COST OPTIMISED HOUSING

WITH SPECIAL REFERENCE TO SANTHAL PARGANAS REGION OF JHARKHAND STATE

A DISSERTATION

Submitted in partial fulfillment of the requirements for the award of the degree of

MASTER OF ARCHITECTURE

By

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CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the dissertation titled "**COST OPTIMISED HOUSING, *with special reference to Santhal Parganas Region of Jharkhand state***" in partial fulfilment of the requirement for the award of the Degree of **MASTER OF ARCHITECTURE** submitted in the Department of Architecture and Planning of the Indian Institute of Technology Roorkee, Roorkee is authentic record of my own my own work carried out during the period from **July 2001 to February 2002** under the supervision of **Prof. P. K. Patel**.

The matter embodied in this dissertation has not been submitted by me for the award of any other degree.

Himalay Verma

Place: Roorkee

Dated: February 20, 2002

(HIMALAY VERMA)

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

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PREFACE

The new state of Jharkhand has recently been formed. The state is very rich in natural resources. Due to the natural resources the state is dotted with many industrial cities like Dhanbad, Bokaro and Jamshedpur. It has also as its population a large proportion of very poor but very hard working and diligent tribal population. The first year of the Jharkhand state and it has shown a surplus budget, one of the few states to do so. Certainly the state is backward although it so rich in natural resources and manpower. The new budget has also proposed to make 85,000 units of low cost houses in the state in the coming year and has put aside 150 crores for housing.

Keeping this in mind and also the general need of the people, it was felt that some work is needed in cost optimised Housing specific to the area. There is also a huge displaced population of displaced industrial workers population that is largely tribal. Such people certainly need Low Cost Housing and because they are away from their homes they need more indigenous material for safeguarding themselves monetarily and socially. The social structure though strong, especially in the tribal community, is slowly breaking up. This structure needs to be reinforced. Housing is one of the methods. The region of Santhal Parganas has been a very important area of Jharkhand. It has produced a lot of leaders of the state but still remains one of the most backward in the state. Thus the topic of the thesis: Cost Optimised Housing, with special reference to Santhal Parganas of Jharkhand state.

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In the age of information technology talking the Gandhian language of Cost optimised Housing if not looked down upon is certainly not considered very good a topic.

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1. INTRODUCTION

1.1. Statement of the problem

One of the major problems in the third world is the glaring deficit of housing. Between one fourth and half the urban population in most large cities of India lives in make shift shelters in squatter settlements or slums. Most of these people live in abject poverty and cannot hope to afford even the cheapest houses available in the urban market.

The situation in the rural areas is far worse, with about 75% of the houses being classified as semi- or non permanent construction, i.e. predominantly of biomass or mud.

Though measures for increasing low cost housing stock have been central to the planned development, the government housing departments are hampered by a number of limitations. Chief among them is the lack of finance for house construction to keep pace with the growing demand for shelter.

It was estimated that total housing shortage in India was more than 40 million units by 2000, of these some 31 million needed in rural areas and nearly 10 million units in urban areas.

The new state of Jharkhand

The movement for a separate state of Jharkhand is a turbulent odyssey spread over a century. A tribal uprising in Bihar during the British rule against exploitation by " DIKUS"(outsiders) grew into a forceful movement for political identity and is headed for its culmination on Tuesday 14th November 2000 midnight with the creation of a separate Jharkhand state –the 28th in India.

The Birsa Munda movement of 1985 - 1900 was the most important among early uprisings against exploitation of the original inhabitants by non-tribal landowners and moneylenders. Munda succeeded in getting the British to prevent, or at least, minimise alienation of tribal land. A landmark in the movement was the formation of the Chota Nagpur Unnati Samaj in 1915, which acquired political overtones with the demand for a sub-state for the adivasis. The demand was, however, turned down by the Simon commission.

The next important step was the formation of the Adivasis Mahasabha, which saw non-tribals coming out openly in support of the movement for the creation of a

separate state. Among those who spearheaded the Jharkhand movement was Jaipal Singh, an Oxford - returned tribal Christian who helped the regional aspiration gain national recognition.

The Adivasis Mahasabha was rechristened the Jharkhand party here in 1949 under the leadership of Jaipal Singh.

It was with the emergence of this party that the Jharkhand movement became purely political. The Jharkhand party became the largest opposition party in the Bihar Assembly winning all the 32 seats from south Bihar and giving fresh impetus to the government for a separate state.

The movement again received a shot in the arm with the emergence of the Jharkhand Mukti Morcha in 1972.

The growing strength of the JMM was reflected in the Lok Sabha and Assembly elections and the demand for a statehood for the first time shook the corridors of power with the then prime minister of India Mr. Rajiv Gandhi setting up a Committee on Jharkhand Matters (CoJM).

In the light of the recommendations by the CoJM, prolonged negotiations between the Centre, the Bihar government and the movement leaders led to the setting up of the Jharkhand Area Autonomous Council (JAAC) in August 1995. It was hailed as a major step towards the creation of Jharkhand.

Buckling under pressure from the JMM members, with whose support the RJD had a majority in the state Assembly, the Bihar government on July 22, 1997 adopted a resolution for the creation of a separate state.

Ultimately, with the support from both RJD and Congress, the ruling coalition at the Centre led by the BJP which has made statehood its mail poll plank in the region in successive polls earlier, cleared the Jharkhand Bill in the monsoon session of the Parliament this year, thus paving the way for the creation of a separate Jharkhand state.

The state comprises of eighteen districts of the erstwhile Bihar- Ranchi, Gumha, Lohardanga, East Singbhum, West Singbhum, Hazaribagh, Giridih, Kodarma, Chatra, Dhanbad, Bokaro, Palamau, Garhwa, Dumka, Deoghar, Godda, Pakur and Sahebgunj. With an area of 74,677 sq km Bihar, MP, Orissa and West

Bengal will border the new state to its north, west, south and east respectively. 35% of the population of former Bihar is in the Jharkhand region.

Jharkhand is one the most industrialised regions of the country today. The region accounts for 35.5% of the country's known coal reserves, 90% of its cooking coal deposits, 40% of its copper, 22% of its iron ore, 90% of its mica and huge deposits of bauxite, quartz and ceramics. It is home to the largest steel plant in Bokaro, apart from Jamshedpur being practically the city of TISCO and TELCO.

With its huge reserves of forests and natural resources, things can look up in this predominantly poverty ridden region. With total revenue of Rs 3,775 crores, Jharkhand may be able to alleviate its poverty. Its revenues can now be utilised for its own development and no longer be diverted to the state's coffers of Bihar, as has been the case. Naturally the biggest loser is Bihar. Bihar will suddenly find its lifeline of revenues shrunk without those contributed by Jharkhand region.

Just consider this fact, about 63% of Bihar's total revenue comes from this region. With the creation of Jharkhand, the truncated Bihar will suffer a revenue loss Rs 1,500 crores annually, as the major contributor to the State's Exchequer, mines and minerals, and a large chunk of the commercial taxes will go to the newly formed State. With everything in its favour, Jharkhand can well look forward to a bright future. It is poised to become the industrial powerhouse of the country, that is, if its leaders set the wheel of development rolling.[1]

1.2. Aims and objectives

1. To provide housing to the people of the region cheap and affordable housing.
2. To provide housing in the region that is easy and quick to construct.
3. To come up with a solution that is easy to build and not very technical to understand the concept of.
4. People of the region are sensitive to aesthetics therefore it is essential that an element of aesthetics should also be considered but keeping the cost factor into account.
5. The people of the Santhali tribe are very hardworking and true to their word. If they are given a better method of construction, which suits their ways and means then they will certainly, pick it up and improve their lot.
6. A solution that a builders want is that there should be a material that can replace RCC but is as strong and does not cost as much. This is the type of solution I am in search for.
7. Mass-customisation of housing
   - i.e. affordable to every man's / woman's pocket
8. Make housing available to people for low income group
   - E.g. coca-cola & Pepsi- automobile industry

1.3. Scope of dissertation

- Design houses for Sathal Pargana region specific to the region
- Santhal Pargana Region consists of districts of Deoghar, Dumka, Sahebganj and Godda.
- Provide a cost optimised solution with a proto-type for low and medium income group each.
- If time permits, make a strategy for the marketing of the solution if it comes out good enough to be executed.

The final aim of this project is to come up with a cost optimised solution that is just perfect for the region. This prototype would be such that it would use the most abundantly available material and use the local labour. It may not necessarily be the naturally found material or the material that is manufactured. It has to be finally deduced that at such a region like this what comes cheaper? Is it the locally available material or is it the material that is available in the market? Or is it a combination of both the materials.

The final outcome would certainly be a prototype but not necessarily that it would be built in situ. It may also be mass-produced if that comes cheaper in the long run. In providing a cost optimised solution each and every aspect of the building industry has to be taken into account. The material, labour, time, elements of the building, architectural elements, manufacturing cost, short term and long-term costs. I shall finally, if time permits, make a strategy for the marketing of the solution if it comes out good enough to be executed.

2. IDENTIFICATION OF RESOURCES

2.1. Geography

The Rajmahal Highland: the Rajmahal Highland forms the north-eastern part of the Jharkhand state. The alluvial tract of the Ganga Plain bound it on all sides except the south and west. It has extremely varied and picturesque topography. The eruption of Rajmahal lava gave birth to such topography. There are several flat-topped small plateaus as well as conical hills.

The principal range in this highland is that of the Rajmahal hills which extends from Sahibganj near the Ganga to Nagalbanga close to the south-eastern boundary of the district. There is a succession of hills; plateaus; valleys and ravines, the general elevation of which varies from 500 to 800 feet above sea level, though some of the hills have an elevation of 1,500 feet. In the south and south-west of this range, there is a broad tableland with rugged terrain.

2.2. Geology/ soil conditions

In the eastern part of the Santhal Parganas the Rajmahal traps overlie the Gondwana sediments which fringe the western edge of the lava. In Palamau and Ranchi are found small plateaus rising upto 3,000 feet. These are called Pats. They are capped by outliers of Deccan Trap, which are more or less equivalent in age to Rajmahal trap. The trap has been altered to laterite at the surface, and in places contains bauxite.

The Rajmahal soils abound in laterites

Laterites are found at various levels right from the capping on the 3,000' plateau in the west down to 150' level along the eastern side of the Rajmahal trap. Although some laterites have been transported by water from higher levels, most of them should be regarded as a special form of surface alteration of underlying rocks. The Rajmahal traps slope gradually eastward to the level of the Ganga Alluvium. It is probable that some of the order alluvium may be of late Tertiary age.

2.3. Climate

The monsoon type of climate can be seen in the typical seasonal rhythm, which runs through all the elements of climate such as precipitation, temperature, pressure, wind and relative humidity. The climatic year is divided into three broad seasons (i) the winter season lasting from November to February, (ii) the summer season from March to May, and (iii) the rainy season from June to October.

(i) *The Winter Season*: During this period, the region experiences anti-cyclonic conditions. The high-pressure system of North-western India sends an arm in the south-east which includes the Plateau. The wind blows from the north-west to south-east, but the actual direction of the wind is controlled by the relief features. The temperature remains between 60° F and 70°F. This period is characterised by charming, clear and fine weather with pure air and azure blue sky. The days are slightly warm and sunny and the nights are cold.

(ii) *The Summer Season*: The temperature starts rising from the first week of March. During this period, the sun gradually moves north-wards and duration of the day increase bringing more and more and more insolation to the area. The sun comes over the tropic of cancer on the 21st June, which passes through the northern portion of the plateau. As a result low-pressure area develops on the Plateau. During April the wind blows from the west. It remains relatively hot, and the temperature rises upto 116° F around Ranchi. By the end of May the low pressure intensifies and extends towards the west. Now the westerly winds begin to fade away. During this period slight precipitation takes place. A characteristics feature of the season, however, is the afternoon or evening storms that burst after the heat of the day and form the chief source of rain of the season. This season normally experiences dust storms, thunder storms and whirl winds. The wind remains normally very hot.

The Rainy Season: This season normally starts from the middle of June, when the monsoon winds bring rain-bearing clouds from the Bay of Bengal. The rainfall during this period seems to be partly guided by altitude, as the Ranchi

Plateau, south-western dissected lands and the Bhanjori Uplands receive over 50". The occurrence of heavy precipitation is the most important characteristic of this season. The distribution of rainfall is not even throughout the rainy season. The occurrence of heavy rain during short period creates flood in the lower valleys.

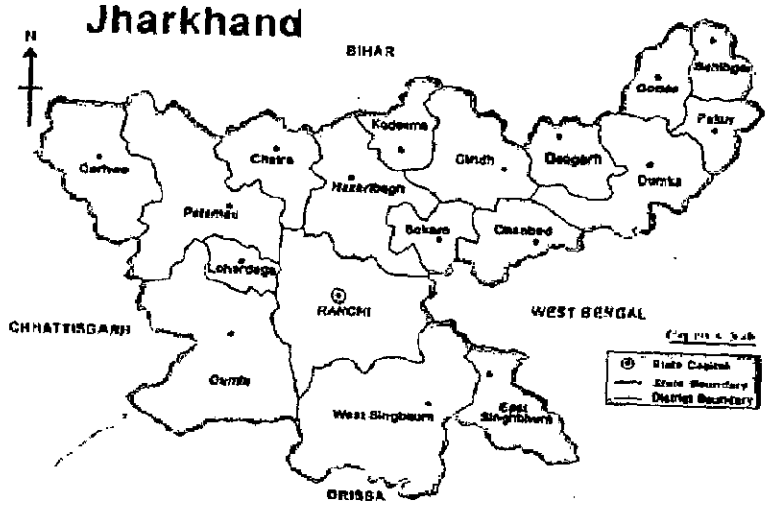
2.4. Vegetation

As the region occupies local variation in elevation, runoff, rainfall, etc. there is also variation in vegetation cover. Though much of the original forest has been depleted by the extension of cultivation in accessible areas, still valuable forests lie conserved in the hilly and rugged terrain. In the Jharkhand state the important vegetation are sal (Shorea Rohusta), Asan (Temidalia tomentosa), Gambhar (Gaelina arborea), Kend (Diopyros melanoxylon), Simul (Bombax melabaricum), etc. The other trees found are Karam (Adina Cardifolia), Kusum (Schbeichero Trijuga), Palas (Butea Frondosa), Bel (Aegle Marelos), etc.

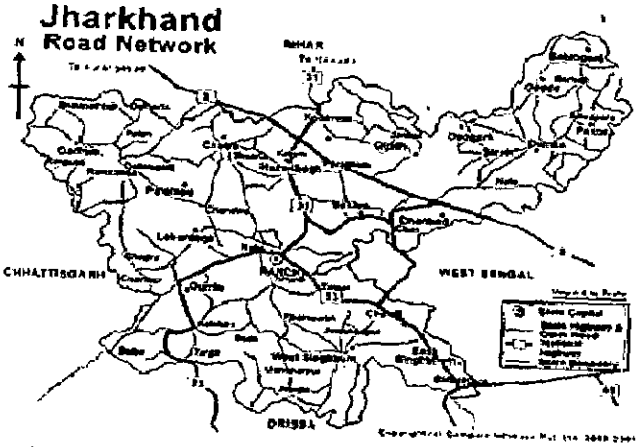
In the cultivated tracts, a number of mixed trees are found such as Mahua, Sajina, Neen, Bar, Pipal, Mango, Jamun and Kathal. Besides these large trees, there are generally scrubs, which include bair (Zizyphus Jujuba), bamboos and 'Babul'. The sal tree is the most valuable. Some species produce edible fruits, while other provide fuel and timber for construction purposes. The chief grasses found in the forest area are Sbai grass (Ischaemium sugustigolium) and spear grass (Andropogon contortus). These grasses are chiefly used for paper manufacture and thatch making particularly in Santal Parganas and South-east Dhalbhum. The forestland is being rapidly denuded by deforestation. Previously people used to burn the forests for cultivation, which was abandoned after two to three years of cropping. This practice exposed the land to erosion. Zamindars who owned the forest also mercilessly exploited the valuable forest resources. This reckless exploitation of the forest reduced the forest to scrub land.

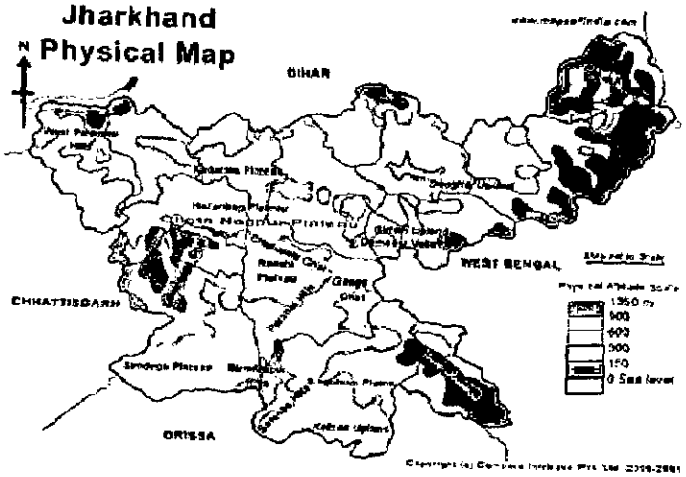
2.5. Mineral

Fire clay also occurs in the Damodar basin as well as parts of Santal Parganas. A large number of building materials are also available in the region and are chiefly used as ordinary brick clay, road metals, building and ornamental stones, and



SANTHALA PARGANAS





SANTHALA PARGANAS-
PHYSICAL

PLATE 1

limestone. The laterite and gravel soil found almost everywhere in the region are suitable for building construction.

2.6. Socio-cultural structure & land holding

The 'Adivasis': The 'adivasis' constitute high percentage of population in all areas of the region more particularly the Rajmahal highland, southern part of Palamau district, Ranchi and Hazaribagh Plateaus, etc. The principal tribes found in the region are Munda, Oraon, Santal, Ho, etc. These are dominantly found in areas, which are hilly and forested. Santals predominate in the hilly areas of Santal Parganas, Dhalbhum and Seraikela, etc. But in the Dhalbhum sub-division, there is considerable admixture of other tribes such as Bhumij, Bhuiya, Kharia, etc. as also Oriyas and Bengalis. Mundas are found all over the Ranchi Plateau and southern part of Hazaribagh Plateau but their highest concentration is in Erki and Kuchai Anchals and adjoining areas. Other tribes found in this part are Gonds, Tamarias, Bhuiyas, in southern part of Ranchi Plateau and Oraon in entire Ranchi Plateau.

The distribution of tribal population is well marked in the rural areas of Ranchi district (65.79%), Singhbhum district (57.94%), and Santal Parganas (40%). The northern portion of Palamau and Hazaribagh district has roughly equal proportion of tribal and non-tribals. In the mining district of Dhanbad also the tribal population is small, 13.73% in rural areas and 3.13% in urban areas according to 1961 Census.

The 'adivasis' are racially believed to be pre-Australoids. They are dark complexioned, squat and stocky with wavy hair, long head (dolichocephalic) and broad nose. They are well built with strong limbs. The true Hos are relatively better looking, particularly the women, about 5'6" tall, and some have even Mongolian eyes.

The 'adivasis' were classed as animists in the earlier Census records although there is considerable Hindu influence. They worship 'Sing Bonga' or Sun God as the Supreme Being, and believe in a large number and ancestral spirit. They are superstitious and believe in witchcraft. Recently there has been considerable conversion to Christianity particularly on the Ranchi Plateau and Santal Parganas.

The 'adviasis' are a simple folk, and were noted for truthfulness, at least some decades ago. They are fair in their dealings, but are quick to take offence. They wear few clothes, and even the women folk are seldom adequately covered. They have a high level of community living and cooperation. All their social and religious gatherings have dance and music as an integral part. Wine (Daru) and rice bear are also a must in the daily social life. The chief festival is Maghi Parab held in January-February with a peak enjoyment on 'Makar Sankranti' (14th January). Next in importance is Sarhul, held when the Sal tree is in bloom in March.

The 'adivasis' have a mixed economy of living on forest produce, agriculture and mining and industrial labour. Since the returns from forests are now subject to the control of the Forest Department and agriculture is insecure and poor on account of infertile land and vagaries of the monsoon, the economy is essentially at subsistence level. In fact if the production of paddy were not supplemented by coarse 'bhadai' crop of maize and 'rabi' and forest produce as lac, firewood, 'mahua', hunting and fishing, etc. or if casual work in the nature of construction activities and in mines were not available, it would be more on starvation level. To some extent the income is supplemented by virtue of the fact that both sexes take part in the agriculture activities. In fact the female is more active than the male.

During recent years a considerable change has been observed in their customs, way of living and economy on account of better transport facilities through which they have come in contacts with the people from outside (dikkus). In Eastern Dhalbhum, Singhbhum Plains, Ranchi Plateau, northern part of Palamau and Hazaribagh districts and Panch Pargana Plains, they have started weaving clothes properly at least when move out of their villages.[2]

Santhals

The third largest tribal community of India with a population of 4,260,842, they are distributed in the states of Bihar, West Bengal, Orissa and Tripura. They call themselves Hor which means man. Their titles are Buna, Mandal, Manjhi, Pradhan and Sardar. According to known history, their traditional home was Chota Nagpur plateau, and the surrounding plains south of the river Damodar. The santal

migration started in AD 1770 into Birbhum and santal pargana, their present homeland. The highest concentration is in the Rajmahal hills of Bihar and in the neighbouring areas.

One reason for the favourable notice of the santal could be that only a few tribes in middle India have been as militant, handsome and mobile. The Santals are justly described as the largest, most integrated and possibly the most resilient tribe in eastern India.

The largest concentration of the santals is found in Bihar. They have originated from pilchu haram and pilchu burhi. Their legends tell of long wandering before reaching their present habitat. They are mainly distributed in the Dumka, Sahibganj, Godda and Deoghar districts of erstwhile Santal parganas, and the hazaribagh, Singbhum, Dhanbad, Bhagalpur and Purnea Districts. According to the 1981 census, there are 2,060, 730 santal in Bihar. Settled agriculture is their main occupation. They also work as labourers, schoolteachers, doctors, nurses and government employees. According to the 1981 census, 36.95% of their population are returned as workers. Of them 66.56% are cultivators, 23.91% as agricultural labourers, 2.64% are engaged in mining and quarrying, and the remaining 6.89% are returned under different occupation.

The santals have their own three-tier community council. The village council (morehor) is headed by a Manjhi, who is assisted by the other council members in looking after village affairs. Ten or fifteen villages constitute the jurisdiction of a pargana, headed by a parganait, who also is helped by his councillors, to look after the inter-village affairs. The posts are hereditary. The highest political authority rests with the hunt council (lobir), headed by a dehri, the supreme judgement like bitlaha or excommunication is pronounced.

The practice of bitlaha is becoming rare.

The 1981 census records, 82.62% santals as followers of Hinduism, 3.29%as Christians, 0.07% as Muslims, 0.02% as Sikhs, 0.02% as Jains. The santals have multifaceted relationship with outsiders (diku) in their area. They depend on the lohar and Mahli for iron implements and baskets, respectively. Their active interest in political affairs is evident from their representation in the state legislature and statutory village and regional councils, and political leadership has emerged from among them at the regional state and national level through participation in national

Jharkhand movement. The present chief minister of the state is also from the same area.

They use their clan names as surnames. According to the Santals the world is divided into the Hor and the Diku, or into the Santal and the non-Santal. Spouses are acquired through negotiation, elopement and capture. Negotiated marriage is preferred. After marriage the bride lives at her husbands house. Divorce is permitted with the sanction of the village council. Rules of succession and inheritance are patrilineal.

The men and women are equal partners in the economic activities of the family.

Major Santal life cycle is purification and naming ceremony performed after birth. Another ceremony initiates the santal adolescent into the tribe and clan. This ceremony is performed these days on the day of marriage. Marriage is their most important life cycle ritual, which involves dancing, and drinking. The dead are cremated and a period of pollution is observed for five days.

The santal have a rich artistic tradition, which is fast disappearing. Their wooden bridal palanquins bear carving of subjects like riders on horseback, elephants and men in fishing boats. Among bird and animal carvings, there are dear peacocks and small birds (perhaps sparrows), fish and frogs. They create figures of animals, birds, and trees and from human beings, scenes from hunting and dancing, as well as geometric forms to ornament their walls. The woman use red and black colours on these walls. The Santal women also tattoo their faces, foreheads, chest and arms. Small wooden combs are made which stick into their hair.

2.7. Settlement pattern

The Rajmahal highlands have distinctive physiographic and cultural features that result in typical settlement types. It has an elevation between 500 feet and 1500 feet and is characterised by rugged topography, isolated conical hills and intermundane valleys. There are numerous divides which are generally unproductive and give rise to linear settlement upon them as the people do not want to misuse the productive valley lands. Linear ridge or divide top settlements are found throughout the highlands. The small valley of the rivers Ajay, Mor, Bansloi etc. is inhabited by santhals. The conical hills such as tin pahar are habitable sites for malpaharias who do not like to settle in valleys and plains

associated with the santhals. The top of the longitudinal ridges is also occupied by the Malpaharias. Examples of such villages of Malpaharias are Gaurpura, Nipania, Salpaha, and Dumarahir near Taljhari Anchal. In the valleys the small ridges are occupied by linear settlements, which generally follow village, fort 'paths' running along the ridges and river divides. Though this is the common feature in the entire upland areas of the Rajmahal but most specific example of such settlements are provided by Hansbhita, Kherua, Kaliani, and Pattargama villages in the Kathkumsandi 'anchal'.

The construction of dwellings on the barren uplands ensures maximum utilization of cultivable lands in the valleys. The western dissected portion of this highland is noted for scattered and dispersed settlements. In this section topography determines the size of the settlements. As agricultural land is found in small patches in the rugged terrain, very small or sprinkled settlements can be supported on the limited agricultural land. The absence of extensive agricultural land precludes nucleation. In the anchals Sunder Pahari, Poreyahat, Pathargama we find almost sprinkled or hamlet type settlements. The southwestern part of the region, which is relatively flat, possesses semi-sprinkled settlements. Here we find large nucleation at the flat land while the high regions occupy isolated hamlets. The examples of large nucleated villages are Chhotochapri, pipra, Domarpahar, Kisma, etc. these villages show nucleation at one site with several smaller hamlets near the agricultural land. Semi-compact and fragmented settlements are in several small pockets. In the river valley of Kajhia we find semi-compact settlements such as Maikita, Saidpur, Dhudrio, GoptoDiha, etc. villages. Peasants prefer to settle close to their small agricultural fields. Mineral resources and communication do not exert and significance influence on the distribution of settlements, as these are underdeveloped.[2]

3. CASE STUDY

3.1. Case study of specific villages

The study involved in this dissertation is as follows:

1) Study of the Santhali houses
2) Study of non-santhali houses
3) Houses built by Sri Panchdashnam Paramhansa Alakh Bara ashram in Rikhia Village.

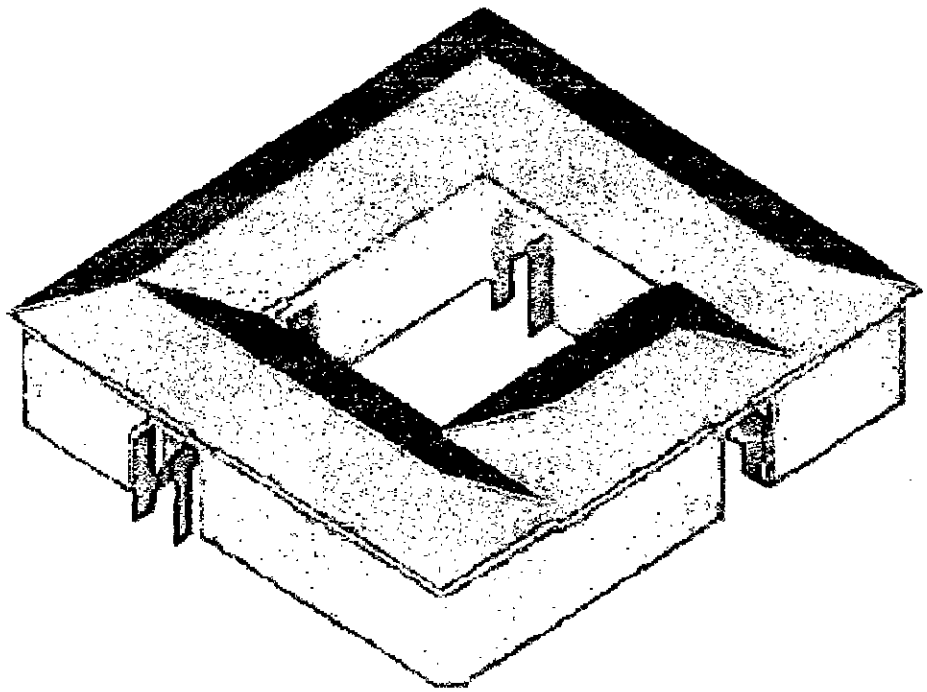
This study has been taken in such a manner so that one gets a complete idea.

The study of the housing would be done under the following heads:

- Socio-cultural
- Economic conditions
- Availability of resources

  Activity pattern, daily routine, spaces according to their needs.
- Need identified according along with duration
- What are the belongings
- Floor area of house along with the plans

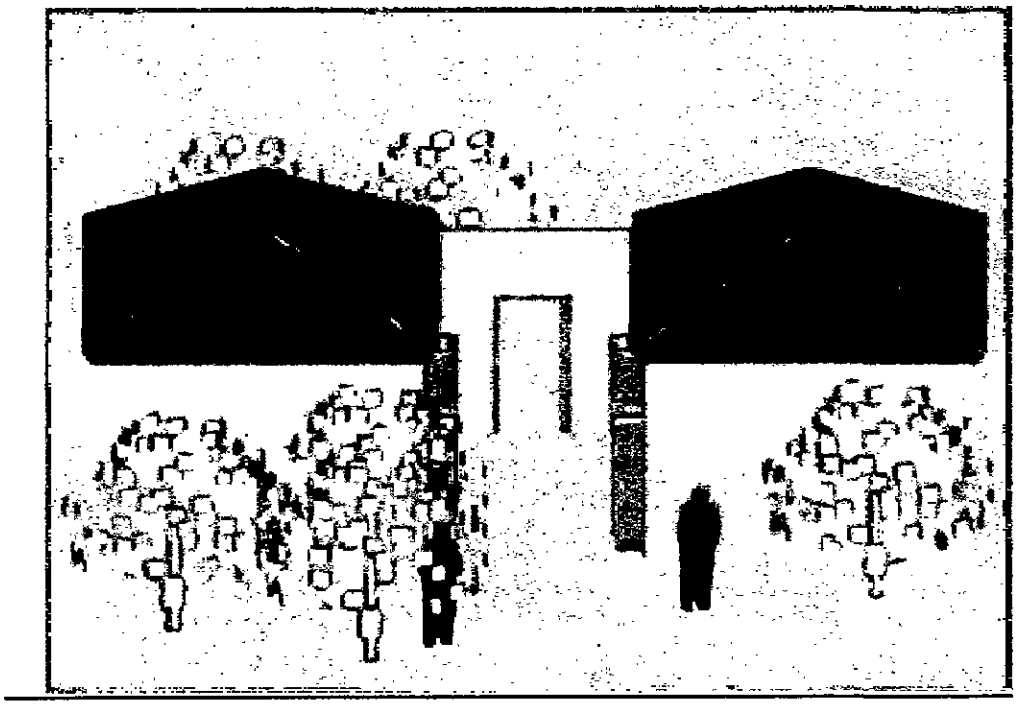
SANTHALI HOUSES



- Mud walls
- Foundation of mud
- Thatch roof with/without desi kavelu

- Courtyard in all houses
- Thatch to be replaced but because of poverty and not
  The right time, thatch not replaced
- Drying of clothes in the courtyard
- Space needed to store wood etc.
- Abject poverty
- Village roads linear, houses along roads double storey houses
- Double storey houses of affluent people in another village
- Material-mud and brick for walls brick for foundations

NON- SANTHALI HOUSES



HOUSES OF NON-SANTHALIS

MATERIAL

- Mud walls
- Mahua wood purlins
- Desi kavelu or khapra
- Low door way
- Timber for door & windows

- Windows absent or very small security from thieves
- Brick paving infront of the house
- Courtyard absent in these houses

METHOD OF CONSTRUCTION

- Mud walls built by putting 2 ½'- 3' mud at one time
- Time consuming method of building
- Small garden preferred in front or near the house
- Courtyard between houses kind of urban/rural space
- Small shed in front of house for cattle
- Cattle not in the courtyard
- Storage space in the form of mezzanine floor
- Beams of mahua wood
- Belongings-utensils trunks lanterns

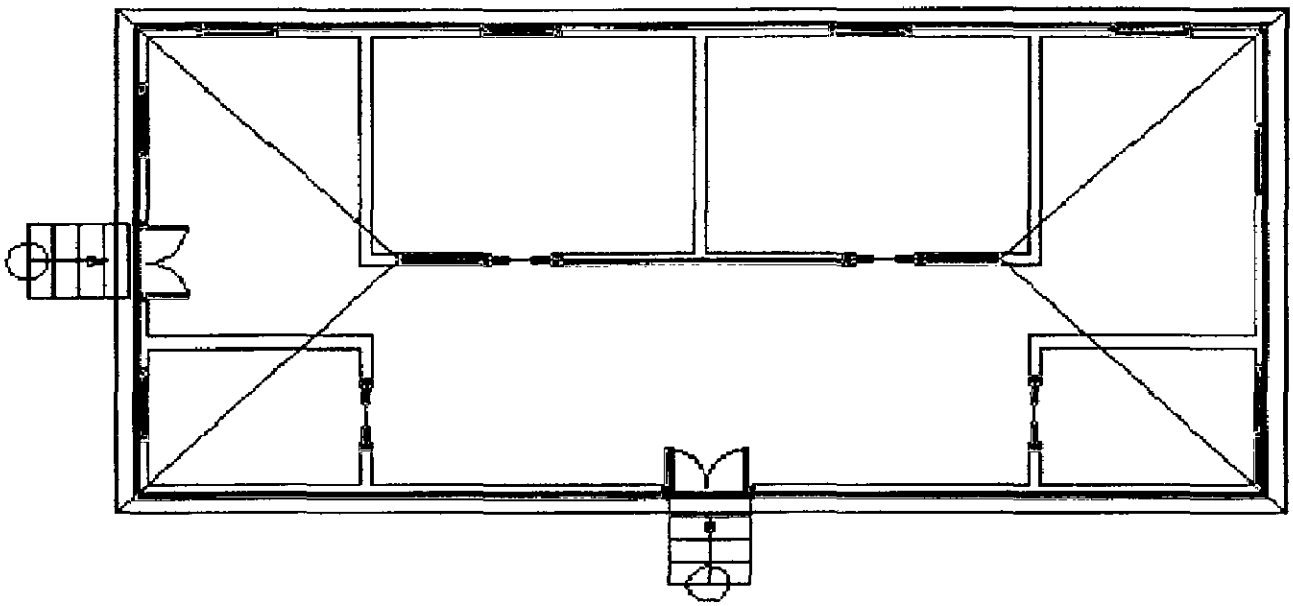
Sri Panchdashnam Paramhansa Alakh Bara

Paramhansa Satyananda at Rikhia, Deogarh, Bihar established Sri Panchdashnam Paramhansa Alakh Bara in 1990. It is a charitable, educational and non-profit making institution.

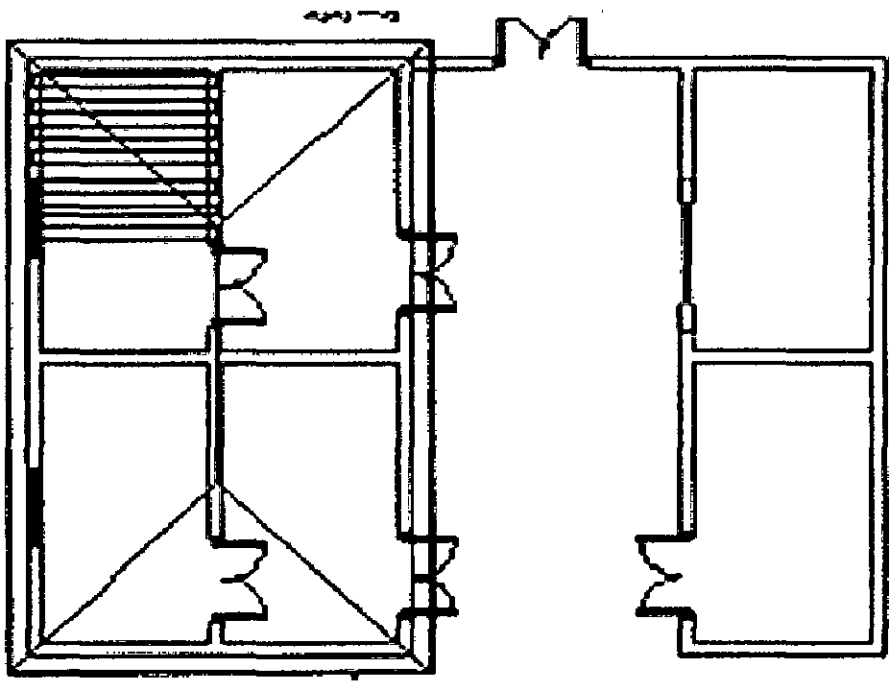
Upholds and propagates the highest tradition of sanyasa, namely *Vairagya* (dispassion), *tyaga* (renunciation) and *tapasya* (austerity). Propounds the tapovan style of living adopted by the rishis and munis of the Vedic era and is intended sanyasins, renunciates, ascetics, tapasvis and paramhansas.

Alakh Bara does not conduct any activities such as yoga teaching and the preaching of any religion or religious concepts.

The guidelines set down for the Alakh Bara are based on classical Vedic tradition of sadhana, tapasya and swadhyaya or atma chintan. Paramhansa Satyananda, who now recides permanently at the Alakh Bara, performs Panch Vidya and other vedic sadhanas, thus paving the way for future paramhansas to uphold their tradition.[3]



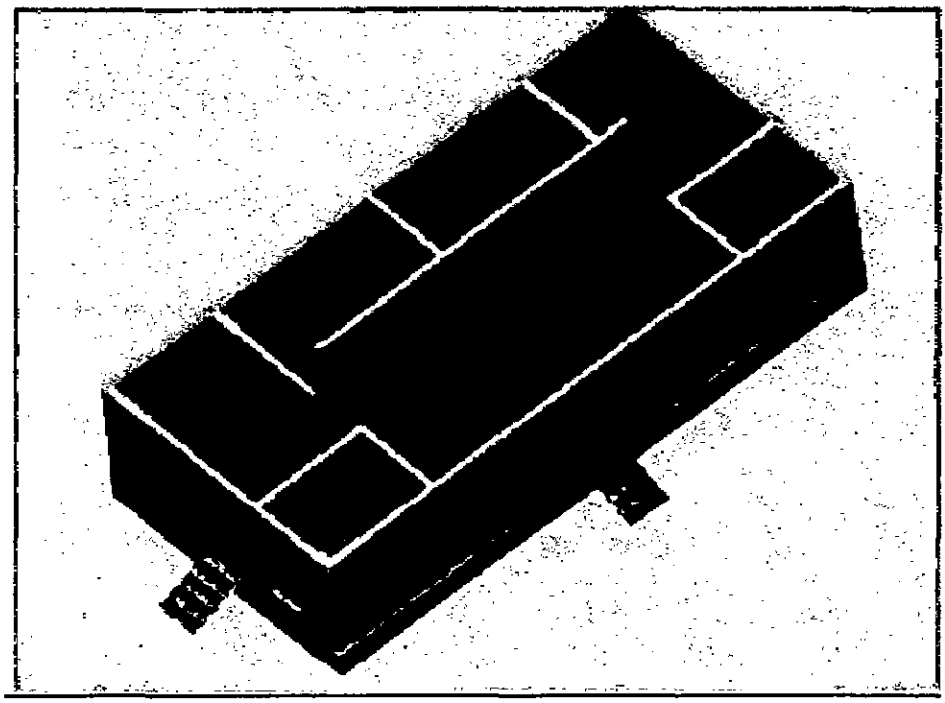
PLAN OF CHANDI'S HOUSE



PLAN OF NON-SANTHALI HOUSE

PLATE 2

HOUSES BUILT BY THE ASHRAM



Owner's name – Chandi

Occupation- auto-driver

Approx cost- rs.40000/-

Material

- Wall –brick & mud mortar
- *Foundation –bricks*
- Roof – bamboo purlins

  Thatch
- Jalis – concrete
- Toilet not in the house

3.2. Housing pattern

House type according to building material

There are certain materials that are in universal use but some regional differences are still to be noticed.

1. Mud walls and thatch roof: this house type is predominant in the plains of Santhal Parganas. The walls are built of locally available mud and the roof material is grass, reed and paddy straw. Such dwelling used to be oval in plan but the roofs

were usually conical in form. Over 80% of the houses in the northeastern section of the Santhal Parganas district have thatched roof and about 75% have mud walls. In Dumka subdivision there are 70% houses made of grass, reeds leaves and bamboo. The walls vary from 7'-9' in height. The chief characteristics of such dwellings are cheapness and suitability for the regional climatic conditions.

2. Mud walls and tiled roof: the conspicuous occurrence of laterite soil in this portion has facilitated the wide distribution of mud walls while tiled roofs are economical. Though mud walls are common in the Rajmahal Highlands, these regions are not marked by preponderance of tiled roofs. In these regions certain geographic and economic conditions prevent the people from preferring tiled roofs. The comparative higher amount of rainfall and the easily available paddy straw induce the people to build thatch roof, which are cheaper and on which the runoff of rainwater is swift.

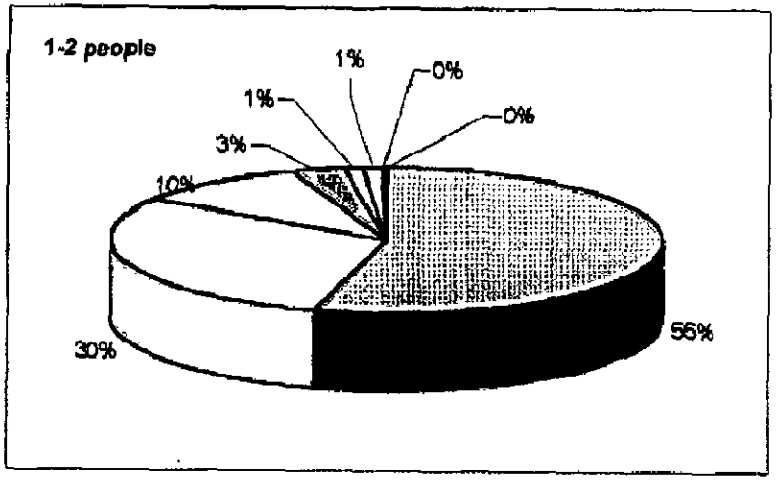
3. The brick houses: the distribution of burnt brick houses is quite negligible in the rural areas of Rajmahal highlands and the adjoining plains. The majority of these have roofs of grass reed and thatch or mud.

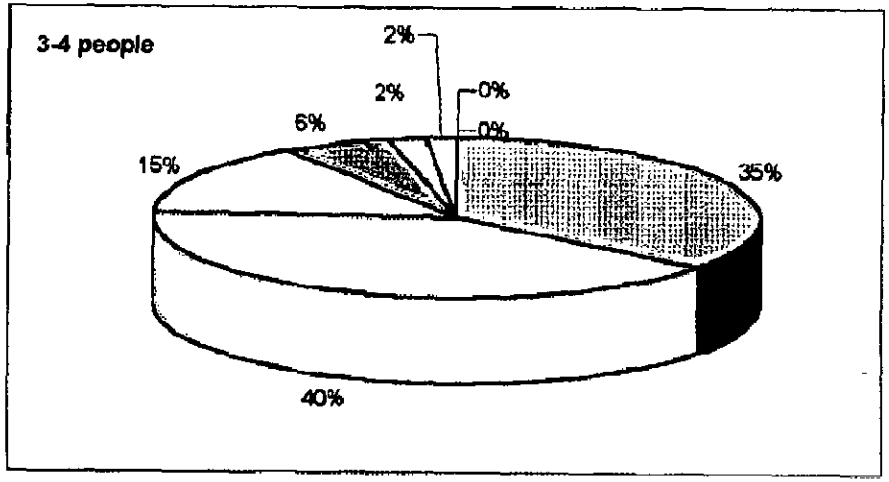
4. Unburnt brick houses: the occurrence of houses made of unburnt bricks are much more as compared to burnt bricks. But the roofing material for them is largely are tiles slate or shingles.

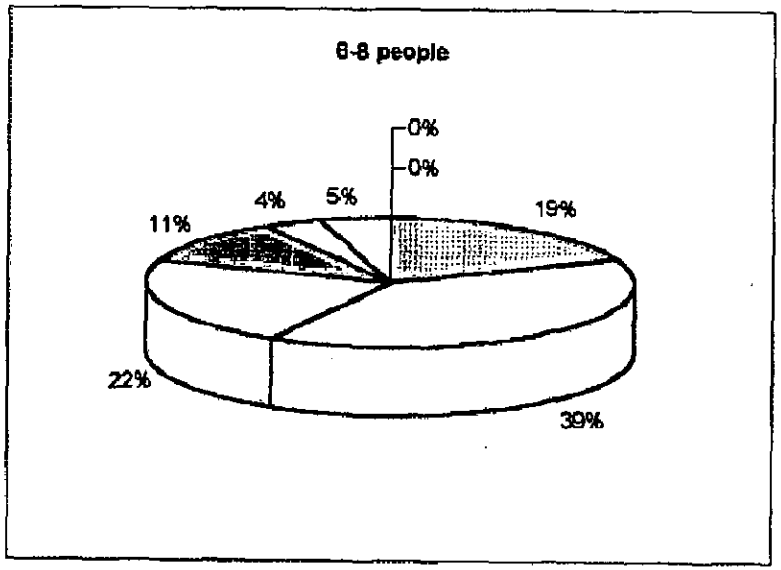
They consist of a fencing wall, a courtyard and a veranda on one two or three sides. Such houses are more common in the hilly areas of santhal Parganas. A large majority of houses are one roomed. But the highest percentage of houses is of 2-roomed houses in the Deogarh district.

Grass, leaves, reeds or bamboo, etc. as a material of wall predominate in the santhal parganas. These buildings are cheaply available from the forests of the region. The economic condition of the region does allow erection of pucca houses with brick and concrete. People construct houses with mud walls and thatched roofs in the uplands and houses are constructed entirely with bamboos and reeds, etc. in the flood plains. The thatch roof is advantageous because it leads to quicker runoff of rainwater. The houses are generally constructed in the months of April and may and the family provides most of the labour. The renewal of the old roofs takes

	TOTAL_HH	ROOM_0	ROOM_1	ROOM_2	ROOM_3	ROOM_4	ROOM_5	ROOM_6	ROOM_7
total	129035	25	33545	46130	23805	12605	5310	7570	45
1-2 people	11715	0	6340	3535	1175	380	130	130	25
3-5 people	48475	0	17080	19635	7125	2880	960	780	15
6-8 people	43320	10	8195	16890	9660	4835	1720	2010	0
9+ people	25525	15	1930	6070	5845	4510	2500	4650	5







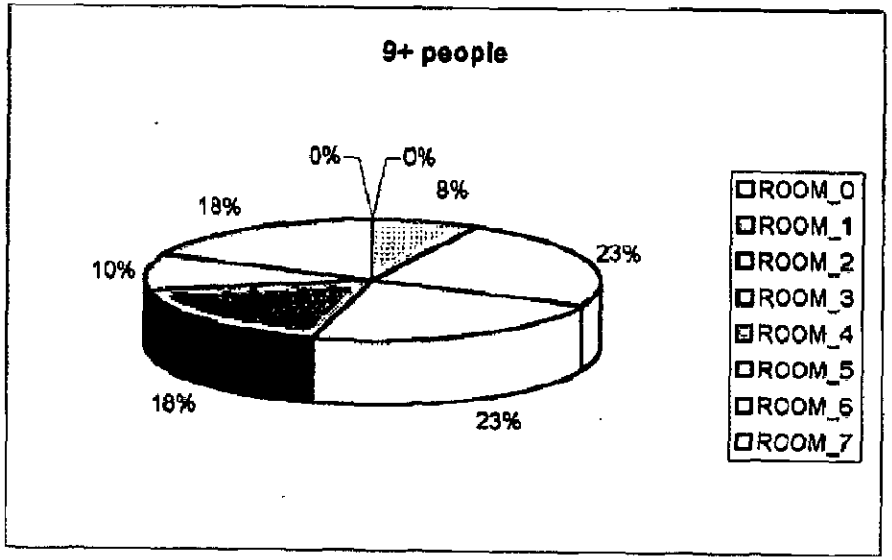


PLATE 3

roofs	grass, thatch wood mud bamboo	tiles slate shingle	CI, Zinc, other metal sheets	asbestos cement sheets	brick stone & lime	stone	concrete RCC,RBC	other materials
walls								
grass leaves thatch,reed, bamboo wall	465	0	5	0	0	0	0	600
mud wall	43405	65670	25	30	0	0	0	55
unburnt bricks wall	75	595	5	5	30	0	25	0
wood wall	35	30	10	10	0	0	0	0
burnt bricks wall	550	8045	105	635	3425	30	4360	300
gi sheets or other metal sheets wall	0	0	0	5	5	5	0	0
stone wall	5	0	0	0	0	0	0	0
cement concrete wall	0	5	0	20	15	0	425	

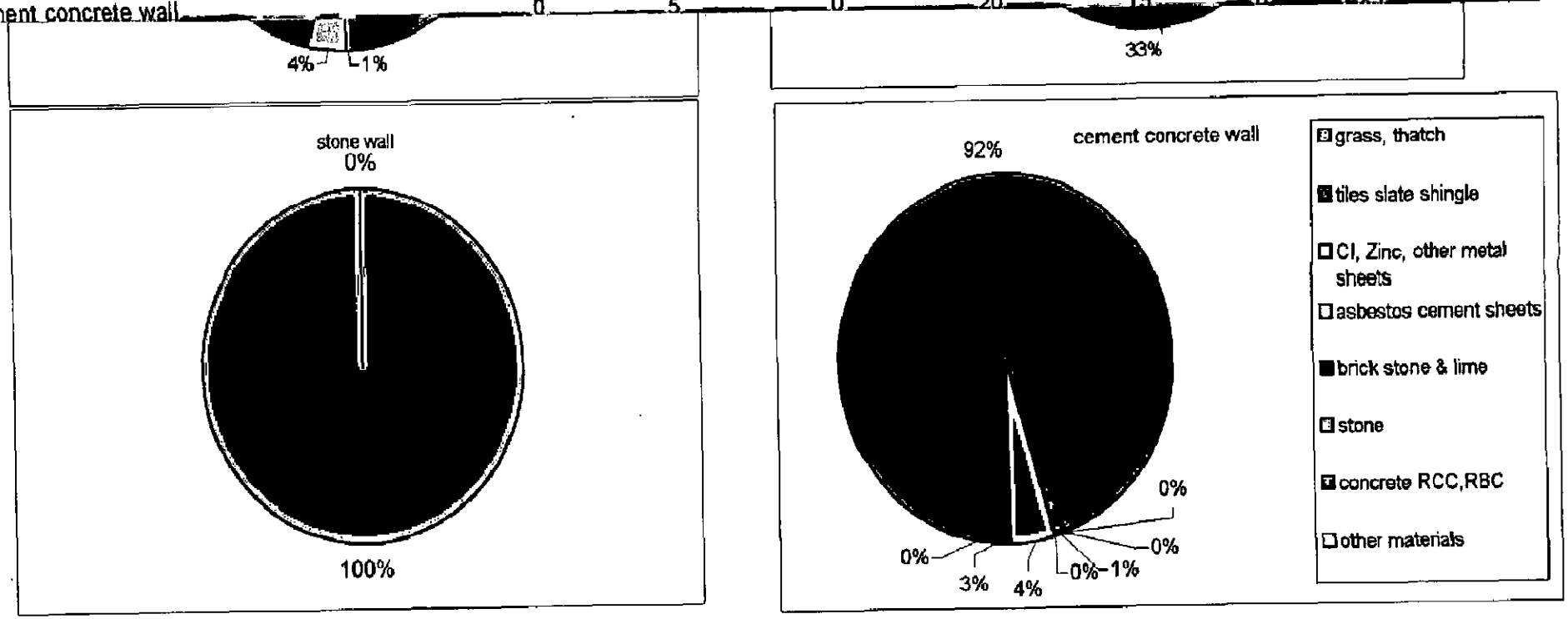


PLATE 4

place in the early part of the season. A few semi-skilled labourers are sometimes used.[2]

3.3. Anthropology- study of daily routine and activity pattern,

Work timings are a little different from the city here in the villages of santhal Parganas. The people here start at about 8 am and finish by about 4:30-5:00 pm. By about 5:00 pm all the men folk are home or near the toddy shop.

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The most other women who do not work spend their time at home tending to the cattle and the chores at home. In the daytime one would find very few menfolk in the villages. Only the women and children would be found at home and in the villages. Even the school going children are not found as they have started attending school.

In the area that I visited, the 8 or 10 villages that I visited, there was one school in villages. And the others did not have schools.

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Most of the villages I surveyed d not have latrines and the villagers defecate in the fields and the forests. When asked how much would they like to spend on the latrine, they replied that they could spend about a Rs. 1000/- in unison.

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Therefore in order to supplement their meagre income the people have taken to other jobs in the nearby villages and towns. Some people are involved in the construction industry, working as masons and labourers, some work as labourers in the nearby towns in sweet shops and other shops. During the festival season there are lot of people coming to the town of Deogarh and so work is found during the festival season. One person had a small shop for household articles etc. there are people who are teachers. They are matric fail and can teach some children of well to do families. Some people drive rickshaw and auto-rickshaw in the town and cities.

3.5. Natural and man-made building materials

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Stone

The main stone that is found here are the ballast, which is good for the construction of roads. This type of stone is not so good for building walls but can serve the purpose of foundations.

Timber

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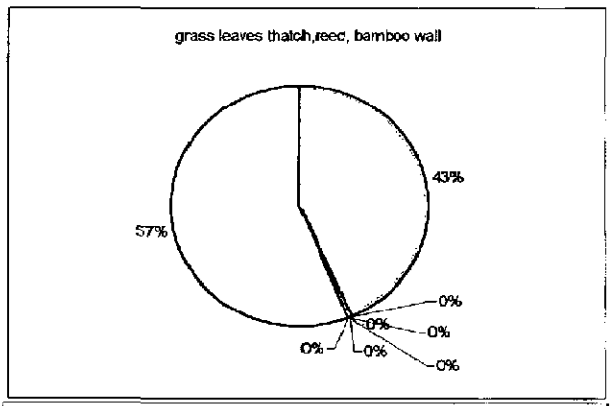
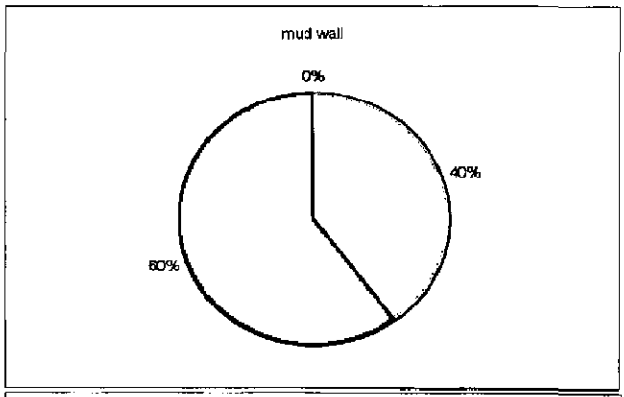
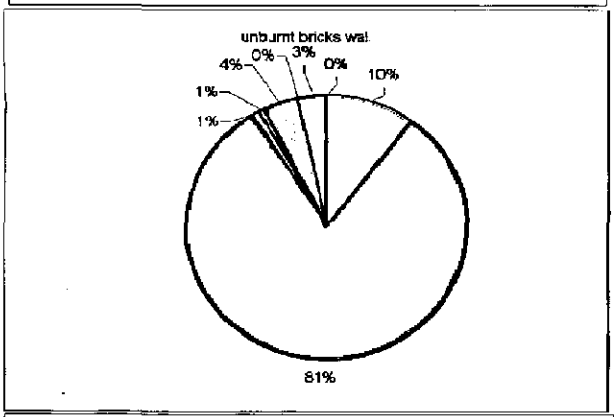
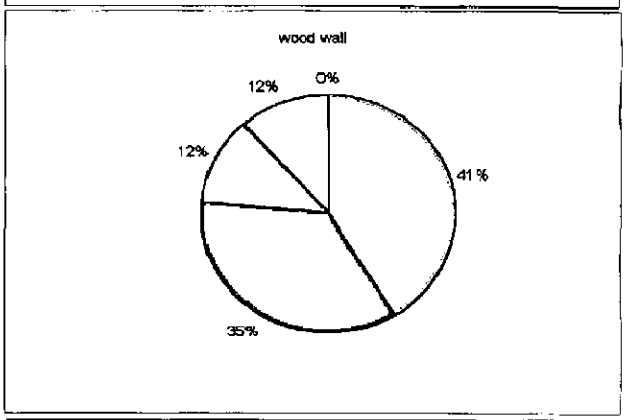
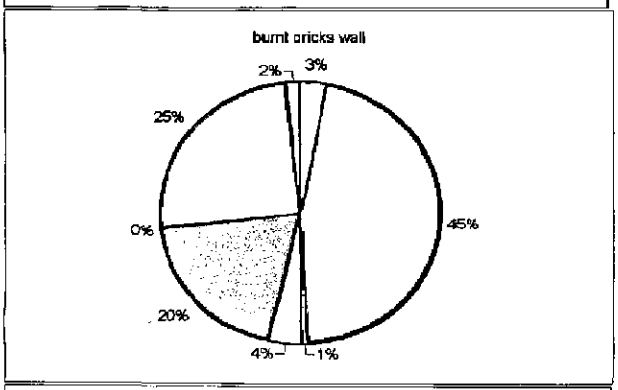
Other materials not stated	0	0	0	0	0	0	0	25

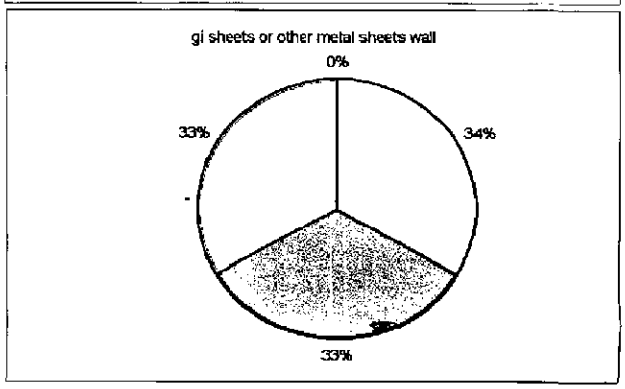


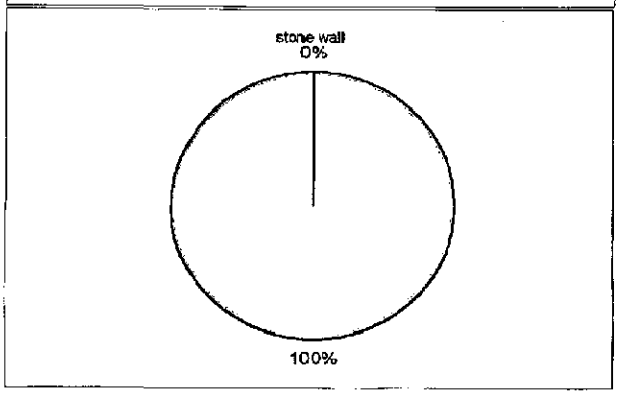












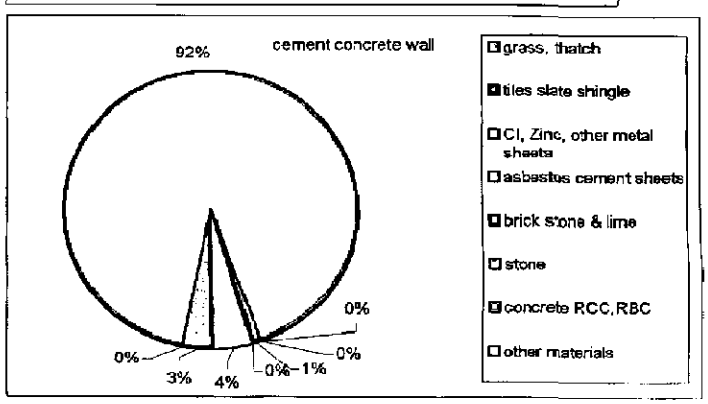


PLATE 4

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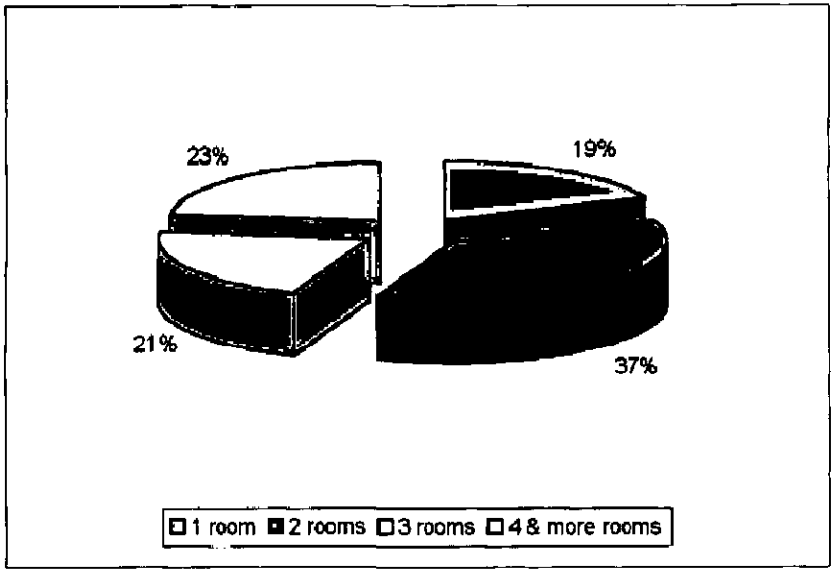
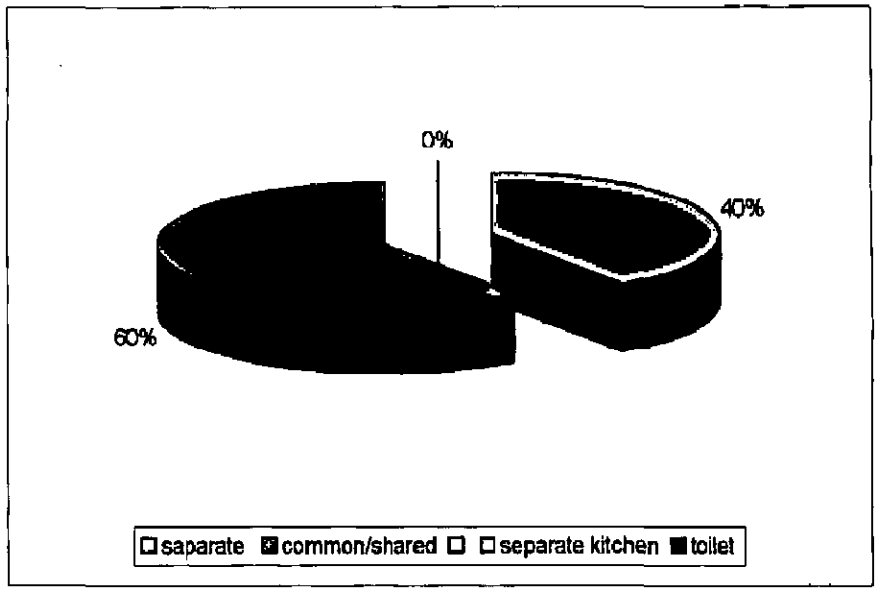
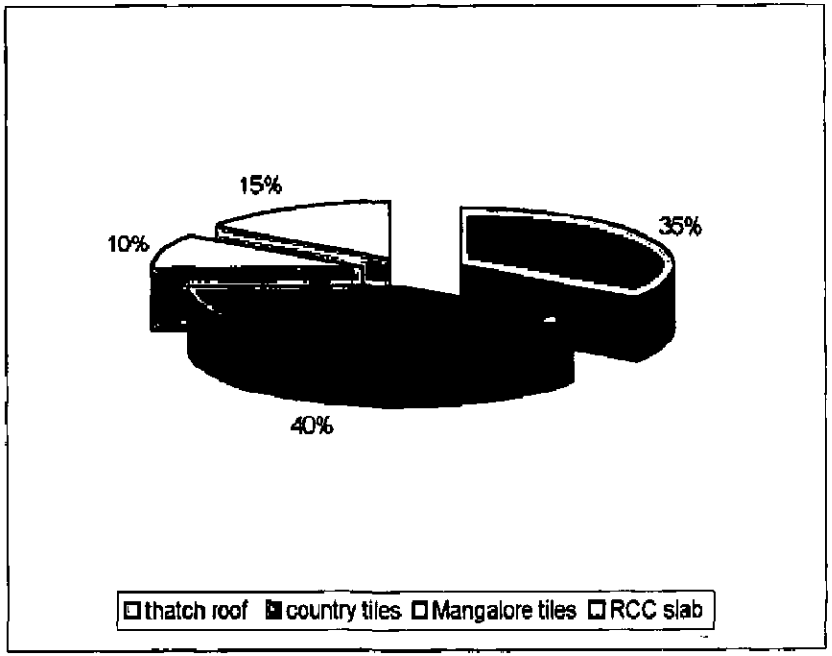
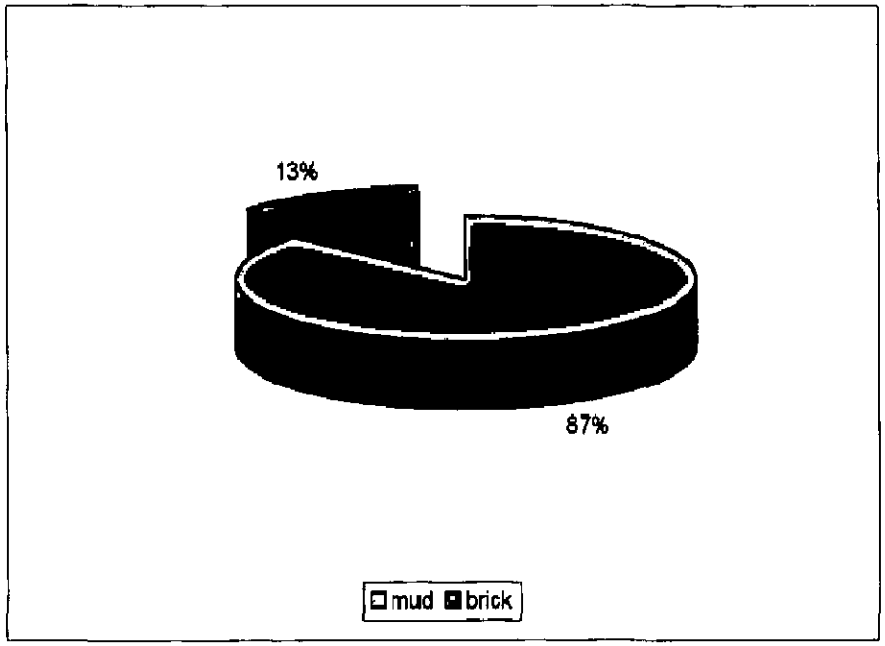








ANALYSIS OF SAMPLE SURVEY PLATE 5

Roofing material

Country tiles and Mangalore tiles are also available and used extensively by the local population. Mahua wood is used for supporting the heavier roof of Mangalore tiles and country tiles.

Cement and steel can be procured from the closest city.

Nails and other smaller things of general use can be obtained from the village market which is once a week and is held at a village 15 km away.

Ceramic and clay tiles also have to be procured from the city and mostly people do not have the money or the need for such luxuries.

Small implements and things like water taps and electrical switches are also available in the village market but due to no water connection in any of the villages they are not required.

3.6. Sample survey of Building material for:

Total no of survey	52	Spaces	
		Courtyard	
No of villages covered	3	Separate	21
		Common/shared	31
No of rooms		Separate kitchen	None
		Toilet	None
1 room	10		52
2 rooms	19	Roofing material	
3 rooms	11		
4 & more rooms	12	Thatch roof	18
	52	Country tiles	21
		Mangalore tiles	5
Material of wall		RCC slab	8
Mud	45		52
Brick	7		
	52		

3.7. Census study

4. CRITERIA FOR OPTIMISATION OF HOUSING ELEMENTS

4.1. Building elements

4.1.1. Land/ layout plan

If the plot and the funds are too small, start with the ground floor, but plan it to contain a stair, first to an open flat roof terrace and later to another floor of bedrooms on the first floor above the original ground floor cottage. This extension will only cost half as much as the first building.

Cluster planning around a common open space for communal work and play (and for bullock cart parking etc) cuts down pucca road lengths, allows for a variety of house designs and encourages neighbourliness.

A common narrow space between clusters can contain fuel and fodder and fruit trees, along with space for sanitation including communal gas plants etc.

Small houses on small plots leave very little open land around each house.

When there are three brothers and their families (or perhaps three close friends) the three houses can be built as one block and then there is much more open space for each family.

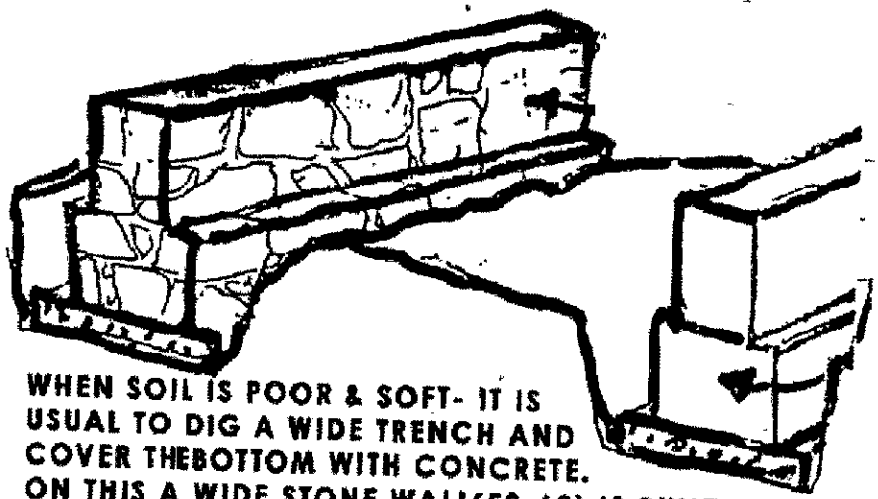
Further more the upper house has a nice big terrace (as large as his house) above the two ground floor houses.

Each site is intrinsically suited to certain uses-a fertile valley is ideal for agriculture, whereas mountainous terrain may support forest or recreational facilities. When land use is planned to be complementary to prevailing physical conditions, the process of living can be more comfortable, more attractive, and more economical.

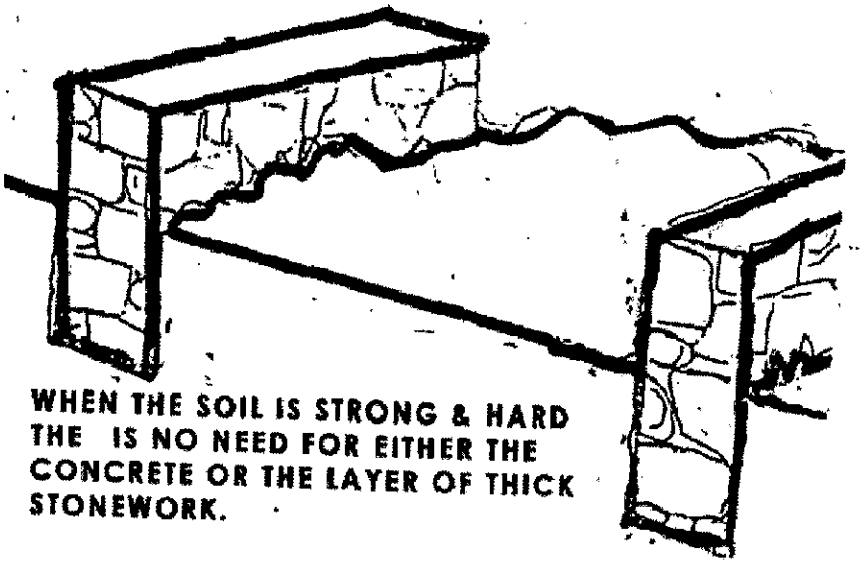
Contemporary technology makes it possible to gauge out lakes, level mountains, and recountour land according to human desire. But a house maybe planned to merge with the landscape, so that it seems to be a natural part of the physical environment. Contemporary site planners try to create dwellings that harmonise with the natural environment and with the lives and activities of those who inhabit them.

Where land is steeply sloping or terraced-

Don't build on the outer edge of the terrace. Strong expensive retaining walls would be required. Build the house along the middle of the terrace and use a long



WHEN SOIL IS POOR & SOFT- IT IS USUAL TO DIG A WIDE TRENCH AND COVER THEBOTTOM WITH CONCRETE. ON THIS A WIDE STONE WALL(50-60) IS BUILT & ON TOP OF THAT- A 30 TO 35 CM WALL.



WHEN THE SOIL IS STRONG & HARD THE IS NO NEED FOR EITHER THE CONCRETE OR THE LAYER OF THICK STONEWORK.

PLATE 6

rectangular plan, not a square one. If the terraces are narrow it is sometimes possible to build a stepped house.[4]

4.1.2. Foundation

In traditional mud houses, mud walls are erected directly on the ground. In some cases shallow trenches are dug up in the ground and the base is consolidated by ramming. The mud wall is then built over the consolidated base. An improved method is also found to exist wherein locally available stones, brick bats, grit or kankar are mixed with the dug up soil and filled back in the trenches in consolidated layers. The wall is then erected above it from the ground level.

To prevent erosion and cutting of plinth during rains, the wall is usually protected by making it thicker at the base on its external periphery. Unless the increased thickness is sufficient, it also does get eroded needing heavy repairs. While the extra widening calls for additional space around the house, insufficiently increased thickness fails to protect the wall from damage.

It is though always preferable that foundations and walls above, upto plinth level, are constructed in stone and burnt brick laid in lime mortar or even in clay mortar to provide desired protection to mud walls against rain water, flooding as well as rising dampness; but, the economic conditions of the people do not permit such constructions and usually oblige them to continue to build in mud only.

When digging out the trenches for the foundation walls, do not scatter the soil all over the place. Keep it altogether in the middle as it will be needed for infilling in between the plinth walls (from ground level to floor level).

For small houses (and specially for single storey ones) there is no need to build the upper brick walls over the middle of the foundation wall.

Set the upper wall over the outer half of the foundation walls. It prevents rain seepage.

Stone foundations usually stop at floor level (30 or 40 cm above ground level). Take them 45 cm higher and you have already made bed or seat. [4]

4.1.3. Plinth height and protection

Traditional foundations and plinth walls can be protected against rain cutting by constructing a low ring wall of burnt brick around the house. A 23 cm deep and

23cm wide trench is dug in which a foundation of 7.5 cm thick soil layer mixed with burnt brick aggregates, stones, grit or kanker is laid and compacted. An 11.5cm. (half brick) thick burnt brick wall is erected in mud mortar to a height of 75 cm above ground level along and abutting the mud wall. A 23 cm wide flat-brick course is laid sloping outwards on top of it, such that the half of the brick length is embedded in the mud wall. The protection wall is pointed with lime or cement mortar on its outer surface. This technique can also be used in existing houses

Usually no damp proof course is provided in mud houses. Rising dampness, therefore produces trouble of reduced strength of walls in the superstructure and create moist and unhygienic conditions inside. The problem of rising dampness is more acute, particularly in the higher rainfall areas and places with high water table. A course of 2.5cm nonerodable mud mortar maybe applied as a damp proof course. Alternatively, a layer of jute reinforced polythene sheet obtained by cutting empty fertiliser bags can also be used as damp proof course.[5]

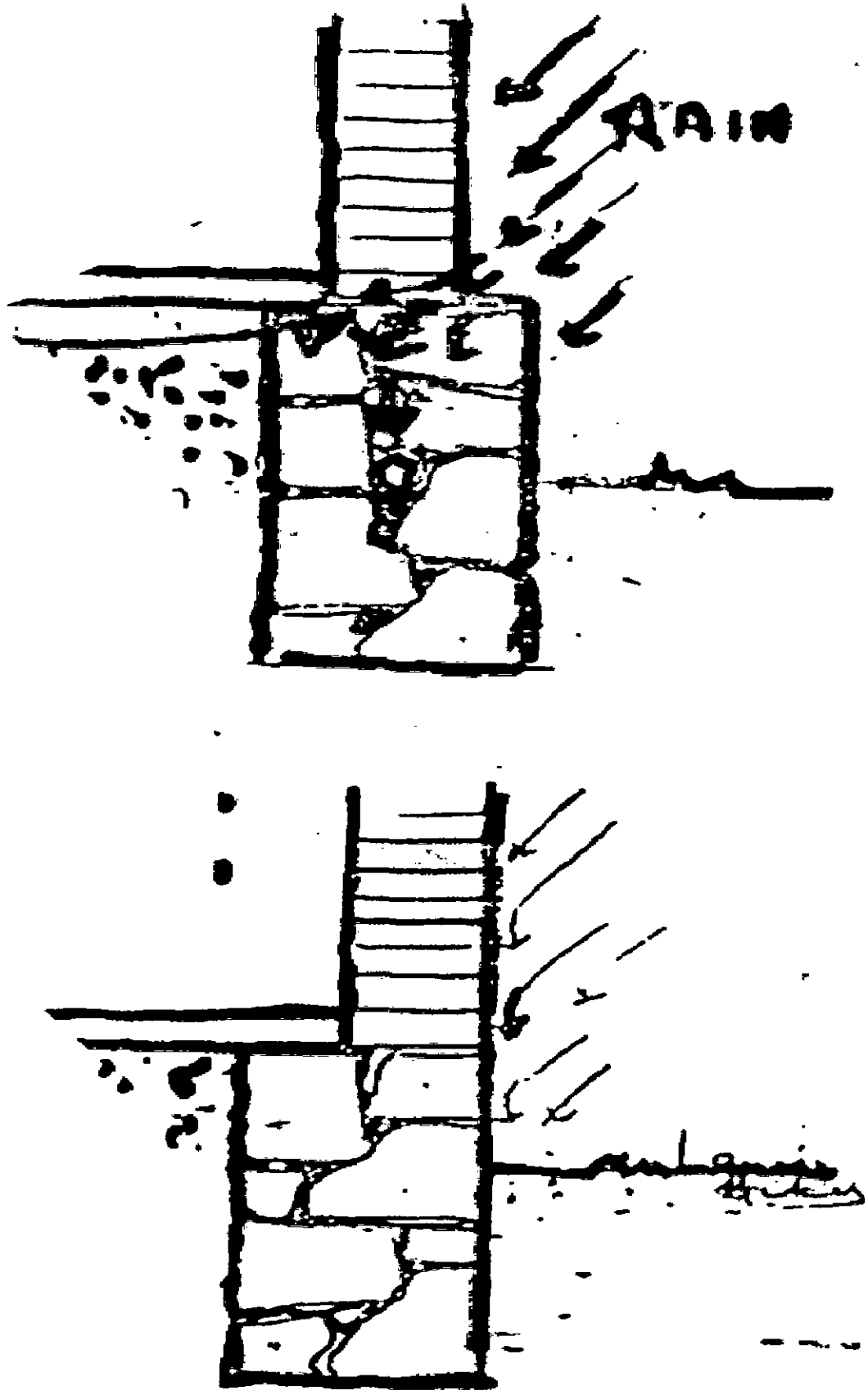
4.1.4. Walling

Soil blocks are very well suited for low-rise construction of upto 2 storeys if they are well protected against water. However, pragmatic design practices make allowable spans less than those of fired brick construction.

The important criteria to be met for a durable structure of soil blocks are:

Minimum strength of masonry units (Direct Compressive strength)

- Unstabilised soil blocks 25+_ 4 kg/sq. cm.
- Stabilised soil blocks (e.g. 4% cement or 6% lime) 35+- 3kg/sq cm
- Maximum tolerance of block size
- 12% on variation of depth of block
- 5% on length and width of block
- Wall design
- Slenderness ratios should not exceed 12. a conservative value is 10. This implies that the minimum thickness for a load bearing wall for a
- 1 storey building – 23- 26 cm
- 2 storeys - 30 – 35 cm
- Slenderness depends on lesser of the two – length and height



PROTECT FOUNDATION FROM RAIN

PLATE7

- Total area of openings should not be more than 20% of wall area. 10- 15% is optimum.
- Openings should not be closer than 60 cm from corners.
- Eccentricity should be reduced to minimum by ensuring central loading on the wall
- Concentrated loads such as trusses and beams should be supported on tie beams or bed blocks to ensure proper load distribution. A 10 cm thickness of the above is necessary.
- Sideways thrust on walls from trusses should be minimised.
- Column design
- Columns should be designed carefully so that no tensile stresses are induced. The thrust line should pass through the middle third of the section.
- Minimum column size is 30 cm X 45 cm. [6]

Cob wall construction

This is the simplest and the oldest method in which the earth is made into a stiff mud and is lay in thick horizontal layers to form the wall. The walls are also made with simple lumps of ill formed clay placed one on top of another. The wall in this method is constructed layer by layer, each layer (60-90 cm high) being put on alternate days or so, after the lower layer has dried. Normally such walls are 40-60 cm thick at the base and slightly tapering towards the top.

Sometimes straw and cow dung are added to the kneaded soil for improving the strength of the wall.

Mix soil with only a little water- pick up as much as u can in your two hands and make a 'roll'.

Place these rolls closely together in rows. Then smooth over the ends.

Anyone can make his sort of wall but you cannot make a high wall. It is very good for curvilinear and circular walls.

Adobe construction

In adobe wall construction, the prepared wet earth is first moulded into bricks of suitable sizes and then sun dried. The bricks are laid in mud mortar to form regular walls. This technique is gradually becoming very common in India. The hand made bricks are normally larger than kiln fired bricks but they do not conform to any

standard size. The maximum size is, of the order of 30 cm X 30 cm X 10 cm. Sun dried bricks usually make stronger walls than mud.

Rammed earth wall construction

In the rammed earth technique moist soil is rammed manually between shuttering (vertical frame work) on either side of the wall. After one layer has been rammed the shuttering is raised and a second layer is rammed on the first layer after it has dried for a day or so. Successive mud layers are similarly rammed upto the desired height. Sometimes, small stones or straw are also are also mixed earth for such construction. Such walls vary from 30 cm to 45 cm in thickness. This technique, however, is not so popular as the adobe or cob wall due to involvement of special technique and necessity of shuttering.

It is specially good for large, low, solid looking buildings and it can take he load of heavy roofing such as reinforced concrete.

Wattle and daub wall construction

A common form of wall construction practised in different parts of India consists of fastening split bamboo mats to the posts or weaving the mats in between the posts, and then applying mud over the outside and inside surfaces. Alternatively, materials like reed, date palm or Palmyra leaves and tree branches are used for making mats in place of bamboo wattle. In some areas wattle of intricate basketwork is doubed with mixture of mud, stone and clay. Usually timber poles, strong tree branches and whole culms of bamboos are used for posts in the system of wall construction.

It is particularly good and safe in areas prone to earth tremors. It is also adaptable to any shape of the building.[7]

Earth wall deterioration

Earth walls deteriorate under the following action:

- Erosion through the rainfall hitting the walls directly or splashing up from ground surfaces.
- Saturation of the lower pat of the wall by rising capillary water
- Earthquakes
- Attack by termites and insects

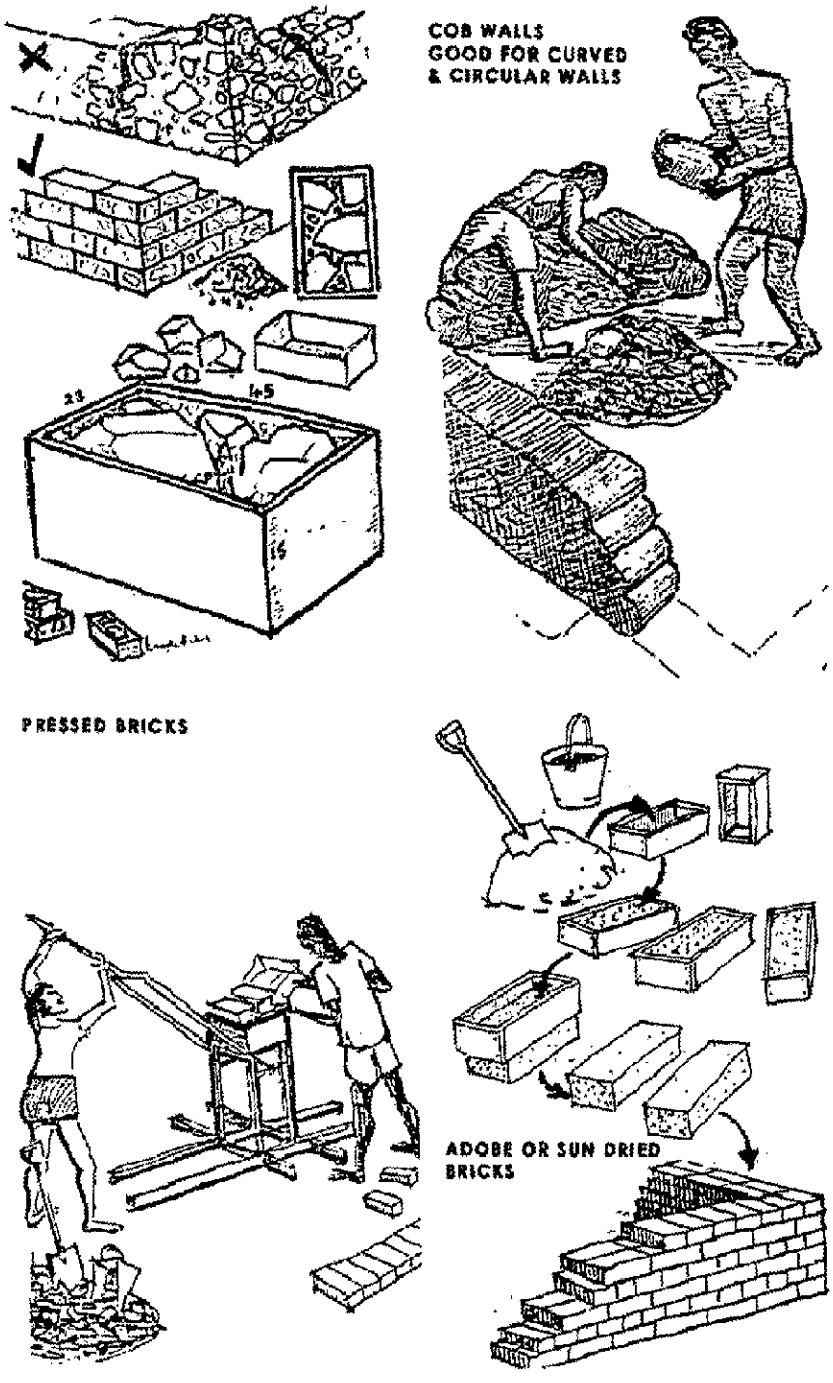

COB WALLS
GOOD FOR CURVED
& CIRCULAR WALLS
PRESSED BRICKS
ADOBE OR SUN DRIED
BRICKS

PLATE 8

- For one storey earth walled houses, structural considerations are less important, because of the light roofing generally used. A badly designed or constructed earth-walled building might crack or distort, but sudden collapse is most unlikely.
- Methods for improving earth walls
- Keep the wall dry after construction
- Block walls are usually superior to mud and pole walls. Mud and pole walls should only be used when a supply of durable poles is available, and the soil is not suitable for block making.
- Avoid the use of pure black cotton soil for construction, because it shrinks greatly on drying, leading to cracks and distortion. Black cotton soil maybe used with lime stabilisation.
- Provide an adequate eave width (roof overhang) to reduce wall erosion. However, eave width is limited to about 0.5m or little more because of wind damage and door clearances. The provision of verandas can often be useful for wall protection.
- A foundation wall can either be constructed either from fired clay bricks, stones se in cement, mud mortar or even stabilizes soil blocks. The foundation wall minimises the effects of all types of water-caused damage to the base of the wall.
- Plastering is an essential means of protecting the wall from water and insects.
- Selection for proper sites for houses and provision for adequate site drainage is a very useful and effective low cost technique.
- Choose a free draining non-swelling soil to construct buildings on. Construction of earth buildings on and with swelling soils may lead to foundation and wall distortion during the rainy season.
- Maintain the wall construction and coating well. Allow good evaporation of capillary moisture from the walls by clearing the low vegetation from around the walls.
- In areas of heavy year-round rainfall, it is difficult to dry mud blocks and high rainfall coupled with low evaporation causes permanent dampness to walls. In these areas durable housing will require cement or lime stabilised block or composite construction with burnt clay bricks.[8]

4.1.5. Roof

Inadequate roofing is the most critical problem in the area of low cost house building in India for both the rural and the urban poor. Given the great geographic and climatic diversity of the country, a large variation in the resource base; a number of traditional roofing system have emerged in the past, as appropriate responses to local environment. However in the last forty years or so these have been continually displaced by in appropriate high cost market based products. Very few appropriate technologies have been able to fill the widening gap between limited resources and increasing needs, individual and sustainable community resource use.

This is a complex area of action influenced by a number of interacting factors including:

- A failure to disseminate and market appropriate roofing products
- A wide gap between need, demand and supply of these materials
- Almost non existent links between the 'field' situation and existing innovation institutions
- An R&D, which is geared to optimising sub systems e.g. roof cladding, sub-structure or joints rather than the entire structural system, that makes up a low cost house. This has led to an adverse effect on technology dissemination as 'implementing and extension' agencies and house owners want a better house rather than a juxtaposition of for example better walls, roof cladding and improved plasters.
- A lack of insight into changing market, skill and resource environments.
- The choice of roof is just not between plain and fancy
- The main considerations needed are the materials available, the climate, the rainfall and the wind direction and most important the traditional shape.

4.1.6. Flooring

The plinth is traditionally filled and raised in ordinary soil by ramming the earth in layers. The plinth level is usually kept 23 cm to 30 cm higher than the general ground level. Though, no specific sub flooring is provided; sometimes, locally available stone or kanker are mixed with soil in the top layer. Thus the rammed earth of the plinth does also serve as the flooring. The top layer of the floor is

levelled and two coats of ordinary cow dung slurry are applied on it. The top coating of the cow dung slurry is frequently repeated as and when so required. This flooring provides a hygienically acceptable flooring surface compatible with the general environment of mud houses.

4.1.7. Plastering

The external wall system, including plaster, may be considered a single element of an entire structure. There are various characteristics of external walls, the four primary functions being:

1. Appearance
2. Structural strength
3. Weather barrier
4. Durability

Plaster coating of walls, evidently, serves the first of these functions directly, by providing the external surface of the wall. Particularly for soil block walls subject to rainfall, the plaster enhances structural strength, in that the wet compressive strength of soil blocks is negligible. We are concerned here primarily with designing plasters to perform the latter two functions of wall systems—weatherability and durability.

Factors influencing plaster performance

The performance and efficiency of plasters is a function of a number of interrelated factors. The most significant performance indicators are erosion resistance, bond strength, (im) permeability and impact resistance. These maybe evaluated against cost per unit area, percentage labour component and percentage local economy component with a view to minimising the first and maximising the latter two. A weighed composite performance index can be prepared when adequate data on the performance indicators becomes available. The detailed impact of each is presented below:

Erosion resistance

In designing adequate protection for a building, we must consider the vagaries of local weather in order to ascertain the severity of rainfall to which it will be subjected during its life. The erosion of a particular material by rain is the combined effect of erosivity of rain and the erodibility of the material.

Though two locations may record the same total precipitation, the rates at which rainfall falls at both are likely to differ. One maybe subjected to gently falling rain prolonged over a period of time, while the other occasionally receives heavy, driving rains during cloudbursts. Of the two the latter will have a greater erosion problem due to higher intensity. For two reasons, intensity appears to be the most appropriate index of the erosivity of rain: it is related to other parameters of rainfall that come to play in the process of erosion; and records of intensity are often, with reliable degree of accuracy, from local daily precipitation data.

The parameters that effect erosivity and are related to intensity are drop size and drop velocity. The percentage of rain falling as large drops (greater than 3 mm dia.) increases with increasing intensity. However, the scatter of drop sizes is still considerable.

Drop velocity, related to wind resistance and mass, increases as drop diameter increases. Large drops (about 5mm dia) can have a still air velocity of 9 m/s. added to this the effect of high wind velocity.

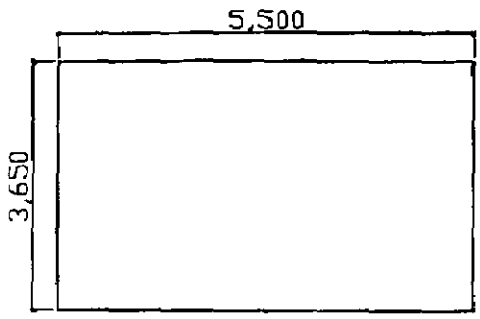
Impact resistance

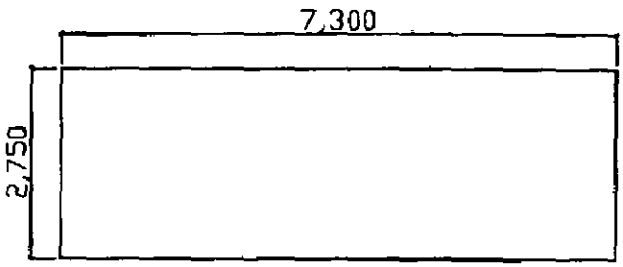
Durability of the plaster coat depends in par on its ability to with stand impact. During the course of its life, the plaster will be bumped, scraped, scratched and generally abused by humans and animals alike. High plaster density and use of several coats are the essential means of ensuring resistance to impact. Surface finishes with low coefficient of friction are more resistant to abrasion than rough plaster surfaces. While material properties are important in providing durability, methods of application, including densification, multiple coats, and surface finishing, are critical in achieving durable plaster.

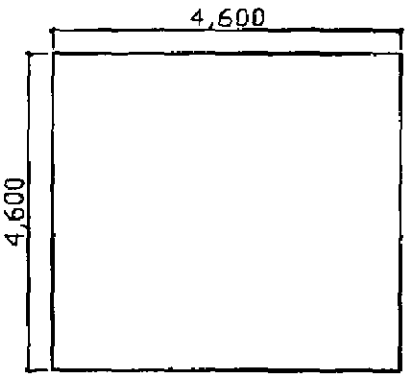
In many cases a single coat of plaster is adequate, though double or triple coats will provide additional protection and reduce maintenance cost.

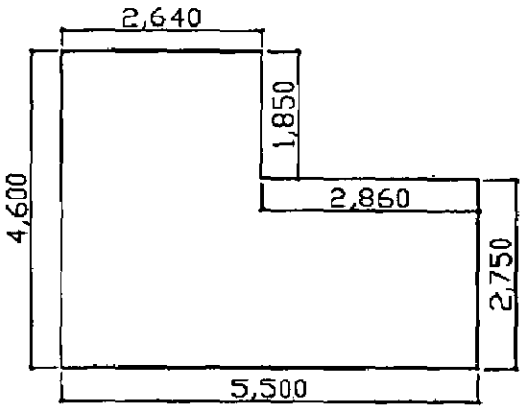
Materials cost for single and double coats of mud-straw plaster are Rs. 0.75/sq.m and Rs. 1.25/sq.m; and labour costs are Rs. 3.00/sq.m and Rs. 5.50/sq.m, respectively. Maintenance cost for a single coat is Rs. 0.65 incurred annually, while for double coats, Rs. 0.75 incurred biannually. Consequently, a double coat will result in lower overall cost after tenth year. [9]

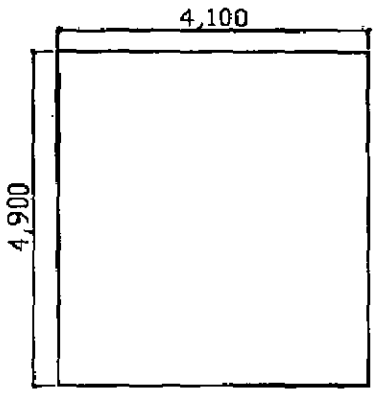
VARIOUS FORMS OF 20M2

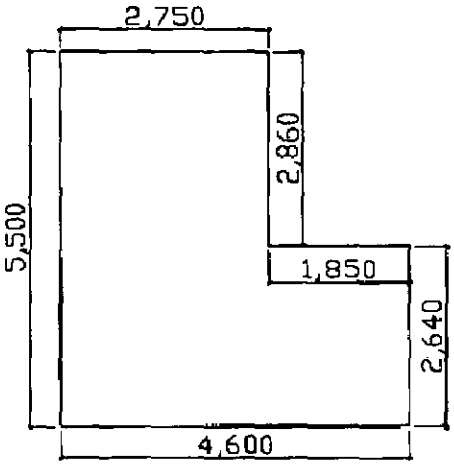


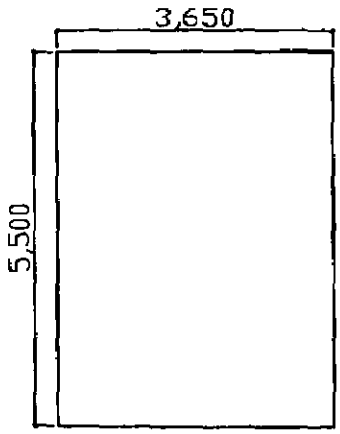


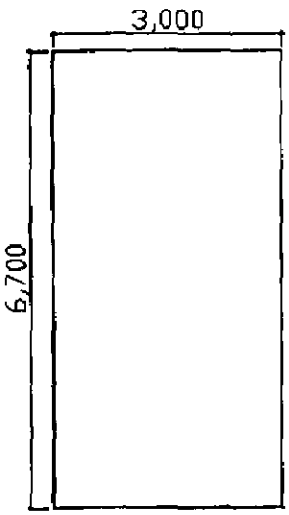












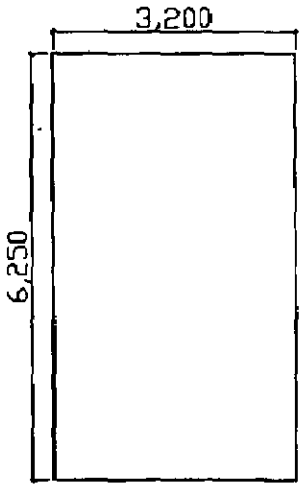


PLATE 9

4.2. Design elements

4.2.1. Plan-form

Traditional rural houses are designed and planned by the villagers themselves based mainly on their experience and limited knowledge. While such houses satisfy their living habit, they generally lack in many essential features like hygienic environment, structural safety and durability. Poor economic conditions, depleting resources and storage of local building materials have made the problem more critical. There is need for rationally designed, economic, efficient and comfortable houses.

The housing pattern varies from country to country, region to region and community to community due to variations in guiding parameters of house design.

The designs are based on studies conducted on the social structure, living habits, space requirements as well as attitude and aspirations of the people.

The indoor space is mainly used for storage and sleeping in the cold and inclement weather. The outdoor and semi-covered spaces like verandas are used for most of the household activities like cooking, dining, gossiping, entertaining guests, grain drying and processing and also for activities of more private nature like nursing babies and bathing. Thus the outdoor space is as important as the indoor space in such houses.

Very often, authorities and institutions limit the sizes of homes they intend to build: sizes such as $20m^2$, $25m^2$, and 30m2

The general immediate reaction of planners and beneficiaries is "homes! What can you do in 20 m2 – a mere 4m X 5m! And then we get accused of putting up identical little concrete boxes- and call them houses.[5]

4.2.2. Space planning

Based on the space requirements for various activities, sizes of furniture and other household articles in common use; minimum space standards can be worked out and along with typical house plans for different sizes of family. For the mud house with thatch roof the width of the room has to be restricted to 2.55 m, so that timber poles of commonly available sizes in the region could span with sufficient overhang.

It is observed that the family members rarely dine together and prefer to dine in the veranda or courtyard. It can be worked out that a veranda space of 1.75m X 1.35m is sufficient for the cooking activity with the provision of one person dining.

Minimum cattle space has been found to be 2.7m X 3.4m required for accommodating one buffalo with one calf.

4.2.3. Circulation

Circulation is mainly from the indoor to the outdoor. The courtyard and the veranda are the most important places in the house as that is the place used as he living room. Courtyard is an integral part of the house and is there in every house however big or small.

The circulation of the women of the house is within the rooms and the courtyard and if needed to the village market on a few days. Their work usually is limited to the four walls of the house and to the well and the hand pump nearby.

The men and the children run errands in the house and they are the once that venture out to the farms and the work place.

The santhali women usually join their men at work and the men share the load of household work also but this is almost a thing of the past. Now the male chauvinism is a part of every household.

4.2.4. Furniture layout

Furniture is not acquired all at one time. It is acquired bit by bit as the need arises. The most important is the khat or khatia. One or two of these are found in each house. They are multipurpose use in each and every household in the village. They are used for sleeping, sitting, eating and studying. Sometimes all these activities are performed on the ground. Very few of the houses surveyed have tables and chairs. Only the wells to do people have chairs and tables.

The storage is usually done in trunks or on the shelves. The attic and the mezzanine level are also used for storage of utensils and other items of daily use.

Other items of use found in the house are battery-operated torches; transistors and some houses have television sets if there is electricity in the village.

The storage of clothes is on pegs and in the trunks. The food grains are stored in gunny bags. Vegetables are stored in the open and there is no use or method of

BRICK-ON-EDGE LINTEL

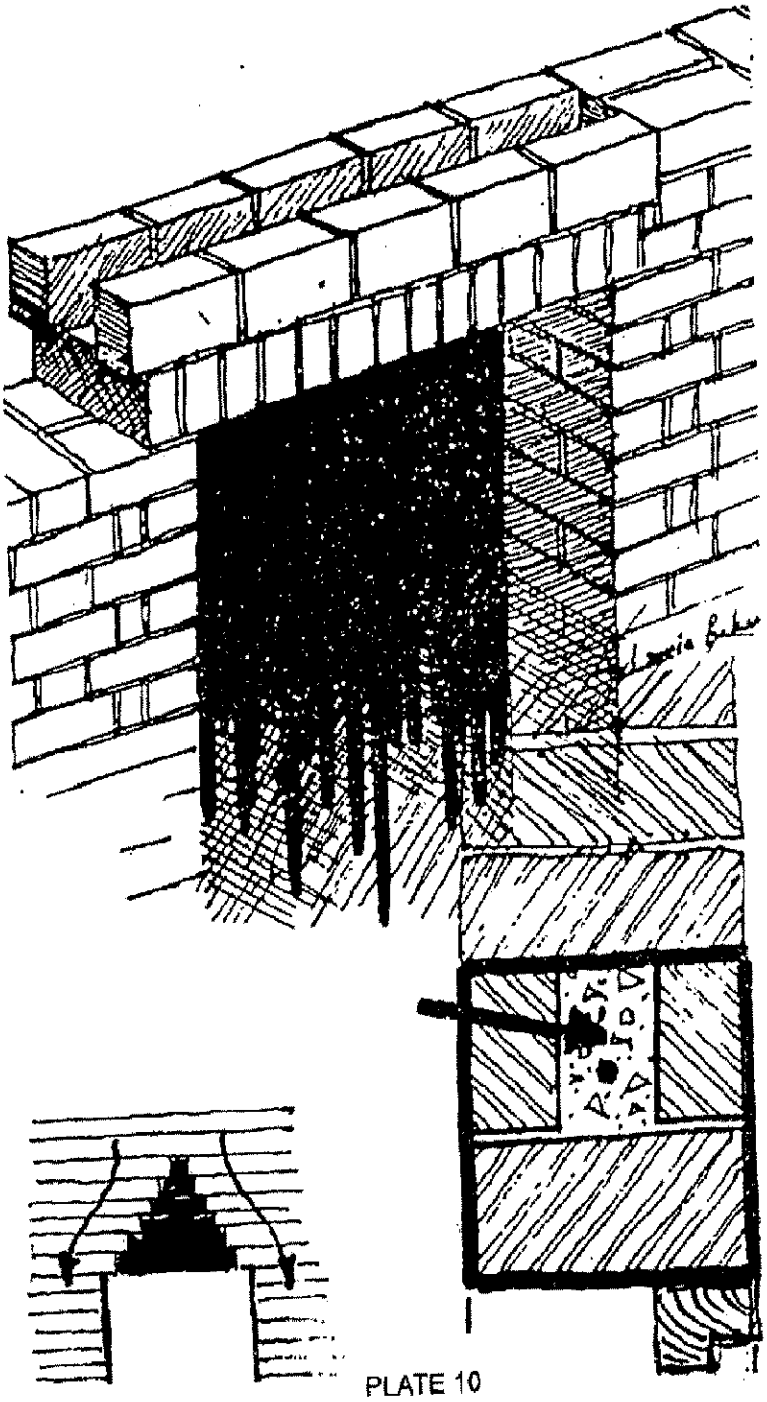


PLATE 10

storing vegetables, as there are no refrigerators to keep them fresh. They are picked garden fresh and cooked on the very day.

The khatiya is so light that it can be moved from place to place and put where required.

4.3. Lintels

A lot of unnecessary steel and cement concrete is used for lintels instead place a row of bricks on edge over the frame (or space) and then above them, a row on each side more bricks on edge. The space between there upper two rows of bricks is then filled with concrete in which a small steel rod is placed. The only load the lintel is carrying is the small triangle of brickwork. All other weights of walls floor etc above are carried by the wall at the sides of the opening.

Arches can be used in different shapes and sizes and ate much less costly than RCC lintels. But while constructing them, some sort of framework or support is necessary.

In one building there maybe arches of different sizes so make the smallest- and add a row or two of dry bricks (no mortar) for the larger arches.[10]

4.4. Doors and windows

Conventionally; lintels of ballies; bamboos or of timber planks are used over the door/ window openings. Door/ window shutters of locals country wood, braced and battened on of bamboo matting are mounted on to the wooden frames. The frames consume substantial quantity of timber and involve significant cost fixtures have been developed that can be used for frameless shutters in different in different situations for various types of doors. In the mud house, wherein the heaviest of the door to be used would generally be the one braced and battened made of country wood.

Brick jails

Jalis-formerly pierced stone panel- is one of India's oldest of letting into a building filtered light and ventilation but maintaining privacy and security. Brick jail can function in the same way as panels or as a complete load-bearing wall. There is an old honeycomb pattern of jail brickwork. The holes can be extended vertically or

there can be alternating sections of row of holes followed by two three rows of holes, then the single row hole again and so on.

Once these patterns have been used a good mason can device and enjoy doing many patterns.

Floor to ceiling, column to column, large panel of jail can be corrugated or folded (for strength and even for 4 ½ inch brick walls) and give first class lighting and ventilation to corridors, class rooms, and even for large halls and auditoria, bay windows make excellent beds in the hot weather.[10]

4.5. Miscellaneous elements

To the fullest possible extent, materials should be indigenous to avoid contributing to depleting of often-scarce cash. Where imported materials can clearly contribute to lowered costs and efficient use of indigenous materials, however they should be considered.

The two-pronged approach to the most efficient use of materials, transportation, and products seem to be indicated. Drawing on indigenous materials and keeping in mind the limitation of transport, and utilising local production facilities, architects can device a system of housing components that can assembled by low skilled or unskilled labour, with minimum supervision and training. The two prongs therefore, are

1. The application of labour intensive and efficient field assembly methods to the production of housing, with maximum use of indigenous resources of materials and labour and
2. The shop production of simple, easy to assemble components.

   Materials should be combined composite properties and assemblages to the fullest possible extent.

   1. To make the most efficient use of materials and to obtain composite properties not attainable with the individual materials acting alone
   2. To reduce the number of components and parts that must be transported and assembled in the field.

5. POLICIES AND GOVERNMENT PROGRAMMES

5.1. Indira Awas Yojana

1. Introduction

Housing is one of the basic requirements for human survival. For a normal citizen owning a house provides significant economic security and status in society. For a shelterless person, a house brings about a profound social change in his existence, endowing him with an identity, thus integrating him with his immediate social milieu.

For the first 25 years after independence, the problem of rural housing did not receive any serious attention from the Government. A housing programme for the rehabilitation of refugees was taken up immediately after partition by the Ministry of Refugee Rehabilitation and lasted till around 1960 under which approximately 5 lakh families were housed in various centres mainly located in Northern India. A Village Housing Scheme was also launched as part of the Community Development Movement in 1957, in which loans to individuals and cooperative were provided up to a maximum of Rs.5000/- per house. However only 67000 houses were built under this scheme by the end of the Fifth plan (1980). In 1972-73, the Estimates

Committee of the Lok Sabha in its 37th Report pointed out that "the Committee are distressed to note that although 83% of India's population live in villages and about 73% of the rural population reside in unsatisfactory kutcha structure, the problem of rural housing has not received the close attention of the Government." Following this, certain initiatives were undertaken by Government including the launching of the House Sites cum Construction

Assistance Scheme which began as Central Scheme in the 4th Plan and was transferred to the State Sector with effect from 1.4.74 on the recommendation of the NDC.

The genesis of the Indira Awas Yojana can be traced to the programmes of rural employment which began in the early 1980s. Construction of houses was one

of the major activities under the National Rural Employment Programme (NREP) which began in 1980 and the Rural Landless Employment Guarantee Programme (RLEGP) which began in 1983. There was, however, no uniform policy for rural housing in the states. For instance some states permitted only part of the construction cost to be borne from NREP/ RLEGP funds and the balance was to be met by beneficiaries from their savings or loans obtained by them. On the other hand others permitted the entire expenditure to be borne from NREP/ RLEGP funds. While some states allowed construction of only new dwelling others permitted renovation of existing houses of beneficiaries.

As per announcement made by Government in June 1985, a part of RLEGP fund was earmarked for the construction of SCs/ STs and freed bonded labourers. As a result, Indira Awas Yojana (IAY) was launched during 1985-96 as a sub-scheme of RLEGP. IAY thereafter continued as a sub-scheme of Jawahar Rozgar Yojana (JRY) since it's launching in April 1989. 6% of the total JRY funds were allocated for implementation of IAY. From the year 1993-94 the scope of IAY was extended to cover Non Scheduled Castes/ Scheduled Tribes below the poverty line families in the rural areas. Simultaneously, the allocation of funds for implementing the scheme was raised from 6% to 10% of the total resources available under JRY at national level, subject to the condition that the benefits to Non-Scheduled Castes/ Scheduled Tribes poor should not exceed 4% of the total JRY allocation. IAY has now been de-linked from JRY and has been made an independent scheme with effect from 1st January 1996.

2. Objective:

The objective of Indira Awaas Yojana is primarily to help construction of dwelling units by members of Scheduled Castes/ Schedule Tribes, freed bonded labourers and also non- SC/ST rural poor below the poverty line by providing them with grant-in-aid.

3. Target Group:

The target group for houses under Indira Awaas Yojana is people below poverty line living in rural areas belonging to Scheduled Castes/ Scheduled Tribes,

freed bonded labourers and non- SC/ST Categories. A maximum of 40% of the total IAY allocation during a financial year can be utilised for construction of dwelling units for non-SC/ST BPL categories.

From 1995-96, the IAY benefits have been extended to widows or next-of-kin of defence personnel and para military forces killed in action irrespective of the income criteria subject to the condition that (I) they reside in rural areas; (ii) they have not been covered under any other scheme of shelter rehabilitation; and (iii) they are houseless or in need of shelter or shelter upgradation. Benefits have also been extended to ex-servicemen and retired members of the paramilitary forces as long as they fulfill the normal eligibility conditions of the Indira Awaas Yojana and have not been covered under any other shelter rehabilitation scheme. The priority in the matter of allotment of houses to the ex-serviceman and paramilitary forces and their dependents will be out of 40% of the houses set apart for allotment among the non-SC/ST categories of beneficiaries.

Funds to the tune of 3% are earmarked for the benefit of disabled persons below poverty line. This reservation of 3% under IAY for disabled persons below the poverty line would be horizontal reservation i.e., disabled persons belonging to sections like SCs, STs and Others would fall in their respective categories.

4. Identification of Beneficiaries:

District Rural Development Agencies (DRDAs) / Zilla Parishads on the basis of allocations made and targets fixed shall decide the number of houses to be constructed Panchayat wise under IAY during a particular financial year. The same shall be intimated to the Gram Panchayat. Thereafter, the Gram Sabha will select the beneficiaries from the list of eligible households according to IAY guidelines and as per priorities fixed, restricting this number to the target allotted. No approval of the Panchayat Samiti is required. The Panchayat Samiti should however, be sent a list of selected beneficiaries for their information.

5. Priority in Selection of Beneficiaries:

Priotisation of beneficiaries is as follows:

(i) Freed bonded labourers.

(ii) SC/ST Households

SC/ST households who are victims of atrocity.

SC/ST households, headed by widows and unmarried woman.

SC/ST households affected by flood, fire, earthquake, cyclone and similar natural calamities.

Other SC/ST households.

(iii) Non- SC/ST households

(iv) Physically handicapped

(v) Families and Widows of personnel from defence services/ para-military forces, killed in action, ex-servicemen and retired members of the paramilitary forces.

(vi) Displaced persons on account of developmental projects, nomadic, semi-nomadic and de-notified tribal and families with disabled members, subject to the condition that these households belong to below poverty line category.

6. Allotment of Houses:

Allotment of dwelling units should be in the name of female member of the beneficiary household. Alternatively, it can be allotted in the name of both husband and wife.

7. Location of Indira Awaas Yojana:

Indira Awaas Yojana dwelling units should normally be built on individual plots in the main habitation of the village. The houses can also be built in a cluster within a habitation, so as to facilitate the development of infrastructure, such as, internal roads, drainage, drinking water supply etc., and other common facilities. Care should always be taken to see that the houses under IAY are located close to the village and not far away so as to ensure safety and security, nearness to work place and social communication.

8. Upper limit for construction assistance:

Ceiling on construction of assistance under Indira Awaas Yojana is as given below:

Hilly/ Difficult Areas (In Rupees)		
Construction of house including Sanitary Latrine and Smokeless Chulla	Rs.17,500	Rs.19,500
Cost of providing infrastructure and common facilities	Rs. 2,500	Rs. 2,500
	Rs.20, 000	Rs. 22,000

In case the houses are not built in cluster/ micro-habit approach, Rs. 2,500/- provided for infrastructure and common facilities should be given to the beneficiary for construction of his house.

9. Involvement of beneficiaries:

The beneficiary should be involved in the construction of the house. To this end, the beneficiaries may make their own arrangements for construction material, engage skilled workmen and also contribute family labour. The beneficiaries will have complete freedom as to the manner of construction of the house. This will result in economy in cost; ensure quality of construction, lead to greater satisfaction and acceptance of the house by the beneficiary. The responsibility for the construction of the house will thus be on the beneficiary himself/ herself. A Committee of the beneficiaries may be formed, if so desired, to coordinate the work.

10. Ban on contractors or departmental construction:

No contractor is to be engaged for the construction of dwelling units under IAY, by the DRDA/ ZP. If any case of construction through contractor comes to notice, Government of India will have a right to recover the allocation made to the State for those IAY houses. The house should also not be constructed by any Government Department. Government departments or organisations can, however,

give technical assistance or arrange for coordinated supply of raw materials such as cement, steel or bricks if the beneficiaries so desire. The spirit of IAY is that the house is not to be constructed and delivered by any external agency. On the other hand, the house is to be constructed by the beneficiary himself/ herself.

11. Appropriate Construction Technology and local materials:

Effort should be made to utilise, to the maximum possible extent, local materials and cost effective technologies developed by various institutions. The implementing agency should contact various organisations/ institutions for seeking expertise and information and information on innovative technologies, materials, designs and methods to help beneficiaries in the construction of durable and cost effective houses. The State Government may also arrange to make available information on cost effective environment friendly technologies, materials, designs etc., at block/ district level. Technologies using bricks, cement and steel on large scale should be discouraged. As far as possible, cement should be substituted by lime and lime surkhi manufactured locally. Brick manufactured by beneficiaries themselves instead of its purchase may also be undertaken to reduce costs and increase opportunities for wage employment.

12. Type Design:

No type design should be prescribed for IAY dwelling units, except that the plinth area of the houses should not be less than 20 sq. Mts. The layout, size and type design of IAY dwelling units should depend on the local conditions and the preference of the beneficiary. The houses should be designed in accordance with the desire of the beneficiaries keeping in view the climatic conditions and the need to provide simple space, kitchen, ventilation, sanitary facilities, smokeless chulha etc., and the community perceptions, preferences and cultural attitude.

The barrier free concept may be incorporated in the construction of houses meant for the disabled with a view to facilitate his smooth and free movement in the house. In areas frequented by natural calamities such as fire, flood, cyclones, earthquake etc., incorporation of disaster resistant feature in the design should be encouraged.

13. Fuel Efficient Chulhas:

It should be ensured that all Indira Awaas Yojana dwelling units are provided with a smokeless chulha, which are fuel-efficient and being smoke free are healthy and more convenient to use.

14. Drinking Water Supply:

The availability of drinking water supply should be ensured by the agencies responsible for the implementation of the Indira Awaas Yojana. Where necessary, a hand-pump should be installed on the site before the work is started, from the funds available under Rural Water Supply or other similar programmes.

15. Sanitation and Sanitary latrines:

Construction of sanitary latrine forms an integral part of Indira Awaas Yojana dwelling unit. It has, however, been observed that in a large number of cases, that the sanitary latrine in these houses is not constructed. The Government of India attaches considerable importance to the construction of sanitary latrines as a sanitation measure and therefore, sanitary latrines should be ensured. A system of drainage from the house should also be provided to avoid overflow from the kitchen, bathroom etc.

16. Environmental Improvements and Social Forestry:

Plantation of trees in the entire habitat or around the individual house should be taken up simultaneously. Trees may be planted near the housing clusters so that, in due course, enough trees are available nearby, to enable the beneficiaries to get fuel/ fodder/ small timber. Such plantations can be taken up under the social forestry programme. Some of the popular indigenous species whose plantation can be undertaken include Neem (Azadirachta indica); Mahuva (Madhuca indica); Amla (Emblica officianlis); coconut (cocos nucifera); Deodar (Credrees deadora); Mango (Magnifera indica); Oak (Quercus & Spp); Rose wood(Dalbergia latifolia); Chandan (Santalum album); Pipal (Fiscus neligiosa) etc. This list is merely illustrative and not exhaustive. Species vary region- location wise and geo-agro-climatic conditions and this may be kept in view while identifying species for propagation.

17. Involvement of Non-Governmental Organisations:

Suitable local voluntary agencies with proven good track record wherever available may be associated indirectly with the construction of Indira Awaas Yojana dwelling units. The supervision guidance and the monitoring of construction can be entrusted to these non-governmental organisations.

18. Inventory of Houses:

The implementing agencies should have a complete inventory of houses constructed under IAY, giving details of the date of start and the date of completion of construction of dwelling unit, name of the village and Block in which the house is located; name, address, occupation and category of beneficiaries and other relevant particulars.

19. Display of Indira Awaas Yojana Board and Logo:

On completion of an IAY dwelling unit, the DRDA concerned should ensure that for each house so constructed, a display board is fixed indicating the IAY logo, year of construction, name of the beneficiary.

20. Monitoring:

Officers dealing with IAY at the State headquarters should visit districts regularly and ascertain through field visits whether the programme is being implemented satisfactorily and whether construction of houses is in accordance with the prescribed procedure. Likewise, officers at the district, sub-division and block levels must closely monitor all aspects of IAY through visits to work sites. A schedule of inspection which prescribes a minimum number of field visits for each supervisory level from the State level to the block level should be drawn up and strictly adhered to.

The State Government should prescribe the periodical reports/ returns through which it should monitor the performance of IAY in the districts and also get appropriate reports and returns prescribed, to be called by the DRDA/ ZPs. The monitoring of the programme at the State level will be the responsibility of the State Level Coordination Committee (SLCC) for Rural Development Programmes. A representative or nominee of the Ministry of Rural Areas & Environment, Government of India should invariably be invited to participate in the meetings of the Committee.

The following reports and returns should be submitted to the Government of India by the States/ Uts separately in respect of the Indira Awaas Yojana.

(i) A monthly progress report to be furnished by Telex/ Fax/ E-mail/ Nicnet in Profarma-1, on or before 10th of every succeeding month.

(ii) A detailed Annual Progress Report to be submitted on or before 25th April of the succeeding financial year in proforma- II.

21. Evaluation Studies:

The States/ Uts should conduct periodic evaluation studies on the implementation of Indira Awaas Yojana. Evaluation studies may be for conducted by reputed institutions and organisation on issues thrown up by the concurrent evaluation, detailed studies by the States / UTs as well as the Government of India. Copies of the reports of these evaluation studies conducted by the States/ UTs should be furnished to the Government of India. Remedial action should be taken by the States/ Uts on the basis of the observations made in these evaluation studies and also in the concurrent evaluation conducted by or on behalf of Government of India.

22. Transparency in Implementation of Indira Awaas Yojana:

It is not utmost importance that Centrally Sponsored Schemes are properly implemented and misutilisation and other irregularities are minimised. This requires greater transparency in the implementation of IAY at various levels and hinges on the assumption that people should have access to information about implementation of these programmes in all their aspects. The disclosure of information should be the rule and withholding of information an exception.

List of items (illustrative not exhaustive) on which information should invariably be made available to people to bring about greater transparency at village, block and district level is given below.

Village Level:

(i) List of people below poverty line in the village.

(ii) List of beneficiaries identified during preceding year and current year including details of SC/ST, women beneficiaries and disabled persons under Indira Awaas Yojana.

(iii) Allocation made to the village under Indira Awaas Yojana.

(iv) Guidelines of Indira Awaas Yojana/ criteria of selecting beneficiaries

(v) Display of Indira Awaas Yojana signboard on the allotted houses.

Block Level:

(i) Details of houses taken up at Block Level with cost, sources of funds, implementing agency.

(ii) Access to muster rolls.

(iii) Distribution of funds village-wise for the scheme.

(iv) Allocation/ Availability of funds and progress in implementation of Indira Awaas Yojana.

District Level:

(i) Distribution of IAY funds block-wise/ village-wise for the scheme.

(ii) Criteria for distribution of funds to blocks/ villages including norms for its selection under Indira Awaas Yojana

23. Pattern of Funding:

Indira Awaas Yojana is a Centrally Sponsored Scheme funded on cost-sharing basis between the Government of India and the States in the ration of 80:20. In the case of Union Territories, the entire resources under this scheme are provided by the Government of India.

24. Criteria for Allocation of Resources:

Central assistance under Indira Awaas Yojana will be allocated to the States/ UTs on the basis of proportion of rural poor in State/ UTs to the total poor in the country. The poverty ratio as approved by the Planning Commission in this regard is used for this purpose. The proportion of rural SC/ST population in a district to the total rural SC/ST population in the State/ UT is the criteria of inter-district allocation of Indira Awaas Yojana funds within a State/UT. Diversion of resources from one district to another is strictly prohibited.

25. Release of Central Assistance to DRDA's:

Indira Awaas Yojana funds are operated by the DRDAs/ ZPs at the district level. Central assistance will be released every year to the DRDAs, in two instalments, subject to the fulfilment of the following conditions:

(a) The first instalment is released in the beginning of the financial year. This is subject to condition that the II nd Instalment during previous year was claimed and released. However, if any specific conditions had been imposed at the

time of release of the last instalment of the previous year, its compliance will be ensured before release of the first instalment.

(b) The second instalment for the districts will be released on the request of the DRDAs as per Performa III on fulfilment of the following conditions:

60% of total available funds, that is, opening balance for the year and the amount received including the State share should be utilised at the time of applying for the second instalment.

The opening balance in the district i.e. the aggregate of balance with DRDA should not exceed 25% of the district allocation during the previous year. In case the opening balance exceeds this limit, the Central share of the excess will be deducted at the time of release of second instalment.

The State provision for the current year will have to be indicated by the DRDAs. The Central release will be restricted in proportion to the provision made to the DRDAs.

The State Government should have released all its contribution (including those of previous year) due upto the date of the application for the second instalment. In the event of shortfall in State Share, corresponding amount of Central share (i.e. 4 times the State Share) will be deducted from the second instalment.

Submission of Audit Report of the DRDA for the previous year.

Submission of Utilization Certificate from the DRDA for the previous year in the prescribed proforma IV that is annexed.

Annual Plan should have been approved by the Government Body of the DRDA.

Submission of Progress/ Monitoring Reports.

Submission of Non-embezzlement certificate.

Certificate to the effect that there has been no diversion of resources from one district to another will have to be submitted.

Any other condition imposed from time to time will also have to be complied with.

(c) The quantum of second instalment will be dependent on the time of reporting of utilization. Depending on the receipt of complete proposal for second instalment, the quantum will be governed as follows:

Proposal received in: -

December 50% of allocated funds

January 40% of allocated funds

February 30% of allocated funds

March 20% of allocated funds

Proposal received after 15th March will not be entertained. ,,

5.2. Jawahar Gram Samridhi Yojana

BROAD OUTLINE AND OBJECTIVES

1.Objectives:

1.1 Jawahar Gram Samridhi Yojana will have the following objectives.

Primary objective:

Creation of demand driven community village infrastructure including durable assets at the village level.

Assets to enable the rural poor to increase the opportunities for sustained employment.

Secondary objective:

Generation of supplementary employment for the unemployed poor in the rural areas.

2. Special Safeguards for the Weaker Sections of the Community.

22.5% of annual allocation shall be earmarked for SCs/STs individual beneficiary scheme.

The wage employment under the programme shall be given to Below Poverty Line families.

3. Status:

3.1 The programme will be implemented as a Centrally sponsored scheme on cost sharing basis between the Centre and the States in the ratio of 75:25. In the case of Union Territories, entire funds under the scheme will be provided by the Centre.

4. Programme Strategy:

4.1 The programme will be implemented through the Village Panchayats.

5. Definition of Village Panchayat:

5.1 Panchayats, Mandals, Nagar Panchayats or traditional village institutions like village Councils and Village Development Boards having statutory character.

5.2 Where the duly elected Village Panchayats are not in existence, their (Village Panchayat/Panchayats) share of funds will be passed on to the concerned Panchayat Samitis who will be responsible for implementing the Gram Samridhi Yojana in those Panchayats. The works to be taken up would however, be decided at the village level itself by the Grama Sabha (Village Assembly) of the concerned panchayats.

6. Forest villages:

6.1 The existing forest villages, which are not part of an existing village panchayat, will be treated as a village panchayat.

WORKS, PLANNING AND EXECUTION

21. Works to be taken up under JGSY:

21.1 All works that result in the creation of durable productive community assets can be taken up under the programme as per the felt need of the area/people by the village panchayat. The works that can be taken up under the programme are given in following paras.

21.2 Priority shall be given in the following order:

- Infrastructure for Scs/STs habitations
- Infrastructure support for Swarnjayanti Gram Swarozgar Yojana (SGSY)
- Infrastructure required for supporting agricultural activities in the village panchayat.
- Community infrastructure for education, health and roads
- Other social, economic and physical infrastructure
- In taking up these works, the village panchayat may take into consideration the facilities being created under Basic Minimum Services and other Centrally Sponsored Schemes or State Government's schemes. For instance, while formation of roads is taken up under JGSY, Black topping of roads may be taken up under other programmes.

21.3 While creating rural infrastructure, the wage material-ratio of 60:40 may be suitably relaxed so as to enable the build up of demand driven rural infrastructure.

Care may, however, be taken to ensure purely material oriented works are not taken up and simultaneously efforts should be made to take up labour intensive works with sustainable low-cost technology. To provide supplementary wage employment to the rural poor, the wage material-ratio shall be as close to 60:40 as possible.

21.4 Keeping in view the importance of primary school buildings, funds may be released for construction of school buildings would be released under Operation Black Board (OBB). This would be out of savings, if any, from JGSY and will be determined towards the end of each year. Rural Development Department of the State Government will be responsible for coordination with the State Education Department and submission of proposal under OBB. The funding pattern under the scheme would be 75:25 between Centre and State. The funds under the scheme will be released directly to the DRDAs/ZPs. State Government may send proposals only in respect of schools for at least three class rooms. This fund will not be available for extra classrooms.

21.5 While there is no ceiling on the cost of works to be taken up under the programme, only such works should generally be taken up whose size and cost and nature are such that they may be implemented at the local level and do not involve high level of technical inputs, etc. The works taken up must be kept within the overall Annual Action Plan (As per Para 22.1). The following works shall not be taken up under the programme.

- Building for religious purposes such as temple, mosque, gurudwara, church etc.
- Monuments, Memorials, Statue, Idols, Arch Gate/Welcome Gate.
- Bridges.
- Building for higher secondary schools
- Building for colleges
- Desiltation of irrigation tanks.
- Black topping/cementing of roads, other than roads within the village site.

WAGES UNDER THE PROGRAMME

29. Wages to be paid on works under the programme.

29.1 The wages under the programme will be paid in cash. The State Governments, however, may provide food grains as a part of wages, if there is demand for it, by making their own local arrangement and by utilizing their own resources towards subsidy, if any.

29.2 The wages for a category of employment shall be the same as notified for the relevant schedule of employment under the Minimum Wages Act or higher wages fixed by the State Govt. Through a procedure prescribed by the State Government. The wages to the worker would be paid either minimum wages or higher wages as fixed by the State whichever is higher. There should not be any attempt to avoid or evade the mandatory obligation by denotifying an area or an employment from Minimum Wages Act.

29.3 Where no wage rates are notified either under Minimum Wages Act or by the State Government, Village Panchayat may make payment to the workers at the prevailing agriculture wage rates in the area.

29.4 Equal wages should be paid under the programme to both men and women workers for the same work or works of a similar nature. No discrimination should be made while recruiting men and women workers under the programme.

29.5 As information regarding various notifications issued under the Minimum Wages Act or by the State Govts. Referred to in para 30.2 above may not be readily available with the implementing agencies, the DRDAs/ZPs should bring out a consolidated circular indicating the wage rates prescribed for different categories of employment under the Minimum Wages Act or higher wages fixed by the State Governments.

29.6 The Village Panchayats shall be responsible for payment of prescribed wages to workers under the programme.

29.7 Payment of wages should be made on a fixed day of the week which should preferably be the local market day.

29.8 In case the implementing agencies do not pay the wages for a category of employment at a rate notified for the relevant schedule of employment under the Minimum Wages Act or by the State Govt. the DRDA may withhold the grant under the Jawahar Gram Samriddhi Yojana to the Village Panchayat.

29.9 Where the Central Government finds that the above provisions are not being followed, it may withhold the release of funds under the programme to the concerned DRDA/ZP.

INDIVIDUAL WORKS

30. Beneficiary Oriented Individual Programmes for SCs/STs.

30.1 As indicated in Para 16.1 of Chapter-III, 22.5% of the amount released to the Village Panchayat shall be used for individual works for SCs/STs. The illustrative list of such works which can be taken up for the benefit of identified individuals belonging to SCs/STs is as under.

Economic Assets

- Development of allotted land in the case of allottees of ceiling surplus land, Bhoodan land, Govt. land.
- Social forestry works, such as fuel wood and fodder plantations on the private lands belonging to SCs/STs.
- Agri-horticulture, floriculture, fruit-tree plantation on the private lands belonging to SCs/STs.
- Work sheds or infrastructure for any self-employment programme.
- Open Irrigation Wells/Bore-wells for irrigation.
- Pond excavation re-excavation with primary support for pisciculture.

Assets for Improving the Quality of Life.

- Dwelling units.
- Sanitary Latrine and smokeless chullahs.

30.2 Priority should be given to provide economic assets to the individual beneficiary for sustainable employment. Assets such as dwelling units, sanitary latrine, smokeless chullha etc. may be given lesser priority and should be considered under exceptional circumstances.

30.3 While providing assets to individual poor, his/her participation in the work may be ensured.

CONVERGENCE WITH THE OTHER PROGRAMMES

31. Contributions by the Village Community:

31.1 The Village Community may be encouraged to contribute either physically or financially for the development of village infrastructure. The Village Panchayats may, subject to relevant laws, even raise additional resources through appropriate cess/tax to ensure people's participation by inculcating on them the feeling of community ownership.

32. Acceptance of Donations

32.1 The Village Panchayat may accept donations from charitable institutions/individuals either to expand the programme or to ensure the durability of the assets requiring funds. These funds should be treated as additional and dovetailed with the JGSY to complete the works.

33. Convergence/Dovetailing with the other programmes

33.1 Funds available from other sources like market committees; co-operatives, cane societies or other institutions could also be dovetailed with the JGSY funds for similar purposes. The funds available with the Village Panchayats from other sources such as National Finance Commission, State Finance Commission, and State Departments etc. can also be dovetailed for construction of durable community assets/works. However, JGSY funds should not be used as a substitute for Departmental Plan funds of different Departments and agencies.

5.3. Antaodaya

In 1989, ANTODAYA was formed and registered as a non-profit organization in India as a result of a group of dedicated people who had previously committed themselves to interact with the inhabitants of Thuamul Rampur Block in Kalahandi.

Thuamul Rampur Block is one of the most backward blocks in the Orissa State -- As per sources from the "Planning and Coordination Department, Government of Orissa (GoO), it ranks third from the bottom in all development indicators. It comes under tribal sub-plan which focused on starvation deaths, child selling, etc.

Sri R.B. Pattanaik, who was then the Collector of Kalahandi, advised the group to explore possibilities for initiating community development work in either Lanjigarth or Thuamul Rampur Blocks. As Lanjigarth Block already had the presence of some Non-Governmental Organizations (NGOs), the group opted to explore possibilities in the Thuamul Rampur Block where no NGOs existed at that time.

The initial strategy was to gain experience by living with the Tribals and to address such issues which have the greatest impact on their very living conditions.

Kalahandi is a district with several deficiencies in services and infrastructures. Especially in the Thuamul Rampur Block where people are deprived of basic services such as health care and education facilities. Thuamul Rampur is in an area of difficult terrain and therefore prevents the community from access to the few facilities that are available.

The people of Thuamul Rampur are more exposed to malarial attacks, malnutrition, and hazardous conditions. The skewed land distribution compels the rural poor to face food scarcity for approximately four to five months per year which in turn manifolds the difficulties.

Keeping all of this in view, ANTODAYA has been working in the area since its inception and is attempting to build a society where there is "NO HUNGER, DISCRIMINATION, INJUSTICE (ARISING OUT OF INERTIA), AND DISEASES.

ANTODAYA believes that it is possible and can be realized through group action and participation, which leads to:

The emergence of strong village level organizations;

- Critical thinking of a situation;
- Having access to development opportunities where they exist and asserting for them where they do not;
- Encouraging the marginalized section for their greater involvement in a development process, which is sustainable, socially acceptable, economically viable, and technically feasible; and
- The collaboration/building of partnerships with like-minded institutions, groups and individuals.

ANTODAYA has extensive experience in working with the rural poor of Thuamul Rampur and perceives that an ISOLATED approach will fall short in answering the needs of the people. ANTODAYA believes that an INTEGRATED approach towards the people's development, with the people's participation, is required in the following areas:

- People empowerment, especially women;
- Community health and nutrition development;
- Natural resource management; and
- Entrepreneurship development.

ANTODAYA aims to facilitate the people's initiatives on these issues to eradicate the high incidence of poverty and under-development which stands as follows:

- 11% literacy among Male and 9% among Female;
- Less facilities of education at the village level;
- Inadequate health service facilities at the village level;
- Malaria endemic zone;
- No drinking water facilities in most of the villages;
- 67% of households are landless;

The agricultural wage rate among the males and females is 3.2 Kg of paddy per day.

No efforts are made by the Government to provide work for the people during the lean seasons.

The interest rate charged by the moneylenders is 50% for a period of three to five months' credit and the formal credit institutions system is weak; and
The incidences of land mortgage and distress sales are prevalent. [12]

6. LITERATURE REVIEW

6.1. CBRI

6.1.1. Live better with mud and thatch

- Construction of house
  1. Foundation and plinth
  2. Damp proof course
  3. Floors
  4. Walls
  5. Roof
  6. Doors and windows

- Protection against earthquake and flood
- Waste disposal
  1. Latrines and night soil disposal
  2. Waste water disposal

6.1.2. Prefabricated floor/ roof using structural clay units (joist and filler scheme)

A structural clay unit is extruded in a brick extrusion machine from plastic clay whose composition is: clay 25 to 30 %, silts 30 to 40%, and sand 35 to 40%. The extruded product is fired in a down draught kiln at a temperature of about 1020 deg. C.

Over-all size of clay unit is 16.5X15.0X19.0 cm with three rectangular hollows. It has got small rectangular serrations on its outer faces to provide better joint with mortar and concrete. The voids are about 37% of the total volume. Dimensions of the unit have been so chosen that one joist and filler combined will correspond to a width of 30 cm or one planning module.

The joist member is prefabricated first. The clay units are placed on a precasting platform end to end and jointed with 1:3(cement: sand) mortar. The units are placed with wider base and the platform and a row of the m is built upto the desired length of the joist member. The wooden planks, cleaned and oiled, are then placed on the two sides of the joist and are held tight with the help of m.s. Clamps. Designed

reinforcement is then placed within the two hollow spaces between the shutter and the tile ensuring proper covers from the top. The hollow spaces are filled to the top level of the clay unit with concrete of M-150 grade. This makes the joist complete. Side shutters are removed after 45 to 90 minutes depending on the weather conditions. The joists are water cured for 7 days and air cured for further 21 days. After about 4 days of casting, joist members maybe inverted and shifted to the stacking yard for making room in the casting yard.

6.1.3. Improved method of making durable and fire retardant thatch roof

The principle behind developing this new method and technique of manually pressing lies that the basic cause of catching and spreading of fire is due to looseness of thatch grass in traditional type of roofing, whereby air is available between the thatch fibres which helps and exaggerate the spread of fire all over the thatch roof within minutes. Manually pressing and tying the thatch roof reduce the available air gap reduced to minimum, which retard the rate of spreading of fire and flame.

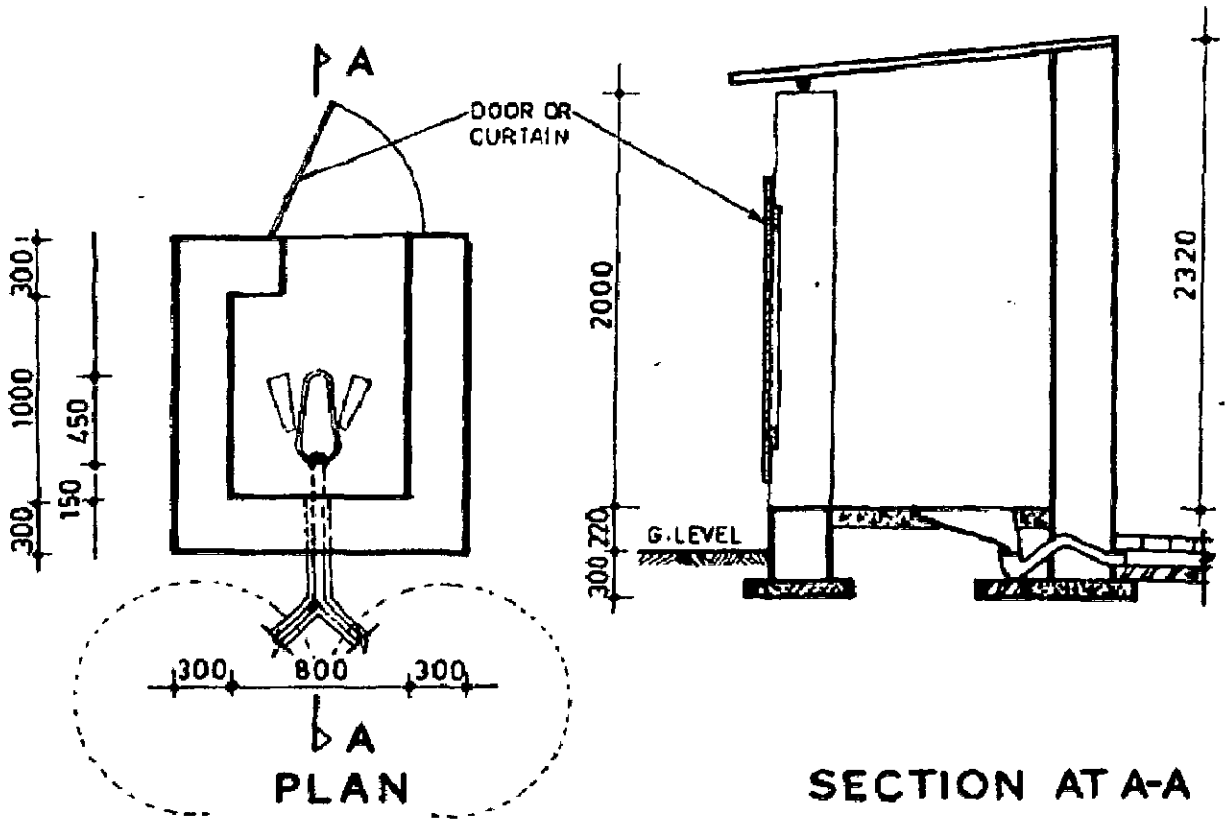
6.1.4. Thin R.C. Ribbed slab for floors and roofs

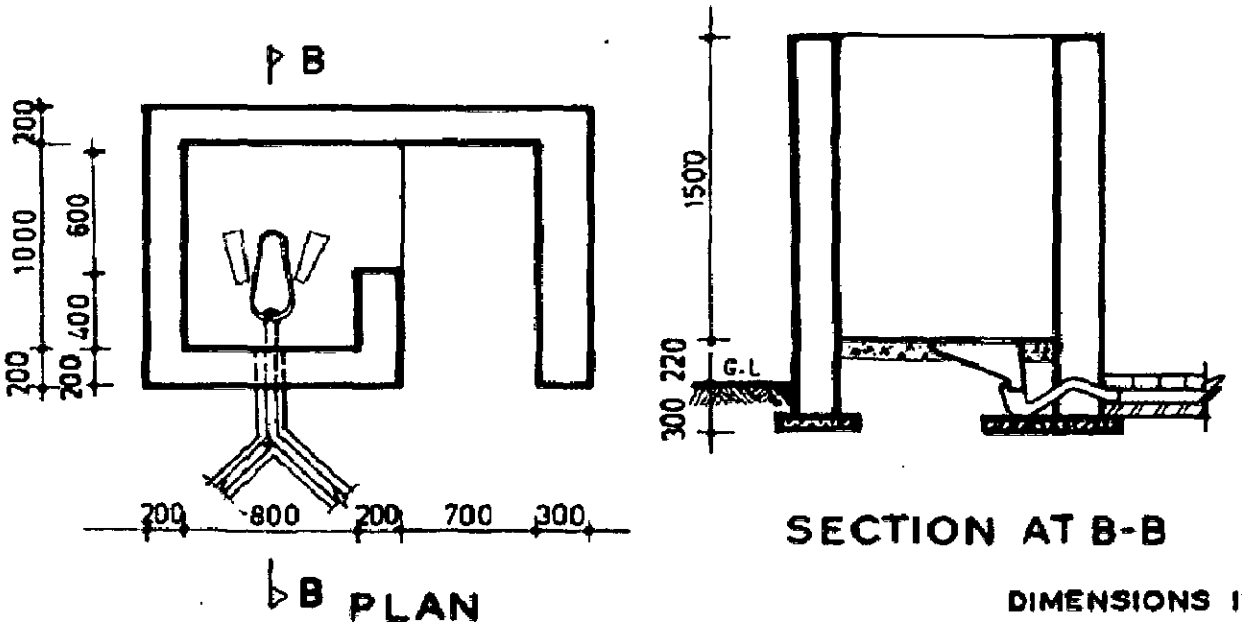
Thin R.C. ribbed slab consists of precast R.C. ribs 110X200 mm spaced at 1200 mm c/c with 50 mm thick cast in-situ R.C. flange above. It can be used as floors and flat as well as sloping roofs in single and multi-storeyed residential and other type of lightly loaded buildings. In case of heavily loaded floors and roofs, the size and reinforcement of ribs and flanges will have to be increased. Conventional floor/ roof finish has to be used above the ribbed slab, as the case may be. Ceiling plaster can be omitted in low cost construction. In situations where very good finish is called for, ceiling should be plastered.

6.1.5. Reinforced brick and reinforced brick concrete slab for floors and roofs

Reinforced brick (R.B.) and reinforced brick concrete (R.B.C.) can economically be used for floor and roof slab especially at places where good bricks are available and cost of aggregate is high.

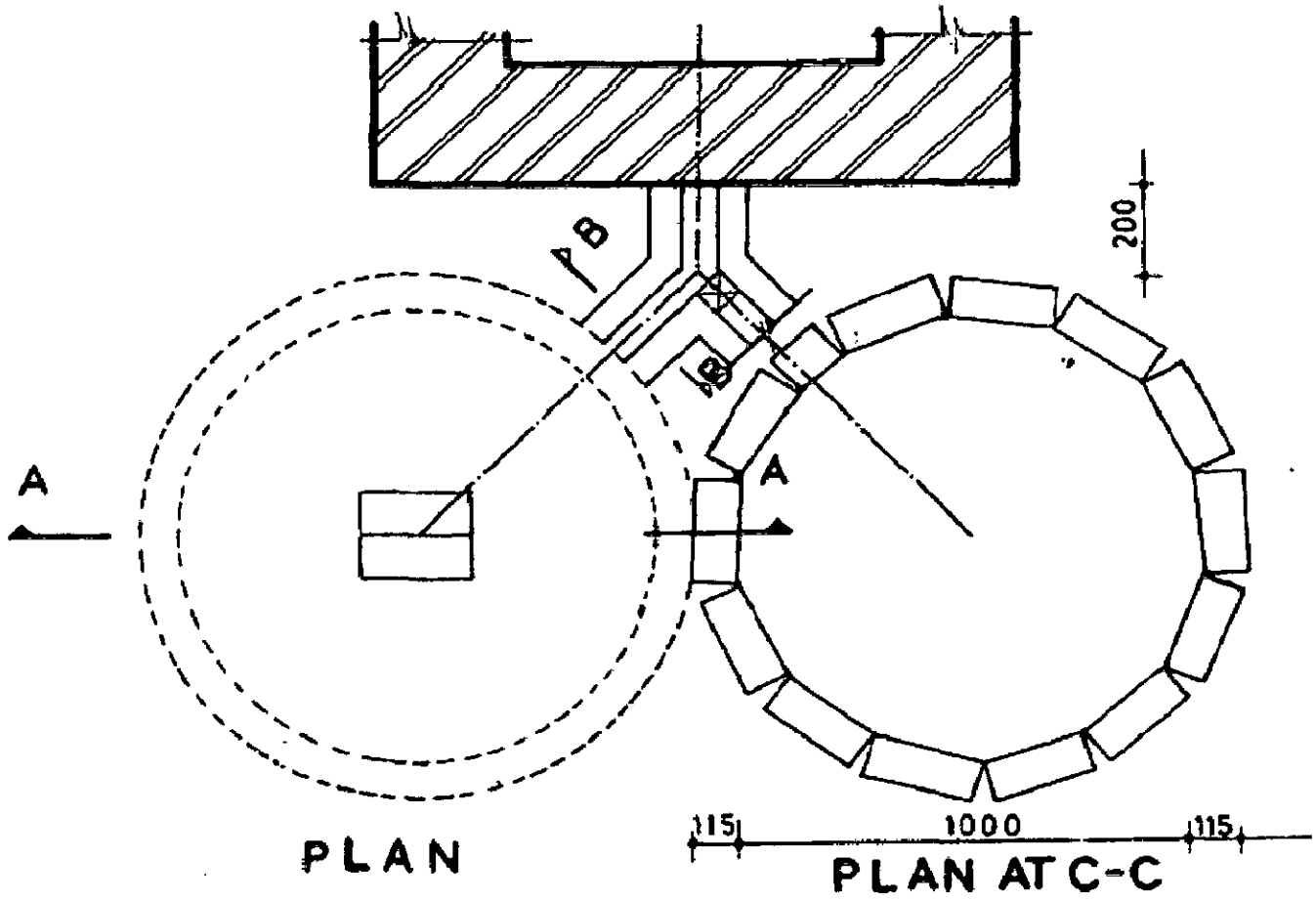
Reinforced brickwork is practically the same as reinforced concrete in all its essential features except in that brickwork in cement mortar is substituted for cement concrete. In reinforced brick concrete construction, cement concrete is used in conjunction with bricks. The thickness of concrete is generally 30- 50 mm and it is laid on top of bricks as also in joints. The compression zone is made up of

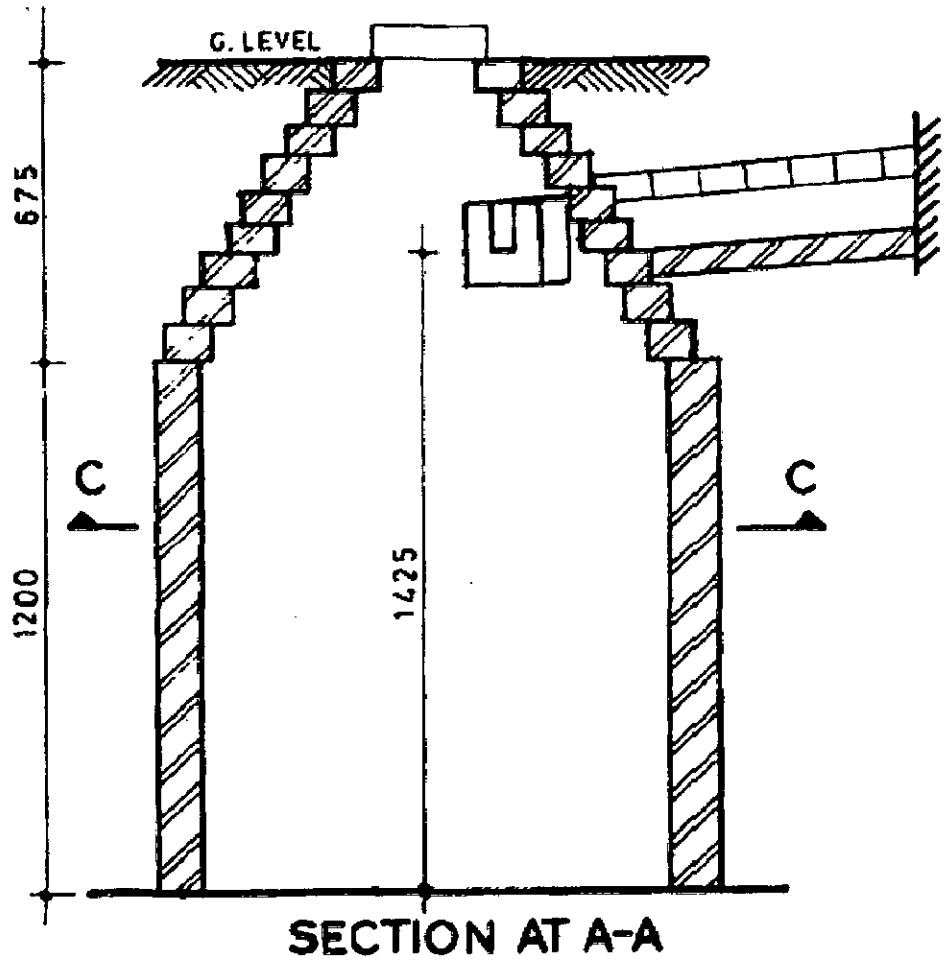


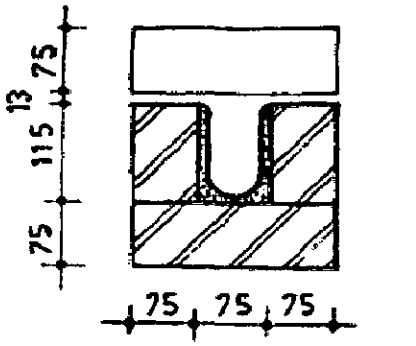


DIMENSIONS IN MM

PLATE 11







DIMENSIONS IN MM

PLATE 12

FIRE RETARDANT TREATMENT

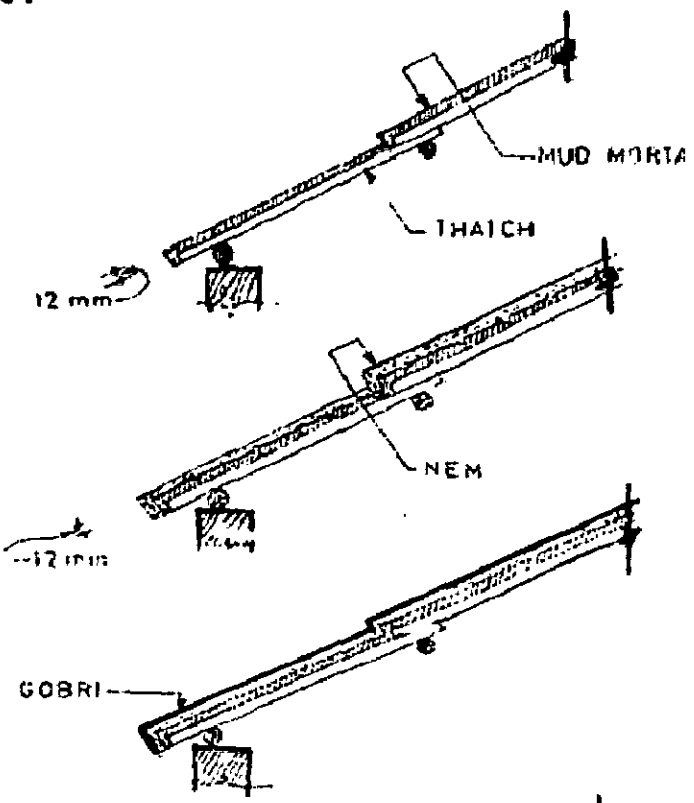
ROOFING TREATMENT

APPLY FIRST LAYER IN SPECIFIED MUD MORTAR (WITHOUT BITUMEN CUTBACK)

ALLOW DRYING & CRACKING FOR A DAY OR SO

PLASTER WITH N E M MORTAR

ALLOW DRYING & CRACKING
FILL CRACKS WITH NEM
APPLY SPECIAL GOBRI IN
TWO COATS



CEILING TREATMENT

FOR CONVENTIONAL THATCH ROOF

PLASTER ENTIRE CEILING
WITH N E M

FOR IMPROVED THATCH PANELS

USING REEDS IN FRAMEWORK

PLASTER THE OVERHANGS
CEILING WITH N E M

USING BAMBOOS IN FRAMEWORK

NO CEILING PLASTER

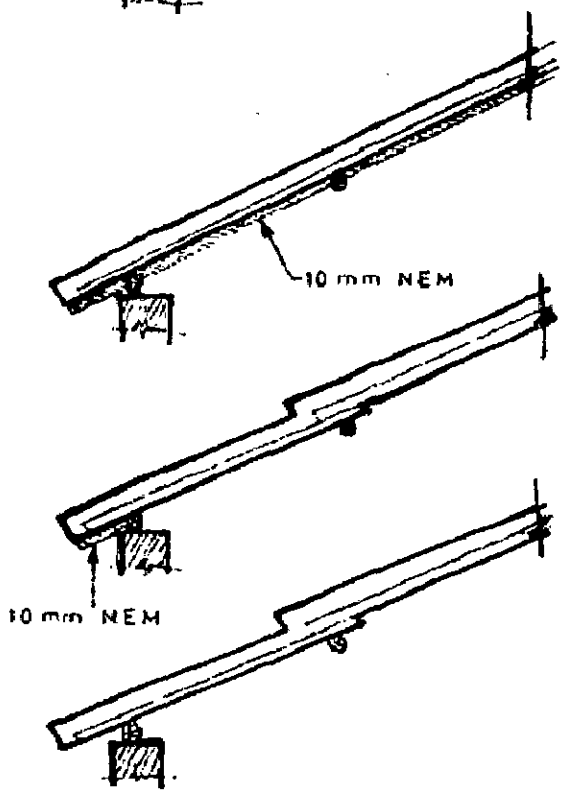


PLATE 13

concrete alone and brick maybe considered as fillers only, since they are generally called upon to carry minimal compressive force.

Reinforced brick slabs are easier to construct than reinforced concrete because they do not require the same amount of close and skilled supervision. [13]

6.1.6. Prefab jack arch panel system

6.1.7. Sugam sauchalya

6.1.8. Small capacity grain storage bins for rural areas

1. Modified domestic clay bins (for use undercover-capacity 1 tonne)
2. Modified brick bin above ground and outdoor capacity 1-3 tonne)
3. Semi-underground cement bin (capacity 1 tonne)

6.1.9. Particle board and its use in buildings

1. Particleboards and hard boards can be used for roofing and cladding units, if they are properly treated with CSNL resin. A life of more than 10 years can be expected from such a material.
2. Alkyd or oil based paints do not protect the board for more than two years.
3. Proper sealing and proofing of the edges and vertical and horizontal joints ensure greater durability of the structure. Covering the ends with beading should be finished at an angle to permit rapid shedding of water.

6.2. Laurie Baker-COSTFORD/HUDCO

6.2.1. Mud

- Different sorts of soil
- Simple soil tests
- Need of stabilisers
- Types of wall
  - I. Cob
  - II. Rammed earth
  - III. Adobe
  - IV. Pressed earth blocks
  - V. Wattle and daub
- Sitting of a mud house
- Plastering and termites

- Foundations
- Protection from splashing rain

6.3. Development Alternatives-TARA

6.3.1. Fibre concrete roofing

Fibre based cement mortar materials are known to have all the properties required for a good roof cladding material. Therefore, the production of fibre based cement mortar roofing tiles is one alternative of roof cladding materials problems. Apart from being able to be produced on a small scale in a local workshop these tiles have the advantage of requiring a lighter structure than other traditional cladding materials. The basic material required for making tiles are cement, sand, water and a fibre, which can range from locally available natural fibre to a synthetic fibre, or a fibre extracted from waste.

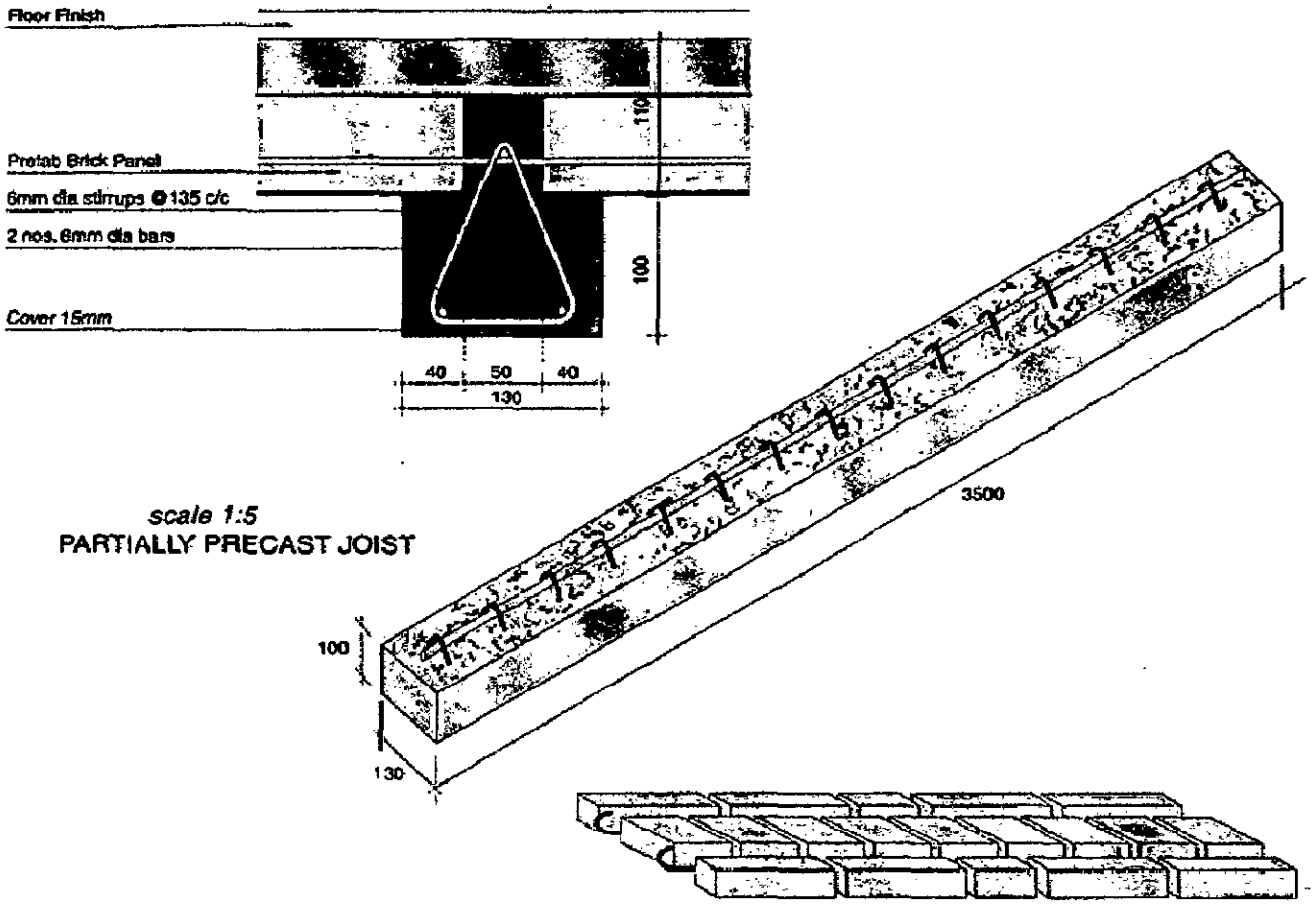
6.3.2. Existing building practices among santhal and kolha tribals

Living in outskirts of Simlipal wildlife sanctuary.

- ❖ Foundation in rammed earth
- ❖ Earth walls (cob)
- ❖ Wooden super structure
- ❖ Thatch roof

The important characteristics of the building techniques to be proposed must be:

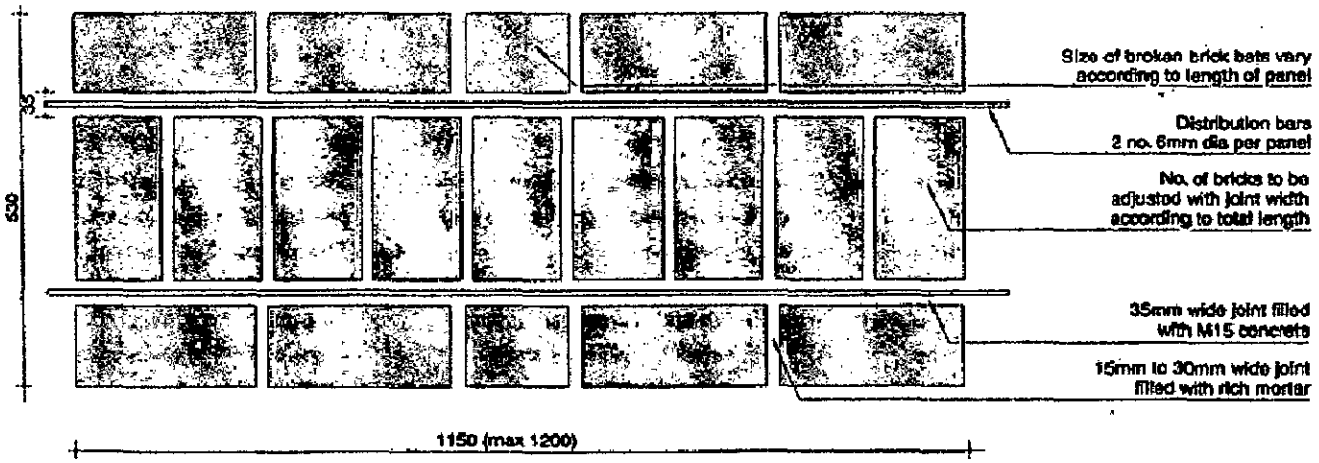
1. The raw material and the skill required to implement the technique must be available in the region and also familiar to implement and familiar to the people who must use them
2. The technique should use as much possible renewable materials, and should be environmentally friendly in production and use and the material should be recyclable
3. Energy inputs, in production as well as use must be as low as possible
4. The skills developed as a requisite for implementing these techniques and the resulting product must have value in the larger market of the region. This will not only increase the employment opportunities available to the tribal community but also draw them into the overall socio-economic framework of the region, in which their present involvement is a most peripheral.



scale 1:5

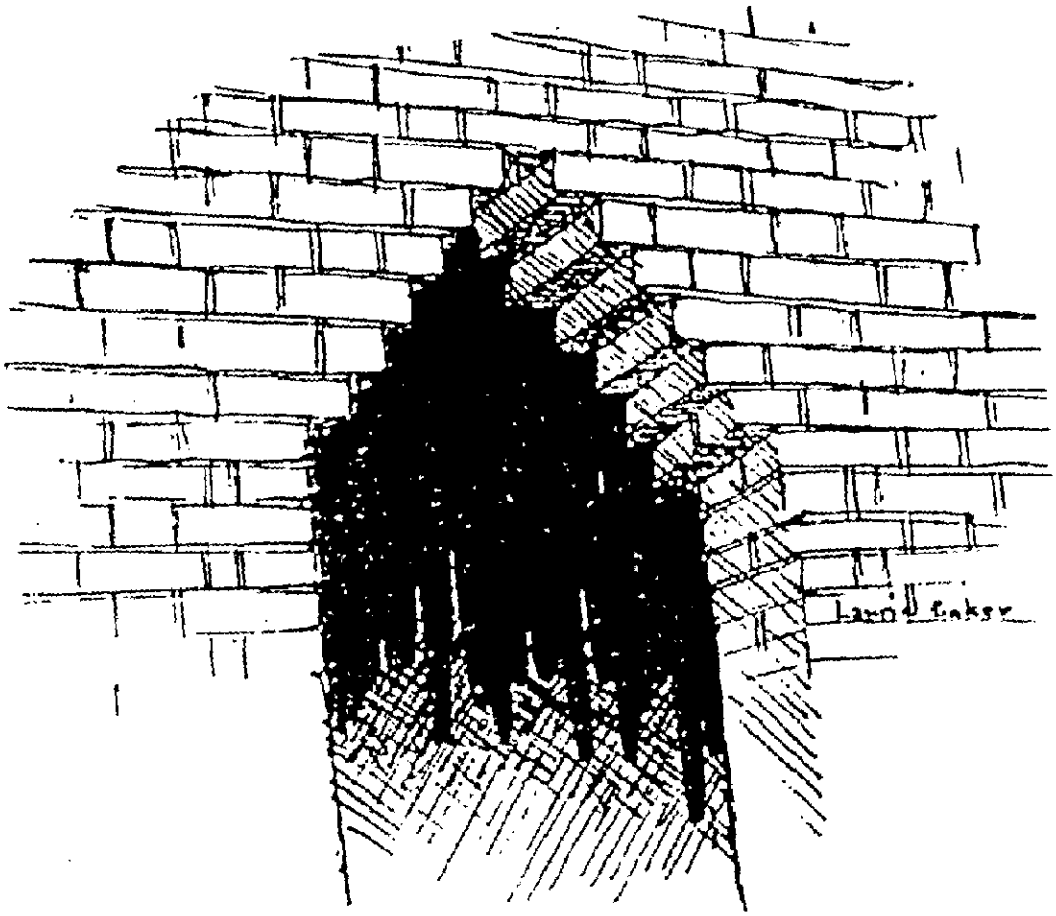
PARTIALLY PRECAST JOIST

PRECAST BRICK PANEL



PLAN Precast Brick Panel

PLATE 14



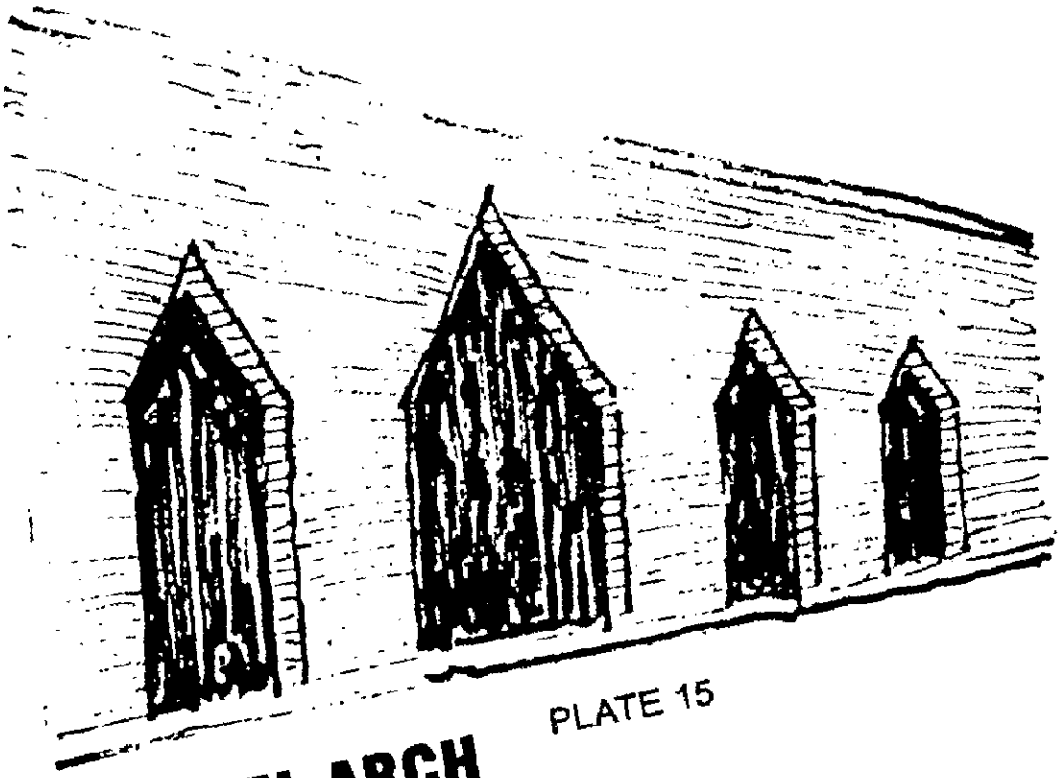


PLATE 15

CORBEL ARCH

6.3.3. Mud architecture

Mud, as a building material has the following advantages:

- It is cheap and in most parts of the world it is readily available
- It provides excellent heat insulation, so inside a mud building is cooler in summer and hotter in winter than a building made with steel and concrete
- It is strong in compression (i.e. difficult to squash)

But mud also has some serious disadvantages:

- It is eroded easily by water, which makes its use difficult in areas with high rainfall or possibilities of flooding
- It has a low tensile strength (i.e. is easy to pull apart), which means mud roofs are difficult to make.
- It is susceptible to mechanical damage. Rodents can easily make holes in mud walls and under the floor, or thieves can dig their way into the house.
- Mud does not grip wood properly, so gaps usually develop around wooden doors and windows in mud walls. Consequently, mud houses have few openings and are badly ventilated. Where walls are made of reinforced mud, wattle plastered with mud, or sun dried mud bricks, this problem is not so severe.
- Mud soaks up water and becomes very heavy. Consequently, wooden beams supporting a mud roof begin to sag, the mud cracks and roof start leaking. To reduce sagging of beams, many villagers in the state of Uttar Pradesh and Punjab build very narrow rooms, across which even a bed cannot be kept.

6.3.4. Plaster for soil block buildings

6.3.4.1. Mud straw plaster

Satisfactory use of mud plaster, also called 'daggi' with various amounts of straw and animal Doug, has been reported from Egypt, the Sudan, Peru, the United States, and India. Making use of locally available materials, these plasters are the cheapest and easiest to apply, though they require considerable preparation and maintenance.

Surface cracking of the plaster may result from a dry or hot wall underneath or too little sand in the soil. Minor cracks are repaired and a smooth finish is imparted by a thin cost of dung wash, or Gobri, applied by hand. This leaping is prepared from 20-

30 kg of fresh dung per 100 sq m of surface, mixed with water to such consistency that a thin layer maybe applied without the leaping running down the wall. The consistency of the mix maybe stiffened by adding soil, though not more than the original quantity of dung.

6.3.4.2. Lime plaster

Plasters made of lime and pozzolanic materials have good cementitious properties, have a high strength to cost ratio, and set quickly enough to allow application of additional plaster coats. All well prepared lime plasters have excellent workability. However lime-sand plasters made of pit sand or river sand are susceptible to erosion and result in a chalky finish, even when well cured.

Lime plaster must be cured for at least seven days before finishing or adding a second coat. Strength depends on hydration and absorption of atmospheric carbon dioxide. Generally, lime plasters reach full strength after decades, even centuries. Structure built by Romans has been found to contain lime mortars that are still not fully hydrated.

6.3.4.3. Cement plaster

Bonding of cement plasters on soil block walls is weak. Providing a cement wash on a raked wall prior to application of cement plaster will improve bonding. Due to the brittle character of cement plasters, cracking will be a problem if plastering is carried out in the summer. Plastering in the evening with adequate curing on the following days produces the best results.

6.3.4.4. Gypsum plaster

Between cement and lime based plasters vis-à-vis hardness, gypsum plasters are water absorbent. For this reason they are perhaps the most ill suited for the plasters discussed to application on earth walls.

Gypsum sets quickly, necessitating the use of retarders. This drawback and the cost of bulk gypsum as compared even to cement and lime preclude its use for low-cost buildings

6.3.5. Role of appropriate technologies and local enterprises

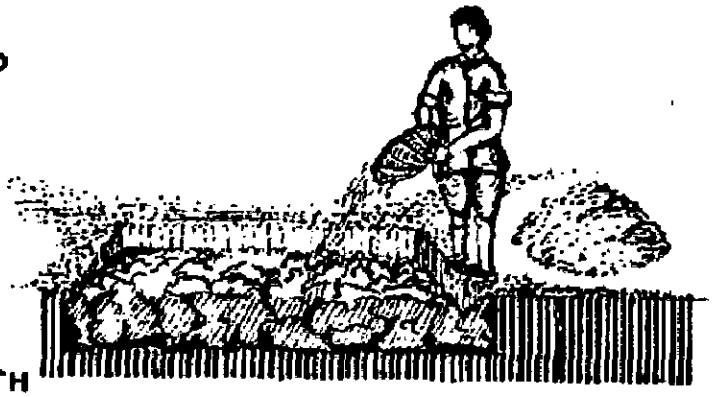
While the basic principles underlying the design of the institutions needed are well known and understood in the industrialised countries, they are largely untried in the

PREPARATION OF MUD MORTAR

FOR 100 M^2 WALL SURFACE: MORTAR REQD = 1·2 M^3 (12mm NEM PLASTER)

COLLECT SOIL

- VOLUME: 1·4 M^3 (Ie @ 1·15 M^3/M^3 OF MORTAR)
- SANDY CONTENTS : 40-50%
- CLAYEY CONTENTS: 60-50%
- PLASTICITY INDEX : 6 - 10
- USUALLY A MIX OF POND-BASE MUD AND ORDINARY SOIL



MIX WHEAT OR PADDY STRAW

- 90 Kg (Ie @ 64 Kg / M^3 OR 1·8Kg/cft. OF DRY SOIL
- WHEAT STRAW CHOPPED IN 2 cm LENGTH
- RICE STRAW CHOPPED IN 5 cm LENGTH
- PREFER OLD STORED STRAW
- MIX THOROUGHLY

ADD WATER

- SUFFICIENT TO FORM CONSISTENT PASTE OF STRAW MIXED SOIL

PUDDLE

- KNEAD DAILY 3-4 TIMES TILL DECOMPOSITION OF STRAW
- MUD MORTAR NOT TO BE ALLOWED TO DRY DURING THE PROCESS

7 DAYS - IN SUMMERS

14 DAYS IN WINTERS

PLATE 16

developing ones. To " transfer " them successfully, they must be appropriately adapted.

This requires adaptation based on research, followed by testing and demonstration of:

- The innovation process (including the R & D process itself, as well as the productionising components)
- The production process
- The delivery process
- The links between these three processes

Because of the close linkages and integration required among these processes, it is highly unlikely that the success of this approach can be demonstrated in a piece meal fashion, e.g., by providing individual components separately. This complex interaction between environmental and resource factors, institutional approaches and technological options will have to be understood.

The challenge that faces building technology in India is three fold:

- To generate access to building resources for those of the poor that even these technologies cannot reach (a sizable proportion of the population) because basic subsistence is a greater problem and priority.
- To develop production and dissemination mechanisms that is adaptive to local needs and resilient to fluctuation in the supply of raw materials and market demand for products.
- To facilitate the transition between traditional systems and alternatives proposed.

The history of rural technologies and products, especially in the area of shelter shows that there exists a considerable barrier to achieving economically viable mechanisms for their delivery on a mass scale. These barriers are a consequence of three factors: the inadequacies in the design of the technologies, the limitations of institutions for delivery, and the nature of the rural economy.

The rural economy is characterised by several feature, which distinguish it from its urban counterparts. A clear understanding of these features is essential for designing innovation, production and marketing strategies for rural area that are as

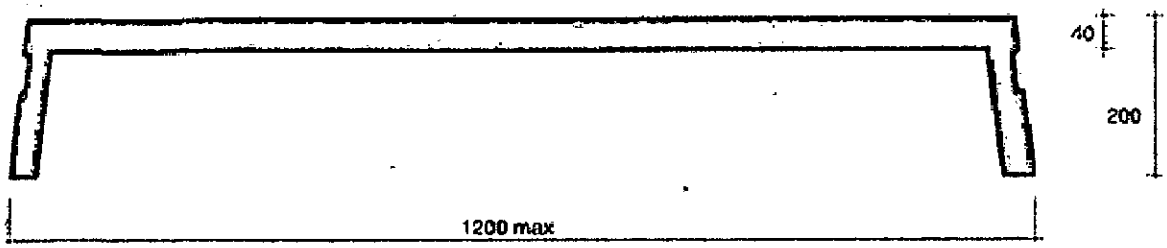
successful as those in urban areas. The relevant distinguishing characteristics of the rural economy are:

- ❖ It is very large but its dispersed nature hampers the introduction of organised production and marketing methods e.g. the number of upgraded and new houses that need to be built is in tens of millions but they are highly dispersed geographically.
- ❖ It is highly variable aver seasons and years and building activity is seasonal, occurring primarily during the dry months between harvests.
- ❖ It is dependent on resources and factors of production which are increasing scarce
- ❖ It primary transactions are non-monetary and non-market based
- ❖ It is linked by poor transportation and communication networks and high resistance to change

6.3.6. Developing and delivering low cost shelter technologies

From a study of the products which have successfully penetrated the rural market (tea, bidis, matches, torch cells, textiles) and the conditions under which modern technologies have been successful in the urban market, it is clear that for science-based products and technologies to reach the rural poor, there must exist a number of conditions including economic viability. In the past, a combination of economic, and social, cultural and political – not to mention scientific, technical and institutional – factors have greatly inhibited both supply and demand for village technologies. The more important among these factors are:

- Capital/ operating costs
- Efficiency of technology
- Evidence of improvement over traditional methods
- Ease of operation and ergonomic design
- Availability of spare parts and ancillaries
- Ease of repair and maintenance
- Problems of production
- Adaptations to local conditions
- Existence of marketing organizations
- Availability of information



scale 1:10
Channel Slab Unit

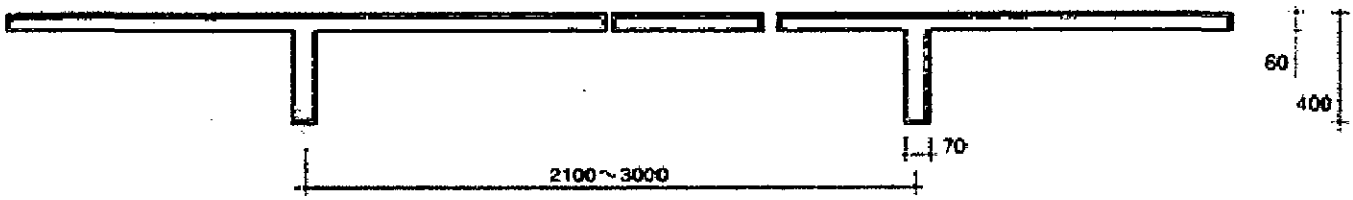
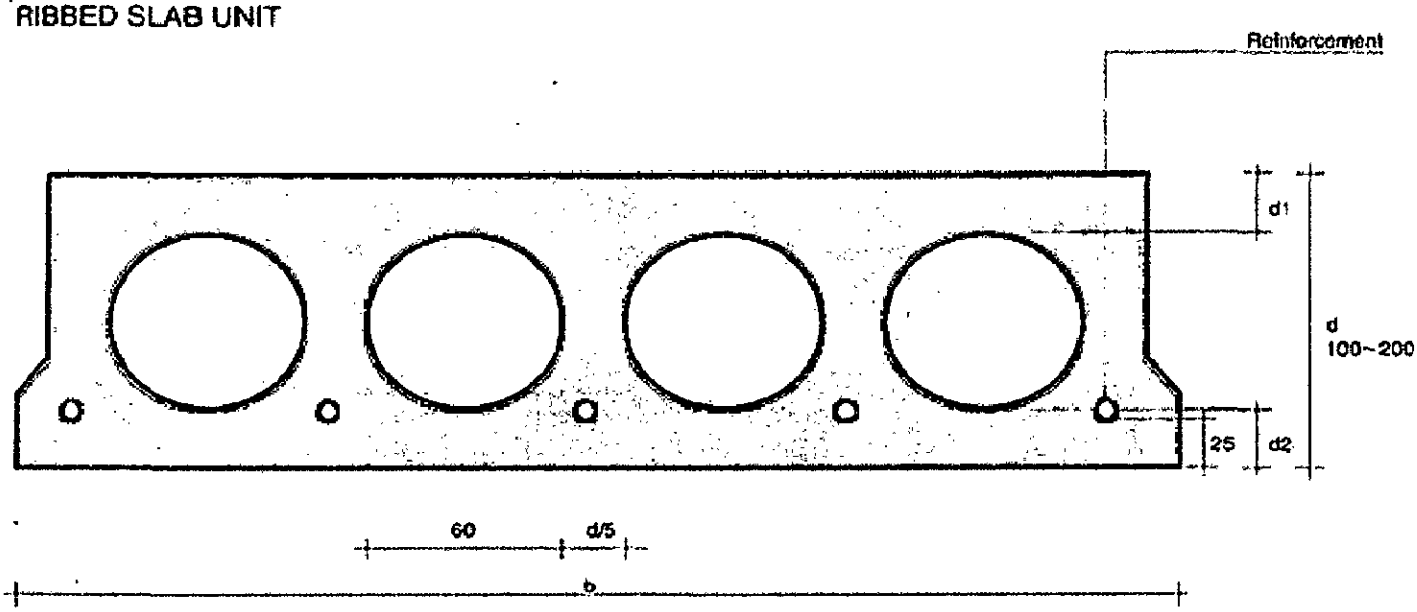


Fig 1b scale 1:25
Double Tee Slab Unit

RIBBED SLAB UNIT



scale 1:10
CORED SLAB UNIT

PLATE 17

- Promotion and extension services
- Management skills and social organization
- Social, class, political, and cultural attitudes

The interaction of these factors is complex. As a simple example, one of the major obstacles to the widespread deployment of certain technologies (e.g. a technology to make low cost fibre concrete roofing materials) is the vicious cycle existing between the design, the number of units installed in a locality and the establishment of local maintenance facilities. It has not been possible to set up maintenance facilities where the number of installations cannot grow until maintenance is easily available.

Thus any successful delivery mechanism must have:

- Have a local presence and, to the largest extent possible, use local resources;
- Be resilient to extreme fluctuations in both supply of raw materials and market demand for specific products;
- Provide both continuity (with existing practices) and change (to new concepts and methods)

6.3.7: *Vertical shaft brick kiln technology*

The vertical shaft chimney technology developed in china is an energy efficient, environmentally friendly and economically viable alternative to produce quality bricks, especially for mid range brick makers, producing 10 to 40 lakhs bricks per year.

The VSBK consists of one or more shafts located inside a rectangular brick structure. The shafts are 1 to 1.25 meters wide with nominal length of 1m, 1.5m, 1.75 m or 2.0m. In India, shaft heights have varied to hold from 8 to 13 batches. The inside surface is a brick wall, often lined with refractory bricks. The gap between the shaft wall and the outer kiln wall is filled with insulating materials- clay and rice husk, etc. provision for peep holes and thermocouple probes are provided along the shaft heights to monitor the position if fire as well as temperature profiles of the kiln.

The shaft is loaded from the top with a number of batches of green bricks for firing. Each batch typically contains four layers of bricks set in a predetermined pattern. The stack of bricks rest on a square support bars (which can be removed or inserted) supported in turn by a pair of horizontal beams across the arches in the unloading tunnel. For evacuation of exhaust gases, typically, two rectangular chimneys are provided at opposite corners of each shaft. Lids are provided to cover the shaft top, which direct the gases through the flue system.

6.3.8. Ferro cement roofing technology

Ferro cement roofing channels have a uniform segmental profile; they are 2.5cm thick and 83 cms wide. Maximum length of mechanically produced channels can be 6 meters. Longer spans for roofing can be built with intermediate supports.

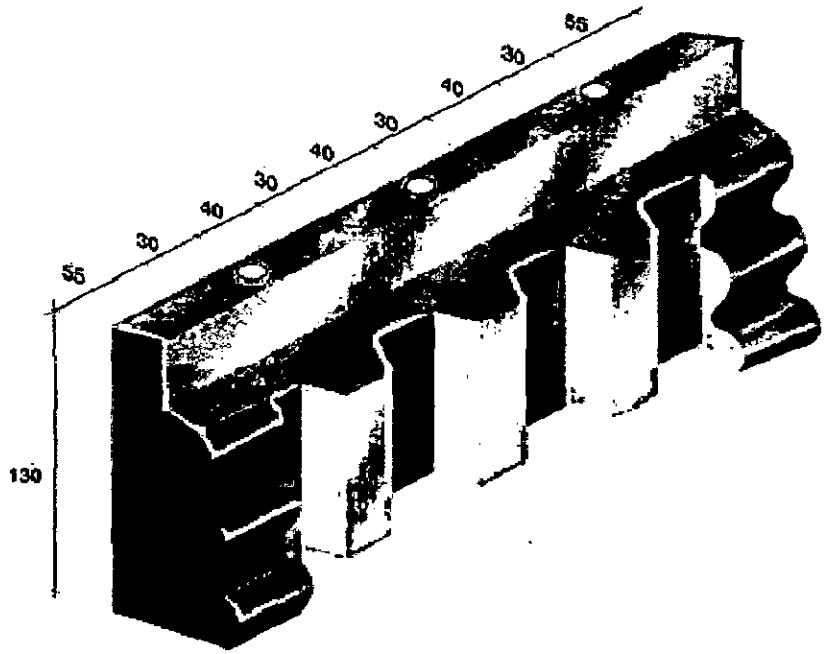
Ferro cement roofing channels are manufactured using a fixed proportion of cement, sand and water to give high strength mortar that is reinforced with a layer of galvanised iron chicken wire mesh of 22 gauge and torr steel bars of 8-12 mm diameter provided in the bottom nibs of the channel.

Ferrocement roofing channels can be safely transported after a curing period of 14 days.

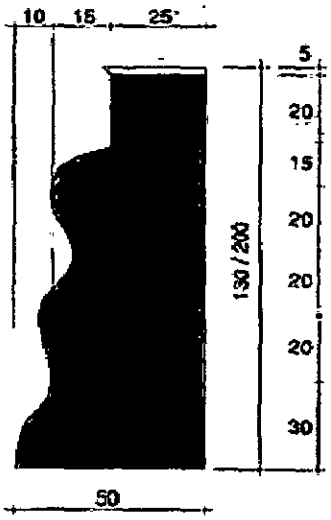
Ferrocement technology is a highly profitable business for small scale building material producers or construction companies. A total investment of Rs.3, 80,000/- for a mechanised production system assures a net profit of approximately Rs. 1,50,000/- per annum.

Ferro cement roofing channels are prefabricated elements. The mechanised system of production uses a vibrating table and profiled steel shell moulds. The production yard consists of a vibrating table positioned under a gantry system 6.5 mts. in width. The gantry is fitted with a chain and pulley system for ease of handling of shell moulds. A production team consisting of 2 masons, 6 semi-skilled workers and a supervisor can produce upto 5 channels of 4.6 mts. Length each in 8 hrs operations.

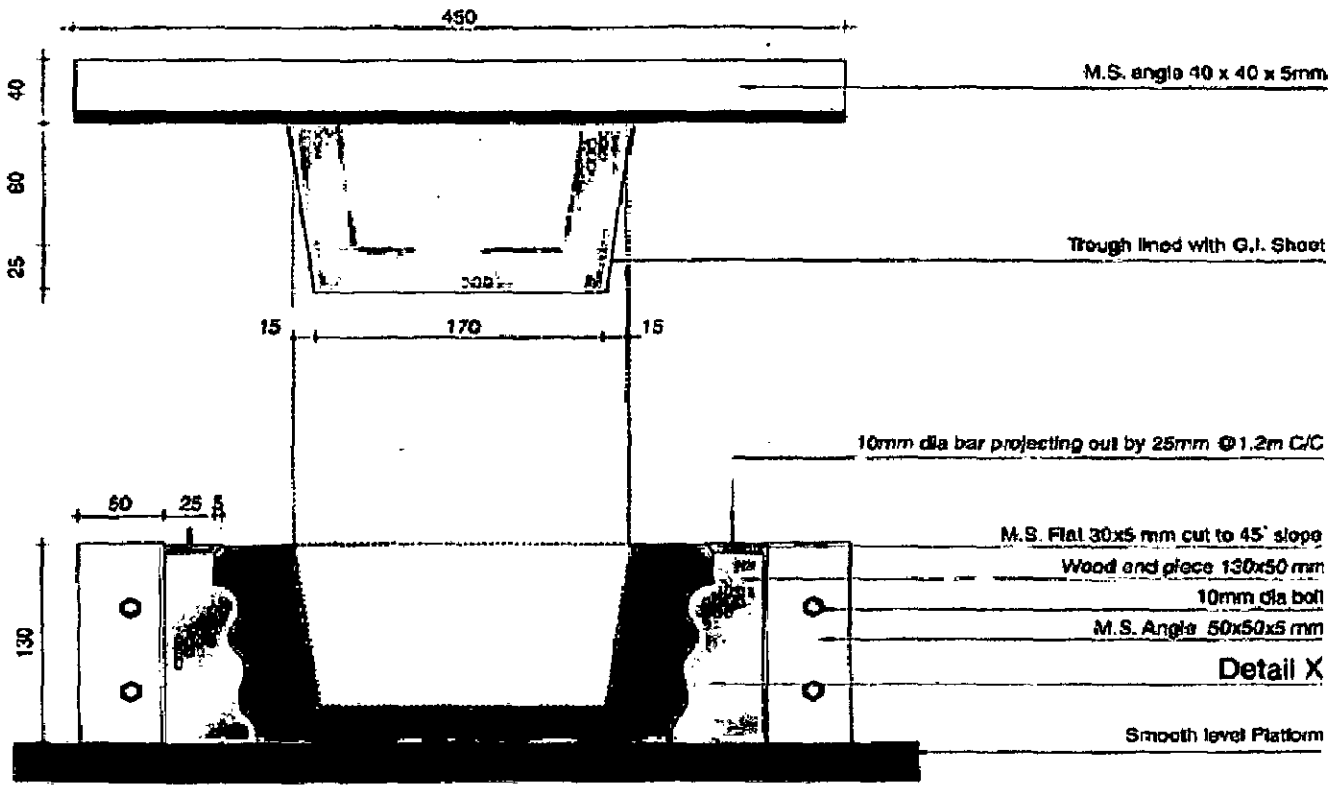
The shell moulds are lifted with the cast channels in the green state. After 24 hrs, using a specially designed mould lifting frame and demoulding tongs demoulds the roofing channels. The mechanised system does not require high skills but ensures high quality. Whereas, manual method needs highly trained masons and stringent quality control.



End View of Long Side Mould



DETAIL X



SECTION AT A

scale 1:5

TIMBER MOULD

PLATE 18

6.3.9. Micro-concrete roofing technology

Micro-concrete roofing tiles are cost effective aesthetic and durable alternative sloping roof technology.

MCR technology is a result of global research and development effort. The tiles are being marketed extensively in Latin America, east and West Africa and south East Asia. Each year almost 40 million tiles are installed.

Vibrating an optimum mix of cement, sand, and fine stone aggregate and water on a vibrating table makes MCR tiles. They are put through rigorous tests for water tightness, shape size etc. MCR tiles can be made in two distinctive profiles; Pan and Roman and an infinite range of colours. MCR tiles are being marketed under different brand names such as TARAcrete, Duracrete, Swisscrete, and MYCON tiles in different regions of the country by leading product promoters.

The mix of cement, sand, aggregate and water is vibrated for about 45 seconds and then transferred on to a High Impact Polystyrene mould to give MCR tiles their unique profile. After initial setting for 24 hrs, they are cured for 7 days.

MCR is a highly profitable for micro & small scale building material producers. A capital investment of about 3 lakhs yields upto 40% profits in the first year of operations. It can easily be adapted to both urban as well as rural markets. TARA, a leading sustainable technology marketing organization, supplies the equipment. To make 12000 tiles per month, 160 cement bags, 10 cu.m of sand and 5 cu.m of aggregate are required along with two skilled staff and five workers.

6.3.10. Compressed earth block technology

A Stabilised Compressed Earth Block has wide application in construction for walling, roofing, arched openings, corbels etc. Stabilised Compressed Earth Blocks (SCEB) are manufactured by compacting raw earth mixed with stabiliser such as cement or lime under a pressure of 20-40 kg/cm^2 using a manual or mechanised soil press.

The Stabilised Compressed Earth Block is a masonry unit of cuboidal shape. This maybe solid or hollow or interlocking. The equipment used in its manufacture defines the shape and size of the block. SCEBs can be used for load bearing construction upto 3 storeys. The cost of a block depend s upon a variety of factors including quality and prise of available soil, amount of stabilisation, labour

productivity, equipment and overhead costs. The degree of stabilisation has the maximum influence on the cost of the product.

A number of manual and hydraulic machines are available in India. The basic principle of all the machines is the compaction of raw earth to attain dense, even sized masonry units.

The production of SCEB is based on the principle of densification of raw earth mixed with stabilisers (cement or lime) in small quantities ranging from 5-10% by weight of the mix. The production process incorporates 3 main stages.

6-10 persons are required to operate a manual machine. For hydraulic machines the manpower required is 6-8 persons. In both the systems 1 skilled worker is required while the rest are semiskilled. The worker is required to operate any machine in 10-12 days.

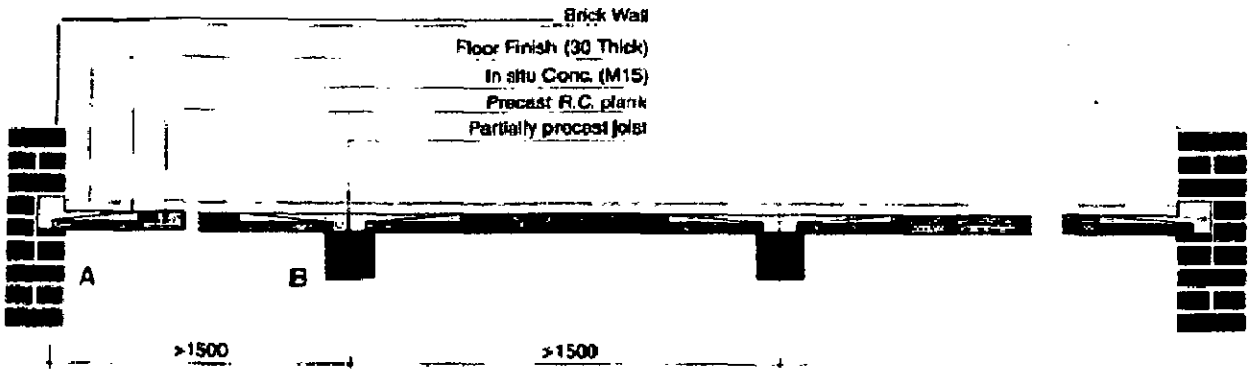
The primary raw material for the production of SCEB is raw earth or soil. OPC cement in small quantities is other constituent. Coarse sand or stone dust maybe added depending on soil quality. Soil is made up of grains of various sizes. The grain size distribution of soil determines its suitability for the manufacture of SCEB.

6.3.11. Concrete block technology

The specifications and the characteristics of a concrete block depend on the machine used to manufacture concrete blocks.

The most common size of solid concrete blocks is 300X200X150mm. The basic raw material is cement, fine aggregate and coarse aggregate. Very little water is used. This is possible only with mechanised compaction and vibration and gives the block high quality in spite of the lean mix, which uses very little cement. Weight of a concrete block is about 18-19kg. Concrete blocks can be surface engineered by using pieces of stone or ceramic waste on their face. Another common type is hollow concrete blocks. They are made with a richer mix, but offer a number of advantages, such as lighter weight, easier handling and facility for conduiting or reinforcement through the hollows.

Concrete are usually produced using a semi mechanised stationary type machine. The other production systems are- manual moulds which require hand tamping, a mobile semi-mechanised egg laying machine and fully mechanized systems, which combines compression and vibration.



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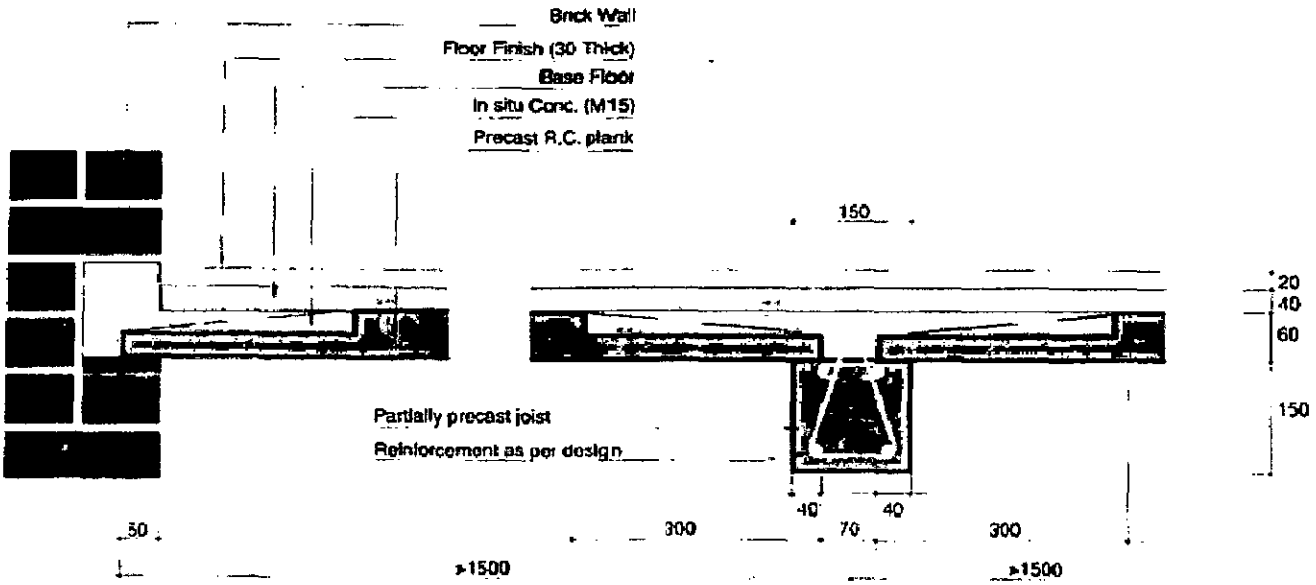
SECTION AT FLOOR LEVEL

PRECAST R.C. PLANK SCHEME



scale 1:10

SECTION AT FLOOR LEVEL

PRECAST R.C. PLANK SCHEME
ENLARGED DETAILS A & B

PLATE 19

High quality machines provide optimum vibration in the mix so that the ratio of cement used can be reduced substantially without compromising on the strength of the blocks. The machine also compacts and consolidates the mix so that the blocks are uniform in size and attain desired physical properties. The blocks are cured for a minimum period of 14 days, before they are ready to use. On an average 600-800 blocks can be made in 8 hour by one skilled and 6-8 semi-skilled workers.

Concrete blocks can be used like any other masonry unit o build foundations, walls, arches, and corbels, etc. a typical concrete block is equivalent to 4.5 bricks, thus construction is faster than with other masonry unit.

The mortar used is also less which results in cost saving concrete blocks have been extensively used in combination with a conventional roofing systems like RCC, RBC, GI sheets, ACC sheets etc. they are also compatible with other material like fired bricks, dressed stone and compressed earth blocks for composite wall construction.

Acceptability of concrete blocks is very high in urban areas for all types of buildings. They are very popular as a long lasting, low maintenance, and investment for institutional buildings. The permanence of a cement-based product is making concrete blocks a preferred choice in rural area as well.

6.3.12. Building advisory service & information network (BASIN)

6.4. Anangpur Building centre- Ar. Anil Laul

6.4.1. General hospital, Kota, Rajasthan

6.4.2. Deepalaya, Delhi

6.5. BMTPC-building material and technology promotion council

6.5.1. Building techniques

6.5.2. Building components

Standards And Specifications For Cost Effective Innovative Building Materials And Techniques,

This publication contains standards and specification on 22 new building materials and construction techniques, which have potential for large-scale adoption and bringing down the cost of housing, and building construction. Bureau of Indian Standards has formulated codes and standards on all the new technologies

included in the publication. The publication will be useful for field applications of new technologies by construction agencies.

6.5.3. Cost effective building materials

6.5.4. Stabilised mud blocks

Stabilised Mud Blocks And Their Use-Guidebook For Technicians And Construction Workers

Book is published in collaboration with VILLE FONTAINE- AUROVILLE- BMTPC-HABITAT POLYTECH. Method of manufacture of blocks along with their correct use has been highlighted.

6.5.5. Compressed earth blocks

Building With Compressed Earth Blocks

Published in collaboration with Development Alternatives. This booklet introduces the theory and practice of construction with compressed earth blocks. The characteristics, earth construction methods, economics, general design principles etc, are highlighted in the booklet.

6.5.6. Precast building components

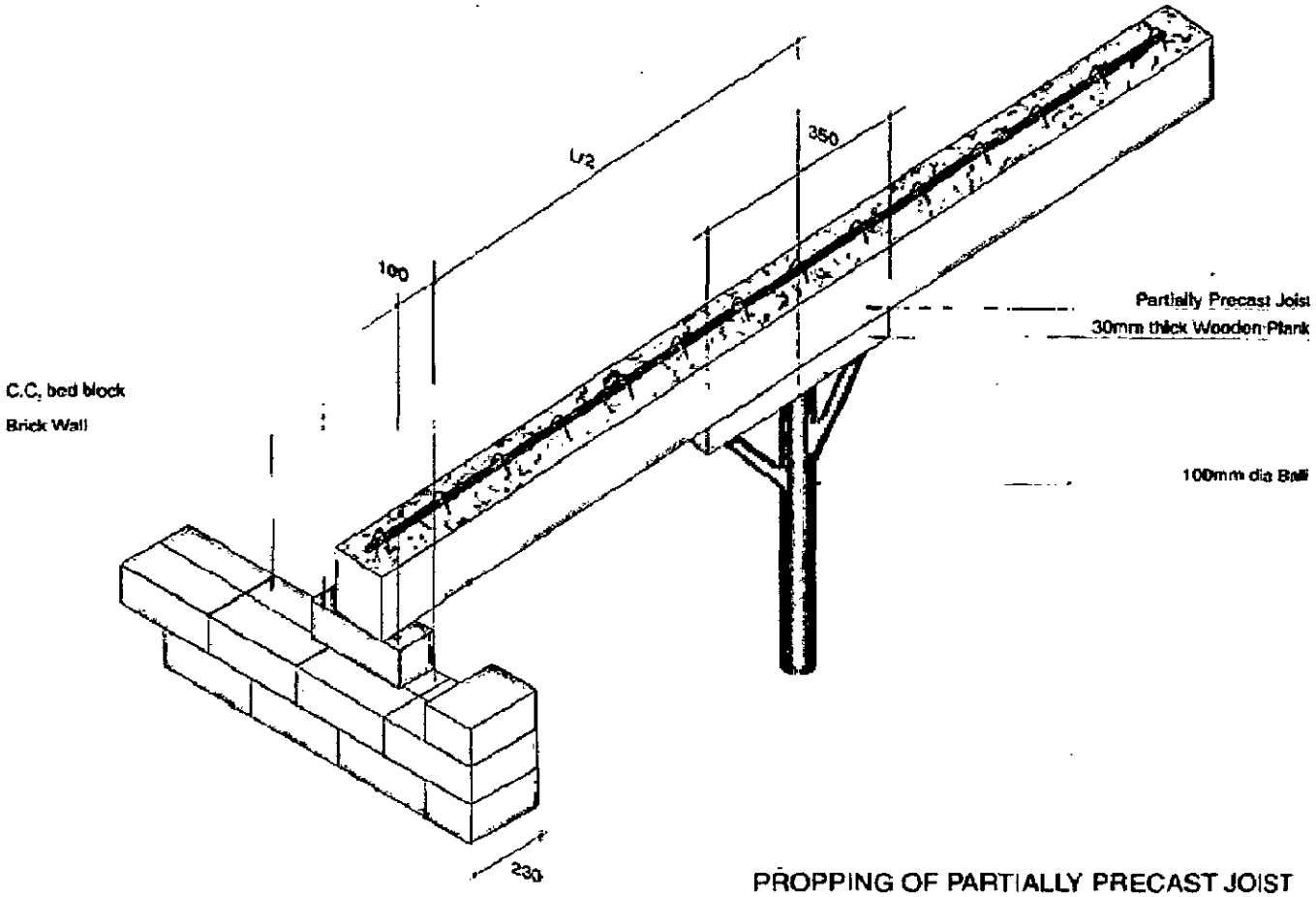
This report contains project profiles for economic level of productions of precast Building Components like Concrete blocks, Concrete Door/window frames, Micro concrete roofing tiles and Ferrocement roofing channels at decentralised locations. The publication will be useful for those who are setting up a production unit for manufacture of precast building components on small scale levels, which can be expanded depending upon the increasing demand and financial strength of the set up.

6.6. Auroville Building centre

6.6.1. Sangamam- a model village

Life in the villages

One of the most critical problems in the area surrounding Auroville is the housing situation. Villagers live in small mud-walled, palm leaf roofed huts. These roofs have to be renewed every two or three years due to the monsoon, and it becomes a financial burden on the already difficult economy. Besides, the urbanisation of the villages is chaotic and deficient. Village streets are eroded and pitted. There is no



PROPPING OF PARTIALLY PRECAST JOIST

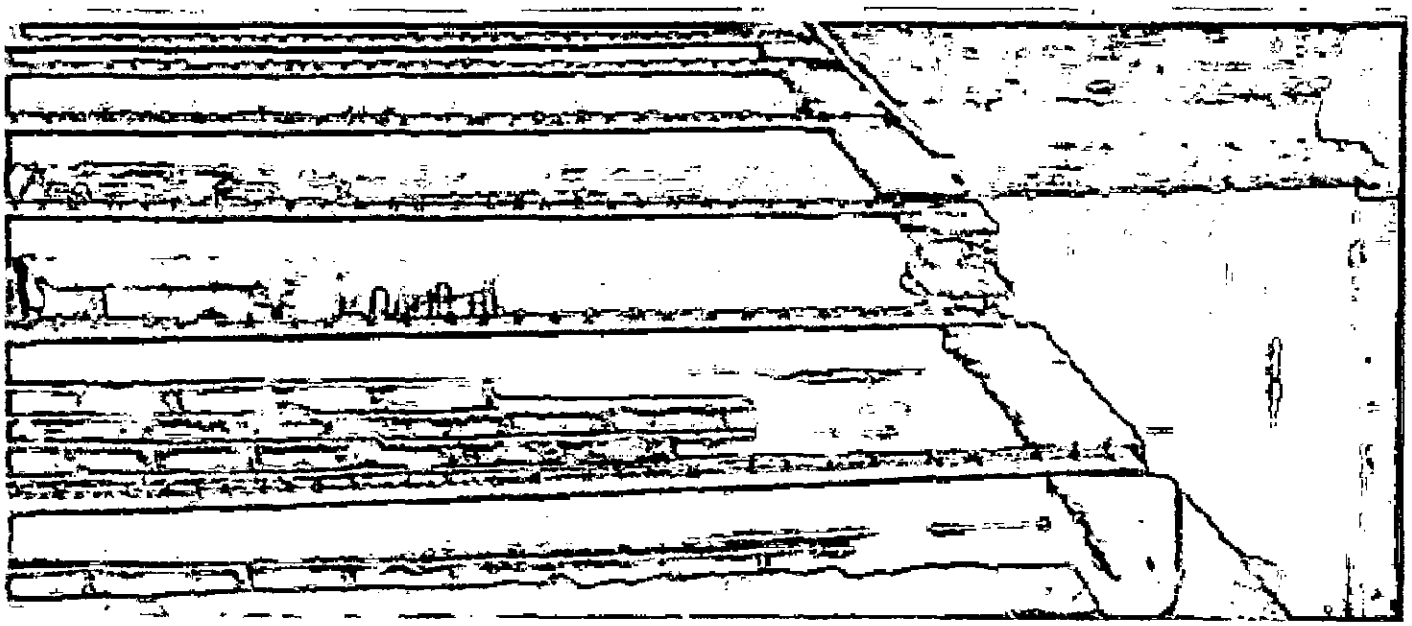


PLATE 20

public sanitation system for wastewater, excreta or household waste. Government programmes for rural electrification, street lighting and sanitation are poorly implemented. For years the various village-oriented groups of Auroville have been working in different aspects in a separate way: water, health, education and other projects for the development of the villages. Along with Auroville's Village Action Group, the Ilaignarkal Educational Centre is working in permanent contact with students and Auroville workers from the surrounding villages. Thanks to this contact, we have been able to identify their main problems and conceive of a project in which the different inputs from Auroville can be put together in an integral way.

Project for a model village

The main objective of this project is to design and build a model village, on a reduced scale, which allows the experimentation, in an integral way, of innovative solutions for the current problems of the villages. We foresee the creation of a model with an effective layout striking a balance between green open spaces and actual construction sites, integrating the necessary infrastructure and the common services. The project will also experiment with different models of affordable housing. A biological wastewater treatment plant will be included in the project, so that 100% of the wastewater will be recycled and reused for watering the green public spaces.

6.6.2. *Low Cost Light Roofing Components*

The aim is to develop lightweight, low cost 'fibre reinforced concrete' (FRC) roofing tiles as an alternative to asbestos products. Manfred, who works on this with his partner Dorothee, gives the following advantages for this material:

i. There is no need for sophisticated technology; therefore initial investment is low.
ii. Low energy consumption for production.
iii. Because of the lightweight of the roofing material, its supporting structure can be cheaper.
iv. Use of environmentally friendly, locally available material.
v. Small-scale fabrication for local use can generate employment for unskilled labourers.

vi. Climatically advantageous, because the very thin tiles do not store the heat: therefore the rooms will cool down fast in the evenings.

vii. Use of colour pigments to create greater variety of materials (lighter shades will reflect the heat better).

The first samples, 45 x 45 cm roofing tiles, are encouraging.

6.7. Other sources

6.7.1.

- **Traditional and new building materials**

Building material account for 60-70% of the house construction cost.

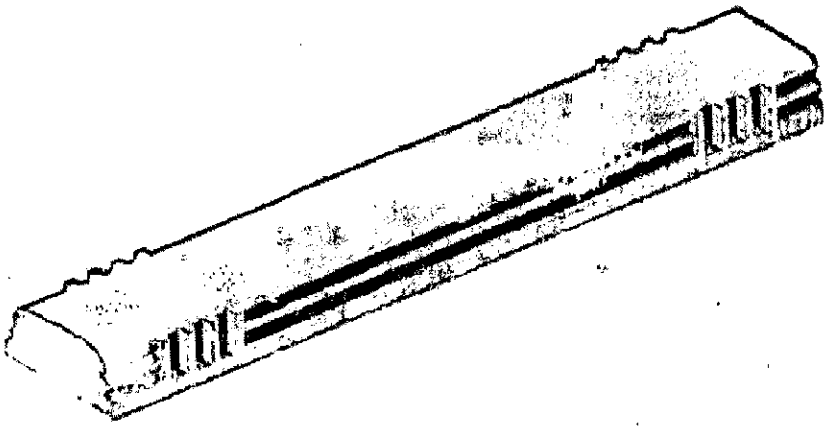
- **Availability of industrial and agricultural wastes in India**

Waste	**Source**	**Availability (million tons/ annum)**
Blast furnace stage	Iron & steel industry	12
Fly ash	Thermal power station	16
Calcium carbonate sludge	Fertilizer industry	2
Lime sludge	Paper and sugar industry	5
By-product gypsum	Fertiliser, phosphoric & hydrofluoric acid industries	2
Red mud	Aluminium industry	1
Kiln dust	Cement industry	1
Rice husk	Agriculture	20

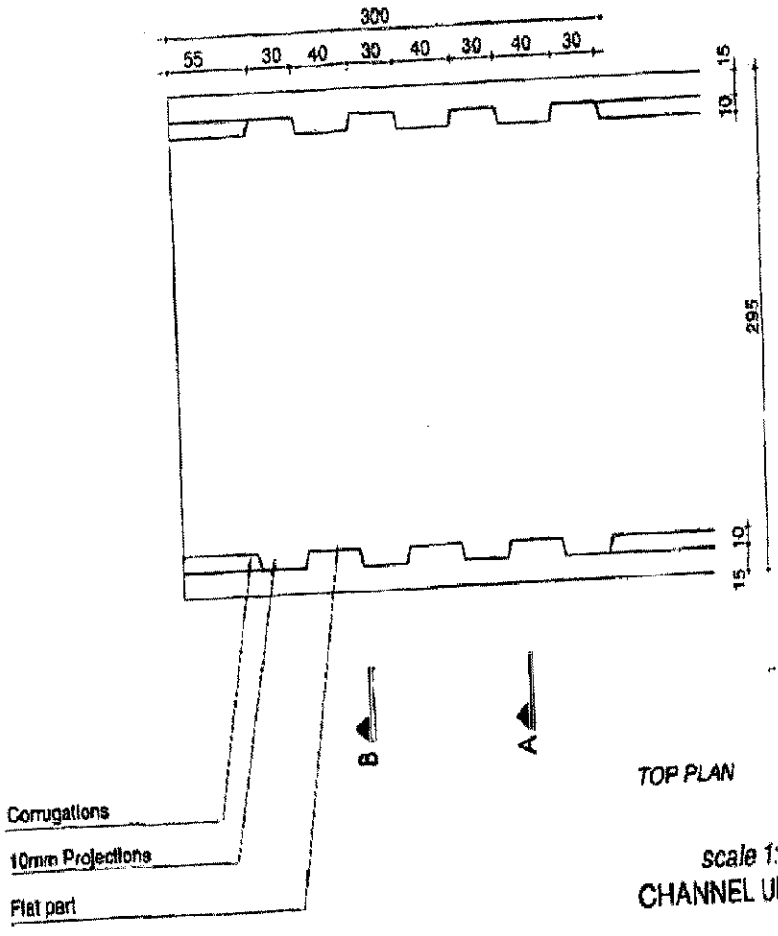
- TRADITIONAL BUILDING MATERIAL

Soil, thatch, bamboo, timber, bricks, stone and lime.

1. Stabilised soil bricks
   Adobe



Channel Unit View



TOP PLAN

scale 1:5

CHANNEL UNIT

PLATE 21

Wattle & daub

Spanish walling

4-5 % cement or 4% cement & 2% lime,

8% water and soil

75-100-kg/mm^2 pressures

2. Improved mud and thatch

✓ Water proofing of mud walls- spraying with a mixture of kerosene and asphalt

✓ Fire proof- diammonium phosphate

✓ Plastering with bitumen and stabilised mud

3. Burnt and unburnt bricks
4. Laterite lime bricks
5. Sand lime blocks
6. Stone block masonry units
7. Bamboo

Research done by forest research institute, Dehradun

Regional research laboratory, Jorhat.

Patented 'bamboo creet'

8. Hollow cement blocks
9. Light weight concrete blocks

Cellular or aerated concrete block produced by Siporex India Ltd. Pune

10. Wood cement products

Building boards using composites using cement, waste from coir, jute, rice straw, rice husk, wood, wood shaving, saw dust, bamboo fibres

11. Fly ash bricks

Fly ash sand bricks- central fuel research institute, Dhanbad

190X90X90

12. Cementations binder from rice husk
13. Lime based binders

- <u>IMPROVED BUILDING TECHNOLOGIES- FOUNDATION</u>
  - ✓ Type of soil
  - ✓ Gravel, sands, silts, clays, peat, chalks, fills

- ✓ Types of foundations – footing, strip, raft piles
- ✓ Foundation on expansive soil
  - Plinth protection slab
  - Under-reamed piles
- ✓ Permissible total settlement
  - Isolated foundation on clay- 6.5 cm
  - Isolated foundation on sand- 4cm
  - Raft foundation on clay- 6.5- 10 cm
  - Raft foundation on sand- 4-6.5 cm
- ✓ Soil investigation

- IMPROVED BUILDING TECHNOLOGIES – WALLS

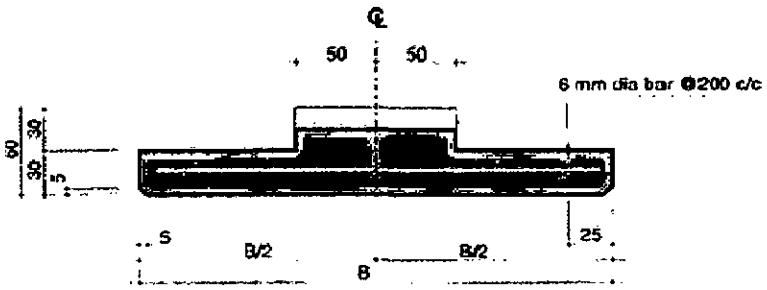
The cost of walls in the total cost of housing construction is about 20% excluding cost of foundation.

- ✓ Stabilised earth wall construction
  - ❖ Rammed earth walls
  - ❖ Building blocks using soil-cement Cinva Ram press
  - ❖ Efficiency of stabilised walls

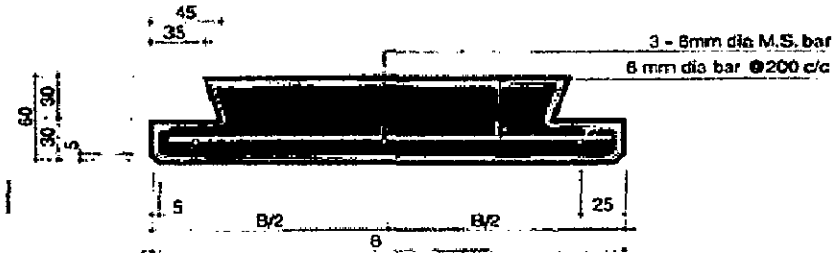
  Ground floor walls 30 cm thk.
  Internal walls 23 cm thk.
  Stabilisers like cement, bitumen, and oil.
  Plaster cement lime sand 1:2:9 1:3:12
- ✓ Building blocks (LATO BLOCKS) from laterite soil. Laterite soil- Kerala, Tamil Nadu, Maharashtra, Madhya Pradesh, Orissa, Karnataka, Goa.
  Structural Engineering research centre, Madras- 600 blocks per hour.
- ✓ Brick masonry walls modular bricks 19cmX9cmX9cm
- ✓ Cellular concrete walls
  - ❖ Calcrete madras
  - ❖ Siporex, Pune

Sand and flyash, quicklime, cement, aluminium powder and gypsum.

ISOMETRIC VIEW



SECTION X



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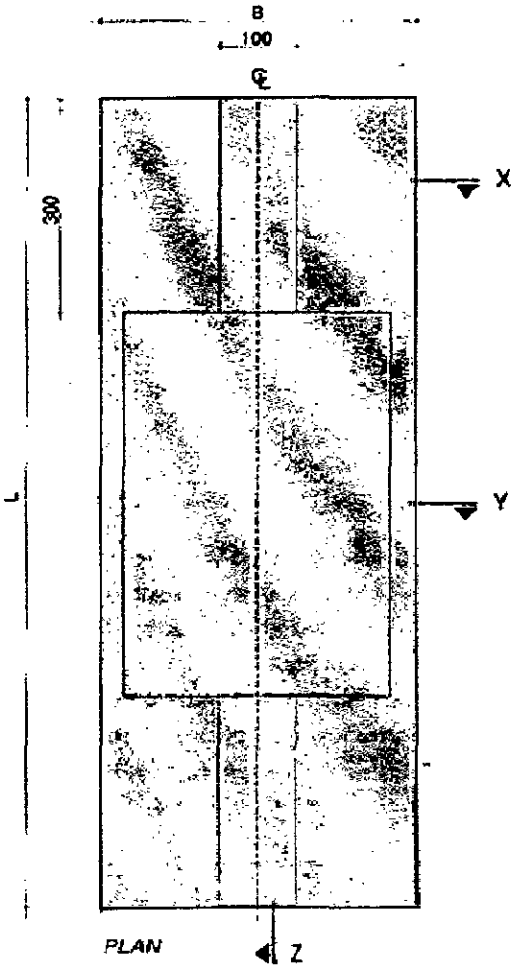
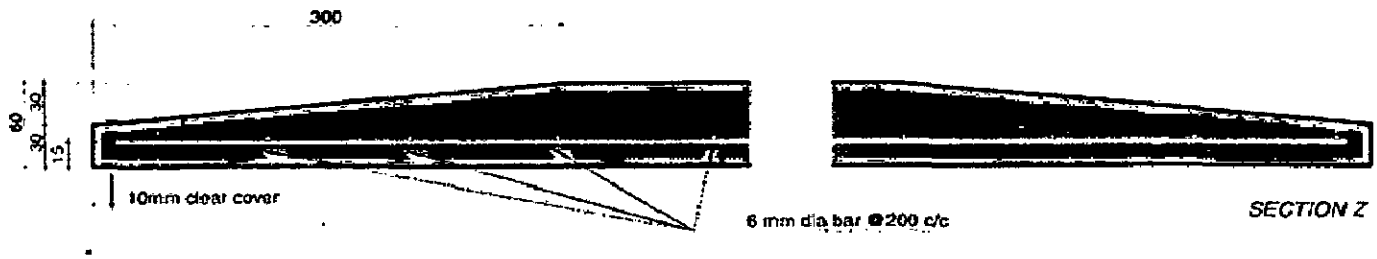


PLAN



SECTION Z

scale 1:5

PRECAST R.C.C PLANK

PLATE 22

- ✓ Hollow concrete walls
  - ❖ M/s Minato Shirke concrete machines pvt ltd pune.
  - 400X200X200 load bearing block
  - 400X200X100 partition block
  - 200X100X200
  - 200X200X200 Band block
  - Max wt 25 kg
- ✓ Shell type house made of hollow clay blocks
- ✓ Precast concrete panels

- <u>IMPROVED BUILDING TECHNLOGIES – ROOFS</u>

Roof accounts for almost 20% of the cost of a low cost house.

- First cost and recurring maintenance
- Durable and maintenance free
- Fire proof and drains water easily
- Shall not be so light as to get blown away
- Built out of light components

- ✓ Precast doubly curved funicular shells
  - 1.5mX1.5m. Wt 70 kg. 2.5cm thick.
  - Economical for spans above 3m.
  - Saving in steel up to 25%
  - Saving in total cost up to 20%
  - Saving in time of construction
  - Reduction in us of shuttering
  - Plastering on the ceiling normally done in insitu slabs is eliminated

- ✓ Brick funicular shell roof
- ✓ Catenary hollow clay block/ brick shell roof
- ✓ Precast reinforced concrete channel units
  - Saving in steel & cement 25 &15% respectively

- ✓ Precast reinforced concrete cored units.

- ✓ Structural clay block units
- ✓ Hollow blocks and precast RCC joists flooring/ flooring unit.
  - Hollow clay blocks 35.5X30.5X11cm 9kg.
  - Hollow concrete blocks 53X25X14cm 14kg

    Messrs Bombay Chemical Ltd. 'Castone'

    M/s B. G. Shirke & co.
- ✓ Roofing system with cellular units
- ✓ Reinforced brick panel roofing system
  - Reinforced brick panel, 560X1040
  - 17 bricks, 1:4 cement: sand mortar
  - 2 m.s bars 6 mm Ø, 40% economical to RCC
- ✓ Two-way spanning flooring system using precast units
  - K.K. Nagar chennai.
- ✓ Cellular light weight concrete roofing unit
- ✓ Ferro cement ribbed slab and folded plates

- PREFABRICATION

SERC, TNHB, SIPOREX, UCOPAN systems in India. Precast concrete wall panels and floors.

1. Column and beam system
2. Panel system
3. Box system

Advantages of prefabrication

1. Speed
2. Disciplined use of scarce material
3. Cost reduction
4. Superior quality control
5. High productivity

Foundation:

- ✓ Spread
- ✓ Column & footing
- ✓ Pile
- ✓ RCC & raft foundation

Floors and roofs

- ✓ Precast funicular shell
- ✓ Precast hollow cored slab
- ✓ Prestressed hollow cored slab
- ✓ Precast battens and hollow block construction
- ✓ Plate floor system
- ✓ Shirke's 3-S system
- ✓ Precast R.C plank and joist system
- ✓ Light weight aerated concrete unit
- o Precast sanitary cored units
- o Ferro cement products
  - Service core units
  - Trusses and rafters
  - Water tanks
  - Cupboards
  - Meter boxes

- COMPUTER AIDED DESIGN-

HUDCO model----computer programme

- SANITATION SYSTEM

On-site dry

1. Overhang latrine
2. Trench latrine
3. Pit latrine
4. Reed odourless earth closet
5. Ventilated pit latrine
6. Batch composting latrine

7. Continuous composting latrine

On-site wet

8. Pour flush latrine soak away
9. Pour flush latrine aqua privy soak away
10. Pour flush septic tank vault
11. Sullage flush aqua privy soak away
12. Sullage flush septic tank soak away
13. Conventional septic tank

On-site or off-site wet

14. Low volume cistern flush or sewer
15. Low volume cistern flush aqua privy soak away
16. Low volume cistern flush septic tank soak away.

Off-site wet

17. Conventional sewerage

Off-site dry

18. Vault vacuum tank
19. Vault manual removal truck or cart
20. Bucket latrine
21. Mechanical bucket latrine

New concepts in sewage treatment

- Concept of ruling gradient approach
- Spot resources recovery systems
- Incremental sewer system
- Off site treatment systems
- Waste stabilisation pond, activated sludge plant, trickling filter plant
- Aerated lagoon, oxidation ditches, bio-discs, deep shaft process
- Aqua culture
- Biogas generation

Wind effect on low rise building

Thatch roof

- Roof angle between 30-45 deg.
- Wind force on roof cladding minimum
- Metal straps and mild steel wires
- Portion of timber post below ground level protected by tar
- Cross bracing on end panels
- Knee bracing and plan bracing
- Additional laying-increased no. of battens
- Additional layer of thatch near the overhang and top ridge
- Overhang 30cm

Clay tiles

- 35-40 DEG.
- Plain tiles, pan tiles, curved tiles or country tiles
- Mangalore tiles, Allahabad tiles
- Self-wt. Of Mangalore tiles- 54kg/m^2
- Country tiles 25-35cm overlap 75mm
- Can be nailed ti vertical/horizontal batten
- Wt. Per unit area 65kg/m^2
- Concrete restraining strips over the tiles
- 1.2 to 1.5m long 100mmX100mm c/s
- 100 mm Ø high strength deformed bars
- Spacing 1.2m

Cyclone resistant core units

1. Ferro cement attic type core units
2. Ferro cement core units at floor level 14

6.7.2. Siporex India ltd. Pune

6.7.3. Calcrete, Chennai

6.7.4. Low Cost Wall Panels From Blast Furnace Slag Cement

In Brazil, as in most of Latin America, increased costs for building materials — especially Portland cement — have compounded a housing crisis affecting the country's low-income population. In the search for alternative low-cost building materials, researchers have investigated the use of industrial and agricultural wastes.

Slag is a good example of one such industrial waste that is abundant in Brazil. A by-product of the country's steel industry, it is produced by purifying iron ore into pig iron, and sits in huge mounds outside iron furnaces. Brazil produces some three million tonnes of blast furnace slag (BFS) per year, and its disposal is a problem. Once broken down, the slag is called granulated blast furnace slag (GBFS).

With IDRC support, engineers of the Instituto de Pesquisas Tecnologicas do Estado de São Paulo S.A. (IPT) at the University of São Paulo have designed and manufactured hollow wall panels and constructed a prototype house. The IPT-IDRC Composite Precast Panel System is a low-cost, environmentally sensitive technology. It uses GBFS-based cement reinforced with coir fibres instead of traditional steel rebar. Taken from the outer husk of the coconut, the stiff, coarse coir fibres are widely available in Brazil and other Latin American countries. Since common Portland cement tends to destroy vegetable fibres, the IPT-IDRC composite is the first to combine low alkaline water-resistant cement with coir fibres, resulting in a durable building material.

Producing GBFS-based cement does not require burning, resulting in 70% less energy consumption compared to the amount necessary to produce Portland cement. The cost of a wall panel plant is thereby reduced because no rotary kiln is needed, which means that smaller, more efficient plants can become economically viable. The cement itself is composed of GBFS (92%), hydrated lime (2 %), and gypsum (6%). The mix proportions are, by weight, 1:1.5:0.51 (cement, sand, water), reinforced with a volume of 2% coir fibres, averaging 30 mm long. Mixing is done in an ordinary concrete mixer.

Designed to be easily produced on-site or in a small plant, the 40 cm wide and 250 cm high IPT-IDRC wall panels weigh less than 120 kg, and can be assembled without any heavy or expensive equipment. Because steel rebar is not used as reinforcement, there is no risk of corrosion in the panel. A complete performance evaluation was developed and performed, and the panels comply with IPT standards, meaning that expected performance will be equivalent to an ordinary hollow brick wall.

To test the panels under real conditions, a 24 square metre prototype building was constructed in 1989 on a Sao Paulo street. The external and internal walls were finished with commercially available emulsion paint. After eight years, there is no visible degradation on the external walls. A detailed investigation of the degradation of the fibres and cement is being performed. First results confirm that neither alkaline degradation nor bio-deterioration occurs with the fibres. [15]

7. RECOMMENDATIONS

Design solution for santhal parganas Region

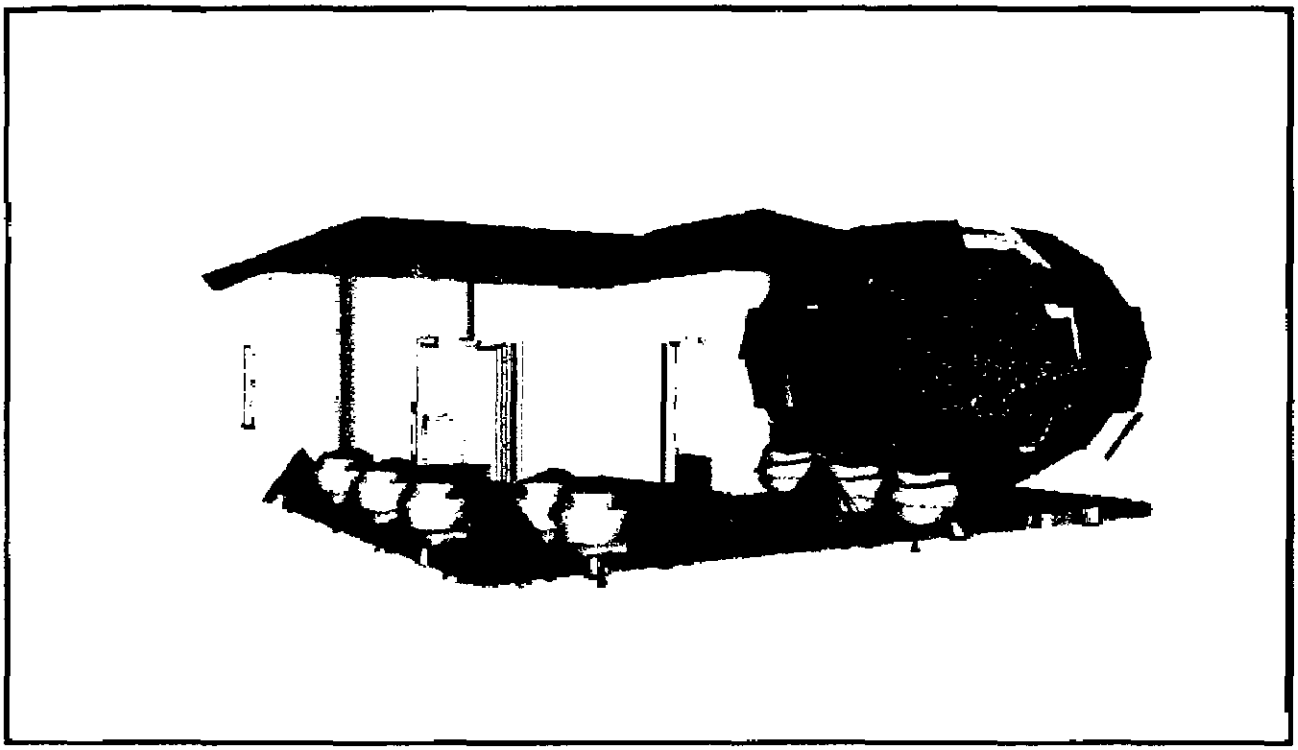
7.1. Materials

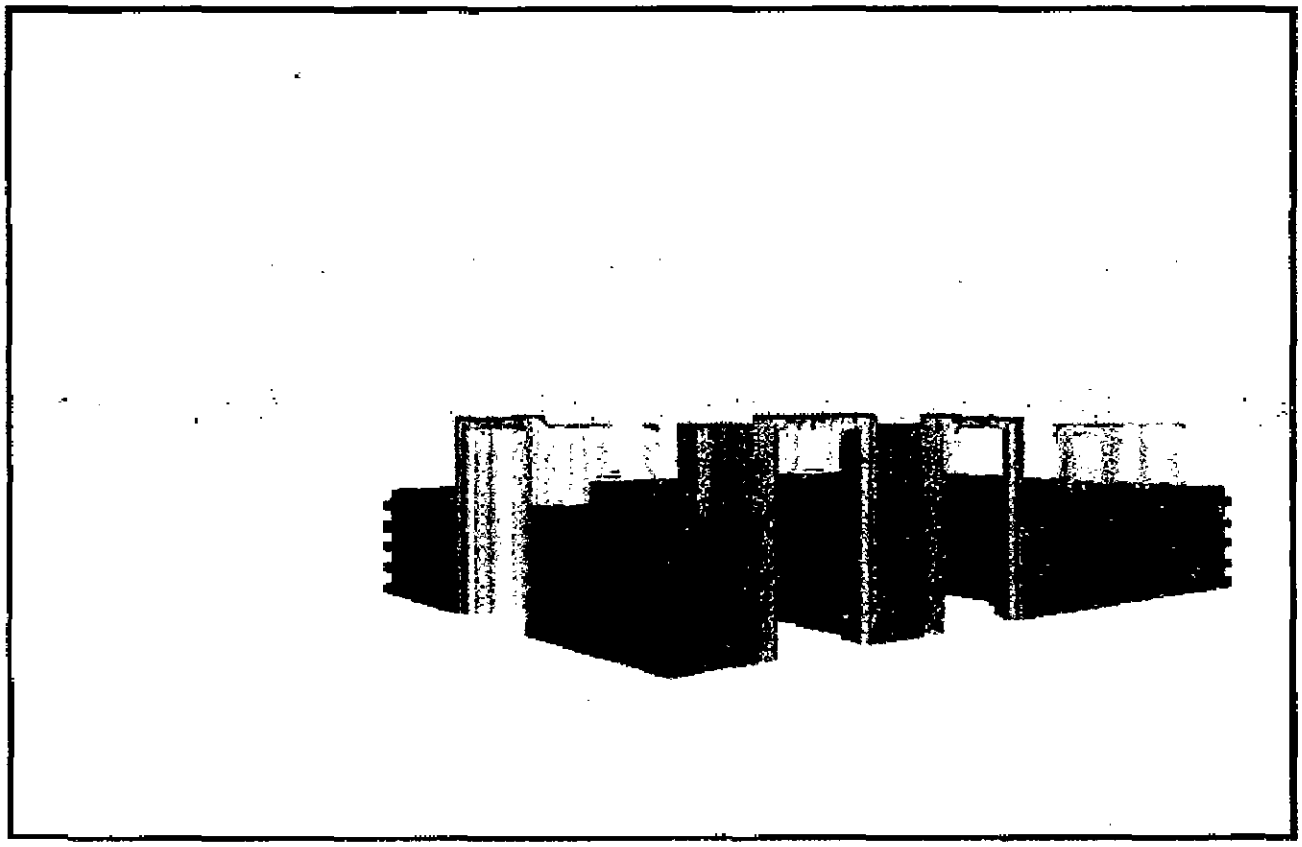
The compressed earth block overcomes all the limitations of a traditional handmade mud brick by an increase in block density through compaction using a mechanical press. The water content in the soil is low for compaction as compared to the puddled clay required for mud blocks made by hand. This reduces the drying time of the block and ensures much greater dimensional stability. A block:

- Has high density which varies between 1.8 and 2.0 gm/cu cm. this gives it a load bearing capacity of at least 18 kg/sq m and improved water resistance;
- Is low cost;
- Is easy to manufacture locally by small groups of people;
- Is low in energy consumption because no fuel is burnt for brick making or transportation;
- Can use soil available at site;
- Has smooth finish.

With these advantages a compressed earth block can easily be used for construction of simple houses of one or two floors. Greater design care and stabilization enables the construction of more ambitious structures and need less maintenance and are longer lasting.

Compressed earth blocks are high quality masonry units. Houses made from them should not be considered temporary or katcha. They can be as strong and durable as burnt bricks. When manufactured locally, compressed earth blocks are generally cheaper than burnt bricks. Their production is an excellent way of generating rural employment. The compressed earth block press is a very simple mechanical device. A number of such machines have been developed all over the world. These range from simple manual presses to motorised production units. In countries with abundant manpower and low capital investment capability, manual presses are more suitable. Prominent among manual presses are the Cinvaram, terstaram, Ellson blockmaster, ASTRAM, and the Auram. Development alternatives designed the BALRAM earth block press to suit an elaborate set of specific requirements and Indian conditions. It is manufactured and marketed by T.A.R.A.





VIEW - PROTOTYPE I

PLATE 23

The balram is a manual soil block press. Its design is based on the first principles of soil mechanics. Soil exhibits a non-linear response under compression. It is important that the compressing mechanism provides a variable mechanical advantage to match this behaviour. Thus in the development of the BALRAM, there is extensive study of force against compaction of soil; compacted dry density versus water content and compressive effort: and grain size distribution of various alluvial soils.

The ramming action of the BALRAM is powered by a toggle and crank mechanism. Soil is filled and manufactured blocks ejected from the top of the mould while ramming takes place from the bottom. The lockable mould is a twin chamber that produced two conventional sized bricks (230mm X 108mm X 76mm) in one ramming cycle. The centre plate in the BALRAM can be removed to make larger blocks.

Using the BALRAM compressed earth block press; five persons can maintain a high production rate of over 150 cycles per hour (300 blocks). Including time spent on preparation of soil and stacking of blocks a team can produce an average of 1200-1500 blocks per day. It is easy to maintain and has a long life.

Stone is available but in small irregular shaped lumps. These make vert poor wall that usually cracks and crumbles.

Wood or metal moulds can be made of suitable sizes. (Say 12" X 8" X 6" or 12" X 6" X 4" etc.) And these lumps are placed in the moulds and the spaces filled in with a weak lime or cement concrete. This produces neat rectangular blocks with which walls of different thicknesses can easily be constructed.[16]

Laminated bamboo mat corrugated roofing sheets

A technology for manufacture of laminated bamboo mat corrugated roofing sheets has been developed at the Indian Plywood Industries Research and Training Institute, Bangalore in collaboration with the BMTPC.

This is an alternative for existing roofing materials like corrugated sheets, G.I. sheets, aluminium sheets, FRP, Red mud and asphaltic sheets.

The sheets possess excellent physicomechanical properties and are based on renewable resources requiring low energy. It also finds use as value added products in the areas as an aesthetically pleasing material.

These sheets are not only highly water and weather resistant but also resistant to decay termites and insects.

The sizes are 1.8X0.9m and 1.8X0.75m.

Stones are available, but only in small irregular shaped lumps. These make a very poor wall that usually cracks and crumbles.

Wood or metal moulds can be made of suitable sizes and these lumps are placed in the moulds and the spaces filled in with a weak lime or cement concrete. This produces neat and rectangular blocks. With which walls of different thickness can easily be constructed.

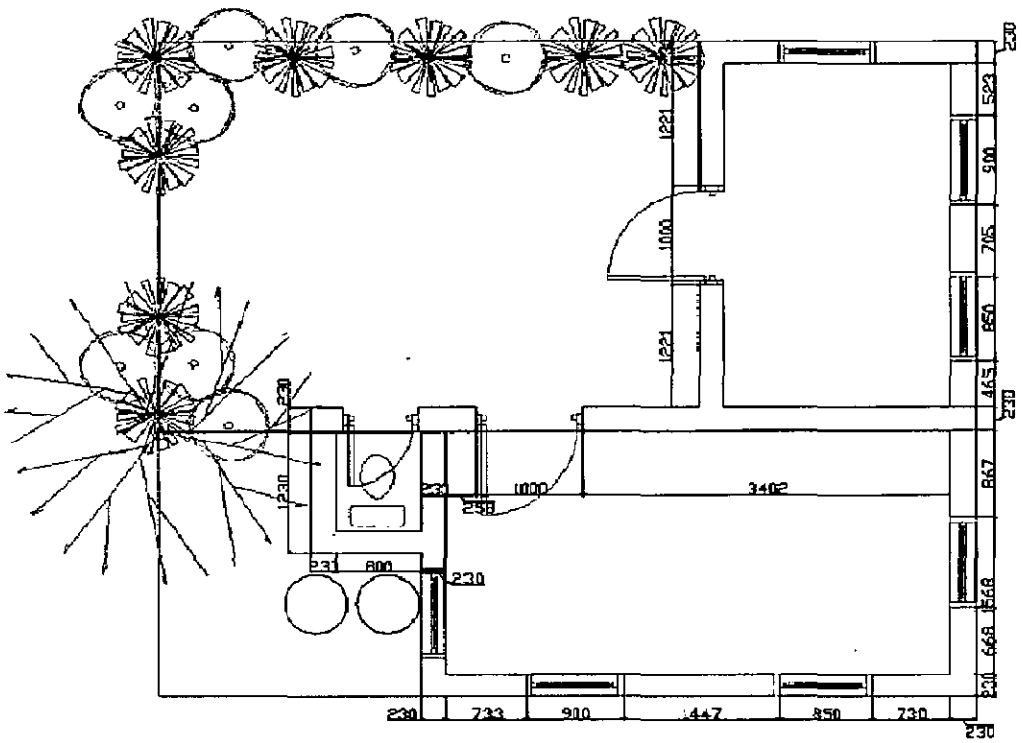
Mud plaster and lime plaster is advisable as they are locally available and they would be cheaper and adhere better to mud.

7.2. Technique

One of the most inexpensive ways of spanning a hole in the wall is the simple **corbel arch**. Each row of bricks project 2 ¼ inches beyond the course below until the bricks meet together in the middle. No formwork or shuttering is necessary.

A good way of spanning the roof is with sun dried bricks which are of a size 8" X 8" X 2". This brick can actually be stuck to the wall behind from where it starts. Then it will proceed to come to the front of the room. This kind of roofing does not require any formwork to make and it can cover large spans. The only requirement is that one has to build a wall from which the roof starts. The other disadvantage is that a higher floor cannot be made. But this kind of a **curvilinear roof** is aesthetically very sound and is also very in expensive. The roof is like an arch and is resting on the sidewalls. The kind of mortar required is also more like a paste than a mortar. The glue is of mud and cement in the ratio 5:9.

At present cement and sand only are commonly used. This is easy to mix and use it sets quickly. **Lime and sand** can give an equally strong mortar but it takes longer to set and lime mortars have mainly gone "out of fashion". Adding surkhi to lime and sand makes similarly **good strong mortars**. These too are slow setting and "unfashionable". Adding to the lime, or lime and surkhi mixes, a small amount of cement can solve the slow setting problem.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733
900
1447
850
730
230

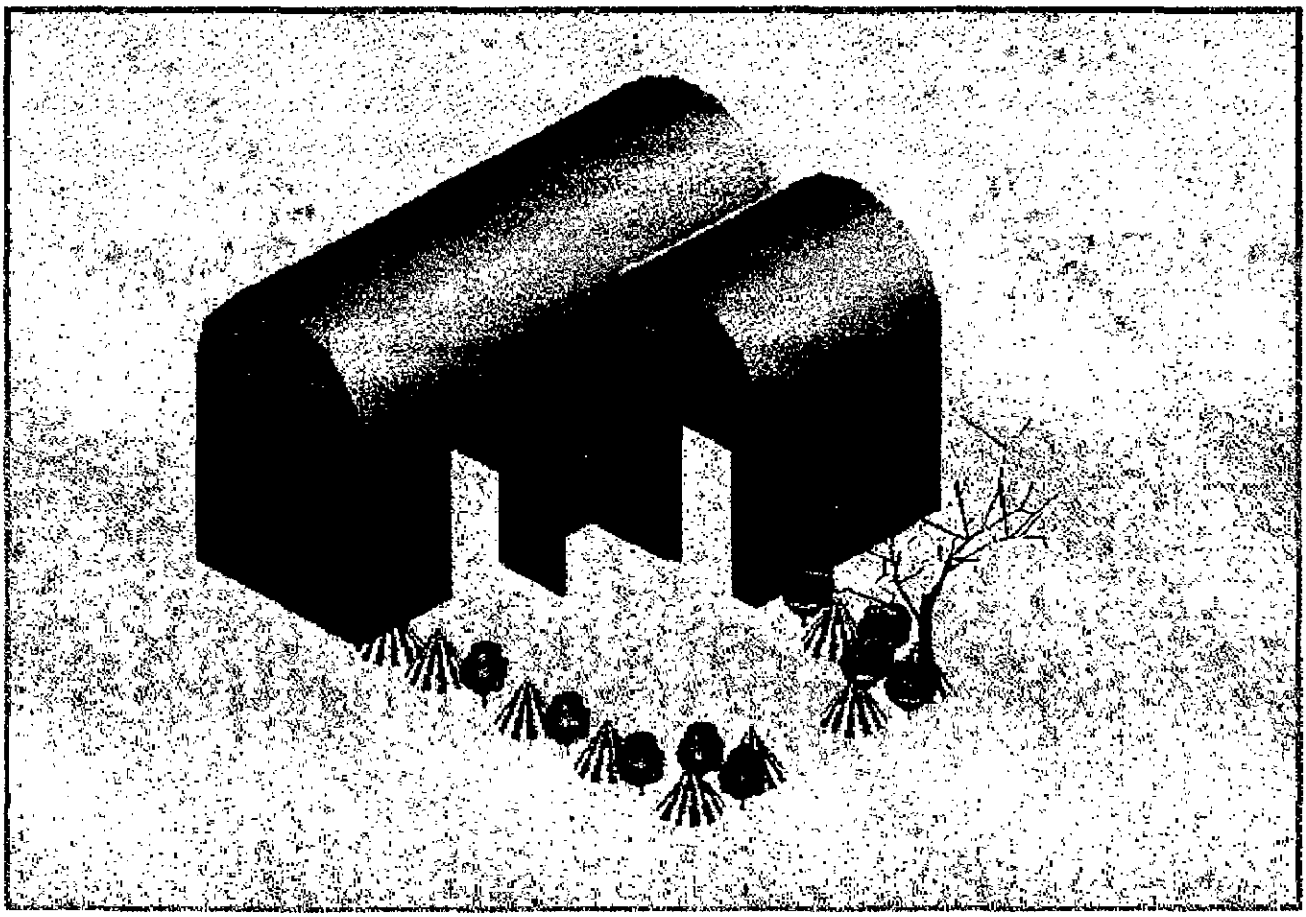


PLATE 24

Lintels

A hollow arrangement of **brick-on-edge filled with one or two steel rods** in concrete will carry very large weights of wall and roof etc. above.

This type of lintel is less than half the cost of the orthodox reinforced concrete lintel.

7.3. Components

Reinforced brick and reinforced brick concrete can economically be used for floor and roof slabs especially at places where good bricks are available and cost of aggregate is high.

Reinforces brickwork is practically the same as reinforced concrete in all its essential features except that brickwork in cement mortar is substituted for cement concrete. In reinforced brick concrete construction, cement concrete is used in conjunction with bricks. The thickness of concrete is generally 30 to 50 mm and it is laid on top of bricks as also in joints. The compression zone is made up of concrete alone and bricks maybe considered as fillers only, since they are generally called upon to carry minimum compressive force. Reinforced brick slabs are easier to construct than reinforced concrete because they do not require the same amount of close and skilled supervision.

As there is quite a lot of unnecessary concrete in an orthodox RCC slab we can replace some of this redundant concrete with any lightweight cheap materials in order to reduce the overall cost of the slab. This alternative RCC roof is called a **filler slab**. For fillers we can use lightweight bricks, or Mangalore or country tiles or earthen teacups. This will reduce the cost of the orthodox RCC slab by about 30-35 %. As roofs and intermediate floors account for 20 to 25 % of the total cost of the house, the saving by using a filler slab is considerable.[17]

Ferro cement roofing components

Advantages:

- Higher strength to weight ratio than RCC
- 20% saving on materials and cost
- Prefabricated elements and light structures
- Suitability for precasting
- Flexibility in cutting drilling and jointing
- Very appropriate for developing societies

7.4. Production and dissemination/marketing

In order to help in the self-help system many things have to be changed and among these are

The delivery of the components and the product has to be decentralised. The concept of organised corporate organised action has to be expanded to include networking as a means of combining the institutional power of the large corporation with the responsiveness of the small, local units.

The whole concept of 'economies of scale' has to be generalised from the current definition which relies on the spreading of the overhead (fixed) costs over large volumes production and marketing of an individual product to a wider concept of spreading such overhead costs over a range of appropriately chosen products.

The appropriate change products has to be identified in terms of two separate, more or less independent sets of scale related criteria: the first to achieve economies of scale in the production process, and the second to achieve in the dissemination/ marketing process. In the case of shelter technologies this has to be explored at three levels:

- At the stage of the manufacture of machines and process production that will be used to produce building material
- At the stage of building material production and finally
- At the stage of the construction of the house

The group of technologies, which can be produced economically in a small production unit, we may call the cluster. Such a cluster comprises technologies and products that have substitutable, or complementary methods of production. In more concrete terms, the skills tooling, raw materials, components and parts are to a considerable extent are the same or interchangeable for each other in the range. A small factory is able to maintain continuity of production and achieve overall economies by being able to switch efficiently and quickly from one product to another. A general engineering workshop with a basic lathe, drilling and welding equipment could easily switch from one mode of production to the other to meet ongoing demand.

To achieve analogous economies at the dissemination or marketing end, the small rural entrepreneur has to be able to offer what we may term "packages" of technologies. This concept relates technologies that are substitutable,

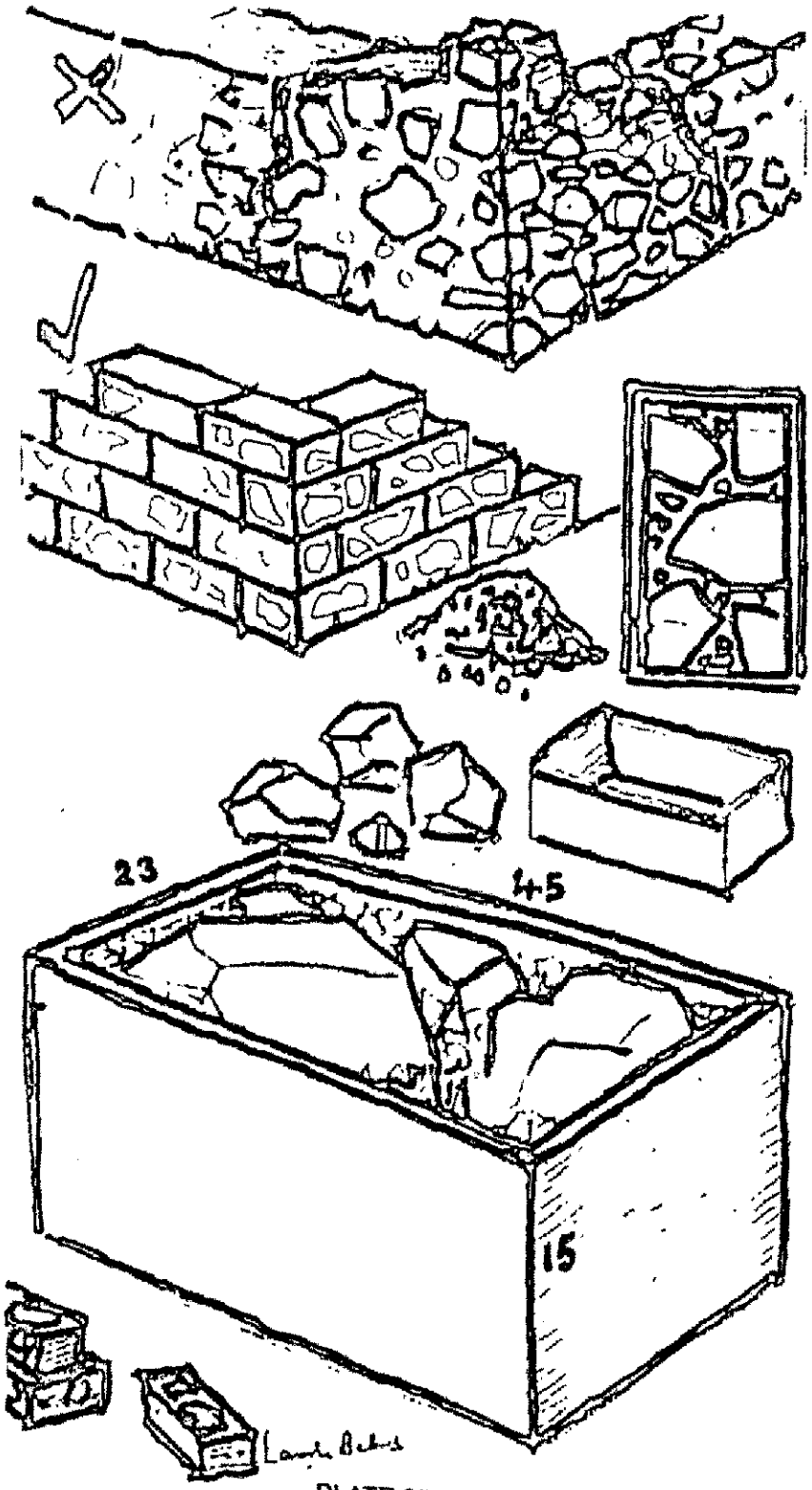


PLATE 25

complementary or in some other way related to each other from the point of view of sales, use or maintenance. For instance, the soil block making process can be made considerably more efficient by adding to the soil block press a number of simple ancillary devices such as sieving and mixing equipment, a hopper and material handling equipment.

At another level the compatibility between different building systems e.g. the interaction of:

- A tiled roof on a wooden under structure or
- A Nubian vault built on adobe blocks.

On compacted soil block walls has to be clearly understood, tested and design principles established, as these are definite parallel building options.

The broad strategy in the development, production and distribution of an appropriate building technology is presented below. It comprises of three sets of phased and interacting activities:

1. Technology identification
2. Technology development
3. Establishment of local enterprise

Technology identification

This activity group is focussed on resource and need identification to ensure sustainable solutions to local problems based on local manpower, resources, technical knowledge, skills and inventiveness.

In particular, this set of activities seeks to develop a systematic approach to link

- Traditional systems of information
- Local materials and energy resources
- Local skills, tools and technologies with the technology choice and development activities.

Need specification- market research

This activity set specifically refers to determining the need for a group of building products/ technologies/ services and isolating those, which can be converted into an effective market demand. This is continually monitored in the light of the evolving development needs of the region and the aspirations of the people.

Identification of resources at local level- feasibility studies at local level

The activity explores the available local resources (for a state of a region) that can be adapted to manufacture the products at local level, such as:

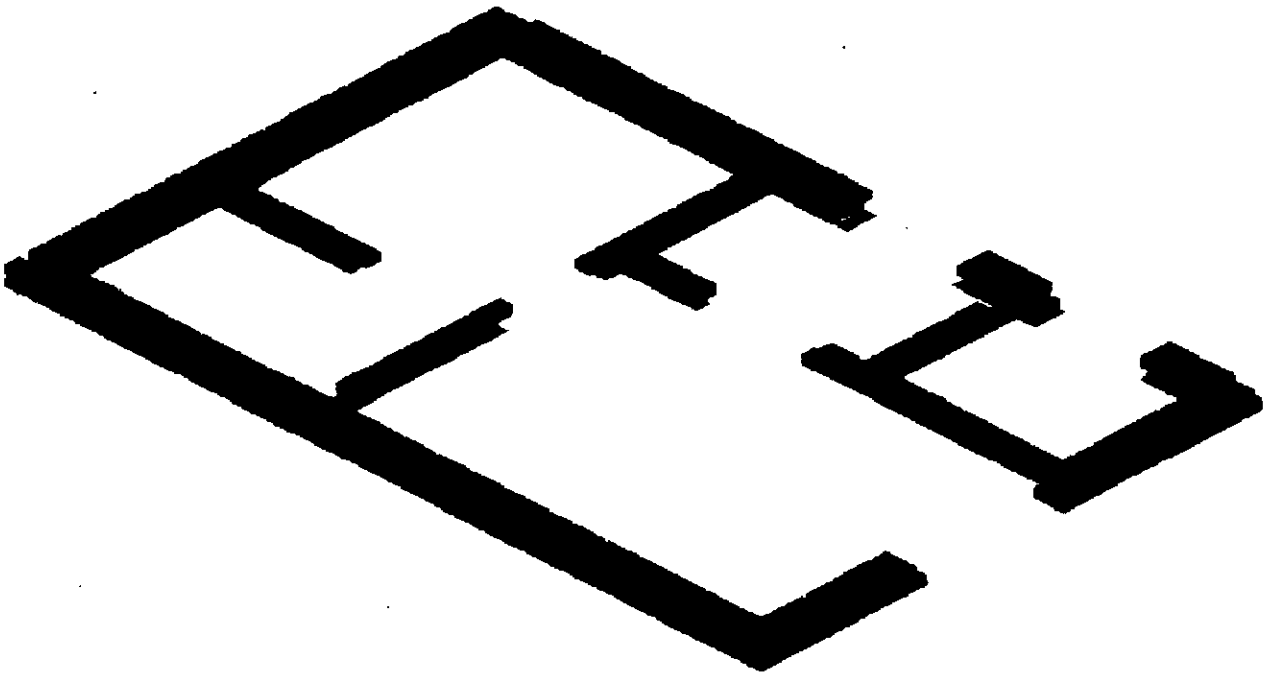
- Materials
- Energy sources
- Skilled manpower
- Institutions
- Production facilities
- Distribution/ marketing channels
- Finance
- Environmental conditions and
- Others

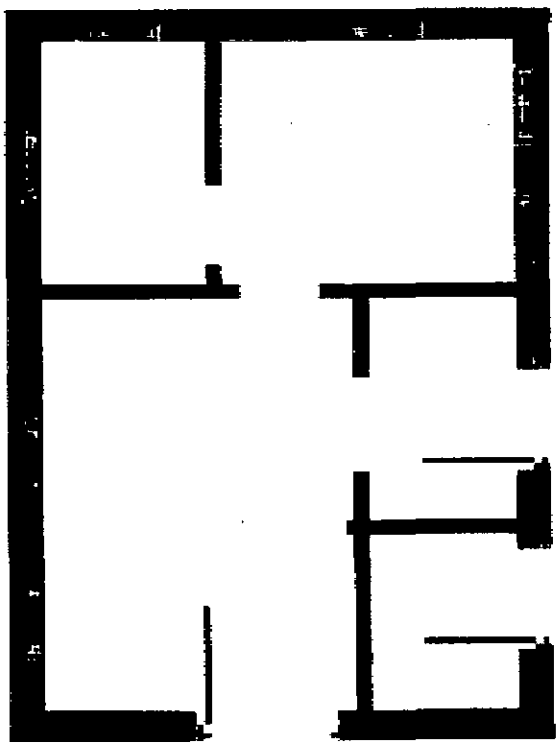
The activity provides key inputs to design, the production research as well as the establishment phase of the local enterprise which will require mobilisation of local resources.

Strategic planning

The activity forms the key set of operations determining the scope and phasing of other activities within the program, some of the major activities under this set will be

1. Short listing cluster(s) of products/ technologies (technology selection)
2. Updating the above list periodically on the basis of regional need, resource and market demand studies.
3. Determining the scope of research, development and design activities i.e. the type of innovation chain to be followed, and further R&D management.
4. Defining and determining the parameters of production research, resource matching
5. Preparing the phasing of activities and scheduling of production research. This is important as there is considerable time in setting up facilities
6. Determining the locations/ region for the establishment of local enterprises
7. Preparation of an action plan: phasing and inputs for the establishment of local enterprises
8. Programming and monitoring programme activity.





ALTERNATIVE I - PLAN AREA 20 SQ M

PLATE 26

Technology development

This is the first phase of the product development cycle in which the products/ technologies identified under the need specification exercise are developed in an industrial research laboratory.

The focus is on repackaging and redesign of the extensive existing research work in these technology areas to make them more appropriate to local needs and aid their dissemination and marketing. The substantial proportion of this work in India has been carried out by government laboratories or small groups of innovators but is dormant in the laboratory in isolated demonstration projects. All basic research and development, conducted under this activity is application oriented, bearing in mind the commercial nature of the operation.

The output of the activity for each product technology is

- Prototypes of the product or the process
- Product/ process drawing, material specifications and performance criteria
- Quality control criteria and indicators of operational efficiency
- Production manuals
- Report on design process

A fairly elaborate design audit exercise is undertaken to continually overview the process of design. The area of design for appropriate technology is seen as a new sub-discipline.

The specific components of this activity include:

- Performance specification
- Field testing and test production
- Value engineering
- Life cycle testing
- Standardisation and quality control
- Tooling requirement
- Material and manpower requirement and management
- Inventory control
- Market research on materials and tools

Choice of product cluster

The choice of a shelter technology package for production is specific to many parameters including

- Geo-climatic region
- Particular resource and financial base
- The prevailing market environment
- The existing governmental and NGO infrastructure

The concept of technology package is especially important in a village economy where the level of demand for a particular product is necessarily limited, and the unit overhead costs is manufacture, marketing, use and maintenance must be minimised.

Preparation of communication aids and training programmes

Emphasis is currently being placed on training, especially learning by doing. The communication aids that can be developed are

- Production manuals
- Maintenance manuals
- Training and refreshers course

Designing the delivery system

The delivery system for the building systems and products:

- Identify the target group- individual, community, intermediate and institutional buyers of products and services by region
- Develop sets of packages for the different sets of packages groups
- Prepare alternative marketing strategies for the different packages and regions.

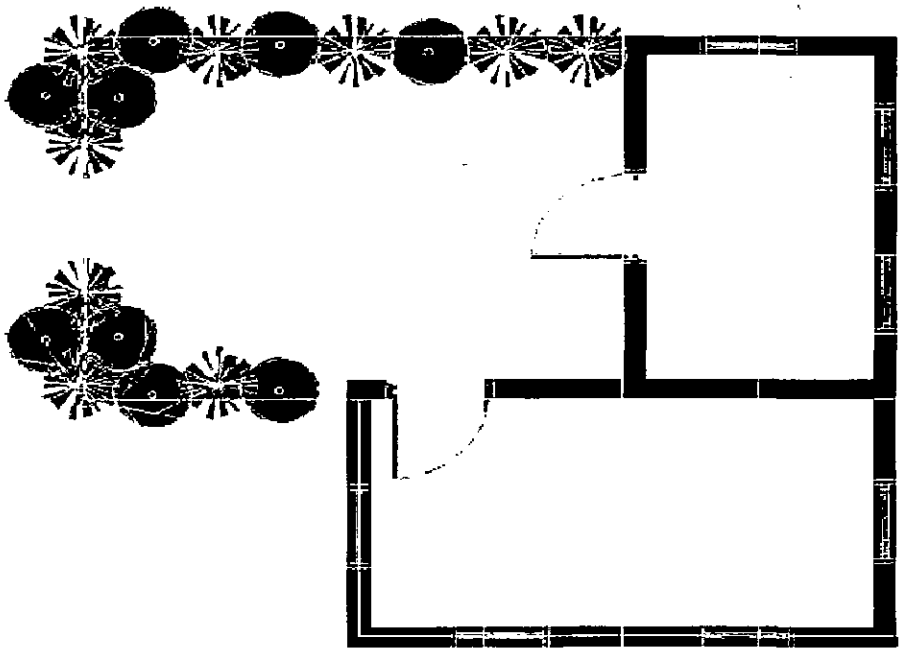
Establishment of local enterprise

The final phase of activities is the establishment of enterprises at local levels. It can be carried out in two stages

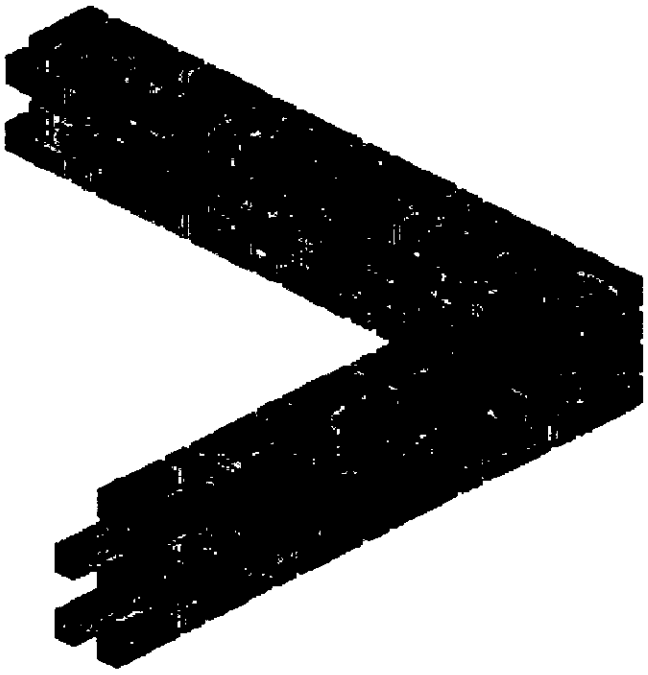
- Establishing local enterprises at selected locations in different regions
- Creating a network of local enterprises all over the country

This is clearly the most important area for future innovation, but can only proceed after an adequate infrastructural base and credibility for the technology package is established.[18]

7.5. Plan-form



ALTERNATIVE II- PLAN 25 SQ M.



VIEW - RAT TRAP BOND

PLATE 27

7.6. Business plan

7.6.1. Machine for Ferro cement roofing channel

Ferro cement is a highly versatile form of RCC consisting of cement mortar and wire mesh reinforcement. Ferro cement can be easily and simply fabricated into almost any shape, and is more durable than most wood, cheaper than steel, and its raw material are easily available.

Ferrocemnent is increasingly being accepted as an appropriate cost effective construction technique for different applications in housing and building. Several building centres functioning under HUDCO have been promoting the use of this material. The Auroville Building centre, Auroville, Pondicherry, has achieved excellence in ferrocement structures. Most of these components are so far being produced by manual methods of casting. In order to further propagate this technology for wide scale application and with a view to introduce mechanisation for better quality, BMPC has developed a machine for production of ferrocement roofing channels upto a span of 6.1m with high load bearing capacity, non-porous surface and uniform thickness throughout. The machine is fabricated in close collaboration with Development Alternatives.

Advantages:

- Higher strength to weight ratio than RCC
- 20% saving on materials and cost
- Prefabricated elements and light structures
- Suitability for precasting
- Flexibility in cutting, drilling and jointing
- Very appropriate for developing countries

Setting up a project

1		Installation capacity	5400mts/annum (300 working days)
2		Saleable product	12.96 lakhs
3	i	Fixed capital	6.34 lakhs
	ii	Working Capital	2.39 lakhs
4		Manpower requirement	9 persons
5		Raw Materials and Inputs	
	a.	Cement	80 tonnes

	b.	Coarse sand	150 cu. mt.
	c.	Steel	10 tonnes
	d.	Chicken mesh	10,800 sq. mt.
	e.	Welded mesh	1450 sq. mts.
	f.	Galvanised building wire	0.54 tonne
	g.	Consumables	L.S.
	h.	Electricity, water	
6.		Annual cost of production	11.18 lakhs
7.		Profitability (per annum)	1.78 lakhs
8.		Profit on sales	14%
9.		Return on investment	20%
10.		Break even point	50%

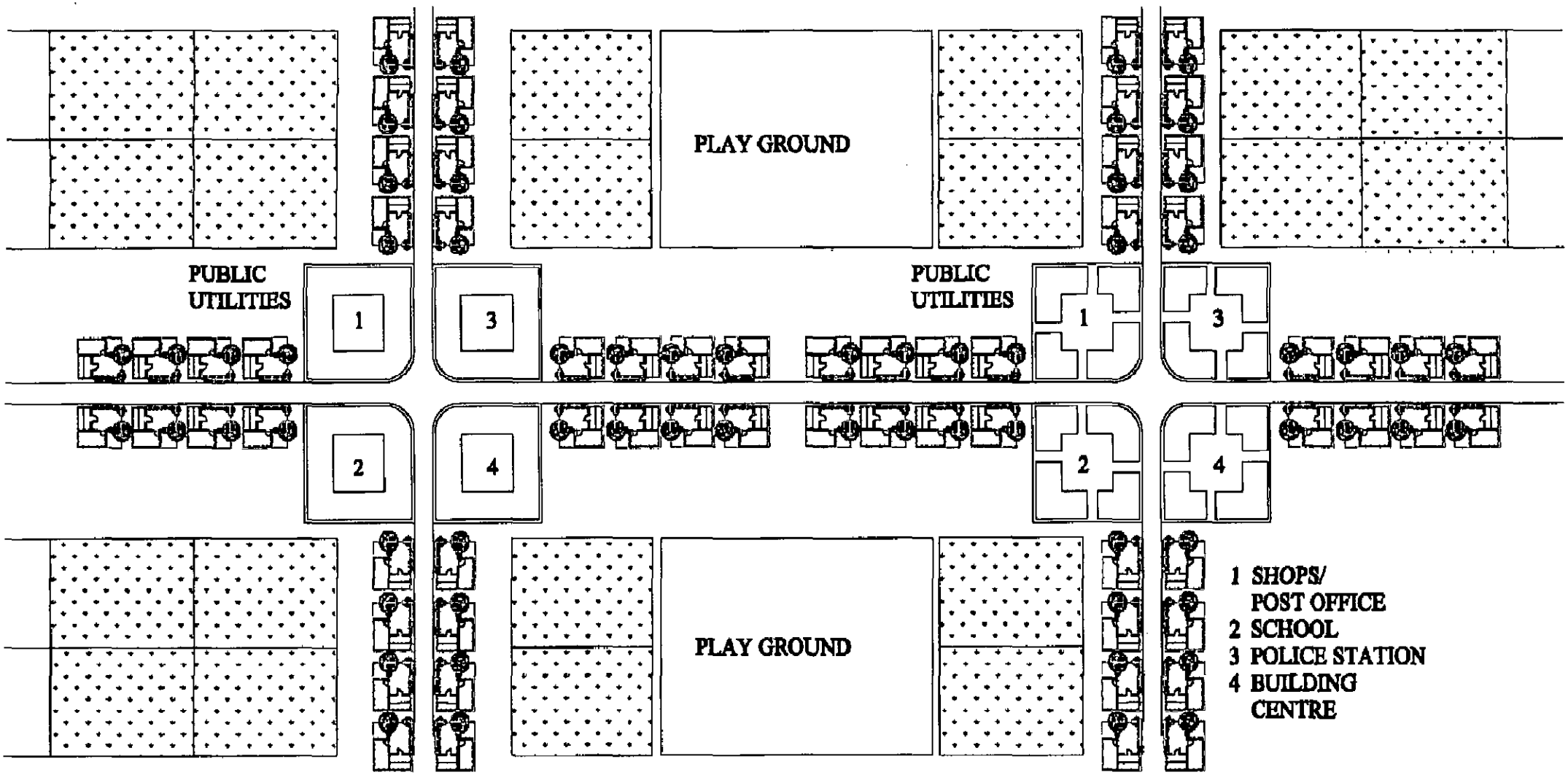
Additional information

Source of technology	BMTPC, DA
Information & guidance	BMTPC, DA, Building Centres
Finance	HUDCO, NHB, IDBI, ICICI, IFCI, SICOM
Plant and machinery	Indigenous
Suppliers of plant and machinery	M/s Victor Electricals and Machinery
	Manufacturers, 3616, Netaji Subhash Marg
	Daryaganj, New Delhi-110002

7.6.2. Alternative Station Hydraulic Press

Salient features

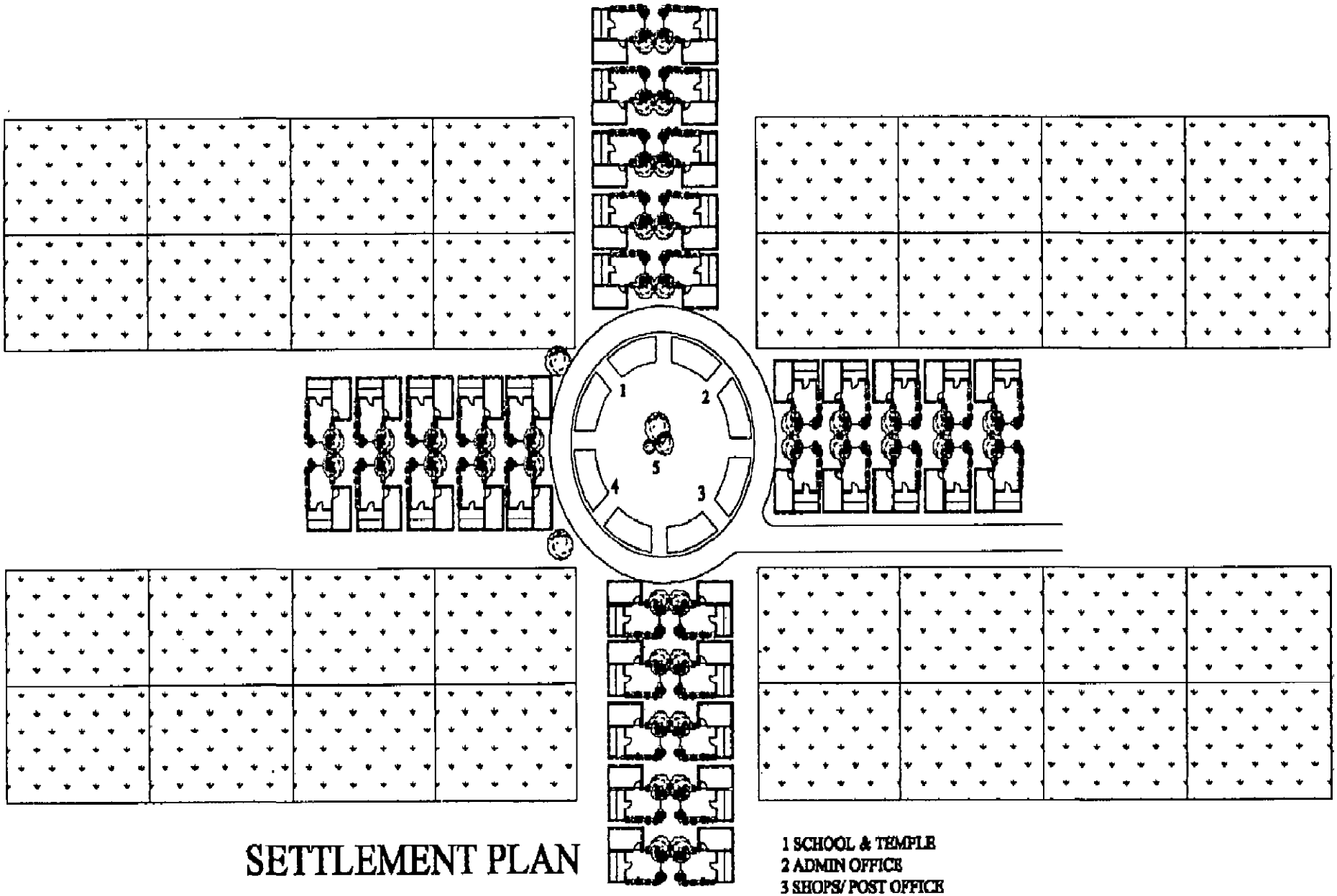
- Suitable for production of clay/ clay flyash/ clay cement/ flyash sand lime gypsum bricks
- Capable of producing 10000 bricks per day in 8 hrs shifts
- Bricks produced are of accurate dimensions and excellent surface finish
- Develops 100 tonnes of pressure during compaction



SETTLEMENT PLAN

PLATE 28

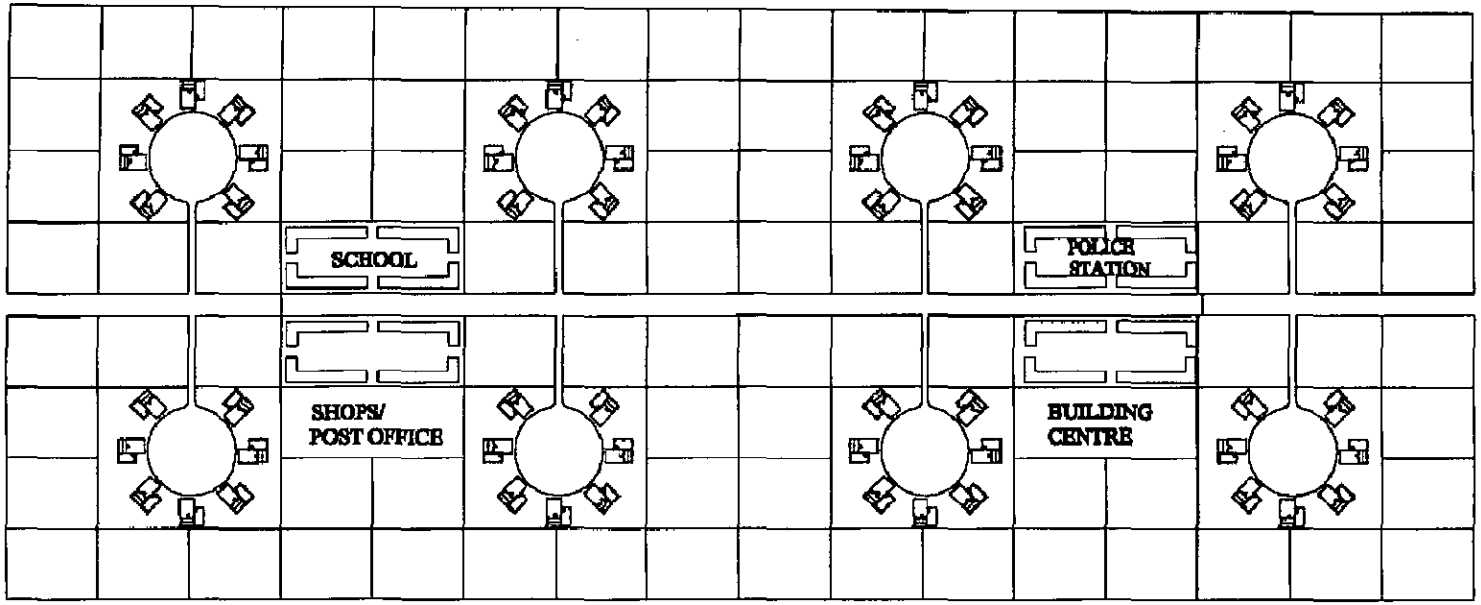
1. CYCLE REPAIR SHOP
2. AGRI IMPLEMENT RETAIL & REPAIR SHOP
3. BULLOCK CART REPAIR
4. TEA & PAN SHOP
5. TWO WHEELER REPAIR
6. BANIYE KI DUKAN



SETTLEMENT PLAN

1 SCHOOL & TEMPLE
2 ADMIN OFFICE
3 SHOPS/ POST OFFICE
4 BUILDING CENTRE
5 MARKET PLACE

PLATE 29



SETTLEMENT PLAN

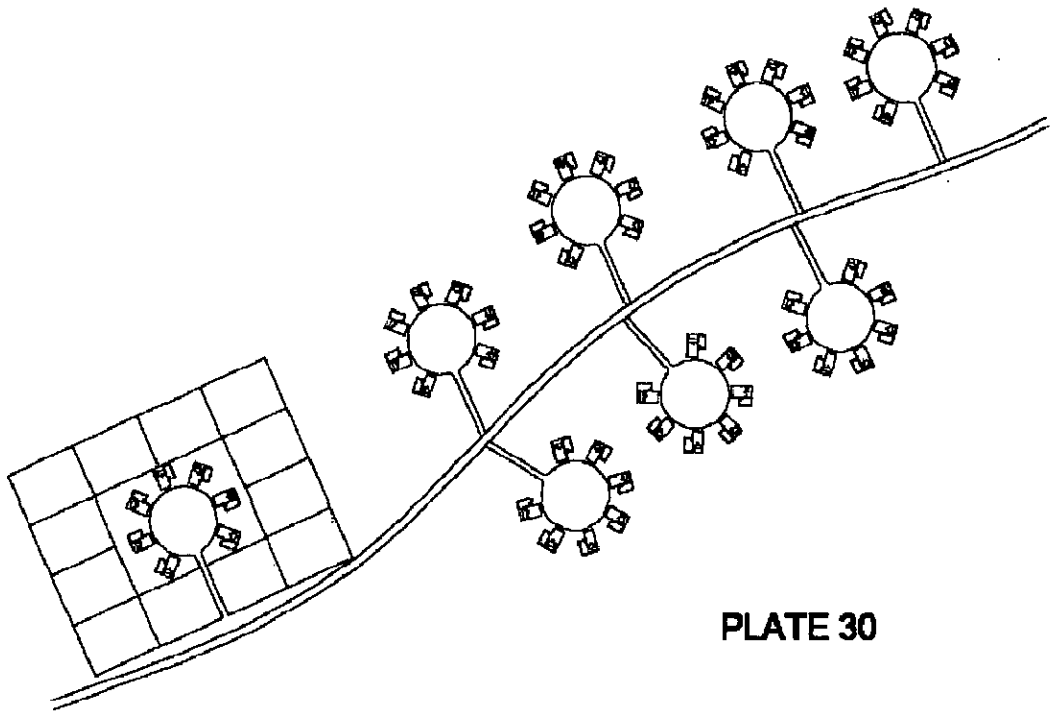


PLATE 30

- Flyash, lime sludge, river sludge & non-agricultural sandy soil can be used for producing bricks.
- The green bricks have excellent strength and can be stacked to desired level
- Quick drying of bricks due to low moisture content.
- Low power consumption, less manpower requirement.
- Heavy-duty machine offers continuous production with low maintenance.
- Ultimate value addition with reduction in production cost[19]

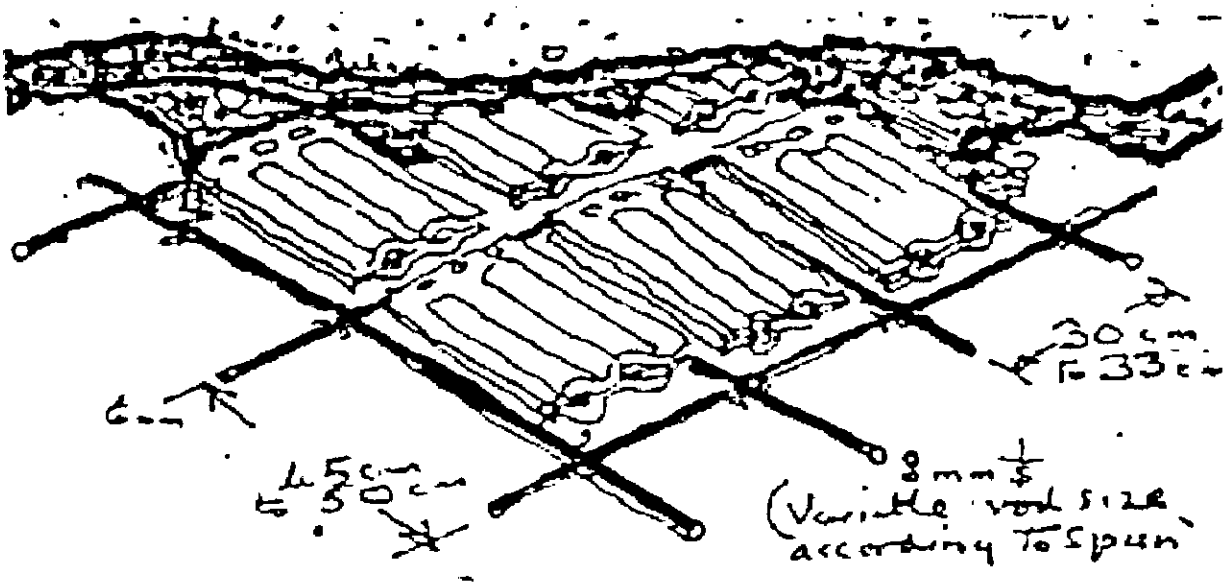
Setting up a project

1		Installed capacity per annum	3 million bricks
2		Capacity at 80% utilisation (300 working days)	2.4 million bricks
3		Saleable product	38.40 lakhs
4	i	Fixed capital	26.87 lakhs
	ii	Working capital	6.61 lakhs
5		Employment potential	13 persons
6		Raw materials and inputs	
	a.	Flyash	2592 tonnes
	b.	Coarse sand	1620 cu.mt.
	c.	Lime	960 tonnes
	d.	Gypsum	336 tonnes
	e.	Consumables	L.S.
	f.	Electricity, water	
	g.	Tools & dies	L.S.
7.		Annual cost of production	Rs. 32.88 lakhs
8.		Profitability (per annum)	Rs. 5.52 lakhs
9.		Profit on sales	14%
10.		Return on investment	16%
11.		Break even point	54%

Additional information

Source of technology	BMTPC, DA
Information & guidance	BMTPC, DA, Building Centres
Finance	HUDCO, NHB, IDBI, ICICI, IFCI, SICOM
Plant and machinery	Indigenous
Suppliers of plant and machinery	M/s Naldehra building centre, 1370, HIG flats, housing Board Colony, Sector 29, Furracabad (Mariana).

FILLER SLAB



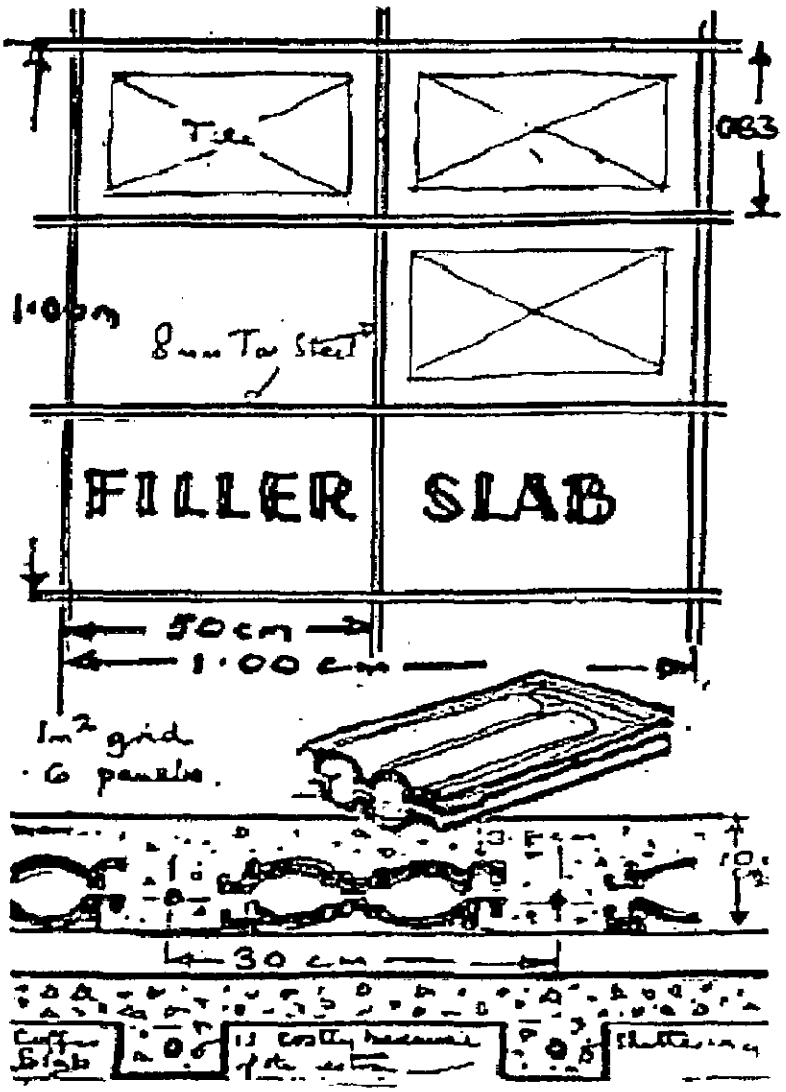
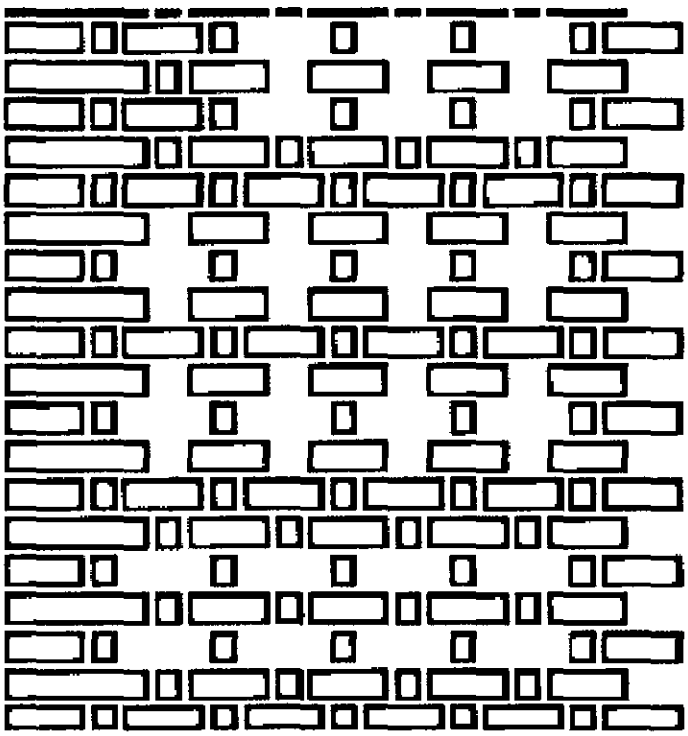


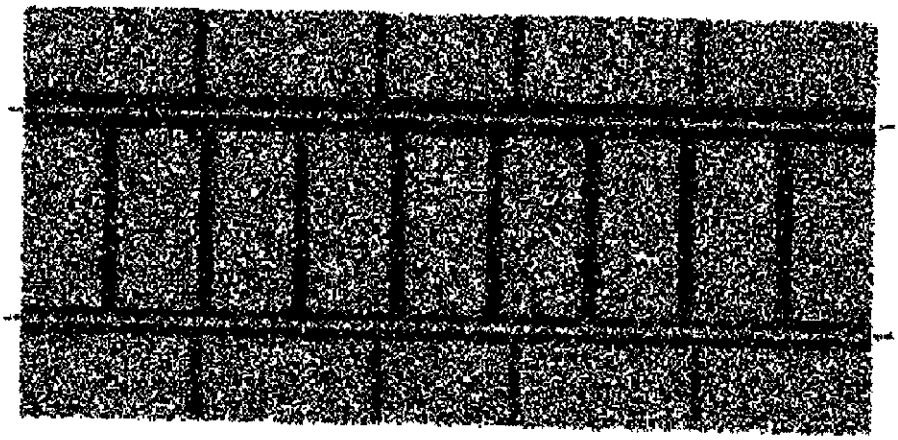
PLATE 31

JALIS - PIERCED STONE PANEL

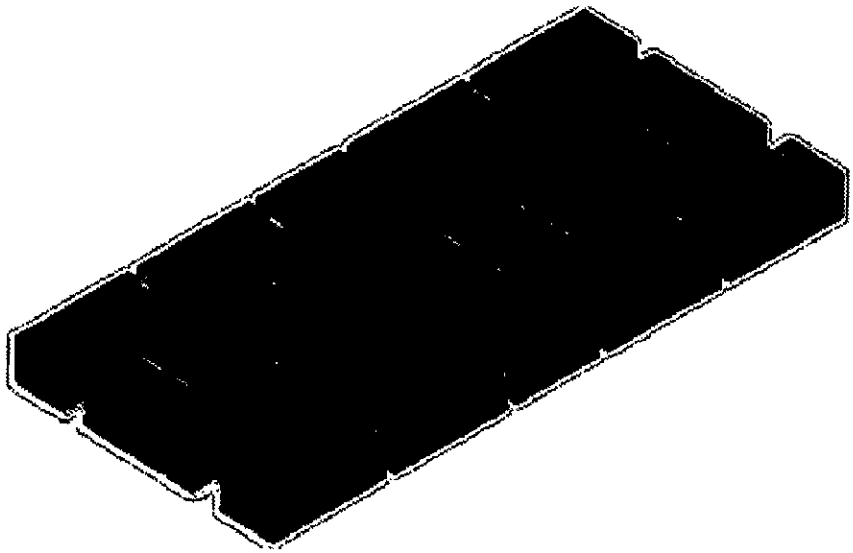


JALIS - PIERCED STONE PANEL

PLATE 32

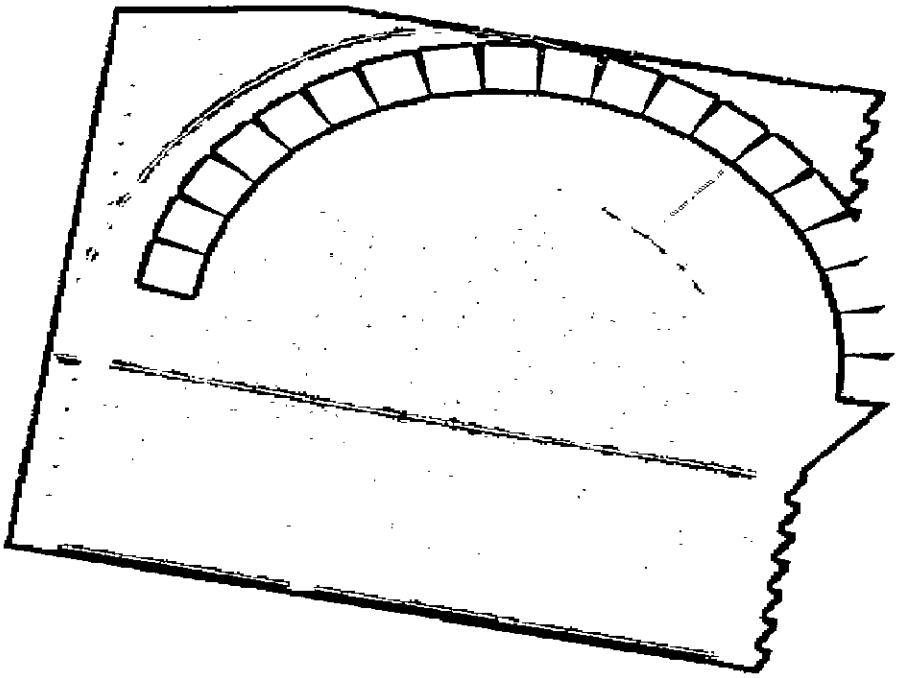


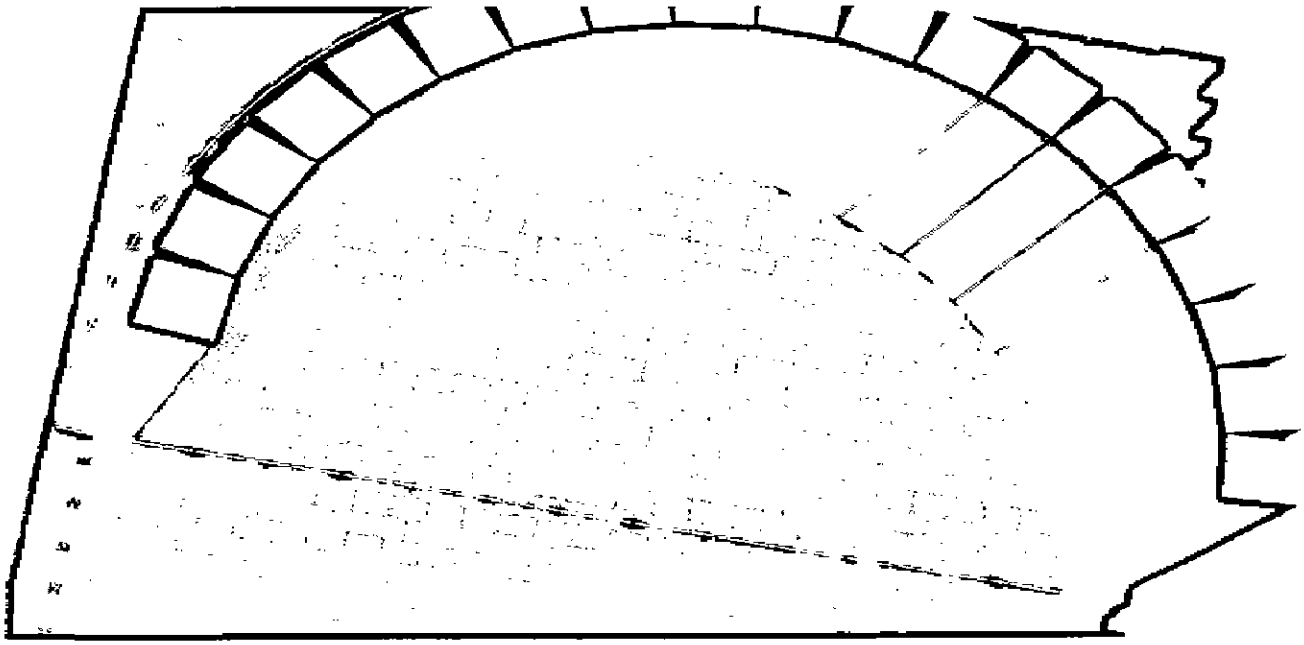
PLAN - PRECAST BRICK PANEL



VIEW - PRECAST BRICK PANEL

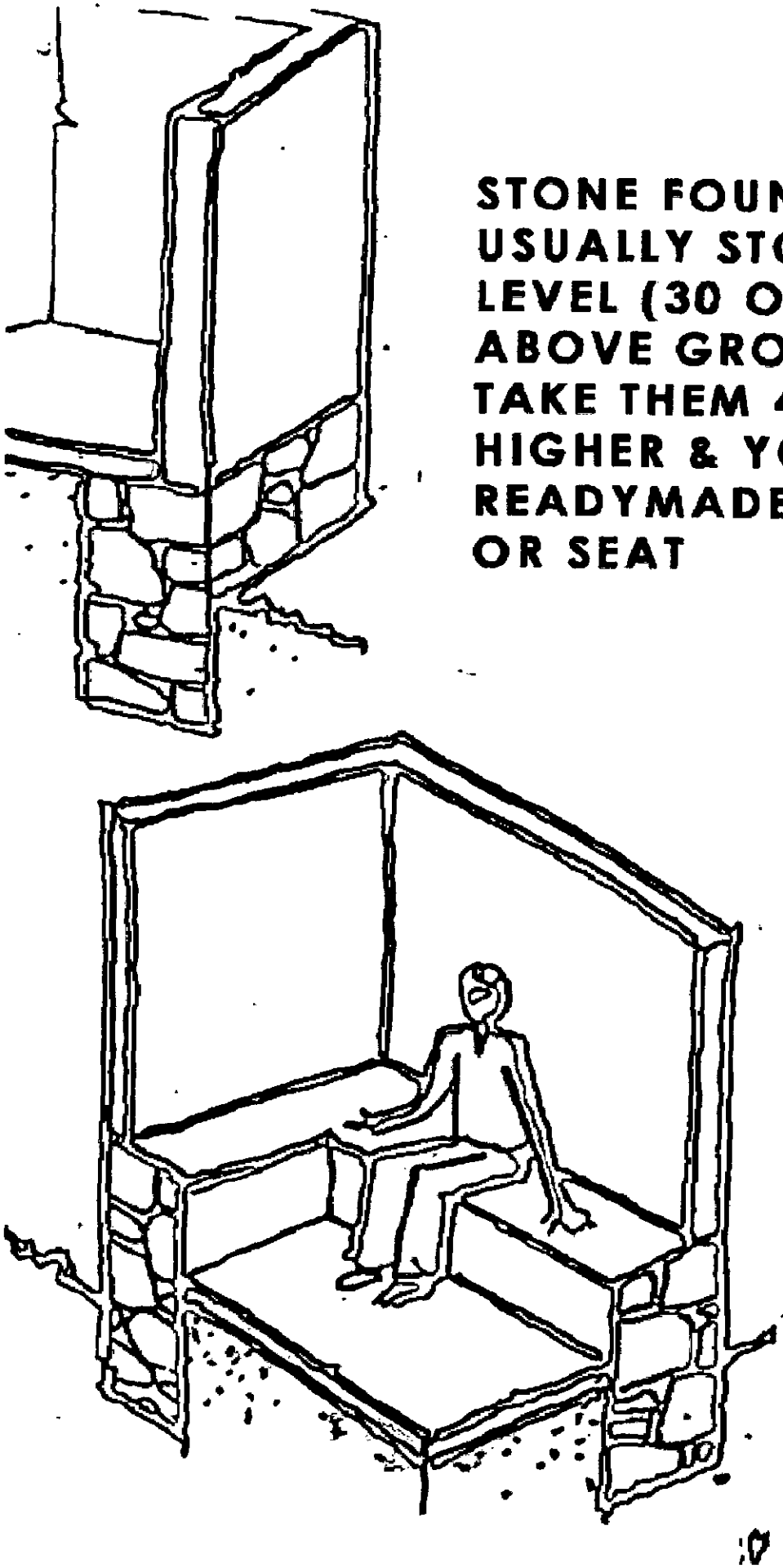
PLATE 33





ARCHED ROOF- COMPRESSED EARTH BLOCKS

PLATE 34



STONE FOUNDATIONS USUALLY STOP AT FLOOR LEVEL (30 OR 40 CM ABOVE GROUND LEVEL) TAKE THEM 45 CMS HIGHER & YOU HAVE A READYMADE BED OR SEAT

PLATE 35

APPENDIX I

Cost of comparative techniques

A coat per running meter of random stone foundation for 23 cm brick wall Stone masonry is in 1:3 lime surkhi mortar and base concrete is 1:3:6 lime concrete.

		Rs.	P.
Base concrete			
Volume of base concrete is (0.65X0.2) X1=0.13 cu m.			
Material			
Bk. ballast	volume of aggregate required for 0.13 cum of work is (1.35X0.13X6)/(1+2+6)=0.15cum		
	Cost of aggregate @ Rs. 175/- per cum is 0.15X175=	26.25	
Lime	volume of lime required for 0.13 cum of work is: 1.35/(1+2+6) X0.13=0.025 cum or 0.025X600=15.04kg (Density of lime is 600 kg/cum)		
	Cost of lime is @ Rs.1.20 per kg is 15.04X1.20=	18.05	
Surkhi	volume of surkhi required for 0.13 cum of work is: (1.35X0.13X2)/(1+2+6)=0.050 cum		
	Cost of surkhi @ Rs. 245/- cum is =0.050X245	12.25	
Labour			
Mason	1.5 man-days are required for 10 cum of work for 0.13 cum of work 0.15X0.13= 0.0195 man-days are required.		
	Cost of man days @ Rs.150/- per day= 0.0195X150 =	2.92	
Labour	24 man-days are required for 10 cum of work For 0.13 cum of work, 2.4X0.13= 0.312 man days are Required		
	Cost of man-days @ Rs 75/- per day is 0.312X75=	23.40	

Bhisti	0.2 man-days are required for 1 cum of work	
	For 0.13 cum of work 0.2X0.13= 0.026 man-days are Required	
	Cost of man-days @ Rs.85/- per day= 0.02X85=	1.7
Miscellaneous		
	Cost incurred on base concrete is	85.71
	Add 5% of this cost=	4.29
	Cost of base concrete	90.0
Footings		
Materials		
	Cross section of stone masonry is = 0.35 (0.525 X 0.6) =0.39 sq m	
	For 1 running meter of foundation, 0.39 cum of stone masonry is required.	
Stone	for 1 cum of work, 1.25 cum of stone is required	
	For 0.39 cum volume of stone required is 0.39X1.25 = 0.4875cum	
	cost of stone @ Rs. 90/- cum is 0.4875X90 =	43.88
lime	for 1 cum of work, volume of lime required is (0.48X0.39)/ (1+3) X1= 0.0468 or 0.0468X690 = 29.95 kg.	
	(density of lime = 600 kg per cum)	
	Cost of lime @ Rs. 1.20 per kg = 29.95X1.20=	35.94
surkhi	for 1 cum of work, volume of surkhi required is : (0.48X3X0.39)/(1+3)=0.14	
	Cost of surkhi @ Rs. 245/- per cum is 0.14X245=	34.30
	Labour	
Mason	1.05 man-days are required for 1 cum of work	
	for 0.39 cum of work, 1.05X0.39= 0.4095 man-days are	

	required	
	Cost of 0.4095 man-days @ Rs.150/- per day is	
	0.4095X150	61.43
Labour	1.8 man-days are required for 1 cum of work	
	for 0.39 cum of work, 1.8X0.39= 0.702 man-days are required	
	Cost of 0.702 man-days @ Rs.75/- per day is 0.702X75=	56.65
Bhisti	0.3 man-days are required for 1 cum of work	
	for 0.39 cum of work, 0.3X0.39= 0.15 man-days are required	
	Cost of 0.15 man-days @ Rs.85/- per day is 0.15X85=	12.75
Miscellaneous		
	Cost incurred on materials and labour for footing till now is	244.95
	Add 5% of this cost as miscellaneous	12.25
	Cost of footing per running meter is	257.2
	Total cost per running meter of foundation = Rs. (90+257.2)=	347.2
B.	Cost of burnt brick masonry superstructure	
	in 1:6 cement sand mortar	
	Material	
Brick	for 1cum of masonry, 500 bricks are required	
	Cost of bricks @ Rs. 1.50 per brick is 500X1.50=	750.0
Cement	for 1 cum of work 0.3 cum is required.	
	Volume of cement required is = 0.31X1/(1+6)=0.043 cum	
	Weight of cement required = 0.043X1440 =64.29 kg	
	(Density of cement is 1440 kg per cum)	
	Cost of cement @ Rs. 160/- per 50kg bag=64.29X3.20=	205.73
Sand	volume of sand required is 0.3X6/(1+6)= 0.257 cum	
	Cost of sand @ Rs. 300/- per cum is 0.257X300=	77.1

Labour		
Mason	for 1 cum of work 1.05 man-days is required	
	Cost of man-days @ Rs.150/- day is 1.05X150=	157.5
Labour	for 1 cum of work, 2.1 man-days are required	
	Cost of man-days @ Rs. 75/- per day is 2.1X75=	157.5
Bhisti	for 1 cum of work 0.15 man-days are required	
	Cost of man-days @ Rs.85/- per day is 0.15X85=	12.75
Miscellaneous		
	Cost incurred till now is	1283.48
	Add 5% of this cost as miscellaneous cost	64.17
Total cost per cum = 1347.65		say Rs. 1348/-

C.	Cost of random stone masonry in superstructure	
	For 1 cum of random stone masonry in 1:6 cement sand mortar	
	Material	
Stone	for 1 cum of stone masonry, 1.25 cum of stone is requited	
	Cost of stone @ Rs. 245/- per cum = 1.25X245 =	306.25
Cement	for 1cum of stone masonry, 0.3 cum of mortar is required	
	Quantity of cement required is :	
	0.3X1/(1+6)= 0.043 m3 = 0.093X1440= 61.71kg	
	Cost of cement @ Rs. 160/- for a 50 kg bag = 61.71X3.20=	197.47
	(Density of cement = 1440 kg per cum)	
Sand	quantity of sand required is:	
	0.3X6/(1+6) = 0.257 cum	
	Cost of sand @ Rs. 300/- per cum= 0.257X 300=	77.1

Labour		
Mason	for 1 cum of work 1.6 man-days is required	
	Cost of man-days @ Rs.150/- day is 1.6X150=	240.00
Labour	for 1 cum of work, 2.4 man-days are required	
	Cost of man-days @ Rs. 75/- per day is 2.4X75=	180.00
Bhisti	for 1 cum of work 0.2 man-days are required	
	cost of man-days @ Rs.85/- per day is 0.2X85=	17.00
Miscellaneous		
	Cost incurred till now is	837.82
	Add 5% of this cost as miscellaneous cost	41.89
	Total cost per cum	Rs. 879.71

D. Reinforced brickwork lintel

In burnt bricks II class in 1:6 cement mortar

Clear span =1.00 m

Effective span = 1.00 + 2X0.15 = 1.30m

Width of lintel= 0.23m

Depth of lintel = 0.17m

Bearing at each end = 0.15m

Masonry

Materials

Bricks	volume of bricks is 1.30X0.230X0.17 = 0.5083 cum	
	1 cum of masonry requires 500 bricks	
	no of bricks required = 0.05083X500 = 26 nos.	
	Cost of bricks required @ Rs. 1.50 per brick= 26X1.50=	39.0
Cement	1 cum of masonry requires 0.3 cum of mortar	
	Volume of cement required = 0.3/(1+6)= 0.0428 cum of cement	
	(Density of cement is 1440kg per cum)	

	Weight of cement required = 0.0428X1440 = 61.63 kg.	
	Cost of cement @ Rs. 160/- per a 50 kg bag	
	= 61.63X3.2X0.05083	10.02
Sand	1 cum of masonry requires = 0.3X6/7=0.25 cum of sand	
	Cost of sand @ Rs.300/- per cum= 0.25X300X0.05083=	3.81
	Labour	
Mason	1.05 man-days are required for 1 cum of work	
	for 0.05083 cum of work, 1.05X0.05083= 0.053	
	man- days are required	
	Cost of 0.053 man-days @ Rs.150/- per day is 0.053X150	7.95
Labour	2.1 man-days are required for 1 cum of work	
	for 0.05083 cum of work, 2.1X 0.05083 = 0.106 man-days are required	
	Cost of 0.106 man-days @ Rs.75/- per day is 0.106X75=	7.95
Bhisti	0.1 man-days are required for 1 cum of work	
	for 0.05083 cum of work, 0.1X 0.05083 = 0.005083	
	man-days are required	
	Cost of 0.005083 man-days @ Rs.85/- per day is	
	0.005083X85=	0.43
Miscellaneous		
	Cost incurred on materials and labour till now is	69.16
	Add 5% of this cost as miscellaneous	3.46

Steel

Provide 2 nos. 8 mm dia bars in the lintel

Cross section area of 8mm dia bar= πX0.8X0.8/4=0.50 sq m

Length of steel = 1.0+(2X0.15) = 1.3m

Volume of steel =1.3X100X2X0.50= 130 sq cm.

Weight of steel = 130X7.85/1000= 1.02 kg.

(Density of steel= 7850 kg per cum)

Cost of steel at Rs. 16.00 per kg = 1.02X16=	16.32
Shuttering	
Cost of hiring shuttering is Rs. 0.5/day for 7 days	
Hence cost of shuttering = 0.5X7	3.50
Cost incurred on making the lintel	92.44
Miscellaneous	
Add 5% misc. cost	4.62
Total cost of lintel	97.06

D. Cost of RCC lintel

In 1:2:4 concrete

Clear span = 1.00m

Effective span= 1.30m

The beam cross section is 0.1mX0.1m bearing at each end

= 0.15 m

4 nos. 8mm dia bars are provided at the top and bottom

5 nos. 6mm dia stirrups are provided

RCC

Materials

Volume of concrete beam = 0.1X0.1X1.3 = 0.013 cum

Cement weight of cement required= 1.52X0.013X1440/(1+2+4)

=4.06 kg.

cost of cement @ Rs.160/- per 50 kg bag= 4.06X3.2 12.99

Sand volume of sand required = 1.52X2X0.013/(1+2+4)

= 0,00565 cum

Cost of sand @ Rs. 300/- per cum = 0.00565X300= 1.695

Aggregate volume of aggregate required 4X1.52X0.013= 0.011 cum

cost of aggregate @ Rs. 500/- per cum= 0.011X500= 5.5

labour

Mason 4.0 man-days are required for 1 cum of work

for 0.013 cum of work, 4.0X0.013= 0.052

Man-days are required

Cost of 0.052 man-days @ Rs.150/- per day is 0.052X150 7.80

Labour 24 man-days are required for 1 cum of work

for 0.013 cum of work, 24X 0.013 = 0.312 man-days are required

Cost of 0.312 man-days @ Rs.75/- per day is 0.312X75= 23.40

Bhisti 0.6 man-days are required for 1 cum of work

for 0.013 cum of work, 0.6X 0.013 = 0.0078

man-days are required

Cost of 0.0078 man-days @ Rs.85/- per day is 0.0078X85= 0.663

Steel

a) Main steel: provide 5 nos. 8mm dia bars at top and bottom

Area of each 8mm dia bar=πX0.8X0.8/4= 0.50 sq m.

Total section area of steel = 5X0.50= 2.5 sq cm.

Length of bar= 1.3m

Volume of steel = 1.3X100X2.5 = 325 cu cm

Weight of steel = 260X7.85/1000= 2.55kg.

(Density of steel is 7850 kg per cu m)

b) Stirrup steel: provide 5 nos. 6mm dia stirrups

Area of each 6mm dia bar= πX0.6X0.6/4= 0.28 sq cm.

Length of bar = 5X2X1.2X(0.1X0.1) = 2.4m

Volume of steel = 2.4X100X.28 = 67.2 cu cm.

Weight of steel = 0.53 kg

Total steel = 3.08kg

Cost of steel @ Rs. 16.5/- per Kg = 3.08X16.5 50.82

Shuttering

Cost of hiring shuttering is Rs. 0.75/- per day and it is

Required for 14 days

Cost of shuttering= 14X0.75	10.50

Hoisting

0.50 labour day is required to lift the beam and position it.	
Cost of hoisting @ Rs. 75/- per day is 75X0.5=	37.50
Total cost	150.87
Add 5% of this as misc. cost	7.54
Grand total of lintel	158.41

F. Cost of RCC slab

Internal length 4.5 m
Internal width =3.60m
Wall thickness = 0.23m
Depth of slab provided = 0.14m
Provide 20 nos 12 mm dia bars @ 25cm C/C along shorter length 3.60m
Provide 20 nos 12 mm dia bars @ 20cm C/C along shorter length 4.50m
Volume of concrete required = (3.60+0.46) X (4.50+0.46) X0.14=2.82 cum
Plan area = (3.6+0.46) X (4.50+0.46)=20.14 sqm

RCC

Materials		Rs. P.
Cement	Volume of cement required = 1.52X2.82/(1+2+4)=0.61CUM Weight of cement required= 0.61X1440 = 878.40 kg (Density of cement is 1440 kg per cum) Cost of cement @ Rs. 3.20 per kg = 878.40 X 3.20=	2810.88
Sand	Volume of sand required = 2X1.52X2.82/(1+2+4)=1.22CUM Cost of sand @ Rs. 300 per kg = 1.22 X 300=	366.00
Aggregate	Volume of aggregate required= 2X1.52X2.82/(1+2+4)=2.45CUM Cost of aggregate @ Rs.600 per cum is 2.45X600	1470.00
	Labour	
Mason	0.35 man days are required for 1 cum of work For 2.82 cum of work no of man days required is 0.35X2.82=0.978 man days Cost of man days @ Rs.150 per day = 0.987X 150	148.05

Labour	3.2 man days are required for 1 cum of work For 2.82 cum of work no of man days required is 3.2X2.82=9.02 man days Cost of man days @ Rs.75 per day =9.02 X 75	676.80
Bhisti	0.6 man days are required for 1 cum of work For 2.82 cum of work no of man days required is 0.6 X 2.82=1.692 man days Cost of man days @ Rs.75 per day = 1.692 X 85	143.82
	Cost of RCC material And labour	5615.55
	Steel Area of one 12 mm dia bar = pi X 1.2X1.2 / 4= 1.13 sqcm	
a.	Provide 20 nos 12mm dia bars along 3.60m Length of bar = (3.6+ 2X0.23) = 4.06m Volume of steel = 4.06 X 100 X 20 X 1.13 = 9175.6 cu cm	
b.	Provide 20 nos 12 mm dia bars along 4.50 m Length of bar = (4.5+ 2X0.23) = 4.96m Volume of steel = 4.96 X 100 X 20 X 1.13 = 11209.60 cu cm Total volume = 11209.60 + 9175.60 = 20385.20 Density of steel is 7850 kg per cum Weight of steel = 20385.20 X 7.85/ 1000 = 160.02 kg Cost of steel @ Rs.16/- per kg = 16 X 160.02 =	2560.32
	Shuttering	
Wood	Shuttering is made by using 1" thick planks and ballies. It is used 20 times. Area of shuttering = 4.5 X 3.6 X 10.75 = 174.15 sqft Volume of shuttering = 174.15X 1/12 = 14.51 cft Cost of wood for shuttering @ Rs. 200/- per cft = 14.51 X 150 = Rs. 2902.00 It is used 20 times = 2176.88 / 20 =	145.10
Ballies	Provide 1 ballie per sqm of area Area = 3.6 X 4.5 = 16.20 sqm No of ballies = 16.20 / 1 = 16.2 Provide 17 ballies Cost of ballies @ Rs. 35/- per ballie = 30 X17 = 595.00 Ballies are used 20 times = 595 / 20 =	29.75

Fixing	*1 carpenter and 1 labourer can fix 100 sqft of shuttering/ day*	
	Area of shuttering = 4.5 X 3.6 X 10.75 = 174.15 sqft	
	For 174.15 sqft, 1.75 carpenter and 1.75 labourer are required	
	Wages = 1.75 (125 + 75) =	350.00
	Miscellaneous	
	Cost incurred till now on making the slab =	8700.72
	Add 5% of this as misc. cost	435.04
	Grand total	9135.76
	Cost per sqm = 9135.76 / 20.13 = 453.84	454.00

G.	Cost of Mangalore tile roofing	
	Cost per sq m	255.27
H.	Cost of ACC roof	
	Cost per sq m	253.12
J.	Cost of country tile roofing	
	Cost per sq m	345.85
K.	Cost of micro concrete roofing	
	Cost per sq m	102.43

L. Cost of compressed soil block walls

To calculate the cost of 10 cum of masonry with 4% cement stabilised blocks
In 6% cement stabilised mortar

Materials	Rs. P.

Soil blocks
Every cum of masonry has 0.78 cum of blocks
Volume of 1 block is 23cm X 10.8 cm X 7.5 cm.
= 1900 cu cm
Therefore 10 cum of masonry contains 4100 blocks
but some blocks will be wasted
So let us take 4250 blocks

Cost of blocks @ Re. 1 / block	4250.00
Mortar	
Every cum of masonry has 0.22 cum of mortar	
Since mortar shrinks when water is added to it.	
we use 0.31 cum of dry mortar	
1 part of cement by volume is added to 3 parts	
of sand and 9 parts of soil	
Soil required for 10 cum is 2.4 cum	
Let us assume soil is available free of cost.	
However we have to pay for digging and sieving it.	
Coarse sand (normally required for cement	
stabilisation)	
0.8 cum @ Rs. 400	320.00
Cement required for 10 cum is 7.5 bags	
Cost of cement @ Rs. 160/ bag	1200.00
Total cost of material (A)	5770.00
Labour	
Mason	
For 10 cum of masonry we need 10.5 man days	
Wages paid to mason @ Rs. 150/ day	1575.00
Labour	
For 10 cum of masonry we need 21 man days	
Wages paid to mason @ Rs. 75/ day	1575.00
Bhisti	
For 10 cum of masonry we need 1 man days	
Wages paid to mason @ Rs. 85/ day	85.00
Total cost of labour (B)	3235.00
Miscellaneous	
We will spend some money on scaffolding,	
tools, water etc.	
Let us assume that this misc. cost is 5%	
of total cost of materials and labour	
Cost of miscellaneous items	450.25
Total cost of 10 cum of masonry (A+B+C)	9455.25
Cost / cum	945.52

M.

To calculate the cost of 1 running m. of foundation in fired bricks (II class) with lime surkhi mortar (1:4) over lime concrete base (1:2:6)

BASE CONCRETE: volume of lime concrete is 0.152 cum	
MATERIALS	Rs. P.
Every cum. of concrete has:	
Lime - slaked 0.16 cum or 102 kg	
Cost of lime for 0.152 cum @ Rs. 5.00/ kg.	80.00
Surkhi-0.32 cum	
Cost of surkhi for 0.152 cum @ Rs. 245/ cum	11.92
Brick bats-1.0 cum	
Cost of brick bats for .152 cum @ Rs. 175/cum	26.60
Labour	
10 cum of concrete needs	
Mason- 1.5 man days	
Cost of mason for .152 cum @ Rs. 125/ day	19.95
Labour 2.4 man days	
Cost of labour for 0.152 @ Rs. 75/day	22.50
Bhisti 2 man days	
Cost of Bhisti for .152 cum @ Rs. 85/day	25.84
	186.81
MISCELLANEOUS	
Let us assume that we spend 5% of total cost of materials and labour on tools, water etc.	
Cost of miscellaneous items	9.34
TOTAL COST OF BASE CONCRETE (A)	196.15
FOOTING: volume of masonry is 0.31 cum.	
MATERIALS:	
Bricks- 1 cum of masonry has 500 bricks	
Cost of bricks for 0.31 cum @ Rs.1.50/brick	232.50
Mortar- 1 cum of masonry has 0.36 cum of mortar	
Therefore 0.31 cum of masonry has 0.112 cum of mortar	
Lime- 1 cum of mortar has 0.2 cum of lime or 128kg	
Cost of lime for 0.112 cum @ Rs. 5.00/kg	71.68
Surkhi- 1cum of mortar has 0.8 cum of surkhi	

Cost of surkhi for .112 cum @ Rs. 245/cum	21.95
LABOUR	
Mason - 10 cum of masonry needs 7.5 man days	
Cost of mason for .31 cum @ Rs. 125/day	29.06
Labour - 10 cum of masonry needs 14 man days	
Cost of mason for .31 cum @ Rs. 75/day	32.55
bhisti - 10 cum of masonry needs 2 man days	
Cost of mason for .31 cum @ Rs. 85/day	5.27
	393.01
MISSELANEOUS	
Cost @ 5% of total of materials and labour	29.46
TOTAL COST OF FOOTING (B)	422.47
TOTAL COST OF FOUNDATION/m (A+B)	618.62

APPENDIX II

HOUSING LOAN FACILITIES FROM HUDCO HELPS YOU

Construct a home
Buy a House or a flat
Purchase a plot from Public Agencies
No charges for repayment of loan ahead of schedule
Free insurance for house or flat prop

Scheme: HUDCO Niwas Loan

Amount Range: max 15lakhs(for purchase/construction), max 5 lakhs(for plot purchase), and max 8 lakhs (for extension/ improvement)

Amount depends on: - Repayment capacity (35%of income = repayment capacity) - A maximum of 85% of the estimated cost including incidentals like stamp duty and registration

Tax Benefits: Principal and interest components of a loan as per income Tax Act, 1961 (varies from year to year)

Eligibility criteria: - minimum 21 years - must be in service / professional/ businessman with regular income Rates of interest: Upto 50,000-11.5%pa, 50,000-2lakhs-12.75%, 2-5 lakhs-13.5%

YOU CAN APPLY FOR AN ANZ LOAN FOR:

- Buying a home under construction, from select developers
- Purchasing a home that is ideally not more than 25 years old
- Constructing a home on a plot of land owned by you or your spouse
- Extending your existing home
- Renovating your existing home
- Buying a plot of land.

Eligibility Criteria: You are at least 21 years of age You have been employed for the last 3 years, or You are a professional (Doctor/Engineer/Chartered Accountant etc) with an established practice of 3 years, or You are a business person, with sound financials for the last 3 years You are a resident in India of Bangalore, Calcutta, Chennai, Mumbai, New Delhi or Pune

Maximum period : You can apply for loan amounts between Rs.2,10,000 and Rs.1,00,00,000 at very attractive rates of interest, for periods ranging from 1-15 years. Interest is also calculated on a daily balance basis, making the ANZ Loan even more affordable than if calculated less frequently.

Processing Fees: The up-front processing charges will be 2% of the loan amount applied for, payable with the loan application.

The ANZ Loans For Homes Advantage: Interest calculated on daily balances, resulting in lower EMIs (Equated Monthly Instalments) One-time processing charge No pre-payment penalty, in case you repay your loan, in part or full, early No commitment charge, in case there is a delay on your part in utilising your loan

CANFIN PROVIDES HOUSING FACILITIES FOR RESIDENT INDIANS AND NON RESIDENT INDIAN HOUSING LOANS ARE AVAILABLE FOR:

- Construction of house.
- Purchase an existing property
- Repairs And renovation
- Extension

Eligibility Criteria:

You must be earning a regular monthly income.
If you are from the salaried class, then you should have a minimum of 5 years of service left.
If you are a business person or a professional or a self employed individual, then your age should be less than 58 years at the time of applying for the loan.
The property you wish to purchase/construct should have a clear and marketable title.
Maximum period: A maximum of Rs 25 lakhs for the construction or purchase or the extension of a house or flat. A maximum of Rs 5 lakhs for the renovation or repairs or the upgradation of a house or flat. If you seek a loan amount that exceeds Rs 25 lakhs, then the same would be sanctioned, based on merits of your case and your current payback financial position. In general, loans are subject to maximum of 80% of the total project cost and at 13.5 % rate of interest.

Tax Benefits: You could claim deductions on the principal and interest repaid under section 88 and 24 as per IT Act 1961 Repayment period : Repayment periods could range from 5 to 15 years. They are payable in easy, Equated Monthly Instalments

Pre-loan fees: One time processing fee of 1% of loan amount on the submission of the loan application. One time administrative fee of 1% on acceptance of the loan sanctioned.

HOUSING LOAN FACILITIES FROM CITIBANK HELPS YOU

- Buy a new property ready for occupation
- Buy an existing property, not more than 50 years old at the time of maturity
- Construct on your own plot of land
- Extend or renovate your existing home

Buy under construction properties in a CITIBANK approved project.
Loan Amount Range: Rs. 1 lakh - 1 Crore Amount depends on: - Repayment capacity as decided by ICICI - A maximum of 85% of the estimated cost

Maximum Period: 15 years Tax Benefits: Principal and interest components of a loan as per income Tax Act, 1961 (varies from year to year)

Eligibility criteria: - minimum 21 years - employed or self-employed with regular income Security: security of the property; additional collateral /security

Rates of interest: Upto 5 years 11.25%; 5-15 years- 12.75% Special scheme (special conditions apply): 20 years-12.75%, 30 years-12.85% Process management fee: 1.8%of sanctioned loan amount

HOUSING LOAN FACILITIES FROM HDFC HELPS YOU

Avail loan facilities to non-resident Indians
Decide on what form can the payment be done
Select accommodation according to your choice
Repay the loan ahead of schedule
Decide on the maximum amount that can be borrowed

HDFC Maximum Period: 15years

Tax Benefits: Principal and interest components of a loan as per Income Tax Act, 1961 (varies from year to year)

Insurance plan: - property to be insured for fire and other appropriate hazards as per HDFC requirements.

Security: first mortgage of property; collateral or interim security by life insurance policies.

Other Schemes: separate schemes for NRIs

Rates of interest: Upto 10,000- 12.5%, 10,00- to 10 lakhs-13.5%, 10-15 lakhs-14.5% above 15lakhs(upto 10 years)-14.5%, above 15lakhs (more than 10 years)-15%

HOUSING LOAN FACILITIES FROM ICICI HELPS YOU

- Pre pay the loan ahead of schedule
- Enjoy some tax benefits
- Repay the loan by equated monthly installments
- Avail special schemes for terms between 16 to 30 years
- Choose a co-applicant for your loan

ICICI loan amount range: Rs. 1 lakh - 1 crore

Amount depends on: Repayment capacity as decided by ICICI - A maximum of 85% of the estimated cost

Maximum Period: 15 years Tax benefits: Principal and interest components of a loan as per income Tax Act, 1961 (varies from year to year)

Eligibility criteria: minimum 21 years - employed or self-employed with regular income

Security: security of the property ; additional collateral/security

Rates of interest: Upto 5years - 11.25%; 5 - 15 years - 12.75%

Special scheme (special conditions apply): 20 years - 12.75%, 30 years - 12.85%
Process management fee: 1.8%of sanctioned loan amount

HOUSING LOAN FACILITIES FROM IDBI HELPS YOU

Customised repayment options
Quick response
Lower processing charge
Personalised services
Lesser EMI when you opt for LIC policy linked loan scheme

Scheme: Money Home Loan

Amount Range: Rs.2-25lakhs Amount depends on: - Repayment capacity as decided by IDBI - A maximum of 85% of the estimated cost

Maximum Period: 15years Repayment options: Structured to suit your requirements

Advantage: Monthly Reducing Balance (monthly outgo is less than the one for the annual reducing balance)

Other charges: nominal processing fee Insurance plan: - Options of repayment as per Life Insurance Policy. - We encourage Mortgage Redemption Assurance Policy (MRA)

Eligibility criteria:- minimum 21 years - salaried persons to have 3 years experience, net take home salary of Rs.10,000 pm and have atleast 7 years for retirement - professionals or businessmen to have atleast 3 years experience, income of Rs.2 lakhs pa as per IT returns

Security: first mortgage of property as finalized collateral or interim security by life insurance policies.

Rates of interest:

Fixed loans: upto 10lakhs-14.5%pa + tax @ 2%of interest; >10lakhs-15%pa + tax @2% of interest

Floating loans: LTPLR + Tax @2% of interest for all amounts Process management fee: .5% of loan amount (payable at time of sanction); 1% of loan amount (time of drawdown)

INDIAN OVERSEAS BANK PROVIDES HOUSING LOANS FOR:

The loan is given for acquisition/construction of a new flat or a house.
The loan is also given for purchase of old house/flat
constructing additional Rooms/ First floor Second Floor or already owned houses.
IOB has separate Scheme for Housing loans for NRI's

Eligibility Criteria: Individuals/Groups of individuals/Members of Co-operative Society. Individuals should have Regular income from Agriculture/Profession/Trade/Business/Salary in the case of Employment.

Other Conditions : In the case of employed persons minimum 3 years of confirmed service. In the case of self-employed professionals, business persons minimum 3 years standing in their respective fields is necessary. Applicants who own a house in the name of self or spouse or minor children are also eligible. The applicant should not be more than 55 years of age

Maximum Amount and repayment period : The quantum of loan is fixed taking into account the age and repaying capacity of the applicant(s). However, the maximum loan allowed under the scheme is 80% of cost of house/flat The maximum period of repayment allowed is 25 years in equated monthly instalments including a maximum holiday period of 18 months from the date of first disbursement or completion of construction, whichever is earlier.

Processing Charges: A flat upfront of 0.75% of the loan amount with a minimum of Rs.1000/-without ceiling for the maximum. Interest rates : The Interest rates differ from 11.5 % to 13.5% depending upon repayment period and loan amount.

HOUSING LOAN FACILITIES FROM LIC HELPS YOU

Buying a home under construction, from select developers

Construct/purchase a new house/flat
Buy an existing house or flat not more than 15 years old
Extend an existing house.
Renovation/repairs to an existing house/flat (GRIHA SUDHAR)
Eligibility Criteria: You must be in permanent service or engaged in a profession or business to be eligible for a loan. You should have a stable job and a regular income. Loan Amount and Maximum period : The maximum loan would be Rs.50 lakhs per unit to any individual applicant. We will extend loan upto 80 % of the cost of property value (including Stamp duty & Registration charges) under all our Schemes except Griha Lakshmi (75%) and Griha Shobha for NRIs (75%) We grant term upto a maximum of 20 yrs (maximum 10 years under Griha Shobha for NRIs and maximum 15 years under Griha Lakshmi). The term for the loan will under no

circumstances exceed the age of retirement or completion of 65 yrs of age whichever is earlier. Tax Benefits:

Exemption under sec 88 of IT Act for repayment of principal upto Rs.10000/-.
Deduction under Sec 24 of IT Act for interest payment on housing loans upto Rs. 75,000/-(in respect of self-occupied house property acquired or constructed with capital borrowed on or after 1.4.99, and acquisition or construction whereof is completed before 1.4.2001. Interest Rates: 12 % on all amounts upto 25000 & upto 15 Years. 13 % for range (slab) from 25001 to 50,00,000 & 15 years and 14% for 16 to 20 years for same range.

FIVE GOOD REASONS FOR YOU TO TAKE A HOUSING LOAN FROM SBI:

- Lowest interest rates, currently between 11.5% p.a. to 12.75% p.a.
- Lowest processing charges- only 0.5% of loan amount. Compare with the 1.5% - 2% charged by others.
- No hidden costs or administrative costs.
- No prepayment penalties.
- In-principle approval given prior to your identifying a house /flat, giving you flexibility in choice.
- Buying a plot of land.

SBI has separate Scheme for

Housing loans for NRI's

Eligibility Criteria: You can avail a loan if you are 21 years or older and have a steady source of income
Loan Amount and Period: While there is no upper limit to the amount of loan, the actual loan amount is determined on the basis of repayment capacity taking into account income, age, assets and liabilities. Up to 48 times the net monthly income will be sanctioned depending upon your age. Income of the spouse is also considered as well as the expected rental.

Repayment period: Repayment in easy instalments spread up to 20 years, based on your age and capacity

Interest rate: 12 % on all amounts upto 2 Lacs. 13 % for range (slab) from 2 to 10 lacs and 13.25% for more than 10 Lac's.

Maximum period: You can apply for loan amounts between Rs.2, 10,000 and Rs.1, 00,00,000 at very attractive rates of interest, for periods ranging from 1-15 years. Interest is also calculated on a daily balance basis, making the ANZ Loan even more affordable than if calculated less frequently.

Weaker Section Housing Programme

Introduction:

Andhra Pradesh State Housing Corporation Ltd., (APSHCL) was established in 1979 to formulate, promote and execute housing schemes for the weaker sections in Andhra Pradesh (A.P). The decision to construct permanent houses in 1983 in place of hutment scheme implemented under Sites and Services programme is an important milestone in Weaker Sections Housing Programme (WSHP). With the humble beginning of construction of 1.03 lakhs houses in 1983, the APSHCL has reached a significant level of construction of 3.74 lakhs houses during 1998-99. As the APSCHL has constructed a total of 36.10 lakhs houses within a limited span of 16 years (upto 15.3.2000), A.P ranks first in the country in construction of houses for the rural poor.

Various Schemes under implementation by APSHCL during the year 1999-2000

Sl. No.	Scheme	Unit Cost (in Rupees.)			
		Govt. subsidy	Loan	Beneficiary Contribution	Total
1	**State Government Schemes**				
i)	Semi Permanent Rural Housing Programme (SPRH)	7,000/-	-	500/-	7,500/-
ii)	Rural Permanent Housing Schemes (RPH)	7,000/-	10,000/-	500/-	17,500/-
iii)	Urban Permanent Housing (EWS)	3,000/-	20,000/-	2,000/-	25,000/-
iv)	Urban Permanent Housing (EWS-Special)	3,000/-	25,000/-	2,000/-	30,000/-
2	**G.O.I. Sponsored Schemes (with state share of subsidy).**				
i)	Indira Awaas Yojana (IAY)	20,000/-	-	-	20,000/-

ii)	Beedi Workers Housing	9,000/-	8,000/-	1,000/-	18,000/-
iii)	Weavers Housing Cum Worksheds				
	a) Rural	23,000/-	8,000/-	4,000/-	35,000/-
	b) Urban	25,000/-	14,000/-	6,000/-	45,000/-
	Weavers Workshed Scheme				
	a) Rural	9,000/-	-	-	9,000/-
	b) Urban	12,000/-	-	2,000/-	14,000/-
iv)	Fishermen Housing	11,750/-	7,000/-	1,250/-	20,000/-

Target group and eligibility criteria:

Rural Areas: The families whose annual income is Rs.13, 000/- and below per annum are eligible for sanction of houses. Sufficient safeguards are provided to socially backward groups. Of the total housing allocation, 50% for SC/ST category, 33% for BC category, 7% for minorities and remaining 10% for EBC category are earmarked. As per the revised guidelines, houses are being allotted in the name of women beneficiaries or in the joint name of husband and wife.

Urban Areas: The families whose annual income is upto Rs.18, 000/- per annum are eligible for sanction of EWS and EWS (Special) houses respectively. For SC/ST category 50%, for BC category 20%, for minorities category 20% and for EBC category 10% are earmarked out of total allocation of houses.

Schemes:

i) Semi Rural Permanent Housing: Under SPRH, houses are allocated for tribals in ITDA areas. Plinth area of the house will be around 22.00 sq.mt. It can be increased or decreased as per the local conditions.

ii) Rural Permanent Housing: Under RPH, core houses with a plinth area of 20.00 Sq.mts is provided. The area can be easily expanded in future without any change/disturbance to the existing structure as per the necessity of beneficiaries.

iii) Urban Housing: The EWS housing scheme is being implemented in all municipalities, notified urban areas and EWS (Special) scheme in the eight municipal corporations. The plinth area is about 23.00 Sq.mts in EWS (U) and 25.00 Sq.mts in EWS (SPL) schemes. The selection of beneficiaries, finalisation and implementation of urban projects are being done through Empowered Committees.

(iv) IAY Housing: In terms of area, RPH norms are followed and the coverage of non SC/ST poor upto 40% of the total allocation has been extended from 1993-94 onwards. The entire cost is grant-in-aid and is being shared by both Central and State governments in the ratio of 75:25.

(v) Housing for special groups: APSHCL is also taking up housing programme sponsored by central government for handloom weavers, silk weavers, craftsmen, beedi workers and fishermen as allotted by the departments concerned.

Unique Features:

Beneficiary Contribution:
The basic concept of implementation of housing scheme through APSHCL is "Self help" and "Mutual help". This concept has succeeded not only in creating awareness among the beneficiaries about the exploitation by middle men but also in capacity building and utilisation of human resources among rural and urban poor. The introduction of PRA exercises and pre-construction orientation programmes have helped in ensuring effective participation of beneficiaries.

Cost effective and Eco-friendly (CEEF) technologies:
To meet the demand of building materials and also to minimise the cost of construction, the APSHCL is encouraging the production and usage of cost effective and eco-friendly materials by the beneficiaries. In A.P., 77 Nirmithi Kendras/Sub Nirmithi Kendras (Building Centres) have been established so far to propagate the use of such materials and technologies. By February 2000 Rs.7739.50 lakhs worth of building components such as SC blocks, pre-cast door & window frames, cement jallies, RCC rafters, hallow blocks etc., have been produced and utilised for WSHP and other works. Further the cost effective technologies like arch foundation, pile foundation, hallow block masonry, fly ash blocks, stone cement blocks & sand cement block masonry, martur slab, RCC joists etc. have been propagated for reducing the cost of construction and early completion of houses. The CEEF technologies are well disseminated into the field through Nirmithi Kendras. In NKs, 6362 men and 2966 women were trained in masonry, production of precast building components etc. So far nearly 33,000 women related to Anganwadi mothers' committees were also trained in construction skills.

Monitoring System:
In order to have effective monitoring on progress of housing "Beneficiary Monitoring Card" has been introduced. These cards are designed to facilitate timely release of materials and payments to the beneficiaries besides bringing more accountability in the functioning of APSCHL.

APPENDIX III

List of Basic Rates of Material and labour

S. No.	Particulars	Unit	Rate (Rs.)
	Materials		
1	Cement	Bag	160.00
2	White cement	Bag	570.00
3	Fine sand	Cum	300.00
4	Coarse sand	Cum	400.00
5	Stone sggregate-40mm grade	Cum	500.00
6	Stone aggregate-20mm grade	Cum	600.00
7	Stone aggregate-12.5 mm & less grade	Cum	650.00
8	Tor steel	Quintal	1600.00
9	6 mm M.S. Steel in coil	Quintal	1650.00
10	Binding wire	Kg	25.00
11	Bricks	1000 Nos	1500.00
12	Sal wood	Cum	28000.00
13	Mango wood	Cum	10000.00
14	Mango wood (planks)	Cum	12000.00
15	125 mm ballies	Meters	30.00
16	Second class teakwood	Cum	45000.00
17	35 mm thk flush door shutters (non-decorative)	Sqm	760.00
18	Wire gauge	Sqm	150.00
19	25mm thk flush door shutters (non decorative)	Sqm	650.00
20	Anodised aluminium butt hinges 100X63X4 mm	10 Nos.	418.00
21	Aluminium screws	100 Nos	38.40
22	iron screws	100 Nos.	40.00
23	Nickel plated hinges(piano type)	Mt	50.00
24	M. S. flat	Kg	18.00
25	M. S. Bar	Kg	16.00
26	20 mm thk rajnagar plain marble	Sqm	600.00
27	Marble chips 1-4 mm size	Quintal	300.00
28	Marble powder	Quintal	180.00
29	Light shade pigment	Kg	65.00
30	Ceramic tiles 6"X6"	Sft	24.00
31	Terrazzo tiles 10"X10"	Sqm	160.00
32	25mm thk kota stone slab	Sqm	300.00
33	Anti termite	Litre	150.00
34	Oil bound distemper	Kg	60.00
35	Lime	Kg	5.00
36	Cement primer	Litre	70.00
37	Water proof cement paint	Kg	36.00

38	Synthetic enamel paint	Litre	135.00
39	Primer paint	Kg	36.00
	Sanitary material		
1	100 mm dia sand cast Iron S&S pipes	Each	192.00
2	75 mm dia sand cast Iron S&S pipes	Each	150.00
3	GI pipes (class B Jindal)		
a	16 mm dia	R. Meter	55.00
b	20 mm dia	R. Meter	67.80
c	25 mm dia	R. Meter	92.50
d	25 mm dia	R. Meter	110.14
4	White plastic solid sheet cover	Each	200.00
5	White glazed european type W.C.	Each	1000.00
6	White Orissa pan 580X440 mm	Each	772.00
7	Foot rest	Pair	30.00
8	PVC 10 lt. White low level cistern	Each	1100.00
9	10 lt. White vitreous china flushing cistern	Each	1600.00
10	White lead	Kg	42.00
11	White vitreous china wash basin 550X400 mm	Each	600.00
12	40 mm flush bend	Each	125.00
13	M.S. bracket 18" X 24"	Pair	40.00
14	CI cover 1'6" X 2'0"	Each	650.00
15	SW gullie trap	Each	40.00
16	GI non return valve		
a	25 mm	Each	140.00
b	32 mm	Each	250.00
	Labour		
1	Mate	Each	85.00
2	Beldar/ coolie	Each	75.00
3	Bhisti	Each	85.00
4	Mason (avg.)	Each	125.00
5	Mason 1st class	Each	150.00
6	Mason 2nd class	Each	125.00
7	Blacksmith 1st class	Each	150.00
8	Carpenter 1st class	Each	150.00
9	Mistry carpenter	Each	125.00
10	Beldar (spl) for rubbing and polishing	Each	90.00
11	Painter	Each	150.00
12	Helper (painter)	Each	75.00
13	Fitter	Each	150.00
14	Asst. fitter	Each	125.00

15	Plumber	Each	150.00
	Machines		
1	Mixer	Day	800.00
2	Vibrator	Day	300.00
3	Polish rubbing machine	Day	200.00
4	White washer	Day	125.00

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