REPORT

ON

RESEARCH AND DEVELOPMENT PROJECT

DEVELOPING APPROPRIATE HOUSE DESIGNS FOR TRIBAL COMMUNITIES IN WAYANAD, KERALA

Submitted to

UNDP India

Prepared By

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November 2019

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BACKGROUND STUDY

CHAPTER 1. INTRODUCTION

1.1 Background

The post flood damages on the housing and associated infrastructure in Kerala has called for disaster resilient eco-friendly housing reconstruction approaches, especially in the geographically vulnerable areas of the state. The post flood rebuilding efforts by the government of Kerala mostly subscribe to the house designs developed by LIFE Mission based on the conventional lifestyle of the majority of the population in the state. Even though the LIFE Mission guidelines allow for customization by the beneficiaries, vulnerable sections of the society such as tribes lack access to technical support for constructing disaster resilient housing satisfying their socio economic and cultural characteristics.

Geographically Wayanad, is one of the highly vulnerable districts in Kerala. Moreover, the districts also has the highest percentage of adivasi population (about 38%) of Kerala which demand special attention with respect to its housing needs. Most of these tribes follow their traditional customs and lead a lifestyle unique to each community, which is also manifested in the spatial vocabulary of their traditional houses. In the wake of the post flood damages in Wayanad, it has been realized that the future shelter redevelopment in the district , especially the housing for tribal community need to be given due consideration through evolving appropriate design solutions meeting their socio economic conditions as well as physical vulnerability.

In this background, the current research project attempts to evolve disaster resilient sustainable housing solutions customized for tribal communities, through a comprehensive participation of the community during various stages of the design process. The housing solutions and the design guidelines thus derived could be used to compliment the conventional housing approaches followed by various government agencies such as LIFE Mission. The participatory design process customized for evolving appropriate housing solutions specifically for the tribal community would help to ensure community inclusion in planning and implementing housing projects. Additionally, the community participation would lead to improved awareness as well as capacity building on shelter planning and development in future. By executing this bottom-up approach for planning and designing housing options would also beneficial to acquire necessary knowledge and skills to perform the shelter construction on their own.

1.2 Aim and Objectives of the study

This research is aimed to develop a participatory design process as a standardized approach for shelter planning and design for tribal community and to develop appropriate housing options following participatory approach specifically for the tribal communities of Wayanad District, Kerala.

The project has been conceptualized through four major objectives

1. To identify the critical issues and concerns of Tribal community in providing sustainable housing solutions
2. To evolve and implement a participatory planning and design process as a universal approach for shelter development in tribal areas
3. To evolve disaster resilient sustainable housing solutions for the tribal community
4. To develop guidelines for cluster planning of housing units in tribal settlements.

Accordingly, the entire project activities have been divided into different phases as given below.

Phase 1- Identification of vulnerable community in need of appropriate housing solutions
Phase 2- Documentation of indigenous housing styles of the tribal community
Phase 3- Developing participatory design approach
Phase 4- Executing the participatory design process to understand the socio economic status and cultural identity as well as the housing need of the community
Phase 5- Documentation of existing housing typologies for the targeted communities
Phase 6-Presenting / exhibiting the design solutions to the community and collecting their feedback
Phase 7- Developing the final housing solutions appropriate to the community contexts minimizing the physical vulnerability.

1.3 Methodology

The study was carried out using various tools and techniques like literature reviews, site visits, questionnaire surveys, participant consultations, etc. The methodology followed for the completion of each phase is given below.

1.3.1 Methodology for Phase I

The process of identification of vulnerable communities was done through literature reviews as well as in discussion with officials from Life mission, Integrated Tribal Development Project, Tribal Extension Officers, etc. Initially a thorough review of relevant literature was carried out to understand the demographic aspects of tribal community in Wayanad district, to explore their socio cultural attributes and to take stock of the community's current status of living. Field visits and discussions with the concerned authorities were also done to corroborate the findings of the literature. Additionally, detailed study was conducted to understand the physical vulnerability of the tribal community in the context of the flooding in 2018. The damage and loss on the socio, economic and housing infrastructure during the flooding was also analysed. These studies led to the identification of vulnerable community in various locations in Wayanad district.

1.3.2 Methodology for Phase II

This phase began with the study of the existing scenario of indigenous housing styles of tribal community. Existing traditional houses at various locations were visited. The typology and architectural plans of the indigenous houses were then studied and documented. The site visits were also utilized in understanding the traditional lifestyle and also user- space interaction of the he community. A detailed understanding on the building materials as well as methods of construction adopted were also done through informal discussion with the occupants. The performance of these houses in terms of their flood resilience was also explored.

1.3.3 Methodology for Phase III

A participatory design approach was formulated in this phase through literature reviews. The PDA thus formed has three stages namely, Appraisal of Human Settlement, Mapping of household and housing characteristics and Design appraisal.

1.3.4 Methodology for Phase IV

Phase IV was carried out mainly through the interaction with the beneficiaries. This phase was actually the execution of different stages of phase III. An initial participatory interaction was conducted to understand the socio economic status and cultural identity of the

community and also to understand the housing need of the community. This was accomplished with the help of a detailed survey of the selected sample of the community using a structured questionnaire.

1.3.5 Methodology for Phase V

This phases intended to document the quality evaluation of existing houses in the communities through field study and documentation. The spatial as well as technical details of different typologies developed under various housing schemes were analysed and documented. The user- space interaction of the communities was observed and recorded. Understanding the construction techniques and materials used in the existing houses was also an important part of this phase. Evaluation of the units in terms of flood resilience was also documented and recorded.

1.3.6 Methodology for Phase VI

This phase is intended to present the initial design solutions to the community. Based on the collected socio economic data and the identified perception of the community about housing, an initial design will be formulated. This design must be then discussed with the representatives of the community and feed backs are to be collected on various aspects of design. The design options are to be discussed with the concerned stakeholders eliciting their suggestions also.

1.3.7 Methodology for Phase VII

This phase is planned to develop the final designs incorporating the opinions and feedback of the community during the phase VI.

CHAPTER 2. IDENTIFICATION OF VULNERABLE COMMUNITIES

2.1 Introduction

General wellbeing, growth, and welfare of a village or a district are highly dictated by the living status and resilience of the communities. Several researchers have recognized that the communities act as a crucial determinant of human health, particularly during a disaster and during disaster recovery. Numerous studies also identified that indigenous communities living in hilly regions are at a higher risk to climate change due to their dependency on the local produce, and livelihoods. In addition, the identification of appropriate vulnerable communities is a pivotal objective of the study. Hence, current research has explored the existing communities in Wayanad district and further evaluated the housing conditions and the vulnerability of the community triggered by the recent floods. As mentioned by Halder et.al., (2012), vulnerability and adaptive capacity among the population widely varies across India. Hence it is essential to investigate the local conditions in a structured and informed manner. The current study has developed criteria for the investigation, which includes housing conditions, livelihood, local communities' perceptions, and responses to the impacts of climate change on their livelihoods. The study employed community-level participatory qualitative and quantitative research methods in three communities. This chapter presents the preliminary investigations, identification of the vulnerable communities, and rational.

2.2 Tribal population in Wayanad

The secondary sources indicate that Wayanad district is one of the backward districts in Kerala with the highest concentration of Scheduled Tribe (ST) population. The 2011 senses data confirms this as 31% (151443 in number) of the total population of Kerala live in Wayanad. According to the report published by IIA Calicut chapter (2018), the tribal settlements in the district are unique in terms of the socio-cultural customs, lifestyle, indigenous technology, and limited services. Amongst the tribal communities, Paniya, Kattunayka, Kurichiya etc are the major ST communities in the district. This will be discussed in detail with respect to the criteria in the following sections.

2.3 Criteria for community selection

The project team initially arrived at three probable criteria to select the vulnerable communities for the current project. The criterion is as given below.

Criteria 1: Community characteristics

Criteria 2: Population distribution of tribal community in Wayanad

Criteria 3: Impact due to the flooding and landslide scenario 2018

A thorough review of relevant literature was conducted to arrive at the criteria mentioned above as well as to identify the sample community that needs appropriate housing (design) intervention. An insight was drawn on key features of the tribal community, such as their heritage, traditional and cultural values, and religious believes, current socio-economic as well as demographic and housing status.

Most of the tribal population of Wayanad District live in vulnerable areas either in flood-prone areas or landslide susceptible areas. Hence the consequences of flood 2018 on the built infrastructure, especially housing, were also reviewed in the process.

2.3.1 Criteria 1: Community characteristics

Wayanad is home to the most significant number of tribes in the State. The native Adivasis, mainly in Wayanad consist of various sections of Paniyas, Mulla Kurumas, Adiyas, Kurichiyas, Vettakuruma, Kattunaikkas, etc. The tribal communities in Wayanad can broadly be categorized into three sections – agricultural labourers, Marginal farmers and forest dependents. They also have their own special life styles, culture, customs, traditions and religious practices. The socio-economic status of various tribal communities is not uniform. A large number of tribal communities continue to be extremely backward and some of them are still in the primitive stage.

Input from various stakeholders directly connected to tribal community development is vital for identifying the most appropriate tribal community for this project. After discussion with the project officers at various capacities (Mr. Vanidas of Integrated Development project officer, Kalpetta, Mr. Junaid , a tribal extension officer at Kalpetta , Panamaram, Sulthan Bathery and Manathavady) as well as Project Coordinator, Life Mission, Wayanad (Mr . Sibi Varghese) it is decided to focus on housing development of the following three communities

1. Paniya Community
2. Adiya Community

3. Kattunaika Community

Paniya and Adiya communities are traditionally bonded labourers and Kattunaika depend upon forest for their livelihood either as forest labourers or as collectors of forest produce. **Paniyas** are the original inhabitants of Wayanad region and are numerically the largest among the tribal communities in Wayanad district. Almost 46% of the tribal community belongs to Paniya tribe. They rarely interact with other tribes and still follow their ancient traditions. Paniyas, as their name indicates were workers and during earlier times, the landlords used to sell them as bonded labour, along with the plantations. Now they work as paid farm laborers. Their huts were constructed with thatched roofs and mud plastered walls.

Almost 85% of the **Kattunayakan community** lives in Wayanad district. The settlement of the Kattunayakan is called kudi. Settlements are seen distributed inside the forests and in revenue land as well. The average number of households in a hamlet is about 10.6. Traditional huts are flimsy structure without foundation. The walls are of bamboo wattle work with mud plastering inside and roof is thatched with grass. The Kattunayakan subsist on food gathering, Non wood forest produces collection, landless agricultural labour, forest labour and small scale cultivation. The families live along with the rural population work as agricultural labourers and also as small scale cultivators. They have no education and do not possess any land. Those living within the forest cultivate in the areas allocated to them by the forest authorities. Occasional forest labor and wage labor in agriculture sector also contribute to their income. The Kattunaika, the indigenous group seems to be one of the most vulnerable sections of the tribal communities of Wayanad. They suffer from social exclusion, typically landless, and live in severely deprived circumstances.

Adiya is one of the significant tribal communities of Wayanad. The name “Adiya” has traces from the sub-servant role they have played under the landlords in the past. Several Ethnographic studies on Adiyas indicate that they were traditionally slaves to the local landlords and attached as bonded labour to their families. The employer would provide huts and food even when there was no work. They lived in groups called *kunt* which is attached to the land lord. The household unit of a kunt is known by the name kulu. Each kunt is known by the family name of the landlord. This explains the origin and evolution of housing (shelter) of this community.

Several researchers have explored the Adiya community as part of their study on the tribal communities in Wayanad district. One of such studies, carried by Aswathy.C et. al., (2018)

documented the findings based on the geographical exclusion, economic exclusion, socio-cultural exclusion, and political-legal exclusion. In terms of literacy and occupation, the study conducted by Binu (2013) reported 40% literacy among Adiyas. On the other hand, Sudeep and Jayasree (2015) documented that 53.70% of the Adiyas were literate. This disparity may also be tied to the growth and awareness on education among the community. Coming to the occupation, Binu (2013) observed that most of the members of the Adiya tribe work as agricultural labour which is the main source of employment in the community. This links to the above discussed history of their ancestors. Several studies also highlighted that Adiyas are the predominant tribe in estate labour in Wayanad.

Regarding housing, the literature indicates a significant transition in the houses occupied by the Adiyas over the past few decades. In past, they lived in thatched and mud walled houses with a single room or a hall with a few provisions for living and kitchen. As with the many old tribal houses, there were no bathrooms reported. It is also found from the existing literature that the community lives in Brick (or) laterite walled thatched, Brick or laterite walled tiled, and small concrete houses.

The research team noticed that education, type of house, land holding, condition of house, and social participation are some of the important factors to measure the existing status of the community. Current research considers all the above indicators for the preliminary study, since they are pivotal in understanding the community in its entirety.

2.3.2 Criteria 2: Population distribution of tribal community in Wayanad

Wayanad district is one of the backward districts in the state with highest concentration of scheduled tribe population. The tribal settlements in the district are unique in terms of the socio cultural customs, lifestyle, indigenous technology and limited services. The scheduled tribe population of the district is 18.53% (151443) of the total population and it is 31.24 % of the total tribal population of Kerala sate. Paniya, Kattunayka, Kurichiya etc are the major class of ST communities in the district. Out of this, Paniya has more population in the district. Table 2-1 shows the population details of Scheduled tribes.

The Major Tribes in the District are Paniyan, Kurichachan/Kurichian, Kurumans/ Mullu Kuruman/ Mulla Kuruman/Mala Kuruman, Kattunayakan and Adiyan. In 2011 Census there are 66068 Paniyans consisting of 32034 males and 34034 females. Majority of them live in rural areas of the District. 96.76 percent of the Paniyan population live in rural areas of the District. The population of Kurichachan/Kurichian is 25093 consisting of 12746 males and

12347 females. Of this 99.30 percent are living in rural areas. The population of Kurumans/ Mullu Kuruman/ Mulla Kuruman/Mala Kuruman is 23591 with 11693 males and 11898 females and 98.07 percent of them are living in rural areas. Kattunayakan and Adiyan are 14557 and 10996 respectively.99.18 percent of Kattunayakan and 99.89 percent of Adiyan live in rural areas.

Table 2-1: Population details of Scheduled tribes (Source: Census Data 2011)

State/ District/ Taluk	% of ST Population
Kerala State	1.5
Wayanad District	18.5
Mananthavady Taluk	21.6
Sulthanbathery Taluk	19.3
Vythiri Taluk	14.6

In the District Scheduled Tribes forms 18.53 percent of the total district population. The percentage of Scheduled Tribe population to total population is the highest in Mananthavady Taluk (21.6) followed by Sulthanbathery Taluk (19.3). The lowest percentage of Scheduled Tribe to total population is reported in Vythiri Taluk (14.62 percent). The proportion of scheduled tribes to the total population in different taluks is given in Table no.2-2, Table no.2-3 and Table no.2-4 (source: District Census Hand Book, 2011)

Table 2-2: Villages according to the proportion of ST population to the total population range

Name of Taluk: Mananthavady		
Range of ST population	**Location code number**	**Name of village**
21 – 30	627295	Payyampilly
21 – 30	627298	Periya
21 – 30	627299	Thondernad
21 – 30	627303	Cherukottur
21 – 30	627304	Panamaram
21 – 30	627305	Anchukunnu
31 – 40	627294	Thissilery
51 - 75	627293	Thirunelly
Name of Taluk: Sulthanbathery		
21 – 30	627309	Naduvayal
21 – 30	627315	Purakkadi
21 – 30	627316	Krishnagiri
31 - 40	627313	Kidanganad
51 – 75	627319	Noolpuzha
Name of Taluk: Vythiri		
21 – 30	627326	Kottathara
21 – 30	627330	Vengappally
21 – 30	627331	Kavumannam
21 - 30	627338	Thrikkaippatta
31 - 40	627332	Thariyode
31 - 40	627334	Pozhuthana

From table no. 2-2 it is realized that the villages namely Payyampally, Thondernad, Periya, Cherukkottur , Panamaram, Anchukunnu and Thirunelli village panchayats in the taluk

Mananthavady, has a major concentration tribal community varying from 30-75 % of the total population in each village. Similarly five panchayats in Sulthanbathery taluk such as Nadavayal, Purakkadi, Krishnagiri, Kidanganad, and Noolppuzha also has tribal community as a major share of population. Similarly few village panchayats in Vythiri Taluk namely, Kottathara, Vengappalli, Thrikkaripatta, Thariyode and Pozhuthana also has major share of tribal community population as presented in Table 2-2. Additionally the distribution of ST colonies in various block Panchayats in Wayanad is given in Table. 2-3.

Table 2-3: Block wise SC / ST Colonies and number of families

Sl.No	Name of Block	No of ST colonies	No of families	ST Population
1	Vythiri	425	6846	29217
2	**Mananthavady**	**614**	**10289**	**45122**
3	**Panamaram**	**550**	**8730**	**37158**
4	**Sulthanbathery**	**535**	**9543**	**38434**
5	Kalpetta	43	727	2959
	District Total	2167	36135	152890

The data in table 2-3 indicates that Manathavady block is having the highest number of ST colonies (614 nos) followed by Panamaram and Sulthanbathery. It is tried to understand the number of tribal colonies in various village panchayats in all the three taluks in Wayanad district and is given in Table no.2-4.

Table 2-4: No. of Tribal settlements (Source: Extracted from Details of settlements, ITDP office, Kalppetta)

Taluk/ panchayath	Tribal Community		
	Kattunaika	**Paniya**	**Adiya**
Sulthanbathery taluk			
Poothadi	**77**	79	3
Pulppally	38	42	5
Meenangadi	29	84	0
Ambalavayal	2	49	0
Noolpuzha	16	112	0
Bathery	17	40	0
Nenmeni	9	57	0
Mullenkolli	14	12	0
Mananthavady taluk			
Panamaram	13	**126**	36
Thavinjal	9	82	5
Thirunelli	**71**	72	**72**
Mamanthavady	3	1	**55**
Thondernadu	0	53	0
Vellamunda	4	88	1
Edvaka	0	69	4
Vythiri thaluk			
Kalpetta	11	38	1
Vengappalli	3	48	0

Kottathara	3	49	7
Kaniyambatta	1	63	13
Muttil	12	72	11
Padinjarethara	3	33	**60**
Vythiri	1	12	0
Meppadi	7	22	**53**
Mooppainadu	1	8	0
Thariyodu	7	25	2
Pozhuthana	8	25	1

The analysis of the distribution of tribal settlements belonging to three communities under consideration realized the following facts:

1. Poothadi panchayat in Sulthanbathery Taluk as well as Thirunelli Panchayat in Manathavady Taluk are found to be having the highest number of tribal settlements belonging to Kattunaika community. (77 settlements in Poothadi Panchayat and 71 in Thirunelli Panchayat)
2. Panamaram village in Manathavady Taluk has the highest number (126 settlements) of Paniya community colonies followed by Noolppuzha village (112 settlements) in Sulthanbathery Taluk'
3. Thirunelli and Mananthavady village panchayaths as well as Padinjarethara in Vythiri Taluk is found to be having higher number of Adiya Tribal colonies when compared to other villages in various taluks. (75,55 and 60 settlements respectively)

The analysis of population distribution as per Table 2-4 shows that Mananthavady , Sulthan Bathery and Pnamaram blocks are having the maximum number of ST colonies. Similarly Kottathara, Vengappalli, Thariyodu , and Pozhuthana are the panchayaths with in Vythiri Taluk having 30% to 40% of population as tribal community. And Panamaram, Anchukunnu, Thirunelli occupies higher percentage of tribal population (30-75% of total population) when compared to other panchayaths in Mananthavady Taluk.

2.3.3 Criteria 3: Impact due the flooding and landslide scenario 2018

In order to assess the vulnerability of the communities, current study explored the regional context of hazard, history of hazards in the district and a close eye study of the Kerala floods 2018. The highlights of the exploration are discussed in the sections below.

Hazard characteristics of Wayanad district

As per the multiple zonation maps done by NCESS in 2015, the district of Wayanad fall under zone III. Wayanad is the second most landslide prone district after Idukki.

Flood is a common phenomenon in Wayanad. The river banks of Mananthavady and Panamaram River and low lying paddy lands flooded by water in monsoon seasons of every year. However, in 2015, 2016 and 2017 the rain fall was very less. Hence, there were no reports on heavy floods. History shows evidences of several landslides in the past. The Wayanad-Kozhikode border has been identified by NCESS as one of the most landslide prone areas in the state. To quote a few major accidents, the Mundakkai debris flow occurred in 1984 claimed 14 lives apart from the loss of prime agricultural land. The Kappikkalam Urulpottal near Padinjarathara occurred in 1992 and claimed 11 lives. Another catastrophic Landslide occurred on 23.06.2007 at Valamthode, which claimed 4 lives. Apart from this, many other Landslide of similar nature and of varying magnitude occurred in Wayanad in the past. Figure 2-1 shows the regional hazard map which includes the Wayanad, Kozhikode, Malappuram and Kannur districts.

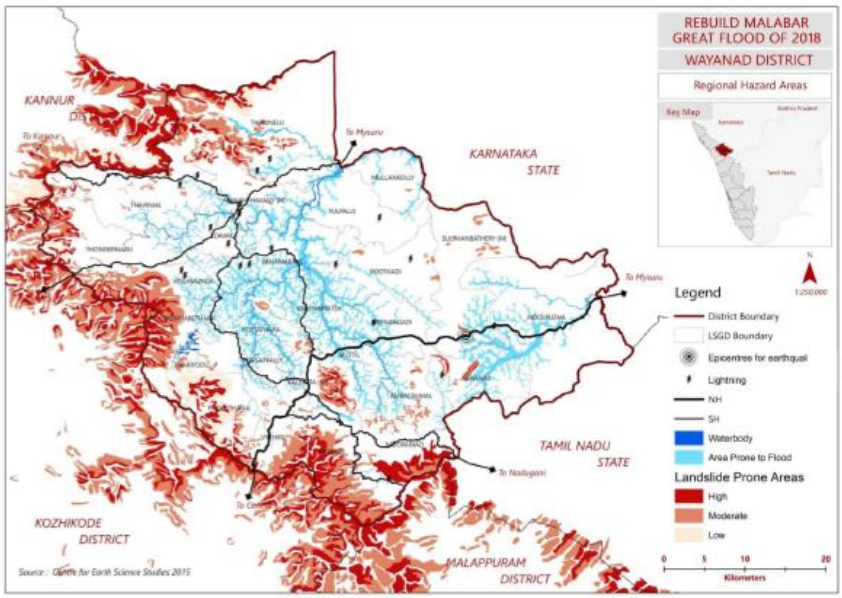


Figure 2-1: Regional Hazard areas (Source: IIIA Report)

The 2018 floods were the most devastating in terms of geographical coverage, severity of damage and extent of loss in Wayanad District. The floods and landslides destroyed public and private infrastructure, including houses, roads, bridges, schools, health facilities, and other utility services and had extensive impacts on production sectors. A large number of populations of the district were affected directly or indirectly. The floods and landslides resulted in the loss of 10 lives and affected almost 38615 people. The disaster damaged over 7725 houses and caused a loss in income of people dependent on agriculture, trade and industries.

Table 2-5 below indicates the panchayat wise affected buildings during the 2018 flood. The degree of damage was highest in the Panamaram and Mananthavady panchayats. It is seen that while Panamaram had the highest number of residential casualties, it also had the highest number of affected institutional and public buildings,

Table 2-5: No of affected building in various Panchayaths (Source: Rebuild Wayanad report , IIA)

LSGD	Commercial	Institutional	Public	Residential
Ambalavayal				68
Edavaka	18	2	4	408
Kalpetta	4	3	3	524
Kaniyambetta			2	29
Kottathara	41	4	11	380
Mananthavady	**39**	**5**	**16**	**799**
Meenangadi	1			124
Meppadi	2			91
Mullankolli	1			51
Muttil		1		178
Nenmeni				8
Noolpuzha				49
Padinjarethara	8	2	6	343
Panamaram	**25**	**10**	**16**	**1000**
Poothadi				47
Pozhuthana	1		5	201
Pulpally	2			34
Sulthanbathery				23
Thariyod	2	1	3	232
Thavinjal	4	1	4	296
Thirunelli	2			126
Thodernadu	1			99
Vellamunda	5	2	5	158
Vengappalli	8	2	7	170
Vythiri	6	3		211
Total	170	36	82	5672

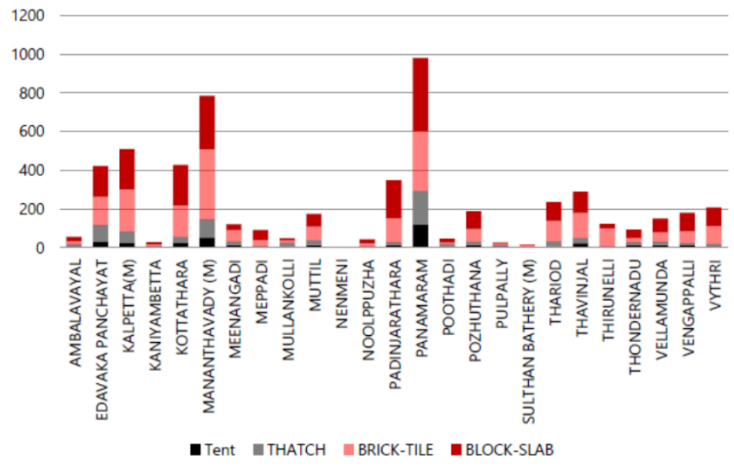


Figure 2-2: Footprint of houses damaged (Source: IIIA Report)

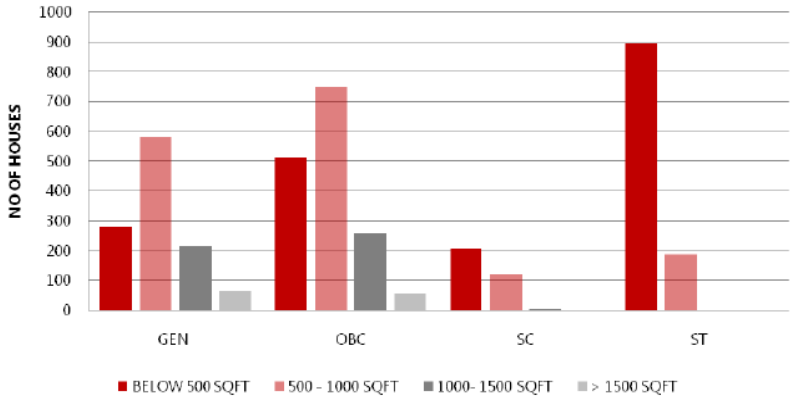


Figure 2-3: Typology of houses damaged during Flood

All of these affected houses were located in the floodplain zone. Their study also revealed that 50 % of buildings in the flood and landslide prone areas were built in the last 10 years. Moreover, majority of houses affected by flood were pucca homes (Brick and Tile or Block and Slab, as given in figure no 1) and were located mostly along the river buffer zone. Another interesting feature revealed as per the study conducted by IIA is that the maximum damage had occurred to houses having a foot print area of less than 500 sqft. (Almost 42%) Homes with footprints less than 500sqft are predominantly owned by the ST populations (Figure 2-2). The maximum houses damaged during flood is in the Panamaram and Kottathara regions as given in figure 2-3.

Literature also indicates that the maximum permanent development has happened in Panamaram and Mananthavady, Panamaram also has a large percentage of homes that are made of thatch or tent like material, thus increasing the vulnerability of those home owners. These panchayats have a large percentage of kucha homes (most likely belonging to a more vulnerable group of people) their presence in the high risk floodplain zone increases their vulnerability to such calamities immediately. Recently all the houses allotted to low income groups by various agencies including local bodies are though pucca in nature and most of them are located in the flood plain areas.

2.4 Selection of Tribal Community in Wayanad

The research team has conducted the vulnerability mapping, need assessment and an exploratory socio economic survey of the accessible locations and communities in Wayanad. Further, current study employed a judgmental sampling methodology for obtaining a representative sample of tribal community across the Wayanad district. Judgmental sampling is a non-probabilistic sampling technique where the sample is selected based on the

experiential knowledge and professional judgment. In case of current study, the sampling was done based on the intensity of damage during flood- 2018 as well as the concentration of tribal settlements in the three taluks of Wayanad, namely Vythiri Mananthavady and Sulthan Bathery. A field study and focused group discussions were also conducted to understand the socio- cultural characteristics of the identified community, and to understand their influence of the current housing pattern. This exercise led to select the tribal communities in the following locations as study areas (locations) for current research.

1. Paniya Community in Manathavady or Vythiri Taluk (Panamaram/ Kalpetta village panchayat)
2. Adiya Community in Manathavady Taluk (Thirunelli/ Mananthavady/ Padinjarethara/ Meppadi village panchayat)
3. Kattunaika Community Sulthanbathery / Mananthavady (Poothadi or Thirunelli village panchayat)

CHAPTER 3. DOCUMENTATION OF INDIGENOUS HOUSING STYLES OF THE TRIBAL COMMUNITY

3.1 Introduction

Reconnaissance field visits were conducted to understand and document the indigenous housing styles of the identified tribal communities. Traditional houses of the tribal communities in Wayanad, has stories to tell that are centuries old. These indigenous houses and their architecture was developed by the tribal people after years of observation of the materials around them and their behaviour in various climatic conditions. Ancestors of such tribes might have used different types of materials and construction techniques on a trial and error basis to finally arrive at a sustainable housing construction method. When the British came to Kerala, they were mesmerized with the natural beauty and abundance of the forests in Wayanad. They were also too happy to exploit the socially vulnerable tribal communities for their benefits. After the British, many others, including the socially well off natives of Wayanad have started encroaching and converting the pristine forests of Wayanad into agricultural lands for their benefits. All these unpleasant interventions had a huge impact not only in their lives, but also in the way they made their homes. But still there are communities and individuals that stick to the traditional methods of housing design and construction. Most of these traditional houses that still exist are believed to be centuries old. The study attempted to document two tribal houses constructed following indigenous materials and methods.

3.2 General layout and features of traditional tribal housing

These houses are built at 30 to 40m away from the nearest public access road in order to improve privacy of the house. Most of these houses are constructed east facing, because they light their sacred “vilakk” (lamp) in this direction during evenings. The verandahs in the East are wider than the verandahs in the other sides. All the mainstream household activities take place in these verandahs. The inhabitants spend most of their day time in these verandahs. This decreases the energy consumption. Since there are very less openings provided, the walls and floors are protected from sunlight, thus their lifetime increases.

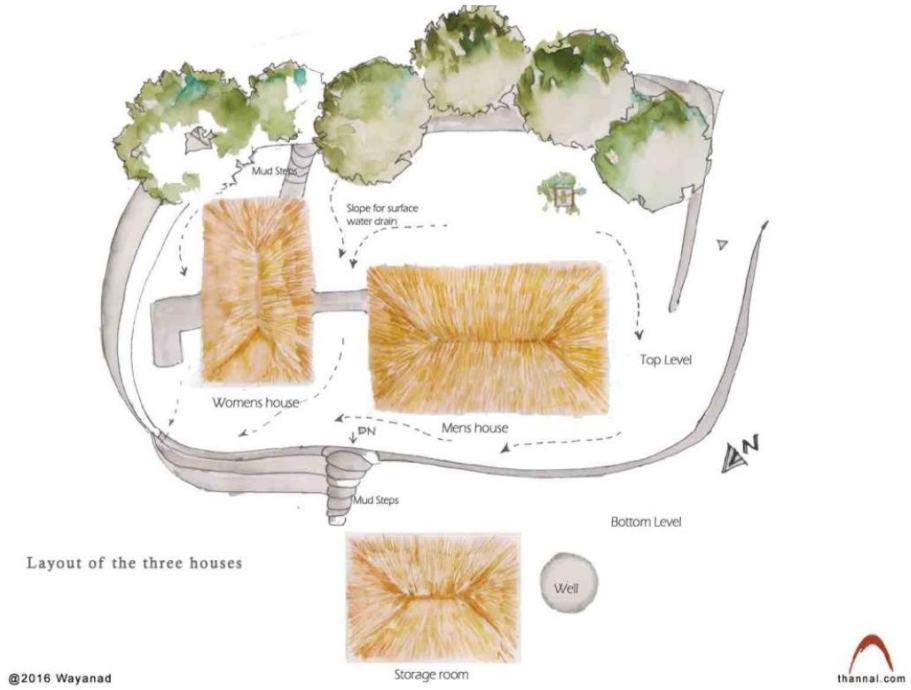


Figure 3-1: Site plan of a traditional tribal house (Source: Thannal.com)

As shown in the Figure 3-1, a typical traditional tribal house places small shrines kept in the "tharavadu" or the ancestral houses. But a "thulsi thara" or a small raised platform with thulsi plant is a must for most of these houses as they consider it sacred. The most striking feature of these houses is their sloping roof. The roof is made in such a way that, the water is not allowed to fall on the walls, which is generally made of clay or bamboo, which may get spoiled soon if exposed to continuous rain. These housing units have minimum of two rooms and a verandah. Kitchen is usually provided outside the house and sometimes a "pooja" room is included within the house.

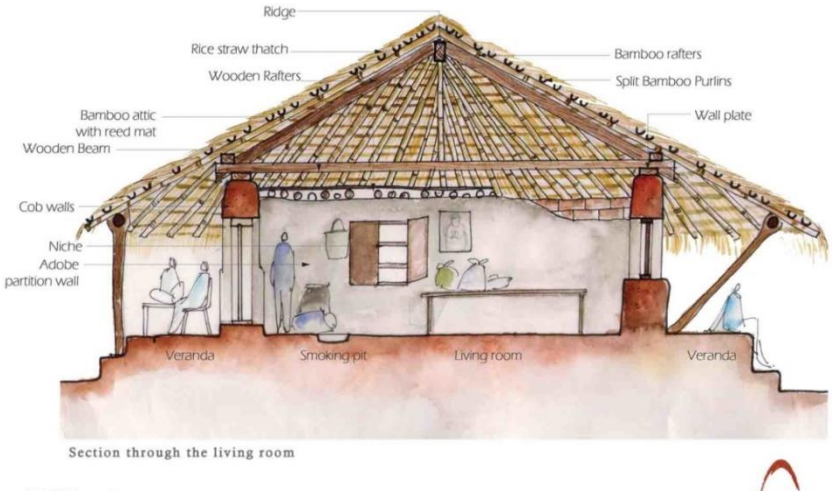


Figure 3-2: Section of a traditional tribal house (Source: Thannal.com)

3.3 Traditional house at Poothadi panchayat, sulthan bathery

Figure 3-3 shows the housing of Paniya community in Poothadi Panchayath in Sulthan Bathery developed using locally available materials and indigenous building techniques. It is a single hall housing unit with a raised veranda all around. The kitchen is placed outside the main house, but directly accessible from the house. The inhabitants spend most of their day time in the verandha. All the mainstream household activities take place in the verandah. The room is used only for sleeping as well as for keeping the household items. The house is provided with only two openings; the main door at the side wall which opens to the front yard of the kitchen unit and relatively smaller door at the façade.

The smaller door (Figure 3-4) is not usually functional as an access way; rather, it acts as a window opening. This door also is used to monitor the movement of wild animals, if any in the housing premises and also help them to swiftly get inside the house if wide animal is spotted around. These houses have a unique system of building an attic (Figure 3-5) inside projected from the top of the walls. These are used for storing farm products and other household items.

Figure 3-3: View of the housing unit

Figure 3-4: Main door and door on the facade

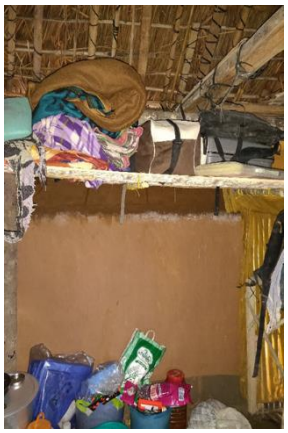


Figure 3-5: Attic Space used as storage space

3.3.1 Building materials

Tribal communities developed houses on their own using materials (Figure 3-6) around them. Locally available materials like Blackwood, bamboo, soil, valavari grass, wild twigs, rice straw, reeds, etc. are used for the construction of these buildings. All these materials are carefully and skilfully selected from the forests. A special type of bamboo known locally as “kallanmula” is used for walls and roof frames. This bamboo is smaller in diameter as compared to normal bamboo and is denser. These bamboo is cut according to the “pakkam” (the right timing according to the tradition) and is then made into bundles. These large bundles of bamboo are then soaked in water for about a month. This is a natural way of seasoning the bamboo, which makes it stronger and the locals claim that such seasoned bamboo can last 300 to 400 years.

Figure 3-6: Making of mud bricks

Bricks used for the foundation and sometimes the walls are made by using the locally available clay. The clay is mixed in large chunks and then filled inside boxes made from locally available wood for giving them their shape. These are then dried in sun for several weeks before using them for construction.

Roof is usually covered using rice straw. Other materials like mountain grass, dried coconut leaves, ragi husk, etc. are also used sometimes. Creepers from the forest are used to tie these materials together before laying them on the roof. Clay from river beds, ponds, fields, rice husk ash, cow dung and locally available clay are used for plastering the walls and floors.

3.3.2 Construction of traditional houses

Foundation, as shown in the figure 3-7, unlike a normal modern house is not built by excavating the Earth. Rather, it is built by beating clay above the surface of the corresponding plot. Usually the foundation is built in two levels in order to avoid erosion of the soil from foundation during heavy rains. The lower level of the foundation is made by beating clay thoroughly. Earlier, the upper layer was also made similarly by beating mud. But later they started using bricks for this next level of foundation.

Once the foundation is done, then the walls are built. In the earlier days, the walls were built by beating up clay similar to that of the foundation. In such case, the load of the roof is transferred to bamboo poles which are driven deep into the ground. Other method of constructing walls are using sun dried bricks and mud mortar or using cob. The walls are made thick, so that it keeps the temperature inside the house always in a moderate range.

Figure 3-7: The two level foundation of an indigenous house

Figure 3-8: Doors made out of bamboo

Doors (Figure 3-8) are made by weaving bamboo into a thick structure. Some of the houses even use a wooden door. Usually there are two doors for such houses, one that is small which is used by the inhabitants to look out for intruders or animals, and which help them to swiftly get inside the house and the other bigger door which is used as the main door.

The walls are then plastered using locally available materials (Figure 3-9). Plastering is very important for these houses, since they protect the internal wall structure from rain and other direct atmospheric exposures.

Figure 3-9 Hand drawn patterns on wall

The walls are naturally colored by using naturally colored plastering materials. The white color is usually obtained by using clay from the bottom of rivers, ponds and from the paddy fields. Grey color is obtained by mixing clay and ashes of burnt rice husk. A slight red color clay is also used for plastering. The floors are also plastered in three to four layers. The first layer consists of cow

dung, rice husk ash and sand. Then the next layer is applied which consists of cow dung, mud and the sap of a locally available plant known as kulamavu. The third layer consists of good quality cow dung. And finally to add a nice grey color to the floor, cow dung is mixed with ash diluted in water. The final layer has to be re applied periodically to keep the color. These walls and floors are then decorated using hand by drawing patterns in the plastering while they are still wet. They run their fingers along these walls and floor in certain patter to create beautiful designs for the walls and floors.

Finally, the roof structure, as shown in the figure 3-10, is made out of bamboo. The main ridges are supported on the bamboo columns. Bamboo rafters are then laid along the main ridge. Then small purlins made out of bamboo are laid across the rafters. Once the framework is complete, the roof is covered using rice straw. Nowadays these roof structures are then covered using tarpaulin sheets to protect them from extreme rainfall. These houses have a unique system of building an attic on top of the walls under the roof. These are used for storing farm products and other household items.

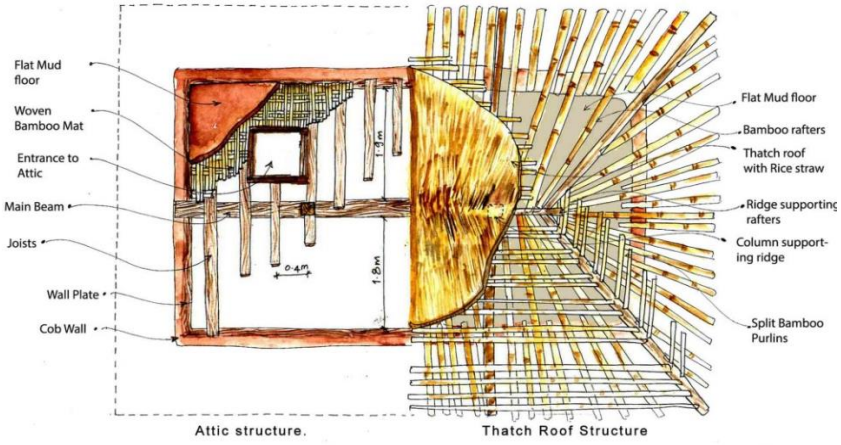


Figure 3-10 Roof structure and plan with details of materials (Source: Thanal)

3.4 Swaminathan foundation project (Mud houses)

The M.S. Swaminathan Research Foundation has built some houses (shown in figure 3-11) post flood in the year 2007, in the Kairali tribal colony of muppainad panchayath. The MSSRF has built 10 green houses at the Kairali Adivasi hamlet at Moopainadu grama panchayat in Wayanad district with the financial support of the State Tribal Development Department and

Figure 3-11: Mud house (Swami Nathan foundation project)

technical assistance of Vasthukam, a green architect concern in Thrissur. The houses, each of 357 sq ft area, were constructed at a cost of Rs.4.24 lakh. Locally available mud was the major material used in the construction.

These houses were built based on sustainable housing concept. Rammed earth construction technology (Figure 3-12) was used for the basement and foundation and cob construction for the walls. Hard wood was used for the construction of windows and doors. The houses were plastered with different colour mud available in the area its roofing frame was done using wood and was covered using Mangalore tiles. Local people were trained for the same and was involved in the construction of these houses.

Figure 3-12: Rammed earth foundation

3.5 Sustainability aspects of traditional tribal housing

Almost all things that are related to traditional houses are sustainable. From building materials to the construction techniques, there is a touch of sustainability in each and everything in an indigenous housing unit. Locally available materials and local skills are used for the construction of such buildings. This eliminates the need of external assistance for maintenance and repair of the housing unit.

There is also a limited use of the main housing unit (i.e. only for sleeping and storage) which results in very low usage of energy. The thick mud walls of these houses regulates the temperature within the house and always keeps it in a moderate level. Thicker walls and lesser openings also protects the interior walls from direct exposure to atmospheric conditions. The roof is also made in such an angle that rain is kept away from the walls. All these building practices ultimately reduces the cost of these housing units. Despite all these sustainable aspects of traditional houses, there is a major factor that truly reflects the sustainability of these units that is their durability. When it comes to durability, there are some major setbacks for indigenous units which are discussed in the section below.

3.6 Critical concerns of traditional tribal housing

Even though traditional housing units are believed to be sustainable, there are some aspects of these units that doesn't make them so sustainable. To start with, the raw materials used (soil and clay) becomes highly vulnerable when exposed to water. Also mud has low tensile strength and develops cracks easily. Compressive strength of the wall reduces with time thus affecting strength and stability of the super structure. Roof materials also becomes highly vulnerable after continuous exposure to rain and dry weather.

Other common problems of the house are (a) damp wall due to soaking of water; (b) mould formation due to humidity; (c) mould due to moisture that is deteriorating the aesthetic quality of the house. Hence, in general, these houses are not considered as Pucca house (houses made of permanent materials); additionally, there is also lack of adequate knowledge and awareness about the local building techniques especially among the current generation. Moreover, these houses require regular up-keeping and maintenance. Lesser number of openings and thick walls also result in inadequate air circulation and lighting.

These houses are an example that proves that mud housing with inadequate maintenance is not a long-term solution for housing. This is mainly due to the fact that mud gets easily disintegrated (Figure 3-13 &3-14) when exposed to continuous rain and other atmospheric changes. Also the knowledge transfers of these type of housing is very difficult and is almost impossible since the new generation prefers to educate themselves and get more secure jobs. Maintaining these houses is also a tedious task, which is not possible because of lesser time available to the working age people in the house. The houses are already deteriorating with sagging roofs, disintegrating plaster, cracks, etc. In brief, it is realised during the study that the tribal community generally aspire to live in housing units made of modern building materials mainly due to disadvantages as highlighted.

Figure 3-14: Disintegrated foundation structure

Figure 3-13: Exposed mud walls with cracks

CHAPTER 4. DEVELOPING PARTICIPATORY DESIGN APPROACH

4.1 Introduction

Definition of PDA

"Process by which people are enabled to become actively and genuinely involved in defining the issues of concern to them, in making decisions about factors that affect their lives, in formulating and implementing policies, in planning, developing and delivering services and in taking action to achieve change' (WHO, 2002)".

Participatory design (originally co-operative design, now often co-design) is an approach to design attempting to actively involve all stakeholders (e.g. employees, partners, customers, citizens, end users) in the design process to help ensure the result meets their needs and is usable. Participatory design is an approach which is focused on processes and procedures of design and is not a design style (Wikipedia, 2019). The idea of participatory involvement in the design process was the soul concept behind this project. Thus there was a need to design a process by which this was possible. Hence a participatory approach which would enable to develop housing solutions appropriate to tribal community has been designed accordingly.

4.2 Design of PDA

The participatory approach adopted basically involves three distinct stages of data collection, interpretation and feedback as explained below.

4.2.1 Stage 1: Appraisal of Human Settlement

The first stage of participatory design is the appraisal of the human settlement and habitation in the regions under considerations. The assessments provide a summary of the key characteristics of the settlement and identify areas of historic sensitivity, landscape and community value.

Participatory appraisal is a major step in the whole process of participatory design. Participatory Appraisal is a community-based approach facilitating consultation that gives priority to the views of local people, on the basis that they are the experts in their own lives,

and are thus best placed to come up with a programme of collective actions. PA provides a wide range of flexible, adaptable tools and techniques, designed to provide methods of consultation that can be chosen and reworked to suit whichever group is taking part in the process (NESP report, 2003). This stage involves formation of community coalition, problem identification and understanding community characteristics. The major tools for PA adopted in the study are, transect walks, village mapping, community activity chart and trend analysis (Figure 4-1).

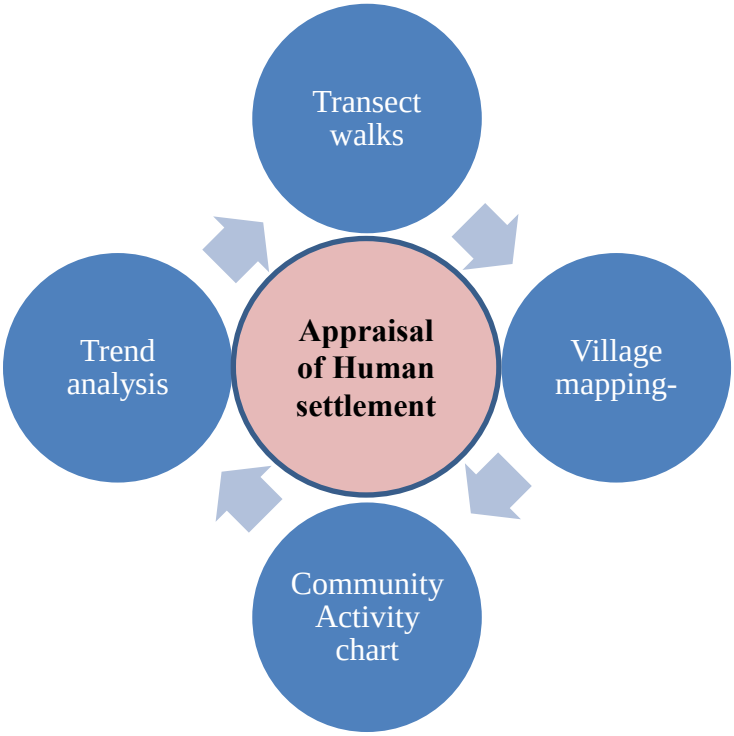


Figure 4-1: Tools of Participatory appraisal

Transect walks are conducted to observe/listen & identify critical settlement conditions and ask relevant questions to identify solutions. Transect walks are usually done in such a way that most of the settlement area is covered. It is an information gathering exercise which gives a clearer picture about the problems and potentials of the site, as perceived by the community. Village mapping is another tool which is used to represent or model current or historical conditions of the site with the help of the people within the community. In village mapping, the boundaries, major landmarks, drinking water sources, community spaces, etc. are mapped either completely by the community members or partially with the help of the community members. This exercise also helps in making the people aware about the problems and potentials of their settlement in terms of orientation, institutional insufficiency and also their resilience to disasters as a community.

The next tool is a community activity chart that is supposed to exhibit different kinds of activities carried out by the members of the community and the spatial connotation of their social activities. This tool is supposed to highlight the major user space interaction of the community. Community activity charts helps in the design process by pointing out the major spaces of utilization by the individuals and also by the community. Finally, a trend analysis is to be carried out in PA to understand the adaptability and change of perception of the community members towards modern construction materials and techniques.

4.2.2 Stage 2: Mapping of households and housing characteristics

Household character mapping is a tool for gathering information about the socio economic and cultural context of different family constituting the community. The major activity in this stage is the household survey. A structured questionnaire has been designed for household

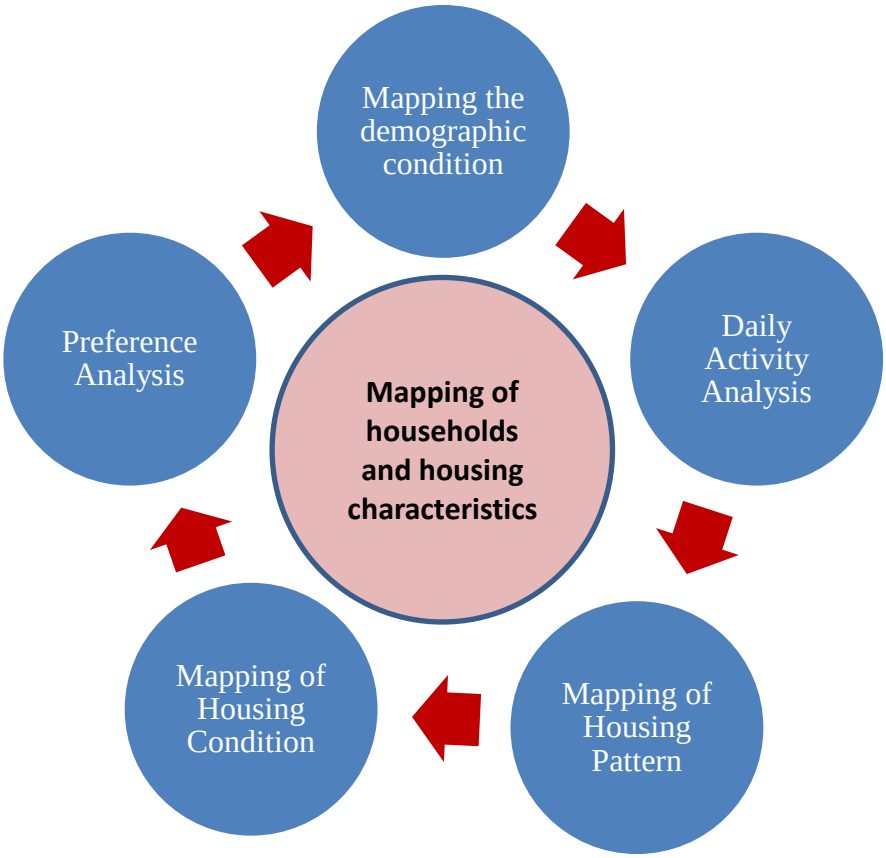


Figure 4-2: Mapping of households and housing characteristics

character mapping (Appendix A). The survey is utilised for various purposes like mapping the demographic condition, for understanding the daily activity pattern of the members of the family, mapping the change and development of housing pattern and typologies in the

settlement and finally for understanding the preferences of the members with respect to design of the housing units, materials and methods of construction , etc. (Figure 4-2).

Daily activity analysis is to be carried out for the Mapping the pattern of activities carried out in one day and its spatial connotation. Housing pattern in the settlements are to be mapped to understand the housing typologies and their spatial organisation and adequacy. The next topic of assessment in the survey was the evaluation of the housing condition to identify the current condition of the units, to identify the building materials used, understand the methods of construction and to know the community's acceptability and satisfaction towards housing. Finally, a preference analysis is included to know the aspirations and preferences of the community about their requirement of future housing units and settlement.

4.2.3 Stage- 3: Design Appraisal

Appraisal of the housing design is planned to present the initial housing solution to the community. Figure 4-3 shows various stages of design appraisal. It facilitates the appraisal of the proposed housing units by the community themselves prior to implementation followed by collecting their feedback on the same. This helps to modify the proposed solutions appropriately incorporating the community opinions.

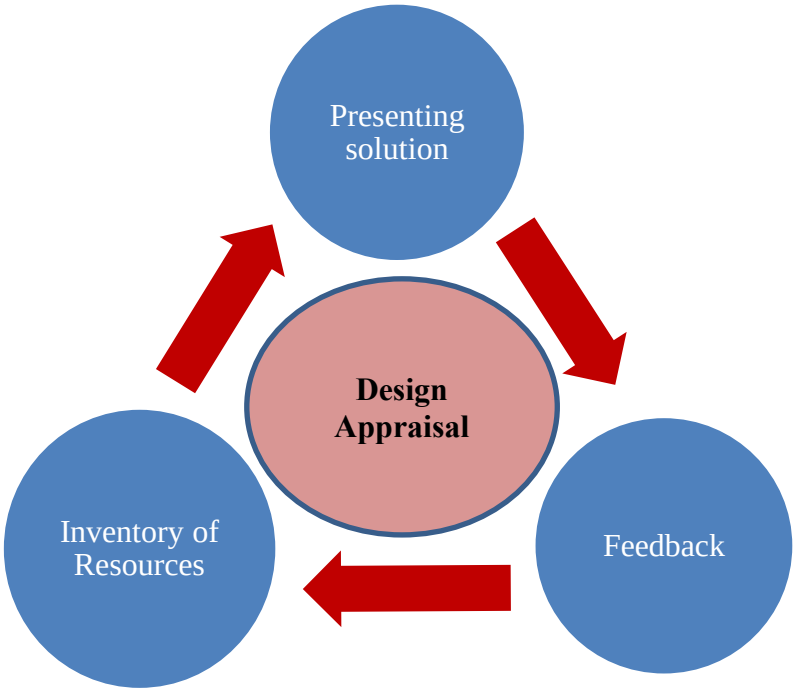


Figure 4-3: Stages of design appraisal

This stage also enables to understand the community perception on the problems and prospects of the current housing style, their preference on materials and methods of housing

construction as well as preference on mode of project implementation. Additionally, an appraisal of available capacities and resources, human as well as material, is also conducted through community consultation. Based on the reflections from the design appraisal, a final housing design that best suits the needs and preferences of the individual as well as the community as a whole can be arrived at.

Part II

Execution of Participatory Design Approach

CHAPTER 5. APPRAISAL OF HUMAN SETTLEMENTS

5.1 Introduction

For the initial appraisal of the current status of the settlement and conditions of human habitation three tribal settlements of the vulnerable community (refer chapter 2- Part I) have been identified. Transect walks were conducted through the settlement. Village mapping was done with the help of the community representatives and tribal promoters. Details of initial site exploration of each community settlement is given below.

5.2 Adiya Tribal Settlement, Chalighadha, Mananthavadi

Chalighadha is a dispersed settlement of Adiya community spread across 10 acres of land at thbank of river of Kabani. This settlement falls under village Payyampally in Mananthavadi Taluk, in Wayanad district. The settlement is of more than 80 years of existence with a present population of 197 people in 52 families housed in 43 houses. This settlement also is dispersed within a total area of 5-7 Acres. The physical characteristics of the settlement is mapped by conducting a transect walk across the community. Each household has land with size varying from 4 cents to 50 cents

Figure 5-1: General view of chaligadha settlement

Some families rent out the nearby fields for cultivating rice, cowpea etc. A few families own lands (about an acre) within the settlement are cultivating coffee and planted rubber trees as well. The settlement primarily comprises of semi pukka houses constructed with the help of various housing schemes and programs. No Educational facilities are available within the settlement. The nearest Anganwadi is 1.5km away, School is 2.5km away, and the nearest college is at Mananthavady which is 12km away. The children who are availing hostel

facilities are attending school regularly others usually drop out after 7th standard. The residents depend on the Public Health centre at Kurukkanmoola (located 2.5 km away) and the Taluk hospital at Mananthavady (12 km away) for most of their basic medical needs and immunisation facilities. The nearest ration shop is at palvelichal which is 2km away from here. The Two community wells within the settlement serve as their drinking water source. No piped water supply is available to the individual houses. There are no community facilities such as community meeting place, playground available. A community graveyard is available in one corner of the settlement. Unlike most of the other tribal settlement, there is no temple or any religious buildings found in the settlements.

Chalighadha is easily accessible within walking distance (800m) from Chalighadha – Kuruvadweep road. The approach road to the settlement is in bad condition due to inundation during the last two years flooding. The location of the settlement is highly vulnerable in terms of flooding and inundation as it's on the shores of Kabani River.

In 2018 flooding, four houses in the settlement had completely damaged, and the floodwater receded only after three days. The water level rose to six feet from the ground level, which damaged some of the temporary shops too. In 2019 floods, the Kabani River changed its course and flowed through the settlement. Seventeen houses got damaged and of which eight

Figure 5-2: Images showing flood destruction

became inhabitable. Trenches have formed in some parts of the settlement which can results in more damages in the raining season. Figure 5-2 shows the destruction due to flooding in the settlement. A reallocation of the settlement by considering the topography and the course of Kabani River is required in this settlement.

From the community interaction it was realised that the majority of the community have shifted their livelihood from being agricultural labourers to becoming farmers now. The community have recognised the importance of education and has started sending their kids to school. They have become more conscious about health these days and are regular in giving vaccination and in hospital visits. There is also a tremendous shift in the housing pattern as shown in Figure 5-3. Most of the buildings in the settlement have converted from kachcha houses to pucca ones. In Chaligadha settlement there was no public space allotted for religious worship or gathering unlike other communities.

Figure 5-3: Change in housing typology

5.3 Paniya Tribal Settlement at Basthipoyil and Kolathara, Panamaram

The paniyas are believed to be slaves to the local landlords and had bonded labour to their families. Employers (landlord) used to provide them with food and shelter, even when there was no work. They live in groups called “kunt” and their household units were known as “kulu”.

Two settlements namely Basthipoyil and Kolathara were studied for mapping the habitat condition of the Paniya Community. There were 26 households in 11 houses in the Basthipoyil tribal settlement while Kolathara settlement consisted of 45 households residing in 32 houses. The general view of the settlement is shown in Figure 5-4.

Figure 5-4: General view of the settlement

The settlement is dispersed within a land of almost 10 Acres with each household owning land of 50 cents to 1.5 Acres. Most of the community is engaged in agricultural activities in their own land in the settlement. Some are also working as agricultural labours in nearby fields.

Figure 5-5: Current pattern of housing

Currently the community lives in brick (or) laterite walled thatched, Brick or laterite walled tiled, and small concrete houses as shown in Figure 5-5. The community is observed to have developed common activity spaces within the settlement (Figure 5-6). They have also made additional living spaces, storage spaces for firewood and other goods, etc. as shown in Figure 5-7.

Figure 5-6: Community spaces

Figure 5-7: Temporary structures

With regard to the infrastructure services, the community receives water supply from jalanidhi water supply connection. It also has three community wells. All houses in the community are electrified. The community also have recognised the importance of education and is sending their kids to school. The nearest angananvadi is 1km away and the nearest UP school is 3km away. Nearest high school is 5km away at Panamaram and the nearest college is in mananthavady which is 10km away. There is no playground or play area within the settlements.

The physical condition of the settlements was mapped during the transect walk. Both the settlements are at the bank of the Panamaram River. As a result, they are found to be highly vulnerable to flooding. The settlements were severely affected during the flooding 2018. Many houses were either fully or partially destroyed beyond repair. Figure 5-8 highlights the pattern of damages to the houses in the settlements.

Figure 5-8: Pattern of damages due to flood

There were also some temporary structures within the community which was made by some NGOs post flood (shown in the figure below). These structures are made of GI sheets, which are bend in such a manner that they act as both walls and roof. These temporary structures were reported to be very hot during day time due to the material used.

Figure 5-9: Temporary shelters built by NGOs

5.4 Kattunaika Tribal Settlement, Vattappadi, Mananthavady

The community is located in a small village called Irulam at Poothadi village panchayath, 3km from Mananthavady town. The settlement is very well connected to the nearby locations by the Pulpally- Sulthan Bathery Highway.

This settlement also is dispersed within a total area of 14- 15 Acres. The physical characteristics of the settlement is mapped by conducting a transect walk across the community. Each household has land with size varying from 50 cents to 1.5 Acres. The settlement is distributed in a radial pattern. There are a total of 25 houses in the colony. Most of the houses are pucca houses as presented in Figure 5-10.

Figure 5-10: General view of the housing units

This kattunaika settlement is located in Irulam, Wayanad. Irulam is a village located 3 km from the Mananthavady town, where we can see the relation between the tribals, forest and farming. The settlement is scattered in between forest and coffee plantation and is found to be developed organically without affecting the existing topography. The settlement is done based on the climatic orientation and less disturbance to the existing topography. There are sacred groves in the centre / origin of the community (Figure 5-11). There are mainly three shrines, and two are situated deep with the forest.

Figure 5-11: Sacred grove at the center of the community

There is no well-defined pattern of houses due to the sloping terrain of the settlement. The settlement is distributed in the radial pattern. Some of the houses are not in use. Community is close knit, and hence buildings are placed close another to have maximum interaction

Figure 5-12: Community center

spaces and protection from others. They also have a community centre at the origin of the settlement (Figure 5-12). Their technical skills are much utilized by the tribes in their building components / elements (Doors and knitted partitions).

The approach to the settlement is by a narrow road that is approximately 2.2m wide which is paved using interlocking tiles. Individual units are approached by muddy footpaths varying in size. Paved footpaths have been laid only partly within the settlements. Individual units are approached by muddy footpaths varying in size, which runs through the side of front yards and provides room for increased interaction between the inhabitants. One of the roads was laid under the NABARD – Tribal department in the year 2016-17.

Figure 5-13: Muddy interior pathways

The main livelihood activity the community engaged is agriculture labour. Some of them do cultivate coffee in their residential land. The main activities that occur within the settlement are cooking, drying of crops, agriculture, handicraft and other daily activities. Cooking is done in an earthen stove slightly above floor level and which is easily accessible by the user by in simple sitting position.

Racks are arranged on top and sides and are easily approached by slightly standing up bending the knee. Dining and sleeping occur within the same area that is the extra hall attached to the kitchen. During day time this space acts, as well as dining space and mats, are removed from floor and stored in storage units situated above room level. At night these are taken out, spread and used for sleeping. Whole of activities which takes place in the settlement ends by the sunset. Morning the routine begins by sunrise. Front yards also host many activities during summer when the climate is favourable

Most of them do not have a patta to their land, but has a right to possess the land. Most of the houses are built in the year 2014 – 15. Several housing schemes including HUDCO, LIFE mission and PVTG, are implemented for housing development (Figure 5-14).

Figure 5-14: Current pattern of housing (built under various schemes)

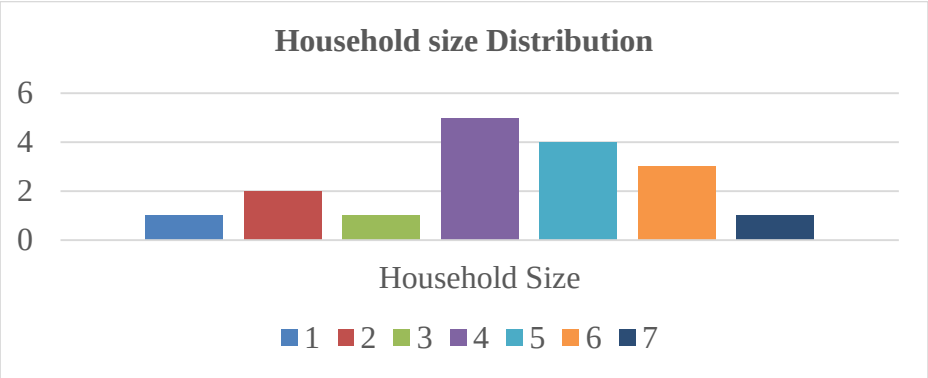
CHAPTER 6. MAPPING OF HOUSEHOLDS AND HOUSING CHARACTERISTICS

6.1 Household survey

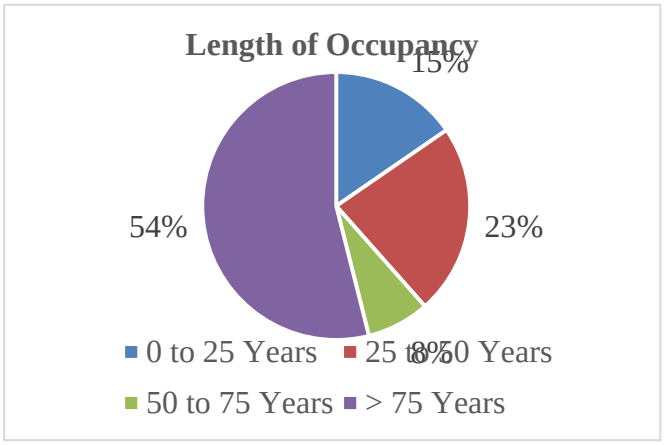
As a part of the execution of participatory design approach, a primary study of the selected tribal communities at specific locations was conducted. This was done to understand the current socio economic status of the identified community settled in a specific spatial context, their settlement and housing characteristics as well as the aspirations and expectations on future housing development. The study also aimed to understand issues and concerns of the community regarding achieving a sustainable housing solution in the specific context. The survey was carried out with the help of questionnaire (attached in Appendix A). It was also attempted to comprehend the requirements of the community through discussions with individual households as well as community leaders and other representatives such as tribal community promoters. The questionnaire had two sections. First section covered the general details of the settlement. The second section dealt with the demographic and housing characteristic of the community which included aspects such as socio economic and livelihood pattern of the members of the family, details of design as well as construction of existing housing, physical vulnerability of the settlement, current status of the housing infrastructure, and level of satisfaction with the same and finally aspiration regarding the future housing. The analysis of the data thus collected is explained in detail in this chapter.

6.1.1 Data analysis

6.1.1.1 Adiya Community at Challigadha, Payyampalli Village

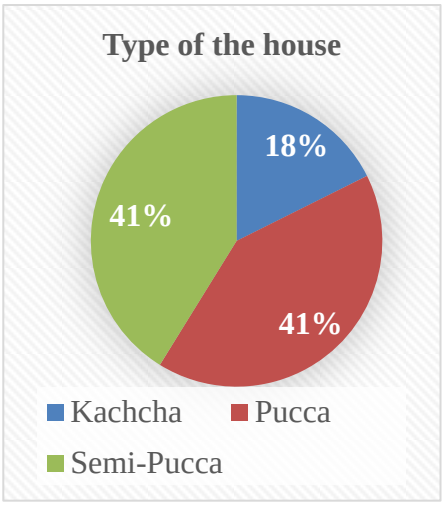


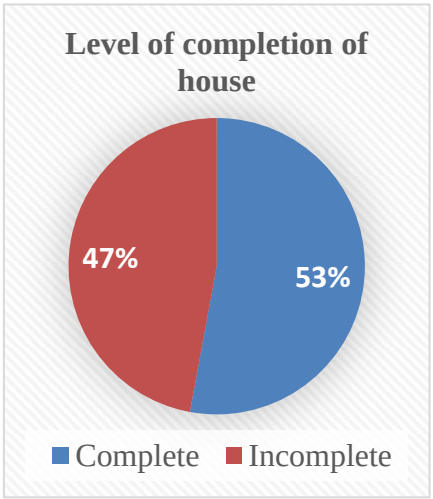
The survey results show that seventy-one per cent of the families are having a household size ranging from 4 to 6. Length of occupancy suggests that more than 50% of the families were residing in the area for 75 years or more. An average daily income per person in the community is found to be Rs.375, and there is a higher percentage of families with growing or matured children.

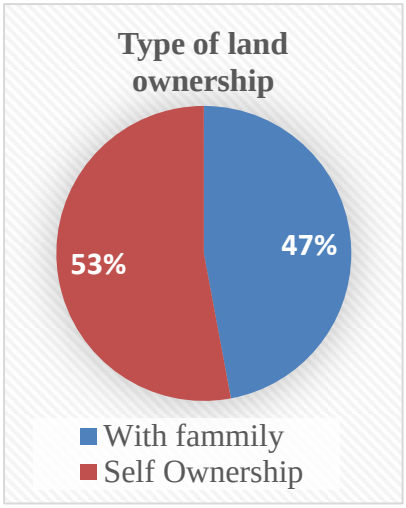


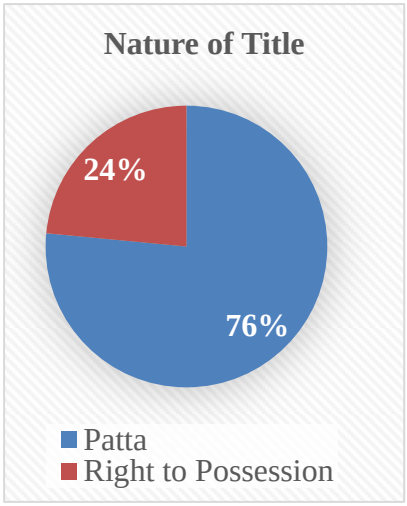
Family Composition			
Aged couple living alone (age > 55 years) /Couples beyond reproductive age	**Coupes with children in the age group of 0 to 6**	**Couples with School going children (age 7 -15)**	**Couples with mature Children**
3	1	5	8

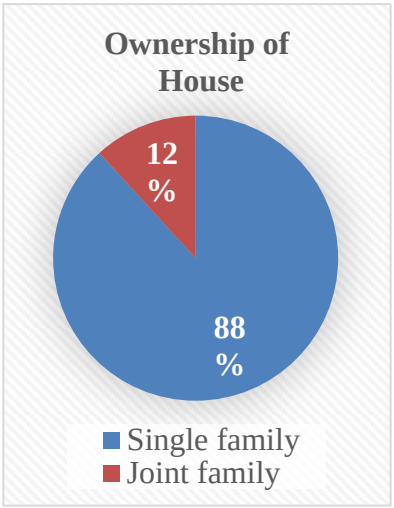
Housing Characteristics





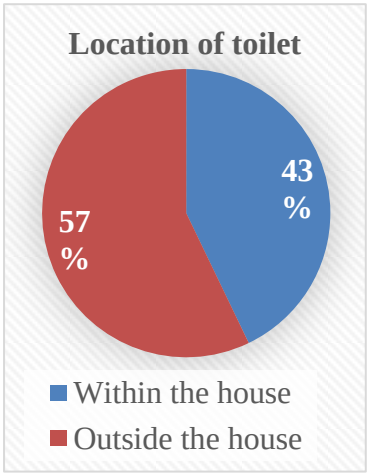


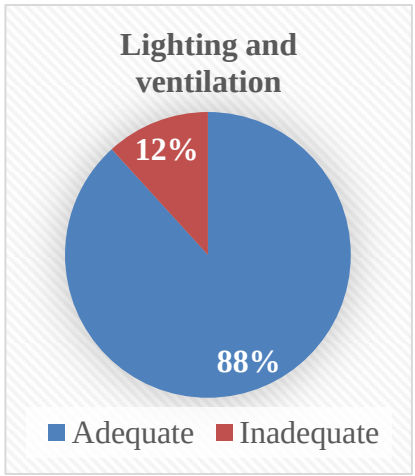


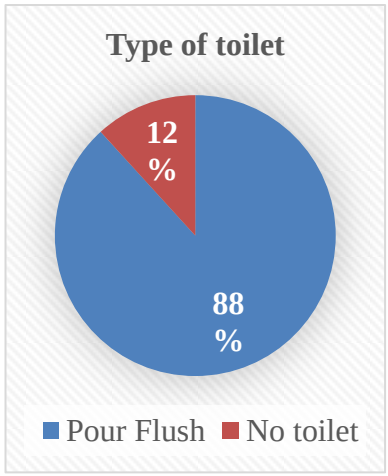


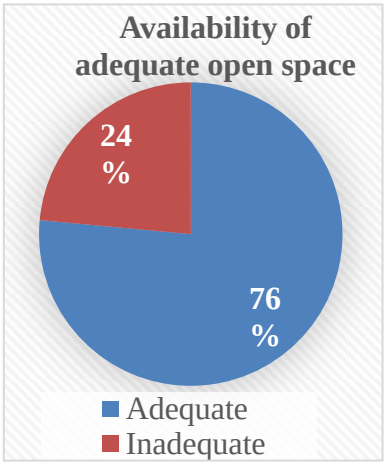
More than half of the land owners are self owners, and 88% of the dwellers own their house (i.e, not along with the family). Seventy six percentage of the land owners possess a patta to their property.

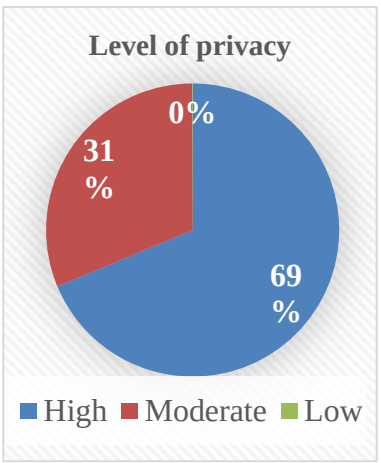
Details of basic amenities





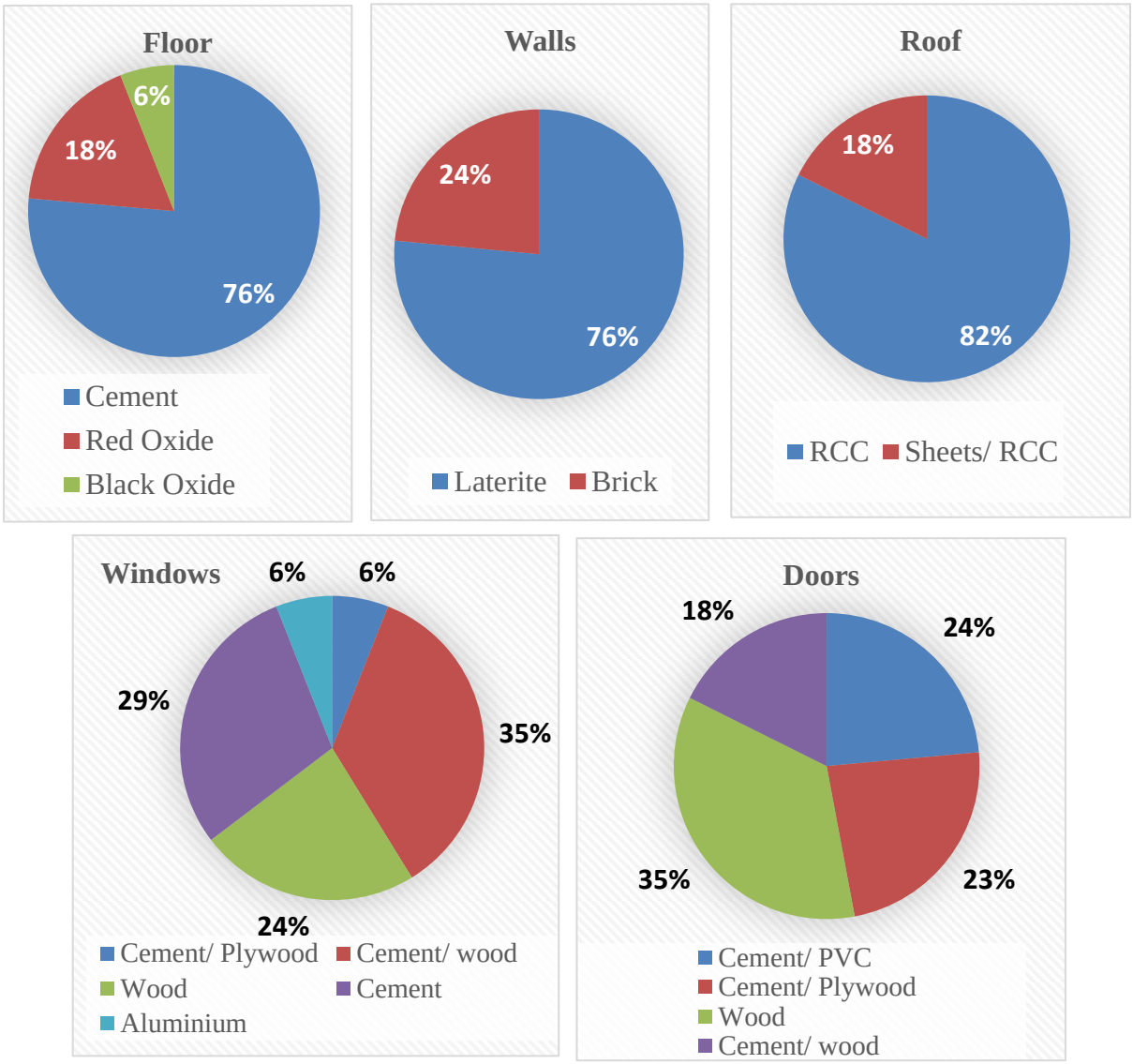




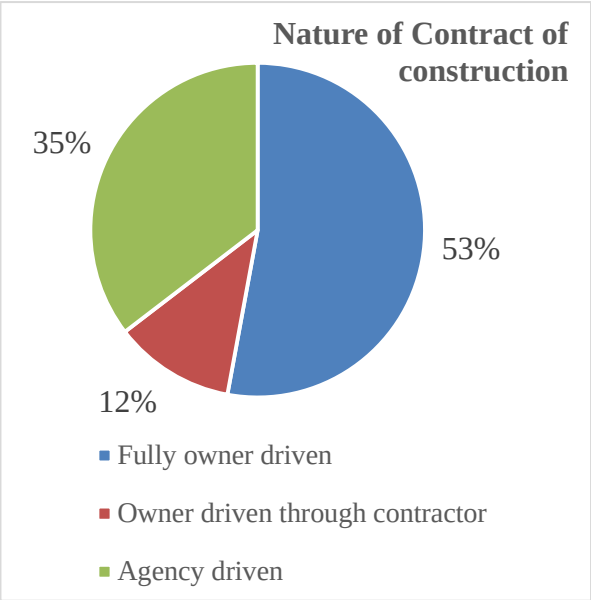


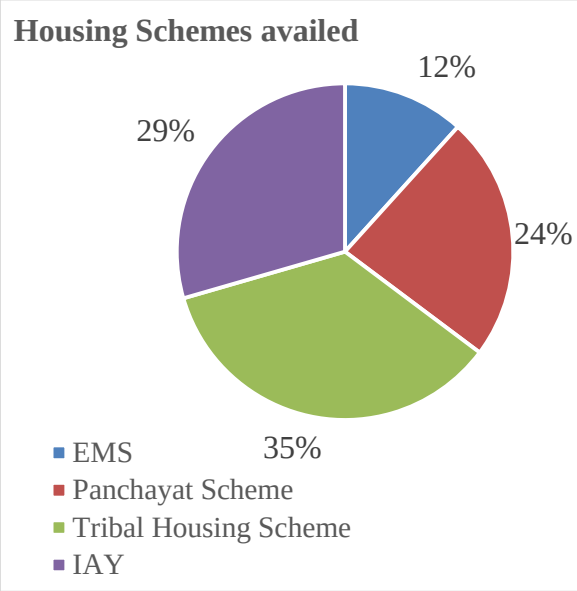
The settlement does not have a closed drainage facility. The community as a whole faces shortage in the water supply. Drinking water is drawn from a well which is more than 100m away. All hoses in the settlement are electrified and 88% reported to have sufficient lighting and ventilation. Seventy-six percentage of the dwellers reported that they are having adequate open space around the house. There is no deity worshipping in any of the houses in this community. 94.2 % of the households surveyed do not own a vehicle and Thirty-one percentage of the people reported to have very low privacy levels in their home.

Materials used in construction



The survey data results reveals that more than 70% of the houses have their walls, floor, roof and foundation made with modern construction materials like laterite, cement, RCC and Granite.





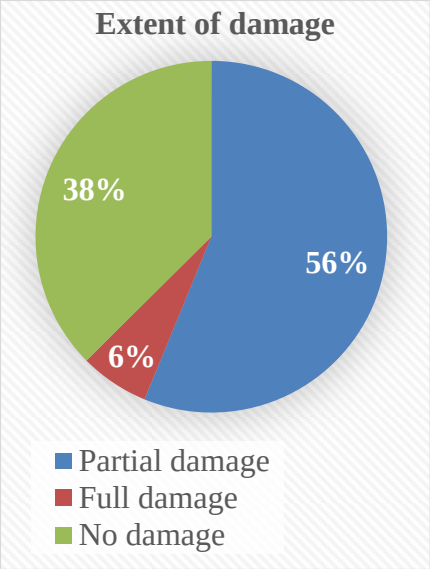
- Period of housing scheme implementation: 2001-2018

Program for construction of Kitchen and Toilet

WSS scheme by Caritas India in 2018 facilitated the construction of kitchen and toilets in some of the houses. The project was entirely executed as an agency driven project. The agency provided materials and labour for the construction of the kitchen and toilet (Figure 6-1). The agency also helped the residents in the installation of the additional plumbing fi by them.

Figure 6-1: Kitchen and toilet constructed under WSS scheme

Physical vulnerability of settlement



All of the houses surveyed were affected by floods and was exposed to either floods or low lying inundation. Fifty six percentage of the houses were partially damaged in the flood, and 6% were fully damaged.

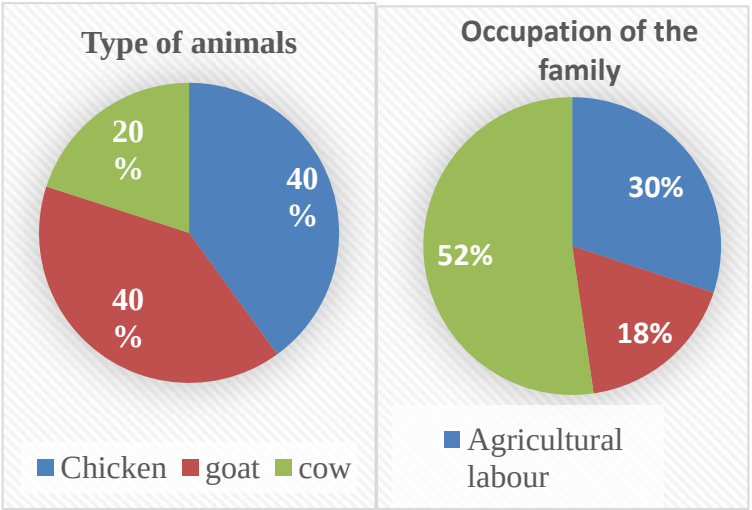
Figure 6-2: Partially Damaged- dislocation of wall masonry

Figure 6-4: Fully damaged house

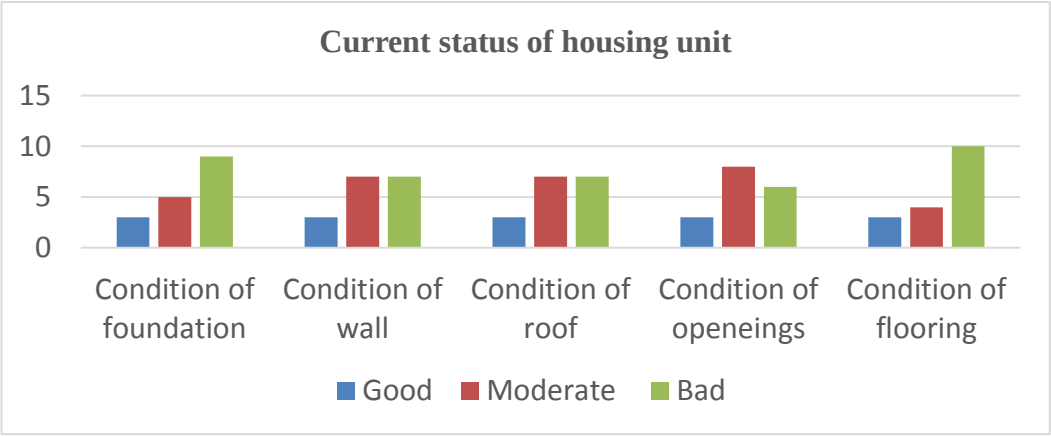
Figure 6-3: Scouring of foundation soil

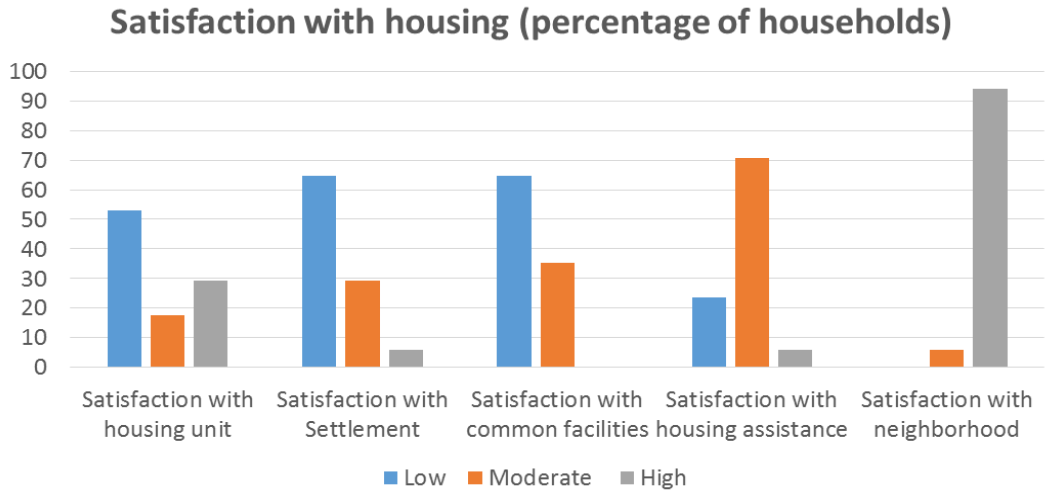
Details of employment status of family

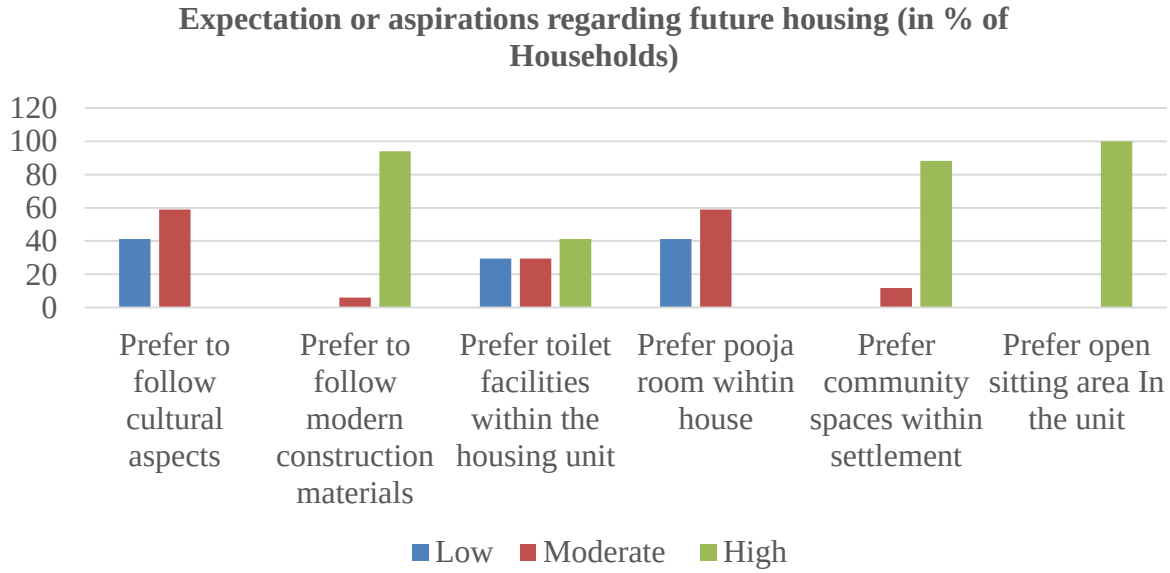
Fifty two percentage of the dwellers are self-employed as coolies or other jobs. 41.2 % of the people surveyed are involved in animal husbandry/ dairying.



41.2 % of the people surveyed are involved in poultry farming, but only 42.85% of these farmers are having the facilities for poultry farming. These data indicate that there is a need for storage space for storing the products of farming and also spaces for storing their fodder, other agricultural tools, etc.





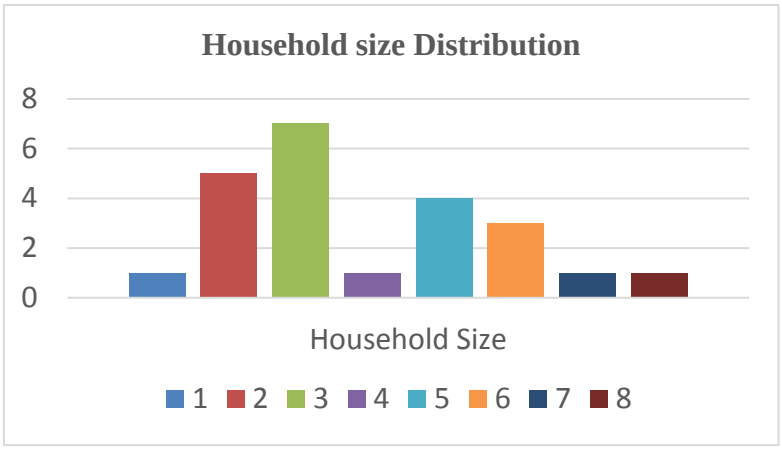


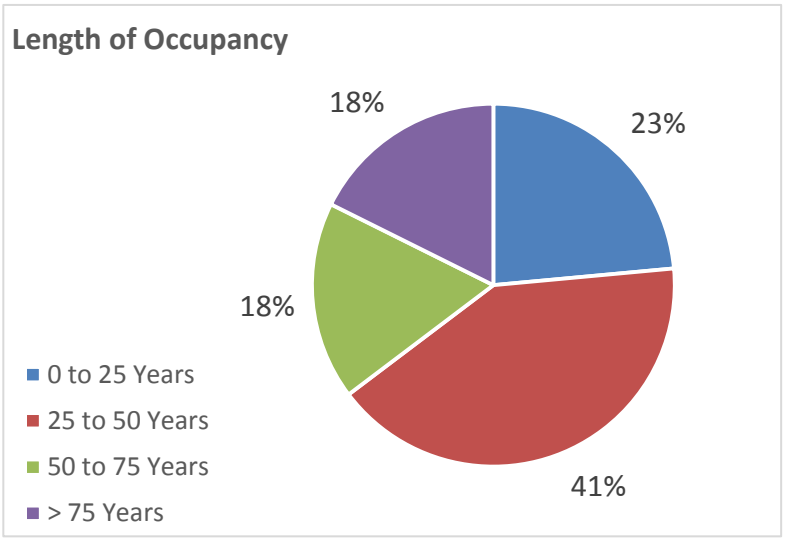
6.1.1.2 Paniya Community at Basthipoyil and Kolathara Settlement, Panamaram

Socio Economic Details

The household survey reveals that Fifty-two percentage of the community has a household size ranging from 2 to 3. 30.43 % of the community has a household size ranging from 5 to 6.

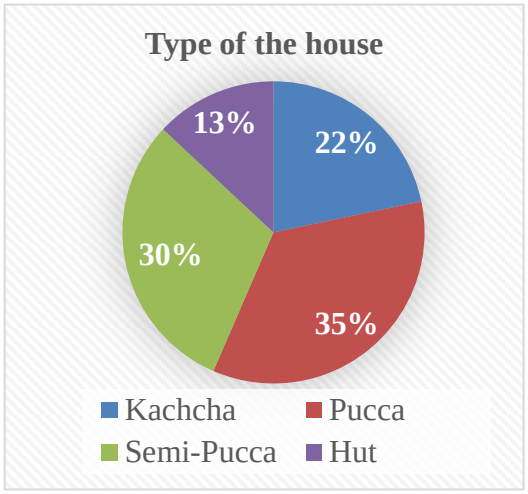
41% of the families are living in the settlement for about 25 to 50 years. The average daily income per person in the community is found to be Rs. 340.

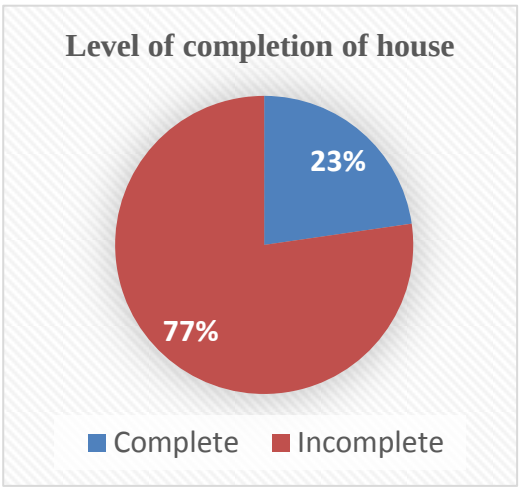


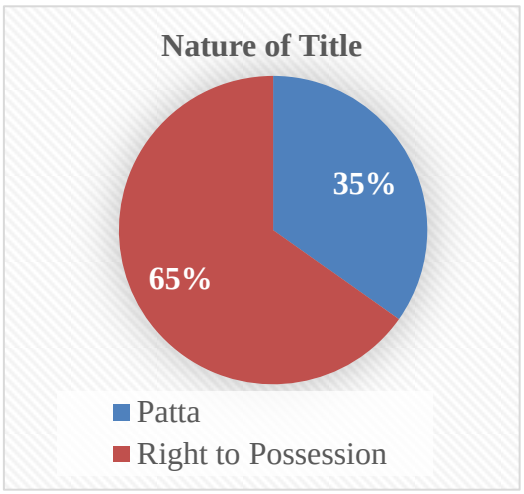


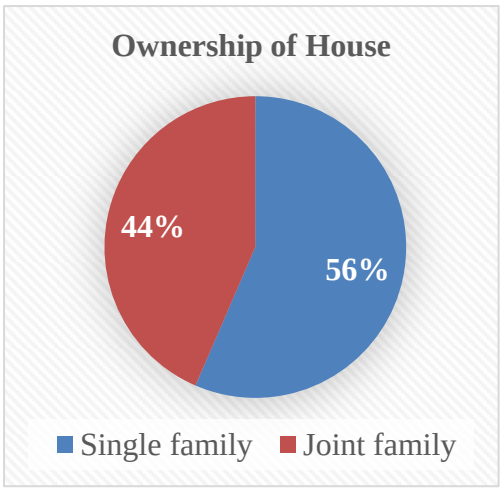
Family Composition			
Aged couple living alone (age > 55 years) /Couples beyond reproductive age	**Couples with children in the age group of 0 to 6**	**Couples with School going children (age 7 -15)**	**Couples with mature Children**
4	4	8	7

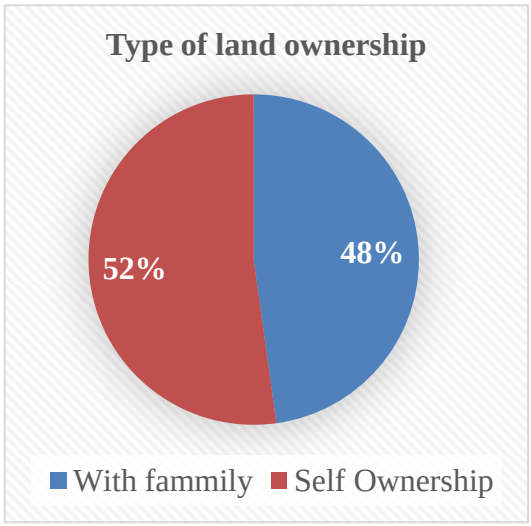
Housing Characteristics





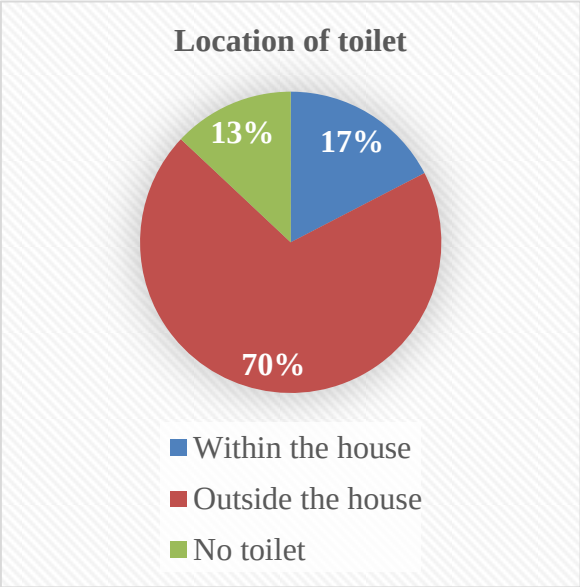


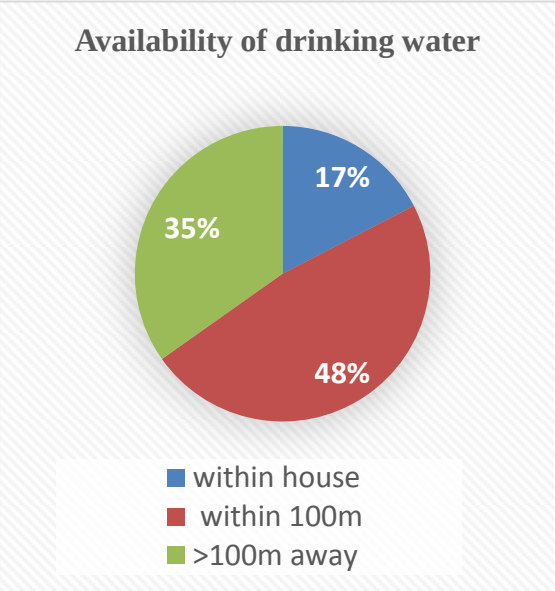


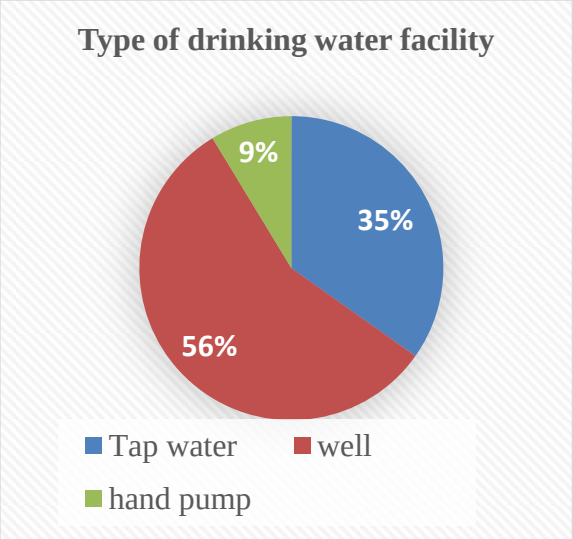


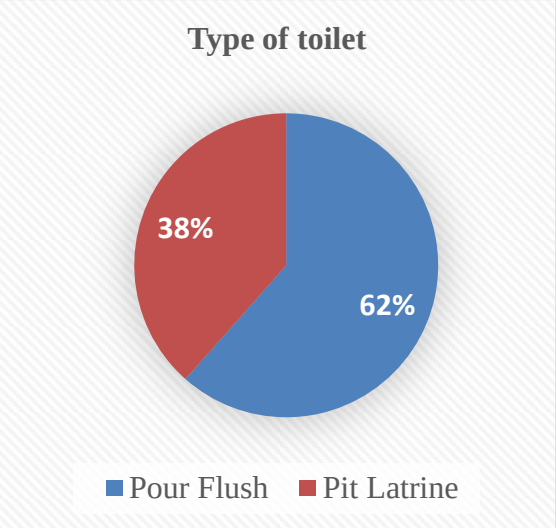
More than half of the community own land, and 56% of the dwellers own their house (i.e, not along with the family). 66% of the land owners possess a patta to their property. Construction of more than half of the houses are still incomplete.

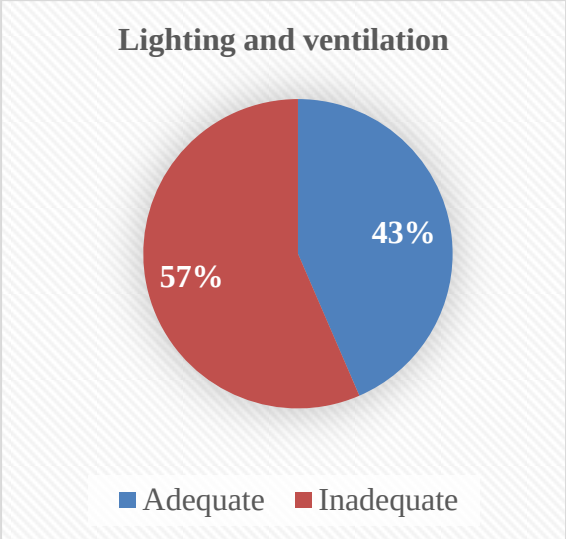
Details of basic amenities

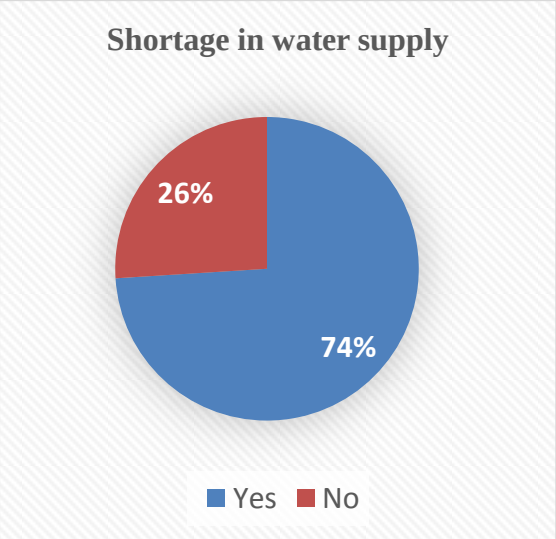






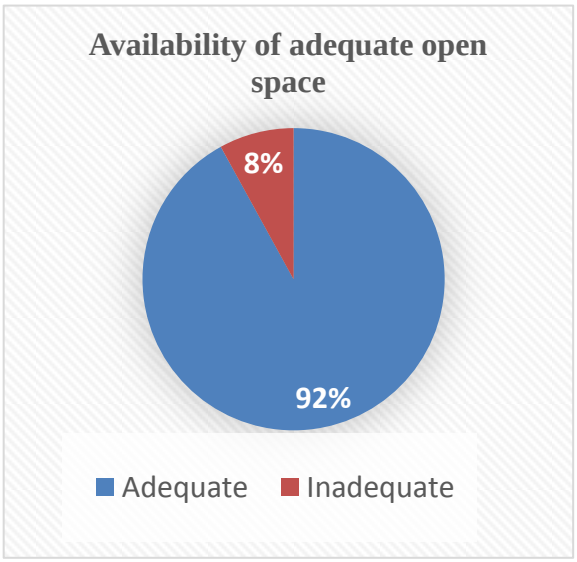


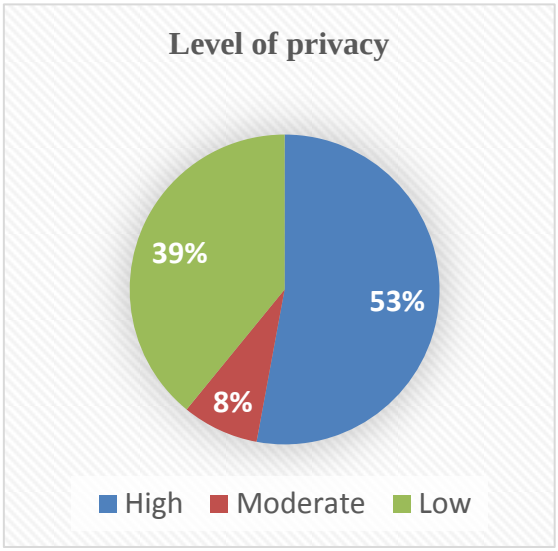


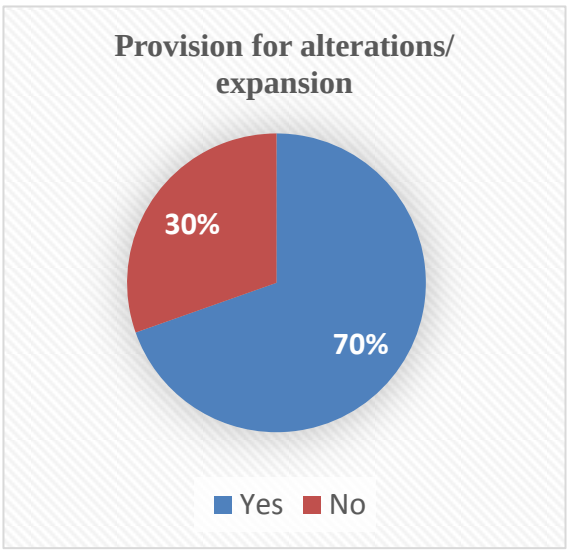


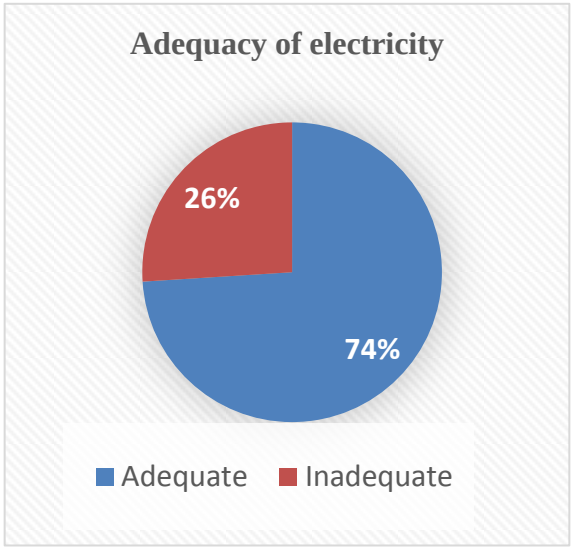
The community has an open drainage facility. Only 17% of the households have drinking water availability within house, while 48% of them have to travel more than 100m for drinking water. Most of the dwellers depend on well water and tap water and less than 10% of them use hand pump. 70 % of the households have toilet outside their house. 62% of them use pour flush system. More than half of the interviewees reported adequate lighting and ventilation.

Details of basic amenities

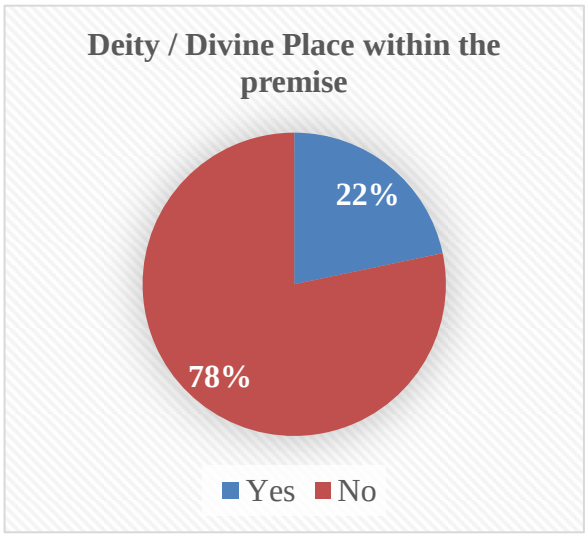




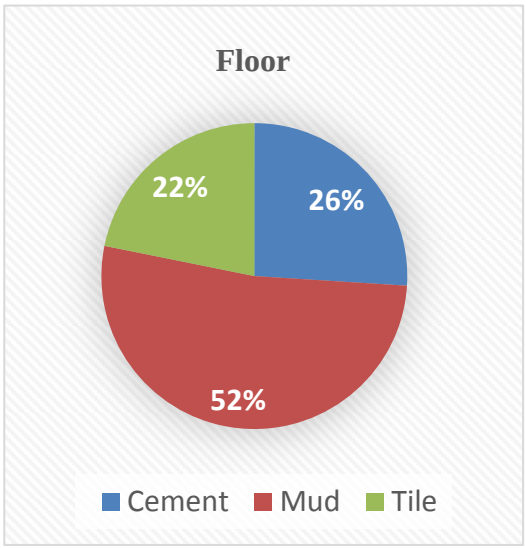


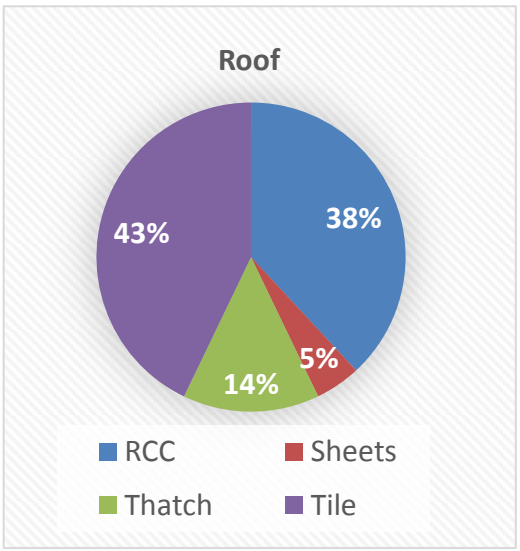


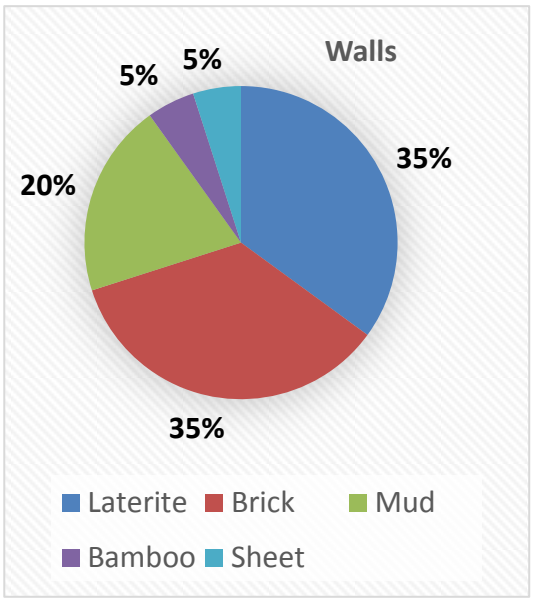
There is no proper solid waste management system in the settlement.74% of the people have adequate electric supply. 39% have complaints on privacy in their home. 70% of the houses have provisions for alterations or expansion of the current unit. 78% reported of not having a deity or divine place in their premise or house.

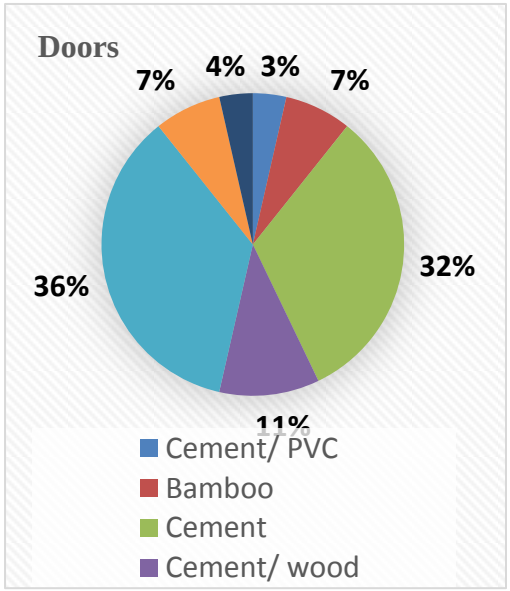


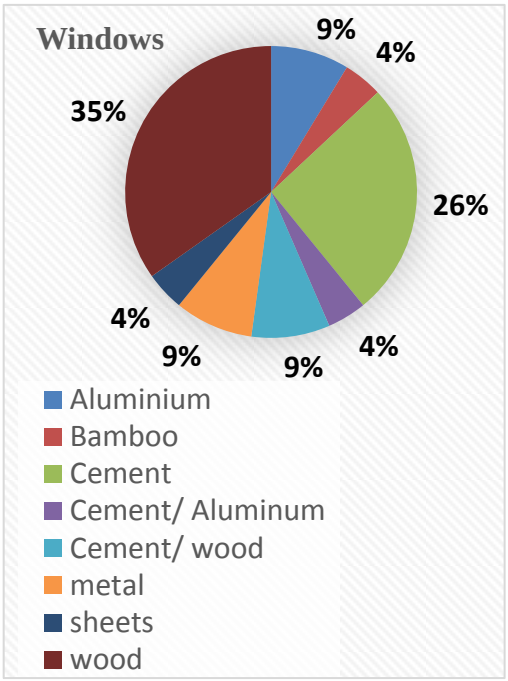
Material used in construction

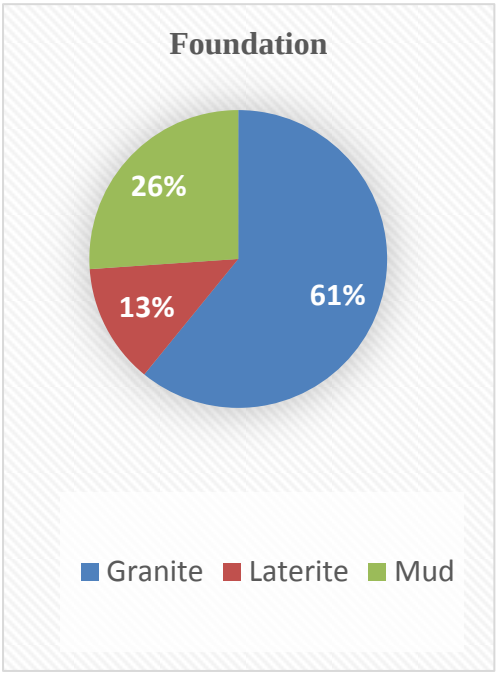


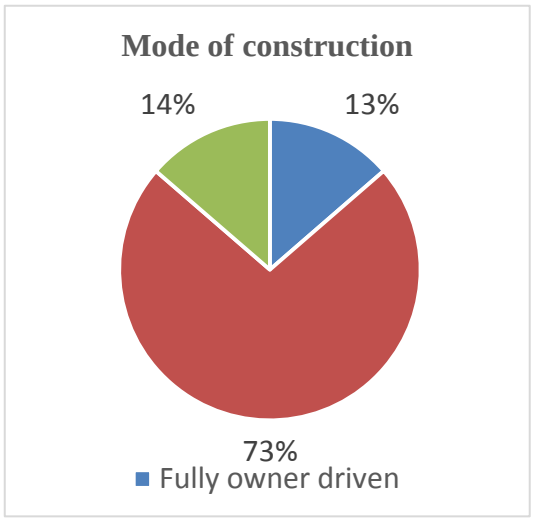


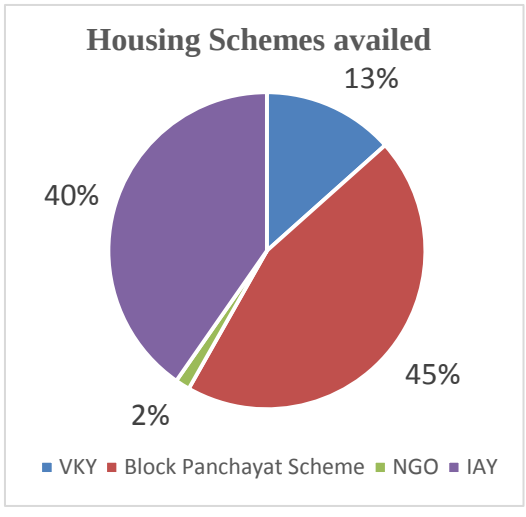






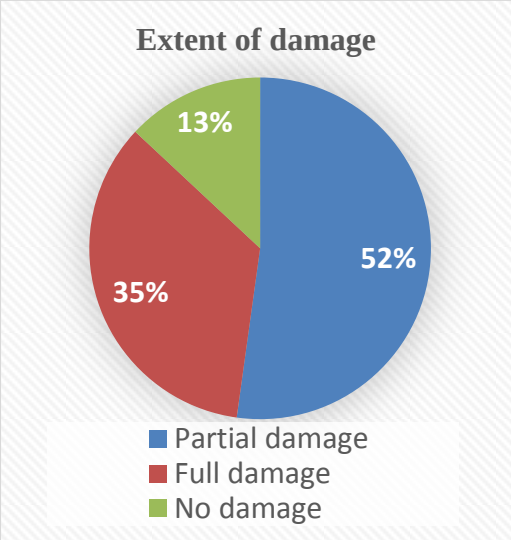






Years of housing scheme implementation: 1996-2019

Physical vulnerability of settlement



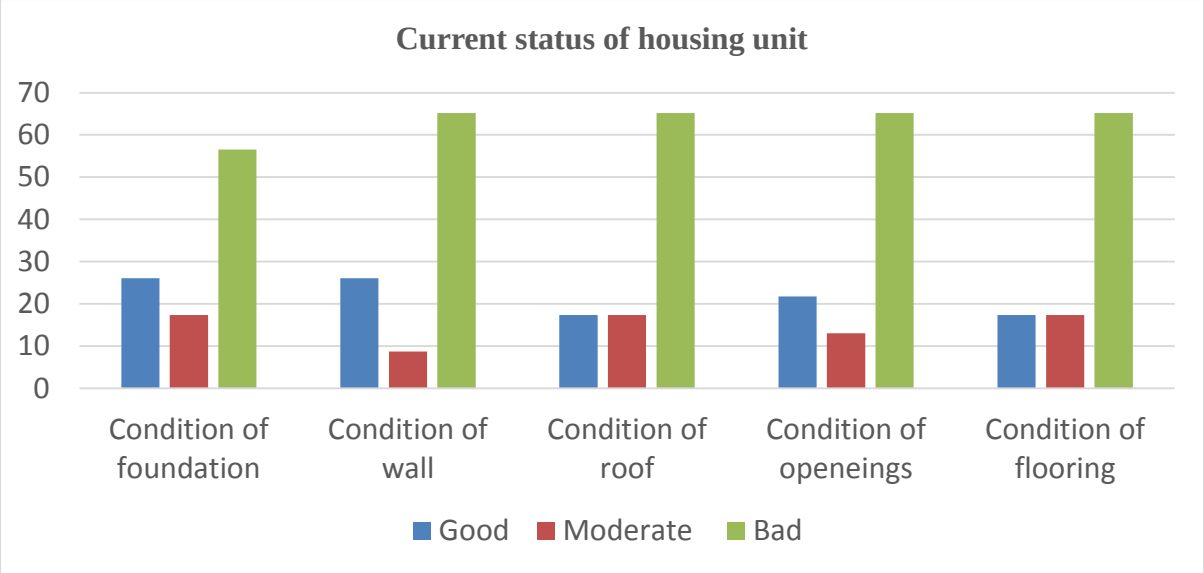
All of the houses surveyed were affected by floods and was exposed to either floods or low lying inundation. 35% of the houses were fully damaged in the floods while 52 % of them were partially damaged. There was dampness on the walls of most of the buildings.

Figure 6-5: Shattered roof

Figure 6-6: Damaged walls

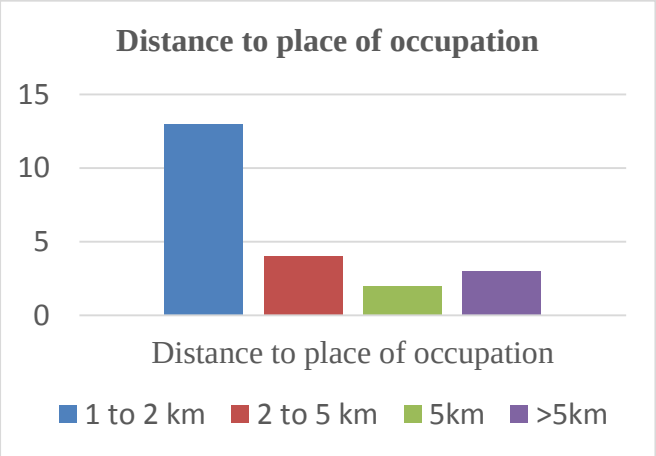
Figure 6-7: Damp walls

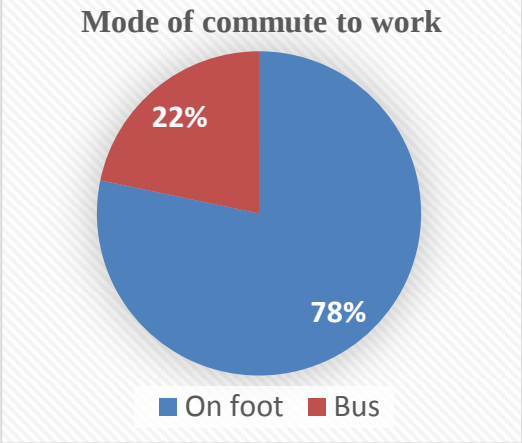
Figure 6-8: Completely collapsed building



In this community 20% of the houses are constructed using mud. 52% of the houses have mud flooring, while 26% of them have foundation made with mud. Even though majority of the houses have RCC or tiles for roofing, 14% are still thatched roofs. Majority houses have cement frames for doors and PVC panels, while majority houses have wooden windows.

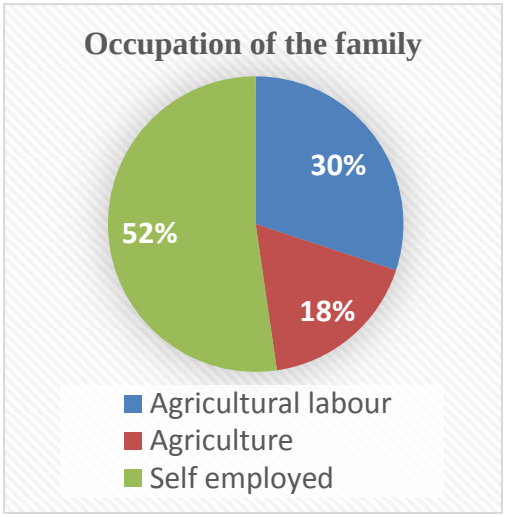
Livelihood Characteristics

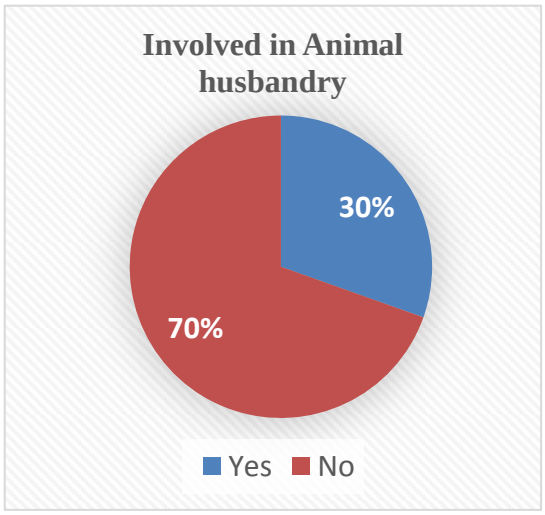


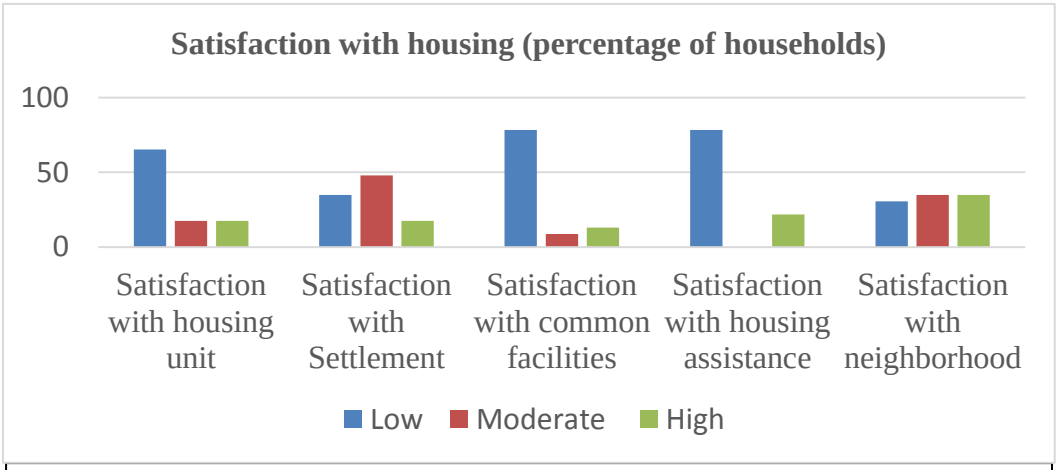


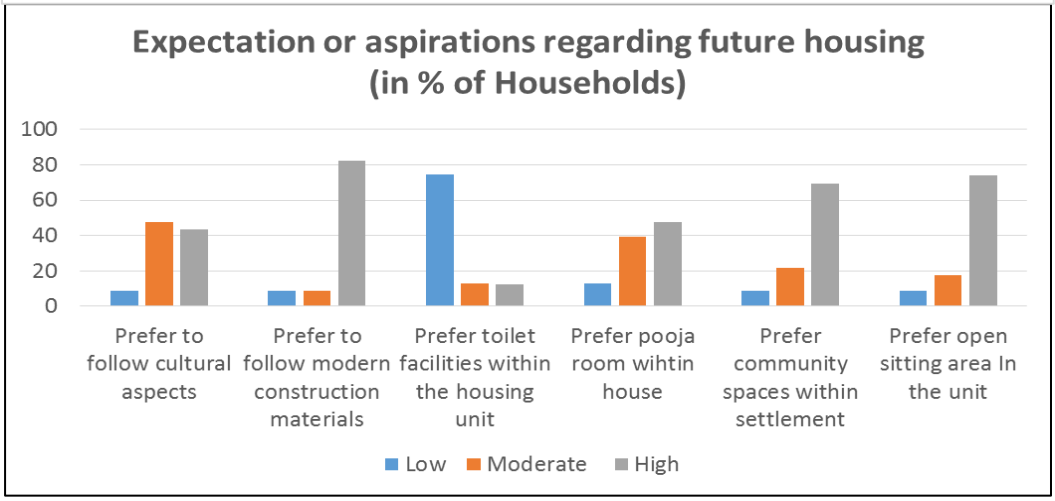
Details of employment status of family

All of the members of the community are engaged in agricultural labour. More than half of the families depend on daily works. Most of these people work within a distance of 1 to 2 km of their house. 78% of the workers commute on foot. 70% of the dwellers are involved in animal husbandry with 75 % of them having cows.



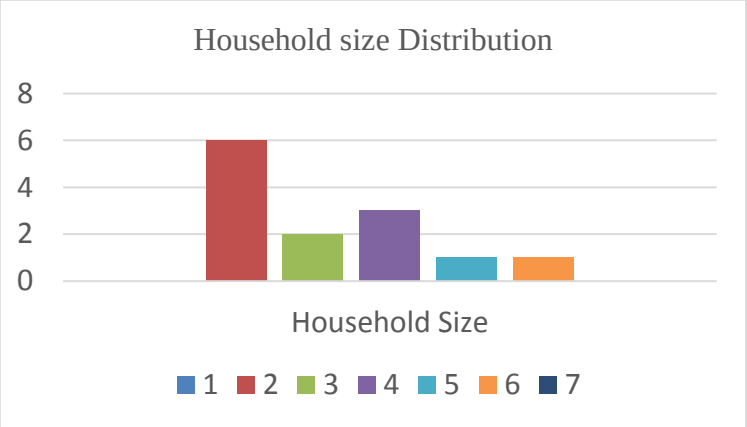


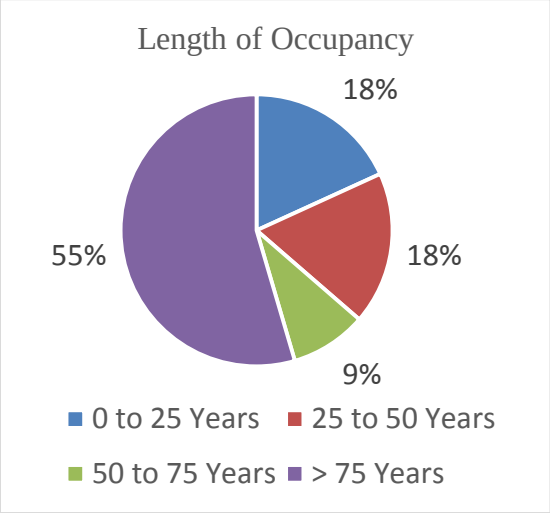




6.1.1.1 Kattunaikka Community, Vattappadi Settlement, Poothadi Village

It is identified from the household survey that forty-six percentage of the community has a household size of 6. More than 50% of the families are residing in this settlement for 75 years or more. The average daily income per person in the community is Rs. 400.





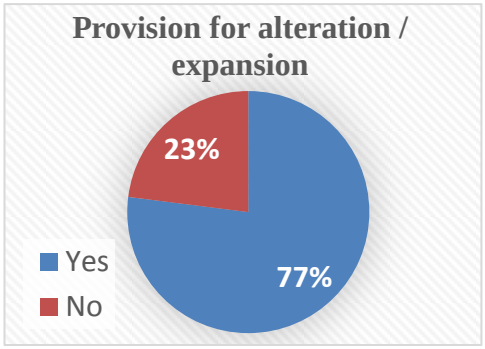
Family Composition			
Aged couple living alone (age > 55 years) /Couples beyond reproductive age	**Couples with children in the age group of 0 to 6**	**Couples with School going children (age 7 -15)**	**Couples with mature Children**
5	4	0	4

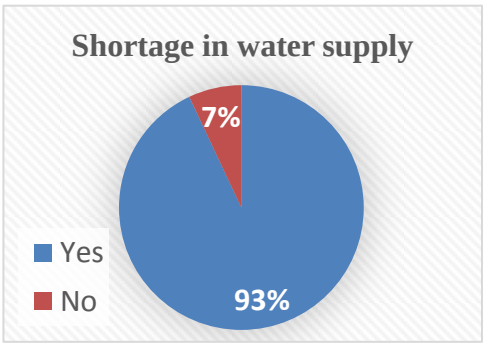
Housing characteristics

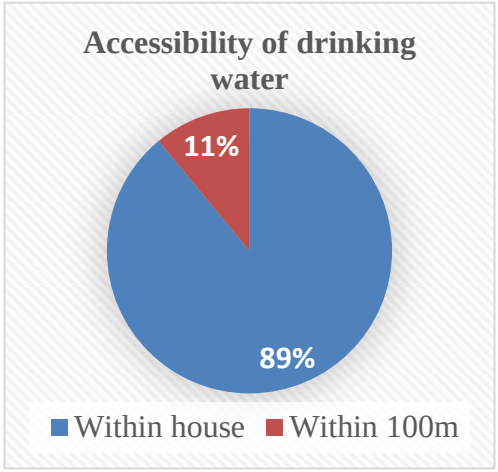
All the houses surveyed were pucca houses. The houses were all completely constructed. Everyone surveyed owns the house they live. Average no of rooms in the units are 3.5. Average size of a housing unit is 640 sq. ft. Average size of plot in which the units are built is 33.5 cents.

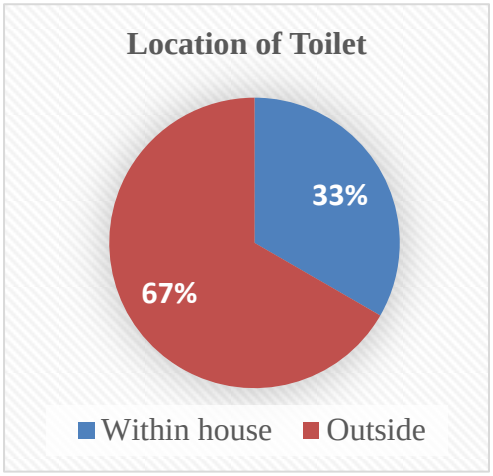
Details of basic amenities

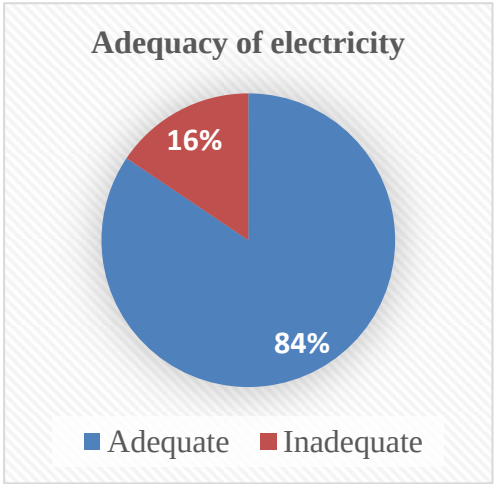
All the houses surveyed were having tap water facility, and 89% had drinking water available within the house. 97% of the interviewees reported a shortage in water supply. 67% of the people have toilet outside of their housing unit. The houses were all equipped with pour flush system in toilets. The community has an open drainage system. All the houses were reported as having adequate lighting and ventilation. 77% of the houses have a provision for expansion or alteration of their housing unit. The community has adequate amount of open space. There is no proper house level solid waste disposal system. 93% of the households does not have deity worship within the house.

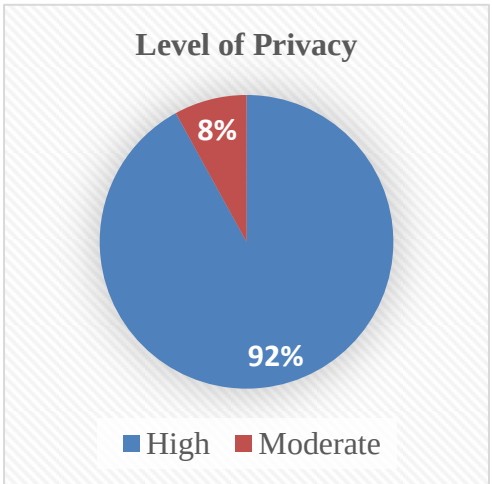






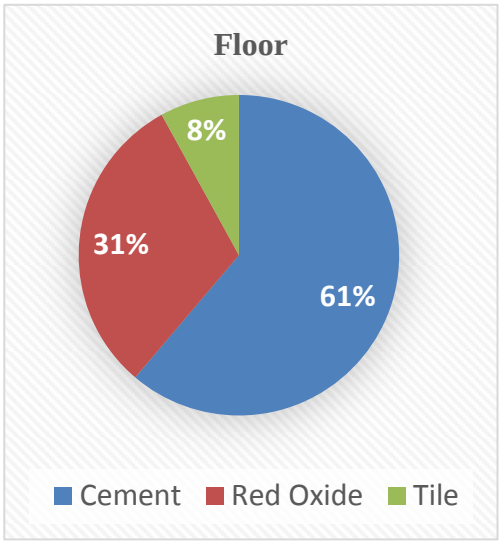


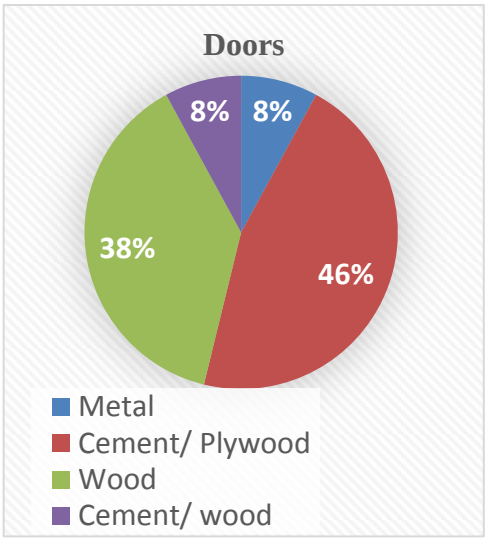


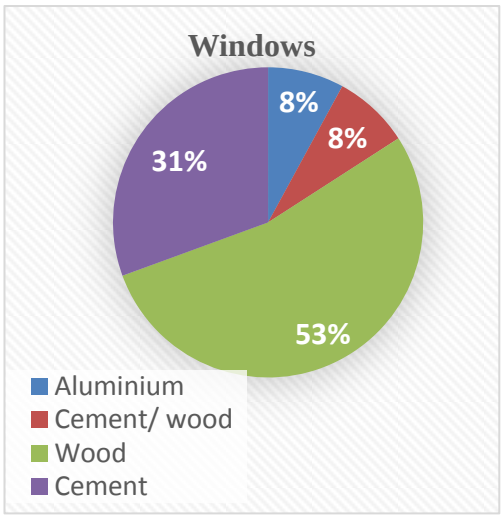


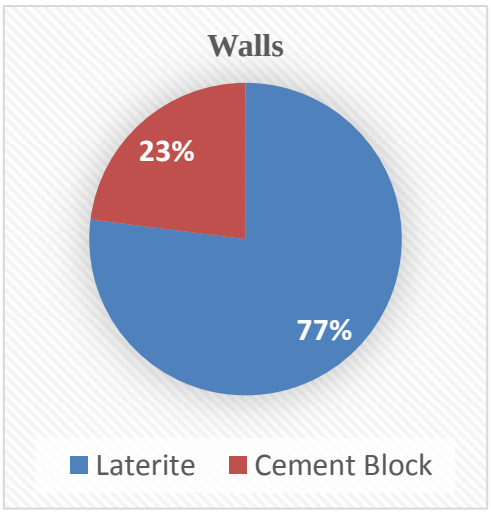
Material used in construction

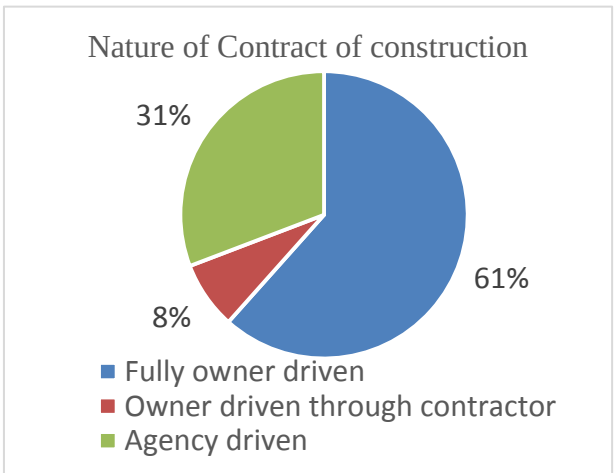
All the houses surveyed were having an RCC roof. Flooring in the community is generally done using granite. Walls and floors of majority of the houses were of laterite and cement respectively. Doors were mainly with cement frames and plywood panels, whereas windows were mostly made of wood.

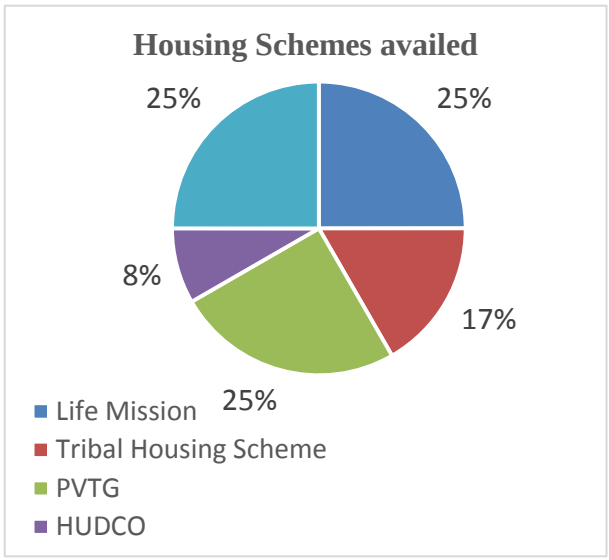








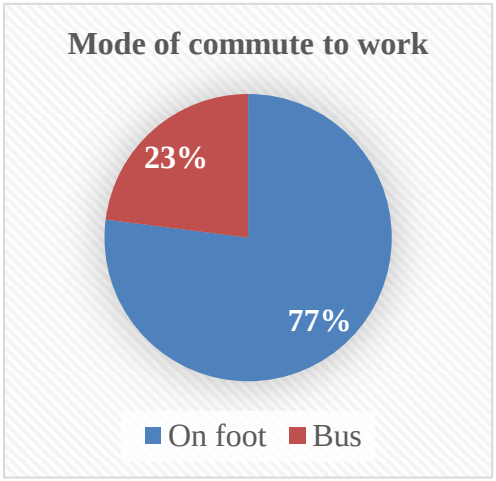


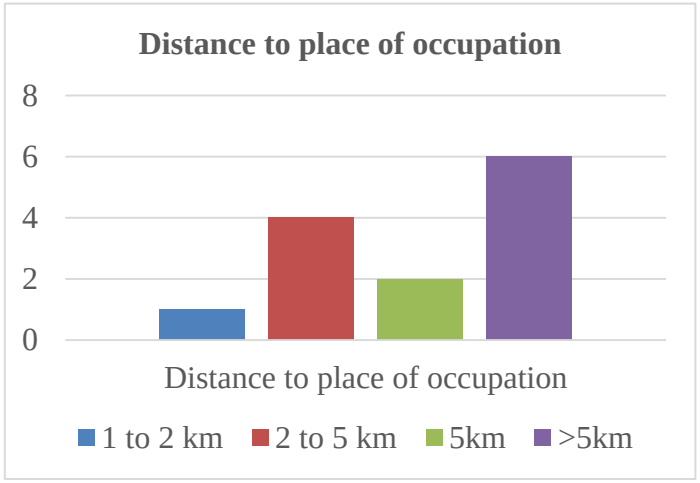


Years of housing scheme implementation: 2008-2019

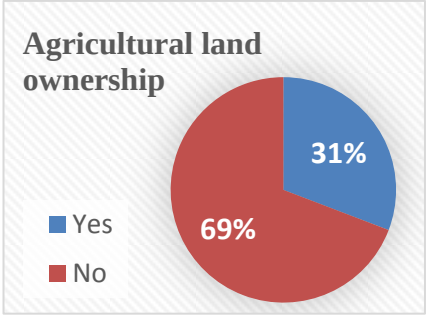
Details of employment status of family

The people in this community are generally self-employed as coolies, daily wage workers, etc. Most of the people goes to work on foot.

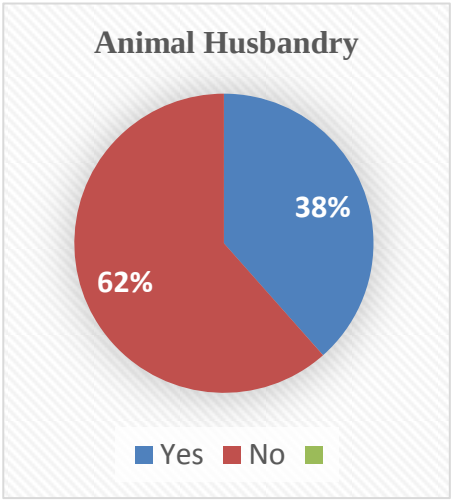


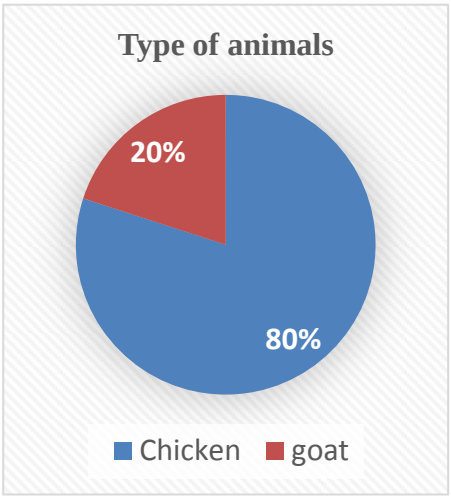


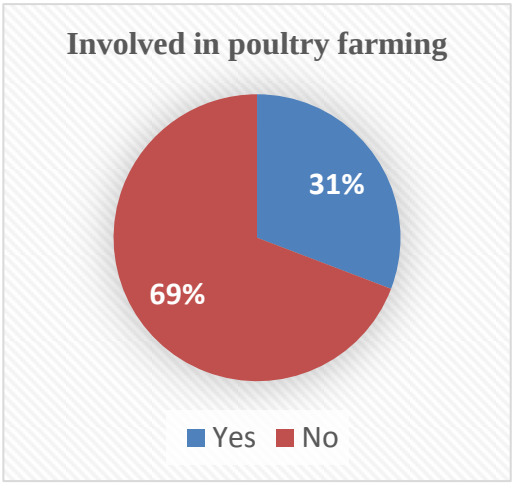
Details of non- residential land ownership



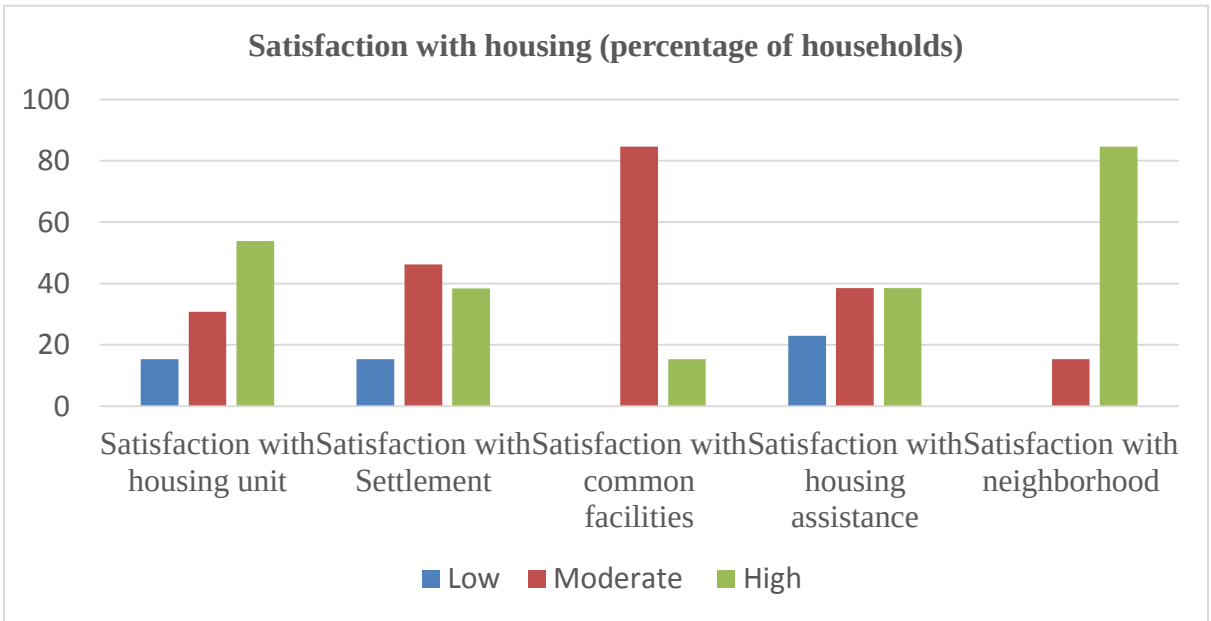
Animal husbandry/ dairying

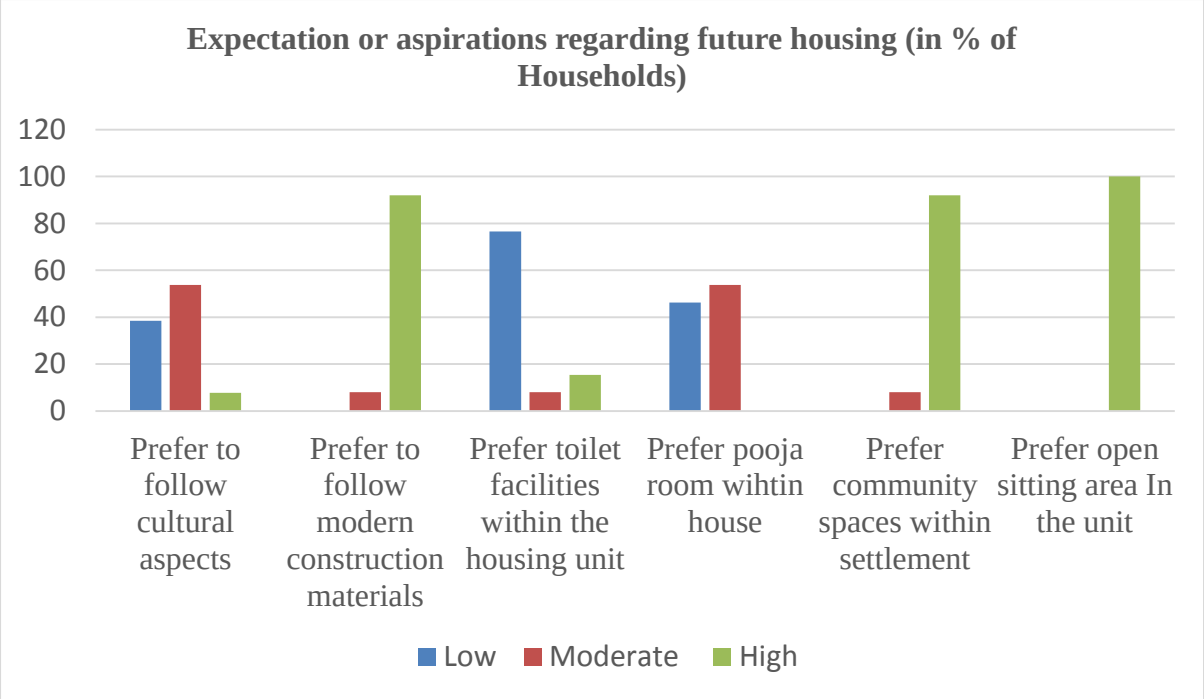






Most of the interviewees reported that they don't receive the service of a veterinary doctor. The products from poultry farm are used for family consumption alone.





6.2 Documentation of existing housing typologies

6.2.1 Introduction

The research team conducted a primary study of the selected tribal communities at specific locations, as indicated in the following sections. The study was conducted to understand the current socio-economic status of the identified community settled in a specific spatial context, their settlement and housing characteristics as well as the aspirations and expectations on future housing development. The study also aimed to understand issues and concerns of the community regarding achieving a sustainable housing solution in the specific context. The survey was carried out with the help of questionnaire (attached in Appendix A). It was also attempted to comprehend the requirements of the community through discussions with individual households as well as community leaders and other representatives such as tribal community promoters.

Assistance by the government to these communities in the form of various schemes were also evaluated during this stage to understand the drawbacks and limitations of the same. Multiple schemes available to the tribal community was also reviewed to understand the nature of assistance provided by government and other departments. The details of community-wise housing typologies are given in the sections below.

6.2.2 Chaligadha Tribal Settlement, Mananthavadi

Housing Pattern

There are 52 households settled in 43 housing units. The housing units are primarily built under various housing schemes such as MES housing scheme, Indira Awas Yojana as well as housing schemes of Tribal department. Most of the houses are ten to fifteen years old. The settlement predominantly consists of two types of housing units. Most of the houses are pucca or semi pucca in nature, but incomplete in many respects.

Typology 1: These housing units were implemented through the Indira Awaz Yojana Scheme. The built-up area was 420 square feet consisting of sit out, two-bedroom, and kitchen. And it was later extended by adding an outside kitchen unit and ante space under the WSS scheme of Caritas India in the year 2009.

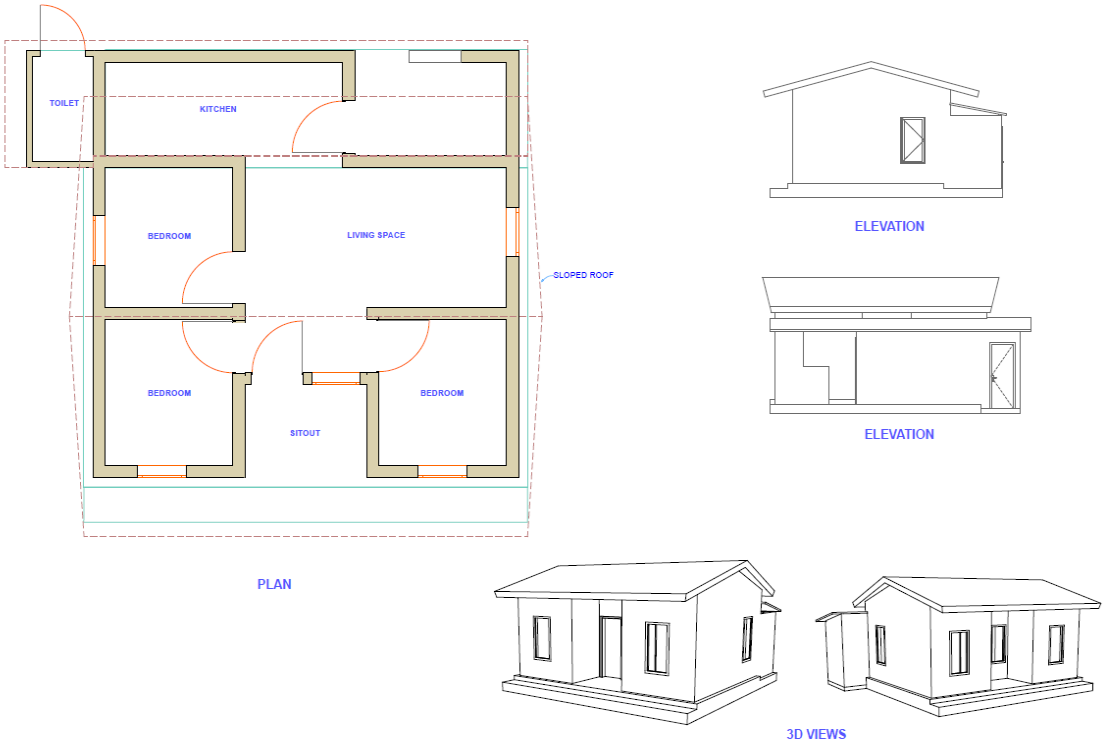


Figure 6-10: Details of Housing Typology 1

Figure 6-9: An example of housing typology 1

Typology 2: These housing units were implemented through the EMS housing scheme. It consists of two halls, one-bedroom, kitchen and toilet. The toilet is accessed from outside the housing unit. There is no open sit –out, and the main entrance is directly into the hall

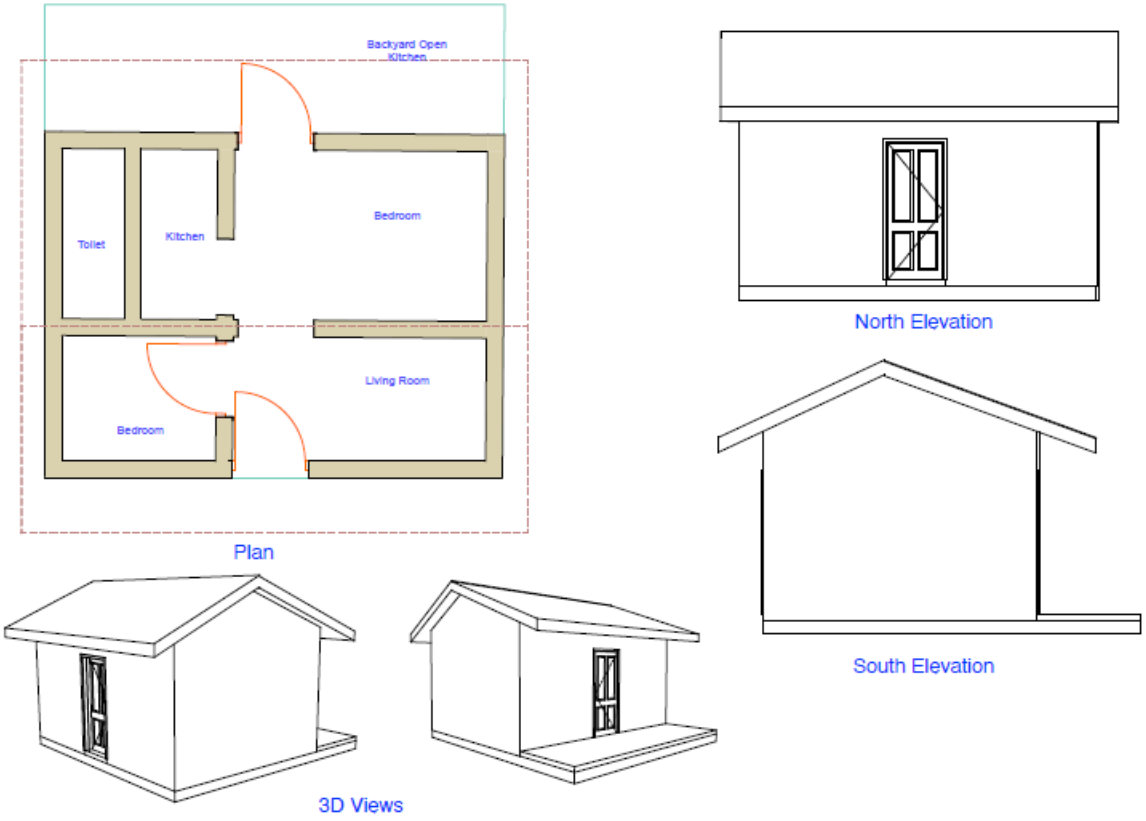
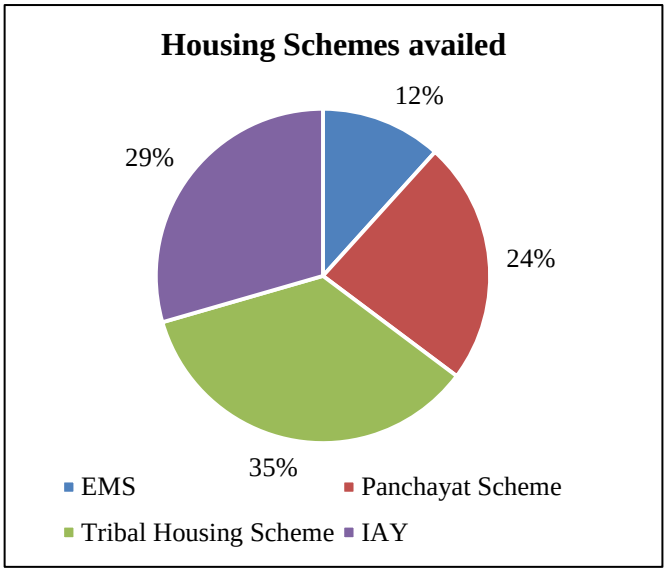


Figure 6-11: Details of Housing Typology 2

Figure 6-12: An example of housing typology 2

Evaluation of housing schemes by various agencies

There were mainly four housing schemes availed by the community in this settlement, the EMS scheme, Panchayat scheme, Tribal housing scheme and the IAY scheme. More number of people have availed the tribal housing scheme.



The major problem that was identified with these houses was that they were not plastered all around. Most of the houses were plastered only on the front. Incomplete construction of the building structure and other components due to improper management and distribution of funds was also another problem.

6.2.3 Basthipoyil and Kolathara Tribal Settlement, Panamaram

Housing pattern

The Basthipoyil, Kolathara settlement is more than 80 years old. There are a total of 61 households living in 43 houses spread across two settlements. Some of the houses are even made with bamboo cobs. Most of the units are double bedroom units. Kitchen is attached to most of the houses. Most of these units are built under various schemes like VKY, Block panchayat scheme, various NGOs and IAY scheme. Sixty-five percentage of the units are either pucca or semi- pucca buildings. Majority of the houses have an age between 25 to 50 years.

Typology 1: These are two bed room units, built under the block panchayat scheme during 2016- 17. They are cement block structures with flat roof. There is a small sitout provided in front of the house. Such units are observed to have a kitchen unit temporarily outside of the unit.

Typology 2: These are units with one hall, an attached kitchen and a toilet. The toilet is built in such a way that the entrance is from outside the unit. The unit has a small sit out in front of the house. They are cement block structures with a flat RCC roof.

Figure 6-14: Example of housing typology 1

Figure 6-13: Example of housing typology 2

Typology 3: These are two-room units made out of bamboo. These units are built on top of a raised floor made by beating mud. The walls are made out of bamboo strips, and on each corner there is a column made out of bigger sized bamboo (Kallanmula). These units have a small sit out like structure called “thinna” in front of the house. Kitchen is provided in front of the house. The roof is made out of GI sheets. These units are completely constructed by the inhabitants alone using locally available materials. These units are totally vulnerable to all kinds of disasters and climatic exposures.

Figure 6-16: Example of housing typology 3

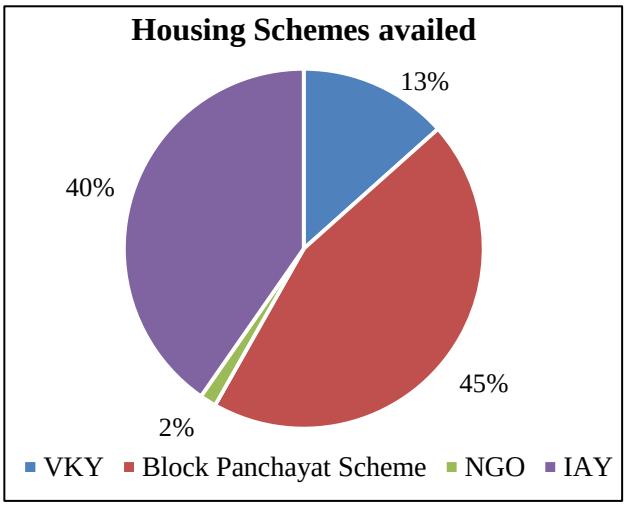
Figure 6-15: Example of housing typology 4

Typology 4: These are two-bedroom units with a living room and a kitchen. They don’t have a sitout in front of the house. They have a flat roof. These are built using laterite stones and are plastered. The kitchen is provided at the rare side of the unit. These units were mainly built under the tribal housing scheme during 2017- 18 period.

Evaluation of housing schemes by various agencies

There were mainly four types of schemes availed by the community members namely VKY scheme, Block panchayat housing scheme, various NGOs help schemes and IAY scheme. Most people have availed the block panchayat housing scheme and the IAY scheme.

Most of these houses were built in recent years. Many of these units had unplastered walls, especially the ones that were built using the IAY scheme. The shelters provided by the NGOs were temporary structures and had just a GI sheet as wall and roof. These units are extremely hot during daytime. Most of the units have dampened walls. The roof of some of the structures is already in a dilapidated state.



6.2.4 Vattapady Tribal Settlement, Sulthan Bathery

Housing pattern

As mentioned, there are 25 houses in the community. Many are built in the year 2014 – 15. Several housing schemes including HUDCO, LIFE mission and PVTG, are implemented in the housing. Small houses are designed with sufficient strength in order to cope up with climate of the region. The house units are basically pragmatic design. In design they provided ample space to sit out space. Very few openings are provided. Majority of the houses have two rooms in addition to a living room and a kitchen. These are discussed in detail in the layout.

All the houses except one have electrification, sanitary and plumbing facilities. The community has a common well and shared tap connection. None of the houses has appropriate or sufficient storage facilities. Also, they experience shortage of water occasionally. All the houses have detached toilets.

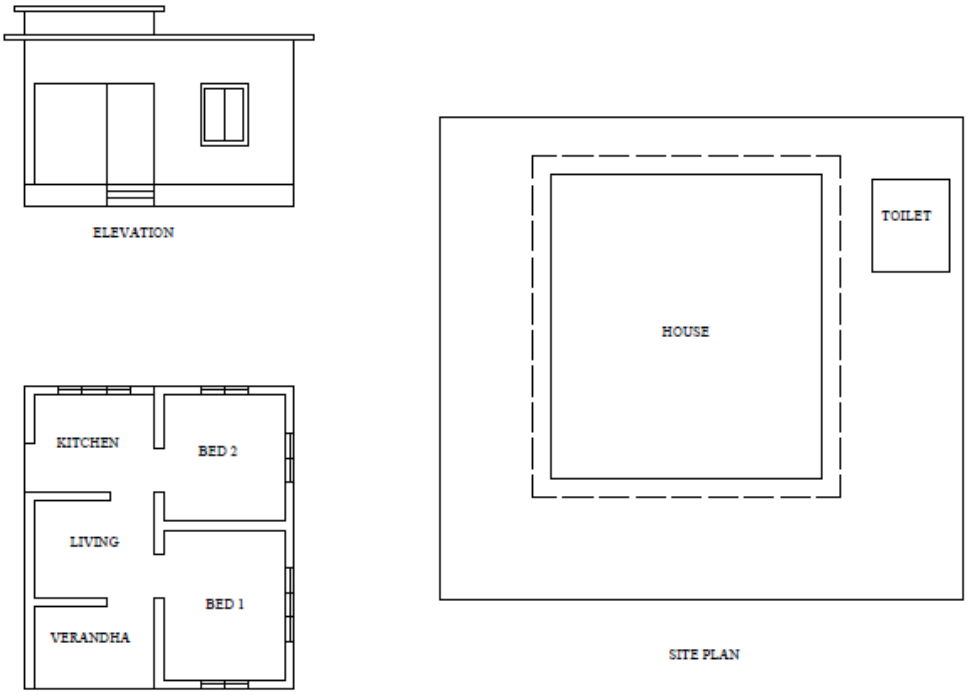


Figure 6-18: Details of typical Housing Unit

Figure 6-17: Example of a typical unit

Regarding the health facilities, the community has a PHC in Chethlya and taluk hospitals in Batheri and Kenrhira. Similary, schools are situated at ½ kilo meter distance from the community. Many children of the community are currently residing in hostels and pursuing their studies. The highest degree of the community is the Diploma. There is a ration shop at Irulam. The primary source of income for majority of residents is daily wages, while female actively participates in Kudumbashree activities. There are no skill training or up gradation provided to these tribes.

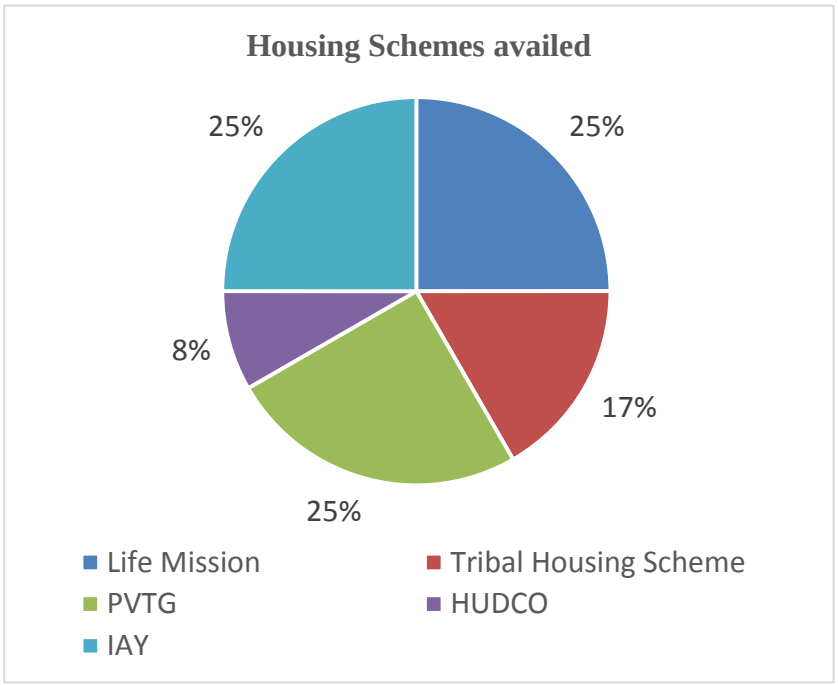
Activities & Spaces

The main activities that occur within the settlement are cooking, drying of crops, agriculture, handicraft and other daily activities. Cooking is done in an earthen stove slightly above floor level and which is easily accessible by the user by in simple sitting position.

Racks are arranged on top and sides and are easily approached by slightly standing up bending the knee. Dining and sleeping occur within the same area that is the extra hall attached to the kitchen. During day time this space acts, as well as dining space and mats, are removed from floor and stored in storage units situated above room level. At night these are taken out, spread and us for sleeping. Whole of activities which takes place in the settlement ends by the sunset. Morning the routine begins by sunrise. Front yards also host many activities during summer when the climate is favourable. Community meetings occur in community hall and also in temple (sacred grove) premises.

Evaluation of housing schemes by various agencies

There were mainly five major housing schemes availed by the community, the Life mission scheme, Tribal housing scheme, PVTG, HUDCO scheme and IAY scheme. Majority of the units were built using PVTG, IAY and Life mission schemes. Majority of the units were recently built. These units were cement block structures with flat roof, sloping roof or sometimes even manglore pattern tiled roof. Walls of some of the houses were dampened due to exposure to rain. Some units were even incomplete.



6.2.5 Description of government housing schemes for tribal communities in kerala

Pradhan Manthri Awas Yojana- Gramin

PMAY – G is a communal welfare program by the government of India, which is aimed at providing low cost housing for people residing in rural areas. It is in harmony with the government's goal of "housing for all" by 2022. The PMAY-G has altered the targets of houses to be constructed and has increased the total number to 1 crore homes by 2022.

Scheduled tribes and scheduled caste are one of the major beneficiaries of this scheme. The unit assistance has been increased from Rs.70,000 to Rs.1.20 lakh in plain and from Rs.75,000 to Rs.1.30 lakh in hilly states, difficult areas and IAP district. The beneficiary is entitled to 90.95 people the day of unskilled labour from MGNREGS. The assistance for construction of toilet shall be leveraged though convergence with SBM-G, MGNREGS or any other dedicated source of funding. Convergence for piped drinking water, electricity connection, LPG gas connection etc. different Government programmers are also to be attempted.

In PMAY-G, programme implementation and monitoring are to be carried out through an end to end e-Governance model- Using AwaasSoft and Awaas App. While AwaasSoft is a work – flow enabled, web-based electronic service delivery platform through which all critical function of PMAY-G, right from identification of beneficiary to providing construction linked assistance (throghPFMS), will be carried out; AwaasApp-a the mobile application is to be used to monitor real time, evidence based progress of house construction through date and time stamped and georeferenced photographs of the house. The two IT application helps identify the slip ups in the achievement of targets during the course of implementation of the programme. All payments to the beneficiary are to be through DBT to beneficiary's Bank/post office accounts registered in Awaas SoftMIS. The programme implementation is to be monitored not only electronically, but also through community participation (Social Audit), Member of Parliament (DISHA Committee), Central and State Government officials, National Level Monitors etc.According to the PMAY- G cumulative progress report, 2754 applications were targeted out of which only 853 are completed till date.

EMS housing scheme

The EMS housing scheme aims to provide housing for all homeless people below the poverty line and to provide space and housing for all landless people. The major objectives of the scheme are, provision of the house to all houseless below poverty line, provision of land and house to all landless, houseless people below poverty line and reconstruction of the dilapidated houses which are constructed under One Lakh Housing scheme. The housing project was started in 2009-10 and was expected to be completed by 31st March 2011. Since the project could not be completed during this period, the implementation period was extended until 31st March 2012. The EMS Housing Scheme, launched in 2007, targets "housing for all" with the local bodies in the lead role. The state hopes to build homes for some 550,000 below poverty line (BPL) families.

With effect from 15.9.2011, the unit cost for a house has been increased to Rs. 2 lakh and Rs. 2.5 lakh for the scheduled tribe. The fund required is to be raised from the plan fund; by way of raising loans from Banks especially Co-operative Banks by Urban Local Bodies (ULB) and other sources like contribution from NRI's Government servants, and NGOs etc. It is a total subsidized scheme to the beneficiaries. As per the Housing Scheme, 128874 houses have been completed till date. The scheme is implemented through the local self-governing bodies with the support of the state government. If the beneficiaries themselves purchase land for construction of the house, SC, ST, Asraya yojana families, people living by the side of railway track, road, and puramboke are eligible for Rs 75000 in gram Panchayat, Rs90000 in municipality and Rs100000 in municipal corporations. In this scheme the ULBs take loan from Co-operative banks for the beneficiaries. This amount is then repaid by the ULB, and the interest is paid back by the state govt.

Housing Schemes by Nirmithi Kendra

The Kerala State Nirmithi Kendra (KESNIK), set up in 1989, is a pioneering organization in the practice and propagation of Cost-Effective and Environment-Friendly construction techniques. Cost-Effective Environment-Friendly (CEEF) technology propounded by KESNIK became a practical alternative to the high priced existing processes and served as a relief to thousands in a dilemma. Nirmithi utilizes locally available materials thereby economizing costs without compromising on the durability and strength of the structure.

The Nirmithi unit in Wayanad district was started its functioning in 1989 as a registered charitable organisation. It is locating at Panamaram (20 kms away from District Headquarters at Kalpatta). The unit has been embarking upon a large number of residential and institutional projects since its inception. For availing help for housing from Nirmithi Kendra, an application is first submitted to the Nirmithi Kendra office by paying registration fees. After registering the Nirmithi Kendra officials will carry out the later procedures as a consultant.

Housing scheme by The Scheduled Tribes Development Department

It is a major programme taken up by the State Government is to provide housing to all scheduled tribes so that there will be no scheduled tribe family without a home in the state. It comprises the following four components.

Construction of New Houses

It is proposed to assist houseless families in constructing new houses. Tribal families who do not have house/shelter will be considered in this scheme. From 2017-18 onwards the housing scheme will come under the broad umbrella of LIFE MISSION. It envisages a comprehensive housing scheme for all the landless and houseless families. The Mission will also provide financial assistance for the completion of incompleted houses sanctioned before 31.3.2016

Completion of Spill over Houses

Providing assistance for completion of houses sanctioned in previous years (spill over houses) is included in this scheme.

Repair of old and dilapidated Houses

Providing additional rooms and repair of dilapidated houses are proposed under the scheme. The amount will be sanctioned according to the requirements and estimates on a case to case basis with a maximum of Rs.1.50 lakhs.

Resettlement of Landless Tribal People [TRDM]

The Tribal Resettlement and Development Mission (TRDM) aims at providing at least one acre of land for a family, subject to a maximum of 5 acres. Resettlement is being done based on a master plan prepared by District Missions Chaired by District Collector and line department officers as members. There are 44 resettlement colonies in the state. The aim of TRDM is the distribution of land to landless tribals and providing all other infrastructure facilities such as housing, drinking water, road, electricity etc. and providing self-

employment schemes (agriculture, animal husbandry, dairy projects etc.) to the resettled tribes.

Vanbandhu Kalyan Yojana

The Government of India, Ministry of Tribal Affairs has launched Vanbandhu Kalyan Yojana (VKY) for the welfare of Tribals. VKY aims at creating an enabling environment for need-based and outcome-oriented holistic development of the tribal people. This process envisages ensuring that all the intended benefits of goods and services under various programmes/schemes of Central as well as State Governments actually reach the target groups by convergence of resources through appropriate institutional mechanism. Under the scheme, Union Government will provide 10 crore rupees for each block for the development of various facilities for the Tribal people. These blocks have been selected on the recommendations of the concerned States and have very low literacy rate. The scheme mainly focuses on bridging infrastructural gaps and gap in human development indices between Schedule tribes and other social groups. VKY also envisages focussing on convergence of different schemes of development of Central Ministries/Departments and State Governments with outcome-oriented approach. Initially the blocks having at least 33 percent of tribal population in comparison to total population of the block will be targeted under the scheme.

6.2.6 Change in Community Perception on Housing requirements

The community now prefers modern materials over traditional materials that were short-lived and temporary. This emphasizes the need for pucca housing. The old perception of toilets being given away from the main unit has also changed. Now the community prefers sanitation facilities that are accessible from the main unit. People also prefer spacious convenient rooms with priority towards privacy over smaller congested rooms. The members also reported that they prefer personal space over dedicated worship space within the house. They were emphasizing on community spaces for worship rather than dedicated space in individual units.

There is also a change in lifestyle from being agricultural labourers to being farmers to becoming non- agricultural labourers. The community now prioritises education and are more conscious about health. These changes in lifestyle have greatly influenced their perceptions about housing.

6.2.7 General Issues and concerns on Housing Schemes

Housing units constructed under various schemes are observed to be of short life, due to poor quality of construction. There is no centralized mechanism to implement the housing schemes available at various levels of govt and by other departments. Certain housing schemes have stringent rules that limit the area of construction and restrict any future expansion. Programes like projects from Nirmithi Kendra directly go for implementation of the projects. Increase in the financial assistance in these schemes is not proportional to the increase in the cost of construction. The conditions for granting the funds for most of these schemes are stringent in nature.

Many of these dwellers do not have a proper Patta for their land which makes it difficult for the processing of schemes. Even though many schemes are available their implementation is mostly irregular due to various political interplays. For certain schemes, construction of the house has to reach a particular stage before they can avail the monetary help. This is troublesome for most of the beneficiaries since most of them do not have the seed money. This results in incomplete houses being constructed. Community's lack of knowledge, awareness and empowerment also results in the failure of most of the schemes.

CHAPTER 7. DESIGN DEVELOPMENT

7.1 Housing planning and design approach

The housing unit for the tribal community is finally designed by taking in to consideration certain factors evolved through the household survey, literature review and the participatory design considerations. These potential factors have been highlighted in Figure 7-1.

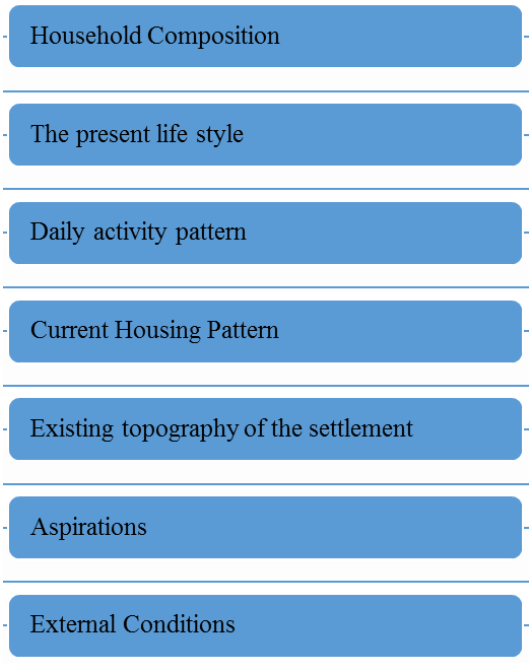


Figure 7-1: Potential factors that influenced design

7.1.1 Household composition

The size of dwelling units and their spatial arrangements were based on the household characteristics, namely household size of the settlements. Learning from the demographic condition of various household across the three settlements studied, four categories of households have been identified as given in Table 7-1. The size and pattern of housing unit was designed to meet the requirements of the varying members of different categories of household.

Table 7-1: Identified categories of households

Type	Type of Family
A	Single Person/ Aged couple beyond reproductive age without children
B	Parents + Children less than 6 years of age
C	Parents + School going Children
D	Parents + Adolescent Children / (Married Son / daughter)

7.1.2 The present lifestyle

It is found that the present lifestyle of all the communities studied have been changed from the traditional lifestyle they used to follow. This is mainly due to the fact like, change in livelihood pattern, interaction with the non-tribal communities for decades and also change in perception of the new generation. The present lifestyle of these communities have influenced their perception of house and the surroundings. Traditionally these people used to depend on the forests for their livelihood and their survival, but presently most of the young population are found to be engaged in non- agricultural activities, other skilled jobs, etc., for their survival. Also, their new jobs demanded interaction with other non-tribal communities. This interaction has opened these communities to a whole new world which they have never experienced before, and this influenced the way they think about housing too. These communities now demand a more private, secure, convenient and healthy living spaces. The aspirations of the new generation adults about a better lifestyle and better future for their kids have also influenced the way they think about housing. Thus provisions like attached kitchen and toilet to the main housing unit, shelves and racks for storing their things, etc. are perceived to be important in their dwelling units.

7.1.3 Daily activity pattern

It has been observed that the communities prefer to spend most of their daytime outside their dwelling unit. The habitable spaces are mostly used during night time. The front yards and other small open spaces around the house act as the venue for community level interaction and socialisation. It was also observed that such spaces also do act as their dining space during day time. However, as the life style of community have changed from the traditional ways of living, their daily activities are otherwise found to be similar to a general community.

Also the fact that most of these dwellers are now daily wagers working during day hours, have influenced the effective utilization of the available spaces within the housing unit. Since most of the men and women now a days go for work, they do not find time for maintain the traditional houses, made using materials like mud.

7.1.4 Current housing pattern

The current housing pattern of the communities are taken into consideration while planning and proposing the settlement guidelines. Almost all of the interviewees have reported that they are satisfied with the neighbourhood they live on, and would like to continue to live as a community rather than living in a relocated settlement. Thus, design approaches like providing shared walls for housing units are considered during the design exercise. On the other hand, most of them reported very less satisfaction on the current housing units and their construction methods. Factors like incomplete construction, congested rooms, poor quality of building materials and construction, etc. were reported to be the factors for low satisfaction level by the communities about their current housing units. However, they have adapted to the present typologies of housing constructed using modern materials and methods of construction

The study also revealed that majority of the community prefer the toilet attached to the house but accessed from outside.

7.1.5 Existing topography of the settlement

Topography of the current settlement areas were considered during the unit design. Two settlements namely Chaligatha and Basthipoyil settlements were exposed to high levels of inundations during riverine floods. This is due to their topographic characteristics. This drawback of the settlements is considered while proposing the guidelines for cluster planning and settlement planning. Additionally, flood resilient measures such as stilted method of construction, water proofing of the structure, etc. are considered in the design of housing units.

7.1.6 External conditions

Another important factor that guided the approaches to design was the external factors especially flooding. Two out of three communities surveyed were affected by the recent

floods of 2018 and 2019. Thus while designing the units a different set of typologies were proposed for the communities that are vulnerable to floods. Stilted construction of the habitable spaces was considered in such units. This can save the lives of the people and also it saves the property of the people from destruction. Materials were also decided based on the fact that it should be resistant to flood waters. In the units that are proposed for resisting floods, there is ample space provided as a first floor for escaping from floods and even for storing their valuables during flood time.

7.2 Design philosophy

Leading from the planning and design approach as explained, the initial housing solutions have been arrived at based on certain set of design philosophy as outlie below.

1. The design must ensure healthy living environment by providing potable water, adequate sanitary facilities and cooking facilities within the housing unit.
2. The establishment of habitable, stable and socially and culturally adaptable residential environment.
3. Permanent residential structures ensuring internal and external privacy and adequate safety.
4. Scope for incremental development
5. Disaster Resilient design and construction
6. Designs ensuring safety against animal attack

To make the housing unit healthy and liveable, certain measures like incorporating kitchen and sanitary facilities within the housing unit has been followed. Providing kitchen within the unit ensures that cooking happens in a sheltered environment as well as the utensils and kitchen tools are kept hygienic. This also helps in healthy cooking practices. Attaching the toilet to the main housing unit ensures better accessibility especially during night time.

While designing dwelling units, it's always important to provide habitable spaces. Providing more number of uninhabitable spaces does not serve the purpose. At the same time, even though less in number, providing spaces that are convenient and habitable is more important. Stability in the built environment is another factor that is to be taken into account. Providing units with short lived building materials and poor construction techniques create an unstable living environment. Establishing a socially and culturally adaptable living environment is also another element of housing design. Incorporating modern techniques, methods and

materials of construction, which are culturally and socially unacceptable or adaptable, is not always a good option. This may even result in abandoning of the units eventually.

Privacy is a factor that is sometimes conveniently neglected while designing housing units. Both internal and external privacy of the housing units are very important, as they make the spaces more habitable and gives the spaces a feeling of a home. Where there is a family, especially a family with women and kid's privacy is inevitable in the design. Providing internal private spaces helps in building up a healthy society. And where there is a family, there is always a scope of expansion of its household size. Thus it's always better to design the housing units in such a way that incremental development of the units is possible in the future.

In this particular study context, flood resilient housing is another important dimension of design. Providing the most beautiful house without looking out for any possible disasters is a blunder. Thus it is always safer to account for vulnerability of the settlement due to impending disasters by considering the past disasters that have occurred. As the settlements studied are exposed to riverine flooding during monsoon, there is high need of incorporating flood resilient design considerations in to the housing units.

Finally as tribal settlements in certain regions of Wayanad district are exposed to animal attack it is important to consider the personal safety of the community especially during night .

7.3 Housing Typologies proposed

Based on the design philosophy and the planning approach, two major housing typologies have been proposed. The proposed housing typologies are shown in Table 7-2.

Table 7-2: Proposed housing typologies

Type	Type of Family	Facilities	Plinth Area (Sq. Ft)
A	Single Person/ Aged couple beyond reproductive age without children	S C U + Multipurpose Hall	345-395
B	Parents + Children less than 6 years of age	S C U + 2BR + Hall	395-489
C	Parents + School going Children		
D	Parents + Adolescent Children / (Married Son / daughter)		

* *SCU: Sit out+ Kitchen + Toilet cum bathroom*

As two of the tribal settlements studied were vulnerable to riverine flooding, separate designs have been proposed for disaster prone sites also.

7.3.1 General features of the housing units

The basic unit (that is unity type I) was designed for households with a couple beyond their reproductive age who are living alone. For such a household there is no necessity of a separate private space as bed room. Thus, the basic unit consisting of the service core and a multipurpose hall was designed for them.

The second unit type (Unit type II), was designed for the other three categories of house hold. Two closed spaces in the form of private bed rooms are provided for such households. Thus, unit type II consists of a service core unit, a multipurpose hall and two bedrooms. Every proposed unit basically has a Service core unit, consisting of a kitchen, bathroom and a sit out. The size of the main hall room is adjusted in each unit type, according to the size of the household that is considered. The hall is provided with a small rack that is embedded in the wall for storage purpose. This rack can also be used for keeping idols for worship. The bedrooms are provided with full length racks that can be used as cupboards. Cup boards and racks are embedded within the wall to increase the living space. The hall can be converted to another bedroom or a study room according to the changes in purpose by providing a screen or even a wall. The whole structure is constructed in an incremental manner so that in future expansions or alterations can be made. The space under the staircase can be used as a storage space in case of rain.

The bathroom is provided along with the unit but with an entrance from outside, this ensures safety during night time. The kitchen is also provided along with the housing unit for making the housing unit complete in all senses.

7.3.2 Features of flood resilient housing unit

These units are designed in such a manner that the habitable spaces are provided at the first floor . This is done in order to minimize property damage and as a place to take refuge during flooding. In this typology the Service Core Unit consists of kitchen and dining space as well as the sit out in the ground floor. The bedrooms are provided at the first floor accessed by a staircase from interior. The toilet is attached to the housing unit but accessed from outside. The housing typology 1 consists of a Service Core Unit, in the ground floor and a

multipurpose hall in the first floor. There is a staircase provided along with the SCU. The hall can be converted into another bedroom or even a small study room by providing proper screens or even a wall. An emergency exit door is also provided at the first floor to facilitate the rescue of the household trapped during flooding.

The second type of unit consists of two bedrooms partly stilted on columns in the ground floor (Refer figure 7.9). The area under the stilted part of these units can be covered using temporary or even permanent materials in the future by the dwellers to create storage space, study area, open kitchen, etc. according to their budget and future requirements. An open terrace is created at the first floor as a platform for refugee during flooding. An emergency exit door is also provided from the bedroom to the open terrace to facilitate the rescue of the household trapped during flooding. Thus, the housing unit is planned in such a way that human as well as property loss during the flood is minimized.

7.3.3 Housing for settlements exposed to man-animal conflict

The tribal settlements in certain regions of Wayanad district are exposed to animal attack. There are numerous measures such as trenches, electric fences, and granite walls etc., provided to prevent the entry of wild animals to the habitable areas. However, the tribal people are found to be unsafe as animals attempt to intrude in to their land especially for food.

In order to minimize their fear of safety and protect them from the animal attack, houses in such areas can be planned multi –level (Refer 7.3.2). This arrangement will provide space in the upper level to ensure personal safety especially women and children when animals enter in to the land. As the bedroom spaces are arranged in the first floor level, the safety during the night time is also ensured. Moreover the structure can be designed to resist lateral forces by building framed structure with columns, beams and slabs integrated with solid cement block wall masonry foe both the floors . This would positively mitigate damage to the property expected due to elephant attack, if any.

Ordinary Unit for locations not prone to disasters

Typology 1 : Area: 354 Sq. Ft

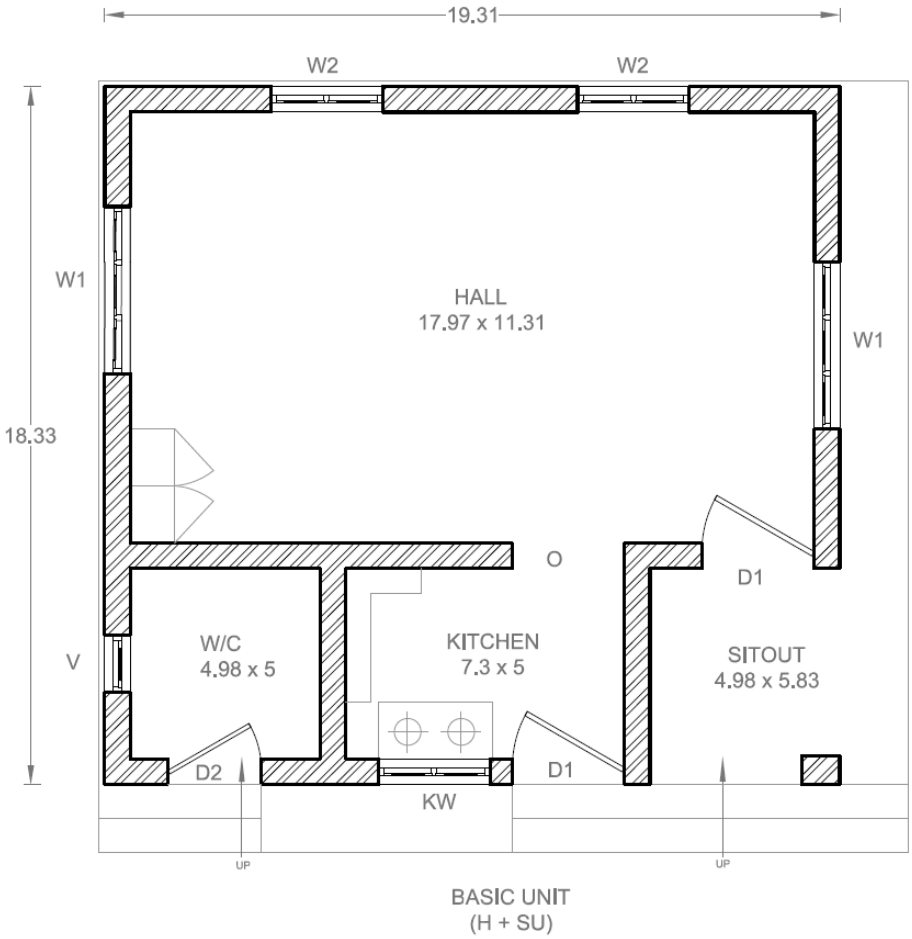


Figure 7-2: Plan of ordinary unit: Typology 1

Figure 7-3: Rendered image of ordinary unit: Typology 1

Typology 2: Area:489 Sq. Ft

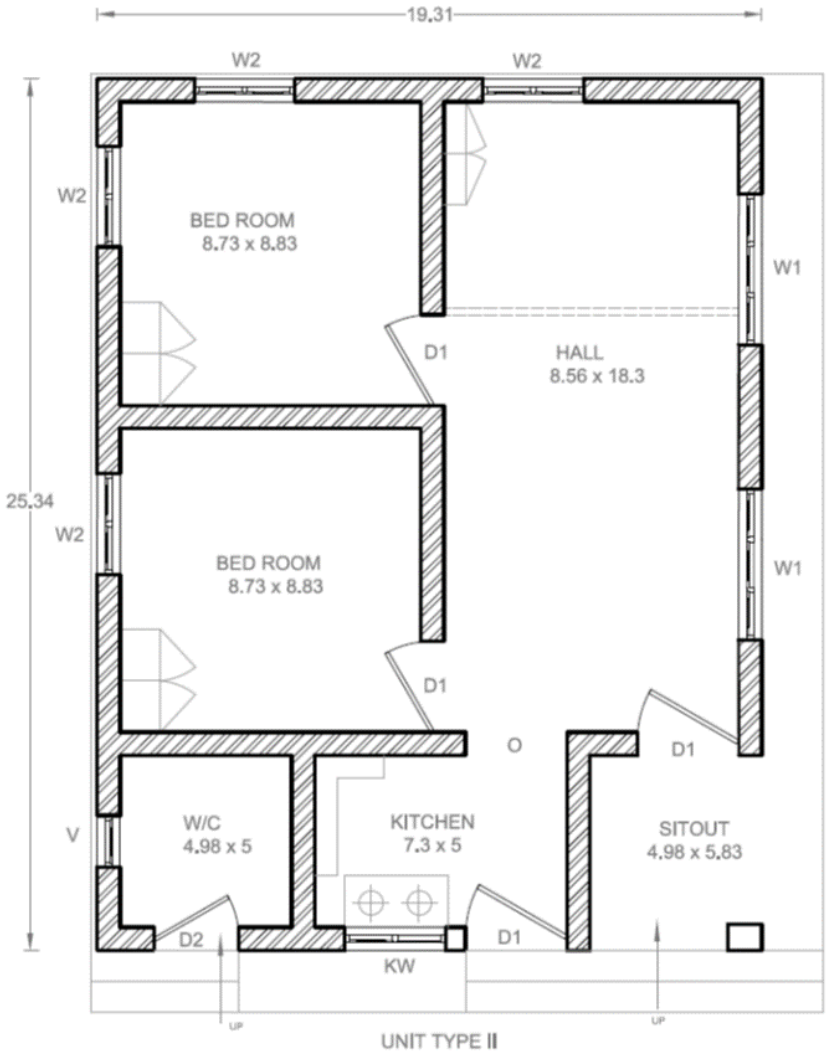


Figure 7-2: Plan of ordinary unit: Typology 2

Figure 7-3: Rendered image of ordinary unit: Typology 2

Flood Resilient Housing Unit ***Typology1*** : Area 395 Sq. Ft

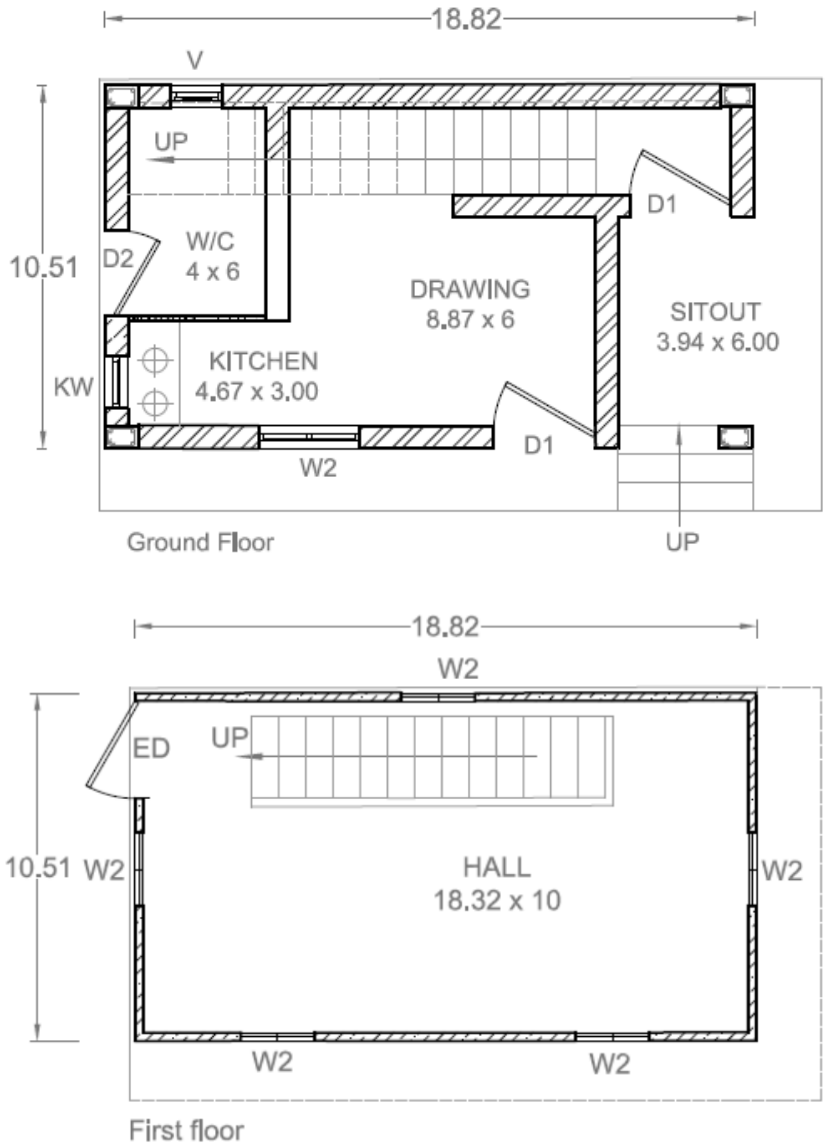


Figure 7-6: Floor plans of flood resilient unit: Typology1

Figure 7-7: Rendered image of flood resilient unit: Typology 1

Typology 2 : Area 395Sq. Ft

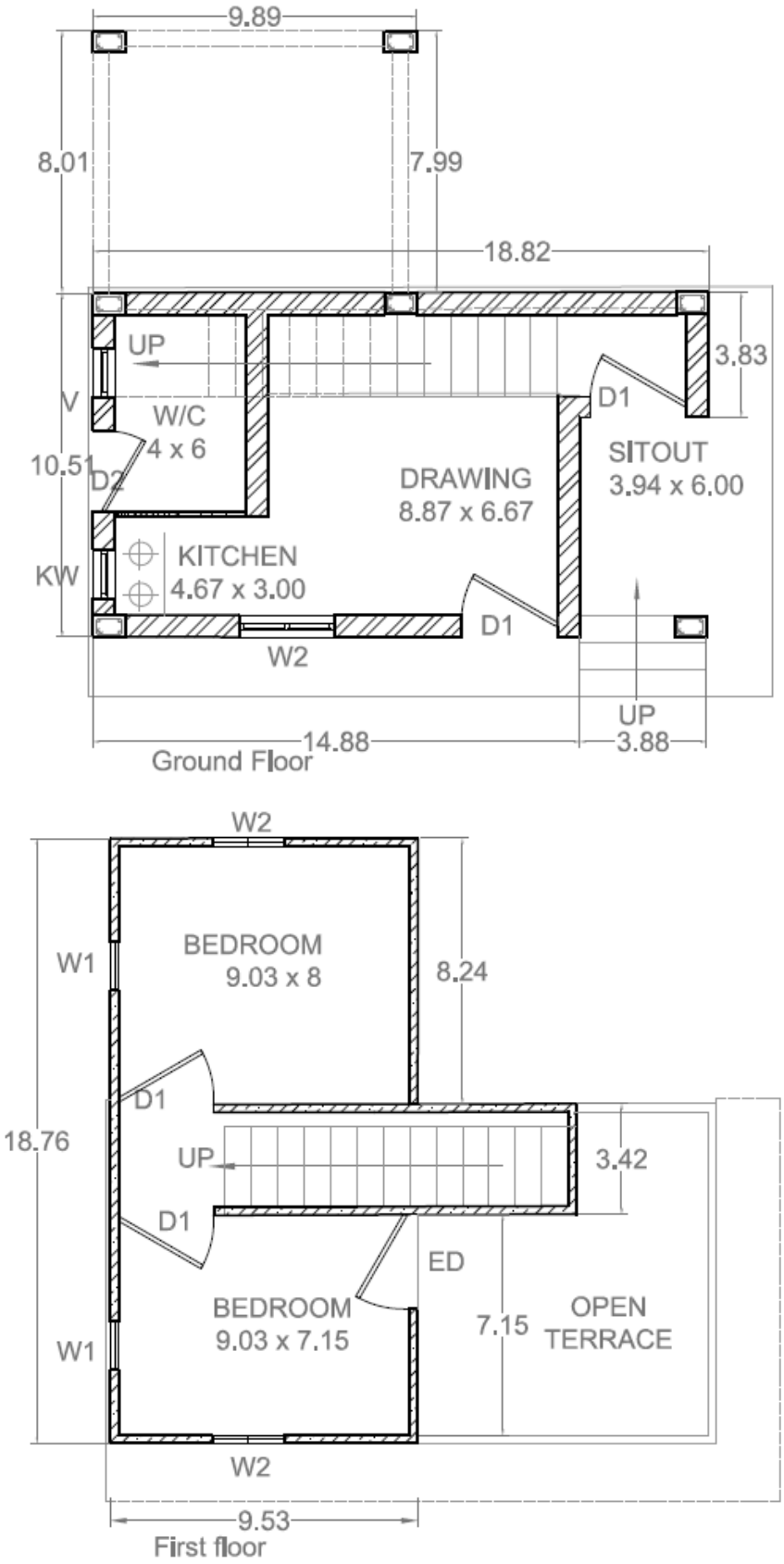


Figure 7-8: Floor plans of flood resilient unit: Typology 2

Figure 7-9: Rendered image of flood resilient unit: Typology 2

7.4 Structural Design and Detailing of Housing Units

Ordinary Unit for locations not prone to disasters: For the housing units in locations not prone to disasters the structural members have been designed to meet the expected dead load and live load of the building.

Sub structure: Foundation and plinth is provided with hard granite broken stone in random rubble dry Packing with Quarry Dust Filling.

Plinth Beam: A plinth beam of minimum size of 15 cm depth has been provided all along the wall line.

Wall Masonry: Wall is proposed to be constructed with interlocking soil blocks and hence material as well as labour cost is minimized. Moreover it also avoids the need of plastering the wall surface as the block provides a smooth finish. However plastering is suggested along the lintel surface as well as at the lower side of both sides of the wall to avoid water seepage and dampness. It is also required to do plastering of the wall surfaces where contact with water is expected especially in spaces such as toilet, kitchen, etc.

Lintel Beam : Doubly reinforced lintel beam of minimum size of 15 cm depth has been provided all along the wall line.

Roofing: Hipped roof with steel sections (Box section as well as C- sections) of approved grade has been provided to reduce the dead load on the wall masonry. Pressed clay tile

(Mangalore tile) of 20 mm nominal thickness and of approved size is laid as the roofing material.

Flood Resilient Housing Unit: : The housing units in disaster locations have been designed as framed structure with columns and beams provided at strategic locations considering the expected dead load and live load of the building as well as the forces of the water expected during flooding. The structural members have been also strengthened to minimize the damage during the flow of water.

Sub structure: The sub structure is designed as grade beam (25 cm depth) up to the plinth level, supported on isolated stepped column footing. The breadth and depth of the grade beam as well as column footing may vary depending on the soil characteristics. The plinth is laid with minimum thickness of 25- 30 cm laterite masonry raising the plinth height up to 60cm above ground level. Foundation is packed with Quarry Dust Filling. The grade beam also avoided the need for extra plinth beam below wall masonry.

Wall Masonry: The wall masonry in the ground floor is proposed to be constructed with cement blocks masonry of 150mm/230mm/300 mm thick solid cement blocks. The first floor is made of V panel (Refer Chapter 9 Materials and methods of construction) . Providing V panel minimizes the dead weight as well as avoids the need for plastering .

Roofing: The ground floor ceiling is designed to be RCC slab of 12cm thick. Beams are provided along the top of the wall hanging from the ceiling slab. No separate lintel beam is required along the openings as only the minimum wall height (minimum 2.4 m for kithen as per the NBC) is provided for the ground floor. Hipped roof with steel sections (Box section as well as C- sections) of approved grade has been provided for the first floor to reduce the dead load on the wall masonry. Pressed clay tile (Mangalore tile) of 20 mm nominal thickness and of approved size is laid as the roofing material.

The technical drawings of all the typologies as well as their three dimensional views have been attached in Appendix B.

CHAPTER 8. DESIGN APPRAISAL

8.1 Presenting the design

The initial design solutions were presented to the community by conducting a community level meeting planned in each of the settlement studied (Refer Appendix C). The design approach as well as the design philosophy adopted for the unit design also was briefed to the community. And the opinion of the community about the proposed housing unit was elicited through an informal discussion as well as interaction with the people present during the meeting. It was also attempted to understand opinion on the following

1. Whether the community has adapted to the new housing style with modern materials and methods

2. Whether the community is satisfied with the spatial organisations in the current housing typologies

3. Whether do they prefer more number of small size rooms or min number of spacious rooms

4. Whether do they prefer dedicated space in the housing unit for worship

5. Willingness to get involved in the housing construction

Additionally, the study also attempted to understand the locally available building materials and methods of constructions as well as preference of the community on using modern building materials for housing construction.

From the community level consultation, it was realised that they are found to be adapted to the new housing style with modern materials and methods as they have been living in houses constructed in contemporary style for the past three decades. And there is no reluctance towards accepting the modern ways of spatial arrangement which is different from their traditional ways of living. Instead of more number of small and congested rooms, the community demanded rooms which are spacious enough to put the required furniture as well as providing better circulation within. Most of them did not really support providing dedicated spaces within each houses for worship of family gods that showed their preference for private personal spaces.

The community also expressed their willingness to get involved during the implementation of the housing projects provided they are given adequate training and awareness regarding materials and methods of construction.

Finally, an inventory of building materials available within 15 km of the site studied was also made so as to propose these materials for housing construction.

Subsequent to the design appraisal the initial housing solutions were modified appropriately. The appropriate materials and methods of construction was adopted based on the opinion of the community during the design appraisal stage. However, a field investigation as well as market survey was also conducted to choose materials which are cost effective and adaptable to the community.

Part III

Materials and Methods of Construction

CHAPTER 9. IDENTIFICATION OF APPROPRIATE MATERIALS AND METHODS OF CONSTRUCTION

9.1 Introduction

In order to identify building materials that are locally available, cost effective, adaptable to the community as well as flood resilient, case studies of houses constructed in the nearby locations following such material have been carried out.

9.1.1 Thanal villa, Anchukunnu, Panamaram

Thanal villa is a rehabilitation project undertaken by the NGO “Thanal” (Vadakara), in Anchukunnu, Wayanad. The project was completed in 45 days. A community has been rehabilitated in whole into this villa. The housing units are basic 2 BHK units with attached toilets. Drinking water is provided by the means of a tube well and a common water tank. Each unit has an area of 450 sqft. A general feature of thanal villa is shown in Figure 9-1.

Figure 9-1: General view of Thanal villa and the V panel house

Materials used for construction

Foundation of these houses are normal rubble masonry foundation. Plinth is made of concrete. Flooring is finished using vitrified tiles. The material used for wall construction is V Panel boards having 3-inch thickness. These boards are fibre reinforced cement panels, which are pre cast and transported to the site.

Door frames in the house is made of steel, and their shutters are made of pressed wood, whereas window panels are made of aluminium and the panels are made of glazed glass.

Doors used in the toilet are fibre doors. Kitchen had shelves and racks made of steel frame and tile slabs. There is a false ceiling provided using V panels.

Figure 9-2: Long narrow windows

Figure 9-3: Steel door panels and Aluminium window panels

Figure 9-4: Fiber door in toilet

Figure 9-5: Racks in kitchen

Figure 9-6: Roof framework

The roofing structure is supported using steel box sections of size 3-inch x 3 inch. The roof frame is a steel truss structure. Roof frame is then covered using Mangalore pattern tiles. The features of the housing units are presented in figures 9.2 to 9.6.

Construction details

Foundation is constructed as normal rubble masonry foundation. Plinth is a two-step construction with a total height of 2 feet. There is a normal plinth up to a height of 1 foot and then it is extended to another one feet with less width. The wall panels (V panels) are inserted

into this extended plinth for support. The walls have a height of 2.7m. Windows and doors are fit into the structure by cutting out the panels in appropriate size. Windows are provided in the corners to avoid cutting the panels from center, which might affect its structural strength. Windows are provided almost along the full wall length for lighting and ventilation purpose. Electrical wiring is done externally and not as concealed wiring.

The roof structure is supported on steel box sections as mentioned above. These steel columns are then inserted into concrete pillars of size 23cm x 23cm. The roof frame is made of steel truss made of box sections and is supported on the top of the steel box columns. The roof structure is covered using mangalore tiles.

9.1.2 KMCA Village, Puthoorkkunnu, Panamaram

KMCA village is a rehabilitation initiative of The Kerala Muslim Community Association (KMCA), a non-profit organisation based in California (Figure 9-7). The project is being executed in association with Daya Rehabilitation Trust (Thanal), a leading NGO based in Kozhikode.

Figure 9-7: General view of KMCA village

Figure 9-9: A typical V panel unit

Figure 9-8: Stilted construction

There is around 15 housing units in the project area. Water supply to this area is from a borewell. The project area is slanting in a way that each plot is at different grade.

Materials used for construction

The materials used in this project is same as that of the units in Thanal villa. Walls are made of V panels. Foundation is on concrete stilts. Roof frame is steel truss and covering is of mangalore tiles.

Construction details

In KMCA village since the plots are at different grade, the houses are built on top of concrete stilts. The foundation is laid in the form of a mat foundation with a cell size of 65 cm x 65 cm. The main load bearing stilts are of size 23cm x 23 cm. In between this load bearing stilts there are smaller sized stilts too.

Figure 9-10: The load bearing stilts in foundation

There is a steel frame connecting the stilts which acts the foundation. The steel box section in this framework is of size 3 inch x 3 inch outside and 2 inch by 2 inch inside. The walls are then placed on top of this steel framework. Steel angle plates are screwed on to the V panels and then welded to the main steel frame. Rest of the construction details is similar to that of the units in Thanal villa. There is no provision for future expansion in both these unit types. The construction details of the project are shown in Figure 9-10.

9.1.3 Aster MIMS project, Muppainad Panchayat

This project is funded by ASTER MIMS Calicut under the CSR scheme of the institution. The execution of the project is sub contracted to HABITAT group. There is around 10 to 15 units under construction in this project. Each unit is having an area of 450 sqft and is designed as a 2 BHK unit. Each unit is given a budget of Rs. 5 lakhs.

Figure 9-11: General view of the units

Figure 9-12: Interlocking mud block unit under construction

Materials used for construction

Foundation of these units are constructed using PCC and normal rubble masonry. Walls of the units in this project are made of interlocking mud blocks (Figure 9-13). These mud blocks are bought from Omassery and Kuttiyadi. The blocks from Omassery site are of size 23cm x 15cm x15cm, and those from Kuttiyadi site are of size 27cm x15cm x 12cm. The blocks have groves of two sides and corresponding projections on the other sides which helps in the interlocking action. Plastering is done using cement mortar.

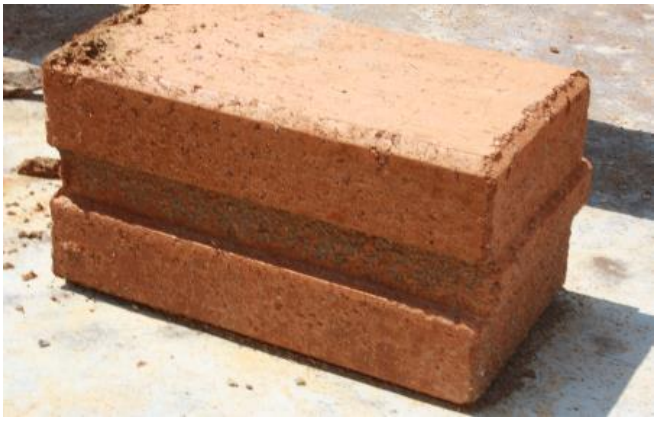


Figure 9-13: Interlocking mud block

Flooring is done using vitrified tiles. Windows and doors have cement frames and wooden panels. The door panels are made of medium quality wood. Roof structure and lintels are made of concrete.

Construction details

The foundation of these houses are constructed as normal rubble masonry structure. Above this foundation, the plinth beam is constructed using concrete. Rammed Earth fill is done between the foundations for flooring.

Flooring is then finished using vitrified tiles. The walls are made of interlocking mud blocks. First layer is bonded to the plinth beam using cement mortar in a skilled manner and then the rest of the wall is constructed by simply arranging the blocks one by one using English bond pattern.

Figure 9-14: Normal RR foundation

Figure 9-15: Partially plastered walls

Figure 9-16: Rcc roof slab under construction

Since the blocks have an interlocking action, there is no need of cement mortar in the joints. Windows and doors are placed between the mud blocks and is then fixed using cement mortar. A concrete belt is then constructed in the lintel level. Roof is constructed as a concrete flat slab on top of the wall. There is no columns used in the construction of these units. The walls are plastered to a height of 60 cm from bottom as well as from top of the walls. This is to avoid exposing the mud blocks to harsh weather conditions. For the construction of a unit, around 2000 mud blocks are used, and each blocks costs around Rs. 25. The construction details of a typical unit is shown in figures 9.14 to 9.16.

Figure 9-17: An interlocking mud block unit under construction

9.1.4 Swaminathan foundation project

The MSSRF has built 10 green houses at the Kairali Adivasi hamlet at Moopainadu grama panchayat in Wayanad district with the financial support of the State Tribal Development Department and technical assistance of Vasthukam, a green architect concern in Thrissur. The NGO had also tried to equip the local community with the knowledge of constructing such low cost sustainable houses. Thus they expect this to turn out to be a way of living for the community memebrs.

Materials and methods of construction

The walls of these housing units were made of rolled clay blocks. Locally available mud was the major material used in the construction. They were then finished by chipping off the extra material. The finished wall is then dried in sun. Roofing framework was found to be wooden, covered using manglore tiles. The walls were 35 cm thick.

Figure 9-19: A typical unit in the project

Figure 9-18: Exposed walls with cracks

These houses were built based on sustainable housing concept. Rammed earth construction technology was used for the basement and foundation and cob construction for the walls. Hard wood was used for the construction of windows and doors. The houses were plastered

with different colour mud available in the area. Its roofing frame was done using wood and was covered using Mangalore tiles. Local people were trained for the same and was involved in the construction of these houses. Around sixty percentage of the cost of construction was the labor cost; thus a large portion of the cost was circulated among the inhabitants of the hamlet.

The houses, each of 357 sq ft area, were constructed at a cost of Rs.4.24 lakh.

CHAPTER 10. PROPOSED MATERIALS AND METHODS FOR CONSTRUCTION

10.1 Normal unit

Foundation for this unit type is proposed to be normal RR masonry foundation. An RCC plinth beam is then built on top of the foundation. Walls are then built on top of the plinth beam using interlocking mud block (**Error! Reference source not found.**). The first layer of he interlocking wall needs to be done with at most care, since this layer determines the alignment of the wall. Thus, skilled labor is required for laying the first layer. The following layers can be arranged even without the help of a mason, sue to the interlocking pattern of the blocks. The walls are then plastered up to a height of 0.6m from both the bottom and top. This is done in order to protect the walls from dampness. Flooring is done using vitrified tiles. The roof framework is a steel truss frame using box sections. And the roof covering is proposed to be of Manglore pattern tiles. Wooden. panels and shutters are suggested for windows, doors and ventilators.

10.1.1 Details of interlocking mud block

Interlocking bricks are bricks that have been designed to fit into each other. Each brick has a protrusion at one end and a depression at the other end which enables them to fit perfectly like jigsaw puzzles (Figure 10-1). As the name suggests brick lock itself with other bricks and it is these interlocks which give strength to wall. Size of interlocking brick available in the market are, 28 cm x 15 cm x 15 cm and 27cm x15cm x 12cm. These blocks are available in Omassery and Kuttiyadi. These blocks cost Rs. 25 each. There are smaller blocks also available in the market (of size 27cm x 15cm x 12cm). But the arrangement of these blocks will take much more time than the bigger ones. Thus the bigger blocks are proposed for the normal unit.

Figure 10-1: Interlocking mud block

10.1.2 Advantages of Interlocking mud block

These blocks are cost saving in terms of cement, sand and water and also saves time of construction. Design is more blended with nature as artificial bonding mechanism is completely done away with. The walls made out of interlocking mud blocks have more strength than the normal brick walls (dead load of these blocks are higher compared to normal bricks). These bricks do not heat up as fast as normal bricks, hence the room will remain cooler, which in turn reduces energy consumption. Painting becomes an option in such walls due to the natural finish and thus reduces cost. Due to interlocking method of construction, work can be completed in lesser time. These bricks can be easily dis assembled in future and can be re used many times. These bricks are much cheaper compared to the conventional bricks (net cost).

10.2 Flood resilient unit

The flood resilient housing unit is designed as framed structure with columns and beams spaced considering the designed loads. An RCC grade beam is provided at the level of the foundation connecting the sloped footing.Two layers of laterite stones are then laid over the grade beam to ensure adequate plinth height above the foundation. Walls of the ground floor is constructed using solid cement blocks. The walls are then plastered using cement mortar. Windows are proposed to be made with metal frames, glazed glass panels and aluminium shutters and the doors to be with metal frame and pressed wood shutters. And the flooring is to be done using terracotta tiles or red oxide. Lintels, columns, beams and staircases are provided as RCC structures according to the design load.

First floor of these units are proposed as stilted units. RCC stilts are provided to support the first floor. Footings of appropriate dimensions according to proper design are to be provided for the stilts. An RCC floor slab is constructed on top of the walls supported using properly designed RCC columns. The walls of the unit in first floor is proposed to be made out of V panel. The V panel is supported in a box steel section of appropriate dimension. Finally, the roofing framework is proposed as steel truss frame using box sections and Manglore pattern tiles as covering.

10.2.1 Details of V panel

V Panels are an excellent substitute over plaster board, particle board, plywood and brick wall partitions. V panel is manufactured using a unique technology by which the asbestos free fibre cement facing sheets and the cementious core are bonded to form a composite panel with an excellent bonding strength (Figure 10-2). It is available in two thicknesses of 2" and 3" and also in three heights of 8", 9" and 10". It is available at a cost of Rs. 180 per Square feet (Including labor and erection charges). The erection of these panels require skilled labor. These panels can be cut according to the design of the walls and then assembled in site.

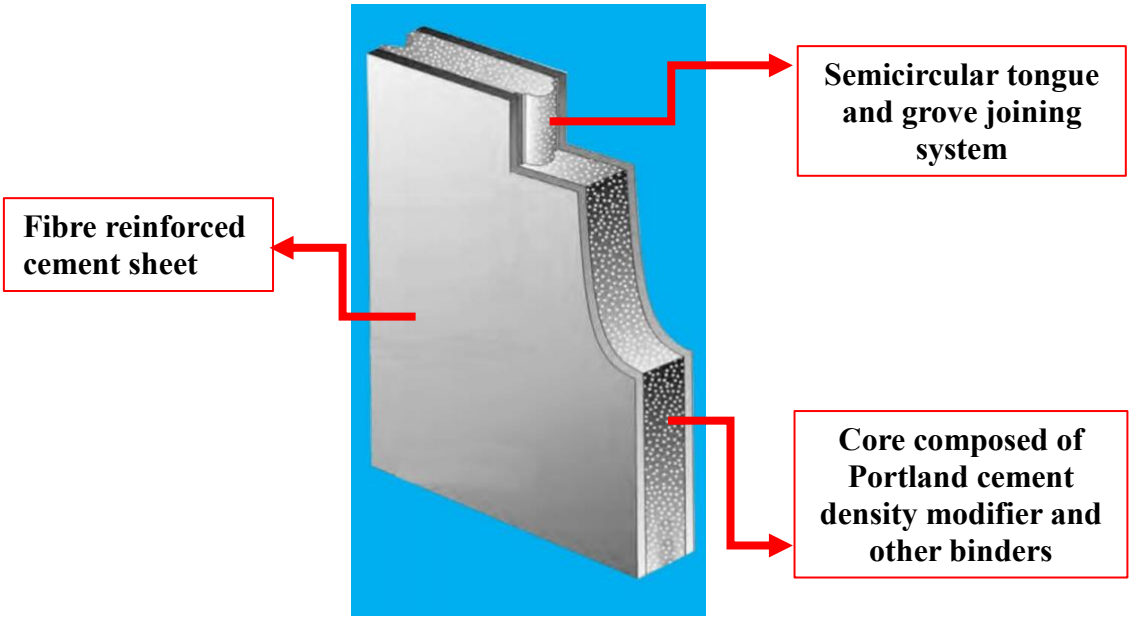


Figure 10-2: V panel section

10.2.2 Advantages of V panel

The unique semi-circular tongue and groove makes installation of Vpanel very easy. It is an energy efficient building product because of its excellent thermal properties. With properties like acoustic insulation, thermal resistance and fire rating, Vpanel is a very good choice for internal partitions for commercial and residential buildings. The slim Vpanel partition results in higher carpet area for construction. Fire Rating of V panel of thickness 75mm is 120min and that of 50mm thick panel is 60min. The product is asbestos free, making it healthier and environmental friendly. V panel is light weight in nature making it more workable in nature. It is also very easy to dismantle and relocate these panels. These are claimed to be water resistant and termite resistant by the manufacturers.

10.3 Estimation and costing

Quantity estimation of the units was done using the center line method of estimation. The rates of various items are taken from DSR 2018 as well as from market survey. The abstract of cost estimation of the units are given Appendix D.

According to the calculated estimates, all the unit costs are bound to the budget limit of Rs. 6 Lakhs (Max amount available to the tribal communities). The rates and amounts specified in the estimates are subjected to changes in market price, revision in price structure, transportation cost inclusion, etc.

Part IV

Tribal Settlement Planning and Development Approach

CHAPTER 11. GUIDELINES FOR PLANNING TRIBAL SETTLEMENTS

11.1 Introduction:

The tribal community generally prefers to settle as self- contained groups along with their family or relatives. They also found to be highly bonded each other socially and culturally. Hence the settlement pattern must be promoting their community living as well as must be socially and culturally adaptable. The following sections highlight the approaches for planning settlements for tribal community followed by guidelines for flood resilient planning.

11.2 Type of Housing Cluster

A cluster is defined as Plots or dwelling units or housing grouped around an open space. Ideally housing cluster should not be very large. In ground and one storeyed structures not more than 20 houses should be grouped in a cluster. Clusters with more dwelling units will create problems in identity, encroachments and of maintenance. By considering the the distinct socio- cultural characteristics of tribal community the study proposes “Interlocking Cluster” as an appropriate housing cluster as shown in Figure 11-1. Interlocking clusters are formed when the dwelling units are joined at back and on sides with at least one side of a cluster common and having some dwelling units opening onto or having access from the adjacent clusters will be considered as interlocking clusters. Dwelling units in such clusters should have at least two sides open to external open space. Houses in an interlocking cluster can have access, ventilation and light from the adjacent and cluster and also cater for future growth of the settlement.

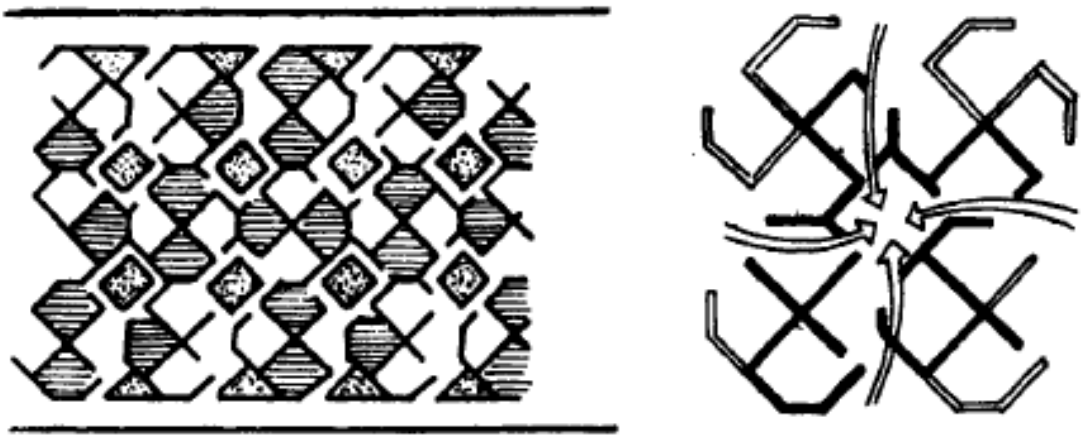


Figure 11-1: Interlocking cluster

11.2.1 General criteria for cluster planning

Plot Size: The minimum plot size permissible shall be 15 rn2 with 100 percent ground coverage and an FSI of two 100 percent ground coverage and FSI of 2 will be applicable up to plot size of 25 m2. For plot sizes beyond 25 m2 provision of IS 8888 (Part 1): 1993 will be applicable.

Size of Cluster Open Space: Minimum dimensions of open spaces shall be not less than 6 m or 3/4th of the height of buildings along the cluster open space, whichever is higher. The area of such cluster court shall not be less than 36 m2. No setbacks are needed from the edges of cluster as pedestrian/vehicular access roads surrounding the cluster.

Vehicular access: A right of way of at least 6 m width should be provided up to the entrance to the cluster to facilitate emergency vehicle movement up to the cluster. Minimum width of pedestrian paths shall be 3m.

Width of Access Between Two Clusters: Built area of dwelling unit within cluster shall have no setbacks from the path or road, space. Hence, the height of the builiding along the pathway or roads shall be not less than 60 percent. of the height of the adjacent building subject to minimum of 3 m in case of pathway and 6m in case of vehicular access.

Density: Cluster planning methodologies result in higher densities with low rise structures. With per dwelling unit covered area of 15 m2 densities of 500 dwelling units per hectare (net) shall be permissible. Densities higher than this should not be allowed.

Group Toilet: Cluster housing for economically weaker section families can have group toilets at the rate of one we, one bath and a washing place for three families. These shall not be community toilets, as keys to these toilets shall be only with these three families, making them solely responsible for the maintenance and upkeep of these toilets.

11.3 Guidelines for siting housing in flood prone areas

Any proposed development in the disaster-hit areas must be to minimize the damage and loss in future disaster contexts. The extent of damage during flooding, cost of repairs of the damages, cleaning the debris, etc. will depend on the following factors: Depth and velocity of the water, period of inundation, debris loads and silt in the water, house location and its orientation to any flow, spacing of houses (which influence the velocity of the flow between buildings), materials used, construction detailing, etc.

Kerala being a multi hazard prone state the infrastructure reconstruction must incorporate standards and design provisions, stipulated by various international and as well as national agencies for siting and design and construction of buildings and structures. However, in the wake of largescale damage due to flooding, housing in the flood prone areas need to be constructed following flood resistant design provision as per the code for Flood Resistant Design and Construction, ASCE 24-14 by American Society of Civil Engineers (ASCE) as well as National Disaster Management Guidelines-Management of Floods by National Disaster Management Authority, India.

New construction and substantial improvements shall be designed and constructed, to resist flotation, collapse, or permanent lateral movement resulting from the action of hydrostatic, hydrodynamic, wind, and other loads during design flood.

The basic approaches and guidelines for settlement planning in flood prone areas have ben explained below.

Approach 1: Dry flood proofing

Dry flood proofing" the houses where depths of inundation is potentially high. Dry flood proofing uses levees, door seals and walls to stop water from entering the house as given in Figure 11-2. This can be achieved by raising the house on earthen fill or embankments as shown in Figure 11-3. Fill can be shaped to optimise the flow of floodwater around the building. In either case, earthworks or fill and the house building shape should be planned to divert floodwater away from buildings. ASCE 24 limits dry flood proofing to areas where flood velocities are less than or equal to 5 feet per second.

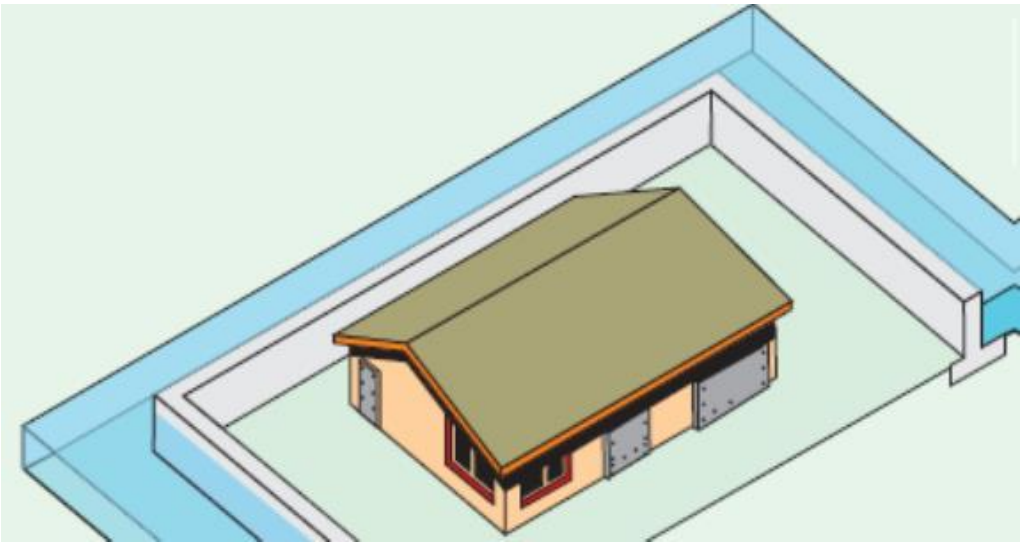


Figure 11-2: Dry flood proofing by sealing the compound

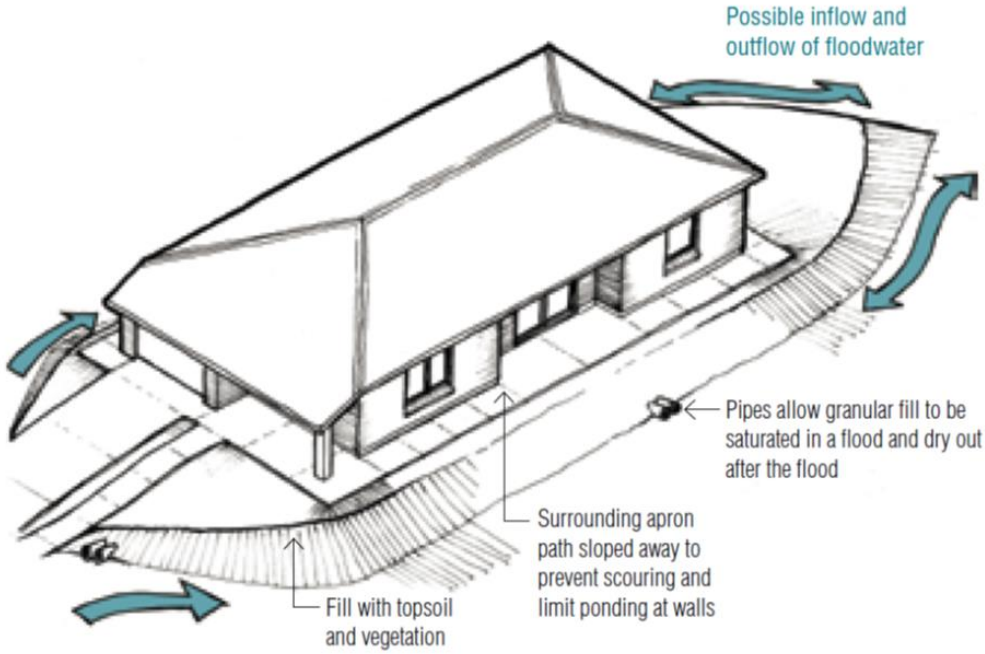


Figure 11-3: House with slab on fill

Approach 2: Building Siting and Orientation

Orientating the house across the flow can reduce the clearance between houses, which increases the local velocity around the house. Hence orientating the house as the shorter wall faces the water flow. It is always ideal to build houses according to the natural topography of the plot. It is also advised to streamline the corners, as these are likely to be mostly damaged due to impact of debris and turbulence. If the length of the house is more in one direction, then the house should be oriented in such a way that the shorter wall faces the direction of flow to minimize the damage. New houses should be constructed in such a manner that evacuation route is clear. Access roads to settlements should be designed in such a way that evacuation in case of flood events is easy. The houses should not be constructed along the path of drainage of flood water. In an area which is likely to be hit by floods, the land-use planning regulations should clearly define at what distance from riverbeds would it be safe to locate the settlement. The figure following explains the best possible ways of building orientation in flood prone areas.

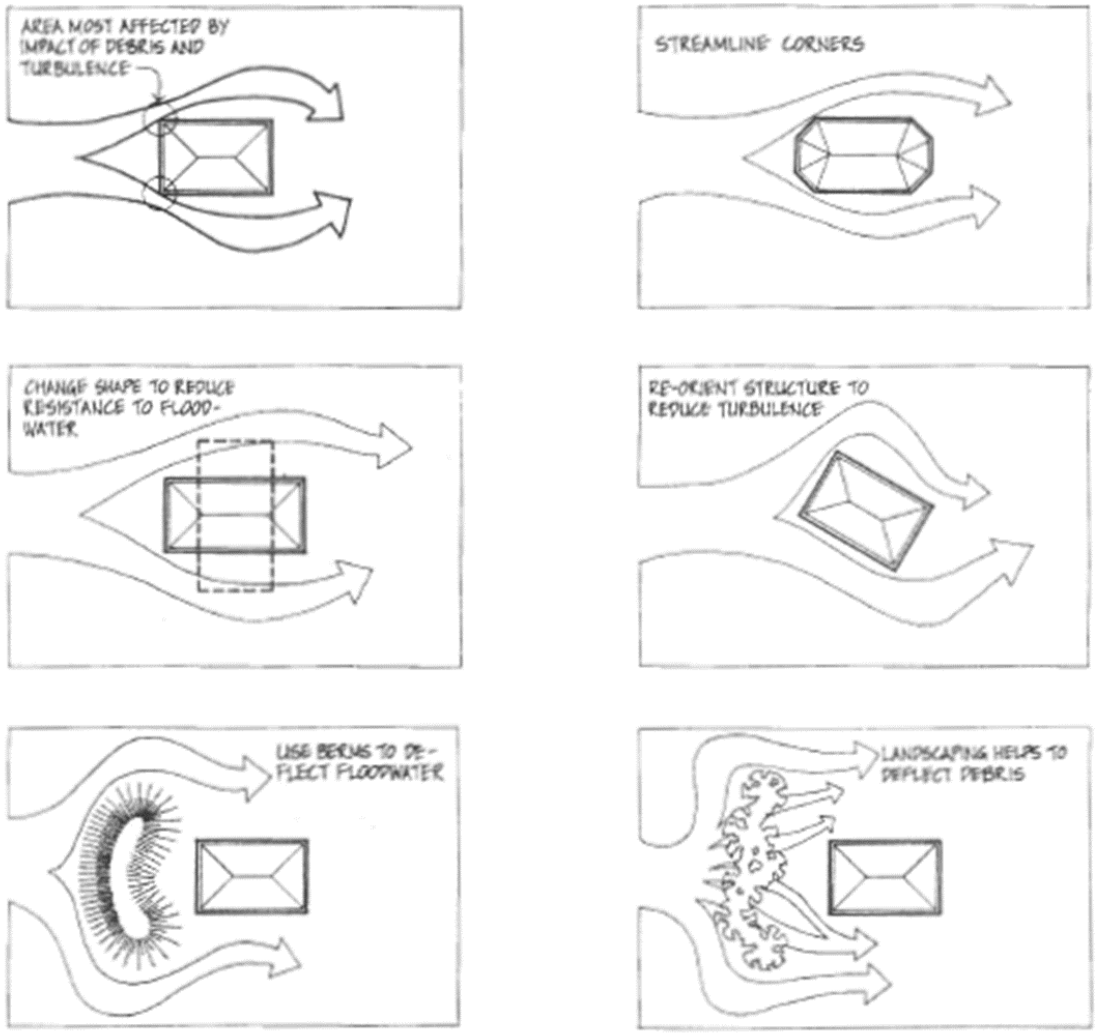


Figure 11-4: possible ways of building orientation in flood prone areas

Approach 3: Lay out of buildings

The layout of buildings in the settlement should be in such a way that, there is adequate spacing between the buildings. This is to ensure that the velocity of the water flowing between the buildings does not increase and thus cause more damage to the buildings. It is most ideal to construct square shaped buildings as they are proved to be more stable. It is ideal to construct circle shaped structures or houses with their sides inclined to the flow of water thus to reduce the damage due to flow of water.

In areas with significant water velocity, following design features have been recommended.

1) ratio of the sides less than 1:2 avoiding long and narrow designs or ones which have long projections off the core,

2) For houses with “L” shapes, it is important to see that the two legs are not significantly different in length - a maximum difference of 1:1.5 in most cases will keep inherent robustness, and
3) Buildings with long walls are more fragile and if the long wall intercepts the direction of flow, floodwater loading and the vulnerability to debris loading is maximised, (although, this impact may be reduced by using the internal walls as bracing of the long wall).

Part IV

Summary

CHAPTER 12. CONCLUSION

12.1 Introduction

The post flood damages on the housing and associated infrastructure in Kerala has called for disaster resilient eco-friendly housing reconstruction approaches, especially in the geographically vulnerable areas of the state. The post flood rebuilding efforts by the government of Kerala mostly subscribe to the house designs developed by LIFE Mission based on the conventional lifestyle of the majority of the population in the state. Even though the LIFE Mission guidelines allow for customization by the beneficiaries, vulnerable sections of the society such as tribes lack access to technical support for constructing disaster resilient housing satisfying their socio economic and cultural characteristics.

12.2 Research methods and deliverables

In this background, the current research project was an attempt to evolve disaster resilient sustainable housing design options customized for tribal communities, through a comprehensive participation of the community during various stages of the design process. This aim was full filled through a structured research through various phases. The research work started with identification of vulnerable community in need of appropriate housing solutions and found that Adiya, Paniya and Kattunaikka community are the most vulnerable communities in Wayanad. Later indigenous housing styles of the identified tribal communities were documented. Housing typologies currently existing housing typologies were documented.

A participatory design process was designed and executed to understand the socio economic status and cultural identity as well as the housing need of the identified three communities. Initial housing solutions were prepared based on this satisfying the community characteristics and housing requirements. These housing solutions were presented to the community and collected their feedback. The final housing solutions were developed appropriate to the community contexts minimizing the physical vulnerability based on the feedback received from the community interactions. The final output of this research project are appropriate house design options for the tribal community (flood affected/non affected) responding to their socio-cultural needs, cost /estimate of each of the typologies and a set of cluster planning guidelines. A detail report to document the entire procedure of the study was

prepared. The report includes a detailed comparative study of the existing housing typologies namely traditional v/s government build houses, questionnaire used to elicit information's about the community and the specific socio-cultural customs or needs that have spatial manifestations in housing design.

12.3 Scope and limitation

Though the aim of the research project was to derive customized design options for tribal communities, the final design solutions were limited to basically few typologies due to some limitations. One settlement of each community was selected to derive the community characteristics and the socio-economic background. This has led to limited sample size and also the location wise changes in characteristics were not able to incorporate while formulating design proposals. The selected communities were basically affected by recent flood; this was also limited the scope of further explorations. A robust design solution can be derived only when we study a number of settlements which are spatially dispersed with a sample representing the entire population of the tribal community. A real prototype of the design solution constructed should be constructed on site and the community perception on the same should be studied.

APPENDIX A

Survey Questionnaire

QUESTIONNAIRE SURVEY

For Housing Design for Tribal Communities in Wayanad, Kerala

This survey is being conducted as part of the Research and Development project on Appropriate Housing Design for Tribal Communities in Wayanad, Kerala. UNDP India funds the project. The data collected shall be used solely for the purpose of the project.

Date: Name of Surveyor: Sl. No.

PART- I
Settlement Characteristics

Name of Settlement: Location: Tribe:

1. Total Area of settlement:
2. Settlement Pattern: Clustered/ Dispersed
3. Is the settlement accessible from any major road: Yes/ No
   If yes type of accessibility: Tarred Road/ Pathway (tarred/ cemented) / undefined
4. Details of Community Infrastructure
   a. Is there any community meeting place: Yes / No, If yes : Built / Open space
      If built space, 1) Type of structure: Pucca/ Kutcha/ Semi pucca
      2) Area: _____
      3) Uses Planned for:
   b. Is sufficient playground available: Yes / No
   c. Is community graveyard available : Yes / No
   d. Availability of Community water supply facility such as well/ storage tank : Yes / No
      If yes, what is the management system: Community/ Authority/ Any Other?
   e. Availability of Community Waste disposal system : Yes / No
      If yes, Type of system: Incinerator/ Compost/ any other
5. Accessibility to social infrastructure
   a. Distance to educational facilities: Anganawadi:_____, Schools:_____, Colleges:_____
   b. Distance to Healthcare facilities: PHC:_____, Govt. Hospitals:_____
   c. Distance to Markets:_____
   d. Distance to theatre/ auditorium:_____

General observations:

PART- II

Socio – Economic and Housing Characteristics of the Community

House No.

1. General Information

1.1 Name of family head :

1.3 Age & Sex: :

1.4 Education :

1.5 Occupation :

1.6. Length of Occupancy :

2. House hold information

2.1 No. of House Hold :

2.2 Owner of House :

2.3 Details of family members :

Members	Relation Ship With Head of the Family	Employment	Age	Education	Income
1.					
2					
3					
4.					
5.					
6					
7					

3. Details of Housing Design

3.1 Type of the House: Kachcha / Pucca / Semi- Pucca / Hut /Other

3.2 Type of land ownership: with Family / self - ownership / govt. owned

3.3 Nature of title: Patta / right to possession

3.4 Ownership of House : Owned / family/ Rented

If rented, rent per month :

3.5 If owned, was Govt. assistance received: Yes / No

3.6 If Yes details of assistance

Scheme / Agency	Year of construction	Owner Driven (Fully)	Owner Driven (Contractor)	Agency driven

3.7 Level of completion of the house: Complete / Incomplete

3.8 No. of Rooms : 1 / 2 / 3 / 4 / >4

3.9 Accessibility to drinking water: Within House/ within 100m / > 100 m away

3.10 Type of drinking water facility : Tap Water / Hand-pump / Well

3.11 Location of toilet : Within the housing unit/ Outside

3.12 Type of Toilet: Pit Latrine/ Pour flush/ Mechanical Flush

3.13 Type of drainage facility : Closed / Open

3.14 Size of housing unit and Plot :

3.15 Lighting and ventilation : Adequate / Inadequate
3.16 Is there any shortage of Water Supply : Yes/ No :
3.17 Adequacy of Electricity Supply : Adequate / Inadequate
3.18 Availability of adequate of Open Space / Yards around the house : Yes/ No
3.19 House level Solid waste disposal : Yes/ No
3.20 Level of privacy : Low/ Moderate /High
3.21 Provisions for alterations/expansion : Yes/ No
3.22 Any deity / divine place in the house : Yes / No
3.23 Do you own a vehicle? : Yes / No. If Yes availability of parking space: Yes / No
3.24 Do you own any furniture: Chairs / Table / Cots / T.V. / Fridge / Radio /Gas?

4. Details of Housing Design and Construction

4.1Principal materials used

a. Walls : Mud / Brick / Laterite / Other:
b. Floor : Mud / Cement / Tile / Other:
c. Roof : Thatch / Sheets / RCC / Tile / others
d. Doors : Cement/ Wood / PVC / Metal/ others
e. Windows : Cement/ Wood / Aluminium / Metal
f. Foundation : Granite / Laterite/ Other stones

5. Physical Vulnerability of the Settlement

5.1 Is it exposed to any hazard / thread : Floods / Landslides / low-lying inundation / Wildlife attack

If Yes a. The time of last hazard occurrence:
b. Were you affected by the recent floods : Yes / No
c. If Yes, Extent of damage : Full damage / Partial damage
d. Nature of damage : Roof/ Walls / Floor/ Other

e. Other observations :

6. Details of Employment Status of the Family

6.1 Your family's occupation (can be more than one):
(Agriculture / Agri.Labour / Forest Labour / Dairying/ Migration / Self Employed/Service)
6.2 Distance of the place of main occupation : 1km / 1- 2km / 2- 5km / 5km / > 5km
6.3 How do you reach your place of work : (On foot / Bus / Pvt. Vehicle / Own Vehicle?)
6.4 Income (Monthly) :
6.5 No of days of work in a month :
6.6 Average wages received per day :

7. Details of Land ownership (Non – residential)

a. Do you own any agricultural land : Yes / No
b. If Yes, how much : _____ Acres
c. Do you cultivate crops : Yes/ No

If yes, which crop is sown? : _____

e. What use do you put this produce? : Family consumption / sale
f. What is annual income from such sale :

8. Animal Husbandry / Dairying

a. Are you connected with Animal Husbandry : Yes / No
b. If Yes, number of animals : Types of Animals : (Cow / Buffalo / Bullock / Goat / Others: Specify)
c. Annual Income from this activity : ` _____
d. Are the services of Veterinary doctors available at village? : Yes / No
e. If No, where do you get such services :
f. Are you involved in poultry farming : Yes / No
g. If Yes, for what? : for house consumption / for sale of eggs / sale of chicken
12. Annual Income from this activity:
13. Do you have facilities for poultry farming : Yes / No

9. Health

a. Which are the general sicknesses reported in the family? :(Cold /fever/depression / skin diseases / arthritis / leprosy)
b. Where do you get treatment :(Govt. Hospital / Pvt. Hospital / PHC / other)
c. Distance of P.H.C. from your house :
d. Are you benefited by P.H.C.? : Yes / No
12. Do you take your children for regular vaccination? : Yes / No
If No, why? :

10. Education

a. Do you feel your children should study? : Yes / No
If Yes, why:
If No, why:
b. Which benefit your children get during education?: (scholarship / books / uniform / food)

11. Current status of housing unit

11.1 Condition of foundation : Bad/ Moderate / Good
11.2 Condition of Wall : Bad/ Moderate / Good
11.3 Condition of Roof : Bad/ Moderate / Good
11.4 Condition of openings : Bad/ Moderate / Good
11.5 Condition of Flooring : Bad/ Moderate / Good
11.6 Other observations:

12. Satisfaction with the Housing

a. Satisfaction with the housing unit: Low/ Moderate/ High
b. Satisfaction with the settlement: Low/ Moderate/ High
c. Satisfaction with the common facilities in the settlement: Low/ Moderate/ High
d. Satisfaction with the housing assistance provided: Low/ Moderate/ High
e. Satisfaction with the neighbourhood: Low/ Moderate/ High

10. Expectation / aspiration regarding future housing

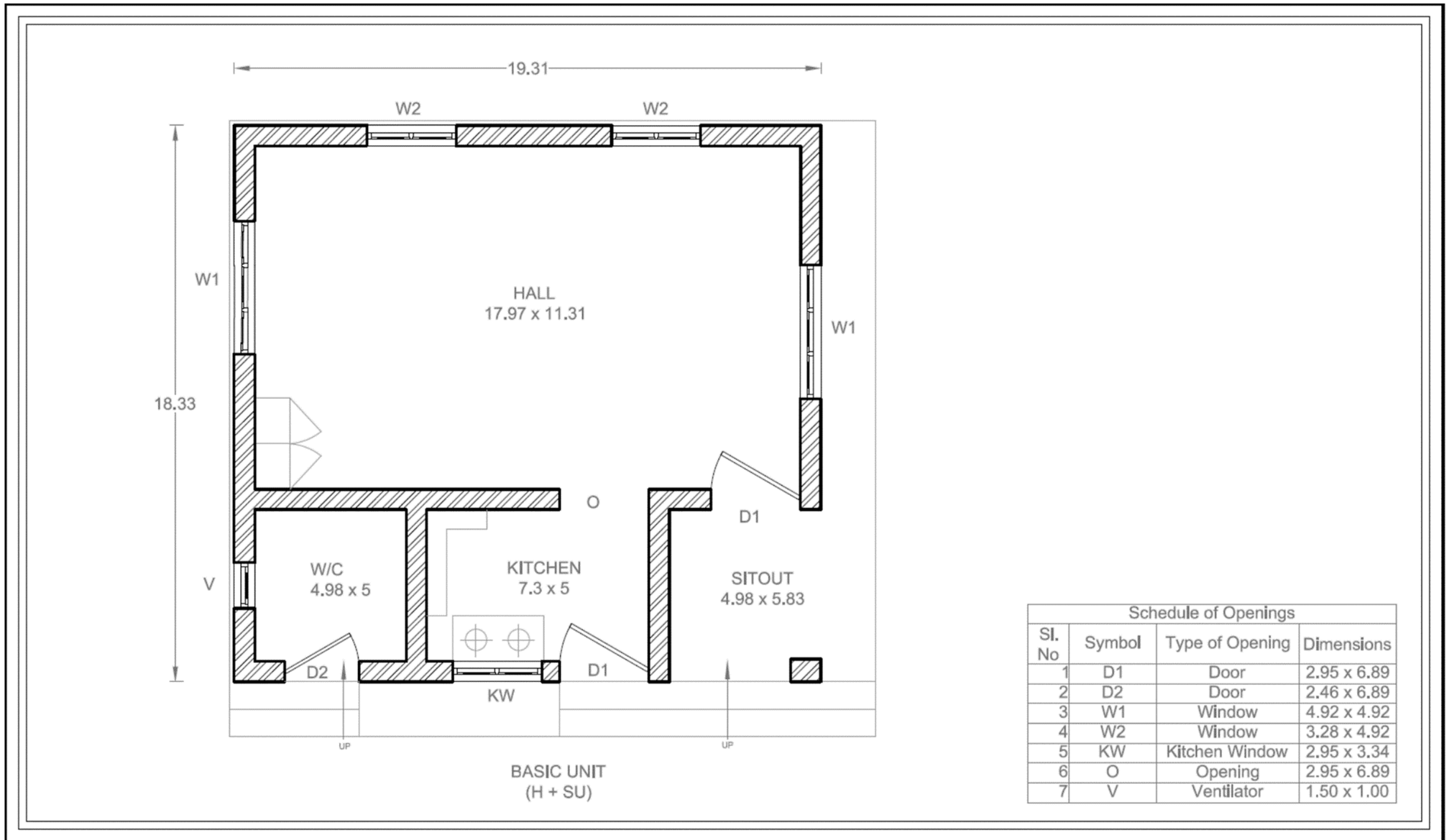
a. Prefer to follow cultural aspects in your housing design: Low/ Moderate/ High
b. Prefer to follow modern material for housing construction: Low/ Moderate/ High
c. Prefer toilet facilities within the housing unit: Low/ Moderate/ High
d. Prefer Pooja room within the housing unit: Low/ Moderate/ High
e. Prefer Community spaces within the settlement: Low/ Moderate/ High
f. Prefer open sitting area in the housing unit: Low/ Moderate/ High
g. Any other observation

General observations:

APPENDIX B

Technical drawings

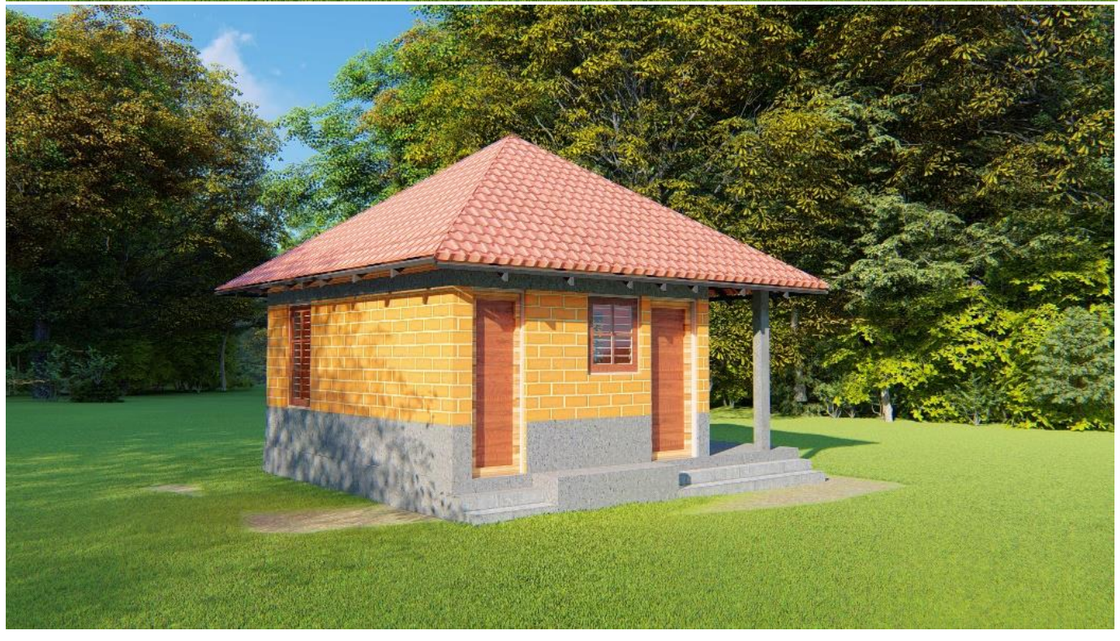
Technical drawing of Normal Unit: Typology 1



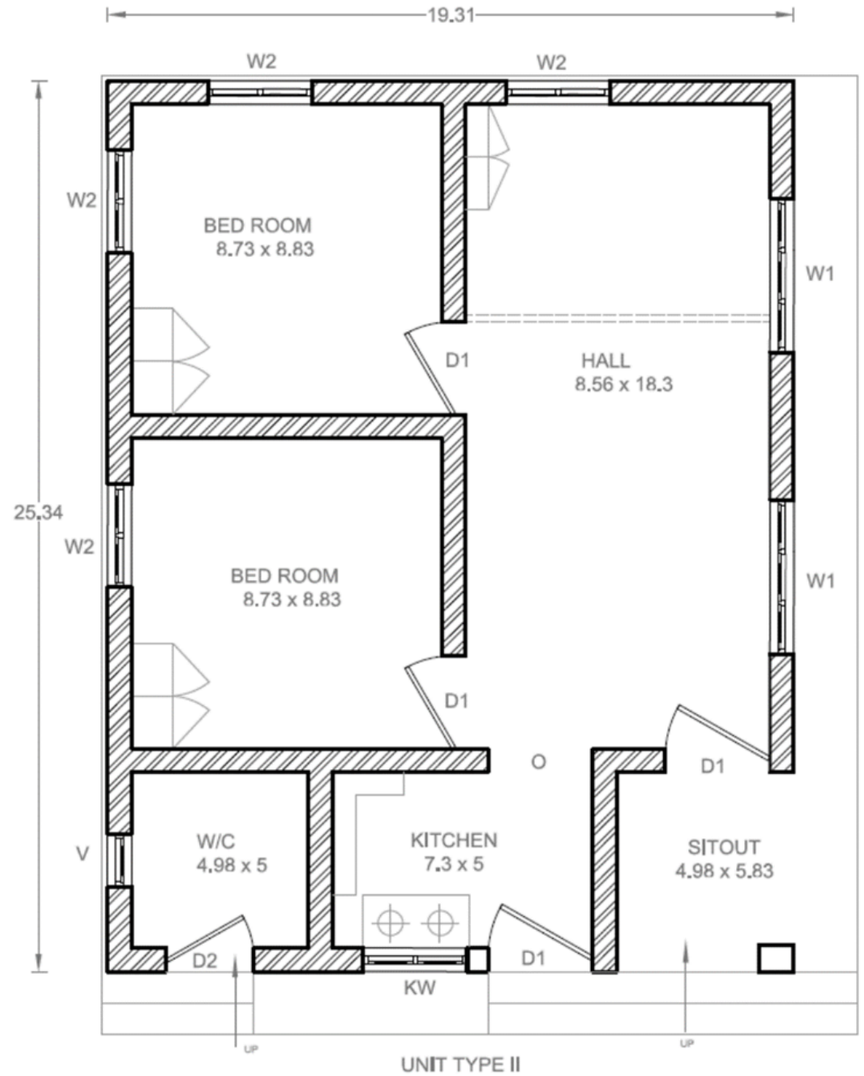
Schedule of Openings			
Sl. No	Symbol	Type of Opening	Dimensions
1	D1	Door	2.95 x 6.89
2	D2	Door	2.46 x 6.89
3	W1	Window	4.92 x 4.92
4	W2	Window	3.28 x 4.92
5	KW	Kitchen Window	2.95 x 3.34
6	O	Opening	2.95 x 6.89
7	V	Ventilator	1.50 x 1.00

Client: UNDP	Title :	PLAN OF BASIC UNIT (TYPE I)		All dimensions are in feet	Area - 354 Sqft
	Dealt :	Dr. Shyni Anilkumar, Assistant Professor Dr.Chithra K, Assistant Professor Dr. Deepthi Bendl, Assistant Professor		Architectural Consultants: Department of Architecture and Planning National Institute of Technology Calicut - 673601	
Project: DEVELOPING APPROPRIATE HOUSE DESIGNS FOR TRIBAL COMMUNITIES IN WAYANAD, KERALA	Apprd:		Chkd:		
	Scale:	1:100	Drg No:	Sheet No:	
	Date:	26 - 09 - 2019	PRO No:		

Rendered images of Normal Unit: Typology 1



Technical drawing of Normal Unit: Typology 2



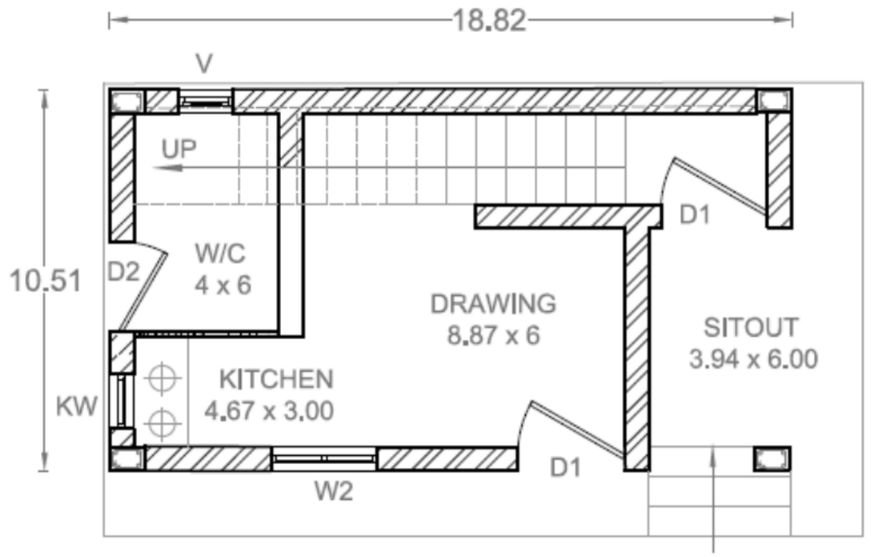
UNIT TYPE II

Schedule of Openings			
Sl. No	Symbol	Type of Openlng	Dimensions
1	D1	Door	2.95 x 6.89
2	D2	Door	2.46 x 6.89
3	W1	Window	4.92 x 4.92
4	W2	Window	3.28 x 4.92
5	O	Opening	2.95 x 6.89
6	V	Ventilator	1.50 x 1.00

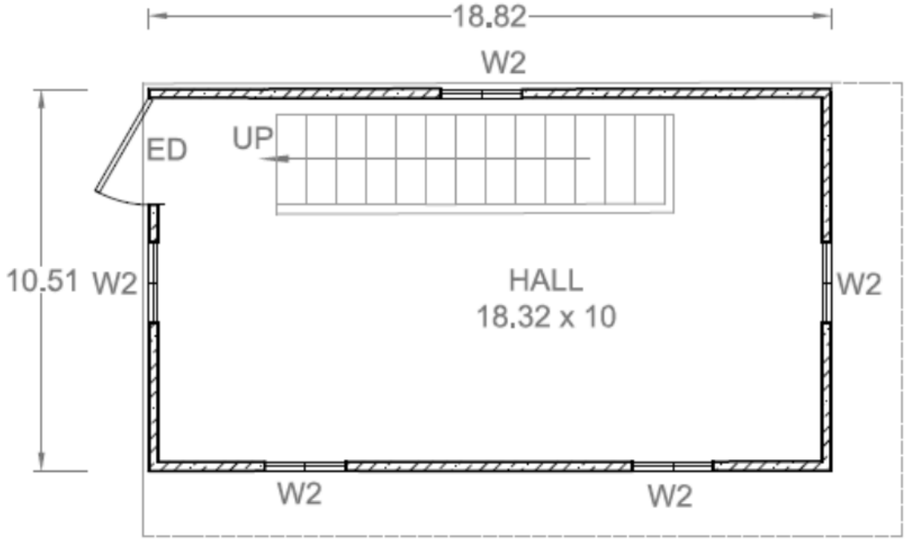
Client: UNDP	Title :	PLAN OF ORDINARY UNIT TYPE II		All dlmensions are In feet	Area - 489 Sqft
	Dealt :	Dr. Shynl Anllkumar, Assistant Professor Dr.Chlthra K, Assistant Professor Dr. Deepthl Bendl, Assistant Professor		Architectural Consultants: Department of Architecture and Planning National Institute of Technology Calicut - 673601	
Project: DEVELOPING APPROPRIATE HOUSE DESIGNS FOR TRIBAL COMMUNITIES IN WAYANAD, KERALA	Apprd:		Chkd:		
	Scale:	1:100	Drg No:	Sheet No:	
	Date:	26 - 09 - 2019	PRO No:		

Rendered images of Normal Unit: Typology 2

Technical drawing of flood resilient unit: Typology 1



Ground Floor



First floor

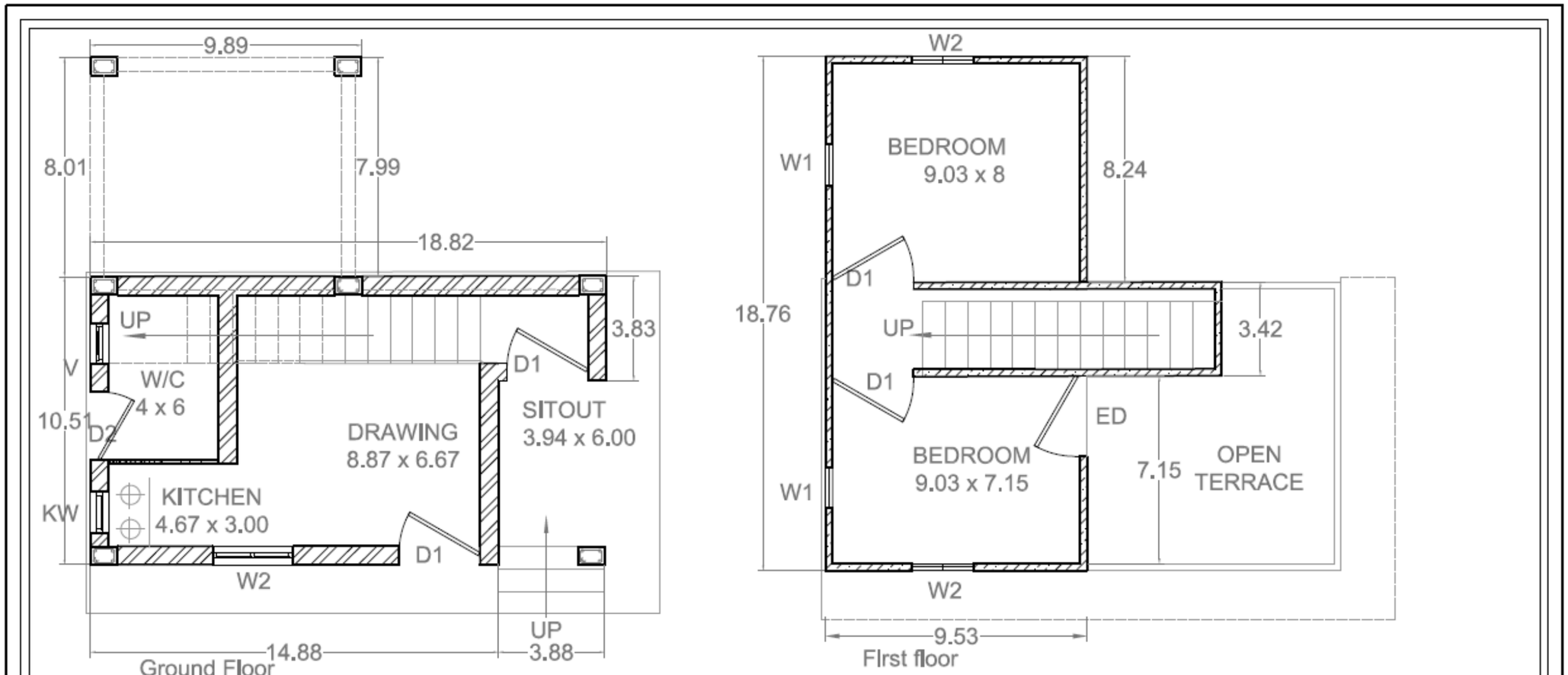
Staircase Details		
Item	Number	Width/ Height
Treads	13	0.82
Risers	14	0.58

Schedule of Openings			
Sl. No	Symbol	Type of Opening	Dimensions
1	D1	Door	2.95 x 6.89
2	D2	Door	2.46 x 6.89
3	W2	Window	2.23 x 4.92
4	O	Opening	2.95 x 6.89
5	V	Ventilator	1.50 x 1.00
6	ED	Emergency Door	2.95 x 6.89
7	KW	Kitchen Window	1.50 x 3.34

Client: UNDP	Title :	PLAN OF FLOOD RESILIENT BASIC UNIT (TYPE I)		All dimensions are in feet	Area - 395 Sq ft
	Dealt :	Dr. Shyni Anilkumar, Assistant Professor Dr.Chithra K, Assistant Professor Dr. Deepthi Bendi, Assistant Professor		Architectural Consultants:	Department of Architecture and Planning National Institute of Technology Calicut - 673601
Project: DEVELOPING APPROPRIATE HOUSE DESIGNS FOR TRIBAL COMMUNITIES IN WAYANAD, KERALA	Apprd:		Chkd:		
	Scale:	1:100	Drg No:	Sheet No:	
	Date:	26 - 09 - 2019	PRO No:		

Rendered images of flood resilient unit: Typology 1

Technical drawing of flood resilient unit: Typology 2



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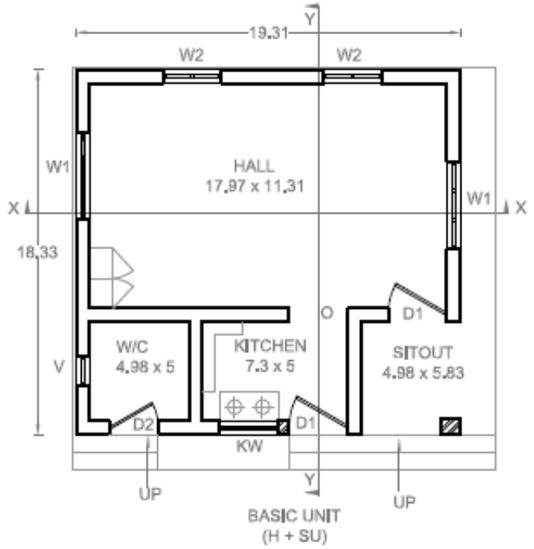
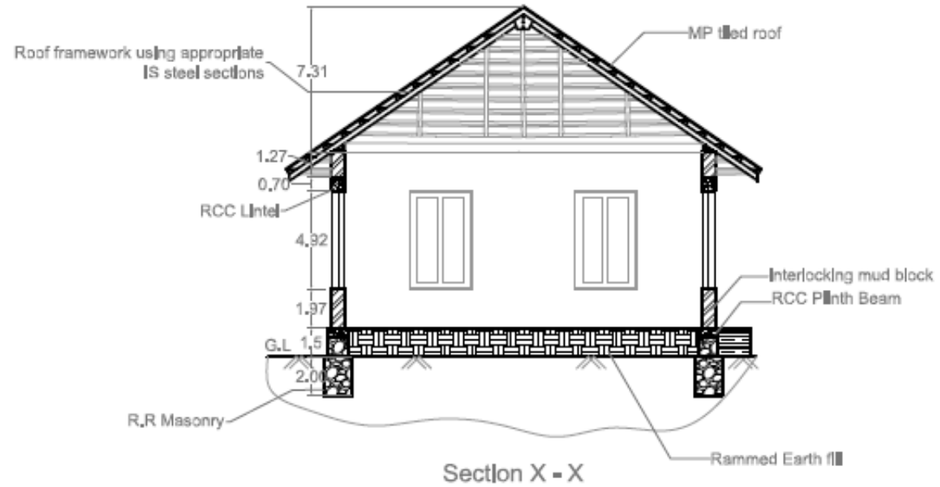
3	W2	Window	2.23 x 4.92
4	W1	Window	1.50 x 4.92
5	O	Opening	2.95 x 6.89
6	V	Ventilator	1.50 x 1.00
7	ED	Emergency Door	2.95 x 6.89
8	KW	Kitchen Window	1.50 x 3.34

Client: UNDP	Title :	PLAN OF FLOOD RESILIENT UNIT TYPE II	All dimensions are in feet
	Dealt :	Dr. Shyni Anilkumar, Assistant Professor Dr.Chithra K, Assistant Professor Dr. Deepthi Bendi, Assistant Professor	Area - 395 Sq ft
Project: DEVELOPING APPROPRIATE HOUSE DESIGNS FOR TRIBAL COMMUNITIES IN WAYANAD, KERALA	Apprd: / Chkd:		Architectural Consultants: Department of Architecture and Planning National Institute of Technology Calicut - 673601
	Scale: 1:100	Drg No: / Sheet No:	
	Date: 26 - 09 - 2019	PRO No:	

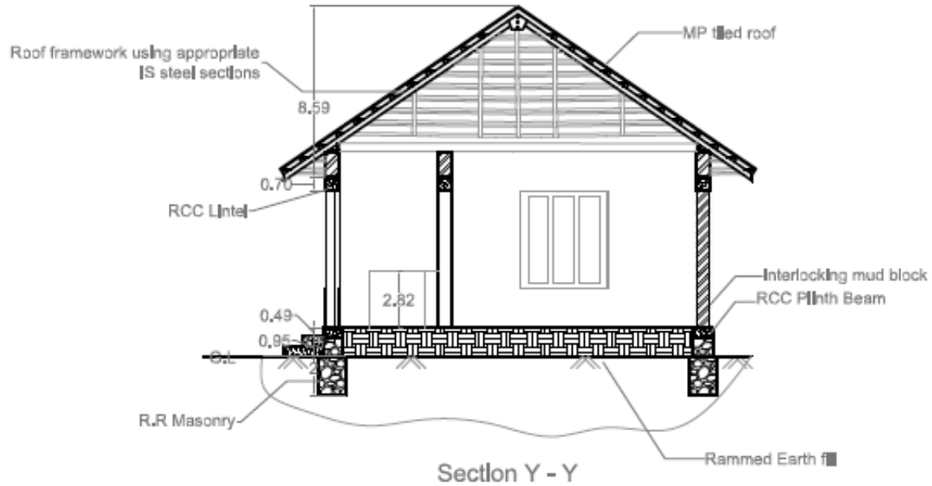
Rendered images of flood resilient unit: Typology 2

Section drawing of Normal Unit: Typology 1





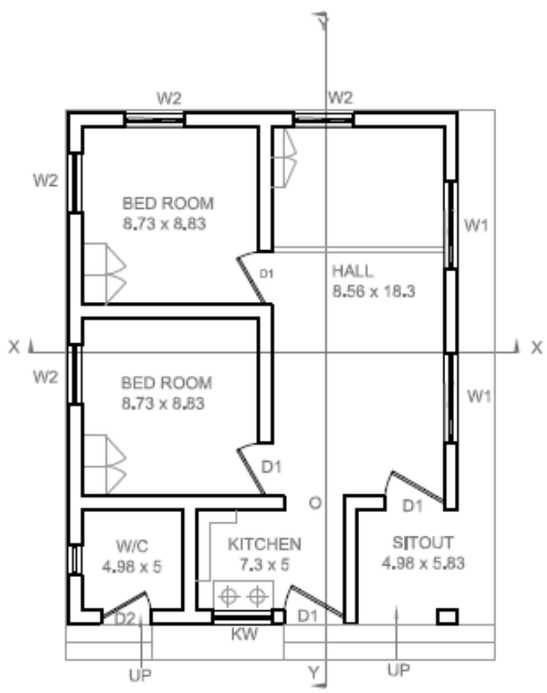
Section X - X

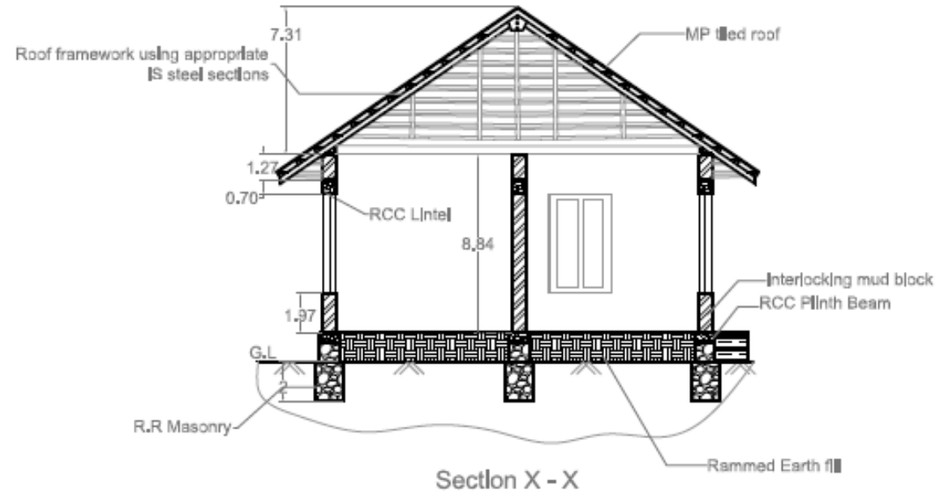


Section Y - Y

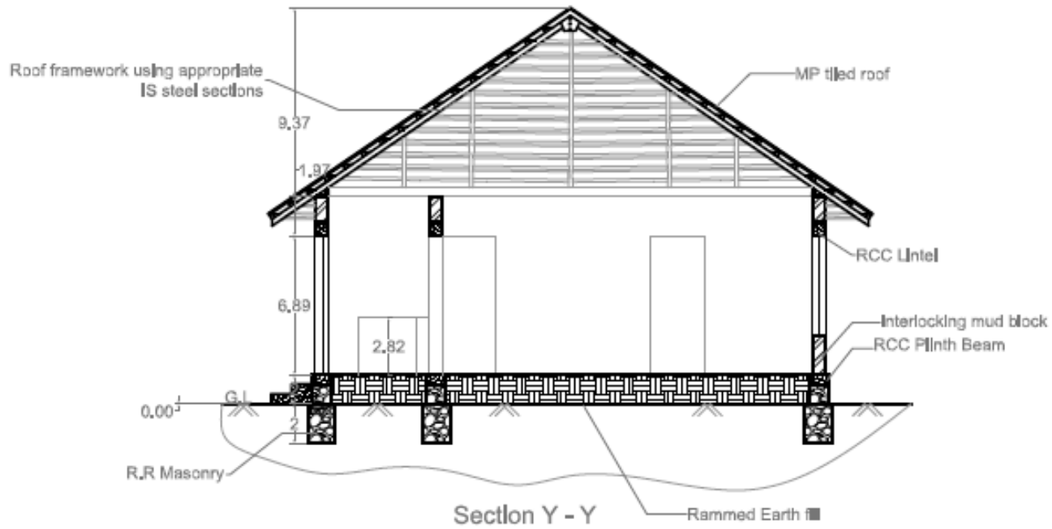
Client: UNDP	Title :	SECTIONS OF ORDINARY UNIT TYPE I		All dimensions are in feet	
	Dealt :	Dr. Shynl Anilkumar, Assistant Professor Dr.Chithra K, Assistant Professor Dr. Deepthi Bendl, Assistant Professor		Architectural Consultants: Department of Architecture and Planning National Institute of Technology Calicut - 673601	
Project: DEVELOPING APPROPRIATE HOUSE DESIGNS FOR TRIBAL COMMUNITIES IN WAYANAD, KERALA	Apprd:		Chkd:		
	Scale:	1:100	Drg No:	Sheet No:	
	Date:	26 - 09 - 2019	PRO No:		

Section drawing of Normal Unit: Typology 2





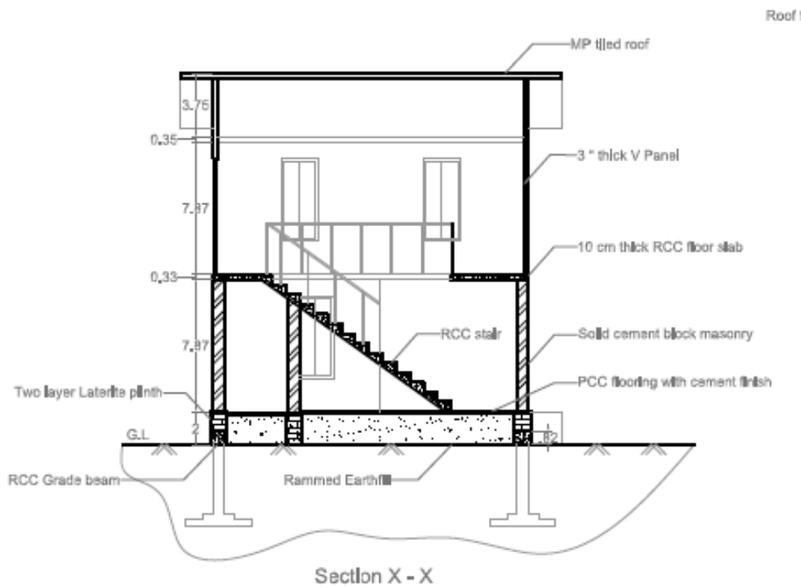
Section X - X

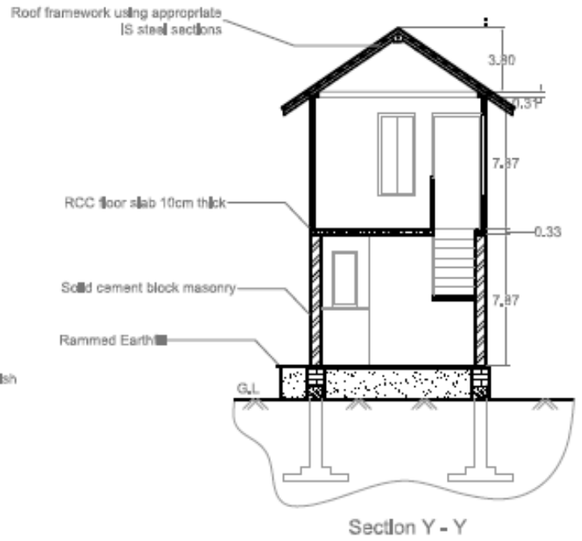


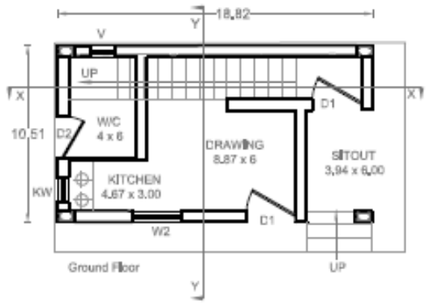
Section Y - Y

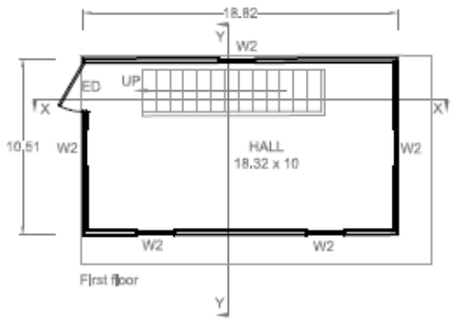
Client: UNDP	Title :	SECTIONS OF ORDINARY UNIT TYPE II		All dimensions are in feet	
	Dealt :	Dr. Shynl Anllkumar, Assistant Professor Dr.Chithra K, Assistant Professor Dr. Deepthl Bendl, Assistant Professor		Architectural Consultants: Department of Architecture and Planning National Institute of Technology Calicut - 673601	
Project: DEVELOPING APPROPRIATE HOUSE DESIGNS FOR TRIBAL COMMUNITIES IN WAYANAD, KERALA	Apprd:		Chkd:		
	Scale:	1:100	Drg No:	Sheet No:	
	Date:	26 - 09 - 2019	PRO No:		

Section drawing of flood resilient unit: Typology 1



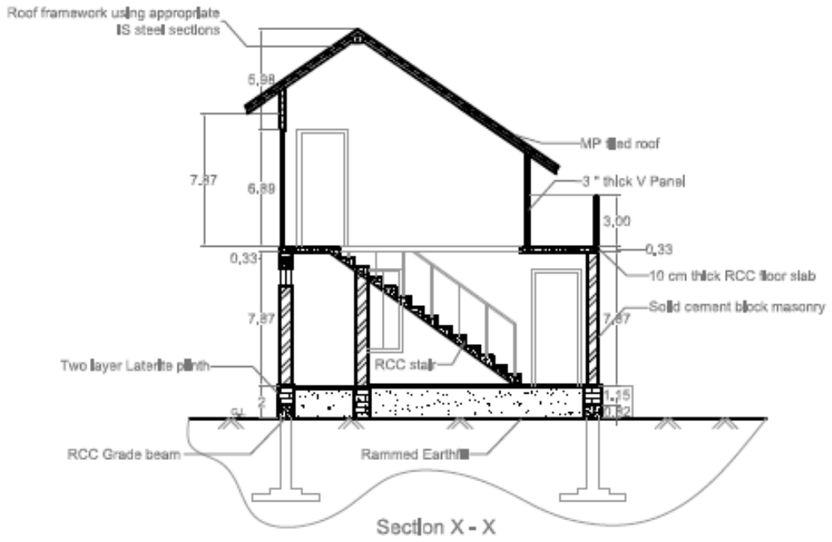


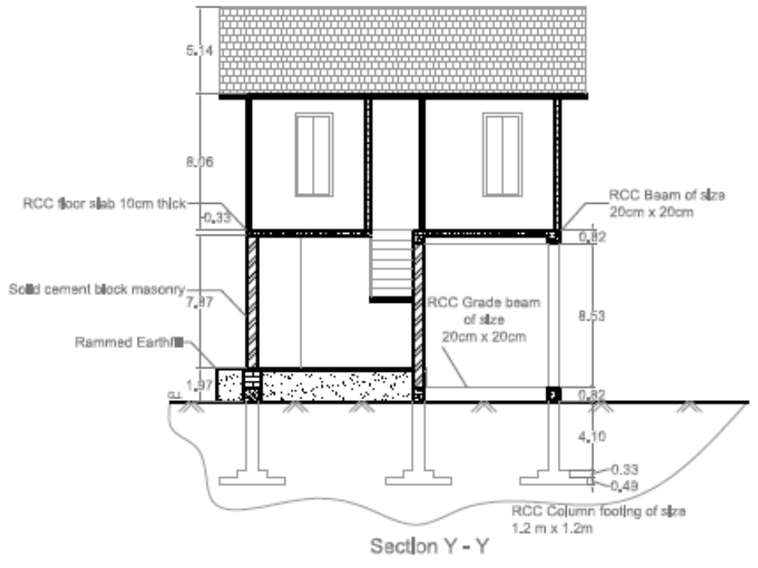


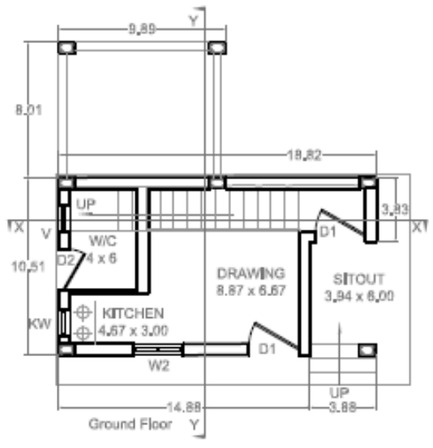


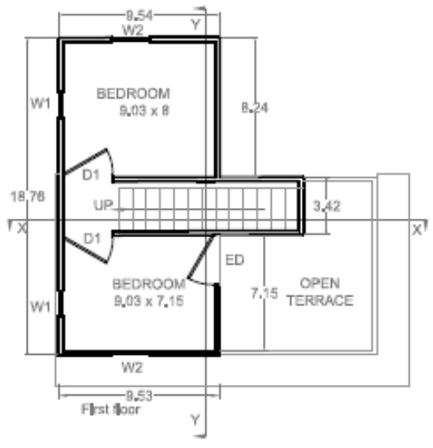
Client: UNDP	Title :	SECTIONS OF FLOOD RESILIENT UNIT I			All dimensions are in feet
	Dealt :	Dr. Shyni Anilkumar, Assistant Professor Dr.Chithra K, Assistant Professor Dr. Deepthi Bendi, Assistant Professor			Architectural Consultants: Department of Architecture and Planning National Institute of Technology Calicut - 673601
Project: DEVELOPING APPROPRIATE HOUSE DESIGNS FOR TRIBAL COMMUNITIES IN WAYANAD, KERALA	Apprd:		Chkd:		
	Scale:	1:100	Drg No:	Sheet No:	
	Date:	26 - 09 - 2019	PRO No:		

Section drawing of flood resilient unit: Typology 2









Client: UNDP	Title :	SECTIONS OF FLOOD RESILIENT UNIT II			All dimensions are in feet
	Dealt :	Dr. Shynl Anilkumar, Assistant Professor Dr.Chithra K, Assistant Professor Dr. Deepthi Bendl, Assistant Professor			Architectural Consultants: Department of Architecture and Planning National Institute of Technology Calicut - 673601
Project: DEVELOPING APPROPRIATE HOUSE DESIGNS FOR TRIBAL COMMUNITIES IN WAYANAD, KERALA	Apprd:		Chkd:		
	Scale:	1:100	Drg No:	Sheet No:	
	Date:	26 - 09 - 2019	PRO No:		

APPENDIX C

Design Appraisal

Presenting the initial design solutions with Kattunaika community (Vattappady settlement)







Presenting the initial design solutions with Adiya community (Chaligadha settlement)






Presenting the initial design solutions with Paniya community (Basthipoyil settlement)






APPENDIX D

Estimation and Costing

Estimation and Costing of Normal Unit: Typology 1					
S.N	**Item of Work**	**Qty.**	**Unit**	**Rate**	**Amount**
1	Earth work in excavation by manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.**(DSR-2018 / 2.6.1)**				
	All kinds of soil	**28.42**	**cum**	**181.85**	**5,168.18**
2	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m. **(DSR-2018 / 2.25)**				
	Total	**16.7**	**cum**	**219.65**	**3,668.16**
3	R R Dry Packing with Quarry Dust Fillng Masonry for Foundation using hard granite broken stone including cost and conveyance of all materials, labour charges, etc., complete **(current market price)**				
	Total	**17.3**	**cum**	**2,500.00**	**43,250.00**
4	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Plinth Beam	**2.09**	**cum**	**6,788.60**	**14,188.17**
5	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Plinth Beam	**210**	**Kg**	**83.50**	**17,535.00**
6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Column	**0.17**	**cum**	**6,788.60**	**1,154.06**

7	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Column	**37.4**	**Kg**	**83.50**	**3,122.90**
8	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Lintel	**0.8**	**cum**	**6,788.60**	**5,430.88**
9	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Lintel	**64**	**kg**	**83.50**	**5,344.00**
10	Interlocking Compressed Soil Earth Bricks / Mud Block Masonry work including cost and conveyance of all materials, labour charges. **(current market price)**				
		1550	**no**	**32.00**	**49,600.00**
11	12 mm cement plaster of mix 1:4 (I cement: 4 fine sand) including cost and conveyance of all materials, labour charges. **(DSR-2018 13.1.1)**				
	1:4 (1 cement: 4 fine sand)	**63.65**	**sqm**	**266.85**	**16,985.00**
12	Wall painting with acrylic emulsion paint of approved brand and manufacture to give an even shade : **(DSR-2018 13.60.1)**				
	Two or more coats on new work	**63.65**	**sqm**	**128.65**	**8,188.57**
13	Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought framed and fixed in position with hold fast lugs or with dash fasteners of required dia & length (hold fast lugs or dash fastener shall be paid for separately). **(DSR-2018 9.1.1)**				
	Second class teak wood	**0.26**	**cum**	**130183.1**	**33,847.59**
14	Providing and fixing panelled or panelled and glazed shutters for windows fixing with butt hinges of required size with necessary screws, excluding panelling which will be paid for separately, all complete as per direction of Engineer-in-charge. (Note:-Butt hinges and necessary screws shall be paid separately)(DSR-2018 9.5.1.1)				
	Second class teak wood	**11.25**	**sqm**	**3,613.35**	**40,650.19**

15	Polishing on wood work with ready mixed wax polish of approved brand and manufacture : **(DSR-2018 4001)**				
	Total	**11.25**	**sqm**	**150.90**	**1,697.63**
16	Door hardware **(current market price)**		**Ls**	**2,000.00**	**2,000.00**
17	M-15 grade plain cement concrete (cement content considered @ 240 kg/cum) **(DSR-2018 4.19.1.1)**				
	Total	**2.78**	**cum**	**7,738.20**	**21,512.20**
18	Structural steel work in single section, fixed with or without connecting plate, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. **(DSR-2018 10.1)**				
	Ridge and Purlins (100mmX50mm)	**987.49**	**kg**	**86.05**	**84,973.51**
	Rafters (50mmX25mm)	**497.74**	**kg**	**86.05**	**42,830.53**
19	Providing & fixing on roof pressed clay tile (Mangalore tile) of 20 mm nominal thickness and of approved size and as per approved pattern on steel frame work complete (steel frame work to be paid separately). **(DSR-2018 12.48)**				
	Total	**63**	**sqm**	**324.40**	**20,437.20**
20	Providing & laying on roof pressed clay tile ridge (Mangalore tile) of 20mm thickness and of approved pattern on steel frame work complete (steel frame work to be paid separately). **(DSR-2018 12.49)**				
	Total	**10.95**	**sqm**	**72.20**	**790.59**
21	Electrification using ISI Mark fitting and all accessories including cost and conveyance of all materials, labour charges etc, complete. **(current market price)**				
	Total		**Ls**	**5,000.00**	**5,000.00**
22	Providing and fixing water Supply arrangements and sanitary fittings using ISI marks Fittings, accessories and leach pit, including cost and conveyance of all materials, labour charges etc.				
	Total	**1**	**no**	**15,000.00**	**15,000.00**

23	Providing & fixing of smokeless oven. 9" 8" 7", including cost and conveyance of all materials, labour charges. **(current market price)**				
	Total	**1**	**no**	**2,250.00**	**2,250.00**
	Total				**4,44,624.36**
	Say	**4,45,000.00**			
	Rupees Four Lakhs forty five thousand Only				

Estimation and Costing of Normal Unit: Typology 2					
S.N	**Item of Work**	**Qty.**	**Unit**	**Rate**	**Amount**
1	Earth work in excavation by manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.**(DSR-2018 / 2.6.1)**				
	All kinds of soil	**38.94**	**cum**	**181.85**	**7,081.24**
2	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m. **(DSR-2018 / 2.25)**				
	Total	**24.74**	**cum**	**219.65**	**5,434.14**
3	R R Dry Packing with Quarry Dust Fillng Masonry for Foundation using hard granite broken stone including cost and conveyance of all materials, labour charges, etc., complete **(current market price)**				
	Total	**25.66**	**cum**	**2500**	**64,150.00**
4	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Plinth Beam	**3.1**	**cum**	**6788.6**	**21,044.66**
5	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Plinth Beam	**310**	**Kg**	**83.5**	**25,885.00**
6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Column	**0.17**	**cum**	**6788.6**	**1,154.06**
7	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Column	**37.4**	**Kg**	**83.5**	**3,122.90**

8	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Lintel	**1.18**	**cum**	**6788.6**	**8,010.55**
9	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Lintel	**94.4**	**kg**	**83.5**	**7,882.40**
10	Interlocking Compressed Soil Earth Bricks / Mud Block Masonry work including cost and conveyance of all materials, labour charges. **(current market price)**				
		2300	**no**	**32**	**73,600.00**
11	12 mm cement plaster of mix 1:4 (I cement: 4 fine sand) including cost and conveyance of all materials, labour charges. **(DSR-2018 13.1.1)**				
	1:4 (1 cement: 4 fine sand)	**70.79**	**sqm**	**266.85**	**18,890.31**
12	Wall painting with acrylic emulsion paint of approved brand and manufacture to give an even shade : **(DSR-2018 13.60.1)**				
	Two or more coats on new work	**70.79**	**sqm**	**128.65**	**9,107.13**
13	Providing wood work in frames of door frames, wrought framed and fixed in position with hold fast lugs or with dash fasteners of required dia & length (hold fast lugs or dash fastener shall be paid for separately). **(DSR-2018 9.1.1)**				
	Second class teak wood	**0.3**	**cum**	**130183.05**	**39,054.92**
14	Providing and fixing panelled or panelled and glazed shutters for doors fixing with butt hinges of required size with necessary screws, excluding panelling which will be paid for separately, all complete as per direction of Engineer-in-charge. (Note:- Butt hinges and necessary screws shall be paid separately) **(DSR-2018 9.5.1.1)**				
	Second class teak wood 35 mm thick shutters	**12.75**	**sqm**	**3613.35**	**46,070.21**

15	Polishing on wood work with ready mixed wax polish of approved brand and manufacture : **(DSR-2018 4001)**				
	Total	**12.75**	**sqm**	**150.9**	**1,923.98**
16	Door hardware **(current market price)**		**Ls**	**2000**	**2,000.00**
17	M-15 grade plain cement concrete (cement content considered @ 240 kg/cum) **(DSR-2018 4.19.1.1)**				
	Total	**4.12**	**cum**	**7738.2**	**31,881.38**
18	Structural steel work in single section, fixed with or without connecting plate,including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. **(DSR-2018 10.1)**				
	Ridge and Purlins (100mmX50mm)	**1349.63**	**kg**	**86.05**	**1,16,135.66**
	Rafters (50mmX25mm)	**731.56**	**kg**	**86.05**	**62,950.74**
19	Providing & fixing on roof pressed clay tile (Mangalore tile) of 20 mm nominal thickness and of approved size and as per approved pattern on steel frame work complete (steel frame work to be paid separately). **(DSR-2018 12.48)**				
	Total	**78.68**	**sqm**	**324.4**	**25,523.79**
20	Providing & laying on roof pressed clay tile ridge (Mangalore tile) of 20mm thickness and of approved pattern on steel frame work complete (steel frame work to be paid separately). **(DSR-2018 12.49)**				
	Total	**11.88**	**sqm**	**72.2**	**857.74**
21	Electrification using ISI Mark fitting and all accessories including cost and conveyance of all materials, labour charges etc, complete. **(current market price)**				
	Total		**Ls**	**7500**	**7,500.00**
22	Providing and fixing water Supply arrangements and sanitary fittings using ISI marks Fittings, accessories and leach pit, including cost and conveyance of all materials, labour charges etc.				
	Total		**Ls**	**15000**	**15,000.00**
23	Providing & fixing of smokeless oven. 9" 8" 7", including cost and conveyance of all materials, labour charges. **(current market price)**				
	Total	**1**	**no**	**2250**	**2,250.00**
	Total				**5,96,510.81**

Rupees Six Lakhs Only

Estimation and Costing of flood resilient Unit : Typology 1					
S.N	**Item of Work**	**Qty.**	**Unit**	**Rate**	**Amount**
1	Earth work in excavation by manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.**(DSR-2018 / 2.6.1)**				
	All kinds of soil	**19.18**	**cum**	**181.85**	**3,487.88**
2	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m. **(DSR-2018 / 2.25)**				
	Total	**6.58**	**cum**	**219.65**	**1,445.30**
3	R R Dry Packing with Quarry Dust Fillng Masonry for Foundation using hard granite broken stone including cost and conveyance of all materials, labour charges, etc., complete **(current market price)**				
	Total	**1.63**	**cum**	**2500**	**4,075.00**
4	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Grade Beam	**1.15**	**cum**	**6788.6**	**7,806.89**
5	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Grade Beam	**115**	**Kg**	**83.5**	**9,602.50**
6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Footing and Column	**3.39**	**cum**	**6788.6**	**23,013.35**
7	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Footing and Column	**745.8**	**Kg**	**83.5**	**62,274.30**

8	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Lintel	**0.54**	**cum**	**6788.6**	**3,665.84**
9	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Lintel	**43.2**	**kg**	**83.5**	**3,607.20**
10	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Beams, Stair and Slab	**3.07**	**cum**	**6788**	**20,839.16**
11	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Beams, Stair and Slab	**675.4**	**kg**	**83.5**	**56,395.90**
12	Laterite Masonry in cm 1:6 for 20cm thick wall in Ground Floor including cost and conveyance of all materials, labour charges, etc., complete **(current market price)**				
	Total	**2.5**	**cum**	**7500**	**18,750.00**
13	Providing and laying solid cement blocks masonry with 150mm/230mm/300 mm thick cement blocks in super structure above plinth level up to floor V level with RCC band at sill level and lintel level with approved block laying polymer modified adhesive mortar all complete as per direction of Engineer-in-Charge. (The payment of RCC band and reinforcement shall be made for seperately). **(DSR-2018 .6.47)**				
	Total	**6.08**	**cum**	**6637**	**40,352.66**
14	Wall Partition with V panel, including cost and conveyance of all materials, labour charges. **(current market price)**				
	Toral	**365.84**	**sqft**	**180**	**65,851.20**
15	12 mm cement plaster of mix 1:4 (I cement: 4 fine sand) including cost and conveyance of all materials, labour charges. **(DSR-2018 13.1.1)**				
	1:4 (1 cement: 4 fine sand)	**69.74**	**sqm**	**266.85**	**18,610.12**

16	Wall painting with acrylic emulsion paint of approved brand and manufacture to give an even shade : **(DSR-2018 13.60.1)**				
	Two or more coats on new work	**69.74**	**sqm**	**128.65**	**8,972.05**
17	Providing wood work in frames of door frames, wrought framed and fixed in position with hold fast lugs or with dash fasteners of required dia & length (hold fast lugs or dash fastener shall be paid for separately). **(DSR-2018 9.1.1)**				
	Second class teak wood	**0.26**	**cum**	**130183**	**33,847.59**
18	Providing and fixing panelled or panelled and glazed shutters for doors fixing with butt hinges of required size with necessary screws, excluding panelling which will be paid for separately, all complete as per direction of Engineer-in-charge. (Note:- Butt hinges and necessary screws shall be paid separately) **(DSR-2018 9.5.1.1)**				
	Second class teak wood 35 mm thick shutters	**11.25**	**sqm**	**3613.4**	**40,650.19**
19	Polishing on wood work with ready mixed wax polish of approved brand and manufacture : **(DSR-2018 4001)**				
	Total	**11.25**	**sqm**	**150.9**	**1,697.63**
20	Door and Window hardware **(current market price)**			**2000**	**2,000.00**
21	M-15 grade plain cement concrete (cement content considered @ 240 kg/cum) **(DSR-2018 4.19.1.1)**				
	Total	**3.97**	**cum**	**7738.2**	**30,720.65**
22	Structural steel work in single section, fixed with or without connecting plate,including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. **(DSR-2018 10.1)**				
	Ridge and Purlins (100mmX50mm)	**486.95**	**kg**	**86.05**	**41,902.05**
	Rafters (50mmX25mm)	**327.29**	**kg**	**86.05**	**28,163.30**
23	Providing & fixing on roof pressed clay tile (Mangalore tile) of 20 mm nominal thickness and of approved size and as per approved pattern on steel frame work complete (steel frame work to be paid separately). **(DSR-2018 12.48)**				
	Total	**30.36**	**sqm**	**324.4**	**9,848.78**

24	Providing & laying on roof pressed clay tile ridge (Mangalore tile) of 20mm thickness and of approved pattern on steel frame work complete (steel frame work to be paid separately). **(DSR-2018 12.49)**				
	Total	**3.45**	**sqm**	**72.2**	**249.09**
25	Electrification using ISI Mark fitting and all accessories including cost and conveyance of all materials, labour charges etc, complete. **(current market price)**				
	Total		**Ls**	**5000**	**5,000.00**
26	Providing and fixing water Supply arrangements and sanitary fittings using ISI marks Fittings, accessories and leach pit, including cost and conveyance of all materials, labour charges etc.				
	Total		**Ls**	**15000**	**15,000.00**
27	Providing & fixing of smokeless oven. 9" 8" 7", including cost and conveyance of all materials, labour charges. **(current market price)**				
	Total	**1**	**no**	**2250**	**2,250.00**
	Total				**5,60,078.64**

Rupees Five Lakhs Sixty Thousand Only

Estimation and Costing of flood resilient Unit : Typology 2					
S.N	**Item of Work**	**Qty.**	**Unit**	**Rate**	**Amount**
1	Earth work in excavation by manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 Sq.m on plan) including getting out and disposal of excavated earth lead up to 50 m and lift upto 1.5 m, as directed by Engineer-in-charge.**(DSR-2018 / 2.6.1)**				
	All kinds of soil	**29.96**	**cum**	**181.85**	**5,448.23**
2	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m. **(DSR-2018 / 2.25)**				
	Total	**6.58**	**cum**	**219.65**	**1,445.30**
3	R R Dry Packing with Quarry Dust Filling Masonry for Foundation using hard granite broken stone including cost and conveyance of all materials, labour charges, etc., complete **(current market price)**				
	Total	**2.44**	**cum**	**2500**	**6,100.00**
4	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Grade Beam	**1.53**	**cum**	**6788.6**	**10,386.56**
5	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Grade Beam	**173**	**Kg**	**83.5**	**14,445.50**
6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Footing and Column	**4.56**	**cum**	**6788.6**	**30,956.02**
7	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Footing and Column	**1033**	**Kg**	**83.5**	**86,255.50**

8	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size)**(DSR-2018 / 4.1.3)**				
	Lintel	**0.81**	**cum**	**6788.6**	**5,498.77**
9	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Lintel	**64.8**	**kg**	**83.5**	**5,410.80**
10	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand (zone-III) : 4 graded stone aggregate 20 mm nominal size) **(DSR-2018 / 4.1.3)**				
	Beams, Stair and Slab	**3.44**	**cum**	**6788**	**23,350.72**
11	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. **(DSR-2018 / 5.22.6)**				
	Beams, Stair and Slab	**776.8**	**kg**	**83.5**	**64,862.80**
12	Laterite Masonry in cm 1:6 for 20cm thick wall in Ground Floor including cost and conveyance of all materials, labour charges, etc., complete **(current market price)**				
	Total	**3.73**	**cum**	**7500**	**27,975.00**
13	Providing and laying solid cement blocks masonry with 150mm/230mm/300 mm thick Cement blocks in super structure above plinth level up to floor V level with RCC band at sill level and lintel level with approved block laying polymer modified adhesive mortar all complete as per direction of Engineer-in-Charge. (The payment of RCC band and reinforcement shall be made for separately). **(DSR-2018 .6.47)**				
	Total	**6.08**	**cum**	**6636.95**	**40,352.66**
14	Wall Partition with V panel, including cost and conveyance of all materials, labour charges. **(current market price)**				
	Toral	**398.03**	**sqft**	**180**	**71,645.40**
15	12 mm cement plaster of mix 1:4 (I cement: 4 fine sand) including cost and conveyance of all materials, labour charges. **(DSR-2018 13.1.1)**				
	1:4 (1 cement: 4 fine sand)	**69.74**	**sqm**	**266.85**	**18,610.12**

16	Wall painting with acrylic emulsion paint of approved brand and manufacture to give an even shade : **(DSR-2018 13.60.1)**				
	Two or more coats on new work	**69.74**	**sqm**	**128.65**	**8,972.05**
17	Providing wood work in frames of door frames, wrought framed and fixed in position with hold fast lugs or with dash fasteners of required dia & length (hold fast lugs or dash fastener shall be paid for separately). **(DSR-2018 9.1.1)**				
	Second class teak wood	**0.3**	**cum**	**130183**	**39,054.92**
18	Providing and fixing panelled or panelled and glazed shutters for doors fixing with butt hinges of required size with necessary screws, excluding panelling which will be paid for separately, all complete as per direction of Engineer-in-charge. (Note:- Butt hinges and necessary screws shall be paid separately) **(DSR-2018 9.5.1.1)**				
	Second class teak wood 35 mm thick shutters	**12.75**	**sqm**	**3613.35**	**46,070.21**
19	Polishing on wood work with ready mixed wax polish of approved brand and manufacture : **(DSR-2018 4001)**				
	Total	**12.75**	**sqm**	**150.9**	**1,923.98**
20	Door hardware **(current market price)**			**2000**	**2,000.00**
21	M-15 grade plain cement concrete (cement content considered @ 240 kg/cum) **(DSR-2018 4.19.1.1)**				
	Total	**1.1**	**cum**	**7738.2**	**8,512.02**
22	Structural steel work in single section, fixed with or without connecting plate,including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. **(DSR-2018 10.1)**				
	Ridge and Purlins (100mmX50mm)	**366**	**kg**	**86.05**	**31,494.30**
	Rafters (50mmX25mm)	**310**	**kg**	**86.05**	**26,675.50**
23	Providing & fixing on roof pressed clay tile (Mangalore tile) of 20 mm nominal thickness and of approved size and as per approved pattern on steel frame work complete (steel frame work to be paid separately). **(DSR-2018 12.48)**				
	Total	**30**	**sqm**	**324.4**	**9,732.00**

24	Providing & laying on roof pressed clay tile ridge (Mangalore tile) of 20mm thickness and of approved pattern on steel frame work complete (steel frame work to be paid separately). **(DSR-2018 12.49)**				
	Total	**2.73**	**sqm**	**72.2**	**197.11**
25	Electrification using ISI Mark fitting and all accessories including cost and conveyance of all materials, labour charges etc, complete. **(current market price)**				
	Total		**Ls**	**5000**	**5,000.00**
26	Providing and fixing water Supply arrangements and sanitary fittings using ISI marks Fittings, accessories and leach pit, including cost and conveyance of all materials, labour charges etc.				
	Total		**Ls**	**15000**	**15,000.00**
27	Providing & fixing of smokeless oven. 9" 8" 7", including cost and conveyance of all materials, labour charges. **(current market price)**				
	Total	**1**	**no**	**2250**	**2,250.00**
	Total				**6,09,625.44**
	Rupees Six Lakhs Ten Thousand Only				