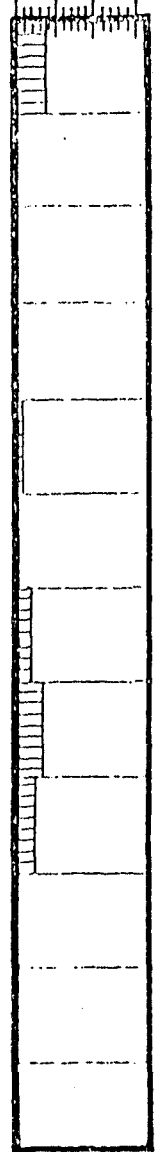
800 hr.



RAIN

mm.

150
100
50
0



4 THE NORTHERN UPLANDS

4.1 Introduction

A mountain range separates the Batinah Coast from the interior desert of Oman. The principle area of habitation is the central valley lying at the foot of the Jebel Akhdar. This valley narrows from the South East, where it opens onto the desert, towards the North West. Nizwa, the largest town, used to be the capital of Oman. As with most of the settlements in the area, Nizwa is surrounded by date gardens. The settlement stands on land not usable for agriculture, and due to limited space, is compactly laid out.

Because of the altitude and the distance from the sea, the humidity is less than on the coast, and annual and diurnal temperature ranges are greater. However, from May to August temperatures exceed the comfort zone, and from November to February temperatures are too cold. (Fig. A.9)

Many families move out from the town into summer houses in the date gardens for comfort during the hottest time of the year.

4.2 House form

Whilst there are considerable local variations, there is a basic housing and settlement pattern in this area. Houses are predominantly built with mud brick. The dense clustering of houses and the use of mud results in a built environment that maintains a high thermal capacity, levelling out the extremes of temperature and producing moderate internal temperatures. Town houses are built on a central courtyard form, and are usually two or three storeys high. The courtyard serves as a light and ventilation shaft to the lower floors. The deep courtyards ensure that privacy is maintained and

materials used for building houses in each location are used differently in response to the immediate condition and to what is immediately available.

Recent trends towards using concrete block and sheet metal for building has negated much of the response to local conditions, and owners of houses using these new materials admit that they are less comfortable.

3.6 Materials

The palm frond stems used in this area are criticised on several points. They are attacked by termites and have to be replaced after a few years. They are liable to catch fire, and they accumulate dust and insects.

Various experiments and tests were conducted with palm frond stems after the field work, as well as comparisons with alternative available materials.

The problem of termites (mainly subterranean termites) can be overcome by careful design. Equally, by careful design and selective use of materials in fire risk areas, including the introduction of fire retardant solutions, the risk of fire can be reduced.

After comparison with concrete block buildings in the area, it was found that the palm frond stem houses did not contain significantly more dust or insects than the concrete block houses.

It was suggested that the local materials had a) a useful potential role to play in meeting the shelter needs of the area, in a way that was cheap and socially and environmentally appropriate and that b) much could be learnt from the way in which the indigenous houses were built and lived in.

same form and with walls of a thickness required with mud brick. The owner had borrowed money to finance the building, and had amassed debts that would be transferred to his children. His motivation for this move to concrete was to reinstate his local prestige, which had been damaged in tribal skirmishes several years previously.

5 DESERT OASIS - BURAIMI

5.1 Introduction

Buraimi is one of several oases on the border between Oman, Abu Dhabi and Saudi Arabia. Its climate is primarily that of the hot dry desert, but it is modified by a) winds blowing from the sea, which bring rain occasionally, and b) by the more humid mild climate of the oases itself, induced by moisture in the soil and plants. Although there is a distinct hot and cold season and a wide diurnal range, the temperatures are not as extreme as the hot dry desert climate. There are seasonal prevailing winds which are stronger in winter than in summer. (Fig. A.12)

As with the settlements in the Northern Uplands the shortage of water ensures that land suitable for agriculture is little used for building, although there are a few houses within the oasis. The main settlement sits at the edge of the date gardens, on land which does not have water for irrigation, but sited as close as possible to the planted areas, to benefit from the more comfortable conditions.

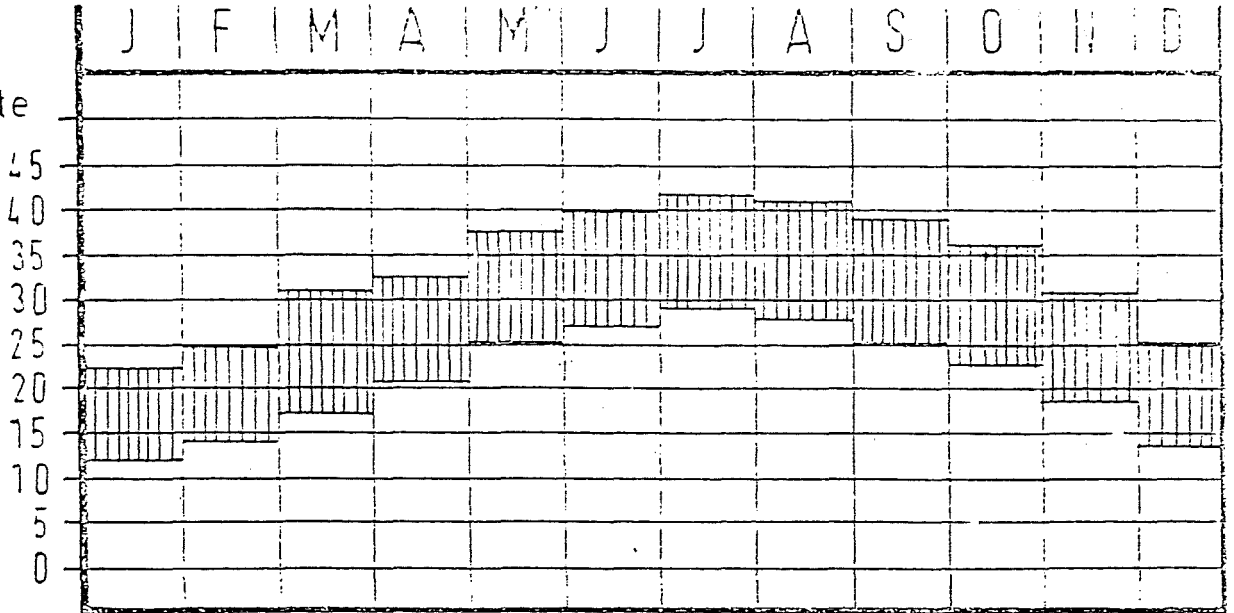
5.2 House form and materials

Houses have traditionally been built of mud brick and are similar to those of the Northern Uplands, with a limited use of palm frond stems in roofing. Recently, corrugated iron and concrete block have been introduced, particularly into the market area. These produce extremely unsatisfactory shelters, especially where the temperatures are high. Corrugated iron transfers the outside surface temperature immediately to the interior, inducing a build up of heat inside which is well in excess of any conceivable comfort level. Many of these shelters were used (1973) to keep and sell food in, particularly in the meat market. Because of the high temperatures this was extremely unhealthy.

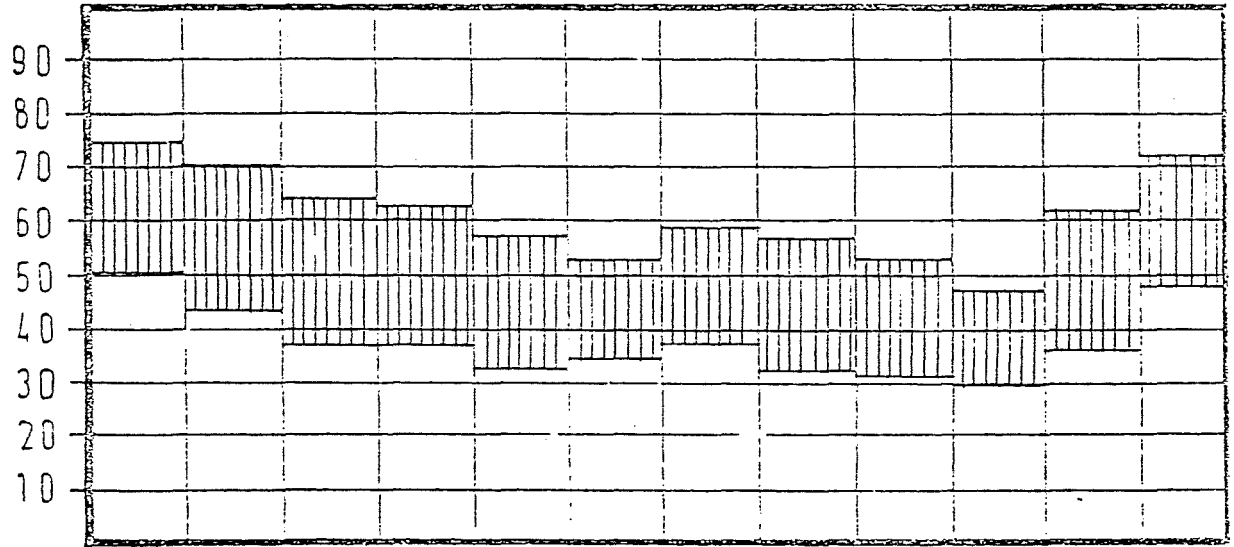
Fig A12
BURAIMI

oasisi climate

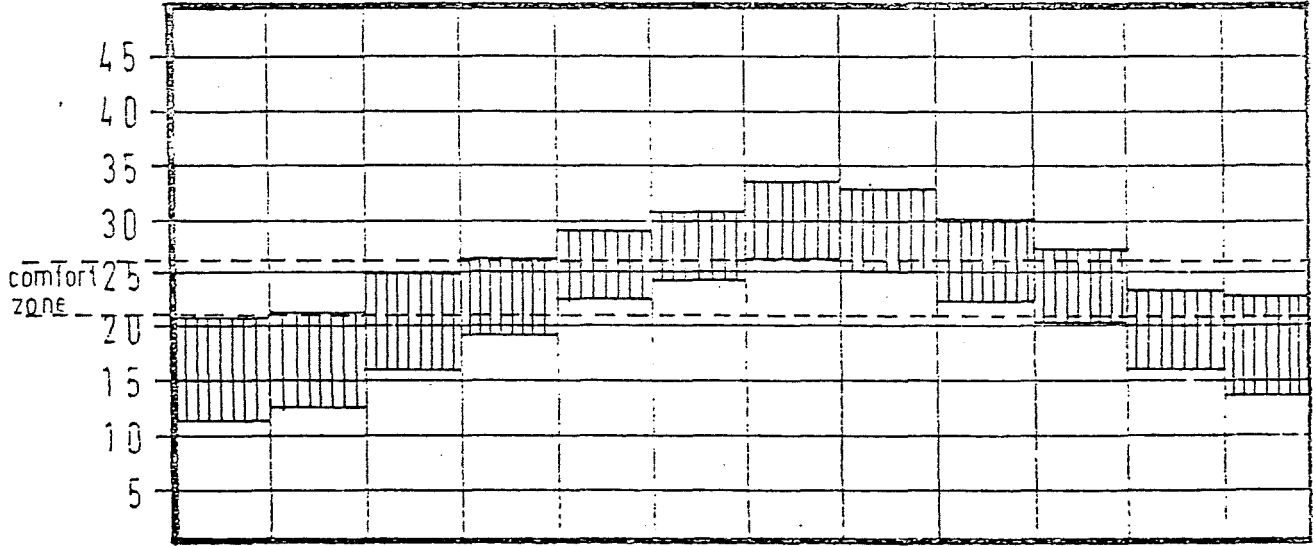
AIR TEMPERATURE °C



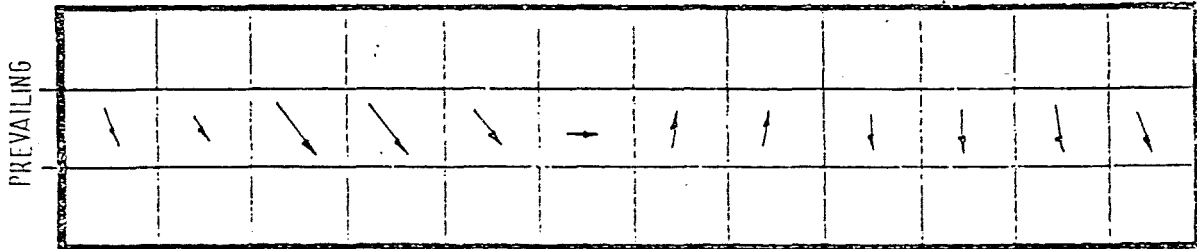
RELATIVE HUMIDITY %



EFFECTIVE TEMPERATURE °C



WIND



RAIN



5.3 Conclusion

In 1973 Buraimi was in the unfortunate position of being a poor neighbour to Al Ain, a rapidly expanding town in Abu Dhabi, and at the same time too far away to attract attention from the coastal and capital region of Oman. The town demonstrated the effect of neglect, with very little attention being paid to its upkeep. The few new buildings that had been erected were neither healthy nor providing protection against extremes of climate.

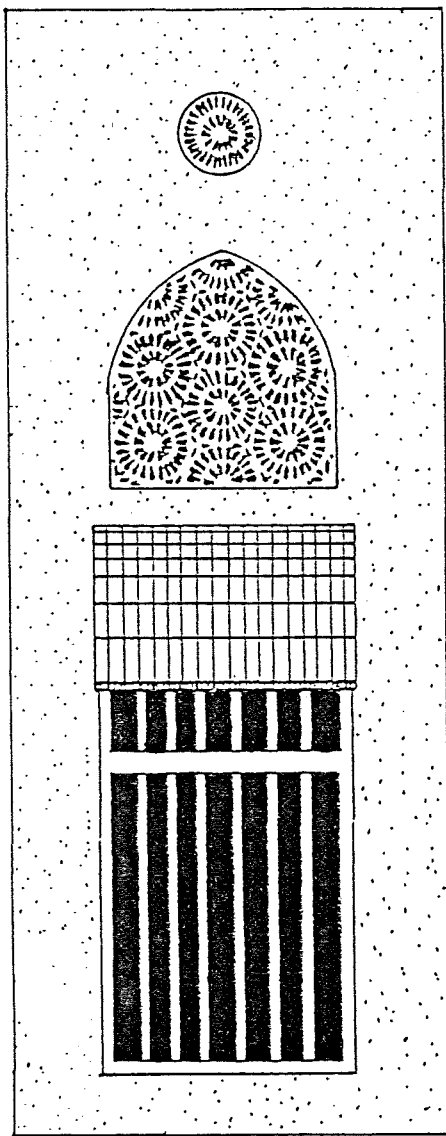
6 THE CAPITAL REGION : MUSCAT, MUTRAH, RUWI

6.1 Introduction

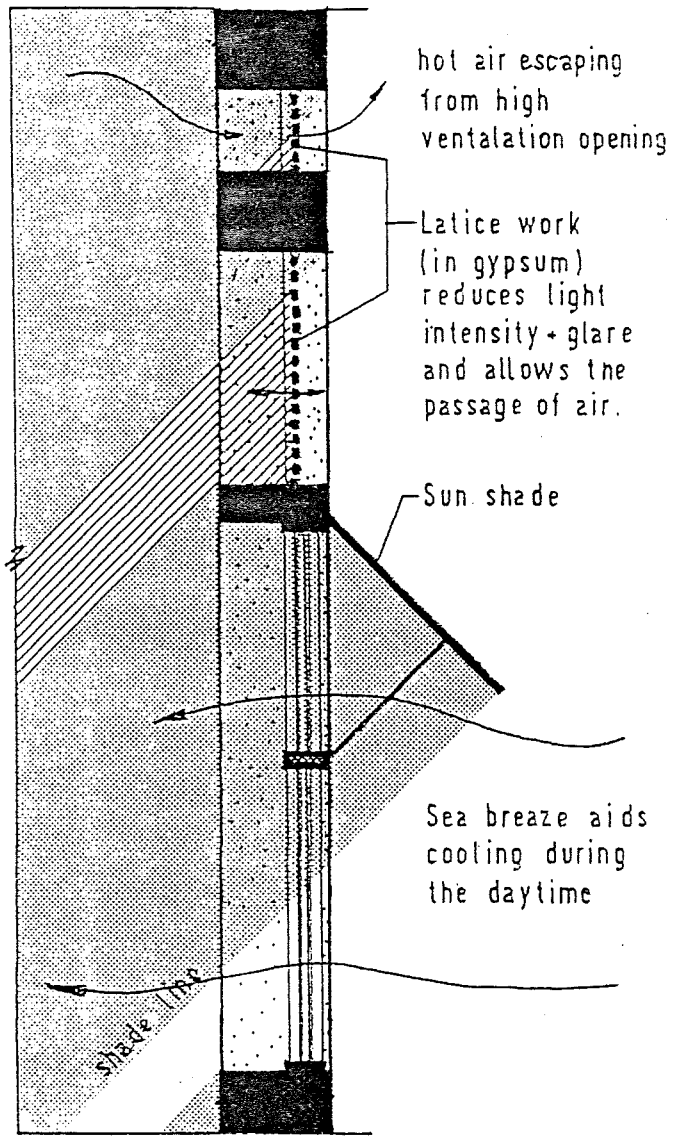
This region is bounded by the sea to the north east, the Batinah Coast to the north west, and is otherwise surrounded by bare mountains. Muscat itself is completely hemmed in by mountains. The division between this area and the Batinah comes at the point where the date gardens are replaced by bare limestone hills.

The climate is characterised by consistently high temperatures and relative humidity, there is little change between night and day. Muscat has an especially harsh climate, since heat is re radiated from the surrounding rock mountain sides which enclose the town, pushing the temperature up an additional 5°C. The critical months for cooling are between April and October. (Fig. A.13)

Muscat has traditionally been a major power centre, and has in consequence more large houses than Mutrah, which still serves as the main commercial centre, with a largely middle class population, many of whom are from India and Pakistan and form the main merchant community. Mutrah is more densely built upon than Muscat, but Muscat has no room for expansion and in 1973 there were signs that some of the old buildings were being replaced. Recent expansion has taken place in the Ruwi valley behind Mutrah, and most new housing, ministries and embassies are situated here. They are characteristic of the sort of building and planning taking place in the area. One would normally expect to find a relatively scattered settlement pattern to respond to the climatic conditions in Muscat and Mutrah, but population pressures have made this impractical.

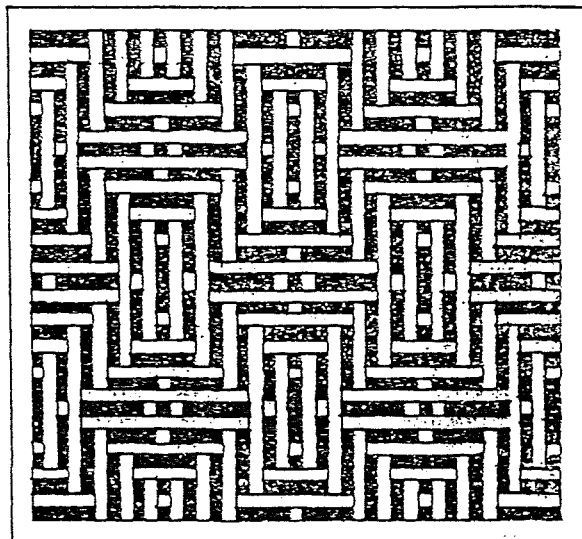
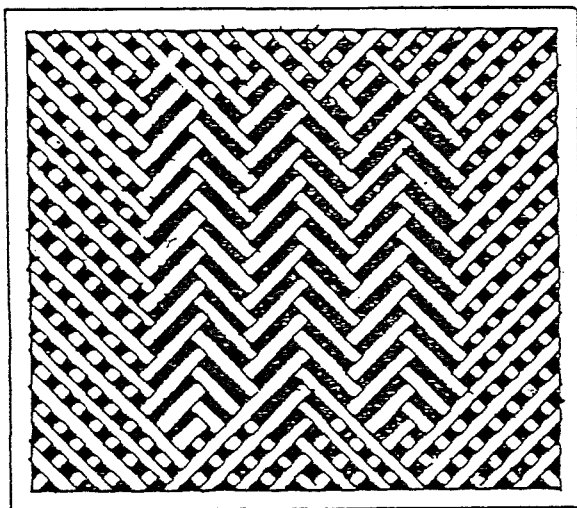


Elevation



Section

Window Details - from Najwani House - Mutrah bay front (Multi-Level Openings) showing function of lattice work and ventilation system.



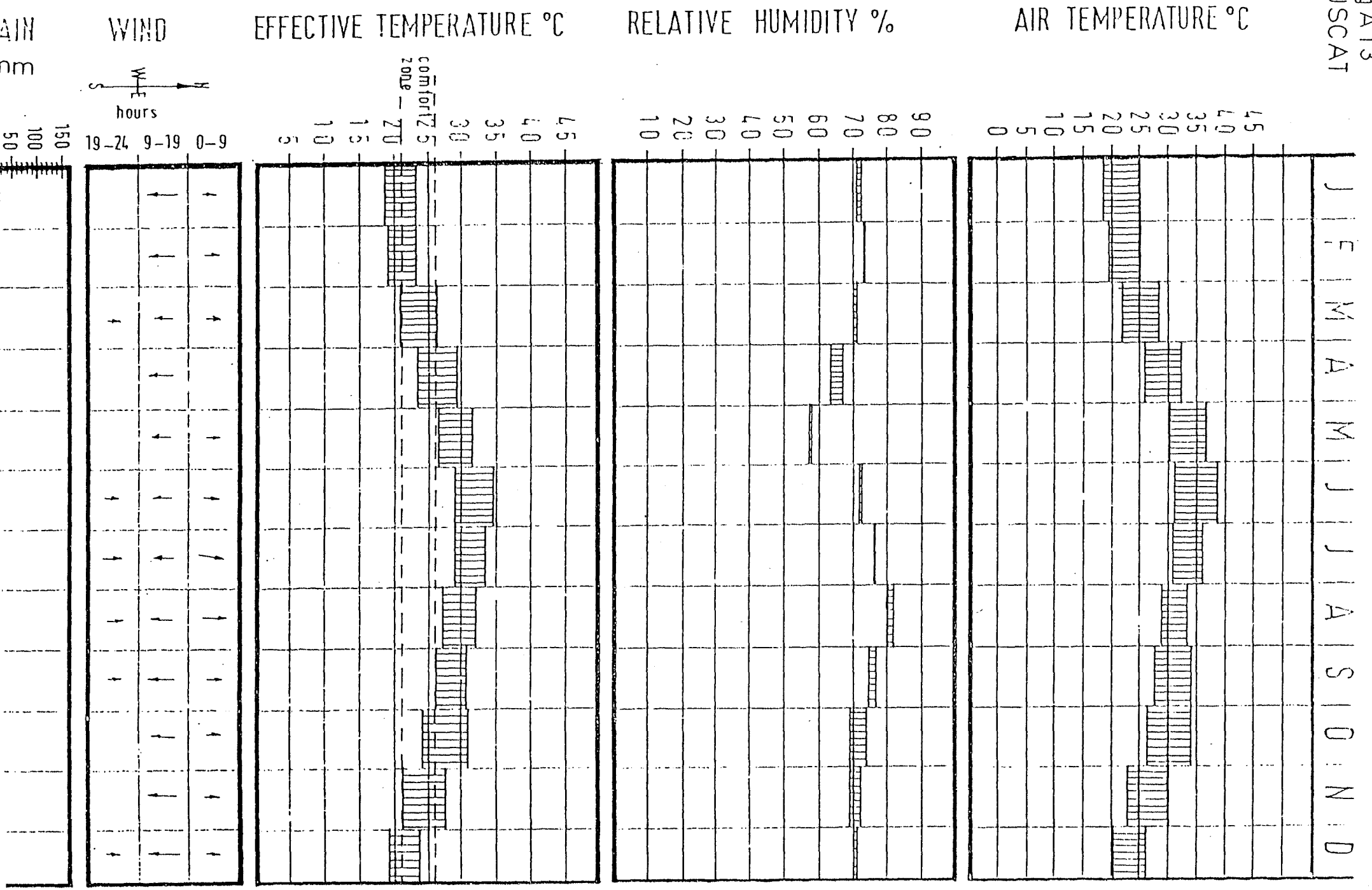
Lattice Windows - from houses in Muscat town centre. Made of small wooden pieces each having a square section, fixed by peg connections.

6.2. House form

The houses of Muscat and Mutrah are traditionally based upon a courtyard plan, where shade and privacy are available and where any cool air can be trapped and help to cool the rest of the building. The walls were usually of limestone, retaining any internal coolness. Upper floor rooms, which are the main living and sleeping spaces, have large windows facing both the sea and the courtyard, to allow any available air movement to pass through rooms. The windows are often of elaborate design, allowing air to enter the room when it is advantageous but excluding solar radiation which would raise indoor temperatures. Because of the air's moisture content the sky reflects a great deal of light and skies are much brighter than one would find in drier regions. Because of the glare problem of bright skies the high windows opening to the sky are generally of lattice work. Openings high up in rooms are also necessary to allow for the escape of warm air which collects in the upper reaches of a room due to convection. (Fig. A.14)

6.3 Conclusion

New houses in the area rely almost entirely upon air conditioning to combat the external climatic conditions; the use of courtyards and properly designed windows can greatly improve the natural performance of the house, most especially in terms of the quality of light and restriction of glare. The model of new housing in the area is furthermore being adopted by people who cannot afford the expensive mechanical means to readjust the unfavourable internal climate that is created when buildings are designed without considering the alternative means already available for creating comfortable internal conditions.



7 SUR

7.1 Introduction

Sur lies at the far north eastern corner of Oman, at the point where the Persian Gulf enters the Indian Ocean, and has developed as a strategic and trading port. It is in decline now. Its trade has dropped off as other routes have developed and the building of traditional dhows is less in demand than in the past. There is high unemployment and many of the workers have migrated to the gulf states in search of employment.

The town of Sur lies on a peninsula, almost entirely surrounded by water, a lagoon inland and the sea on the other side. The town is densely built up on the permanent dry land separating these two. Some houses rise to 2 or 3 storeys.

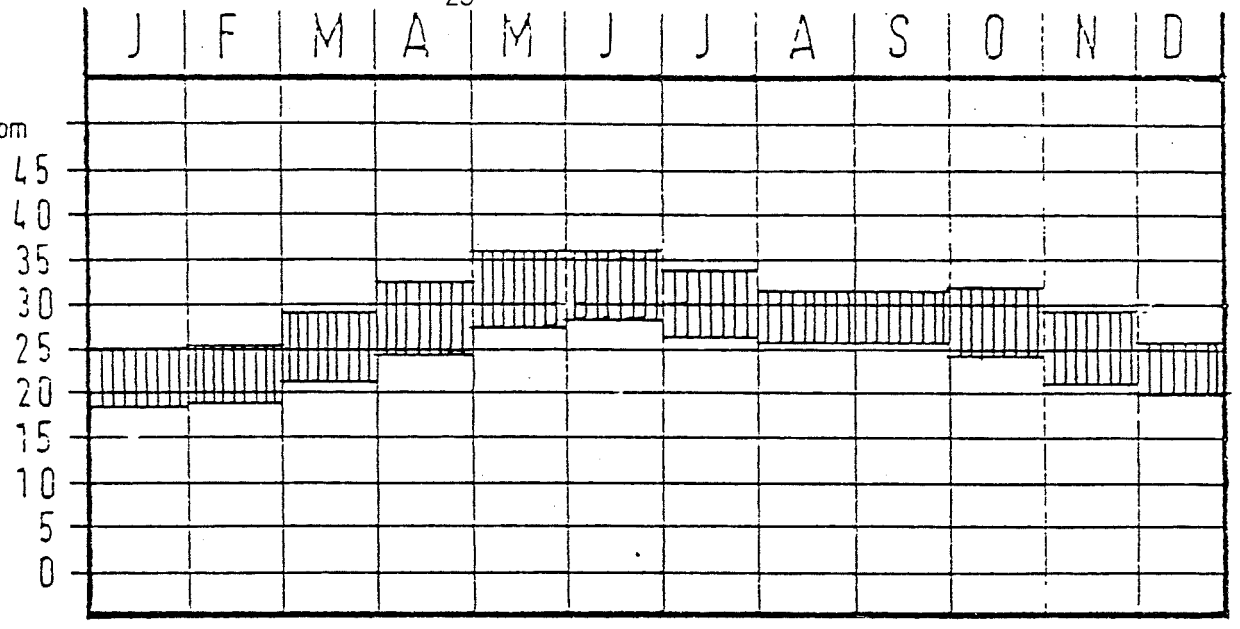
Sur is uncomfortably warm between May and September, but for the rest of the year has a comfortable to slightly cool climate, Relative humidity is always high, with a peak during the summer. Because of its position on the coast the town experiences daytime onshore breezes and nighttime offshore breezes for most of the year, with a modified pattern during the middle of the winter, due to prevailing winds from the North, and at the height of the summer, a southerly land breeze which negates the daytime sea breezes and reduces air movement at the most uncomfortable time of day. (Fig. A.15)

The settlement pattern of the town helps to compensate for this lack of breeze. The compact streets remain in shade for most of the day, and air is cooler here than in the public and private open spaces, where direct solar radiation heats up the air and causes it to rise. This air is replaced with cooler air from the shady streets, and in this way air movement is induced.

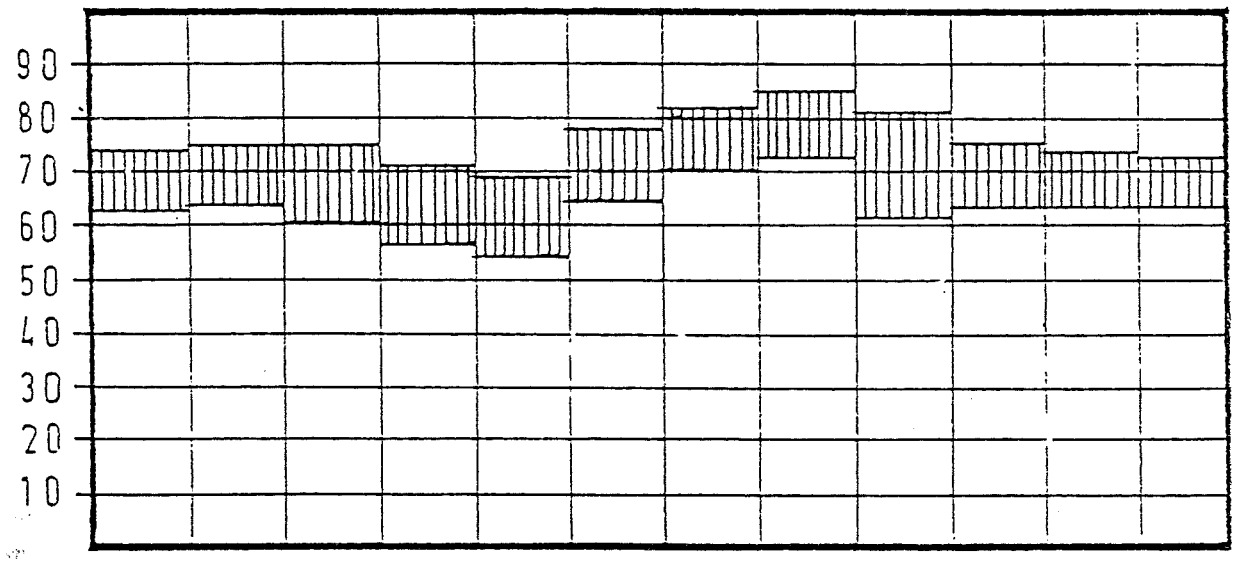
Fig A15
SUR

(extrapolated from
Mazirah + Muscat)

AIR TEMPERATURE °C

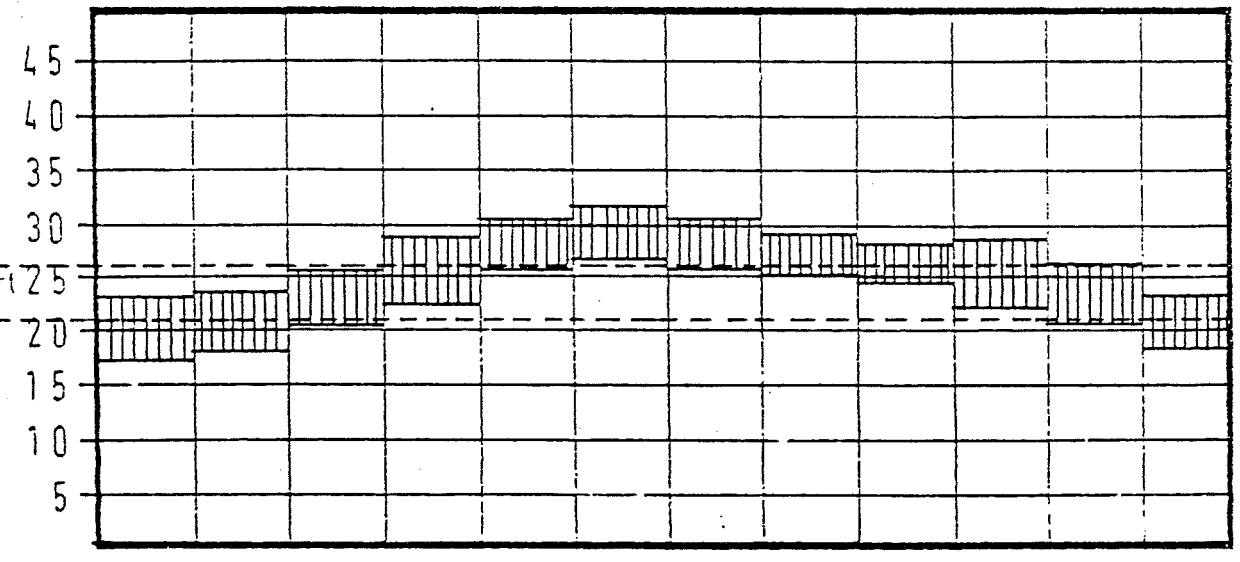


RELATIVE HUMIDITY %



EFFECTIVE TEMPERATURE °C

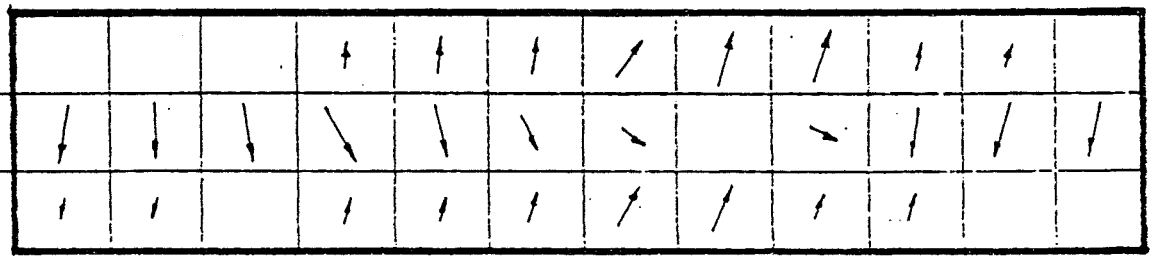
comfort zone



WIND

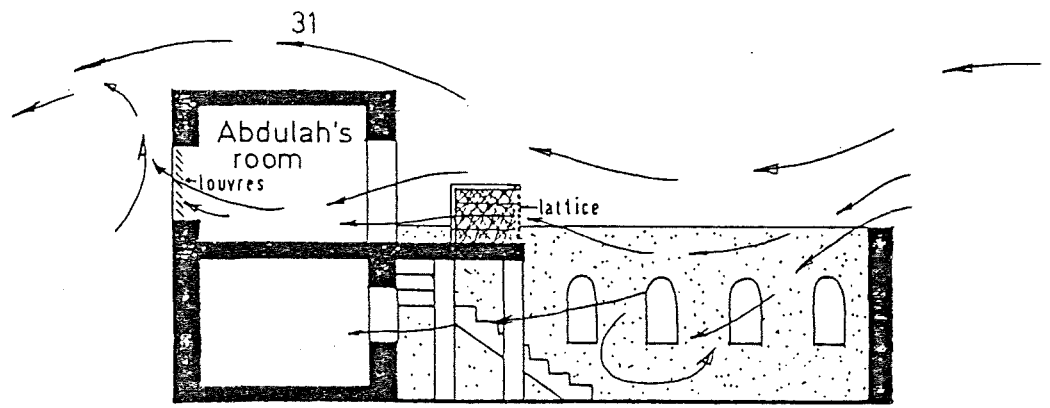


hours
19-24
9-19
0-9

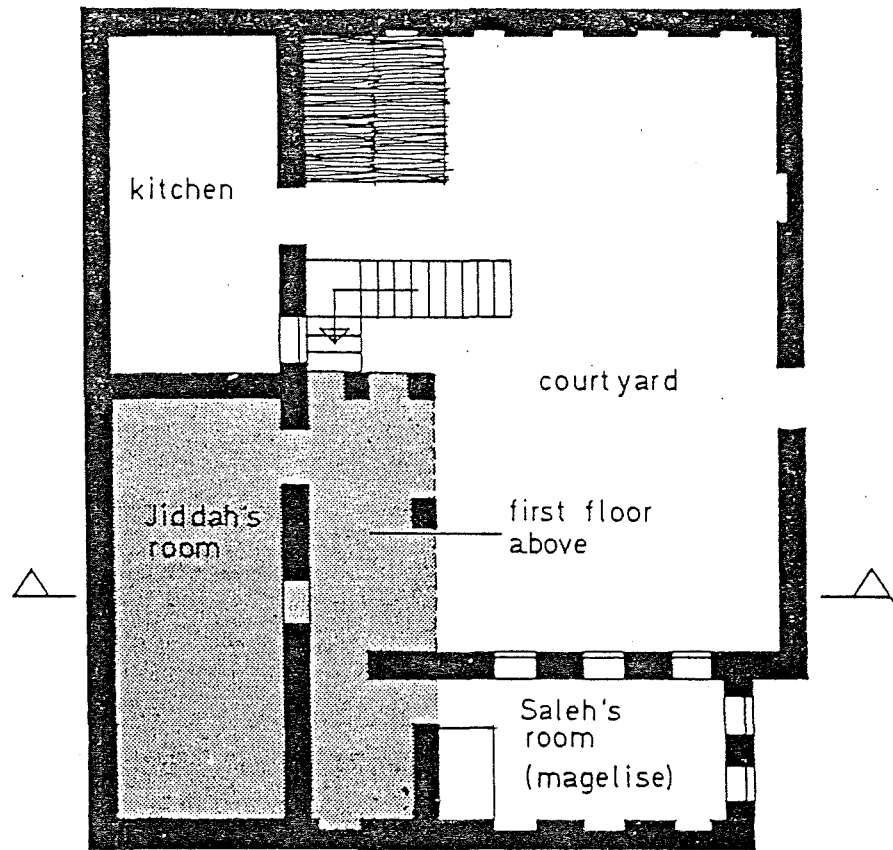


RAIN





Section showing air movement

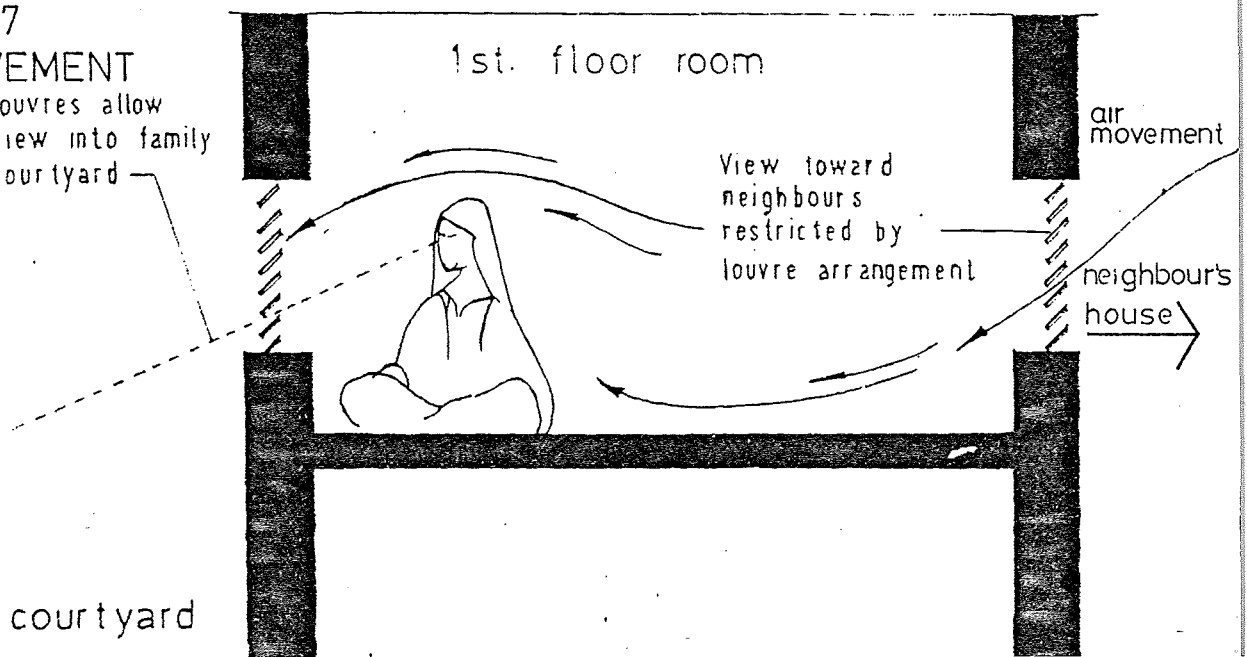


street
Ground Floor Plan

FigA16
House of
three brothers.
SUR

Fig A 17
AIR MOVEMENT

Louvres allow view into family courtyard



courtyard

to the merchants of Salala. New houses are built of limestone or concrete block.

The thick limestone walls transfer heat quite slowly having a high thermal capacity. This means that heat from direct solar radiation does not reach the interior until about 18 hours later. Mid day heating will thus be entering the house at about 6 a.m. the following morning, when the interior is coolest. This thermal capacity is more important during the winter when temperatures drop below the comfort level.

The houses are all built around a courtyard. Older houses rise to 3 or 4 storeys, and the courtyard is a cool shady space where any colder air will be trapped and used to cool the adjacent rooms. At the hottest time of day the rooms will be noticeably cooler than the external air temperature.

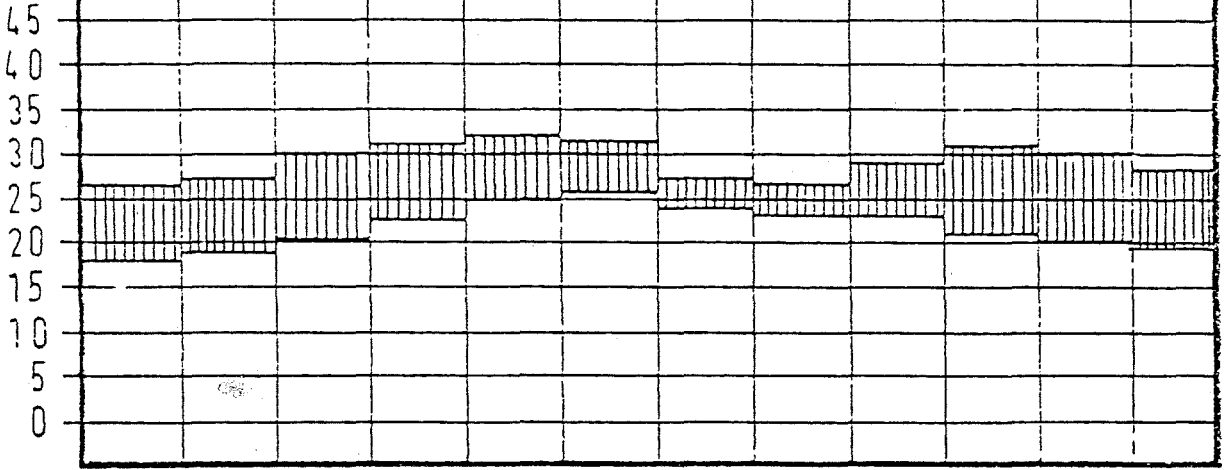
Cement blocks which are coming into widespread use are cheaper than limestone (1973 price 22 Omani Rials per 100 cement blocks as opposed to 30 Omani Rials/100 limestone blocks). However the limestone blocks are larger and have a better thermal performance. The preference was for limestone where finance permitted.

The production of limestone blocks had scope for improvement. With the exception of one imported stone cutting machine which produced very little and was inefficient, all limestone blocks were quarried by hand. Whilst this was a major source of employment, the blocks were irregular in size and production slow. The introduction of some machinery on a co-operative basis to help these people was suggested.

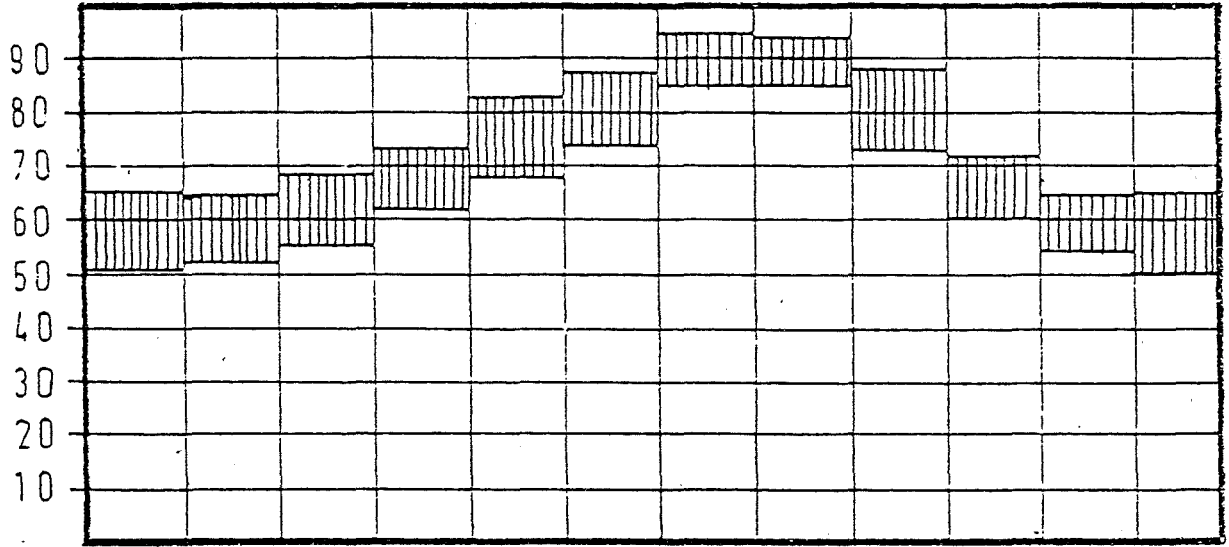
SALALA

Fig A18

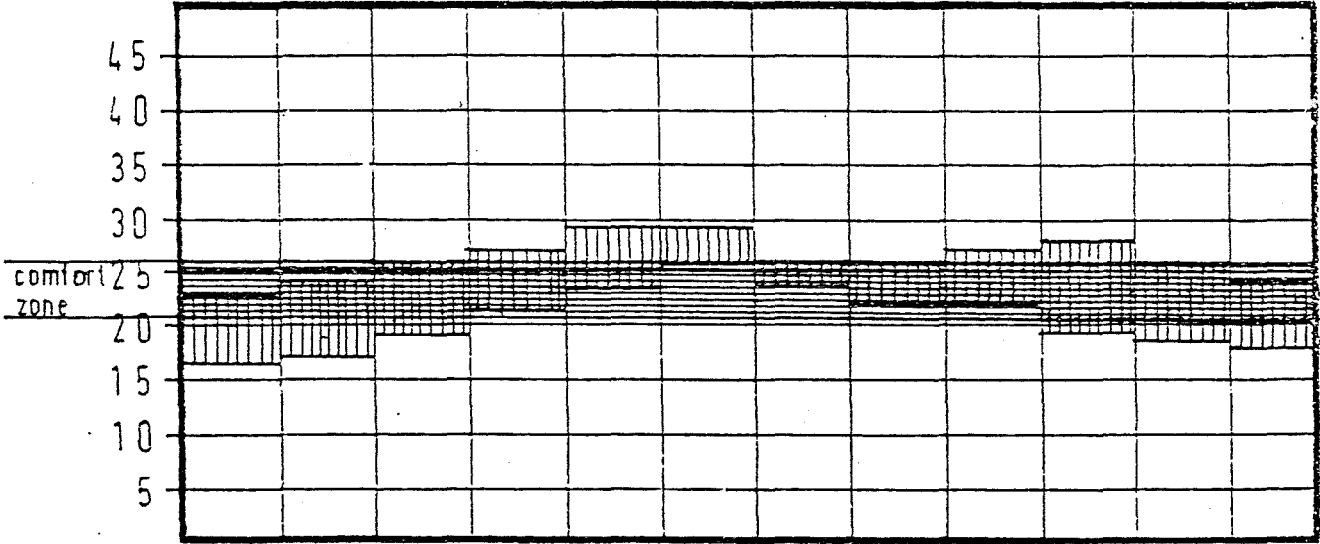
AIR TEMPERATURE °C



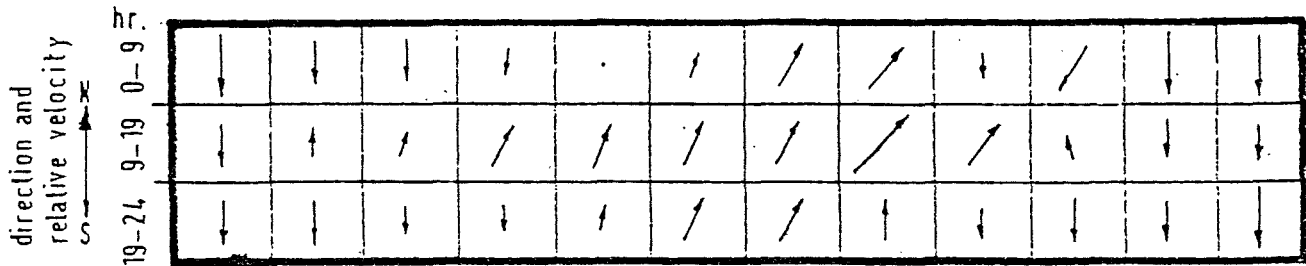
RELATIVE HUMIDITY %



EFFECTIVE TEMPERATURE °C



WIND



RAIN



8.2 Settlement Pattern

The layout of the town is responsive to the need for air movement. Houses are set well apart from each other, aligned parallel to the sea. Houses are situated not only to accept the maximum breeze (diurnal on-shore/off-shore breezes and prevailing south/Westerly winds in summer) without blocking the passage of air movement to the houses behind. Where two houses are in line with the breeze, there is sufficient space between the houses for the air movement pattern to return to normal, i.e., the second house lies beyond the wind shadow of the first house. (Fig. A.19)

A prominent feature of Salala houses is the large yard in the southern front of the house, defined by a low perimeter wall. This land belongs to the house owner and ensures that no one else builds too close.

The refugee problem is increasing the density in newer parts of the town, but wherever possible new house builders adhere to the same principles of orientation and spacing.

8.3 House form and materials

Houses on the beach front, lived in mainly by fishermen, are of palm frond stems collected on site from the coconut groves. These houses allow free air movement during summer. Some rooms are plastered with mud and are used in winter, when thermal and insulation is desirable.

The summer rooms of palm frond stems are well suited to the beach front sites, where relative humidity is at its highest.

Inland from the beach front and the palm tree belt are more substantial houses of limestone belonging primarily

8 DHOFAR COAST (SALALA)

8.1 Introduction

The inhabited section of the Dhofar coastal plain is mainly focused upon Salala. The town lies 4 - 5 kms to the south of the Dhofar hills which are green with trees and grass during the rainy season. Salala itself has numerous coconut palm groves supported in the past by the 'Falaj' system of irrigation and by tapping the water table where the limestone bedrock has been dug away to allow trees to root.

The political instability in the Dhofar hills (1973) has led to both economic changes in Salala and to a large influx of refugees into the town. There is considerable building activity by the new arrivals.

Previously Salala's economy was very dependant on its fishing industry, with a strong trading link with the people in the hills, who used the fish to feed their cattle, which were traded in return. This trade has largely died out and Salala now imports most of its requirements. Much of the money in the town comes from relatives working in the United Arab Emirates.

Salala technically lies within the Warm Humid Tropical Zone and is often regarded as being monsoonal, although the monsoon's affect is one of extremely high humidity (95%) during the summer but more mist and slight drizzle than proper rainfall. The annual rainfall is in fact low (80 mm per annum). Climatically critical times of year are between May and June and again in October, but throughout the summer air movement is important for cooling. (Fig. A.18)

7.3 Conclusion

Two features in Sur which will hopefully remain in continued use are the courtyard and the positioning and design of windows. They are both simple means to ensure privacy whilst encouraging air movement into dwelling spaces. In 1973 there had been little outside influence in terms of building styles and new houses were being developed to make full use of these principles. Such an approach was to be encouraged where mechanical means of cooling are both expensive and not readily available.

7.2 House form

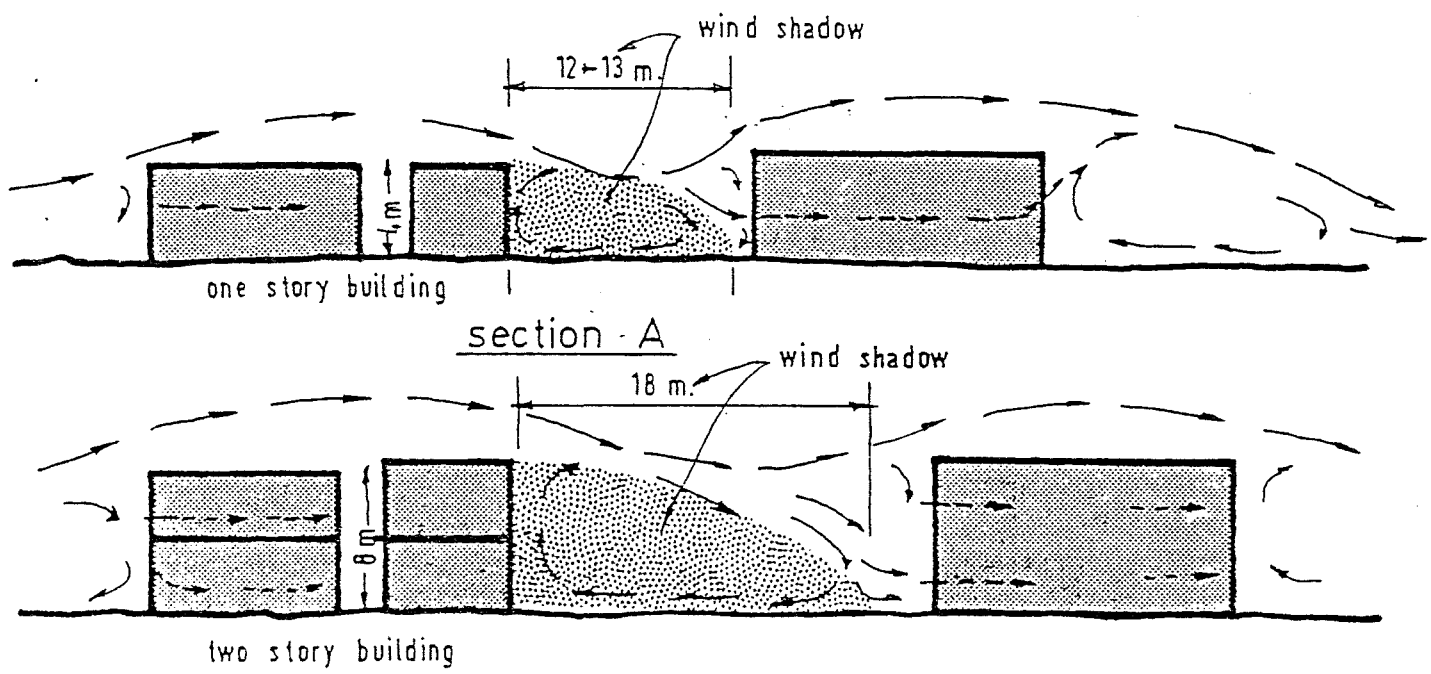
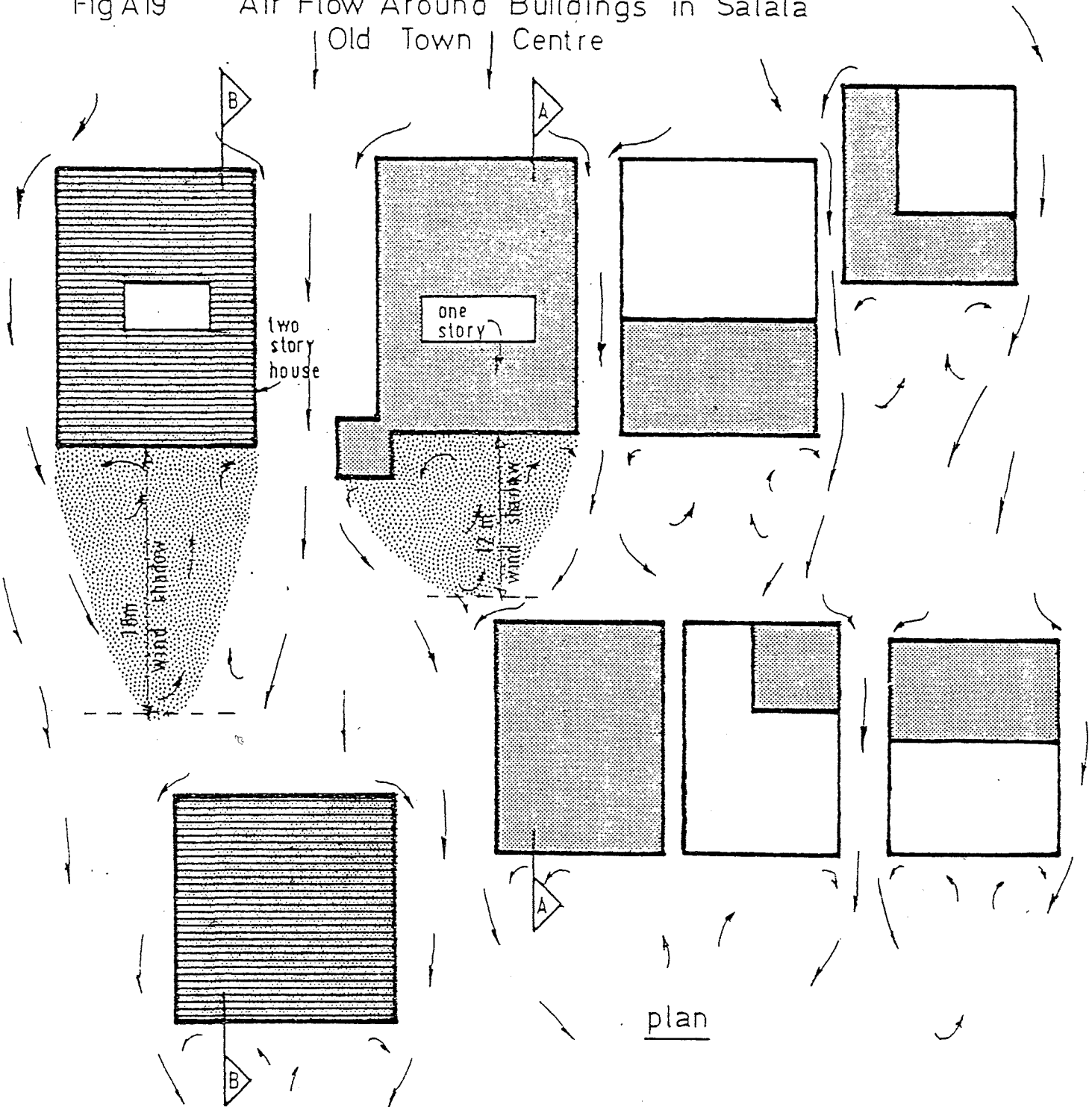
The courtyard house is the dominant house form of the area. These houses usually start with one room and a 2.5 metre high perimeter wall encompassing the site. As demand and finance permit, the house grows, first by adding rooms at ground floor level and then moving up to the first and sometimes second floor. (Fig. A.16)

Older houses are made of limestone. Newer houses are made of concrete block but based upon the same plan form. Because of the density, privacy is important and houses are inward looking, and where there are openings facing outwards they have carefully arranged screens which restrict a view over a neighbour's property. There is an extremely strong social consciousness about a neighbour's privacy. Rooms where possible are concentrated on the south side of the courtyard, to allow as much air movement to enter after passing across the unobstructed courtyard to the seaward side of the rooms. This serves to slightly overcome the restriction to air movement resulting from the dense town plan.

Windows are mainly in higher rooms, but are placed low enough so that the breeze will pass through the room at floor sitting height. Louvres are used to encourage the air to flow in the right direction. Windows are placed on opposing walls to allow a cross flow through the room. (Fig. A.17)

Some houses are built with palm frond stems, but this is usually a transitional stage before building more substantial rooms.

Fig A19 Air Flow Around Buildings in Salala Old Town Centre

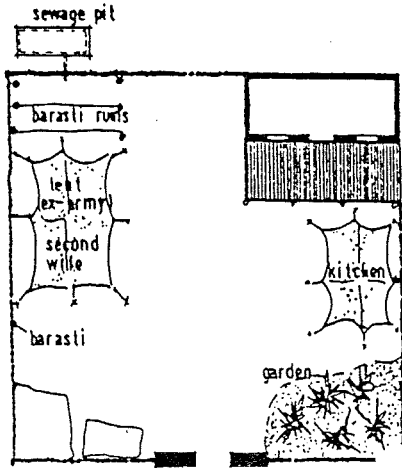


The process of housing allowed for the use of more expensive materials. Houses developed room by room, influenced by the size of the family and the money available. New refugee housing was following the same pattern, with the initial room being of palm frond stems or canvas, whilst a more substantial room was developing on the same site. This process was greatly assisted by the local official policy of giving security of land tenure to new arrivals, who could then develop their plot of land as their own situation permitted, rather than having to achieve the whole house at one stage. (Fig. A.20)

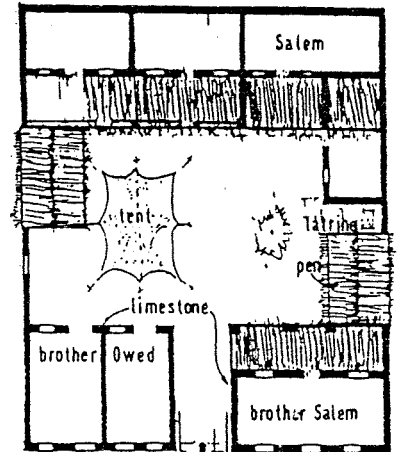
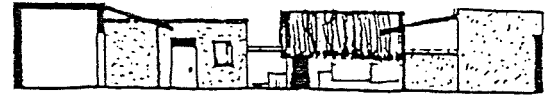
8.4 Conclusion

The social responsiveness towards neighbours in the layout of the town was excellent. New officially planned housing tended to ignore many of the simple requirements for providing a healthy and comfortable and socially responsive environment. Salala also illustrated how, through a gradual process of house building, an insubstantial start, using palm frond stems, can be developed into sophisticated permanent housing which responds to the family needs and capabilities in a manner that cannot be achieved by housing provided for families without their participation over the years. It was noted that limestone was also favoured because it could be more easily re-used for new room arrangements than cement block.

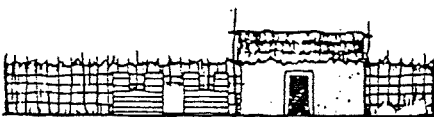
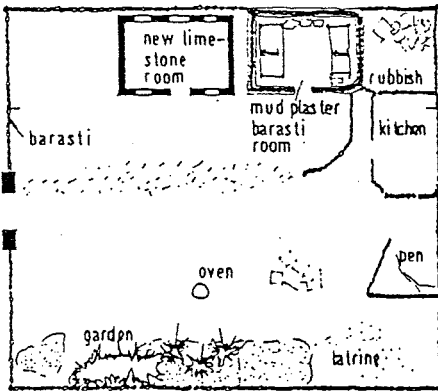
Fig A20 EVOLUTION OF COURTYARD HOUSE SALALA



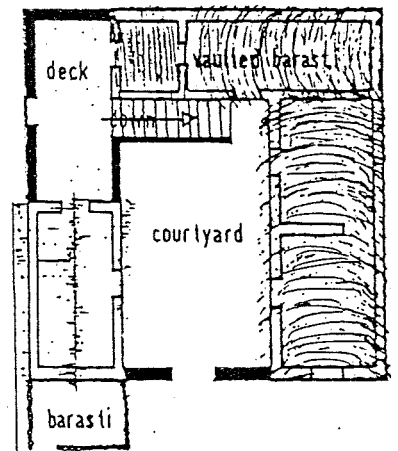
A low income family would first establish a perimeter wall and install a temporary shelter. This may be a tent or a palm frond stem room.



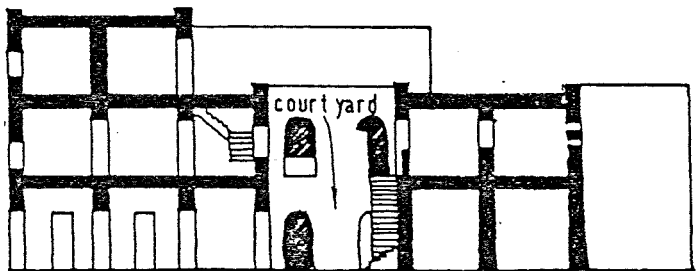
When more money is available, the temporary rooms are replaced, using a more durable material such as limestone, with a view to supporting a second floor in the future.



The palm frond stem room is later plastered with mud to form a more permanent shelter.



Once the ground floor rooms are completed in load bearing materials, rooms are built following the same pattern on the first floor. (2 storey house in limestone with vaulted 'barasti' roofing.)



The house thus grows in a spiral manner until a substantial house develops. (3 storey limestone house in old town centre of Salala)

9 OVERALL CONCLUSION

From the study of the 6 regions, it became clear that:

a) No one unified type of building could realistically be applied to the whole country. Unfortunately there was evidence in 1973 that a unified approach was being taken, with identical new buildings occurring in different areas.

b) The local materials and techniques were capable of meeting many of the local requirements. In the process, their use enabled the house owner to adapt his house to suit his needs. The use of local materials and skills also helped to generate and stimulate the local economy. New official projects tended to employ foreign labour and skills and materials. New skills were not being learnt and old ones were being forgotten.

c) In most regions visited, the indigenous building methods were capable of providing comfortable and healthy living conditions. The indigenous building methods suffer most from being associated with underdevelopment and the notion that they are inferior to newly introduced 'solutions'. In all areas visited, local inhabitants voluntarily explained how their indigenous houses functioned and how they provided for comfort. Prestige was the one major factor that was inducing the change from the traditional pattern.

d) For the country to genuinely attempt to meet the building and other needs that it faced, the population had to participate to ensure that there would be a balanced distribution of facilities and opportunities. There were insufficient resources and skills and capital to allow development to take place relying primarily upon imported technologies and materials. Local resources needed to be used and could benefit the economic and social development of each area. The use of new and imported techniques should be applied selectively where they were really needed, and not as an overall approach, destroying the existing fabric of the country.

END

1. Research and development of the Indigenous building methods, materials, local skills and resources.

b) Selseleh, Luristan, Iran.

by

John Norton

April 1980

RESEARCH & DEVELOPMENT OF THE INDIGENOUS BUILDING
METHODS, MATERIALS, LOCAL SKILLS AND RESOURCES.

B IRAN LURISTAN

A. INTRODUCTION

In 1974 the Selseleh Integrated Rural Development Project was set up in Western Iran. Selseleh is a high plain, ranged by the Zagros Mountains. The project area was approximately 400 km² and contained a population of 40,000 living in about 250 villages and homesteads. These settlements are scattered over the plain, which was the main agricultural land, and the foothills, used for dry farming and animal husbandry. The settlements in the plain were wealthier than those on the foothill slopes, where it was harder to make a living. (Fig. B 1)

Although this part of Luristan Province, within which Selseleh lies, has a history of settlement, in the more recent past up to 1930, there were few sedentary villages with the exception of Alashtar, the regional centre and the site of ancient settlement. The Lurs lived off agro-pastoral activities and sold their animals and products to the main market centres. Their existence was primarily nomadic and their experience in providing for their shelter needs was best developed in the nomadic tents and responded to a nomadic way of life. Since 1930, through a process of political and economic restraints, the majority of the population became, at least in part, settled. Villages and extended family units developed in the areas traditionally belonging to each specific tribe.

The aim of the Selseleh Integrated Development Project (S.I.D.P.), in relationship to the rural development policies being pursued nationally and in other parts of the country, was to put into operation an alternative rural

THE SELSELEH INTEGRATED DEVELOPMENT PROJECT (S.I.D.P.)

The S.I.D.P. was set up as an experimental project to investigate and apply a policy of rural development based upon a concept of 'endogenous' or internalised development. This aimed for the improvement of living conditions within the project area through active participation of the community and by the use of local resources. The S.I.D.P. worked on the development of Health, agriculture and education and building, as well as the infra structure and creation of new job opportunities.

An essential part of the programme was the training of 90 'Front line Workers' in the fields of health, agriculture and education. Specific training was also conducted for other activities in the area. The trainees later took on the task of assisting the villagers in meeting their basic health, education, agriculture and building needs. The S.I.D.P. was based in 400 km² of the Selseleh Region of Luristan, western Iran. This is a high basin ringed by the Zagros Mountains.

The Development Workshop were the Architects and Planners for the S.I.D.P. from 1975-78.

DEVELOPMENT WORKSHOP

The Development Workshop is a team of architects, planners and researchers from a number of countries who work collectively on the development of indigenous building and planning methods in the Third World. Projects have been undertaken in African, Middle Eastern and Asian countries. Members of the Workshop believe that appropriate solutions to human settlement problems can be developed from indigenous methods which have evolved from and remain in the hands of Third World communities. The Workshop works in the field of rural and urban human settlements. The development of small scale construction industries, technical training and local participation are integral to the Workshop's approach.

John Norton is a founder member of Development Workshop.

1b LURISTAN, IRAN

Contents

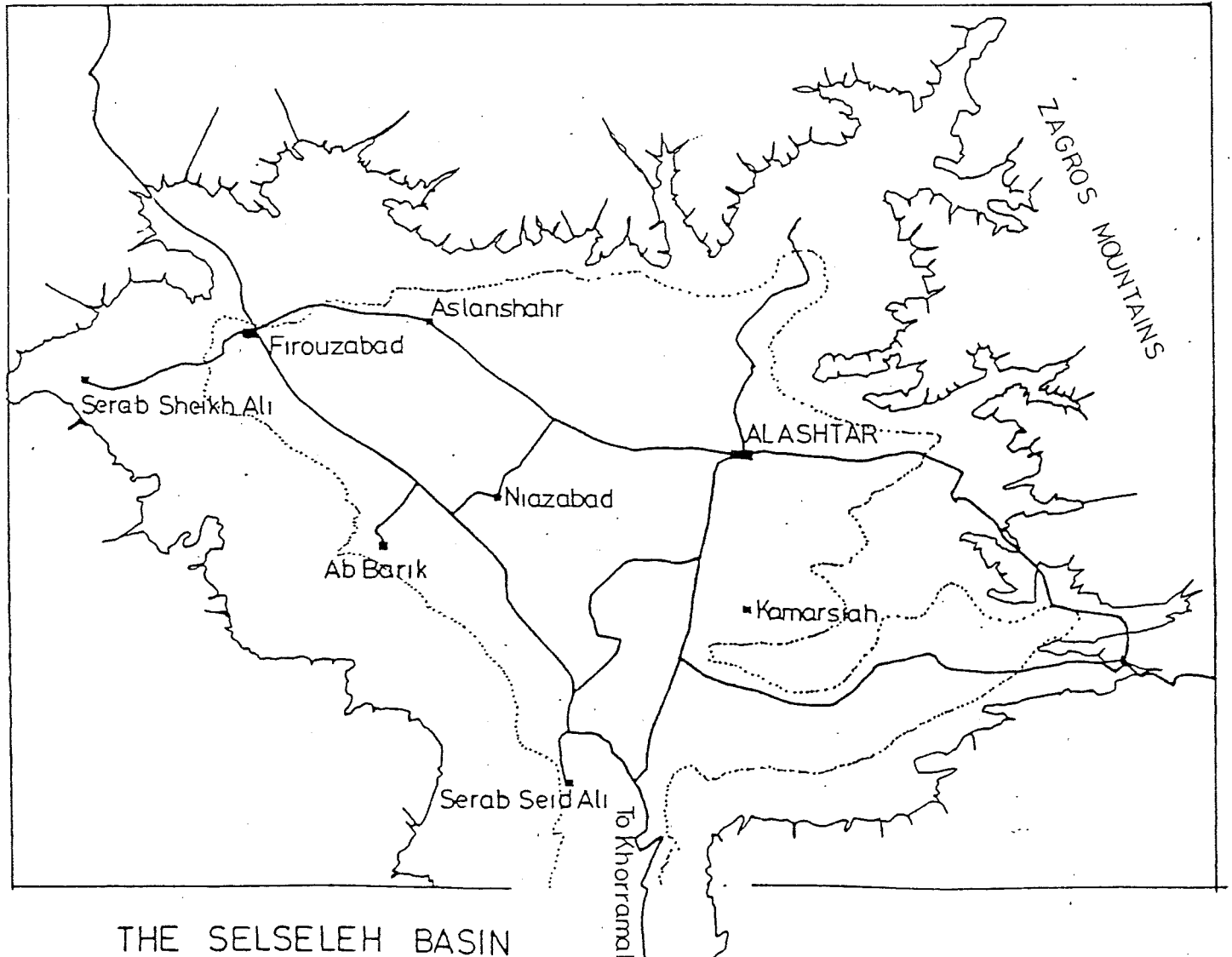
A	Introduction	Page 1
1.	Analysis of climatic information and other documents concerning the area	
1.1	Climate	4
1.2	Documentation	4
2.	Research and analysis of house form	
2.1	House form	6
2.2	Climatic performance	8
2.3	Improvements in design and layout	9
3.	Research and analysis of building materials and resources in the area	
3.1	Walls	9
3.2	Roofs	10
3.3	Development and dissemination of new or improved solutions	11
4.	Research into the needs and potentials of building materials production units	11
5.	Investigation of specific problems related to to public building with particular reference to public baths	12
6	Conclusion	14

Illustrations

Fig. B.1	Location of Selseleh in Iran and detail	2
B.2	Alashtar climatic data	5
B.3	Typical Luri house	7
B.4	Traditional bath, Alashtar	13



Fig B1 LOCATION OF SELSELEH & DETAIL



THE SELSELEH BASIN

development policy based upon the concept of 'endogenous' or internalised development, which called for the improvement of living conditions within the region through active participation of the community and by the use of local resources wherever possible. This approach implied a process of ongoing research and discussion with the indigenous population.

Development Workshop employed as the group primarily responsible for the development of the built environment programme within the S.I.D.P. framework. From the beginning of the programme the demand for immediate building activity was great. Very few public facilities existed in the region; of those that did, most had fallen into disrepair. However, before any building work could be undertaken, a much greater understanding of the built environment of the region needed to be acquired, as well as finding out what skills were available in the region. Even though recent experience of building had been limited, the forms and basic uses of materials were responsive to the local conditions.

Early research showed that the region's built environment was poorer than it had been even 30 or 40 years ago. There were still people who claimed to remember skills and techniques which had been in more common use but had died out as demand and the finance had disappeared.

The research required to understand the requirements, potentials and problems of the built environment in the region divided up as follows:

1. Analysis of climatic information and other existing documents concerning the area.
2. Research and analysis of house form.

One noticeable change in housing in recent years has been the size of windows. Fuel oils have become more readily available and winter heating is less of a problem than in the past. Windows have in consequence become larger, which, whilst allowing heat to escape at night, does let in more heat during the sunny winter days..

2.3 Improvements in design and layout

It was felt that two areas required particular attention in terms of the design of houses. a) Provision of lavatory and washing facilities, b) Cooking and food storage facilities.

During the period of the survey (covering the years 1975-1978) very few houses visited had any form of lavatory, and in the absence of public baths in villages, people used the neighbouring open spaces/fields. This led to unhealthy conditions, and attempts were made to provide running water in villages, and to introduce, by example, suitably designed excreta disposal systems.

Whilst nobody objected to certain types of food preparation outside, very often food was prepared and stored in unhygienic conditions, and, again by examples, suggestions were made to improve food preparation and storage areas.

3 RESEARCH AND ANALYSIS OF BUILDING MATERIALS AND RESOURCES IN THE AREA

3.1 Walls

In the Selseleh region, walling materials in the villages are stone, mainly on the foothills, and mud, in the agricultural plain. Both of these, but particularly mud, needed improvement to protect them against rainfall, snow and impact damage. The method of laying stone walls was also potentially unstable, especially mud mortars were used for building with stone. The area is an earthquake high risk zone, and the introduction of measures

necessary, food is prepared in one of the rooms. There is very little fixed furniture. Bedding and belongings are stored in alcoves in the walls. Sitting and eating is done on the floor. Winter heating is by woodfired or more recently oil/parafin fired stoves. Chimneys are metal and are erected when needed but are not permanent. Much of the summer living takes place outside, and responsive to the nomadic background, many people move into tents during the summer, sometimes at some distance from the house.

Rooms are used primarily for privacy (not a major factor amongst Lurs), security and warmth in winter.

Animals live in the basement and the heat generated by their bodies is appreciated as a source of warmth by the humans upstairs.

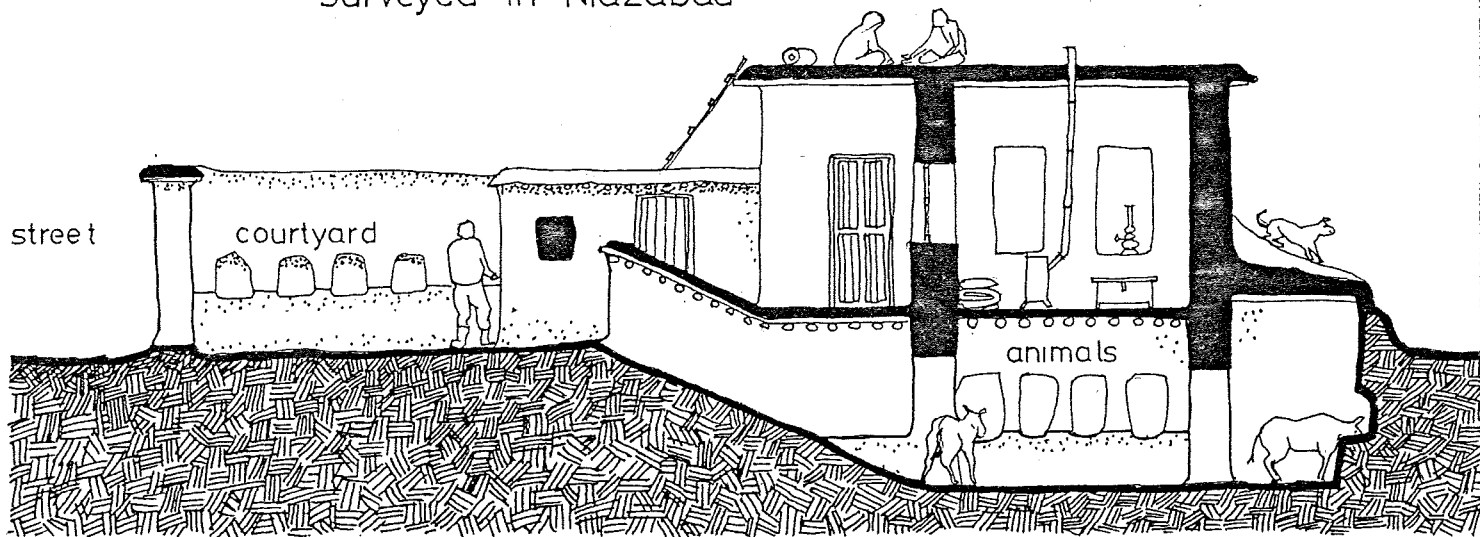
All houses have some form of access to the roof, since it is used for drying crops in the summer, whilst during the winter the compacted mud needs to be rolled after every rain storm, and snow has to be cleared away.

2.2 Climatic performance

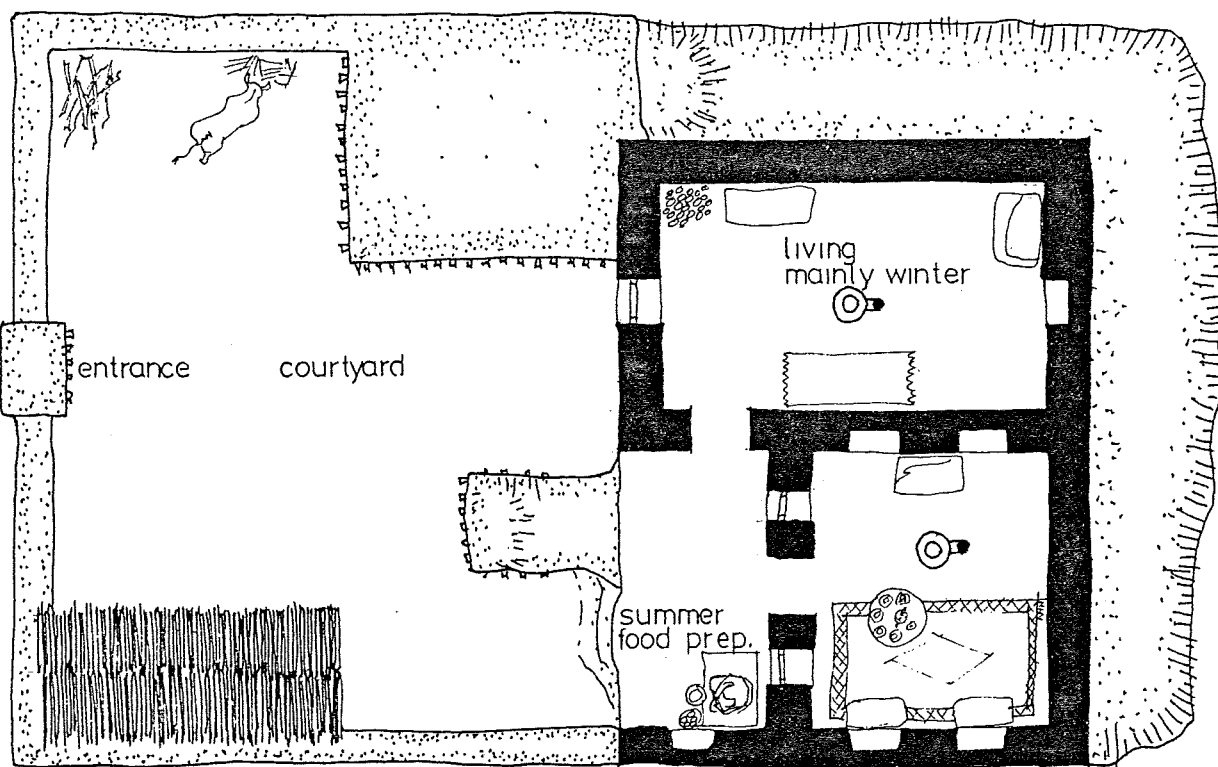
The massive construction of walls helps to store heat during the winter and to keep interiors cool during the summer. The windows are positioned to let sunshine into rooms during the winter when the sun is low in the sky and its heat is needed. Because of the overhanging roof and the depth of the window opening, little sun penetrates the house during the summer. Openings on the East or West elevation of the building would not provide this control. Some new houses in Alashtar have paid less attention to the position of windows, but in general it is a well understood principle in the region and Iran in general.

Roofs, made of 15 - 20 cms of mud on top of the supporting timber framework, have a good insulation value.

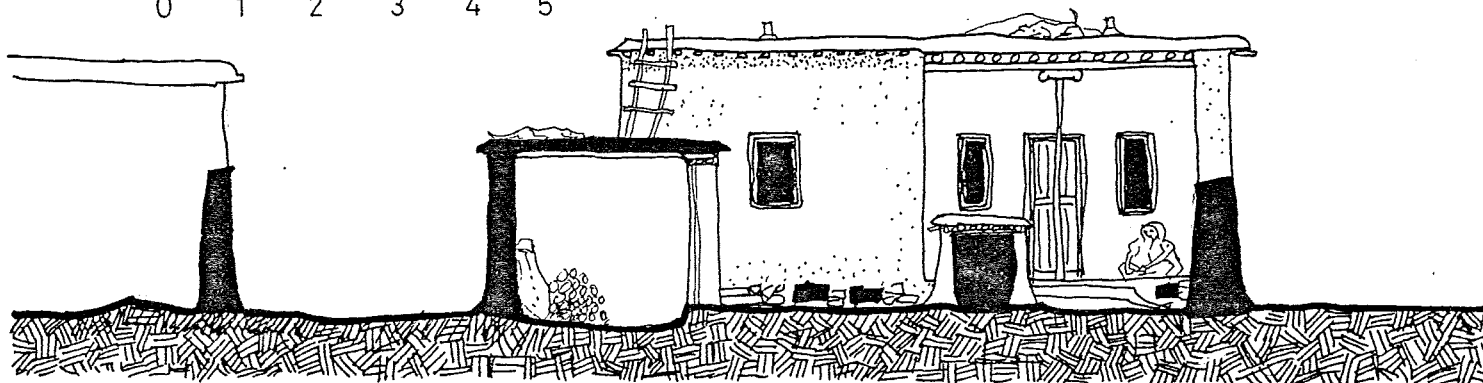
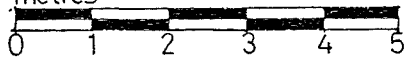
Fig B3 TYPICAL LURI HOUSE surveyed in Niuzabad



SECTION



PLAN metres



ELEVATION

Plain and there are a number of unexcavated sites in the neighbourhood of Alashtar.

2. RESEARCH AND ANALYSIS OF HOUSE FORM

2.1 House form

Houses in the Selseleh region are single storey, but usually have semi underground basements, below the living rooms, where animals are kept. Walls are made of stone or mud and support flat roofs held up by timber beams. The size and length of the available timber is a major factor dictating the dimensions of rooms. Few rooms are wider than 3 to 3.5 metres and are usually 5 - 6 metres from front to back.

Roofs are covered with mud and, as with walls, require constant maintenance during the rainy season.

Except where the local physical features make it unsuitable, all houses face towards the south, and windows are positioned in the south facing walls.

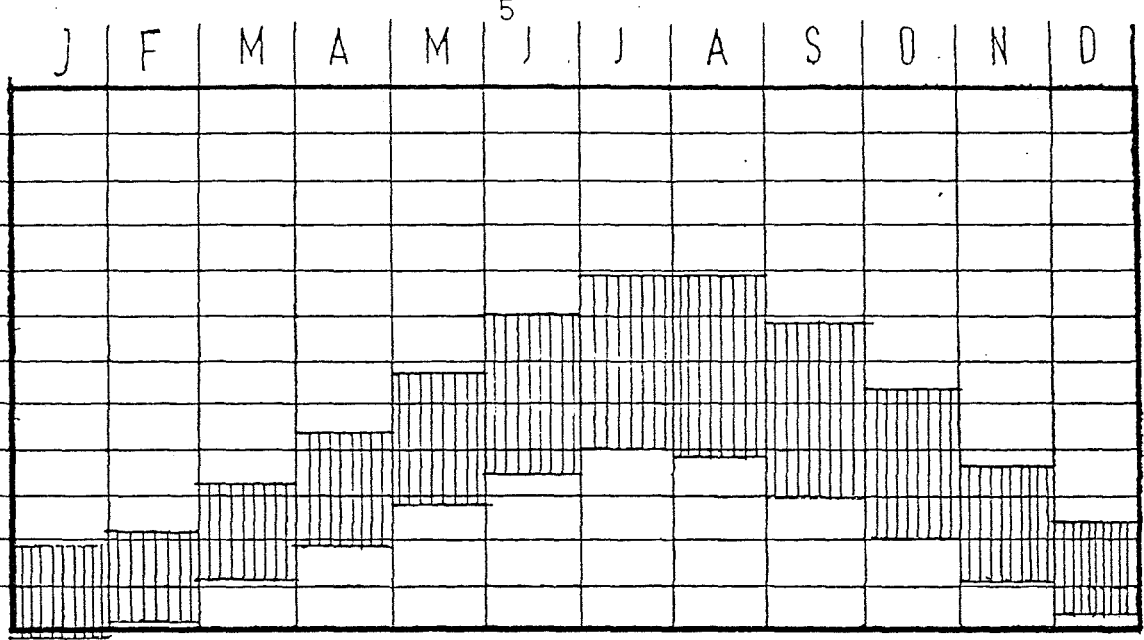
There are two basic plan forms, one an extension of the other. The basic house consists of two rooms, one at right angles to the other. In front of the room with its longest side facing south is a covered open verandah (aivan) which provides shade in the summer, access from one room to the other where interconnection is not provided, and, by its overhanging roof, stops summer sunshine from penetrating into the room behind. This is basically an 'L' shape house with verandah. (Fig. B 3) Its extension adds another room to the other side of the verandah, symmetrically matching the room on the original side.

Very few washing facilities are provided, except where a well or pool is situated in the courtyard which in nearly all houses encloses the space in front of the house. In summer food is prepared outside or under the shade of the verandah. In winter on days when conditions make it

Fig B2
ALASHTAR

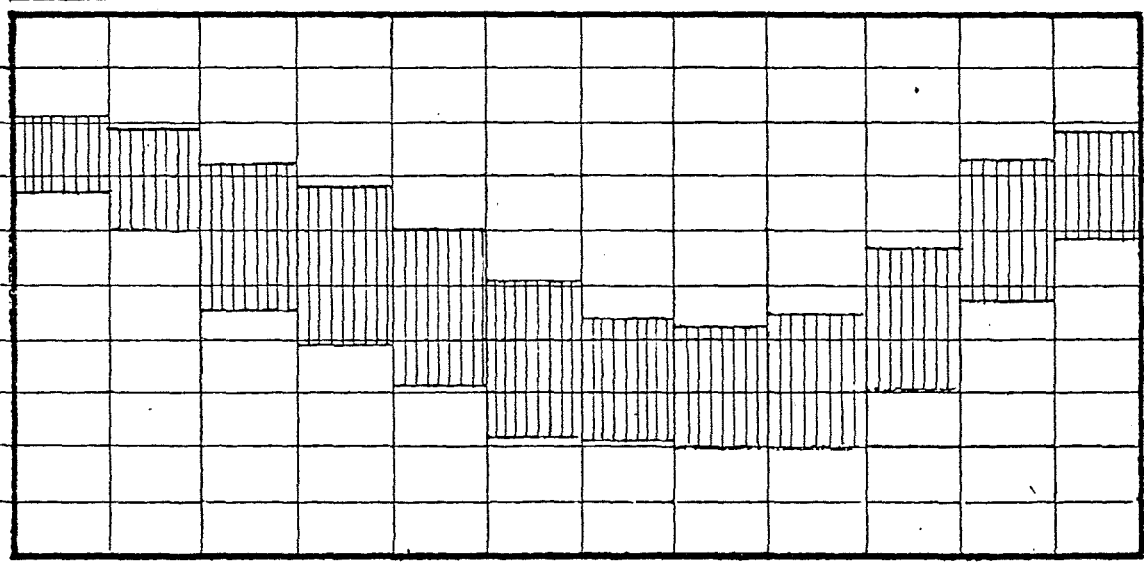
AIR TEMPERATURE °C

45
40
35
30
25
20
15
10
5
0



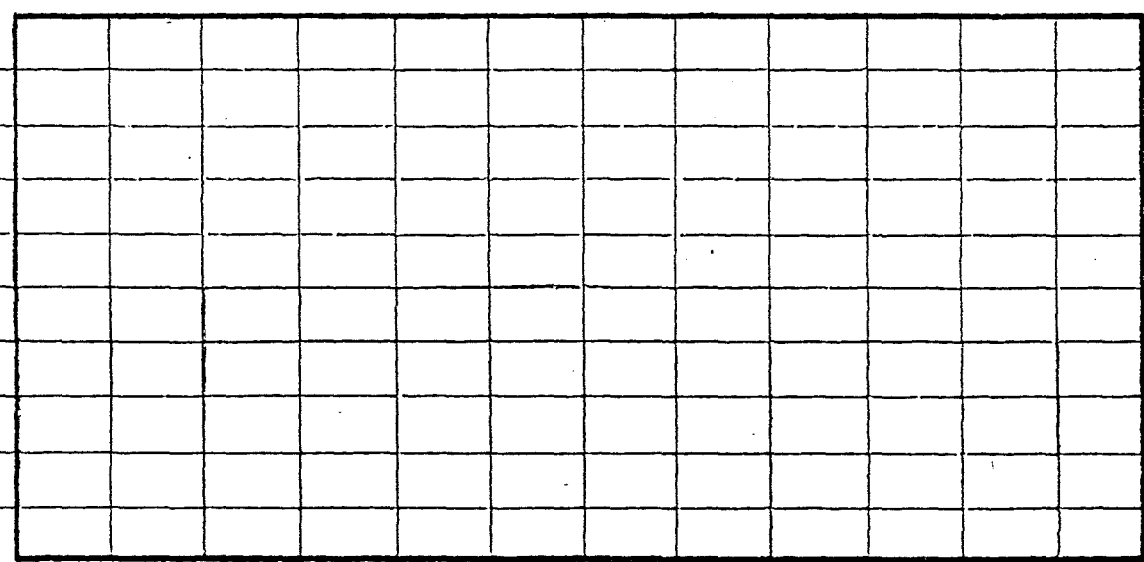
RELATIVE HUMIDITY %

90
80
70
60
50
40
30
20
10



EFFECTIVE TEMPERATURE °C

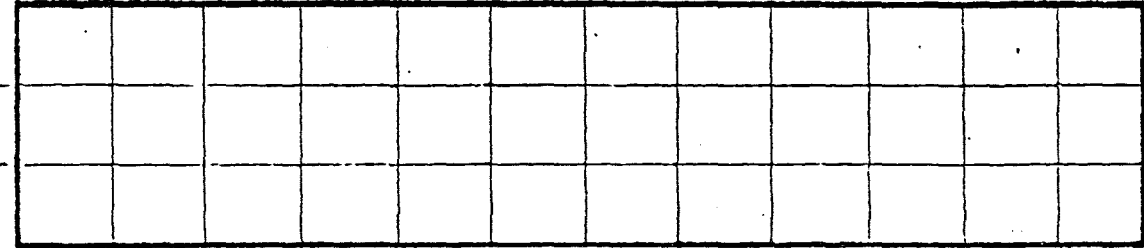
45
40
35
30
25
20
15
10
5



WIND
Direction and
Relative Velocity

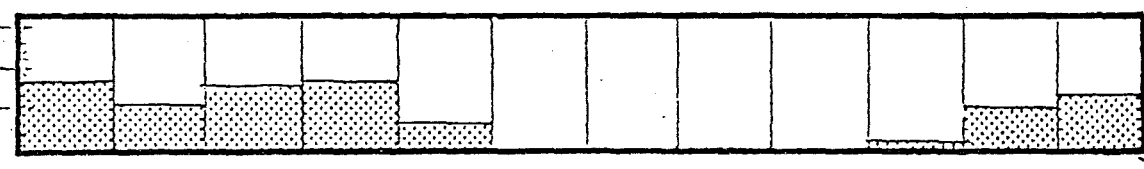
Hours
0-9
9-19
19-24

0-9
9-19
19-24



RAIN
mm.

150
100
50
0



3. Research and analysis of building materials, skills and resources in the area.
4. Investigation into the possibilities of building material production.
5. Investigation of specific problems related to public building with particular reference to public baths.

1 ANALYSIS OF CLIMATIC INFORMATION AND OTHER DOCUMENTS CONCERNING THE AREA

1.1 Climate

No reliable climatic data was available for the Selseleh Region. Climatic data had to be extrapolated from meteorological stations in Khorramabad, Arak, Desful and Kermanshahr, with consideration taken for different altitudes and location. This information was updated and checked against local recordings made during the following 4 years. The climatic data chart gives an indication of the basic pattern. There are cold wet winters and warm, but seldom uncomfortable, dry summers. The rainfall during the winter and spring is at times extremely heavy. Much of the plain is waterlogged during the spring months and movement around the region is restricted. In winter there are short periods of heavy snow. Local inhabitants agree that the prevailing wind is from the south-west, with small local variations due to topography. The mountains surrounding the Selseleh Basin to a certain extent protect it from extremely bad weather in winter. (Fig. B 2)

1.2 Documentation

Very little recent contemporary information existed regarding the built environment. Few writers had travelled in the area and studied the people. Most documentation focusses upon the archeological interest in the area. Luri Bronzes have been found within the Selseleh

to resist the effect of earthquakes was essential. Especially in the regional market town, fired brick was in fairly widespread use, but most commonly as a facing material backed by mudbrick. The cost of fired bricks, brought in from outside the region, restricted its more widespread use.

Because of its cheapness and availability, as well as its good thermal performance, it was felt worthwhile to encourage the use of mud, especially mud brick, whilst attempting to overcome the problems that its use involved. The following suggestions were made, and through example and builders training programmes, disseminated to the villagers:

- a. Mud brick should be stabilized to make it stronger and more water resistant, and stabilized wall renders should be used. Various different methods were researched and used on S.I.D.P. buildings with local builders.
- b. Where stone or fired brick are used, they should use proper mortars, of which the most readily available was a lime/sand mortar. Very little additional expense was involved in its use. Many people had already turned to using cement for mortars at much greater expense.
- c. All walls using mud bricks, fired bricks or stone should be laid with proper bonding between different parts of the wall.
- d. Where possible, reinforcement, (timber framing within the structure) should be used to resist movement in a building in the event of an earthquake.

3.2 Roofs

The traditional roofing system on houses used large timber beams (15 - 20 cms diameter) at very close intervals,

with boards or cardboard between to support a layer of mud, 13 - 20 cms thick. The mud provided the protection against rain and insulation. These roofs needed constant attention during the winter, and in addition were expensive in their use of timber and extremely heavy.

Based upon experiments conducted, the following suggestions were made:

- a. The use of a stabilized mud finish would reduce the amount of maintenance required. The most practical stabilizing material locally was bitumen. This was already being used as a waterproof barrier on public buildings, but in quantities which would be expensive for most private building.
- b. The roof structure used large numbers of expensive timber beams. Alternative methods of laying the timber were suggested and demonstrated, which would reduce a) the amount of timber being used and consequently the cost, and b) the number of trees being felled. Timber for roofing was grown specially for the purpose in plantations in the region.

3.3 Development and dissemination of new or improved solutions.

The builders training programmes which were organised as part of the S.I.D.P. activities were used as the main medium for developing solutions to the local problems in building, and for spreading the information.

4 RESEARCH INTO THE NEEDS AND POTENTIALS OF BUILDING MATERIALS PRODUCTION UNITS.

Analysis of the regions potentials showed that there was the capability for locally producing lime, chalk and fired brick. All three materials were being brought in from outside the region. Before any implementation of

this part of the programme took place, we visited production centres in neighbouring regions, especially those where the people were acquainted with our region. The purpose of these visits was to find out if there were any local problems in the processing of the materials mentioned. At the same time, through discussion with local builders and by visiting the areas near older settlements in the region, particularly near Alashtar, traces of old kilns were found, including bricks of considerable age produced locally. (The establishment of small scale production centres will be discussed in Case Study 3.)

In addition to the more obvious resources of the region, it became apparent that considerable sums of money were leaving the region in order to purchase doors, windows, hot water boilers, simple furniture etc. A further aspect of the research was to investigate what skills and equipment was available locally for the production of these items, and through discussion, to find out what sort of assistance was required to stimulate any local capability that existed.

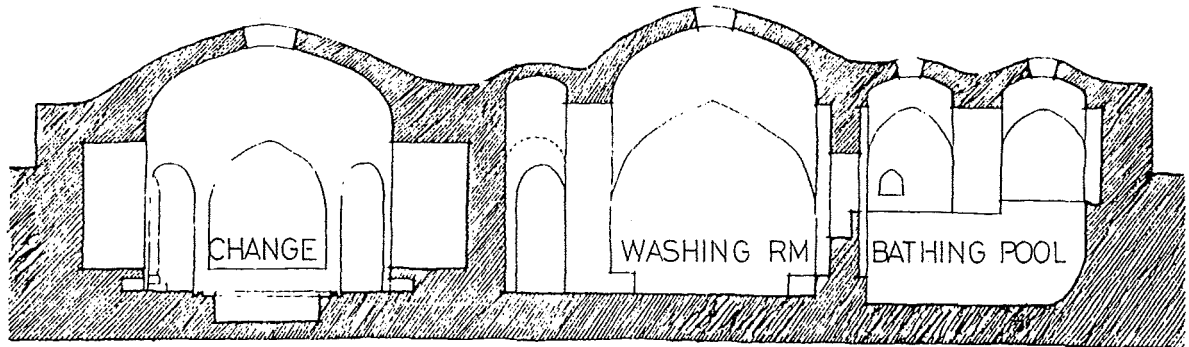
5 INVESTIGATION OF SPECIFIC PROBLEMS RELATED TO PUBLIC BUILDING WITH PARTICULAR REFERENCE TO PUBLIC BATHS.

Whilst the shelter needs of the region were being met with local resources and skills, the public building of the area was mainly built by contractors coming from outside the region, using non-local materials. This was proving both expensive and did not allow the local population to participate in the public building process, nor learn how to.

A particular aspect involved in the building of public baths illustrates some of the difficulties faced.

Government sponsored public baths were built using rolled steel joists to support the roof. Whilst this was the standard technique for modern roofing in urban building in Iran, in the hot humid atmosphere of the baths these R.S.J's rust and the building deteriorates. On the other hand, the local system of roofing used timber and mud, which, whilst being much cheaper, also deteriorates quickly in the bath's atmosphere.

It was necessary to find a roofing system that was cheap, suitable, within the range of local skills and locally acceptable. Two traditional baths were found in the area, one in Aslanshahr, the other in Alashtar, both of which used vaults and domes to roof the bath, providing a roof which will not be seriously affected by the bath's dampness. (Fig. B.4)



TRADITIONAL BATH IN ALASHTAR, LURISTAN, IRAN

Fig. B.4 SECTION

However, initially there was no evidence in the Selseleh area that anyone knew how to build either vaults or domes.

Through further investigation, villages were found where mud brick vaults were still being built, to cover the basements of houses, and through discussions with local builders in the Selseleh area, it transpired that one or two of them had known how to build both vaults and domes in the past, but that through lack of practice had lost the skill over the years.

Lack of finance in the area had greatly reduced the occasions when a builder had been called upon to demonstrate or maintain his skill. In general a low standard of building skill had been sufficient for most of the work being undertaken.

In order to create a team of local builders capable of building baths (and other public buildings needed in the area) a training programme was required, to re-introduce a skill that had died out.

Two master masons were brought from Central Iran (Yazd), where vault and dome technologies are highly developed and very much in current use. These master masons were hired on the understanding that they were prepared to teach and share their knowledge with the 'trainee' builders in Selseleh. All the S.I.D.P. building work was undertaken on a basis of training through practical experience, with the more skilled passing on their knowledge to people from the villages.

6 CONCLUSION

The understanding of conditions in the Selseleh region, and the difficulties that existed, was not achieved through a comprehensive research programme. Demands to start the work of building public facilities took up much of the time. The basic knowledge of the area and its indigenous built

environment was complemented in the following years by the knowledge that builders and others from the area already had. Many of the ideas that were later put into practice were based upon their suggestions, and equally, systems developed elsewhere were adapted to meet local requirements through the builders' understanding of their own locality and building needs.

The local people began to develop an investigative attitude towards meeting their own shelter needs, and through this an ability to find solutions to new problems when they arise. Underlying this was a renewed belief that it was possible to solve many of the local problems through the use of their own skills and resources.

END

1. Research and development of the Indigenous building methods, materials, local skills and resources.

c) Caspian Region, Iran

by

John Norton

April 1980

RESEARCH AND DEVELOPMENT OF INDIGENOUS BUILDING
METHODS, MATERIALS, LOCAL SKILLS AND RESOURCES

C THE CASPIAN

1. Introduction

In 1978 a research programme was instigated as the pilot phase for the development of the built environment in the Caspian Region of Iran *¹, covering the provinces of Gilan and Mazandaran *². (Fig C.1)

2 Aims

The aim of this programme was two fold. Firstly, few people in official decision making positions were acquainted with the real needs, potentials and conditions of the region. For decisions to be made which could accurately reflect the local requirements the information had to be collected and presented in a way that could be used by decision makers. Secondly, the more direct aim was to understand the problems and potentials of the built environment in the area, and through that process, ascertain what assistance could be given to:

- 1) Improve the quality of the built environment.
- 2) Stimulate the use of local materials/resources where possible and through this generate more local employment opportunities and less dependance upon imported skills or materials, i.e. from Tehran or abroad.

*¹ Documented in: DARAIE. M; CAIN. A; NORTON. J; AFSHAR. F.
INDIGENOUS BUILDING OF THE CASPIAN REGION

Tehran, Institute for Peasant and Rural Studies. 1979

*² This programme was sponsored by the Iranian Institute
for Peasant and Rural Studies. Tehran, Iran.

DEVELOPMENT WORKSHOP

The Development Workshop is a team of architects, planners and researchers from a number of countries who work collectively on the development of indigenous building and planning methods in the Third World. Projects have been undertaken in African, Middle Eastern and Asian countries. Members of the Workshop believe that appropriate solutions to human settlement problems can be developed from indigenous methods which have evolved from and remain in the hands of Third World communities. The Workshop works in the field of rural and urban human settlements. The development of small scale construction industries, technical training and local participation are integral to the Workshop's approach.

John Norton is a founder member of Development Workshop.

1c CASPIAN

Contents

1. Introduction	Page 1
2. Aims	1
3. Programme of study	3
4. Caspian Region	4
5. Building techniques, materials and forms	
5.1 Roofs	7
5.2 Walls	14
5.3 Platforms	16
5.4 Orientation	18
6. House Form	18
7. Analysis and conclusion	19

Illustrations

Fig. C.1 Location of Caspian Region	2
C.2 Study Regions	5
C.3 Fouman climatic data	8
C.4 Shahi climatic data	9
C.5 Caspian Region precipitation	10
C.6 Reed thatch house	12
C.7 Rice thatch house	12
C.8 Shingle roof house	12
C.9 Flat roof house	13
C.10 Turkoman house	13
C.11 Timber lath and mud packed wall	15
C.12 Platforms	17
C.13 Basic generative house form	20
C.14 Front verandah house	21
C.15 'L' shape plan	21
C.16 Mezzanine house	21
C.17 Maklavan house	22

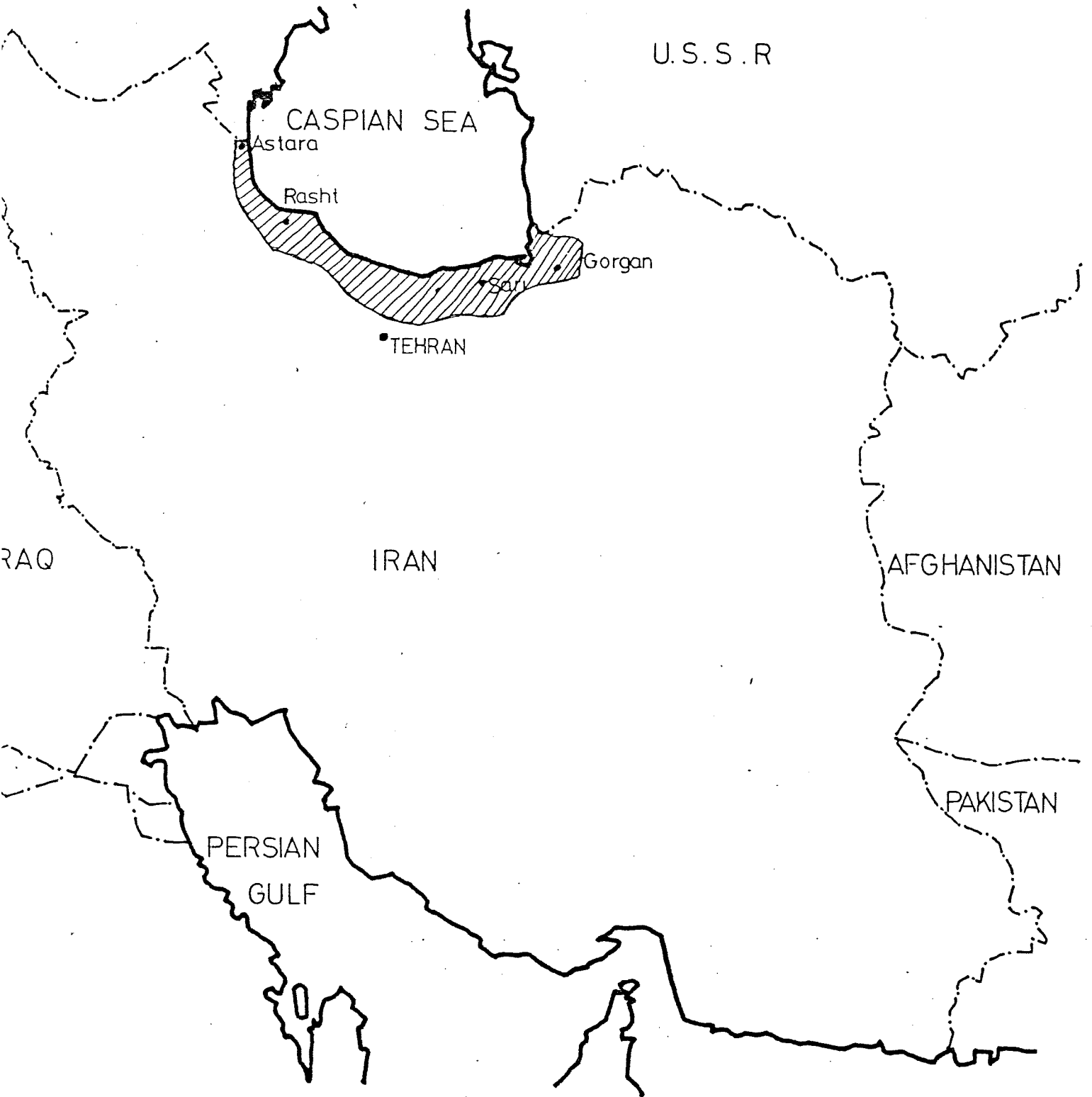


Fig C1 LOCATION OF CASPIAN IN IRAN

3 Programme for study

The overall research programme was conducted by an average of 4 people over a period of 6 months, including the time for analysis and production of the results as well as the field work. The field work was done in 3 trips, firstly to Gilan, then to Mazandaran, and a final more selective trip to study certain areas in greater detail in both of the provinces.

Before the field work documented information was collected in Tehran. This included maps, climatic data, and any information already available. There were already some detailed studies of specific villages and neighbourhoods, which, depending on their degree of detail, were later used to cross check the findings of the field work period and were useful in giving an indication of changes that had taken place in the time that had elapsed since the earlier studies were done.

The information on the Caspian Region was gathered on three broad levels: visual observation, physical surveys and case study interviews.

While travelling through the region, visual observations on changes in house types, building materials, settlement pattern and distribution, as well as topography and land use, were recorded in writing and small illustrations, taking the form of Route Notes. This information was also documented photographically. Similar visual observations were recorded on settlements and houses. This material provided a valuable broad reference to the whole region.

Settlements were selected at regular intervals throughout the region and physically surveyed. The settlement

pattern was drawn up and observations were made on the local topography, climate, water resources, social characteristics, defence measures and building resources, at the same time noting what influence these have had on the form of the settlement. In each settlement several representative houses were selected for detailed survey and many others were sketched and photographed. Plans, sections and elevations were measured and drawn up, and a house observation sheet on space use and building technology was filled in.

In the houses surveyed in interview on various aspects of the settlement and the house was held, usually with the head of the family. These interviews, in addition to providing detailed current information, also provided much of the local historical information and details on the development of the house and settlement.

Based on a preliminary study of the region, physical surveys and interviews were conducted on local building and production industries, complementing the information collected on houses and settlements. Whenever possible, local builders were interviewed in addition to the house surveys and interviews. Builders were asked to demonstrate or explain particular local building methods and their opinions on various building materials and techniques were obtained, as well as comparative costs.

Samples of building materials were also collected and analysed.

4 Caspian Region

The field area for this study was defined by the northern slopes of the Alborz mountains (Fig. C.2); a region which exhibits similar ecological characteristics from Astara

Moving inland reed is replaced by rice thatch. Rice is grown over much of the Gilan plains. The pitch is shallower (40°): the rainfall is less (1000 mm/year). (Fig. C.7)

At the junction of plains and foothills, as forests start replacing fields of rice, wood shingles replace thatch. These shingles allow the roof pitch to be much shallower, and as the rainfall decreases into the mountains, the pitch can be further lowered. There is a progression from 35° to 25° . (Fig. C.8) Although there are exceptions, such as Masouleh, the change from shingles to flat timber and mud roofs occurs at the point where there is insufficient rain to support forests, altering the materials which are available for roofing, and where the relative dryness of the climate makes flat roofs practical. Flat roofs are typical of the drier slopes and plateaux of the mountains. (fig. C.9)

Tile roofs which occur in areas where soil is suitable for tile production (Astara, Behshar and the towns of the Rasht/Lahijan area), are in exception to the pattern outlined above, since they are suitable for use in areas of heavy rainfall without requiring a steep pitch.

Similarly, sheet metal roofs do not reflect local changes in climate, the exception of those in the Turkomansahra area where a peculiar 'H' ridge form of sheet metal roof is, according to locals, to assist in the collection of rainwater. (Fig. C.10)

Fig C5 CASPIAN REGION PRECIPITATION

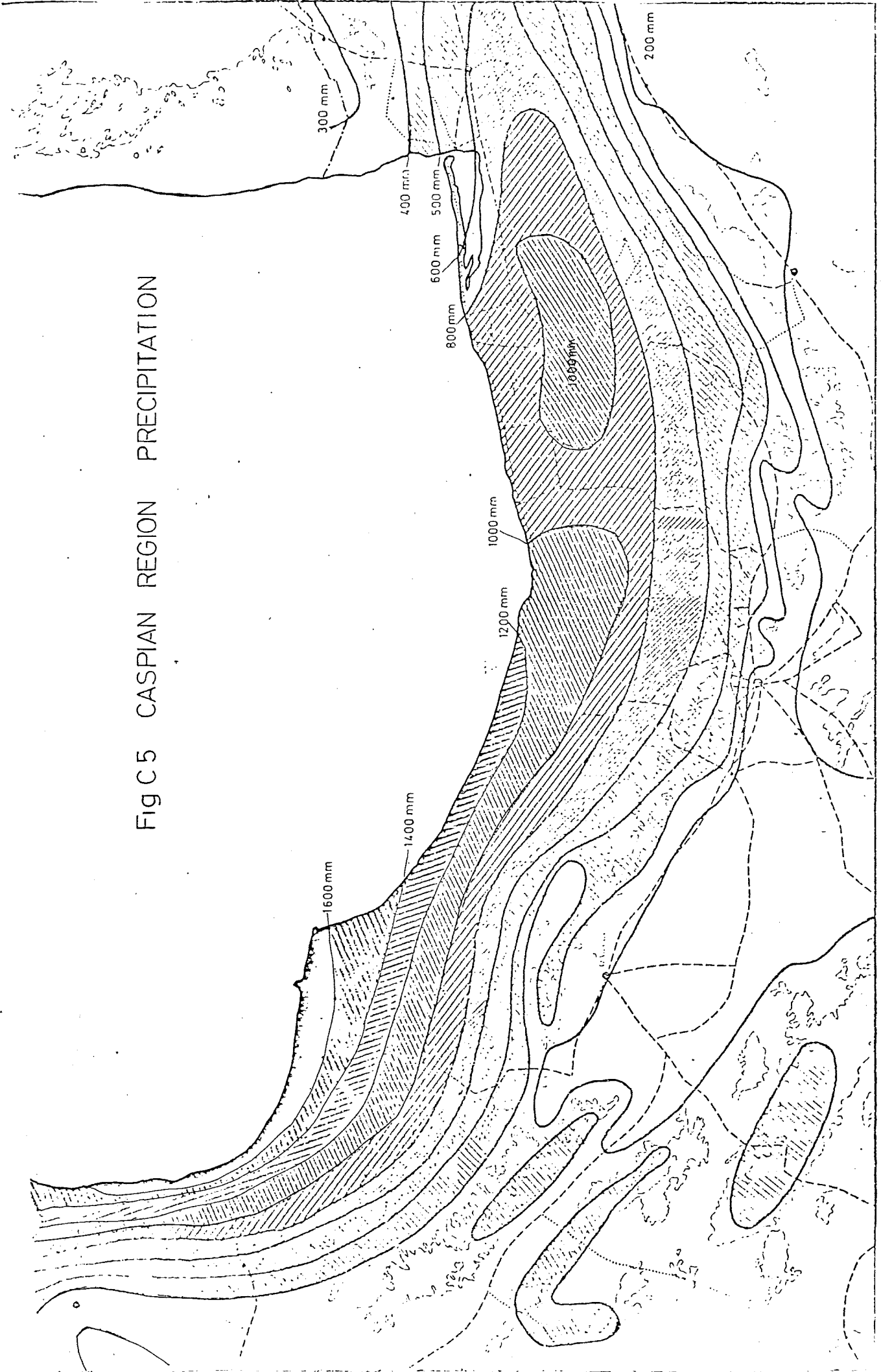
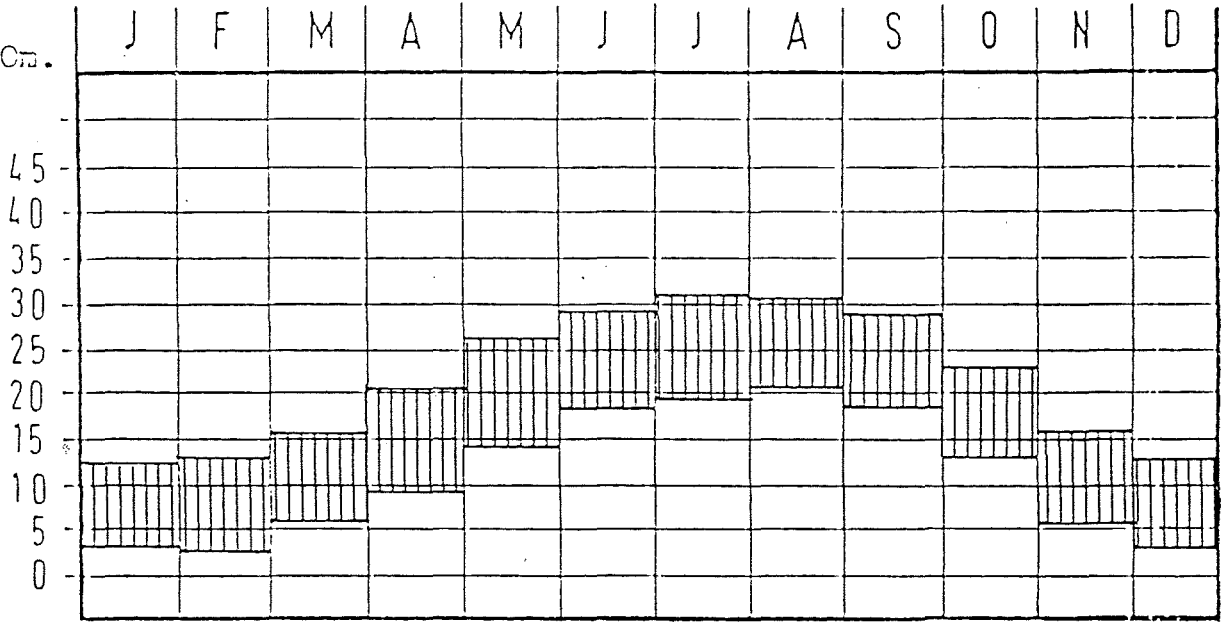


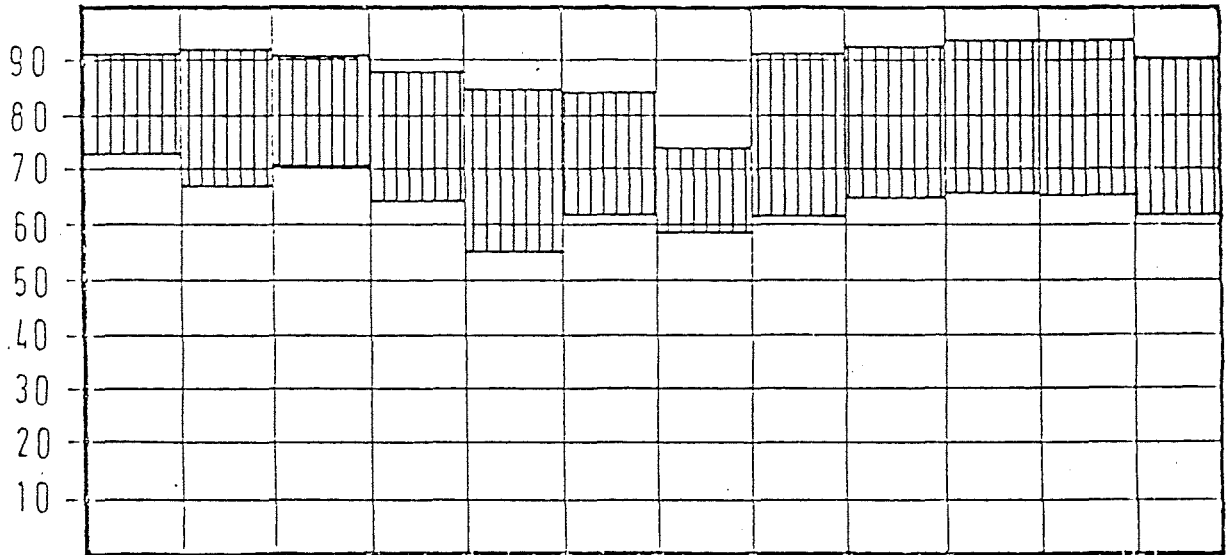
Fig C4
SHAHI

Elevation 150m.

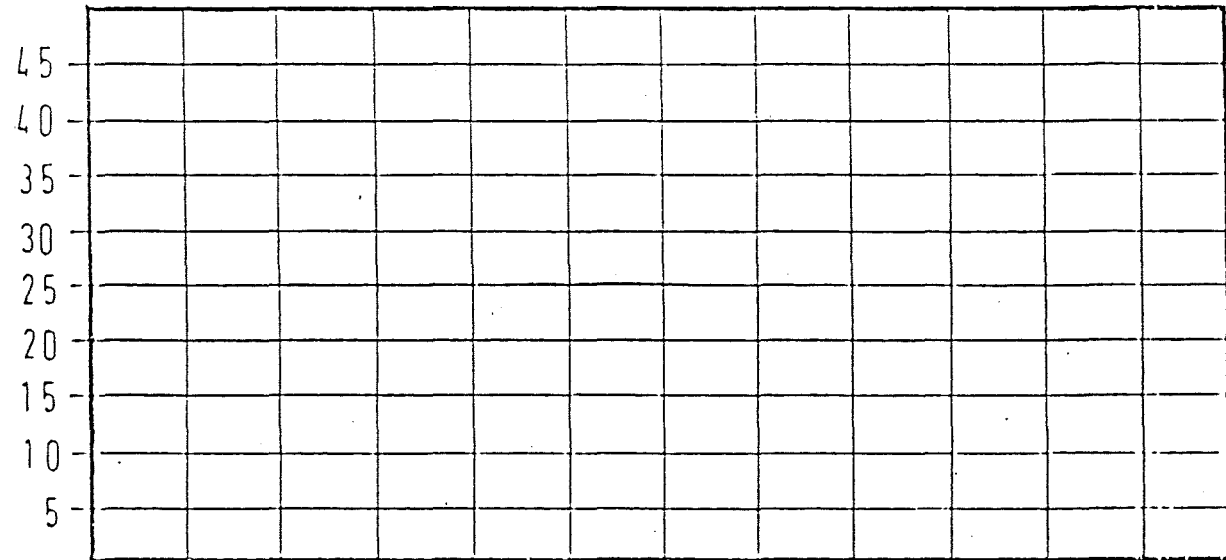
AIR TEMPERATURE °C



RELATIVE HUMIDITY %



WIND EFFECTIVE TEMPERATURE °C



RAIN mm.

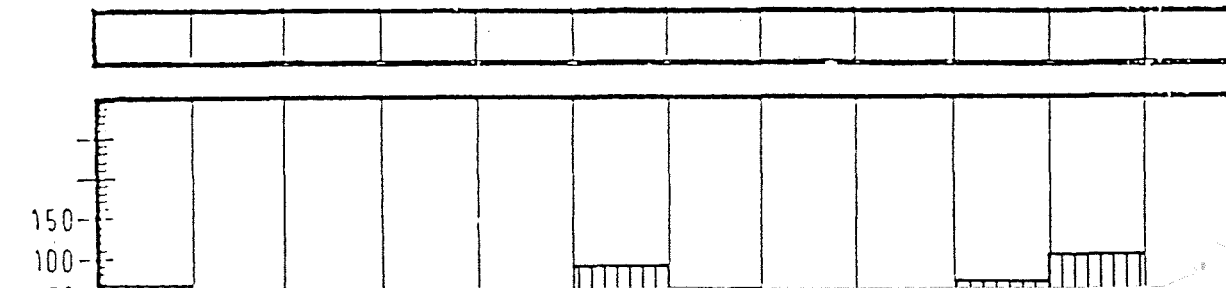
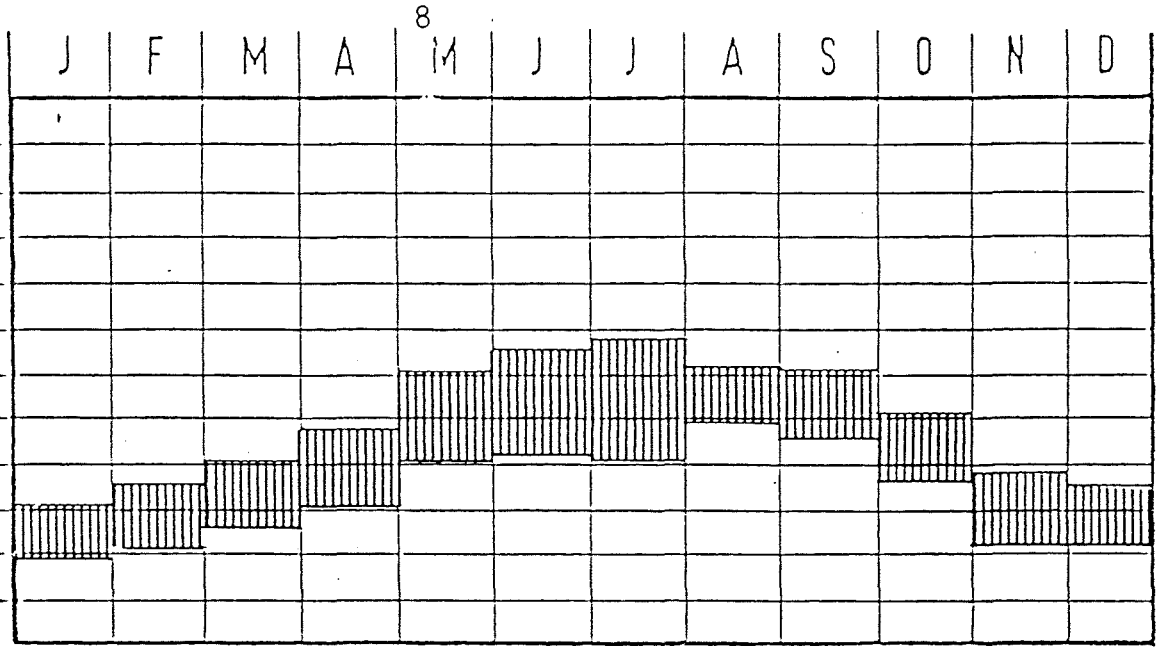


Fig C3

FOUMAN
Elevation -10m.

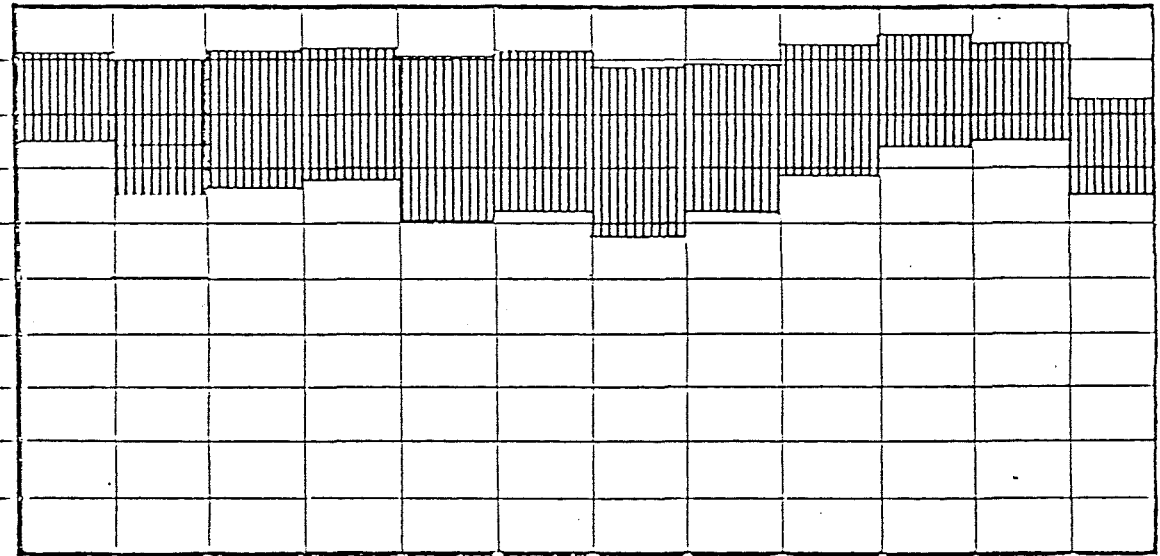
AIR TEMPERATURE °C

45
40
35
30
25
20
15
10
5
0



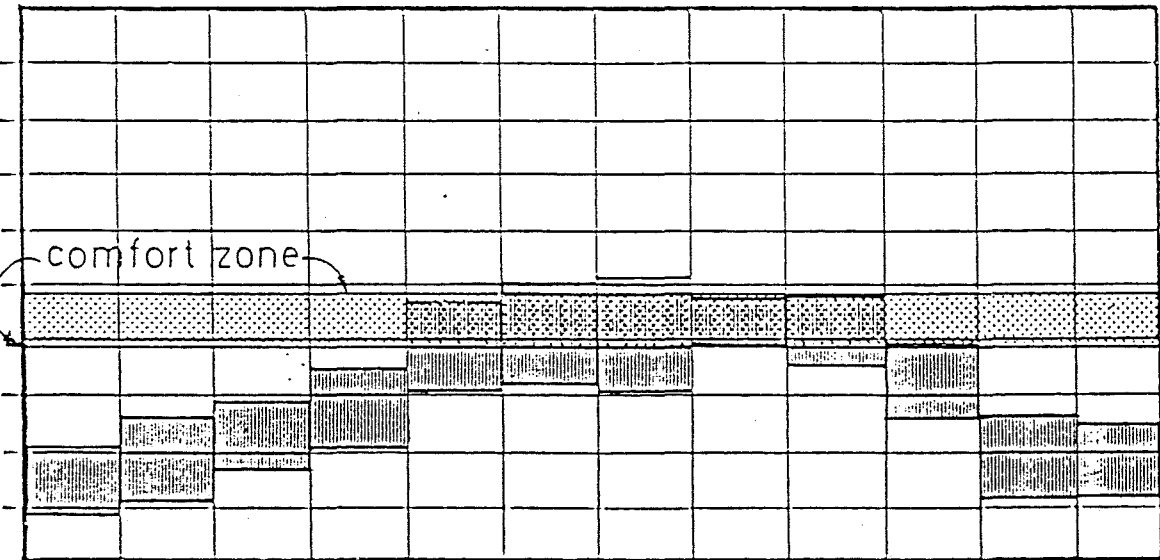
RELATIVE HUMIDITY %

90
80
70
60
50
40
30
20
10



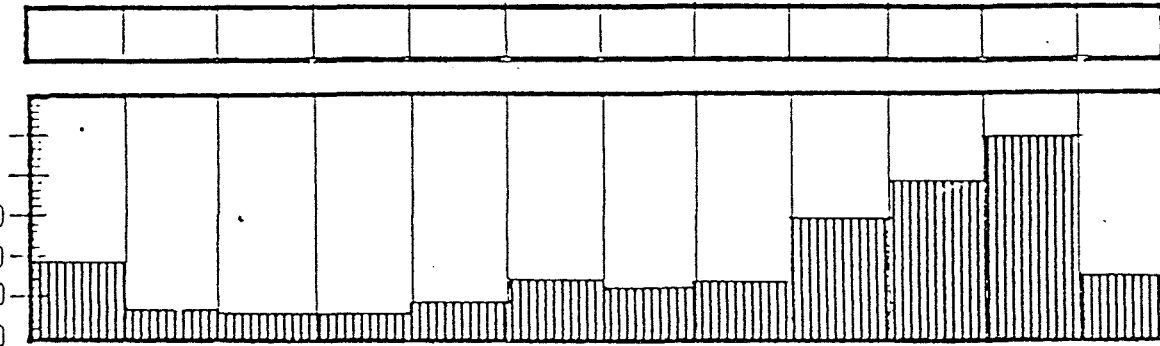
WIND EFFECTIVE TEMPERATURE °C

45
40
35
30
25
20
15
10
5



RAIN
mm.

150
100
50
0



by a humid and subhumid subtropical climate. These areas include the Caspian provinces of Gilan, Mazandaran, and Gorgan. Climatic conditions in these regions differ from those of other parts of Iran and have certain similarities to the Mediterranean climate; it is humid in the western part and subhumid, semiarid in the eastern part. (Fig. C.3, C.4, C.5)

5 Building techniques, materials and forms.

The particular topographical, environmental and socio-cultural conditions of the Caspian Region have produced a range of building techniques and forms unlike those found in the rest of Iran.

5.1 Roofs

Regional construction variations in the study area are most clearly reflected in the roof types, reflecting changes in materials and micro climate. In general the steepness of pitched roofs decreases from the coast to the mountains. This is most marked in a section taken from the coastal area north of Rasht and passing through Fouman inland to the mountains.

The reason for the change at each stage of this cross section is twofold. Reed thatch is used in the coastal areas because it is the most abundantly available material, growing in the marshes. The pitch of these roofs is very steep where the rainfall is high (1600 mm/year) to ensure water run off; the pitch is shallower where rainfall is less, producing the difference between reed thatch roofs in Gilan (55°) and Mazandaran (35°). In Gilan the coastal houses have large overhanging eaves which reflect the degree of exposure to, and direction of bad weather. The overhangs often protect frail wall structures behind, such as reed walls. (Fig. C.6)

in the northwest to the foothills of Gorgan in the east of the region. The Alborz mountains, forming a barrier to the penetration of rain clouds into the south, contain the abundant rain and humidity on their norther slopes and the coastal plains of the Caspian.

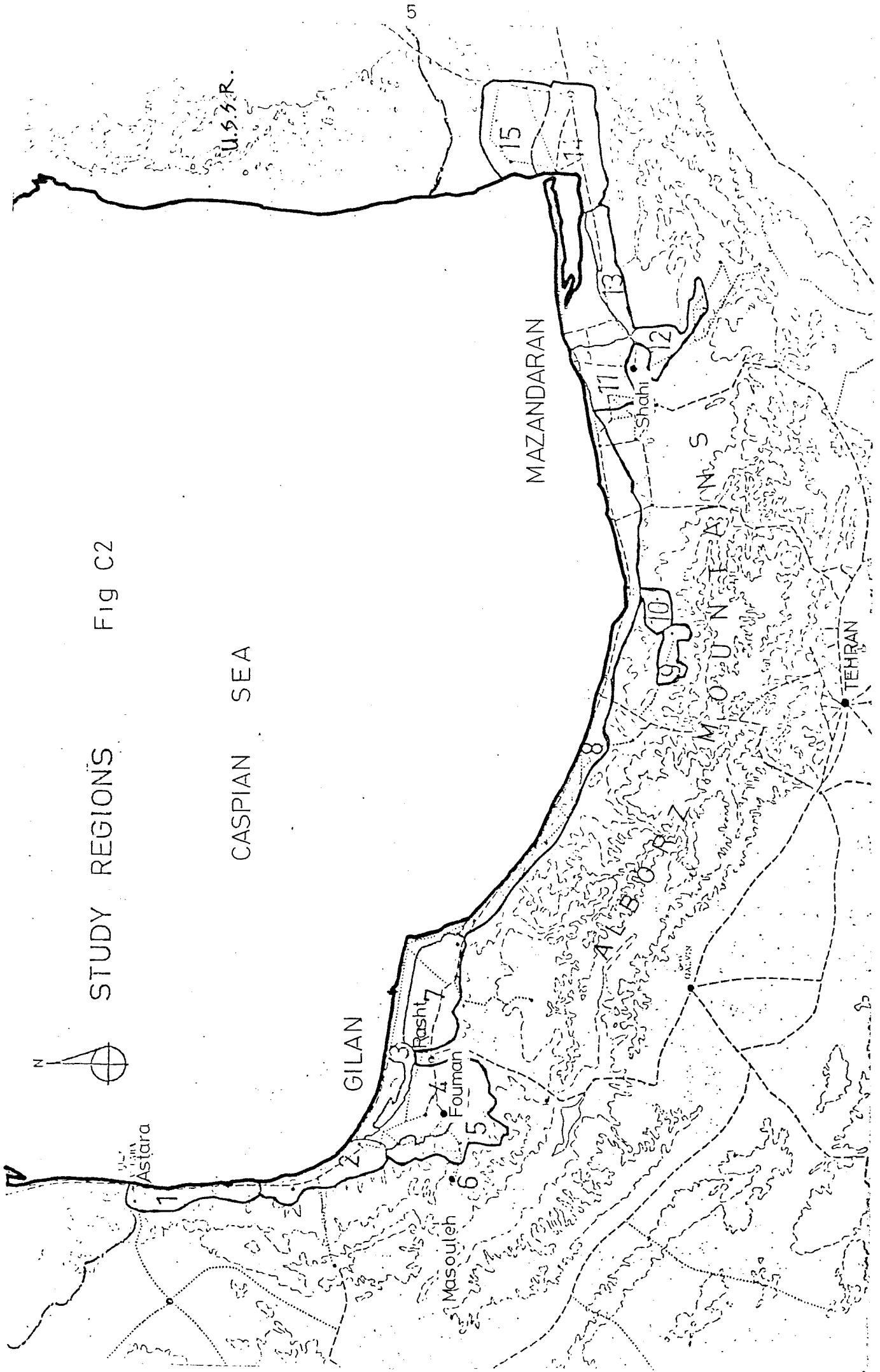
The study area was divided into two broad ecological subregions:

The plains; occupied by a sedentary population who were traditionally engaged in rice cultivation, silk production, and animal husbandry. The plains have a high mean annual rainfall, humidity and air temperature.

The hills; covered by forests and vegetation and provide good grazing grounds for animal husbandry. The population engaged in this activity migrates to the cooler, less humid hills in the summer and returns to the plains in the winter months.

The Caspian's narrow coastal plain has an average width of about fifty kms, and was produced by a general retreat of the sea, which at one time probably extended as far as the foot of the Alborz mountains. Numerous rivers originate in the northern foothills of the Alborz, but they are all short and cover small distances before they reach the sea. There are, however, four rivers of importance that empty their water in the Caspian. They are, the Aras (Arazes), Sefid Rud, Gorgan, and Atrek. These rivers have respectively built the Moghan Plain, the Sefid Rud Delta (Rasht Plain), the Gorgan and Atrek Plains. In addition, a group of rivers - Talvar, Haraz, Babol, and Tejan - have built up the Mazandaran Plain.

The northern foothills and the slight to moderately sloping foothills areas of the Alborz mountains bordering the southern coast of the Caspian Sea are characterised



STUDY REGIONS Fig C2

CASPIAN SEA



Astara

GILAN

Masouleh

Rasht

Foyman

MAZANDARAN

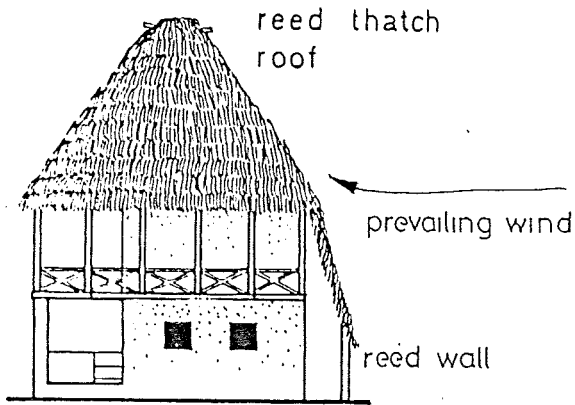
ALBORZ

ALBORZ MOUNTAINS

Shahri

TEHRAN

U.S.S.R.



Side Elevation
Shijan Village

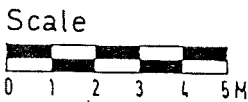


Fig C6 REED THATCH HOUSE

Fig C7
RICE THATCH
HOUSE

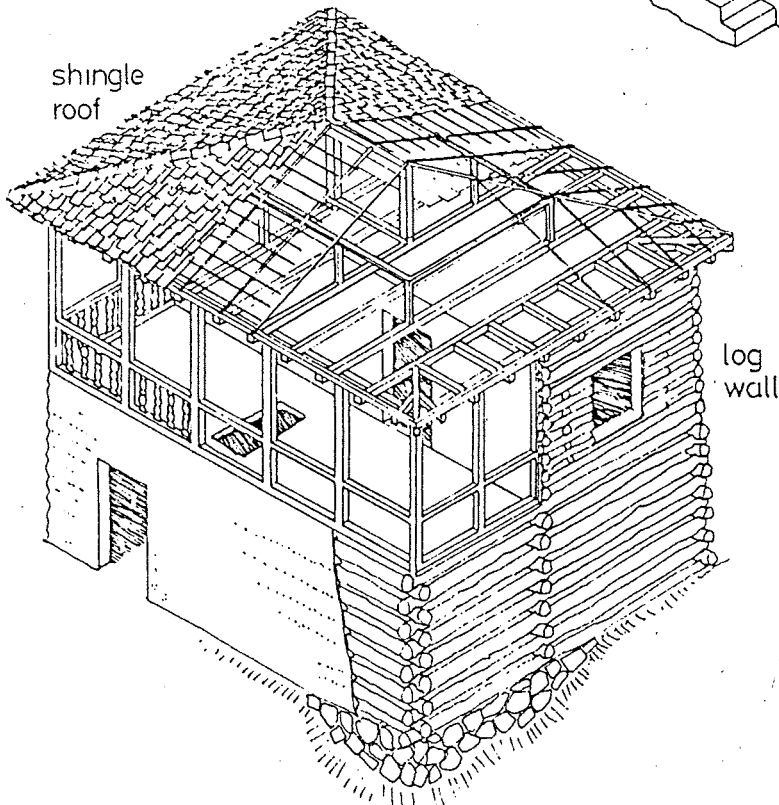
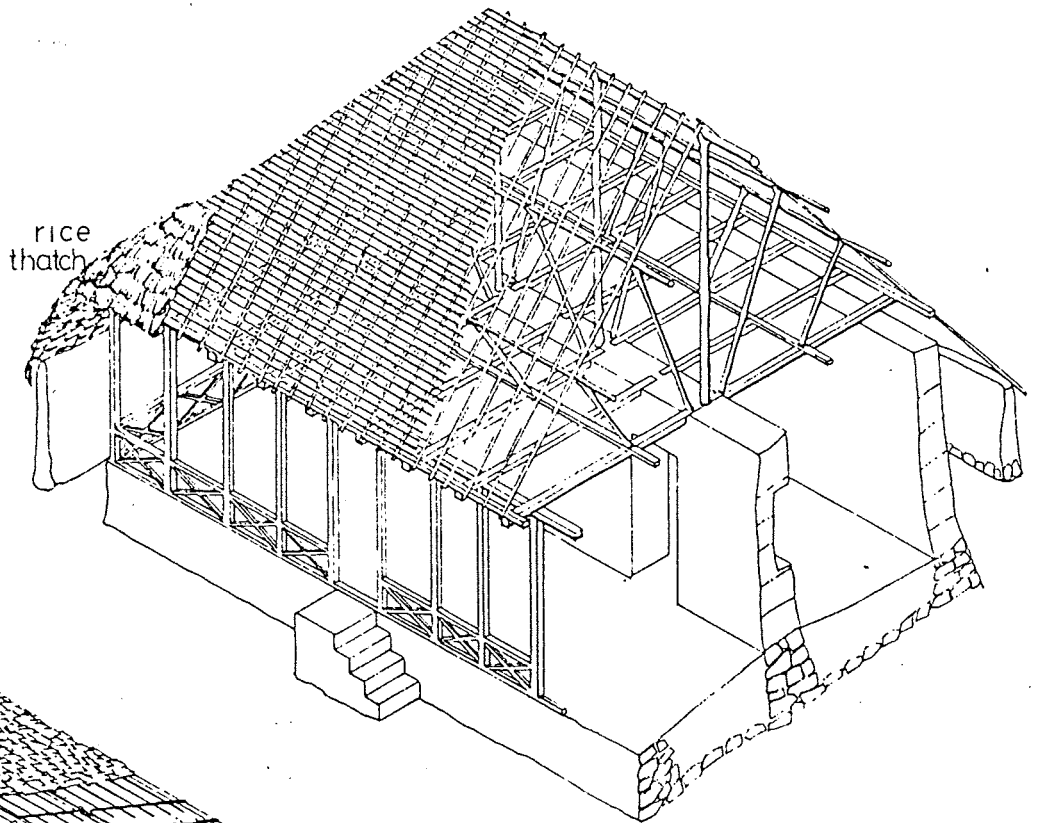
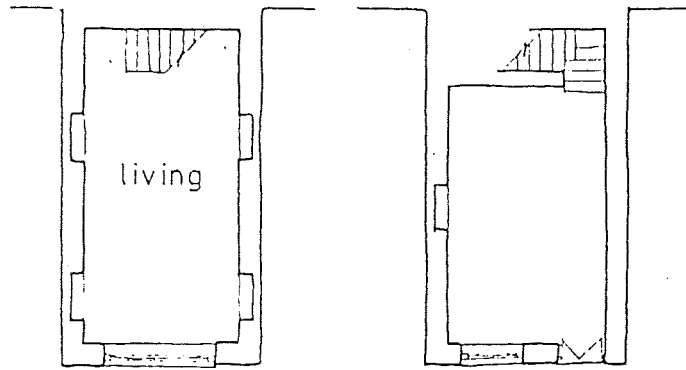


Fig C 8 SHINGLE ROOF
HOUSE

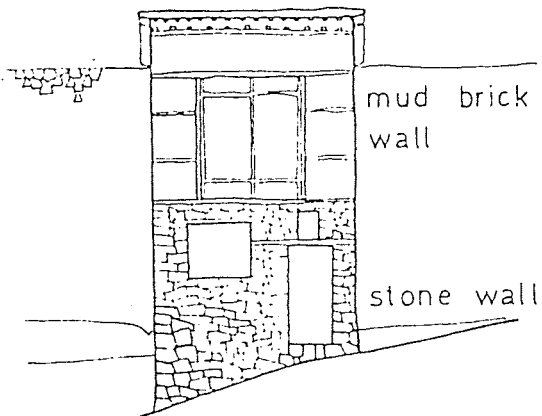
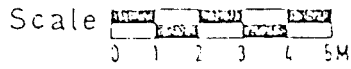
Fig C9 FLAT ROOF HOUSE



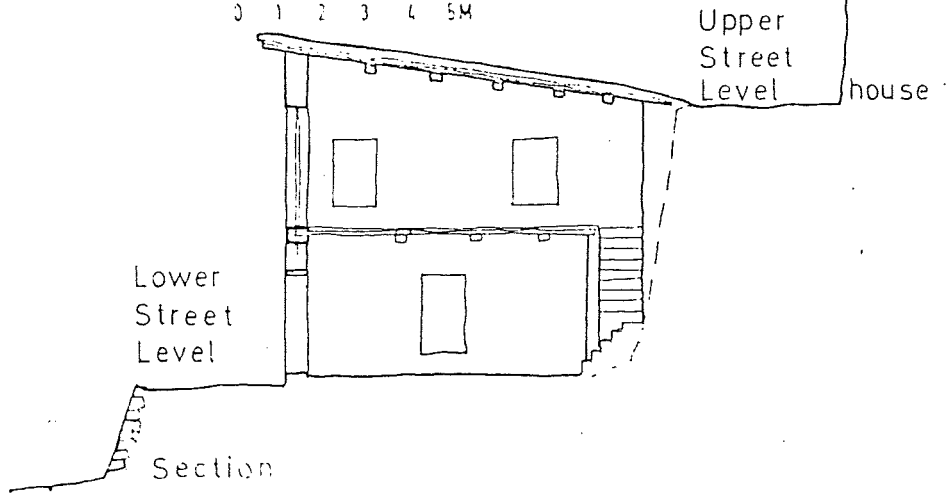
Upper Floor Plan

Ground Floor Plan

Masouleh



Elevation



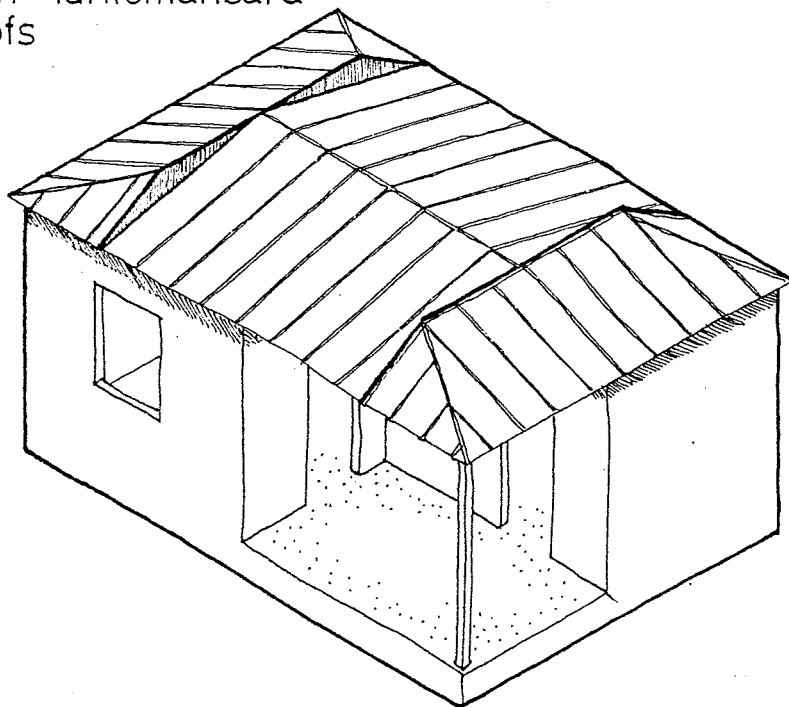
Lower Street Level

Upper Street Level

house

Section

Fig C 10 Houses in Turkomansara have unusual roofs



5.2 Walls

Walls, in the same manner as roofs, vary according to the materials available locally and the climate.

Reed walls supported by a timber framework occur in the coastal areas, where reed is more available than other walling materials. (Fig. C.6) This wall type is well suited to the warm humid conditions of the coast, where thermal insulation is less important than inland, where temperatures are more extreme. A general observation is that walls increase in thickness with distance from the coast. Linked to this is a similar transition from framed wall construction near the sea changing to load bearing wall construction in the mountains. This change reflects changes in the availability of walling materials. Loadbearing walls are naturally thicker than framed walls, and so the change required by climatic conditions is facilitated by the change in the physical properties of the wall.

Moving from the thin reed walls on the coast inland, walls of timber lathing with a packed mud infill occur. These walls are thicker than the reed walls but are still supported by a timber framework. (Fig. C.11) However, where timber is less available, packed earth (chineh) walls are used, as in Sari and Fouman plains. The choice between these two types of walling is influenced by variations in local climatic conditions as well as the suitability of the materials.

Log walls, which are loadbearing, coincide with forested areas, and are the major wall type in the foothills and forested mountains. (Fig. C.8) Because of the good thermal properties of timber, these walls provide greater insulation against extremes of temperature than the thin

PLATFORMS

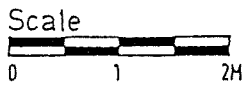
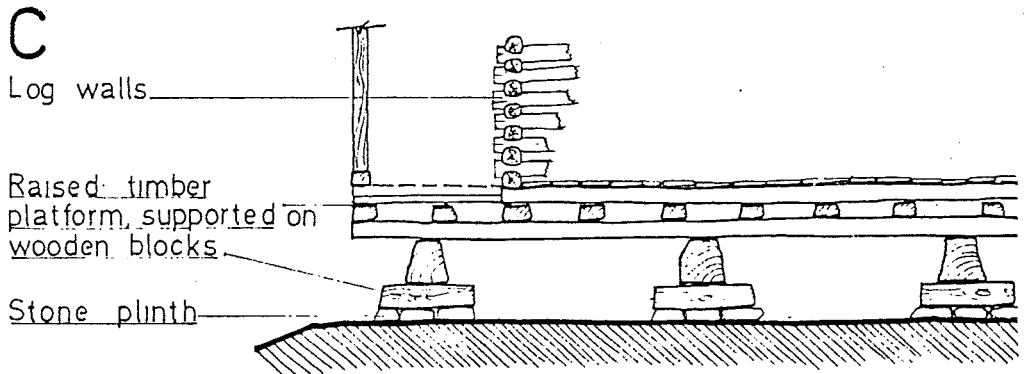
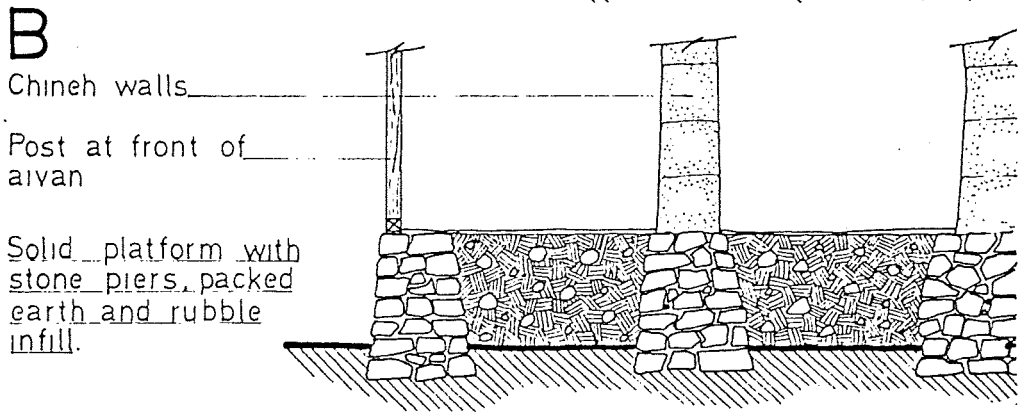
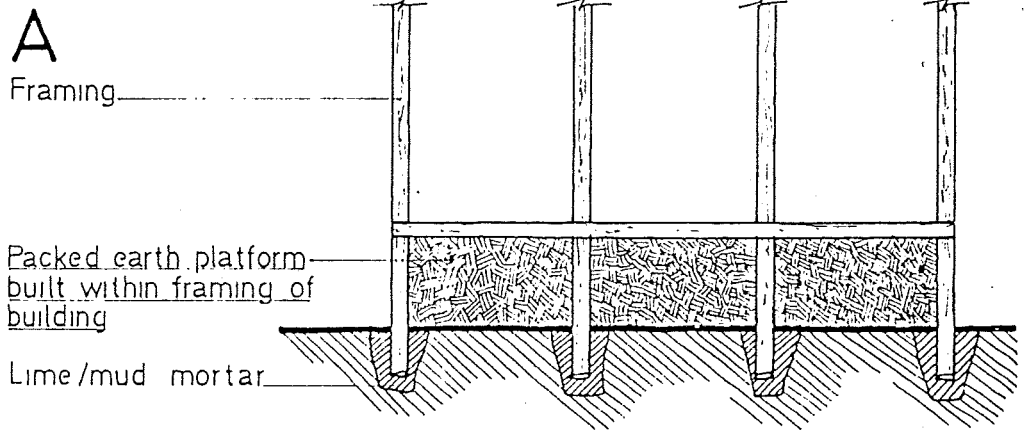


Fig C12

walls found on the coast. The use of log walls is restricted to areas where timber is plentiful, and thick stone or mud loadbearing walls replace logs where the forests decrease inland. At this point thermal insulation is essential to counteract the cold winters and cool summer nights which occur in the mountains, and the thick loadbearing walls are responsive to both the local climatic conditions and the availability of walling materials.

All the wall types mentioned above require rendering and maintenance. A major potential improvement in building quality and maintenance can be through the introduction of improved renders, using stabilisers to make them more water and impact resistant. In areas where the soil is suitable fired bricks are produced and used for walling. (Astara and Behshar) They have the advantage of being less subject to damage by rainfall and consequently require less maintenance. However, the cost restricts the rural use of fired brick even in areas where it is produced. Similarly concrete block has come into use throughout the coast and plains of the Caspian region for those who can afford it. Although it is less environmentally responsive, concrete block is locally believed to be long lasting and maintenance free.

5.3 Platforms

Houses are built on platforms to raise them above damp ground conditions and the risk of flooding. Platforms are therefore a predominant feature in the coastal and plain areas of the Caspian. Two basic forms of platform exist - those which are raised clear of the ground, which occur in areas where rivers are likely to flood (Sefid Rud delta), and those which are solid. (Fig. C.12) Solid platforms are highest near the coast, and in gen-

Fig C 11
TIMBER LATH AND
PACKED MUD WALL

Vertical framing

Horizontal laths
internally

Diagonal laths
externally

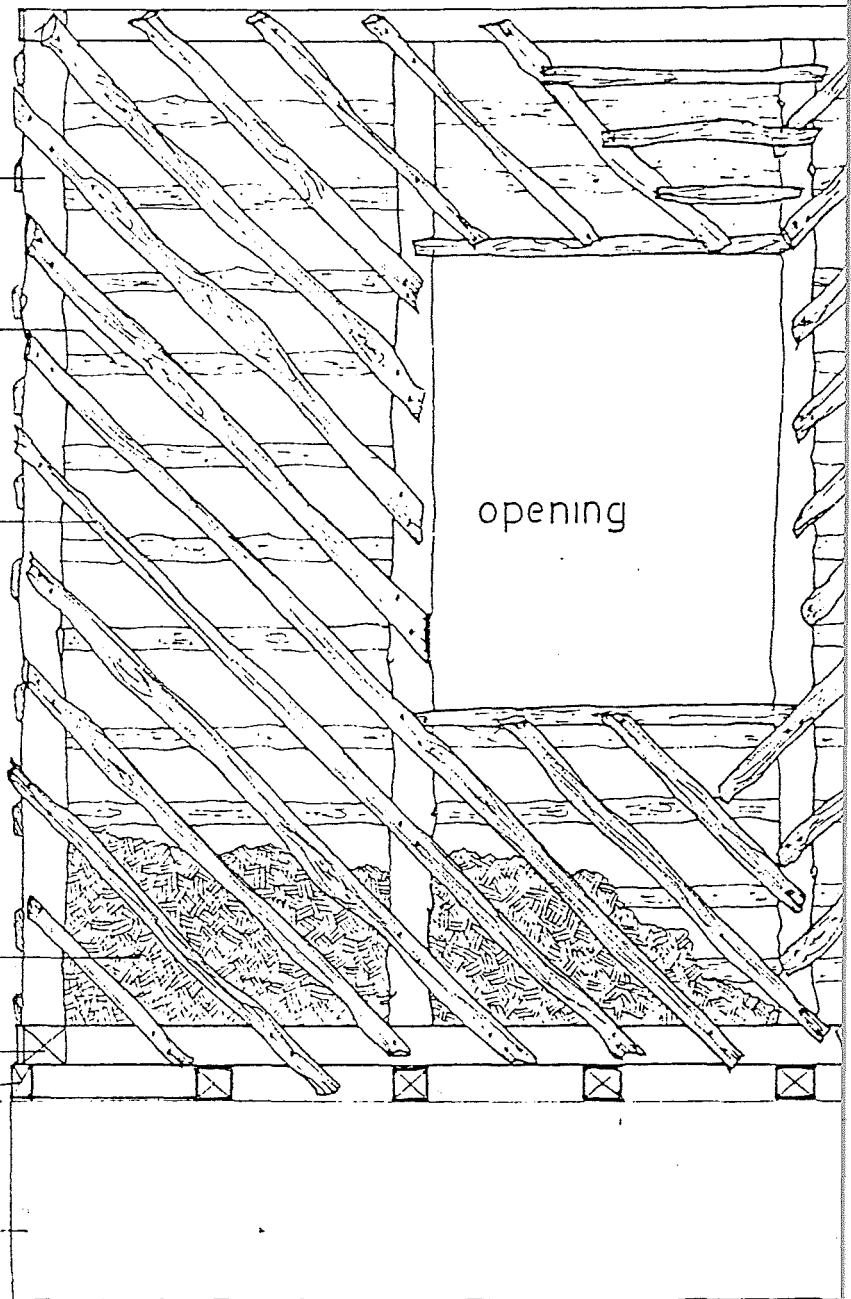
Packed mud and
straw infill

Horizontal framing

Floor joists

Platform

ELEVATION

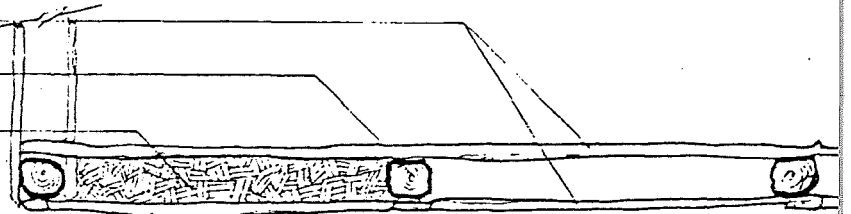


Laths

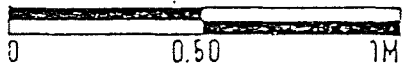
Framing

Mud packing

PLAN



Scale



eral get lower towards the foothills, corresponding to the areas with drier and better drained ground.

Platforms are not a predominant feature of mountain dwellings, but visually the levelling of ground below the main structure of the building produces an effect similar to the platforms of the plains.

5.4 Orientation

Orientation of houses also alters from the coast to the mountains. To take maximum advantage of the sun's warmth in winter, houses in an ideal situation face south, with windows primarily on the south wall. However this ideal orientation is not always the most practical. On the coast houses tend to be oriented towards the south-east, turning the back of the house towards the prevailing north-westerly storms. Moving inland onto the plains, a south facing orientation is more practical, since the houses are less exposed to bad weather. The situation is notably different in the foothills and mountains, where topography becomes a dictating factor. Houses primarily face downhill, with their backs turned toward the slope behind. This is not an ideal situation and where the site is sufficiently open towards the south, a south facing orientation is chosen.

6 House form

Any typology of house form can only be a generalisation in a region demonstrating varied natural conditions, economic and social patterns and different ethnic and tribal backgrounds. However, some basic features are common to the whole area, with the exception of Masouleh, which is built on a steep hillside and has houses unique to its own position.

There is a basic type of shelter which is generative of all the other house types. It consists of two fundamental spaces necessary for the house in the Caspian region: an enclosed room and a roofed but unwalled verandah (aivan). The room provides an enclosed space for use during the cooler less humid months and in some areas for sleeping at night; the verandah is a shaded semi enclosed roofed space in which most daytime activities take place, especially during the warm humid summer months. (Fig. C.13)

These two spaces are found in almost all house types in the region but the ratio of room area to verandah and their relationship vary according to the climate and lifestyle requirements within each sub region.

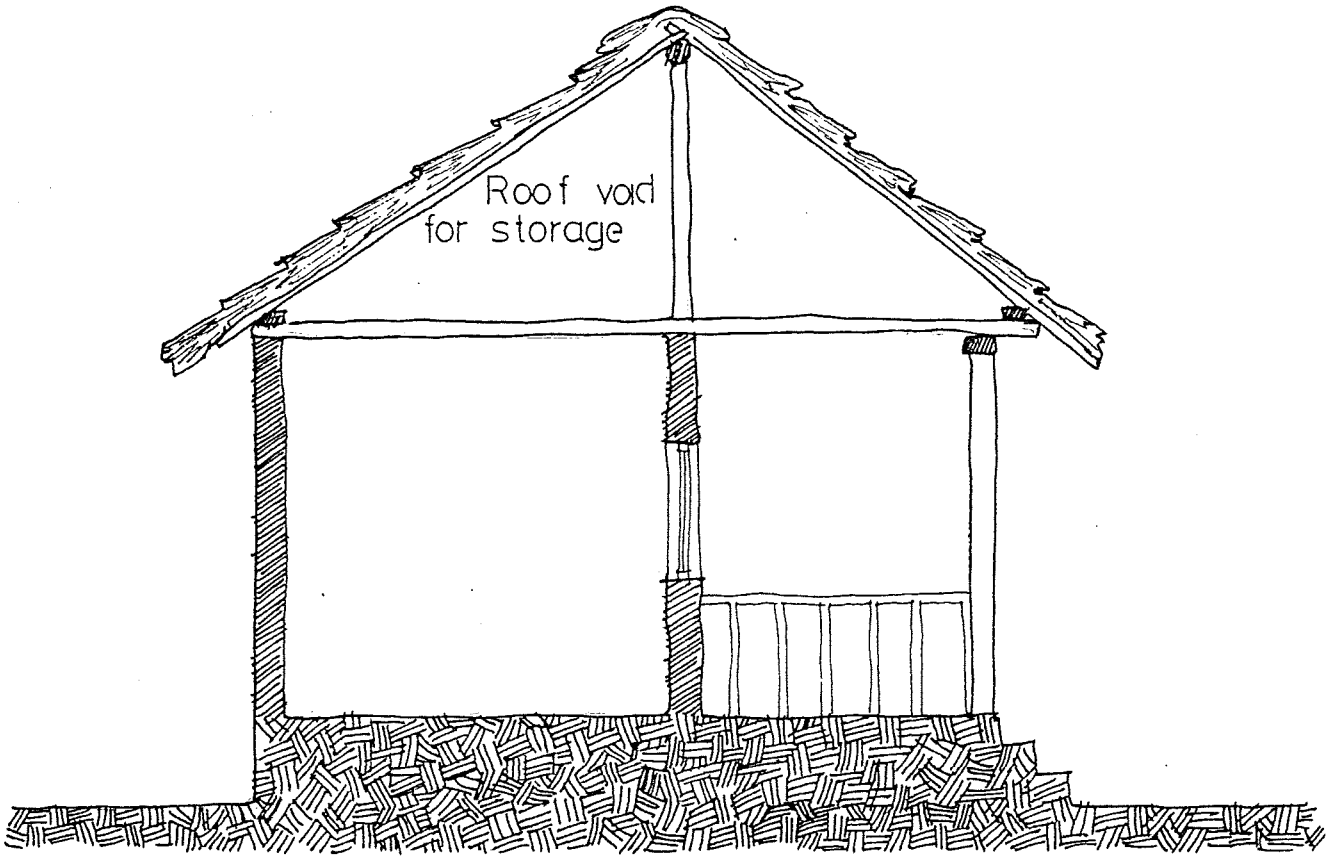
Along the coast, where there are high winds and rainfall, expansion of this basic form is horizontal, with rooms being added side by side and the verandah running across the front. (Fig. C.14) Smaller houses in the Astara region are often 'L' shaped, enclosing the verandah on two sides. (Fig. C.15) Moving inland, the house changes from being single storey and develops upwards. (Fig. C.16) Often the verandah is at the upper floor, with the ground floor being used for storage. (Fig. C.17)

New houses in the coastal areas most commonly adopt the 'L' shape plan, and this is becoming the general regional pattern. Local variation and local response to climate is much less apparent in the more recent buildings.

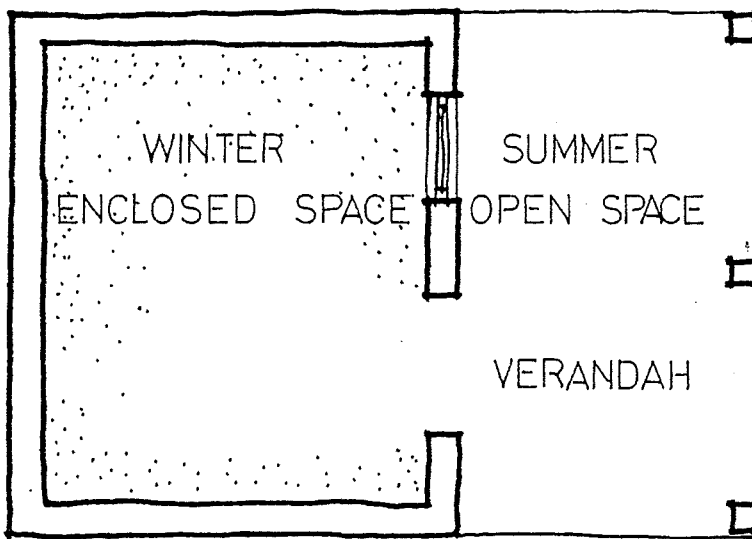
7 ANALYSIS AND CONCLUSION

The development and pattern of rural building in the Caspian Region depended largely upon house occupiers building and maintaining their own houses. This was an understood and accepted pattern. The time involved

Fig C 13 BASIC GENERATIVE HOUSE FORM

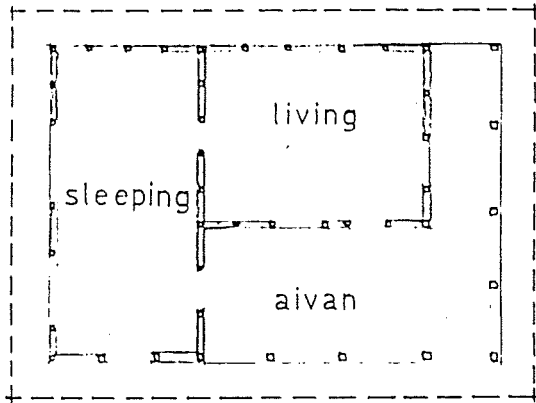
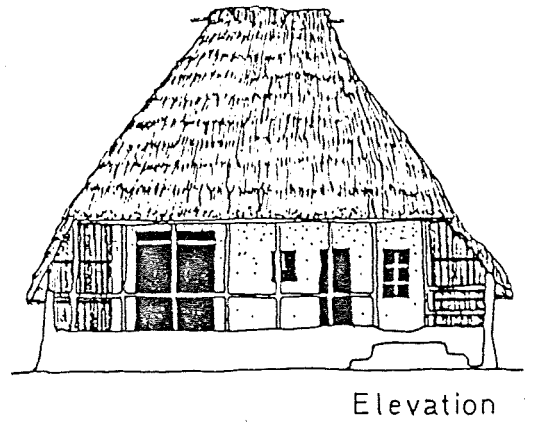
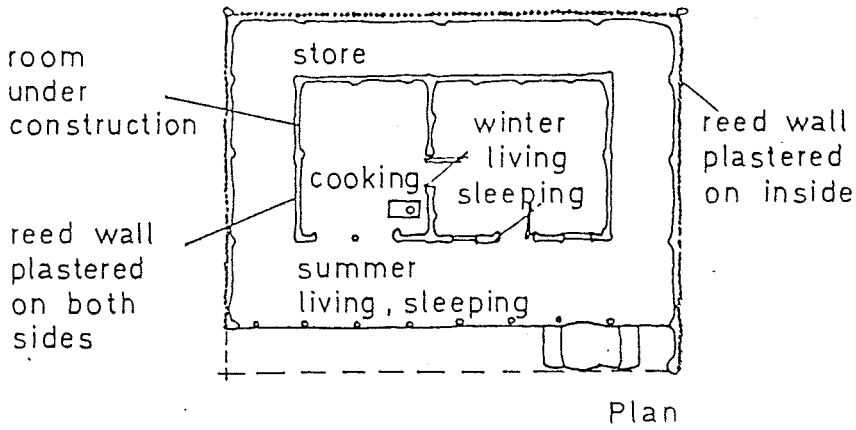


SECTION



PLAN

Fig C14 FRONT VERANDAH HOUSE



Floor Plan
Fig C15 'L' SHAPE PLAN

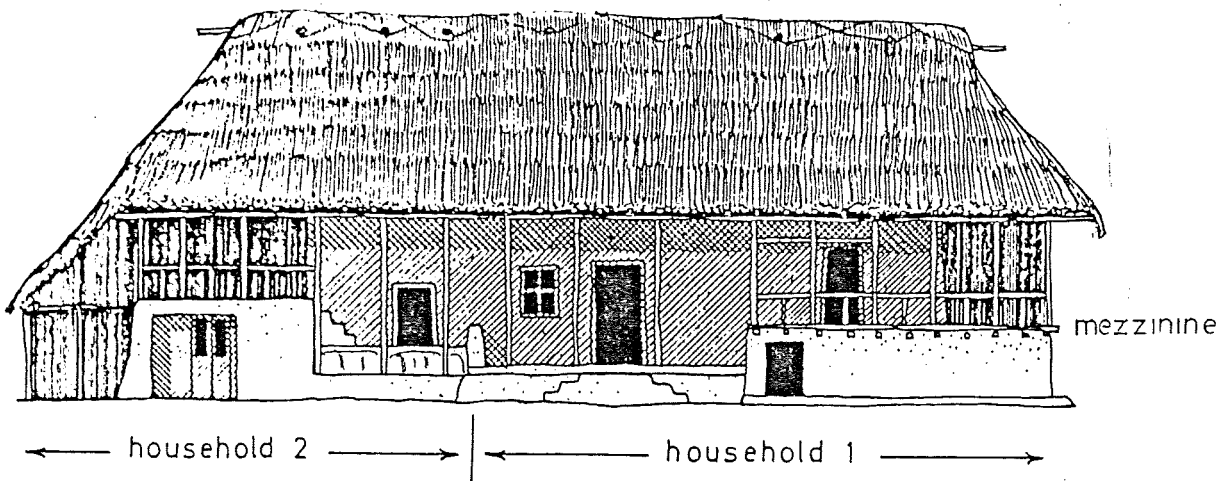
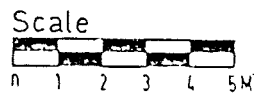
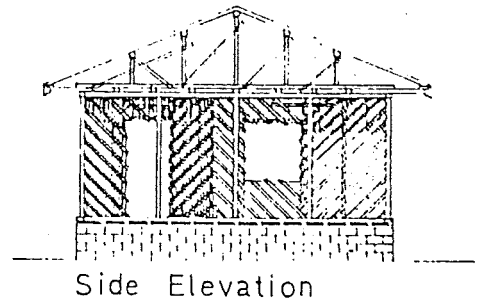
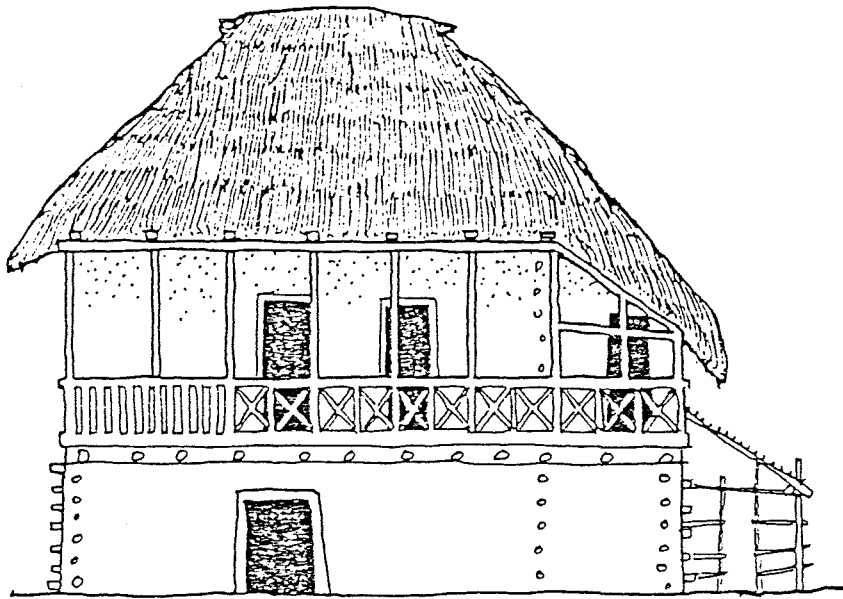
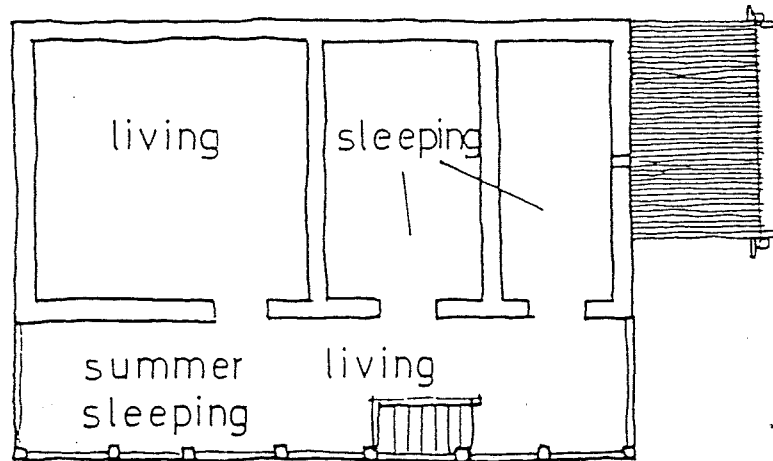


Fig C16 MEZZININE HOUSE

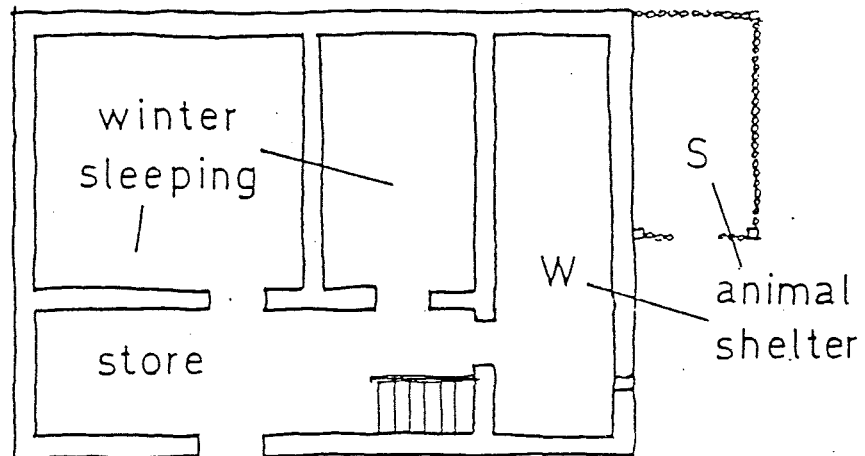
House Maklavan



Elevation



Upper Floor Plan



Ground Floor Plan

Scale



was not considered time wasted. A noticeable change occurs when, through alteration to the life style and economy of the family, time is valued in terms of money. People are less prepared to spend time on the upkeep of their buildings, but prefer to pay someone to do it for them, or use materials which will hopefully remove the need for maintenance. Hence, there has been a growing shift to the use of cement blocks, which are believed to be long lasting and maintenance free. Unfortunately the quality of the blocks produced is usually poor and deterioration is noticeable. Roofing materials have shifted from those locally available to a widespread use of galvanised metal sheeting, which also performs less well than is commonly believed. The overall quality of building is deteriorating. The locally available materials are ideally suited to the local conditions, but they do frequently have problems. Thatch roofing, whilst being cheap and thermally excellent, deteriorates and requires replacement. This can be largely overcome by using simple preservatives. Various methods have been suggested. The tile industry, in the Astara and Behshahr areas, could be made more viable than it is already. Much of this can be achieved through improving the production and transportation systems.

The walling materials, especially the timber frame walls, are still popular because they are cheap, and last for many years. Given the high incidence of earthquakes, the use of timber should be encouraged. Overall, the use of timber has been restricted because of forestry control. Careful use of the forestry resources should be encouraged, but equally, selective use and replacement of trees will do more to ensure the continued existence of woodland in the area. Replanting is essential. The controls have not reduced the cutting of trees - it has continued

in a less noticeable form. Predominantly it is small timber that is taken whilst mature trees are left. This will only become noticeable in years to come when new growth is less.

Especially in the coastal areas, materials and design of houses which do not allow for air movement to combat the heat and humidity of the summer will provide inferior housing which will then need the additional expense of mechanical cooling.

A Careful use of the resources of the Caspian Region would enable the majority of the building needs to be met with local materials and skills, providing income and employment to a region, that, as with much of Iran, is becoming increasingly dependant upon the urban centres.

The trend has been towards increasing migration from the rural areas to the towns and from the Caspian to the larger industrial centres south of the Alborz mountains. In consequence, less money circulates within the local economy; skills are forgotten and the level of regional self sufficiency drops.

The condition and changes in the built environment are a reflection on the changing pattern in agriculture and production. It is in the advantage of the area to stimulate the use of its potential.

END

Training workshop for local builders and artisans.

Builders training workshop in Yazd, Iran.

This case study records the aims, process and content of a builders training programme held in Yazd, Central Iran, in 1977. Whilst some of the subjects covered in the workshop were specifically related to the region from which the builders came, the overall approach and methodology is applicable to other places.

The workshop outlined the problems and potentials for development of a specific region, and then dealt with the different elements and processes involved in building construction in the area. At each stage a variety of solutions were discussed and the most suitable adopted for practical development, firstly in the workshop yard, and then in practical building projects within the Development programme which sponsored the workshop.

During the period of the workshop, all the participants were involved in experiments to develop solutions to building problems in the area.

Through the training programme, the builders learnt that the majority of the local building needs could be met by the use of the local resources and their own skills, and that by co-operating with each other they could continue to resolve new problems that might arise in the building needs of the area.

2. Training workshop for local builders in Iran

by

John Norton

April 1980

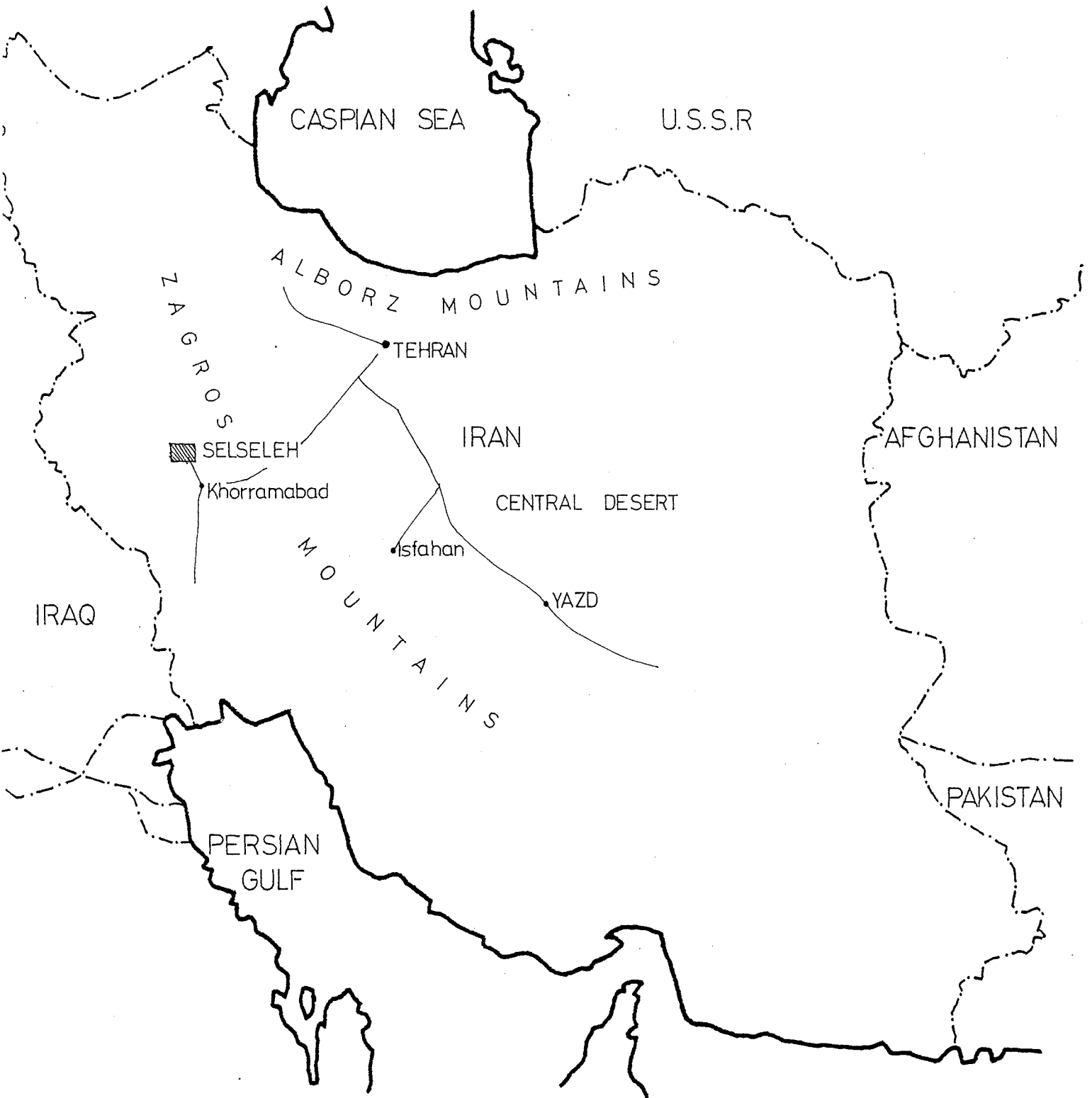


Fig 1 LOCATION OF YAZD & SELSELEH

DEVELOPMENT WORKSHOP

The Development Workshop is a team of architects, planners and researchers from a number of countries who work collectively on the development of indigenous building and planning methods in the Third World. Projects have been undertaken in African, Middle Eastern and Asian countries. Members of the Workshop believe that appropriate solutions to human settlement problems can be developed from indigenous methods which have evolved from and remain in the hands of Third World communities. The Workshop works in the field of rural and urban human settlements. The development of small scale construction industries, technical training and local participation are integral to the Workshop's approach.

John Norton is a founder member of Development Workshop.

the largely nomadic background of the people, who, unlike much of the rest of Iran, did not have a long and rich tradition of building to develop from.

In general, the 'builders' suffered from a combination of difficulties; lack of experience, skill and pride in their work.

At the time that the Builders training workshop was organised, some participants had been working in agriculture less than a year before. One had been and periodically continued as, the assistant cook in the S.I.D.P. canteen.

All the participants had one thing in common; the desire to learn and improve their buildings skills. Lack of pride in their work was primarily an expression of the low standard that had been accepted in the past. There had been very little exposure to work of good quality.

The building season in the Selseleh Region is between April and November. Buildings must be weatherproof by the time that the main rainy season begins. Interior work can carry on for a while, but by the end of December the weather becomes so cold that materials freeze and much of the work is slow and unproductive. Any training programme that was not to interrupt the scheduled building programme had to take place between December and April, when the participants could be involved entirely in training.

The first obstacle to be overcome was the location for the training workshop. The training required outdoor space that could be used for practical work and experimentation. Selseleh was unsuitable because of the winter climate.

TRAINING WORKSHOP FOR LOCAL BUILDERS AND ARTISANS.
BUILDERS WORKSHOP IN YAZD, CENTRAL IRAN

1 Introduction

The main basis of the approach taken by the Selseleh Integrated Development Project was aimed towards improving the living conditions within the region through active participation of the community and by the use of local resources.

The four major activities of the S.I.D.P. lay in the fields of education, health, agriculture and physical services. These four activities were introduced through education, so that, while the immediate needs of the four aspects were being met, the local population were at the same time being trained to provide these things for themselves, and to eventually cease relying so heavily upon others to help them.

At the start of the S.I.D.P. work, 90 volunteers from the region were chosen and given a broad training in agriculture, health and education (initially primary and literacy education). After the basic training period these people were sent back to their villages where they could work with the local people to improve conditions in the area.

Because of the pressing needs for new facilities in the area, even though there was an extreme shortage of even relatively skilled builders, it was not possible to begin with a comprehensive builders training programme before starting on practical building work. Training had to take place whilst building was going on. Because of the impossibility of supervising every building site constantly, a number of bad building practices were incorporated into the earlier buildings. This was understandable given

TRAINING WORKSHOP FOR BUILDERS

Contents

1.	Introduction	Page 1
2.	Methodology	6
3.	The Workshop	7
4.	Drawing, designs and building methods	
5.	Technical and practical content of the Workshop	
5.1	Overall approach	10
5.2	Site evaluation	10
5.3	Foundations	11
5.4	Walls	12
5.5	Renders	16
5.6	Openings	17
5.7	Roofs	17
5.8	Specific subjects related to Seleleh	20
5.9	Conclusion and continuation	22

Illustrations

Fig. 1	Location of Yazd and Seleleh	Page 3
2	Layout of builders workshop	5
3	Cuts on model	9
4	Flat roof experiments	19
5	Three metre span vault building	21

THE SELSELEH INTEGRATED DEVELOPMENT PROJECT (S.I.D.P.)

The S.I.D.P. was set up as an experimental project to investigate and apply a policy of rural development based upon a concept of 'endogenous' or internalised development. This aimed for the improvement of living conditions within the project area through active participation of the community and by the use of local resources. The S.I.D.P. worked on the development of Health, agriculture and education and building, as well as the infra structure and creation of new job opportunities.

An essential part of the programme was the training of 90 'Front line Workers' in the fields of health, agriculture and education. Specific training was also conducted for other activities in the area. The trainees later took on the task of assisting the villagers in meeting their basic health, education, agriculture and building needs. The S.I.D.P. was based in 400 km² of the Selseleh Region of Luristan, western Iran. This is a high basin ringed by the Zagros Mountains.

The Development Workshop were the Architects and Planners for the S.I.D.P. from 1975-78.

Yazd, in the centre of Iran was chosen because of

- a) the climate was drier and milder.
- b) the two master masons who had been primarily involved in the vault and dome programme came from Yazd and could provide the temporary accommodation and land needed, as well as knowing where to get materials and supplies from.
- c) Yazd itself lies at the heart of an area with an extremely rich and well developed building tradition, and it was hoped that the exposure to a high quality workmanship would have a beneficial effect upon the participants of the training workshop. They would also be able to see, albeit in a different context, to what extent local resources can be used to meet all the building needs of an area. (Fig. 1)

A further incentive in moving the builders out of their own region was to bring them together as a more cohesive group, who would in future be able to undertake building projects as a co-operative of builders.

The workshop programme was paid for by the S.I.D.P., who also contributed a basic maintenance wage for the builders taking part.

In all, 14 trainee builders from Selseleh, two master masons from Yazd, and the four members of the Architectural and Planning group of the S.I.D.P. (Development Workshop) took part in the programme. The duration of the workshop was from January through to March 1977.

Accommodation and discussion space was provided in a house in Yazd, with a large courtyard where practical work, experiments and outdoor discussion took place. (Fig. 2)

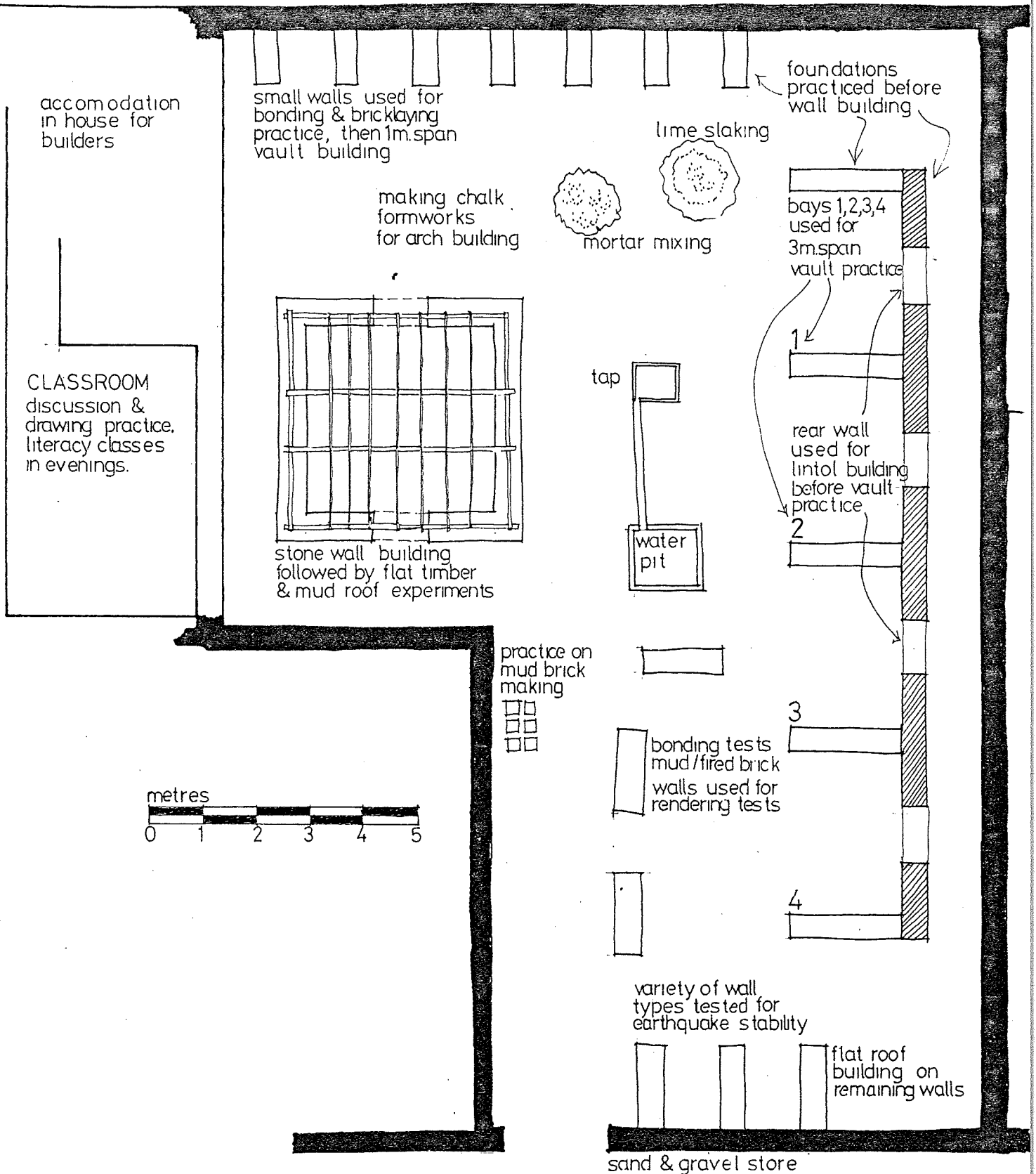


Fig 2 LAYOUT OF BUILDERS' WORKSHOP

There were two closely inter-related aims in the workshop; firstly to develop indigenous building methods through the pooled knowledge of the participants; and secondly to train the village builders in practical and organisational skills so that they were equipped to meet most rural shelter needs without dependance on city based contractors, engineers and building materials.

The workshop was not, however, a conventional teaching process. Each aspect of the programme was based upon the sharing of experience amongst all the participants. This experience was discussed and the best solutions to meet the needs and potentials of the Selseleh area were collectively decided upon. Each solution was tested and developed through practical work in the courtyard. It was stressed from the beginning that, whilst some of the participants had greater knowledge than others, each person had something valuable to contribute. In practice, as many valuable suggestions came from people who had no specialised background in building as came from those who had been trained, i.e. the master masons and the members of the Development Workshop.

The builders from Selseleh had an invaluable understanding of what could or could not be done in their own region. Without this, some ideas could have been developed without being entirely suited to the local conditions.

2 Methodology

The methodology adopted for the workshop was: learning through discussion, through practice and through experimentation. As an additional part of the workshop, basic literacy classes were conducted in the evenings, since the majority of the builders were illiterate. These literacy classes were directly related to the subjects being

dealt with in the workshop, and consequently took on a greater degree of relevance to the day to day life than was normal. Certain aspects of the workshop programme clearly demonstrated the need to be literate, most particularly the ability to read architectural drawings and understand their basic requirements; and to be able to organise the building process - ordering of materials, accounting etc. These skills were important if the builders were to take on Government contracts in Selseleh.

3 The Workshop

Before any practical discussion was to begin dealing with building in particular, it was important to establish an understanding of what sort of approach should and could be taken in the development of the Selseleh Region.

The builders were asked to identify the negative and positive aspects of the Selseleh area. Having listed the resources/potentials and shortages/problems in the area, they were then asked to see to what extent the resources could be used to overcome the problems in the area. Because of their background, many of the ideas related to the agricultural and animal husbandry. Through the discussion a strategy for the practical development of the Selseleh Region was developed which included ways of increasing employment, through the establishment of workshops, for metal, handicrafts, woodworking etc., and kilns, for producing bricks, chalk and lime, all of which were locally available. They also identified certain essential facilities which could and should be provided - new roads, public buildings, work places etc., and the extent to which the people of the area could do this themselves and what role or assistance the Government needed to provide to supplement their own potential. One of the major difficulties was the shortage of capital required

in establishing many of the things required in the region, and this was seen as a major area of needed assistance. However they felt that by stimulating the local economy, they would be increasingly capable of improving conditions in the region without assistance. The builders suggested that the poor quality of the built environment in the area was mainly a reflection of the economic poverty of the area, and illustrated this by saying that if there was more money in circulation, more people would be able to afford better materials, and to improve the use of existing materials.

More detailed discussion dealt with the provision of public facilities, looking particularly at the role of the Government and its relationship with the village community. The builders felt that the best results occurred when village financed and participated in the process, but that this was seldom possible because so little money was available. On the other hand, when the Government provided a building, its design and operation seldom met the specific requirements of the village and its environment, and the people tended to neglect the building after completion. The suggested solution was through participation of the people and the help of the Government, where the future users would be involved from the beginning, from decision making through to use and maintenance, and could harmonise the building to their needs.

For such a strategy to work, it was essential that the builders could read and interpret architectural drawings, so that they could take on Government work in the area and produce simple plans for the local buildings.

4 Drawing design and building methods

The discussion on drawing, design and building methods was introduced by asking the builders to draw their own

homes. Whilst these initial drawings were in many cases not very clear, they provided the basis for discussion of buildings with which they were already familiar. With these buildings, basic principles of design and construction were illustrated; for example, the positioning of windows in relationship to the building's orientation. A ~~stereotyped~~ cardboard ^{of a stereotyped house} model was made, with which the different views of the standard house in Luristan could be seen in terms of plans, sections and elevations, by removing parts of the building. (Fig. 3)

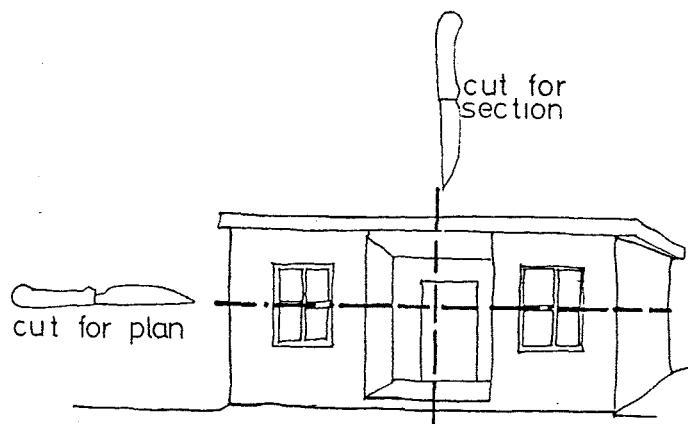


Fig 3 CUTS ON MODEL

Through this the builders quickly developed a basic ability to produce more accurate drawings. Methods of dimensioning their drawings and using scales, i.e. 1:100, 1:50 were introduced.

digging trial holes to find out what the ground was like, the height the water table, etc.

All of these could influence the location of the building and the type of foundation used.

Later on in the programme simple methods were demonstrated for analysing soil types. At this stage the behaviour of different soil types was explained.

5.3 Foundations

The Function of foundations was discussed, and the builders described the method they knew. It was pointed out that many buildings in the area did not have proper foundations, and that where used, the method of building the foundations was often poor. The discussion stressed the importance of having properly built foundations since the whole weight of the building rested on them.

Practical demonstration focussed upon two foundation types suitable for small buildings of less than 2 storeys, one for firm and stable ground and the other for unstable ground.

In Selseleh, the accepted materials for foundations were lime and earth for the mortar (Shefte), and stone. The lime used in the mortar was not always slaked before mixing, which resulted in cracking when the lime came in contact with humidity in the soil. It was stressed that lime should always be soaked in water before use.

Stones were usually thrown into the foundation, with no attention paid to laying them properly. This too resulted in weak foundations. The correct laying of stones was demonstrated and practiced.

5.4 Walls

The builders were asked to describe the various functions of walls in a building. Their answers were comprehensive and included the following requirements:

- to be able to support own weight, roof load and snow.
- to provide shelter from undesirable climatic effects i.e. rain, snow, sun in summer.
- to provide security
- to make a boundary for the family
- to keep noise out
- to have stability against earthquake, flooding and other accidents.
- to be fire resistant.

Ways of meeting these requirements were discussed and the various wall types used in Selseleh were considered, both in terms of how they performed and how they could be improved.

a) Packed Earth walls (Chineh). The simplest and cheapest of the walling types used mud and straw, placed in lumps on the wall so that the wall is built up in 50 cm layers. The strength of these walls was low and two suggestions were made 1) that a ram and form-work could be used so that the mud would be compacted and have a greater load bearing capacity. 2) That improved water resistant renders should be used to stop surface deterioration.

Both these suggestions were developed upon through practical test walls.

There was a general consensus of opinion that these walls were not very strong and that where possible alternative wall building systems should be used. They were regarded as being satisfactory for building perimeter walls to courtyards. (This was probably the

5 TECHNICAL AND PRACTICAL CONTENT OF THE 'WORKSHOP'

5.1 Overall approach

The various elements of the building were dealt with from the ground upwards. At each stage the basic requirement was discussed, including the principles involved, and from this analysis, a variety of solutions were investigated. Those that seemed suitable for the Selseleh Region were practiced on in the yard, with demonstrations of the correct or best method.

The detailed programme of the workshop was along the following lines: Each new subject was introduced and its function explained. The builders were asked to describe the methods that they were acquainted with. Members of D.W. or others with specialised knowledge, added information where necessary which was also analysed. The most

Alternative methods which seemed most promising were selected, and the group moved to the practice yard where the ideas could be demonstrated and experience gained in (how each stage of the building should be done.) *Alternative methods which seemed most promising were selected, and the group moved to the practice yard where the ideas could be demonstrated and experience gained in (how each stage of the building should be done.) their implementation.*

In addition to basic building techniques, certain specialised subjects were dealt with, In this case, because Luristan has a high incidence of earthquakes, special attention was paid to the introduction of earthquake resistant features in building and the principles explained.

5.2 Site evaluation

It was explained that before positioning the building, one should find out whether there were any features in the site which might affect the type of structure or the future performance of the building. These could be simply investigated by observation, to note evidence of flooding, marshy ground, rubbish tips, the proximity of trees etc.; and by physical investigations, which basically meant

most widely used method of wall construction in the Selseleh plain.)

The builders remarked that in building these walls it was essential to remove all rubbish, plastic, cloth and organic material which, if left in would weaken the wall. This applied equally to other walling systems using earth.

b) Mud brick walls. It was agreed that these were better than the packed earth walls. They have greater compressive strength, but, the bricks used in Selseleh were not well made and were easily damaged by rain, snow and impact. The mud bricks made in Yazd were of greatly superior quality, at times achieving strengths which nearly equalled that of fired brick. By comparing the process in Selseleh with that of Yazd, a set of basic guidelines were established.

- 1) Ground soil, particularly that which has been used for agriculture, has organic matter in it, and should not be used.
- 2) The earth must contain no rubbish.
- 3) Earth must be soaked so that all lumps are dissolved.
- 4) Clay will crack during and after drying.
There must be at least 30% sand in the mix. *
- 5) Straw can be added to reduce cracking if there is a shortage of sand.
- 6) The mud for brick making must be thoroughly mixed before use.
- 7) Mud brick should not be used before it has dried properly. Where the clay content is high, the bricks must be dried in the shade gradually, and it will take longer.

* Different ratios of clay and sand will produce bricks with different properties which can be used advantageously i.e. More sand gives greater resistance to water damage, whilst more clay produces a stronger brick in compression.

These guidelines suggested that there was a great deal more skill involved in making the bricks than had normally been applied in Selseleh.

The way that bricks were laid in the wall could also be improved. There was very little bonding between the front and the back of the wall, and between each layer of bricks. In the event of movement, i.e. during an earthquake, the wall could easily crack. Exercises were conducted to ensure that everyone knew how to lay bricks properly.

A common habit in Selseleh was to build a wall which was part mud brick, on the inside, but faced on the outside, with fired brick, to provide protection against rain and to improve the appearance of the building. This method was extremely popular since the finished effect of fired bricks was achieved at a fraction of the cost. It highlighted a major problem which had to be explained and demonstrated. Mud bricks can only be laid with mud mortar: conversely, fired bricks cannot be laid with mud mortar as there is no adhesion. It is extremely difficult to tie these two materials together, and the likelihood is that the fired brick facing will peel off and collapse.

A variety of experimental walls were built, using different ways of bonding the fired brick into the mud brick. For each wall, the footings were dug out and flooded so that the wall collapsed to one side, in the process accentuating the behaviour of the two incompatible materials.

- c) Fired brick walls. Whilst fired bricks have greater strength than mud brick, it was pointed out that the mortar that is used to lay the bricks, and the way in which each brick is laid can make a great difference in the quality of the finished product.

Common faults in bricklaying were identified and, after discussing the reasons why, the correct method was demonstrated and practiced upon.

These faults included: 1) Using incorrect mortars. Various mortars were experimented with. To achieve a balance between cost and efficiency, a lime/Sand mortar was agreed upon as being satisfactory for most situations in Selseleh.

2) Bricks should be dipped in water before laying to improve adhesion.

3) Bricks were usually laid with no mortar between vertical joints. This practice lead to weak walls and was to be avoided.

4) The pattern that bricks were laid in seldom incorporated any proper bonding, either through the brick from one face to the other, or between one horizontal course and the one below it. The practice of filling in the middle of walls with broken bricks in order to save money was discouraged. The participants of the workshop practiced on various types of bonding patterns.

5) Because it was easier, a common practice was to build up walls at either end, and then fill in the wall between afterwards. This produced weak corners which fail in earthquakes, and the builders were encouraged to complete one course at a time.

Some of the builders knew how bricks should be laid, but had seldom bothered. It was stressed that, by taking care and attention at each stage of the building, the finished product would be of better and stronger quality.

d) Stone walls. Many houses in Selseleh had stone walls but these were usually of the 'rubble stone' type,

held together with mud mortar. Where cement or lime based mortars were used, the quantity of mortar was often greater than stone, producing extremely expensive walls. A skilled stone mason from the mountains south of Yazd was invited to come and talk about and demonstrate how stones should be used in wall building.

By first observing then participating, the builders could compare how they had been using stone with the way that was being demonstrated.

As in fired brick walls it was important with stone that the individual units should be laid so that there was proper bonding in the wall. There should be a stone laid through the wall to at least $\frac{3}{4}$ of its width every 1.5 metres. Larger stones should also be used round doors and windows and at all corners. Most of the builders had been accustomed to using stones unselectively. The stone mason showed them how to select a stone and position it so that it fitted as closely as possible into its position. In this way much less mortar was required and money would be saved.

In the period that followed the training workshop, one of the most noticeable improvements was in the quality of the stone wall building.

5.5 Renders

Because many of the walls used in Selseleh had poor resistance to rain, a number of experiments were carried out on different and improved types of rendering mixtures. By comparing these with the mixtures normally used, the builders selected several that they felt were applicable and could be easily used.

described the local method: placing poplar tree (Tabrizi) beams, usually three per metre, over which boards were laid. On top of the boards, cardboard was used to seal any gaps in the boards. This was covered by 15 cms. of compacted earth. Where money permitted, covering layers of cement, hessian and bitumen were used to provide a proper waterproof finish. The depth of compacted earth, which in the villages provided the waterproof layer, was not reduced when cement and bitumen were added on top.

The weight of such roofs was considerable. Suggestions were made to reduce the number of expensive large timber beams, and to use instead fewer main beams supporting smaller, and considerably cheaper, subsidiary beams. (Fig.4)

Two experimental roofs were built to develop and show this idea in practice. Wall plates were also used to tie the beams together and fix them to the walls. This was important in an area subject to earthquakes, since failure of buildings often occurred when the roof fell off the walls. (Fig.4)

Whilst the Selseleh region received considerable rain and snow fall during the winter, roofs were seldom laid with any slope. Drainage off the roof relied on piling up the earth on the roof at one end, which increased the weight and was not very effective. This could be simply resolved by laying the beams at a gentle slope, hence reducing the amount of earth needed and the consequent weight.

- b) Vaulted Roofs. The Iranian system of vault building with fired brick, mud brick or stone needs to use no shuttering during the construction process, avoiding a wasteful use of material.

DEVELOPMENT WORKSHOP

The Development Workshop is a team of architects, planners and researchers from a number of countries who work collectively on the development of indigenous building and planning methods in the Third World. Projects have been undertaken in African, Middle Eastern and Asian countries. Members of the Workshop believe that appropriate solutions to human settlement problems can be developed from indigenous methods which have evolved from and remain in the hands of Third World communities. The Workshop works in the field of rural and urban human settlements. The development of small scale construction industries, technical training and local participation are integral to the Workshop's approach.

John Norton is a founder member of Development Workshop.

3. Stimulation and improvement or establishment of
locally based materials or elements production

a) Luristan, Iran

b) Caspian, Iran

by

John Norton

April 1980

5.9 Conclusion and Continuation

The workshop was not seen as a finite process, but instead the beginning and establishment of an educational methodology which the builders could use to further develop themselves and their indigenous methods. This was based upon identification and problem solving, and by sharing each others knowledge. The process of discussion, practice and experimentation was carried over into the ordinary building work in the Selseleh Region.

The range of subjects and skills introduced in the workshop was broadened in the practical work that followed.

Because of the builders' improved capability, it was possible to devolve to them a large amount of the responsibility for the building requirements in the Selseleh Region. With this responsibility came the need to find more people to assist them in meeting the building needs of the area. Just over a year after the initial Builders Workshop programme, the original builders organised a second workshop to go over what they had learnt and to pass on the knowledge to a new group of trainee builders.

END

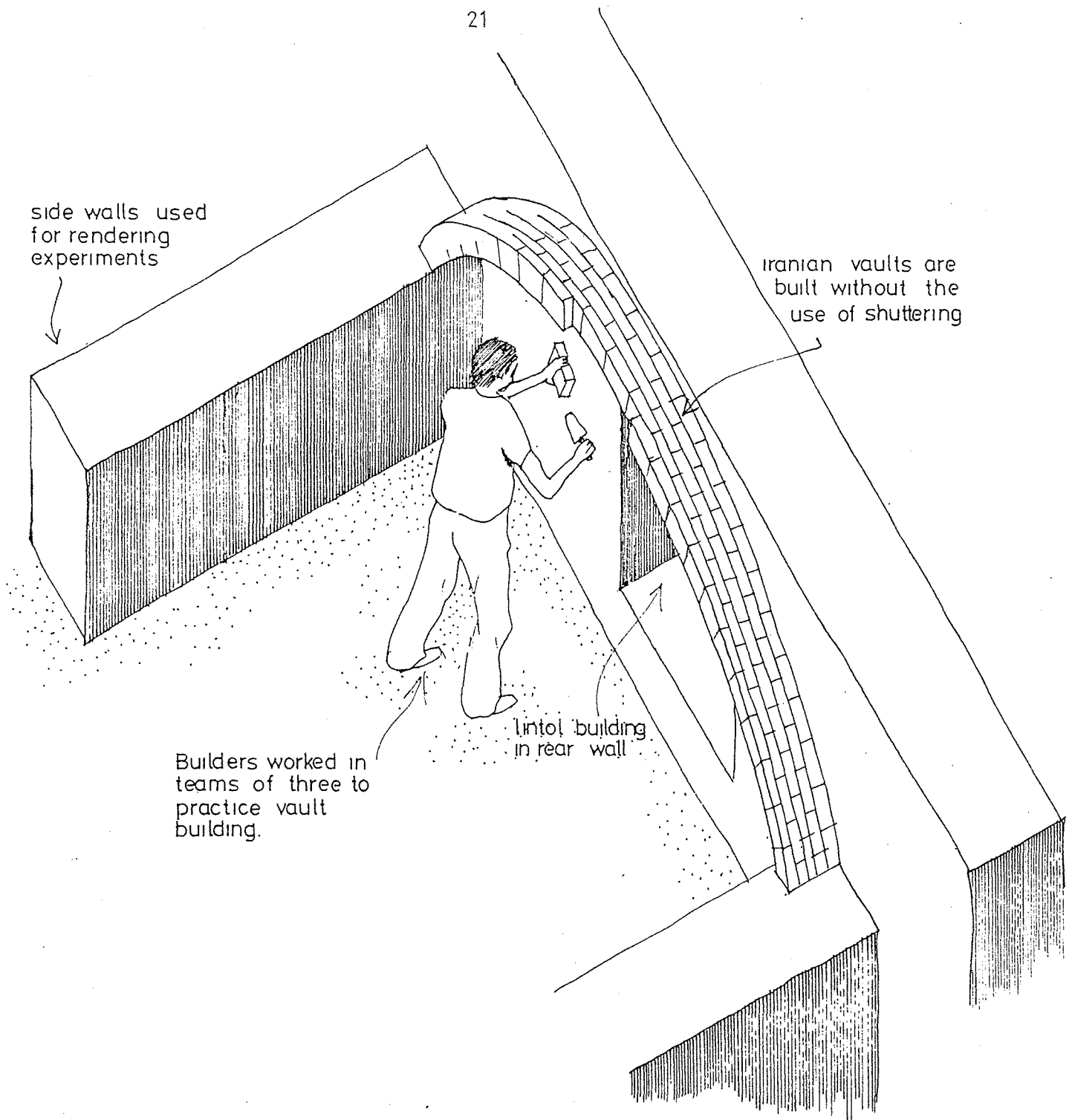


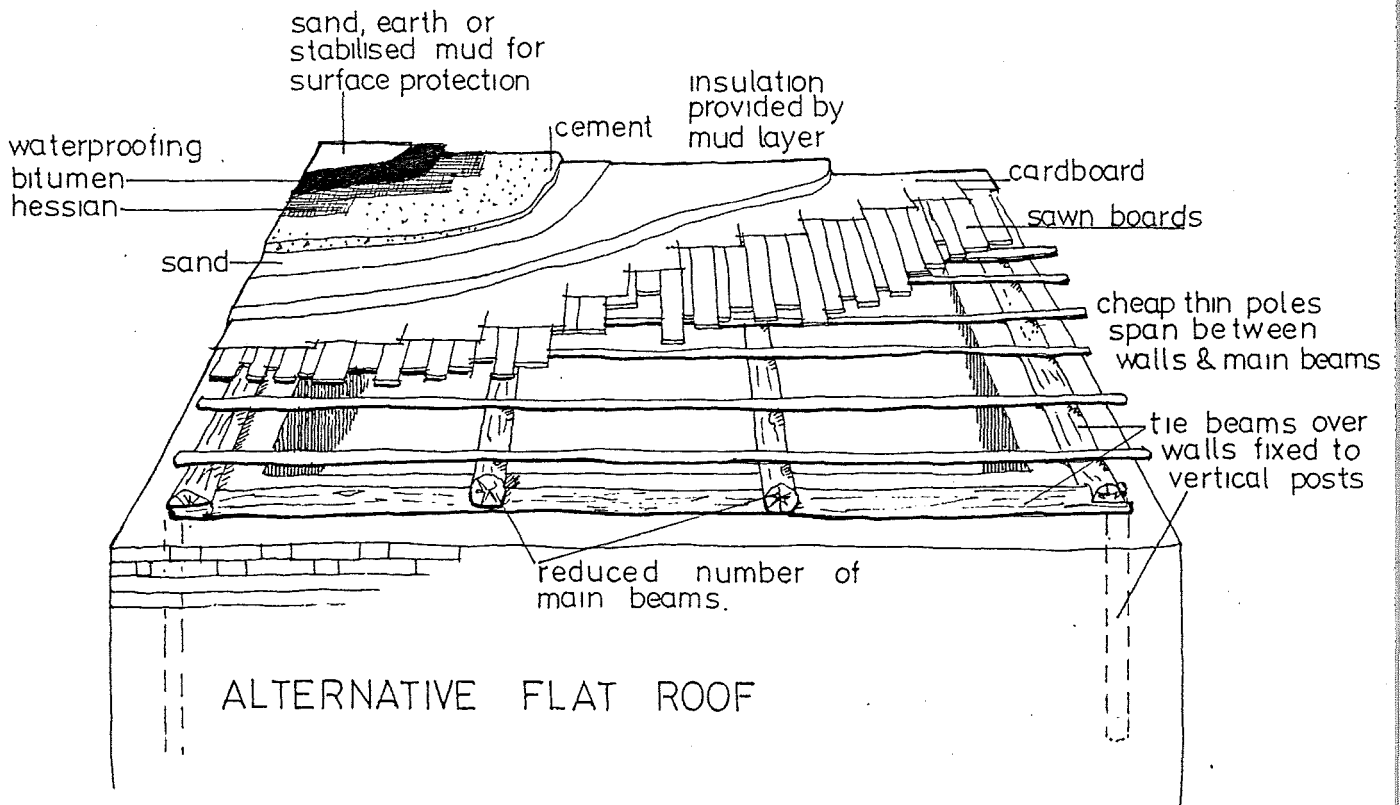
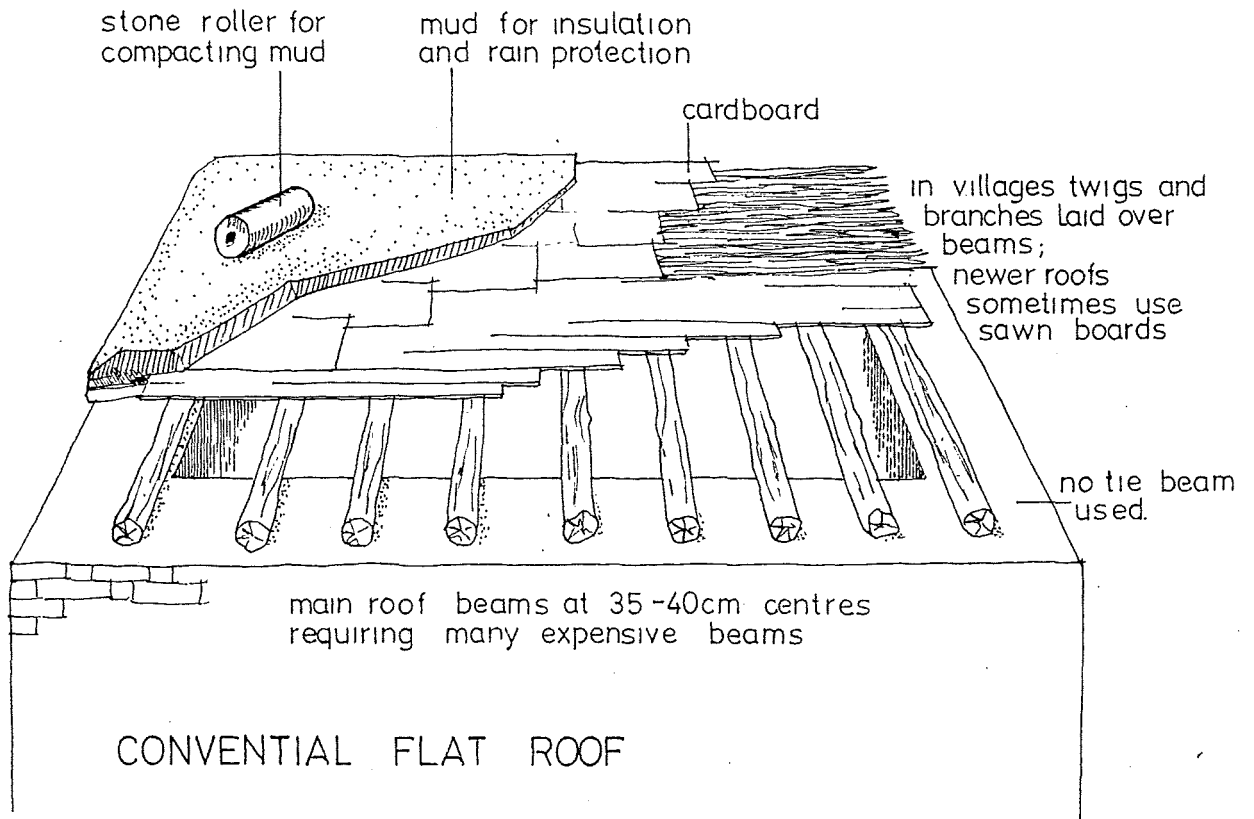
Fig 5 THREE METRE SPAN VAULT BUILDING
Each area was used for other practice exercises as well.

Because this type of roofing was particularly applicable to public bath and high fire risk building in Selseleh, but was no longer a local skill, the Yazd master masons, who were skilled in this technology, were asked to explain and teach the method of vault building. In discussion, the various spans and relevant wall thicknesses required to support vaults were explained, as well as the basic principles. Practice (Fig 5) was initially on small 1 metre vaults, from which the builders progressed to 3 metre spans. Visits were also made to various domestic and public buildings in Yazd, where vaults and domes are the most common roofing method. The builders could see a wide variety of spaces covered simply and efficiently. They requested that some of the more complicated vault systems should also be demonstrated, to allow them to compare these with the method they had learnt.

- 5.8 Towards the end of the workshop programme a series of discussions were held on various subjects related to Selseleh and to the organisational skills that the builders would need when operating independently in the future. The effects of earthquakes on building were outlined, and followed by ways in which the building could be made to withstand them. Many of the principles outlined during the workshop were involved in this: bonding in walls, positioning of openings, roof construction, but overall emphasis was put on always building with care and precision.

Discussion also covered the organisation of the workforce on the building site, ordering and estimating for materials and equipment, and costing and keeping records. These were all skills which would be developed further after returning to Selseleh to build.

Fig 4 FLAT ROOF EXPERIMENTS



Stimulation and improvement or establishment of locally based materials or elements production.

Iran: Luristan, Caspian.

The first case study, in Luristan, deals with the setting up of the kilns in the area, and with making use of local skills and resources to meet local needs. The emphasis is on providing job opportunities to supplement the existing agricultural economic base, as well as supporting the local building industry, and is seen as an essential part of the development of the region which was suffering from seasonal migration to the towns for work. The case study points out that the success of these industries depends primarily upon the acceptance and involvement of the local community, and that it is insufficient to set up production units without ensuring the participation of the people who are to operate it in the future.

The case study in the Caspian Region looks at the existing tile production industry, which is facing increasing competition from new materials, with consequent threat to jobs in the area. In this case the approach is to reorganise the processes involved in tile production, so that the production becomes more efficient and profitable. At the same time the essentially labour intensive nature of the production units is maintained to ensure that local employment opportunities are not lost.

Renders using bitumen and emulsifiers were the most acceptable, since the raw materials were readily available and both easy to mix and apply.

As an essential part of these experiments and the selection of the right materials for mud brick making, simple methods of soil testing were introduced. By placing a sample of the soil in a bottle or jar, adding water and then allowing the contents to settle, one could get a good indication of the type of soil, how much sand and how much fine silt or clay it contained. Having explained the proportions of sand to clay that were desirable for brick making, from this test the builders could decide whether the proportions needed to be altered.

5.6 Openings.

Discussion first of all dealt with the position of openings in a building, in relation to climate and earthquakes, and their function and then the methods for making lintels. These included timber and steel lintels; it was stressed that the material spanning an opening should extend well into the walls on either side. Various types of arched lintels were investigated, ranging from almost flat arches to semicircular, and different types of arch were built. One of the builders suggested a combination of wood and bricks which was also built producing an almost flat lintel. Practice also included making formwork with chalk for use in arch construction.

5.7 Roofs

Because the programme was geared towards the needs of the Selseleh Region, two types of roofing were discussed and developed upon.

a) Flat timber roofs. This was the standard roof of the region, used in nearly all building. The builders

THE SELSELEH INTEGRATED DEVELOPMENT PROJECT (S.I.D.P.)

The S.I.D.P. was set up as an experimental project to investigate and apply a policy of rural development based upon a concept of 'endogenous' or internalised development. This aimed for the improvement of living conditions within the project area through active participation of the community and by the use of local resources. The S.I.D.P. worked on the development of Health, agriculture and education and building, as well as the infra structure and creation of new job opportunities.

An essential part of the programme was the training of 90 'Front line Workers' in the fields of health, agriculture and education. Specific training was also conducted for other activities in the area. The trainees later took on the task of assisting the villagers in meeting their basic health, education, agriculture and building needs. The S.I.D.P. was based in 400 km² of the Selseleh Region of Luristan, western Iran. This is a high basin ringed by the Zagros Mountains.

The Development Workshop were the Architects and Planners for the S.I.D.P. from 1975-78.

3. Stimulation and improvement or establishment of
locally based materials or elements production

a) Luristan, Iran

by

John Norton

April 1980

fill a reservoir on the site. Later, because of agricultural demand, this water supply became too unreliable and it was necessary to dig a well. It would have been better to do this at the beginning.

Two updraught kilns were built, using the traditional design of the area (Fig. A.3), using oil for fuel, which was cheap (subsidised in Iran) and easy to obtain. The usual method of firing kilns in the general area is to have a small reservoir - 200 litres - from which a pipe supplies a drip feed into the firing chamber. This is difficult to regulate and inefficient. As the oil level drops, so the frequency of drips also decreases. Oil falls onto the floor of the firing chamber where it burns. In the new kilns a large fuel reservoir was built, providing enough head to introduce fuel into the firing chamber under pressure. This results in a finer distribution of fuel and more efficient combustion. The constant pressure from the reservoir makes the system easier to regulate and control.

Several problems hampered the smooth operation of these two kilns. Whilst the villagers had been enthusiastic about acquiring a source of income as an alternative or supplement to the local agricultural and animal husbandry potential, in practice they were nervous of committing themselves to the new kilns. Each time that temporary work was required, all the labour would disappear from the kiln, since they feared that they would not be employed in the fields again if they failed to turn up, and equally believed that, after the S.I.D.P. contribution and control was removed, the kiln would not support them financially, and there would be nothing else to turn to. This situation was unfortunately encouraged by one of the landlords in the village, who feared that his cheap supply



Fig A1

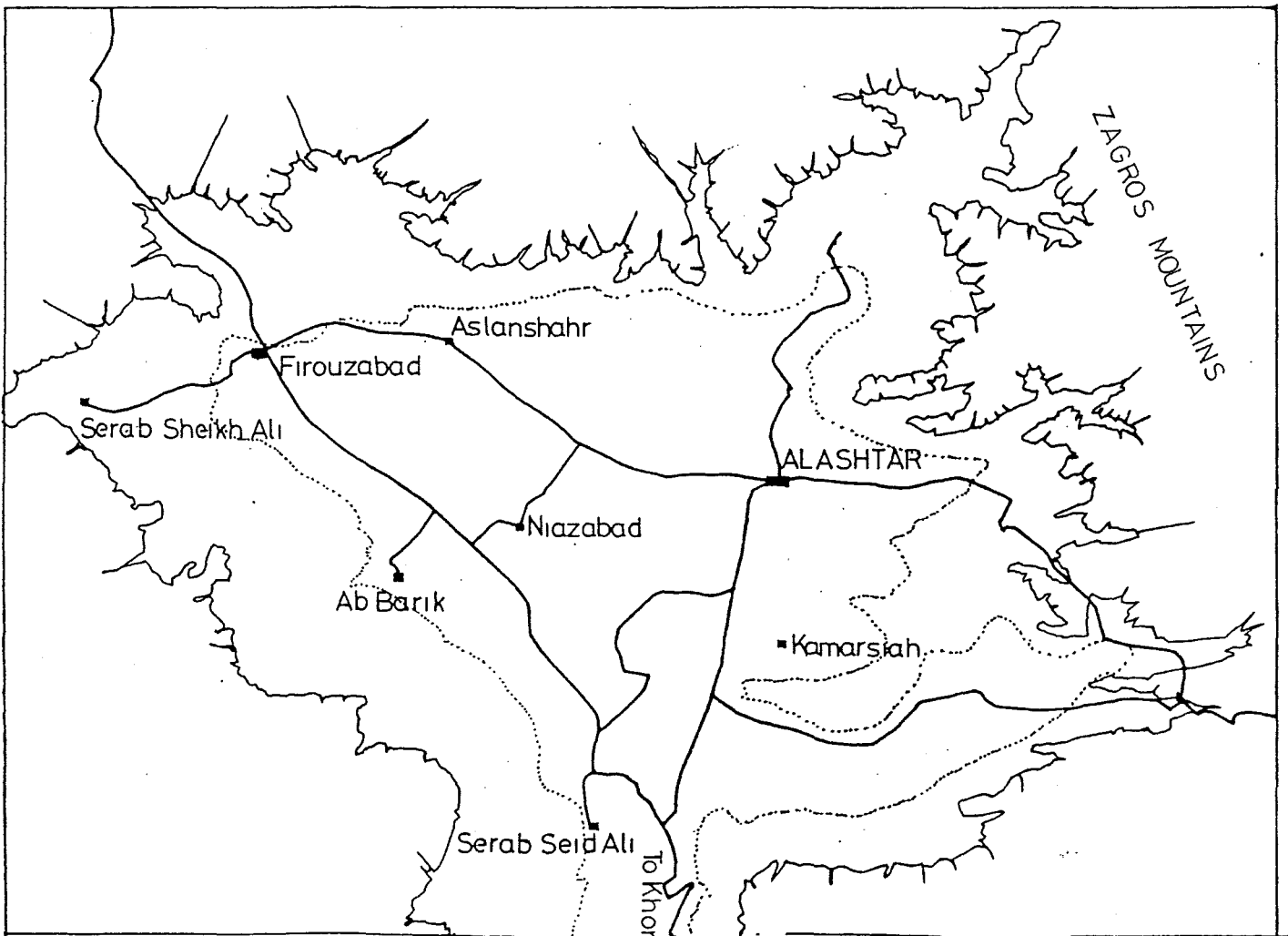


Fig A2 THE SELSELEH BASIN

in an unprocessed state; mud, timber, sand and some stone; and materials brought in from outside, most of which had been through some form of processing before arriving in the area; these included fired bricks, lime, cement, steel and some timber (particularly sawn timber.) Some of these materials had to be transported by truck for considerable distances and over extremely poor roads. The extra cost of transport was extremely high, and in the case of fired bricks which were normally brought from Malayer (see Map Fig. A.1), a distance of 200 kms, the transport cost was 100% extra on the cost of the bricks. Additionally, difficult road conditions, often in poor weather, made these deliveries unreliable. Nationally there were shortages of certain materials at various times (e.g. bricks or cement) which further hampered the possibilities of completing buildings during the dry period of the year when most building took place (May to October).

Within the Selseleh Region there were a number of natural resources, and the potential for producing more, for example by re-forestation. The natural resources included limestone, clayey soils, sand, plentiful supplies of water and scattered deposits of chalk. These materials formed the basis for providing a range of local building materials at low cost and that could be easily used by the local population.

A.3 Planning and village organisation

The first steps to be taken in setting up new or improved production industries were to find out what materials were available and what skills also available for the various processes that these materials required, and finally to find the best sites for setting up these industries. This depended upon the exact locality of raw mat-

erials, ease of access for collection and deliveries and the availability of people ready to participate in the new activity.

The still predominantly feudal structure of many of the villages in the area made the proper organisation of labour and management essential since the intention was to set up a system that would be devolved to the total control of the community after the initial setting up period by the S.I.D.P. This was closely linked to the other activities of the S.I.D.P. The trainee health, agriculture and education team, who were initially paid for by the S.I.D.P., would in future be paid for by the community that they served.

SERAB SHEIKH ALI

The relationship developed for the village of Serab Sheikh Ali (Fig. A.2) illustrates the broad principle.

In the village the three front line workers who had been trained by the S.I.D.P. were based in a collective building, providing a small clinic, teaching space and storage for agricultural items, such as seeds. Adjacent to this was a small experimental agricultural plot. The task of the front line workers in addition to their basic trained skills, i.e. health work, was to stimulate and assist local productive activities such as weaving, and to help in the establishment of public services in the village.

A brick kiln was also set up outside the village by the S.I.D.P. The kiln provided work for labourers in the village who owned no land and/or were working seasonally. The front line workers had organisational and financial responsibility for the kiln, whilst they were not actually in charge of its practical running. Profit from the

kiln pays for the front line workers, who are now in effect supported by the efforts of the village, and any extra profit is channelled into providing new required facilities, hence providing direct benefit to the whole community.

A.4 Kilns

After discussion with local builders in the Selseleh Region, it was decided that a selection of kilns should be set up to produce fired bricks, lime and chalk for building. One of the older builders had had some experience in operating a kiln in the past and there were remains of kilns in the area, around Alashtar.

Because the smoke from the kiln would pollute the air, locating it near to Alashtar, the regional centre (Fig.A.2) was decided against. In addition, Alashtar was also attracting more investment and therefore more job opportunities, whilst in part the aim of the small scale industries programme was to provide better opportunities in the villages.

Several sites were visited to find out their suitability for setting up a kiln and to see whether the roads leading to them could be used by small lorries. Soil samples were taken at each site and tested to see whether they were suitable for brick making. After a basic selection, second visits were made to chosen sites to discuss with the locals the availability of water and who would be interested in working at the kiln if it was set up.

Finally, for the first kiln, the village of Kamarsiah (Fig. A.2) was chosen. Water to the kiln site was available in an open channel on a shared basis with the needs of the agricultural land nearby. This water was used to

SMALL SCALE INDUSTRIES

Contents

A	<u>Seleleh, Luristan, Iran</u>	
A.1	Introduction	Page 1
A.2	Existing supplies and resources	1
A.3	Planning and village organisation	2
A.4	Kilns	5
A.5	Woodworking and metal working	8
A.6	Conclusion	9

Illustrations

Fig. A.1	Location of Selseleh in Iran	Page 3
A.2	The Selseleh Basin	3
A.3	Kiln in Kamarsiah	7

STIMULATION AND IMPROVEMENT OR ESTABLISHMENT OF LOCALLY
BASED MATERIALS OR ELEMENTS PRODUCTION

A SELSELEH, LURISTAN, IRAN

A.1 Introduction

As an inherent part of providing means to achieve appropriate building solutions and methods where local builders and the population in general have control over the provision of the shelter needs, it is not sufficient to simply ensure that there are people capable of meeting these needs, and that they are conversant with a range of different requirements and solutions. Trained builders and artisans (see Builders Training Workshop Case Study), must be backed up by a variety of production units providing those elements and items which are not available in a natural state locally. This covers a wide range of activities. The case study of this aspect of the work carried out by the Selseleh Integrated Development Project (S.I.D.P.) in Luristan, Iran (see S.I.D.P. introduction), is a useful example of some of the things that can be done and some of the problems that one can expect to face in their implementation.

One of the aims of the S.I.D.P. was to make as much use as possible of the locally available resources, and at the same time, create more and alternative job opportunities, thus strengthening the economic base of the region. This approach covered agriculture and handicrafts as well as items more directly related to the local building industry.

A.2 Existing supplies and resources.

At the time that the S.I.D.P. programme was set up, the use of building materials fell into two basic categories: materials immediately available in the region, used largely

Alashtar for the village public baths. All the work was done in a metal working shop run by the S.I.D.P., using local apprentices. Apart from the cheaper cost, the main advantage over the old boilers was that in future any repair and maintenance work could be done locally. This same workshop also built a number of solar collectors, developed for use heating water on the village public baths.

In Alashtar there was also a small vocational workshop equipped with carpentry machinery, but which had no practical work to do. At the same time, wooden doors and windows were brought from Khorramabad, the provincial capital. It was logical to give this work to the school, who were then able to get practical experience whilst the joinery needs in the S.I.D.P. assisted buildings were met locally. More elaborate work was undertaken as their skill increased.

A.6 Conclusion

Although the potential resources existed, it was often difficult to establish new industries where there had been no background in this type of work. It required considerable guidance and encouragement, after the initial setting up process, to develop the confidence needed for successful future operation. In this respect careful use of human resources was far more important than the use of material resources. It would have been insufficient to consider the programme purely in terms of providing the capital and basic skills needed to start up a production unit.

END

of labour was being eroded.

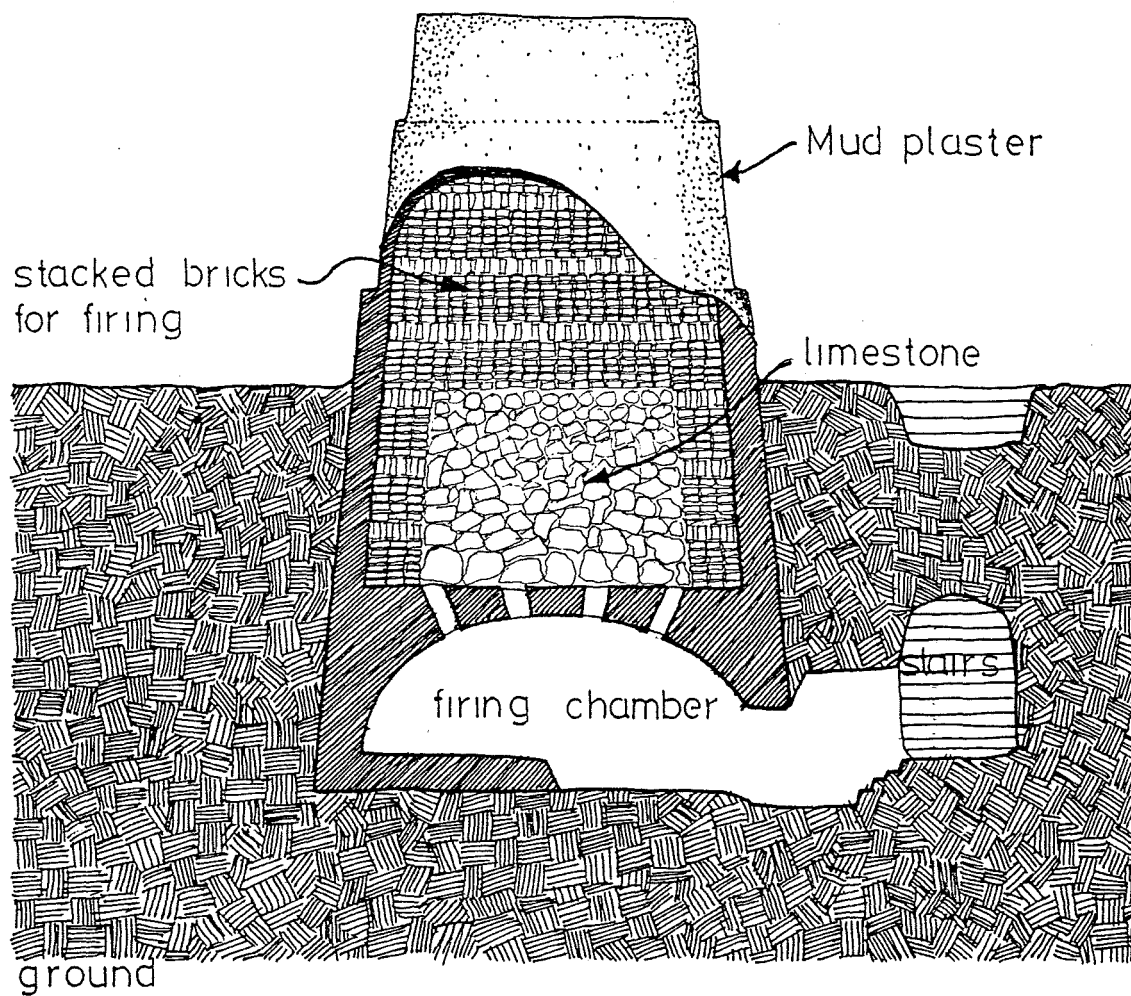
Because the workers on the kiln were constantly changing, it was difficult to develop a team who could operate responsibly and carefully. This resulted in poor quality and productivity: the soil on the site was suitable for fired brick production but occasionally contained small lumps of lime which had to be removed. The process for removing them was simple (by sieving and sedimentation pits) but was often not performed rigorously. Batches of bricks were produced with lime in them, and were therefore unusable. Without improvement in the quality of production, the kiln would in effect not pay for itself, and the fears of the villagers would be justified. To avoid this and to allow confidence to develop that the kiln was of value to the village, one of the kilns was switched to lime production, using limestone from adjacent hillsides. This was a very much easier process, required much less skill and the product was guaranteed to be saleable.

Problems varied between villages. The brick kiln set up at Serab Sheikh Ali was more successful than Kamarsiah, and was largely a reflection of the attitude held by the people in the village towards a scheme of this sort.

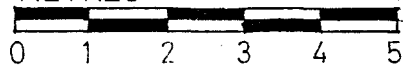
A.5 Woodworking and metalworking

Public building in the Region generated new needs and possible productive activities. Previously, the existing public baths in the area used boilers made elsewhere. With the building of new public baths the possibility developed for making boilers in Alashtar, which would save money and help the small metalworkers in the town. Based on a prototype brought from Hamadan for the first public bath, several hot water boilers were built in

Fig A3 KILN IN KAMARSI AH



CUT AWAY SECTION
METRES



3. Stimulation and improvement or establishment of
locally based materials or elements production

b) Caspian, Iran

by

John Norton

April 1980

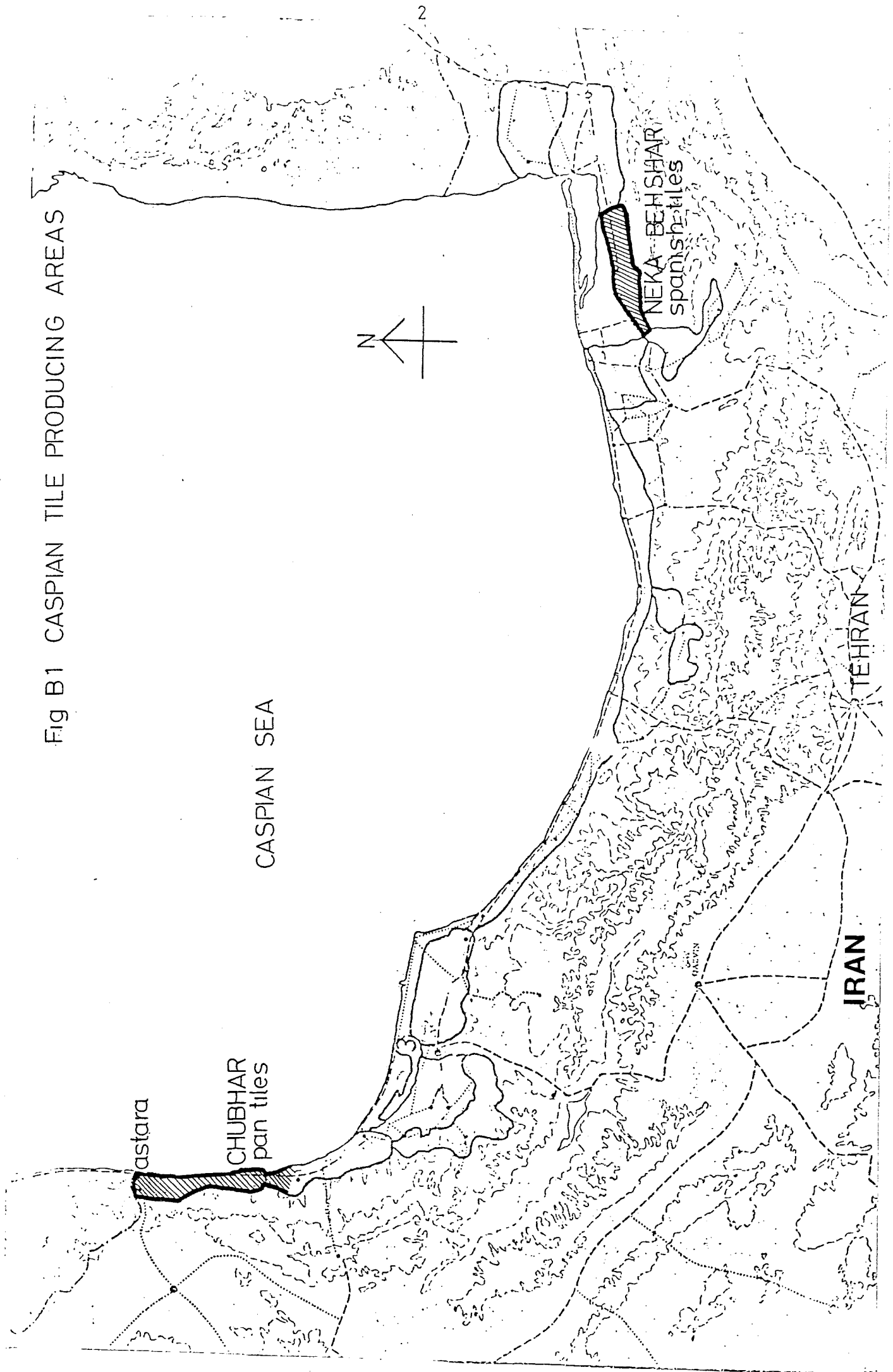
B CASPIAN

B.1 Introduction

Small scale industries in the Caspian Region of Iran (Location Fig. B.1) play an active part in the economy of the region. Small workshops and kilns are scattered throughout the area, processing timber into component parts for buildings and producing tiles for roofing. Brick kilns are less common nowadays but have been replaced by the viable activity of producing cement blocks. Nearly all these industries are catering for local demand, and are extremely susceptible to changes in the local economy and building methods. These are an important factor in understanding the condition of building material industries in the contemporary situation of the Caspian.

The traditional pattern of building in the Caspian Region makes good use of materials which are available in the immediate locality of the building. This means that there are a very wide range of different building types and materials, and material production sites have consequently catered for quite a small market area. Much of the local building was done by owner-builders and village assistance. Labour was usually paid for in kind, in terms of providing meals during the building process and helping your neighbour in turn when he required assistance. Two notable changes have occurred in recent years: people have changed over to the system of paying money for labour, with an increased awareness of the amount of time involved in building resulting from this, and two materials which are widely regarded as being long lasting and relatively maintenance free, concrete block and galvanized sheet metal imported from outside the region, have been introduced into the area, and are generating a more unified style of building throughout the region. Of all the production sites that are flourishing, small yards employing 2 or 3

Fig B1 CASPIAN TILE PRODUCING AREAS



SMALL SCALE INDUSTRIES

Contents

B Caspian

B.1	Introduction	Page 1
B.2	Roofing - change and effect	3
B.3	Pan tile production	4
B.4	Improvements	8
B.5	Conclusions	16

Appendix 1.	Notes on proofing materials comparative costs chart' and 'roofing materials comparative costs'.	17
-------------	---	----

Illustrations

Fig. B.1	Caspian tile producing areas	Page 2
B.2	Pan tile	5
B.3	Soil classification - mechanical analysis	7
B.4	Tile kiln, Chubhar, Gilan	9
B.5	Tile production unit, Chubhar	11
B.6	Traditional tile production system organisation	12
B.7	Improved production system	13
B.8	Improved tile production system organisation	15

men to produce concrete blocks are the most common and successful. The more traditional materials, such as tiles for roofing, are often being spurned for the attractiveness of the new materials which are often somewhat erroneously believed to be longer lasting and maintenance free.

During the summer and autumn of 1978 Development Workshop conducted an extensive survey to ascertain what the condition of the rural building industry was in the area, what problems it faced and what could be done about it. The results of this survey, produced certain conclusions:^{*1} amongst which certain of them relate directly to the choice of building material and the methods by which those materials are produced and used.

B.2 Roofing - Change and Effect

The cost of roofing with galvanised sheet metal was, in 1978, an average of 10% more than the cost of roofing a similar space with 'Spanish' or 'Pan' tiles in the areas within which these latter materials are produced. ^{*2}

The life span of the sheet metal was no greater than the tiles, and the maintenance requirements were in some cases more. The 'Pan' tiles produced in the Astara region required practically no maintenance. Furthermore, people living in houses roofed with sheet metal, whilst admitting that the material had a prestige value, pointed out that their roofs were poor insulators, transferring extremes of temperature to the interior rendering them unsuitable

^{*1} Produced in full in: DARAIE. M.R; CAIN. A; NORTON. J; AFSHAR. F; INDIGENOUS BUILDING OF THE CASPIAN REGION Tehran, Iranian Institute for Peasant & Rural Studies 1979. Limited Edition. 457 pages. Text, illustrations.

^{*2} See Appendix 1 for comparative costs of roofing materials in Caspian Region.

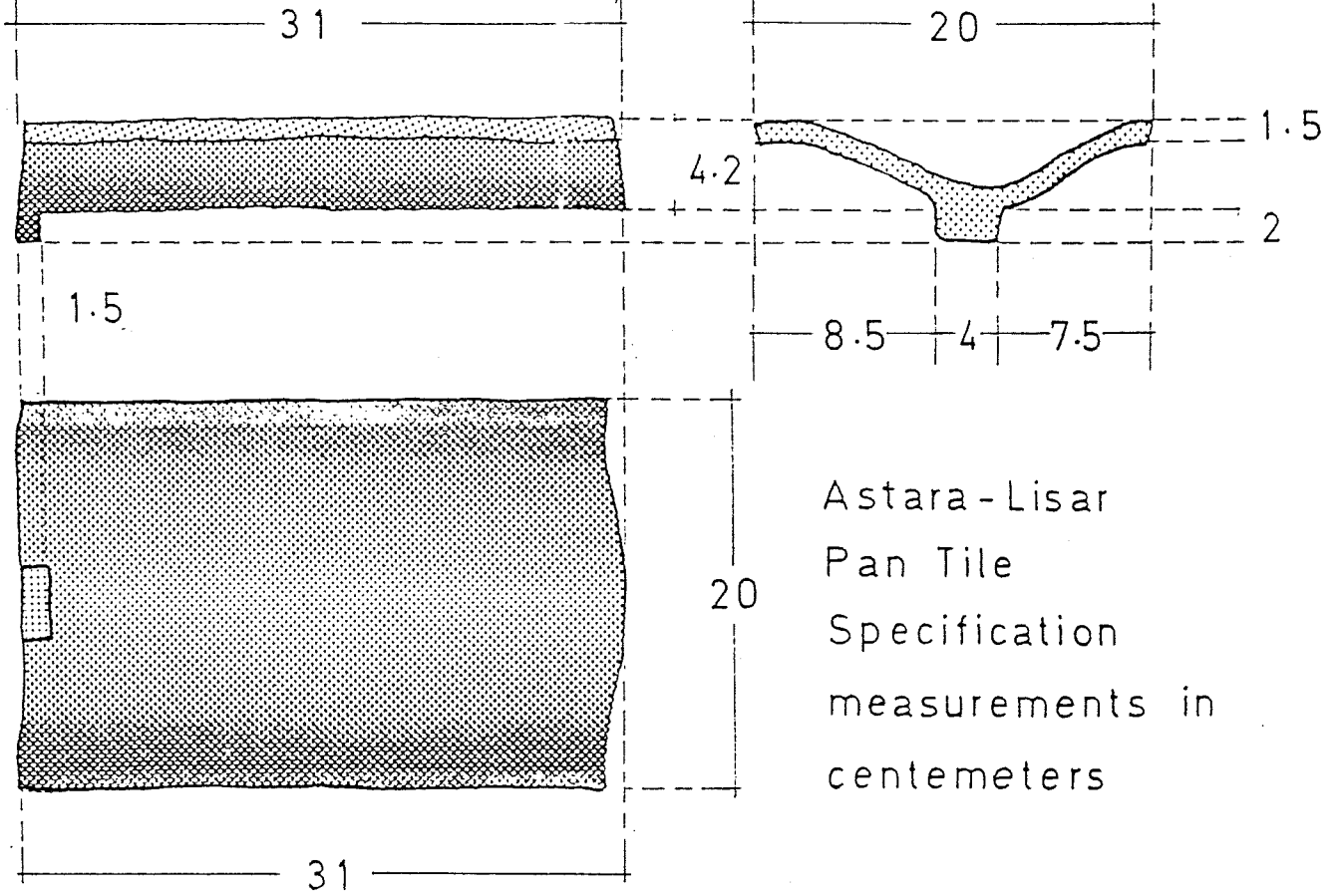
for food storage, a popular practice in the houses with tile or thatch roofs found in the area. They also complained that the metal roofs were poor accoustically and that during rain storms the noise on the roof was considerable. Weighed against this were the attractions of prestige and the relative simplicity of putting up the sheet metal roof.

The conclusion drawn from this was that, albeit there are advantages in using tiles or thatch, the sheet metal roofs are gaining in popularity and use.

This has had the effect that tile kilns which previously operated at a small profit, in losing custom, have ceased to be economical and have gone out of business in all areas except for the kilns around Astara. In consequence, job opportunities have been lost, forcing people to migrate to other areas, local resources are not being used, and valuable capital is being spent outside the region, instead of stimulating and circulating within the local economy.

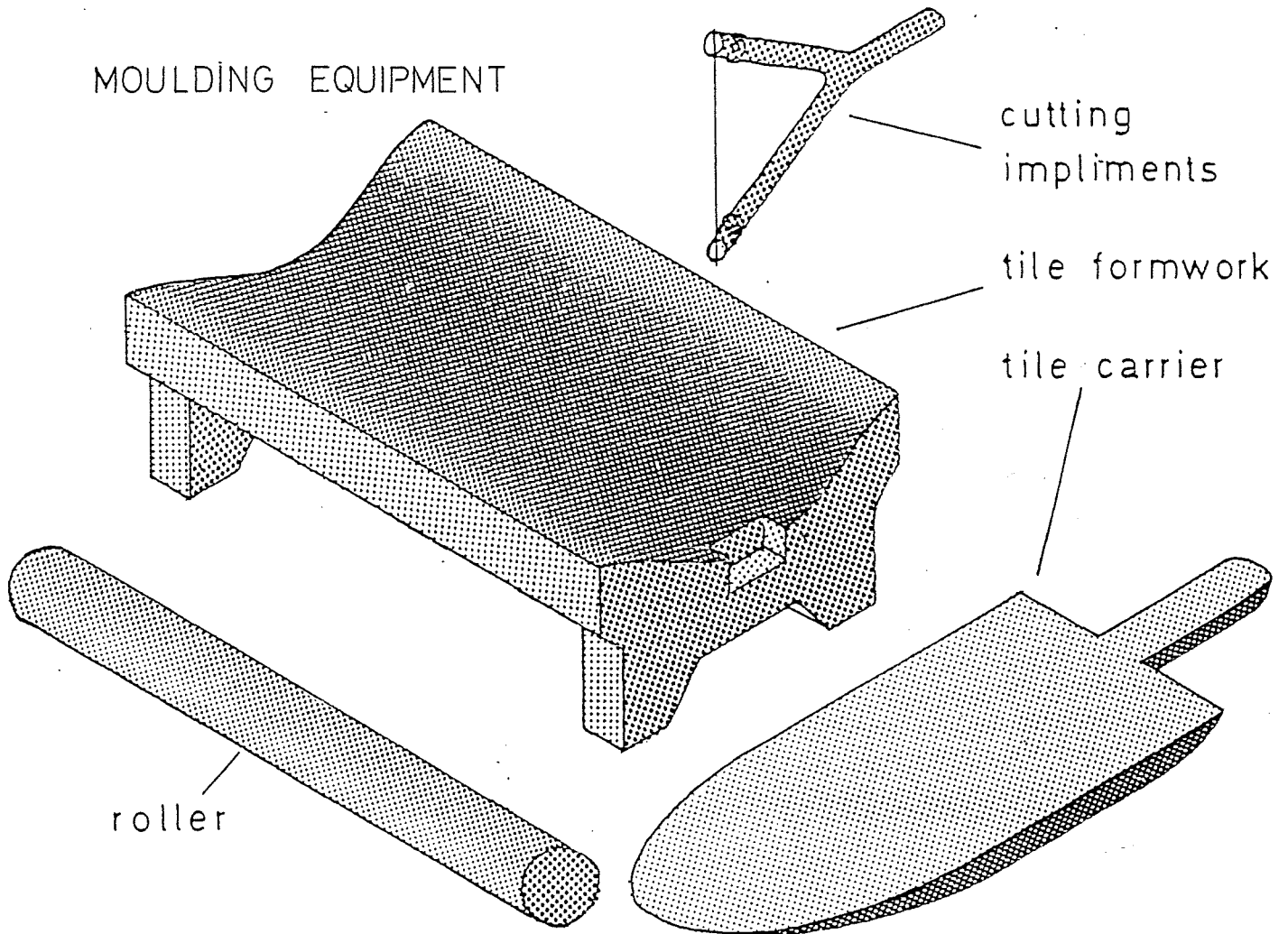
Of the different tile producing areas, it was concluded that for the Neka/Behshar area the market still existed for tiles, if they could be produced at lower cost, and that in the Astara area the tile industry, whilst still being active, could greatly improve in terms of efficiency, and by lowering the costs, could cater for a wider market area. In both cases the existing processes were not making full use of their potential.

- B.3 'Pan' Tile production. Chubhar, Gilan (Astara Area).
The tile kilns in the Astara area produce a 'Pan' type tile, measuring 31 x 20 cms, with a shallow 'S' shaped profile. (Fig. B.2) They provide a good coverage on



Astara - Lisar
Pan Tile
Specification
measurements in
centimeters

MOULDING EQUIPMENT



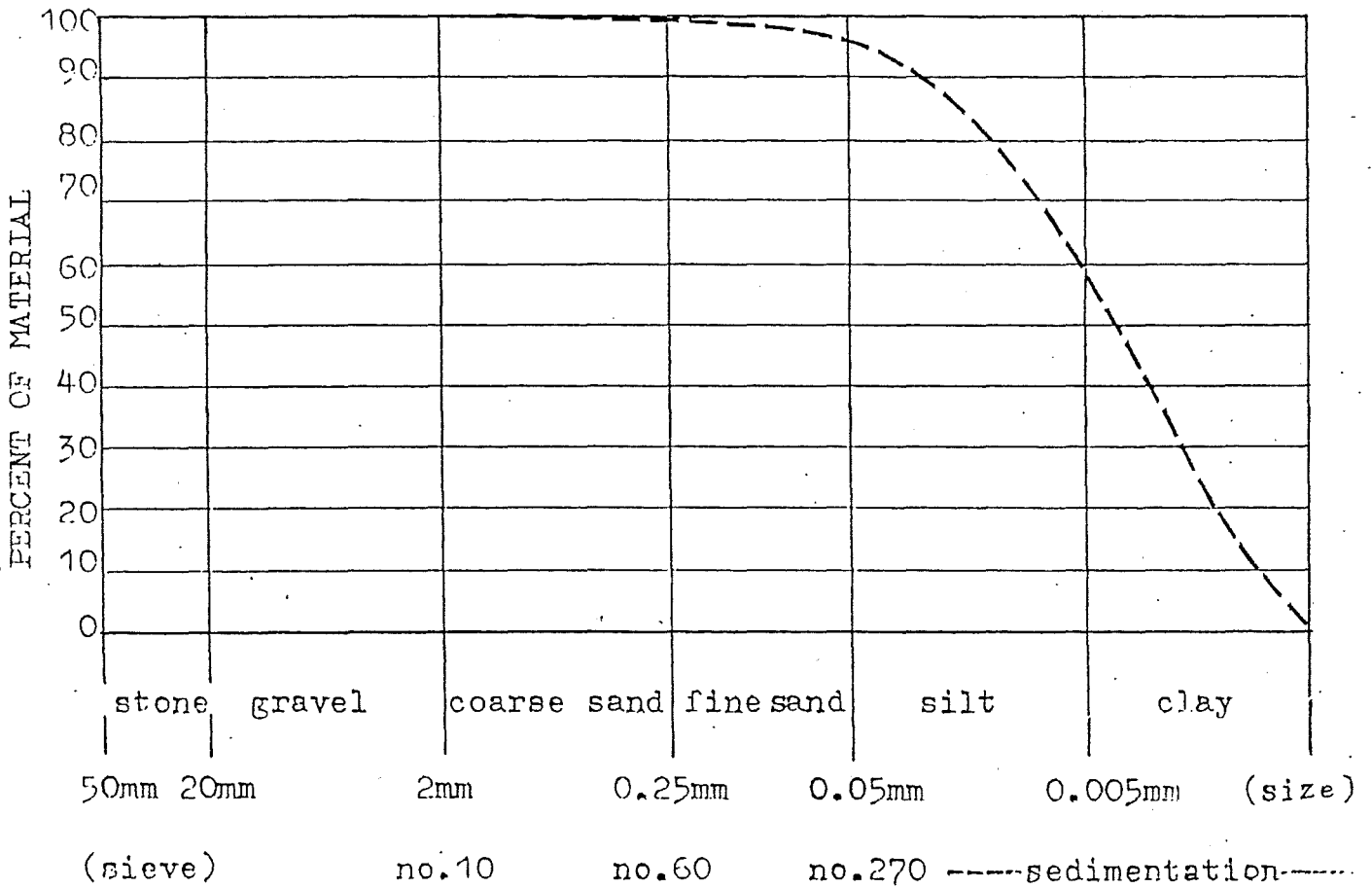
the roof with a minimum amount of overlap between tiles. Because this is a single lap tile, its weight is relatively less than the double lap tiles used in the Neka/Behshar area, and the roof structure required to hold it up is less.

The existing process of making tiles in the Astara area is highly labour intensive process. The kiln described in this case study at Chubhar, employed 5 people. One man ran a horse driven clay mixing mill, where clay, after soaking in water, is mixed until it has the right consistency for moulding into tiles. Clay comes from nearby. (Fig. B.3) This mixed clay is delivered to the moulding and drying sheds. These sheds are low covered structures which provide shelter from direct sunshine and rain, but which allow air movement through the shed which is important in the drying process of the formed tiles. In the centre of the drying shed is a space set aside for the moulding of the tiles. An assistant takes the clay which has been brought from the mill and forms it into lumps, each lump sufficient for one tile, and then rolls it flat. The tilemaker cleans his shallow wooden mould and sprinkles sand over it to prevent sticking. The clay is pressed into the mould with a wooden roller, and extra clay is trimmed off round the edges. The mould and clay are turned over onto a suitably shaped platter, which the assistant uses to carry the tile to the drying racks. The drying sheds surveyed could hold more than 9,000 tiles. Drying takes 2 to 3 weeks. When the tiles have dried to about 10% moisture content and are rigid they are ready for firing. Loading the kiln takes one day, firing another four, and a final day for unloading. About 700 tiles are produced by a team each day. About 7,500 tiles can be fired in a week, In this kiln there were two teams of men moulding tiles.

Fig B3 ⁷ MECHANICAL ANALYSIS OF SOIL
 LOCATION: Chub-bar , Gilan, Iran

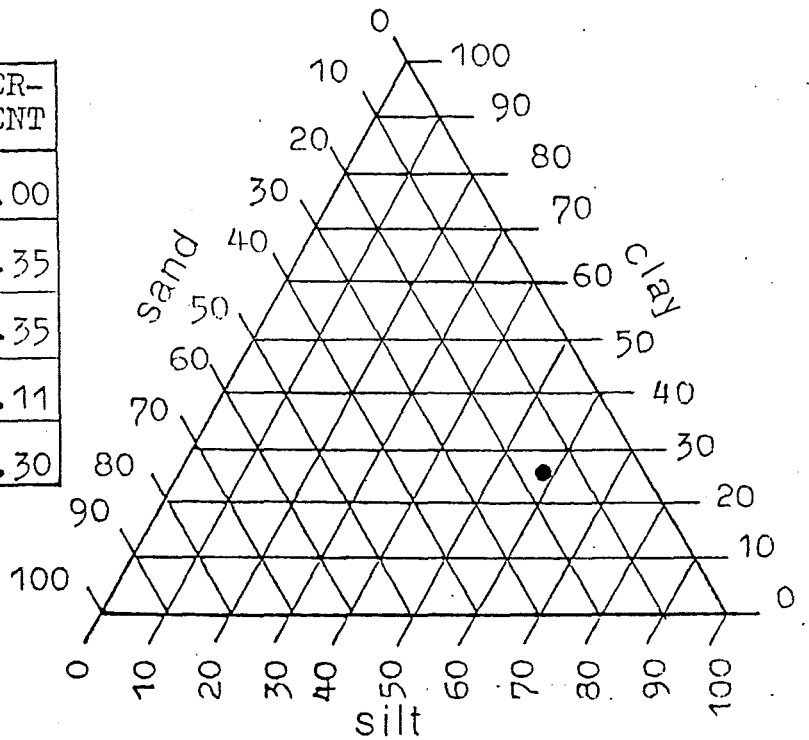
SITE: tile-kiln

DATE: Granulometric Chart



Particle Gradation

PARTICLE	mm SIZE	no. SIEVE	PER-CENT
Gravel	+2	10	0.00
Coarse Sand	+.25	60	0.35
Fine Sand	+.05	270	14.35
Silt	-.05	270	59.11
Clay	.005	sed.	26.30



Soil Classification:

Clay-Silt

Classification Chart

Tile moulding is contracted at a rate of 4,000 Rials (Iran) (approx. US\$ 60 at 1978 rate) per thousand to the master who is responsible for the skilled work of actually moulding the tile. He in turn pays a daily salary of 500 Rials (approx. US\$ 7 in 1978) to the worker operating the clay mill and 600 Rials (US\$ 8.5 in 1978) to his moulding assistant.

The kiln is fired with wood and costs about 5,000 Rials per firing (US\$ 70 in 1978). (Fig. B.4) At the time of the survey tiles were marketed at a cost of 9,000 Rials (US\$ 130 in 1978) per 1,000 tiles. Rapidly increasing labour costs have raised tile prices in the previous 3 years from 3,000 Rials per 1,000 (US\$ 40) but the tile is still competitive with other roofing materials and is favoured in the area.

Tiles are only produced over a 6 month period (Summer). In winter the atmosphere is too damp and tiles will not dry enough to be ready for firing.

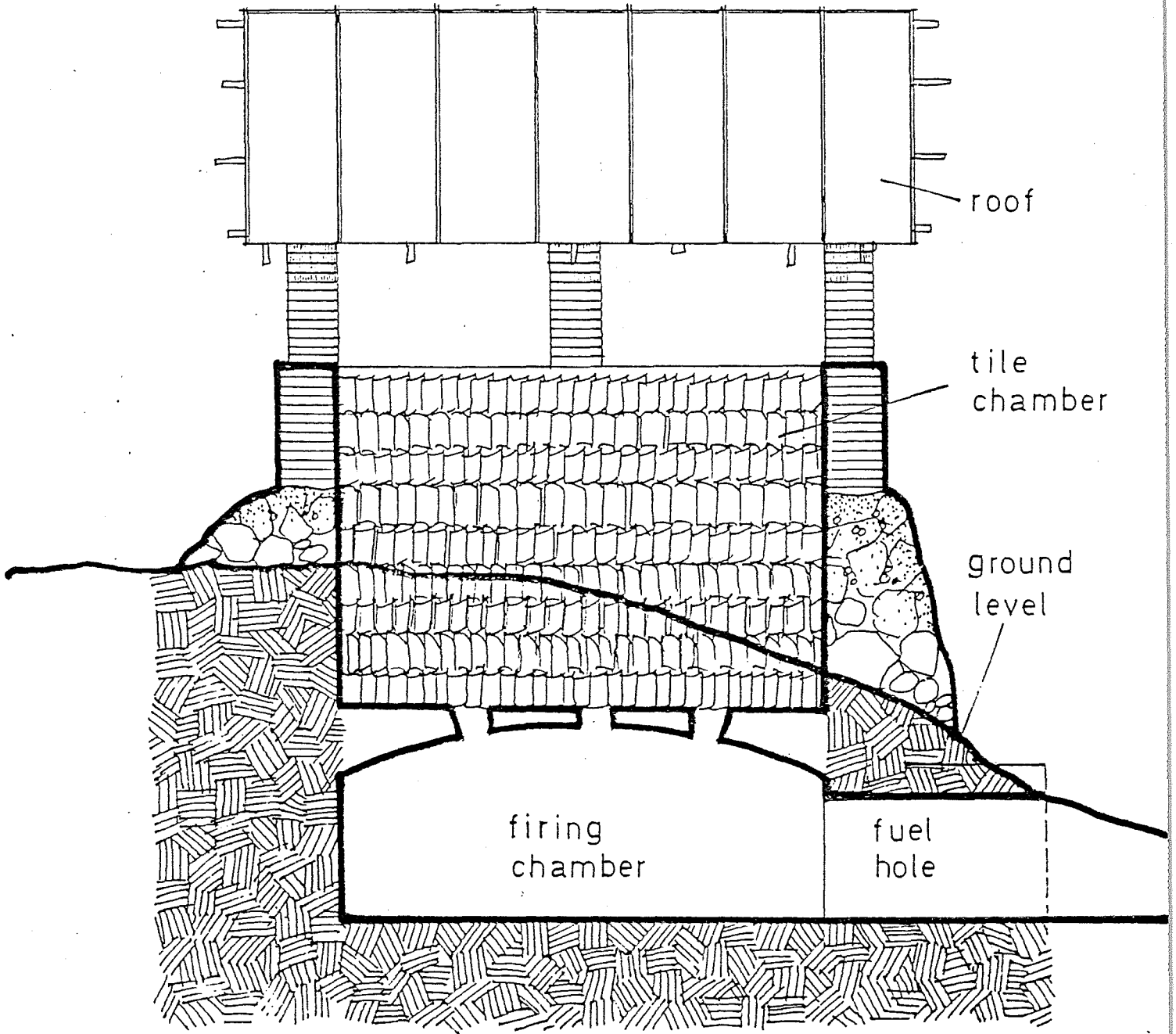
B.4 Improvements

It was possible to propose various improvements to the production in the area. However, it was essential that, whilst efficiency needed to be improved if the tiles were to remain competitively priced, any alteration to the present system had to be at minimum cost and without removing employment generating component in the industry. The kilns in the area were all labour intensive and labour was a significant item in the running costs of the kilns.

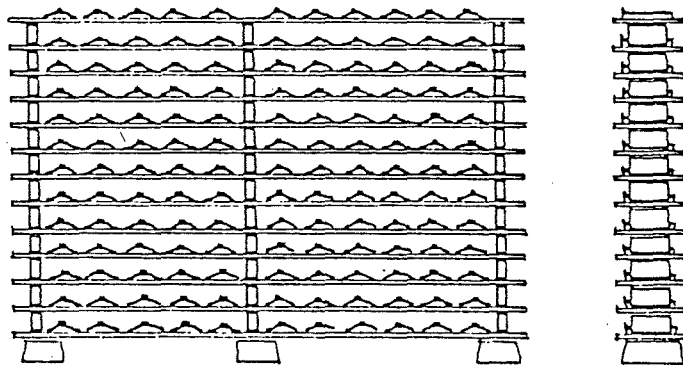
The capital costs involved in introducing mechanisation into the process were regarded to be too high for the small production yards in the Caspian, although mechanical moulding and mixing would have greatly increased the output.

Fig B4

9
Tile Kiln - section
Chubhar , Gilan



Tile Drying Racks



There would also be a degree of centralisation into larger production units, which would in the long run cease to be an important source of rural employment.

Rationalization of the tile making process was regarded as being the best approach, without destroying the employment generating potential.

It can be seen from the plan of the Chubhar kiln (Fig. B.5) that the positioning of elements; work areas, drying racks, and kiln; are in a random fashion. A great deal of time and labour is spent transporting clay to the work area, and the tile to the drying racks and then to the kiln. Additionally, because the firing process requires several days for unloading and cooling, tiles cannot be fired continuously. Also, because of the intermittent nature of the firing process, requiring periodic labour inputs, there is little specialisation of the production activities. (Fig B.6) It was proposed that the production method could be rationalized by improved site organisation and better management of labour.

Fig. B.7 shows the proposed layout for an upgraded tile production site in the Chubhar area. Two kilns, fired alternatively, are used, so that tiles are being constantly burned. Elements such as the clay mill and drying racks are positioned so as to cut down transportation distances. The same production method as already exists is retained, being directly related to employment. However, a high degree of specialization means that the tile-moulder or his assistant need not leave their work periodically to help load or unload the kiln. A new specialised role of kiln keeper is created; he has the skilled task of supervising the laying of the kiln and maintaining the firing temperatures. He has an assistant

Fig B5

Tile Production Unit
Chubhar, Gilan

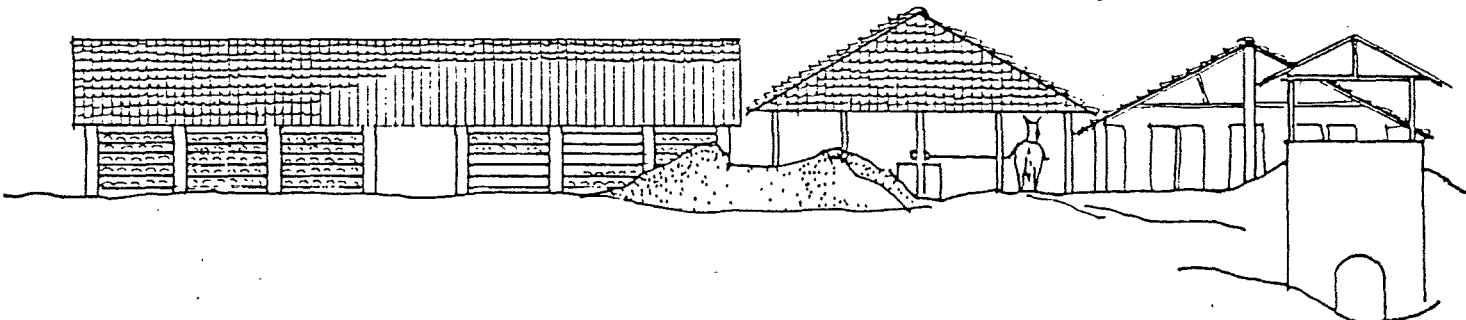
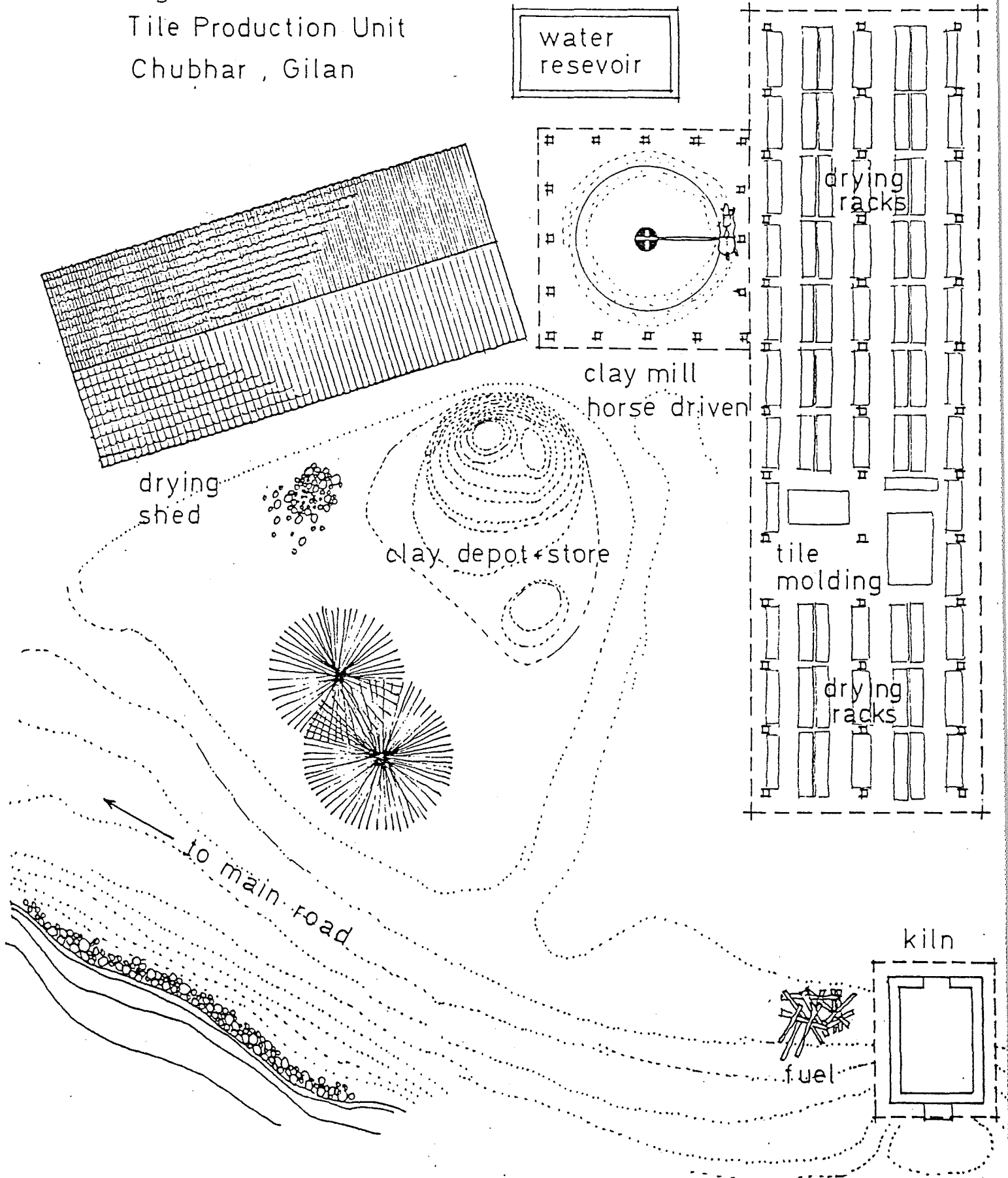


Fig B 6

Traditional Tile Production System

From the Chubar Kiln

(Output 7,500 tiles per week)

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Wage in Rls.
Kiln Schedule	|	f	.....	.....	▶	c	u	|	f	.....	.....	▶	c	u	
Tile Maker 1	|	f	Moulding				m	|	f	Moulding				m	1500
Assistant 1	|	f	Stacking				u	|	f	Stacking				u	600
Tile Maker 2	Moulding.....▶							.....▶							1500
Assistant 2	Measuring and Stacking.....▶							.....▶							600
Mill Worker	Milling.....▶						u	Milling.....▶						u	500
Total Labour Cost														4700	

| Loading Kiln

u Unloading Kiln

f Firing Kiln

m Moulding Tile

c Cooling


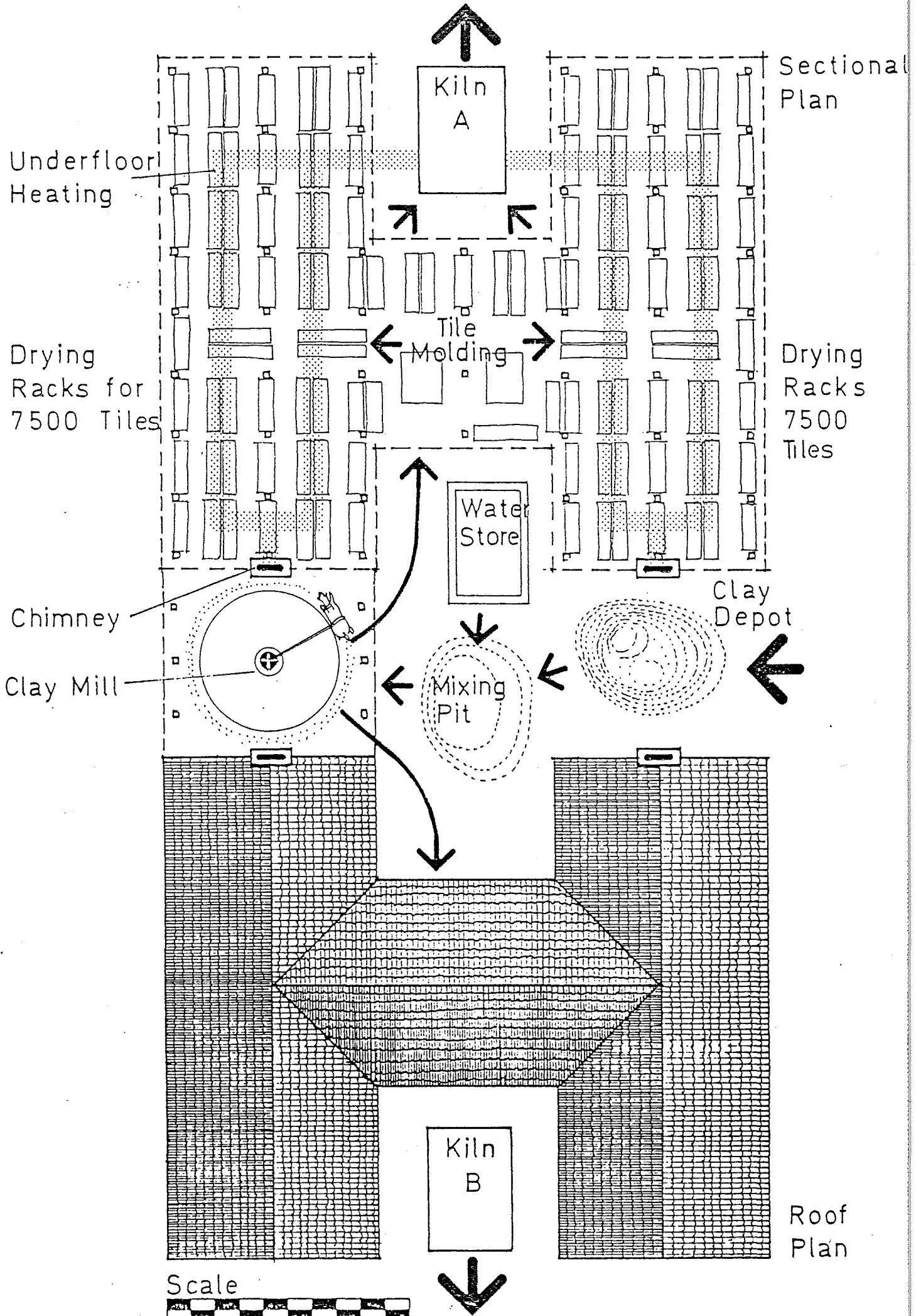
 Holiday

Fig B 7 IMPROVED PRODUCTION SYSTEM



who also helps work on the mill on the days that there is no work in the kiln. (Fig. B.8) With the present firing and production methods, this alteration results in an increased efficiency of about 27%.

It was also suggested that the exhaust heat from the kilns could be used for pre heating and drying tiles before being put in the kiln. About 30 - 40% of the heat generated in the kiln and the kiln structure is lost to the atmosphere in cooling after the firing period. By channelling this exhaust and waste heat under the drying area, the drying process could be improved.


The major effect of this would be to increase the period of tile production from the present 6 months to nearer twelve, hence doubling production. It still remains to be seen whether the market demand in the area will justify this extra production.

Alternative fuels to timber are also available, but oil, to which the kilns can be easily converted, is rising in price in Iran as elsewhere, even though its use is subsidised. An immediate improvement to the present system was suggested: Normally, the timber used in the kiln is left out in the open before use, and still has a high moisture content, of 25% or more, being freshly cut. It was suggested that a covered storage area should be introduced, which would allow the timber to dry. Air dried oak, has a moisture content of 12-15%, as opposed to the 25% content in timber used now. Drier wood produces more heat per cubic metre, with corresponding reductions in the quantity of wood being burnt.

Labour Organization and Kiln Firing Schedule

(Output 15,000 tiles per week)

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Daily wage in rials
Kiln A	|	f.....			→	c	u	|	f.....			→	c	u	Daily wage in rials
Kiln B	→	c	u	|	f.....			→	c	u	|	f.....			
Kiln Keeper	A	A	B	B	B		A	A	A	B	B	B		A	1000
Kiln Worker	A	M	B	B	M		A	A	M	B	B	M		A	500
Mill Worker	Operate Clay Mill												→		500
Tile Maker 1	Moulding Tile for Kiln A												→		1500
Assistant 1	Measuring Clay and Stacking												→		600
Tile Maker 2	Moulding Tile for Kiln B												→		1500
Assistant 2	Measuring Clay and Stacking												→		600
Apprentice	Moulding Tile Alternately for Kiln A&B														800
Total Labour Cost														7000	

- | Loading Kiln
- f Firing Kiln
- c Cooling
- u Unloading Kiln
- A Kiln A
- B Kiln B
- M Mixing
-  Holiday

B.5 Conclusions

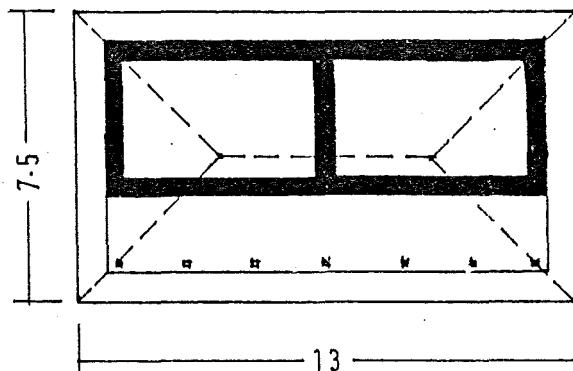
In this case, the improvements were all within the capability of the existing skills and resources. Nothing new was required from outside the area. Improvements are necessary if industries which are viable now are to remain so in the future, as they face increasing competition from new materials and techniques brought from elsewhere. Another kiln, in the Neka-Behshahr area (Mazandaran) had ceased to function because, whilst there was still a demand for tiles, they could no longer be produced at efficient costs. A more substantial reappraisal of the production method and tile form was required. Changes to the tile form in the Neka/Behshahr area (Spanish tiles) would, however, require major alterations to structures, since a tile which produced a more efficient coverage for the material used (i.e. a 'Pan' tile as used in the Astara area) would need a different arrangement of battens on the roof. The acceptability of such a change needed to be established before implementation of changes to production could take place.

END

APPENDIX 1

Notes on 'Roofing Materials Comparative Costs Chart'

- *1 The price of one labourer's work in one day (which at the time of the research was 600 Rls.) is taken as the basic unit of cost, and all costing figures given in the table are fractions and multiples of this unit. Since the prices of local materials in the Caspian area include a large labour component in production, this appears to be an appropriate unit. The labour unit maintains its comparative value over time as prices change.
- *2 The unit of construction is taken to be a standard two room house with a front 'aivan' covering a built area of 97.4m. The pitch of the roof varies according to the different roof covering material used and thus the surface area of the roof to be covered also varies.



On comparing Costs:

The costs should be regarded in connection with the life-span of the material, although in rebuilding the roof after its period of lifespan some materials may be salvaged in certain cases and the cost of the new roof is not necessarily as high as the original roof. Also it should be noted that low income groups find it economically easier to invest a small capital in a relatively short term structure than a large sum in a longer lasting building. Thus a relatively small initial capital outlay with periodic inputs for maintenance is more geared to a rural family's economy.

Public Buildings.

This case study summarises some of the experiences in public building in the Selseleh region of Luristan, Iran. A variety of public buildings programmes are discussed; schools, baths, village centres. Each situation presented different conditions and problems, which had to be resolved according to the specific context within which each project was located. The building projects all relied upon public participation, and all were seen as an educational process, where the community could learn to meet their own building needs and take on a degree of responsibility for their community requirements.

4. Public Building

Building of Schools and other Public Building in
Selseleh, Western Iran.

by

John Norton

April 1980

ROOFING MATERIALS: COMPARATIVE COSTS

name of material	Rice Thatch	Reed Thatch	Shingles	Rasht Tiles	Astara Tiles	Sheet Metal
local name	Koloush	Lee	Lat/ Takhteh	Sofal	Sofal	Halab
cost* ¹ of material/m ² Roof Surface Area	0.075	0.155	0.333	0.378	0.450	0.413
cost* ¹ of construction/m ² Roof Surface Area	0.133	0.133	0.050	0.165	0.050	0.166
total cost* ¹ /m ² Roof Surface Area	0.208	0.288	0.383	0.543	0.500	0.579
pitch of roof ⁰	55°	55°	25°	25°	35°	25°
surface area of roof m ²	170	170	110	110	120	110
cost* ¹ of material/unit of construction	12.5	26.	37.5	41.	54.	45.5
construction cost of unit* ²	22.5	22.5	5.5	16.5	6.	18.5
total cost of unit * ²	35.	48.5	43.	57.5	60.	64.
lifespan yrs.	8-12	15	15-20	25-30	25	20-25
maintenance requirements	thatch renewed in parts of roof. Ridge rope tightened & replaced when rotted.	ridge rope tightened every yr. & renewed when rotted.	shingles turned over every 5 years.	lower tiles moved to the surface after 15	-	joints loosened by wind are tightened. Rusted holes are fixed

PUBLIC BUILDING, SELELEH. WESTERN IRAN.

Contents

1.	Introduction	Page 1
2.	School building	5
3.	School Building	
	3.1 Kaka Reza	7
	3.2 Ab Barik	7
	3.3 Kindergarten, Alashtar	12
4.	Village centres	15
5.	Water supply and Public Bath building in Serab Seid Ali	19

Illustrations

Fig. 1	Location of Selseleh in Iran	2
2	The Selseleh Basin	2
3	Primary school at Kaka Reza	8
4	Location of new school at Ab Barik	11
5	Schematic section, Ab Barik School	11
6	Kindergarten plan, Alashtar	13
7	Village centre with accommodation	16
8	Village centre with agricultural store	18
9	Location of new facilities in Serab Seid Ali	20
10	Two shower public bath, Serab Seid Ali	23

THE SELSELEH INTEGRATED DEVELOPMENT PROJECT (S.I.D.P.)

The S.I.D.P. was set up as an experimental project to investigate and apply a policy of rural development based upon a concept of 'endogenous' or internalised development. This aimed for the improvement of living conditions within the project area through active participation of the community and by the use of local resources. The S.I.D.P. worked on the development of Health, agriculture and education and building, as well as the infra structure and creation of new job opportunities.

An essential part of the programme was the training of 90 'Front line Workers' in the fields of health, agriculture and education. Specific training was also conducted for other activities in the area. The trainees later took on the task of assisting the villagers in meeting their basic health, education, agriculture and building needs. The S.I.D.P. was based in 400 km² of the Selseleh Region of Luristan, western Iran. This is a high basin ringed by the Zagros Mountains.

The Development Workshop were the Architects and Planners for the S.I.D.P. from 1975-78.

DEVELOPMENT WORKSHOP

The Development Workshop is a team of architects, planners and researchers from a number of countries who work collectively on the development of indigenous building and planning methods in the Third World. Projects have been undertaken in African, Middle Eastern and Asian countries. Members of the Workshop believe that appropriate solutions to human settlement problems can be developed from indigenous methods which have evolved from and remain in the hands of Third World communities. The Workshop works in the field of rural and urban human settlements. The development of small scale construction industries, technical training and local participation are integral to the Workshop's approach.

John Norton is a founder member of Development Workshop.

the required facility was different from what we had expected. At the same time, people recognised that there were certain buildings which were more difficult for the village to complete than others. (i.e. in building a public bath, the mechanical servicing is often beyond a village's current capabilities.)

In the village of Niazabad, (Fig. 2) the S.I.D.P. organised and built a public bath at the request of, and with the active participation of, the villagers. The building was too complex for them to complete on their own, and would have placed a large burden on the village resources. In the two years that followed the completion of this bath the village independently built a school and were then starting on a Mosque. The process of building the bath had helped to reinstate their confidence to undertake such schemes and to counter their belief that the Government would and could provide such facilities to every village.

Much of the communication between the village communities and the S.I.D.P. took place through the 90 trained 'Front line workers', who, as members of both, could reflect the needs of the village and the role that the S.I.D.P. could play. Through this process, these same people learnt how to approach the Government for assistance and to know what was available, and, through their activities in the village, gained the trust of the villagers as people who could and would actively help in resolving village problems and needs.

Some of the difficulties that the villages faced could be resolved by providing information; on the one hand about what they could reasonably expect from the Government (and the S.I.D.P.); and at the same time, how they



Fig 1

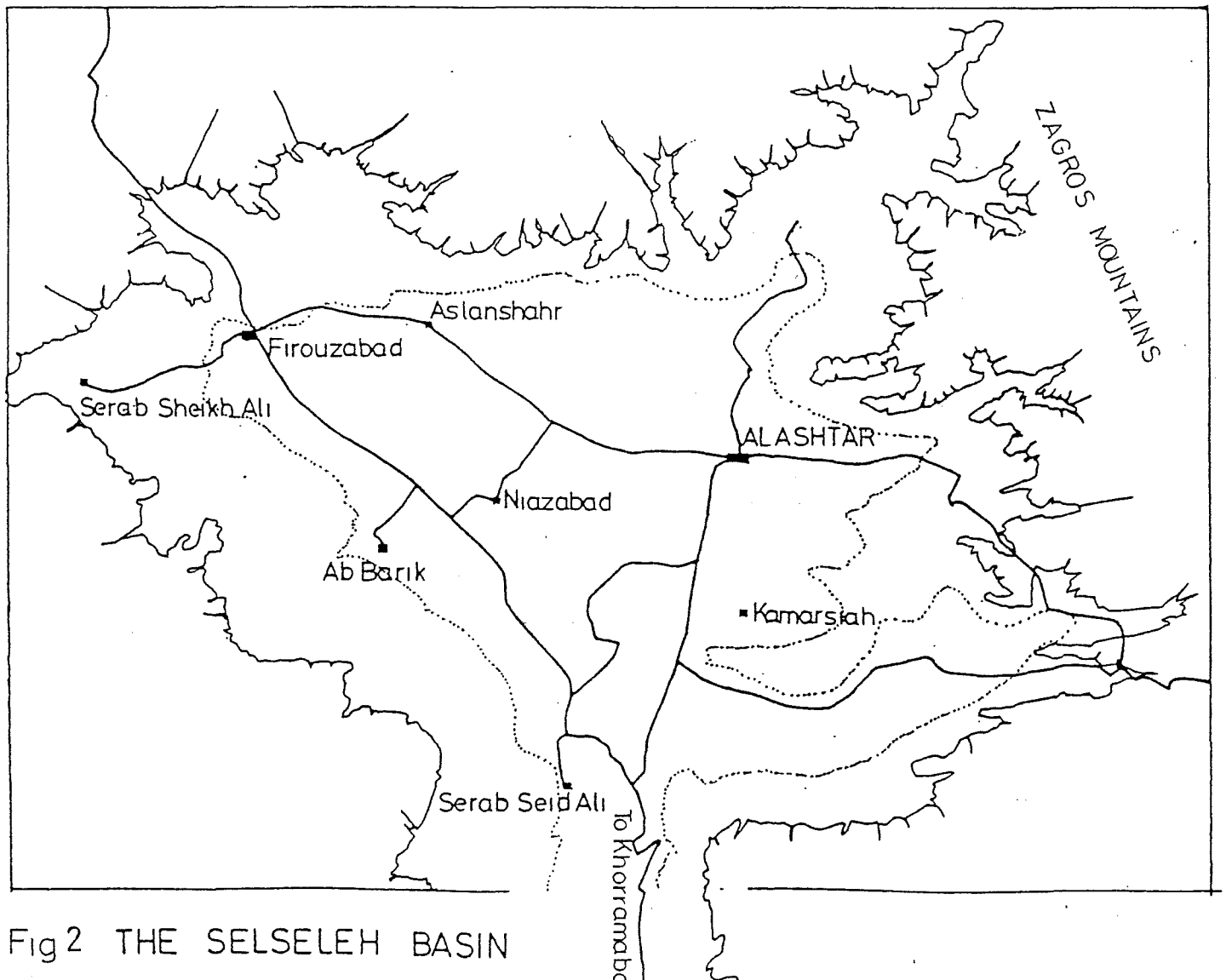


Fig 2 THE SELSELEH BASIN

PUBLIC BUILDING

Building of Schools and other Public Building in Selseleh, Western Iran.

1 Introduction

The practical conclusion to the research, training and small scale industry programmes, is the channelling of the resulting increased understanding, expertise and material resources into the physical process of meeting the building needs of village communities and small town neighbourhoods. This is also an extension of the training programme, both in terms of passing on the skills that the builders have acquired to those members of the community who will participate in the building process, and in becoming involved in the decision making process of what sort of facility or building is required by the community.

The overall process of public building is in this context educational as well as practical. The examples given in this paper were all done as part of the work of the Selseleh Integrated Development Project (S.I.D.P.), Luristan Iran. * (Fig. 1)

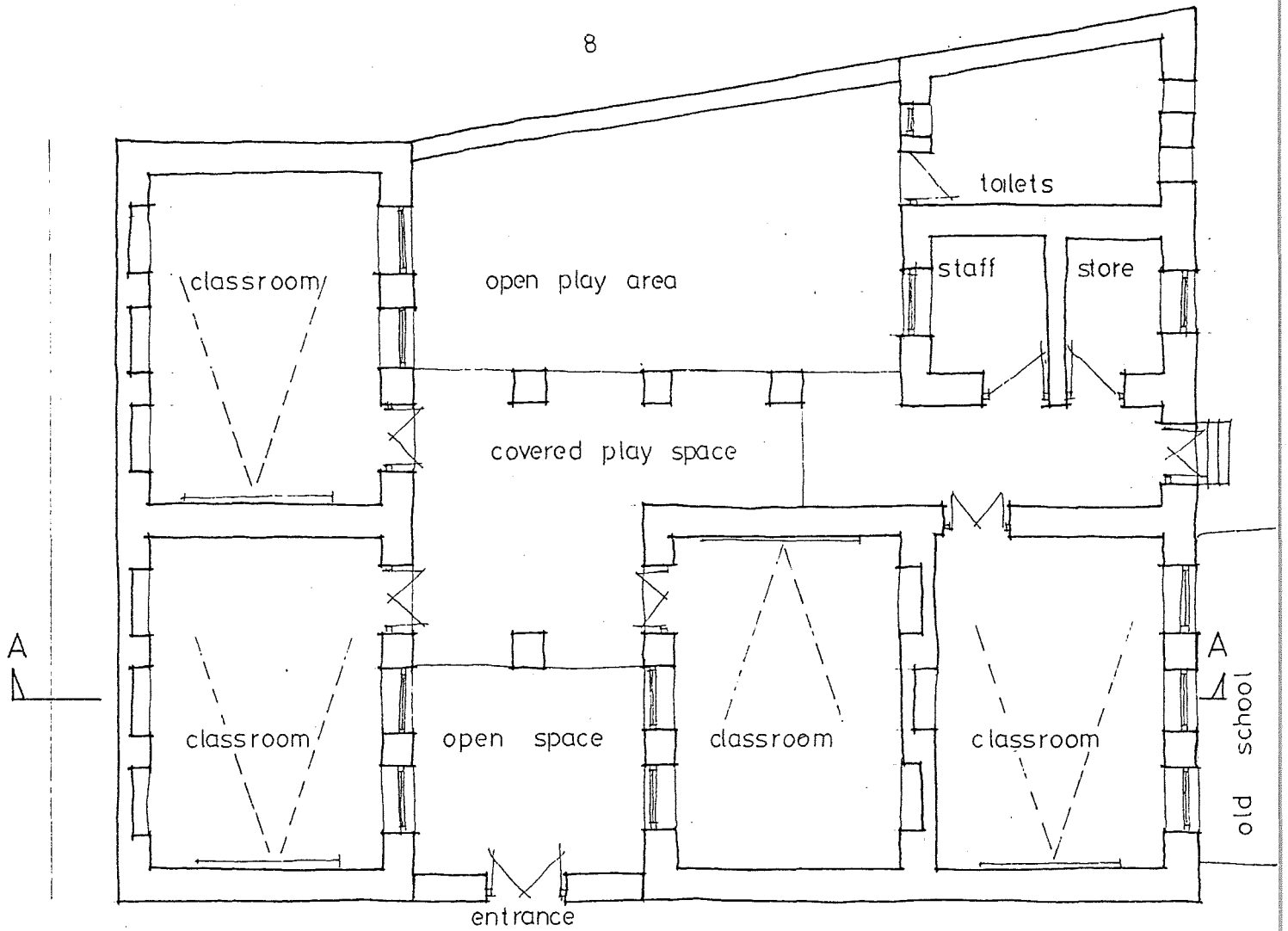
In the Selseleh project area there was a shortage of almost every type of facility: schools, public baths, clinics, water supply, roads etc. Establishing these facilities in the region formed an essential part of the practical work of the S.I.D.P. However, to ensure their future success and proper functioning, such facilities cannot be introduced into a community without the participation of the people who will use them. This participation must be at all stages of a proposed building programme, but most of all at the decision making stage. They are the people who know best what is needed in their community, and in several cases we found that

* See S.I.D.P. introduction.

could organise themselves to make better use of these and their own resources..

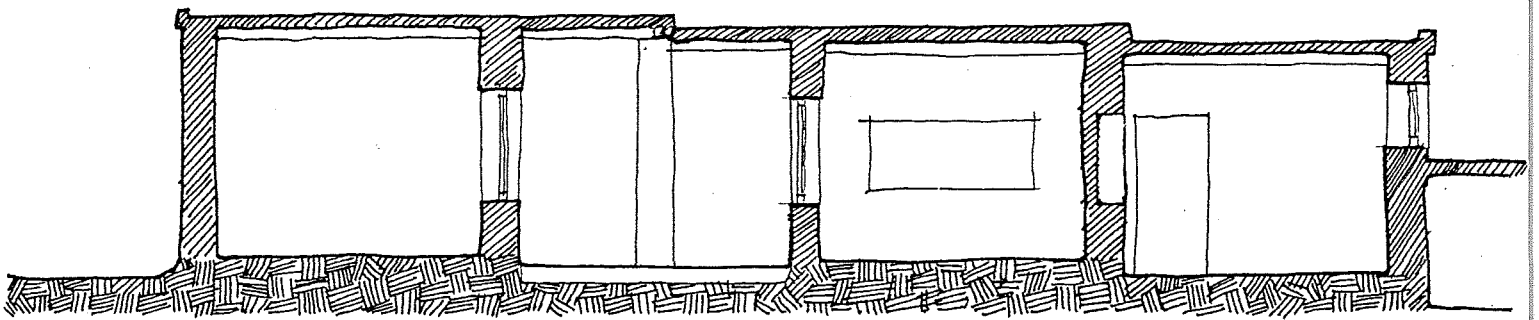
For example, the Government of Iran at that time (1976/7) would provide up to 50% matching funds to supplement money collected by a community for a specific project. Many people were unaware of this or how to go about acquiring these funds. On the other hand, some form of organisation was needed if the funds were to be used to the best advantage of the village. The use of government funds had normally dictated that the required building was designed in centralised offices and that the building was erected by a recognised contractor (usually city based). In almost all cases this resulted in costs being high and the building itself not being suited to the specific needs and location of the village. The villagers did not participate in the process nor were any local resources used. Furthermore, the villagers invariably regarded the finished product as being the responsibility of the Government and were rarely prepared to participate in its up-keep and running. In instances where the building ceased to function properly, often through lack of maintenance, it sometimes stood idle for years, even though the skill and equipment was often available in the area for repairs. To resolve this situation further stretched the capability of the Government, which, faced with national shortages of public facilities, were even less capable of providing them.

The understanding that the people of the region gained about their role in developing the area had to be supported by the training programmes: builders; health, education and agriculture workers; producing teams who would be able to help the villagers practically meet their needs: and by the stimulation and development of the uses of local resources.



PLAN

Fig 3 PRIMARY SCHOOL AT KAKA REZA



SECTION A-A

metres

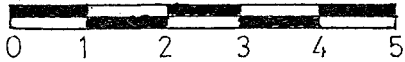
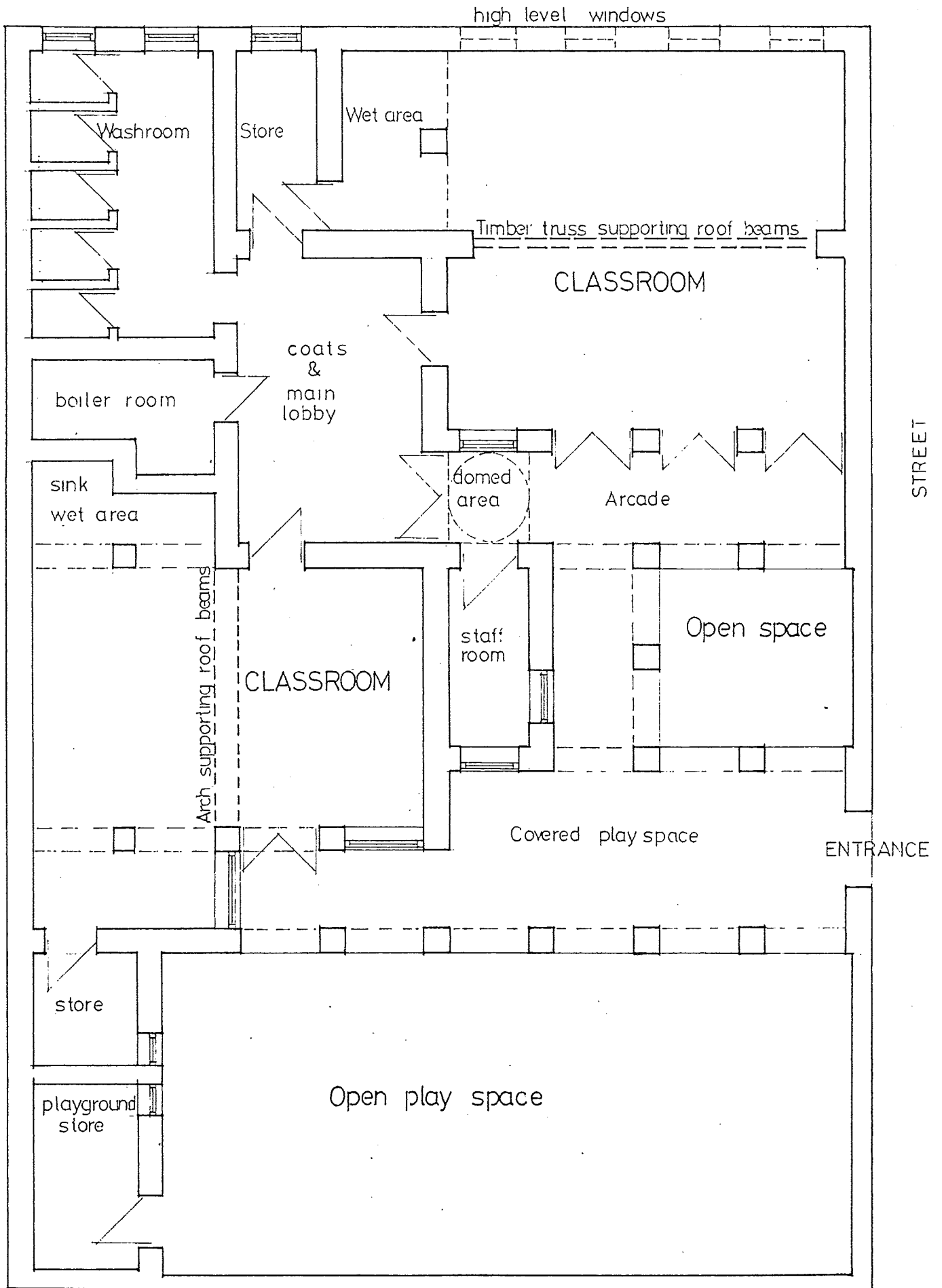
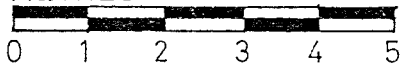


Fig 6 KINDERGARTEN PLAN , ALASHTAR



METRES



south facing windows, small high level windows were included on the north facing wall to permit cross ventilation and provide additional light. (Fig. 5)

The finished school was simple, but some of the original problems had been overcome. They could have been easily avoided in the first place if consideration had been paid to the local conditions and to the existing knowledge and dwellings in the village.

3.3 Kindergarten. Alashtar

In all the schools built by the S.I.D.P. the process of building was used whenever possible for training. In addition to this, most of the public building work was designed so that they would have a relevance to the housing problems faced in the area, and that people in the area could use techniques and ideas introduced through the public buildings to improve their housing.

The Kindergarten in Alashtar (Fig. 2) was an example of this approach. It was felt that, because the children in this school were of a highly impressionable age, it was essential that this building should demonstrate a range of building solutions which would be useful and appropriate to the overall building needs in the area, and unlike many of the public buildings in Alashtar, not reinforce the rejection of the available building methods by only using materials and elements brought into the area from the city.

The kindergarten (Fig. 6) required two large teaching spaces, both approximately 7 metres by 7 metres. The local method of roofing used timber beams to support a flat mud roof. These beams effectively limited the width of rooms to 3.5 metres. In every case that a larger space

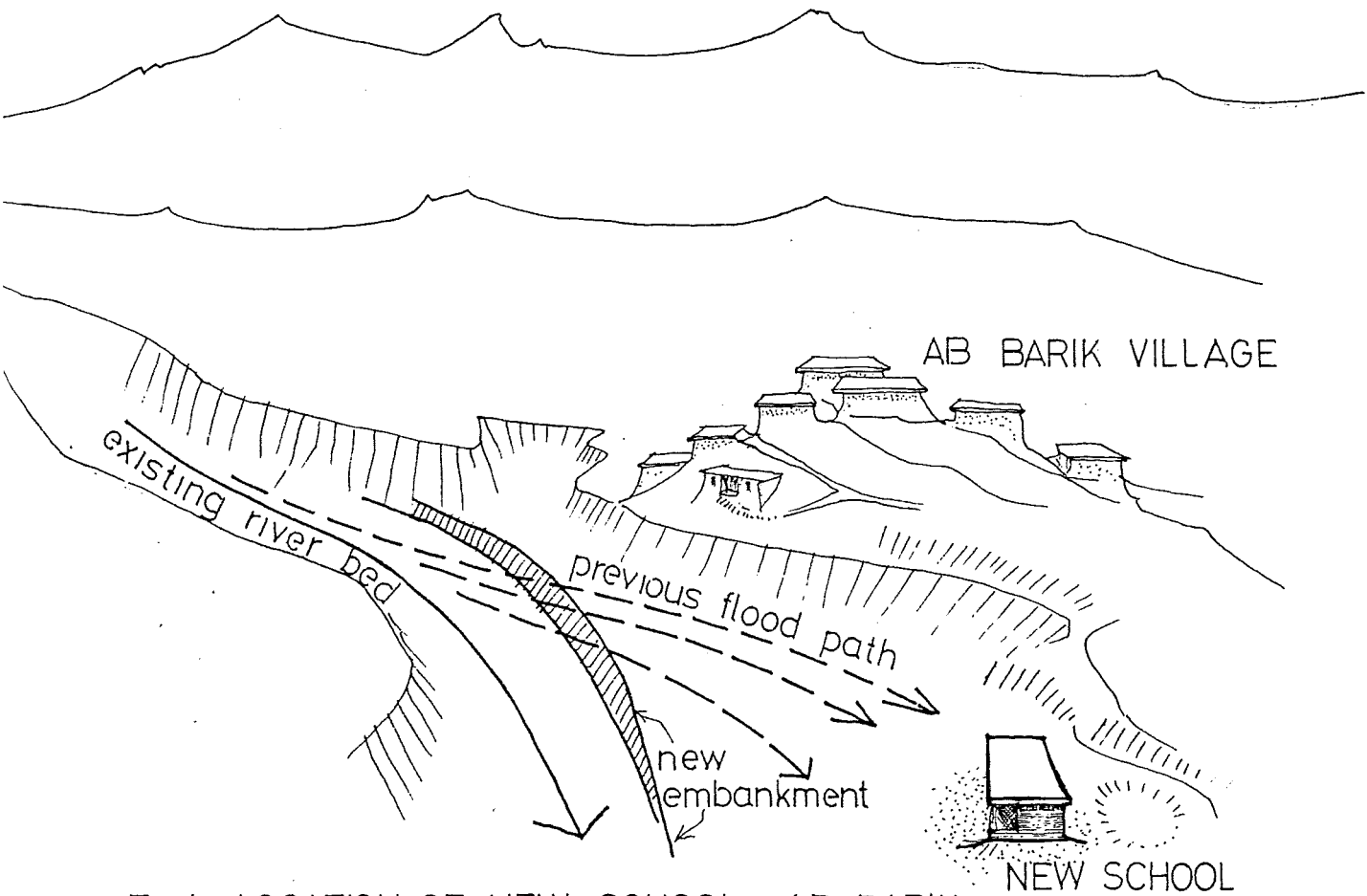


Fig4 LOCATION OF NEW SCHOOL - AB BARIK
 All existing building safe on high ground

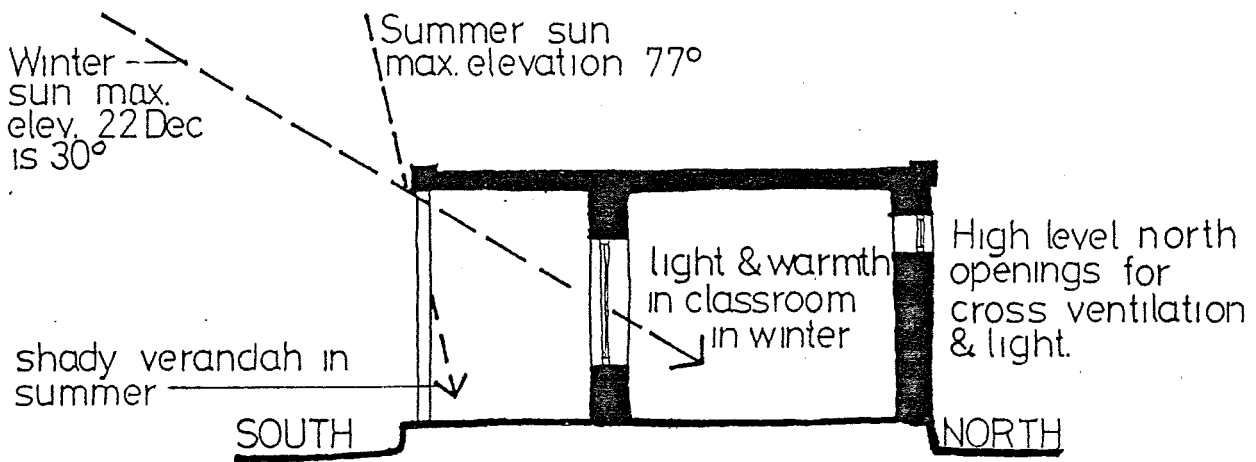
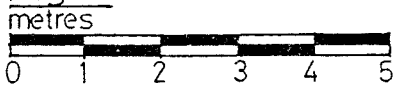


Fig 5 SCHEMATIC SECTION - AB BARIK SCHOOL



whilst not permitting low winter sunshine to penetrate and warm the rooms in winter, when the sun is further south in the sky.

The villagers themselves orientated their buildings to face south whenever possible, to assist in keeping them cool in summer and warm in winter. Equally, they would not have built on a piece of land which they knew was liable to flood.

To rectify the situation, a channel was dug to ensure that any flash flooding water would pass safely beyond the site. It was possible, because some of the building work already done was of poor quality, to move the orientation of the building round to the south, whilst retaining part of the walls already built. A pit at the rear of the building was filled in, since otherwise it would have weakened the foundations.

The villagers were encouraged to participate in the building work, whilst the S.I.D.P. provided two trained builders.

The new school was developed upon the same principles that applied to local houses. A covered area at the front of the building provided shade in summer, helping to keep the classrooms cool but allowed sun to shine in underneath the projecting roof into the classrooms in winter. (Fig. 5) This same space was used for recreation in winter. The classrooms were organised so that the occupants would sit with light coming from the left hand side. A chimney for the heater was built into the wall of each room; in the old school the chimney was a metal pipe free standing in the room, dictating the poor position of the heater. In addition to the main

the one classroom was heated by a large oil fired heater placed in the middle of the room which obscured the view between teacher and pupils. The fumes given off by this heater were noticeable even during a short visit to the classroom. The windows were sealed up to keep the heat in.

As part of a national programme, a group of students came to the area for their summer vacation, with the task of involving themselves in local activities. These students, mostly from Tehran, undertook to build a new school in the village of Ab Barik. They requested that land should be donated for this scheme. The village itself is situated on a small hill. The land donated was down on the flat land below the village. A start was made on the building, and then the students returned to their colleges. The building work came to a standstill, and the people from the village came to the S.I.D.P. and requested that the S.I.D.P. should finish what had been started.

During the first visit to the site, a number of problems were noted, and because parts of the building were relatively advanced, some problems were beyond rectification.

The land that had been donated was unusable for any other purpose, and explained why it had been given. This in itself reflected the attitude that the village had had to the building when it was started; they were not involved in the building and therefore had little desire to give valuable land. The building had been positioned almost directly in the route of a flood path.(Fig. 4) The whole area showed signs of regular flooding during the rainy season. The orientation of the building and its windows was towards the east, which was unfavourable because of the build up of heat during the morning in the summer,

solutions, some applicable for larger spaces, some at a domestic scale. All of the building used locally available materials.

At the same time that the kindergarten was built, three houses for teachers were built nearby, using the same principles. Each house demonstrated different techniques. In the following building season, a number of dwellings were built privately in the area and made use of the methods used in these buildings.

It is important in public building, that, where possible, the new construction should stand as a model relevant to local domestic building needs. Too often, official building is at variance with the techniques available to the public.

4 Village centres

Because of the size of the community and the availability of teachers, in a number of settlements it was not practical to build schools: Instead, village centres were developed. These had an educational role covering more than primary education, and were established as the bases out of which the trained health, agriculture and education workers could operate. The buildings combined specialised space with multipurpose space, and were consequently used intensively all year round. A variety of these centres were built, not all of them as single unified buildings (i.e. a cluster comprising of a small clinic and school). However, most conformed to a basic pattern developed for the area, which could be built with different materials depending on the specific location.

Each centre was usually made up of the following spaces (Fig. 7): Accommodation for one of the three trained

'Front line workers', who would therefore be available in emergencies and could look after the building; connected to the accommodation, was a private courtyard and w.c. and washing facilities. At the centre of the building was a large room, opening onto a verandah at the front of the building and used as a waiting room when the clinic was open, and also as the room where the agricultural worker could dispense seed and implements as available. Adjacent to this space was a one room clinic with washing area and medical store. This was the only specialised space in the building. To the rear of the building, with separate access as well as access from the waiting room, was the classroom. used during the day for child education and in the early evenings for adult literacy classes. The classroom was also used for discussions and meetings.

In some of these centres, depending on the activities of the community, an agricultural store was added. In others, the accommodation was omitted and additional space provided for teaching/assistance. In those cases the 'Front line workers' lived nearby in their own house. (Fig. 8)

Whilst containing certain specialised spaces, these centres were essentially developed from the local style of housing. In all cases, the community participated in the building process, and the variations in design reflected the differences in local situations. In some cases, a particular space was omitted where the villagers felt that a room was already available for that specific activity nearby in the village. One of the main advantages of these centres was the process of exposing individuals to different activities relating directly to their lives. Academic education became more directly related to events, conditions and needs in the community.

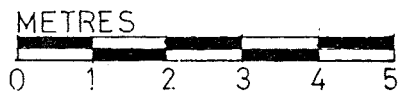
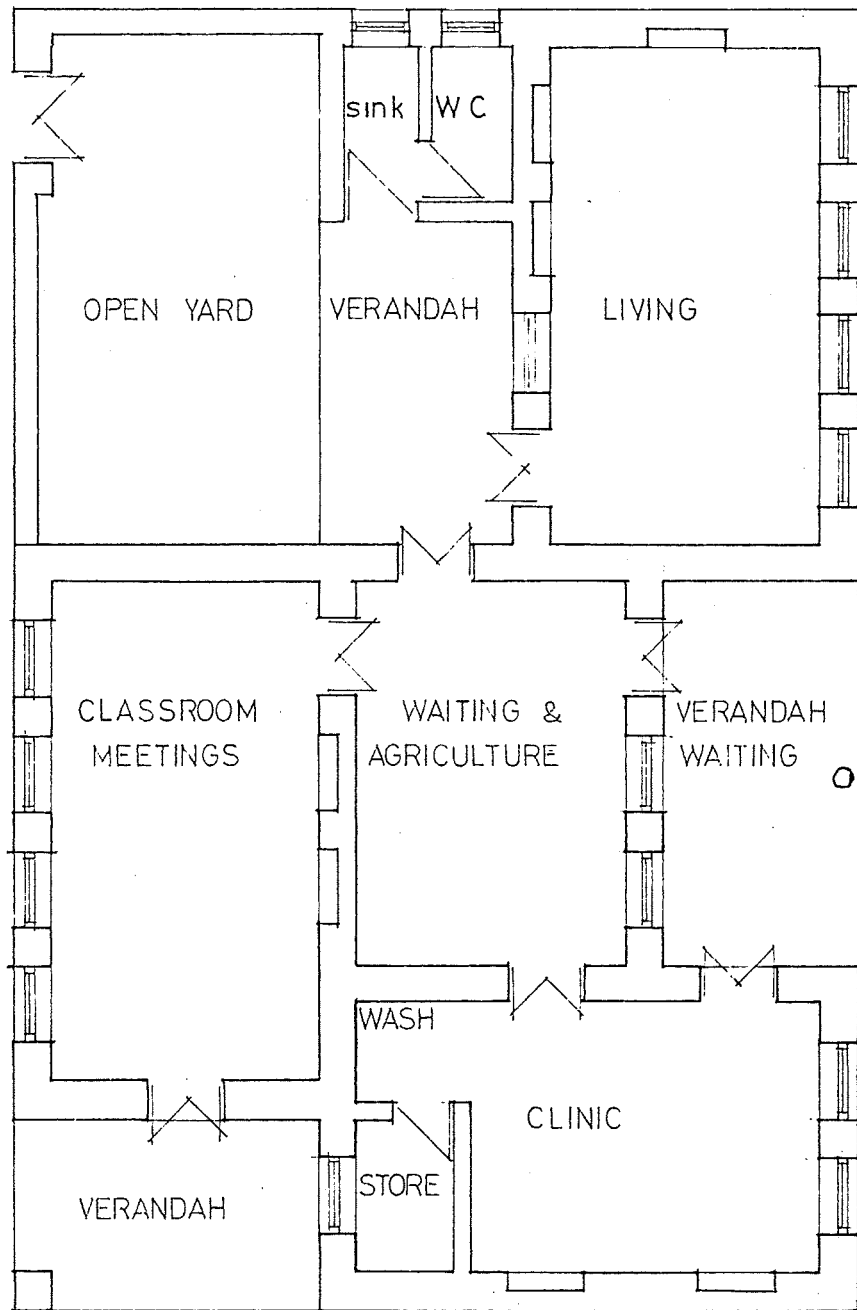


Fig 7 VILLAGE CENTRE
with accomodation

3 School Building

3.1 Kaka-Reza

The school building in Kaka Reza (Fig. 2) illustrates some of the possibilities that occur when the people in the community are involved in the process and local resources are used.

The villagers of Kaka Reza asked the S.I.D.P. to assist them in building a new school. The village had already organised funds for the building, with some of the money coming from the Ministry of Education. (It was in fact unusual to find villages that had organised this.)

The costing of the building had been to allow enough to replace two existing classrooms with two new ones. This allowed nothing for the growth of the village, nor the provision of additional facilities; storage, sheltered play space etc. The school was therefore redesigned so that there would be four classrooms, a teacher's office, a store room, lavatories and covered and open play areas for summer and winter use. (Fig 3) The additional space at the original cost was made possible by using local stone for the walls and timber for the roofs instead of concrete and steel as had originally been intended, and by using local labour and builders from the region. Some families who had not been able to donate money were in this way also able to contribute valuably to the scheme.

3.2 Ab Barik

The building of a new school in Ab Barik (Fig. 2) was also started to replace an existing school, but in this case the village was not seriously involved at the beginning. A number of problems developed.

The village had an existing small primary school in its centre. It was overcrowded and poorly lit. In winter

and west).

Sanitary arrangements were poor (sometimes almost non-existent). There was no provision for recreation during periods of the year when rain and snow restricted outdoor play.

School building in the area depended largely upon the likelihood of getting a teacher to live in a rural community. This difficulty tended to focus schools upon the larger communities where transport and facilities were better. This was not an ideal arrangement since the children were then forced to walk considerable distances to school. Across the Selseleh plain there are numerous rivers and streams, which in many cases meant that the distance to be walked was increased by not being able to cross to a nearby school.

A major aspect of the S.I.D.P. programme was to establish a comprehensive network of roads connecting the villages to each other and to the regional centre, Alashtar. This network allowed the regional planning of facilities to develop upon groups of villages, who could share common facilities within easy reach. It would have been both physically impossible and impractical to attempt to provide facilities in every settlement. Moreover, many of the settlements were little more than extended family groupings, and sometimes numbered only a few houses.

The shortage of teachers was alleviated by the training programmes run by the S.I.D.P., which produced people in the villages capable of teaching at primary school level and of running adult literacy classes.

To meet the demand for schools and other public buildings, within the limitations of the funds and resources available, it was essential that local resources, skills and manpower was used.

The case studies for the Builders Training Programme *1 and the stimulation of small scale building industries *2 formed only a part of the overall process. Through this process, the incentive to develop the region could be matched by an increasing capability to do so.

2 School building

The few schools that existed in the region prior to the setting up of the S.I.D.P. were either in extremely poor repair (usually the Government built schools) or based in small dark rooms. It is worth noting that many of the problems in the schools derived as much from the school furniture as from the buildings themselves. The standard form of school seating and desks were in bench form, with each child leaning back against the desk behind. This produced an extremely cramped seating arrangement, since one could not space the desks and benches further apart. Efforts were made to alleviate this situation and introduce more suitable and flexible furniture.

The arrangement of classrooms and the elements within them were also poor. Common conditions included: small windows, sometimes reduced in size during the winter to keep the heat in. The level of lighting was invariably low, making it hard for the children to see what they were doing. In the villages there was no electricity. The ventilation of these classrooms was often very poor. Windows were positioned so that light was often directed disadvantageously at the children, so that they were writing in the shadow, of their own hands or could not see the blackboard because of direct sunlight shining into their eyes. The orientation of classrooms often meant that sun and heat came into the classroom during the hotter periods of the year, whilst not allowing either in winter, (i.e. classrooms facing east

*1 Reference title: NORTON. J. Builders Workshop. Yazd, Central Iran. Case study for UNESCO, 1980, Unpublished.

*2 NORTON. J: Stimulation and improvement or establishment of locally based materials or elements production. Case study for UNESCO

had been required, steel beams and jack arches had been used for the roof, often using a steel truss to support longer spans. This was an obvious restriction on the use of local materials. To overcome this each of the classrooms used a different method to permit the large roof area to be covered by local materials. The middle of one of the classrooms was spanned by a large 6.5 metre wide brick arch, which supported the timber beams spanning across to the external walls of the room. This arch was the largest to be built in the area, and demonstrated another use that arches could be put to. Previously arches had only been used to span across window and door openings. The other classroom used a timber truss to support the beams. The truss was made in the local wood working shop.

The open spaces within the kindergarten contained covered arcades which provided playspace in the winter. These arcades used a combination of arches and timber beams to support the flat roof.

Low level windows openings were spanned by arches, high level openings, for light and cross ventilation, used timber lintels, connected to ring beams (the latter as an earthquake resistant precaution.)

A small space in the centre of the building, forming the entrance to the teacher's office and cloakroom, was, at the suggestion of the builders, covered with a raised dome, positioned over small openings which let light in and allowed hot air to escape in the summer. The internal construction of the dome was left exposed so that one could see the materials and how they had been used.

The finished building demonstrated a variety of building

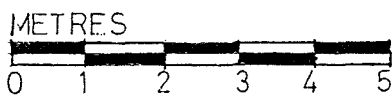
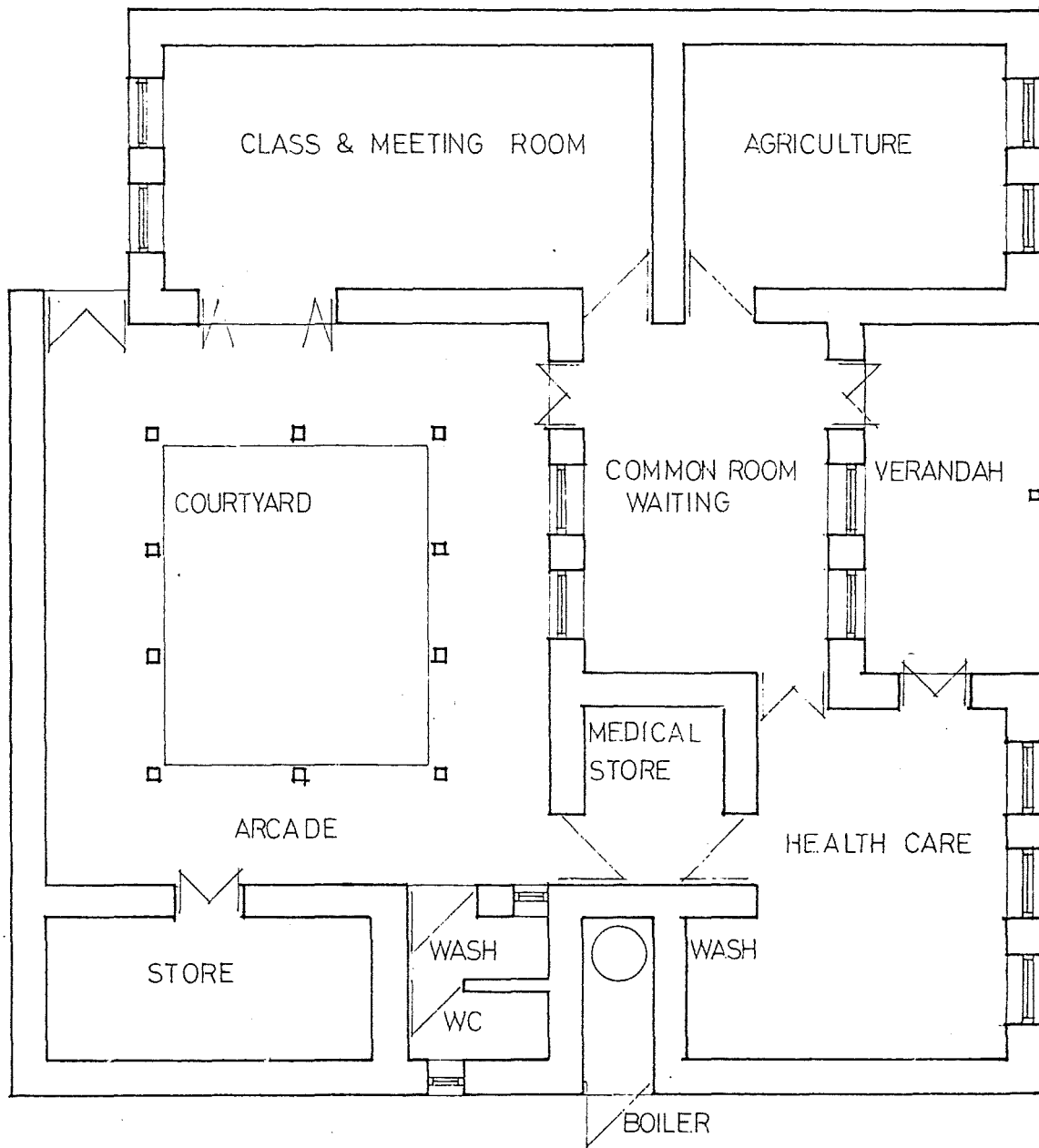


Fig 8 VILLAGE CENTRE
no accomodation ; includes agricultural room / store

5 Water supply and Public Bath building in
Serab Seid Ali

Many of the settlements in the Selseleh Region had no facilities at all. The process of organising the public facilities in Serab Seid Ali (Fig 2.) was characteristic of other villages in the area. In this village the S.I.D.P. assisted in the provision of a water supply and a public bath. The choice of facilities was made by the village. However, the public bath (Hamam) is traditionally not purely a place for washing but is directly related to the health of the village. In the past, medical assistance was found in the public bath, provided by the village barber. The public bath also provided a warm convivial atmosphere for meeting and talking, and hence played an essential social role in village life, particularly for the women.

In the spring of 1979 the 'front line worker' from Serab Seid Ali came to the S.I.D.P. staff and requested that the village water supply should be improved. At the time water was carried by hand from a spring 1 km distant from the village. The labour involved was considerable, but additionally sheep and goats were polluting the water at the source. The amount of water coming from the spring was considerable but nearly all of it flowed unused into the river at the bottom of the valley (Fig. 9).

We visited the village to get a clearer understanding of the situation and by talking to the villagers, found out what was really needed and what resources were available. This village was extremely poor, situated on marginal agricultural land on the hillsides where little more than subsistence was possible. The majority of able bodied men had moved away to Tehran or Isfahan where the job opportunities were better. In effect the village was made

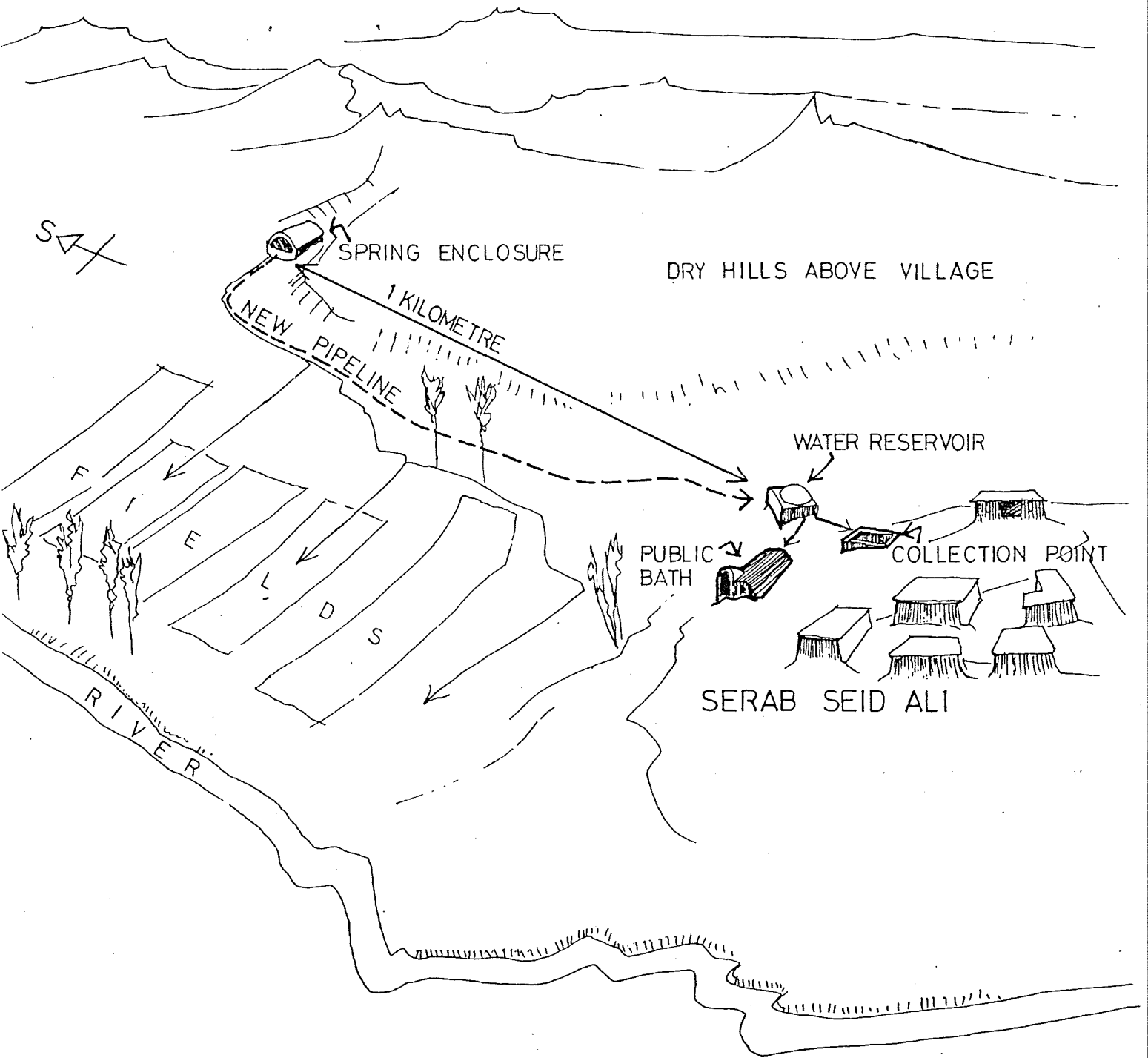


Fig 9 DIAGRAMMATIC LOCATION OF NEW FACILITIES IN SERAB SEID ALI.

up of women, children and old men, who received money from the men working in the cities. There was practically no cash available for donation towards any public activity. We explained to the villagers that there had to be some sort of contribution from them if they expected to get assistance from the S.I.D.P.

It was necessary to find out who would be available or capable of working on a building project, and in basic labouring jobs, since this contribution by the village could help to offset some of the costs of any work undertaken, and be taken as payment in kind. Furthermore, in order to get assistance from the project, and through them, the Government programme, it was felt that a more wide ranging programme should be attempted, incorporating more than piping water to the village. In this way the village could contribute more in labour and materials, and there would be more money available in terms of matching funds from the Governemtn.

We asked the village to select what sort of facilities they would like, if the resources were obtainable, and what order of preference did they give to these facilities. The villagers collectively decided that the most immediate need was for a public bath house. This choice had advantages; the building was directly linked to the water supply project, and represented a possible source of income and prestige to the village, since people from neighbouring villages could come and use the bath, and help to pay for its upkeep. The village already had access to a rudimentary primary school in a neighbouring village. Five old men and two boys volunteered to work on the scheme. No one else was available. The S.I.D.P. agreed to provide the skills required, and those materials not readily available near the village.

elderly?

skilled bldrs. ?

Practically, the first step was to enclose the spring sufficiently enough to provide a head of water for supplying the pipe, and to stop animals contaminating the water before it was piped. At the same time, water had to continue to supply the fields below. Only a small part would be taken to the village. A simple stone shelter was built round the spring, with a vaulted brick roof. At the lower end was a low wall acting as a dam, through which a pipe passed into the reservoir behind. Any water not taken into the pipe flowed over the top of the wall and was channelled down into the fields below for irrigation. Below the wall the pipe was laid in the side of the existing water source, to save excavation. Only when it approached the village did it deviate from this route. Because the route the pipe had to follow was not straight, plastic pipe was used, which was also cheap and simple to assemble. No heavy equipment was required. The pipe was buried to protect it from the sun. At the village end, a small 3 metre square reservoir was built of stone, collected locally, with a domed roof, using brick brought from one of the new local kilns. The reservoir was needed if both drinking water and bathing water could be drawn off at the same time. One pipe fed from the reservoir to a water collection point and dish/clothes washing area. Another pipe fed the bath, built slightly down the hillside from the reservoir. The bath house itself was built dug into the hillside, so that the minimum of walling material would be required to support the roof, the bath would not lose heat to the cooler outside air in winter and water required only gravity to carry it through the bath. The hot water boiler room was built above the main bathing room. The bath also incorporated a public lavatory. (Fig. 10)

Because the vilage was poor, the building was orientated to allow the use of solar collectors on the roof, so that

50m or other damage?

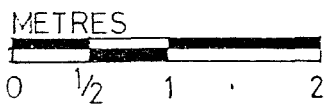
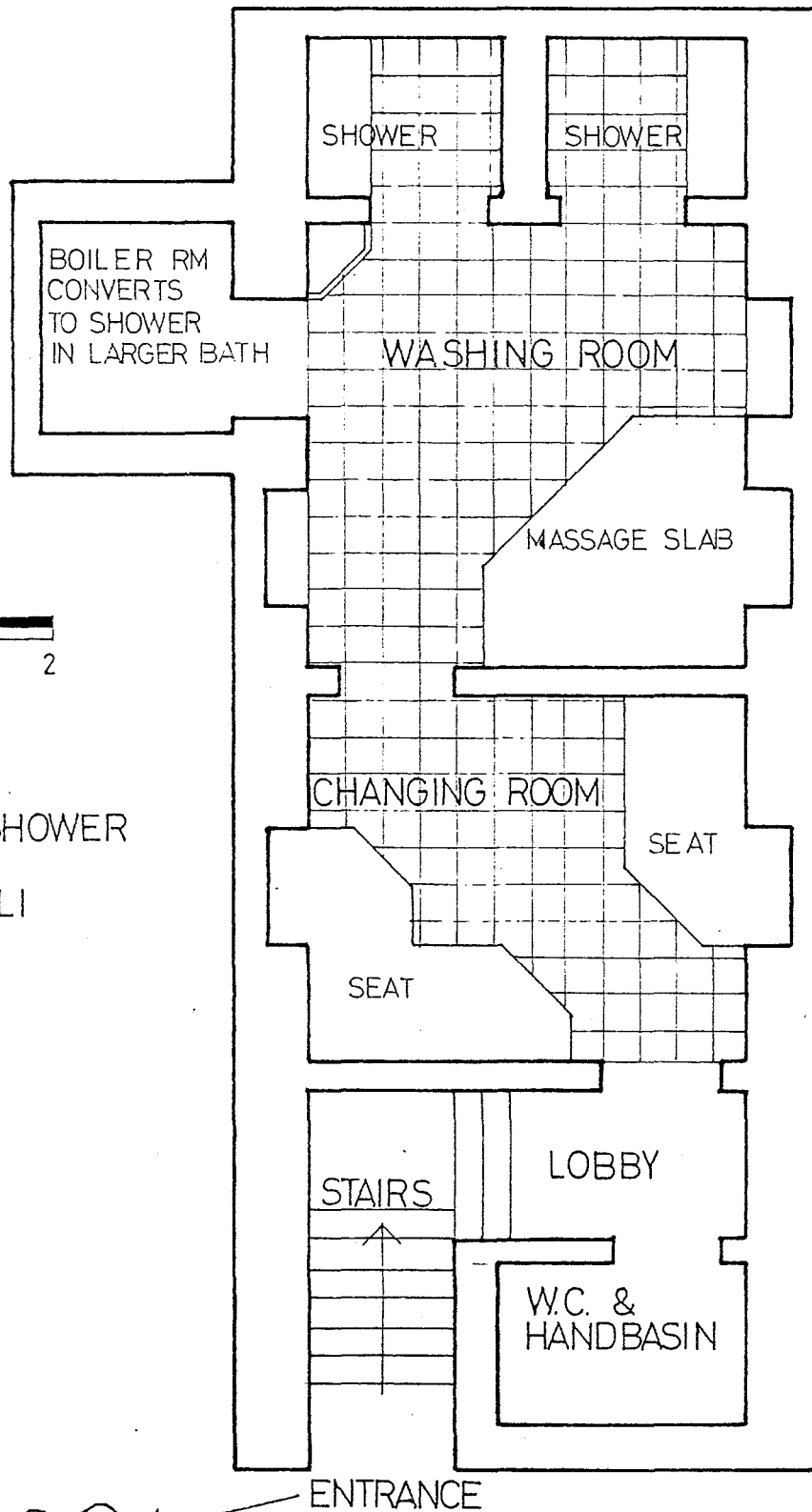
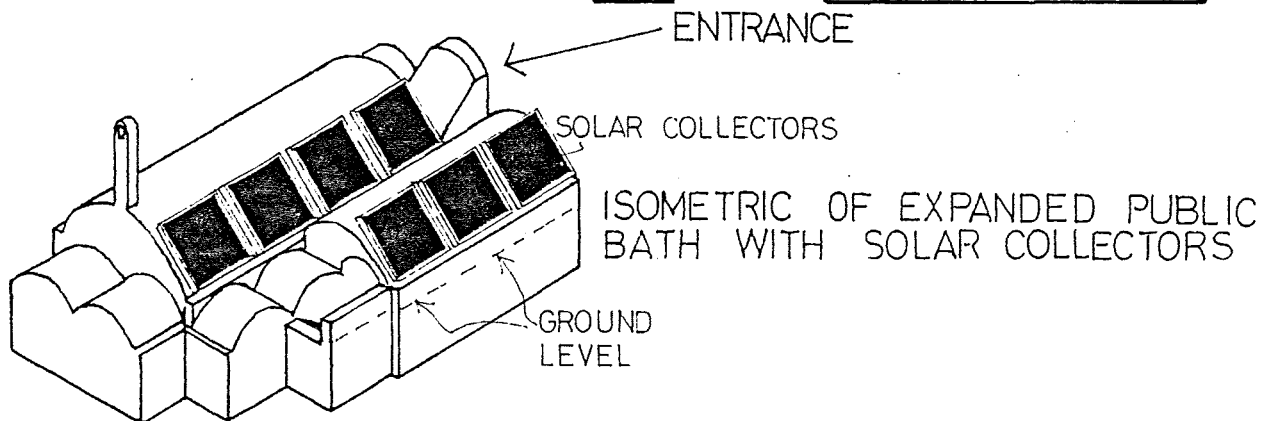


Fig 10
PLAN. TWO SHOWER
PUBLIC BATH
SERAB SEID ALI



the water could be heated by solar energy for up to 6 - 7 months of the year and reduce fuel costs.

The whole of this programme was completed at extremely low financial cost. All of the labour, including the excavation for the bath, came from the village. This would otherwise have greatly increased the expense of the building. Many of the materials came from nearby; sand was delivered by tractor and trailer from a river 3 kms away; lime came from a kiln 6 kms away, and was used for the mortar; most of the stone was collected locally; very little cement was used, except where bitumen was being applied as a damp proof course in the buildings. The bricks used on the roofs were produced in local kilns.

In the process of building the bath, trainee builders were employed to gain experience in the process, and the team developed from this village moved on to build a similar bath in another village in the area, but this time with much less supervision.

In financial terms, the amount of labour expended on the work would have made the scheme prohibitively expensive, but labour was the main resource that the village could offer and had the time to do so, especially during off seasons when not required by agriculture. The villagers now run the bath independantly, operating it on the days that they choose. They recognise that these facilities are there primarily through their own effort, and are consequently their responsibility.

END