

A Compendium of Rural Housing Typologies

प्राकृति

Prakriti Hunar Lokvidya

Pradhan Mantri Awaas Yojana – Gramin



Partners :



Indian Institute of Technology Delhi



Empowered lives.
Resilient nations.

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This concise book of Rural Housing technologies has been developed by UNDP. The house designs proposed are a result of a study conducted by UNDP in collaboration with Ministry of Rural Development, Government of India in eight states and by Indian Institute of Technology, Delhi in two states.

Special Note: An in-depth study conducted in the 18 states of India has helped in developing 130 zone specific comfortable, affordable, green and multi-hazard safe designs for the PMAY(G). This compendium contains some of these designs and technologies.

A number of region-specific technologies have been developed based on local materials and traditional construction practices, which are less costly and more environment friendly than brick, cement, and steel intensive systems. While some of them are in this book, the remaining will be published shortly.

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Message

नरेन्द्र सिंह तोमर
NARENDRA SINGH TOMAR



ग्रामीण विकास, पंचायती राज और
पेयजल एवं स्वच्छता मंत्री
भारत सरकार
कृषि भवन, नई दिल्ली
MINISTER OF RURAL DEVELOPMENT, PANCHAYATI RAJ
AND DRINKING WATER & SANITATION
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI

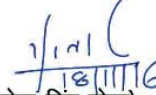
संदेश

वर्ष 2022 में भारत अपनी स्वतंत्रता के 75 वर्ष पूर्ण करेगा। माननीय प्रधानमंत्री जी के स्वप्न वर्ष 2022 तक 'सबके लिए आवास' के दृष्टिगत ग्रामीण विकास मंत्रालय ने प्रधानमंत्री आवास योजना- ग्रामीण के अंतर्गत तीन वर्षों (2016-17 से 2018-19 तक) में एक करोड़ ग्रामीण आवास निर्माण हेतु सहायता देने का एक महत्वाकांक्षी लक्ष्य निर्धारित किया है। यह सहायता उन परिवारों को दी जाएगी जो कच्चे एवं जीर्ण मकानों में रह रहे हैं।

प्रधानमंत्री आवास योजना - ग्रामीण के अंतर्गत लाभार्थी आवास का निर्माण स्वयं करते हैं। आवास निर्माण के दौरान मार्गदर्शन तथा सहायता के अभाव में निर्माण गुणवत्ता में कमी आ जाती है। साथ ही इन आवासों में आपदा रोधी उपायों का प्रयोग भी नहीं किया जाता है। इन सबको ध्यान में रखते हुए ग्रामीण विकास मंत्रालय ने राज्य सरकारों, सहयोगी संस्थाओं - यू.एन.डी.पी. तथा आई.आई.टी., दिल्ली - के सहयोग से स्थानीय भौगोलिक, मौसमी कारकों को ध्यान में रखते हुए विभिन्न क्षेत्रों में विभिन्न प्रकार के आवास डिजाइन तैयार करने का कार्य किया।

प्रकृति से समरस, स्थानीय हुनर एवं लोक विद्या के साथ आधुनिक तकनीक का उपयोग करते हुए तैयार डिजाइनों का संकलन 'पहल' (प्रकृति, हुनर, लोकविद्या) के रूप में सामने लाया गया है। इसके माध्यम से विभिन्न स्टेक होल्डर (लाभार्थी सहित) को क्षेत्र विशेष की विभिन्न आवास डिजाइन के संबंध में ज्ञात हो सकेगा। 'पहल' हमारे देश में उपलब्ध आवास डिजाइन की विविधता, स्थानीय सामग्री के उपयोग एवं सस्ती तकनीक को भी प्रदर्शित करती है जिसका पर्यावरण पर न्यूनतम प्रतिकूल प्रभाव पड़ता है। साथ ही ये डिजाइन प्राकृतिक आपदा रोधी भी हैं। इन्हें लाभार्थियों के समक्ष रखा जायेगा जिसमें से वे अपनी इच्छानुसार डिजाइन का चयन कर स्वयं का आवास बना सकेंगे।

'पहल' को आपके समक्ष लाते हुए मुझे अपार प्रसन्नता हो रही है क्योंकि 'सबके लिए आवास' के हमारे संकल्प में यह काफी महत्वपूर्ण है।


(नरेन्द्र सिंह तोमर)

Office: 'G' Wing, Ground Floor, Krishi Bhawan, New Delhi- 110001
Tel.: 011-23782373, 23702327 Fax: 011-23385876
Resi.: 3 Krishna Menon Marg, New Delhi-110001
Ph.: 011-23794697/98, Fax: 011-23794696

Foreword

For the last several decades, efforts have been made to provide quality housing to poor households in rural India. Pradhan Mantri Awaas Yojana-Gramin (PMAY-G) holds the potential as a turning point in this journey given its multi-pronged strategy for addressing the need for quality housing in rural India. Realising the aspirational aspects of housing, base financial assistance has been raised to Rs. 1,20,000/- in plain areas and Rs. 1,30,000/- in hill states, difficult areas and IAP districts. To compliment PMAY-G, assistance of Rs. 12,000/- for the construction of a toilet for every PMAY-G house through Swachh Bharat Mission has been built as component in the scheme. Apart from this, further 90 / 95 persondays of unskilled labour under Mahatma Gandhi NREGS has been provided. We are also facilitating an optional loan of up to Rs 70,000/- that beneficiaries can avail through banks or other financial institutions for the construction of their houses. Together these measures will go a long way in reducing the burden on the poorest of the poor, while providing them with a dignified shelter that they can call home. We have further enhanced the minimum unit size to be built under this scheme to 25 square meters. This is minimal core area, which a beneficiary may expand, will allow her / him to access dignified and sufficient accommodation.

To address the critical question of construction of quality houses on sustainable basis on such a large scale, Ministry of Rural Development, Government of India initiated a study of housing typologies for each state. Housing prototypes have been

developed for each housing zone within a state based on the climatic conditions, disaster risk factors, local materials and traditional skills. The current compendium of recommended type designs and technologies for an initial set of 11 states is a milestone in this journey. Construction technologies that have been identified in these State specific studies include locally available materials and prevailing rural construction skill sets. These technologies therefore can be put to use right away at the village level with materials sourced from not too far. The technologies identified are sustainable which ensures the potential for long term availability of the materials. They are durable and designed to withstand the climatic variations and natural hazards that the specific housing zone is exposed to.

I am sure this compilation will support endeavors at the state and the local levels to enable and empower PMAY-G beneficiaries to build quality, sustainable and disaster resilient homes.

Ram Kripal Yadav

Minister of State for Rural Development and Land Resources

Preface

Pradhan Mantri Awaas Yojana – Gramin, (PMAY-G), is a flagship programme of the Ministry of Rural Development, that aims to fulfill the vision of providing “Housing for All” by 2022. As a major shift from earlier social housing schemes of the government, PMAY-G has a strong focus on providing credible assistance and support to the beneficiaries in making informed choices with regard to the construction of her/his house.

As a major step in this direction, the Ministry, in partnership with United Nations Development programme (UNDP) and Indian Institute of Technology (IIT) Delhi, has undertaken detailed exercise in 18 states so far, to provide a menu of technically validated options for design, construction materials and technologies to the beneficiaries. These options have been developed through rigorous multi-stakeholder participatory exercises in the different ‘housing zones’ within each state with a view to provide climatic comfort, disaster resilience and reducing the environmental impact of construction. Detailed cost estimates have also been drawn up for the each prototype and their structural soundness has been vetted by technical agencies such as Central Building Research Institute (CBRI) and National Institutes of Technology. Some state governments designated their own vetting committees to better incorporate the local nuances of house construction.

State specific recommendation on design and construction technologies have been compiled in a concise and usable form designated as Zonal Rural Housing Manuals.

These manuals are also uploaded on Rural Housing Knowledge Network Portal (www.ruralhousingnetwork.in) to assist PMAY-G implementers and beneficiaries in easy retrieval of this knowledge bank. Model houses are also being constructed in the states to demonstrate the efficacy of design and construction technologies to potential beneficiaries.

The current compendium provides a snapshot view of this ambitious project in respect of 10 States. This is however, a continuous endeavour as the Ministry plans to involve remaining states also in this work. We express our sincere gratitude to UNDP, IIT Delhi and CBRI for collaborating in development of the designs typologies. We further thank UNDP for taking on the arduous task of compiling this document. We hope that this effort will help us contribute effectively in ‘housing’ rural India.

Amarjeet Sinha

Secretary, Rural Development, Ministry of Rural Development

Introduction

Significant focus has been given over the last few decades to meeting housing requirements of the rural poor in India through various Central and State Government programmes, especially through the Indira Awaas Yojana (PMAY-G). However, with increasing rural prosperity over recent years and the changing socio-economic scenario in rural areas, it was realized that the flagship programme of the Government of India, the Indira Awaas Yojana, required significant changes to meet the changing expectations of the rural poor. To address such issues in rural housing and in view of Governments' commitment to provide "Housing for All" by 2022, the PMAY-G scheme has been re-structured into the Pradhan Mantri Awaas Yojana – Gramin (PMAY-G) with effect from 1st April, 2016.

The PMAY-G aims to provide assistance for construction of one crore houses in rural areas over the period of three years from 2016-17 to 2018-19. The overall effort is to support poor households to develop a functional, comfortable home which meets the aspirations of the beneficiary rather than just construction of low-cost houses. To meet this aim, PMAY-G proposes the creation of a menu of housing designs based on local typologies incorporating local materials, traditional knowledge and aesthetics.

As a first step towards this objective, UNDP under the guidance of MoRD and through technical guidance from the Housing and Urban Development Corporation (HUDCO) undertook the process of developing housing typologies for clearly identifiable housing zones in five states. This was done through a consultative process with rural communities, government stakeholders at different levels and civil society representatives. Housing zones in each of the selected states were identified on the basis of local materials and technologies, vulnerability to disasters/hazards, livelihood aspects linked to housing designs, and existing community skills. The effort has been to develop at least one representative design typology for a particular housing zone. In the second phase, these studies were then extended to 13 more states – eight covered by UNDP and five by IIT, Delhi. Very significantly, the work builds on available knowledge, talents and resources, the local traditional skills, the local fabric of a particular place and retains the local character determined by the intrinsic factors in different regions of the country. Housing designs developed through this process incorporate disaster-resilient

features found in traditional houses and also incorporate contemporary disaster-resilient features such as structural reinforcement in walls and improved jointing. This initiative has now progressed towards enabling transfer of technology and implementation, addressing challenges of demonstration and adoption of the design and construction recommendations in the large scale.

More than 130 design typologies have now been developed as part of this engagement and validation of the range of materials and technologies proposed through the housing typologies is being undertaken by Central Building Research Institute (CBRI), Roorkee, the premier institution of the country engaged in research and development on building construction and habitat planning. Of the total 18 states covered through these studies, this manual presents housing designs for 10 states where the designs have been validated through State-level consultations with concerned stakeholders including government officials, engineers, local architects, masons and especially rural communities.

The designs included in this manual aim to provide government decision makers, engineers engaged in PMAY-G implementation, panchayats, masons and potential beneficiary households with a wider range of options related to designs, materials and technologies for implementation of PMAY-G. The manual also details costs related to the different housing elements in the designs such as flooring, walling, roofing and other essential fixtures. These designs are further supported with detailed drawings, specifications and narratives in zone-wise manuals that are being developed for each state studied. The process of designing the housing typologies has also led to the redefinition of the use of word 'pucca' to not just be limited to brick and concrete structures, but also to encourage locally durable materials with improvements through innovations wherever appropriate and applicable. The effort is to eventually enable PMAY-G beneficiaries to make informed decisions related to choice of size, layout, materials and technologies for construction of the house they would like to build through PMAY-G support. The objective of this effort is also to ensure construction of a PMAY-G house that is appropriate, affordable, disaster-resilient and aesthetic in the context of specific regional attributes.

Rural Housing Typologies

ZONE - A
UP-A-01

This indicates the housing zone in a particular state

The code to the housing typology proposed

UP - A - 01

Typology Number

Zone

State Initial in this case - Uttar Pradesh

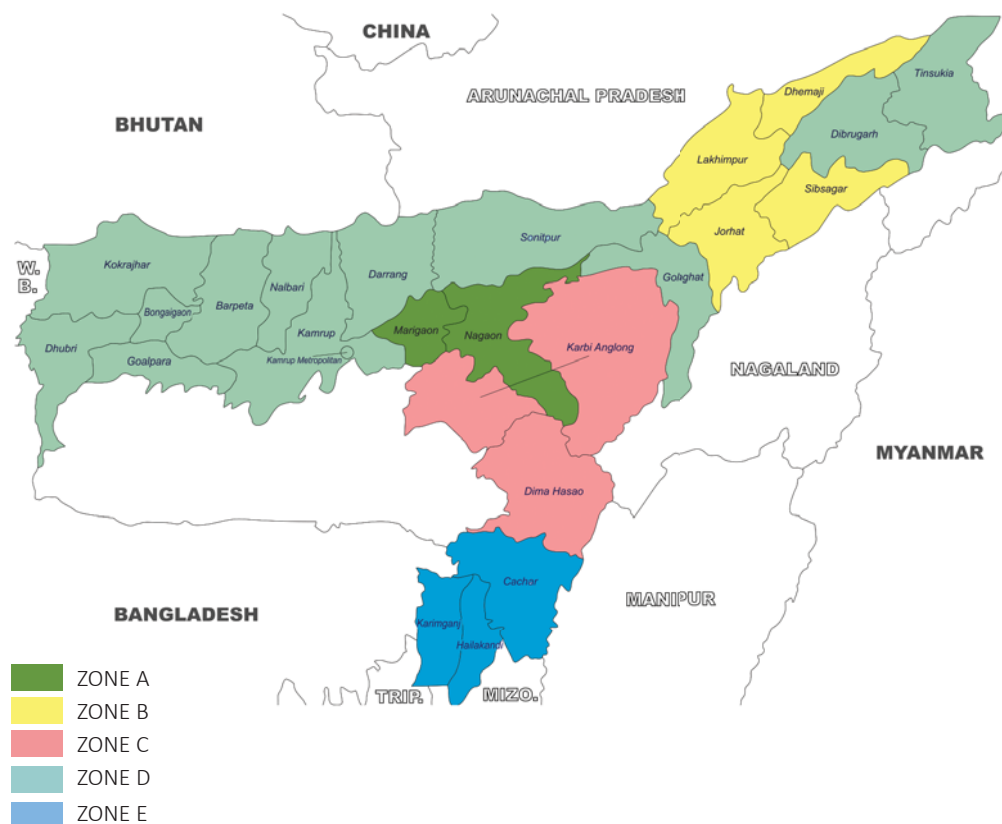
How to read this document

State MAP for example Uttar Pradesh
with housing zonations marked/coloured

State name

STATE

Assam



Assam contains three physiographic divisions (out of the six in India)- The Northern Himalayas (Eastern Hills), The Northern Plains (Brahmaputra plain) and Deccan Plateau (Karbi Anglong). Plains in the 20-120 metre elevation range occupy most of the upper and lower Assam valley, covering almost 72% of the state's total area and constituting the most flood prone regions of Assam.

The chief criteria for these designs are the geographical constraints – namely plains, hilly areas and flood affected areas – and consequently, the availability of building materials for house construction. One important criterion which must be considered is the cultural preferences of people in different parts of the state and, as a result, the variety of spatial designs of houses. This factor has traditionally not been taken into account by the proposed type designs for PMAY-G houses.

The following three have been identified as the main criteria for design of PMAY-G houses for Assam and the state has been divided in to five housing zones –

1. Vulnerability to natural hazards
2. Physiography and access to building materials
3. Cultural Compatibility

Zone A

High vulnerability to floods- 50-75% flood hazard area and likelihood of flood inundation for more than 24 hours almost every year. Marigaon, Nalbari and Darrang are most vulnerable, Medium vulnerability to cyclonic storms, and mostly low vulnerability to river bank erosion. This zone lies entirely in the alluvial plains of the Brahmaputra valley, with the average elevation in the range of 25m-50m. There is negligible forest cover in this zone.

Zone B

High vulnerability to floods- 50-75% flood hazard area and likelihood of flood inundation for more than 24 hours almost every year, Medium to high vulnerability to cyclonic storms, Medium to high vulnerability to river bank erosion. Housing in the river island areas such as Majuli are highly vulnerable to river bank erosion, high incidence of post flood silt deposition. This zone lies entirely in the alluvial plains of the Brahmaputra valley, with the average elevation in the range of 75m-125m. There is negligible forest cover in this zone

Zone C

Low vulnerability to flooding and erosion, medium to high vulnerability to cyclonic wind storms, High vulnerability to landslides. This zone has the highest forest cover in the state, with more than 3/4th of the zone covered with a mix of moist semi-evergreen, mixed deciduous and bamboo forests. Access to bricks for house construction is difficult in the zone.

Zone D

Majority of the zone has low to medium vulnerability to flooding. Most areas in the zone face threat of severe floods once in about 10 years. High vulnerability to the northern part of the zone to flash floods in rivers flowing from Bhutan. High vulnerability to cyclonic wind storms with wind speeds reaching above 50 m/s in large parts of the zone. High vulnerability to river bank erosion and loss of land to erosion – this happens in Char areas are present in many parts of the zone Goalpara, Kamrup, Darrang, Bongaigaon, Barpeta, Tinsukia. This is a predominantly plain zone with the average elevation of 25-50 metres for the most part. The northern part of the zone has pockets of higher elevation of 125-150m. Bricks are easily available in most parts of the zone.

Zone E

Low vulnerability to floods – about 25% of the zone area is vulnerable to floods with a frequency of about 1 or 2 floods in 10 years. High vulnerability to cyclonic wind storms due to proximity to the Bay of Bengal. Predominantly plains and wetlands with an elevation of 25-50m, interspersed with hills. Karimganj has about 30% forest area Bricks, sand, aggregate are easily available in most parts of the zone. The zone is rich in bamboo- with a good stock of species suitable for good quality bamboo construction.

ASSAM

ZONE-A

The classification Zones in Assam is based on Vulnerability to natural hazards :

- High vulnerability to floods- 50-75% flood hazard area and likelihood of flood inundation for more than 24 hours almost every year. Marigaon, Nalbari and Darang are most vulnerable
- Medium vulnerability to cyclonic storms
- Mostly low vulnerability to river bank erosion

Resources Available

There is high concentration of brick kilns- bricks

- Flyash bricks are also a viable alternative due to presence of thermal power plants.
- Bamboo is also used extensively for verandah roof posts, internal partition walls of mud plastered bamboo splits and bamboo jaali in gable portions of walls.

Zone A has one typology

AS-A-01



ASSAM



AS-A01



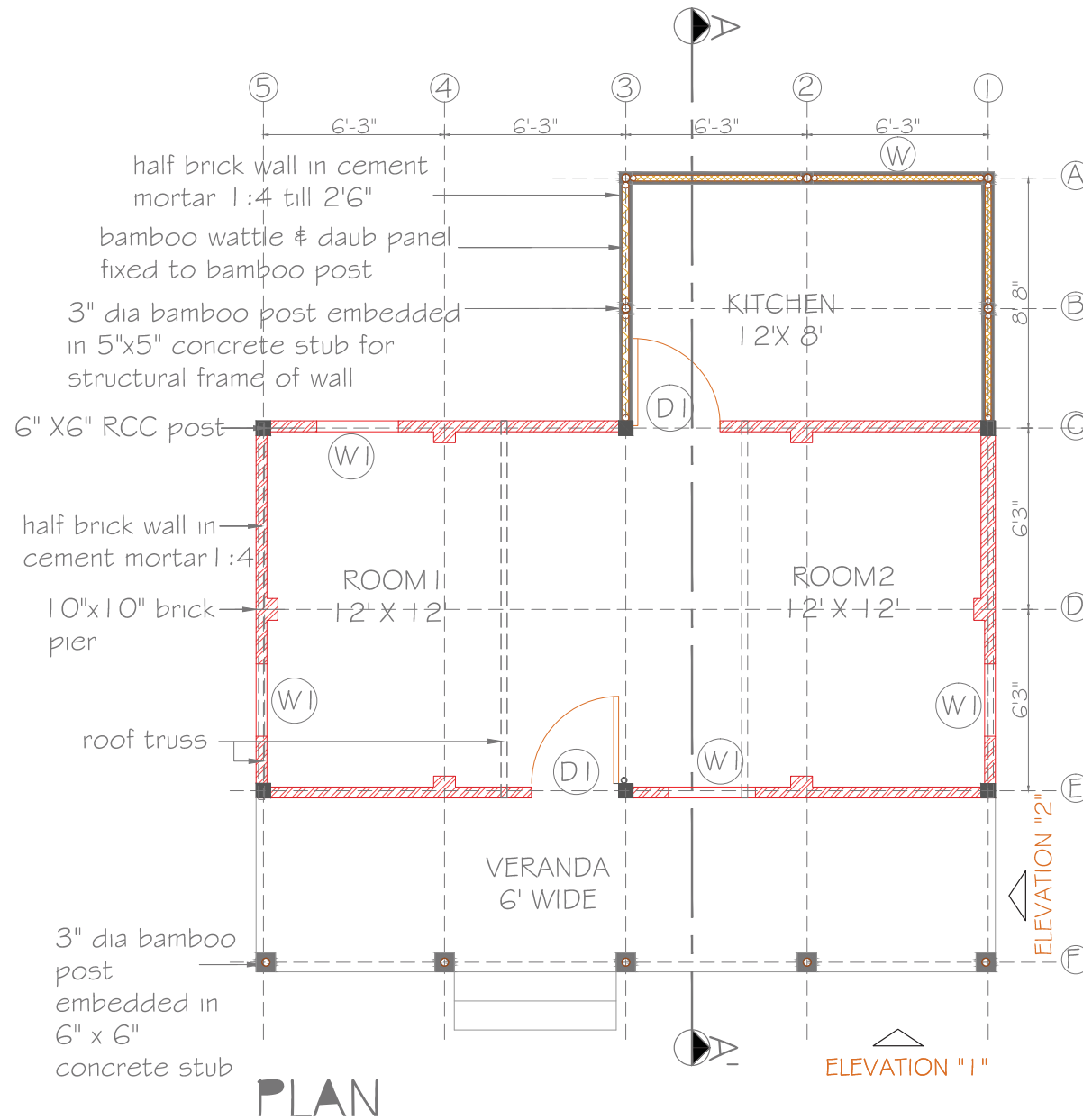
Side view



- This design responds to the brick masonry houses with 3" walls which are the most common PMAY-G design followed in plains area of the Brahmaputra valley.

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
This design responds to the brick masonry houses with 3" walls . An adequate front verandah of 6' width has been introduced as per the preference of people.	High Plinth Design	Sloped roof.

Recommendations for construction systems	
Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> Isolated footings of 6"x6" RCC column and 6"x8" plinth beam; half brick masonry in 1:4 cement mortar till plinth beam and in verandah perimeter
Plinth	<ul style="list-style-type: none"> The Plinth band is extended to also cover the kitchen area, so as to provide a good foundation for incremental construction. A plinth beam has been introduced to connect the RCC posts – this is important because the high incidence of construction in alluvial soils of medium to low bearing capacity.
Wall	<ul style="list-style-type: none"> Isolated footings of 6"x6" RCC column and 6"x8" plinth beam ; half brick masonry in 1:4 cement mortar till plinth beam and in verandah perimeter
Wall Finish	<ul style="list-style-type: none"> Exposed Brick
Roof Structure	<ul style="list-style-type: none"> CGI sheet gable roof on wooden truss anchored in concrete with 1/3" J- bolt; Roof is additionally anchored with bamboo on top tied to truss rafter in areas of high winds/ cyclones
Floor	<ul style="list-style-type: none"> Room- Cement concrete floor 2" thick on brick flat soling; Kitchen- cement stabilized earthen floor



TYPICAL PLAN

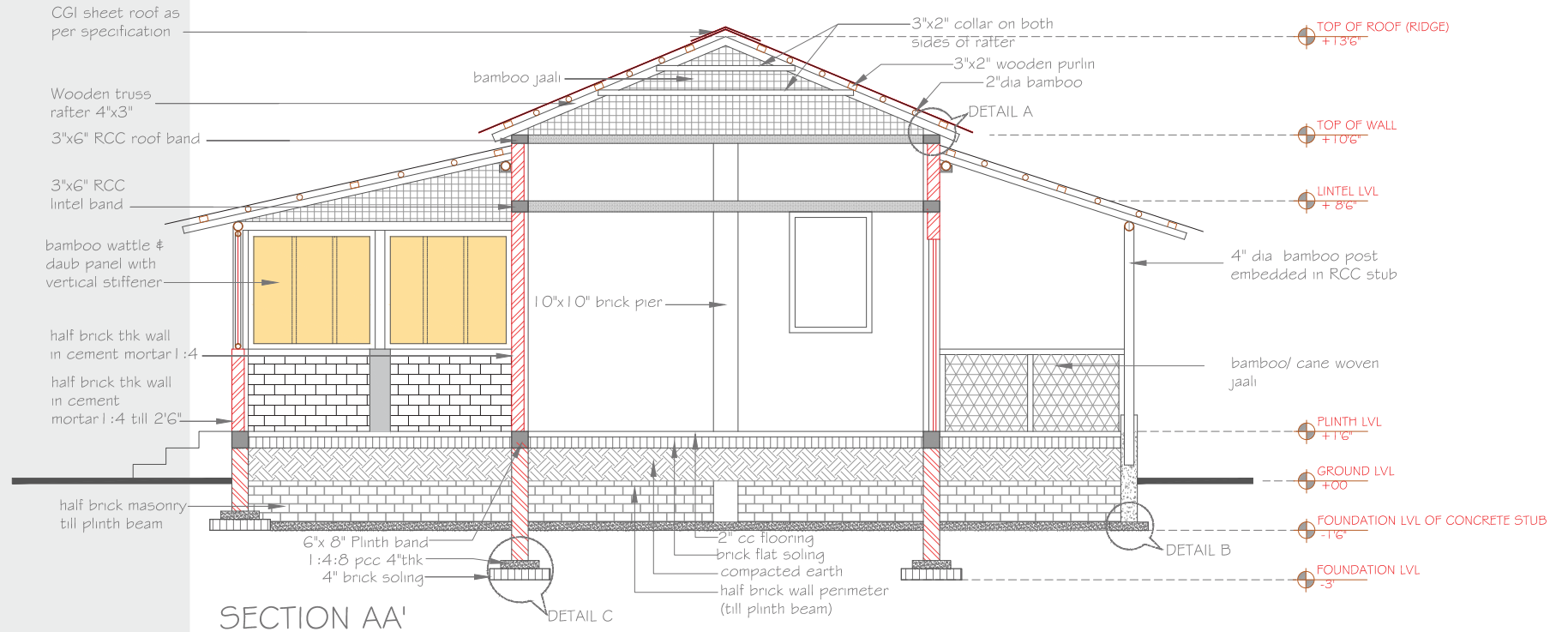
ZONE - A AS-A-01

Total cost ₹ 1,64,737/-



ASSAM

ZONE - A AS-A-01



ASSAM

SECTION AA'

			Room				Kitchen				Verandah					
			quantity	unit	rate	amount	quantity	unit	rate	amount	quantity	unit	rate	amount		
1	Excavation															
	Wall		262.5	cft	3.08	808.5	90.0	cft	3.08	277.2	108.0	cft	3.08	332.64		
	RCC post, 6 No.		72.0	cft	3.08	221.76										
2	Brick Soling															
	Wall		87.5	cft	35	3062.5	30.0	sft	35	945	15.1	cft	139.21	1894.37		
	RCC post, 6 No.		9.0	cft	35	315										
3	PCC 1:4:8															
	Wall		55.1	cft	110.17	5465.8	18.9	cft	110.17	1874	22.7	cft	110.17	2248.79		
	RCC post, 6 No.		3.8	cft	110.17	374.8										
4	Brickwork foundation															
	half brick wall		29.4	cft	165.96	4391.3	10.1	cft	165.96	1505.6	12.1	cft	165.96	1806.707		
	brick stubs 10"x10"		1.7	cft	165.96	252.9	1.4	cft	165.96	210.8						
5	Brickwork above plinth										concrete 1:2:4 foundation for bamboo posts					
	half brick wall		272.2				12.6	cft	170.68	1935.5	8.58	cft	170.68	1463.581		
	deduction for openings		30.0								min 3" dia bamboo posts					
	total brickwork		242.2	cft	170.68	37198.7					40	R.ft	20.83	833.2		
	Brick pier, 6 No.		19.1	cft	170.68	2926.5										
6	Concrete 1:1.5:3															
	Plinth beam		30.6	cft	171.70	4732.5	3.8	cft	171.70	579.5						
	Lintel and roof band		18.0	cft	171.70	2781.5	concrete 1:2:4 for embedding bamboo									
	Post		17.6	cft	171.70	2712	2.5	cft	155.65	351.8						
7	Reinforcement steel										steel in concrete foundation for bamboo post					
	Plinth beam		117.0	kg	60.27	6346.431	15.0	kg	60.27	813.645	10	kg	60.27	542.43		
	Lintel and roof band		112.0	kg	60.27	6075.216										
	Post		95.0	kg	60.27	5153.085										
8	Truss						min 3" bamboo post									
	2nd class treated wood		20.0	cft	700	14000	35.0	R.ft	20.83	729.05						
9	GCI sheet (0.45 mm thick)										GCI sheet					
	with fitting complete		500.0	sq.ft	41.85	18832.5	120.0	sq.ft	41.85	4519.8	217	sq.ft	41.85	8173.305		
10	Door (With 2nd class treated timber)						bamboo rafter, 3"-4"dia				bamboo understructure, 3"-4"dia					
	wooden frame, section 4"x3"		2.8	cft	700	1963.5	30	R.ft	12.00	360	67.5	Rft	12.00	810		
	Window (With 2nd class treated timber)						bamboo purlin, 2"-3"dia				bamboo understructure, 2"-3"dia					
	wooden frame, section 4"x3"		8.6	cft	700	6006	50.0	Rft	8.00	400	100	Rft	8.00	800		
11	Cement-sand plaster 1:6 (15 mm thick)						bamboo mud plastered wall 4' high									
	internal wall		648.0				165.0	sq.ft	10.05	1658.25						
	minus openings		82.0													
	total plaster		566.0	sft	11.88	6051.672										
Total						129672	Total				16160	Total				18905

ZONE-B

The classification Zones in Assam is based on Vulnerability to natural hazards:

- High vulnerability to floods- 50-75% flood hazard area and likelihood of flood inundation for more than 24 hours almost every year.
- Medium to high vulnerability to cyclonic storms
- Medium to high vulnerability to river bank erosion. Housing in the river island areas such as Majuli are highly vulnerable to river bank erosion
- High incidence of post flood silt deposition

Resources Available

- There is high degree of skill in bamboo in house construction for structural frames, roof trusses and floors.

Zone B has one typology

AS-B-01



ASSAM



AS-B-01



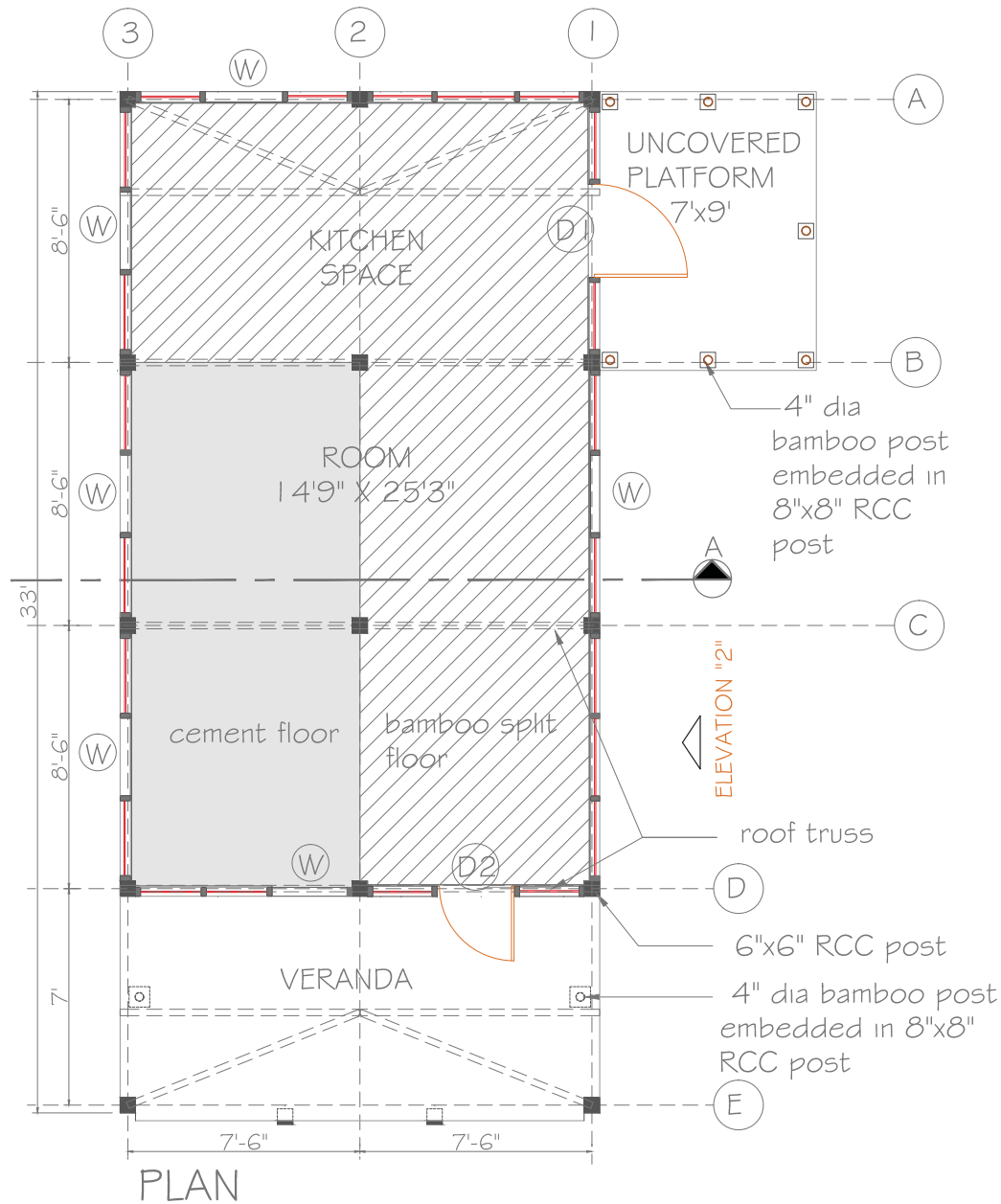
Side view



Top view

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
This design responds to the custom of stilted houses in parts of Assam.	Stilt Floor Design	Sloped roof

Recommendations for construction systems	
Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> RCC columns of 8"x8" section below plinth and 6"x6" section above plinth; RCC plinth beam of 6"x6" cross section
Plinth	<ul style="list-style-type: none"> RCC stubs have been introduced as foundation for bamboo posts which are used to support verandah and washing platform. A stilted RCC frame structure with plinth beam connecting the columns has been provided as the core space. The size of the stilted space is as per common practice to comfortably accommodate a kitchen at the rear end. RCC braces have been integrated into RCC posts to support the primary rafters for floor.
Wall	<ul style="list-style-type: none"> Assam type wooden frame construction with infill of interwoven bamboo splits having cement plaster on the outside and mud plaster on the inside; Burnt brick masonry in cement mortar 1:5 or Flyash brick masonry in cement mortar 1:4 till sill level
Floor	<ul style="list-style-type: none"> bamboo split floor on bamboo primary and secondary understructure; part of the floor is 2" cement concrete with nominal 6mm reinforcement in both directions
Floor Finish	<ul style="list-style-type: none"> A part of the bamboo floor has been made solid with cement plaster to increase its functionality



TYPICAL PLAN

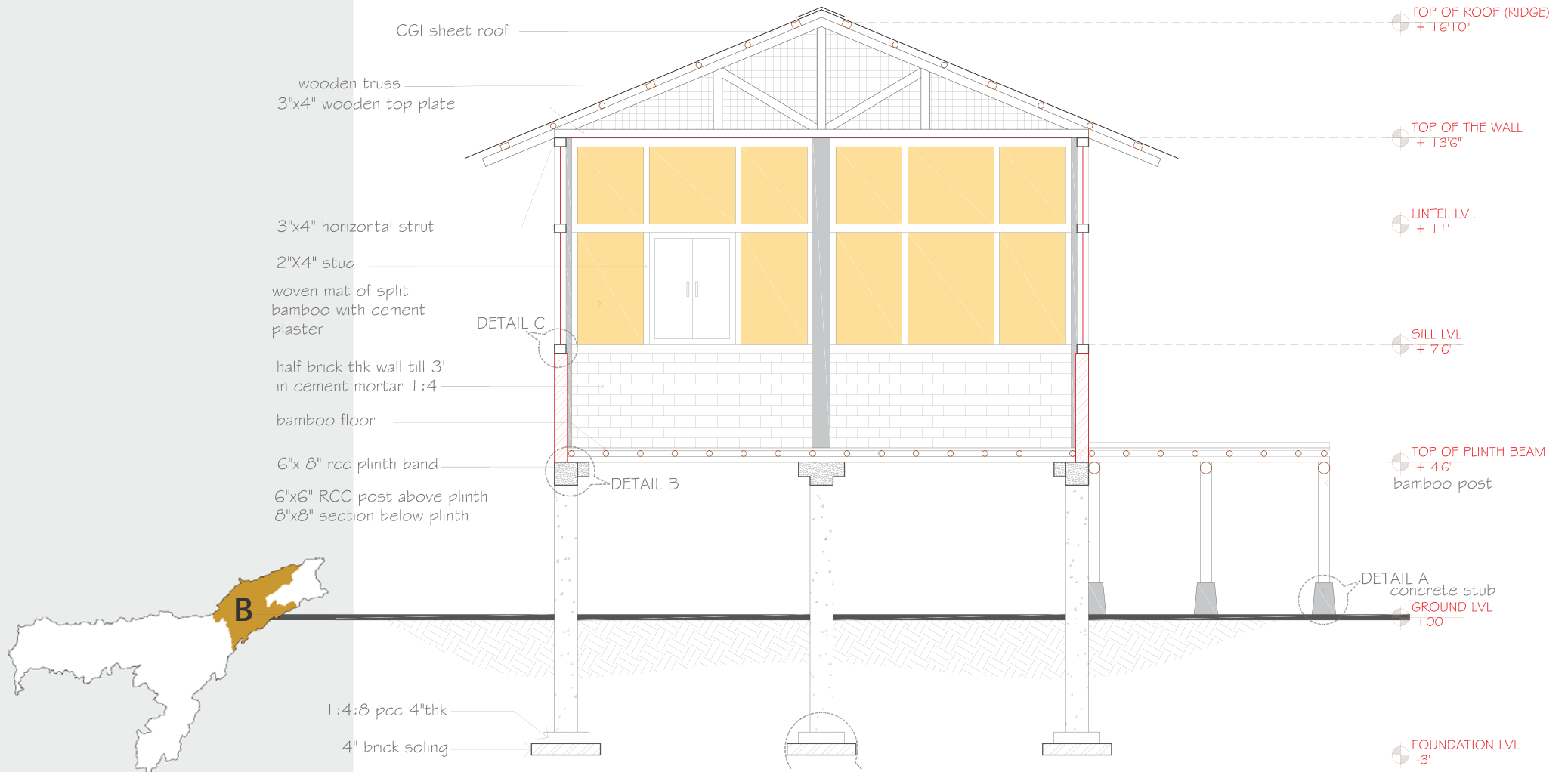
ZONE-B AS-B-01

Total cost ₹ 1,42,091/-



ASSAM

ZONE-B AS-B-01



ASSAM

SECTION AA'

Cost Estimate for ZONE-B Design 01

				Room			
				quantity	unit	rate	amount
1	Excavation						
	RCC stub			42.00	cft	3.08	129.36
	RCC post			168.00	cft	3.08	517.44
2	Brick Soling						
	RCC stub			0.00	sft	35.00	0.00
	RCC post			31.50	sft	35.00	1102.50
3	PCC 1:4:8						
	RCC stub			3.91	cft	99.15	387.32
	RCC post			13.78	cft	99.15	1366.45
4	Brickwork above plinth (1:4)						
	half brick wall			107.10			
	deduciton for openings			6.93			
	total brickwork			100.17	cft	153.61	15387.31
5	Wooden frame						
	Horizontal member 3"x4"			21.04	cft	650.00	13148.44
	Vertical member 2"x4"			15.84	cft	650.00	9900.00
6	Bamboo split wall 3" thick with cement plaster 1:4						
				467.50	sft		
	deduciton for openings			61.19	sft		
	total wall			406.31	sft	27.68	11248.36
7	Concrete 1:1.5:3						
	Plinth beam long,1 bracket			25.70	cft	154.53	3972.04
	Plinth beam long,2 brackets			17.67	cft	154.53	2730.78
	Plinth beam, transverse			9.45	cft	154.53	1460.31
	Full Post below plinth			30.87	cft	154.53	4770.34
	Full Post above plinth			15.75	cft	154.53	2433.85
	Post till plinth			12.35	cft	154.53	1908.14
	Stub			9.00	cft	154.53	1390.77
8	Reinforcement steel						
	Plinth beam with 1 bracket			108.00	kg	54.24	5858.24
	Plinth beam with 2 brackets			64.80	kg	54.24	3514.95
	Plinth beam without bracket			14.40	kg	54.24	781.10
	Full Post			72.2	kg	54.24	3916.3
	Post till plinth			58.4	kg	54.24	3167.8
9	Truss						
	2nd class treated wood			22.5	cft	575.00	12937.5
10	GCI sheet (0.45 mm thick)						
	with fitting complete			560.00	sq.ft	37.67	21092.40
11	Door (With 2nd class treated timber)						
	wooden frame, section 4"x3"			2.23	cft	700.00	1559.0
	Window (With 2nd class treated timber)						
	wooden frame, section 4"x3"			5.12	cft	700.00	3586.3
12	Bamboo for floorplate						
	4" primary bamboo			165.00	Rft	12.00	1989.00
	3" secondary bamboo			265.00	Rft	8.00	2496.00
	Flooring bamboo			340.00	Rft	8.00	2720.00
	Carpenter						2000

Open platform			
quantity	unit	rate	amount
49.00	cft	3.08	150.92
	cft	139.21	0.00
5.47	cft	110.17	542.24
min 3" dia bamboo posts			
40.00	R.ft	8.00	320.00
concrete 1:2:4 foundation for bamboo posts			
14.00	cft	155.65	2179.10
steel in concrete foundation for bamboo post			
10.00	kg	60.27	542.43
bamboo understructure, 3"-4" dia			
27.00	Rft	12.00	324.00
bamboo understructure, 2"-3" dia			
70.00	Rft	8.00	560.00
Total			
		4168.69	

ZONE - B AS-B-01

Cost breakup

Item	Cost (INR)
House	137,472/-
Open platform	4,168/-
Total	142,090/-



ASSAM

ZONE-C

The classification Zones in Assam is based on Vulnerability to natural hazards:

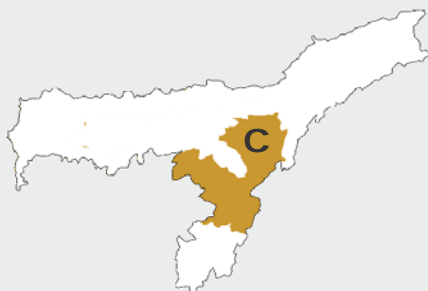
- Low vulnerability to flooding and erosion
- Medium to high vulnerability to cyclonic wind storms
- High vulnerability to landslides
- This is a predominantly hilly zone which includes the Mikir, Rangma and North Cachar hills.

Resources Available

- Access to bricks for house construction is difficult in the zone.
- There is abundance of forest resources of timber, bamboo and stone.
- Majority of the houses have traditionally been built with natural materials like timber and bamboo.
- Wooden posts using secondary timber are most commonly used for structural framing of houses. Interwoven bamboo mats are the most common wall material.

Zone C has one typology

AS-C-01



ASSAM



AS-C-01



Side view



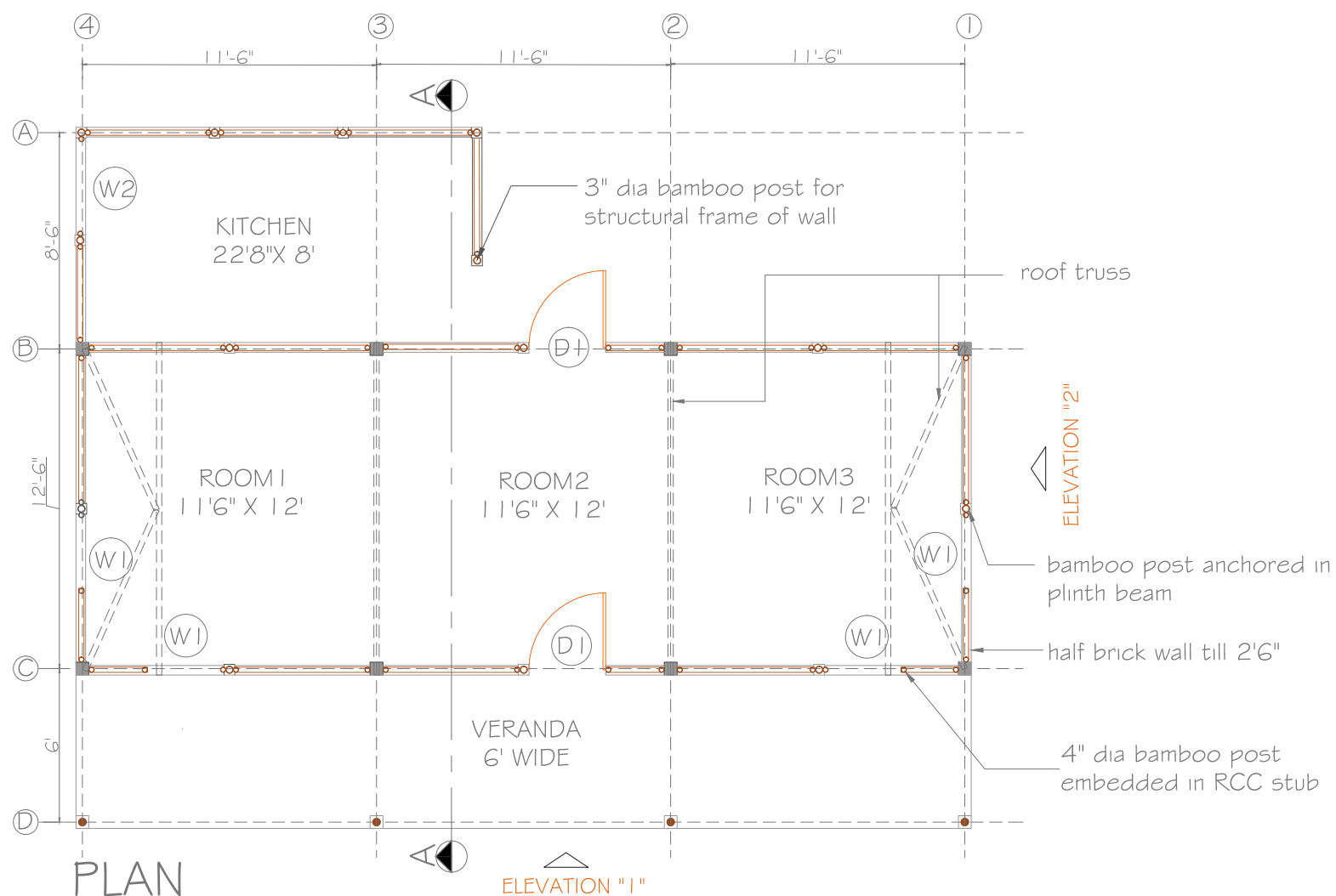
Top view

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
This plan type includes a larger area with three rooms and a front verandah and kitchen at the rear.		Sloped roof

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Isolated footings of RCC columns of 6"6" section below plinth and plinth beam of 6"x6" section; half brick masonry with 10"x10" brick stubs in 1:4 cement mortar till plinth beam 	
Plinth	<ul style="list-style-type: none"> Plinth area extended for additional rooms for incremental construction 	
Wall	<ul style="list-style-type: none"> Bamboo frame construction with bolted joints; infill of panels of interwoven bamboo mats; Burnt block masonry in cement mortar 1:5 or Flyash brick masonry or Hollow Concrete Block masonry in cement mortar 1:5 is proposed till sill height 	<ul style="list-style-type: none"> Treatment of bamboo is proposed for durable construction The practice of tying large spans of bamboo mat to the structure makes the wall weak and decreases the durability of the enclosure.
Wall Finish		
Roof Structure	<ul style="list-style-type: none"> CGI sheet gable roof on bamboo truss, additionally anchored with bamboo on top tied to truss rafter in areas of high winds/ cyclones 	
Roof Cover	<ul style="list-style-type: none"> GCI sheet with Timber Understructure. 	
Floor	<ul style="list-style-type: none"> Room - Cement concrete floor 2" thick on brick flat soling; Kitchen - cement stabilized earthen floor 	

ZONE-C AS-C-01

Total Cost ₹ 1,62,555/-



TYPICAL PLAN



ASSAM

ZONE-C AS-C-01

Bamboo truss
bamboo jaali
bottom of raft

bamboo frame
4" dia bamboo post
embedded in
concrete stub
horizontal bamboo
3" dia.
bamboo railing
6"x6" RCC stub

SECTION AA

DETAIL A

6"x 8" Plinth band
1:4:8 pcc 4"thk
4" brick soling

2" cc flooring
brick flat soling
compacted earth

half brick wall perimeter
(till plinth beam)

CGI sheet roof

2" dia bamboo
3" dia bamboo

TOP OF ROOF (RIDGE)
+13'6"

TOP OF WALL
+10'6"

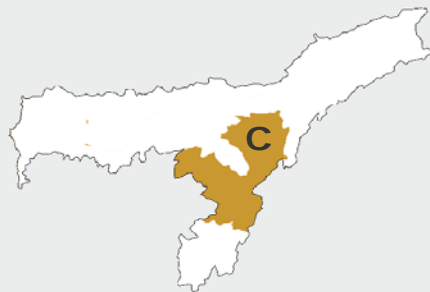
LINTEL LVL
+7'6"

bamboo mat
bamboo splits on
both side of
bamboo mat
conc. block
masonry

PLINTH LVL
+1'6"

GROUND LVL
+00

FOUNDATION LVL
-3'



ASSAM

SECTOIN AA'

Cost Estimate for ZONE-C Design 01

		Room				Kitchen				Verandah			
		Quantity	unit	Rate	Amount	Quantity	unit	Rate	Amount	Quantity	unit	Rate	Amount
1	Excavation												
	Wall	376.00	cft	3.08	1158.08	128.00	cft	3.08	394.24	184.00	cft	3.08	566.72
	RCC post	96.00	cft	3.08	295.68								
2	Brick Soling												
	Wall												
	RCC post	20.00	cft	35.00	700.00								
3	PCC 1:4:8												
	Wall	39.48	cft	99.15	3914.56	14.70	cft	110.17	1457.55	19.32	cft	110.	1915.64
	RCC post	10.08	cft	99.15	999.46								
4	Concrete block masonry in foundation and plinth-in 1:6 cement mortar												
	6" thick concrete block wall	117.5	cft	140.00	16450.0	26.25	cft	140.00	3307.50	34.50	cft	140.	4830.00
	Stubs 10"x10"	11.29	cft	140.00	1580	5.64	cft	140.00					
5	Concrete block masonry in 1:6 cement mortar												
	6" thick concrete block wall	141.00				24.00	cft	150.00	3240.00				
	deduciton for openings	16.20											
	total block masonry	124.80	cft	150.00	18720.0								
6	Bamboo mat wall in bamboo frame	517.00	Sft			176.00	Sft	25.00	3960.00				
	Deduction for opening	60.25	Sft										
	Bamboo mat	456.75	Sft	22.50	10276.8	4" dia bamboo verticals				4" dia bamboo verticals			
	Bamboo frame					60.00	Rft	12.00	648.00	45.00	R.ft	12.0	540.00
	4" bamboo	174.00	Rft	12.00	2088.00								
	3" bamboo	270.00	Rft	8.00	2160.00								
	Labour												
7	Concrete 1:1.5:3									concrete 1:2:4 foundation for bamboo posts			
	Plinth beam	23.50	cft	154.53	3631.46	4.00	cft	171.70	618.12	3.25	cft	155.	505.86
		0.00	cft	154.53	0.00	concrete 1:2:4 foundation for bamboo posts							
	Post	26.00	cft	154.53	4017.78	3.90	cft	155.65	546.33				
8	Reinforcement steel					steel in concrete foundation for bamboo post				steel in concrete foundation for bamboo post			
	Plinth beam	104.88	kg	54.24	5689.01	12.65	kg	60.27	686.07	10.54	kg	60.3	571.72
	Post	127.74	kg	54.24	6929.22								
9	Treated bamboo truss												
	3" dia bamboo	300.00	Rft	8.00	2400.00								
	4" dia bamboo	130.00	Rft	12.00	1560.00								
	Tools, hardware				1000.00								
	Labour				2500.00								
10	GCI sheet (0.45 mm thick)					GCI sheet				GCI sheet			
	with fitting complete	685.00	sq.ft	37.67	25800.5	220.00	Sft	37.67	8286.30	250.00	sq.ft	41.8	9416.25
11	Door (With 2nd class treated timber)									bamboo understructure, 3"-4"dia			
	wooden frame, 4"x3"	2.80	cft	700.00	1963.50	30.00	R.ft	12.00	360.00	67.50	Rft	12.0	810.00
	Window (With 2nd class treated timber)									bamboo understructure, 2"-3"dia			
	wooden frame, section 4"x3"	6.60	cft	700.00	4620.00	80.00	Rft	8.00	640.00	100.00	Rft	8.00	800.00
	TOTAL AMOUNT				118455				24144				19956

ZONE -C AS-C-01

Cost breakup

Item	Cost (INR)
Room	118,455/-
Kitchen	24,144/-
Verandah	19,956/-
Total	1,62,555/-



ASSAM

ZONE-D

The classification Zones in Assam is based on Vulnerability to natural hazards:

- Majority of the zone has low to medium vulnerability to flooding. Most areas in the zone face threat of severe floods once in about 10 years
- High vulnerability to the northern part of the zone to flash floods in rivers flowing from Bhutan
- High vulnerability to cyclonic wind storms with windspeeds reaching above 50m/s in large parts of the zone.
- High vulnerability to river bank erosion and loss of land to erosion – this happens in Char areas present in many parts of the zone includes districts of Goalpara, Kamrup, Darrang, Bongaigaon, Barpeta, Tinsukia

Resources Available

- Due to presence of thermal power plant in both Bongaigaon and Tinsukia, flyash is also a feasible material

Zone D has two typologies

AS-D-01

AS-D-02



ASSAM



AS-D-01



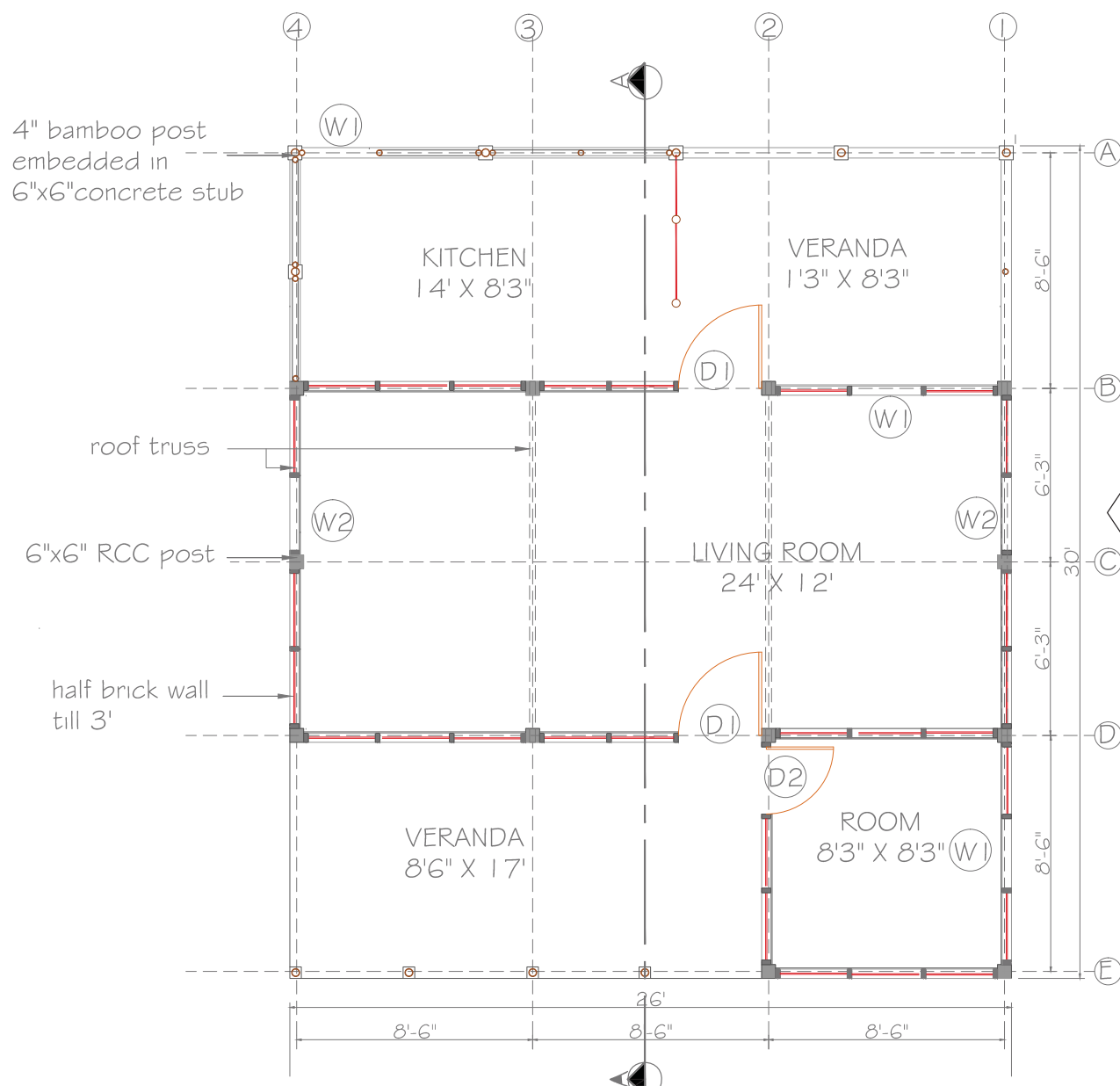
Side view



Top view

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
This design incorporates the traditional 'Assam' type construction of wooden frames with infill bamboo plastered walls. . It is currently being used with bamboo splits which have replaced traditional ekra.	High Plinth Design	Sloped roof.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Isolated footings of 6"x6" RCC column with a 6"x6" plinth beam; half brick masonry in 1:4 cement mortar till plinth beam and in verandah perimeter 	
Plinth	<ul style="list-style-type: none"> A plinth beam for the core structure and an extended plinth band for the kitchen space has been provided. A plinth provision has been made for an additional room in the front veranda – this can be constructed by the house owner incrementally 	
Wall	<ul style="list-style-type: none"> A core space constructed using a combination of half brick masonry and wooden frame construction – this has high resistance to earthquake forces. 	
Wall Finish	<ul style="list-style-type: none"> The external surface of the wall has a cement-sand plaster to increase its weather resistance and durability 	
Roof Structure	<ul style="list-style-type: none"> CGI sheet gable roof on wooden truss, additionally anchored with bamboo on top tied to truss rafter in areas of high winds/ cyclones 	
Floor	<ul style="list-style-type: none"> Room- Cement concrete floor 2" thick on brick flat soling; Kitchen- cement stabilized earthen floor 	



TYPICAL PLAN

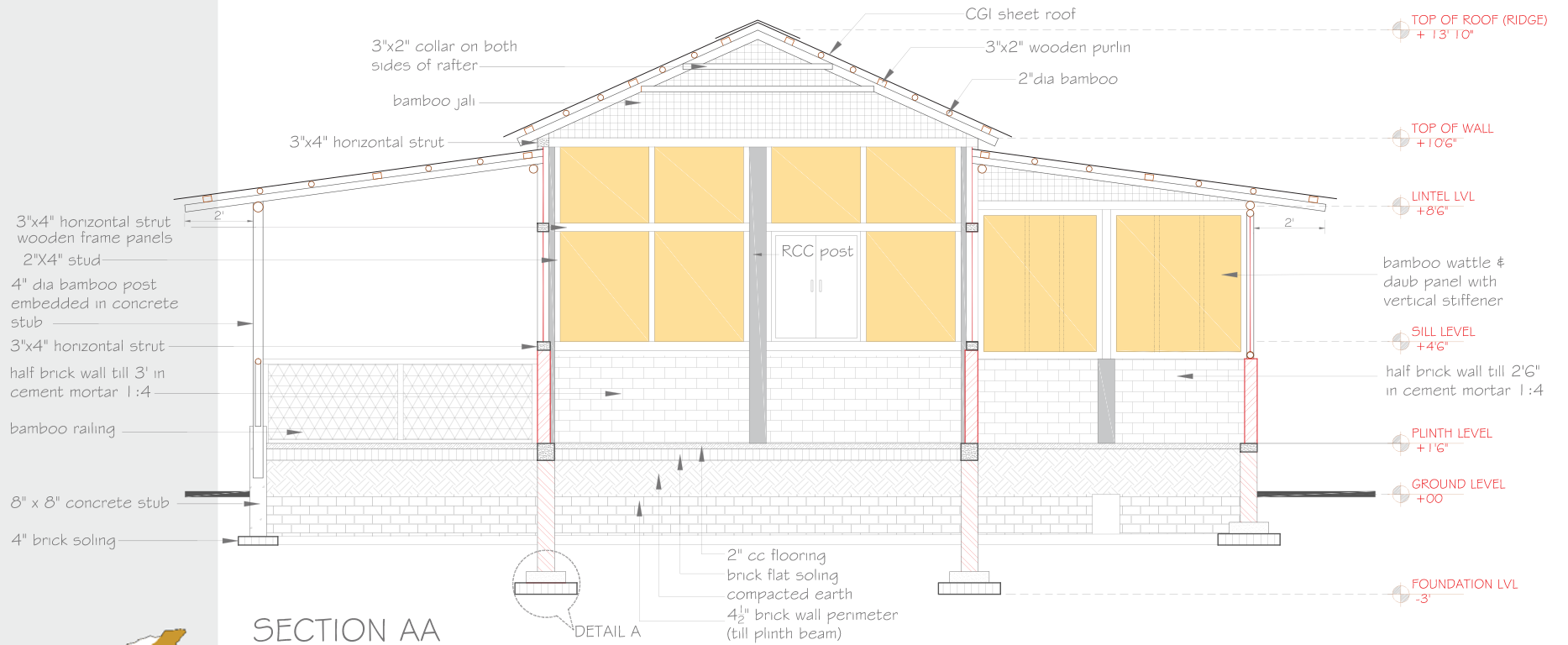
ZONE-D AS-D-01

Total Cost ₹ 1,54,230/-



ASSAM

ZONE-D AS-D-01



SECTION AA



ASSAM

SECTION AA'

Cost Estimate for ZONE-D Design 01

		Room				Kitchen+store				Verandah+ additional room			
		quantity	unit	rate	amount	quantity	unit	rate	amount	quantity	unit	rate	amount
1.0	Excavation												
	Wall	231.0	cft	3.1	711.5	90.0	cft	3.1	277.2	156.0	cft	3.1	480.5
	RCC post, 10 No.	120.0	cft	3.1	369.6								
2.0	Brick Soling												
	Wall	57.8	sft	35.0	2021.3	24.0	cft	35.0	840.0	41.6	cft	35.0	1456.0
	RCC post, 10 No.	10.0	sft	35.0	350.0								
3.0	PCC 1:4:8												
	Wall	19.3	cft	99.2	1908.7	7.4	cft	99.2	662.6	6.4	cft	99.2	638.0
	RCC post, 10 No.	2.5	cft	99.2	247.9								
4.0	Brickwork foundation (1:4)												
	half brick wall	25.9	cft	149.4	3864.3	10.1	cft	149.4	1355.0	17.5	cft	149.4	2609.7
	brick stubs 10"x10"				0.0	1.4	cft		0.0				
5.0	Brickwork above plinth (1:4)									concrete 1:2:4 foundation for bamboo posts			
	half brick wall	97.0	cft	153.6	14903.4	18.9	cft	153.6	2613	4.4	cft	155.7	686.4
6.0	Wooden frame					concrete 1:2:4 foundation for bamboo posts							
	Horizontal member 3"x4"	16.5	cft	750.0	12375.0	2.9	cft	155.7	457.6				
	Vertical member 2"x4"	14.2	cft	750.0	10642.5								
7.0	Bamboo split wall 3" thick with cement plaster 1:4	462.0				concrete 1:2:4 for embedding bamboo				min 3" dia bamboo posts			
	deduciton for openings	86.5				2.5	cft	155.7	389.1	35.0	R.ft	10.0	350.0
	total wall	375.5	sq.ft	30.8	11550.4								
6.0	Concrete 1:1.5:3												
	Plinth beam	19.3	cft	154.5	2974.7	4.0	cft	154.5	618.1	3.1	cft	171.7	536.6
	Post, 10 No.	29.3	cft	154.5	4520.0								
7.0	Reinforcement steel									32.0	kg	54.2	1736
	Plinth beam	96.7	kg	54.2	5244.2	21.3	kg	54.2	1156.9	34.3	kg	54.2	1862
	Post	146.9	kg	54.2	7967.2	steel in concrete foundation for bamboo post				steel in concrete foundation for bamboo post			
						4.0	kg	54.2	217.0	9.0	kg	54.2	488.2
8.0	Truss					min 3" bamboo post							
	2nd class treated wood	22.0	cft	700.0	15400.0	65.0	R.ft	8.0	520.0				
9.0	GCI sheet (0.45 mm thick)					GCI sheet				GCI sheet			
	with fitting complete	435.0	sq.ft	37.7	14745.8	140.0	sft	37.7	4746	260.0	sq.ft	37.7	9793
10.	Door (With 2nd class treated timber)					bamboo rafter, 3"-4"dia				bamboo rafter, 3"-4"dia			
	wooden frame, section 4"x3"	2.8	cft	700.0	1963.5	60.0	R.ft	12.0	720.0	70.0	Rft	12.0	840.0
	Window (With 2nd class treated timber)					bamboo purlin, 2"-3"dia				bamboo purlin, 2"-3"dia			
	wooden frame, section 4"x3"	4.3	cft	700	3003.0	120.0	Rft	8.0	960.0	100.0	Rft	8.0	800.0
						bamboo mud plastered wall 4' high							
						165.0	sft	10.1	1658.3				
	TOTAL AMOUNT				114763				17191				22276

ZONE-D AS-D-01

Cost breakup

Item	Cost (INR)
Room	114,763/-
Kitchen	17191/-
Verandah	22,276/-
Total	154,230/-



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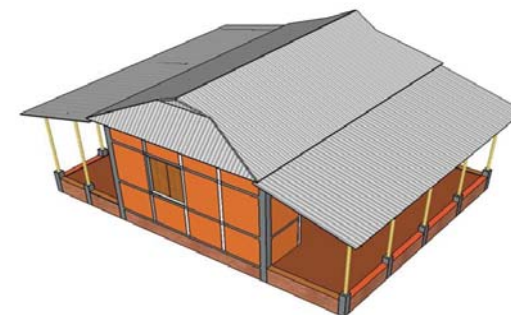
ZONE-D



AS-D-02



Side view



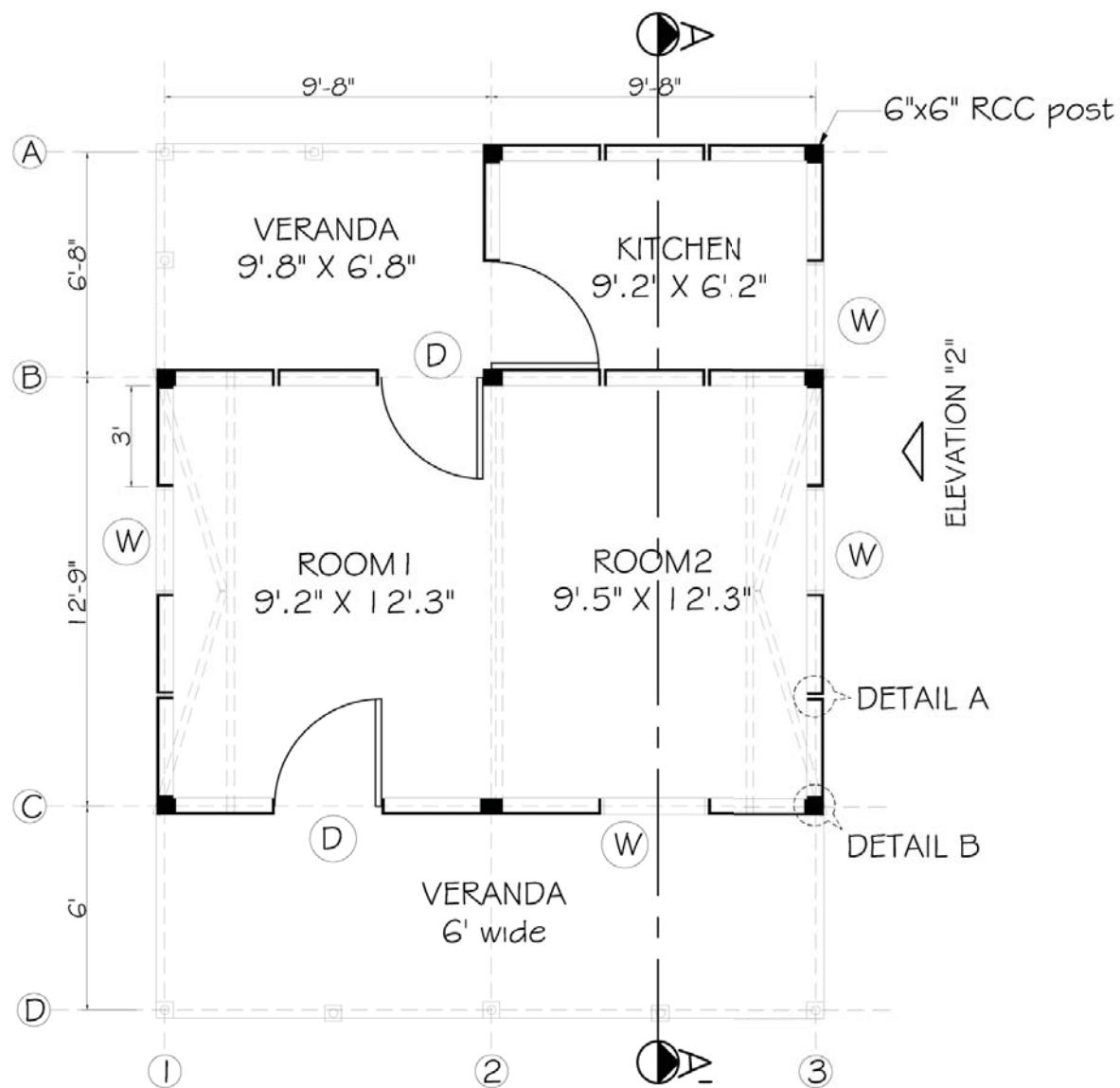
Top view

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
This plan type includes an attic space which is needed by families to store possessions in instance of severe flooding.	Normal plinth design.	Sloped roof.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Isolated RCC footings and plinth beam ; half brick masonry below plinth beam with step footing on PCC. 	The foundations of the house are also poorly secured in the ground to be able to withstand flooding when soil eordes.
Plinth	<ul style="list-style-type: none"> Minimum 30 cm and 30 cm projected from the walls to protect the foundation and provide stability to the structure. 	
Wall	<ul style="list-style-type: none"> CGI sheet walls Precast ferrocement wall panels of C-profile 25mm thick-sizes 3'x3' , 3'x4' and 3'x2' ;plinth and lintel bands 	<ul style="list-style-type: none"> The Panels require simple production infrastructure and can be produced locally at the block level
Wall Finish		
Roof Structure	<ul style="list-style-type: none"> CGI sheet gable roof on bamboo truss, additionally anchored with bamboo on top tied to truss rafter in areas of high winds/ cyclones 	
Roof Cover	<ul style="list-style-type: none"> GCI sheet with Timber Understructure. 	
Floor	<ul style="list-style-type: none"> Room- Cement concrete floor 2" thick on brick flat soling; Kitchen - cement stabilized earthen floor 	



ASSAM



TYPICAL PLAN

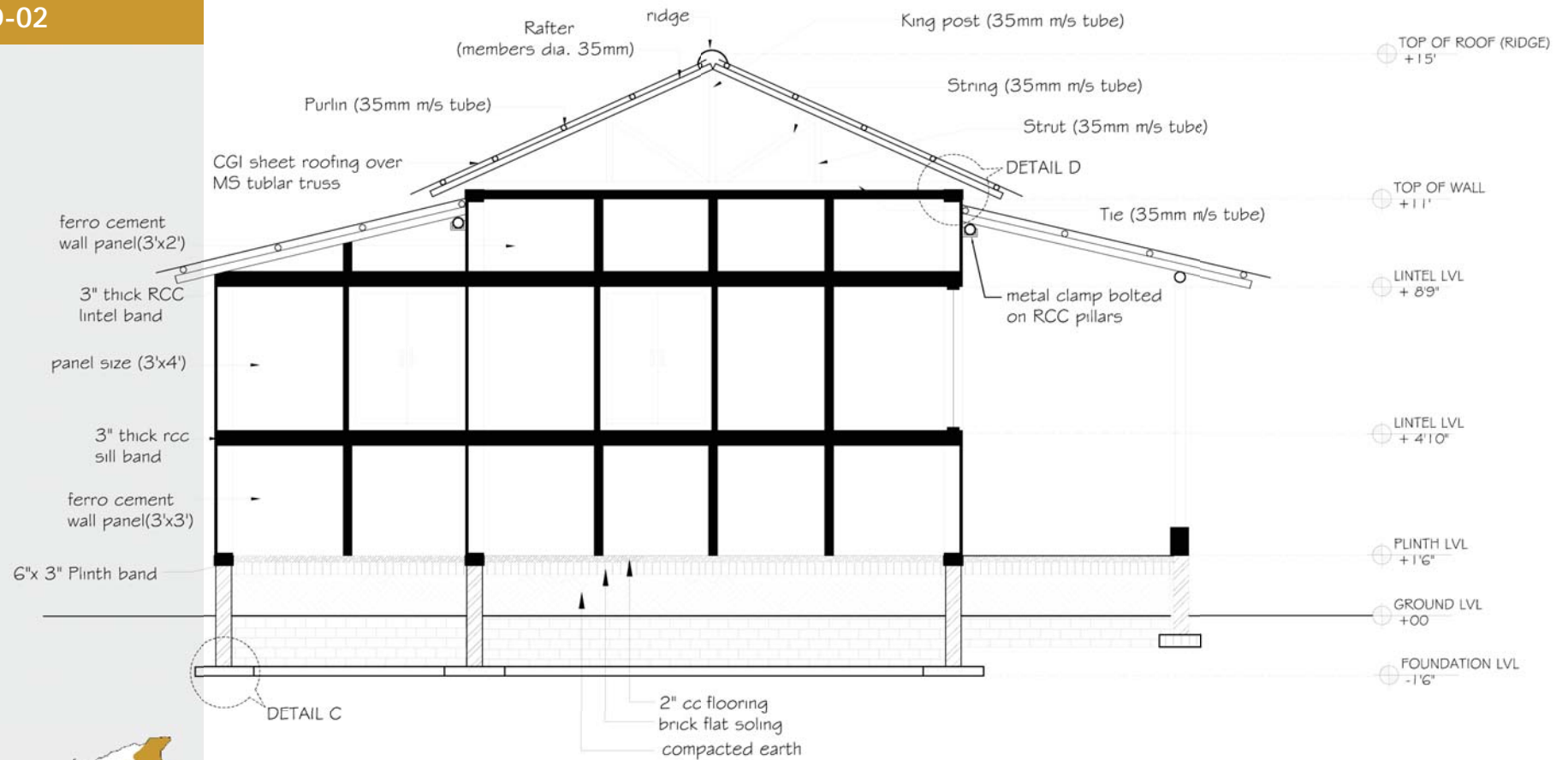
ZONE-D AS-D-02

Total Cost ₹ 1,54,120/-



ASSAM

ZONE-D AS-D-02



ASSAM

SECTION AA'

Cost Estimate for ZONE-D Design 02

	Room				Kitchen				Verandah	
	quantity	unit	rate	amount	quantity	unit	rate	amount	quantity	unit
1.0 Excavation										
Wall	292.5	cft	3.1	900.9	148.5	cft	3.1	457.4	90.0	cft
RCC post, 6 No.	48.0	cft	3.1	147.8						
2.0 Brick Soling										
Wall	0.0	Sft	35.0	0.0					54.0	Sft
RCC post, 6 No.	0.0	Sft	35.0	0.0						
3.0 PCC 1:4:8										
Wall	20.5	cft	99.2	2030.2	10.4	cft	99.2	1030.7		cft
RCC post, 6 No.	2.5	cft	99.2	249.9						
4.0 Brickwork foundation (1:4)										
half brick wall	41.0	cft	149.4	6116.5	29.8	cft	149.4	4450.9	30.2	cft
brick stubs 10"x10"	1.7	cft	149.4	252.9	1.4	cft	149.4	210.8		
5.0 Ferrocement wall panels										
Size 3'x3'	18.0	No.	800.0	14400.0	6.0	No.	800.0	4800.0		
Size 3'x4'	15.0	No.	1000.0	15000.0	5.0	No.	1000.0	5000.0		
Size 3'x2'	20.0	No.	600.0	12000.0						
6.0 Concrete 1:1.5:3										
Plinth beam	8.1	cft	154.5	1255.6	4.1	cft	154.5	637.4	concrete 1:2:4 foundation for bamboo posts	
Lintel and roof band	16.3	cft	154.5	2511.1	4.1	cft	154.5	637.4	4.3	cft
Post	13.2	cft	154.5	2044.4	3.62	cft	154.5	558.8		
7.0 Reinforcement steel										
Plinth, lintel and roof bands	123.0	kg	54.2	6671.9	41.1	kg	54.2	2230.5		
Post	51.9	kg	54.2	2816.5	14.3	kg	54.2	777.8		
Single vertical bar at panel junctions	56	kg	54.2	3038	16	kg	54.2	868		
8.0 Roof truss and purlins- tubular steel										
42.4 mmOD steel tube for king post truss	175.8	kg	84.1	14782.3	6.51	kg	84.1	547.5	min 3" bamboo post	
33.7 mmOD steel tube for purlins	106.3	kg	84.1	8938.2	35.4	kg	84.1	2979.4	40.0	R.ft
9.0 GCI sheet (0.45 mm thick)										
GCI sheet of approved brand ridging and accessories	465.0	sq.ft	37.7	17514.2	GCI sheet 100.0	sq.ft	37.7	3766.5	GCI sheet 160.0	sq.ft
23.0	Rft	41.0	943.0							
10.0 Door (With 2nd class treated timber)										
wooden frame, section 4"x3"	2.8	cft	850.0	2384.3					bamboo understructure , 3"dia	
Window (With 2nd class treated timber)									42.5	Rft
wooden frame, section 4"x3"	3.5	cft	850.0	2945.3					bamboo purlin, 2"-3"dia	
									63.0	Rft
10.0 Cement-sand plaster 1:6 (15 mm thick)										
external along the joints of panels total plaster	10.6	sft	12.0	127.7	32.0	sq.ft	12.0	384.0		
TOTAL AMOUNT				117070				29300		

ZONE-D AS-D-02

Cost breakup

Item	Cost (INR)
Room	117,070/-
Kitchen	29,300/-
Verandah	7,750/-
Total	1,54,120/-



ASSAM

ZONE-E

The classification Zones in Assam is based on Vulnerability to natural hazards

- Low vulnerability to floods – about 25% of the zone area is vulnerable to floods with a frequency of about 1 or 2 floods in 10 years.
- High vulnerability to cyclonic wind storms due to proximity to the Bay of Bengal.
- Parts of Cachar hills and Karimganj fall in this zone.

Resources Available

- Bricks are feasible option for major part of this zone
- Negligible forest cover in this zone

Zone E has one typology

AS-E-01



ASSAM



AS-E-01



Side view



Top view

Recommendations for Built Form

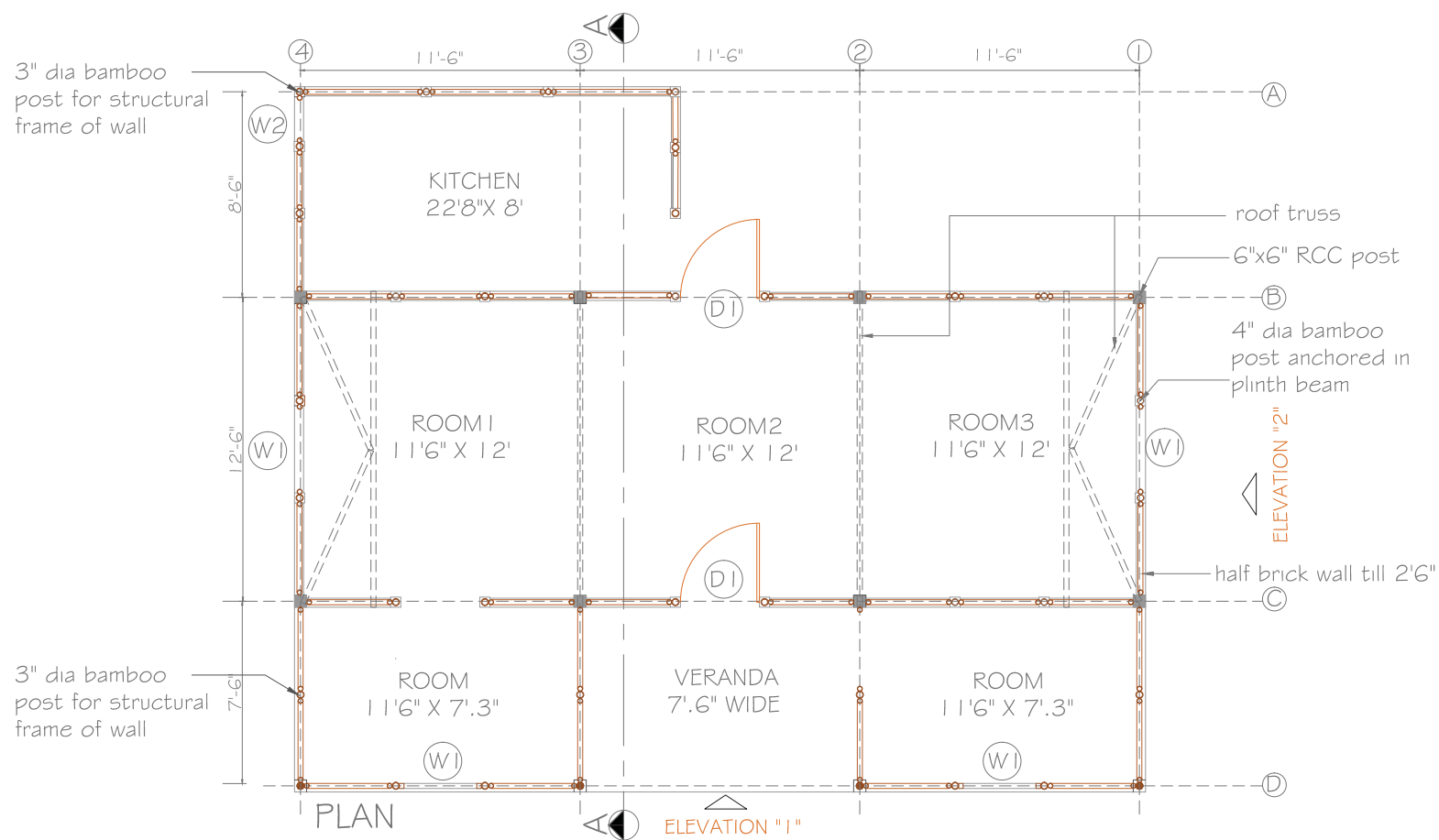
Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
This is the most common traditional construction in plain areas. These houses are generally larger in size with three rooms and a front verandah. Deterioration of structural bamboo directly supported on ground is a common problem.	High Plinth Design	Sloped roof

Recommendations for construction systems

Recommendations for construction systems	
Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> Isolated footings of RCC columns of 6"6" section below plinth and plinth beam of 6"x6" section; half brick masonry with 10"x10" brick stubs in 1:4 cement mortar till plinth beam
Plinth	<ul style="list-style-type: none"> Plinth area extended for additional rooms for incremental construction Treatment of bamboos proposed for durable construction.
Wall	<ul style="list-style-type: none"> Bamboo frame construction with bolted joints; infill of interwoven bamboo splits having cement plaster on the outside and mud plaster on the inside; Burnt brick masonry in cement mortar 1:5 or Flyash brick masonry or Hollow Concrete Block masonry in cement mortar 1:5 till sill level
Roof	<ul style="list-style-type: none"> CGI sheet gable roof on bamboo truss, additionally anchored with bamboo on top tied to truss rafter in areas of high winds/ cyclones
Floor	<ul style="list-style-type: none"> Room- Cement concrete floor 2" thick on brick flat soling; Kitchen- cement stabilized earthen floor

ZONE-E AS-E-01

Total Cost ₹ 1,62,081/-



TYPICAL PLAN

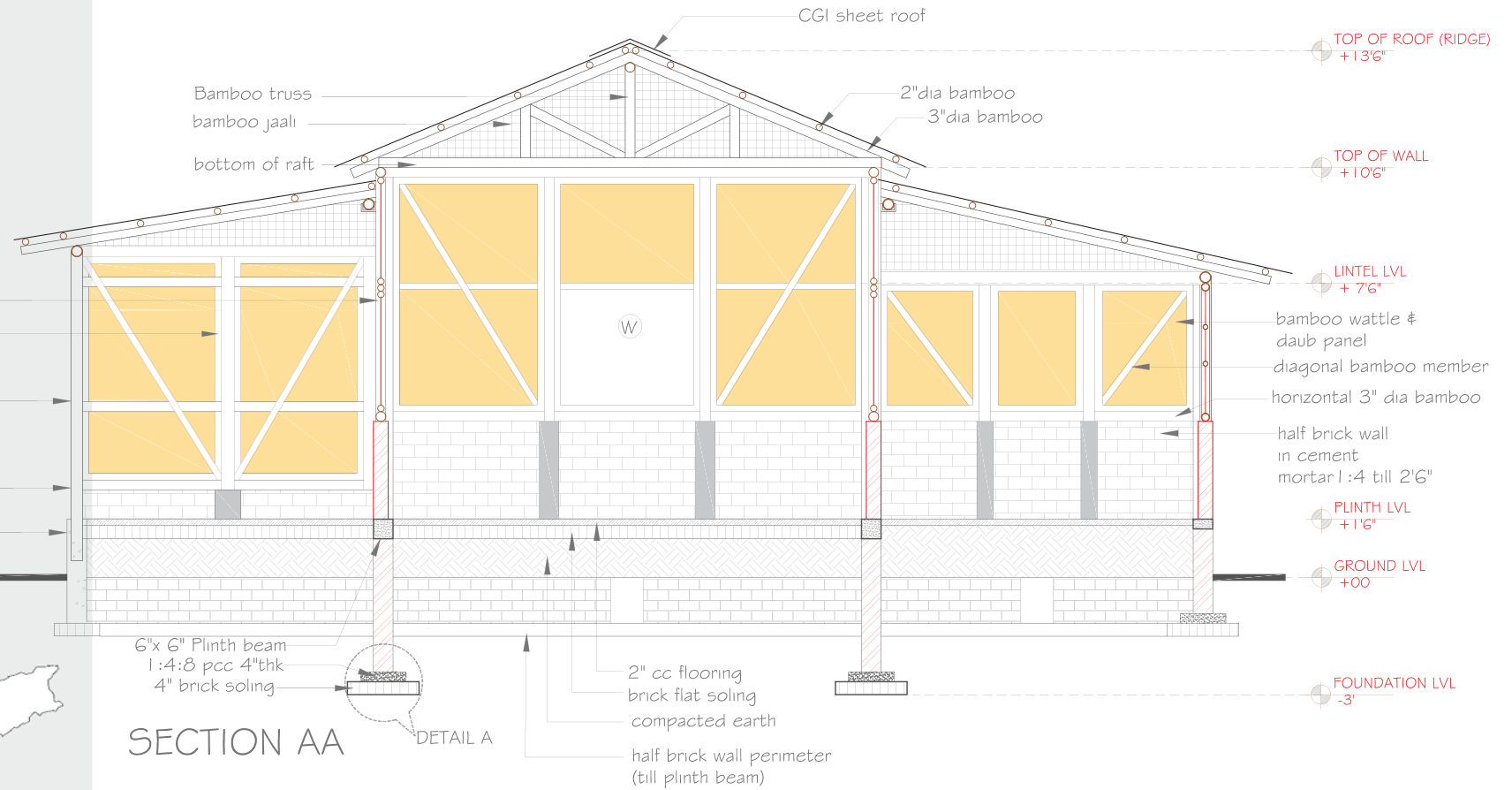


ASSAM

ZONE-E AS-E-01



ASSAM



Cost Estimate for ZONE-E Design 01

		Room				Kitchen				Verandah			
		quantity	unit	rate	amount	quantity	unit	rate	amount	quantity	unit	rate	amount
1	Excavation												
	Wall	376.00	cft	3.08	1158.08	128.00	cft	3.08	394.24	200.00	cft	3.08	616.00
	RCC post	96.00	cft	3.08	295.68								
2	Brick Soling												
	Wall												
	RCC post	16.00	cft	35.00	560.00								
3	PCC 1:4:8												
	Wall	21.15	cft	99.15	2097.09	7.20	cft	110.17	713.90	10.35	cft	110.17	1026.23
	RCC post	7.56	cft	99.15	749.60								
4	Brickwork foundation (1:4)												
	half brick wall	117.50	cft	149.36	17550.27	35.00	cft	165.96	5227.74	38.64	cft	165.96	5771.42
	brick stubs 10"x10"	11.29	cft	149.36	1686.26	5.64	cft	165.96	843.13				
5	Brickwork above plinth (1:4)												
	half brick wall	118.44				22.05	cft	170.68	3387.14	27.3	cft	170.68	4193.61
	deduciton for openings	7.56											
	total brickwork	110.88	cft	153.61	17032.50								
6	Bamboo split wall in bamboo frame with mud plaster	517.00	Sft			160.00	Sft	12.00	1728.00	390	Sft	12.00	4680.00
		60.25	Sft										
		456.75	Sft	12.00	5481.00	4" dia bamboo verticals				4" dia bamboo verticals			
	4" bamboo verticals	160.00	Rft	12.00	1920.00	50.00	Rft	12.00	540.00	90.00	R.ft	12.00	1080.00
	Labour				1500.00								
7	Concrete 1:1.5:3									concrete 1:2:4 foundation for bamboo posts			
	Plinth beam	23.50	cft	154.53	3631.46	4.00	cft	171.70	618.12	2.00	cft	155.65	311.30
		0.00	cft	154.53	0.00	concrete 1:2:4 for embedding bamboo							
	Post	26.00	cft	154.53	4017.78	3.00	cft	155.65	420.26				
8	Reinforcement steel					steel in concrete foundation for bamboo post				steel in concrete foundation for bamboo post			
	Plinth beam	97.81	kg	54.24	5305.62	12.65	kg	60.27	686.07	8.43	kg	60.27	457.38
	Post	119.81	kg	54.24	6498.75								
9	Treated bamboo truss												
	3" dia bamboo	300.00	Rft	8.00	2400.00								
	4" dia bamboo	130.00	Rft	12.00	1560.00								
	Tools, hardware				1500.00								
	Labour				2500.00								
10	GCI sheet (0.45 mm thick)					GCI sheet				GCI sheet			
	with fitting complete	685.00	sq.ft	37.67	25800.53	220.00	sq.ft	37.67	7457.67	280.00	Sft	37.67	9491.58
1	Door (With 2nd class treated timber)					bamboo rafter, 3"-4"dia				bamboo understructure, 3"-4"dia			
	wooden frame, section 4"x3"	2.80	cft	700.00	1963.5	30.00	R.ft	12.00	360.00	67.50	Rft	12.00	810.00
	Window (With 2nd class treated timber)					bamboo purlin, 2"-3"dia				bamboo understructure, 2"-3"dia			
	wooden frame, section 4"x3"	6.60	cft	700.00	4620.00	80.00	Rft	8.00	640.00	100.00	Rft	8.00	800.00
	TOTAL AMOUNT				109828				23016				29237

ZONE - E AS-E-01

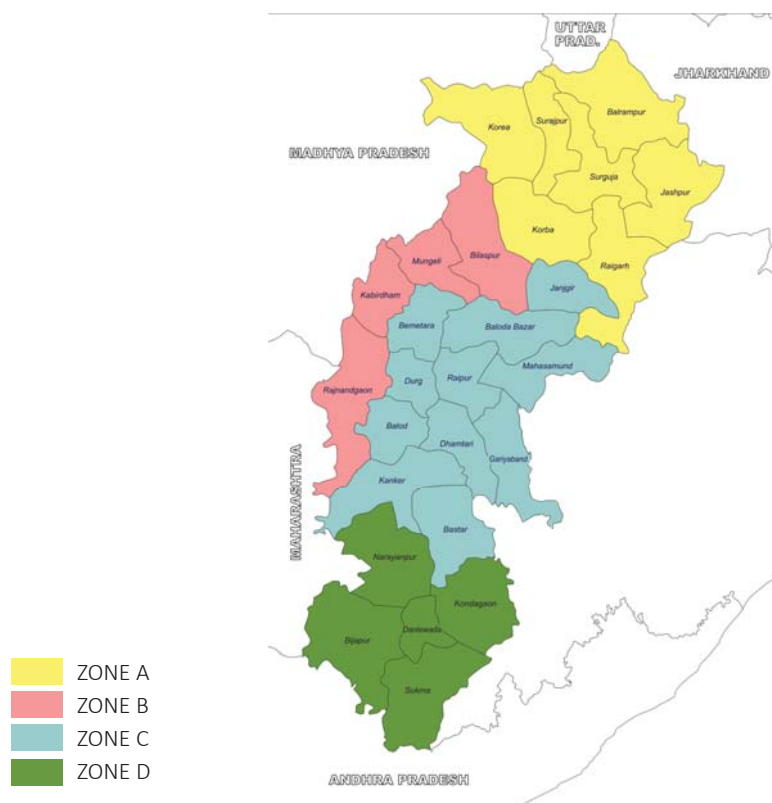
Cost breakup

Item	Cost (INR)
Main Room	109,828/-
Kitchen	23,016/-
Verandah	29,237/-
Total	1,62,081/-



ASSAM

Chhattisgarh



Chhattisgarh is located in the middle eastern part of India. As a result, the state has a Tropical Monsoon climate or Dry Sub-humid climate, similar to the rest of the country.

The northern and southern parts of the state are hilly, while the central part is fertile plains. Self-sustaining culture of several communities around the regions of Jashpur, Ambikapur, Bastar and other areas with its unique geography and land features, that use the locally generated resources for most of its building needs, is very much alive. This is also clearly reflected in many of the housing that is constructed under PMAY-G; houses being spacious, built with traditional materials that are locally procured.

House designs are based on traditional use of space, with dark interiors, with minimum windows and large verandah spaces, around a courtyard in most places, also addressing the need for incremental housing.

The total forest area of the state is approximately 45%. Various building materials are used for house construction in the state ranging from mud, bamboo, wood, stone, concrete, bricks, metal sheets, cement sheets, etc. At some places thatch, leaves, jute reeds are also used.

Though state of Chhattisgarh is not under any high-risk zones of natural disaster it is enriched with natural resources, which led to high amount of extraction and consumption of resources.

Zone A

Zone A is classified with its vast array of industries and mineral deposits. Bauxite and coal deposits are abundant in the district of Surguja. The falling of temperatures to close to zero degrees Celsius has resulted in the larger widths of walls for optimal thermal comfort.

Building typology Zone A is characterized by tribal cultural associations. Large parts of the zone have dense deciduous forest, which makes accessibility of certain forest resources easier. People generally have large courtyard houses.

Most of the zone falls under Seismic Zone II except for 3 districts, which are under Seismic Zone III.

Zone B

Zone B comprises of the foothills of the Maikal-Satpura mountain range and plains of Mahanadi river system geographically. The western half of the zone is mainly forest in the foothills and the eastern half is the Mahanadi river basin plains with more urban areas.

A large population harvests a single crop annually. The eastern part of the zone is highly urbanized comprising of urban centers like Bilaspur and Rajnandgaon. The region has influences from both the abutting zones of A and C.

Zone C

Building typology Zone C is the largest zone of the state, both area wise and population wise. The zone is formed by the fertile plains of Mahanadi river system basin. Soil for making bricks and mud walls is easily available. It has humid subtropical composite climate. The temperature ranges between 5°C to 48 °C annually.

The zone is the most urbanized and connected area of the state. Aspirations are high and influenced by the urban areas. People making brick houses with mud mortar, also lot of people hire masons for the construction. Self help component is still high in most of the areas.

Zone D

Building typology Zone D is the southernmost zone of the state. The Indravati-Dantewada-Gollapal plateau forms the zone. It also comprises of Bastar and Albaka hills. The zone is rich in natural resources and minerals. Stone is easily available and is the most prevalent building material. Bricks are relatively expensive and difficult to access in remote locations as connectivity is relatively poor. Mud mortar is extensively used.

Timber It has dense forest in most of its region. Due to dense forests the zone is sparsely populated. It is one of the poorest regions of the country.

CHHATTISGARH

ZONE-A

Zone A comprise 7 districts

1. Surguja
2. Korba
3. Raigarh
4. Korea
5. Surajpur
6. Balrampur
7. Jashpur

Resources Available

- Timber And Bamboo
- Fired Brick, Fly Ash Brick
- Thatch

Zone A has two typologies

CG-A-01

CG-A-02



CG-A-01

- Suitable for families which can afford only very small houses that can be incremented later.
- It is a single storey load bearing structure built in cob. It has rammed earth foundation walling material is cob wall with provision for stabilized mud plaster.
- The roofing material is terra-cotta country tiles with locally available timber with bamboo as under-structure.



CG-A-02

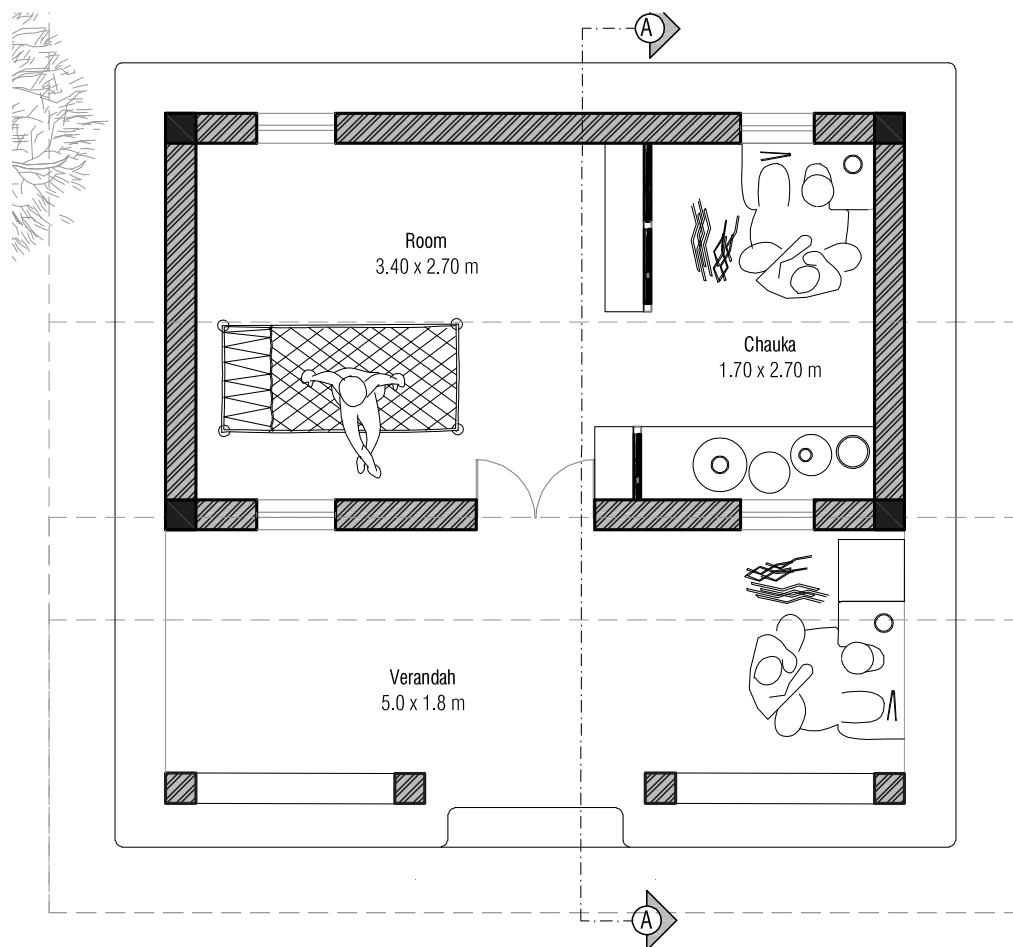
- The advantage of this type of structure is that the roof comes before the walls.
- This plan type includes two individual structures with a shaded court between. Each structure has 2 rooms.
- It is a single storey framed structure built in timber frame and wattle and daub walls. The roofing material is compressed bamboo mat corrugated sheets with timber and bamboo under-structure.
- The open area in between 2 structures is used for livelihood and social activities.

Recommendations for Built Form

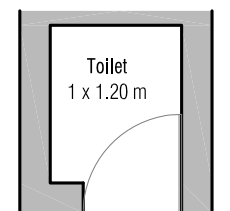
Plan Layout	Plinth/Floor	Roof Profile
This plan type includes a single room with a two way pitch roof extended over the open verandah in the front	Normal plinth design.	Sloped roof.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Brick foundation in cement mortar. 	
Plinth	<ul style="list-style-type: none"> Minimum 30 cm and 30 cm projected from the walls to protect the foundation and provide stability to the structure. 	
Wall	<ul style="list-style-type: none"> 23 cm thick brick work in sand cement mortar 	<ul style="list-style-type: none"> Wall plates should take loads of rafters and beams to further distribute the load on the cob walls.
Wall Finish	<ul style="list-style-type: none"> Stabilized Mud Plaster 	
Roof Structure	<ul style="list-style-type: none"> Roof slope angle – Min 25 & Max 33. Covered with sheet & has treated bamboo under structure 	<ul style="list-style-type: none"> Rigid connections between all roof members to increase stability.
Roof Cover	<ul style="list-style-type: none"> Country Tiles with Timber Under structure. 	<ul style="list-style-type: none"> Woven reed mats can be used below the tiles as false ceiling for thermal insulation.
Floor	<ul style="list-style-type: none"> Mud Floor with cow dung 	



TYPICAL PLAN



Wattle partition for room
segregation

23cm thick Brick wall/ Rat trap
Brick work in Cement mortar
Raised plinth at 30cm from ground
level

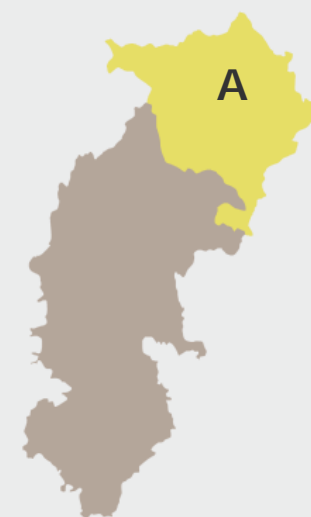
Concrete corner columns with
vertical steel

Exterior Kitchen

23cm thick Brick wall/ Rat trap
Brick work in Cement mortar raised
till 120cm
23cm x 23cm brick column

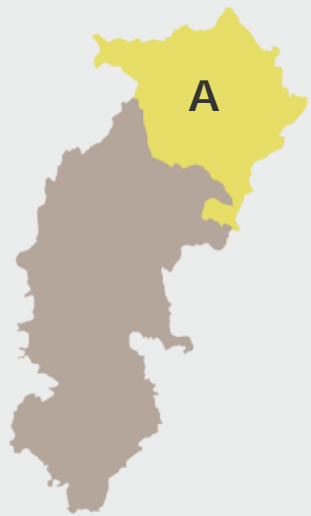
ZONE - A CG-A-01

Total Cost ₹ 98,230/-

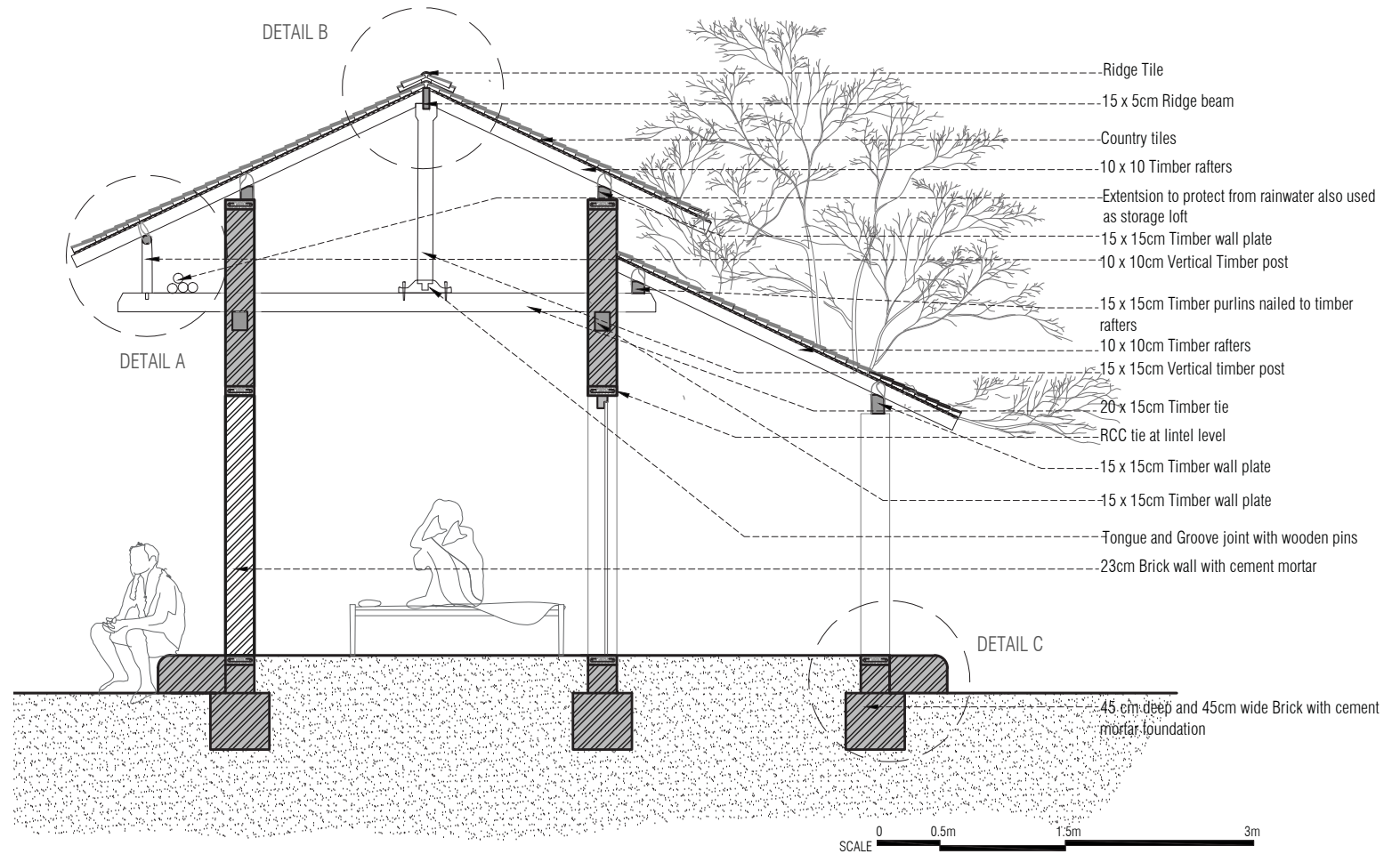


CHHATTISGARH

ZONE-A CG-A-01



CHHATTISGARH



TYPICAL SECTION

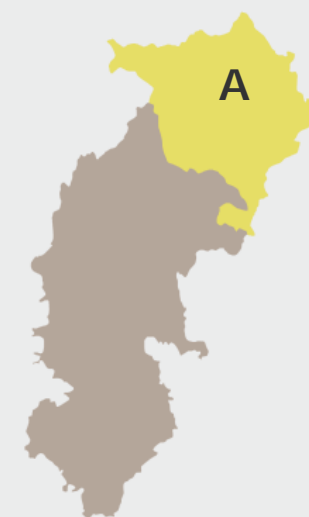
Cost Estimate for ZONE-A Design 01

SR. NO.		Cross Section Area	Length	width	Height	Quantity	Volume	Area	Material Cost	Rate per unit (Rs)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	sqm				
1	FOUNDATION											
	Rammed Earth	0.3	26.5				7.95		₹ 6,360.00	₹ 800.00	per cu m	₹ 10,500.00
	Mud work	30			0.3		9		₹ 1,800.00	₹ 200.00	per cum	
W	TOTAL								₹ 8,160.00			₹ 10,500.00
2	WALLS											
	Bamboo Screen		2	2				4	₹ 1,000.00	₹ 250.00	per sqm	
	Cob	65		0.4			26		₹ 16,900.00	₹ 650.00	cum	₹ 9,000.00
	Doors			0.9	2.1	1			₹ 1,000.00	₹ 1,000.00	per unit	
	Columns					4			₹ 3,200.00	₹ 800.00	per unit	
	Windows					4			₹ 2,000.00	₹ 500.00	per unit	
X	TOTAL								₹ 24,100.00			₹ 9,000.00
3	STRUCTURE ROOF											
	Timber rafters	0.47		0.05		12	0.282		₹ 4,977.30	₹ 500.00	per cu ft	₹ 15,000.00
	Distributer Purlins (bamboo slits)								₹ 7,000.00		per sq m	
	Rafter	0.6		0.07		4	0.168		₹ 2,965.20	₹ 500.00	per cu ft	
	Timber ties 2	0.21		0.07		12	0.1764		₹ 3,113.46	₹ 500.00	per cu ft	
Y	TOTAL								₹ 18,055.96			₹ 15,000.00
4	ROOF											
	Country tiles					5100		70	₹ 8,415.00	₹ 1.65	per unit	₹ 5,000.00
Z	TOTAL								₹ 8,415.00			₹ 5,000.00
						Total (W+X+Y+Z)			₹ 58,730.96			₹ 39,500.00
									A			B
	GRAND TOTAL (A+B)	₹ 98,230.96		Note:	The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from on the urban center or source, geography, time, availability and accessibility to the local resources, etc.							
	AREA (sqm)	32										
	RATE OF CONSTRUCTION (per sqm)	₹ 3,069.72			The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.							
	AREA (sqft)	342.4										
	RATE OF CONSTRUCTION (per sqft)	₹ 286.89										

ZONE - A CG-A-01

Cost breakup

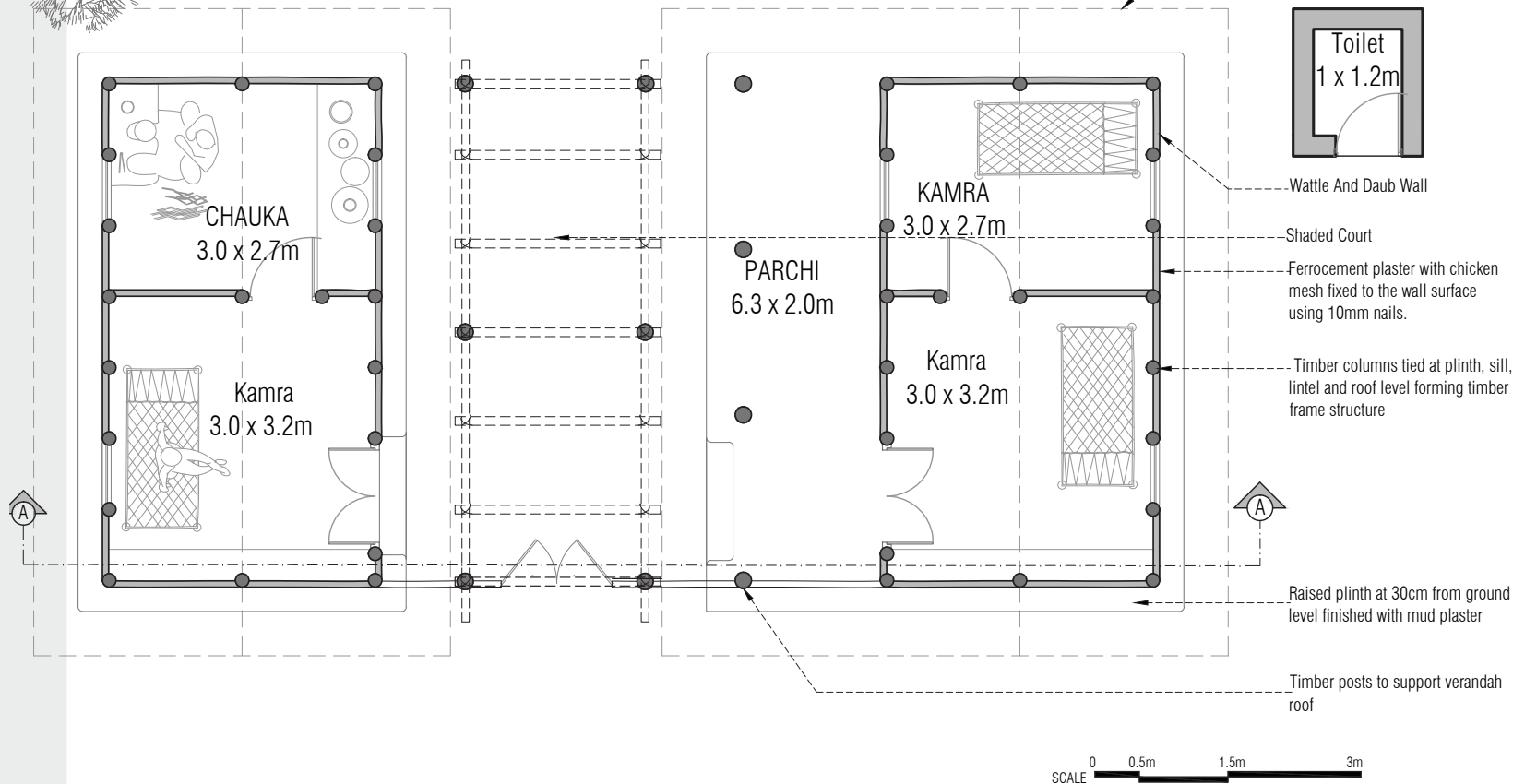
Item	Cost (INR)
Foundation	18,660/-
Walls	33,100/-
Roof (with structure)	46,470/-
Total	98,230/-



CHHATTISGARH

ZONE-A CG-A-02

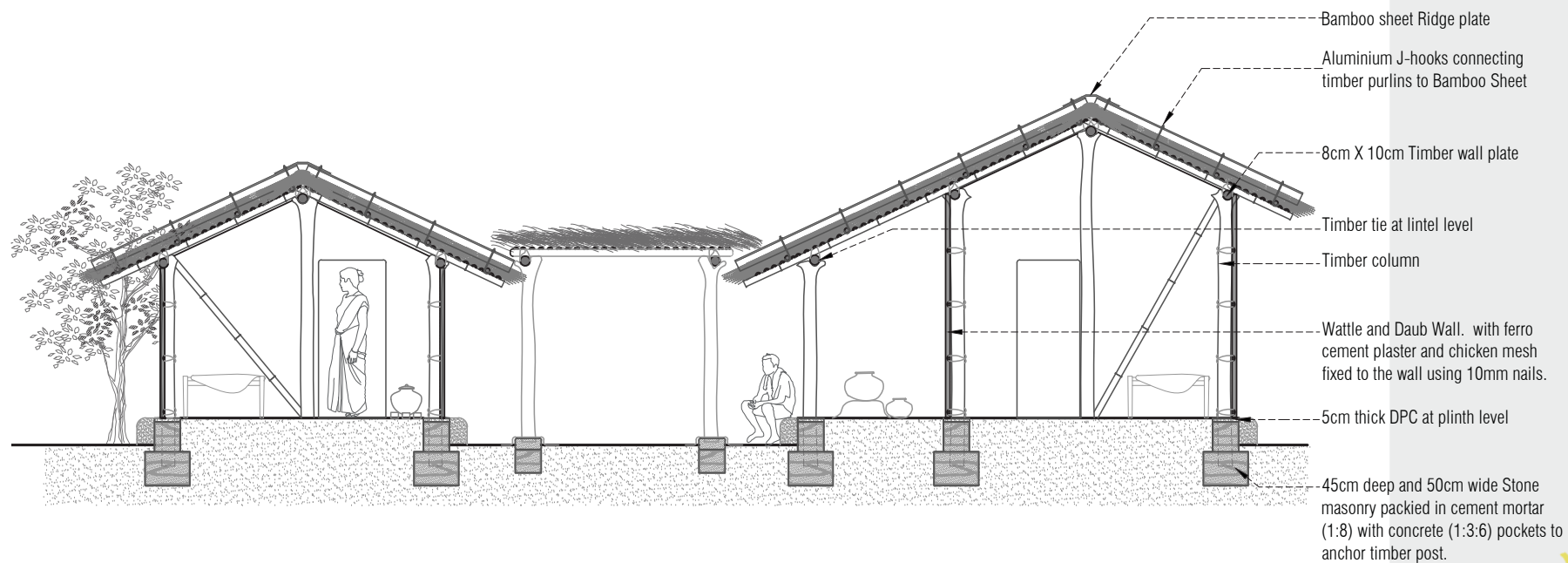
Total Cost ₹ 186,023.00/-



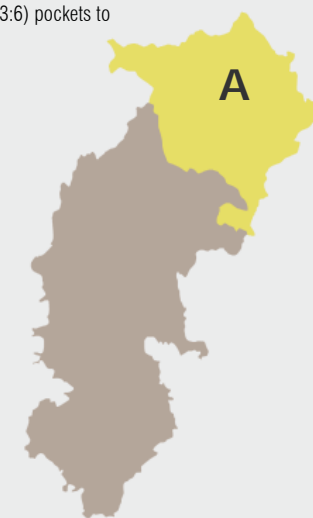
CHHATTISGARH

TYPICAL PLAN

ZONE - A CG-A-02



SCALE 0 0.5m 1.5m 3m



TYPICAL SECTION

CHHATTISGARH

Item	Cost (INR)
Foundation	51,273/-
Walls	38,950/-
Roof (with structure)	95,800/-
Total	98,230/-



CHHATTISGARH

[illegible]



CG-B-01

- Suitable for families who can afford only very small houses that can be incremented later. The roof come before the walls.
- It is a single storey framed structure built in adobe.
- The roofing material is terra-cotta country tiles with locally available timber with bamboo as under-structure.



CG-B-02

- Suitable for families who can afford only very small houses that can be incremented later.
- It is a single storey load bearing structure built in cob. It has sand packed stone foundation, walling material is cob with provision for stabilized reinforced mud plaster.
- The roofing material is terra-cotta Mangalore tiles with locally available timber with bamboo as under-structure

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
This plan type includes a long single room with a two way pitch roof. Suitable for families who can afford only very small houses that can be incremented later.	Normal plinth design.	Sloped roof.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • Brick/stone foundation in cement mortar. 	
Plinth	<ul style="list-style-type: none"> • Minimum 30 cm and 30 cm projected from the walls to protect the foundation and provide stability to the structure. 	
Wall	<ul style="list-style-type: none"> • 25 cm thick rat trap masonry wall in bricks and cement. 	<ul style="list-style-type: none"> • Thick adobe wall acts as thermal barrier
Wall Finish	<ul style="list-style-type: none"> • Stabilized Mud Plaster 	
Roof Structure	<ul style="list-style-type: none"> • Roof slope angle – Min 25 & Max 33. • Covered with sheet & has treated bamboo under structure 	<ul style="list-style-type: none"> • Rigid connections between all roof members to increase stability.
Roof Cover	<ul style="list-style-type: none"> • Country Tiles with Timber Under structure. 	<ul style="list-style-type: none"> • Woven reed mats can be used below the tiles as false ceiling for thermal insulation.
Floor	<ul style="list-style-type: none"> • Mud Floor with cow dung 	

ZONE-B

Zone B comprise 4 districts :

1. Rajnandgaon
2. Kabirdham
3. Mungeli
4. Bilaspur.

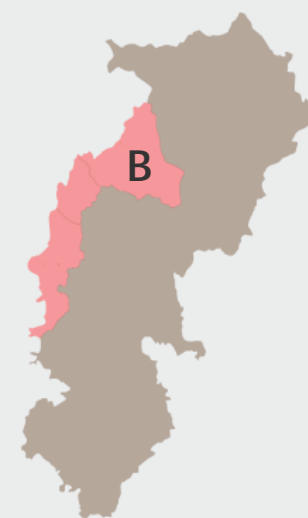
Resources Available

- Stone, Cob, Fired Clay

Zone B has two typologies

CG-B-01

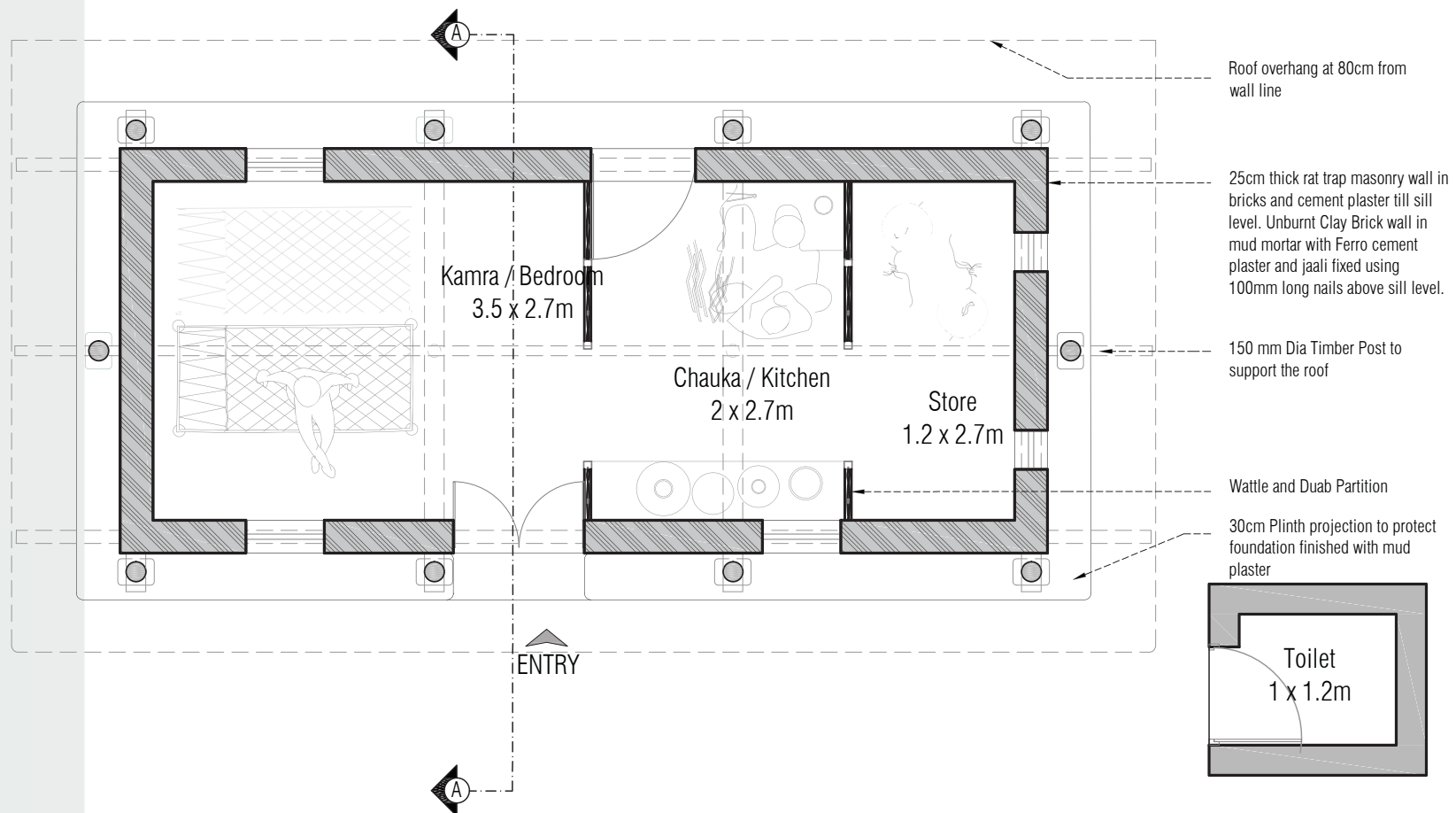
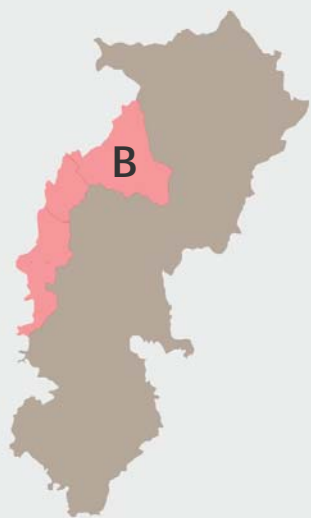
CG-B-02



CHHATTISGARH

ZONE-B CG-B-01

Total Cost ₹ 83,875/-



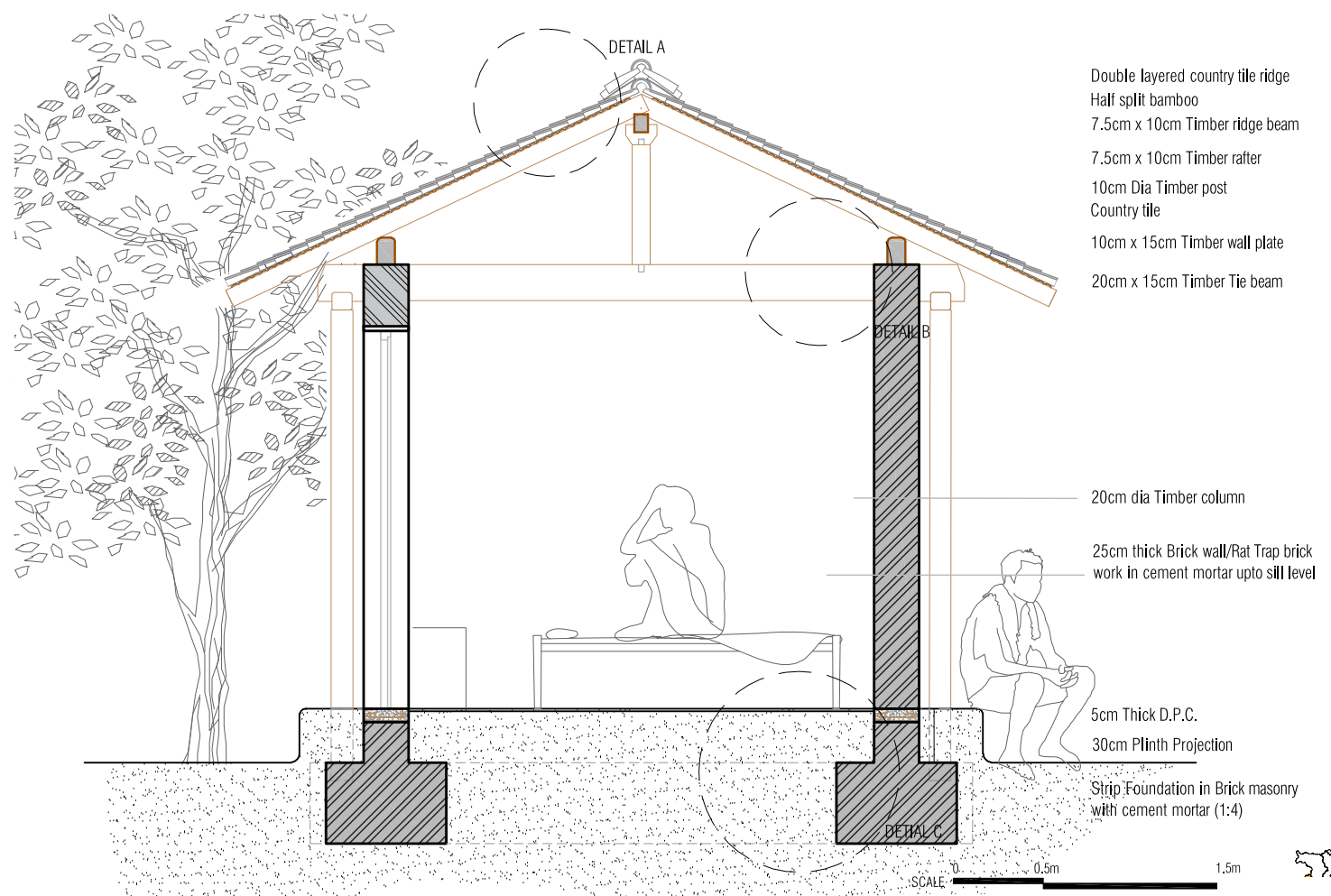
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CHHATTISGARH

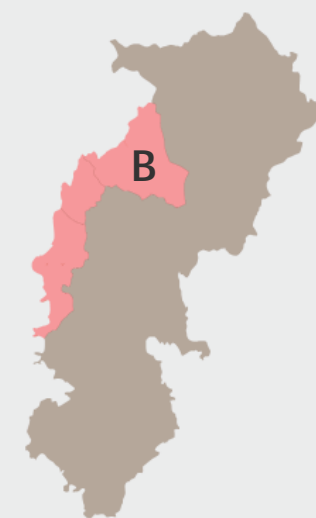
TYPICAL PLAN

ZONE - B

CG-B-01



TYPICAL SECTION

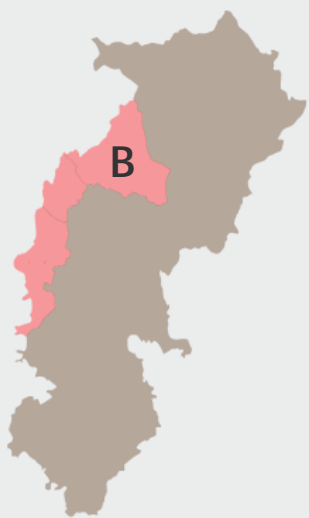


CHHATTISGARH

ZONE-B CG-B-01

Cost breakup

Item	Cost (INR)
Foundation	8,450/-
Walls	23,300/-
Roof (with structure)	52,125/-
Total	83,875/-



CHHATTISGARH

Cost Estimate for ZONE-B Design 01

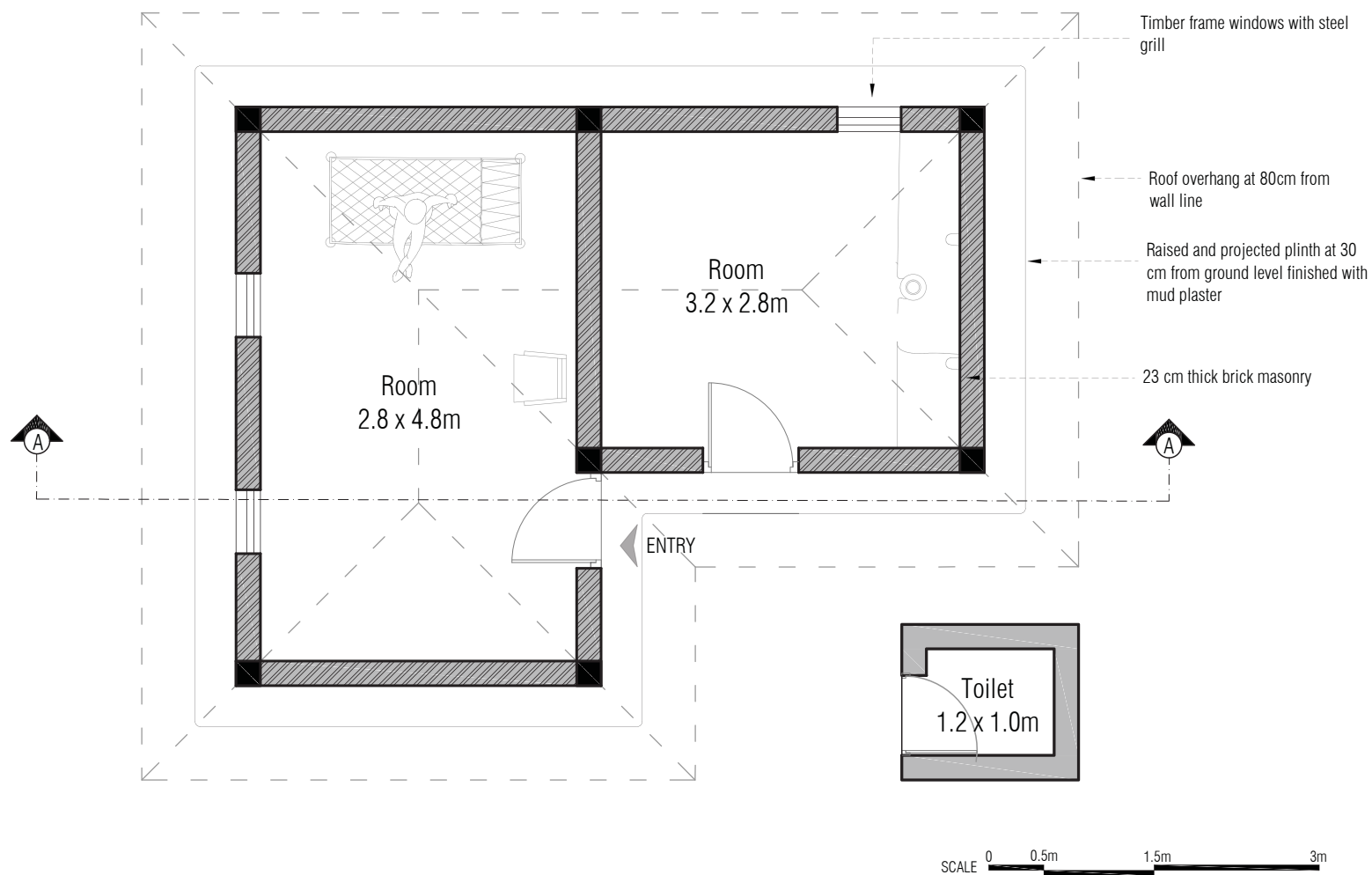
SR. NO.		CS Area	Length	Width	ht	Quantity	Volume	Volume	Area	Material Cost	Rate per unit (Rs)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	cft	sqm				
1	FOUNDATION												
	Sand packed stone	0.25	20				5			₹ 3,450.00	₹ 690.00	cum	₹ 5,000.00
W	TOTAL									₹ 3,450.00			₹ 5,000.00
2	WALLS												
	Bamboo Screen		2	4					8	₹ 2,000.00	₹ 250.00	per sqm	₹ 9,050.00
	Adobe	35		0.25			8.75	308.875		₹ 8,750.00	₹ 1,000.00	cum	
	Doors			0.9	2.1	2				₹ 2,000.00	₹ 1,000.00	per unit	
	Window 1					3				₹ 1,500.00	₹ 500.00	per unit	
	Window 2					2				₹ 500.00	₹ 250.00		
X	TOTAL									₹ 14,250.00			₹ 9,050.00
3	STRUCTURE ROOF												
	Timber columns	0.55		0.1		10	0.55	19.415		₹ 9,707.50	₹ 500.00	per cu ft	₹ 6,000.00
	Timber ties	0.27		0.1		12	0.324	11.4372		₹ 5,718.60	₹ 500.00	per cu ft	
	Purlins									₹ 5,700.00			₹ 9,000.00
	Rafter	0.6		0.07		8	0.336	11.8608		₹ 5,930.40	₹ 500.00	per cu ft	
Y	TOTAL									₹ 27,056.50			₹ 15,000.00
4	ROOF												
	Country tiles (80 tiles per sq m)					2816			35.2	₹ 5,068.80	₹ 1.80	per unit	₹ 5,000.00
Z	TOTAL									₹ 5,068.80			₹ 5,000.00
							Total (W+X+Y+Z)			₹ 49,825.30			₹ 34,050.00
										A			B
	GRAND TOTAL (A+B)	₹ 83,875.30											
	AREA (sqm)	22.4											
	RATE OF CONSTRUCTION (per sqm)	₹ 3,744.43											
	AREA (sqft)	239.68											
	RATE OF CONSTRUCTION (per sqft)	₹ 349.95											

Note: The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from on the urban center or source, geography, time, availability and accessibility to the local resources, etc.

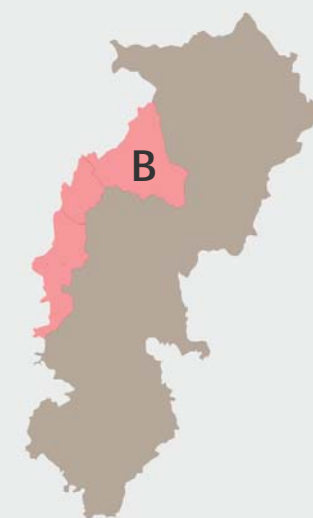
The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.

ZONE - B CG-B-02

Total Cost ₹ 93,866/-

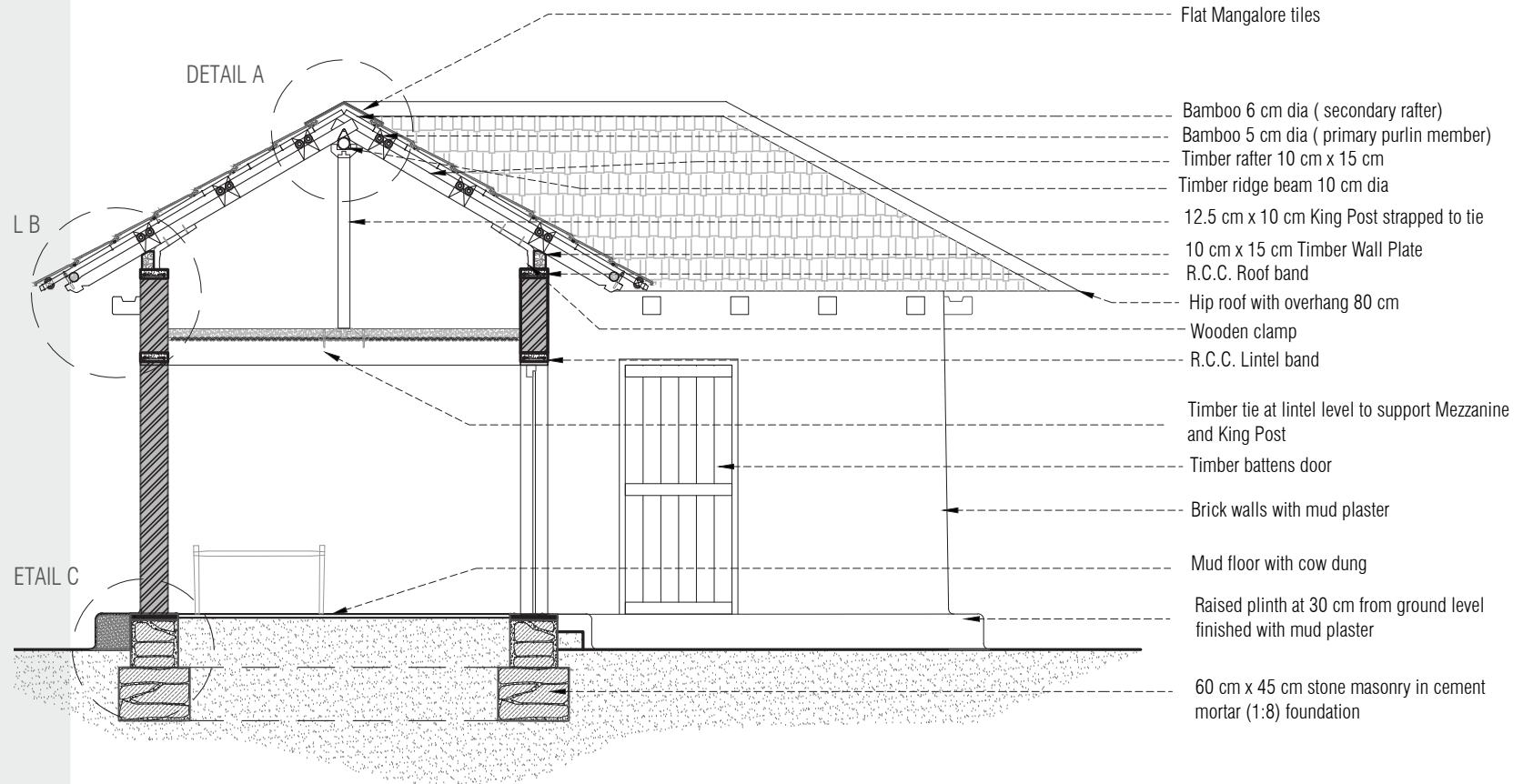
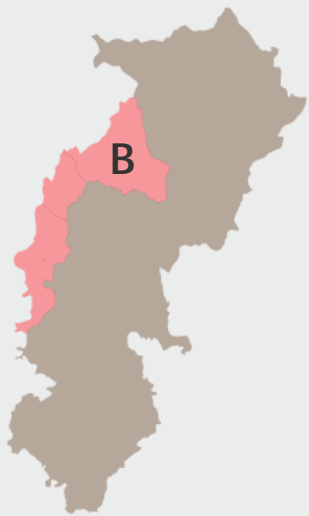


TYPICAL PLAN



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ZONE-B
CG-B-02



SCALE 0 0.5 m 1.5 m 3.0 m

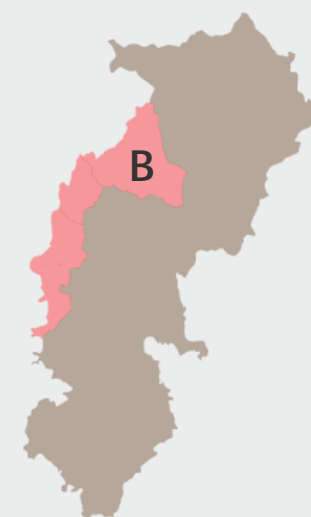
CHHATTISGARH

TYPICAL SECTION

[illegible]

Cost breakup

Item	Cost (INR)
Foundation	6,741/-
Walls	26,058/-
Roof (with structure)	61,038/-
Total	93,867/-



CHHATTISGARH

ZONE-C

Zone C comprise 11 districts :

1. Kanker
2. Bastar
3. Dhamtari
4. Balod
5. Durg
6. Raipur
7. Mahasamund
8. Janjgir Champa
9. Baloda Bazar
10. Bemetara
11. Gariyband

Resources Available

- Burnt Clay/Fly ash

Zone C has two typologies

CG-C-01

CG-C-02



CG-C-01

- Incrementality is in built in the design. Evolves into a courtyard house.
- It is a single storey load bearing structure built in adobe. It has sand packed stone foundation, walling material is adobe with provision for stabilized reinforced mud plaster.
- Thick adobe wall acts as thermal barrier. The roofing material is compressed corrugated bamboo mat sheets with locally available timber with bamboo as under-structure.



CG-C-02

- Incrementality is in built in the design. Evolves into a house locally known as chaukhundi. Most prevalent housing typology across the state.
- It is a single storey load bearing structure built in burnt bricks. It has brick foundation, walling material is brick with mud mortar with provision for stabilized reinforced mud plaster thick cob wall acts as thermal barrier.

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
This plan type includes two rooms with a long parchi in the front having kitchen on one end.	Normal plinth design.	Sloped roof.

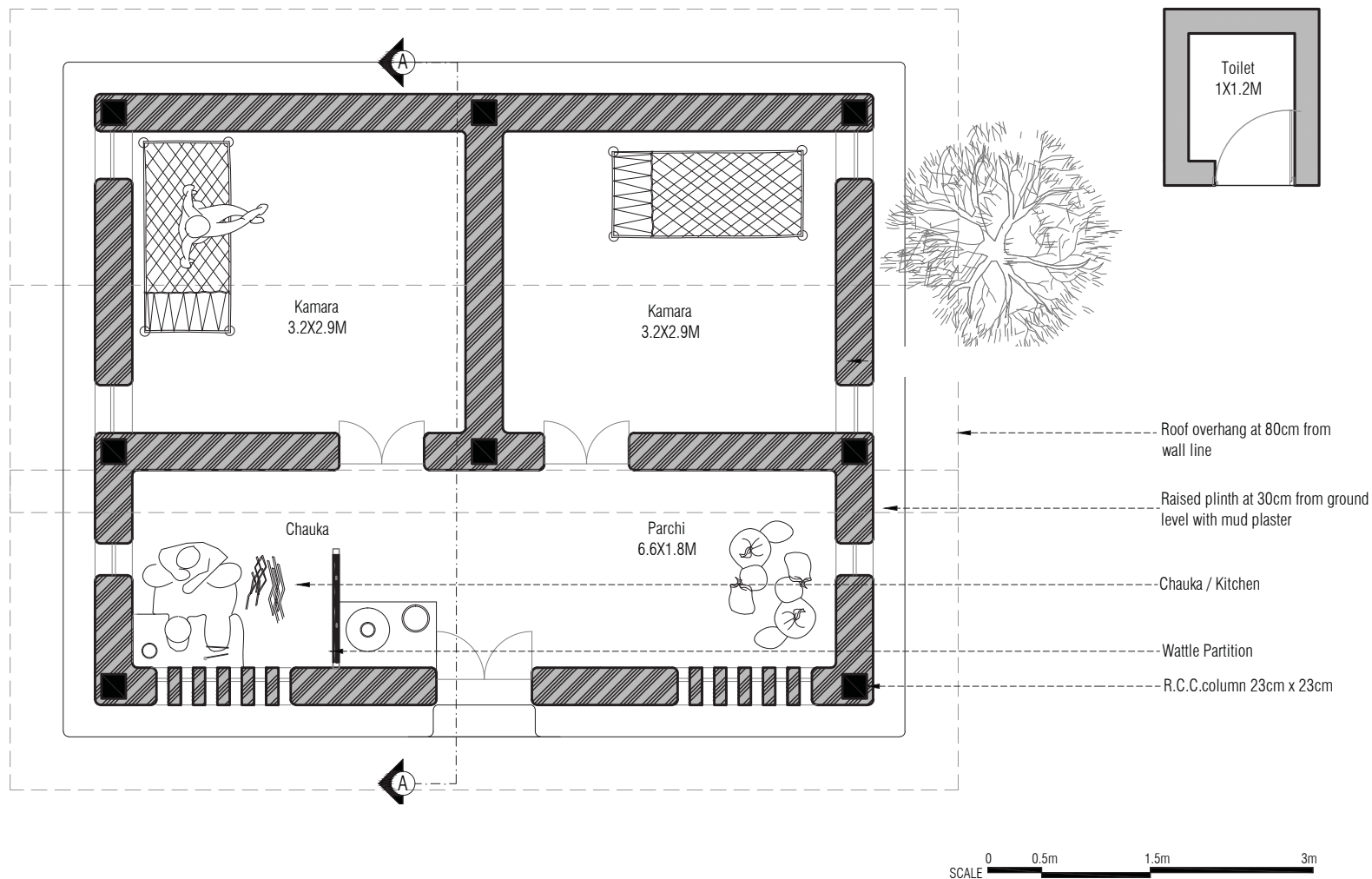
Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Strip footing in brick with cement mortar 	
Plinth	<ul style="list-style-type: none"> Minimum 30 cm and 30 cm projected from the walls to protect the foundation and provide stability to the structure. 	
Wall	<ul style="list-style-type: none"> wall in Brick and Cement 	<ul style="list-style-type: none"> Thick adobe wall acts as thermal barrier
Wall Finish	<ul style="list-style-type: none"> cement Stabilized Mud Plaster 	
Roof Structure	<ul style="list-style-type: none"> Roof slope angle – min 25 & max 33. 	<ul style="list-style-type: none"> Rigid connections between all roof members to increase stability.
Roof Cover	<ul style="list-style-type: none"> Compressed corrugated bamboo mat sheets with locally available timber with bamboo as under-structure. 	<ul style="list-style-type: none"> Woven reed mats can be used below the tiles as false ceiling for thermal insulation.
Floor	<ul style="list-style-type: none"> Mud Floor with cow dung 	

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ZONE-C CG-C-01

Total Cost ₹ 122,424/-

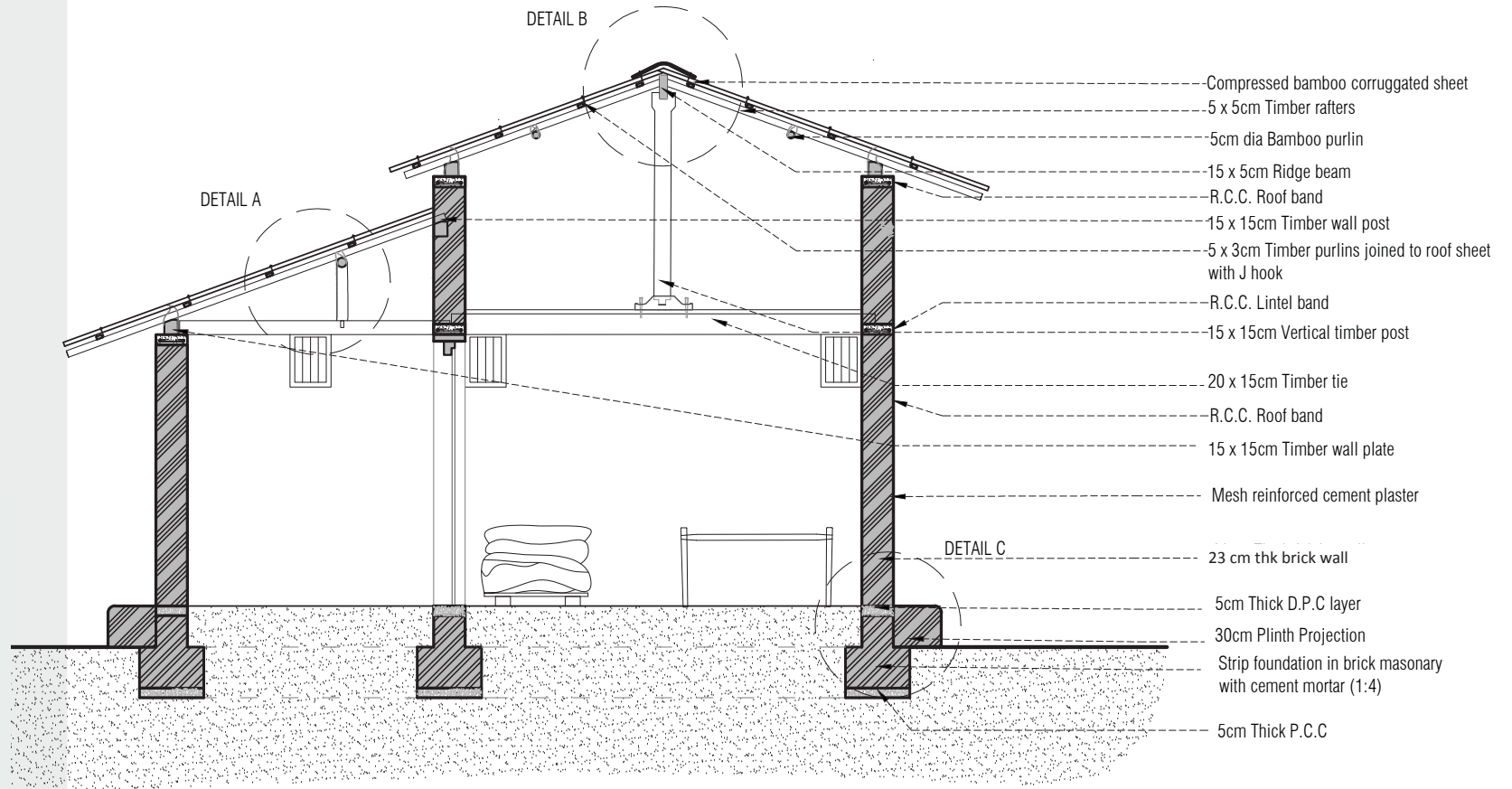


TYPICAL PLAN



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ZONE - C CG-C-01



SCALE 0 0.5m 1.5m 3m

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TYPICAL SECTION

Cost Estimate for Zone-C Design 01

SR. NO.		CS Area	Length	width	ht	Quantity	Volume	Volume	Material Cost	Rate per unit (Rs)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	cft				
1	FOUNDATION											
	Rammed earth	0.3	37				11.1		₹ 8,880.00	₹ 800.00	per cum	₹ 3,150.00
	Mud work	47.4			0.3		14.22	501.966	₹ 2,844.00	₹ 200.00	per cum	
W	TOTAL								₹ 11,724.00			₹ 3,150.00
2	WALLS											
	Adobe	75.2		0.25			18.8	663.64	₹ 18,800.00	₹ 1,000.00	cum	₹ 10,500.00
	Mud Plaster Stabalized with chicken mesh	70							₹ 14,000.00	₹ 200.00	sq m	
	Doors			0.9	2.1	3			₹ 3,000.00	₹ 1,000.00	per unit	₹ 1,500.00
	Windows			0.3	0.4	6			₹ 3,000.00	₹ 500.00	per unit	
X	TOTAL								₹ 38,800.00			₹ 10,500.00
3	STRUCTURE ROOF											
	Timber rafter	0.5	85				42.5		₹ 21,250.00	₹ 500.00	per m	₹ 5,000.00
	Purlins, fixtures, etc.								₹ 6,000.00			
Y	TOTAL								₹ 27,250.00			₹ 5,000.00
4	ROOF											
	Bamboo Corrugated Sheets					21			₹ 21,000.00	₹ 1,000.00	per unit	₹ 5,000.00
Z	TOTAL								₹ 21,000.00			₹ 5,000.00
									₹ 98,774.00			₹ 23,650.00
									A			B
	GRAND TOTAL (A+B)	₹ 122,424.00										
	AREA (sqm)	42										
	RATE OF CONSTRUCTION (per sqm)	₹ 2,914.86										
	AREA (sqft)	449.4										
	RATE OF CONSTRUCTION (per sqft)	₹ 272.42										

Note: The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from the urban center or source, geography, time, availability and accessibility to the local resources, etc.

The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.

ZONE - C CG-C-01

Cost breakup

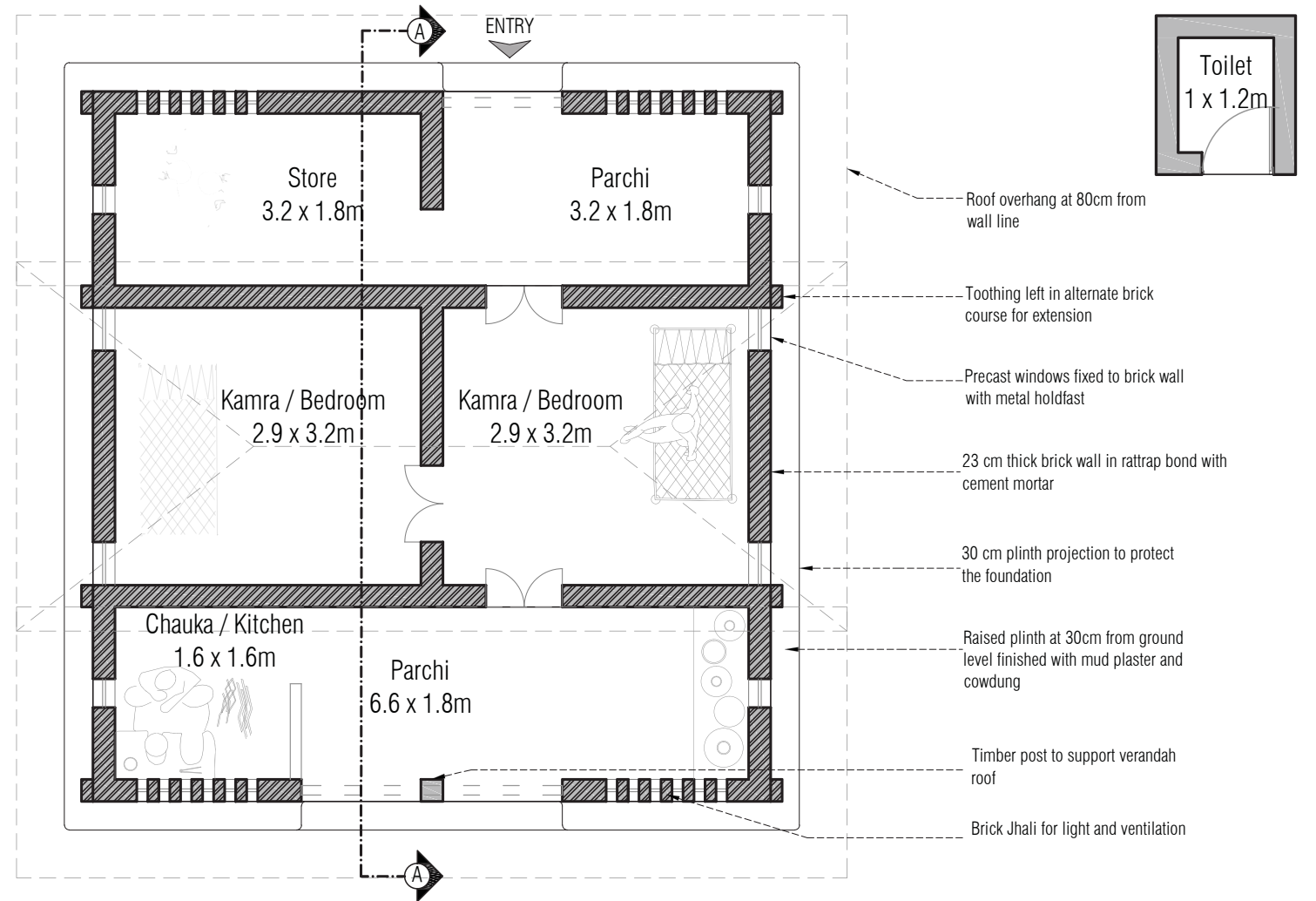
Item	Cost (INR)
Foundation	14,874/-
Walls	49,300/-
Roof (with structure)	58,250/-
Total	122,424/-



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ZONE-C CG-C-02

Total Cost ₹ 200,625/-



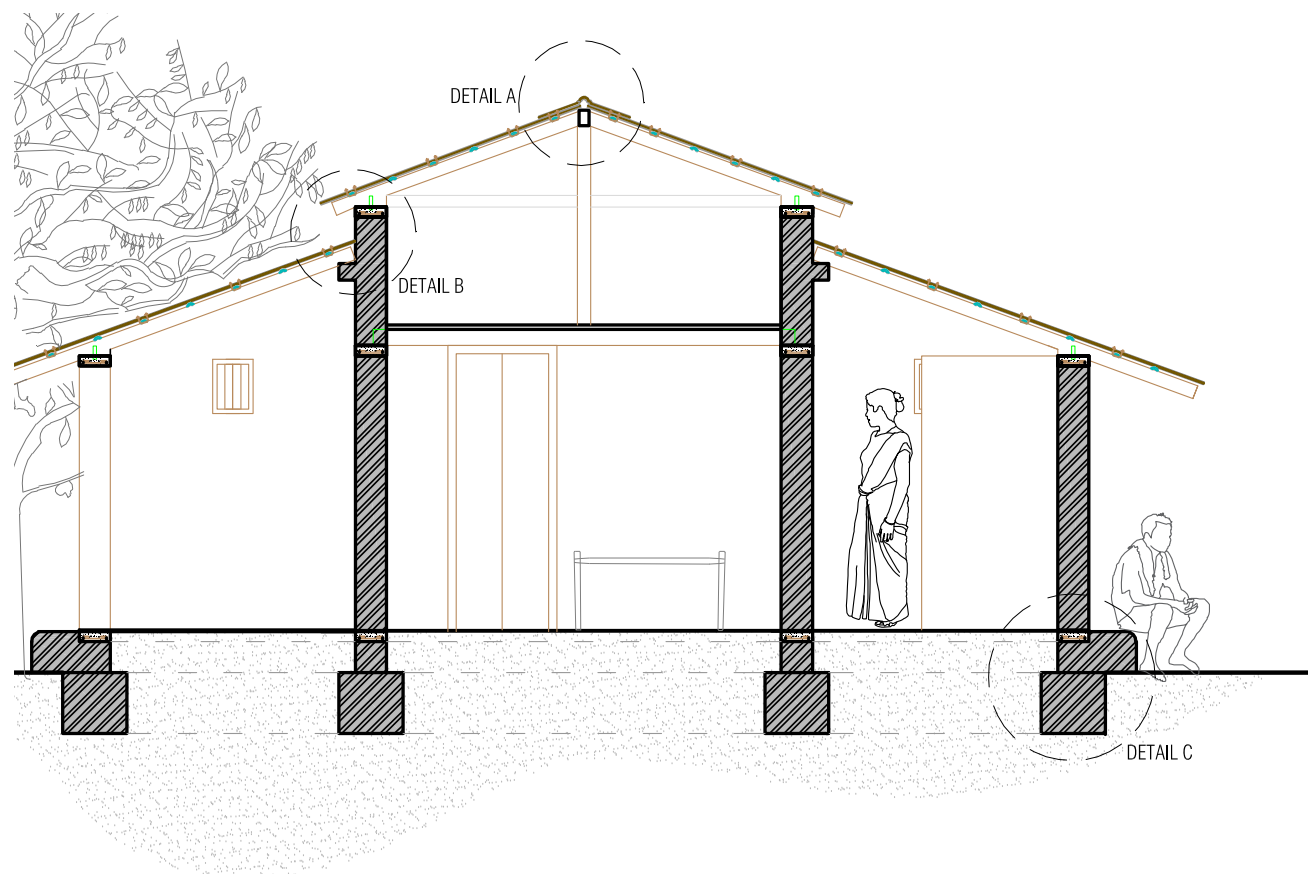
SCALE 0 0.5m 1.5m 3m

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TYPICAL PLAN

ZONE-C

CG-C-02



Compressed bamboo mat Ridge plate
Precast RCC ridge beam 75mm x 100mm

Precast RCC rafters fixed to wall plate with
metal plate 70mm x 100mm

Metal Plate to join rafter and wall plate
RCC wall plate 75 mm thick

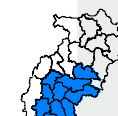
U-hooks connecting timber purlins to
Corrugated bamboo sheet roof
Split bamboo purlins clamped to precast RCC
rafters

RCC tie at lintel level
23 cm thick Brick wall/ Rat trap Brick work in
Cement mortar

75 mm thick RCC plinth beam
Plinth projection to protect foundation

45 cm deep and 45cm wide Brick with cement
mortar foundation.

SCALE 0 0.5m 1.5m 3m



TYPICAL SECTION

CHHATTISGARH

ZONE-C
CG-C-02

Cost breakup

Item	Cost (INR)
Foundation	43,861/-
Walls	104,964/-
Roof (with structure)	51,800/-
Total	200,625/-



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Cost Estimate for ZONE-C Design 02

[illegible]



CG-D-01

- It is a single storey load bearing structure built in stone rubble. Provision for storage loft above the rooms is there. It has stone rubble masonry, walling material is stone rubble with mud mortar with provision for stabilized reinforced mud plaster.
- The roofing material is corrugated bamboo mat sheets with locally available timber and bamboo rafters and beams as under-structure.



CG-D-02

- Incrementality is in built in the design. Evolves into a cluster of structures for the extended family.
- It is a single storey load bearing structure built in rubble masonry. It has stone rubble masonry, walling material is stone rubble with mud mortar with provision for stabilized reinforced mud plaster.
- The roofing material is locally available stone slabs with timber or bamboo rafters and beams as under-structure.

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
Evolves into a house locally known as chaukhandi. This plan type includes two rooms with a long parchi in the rear. Later having kitchen on one end as chaukhandi.	Normal plinth design.	Sloped roof.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundation	• strip foundation with brick and cement mortar	• In case of black cotton soil should go to 60 cm, else minimum 45 cm.
Plinth	• Minimum 30 cm and 30 cm projected from the walls to protect the foundation and provide stability to the structure.	
Wall	• stone concrete block masonry in cement mortar	• Thick adobe wall acts as thermal barrier
Wall Finish	• Stabilized Mud Plaster	
Roof Structure	• Roof slope angle – min 25 & max 33.	• Rigid connections between all roof members to increase stability.
Roof Cover	• Compressed corrugated bamboo mat sheets with locally available timber with bamboo as under-structure.	• Woven reed mats can be used below the tiles as false ceiling for thermal insulation.
Floor	• Mud Floor with cow dung	

ZONE-D

Zone D comprise 5 districts :

1. Sukhma
2. Bijapur
3. Dantewada
4. KondagTaon
5. Narayanpur

Resources Available

- Bamboo, stone, mud

Zone D has two typologies

CG-D-01

CG-D-02



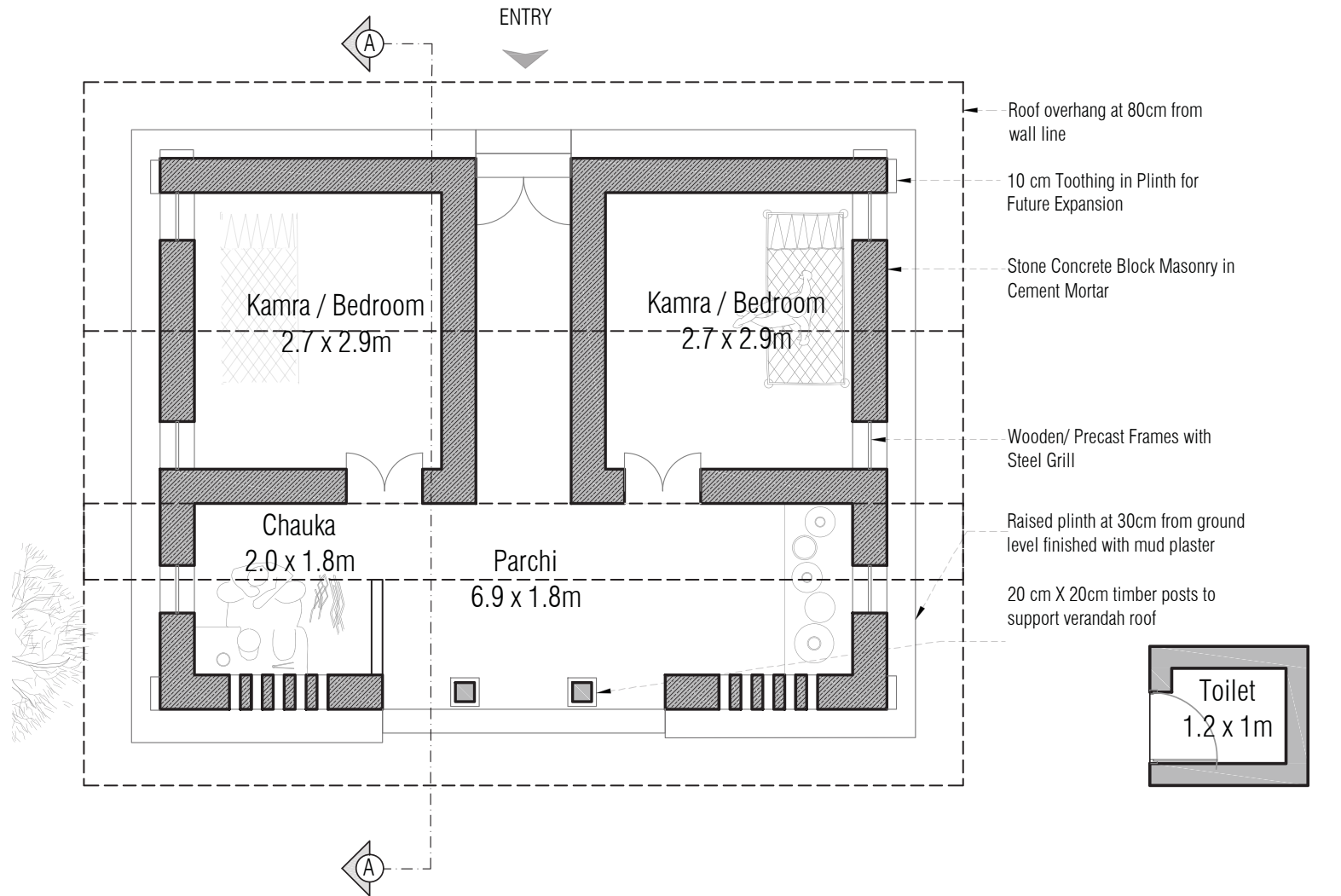
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ZONE-D CG-D-01

Total Cost ₹ 166,460/-



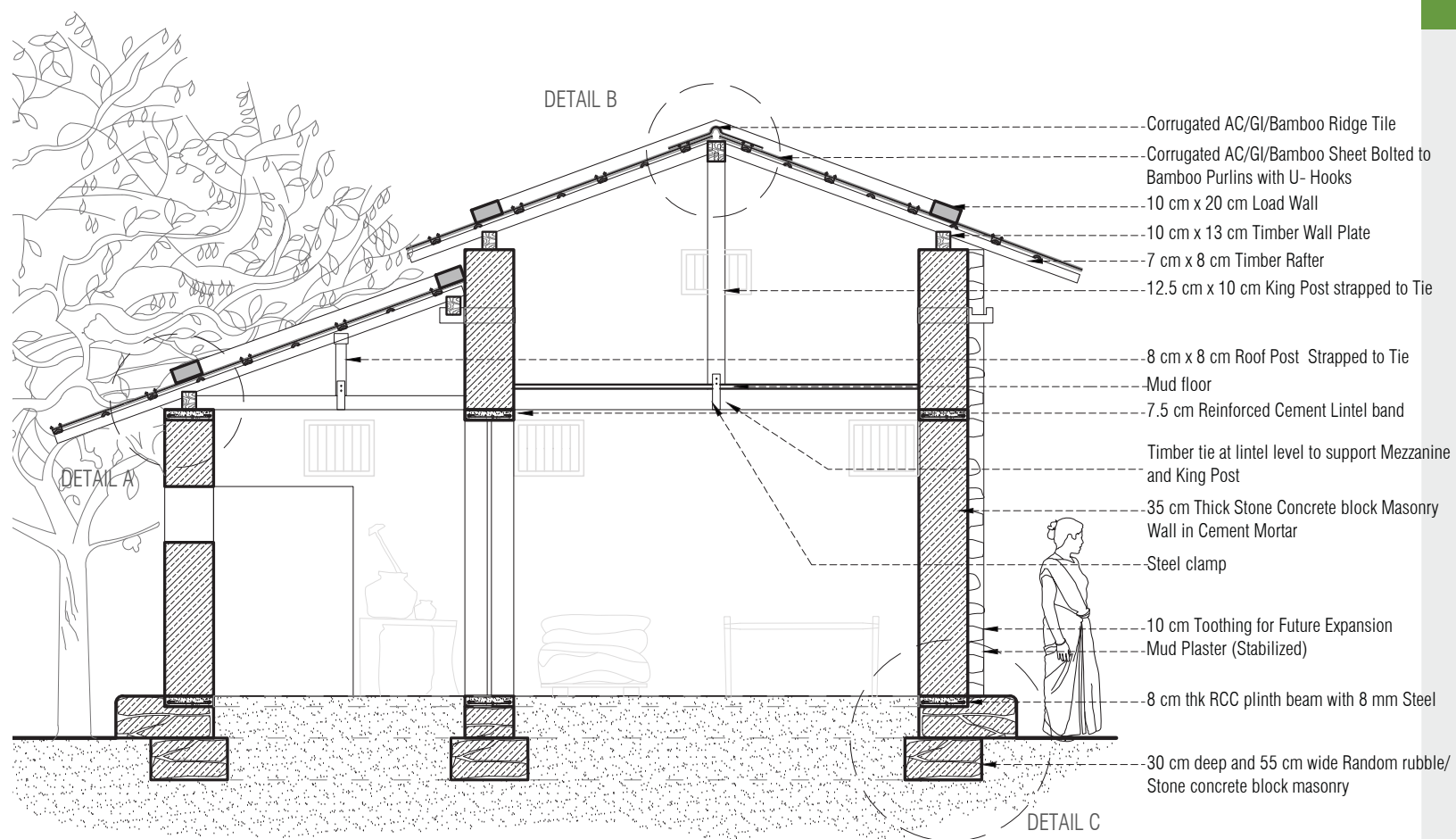
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SCALE 0 0.5 m 1.5 m 3.0 m

TYPICAL PLAN

ZONE-D CG-D-01



SCALE 0 0.5m 1.5m 3m

TYPICAL SECTION



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ZONE-D CG-D-01

Cost breakup

Item	Cost (INR)
Foundation	29,900/-
Walls	59,560/-
Roof (with structure)	77,000/-
Total	166,460/-



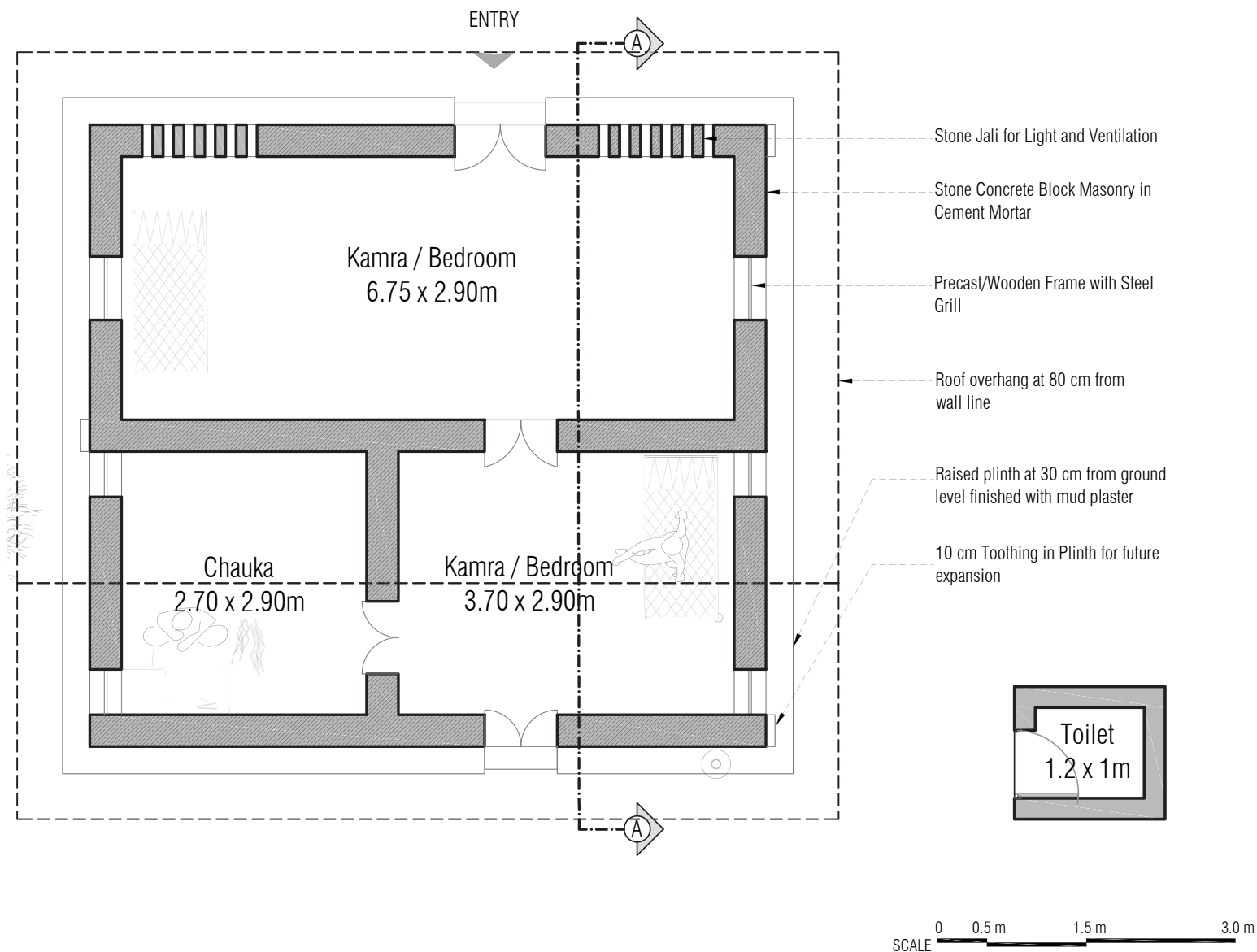
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Cost Estimate for ZONE-D Design 01

SR. NO.		CS Area	Length	width	ht	Quantity	Volume	Volume	Material Cost	Rate per unit (Rs)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	cft				
1	FOUNDATION											
	RCC Plinth Beam	0.03	40				1.2		₹ 8,400.00	₹ 7,000.00	cum	₹ 5,000.00
	Stone	0.25	40				10		₹ 15,000.00	₹ 1,500.00	cum	
	Mud work						10		₹ 1,500.00	₹ 150.00	cum	
W	TOTAL								₹ 24,900.00			₹ 5,000.00
2	WALLS											
	Stone Masonry	10			2.7		27	953.1	₹ 40,500.00	₹ 1,500.00	cum	₹ 4,500.00
	Mud Plaster Stabilized with chicken mes	23							₹ 5,060.00	₹ 220.00	sq m	₹ 1,500.00
	Doors			0.9	2.1	3			₹ 3,000.00	₹ 1,000.00	per unit	₹ 1,000.00
	Windows					8			₹ 4,000.00	₹ 500.00	per unit	
X	TOTAL								₹ 52,560.00			₹ 7,000.00
3	STRUCTURE ROOF											
	Timber Under Structure	0.6	120				72		₹ 36,000.00	₹ 500.00	per cu m	₹ 4,000.00
	Purlins, fixtures, etc.								₹ 10,000.00			
Y	TOTAL								₹ 46,000.00			₹ 4,000.00
4	ROOF											
	Bamboo Corrugated Sheets					24			₹ 24,000.00	₹ 1,000.00	per unit	₹ 3,000.00
Z	TOTAL								₹ 24,000.00			₹ 3,000.00
									Total (W+X+Y+Z)	₹ 147,460.00		₹ 19,000.00
									A			B
	GRAND TOTAL (A+B)	₹ 166,460.00										
	AREA (sqm)	44										
	RATE OF CONSTRUCTION (per sqm)	₹ 3,783.18										
	AREA (sqft)	470.8										
	RATE OF CONSTRUCTION (per sqft)	₹ 353.57										

Note: The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from the urban center or source, geography, time, availability and accessibility to the local resources, etc.

The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.



TYPICAL PLAN

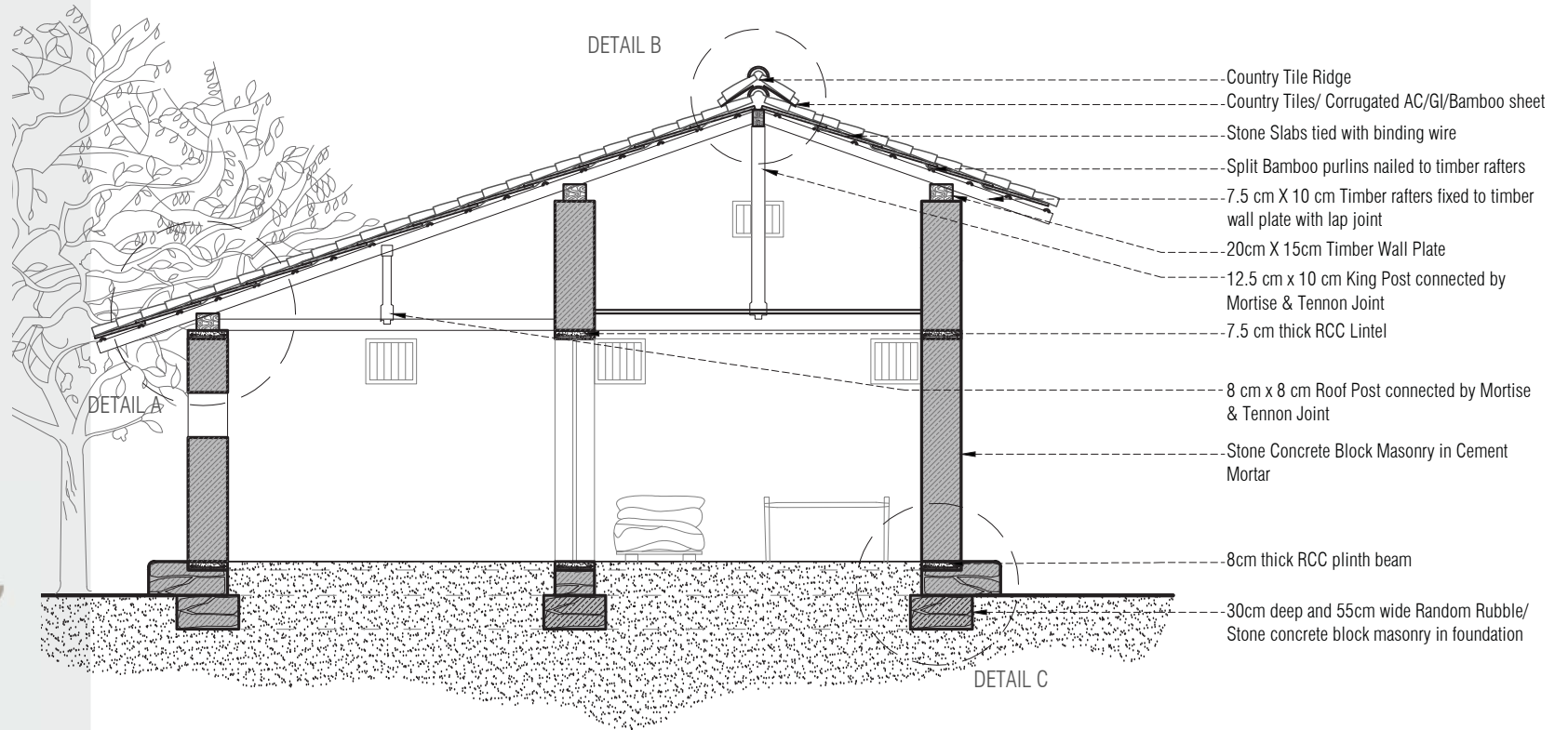
ZONE-D CG-D-02

Total Cost ₹ 174,305/-



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ZONE-D
CG-D-02



SCALE 0 0.5 m 1.5 m 3.0 m

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TYPICAL SECTION

Cost Estimate for ZONE-D Design 02

SR. NO.		CS Area	Length	width	ht	Quantity	Volume	Volume	Material Cost	Rate per unit (Rs)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	cft				
1	FOUNDATION											
	RCC Plinth Beam	0.03	40				1.2		₹ 8,400.00	₹ 7,000.00	cum	₹ 5,000.00
	Stone	0.25	40				10		₹ 15,000.00	₹ 1,500.00	cum	
	Mud work						10		₹ 1,500.00	₹ 150.00	cum	
W	TOTAL								₹ 24,900.00			₹ 5,000.00
2	WALLS											
	Stone Masonry	10.5			2.7		28.35	1000.755	₹ 42,525.00	₹ 1,500.00	cum	₹ 4,500.00
	Mud Plaster Stabilized with chicken mes	24							₹ 5,280.00	₹ 220.00	sq m	₹ 1,500.00
	Doors			0.9	2.1	4			₹ 4,000.00	₹ 1,000.00	per unit	₹ 1,000.00
	Windows					6			₹ 3,000.00	₹ 500.00	per unit	
X	TOTAL								₹ 54,805.00			₹ 7,000.00
3	STRUCTURE ROOF											
	Timber Under Structure	0.6	122				73.2		₹ 36,600.00	₹ 500.00	per cu m	₹ 4,000.00
	Purlins, fixtures, etc.								₹ 11,000.00			
Y	TOTAL								₹ 47,600.00			₹ 4,000.00
4	ROOF											
	Bamboo Corrugated Sheets					28			₹ 28,000.00	₹ 1,000.00	per unit	₹ 3,000.00
Z	TOTAL								₹ 28,000.00			₹ 3,000.00
									Total (W+X+Y+Z)	₹ 155,305.00		₹ 19,000.00
									A			B
	GRAND TOTAL (A+B)	₹ 174,305.00		Note:	The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from on the urban center or source, geography, time, availability and accessibility to the local resources, etc. the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.							
	AREA (sqm)	51										
	RATE OF CONSTRUCTION (per sqm)	₹ 3,417.75										
	AREA (sqft)	545.7										
	RATE OF CONSTRUCTION (per sqft)	₹ 319.42										

ZONE-D CG-D-02

Cost breakup

Item	Cost (INR)
Foundation	29,900/-
Walls	61,805/-
Roof (with structure)	82,600/-
Total	174,305/-



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ALL ZONES

Common Design proposal for all the zones identified for the state.

Design for All Zones

Bamboo , mud

All Zones have three typologies

CG-ALL-01

CG-ALL-02

CG-ALL-03



CG-ALL-01



CG-ALL-02



CG-ALL-03

DESIGN HIGHLIGHTS

- Incrementality is inbuilt in the design. Evolves into a house locally known as chaukhandi. Most prevalent housing typology across the state.
- This plan type includes two rooms with a long parchi both in the front, a kitchen in the side accessible from the parchi and a store or cattle room.
- It is a single storey load bearing structure. It has rammed earth foundation, walling material is rammed earth with provision for stabilized reinforced mud plaster.
- The roofing material is compressed corrugated bamboo mat sheets with RCC pre casted rafters and beams as under-structure.

SPECIFICATIONS

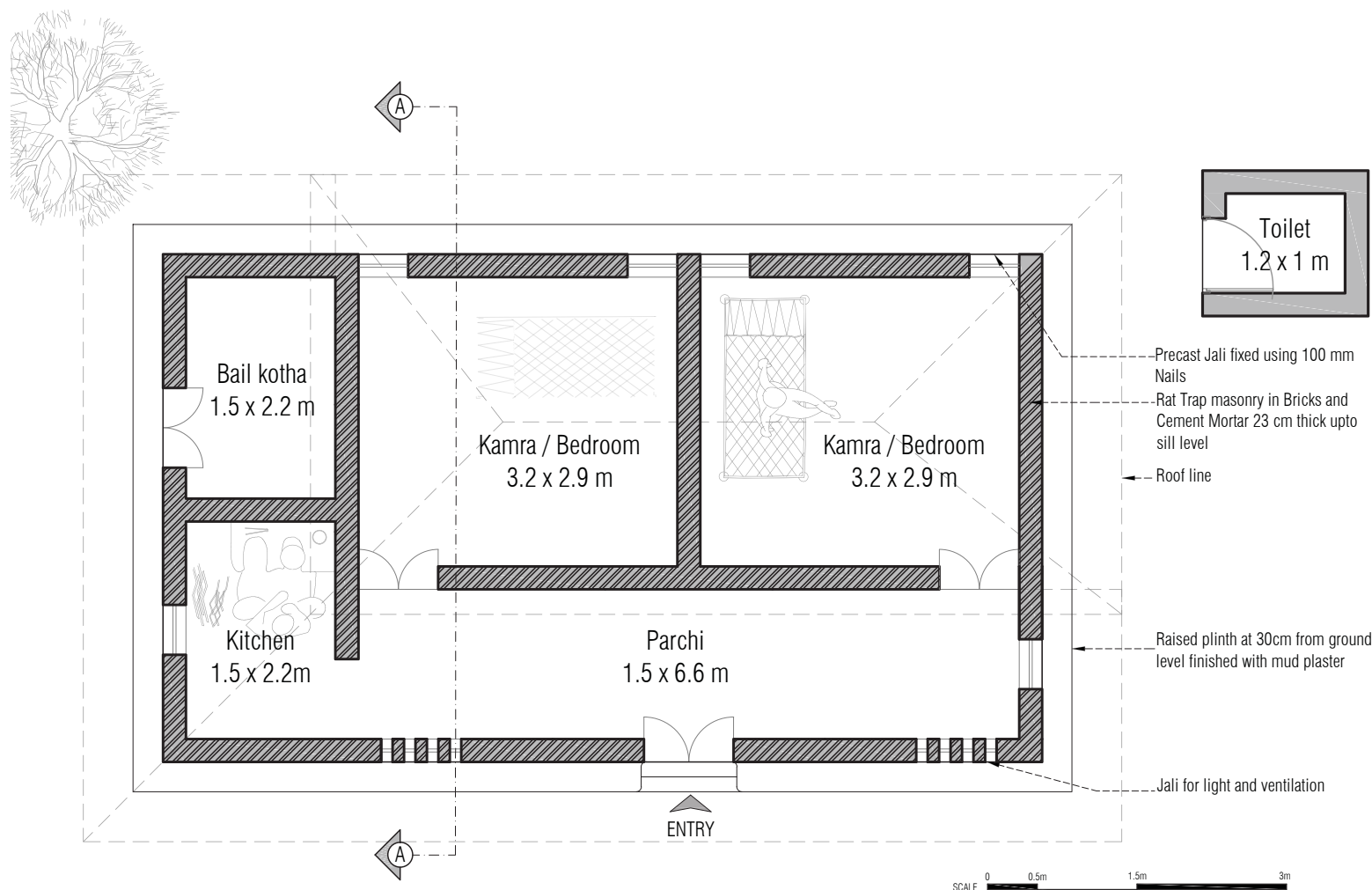
- Roof slope angle- Tile/ Thatch: minimum 25° - recommended 33 °
- Min 50 cm roof overhang on all sides- recommended 80 cm.
- In case of black cotton soil depth of foundation should go to 60 cm, else minimum 45 cm. Plinth height should be minimum 30 cm and 30 cm projected from the walls to protect the foundation and provide stability to the structure.
- In the event of use of stabilized mud plaster, the surfaces should be adequately cured.
- Rigid connections between all roof structure members to increase stability.
- Wall plates should take loads of rafters and beams to further distribute the load on the brick walls.
- Reinforcements in the RCC beams should be tied properly with metal binding wire, while casting proper vibration should be done. RCC beams should be cured properly. Suitable curing should be done.
- Rammed earth can be stabilized by adding 5% of cement to the suitable soil.
- Precast cement jali windows can be used.
- Bamboo sheets to be fixed with the understructure by J or U hook bolts.



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ALL ZONES CG-ALL-01

Total Cost ₹ 164,805/-

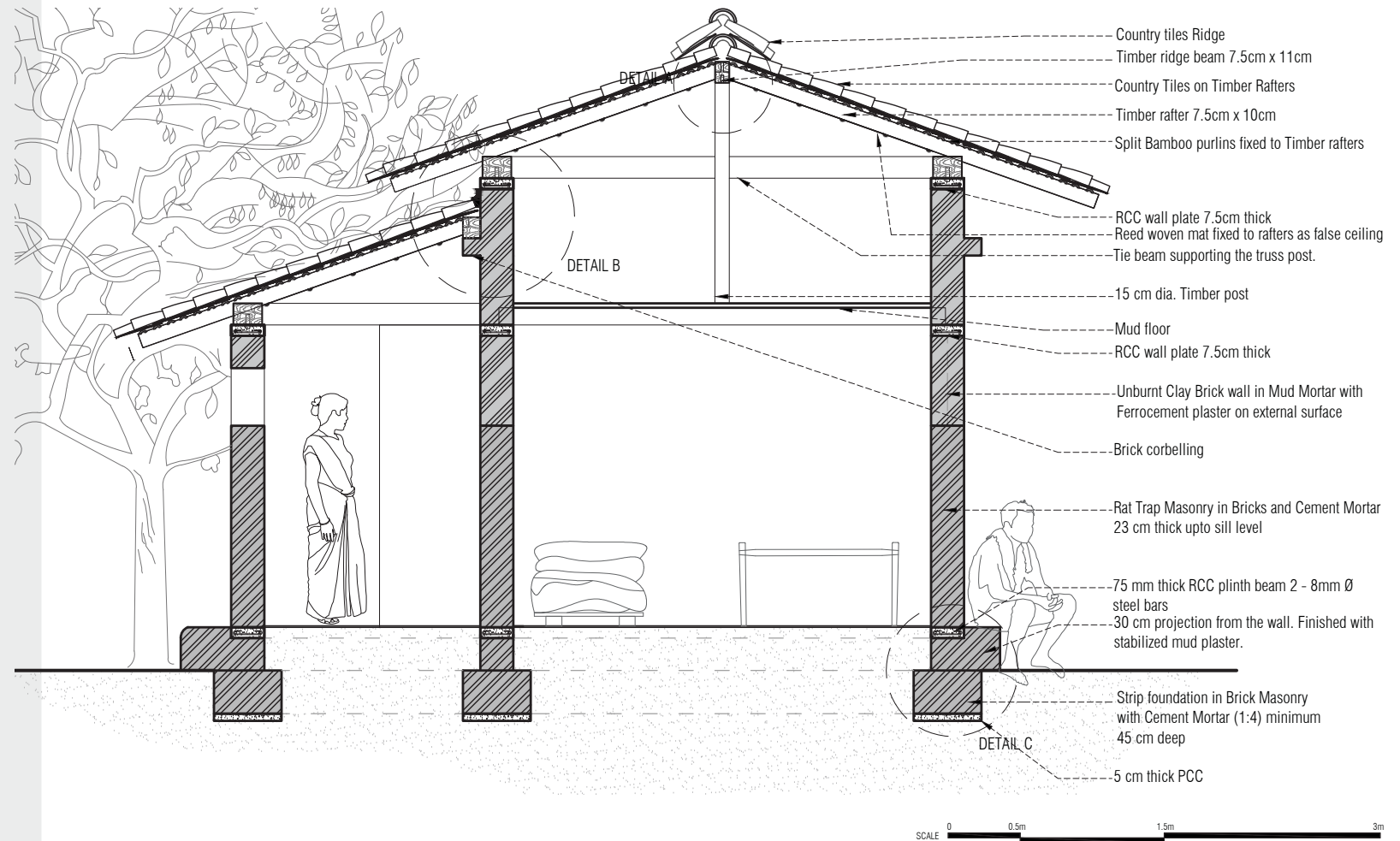


TYPICAL PLAN



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ALL ZONES CG-ALL-01



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TYPICAL SECTION

Cost Estimate for All Zones Design 01

SR. NO.		CS Area	Length	width	ht	Quantity	Volume	Material Cost	Rate per unit (Rs)	Unit	Labour cost	
		sqm	m	m	m	Nos.	cum					
1	FOUNDATION											
	RCC Plinth Beam	0.012	44.4				0.5328	₹ 4,262.40	₹ 7,000.00	per cum		
	Rammed Earth	0.3	44.4				13.32	₹ 10,656.00	₹ 800.00	per cum	₹ 3,150.00	
	Mud work	0.62			0.3		0.186	₹ 37.20	₹ 200.00	per cum		
W	TOTAL							₹ 14,955.60			₹ 3,150.00	₹ 18,105.60
2	WALLS											
	Rammed Earth and plaster						66.5	₹ 79,800.00	₹ 1,200.00	per cu m	₹ 10,000.00	
	Doors					3		₹ 3,000.00	₹ 1,000.00	per unit	₹ 1,500.00	
	Windows					6		₹ 3,000.00	₹ 500.00	per unit		
X	TOTAL							₹ 85,800.00			₹ 11,500.00	₹ 97,300.00
3	STRUCTURE ROOF											
	Pre-Cast	0.02	70				1.4	₹ 8,400.00	₹ 6,000.00	per cu m		
	Purlins, fixtures, etc.							₹ 5,000.00			₹ 5,000.00	
Y	TOTAL							₹ 13,400.00			₹ 5,000.00	₹ 18,400.00
4	ROOF											
	Bamboo Corrugated Sheets					26		₹ 26,000.00	₹ 1,000.00	per unit	₹ 5,000.00	
Z	TOTAL							₹ 26,000.00			₹ 5,000.00	₹ 31,000.00
						TOTAL (W+X+Y+Z)		₹ 140,155.60			₹ 24,650.00	₹ 164,805.60
								A			B	
	GRAND TOTAL (A+B)	₹ 164,805.60		Note:	The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from on the urban center or source, geography, time, availability and accessibility to the local resources, etc. The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.							
	AREA (sqm)	45										
	RATE OF CONSTRUCTION (per sqm)	₹ 3,662.35										
	AREA (sqft)	481.5										
	RATE OF CONSTRUCTION (per sqft)	₹ 342.28										

ALL ZONES CG-ALL-01

Cost breakup

Item	Cost (INR)
Foundation	18,105/-
Walls	97,300/-
Roof (with structure)	49,400/-
Total	164,805/-



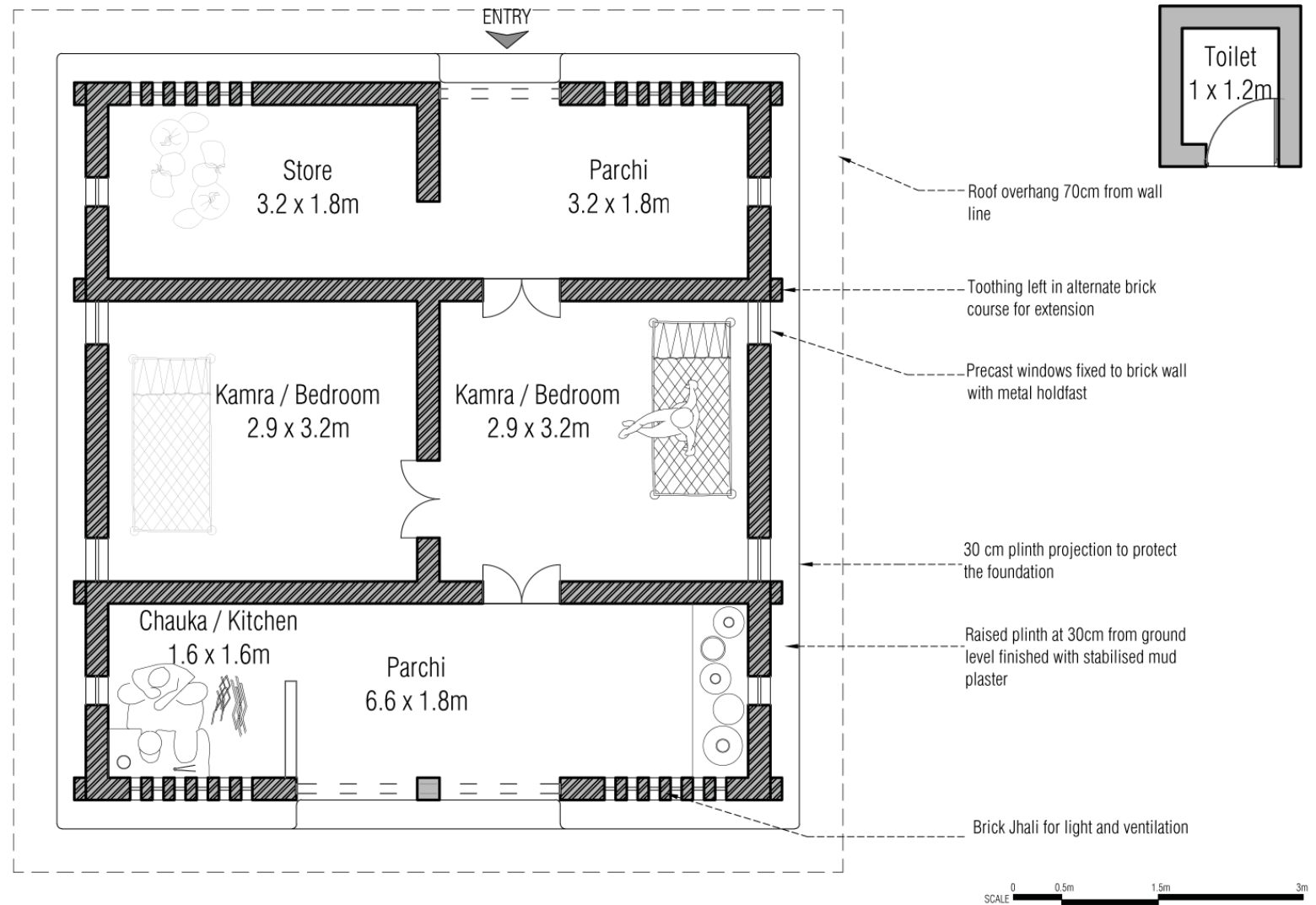
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ALL ZONES CG-ALL-02

Total Cost ₹ 237,186.44

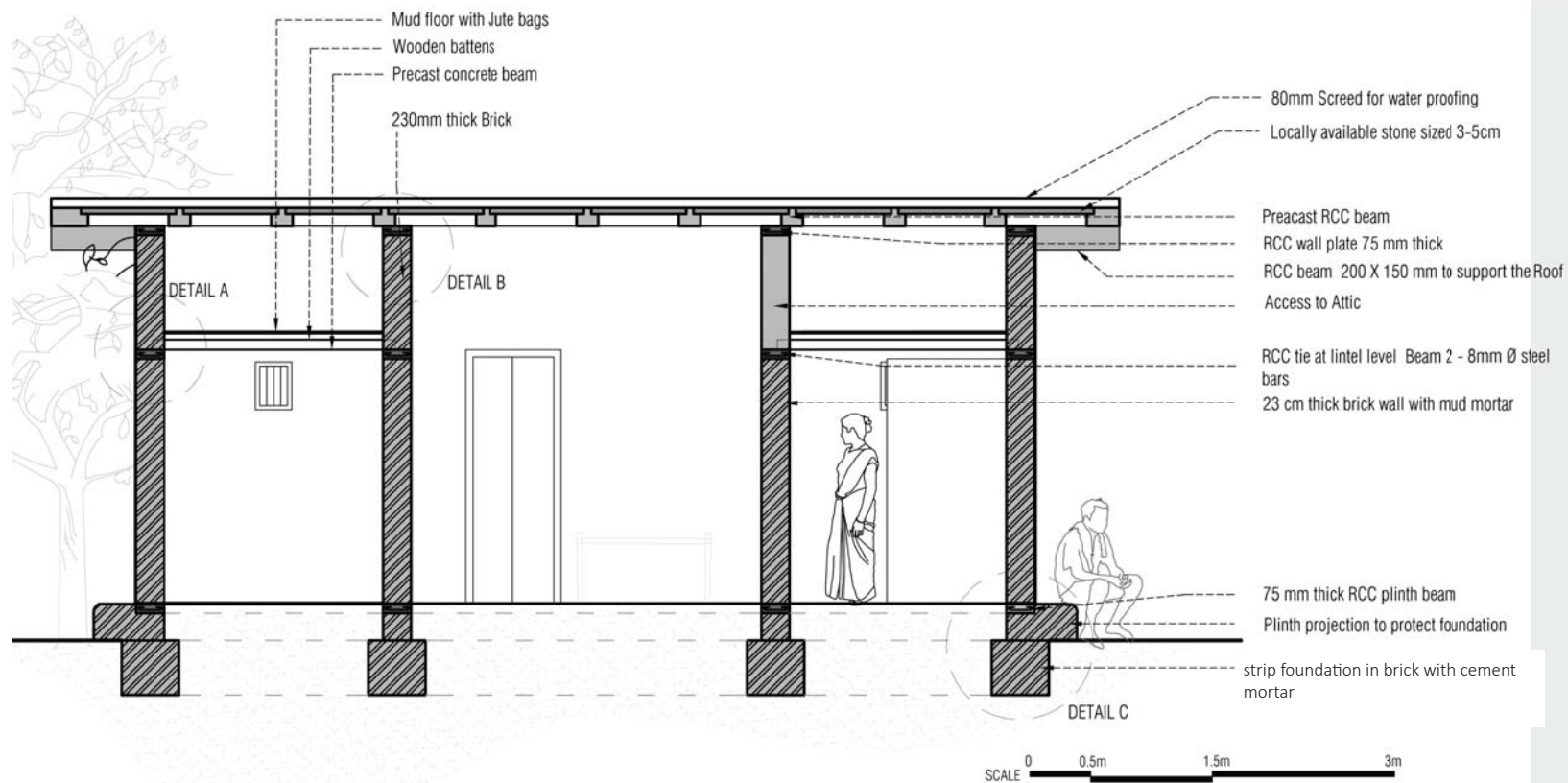


CHHATTISGARH



TYPICAL PLAN

ALL ZONES CG-ALL-02



TYPICAL SECTION



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ALL ZONES CG-ALL-02

Cumulative cost breakup

Item	Cost (INR)
Foundation	40,038/-
Walls	95,890/-
Roof (with structure)	101,258/-
Total	237,186/-



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Cost Estimate for All Zones Design 02

SR. NO.		CS Area	Length	width	ht	Quantity	Volume	Volume	Material Cost	Rate per unit (Rs)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	cft				
1	FOUNDATION											
	RCC Plinth Beam	0.017	46.86				0.80	28.12069	₹ 4,779.72	₹ 6,000.00	cum	
	Earth Work Digging	0.211	46.86				9.88746	349.0273				₹ 10,000.00
	Brick	0.26	46.86			12183.6	12.1836	430.0811	₹ 24,367.20	₹ 2.00	per brick	
	Earth Work Filling	29.7			0.3		8.91	314.523	₹ 891.00	₹ 100.00	per cum	
W	TOTAL								₹ 30,037.92			₹ 10,000.00
2	WALLS											
	Brick					28680	28.68	1012.404	₹ 57,360.00	₹ 2.00	per brick	
	Mud Plaster Stabilized with chicken mesh	85							₹ 12,750.00	₹ 150.00	sq m	
	Lintel Beam	0.017	46.86				0.80		₹ 4,779.72	₹ 6,000.00	per cum	₹ 10,000.00
	Doors					6			₹ 6,000.00	₹ 1,000.00	per unit	
	Windows					8			₹ 4,000.00	₹ 500.00	per unit	₹ 1,000.00
X	TOTAL								₹ 84,889.72			₹ 11,000.00
3	STRUCTURE ROOF											
	Pre-Cast RCC beam Under Structure Loft	0.16		0.06		22	0.2112		₹ 1,372.80	₹ 6,500.00	per cu m	₹ 5,000.00
	Loaft Mud Plaster	23.86							₹ 2,386.00	₹ 100.00	per sqm	₹ 500.00
Y	TOTAL								₹ 3,758.80			₹ 5,500.00
4	ROOF											
	RCC beam T section	0.02	8.6			12	2.064		₹ 78,000.00	₹ 6,500.00	per unit	
	RCC beam	0.03	8.9			2	0.534		₹ 3,204.00	₹ 6,000.00	per cum	₹ 12,000.00
	Stone Slabs	0.7				88			₹ 2,156.00	₹ 35.00	per sqm	
	Lime/Cement Screed	76							₹ 26,600.00	₹ 350.00	sqm	₹ 2,000.00
Z	TOTAL								₹ 78,000.00			₹ 14,000.00
							Total (W+X+Y+Z)		₹ 196,686.44			₹ 40,500.00
									A			B
	GRAND TOTAL (A+B)	₹ 237,186.44										
	AREA (sqm)	50										
	RATE OF CONSTRUCTION (per sqm)	₹ 4,743.73										
	AREA (sqft)	535										
	RATE OF CONSTRUCTION (per sqft)	₹ 443.34										

Note:

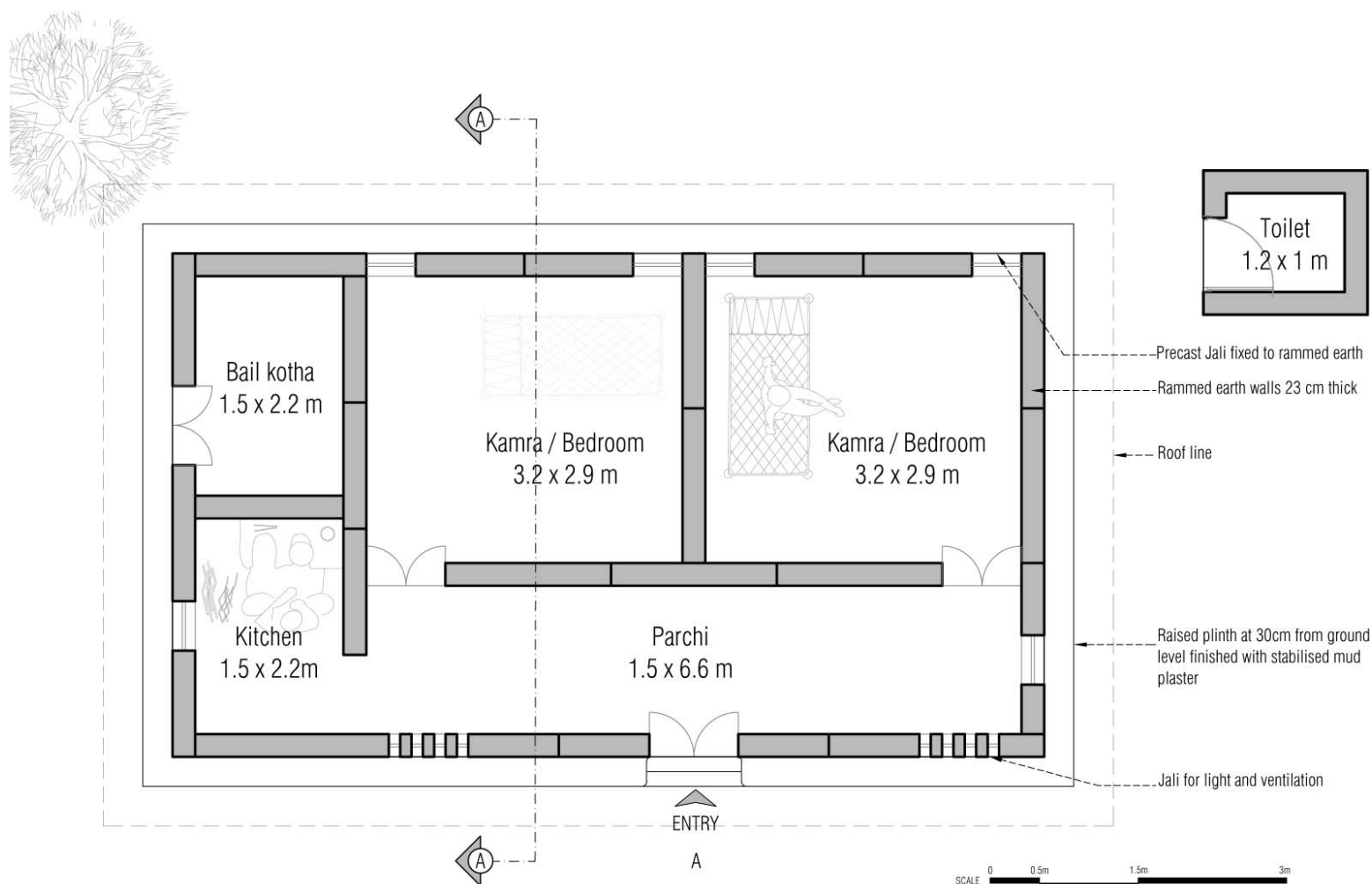
The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from the urban center or source, geography, time, availability and accessibility to the local resources, etc.

The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.

Cost of Toilet is exclusive of the given estimate.

ALL ZONES CG-ALL-03

Total Cost ₹ 237,186.44



TYPICAL PLAN

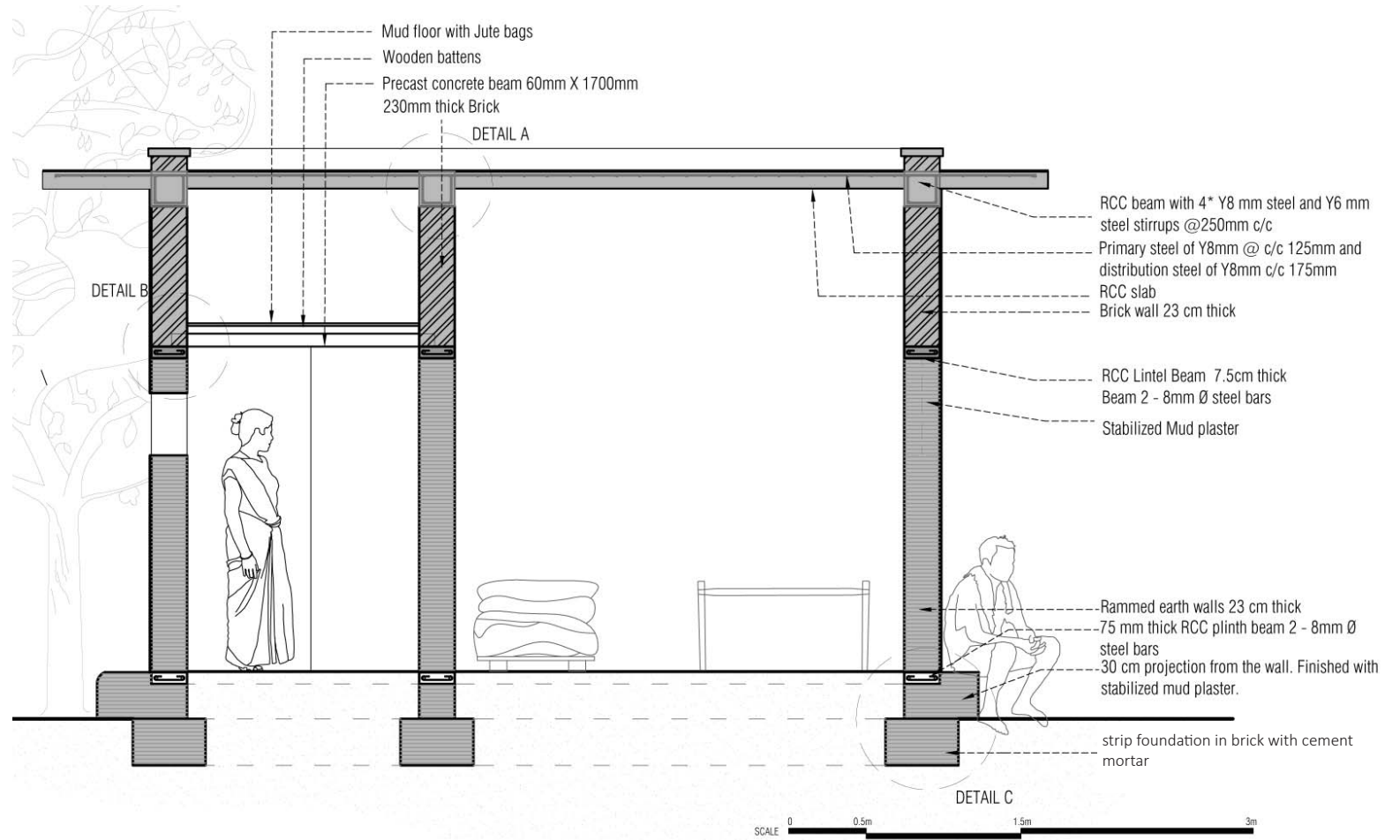


CHHATTISGARH

ALL ZONES CG-ALL-03



CHHATTISGARH



TYPICAL SECTION

Cost Estimate for All Zones Design 03

SR. NO.		CS Area	Length	width	ht	Quantity	Volume	Material Cost	Rate per unit (Rs)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum				
1	FOUNDATION										
	RCC Plinth Beam	0.017	43.3				0.7361	₹ 5,888.80	₹ 7,000.00	per cum	
	Earth Work Digging	0.141	43.3				6.1053	₹ 610.53	₹ 100.00	per cum	
	Rammed Earth	0.19	43.3				8.227	₹ 6,581.60	₹ 800.00	per cum	₹ 6,000.00
	Mud work filling	34.4			0.3		10.48	₹ 2,096.00	₹ 200.00	per cum	
W	TOTAL							₹ 15,176.93			₹ 6,000.00
2	WALLS										
	Rammed Earth	7.9			2		15.8	₹ 18,960.00	₹ 1,200.00	per cu m	
	Lintel Beam	0.017	43.3				0.7361	₹ 5,152.70	₹ 7,000.00	per cum	₹ 10,000.00
	Brick Work	0.208	43.3			9006.4	9.0064	₹ 18,012.80	₹ 2.00	per unit	
	Stabilised Mud Plaster	83.56						₹ 12,534.00	₹ 150.00	per sqm	₹ 2,000.00
	Doors					4		₹ 4,000.00	₹ 1,000.00	per unit	₹ 1,500.00
	Windows					6		₹ 3,000.00	₹ 500.00	per unit	
X	TOTAL							₹ 61,659.50			₹ 13,500.00
3	STRUCTURE ROOF										
	Pre-Cast loft	0.142		0.06		14	0.00852	₹ 834.96	₹ 7,000.00	per cu m	
	Mud Flooring	10.79						₹ 1,079.00	₹ 100.00	per sqm	₹ 5,000.00
Y	TOTAL							₹ 1,913.96			₹ 5,000.00
4	ROOF										
	RCC slab	38.7			0.11		4.257	₹ 29,799.00	₹ 7,000.00	per cum	
	RCC beam	0.02	43.3				0.866	₹ 6,062.00	₹ 7,000.00	per cum	₹ 7,000.00
Z	TOTAL							₹ 35,861.00			₹ 7,000.00
								TOTAL (W+X+Y+Z)			₹ 31,500.00
								A			B
	GRAND TOTAL (A+B)	₹ 146,111.39									
	AREA (sqm)	38									
	RATE OF CONSTRUCTION (per sqm)	₹ 3,845.04									
	AREA (sqft)	406.6									
	RATE OF CONSTRUCTION (per sqft)	₹ 359.35									

Note: The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from on the urban center or source, geography, time, availability and accessibility to the local resources, etc.

The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.

Cost of Toilet is exclusive of the given estimate.

ALL ZONES CG-ALL-03

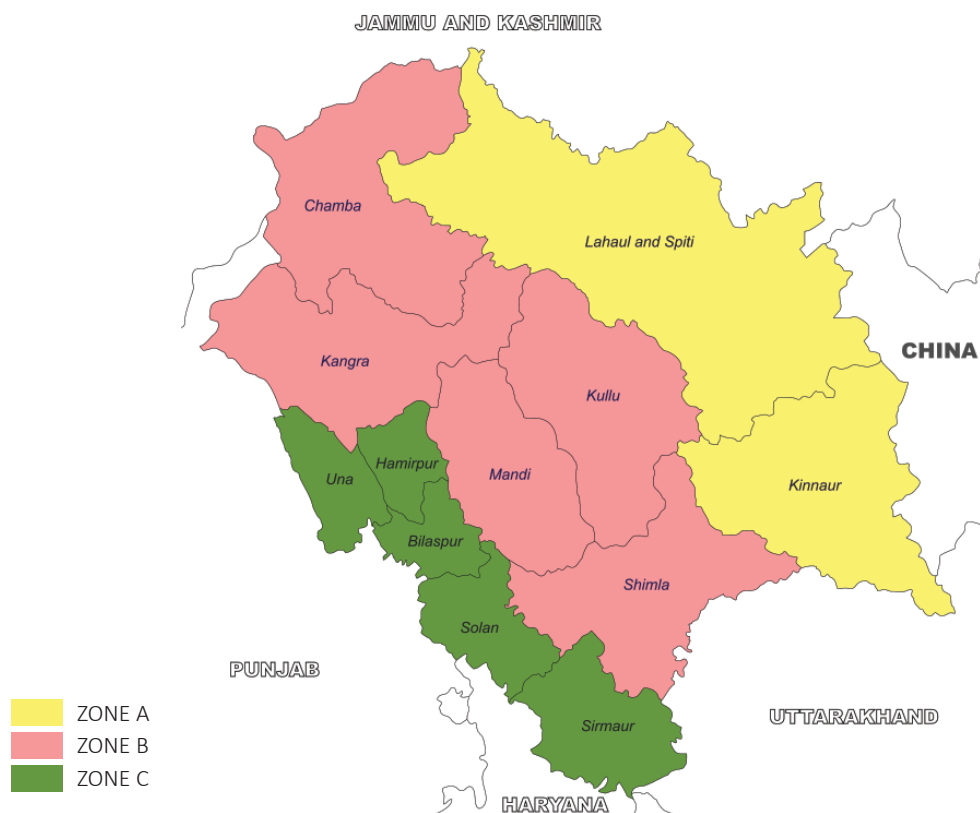
Cumulative cost breakup

Item	Cost (INR)
Foundation	21,176/-
Walls	75,160/-
Roof (with structure)	49,775/-
Total	146,111/-



CHHATTISGARH

Himachal Pradesh



Himachal Pradesh is a State in North India. Its area is 55,673 km² (21,495 sq mi), and is bordered by Jammu and Kashmir on the North, Punjab on the West, Haryana on the South-West, Uttarakhand on the South-East and by the Tibet Autonomous Region on the East.

There are several valleys in the state with more than 90% of the population living in rural areas. However, 100% hygiene has been achieved in the state and practically all houses have a toilet. The villages have good connectivity with roads, public health centres, and now with Lokmitra Kendra using high-speed broadband.

Shimla district has maximum urban population of 25%. Successfully imposed environmental protection and tourism development with ban on the use of polyethylene and tobacco products by the Government has led to a boost in tourism.

The rural housing typology in the state has a lot of variation based on the local conditions and availability of resources with people. Defining the rural housing typologies for state therefore needs to consider simple criteria that can be considered across the state and can be evaluated based on the purpose of supporting the need for defining these typologies at its basic level.

Zone A

Zone A has a square layout with covered verandah and an attached toilet. As per the climatic comfort requirement of the zone the type design focuses to reduce air-infiltration to have minimal heat loss. In addition, Trombone wall is introduced on southern facade to trap solar heat.

Since the heat loss is maximum through the roof, therefore, insulation is required in the form of false ceiling with the help of thermocol or any other local material. Incorporating usage of Bamboo as roof under-structure in the type design reduces the dependency on timber. The 350 mm thick coursed rubble wall with smaller size openings and low roof height also prevents the heat loss and maintain the interior climatic comfort. It covers districts Lahaul & Spiti and Kinnaur under it.

Zone B

The recommended type design has a rectangular layout with a covered verandah on both sides and a toilet. The verandah acts as a buffer space and can be used as a sitting space for visitors and family members. The rear verandah also serves as a service area for kitchen. The kitchen is provided on the ground floor but in case of using the kitchen as bedroom or in case of future extension kitchen space can be shifted to attic space.

The preferable orientation for house is front verandah facing the southern face since it's the larger face, so as to maximize the heat gain. Proper anchorage is provided to tie the roof to the main structure as there is high wind in this zone. It covers districts Chamba, Kangra, Kullu and Shimla.

Zone C

The prototype design for this zone has a rectangular layout with an integrated kitchen. A semi-covered verandah acting as a buffer space is proposed in the front of the house. The prototype design includes a room, semi-covered verandah, a room and attached toilet & bath. The kitchen can be accessed from the room and also has an alternate access from the rear of the house which might be used as washing area. Compressed Earth Blocks (CSEB) are used for 230 mm thick walls. Also, CSEB posts are made to support the verandah roof. The toilet is attached with the house but only can be accessed from outside of the house. It covers districts Sirmour, Solan, Bilaspur, Hamirpur and Una

HIMACHAL PRADESH

ZONE-A

The type designs recommended for the Zone A of the State responds to different physical & socio-economic factors among which livelihood is one such factor.

Zone A includes 2 Districts

- Lahaul and Spiti
- Kinnaur

Resources Available

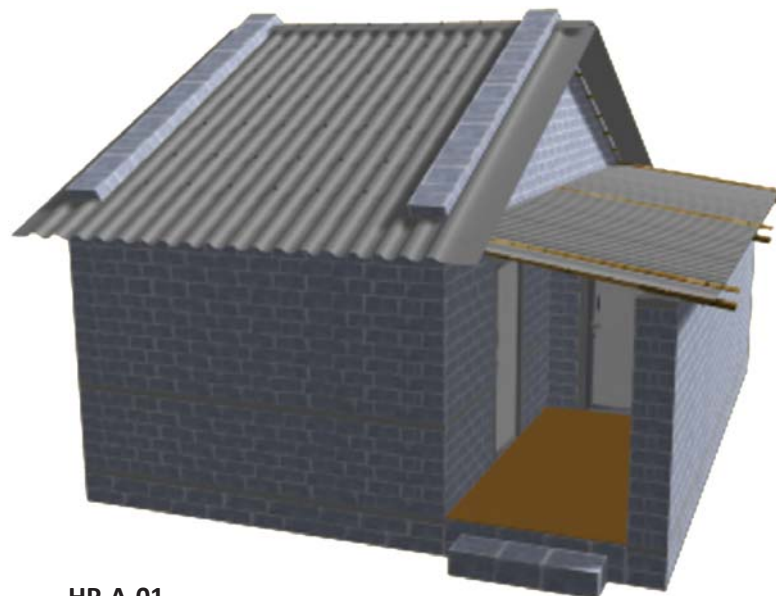
- Stone, CGI sheet

One typology

HP-A-01



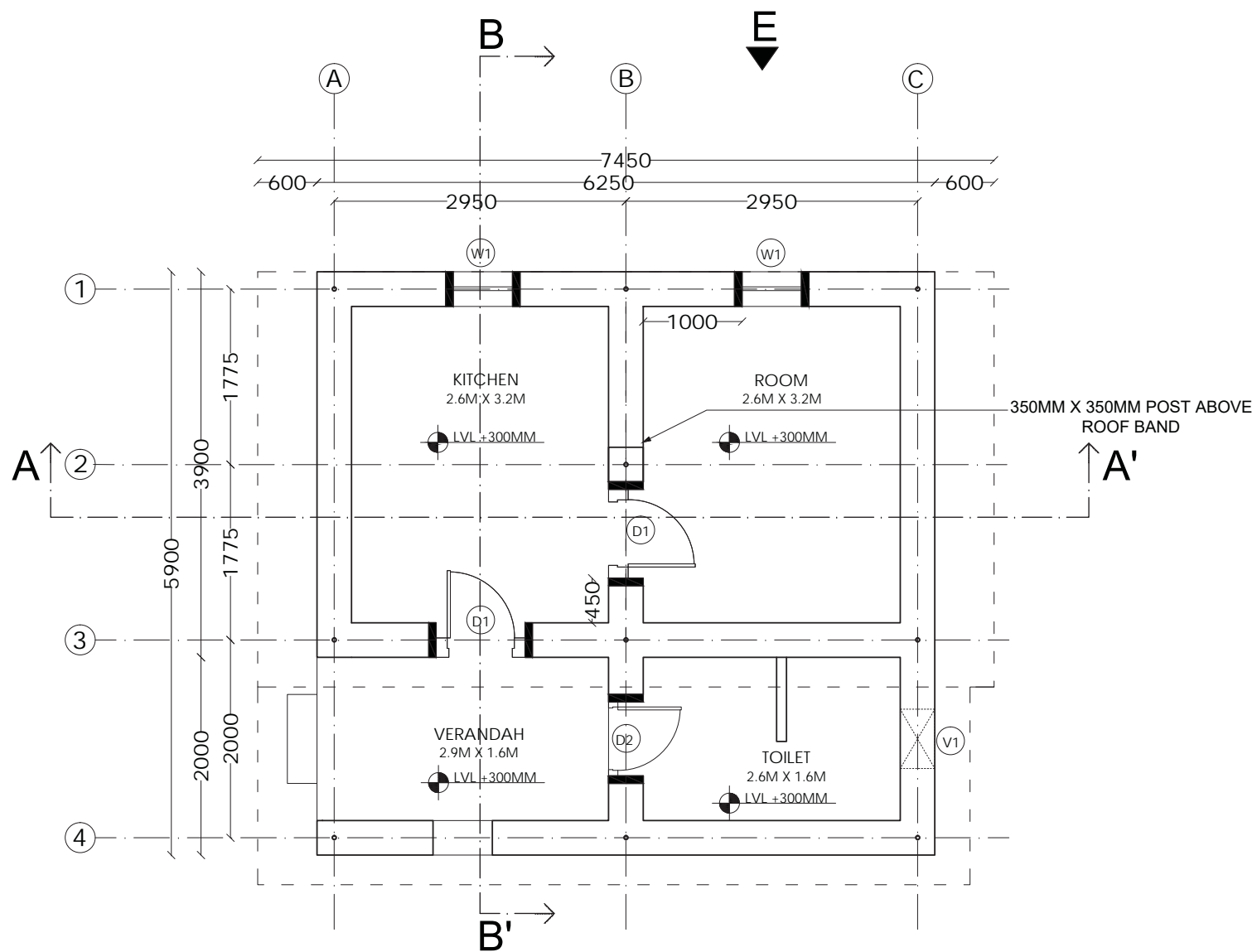
HIMACHAL PRADESH



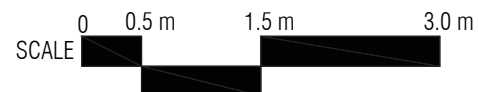
HP-A-01

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
Zone A has a square layout with covered verandah and an attached toilet. As per the climatic comfort requirement of the zone the type design focuses to reduce air-infiltration to have minimal heat loss.	Normal Plinth design	Sloped roof

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundation	• Continuous Coursed rubble foundation with cement mortar.	
Plinth	• Crushed stone with sand filling with 75 mm Plinth band provided at plinth level	
Wall	• 350 mm thick coursed rubble wall.	
Wall Finish	• Cement plaster with pointing.	
Roof Structure	• It consists of three parts. Roof with Bamboo under structure, Bamboo loft, false ceiling with thermocol insulation.	
Roof Cover	• Roof Cover 0.63 mm CGI sheet	
Floor	• Mud Flooring	
Door and Windows	• Wooden shutter door and window.	
Trombe Wall	• Proposed on the southern facade.	



TYPICAL PLAN



ZONE-A
HP-A-01

Total Cost ₹ 1,71,377/-

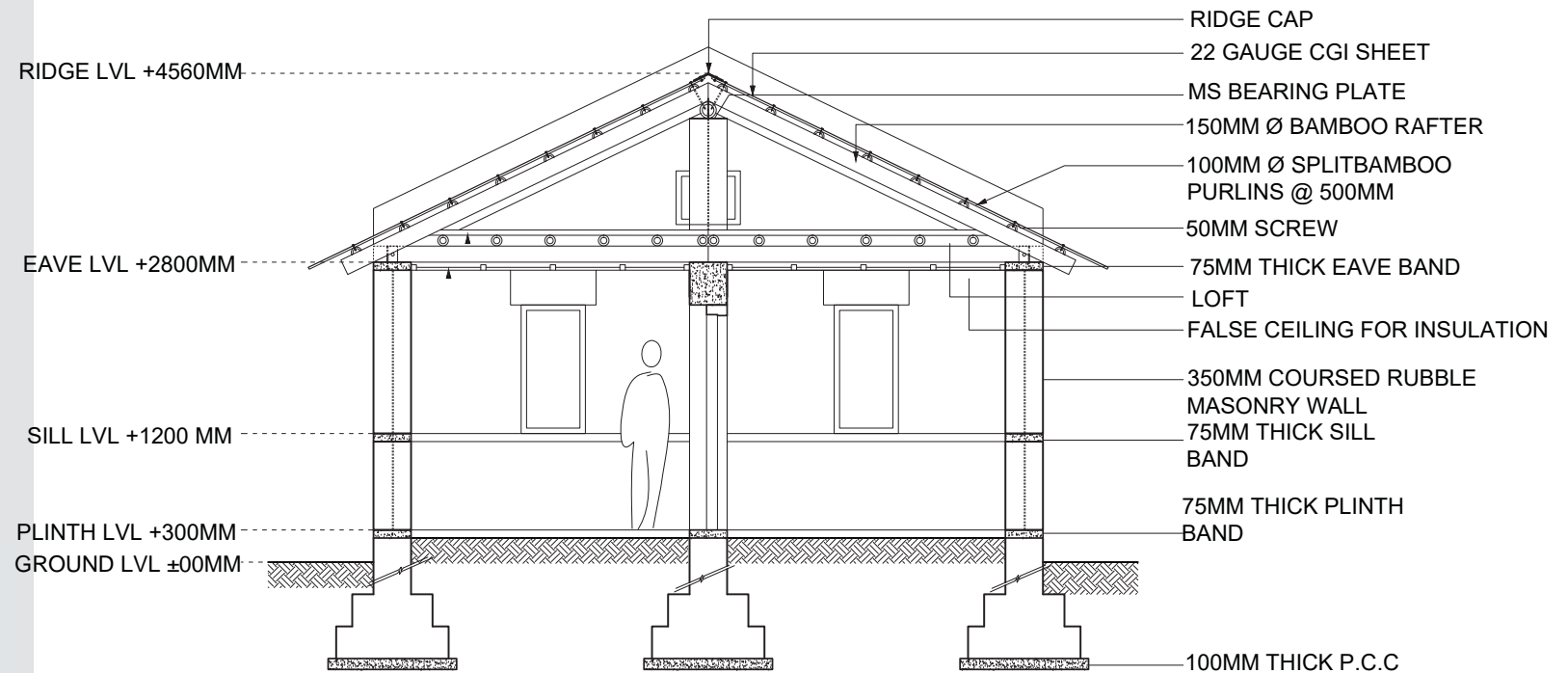


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ZONE - A
HP-A-01



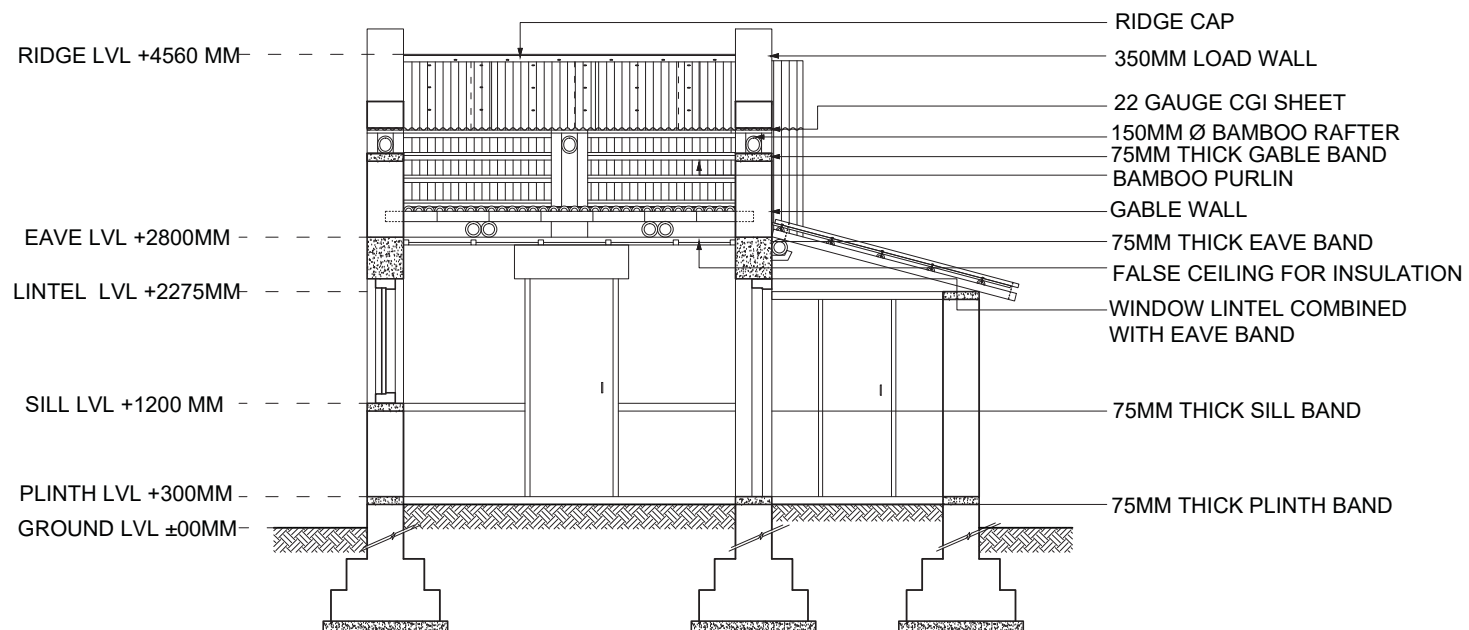
**HIMACHAL
PRADESH**



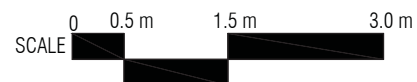
SECTION AA'

SECTION AA'

ZONE-A HP-A-01



SECTION BB'



SECTION BB'



HIMACHAL
PRADESH

ZONE - A
HP-A-01



**HIMACHAL
PRADESH**

Cost Estimation of the Core House for Zone A, HP-A-01		
S. No.	Components	Amount (₹)
1.	Excavation	2,403.38
2	Filling	401.11
3	Foundation and Plinth masonry	34,593.38
4	Flooring Finish	100
5	Superstructure	40,716.63
6	Bands	9,432.45
7	Roofing including false ceiling	23,856.95
8	Wood work(D/W) & D/W painting	8,020.6
9	Pointing & Plastering	4,451.45
10	Plinth protection	1,021.7
11	Trombe wall	6,830.6
	Total	1,31,828/-
Cost Indexing 30% extra with respect to HP SOR 2009		39,548.48
Total cost of core house(approx.)*		1,71,377/-



HP-B-01

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
It has a rectangular layout with a covered verandah on both sides and a toilet. The verandah acts as a buffer space and can be used as a sitting space for visitors and family members.	Normal Plinth design	Sloped roof

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundation	<ul style="list-style-type: none"> Continuous Coursed rubble foundation with cement mortar. 	
Plinth	<ul style="list-style-type: none"> Crushed stone with sand filling with 75 mm Plinth band provided at plinth level 	
Wall	<ul style="list-style-type: none"> 350 mm thick coursed rubble wall. 	
Wall Finsih	<ul style="list-style-type: none"> Cement plaster with pointing. 	
Roof Structure	<ul style="list-style-type: none"> It consists of three parts. Roof with Bamboo under structure, Bamboo loft, false ceiling with thermocol insulation. 	
Roof Cover	<ul style="list-style-type: none"> Roof Cover 0.63 mm CGI sheet 	
Floor	<ul style="list-style-type: none"> Mud Flooring 	
Door and Windows	<ul style="list-style-type: none"> Mild steel door and window 	

ZONE-B

The type designs recommended for the Zone B of the state responds to different physical & socio-economic factors among which livelihood is one such factor.

Zone B includes 5 Districts

- Chamba
- Kangra
- Kullu
- Mandi
- Shimla

Resources Available

- Stone, Bamboo Cement

Two typologies

HP-B-01



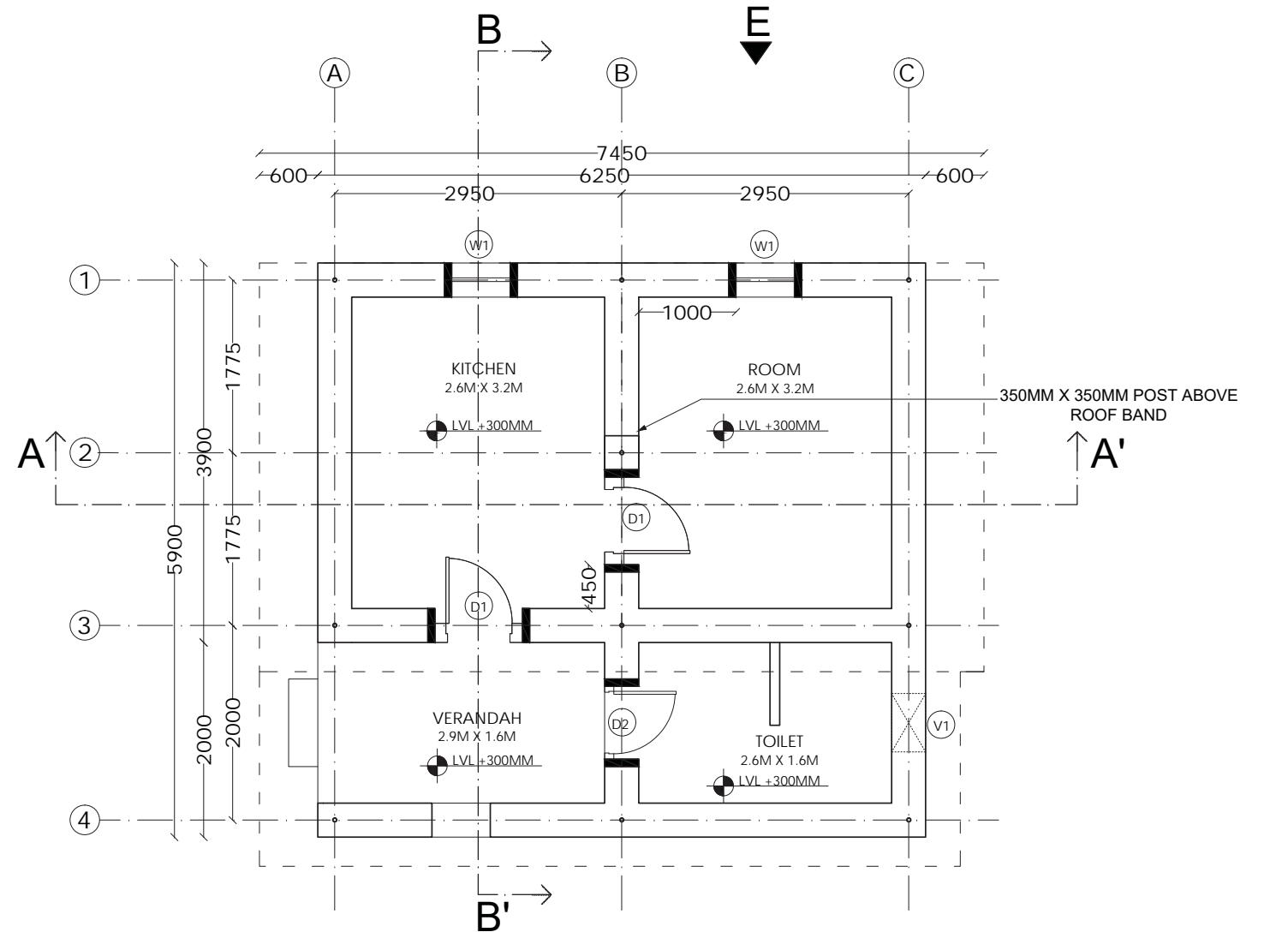
HIMACHAL PRADESH

ZONE-B HP-B-01

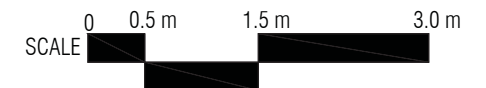
Total Cost ₹ 1,63,289/-



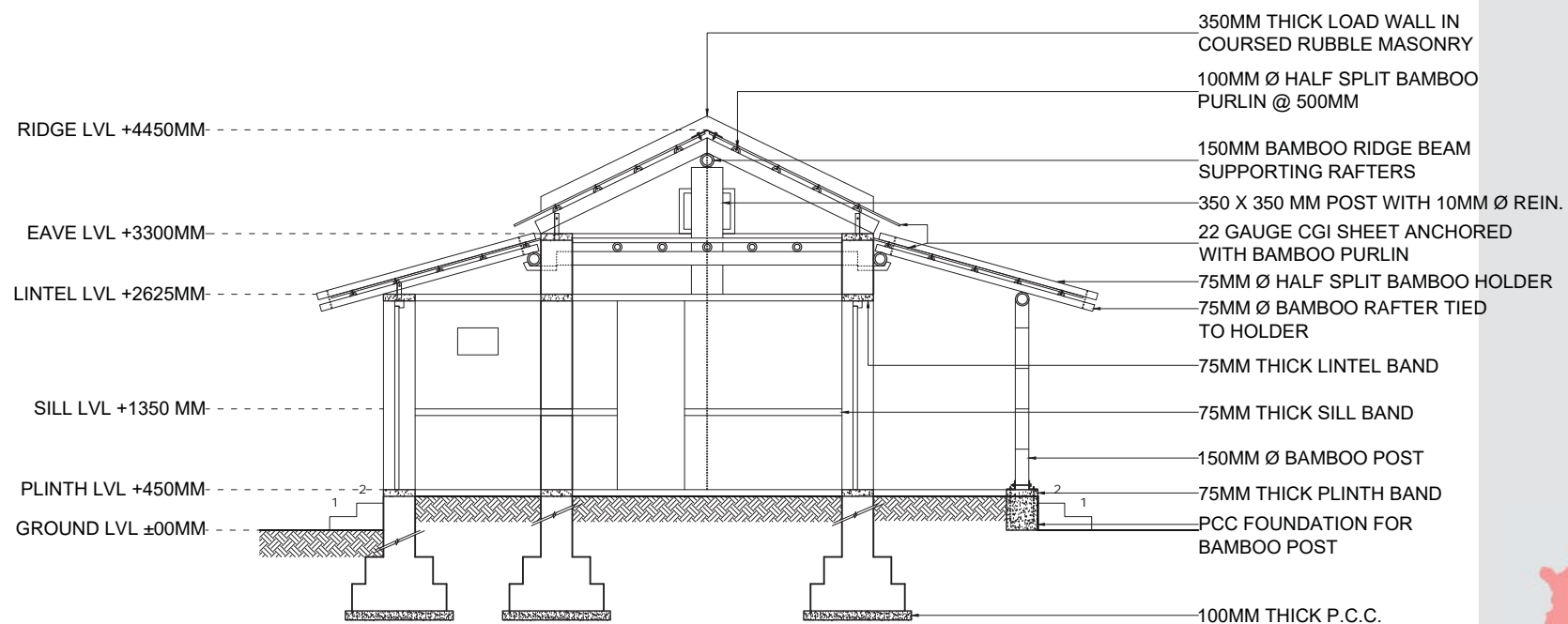
HIMACHAL PRADESH



TYPICAL PLAN



ZONE-B HP-B-01



TYPICAL SECTION AA'

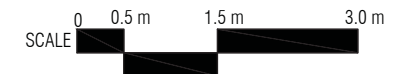
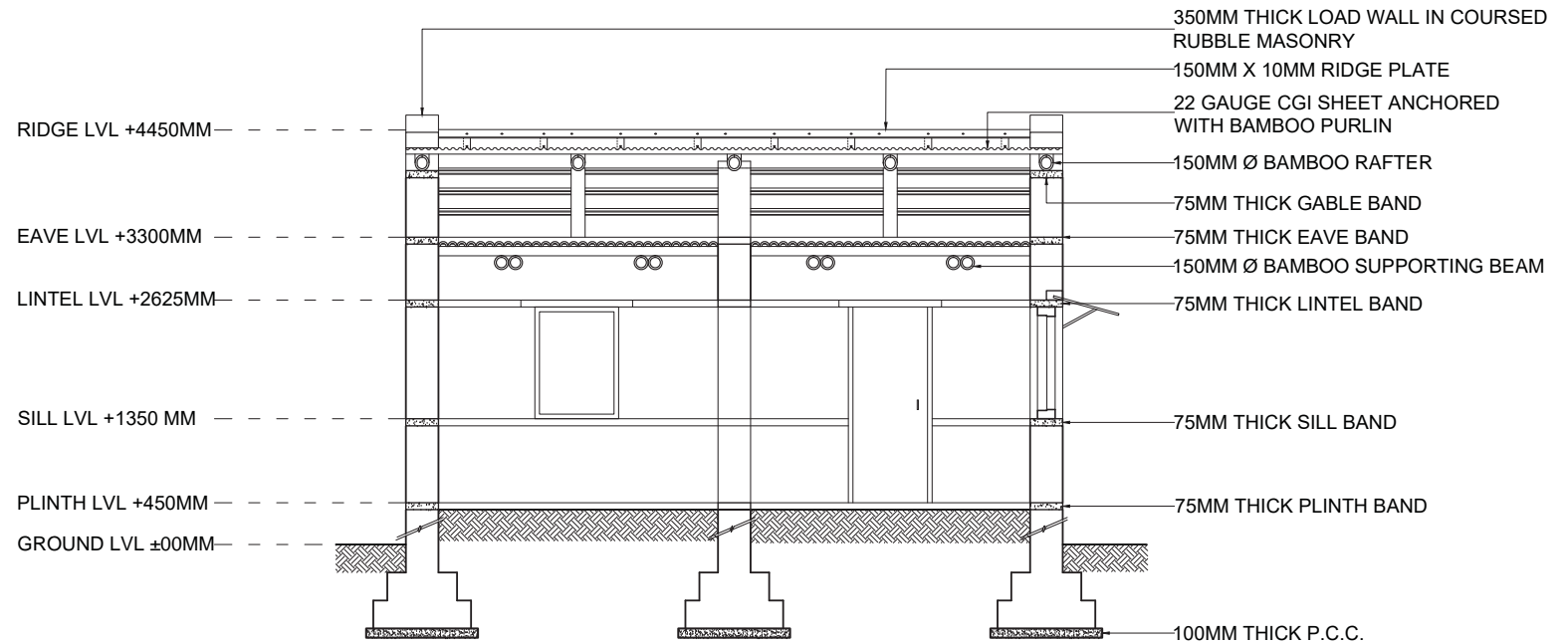


HIMACHAL PRADESH

ZONE-B HP-B-01



HIMACHAL PRADESH



TYPICAL SECTION BB'

ZONE - B
HP-B-01

Cost Estimation of the Core House for Zone B, HP-B-01		
S.No.	Components	Amount (₹)
1	Excavation	2,550.405
2	Filling	585.75
3	Foundation and Plinth masonry	37,235.41
4	Flooring Finish	100
5	Superstructure	40,502.89
6	Bands	8,386.1
7	Roofing	20,619.3
8	D/W & D/W painting	8,632.6
9	Pointing & Plastering	5,942.35
10	Plinth protection	1,052.3
	Total	1,25,607/-
	Cost Indexing 30% extra with respect to HP SOR 2009	37,682.13
	Total cost of core house(approx.)*	1,63,289/-



**HIMACHAL
PRADESH**

ZONE-B HP-B-02

The type designs recommended for the Zone B of the state responds to different physical & socio-economic factors among which livelihood is one such factor.

Zone B includes 5 Districts

- Chamba
- Kangra
- Kullu
- Mandi
- Shimla

Resources Available

- Stone, Bamboo

Two typologies

HP-B-01



HIMACHAL PRADESH



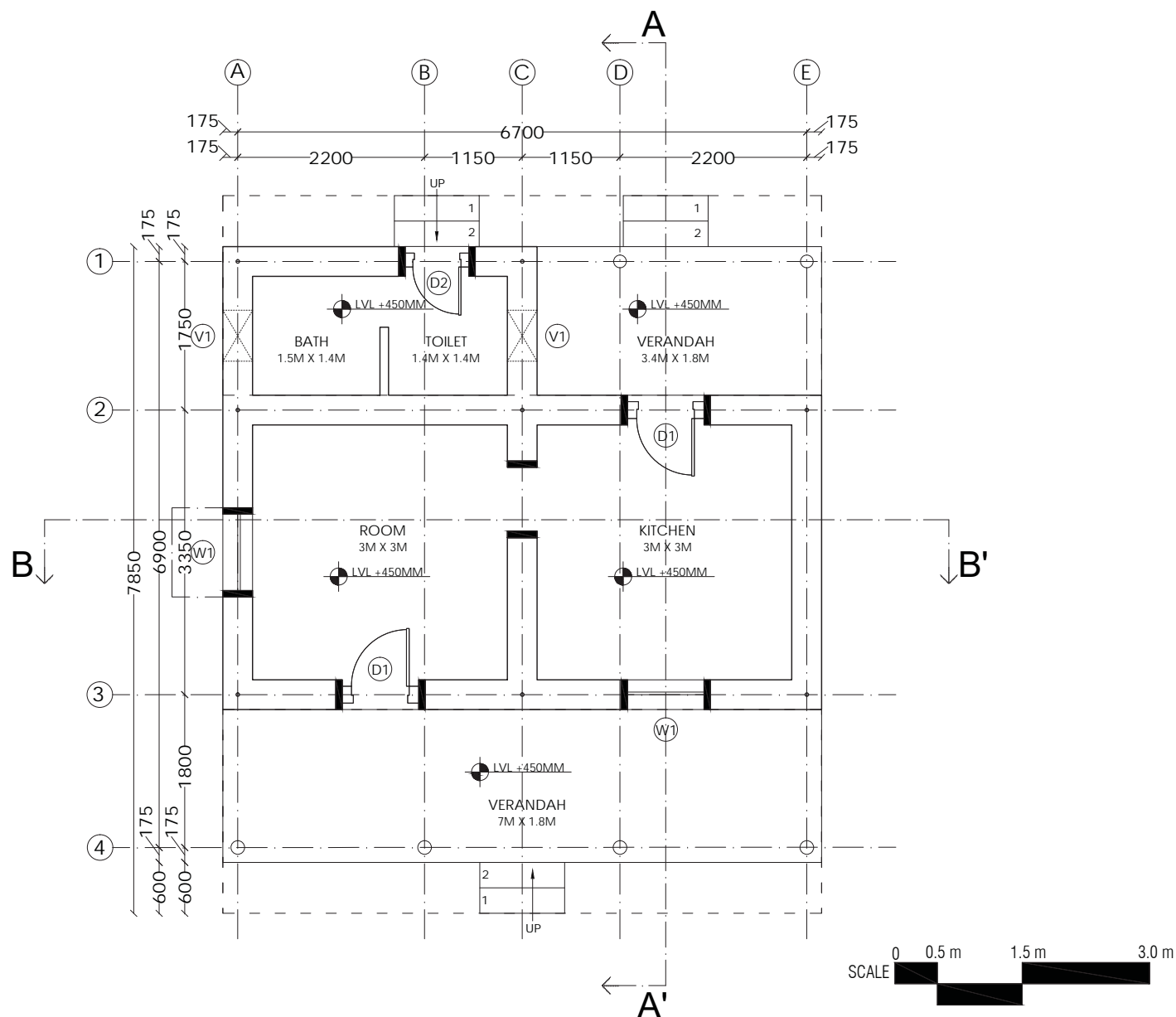
HP-B-02

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
It has a rectangular layout with a covered verandah on both sides and a toilet. The verandah acts as a buffer space and can be used as a sitting space for visitors and family members.	Normal Plinth design	Sloped roof

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	• Continuous Coursed rubble foundation with cement mortar.	
Plinth	• Crushed stone with sand filling with 75 mm Plinth band provided at plinth level	
Wall	• 350 mm thick coursed rubble wall.	
Wall Finsih	• Cement plaster with pointing.	
Roof Structure	• Filler slab with bamboo as the filler material	
Roof Cover	• Roof Cover 0.63 mm CGI sheet	
Floor	• Mud Flooring	
Door and Windows	• Mild steel door and window	

ZONE-B HP-B-02

Total Cost ₹ 1,49,435/-



TYPICAL PLAN

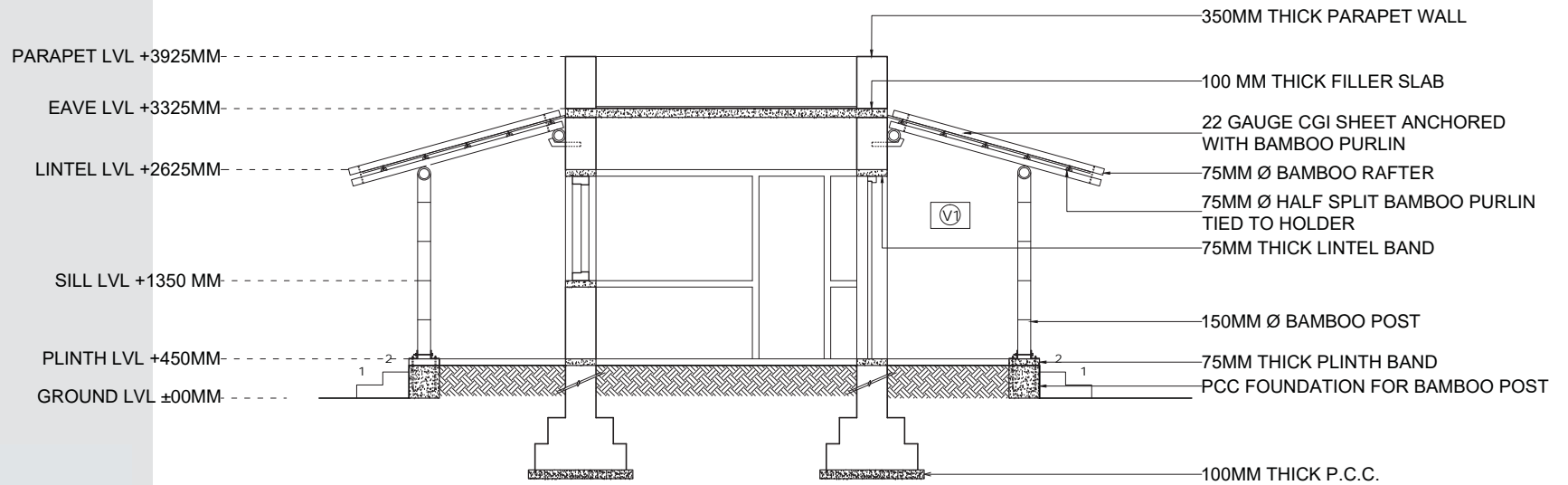


HIMACHAL PRADESH

ZONE-B HP-B-02

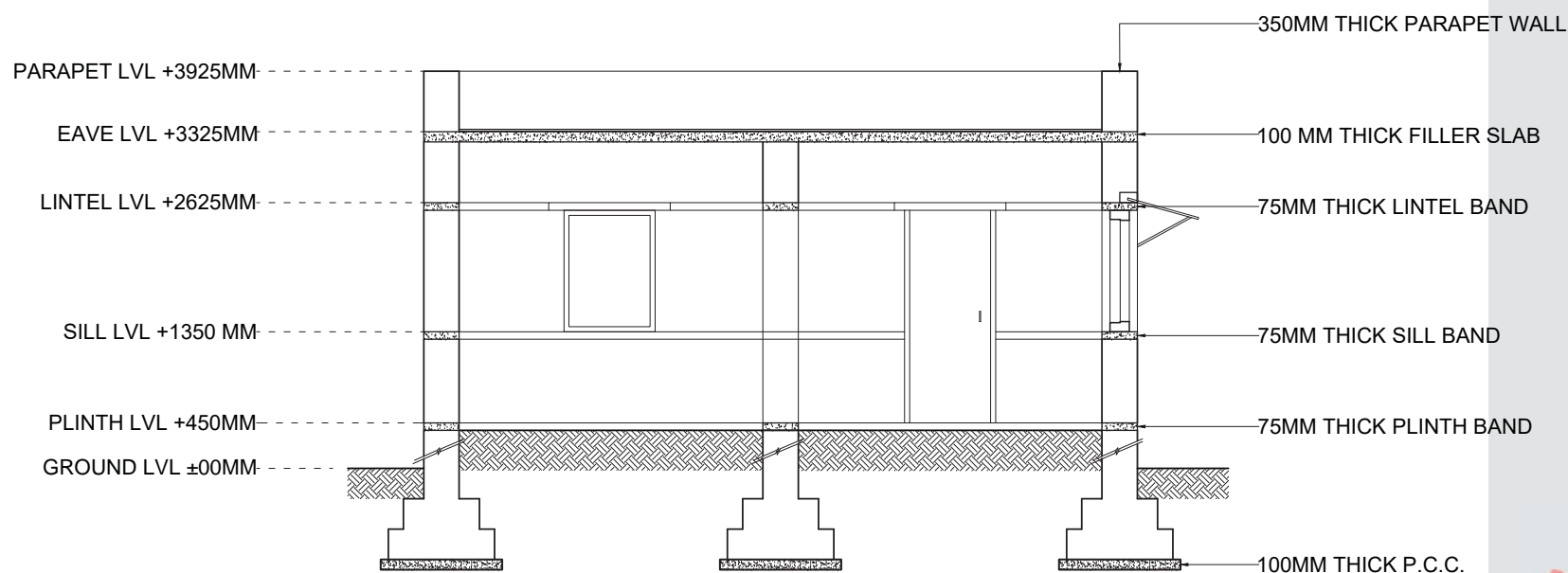


HIMACHAL PRADESH



TYPICAL SECTION AA'

ZONE-B HP-B-02



SECTION BB'



HIMACHAL
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ZONE-B
HP-B-02



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Cost Estimation of the Core House for Zone B, HP-B-02		
S.No.	Components	Amount (₹)
1	Excavation	2,550.405
2	Filling	390.50
3	Foundation and Plinth masonry	37,235.41
4	Flooring Finish	100
5	Superstructure	44,548.5
6	Bands	7,197.8
7	Roofing	8,944.55
8	D/W & D/W painting	7,684
9	Pointing & Plastering	5,246.2
10	Plinth protection	1,052.3
	Total	1,14,949.7/-
	Cost Indexing 30% extra with respect to HP SOR 2009	34,484.90
	Total cost of core house(approx.)	1,49,435/-



HP-C-01

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
A rectangular layout with an integrated kitchen. A semi-covered verandah acting as a buffer space is proposed in the front of the house. The prototype design includes a room, semi-covered verandah, a room and attached toilet & bath.	Normal Plinth design	Sloped roof

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundation	• Continuous Coursed rubble foundation with cement mortar.	
Plinth	• Crushed stone with sand filling with 75 mm Plinth band provided at plinth level	
Wall	• 350 mm thick coursed rubble wall.	
Wall Finish	• Cement plaster with pointing.	
Roof Structure	• Bamboo under structure, Bamboo loft space for storage	
Roof Cover	• 0.63 mm CGI sheet on the core house and toilet, Thatch roof on Verandah.	
Floor	• Mud Flooring	
Door and Windows	• Mild steel door and window	

ZONE - C HP-C-01

The type design recommended for the Zone C of the state responds to different physical & socio-economic factors among which livelihood is one such factor.

Zone C includes 5 Districts

- Sirmaur
- Solan
- Bilaspur
- Hamirpur
- Una

Resources Available

- Stone, Bamboo, CSEB

Zone C has one typology
HP-C-01



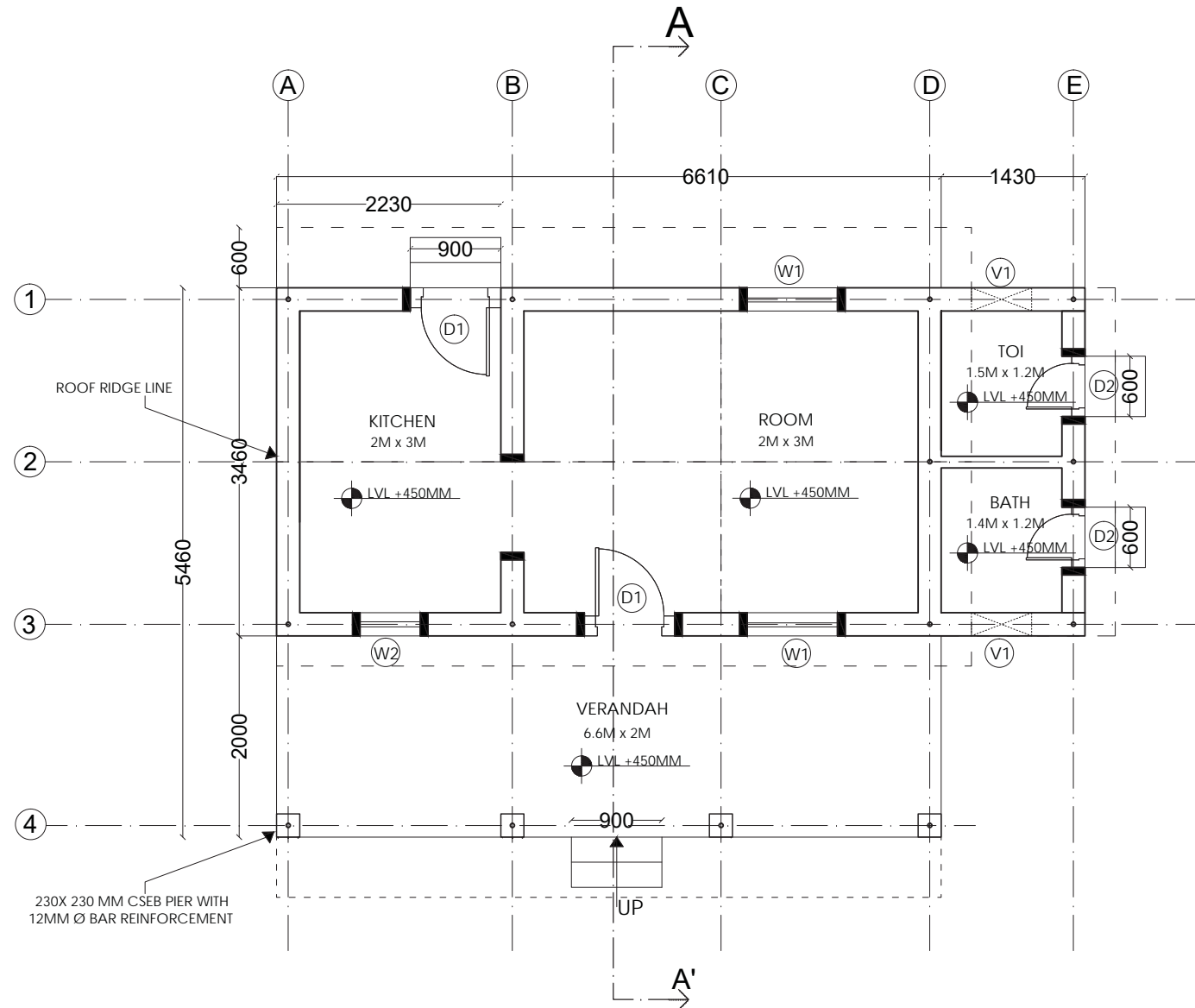
HIMACHAL PRADESH

ZONE - C HP-C-01

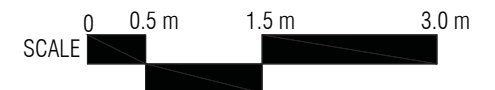
Total Cost ₹ 1,08,561/-



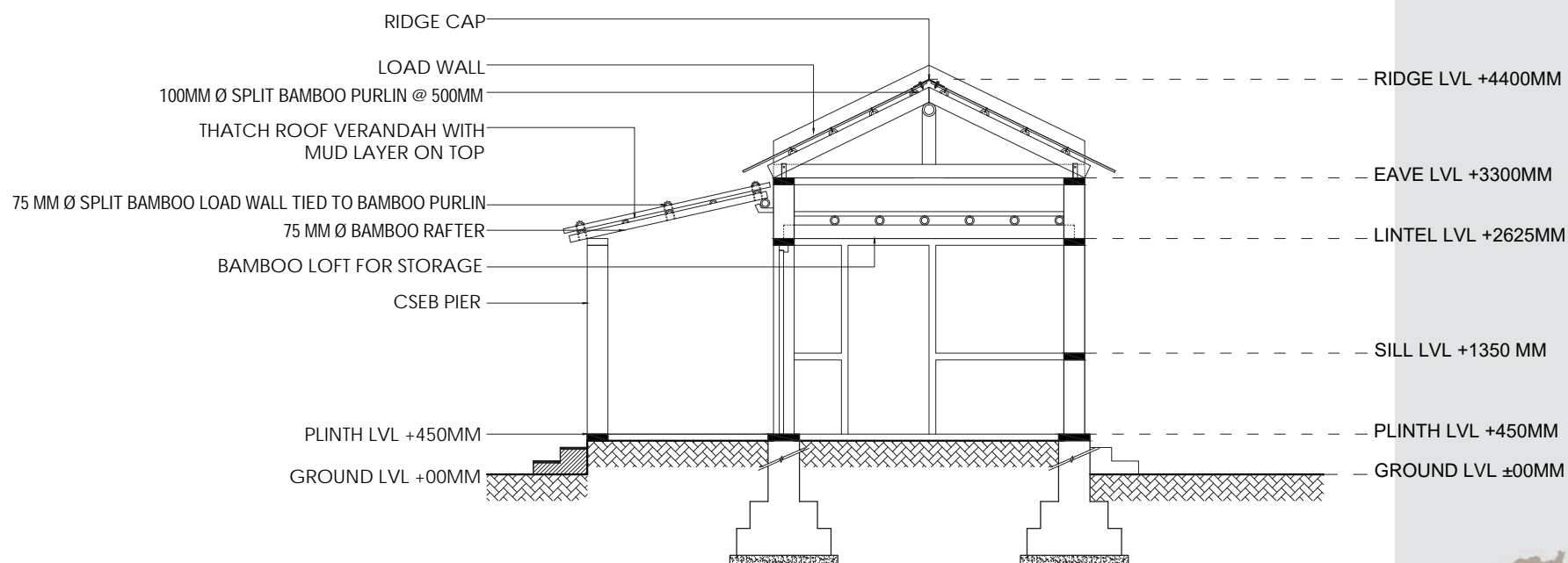
HIMACHAL PRADESH



TYPICAL PLAN



ZONE-C HP-C-01



TYPICAL SECTION



HIMACHAL PRADESH

ZONE - C
HP-C-01



**HIMACHAL
PRADESH**

Cost Estimation of the Core House for Zone C, HP-C-01		
S.No.	Components	Amount (₹)
1	Excavation	2,102.95
2	Filling	642.16
3	Foundation and Plinth masonry	31,279.15
4	Flooring Finish	100.00
5	Superstructure	12,698.15
6	Bands	6,074.10
7	Roofing	17,177.65
8	Wood work(D/W) & D/W painting	8,647.90
9	Pointing & Plastering	3,772.30
10	Plinth protection	1,014.05
	Total	83,508.41
	Cost Indexing 30% extra with respect to HP SOR 2009	25,052.52
	Total cost of core house(approx.)*	1,08,561/-



HP-C-02

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
A rectangular layout with a semi-covered verandah. The house has a temporary partition in between the room which can be made from any suitable local material. The verandah acts as a buffer space and can be used as a sitting space for visitors and family members.	Normal Plinth design	Sloped roof

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	• Continuous Coursed rubble foundation with cement mortar.	
Plinth	• Crushed stone with sand filling with 75 mm Plinth band provided at plinth level	
Wall	• 230 mm thick coursed rubble wall.	
Wall Finsih	• Cement plaster with pointing.	
Roof Structure	• Bamboo under structure, Bamboo loft space for storage	
Roof Cover	• 0.63 mm CGI sheet on the core house and toilet, Thatch roof on Verandah.	
Floor	• Mud Flooring	
Door and Windows	• Mild steel door and window	

ZONE - C HP-C-02

The type designs recommended for the Zone C of the state responds to different physical & socio-economic factors among which livelihood is one such factor.

Zone B includes 5 Districts

- Sirmaur
- Solan
- Bilaspur
- Hamirpur
- Una

Resources Available

- Stone, Bamboo, CSEB

Zone C has one typology
HP-C-02



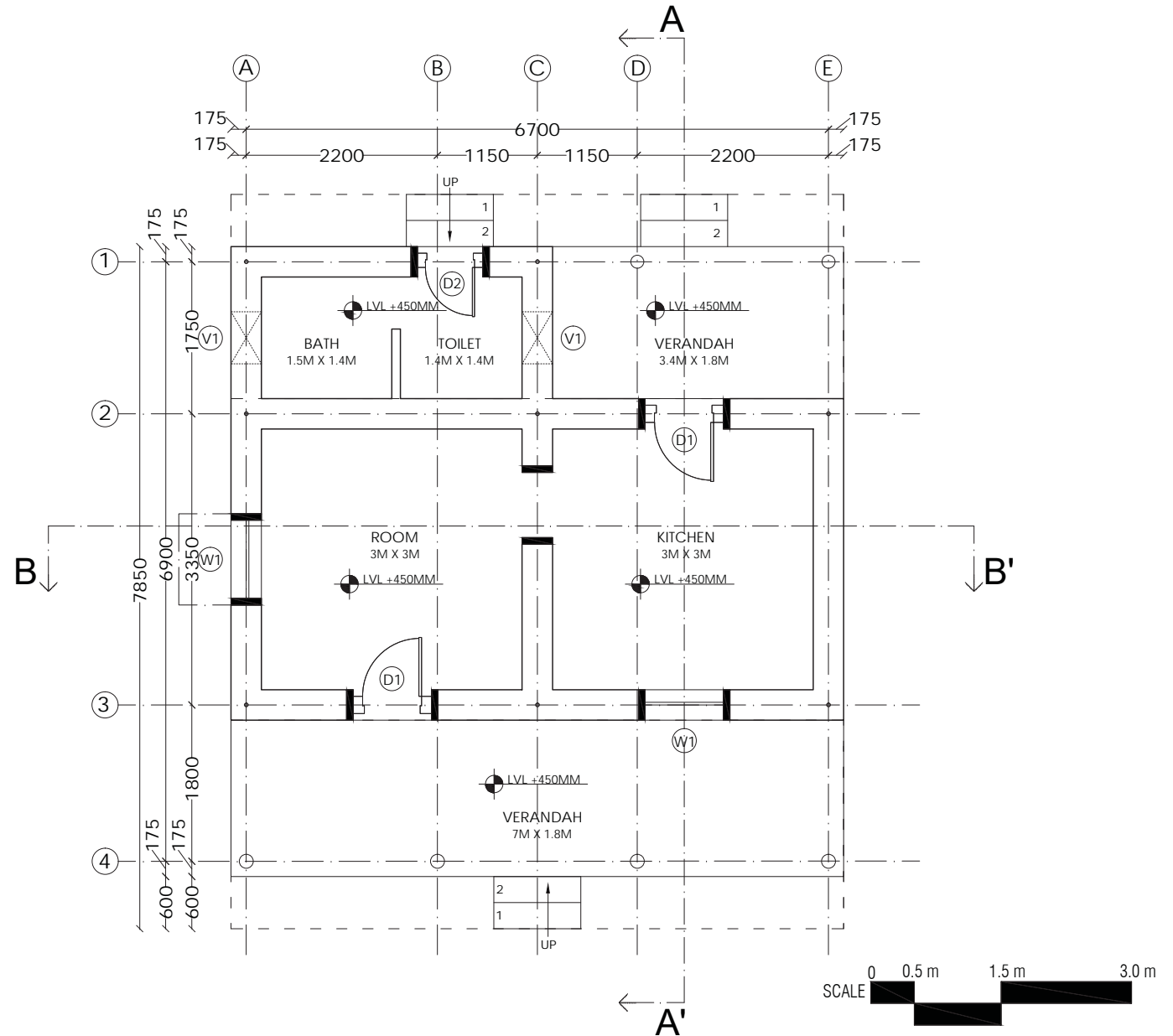
HIMACHAL PRADESH

ZONE - C HP-C-02

Total Cost ₹ 1,14,355/-

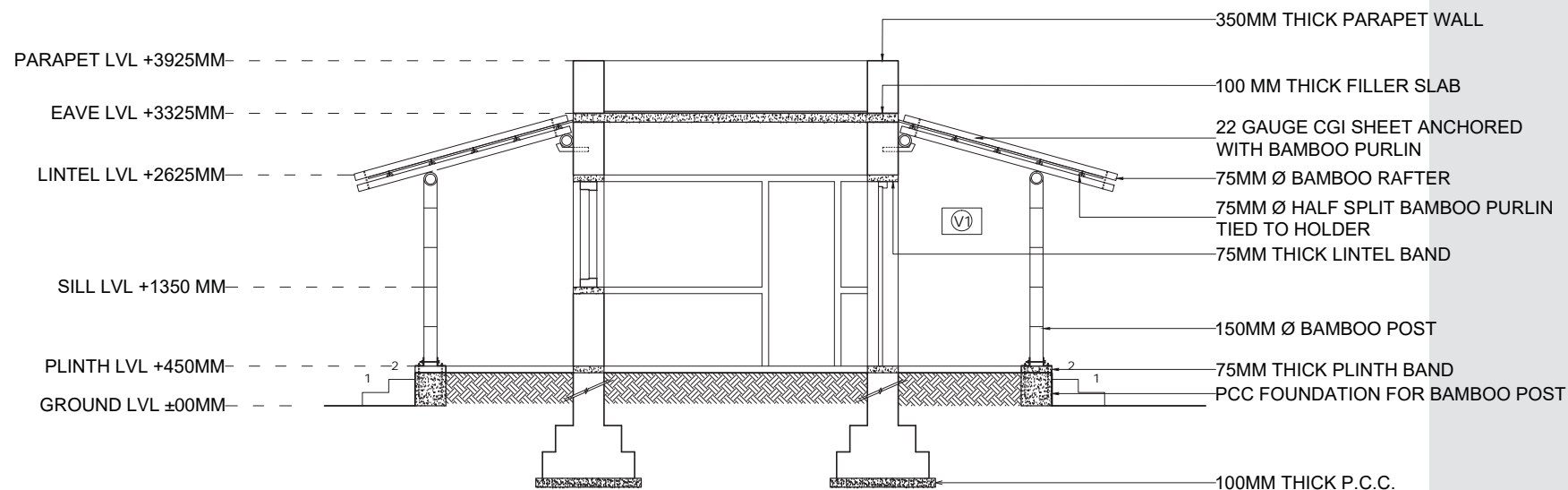


HIMACHAL PRADESH



TYPICAL PLAN

ZONE-C HP-C-02



SECTION AA'

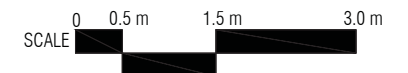
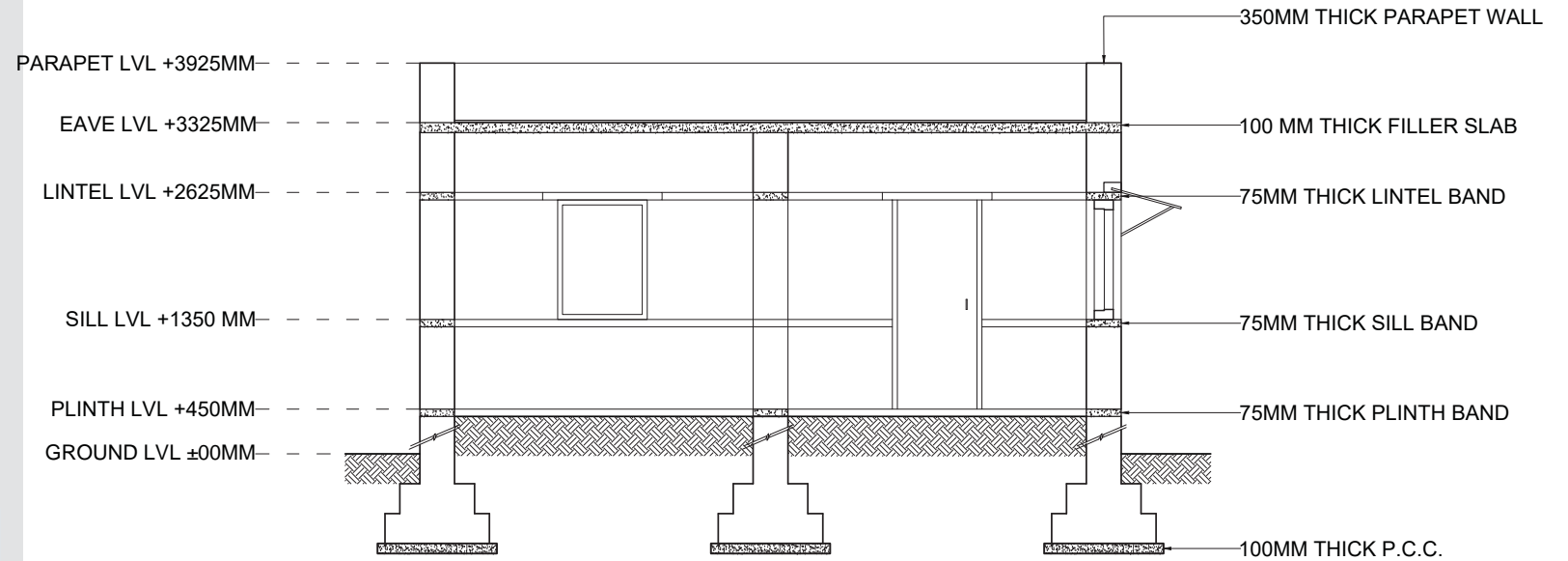


HIMACHAL PRADESH

ZONE - C HP-C-02



HIMACHAL
PRADESH



SECTION BB'

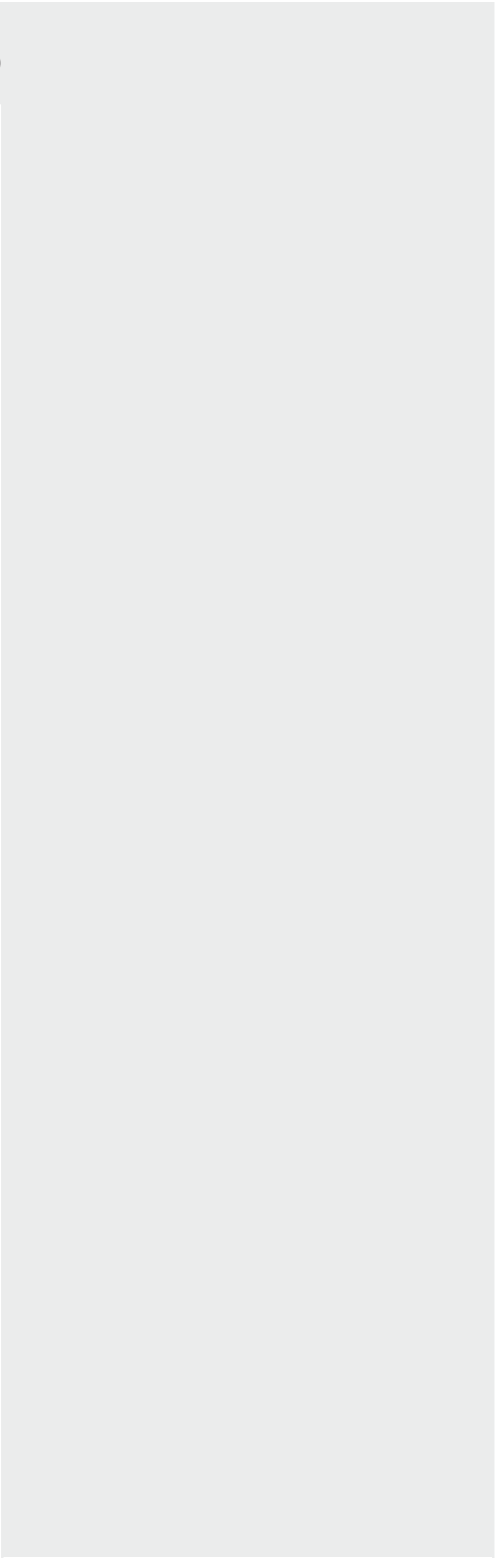
ZONE - C
HP-C-02

Cost Estimation of the Core House for Zone C, HP-C-02		
S.No.	Components	Amount(₹)
1	Excavation	1,872.37
2	Filling	804.50
3	Foundation and Plinth masonry	27,322.72
4	Flooring Finish	100
5	Superstructure	23,104.48
6	Bands	5,316.75
7	Roofing	18,457.75
8	D/W including Painting	6,244.1
9	Pointing & Plastering	3,744.25
10	Plinth protection	998.75
	Total	87,965.7/-
Cost Indexing 30% extra with respect to HP SOR 2009		26,389.7
Total cost of core house (approx.)		1,14,355/-



**HIMACHAL
PRADESH**

Jharkhand





Jharkhand contains two major types of forests, namely, Tropical Zone Dry Forests, and Tropical Zone Wet Forests. However, majority of the area under forests in the Jharkhand is dry deciduous type.

The state falls under the Tropical Monsoon climatic region, having monthly mean temperatures above 18 °C in every month of the year and feature wet and dry seasons. The average annual rainfall in the state is 1400 mm and more than 80% of the precipitation occurs between June to September. This rainfall is from the branch of monsoon from the Arabian Sea.

Various types of building materials are used for house construction in the state ranging from earth, wood, thatch, stone, concrete, bricks, metal sheets etc. Hence, people utilise wide range of materials to build their houses.

Jharkhand is vulnerable to various hazards such as droughts, floods, earthquakes, lightening, forest fire and mining related disasters.

Majority of the districts of south Jharkhand fall under seismic zone II, a minor earthquake risk zone and remaining fall under seismic zone III, having moderate-risk for earthquake.

Zone A

This zone includes the northern districts Sahibganj, Godda, Pakur, Deoghar and Dumka. Since this zone consists of districts of the Santhal Parganas region, the specificities of Santhal culture form main reference for this zone. This region has parts of the state that fall under zone 3 of earthquakes, one of the highest for the state. However, in terms of possibility of earthquake and related damage, this is still moderate risk area.

Zone B

Zone B consists of Dhanbad, Jamtara, Bokaro, Khunti, parts of Ranchi, Saraikela and West Singhbhum districts. It is characterised by presence of minerals and metals, and hence mining and related establishments form major economic activities. Due to this, it consists of some of the highly industrialised parts of the state.

This zone is characterised by presence of stone masonry walls along with cob and brick masonry walls. Often one can see cob construction combined with stone or brick masonry structures to construct the wall.

Zone C

Entire region comes under earthquake zone 2, and hence is one of the safest regions from the viewpoint of earthquake safety. Similarly, flooding or cyclones are also almost non-existent threats for houses in the region. In terms of design compositions, people in this region utilise variety of configurations. Hence, possibility of various design choices is very important for this region. The designs also reflect the choice of materials and technologies they employ for construction.

Zone D

The zone is characterised by consistency of available materials with very few variations and options. The earth and burnt-bricks are the main walling options found in this region. There was almost no presence of stone or adobe structures. In terms of construction techniques, it showed mostly load bearing construction using cob and masonry using bricks.

No frame structures using wattle and daub were found in this region. For roofing too, the region showed prevalence of country tiles, while Bengal tiles and thatch were almost absent from the region. Lately, people have started using sheet roofing as well as RCC.

JHARKHAND

ZONE-A

Zone A comprise 5 districts

1. Sahibganj
2. Godda
3. Pakur
4. Deoghar
5. Dumka

Resources Available

- Timber And Bamboo
- Fly Ash
- Stone

Zone A comprises of one typology

JH-A-01



JHARKHAND



JH-A-01



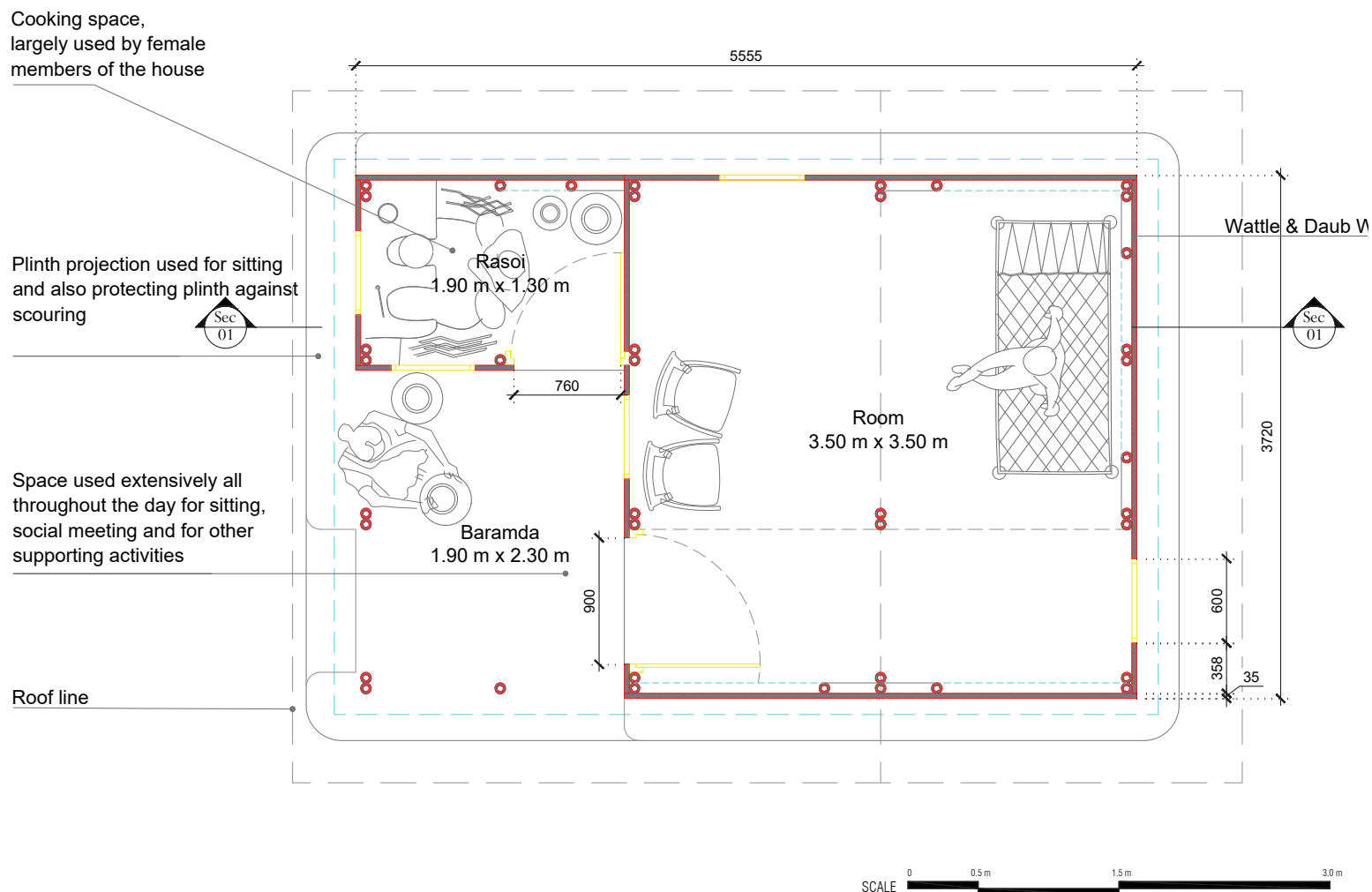
JH-A-01

Recommendations for Built Form - Zone A		
Plan Layout	Plinth/Floor	Roof Profile
Characterized by Santhal cultural associations. Large open spaces in form of central courtyard, backyard or front yard. Elements like tulsī- kyari and intermediate loft – incorporated. Loft design structure.	Normal plinth design.	Flat roof.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • Brick stub foundation for bamboo frame structure houses. • Brick foundation in cement mortar • Minimum depth – 450 mm • Minimum width 450 mm 	
Plinth	<ul style="list-style-type: none"> • Minimum (300 mm or 150 mm more than last 50 year flood level) 	
Wall	<ul style="list-style-type: none"> • Stabilized adobe wall • Stone in cement mortar • Load bearing walls 	
Wall Finish	<ul style="list-style-type: none"> • Mud wall plastered finish 	
Roof Structure	<ul style="list-style-type: none"> • Roof slope angle – min. 25 & max 45. • Roof over hang min. 450 missing. • Sheet and thatch with bamboo under structure • R.C.C. Slab 	
Roof Cover	<ul style="list-style-type: none"> • 'Bengal' tiles • Country tiles • Corrugated sheets 	
Floor	<ul style="list-style-type: none"> • Mud filling over plastic sheet • Woven bamboo mat flooring • Plastic sheet laid over split bamboo base and finished with mud flooring. 	
Door and Windows	<ul style="list-style-type: none"> • Mild steel door and window 	

ZONE - A JH-A-01

Total Cost ₹ 99,928/-



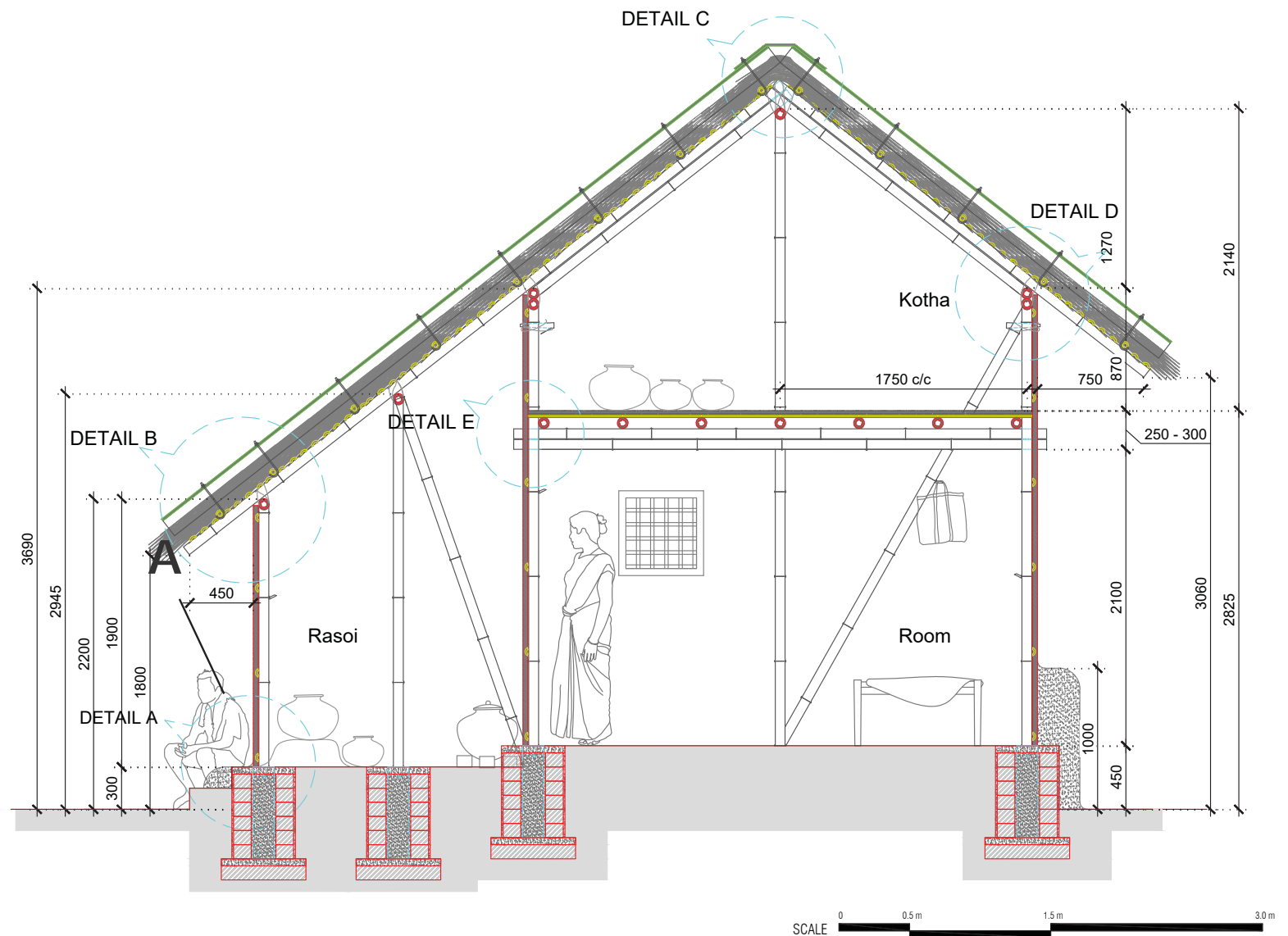
TYPICAL PLAN



JHARKHAND



JHARKHAND



SECTION

Cost Estimate for ZONE-A Design 01

SR. NO.		CS Area	Length	Width	Ht	Quantity	Volume	Area	Material cost	Rate per unit (Rs.)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	sqm				
1	FOUNDATION											
	Brick	0.38	21.8			3313.6	8.284		11597.6	3.5	per brick	8820
	Cement mortar						8.284		4556.2	550		
	Plinth Filling for Otta	9.1			0.3		2.73		546			
	Plinth Filling for Room	17.4			0.45		7.83		1566	200	per cmt	
W	TOTAL								18265.8			8820
												27085.8
2	STRUCTURE AND ROOF											
	Bamboo columns 1					3			450	150	per pc	12000
	Bamboo columns 2					15			2250		per pc	
	Bamboo for roof		4.9			21			3150			
	Bamboo for rafter		3.22			14			2100			
	Bamboo perimeter tie		3.9			2			300			
	Bamboo for splits					30			4500			
	Bamboo for intermediate floor					5			750			
X	TOTAL								13500			12000
												25500
3	ROOF											
	Sheets						18		14400	800	per sqm	2520
	Thatch	32.8				0.4	13.12		1312	100	per cmt	
Y	TOTAL								15712			2520
												18232
4	WALLS											
	wattle panels 1 (short)		4.35		1.8			7.83				8000
	wattle panels 2 (tall)		12.88		4.4			56.672				
	Deductions	3.75						3.75				
								60.752	9112.8	150		
	Mud plaster for daub 1 (short)		4.35		1.8			7.83				
	Mud plaster for daub 2 (tall)		12.88		4.4			56.672				
	Deductions	3.75						3.75				
								60.752	3037.6	50		
	stabilized mud plaster for exterior 1 (short)		4.35		1.8			7.83				
	stabilized mud plaster for exterior 2 (tall)		12.88		4.4			56.672				
	Deductions	3.75						3.75				
								60.752	4860.16	80		
	Doors					2			1600	800		per pc
	Windows					5			2500	500		
Z	TOTAL								21110.56			8000
												29110.56
									68,588.36			31,340.00
									A			B
	Total (A+B)	99,928.36										
	Total (c)	20,000.00										
	GRAND TOTAL (A+B+C)	119,928.36										
	AREA (sqm)	24.3										
	RATE OF CONSTRUCTION (per sqm)	4,935.32										
	AREA (sqft)	261.468										
	RATE OF CONSTRUCTION (per sqft)	458.67										

Notes :

The cost of material is based on the data collected during the field visits. Average or prevalent zone specific rate figures have been used. The rates may change from region to region depending on the distance from urban center, source, geography, availability etc. Bamboo is proposed to be chemically treated bamboo.

The labour rates are derived from the rates observed during the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp and community help components in the construction, the labour rates vary a lot. The labour rates also depend on the time of construction in the in the annual cycle of agrarian productivity.

ZONE - A JH-A-01

Cost breakup

Item	Cost (INR)
Foundation	27,085/-
Walls	29,110/-
Structure	25,500/-
Roof	18,232/-
Total	99,928/-



JHARKHAND

ZONE-B

Zone B comprises of 7 districts

1. Dhanbad
2. Jamtara
3. Bokaro
4. Khunti
5. Ramgarh
6. Ranchi
7. Saraikela

Resources Available

- Timber And Bamboo
- Fly Ash Brick
- Stone

Zone B comprises of one typology

JH-B-01

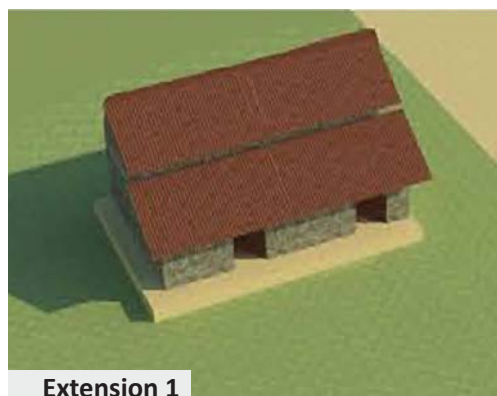
This typology is also applicable to Zone C



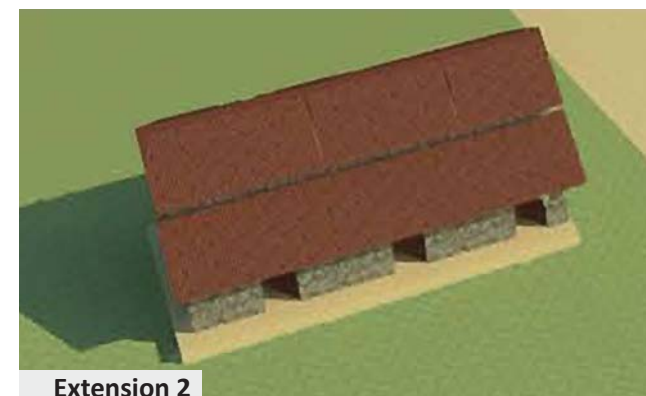
JHARKHAND



JH-B-01 Core House



Extension 1



Extension 2

Highlights of the Prototype

- Built up area of the house is optimised to 28 sq.m. with possibility for incremental growth upto 83 sq.m.
- Construction is done with load bearing stone masonry walls.
- A continuous timber lintel band is provided to support the loft & protect against seismic activities.
- Roofs are covered with country tiles with timber roof understructure. Treated bamboo is used for rafters, purlins & battens.
- A loft has been provided for additional storage space.
- The main house consists of 2 rooms. 1 room is used to store agricultural produce where as at the other acts as a space for ancillary activities such as cooking & rearing cattle.

Recommendations for Built Form - Zone B		
Plan Layout	Plinth/Floor	Roof Profile
Large open spaces in form of central courtyard, backyard or front yard. Elements like tulusi- kyari and intermediate loft – incorporated. Loft design structure.	High Plinth Floor	Flat roof.

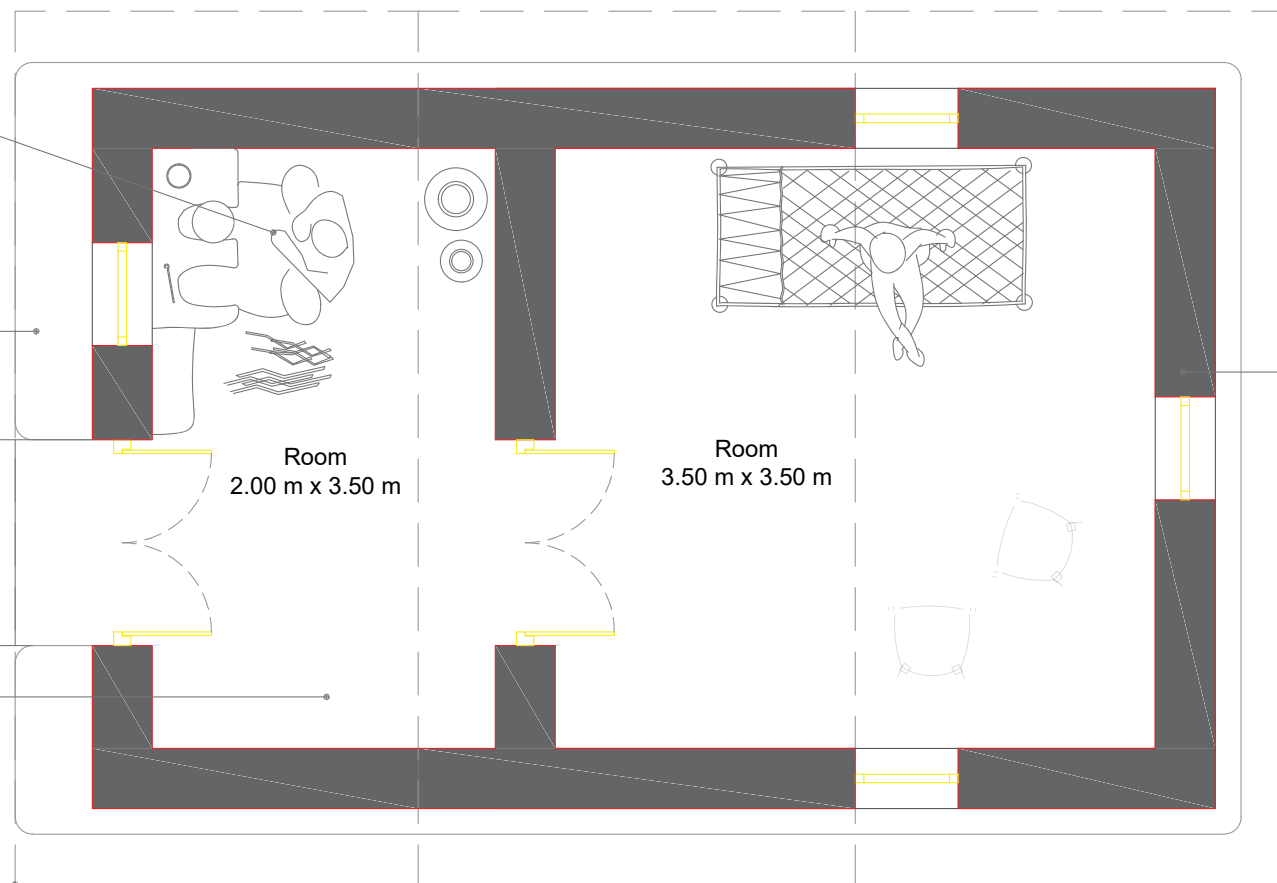
Recommendations for construction systems	
Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> • Stone foundation with cement-sand packing • Brick foundation
Plinth	<ul style="list-style-type: none"> • Minimum (300 mm or 150mm more than last 50 year flood level)
Wall	<ul style="list-style-type: none"> • Stone wall • Load bearing walls
Wall Finish	<ul style="list-style-type: none"> • Stabilised mud plaster
Roof Structure	<ul style="list-style-type: none"> • Roof slope angle – min. 25 & max 45. • Roof over hang min. 450 missing. • Sheet and thatch with bamboo under structure
Roof Cover	<ul style="list-style-type: none"> • 'Bengal' tiles • Country tiles • Corrugated sheets
Floor	<ul style="list-style-type: none"> • Sheet and thatch with bamboo under structure
Door and Windows	<ul style="list-style-type: none"> • Mild steel door and window

Cooking space,
largely used by
female members of
the house

Plinth projection
used for sitting and
also protecting plinth
against scouring

Space used
extensively, all
throughout the day
for sitting, social
meeting and for
other supporting
activities

Roof line



SCALE 0 0.5 m 1.5 m 3.0 m

TYPICAL PLAN

ZONE - B JH-B-01

Total Cost ₹ 1,22,792/-

Stone wall
with
mud/cement
mortar

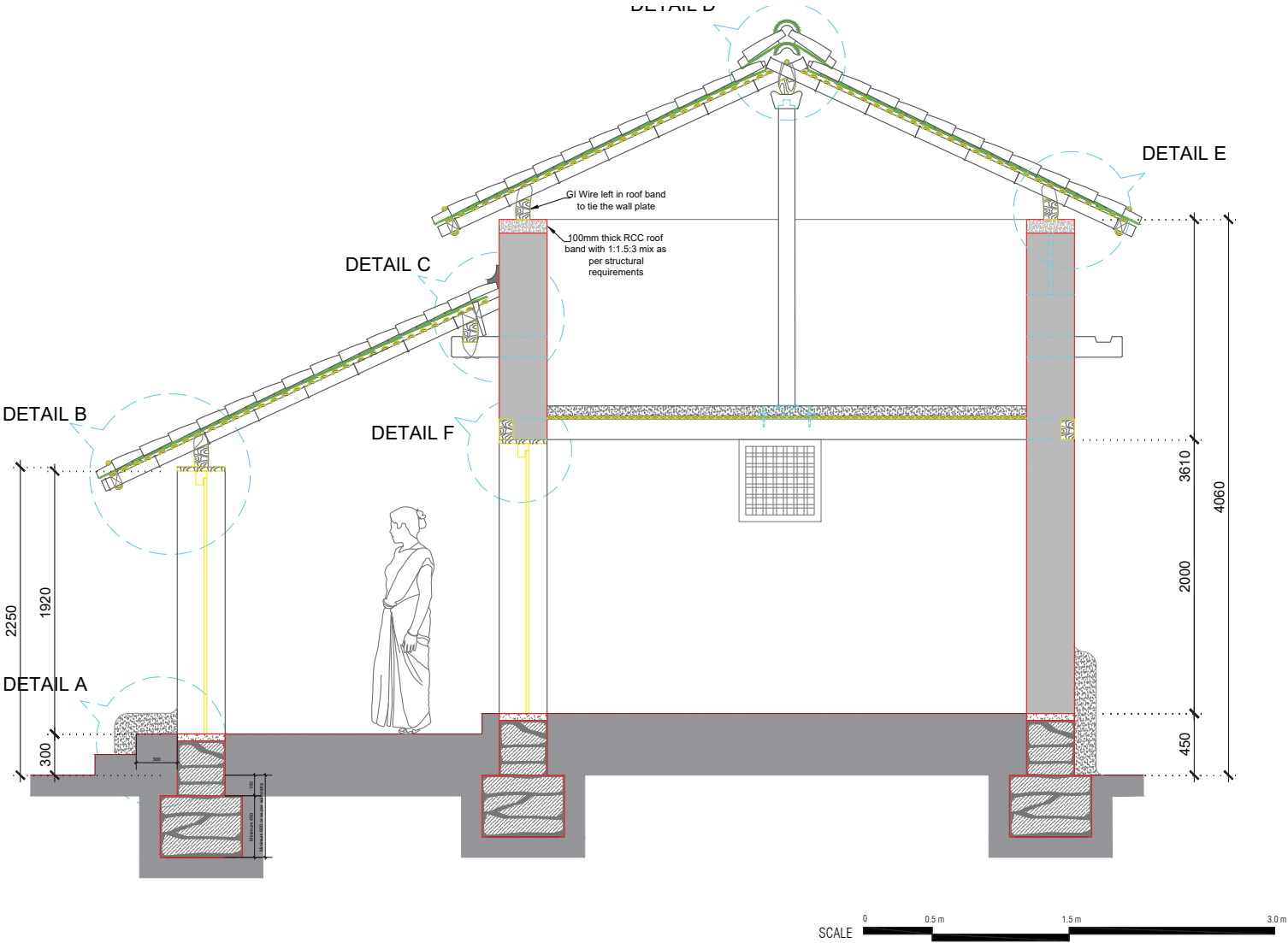


JHARKHAND

ZONE-B
JH-B-01



JHARKHAND



SECTION

Cost Estimate for ZONE-B Design 01

SR. NO.		CS Area	Length	Width	Ht	Quantity	Volume	Material cost	Rate per unit (Rs.)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum				
1	FOUNDATION										
	Stone Foundation	0.42	23.7				9.954	12094.11	1215	CMt	
	Plinth Filling for Otta	12.59			0.3		3.777	755.4	200	CMt	8800
	Plinth Filling for Room	19.06			0.45		8.577	1715.4	200	CMt	
W	TOTAL							14564.91			8800
											23364.91
2	WALLS										
	Stone 1 (short)	4.84			1.92		9.2928			CMt	
	Stone 2 (tall)	5.64			3.6		20.304			CMt	18000
	Deductions	3.84		0.35			1.344			CMt	
	Stone Work (all)						28.2528	34327.152	1215	CMt	
X	TOTAL							34327.152			18000
											52327.152
3	INTERMEDIATE FLOOR AND ROOF										
	Timber for Intermediate Floor	0.015	17.2				0.258	1290	5000	CMt	3500
	Bamboo for Intermediate Floor					16		2400	150	per Piece	
	Other materials for Intermediate Floor							2000		Lump Sum	
	Timber for Roof (4" X 6")	0.015	20			1	0.3	1500	5000	CMt	
	Timber for Roof (6" X 8")	0.03	2.2			2	0.132	660	5000	CMt	
	Timber for Roof (other)						1.5	7500	5000	CMt	7000
	Bamboo for Roof					17		2550	150	per Piece	
	Bamboo splits					28		4200	150	per piece	
	Country tiles							4000	1	per sqm	
	Other Materials							3000		Lump Sum	
Y	TOTAL							29100			10500
											39600
3	DOORS, WINDOWS AND OTHER FINISHES										
	Door					2		2000	1000	per Piece	2500
	Windows					2		1000	500	per Piece	
	Hand Plaster and other finishes							2000		Lump Sum	
Z	TOTAL							5000			2500
											7500
								82,992.06			39,800.00
								A			B
	Total (A+B)	122,792.06									
	Total (C)	20,000.00									
	GRAND TOTAL (A+B+C)	142,792.06									
	AREA (sqm)	32.39									
	RATE OF CONSTRUCTION (per sqm)	4,408.52									
	AREA (sqft)	348.52									
	RATE OF CONSTRUCTION (per sqft)	409.71									

Notes : The cost of material is based on the data collected during the field visits. Average or prevalent zone specific rate figures have been used. The rates may change from region to region depending on the distance from urban center, source, geography, availability etc. Bamboo is proposed to be chemically treated bamboo.

The labour rates are derived from the rates observed during the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp and community help components in the construction, the labour rates vary a lot. The labour rates also depend on the time of construction in the in the annual cycle of agrarian productivity.

ZONE - B JH-B-01

Cost breakup

Item	Cost (INR)
Foundation	23,365/-
Walls	52,327/-
Roof and Floor	39,600/-
Doors and Windows	7,500/-
Total	1,22,792/-



JHARKHAND

ZONE-C

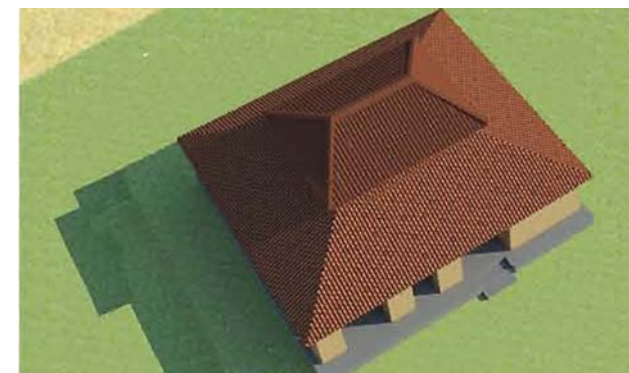
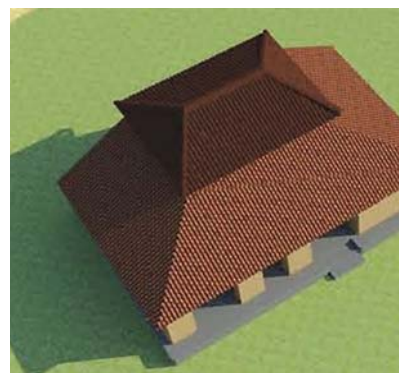
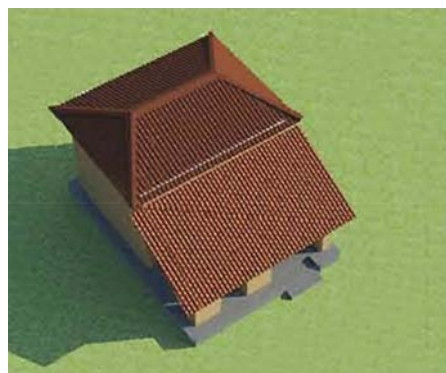
Zone C comprise 3 districts

1. Simdega
2. West Singhbhum
3. East Singhbhum

Resources Available

- Timber And Bamboo
- Fly Ash Brick
- Stone

ZoneC comprises of one typology JH-C-01



JH-C-01

Highlights of the Prototype - JH02

- Built up area of the house is optimized to 31.11 sq.m. with possibility for incremental growth upto 91.0 sq.m.
- construction with brick walls A continuous timber lintel band is provided to support the loft and protect against seismic activities.
- A loft has been provided for additional storage space.
- Roofs covered with thatch and timber roof understructure. Treated bamboo is used for rafters, purlins & battens.
- Main spaces of the house including room, semi-open veranda & kitchen are organised around a central courtyard.

Recommendations for Built Form - ZONE C

Plan Layout	Plinth/Floor	Roof Profile
Large open spaces in form of central courtyard, backyard or front yard. Elements like tulsi- kyari and intermediate loft – incorporated. Loft design structure.	High Plinth Floor	Sloped roof.

Recommendations for construction systems

Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> • RR stone masonry foundation with cement mortar • minimum depth based on soil starta, min 450 mm • minimum width 450 mm
Plinth	<ul style="list-style-type: none"> • Minimum(300mm or 150mm more than last 50 year flood level)
Wall	<ul style="list-style-type: none"> • half brick thick wall
Wall Finish	<ul style="list-style-type: none"> • stabilised Mud wall plastered finish.
Roof Structure	<ul style="list-style-type: none"> • Roof slope angle – min 25 & max 30. • Covered with sheet & has treated bamboo understructure.
Roof Cover	<ul style="list-style-type: none"> • Bengal tile.
Floor	<ul style="list-style-type: none"> • Mud filling over plastic sheet



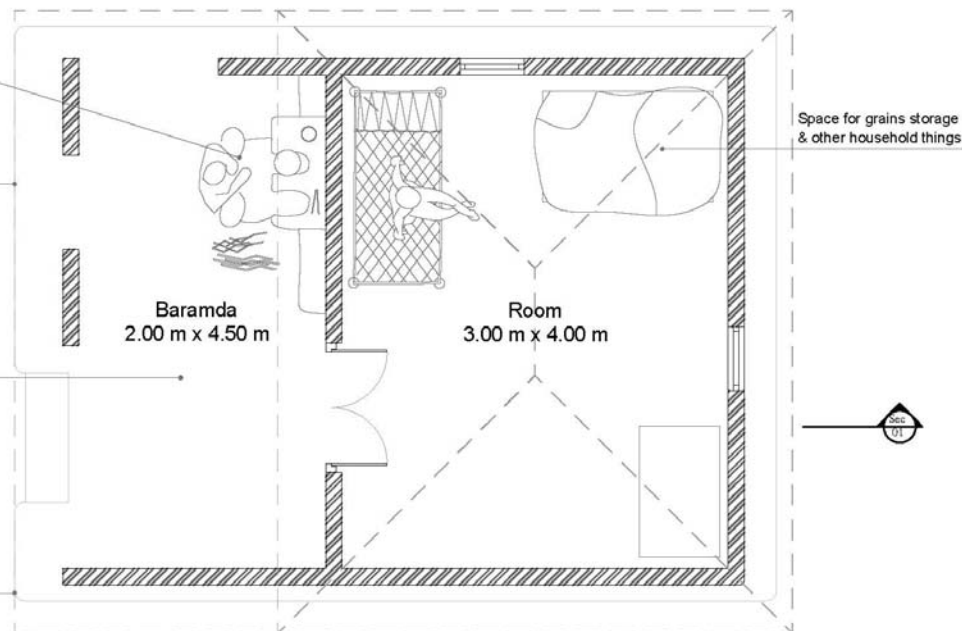
JHARKHAND

Cooking space,
largely used by female
members of the house

Plinth projection used for sitting
and also protecting plinth against
scouring

Space used extensively, all
throughout the day for sitting,
social meeting and for other
supporting activities

Roof line



FLOOR PLAN

Built Up Area 31.11 sqm

TYPICAL PLAN

ZONE - C JH-C-01

Total Cost ₹ 1,03,599/-



JHARKHAND

ZONE - C

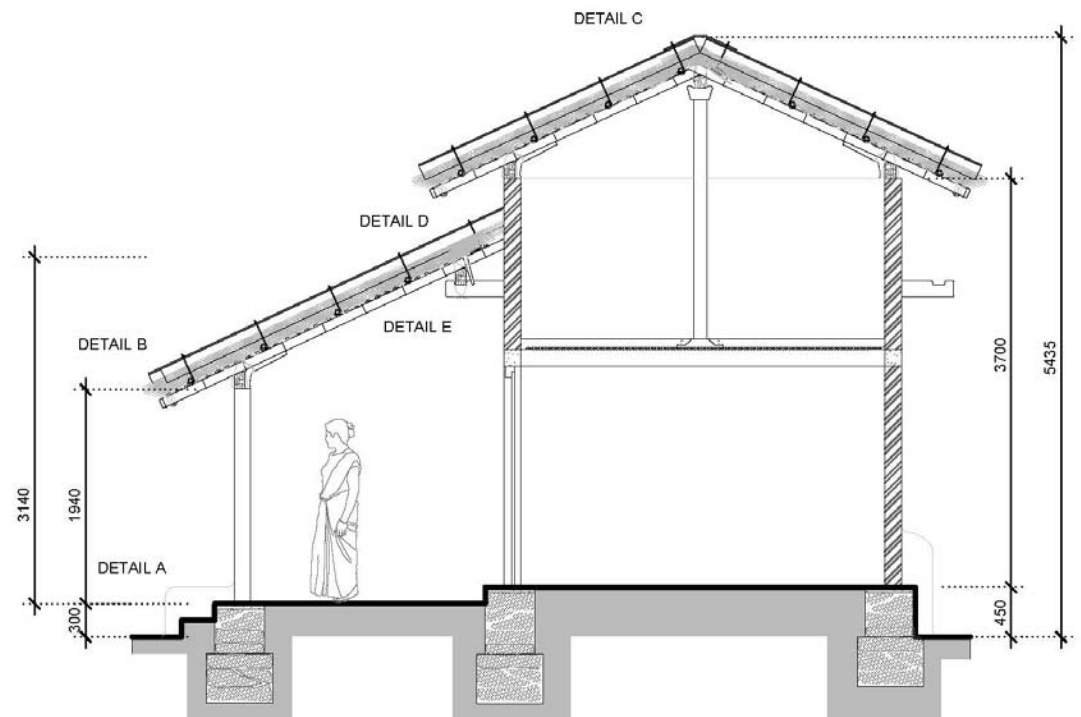
JH-C-01



JHARKHAND

Desirable Features

1. Roof slope angle:
Minimum 25 degree & Maximum 30 degree
2. Roof overhang to be minimum 450 mm
3. RR Stone Masonry Foundation with Cement Mortar
Minimum depth - based on soil strata, minimum 450mm
Minimum width - 450 mm
4. Plinth - minimum 300 mm above the ground level or
150mm above 50 year average flood level whichever
is higher
5. Rigid connection between all structural members to
increase stability
6. Dimension mentioned in the drawings are in
millimeters



SECTION

Cost Estimate for ZONE-C Design 01

SR. NO.		CS Area	Length	Width	Ht	Quantity	Volume	Material cost	Rate per unit (Rs.)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum				
1	FOUNDATION										
	Stone Foundation	0.46	25.15				11.569	14056.335	1215	CMt	8800
	Plinth Filling for Otta	15.5			0.3		4.65	930	200	CMt	
	Plinth Filling for Room	23			0.45		10.35	2070	200	CMt	
W	TOTAL							17056.335			8800
											25856.335
2	WALLS										
	cob 1 (short)	2.36			2		4.72			CMt	10000
	cob 2 (tall)	7.98			3.7		29.526			CMt	
	Deductions	3.6		0.45			1.62			CMt	
	Cob Work (all)						32.626	4078.25	125	CMt	
X	TOTAL							4078.25			10000
											14078.25
3	INTERMEDIATE FLOOR AND ROOF										
	Timber for Intermediate Floor	0.015	30				0.45	2250	5000	CMt	4000
	Bamboo for Intermediate Floor					16		2400	150	No.	
	Other materials for Intermediate Floor							1000			
	Timber for Roof (4" X 6")	0.015	32			1	0.48	2400	5000	CMt	7000
	Timber for Roof (6" X 8")	0.03	2.5			4	0.3	1500	5000	CMt	
	Timber for Roof (other)						1.75	8750	5000	CMt	
	Bamboo for Roof					38		5700	150	No.	
	Bamboo splits for Roof					26		3900	150	No.	
	Sheet					17		13600	800	No.	
	Thatch	41.6			0.4		16.64	1664	100	CMt	
	Other Materials							3000		Lump Sum	
Y	TOTAL							46164			11000
											57164
3	DOORS, WINDOWS AND OTHER FINISHES										
	Door					1		1000	1000	No.	2500
	Windows					2		1000	500	No.	
	Hand plaster and other finishes							2000		Lump Sum	
Z	TOTAL							4000			2500
											6500
								71,298.59			32,300.00
								A			B
	Total (A+B)	103,598.59									
	Total (C)	20,000.00									
	GRAND TOTAL (A+B+C)	123,598.59									
	AREA (sqm)	36.81									
	RATE OF CONSTRUCTION (per sqm)	3,357.74									
	AREA (sqft)	396.08									
	RATE OF CONSTRUCTION (per sqft)	312.06									

Notes : The cost of material is based on the data collected during the field visits. Average or prevalent zone specific rate figures have been used. The rates may change from region to region depending on the distance from urban center, source, geography, availability etc. Bamboo is proposed to be chemically treated bamboo.

The labour rates are derived from the rates observed during the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp and community help components in the construction, the labour rates vary a lot. The labour rates also depend on the time of construction in the in the annual cycle of agrarian productivity.

ZONE - C JH-C-01

Cost breakup

Item	Cost (INR)
Foundation	25,856/-
Walls	14,078/-
Doors/Windows	6,500/-
Floor and Roof	57,164
Total	1,03,599/-



JHARKHAND

ZONE-D

Zone D comprise 9 districts

1. Gharwa
2. Palamu
3. Chatra
4. Latehar
5. Hazaribagh
6. Koderma
7. Giridih
8. Lohardaga
9. Ghumla

Resources Available

- Timber And Bamboo
- Fly Ash Brick
- Stone

ZoneD comprises of five typologies

JH-D-01

JH-D-02

JH-D-03

JH-D-04

JH-D-05

These typologies are applicable to all the zones.



JHARKHAND



JH-D-01 Core House



Extension 1



Extension 2



JH-D-02 Core House



Extension 1



Extension 2



JH-D-03 Core House



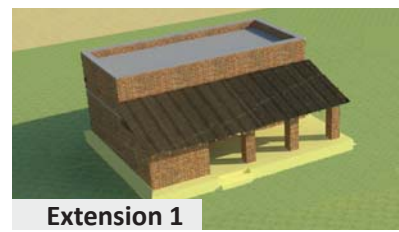
Extension 1



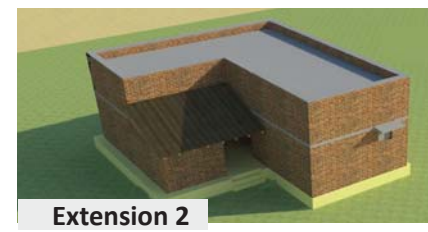
Extension 2



JH-D-04 Core House



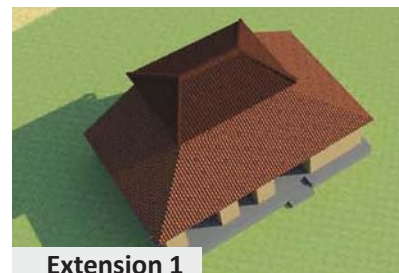
Extension 1



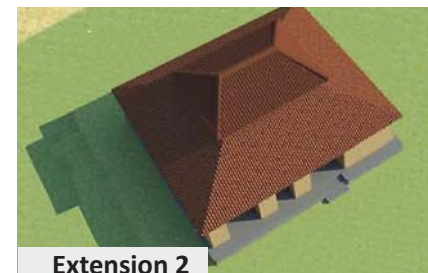
Extension 2



JH-D-05 Core House



Extension 1



Extension 2



JH-D-01



Extension 1



Extension 2

Highlights of the Prototype - JH-D-01

- Built up area of the house is optimised to 51.90 sq.m. with possibility for incremental growth upto 176 sq.m.
- Construction with load bearing tapering cob walls, reducing from bottom to top for increased stability.
- A continuous timber lintel band is provided to support the loft & protect against seismic activities.
- Roofs are covered with bengal tiles with timber roof understructure. Treated bamboo is used for rafters, purlins & battens.
- Main spaces of the house including room, semi-open veranda & kitchen are organised around a central courtyard.
- Courtyard ventilates the surrounding rooms, provides a space for interaction.

Recommendations for Built Form - ZONE D		
Plan Layout	Plinth/Floor	Roof Profile
Characterised by Santhal cultural associations. Large open spaces in form of central courtyard, backyard or front yard. Elements like tulsi- kyari and intermediate loft – incorporated. Loft design structure.	Normal plinth design.	Sloped roof.

Recommendations for construction systems	
Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> Brick foundation with cement mortar Minimum depth – 450mm Minimum width 450mm
Plinth	<ul style="list-style-type: none"> Minimum(300mm or 150mm more than last 50 year flood level)
Wall	<ul style="list-style-type: none"> Brick masonry with wattle and daub walling system. Continuous earthquake bands in the structure. Daubing is done on a wattle frame construction structure.
Wall Finish	<ul style="list-style-type: none"> Stabilised Mud wall plastered finish.
Roof Structure	<ul style="list-style-type: none"> Roof slope angle – min 38 & max 45. Covered with sheet & has treated bamboo understructure.
Roof Cover	<ul style="list-style-type: none"> Bengal tile.
Floor	<ul style="list-style-type: none"> Mud filling over plastic sheet

ZONE - D JH-D-01



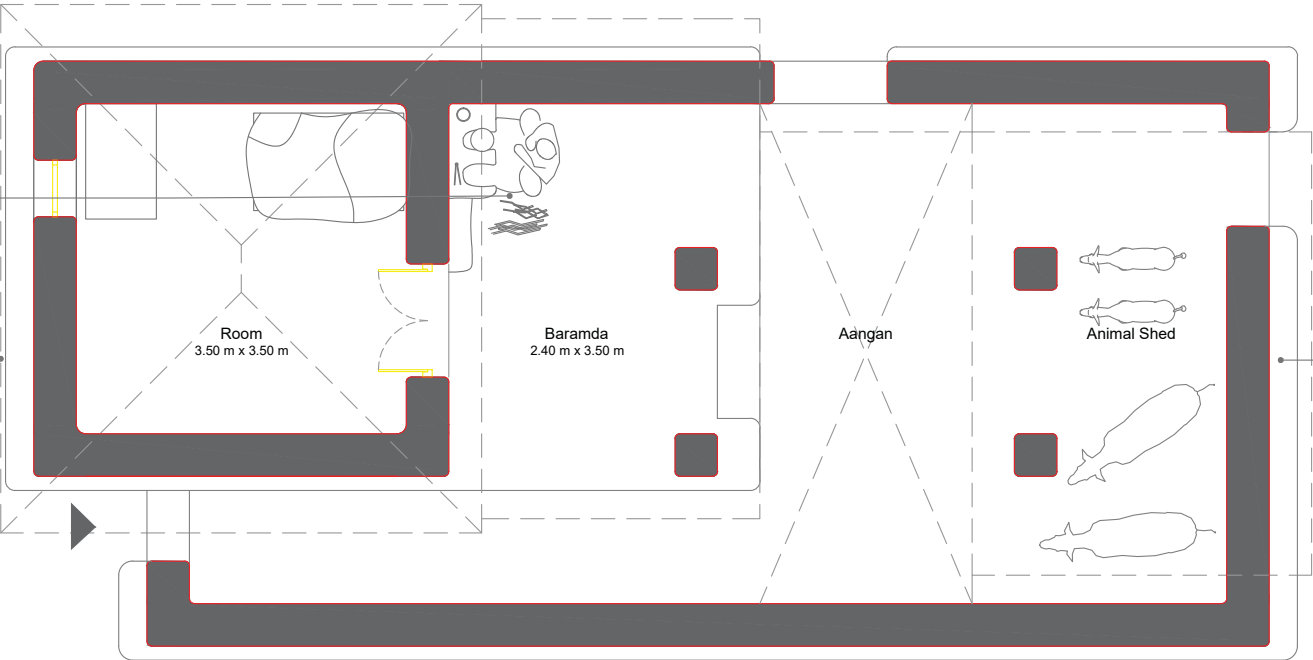
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ZONE - D
JH-D-01

Total Cost ₹ 1,27,724/-

Cooking space,
largely used by female
members of the house

Roof line



FLOOR PLAN

Built Up Area 51.90 sqm

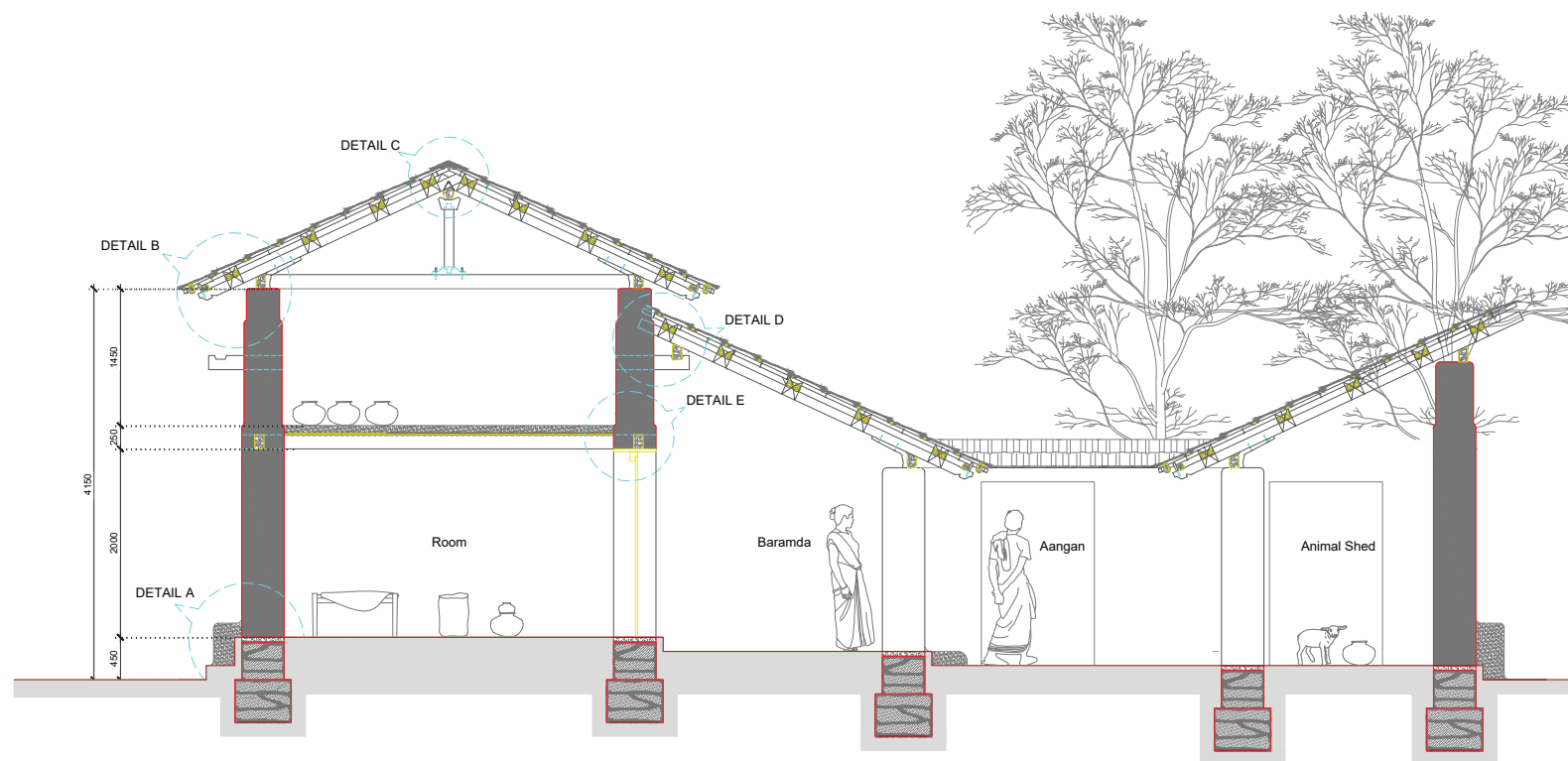


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TYPICAL PLAN

ZONE - D

JH-D-01



SCALE 0 0.5 m 1.5 m 3.0 m

SECTION



JHARKHAND

ZONE - D

JH-D-01

Cost breakup

Item	Cost (INR)
Foundation	34,979/-
Walls	19,445/-
Doors/Windows	67,300/-
Floor and Roof	6,000/-
Total	1,27,724/-



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Cost Estimate for ZONE-D Design 01

SR. NO.		CS Area	Length	Width	Ht	Quantity	Volume	Material cost	Rate per unit (Rs.)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum				
1	FOUNDATION										
	Stone Foundation	0.46	41.9				19.274	23417.91	1215	CMt	8800
	Plinth Filling for House	36.5			0.3		10.95	2190	200	CMt	
	Plinth Filling for Cowshed	19.06			0.15		2.859	571.8	200	CMt	
W	TOTAL							26179.71			8800
											34979.71
2	WALLS										
	cob 1 (short)	11.64			2.5		29.1			CMt	12500
	cob 2 (tall)	6.885			4.1		28.2285			CMt	
	Deductions	3.93		0.45			1.7685			CMt	
	Cob Work (all)						55.56	6945	125	CMt	
X	TOTAL							6945			12500
											19445
3	INTERMEDIATE FLOOR AND ROOF										
	Timber for Intermediate Floor	0.015	20				0.3	1500	5000	CMt	4000
	Bamboo for Intermediate Floor					14		2100	150	per Piece	
	Other materials for Intermediate Floor							1000		Lump Sum	9000
	Timber for Roof (4" X 6")	0.015	42			1	0.63	3150	5000	CMt	
	Timber for Roof (6" X 8")	0.03	2.5			4	0.3	1500	5000	CMt	
	Timber for Roof (other)						3	15000	5000	CMt	
	Bamboo for Roof					58		8700	150	per Piece	
	Bamboo splits					46		6900	150	per piece	
	Manglore tiles					1050		9450	9	per Piece	
	Other Materials							5000		Lump Sum	
Y	TOTAL							54300			13000
											67300
3	DOORS, WINDOWS AND OTHER FINISHES										
	Door					1		1000	1000	per Piece	2500
	Windows					1		500	500	per Piece	
	Hand plaster and other finishes							2000		Lump Sum	
Z	TOTAL							3500			2500
											6000
								TOTAL (W+X+Y+Z)	90,924.71		36,800.00
								A			B
	Total (A+B)	127,724.71									
	Total (C)	20,000.00									
	GRAND TOTAL (A+B+C)	147,724.71									
	AREA (sqm)	50.15									
	RATE OF CONSTRUCTION (per sqm)	2,945.66									
	AREA (sqft)	539.61									
	RATE OF CONSTRUCTION (per sqft)	273.76									

Notes : The cost of material is based on the data collected during the field visits. Average or prevalent zone specific rate figures have been used. The rates may change from region to region depending on the distance from urban center, source, geography, availability etc. Bamboo is proposed to be chemically treated bamboo.

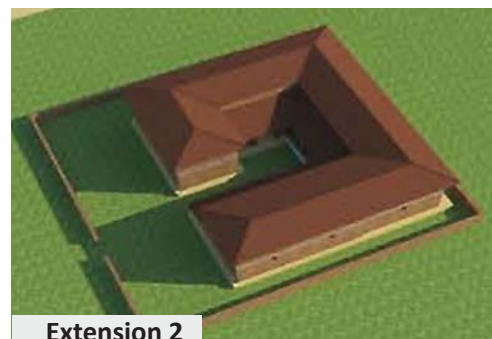
The labour rates are derived from the rates observed during the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp and community help components in the construction, the labour rates vary a lot. The labour rates also depend on the time of construction in the in the annual cycle of agrarian productivity.



JH-D-02 Core House



Extension 1



Extension 2

Highlights of the Prototype - JH-D-02

- Built up area of the house is optimized to 25.88 sq.m. with possibility for incremental growth up to 198.0 sq.m.
- The main house consists of a room and veranda. The room is used to store agricultural produce where as the veranda acts as a space for ancillary activities such as cooking and rearing cattle.
- Wall is constructed with stabilized adobe blocks
- Roof is covered with country tiles and timber- bamboo under structure

Recommendations for Built Form - ZONE D		
Plan Layout	Plinth/Floor	Roof Profile
Characterised by Santhal cultural associations. Large open spaces in form of central courtyard, backyard or front yard. Elements like tulsi- kyari and intermediate loft – incorporated. Loft design structure.	Normal plinth design.	Sloped roof.

Recommendations for construction systems	
Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> • Brick foundation. • Minimum depth – 450mm • Minimum width 450mm
Plinth	<ul style="list-style-type: none"> • Minimum(300mm or 150mm more than last 50 year flood level)
Wall	<ul style="list-style-type: none"> • Brick masonry with wattle and daub walling system. • Continuous earthquake bands in the structure. • Daubing is done on a wattle frame construction structure.
Wall Finish	<ul style="list-style-type: none"> • Stabilised Mud wall plastered finish.
Roof Structure	<ul style="list-style-type: none"> • Roof slope angle – min 38 & max 45. • Covered with sheet & has treated bamboo understructure.
Roof Cover	<ul style="list-style-type: none"> • Bengal tile.
Floor	<ul style="list-style-type: none"> • Mud filling over plastic sheet

ZONE - D JH-D-02



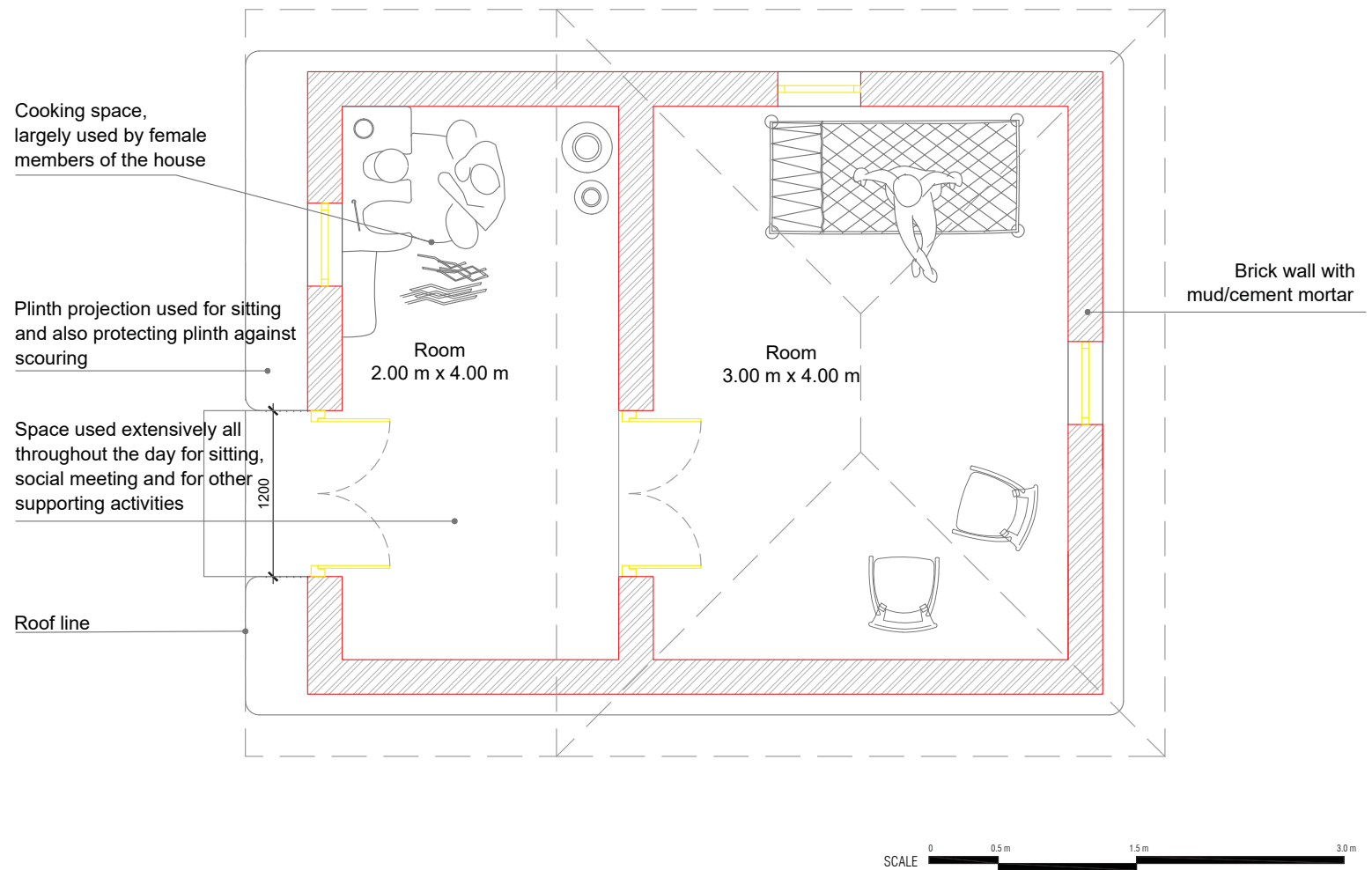
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ZONE - D JH-D-02

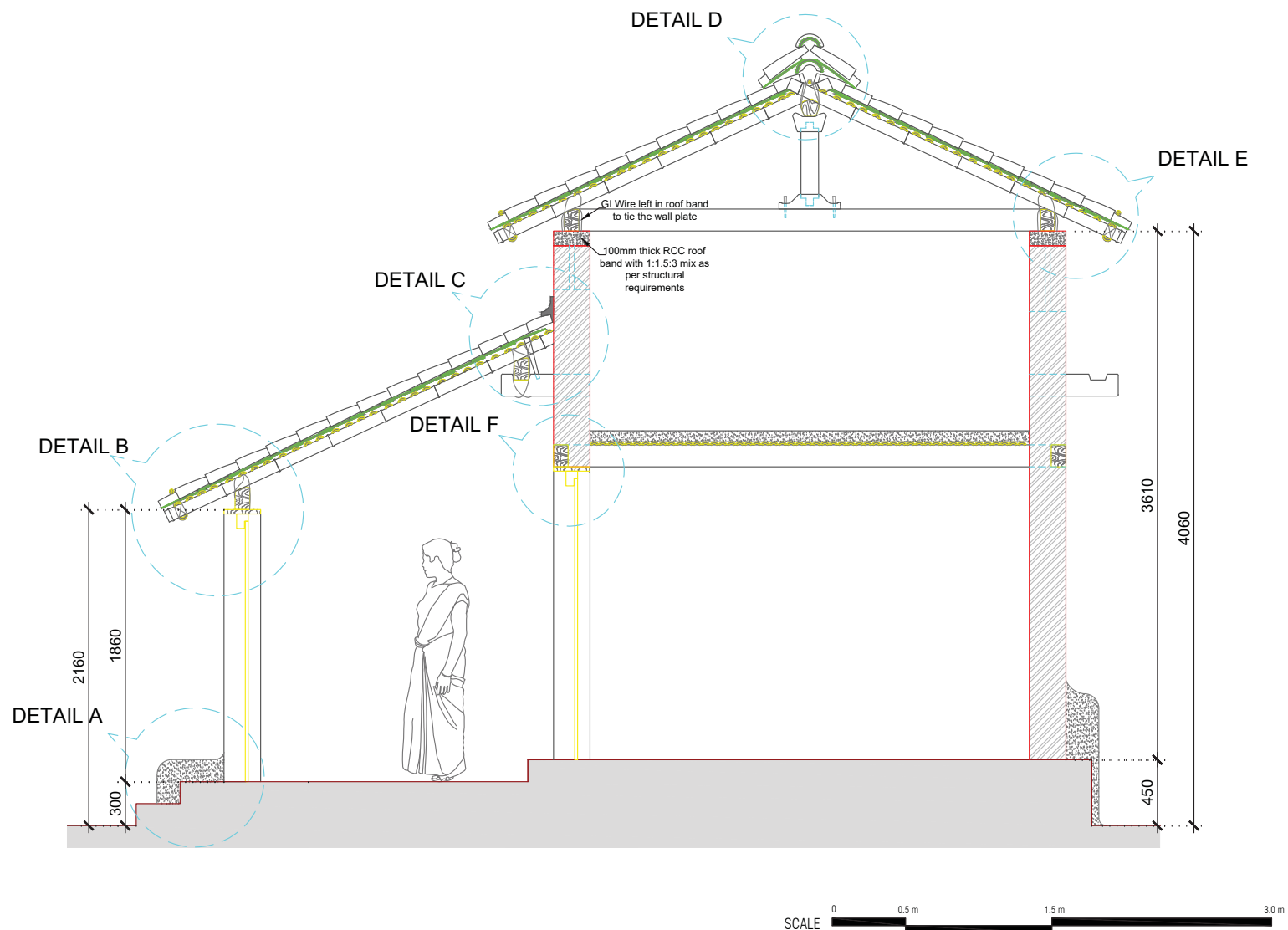
Total Cost ₹ 1,06,276/-



JHARKHAND



TYPICAL PLAN



SECTION

ZONE - D
JH-D-02



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ZONE - D

JH-D-02

Cost breakup

Item	Cost (INR)
Foundation	23,212/-
Walls	35,250/-
Doors/Windows	7,500/-
Floor and Roof	40,314/-
Total	1,06,276/-



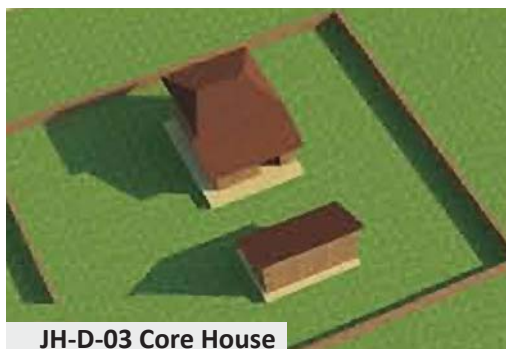
JHARKHAND

Cost Estimate for ZONE-D Design 02

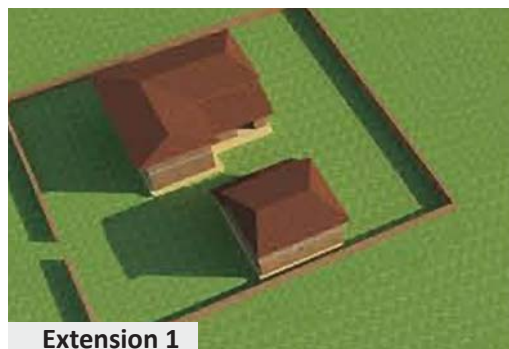
SR. NO.		CS Area	Length	Width	Ht	Quantity	Volume	Material cost	Rate per unit (Rs.)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum				
1	FOUNDATION										
	Stone Foundation	0.42	23.4				9.828	11941.02	1215	CMt	8800
	Plinth Filling for Otta	12.59			0.3		3.777	755.4	200	CMt	
	Plinth Filling for Room	19.06			0.45		8.577	1715.4	200	CMt	
W	TOTAL							14411.82			8800
											23211.82
2	WALLS										
	Brick 1 (short)	1.9			1.86		3.534			per brick	12500
	Brick 2 (tall)	3.96			3.61		14.2956			per brick	
	Deductions	3.84		0.25			0.96			cMt	
	Brick Work (all)					6500	16.8696	22750	3.5	per brick	
X	TOTAL							22750			12500
											35250
3	INTERMEDIATE FLOOR AND ROOF										
	Timber for Intermediate Floor	0.015	31				0.465	2325	5000	CMt	3500
	Bamboo for Intermediate Floor					14		2100	150	per Piece	
	Other materials for Intermediate Floor							2000		Lump Sum	
	Timber for Roof (4" X 6")	0.015	20			1	0.3	1500	5000	CMt	7000
	Timber for Roof (6" X 8")	0.03	0.63			2	0.0378	189	5000	CMt	
	Timber for Roof (other)						1.5	7500	5000	CMt	
	Bamboo for Roof					20		3000	150	per Piece	
	Bamboo splits					28		4200	150	per piece	
	Country tiles							4000	1		
	Other Materials							3000		Lump Sum	
Y	TOTAL							29814			10500
											40314
3	DOORS, WINDOWS AND OTHER FINISHES										
	Door					2		2000	1000	per Piece	2500
	Windows					2		1000	500	per Piece	
	Hand plaster and other finishes							2000		Lump Sum	
Z	TOTAL							5000			2500
											7500
								71,975.82			34,300.00
								A			B
	Total (A+B)	106,275.82									
	Total (C)	20,000.00									
	GRAND TOTAL (A+B+C)	126,275.82									
	AREA (sqm)	30.94									
	RATE OF CONSTRUCTION (per sqm)	4,081.31									
	AREA (sqft)	332.91									
	RATE OF CONSTRUCTION (per sqft)	379.30									

Notes : The cost of material is based on the data collected during the field visits. Average or prevalent zone specific rate figures have been used. The rates may change from region to region depending on the distance from urban center, source, geography, availability etc. Bamboo is proposed to be chemically treated bamboo.

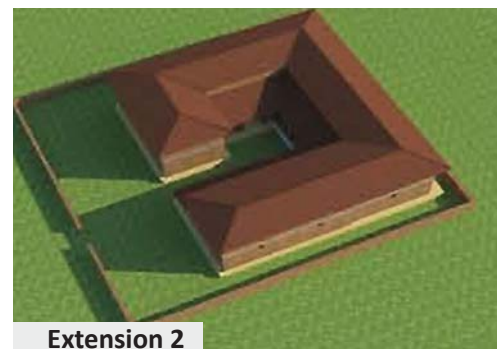
The labour rates are derived from the rates observed during the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp and community help components in the construction, the labour rates vary a lot. The labour rates also depend on the time of construction in the in the annual cycle of agrarian productivity.



JH-D-03 Core House



Extension 1



Extension 2

Highlights of the Prototype - JH06

- Built up area of the house is optimised to 25.86 sq.m. with possibility for incremental growth upto 185 sq.m.
- Construction is done with load bearing stabilised adobe bricks.
- A continuous timber lintel band is provided to support the loft & protect against seismic activities.
- Roofs are covered with country tiles with timber roof understructure.
- Treated bamboo is used for rafters, purlins & battens.
- A loft has been provided for additional storage space.
- The main house consists of 2 rooms. 1 room is used to store agricultural produce where as at the other acts as a space for ancillary activities such as cooking & rearing cattle.

Recommendations for Built Form - ZONE D		
Plan Layout	Plinth/Floor	Roof Profile
Characterised by Santhal cultural associations. Large open spaces in form of central courtyard, backyard or front yard. Elements like tulsi- kyari and intermediate loft – incorporated. Loft design structure.	Normal plinth design.	Sloped roof.

Recommendations for construction systems	
Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> Brick foundation with cement mortar Minimum depth – 450mm Minimum width 450mm
Plinth	<ul style="list-style-type: none"> Minimum(300mm or 150mm more than last 50 year flood level)
Wall	<ul style="list-style-type: none"> Brick masonry with wattle and daub walling system. Continuous earthquake bands in the structure. Daubing is done on a wattle frame construction structure.
Wall Finish	<ul style="list-style-type: none"> Mud wall plastered finish.
Roof Structure	<ul style="list-style-type: none"> Roof slope angle – min 38 & max 45. Covered with sheet & has treated bamboo understructure.
Roof Cover	<ul style="list-style-type: none"> Bengal tile.
Floor	<ul style="list-style-type: none"> Mud filling over plastic sheet

ZONE - D JH-D-03



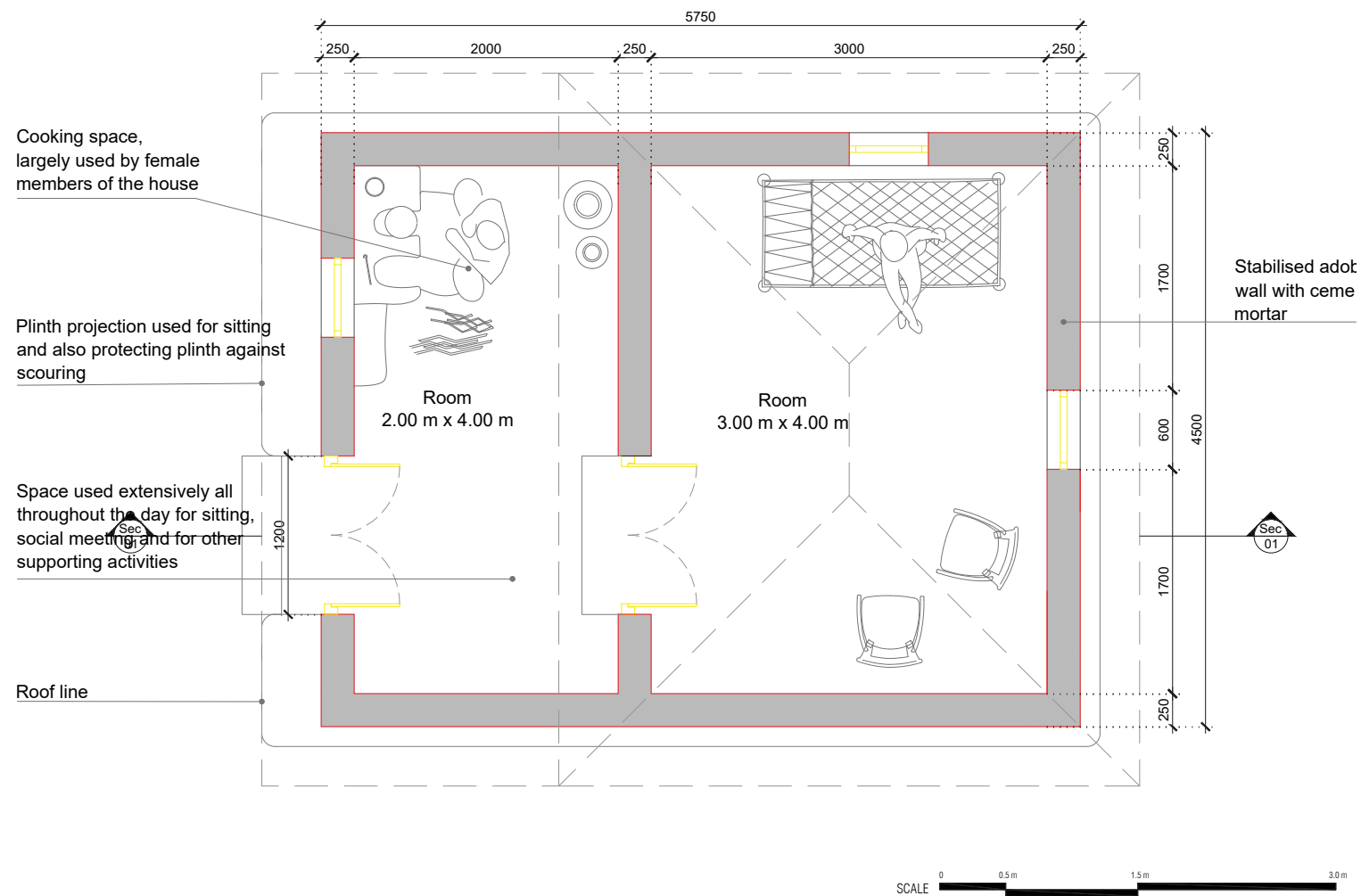
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ZONE - D JH-D-03

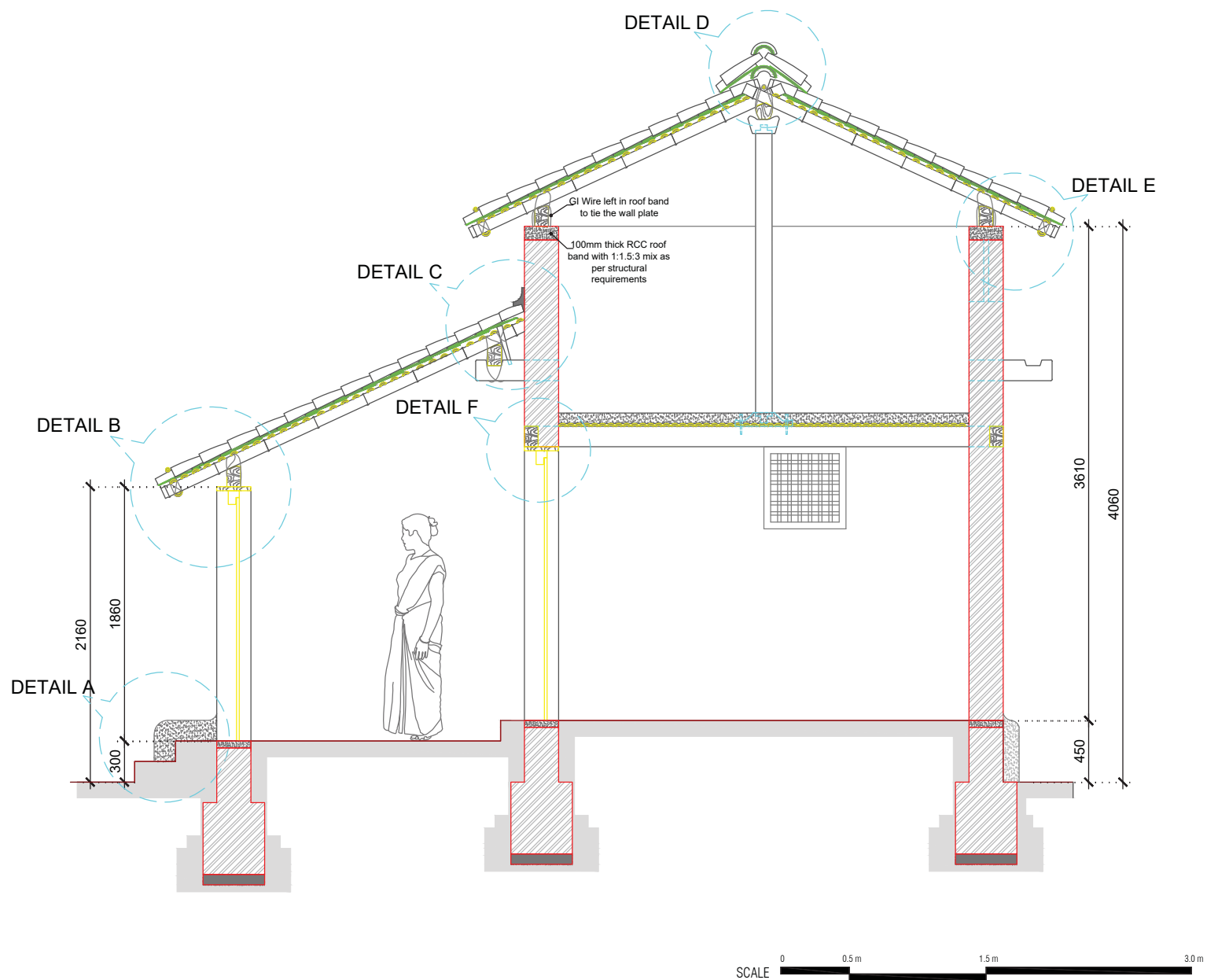
Total Cost ₹ 1,48,157/-



JHARKHAND



TYPICAL PLAN



SECTION

ZONE - D
JH-D-03



JHARKHAND

ZONE - D JH-D-03

Cost breakup

Item	Cost (INR)
Foundation	31,465/-
Walls	60,492/-
Doors/Windows	8,000/-
Floor and Roof	48,200/-
Total	1,48,157/-



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Cost Estimate for ZONE-D Design 03

SR. NO.		CS Area	Length	Width	Ht	Quantity	Volume	Material cost	Rate per unit (Rs.)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum				
1	FOUNDATION										
	Stabilized Adobe Foundation with cement mortar	0.38	23.5				8.93	20315.75	2275	CMt	
	Plinth Filling for Otta	12.9			0.3		3.87	774	200	CMt	8800
	Plinth Filling for Room	17.5			0.45		7.875	1575	200	CMt	
W	TOTAL							22664.75			8800
											31464.75
2	WALLS										
	Adobe 1 (short)	2.1			1.86		3.906			CMt	
	Adobe 2 (tall)	6			3.61		21.66			CMt	12500
	Deductions	4.2		0.25			1.57			CMt	
	Adobe Masonry Work (all)						23.996	47992	2000	CMt	
X	TOTAL							47992			12500
											60492
3	INTERMEDIATE FLOOR AND ROOF										
	Timber for Intermediate Floor	0.015	30				0.45	2250	5000	CMt	4000
	Bamboo for Intermediate Floor					18		2700	150	No.	
	Other materials for Intermediate Floor							1000		No.	
	Timber for Roof (4" X 6")	0.015	32			1	0.48	2400	5000	CMt	
	Timber for Roof (6" X 8")	0.03	2.5			4	0.3	1500	5000	CMt	
	Timber for Roof (other)						1.75	8750	5000	CMt	
	Bamboo for Roof					38		5700	150	No.	
	Bamboo splits for Roof					26		3900	150	No.	
	Country tiles							4000	1	No.	
	Other Materials							3000		Lump Sum	
Y	TOTAL							35200			13000
											48200
3	DOORS, WINDOWS AND OTHER FINISHES										
	Door					2		2000	1000	per Piece	
	Windows					3		1500	500	per Piece	2500
	Hand plaster and other finishes							2000		Lump Sum	
Z	TOTAL							5500			2500
											8000
								111,356.75			36,800.00
								A			B
	Total (A+B)	148,156.75									
	Total (C)	20,000.00									
	GRAND TOTAL (A+B+C)	168,156.75									
	AREA (sqm)	32.86									
	RATE OF CONSTRUCTION (per sqm)	5,117.37									
	AREA (sqft)	353.57									
	RATE OF CONSTRUCTION (per sqft)	475.59									

Notes : The cost of material is based on the data collected during the field visits. Average or prevalent zone specific rate figures have been used. The rates may change from region to region depending on the distance from urban center, source, geography, availability etc. Bamboo is proposed to be chemically treated bamboo.

The labour rates are derived from the rates observed during the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp and community help components in the construction, the labour rates vary a lot. The labour rates also depend on the time of construction in the in the annual cycle of agrarian productivity.



JH-D-04 Core House



Extension 1



Extension 2

Highlights of the Prototype - JH07

- Built up area of the house is optimised to 22.80 sq.m. with possibility for incremental growth upto 60.70 sq.m.
- Construction is done with load bearing stabilised adobe blocks or burnt bricks.
- A continuous R.C.C. lintel band is provided to support the loft & protect against seismic activities.
- The roof over the rooms is RCC flat slab, while the verandah is covered with corrugated sheets using timber and bamboo understructure. the bamboo is chemically treated for longevity.
- An RCC shelf is provided at lintel level for storage.
- The main house consists of 2 rooms. 1 room is used to store agricultural produce where as at the other acts as a space for ancillary activities such as cooking & rearing cattle.

Recommendations for Built Form - ZONE D

Plan Layout	Plinth/Floor	Roof Profile
Characterised by Santhal cultural associations. Large open spaces in form of central courtyard, backyard or front yard. Elements like tulsi- kyari and intermediate loft – incorporated. Loft design structure.	Normal plinth design.	Sloped roof.

Recommendations for construction systems

Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> • Brick foundation with cement mortar • Minimum depth – 450mm • Minimum width 450mm
Plinth	<ul style="list-style-type: none"> • Minimum(300mm or 150mm more than last 50 year flood level)
Wall	<ul style="list-style-type: none"> • Brick masonry with wattle and daub walling system. • Continuous earthquake bands in the structure. • Daubing is done on a wattle frame construction structure.
Wall Finish	<ul style="list-style-type: none"> • Stabilised Mud plastered finish.
Roof Structure	<ul style="list-style-type: none"> • Roof slope angle – min 38 & max 45. • Covered with sheet & has treated bamboo understructure.
Roof Cover	<ul style="list-style-type: none"> • Bengal tile.
Floor	<ul style="list-style-type: none"> • Mud filling over plastic sheet

ZONE - D JH-D-04



JHARKHAND

ZONE - D

JH-D-04

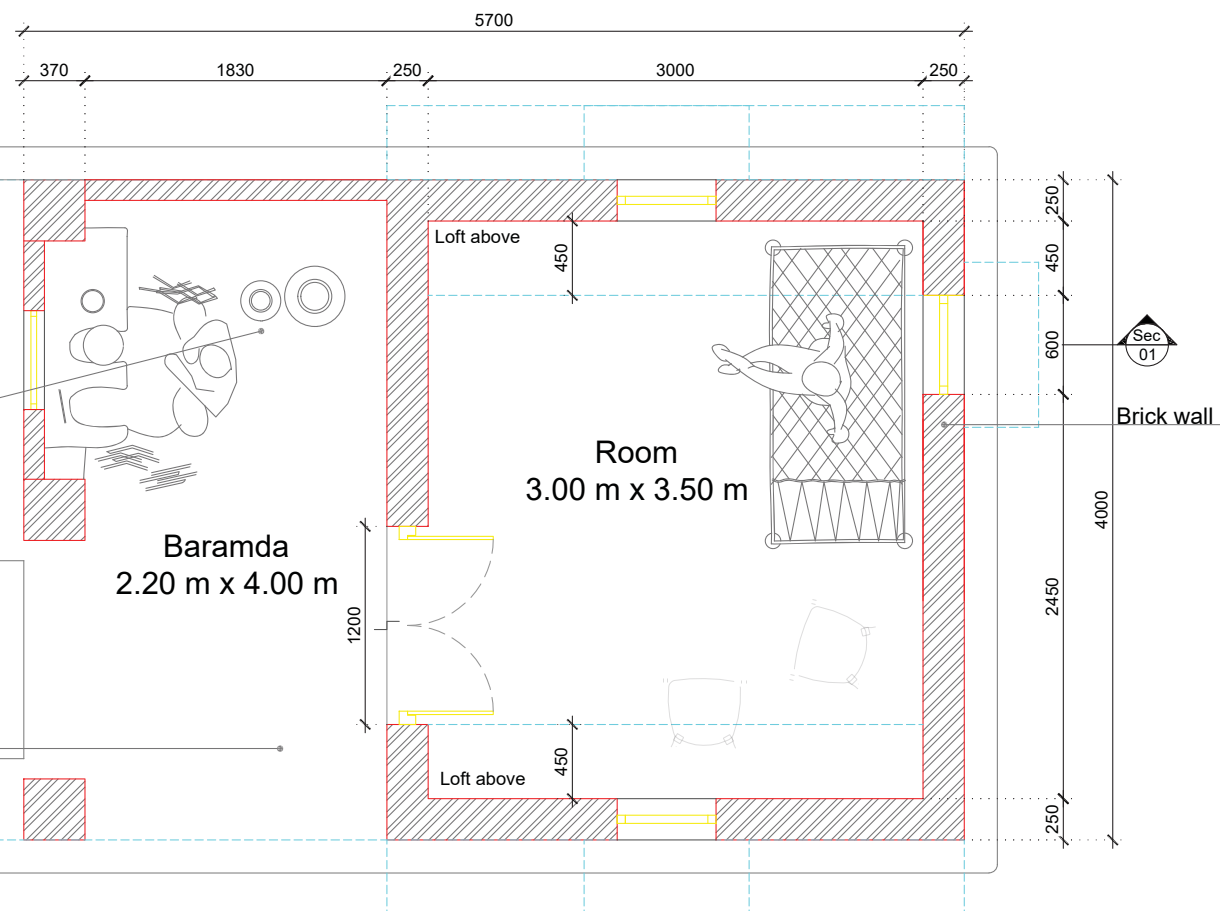
Total Cost ₹ 1,36,415/-

Cooking space,
largely used by female
members of the house

Plinth projection used for sitting
and also protecting plinth against
scouring

Space used extensively all
throughout the day for sitting,
social meeting and for other
supporting activities

Roof line

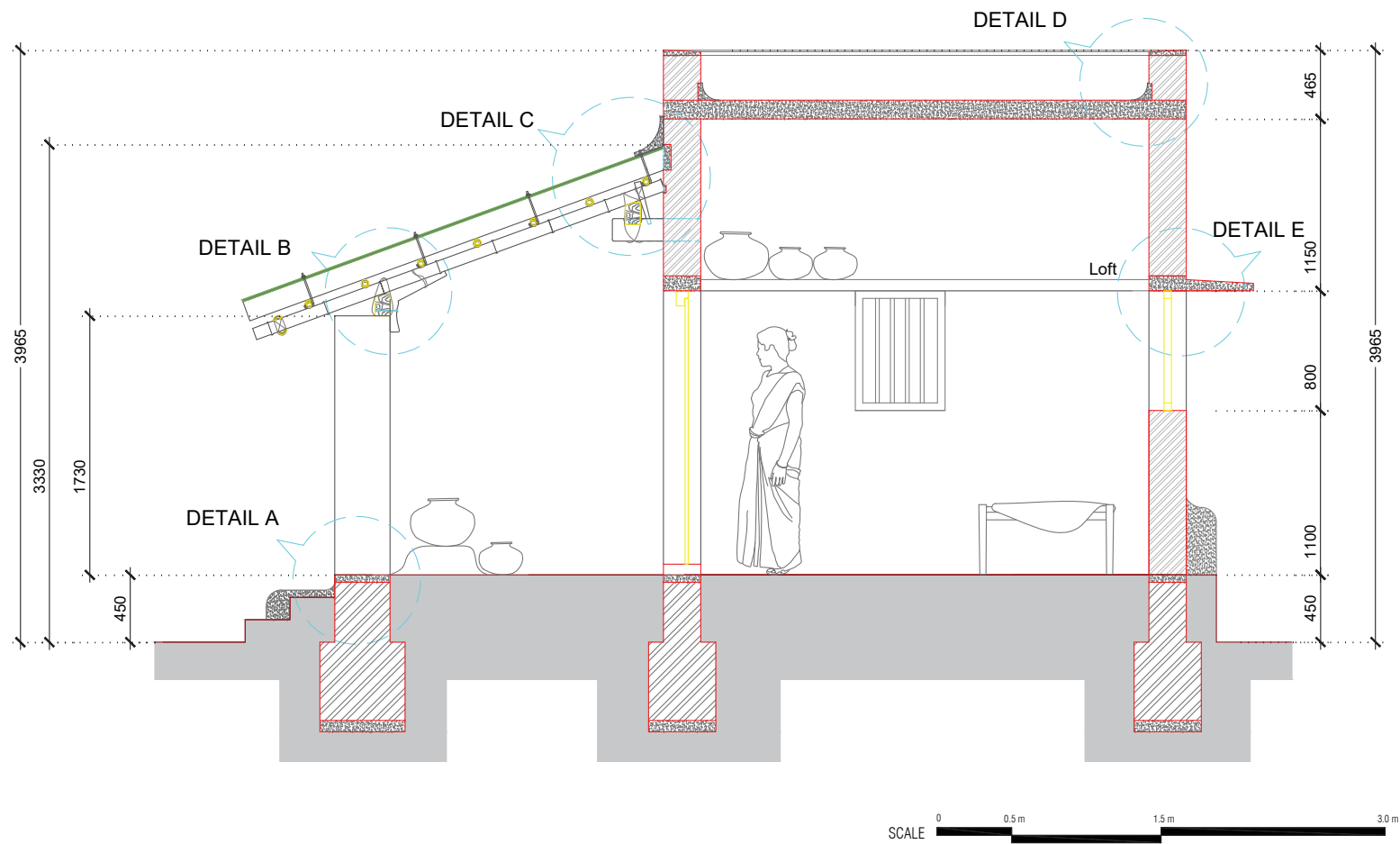


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TYPICAL PLAN

ZONE - D

JH-D-04



SECTION



JHARKHAND

ZONE - D

JH-D-04

Cost breakup

Item	Cost (INR)
Foundation	40,921/-
Walls	54,354/-
Doors/Windows	8,500/-
Roof and RCC	32,640/-
Total	1,36,415/-



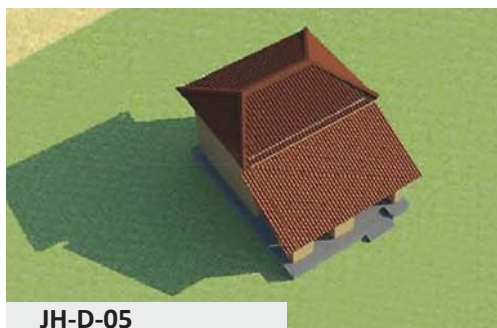
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Cost Estimate for ZONE-D Design 04

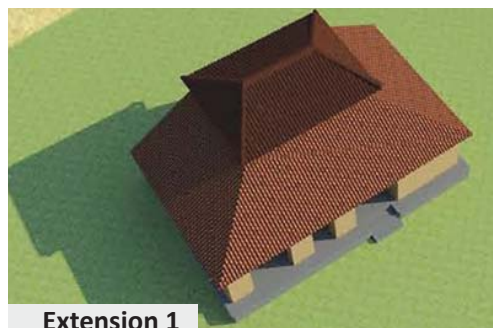
SR. NO.		CS Area	Length	Width	Ht	Quantity	Volume	Material cost	Rate per unit (Rs.)	Unit	Labour cost
		sqm	m	m	m	Nos.	cum				
1	FOUNDATION										
	Brick Foundation	0.5	23.5			5875	11.75	23,500.00	4	No.	8,800.00
	Cement mortar						11.75	6,462.50	550	CMt	
	Plinth Filling for Otta	11.5			0.3		3.45	690.00	200	CMt	
	Plinth Filling for Room	16.32			0.45		7.344	1,468.80	200	CMt	
W	TOTAL							32,121.30			8,800.00
											40,921.30
2	WALLS										
	Brick 1 (short)	0.8			1.72		1.376			CMt	12,500.00
	Brick 2 (tall)	3.5			3.72		13.02			CMt	
	Deductions	4.5		0.25			1.125			CMt	
	Brick Work (all)					6635.5	13.271	26,542.00	4	No.	
	Cement mortar						13.271	7,299.05	550	CMt	2,100.00
	RCC plinth & lintel		28	0.25	0.1		0.7	4,900.00	7000	CMt	
	RCC chajja		1	0.45	0.075	3	0.10125	708.75	7000	CMt	
X	TOTAL							39,449.80			14,903.75
											54,353.55
3	ROOF AND OTHER RCC WORK										
	RCC slab	14			0.15		2.1	14,700.00	7000	CMt	6,300.00
	Timber for Roof (4" X 6")	0.015	11.2			1	0.168	840.00	5000	CMt	4,000.00
	Bamboo for Roof					4		600.00	150	No.	
	sheet				4			3,200.00	800	No.	
	Other Materials							3,000.00		Lump Sum	
Y	TOTAL							22,340.00			10,300.00
											32,640.00
3	DOORS, WINDOWS AND OTHER FINISHES										
	Door					1		1,000.00	1000	No.	2,500.00
	Windows					4		2,000.00	500	No.	
	Plaster and other finishes							3,000.00		Lump Sum	
Z	TOTAL							6,000.00			2,500.00
											8,500.00
								99,911.10			36,503.75
								A			B
	Total (A+B)	136,414.85									
	Total (C)	20,000.00									
	GRAND TOTAL (A+B+C)	156,414.85									
	AREA (sqm)	26.46									
	RATE OF CONSTRUCTION (per sqm)	5,911.37									
	AREA (sqft)	284.71									
	RATE OF CONSTRUCTION (per sqft)	549.38									

Notes : The cost of material is based on the data collected during the field visits. Average or prevalent zone specific rate figures have been used. The rates may change from region to region depending on the distance from urban center, source, geography, availability etc. Bamboo is proposed to be chemically treated bamboo.

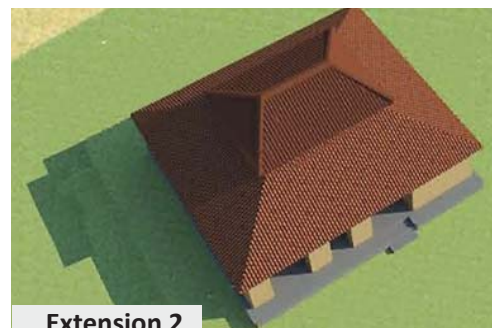
The labour rates are derived from the rates observed during the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp and community help components in the construction, the labour rates vary a lot. The labour rates also depend on the time of construction in the in the annual cycle of agrarian productivity.



JH-D-05



Extension 1



Extension 2

Highlights of the Prototype - JH-D-05

- Built up area of the house is optimized to 25.86 sq.m. with possibility for incremental growth upto 78.0 sq.m.
- Construction is done with rammed earth.
- A continuous timber lintel band is provided to support the loft & protect against seismic activities.
- Roofs are covered with sheet and thatch roofing over timber and bamboo under-structure. Treated bamboo is used for rafters, purlins & battens.
- A loft has been provided for additional storage space.
- The main house consists of 2 rooms. 1 room is used to store agricultural produce where as at the other acts as a space for ancillary activities such as cooking & rearing cattle.

Recommendations for Built Form - ZONE D		
Plan Layout	Plinth/Floor	Roof Profile
Characterised by Santhal cultural associations. Large open spaces in form of central courtyard, backyard or front yard. Elements like tulsi- kyari and intermediate loft – incorporated. Loft design structure.	Normal plinth design.	Sloped roof.

Recommendations for construction systems	
Components	Recommended Specifications
Foundations	<ul style="list-style-type: none"> • Brick foundation with cement mortar • Minimum depth – 450mm • Minimum width 450mm
Plinth	<ul style="list-style-type: none"> • Minimum(300mm or 150mm more than last 50 year flood level)
Wall	<ul style="list-style-type: none"> • Brick masonry with wattle and daub walling system. • Continuous earthquake bands in the structure. • Daubing is done on a wattle frame construction structure.
Wall Finish	<ul style="list-style-type: none"> • Stabilised Mud plastered finish.
Roof Structure	<ul style="list-style-type: none"> • Roof slope angle – min 38 & max 45. • Covered with sheet & has treated bamboo understructure.
Roof Cover	<ul style="list-style-type: none"> • Bengal tile.
Floor	<ul style="list-style-type: none"> • Mud filling over plastic sheet

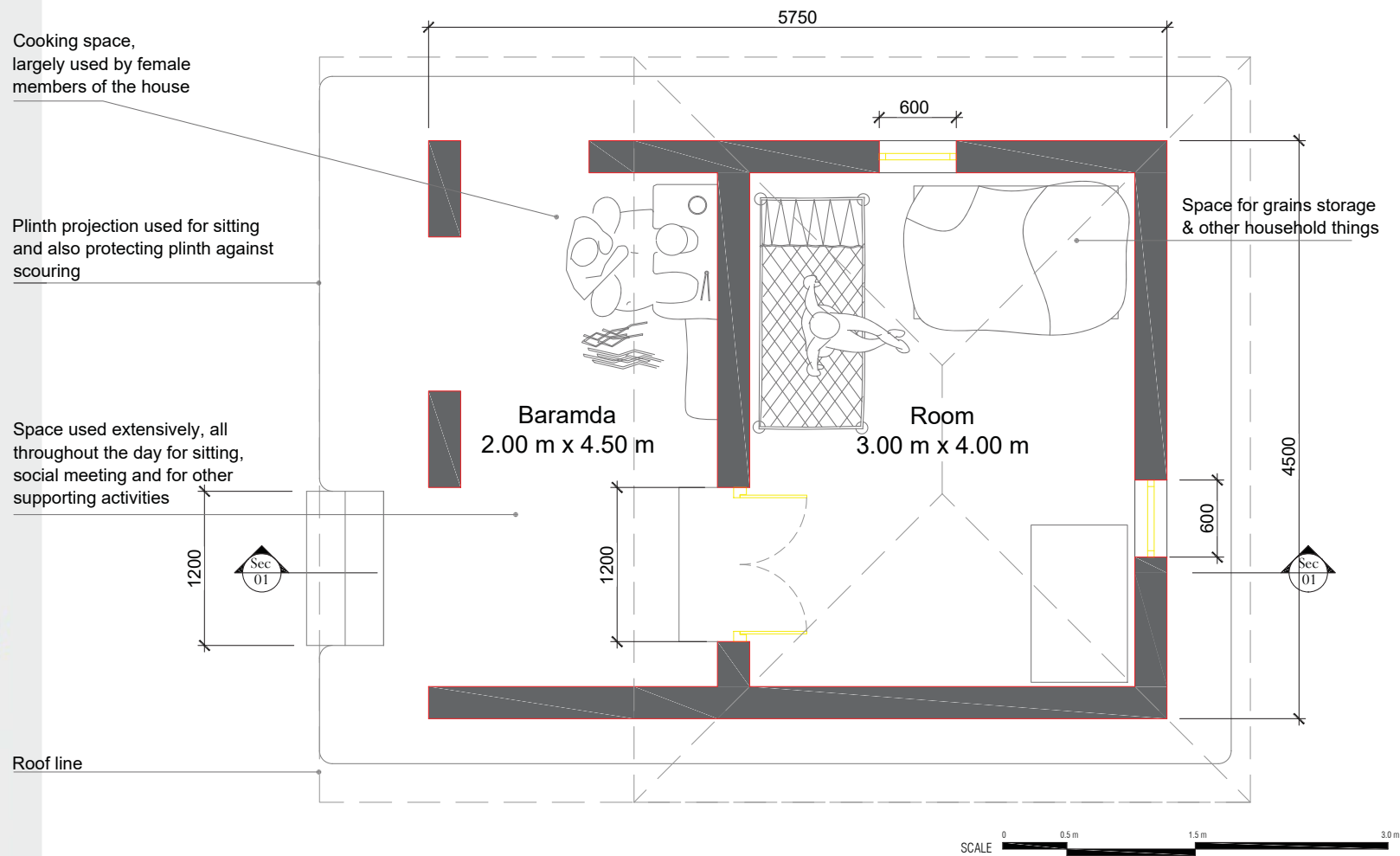
ZONE - D JH-D-05



JHARKHAND

ZONE - D JH-D-05

Total Cost ₹ 1,38,711/-

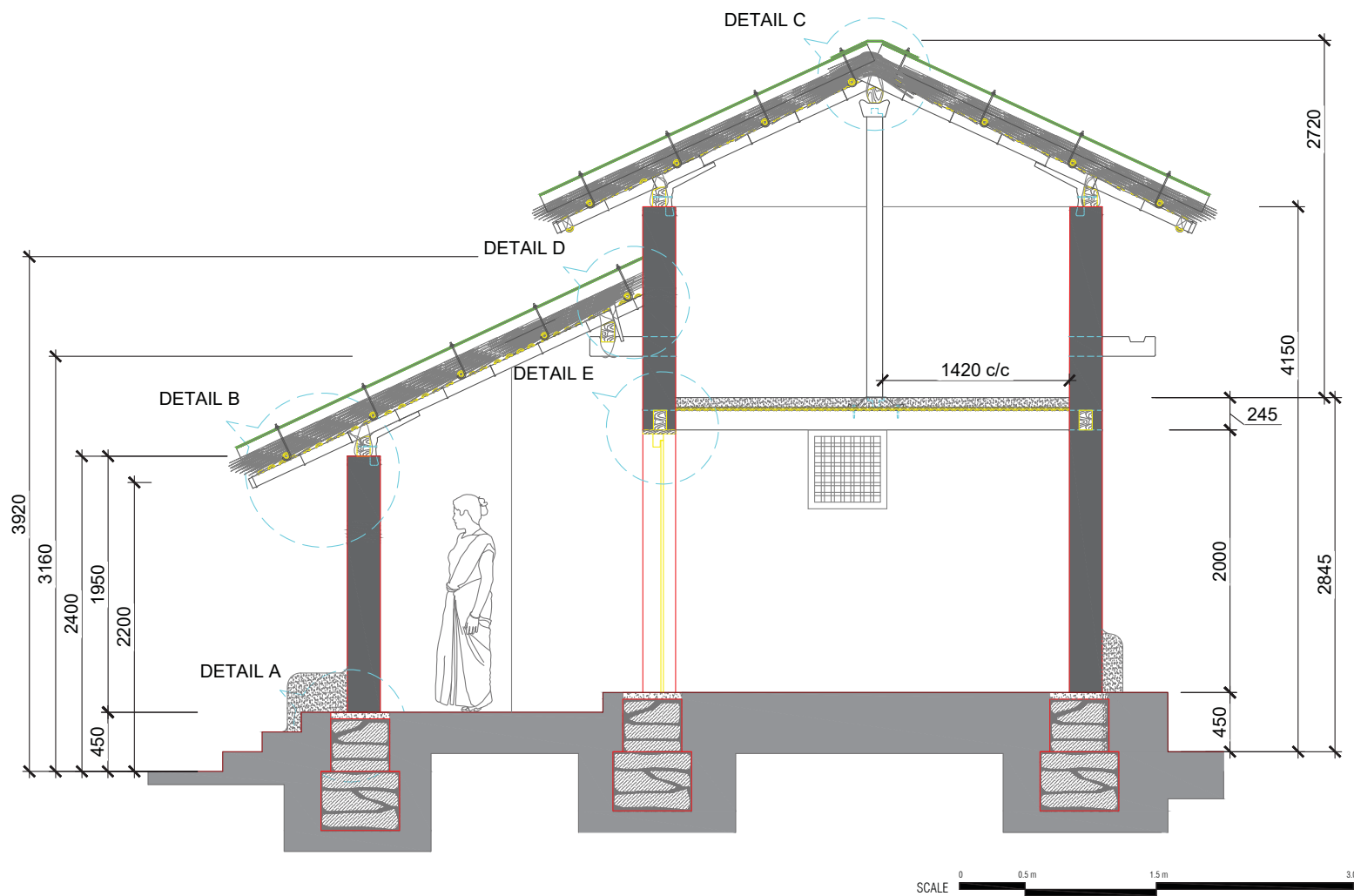


JHARKHAND

TYPICAL PLAN

ZONE - D

JH-D-05



SECTION



JHARKHAND

ZONE-D
JH-D-05

Cost breakup

Item	Cost (INR)
Foundation	24,878/-
Walls	50,169/-
Doors/Windows	6,500/-
Floor and Roof	57,164/-
Total	1,38,711/-

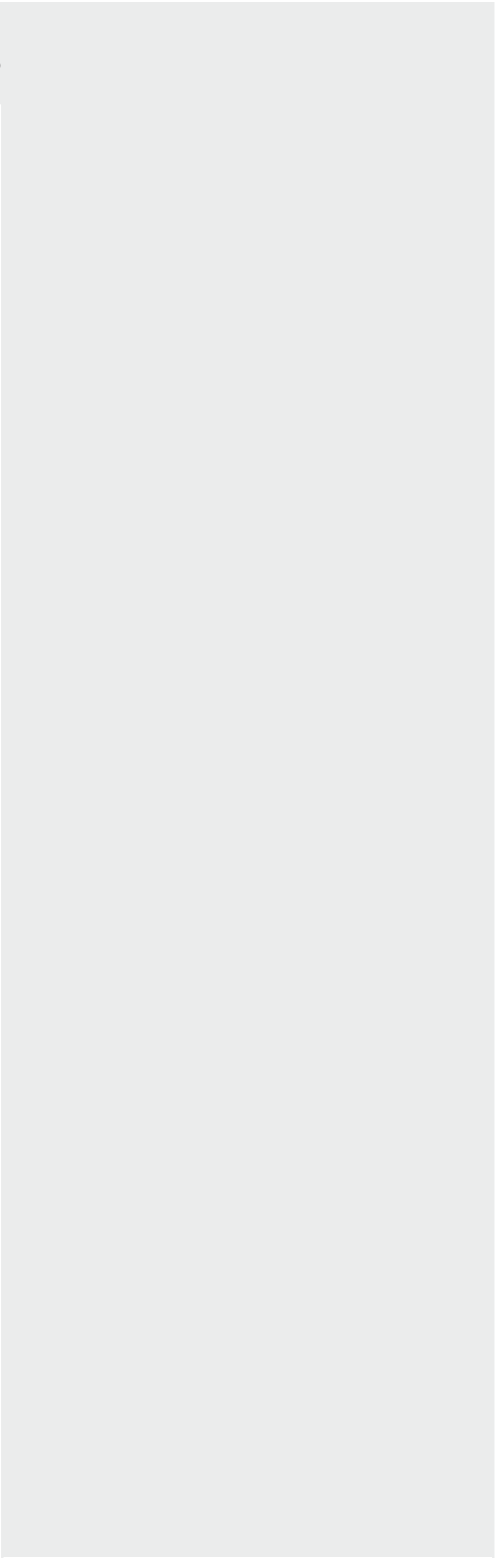


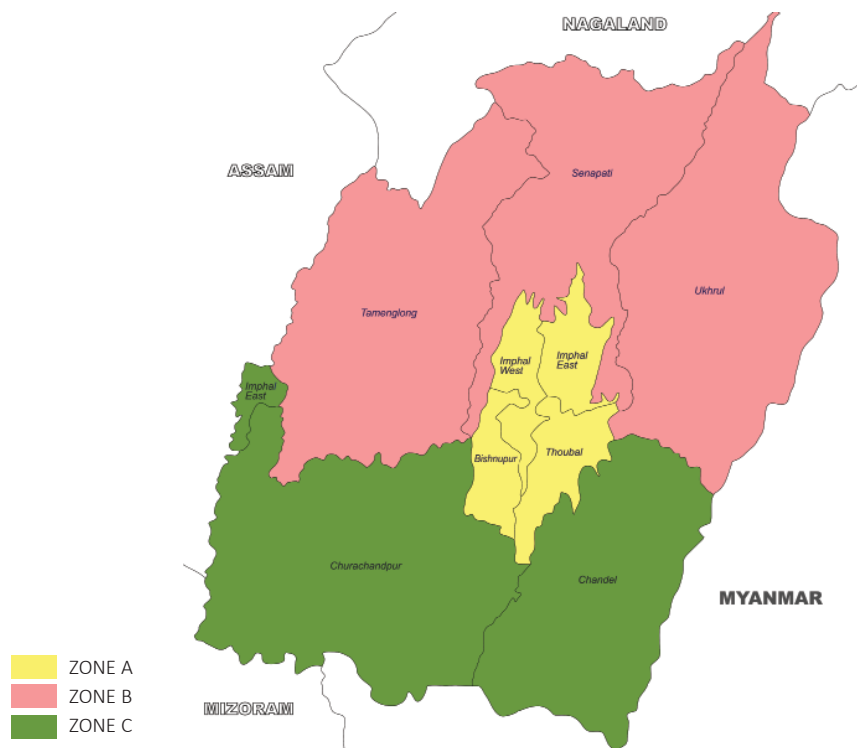
JHARKHAND

Cost Estimate for ZONE-D Design 05

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Manipur





Forested hills of the state occupy about 90 percent of the land area. The use of timber and bamboo has been a predominant feature in construction of houses. Nearly 64% of the total geographical area of the state. Vegetation consists of plants ranging from short and tall grasses, reeds and bamboos, to trees. Manipur is richly endowed with bamboo forests and various timber yielding trees species. Its abundance and multiple uses has made bamboo play a pivotal role in the life of the people of the state.

The temperature ranges from sub-zero to 36° C. Average annual rainfall ranges from 1250 mm to 2700 mm. Various regions in the state are vulnerable to seismic activity, landslides and flooding.

Manipur is graded zone V which means that this state is a region of high seismic activity and has a high probability of witnessing extremely strong earthquakes higher than 9.0 in the Richter scale. The months of the pre-monsoon period from March to May sees stormy weather and high wind speeds blowing across most of the state. Almost two thirds of the population of Manipur is concentrated in the Manipur Valley, which has only 8.2% area of the state. Rivers from these hills flow into the valley and very often lead to flash floods every year. Thus river flooding is a regular hazard faced by the State

Zone A

This area comprises the districts of Imphal West and East, Bishnupur and Thoubal. These districts nearly entirely comprise the valley areas and some adjoining hills that are in the centre of the state. As mentioned earlier, these areas have abundant availability of adobe which is reflected in the traditional and local architecture. The Meiteis are the predominant community that occupy these areas, with some other communities like the Kabui also calling this region home.

Zone B

This area comprises the districts of Tamenglong, Senapati and Ukhrul. These districts comprise of the higher hill areas and are areas with greater prevalence of timber based construction that is also reflective of the lack of good construction grade bamboo, or abundant adobe for construction. These areas are predominantly home to a number of Naga tribes.

Zone C

This area comprises the districts of Churachandpur and Chandel. These districts comprise of lower elevation hills (on average, and in comparison to the northern districts) and is in general an area where good construction grade bamboo with good wall thicknesses are found apart from timber. These areas are predominantly Kuki tribe belts.

ZONE -A
MN-A-01

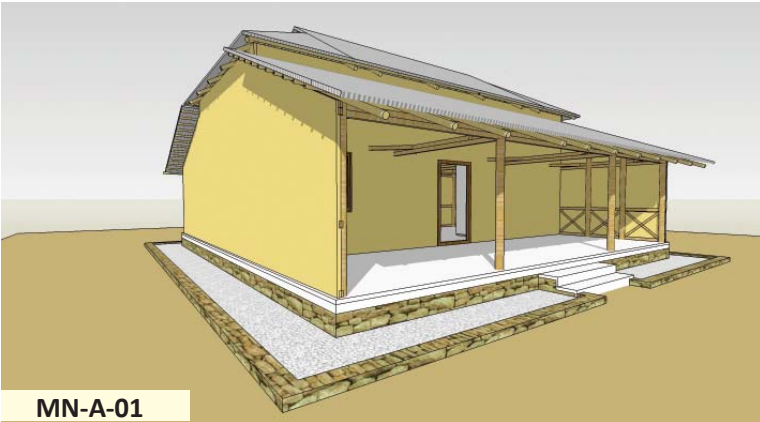
- Zone A comprise 3 districts :
- 1. Imphal West and East
 - 2. Bishnupur
 - 3. Thoubal

- RESOURCES AVAILABLE:
- Timber and Bamboo

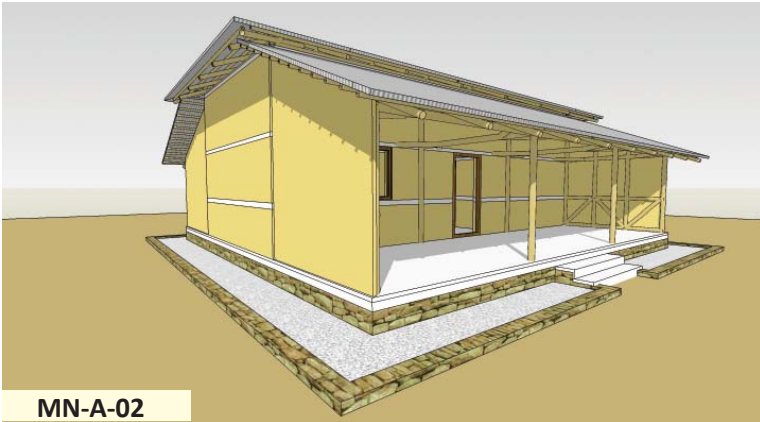
Zone A has two typologies
MN-A-01
MN-A-02



MANIPUR



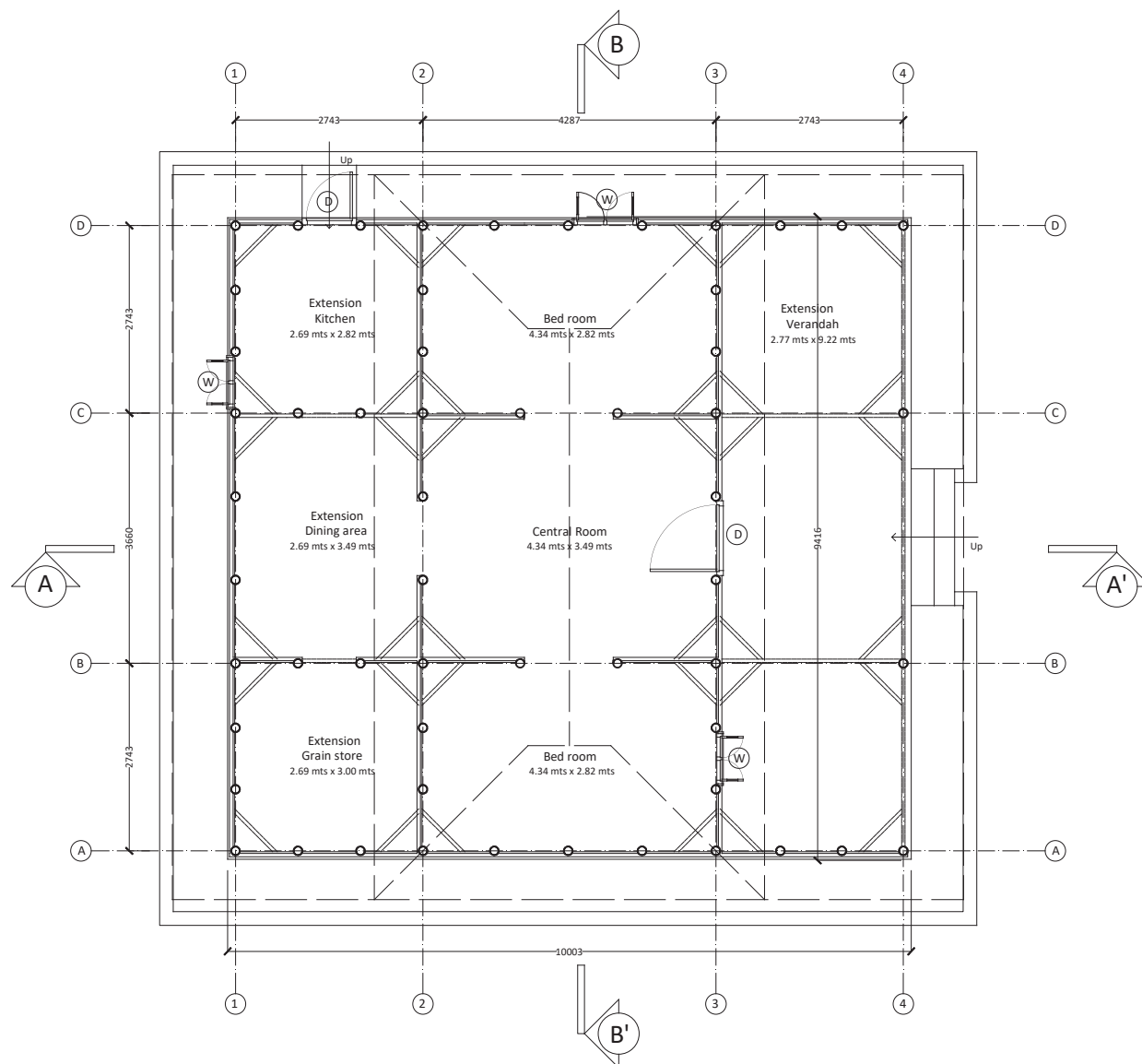
- The house essentially consists of a front verandah about 9 feet in width and which spans the entire frontage of the house.
- Sleeping quarters with a high roof, starting at about 10-11 feet in height from the floor level.
- A hipped or gable roof spans over the central bay. This further leads out into a rear bay that contains the cooking area, dining space and a store/granary.
- Horizontal and vertical structural members in timber/bamboo for main structure.



- This house is based closely on the traditional adobe masonry house one finds in the valley and adjoining areas.
- This prototype incorporates stabilized adobe block masonry and introduces reinforcement bands and masonry containment to ensure resilience to seismic forces.
- Similar to Valley House 1, this house too consists of a front verandah about 9 feet in width and which serves as the public interface of the residence.
- A hipped or gable roof spans over the central bay.
- A standalone toilet and bathing enclosure is provided in the rear yard of the house.

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
The house essentially consists of a front verandah about 9 feet in width and which spans the entire frontage of the house.	The house has an earthen plinth that is about 450 mm high.	A hipped or gable roof spans over the central bay.

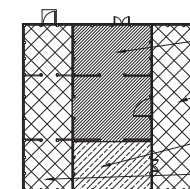
Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none">• Nominal Strip foundation to support the plinth retention masonry and concrete pedestals as vertical support anchors.	
Plinth	<ul style="list-style-type: none">• Stone or Stabilized Adobe Block Masonry plinth with earth back-filling.	2, 8-mm rods with stirrups at every 200 mm can be provided as a plinth reinforcement band, on top of the plinth masonry.
Wall	<ul style="list-style-type: none">• Main support members formed by timber or bamboo vertical supports, tied at four levels by horizontal bands and diagonal bracing both in the vertical and horizontal planes.• Diagonal split bamboo grid affixed to the outer side of the main support members.• Valley House 2 uses all the stabilized adobe block masonry with reinforced tie bands and containment using G.I. wire.	<ul style="list-style-type: none">• The vertical supports can be either grouted into the concrete pedestals provided in the plinth or, can be rested on the pedestals with a bent 8 mm rod anchoring it to the pedestals.
Wall Finish	<ul style="list-style-type: none">• Walls Cement stabilized mud plaster for internal & external faces in split bamboo walling grid.• Timber/Bamboo members• Linseed Oil (or similar) polish	Optional: Cement based paint for external walls and lime rendering for internal walls.
Roof Structure	<ul style="list-style-type: none">• Hipped or Gable Roof over the central bay comprising of the sleeping quarters	
Floor	<ul style="list-style-type: none">• Plain cement flooring over RCC bed on a back filled plinth.• Stabilized Soil cement flooring. and Earthen flooring.	



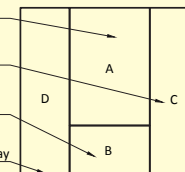
TYPICAL PLAN

ZONE - A MN-A-01

Total Cost ₹ 196,590/-



- Core Area:
 - Central Bay
- Extension1:
 - Verandah
- Extension2:
 - Sleeping area
- Extension 3:
 - Kitchen/Dining/Storage bay



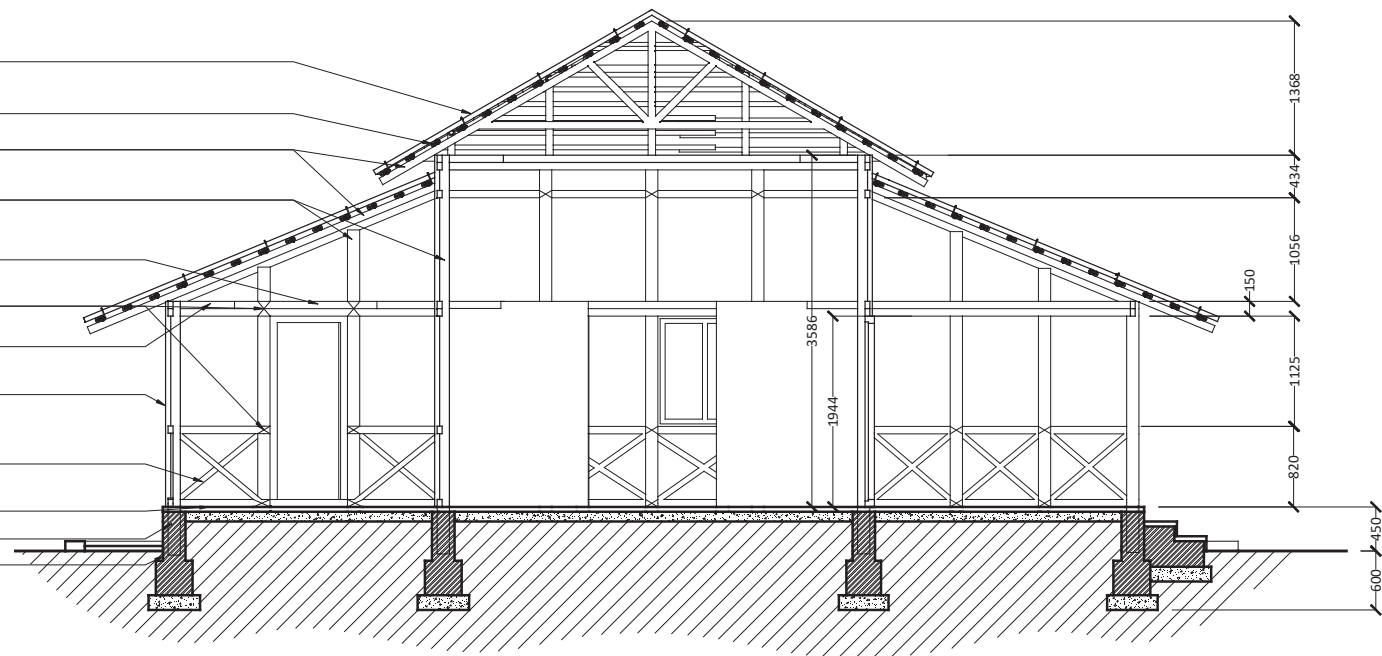
TYPE	NET AREA (SQ.M.)
Initial Built (A)	29.24
Extension (B)	12.35
Extension (C)	25.82
Extension (D)	25.57
Total	92.98



MANIPUR

ZONE - A MN-A-01

- BMCS/CGI Sheet fixed to the purlins using J-bolts
- 50 mm dia bamboo purlins
- 75 mm dia bamboo rafter and truss members
- 125 mm dia timber posts
- 50mm x 75 mm timber horizontal ties
- Bolted joints or Cane or Bamboo Lashing/at all junctions of posts and horizontal ties
- 50xx x 75mm corner ties of horizontal members
- 50mm thk Ferrocement plaster on split bamboo grid tied onto walling framework
- 50mm x 50 mm diagonal bracing of all vertical posts
- Cement floor laid on rammed earth
- Grouted vertical posts
- Random Rubble or Stone Block masonry in cement mortar plinth and foundation with RCC plinth band above

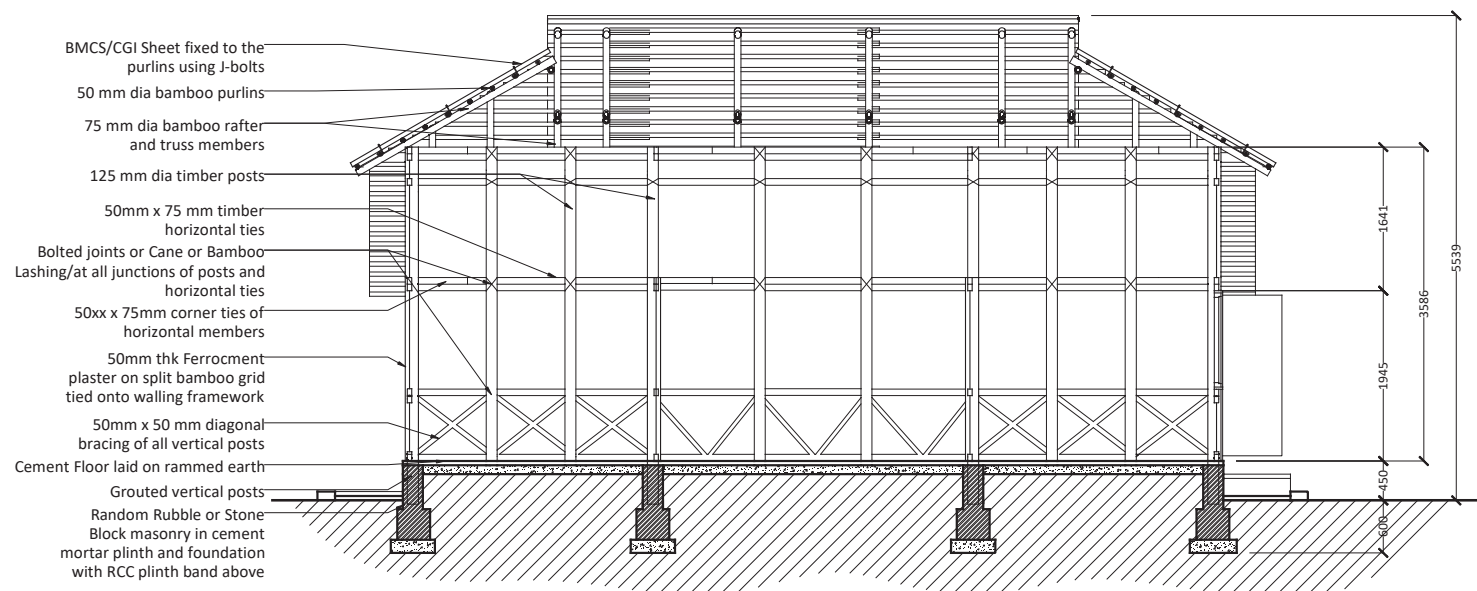


MANIPUR

SCALE 0 0.5 m 1.5 m 3.0 m

SECTION AA'

ZONE - A MN-A-01



SECTION BB'
1 : 50



SECTION BB'



MANIPUR

ZONE - A MN-A-01

Cost breakup

Item	Cost (INR)
Excavation	5,600/-
Foundation	32,716/-
Walling and structure	50,702/-
Doors and Windows	8,116/-
Roofing	53,032/-
Finishing Work	19,048/-
Ext. Development	576/-
Electrical	14,800/-
Total	1,84,590/-

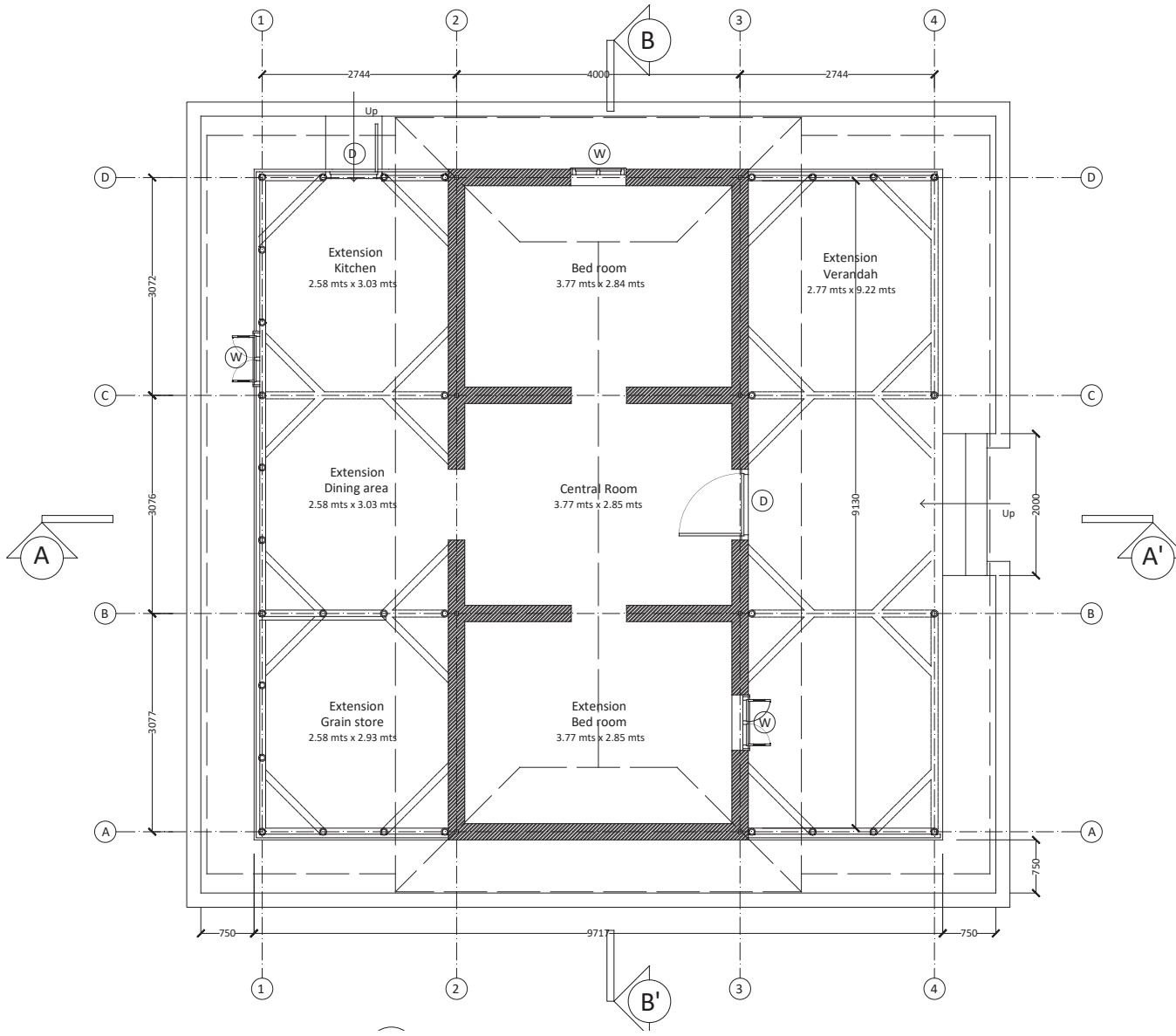


MANIPUR

Cost Estimate for ZONE-A Design 01

S No	Work Head	Material	Labour	Transport	Total
1	Excavation	-	5,600	-	5,600
2	Foundation and Plinth	20,466	7,250	5,000	32,716
3	Walling and Walling structure	22,102	25,600	3,000	50,702
4	Raised flooring	-	-	-	-
5	Doors and Windows	4,116	4,000	-	8,116
6	Roofing	37,032	14,000	2,000	53,032
7	Finishing works	9,248	8,800	1,000	19,048
8	Ext. Development	576	-	-	576
9	Electrical	12,800	2,000	-	14,800
	Total	106,340	67,250	11,000	184,590
	Add cost of toilet				12,000
	Cost of Construction including toilet				196,590
	Total Area of Construction (Initial Built A)			Rs	314.7
	Rate of Construction			Rs/sft	625
	Pro-rata cost of Built area of 25 square metres				168,083

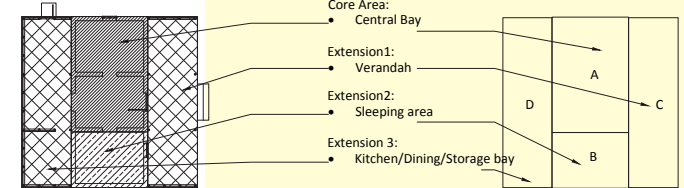
Potential areas of reduction in costs		
	Labour	
1	If excavation is done by the house owners	(4,900)
2	If backfilling of earthen plinth is done by the house owners	(1,400)
3	If split bamboo framework is fixed by the house owners	(8,400)
4	If stabilised mud plaster is done by the house owners	(8,400)
5	If stabilised earthen floor is laid by the house owners	(4,800)
	Material	
	If bamboo is used as reinforcement instead of steel	(1,713)
	If upper 1/3rd of mud plastered wall is not stabilised	(2,894)
	Net Cost of Construction of the initial Built Area	164,082



TYPICAL PLAN

ZONE - A MN-A-02

Total Cost ₹ 198,763/-

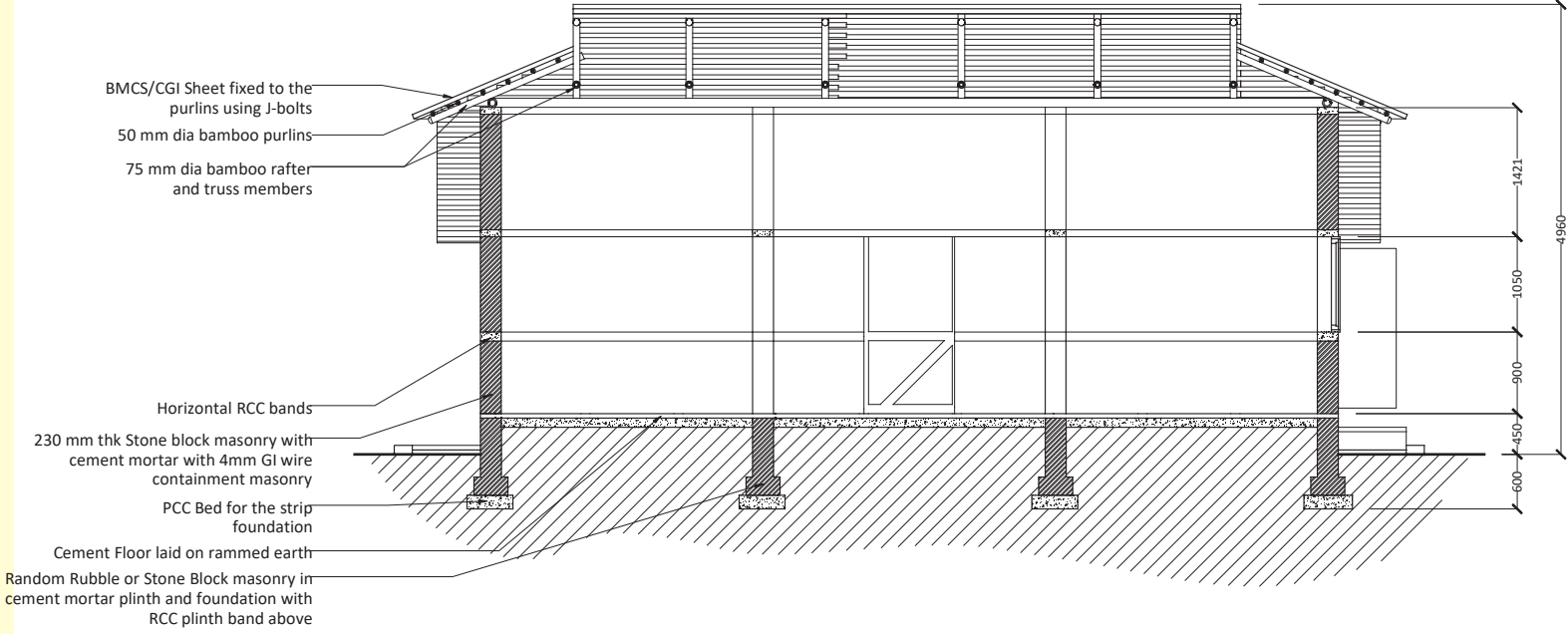


TYPE	NET AREA (SQ.M.)
Initial Built (A)	26.98
Extension (B)	13.02
Extension (C)	25.76
Extension (D)	25.47
Total	91.23

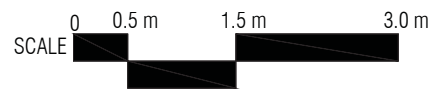


MANIPUR

ZONE - A
MN-A-02

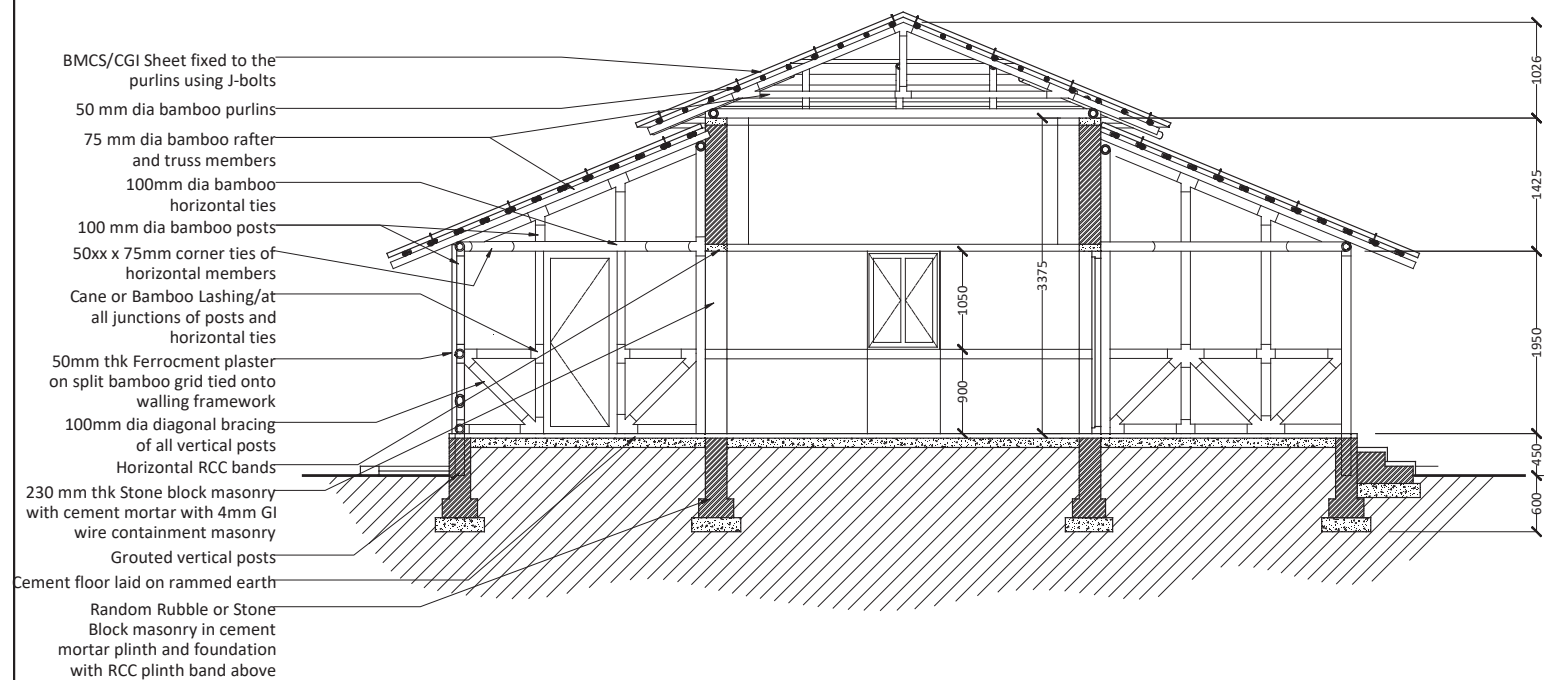


MANIPUR



SECTION AA'

ZONE-A MN-A-02



SCALE 0 0.5 m 1.5 m 3.0 m

SECTION BB'



MANIPUR

ZONE – A
MN-A-02

Cost breakup

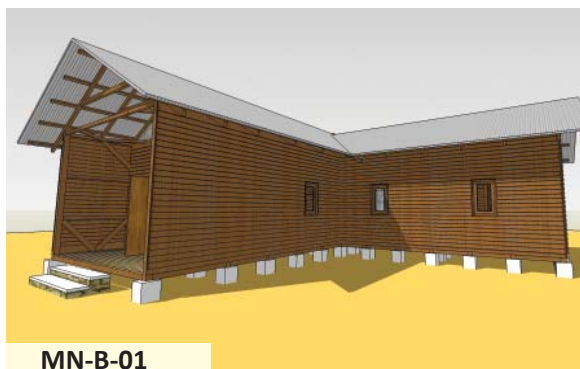
Item	Cost (INR)
Excavation	5,600/-
Foundation	25,789/-
Walling and structure	63,632/-
Doors and Windows	8,116/-
Roofing	52,632/-
Finishing Work	15,617/-
Ext. Development	576/-
Electrical	14,800/-
Total	1,86,762/-



MANIPUR

Cost Estimate for ZONE-A Design 02

S No	Work Head	Material	Labour	Transport	Total
1	Excavation	-	5,600	-	5,600
2	Foundation and Plinth	13,539	7,250	5,000	25,789
3	Walling and Walling structure	36,832	24,800	2,000	63,632
4	Raised flooring	-	-	-	-
5	Doors and Windows	4,116	4,000	-	8,116
6	Roofing	36,632	14,000	2,000	52,632
7	Finishing works	5,817	8,800	1,000	15,617
8	Ext. Development	576	-	-	576
9	Electrical	12,800	2,000	-	14,800
	Total	110,313	66,450	10,000	186,763
	Cost of toilet construction				12,000
	Cost of Construction including toilet				198,763
	Total Area of Construction (Initial Built A)			Rs	290.4
	Rate of Construction			Rs/sft	684
	Pro-rata cost of Built area of 25 square metres				184,176



MN-B-01



Front view



Side view

- The plan form is an L-shape, with the entry through a short verandah leading onto a common room (akin to the entry room in traditional Naga houses, which leads on to a dining space and then onto a cooking area and store.
- The roof form is a hipped roof that follows the plan form of the house.
- The cooking area is provided with a chimney.

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
The plan form is an L-shape, with the entry through a short verandah leading onto a common room (akin to the entry room in traditional Naga houses, which leads on to a dining space and then onto a cooking area and store.	Timber flooring on a raised floor with adequate lap joints and cement floor in the case of a masonry back-filled plinth.	A hipped or gable roof spans over the central bay.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Concrete pedestals as anchors for all vertical timber/treated bamboo supports (both main vertical supports and additional flooring supports). 	
Plinth	<ul style="list-style-type: none"> Masonry plinth with back filled earth. Raised floor supported on a two-layer system of primary and secondary timber members that support a wooden floor above. 	
Wall	<ul style="list-style-type: none"> The support members of the front verandah and rear cooking/dining/storage bay are formed by timber or treated bamboo vertical supports, tied at four levels by horizontal bands and diagonal bracing both in the vertical and horizontal planes. 	<ul style="list-style-type: none"> 1-inch-thick Timber planks between 150 mm to 200 mm in width fixed to the external side of the timber walling framework, with adequate overlaps. Internal walls can be clad with bamboo mats, board etc.
Wall Finish	<ul style="list-style-type: none"> Timber Bamboo members Linseed Oil (or similar) polish 	
Roof Structure	<ul style="list-style-type: none"> Hipped roof following the L-shaped plan. 	<ul style="list-style-type: none"> Treated bamboo roofing members (trusses, ties and purlins) support a roof with an angle of slope of 30 degrees
Floor	<ul style="list-style-type: none"> Timber plank flooring fixed onto a timber/treated bamboo under-structure. 	<ul style="list-style-type: none"> Cement floor on backfilled earth in the case of a masonry plinth.

ZONE-B

Zone B comprise 3 districts :

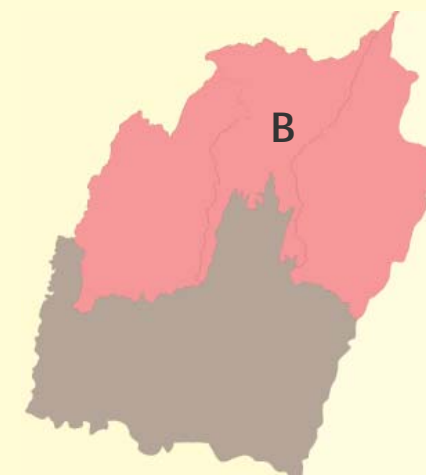
1. Tamenglong
2. Senapati
3. Ukhrul

RESOURCES AVAILABLE:

- Timber or Bamboo

Zone B has one typology

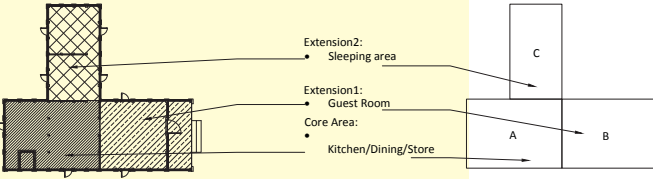
MN-B-01



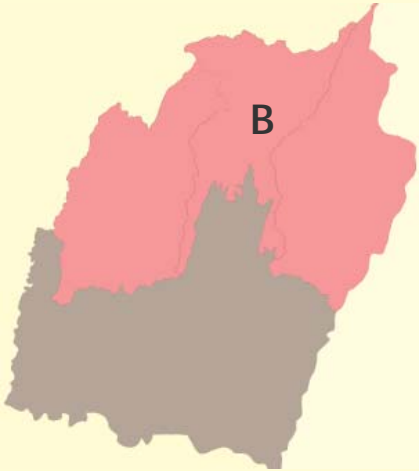
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ZONE - B
MN-B-01

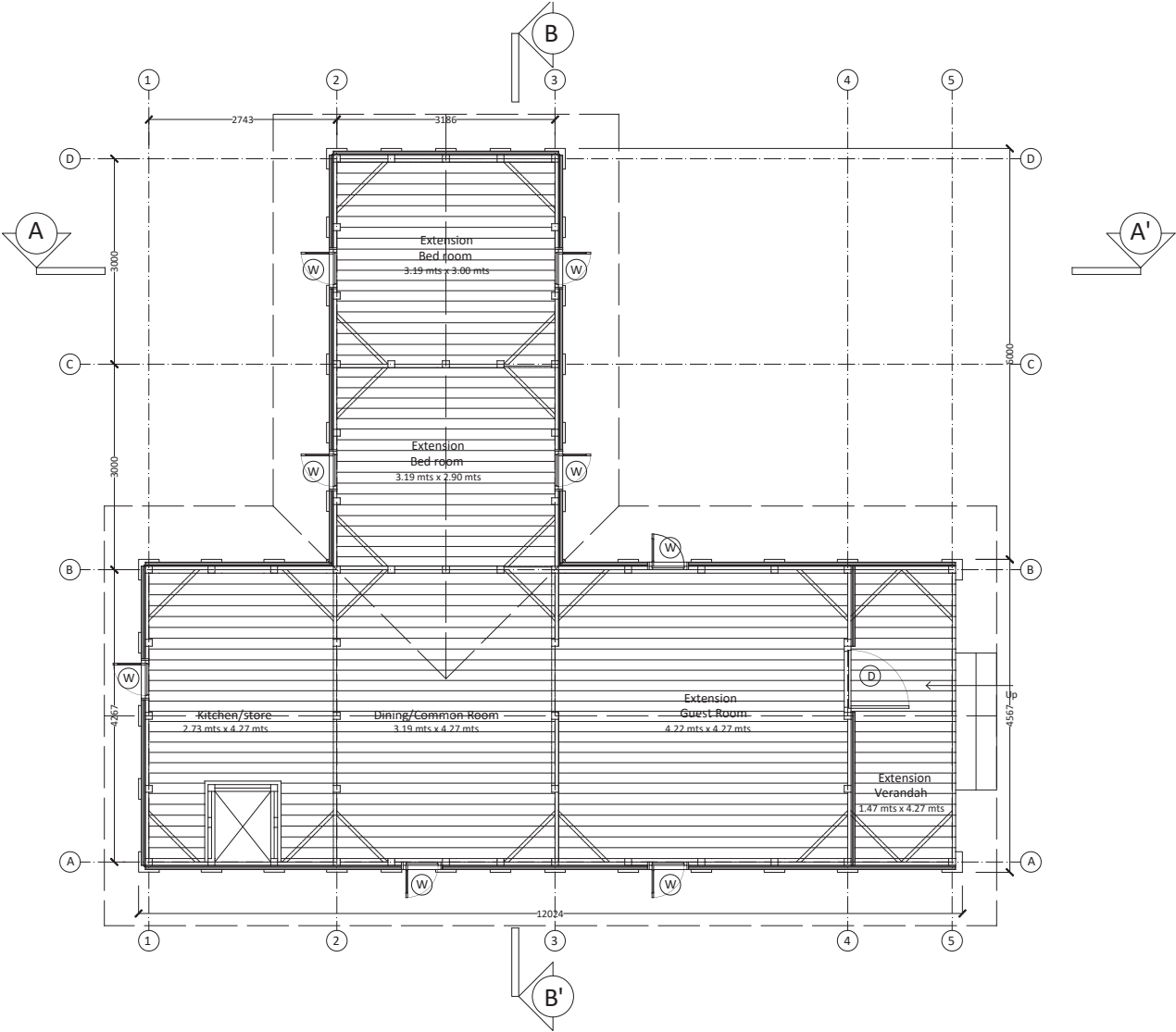
Total Cost ₹ 190,591/-



TYPE	NET AREA (SQ.M.)
Initial Built (A)	26.32
Extension (B)	25.30
Extension (C)	19.71
Extension (D)	-
Total	71.33



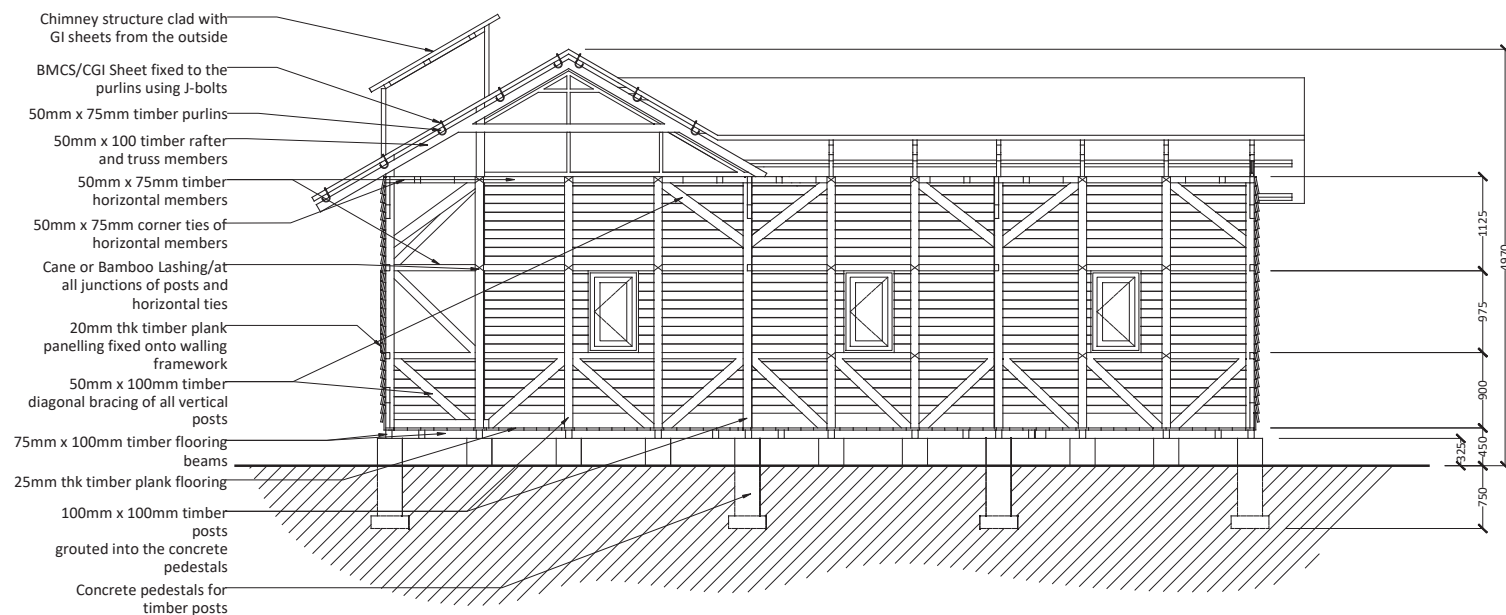
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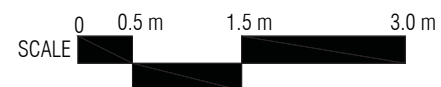
TYPICAL PLAN

ZONE - B

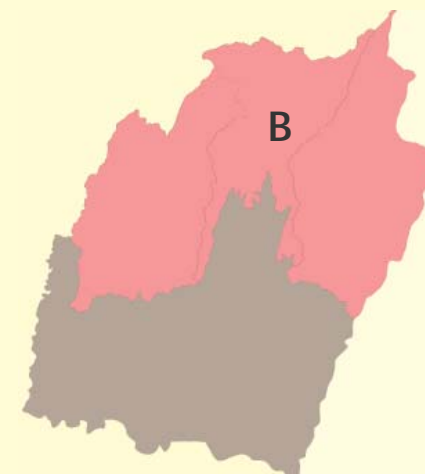
MN-B-01



SECTION BB'
1 : 50

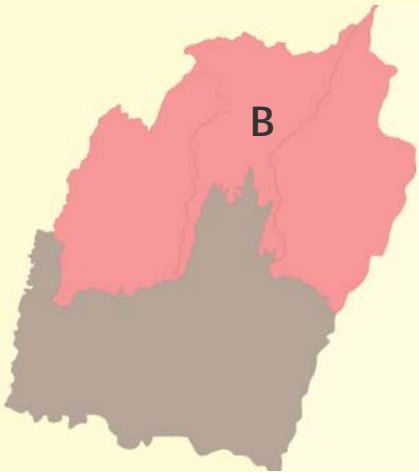


SECTION AA'

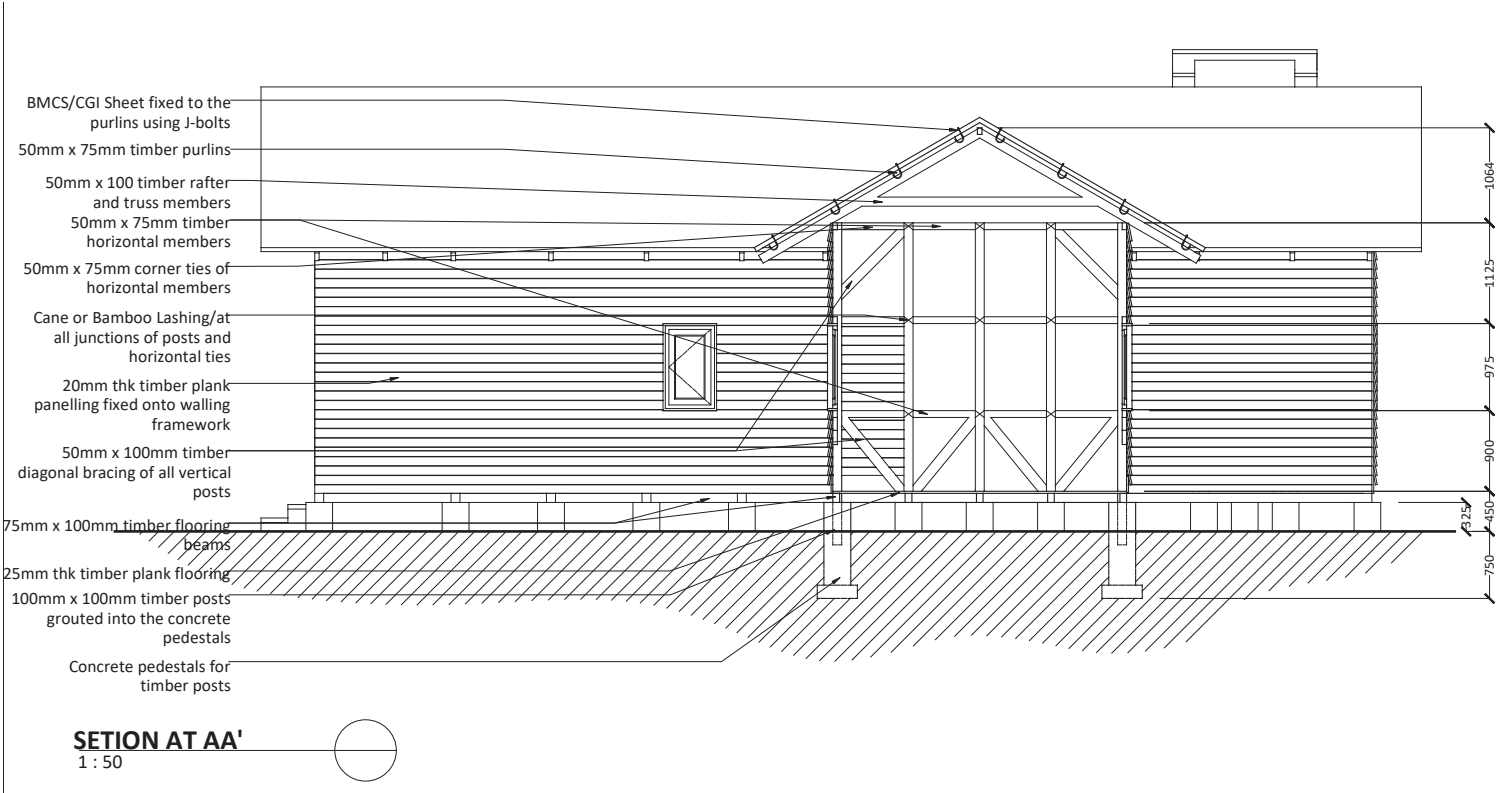


MANIPUR

ZONE - B
MN-B-01



MANIPUR



SECTION BB'

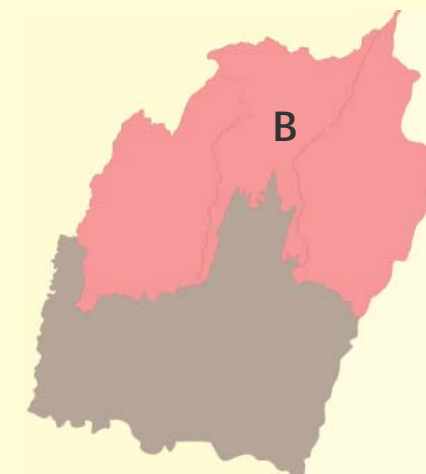
Cost Estimate for ZONE-B Design 01

S No	Work Head	Material	Labour	Transport	Total
1	Excavation	-	4,200	-	4,200
2	Foundation and Plinth	8,312	2,100	2,500	12,912
3	Walling and Walling structure	55,151	11,000	3,000	69,151
4	Raised flooring	12,195	8,000	-	20,195
4	Doors and Windows	3,819	4,000	-	7,819
5	Roofing	30,938	11,000	2,000	43,938
6	Finishing works	-	4,000	1,000	5,000
7	Ext. Development	576	-	-	576
8	Electrical	12,800	2,000	-	14,800
	Total	123,791	46,300	8,500	178,591
	Cost of toilet construction				12,000
	Cost of Construction including toilet				190,591
	Total Area of Construction (Initial Built A)			Rs	283.3
	Rate of Construction			Rs/sft	673
	Pro-rata cost of Built area of 25 square metres				181,032

ZONE - B MN-B-01

Cost breakup

Item	Cost (INR)
Excavation	4,200/-
Foundation	12,912/-
Walling and structure	69,151/-
Raised Flooring	20,195/-
Doors and Windows	7,819/-
Roofing	43,938/-
Finishing Work	5,000/-
Ext. Development	576/-
Electrical	14,800/-
Total	1,78,591/-



MANIPUR

ZONE-C MN-C-01

Zone C comprise 2 districts :

- 1. Churachandpur
- 2. Chandel

RESOURCES AVAILABLE:

- Timber And Bamboo, adobe from valley areas.

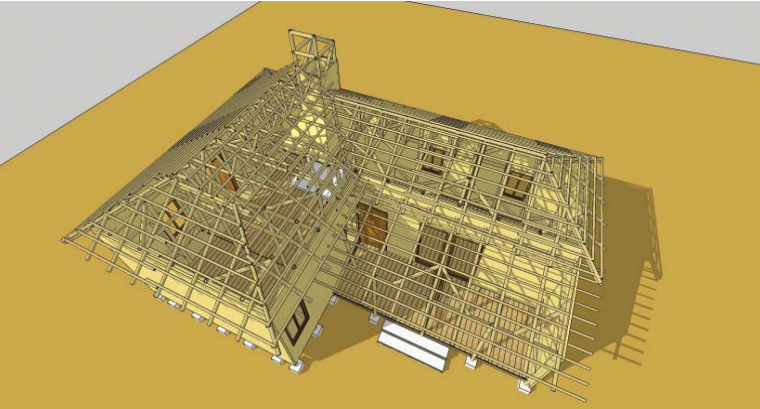
**Zone C has one typology
MN-C-01**



MANIPUR



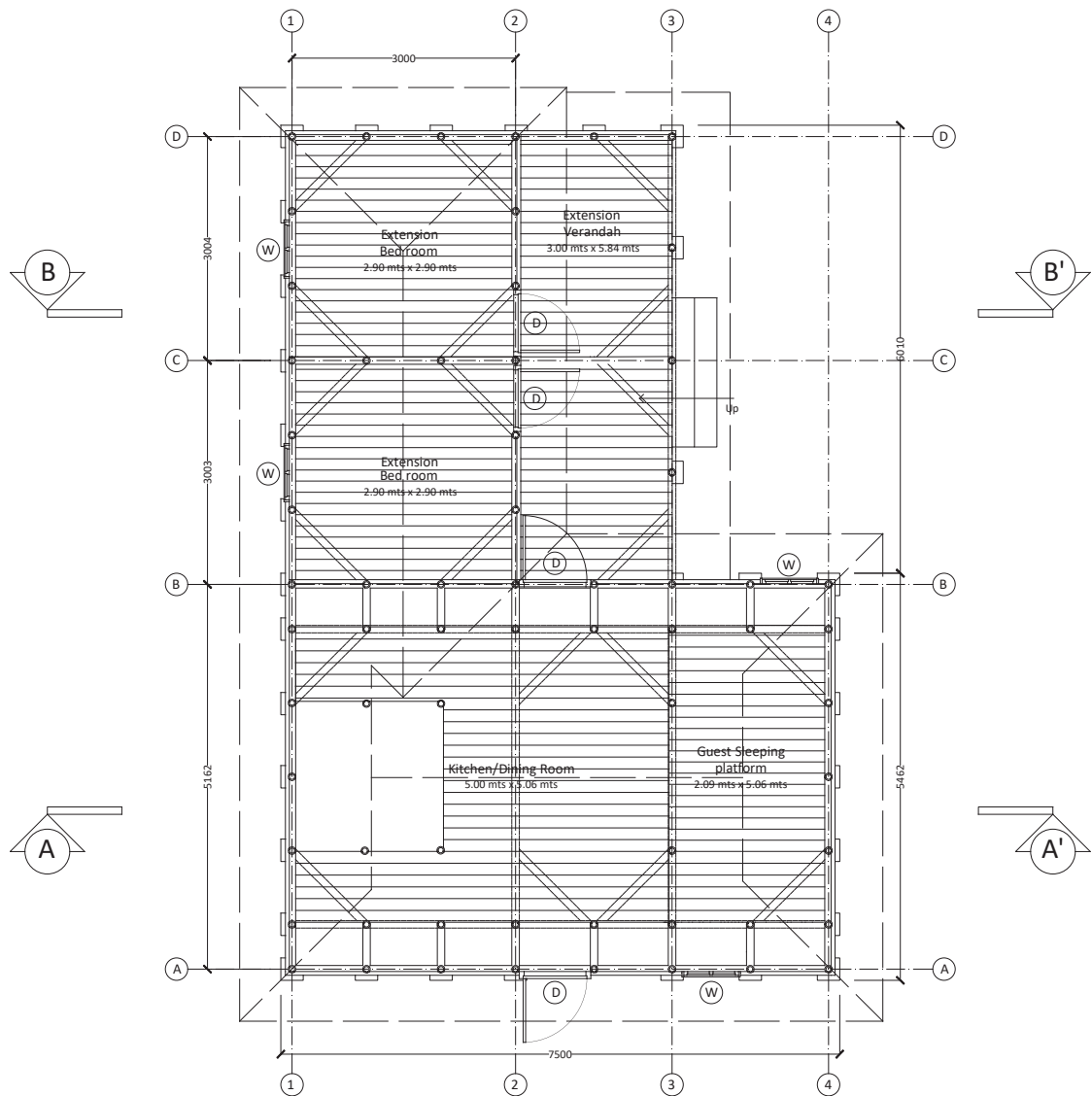
- The lay of the house is roughly in an L-shape, with one extension of the L housing the sleeping quarters with a front verandah, and the other having a large cooking, storage, dining and guest sleeping platform.



- The roof form is a hipped roof that follows the plan form of the house.
- The cooking area is provided with a chimney.
- A standalone toilet and bathing enclosure is provided in the rear yard of the house.

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
The lay of the house is roughly in an L-shape, with one extension of the L housing.	The house is provided with a raised timber floor that is supported on either timber or bamboo flooring supports.	A hipped or gable roof spans over the central bay.

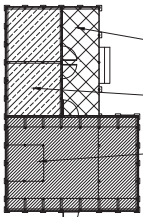
Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none">• Concrete pedestals as anchors for all vertical timber/treated bamboo supports (both main vertical supports and additional flooring supports).	
Plinth	<ul style="list-style-type: none">• No masonry plinth.• The flooring is supported on a two-layer system of primary and secondary timber/treated bamboo members that support a wooden floor above.	These members are supported by the main vertical members of the structure and an additional set of stub posts that provide additional support to the flooring members.
Wall	<ul style="list-style-type: none">• The support members of the front verandah and rear cooking/dining/storage bay are formed by timber or treated bamboo vertical supports, tied at four levels by horizontal bands and diagonal bracing both in the vertical and horizontal planes.	<ul style="list-style-type: none">• The vertical supports are grouted into the concrete pedestals provided. These vertical members are provided with a bitumen protective coating for those portions that are encased in the concrete.
Wall Finish	<ul style="list-style-type: none">• Walls Cement stabilised mud plaster for internal & external faces. Can be left exposed.• Timber/Bamboo members• Linseed Oil (or similar) polish	Optional: Cement based paint for external walls and lime rendering for internal walls.
Roof Structure	<ul style="list-style-type: none">• Hipped or Gable Roof over the central bay comprising of the sleeping quarters	<ul style="list-style-type: none">• Treated bamboo roofing members (trusses, ties and purlins) support a roof with an angle of slope of 30 degrees.
Floor	<ul style="list-style-type: none">• Timber plank flooring fixed onto a timber/treated bamboo under-structure.	



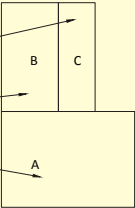
TYPICAL PLAN

ZONE - C
MN-C-01

Total Cost ₹ 2,09,341/-



- Extension2:
 - Verandah
- Extension1:
 - Sleeping Area
- Core Area:
 - Kitchen/Dining



TYPE	NET AREA (SQ.M.)
Initial Built (A)	39.14
Extension (B)	19.02
Extension (C)	12.24
Extension (D)	-
Total	70.40

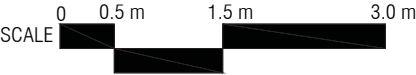
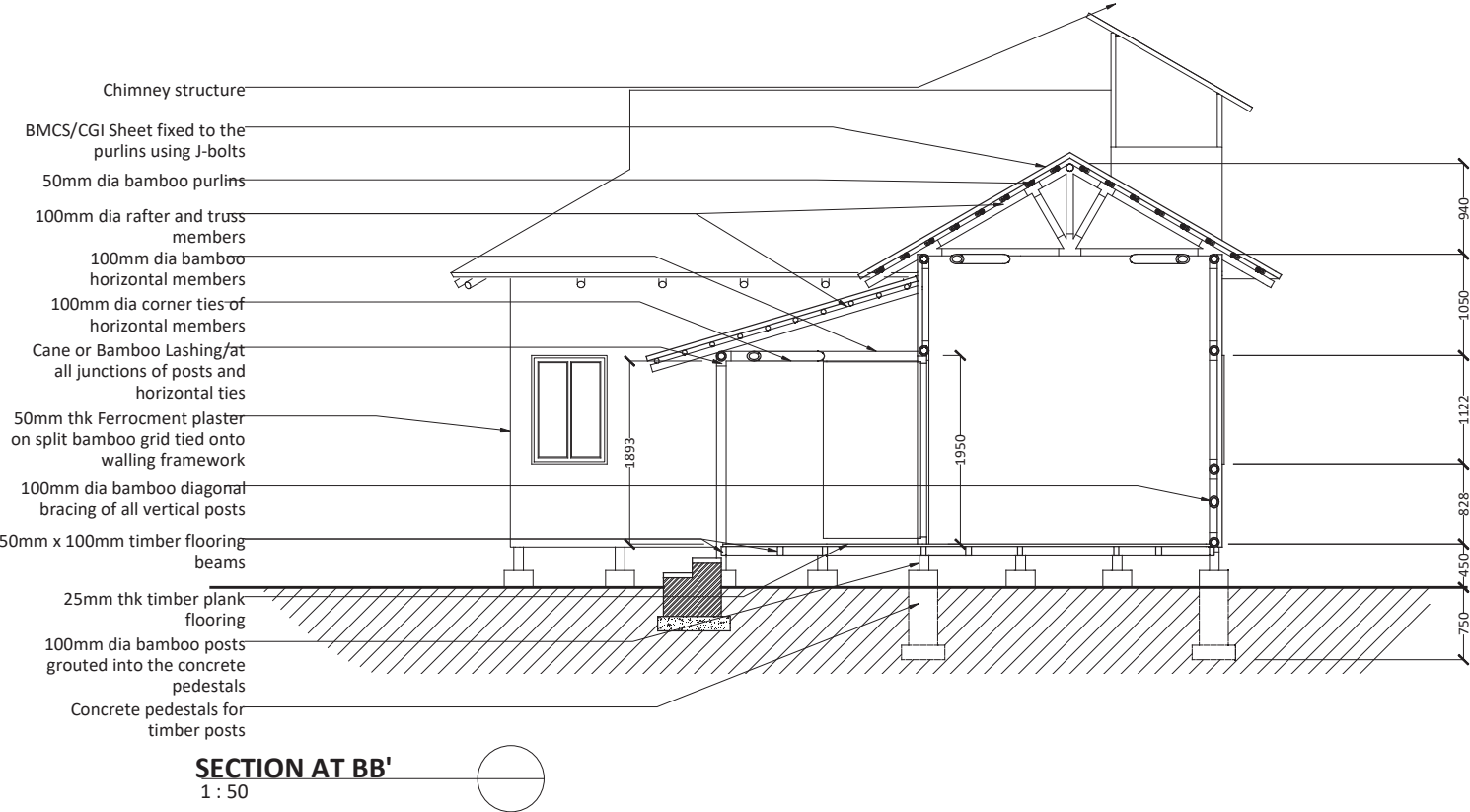


MANIPUR

ZONE - C
MN-C-01

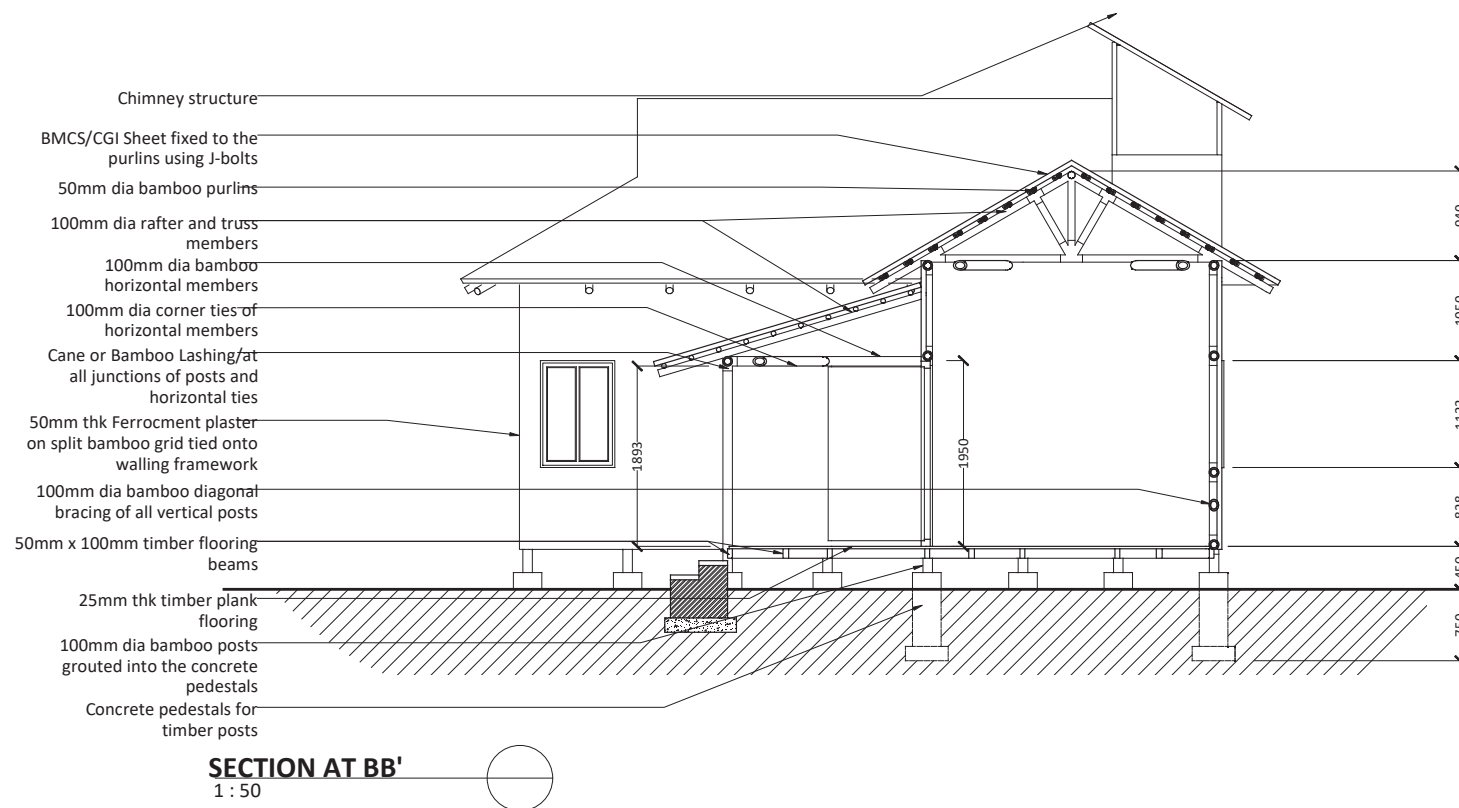


MANIPUR



SECTION AA'

ZONE - C MN-C-01



SECTION BB'



MANIPUR

ZONE - C
MN-C-01

Cost breakup

Item	Cost (INR)
Excavation	5,600/-
Foundation	16,114/-
Walling and structure	50,178/-
Raised Flooring	22,861/-
Doors and Windows	8,917
Roofing	65,640
Finishing Work	12,655/-
Ext. Development	576/-
Electrical	14,800/-
Total	1,97,341/-

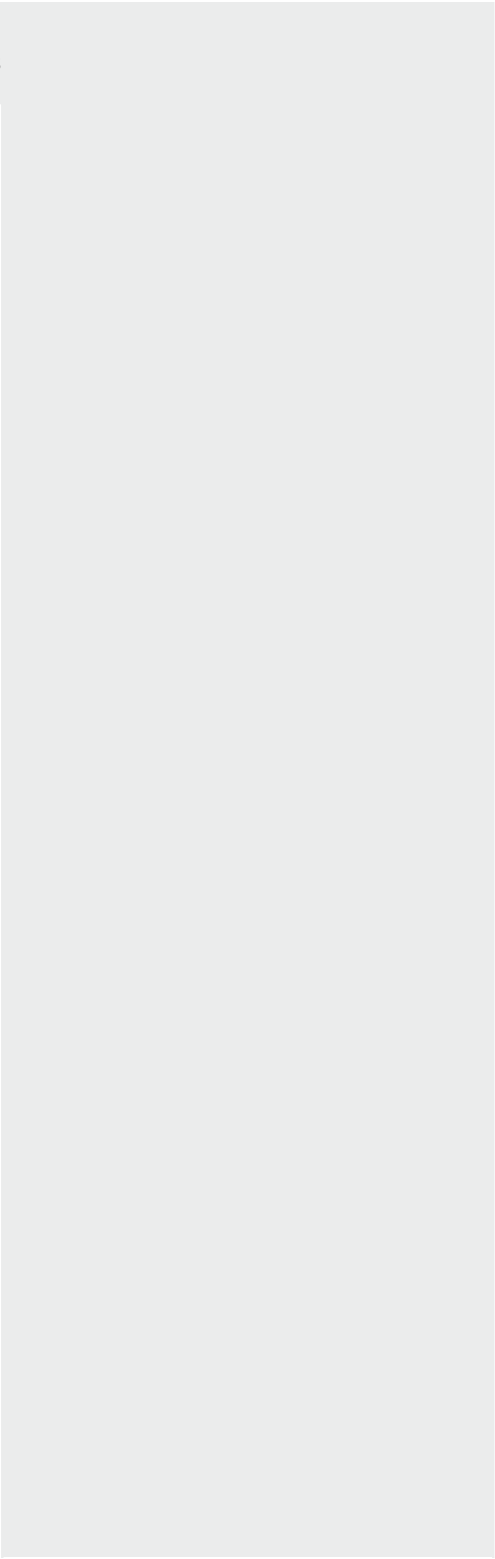


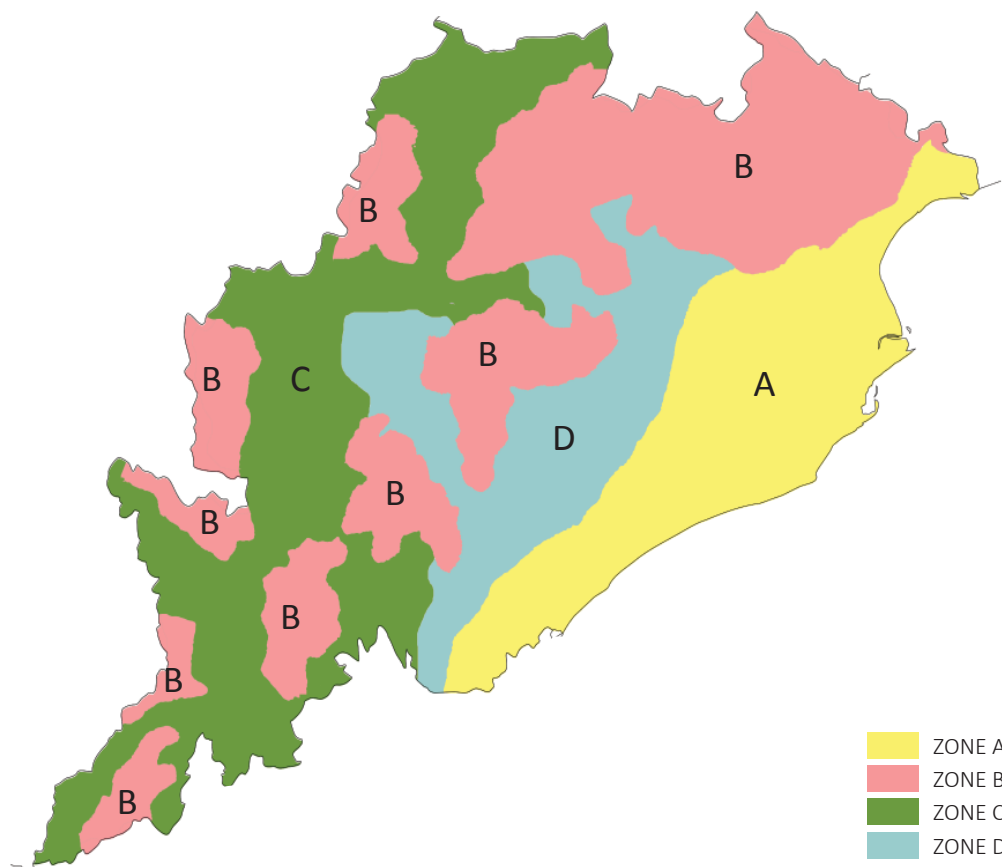
MANIPUR

Cost Estimate for ZONE-C Design 01

S No	Work Head	Material	Labour	Transport	Total
1	Excavation	-	5,600	-	5,600
2	Foundation and Plinth	11,514	2,100	2,500	16,114
3	Walling and Walling structure	22,378	24,800	3,000	50,178
4	Raised flooring	14,861	6,000	2,000	22,861
5	Doors and Windows	4,917	4,000	-	8,917
6	Roofing	46,640	17,000	2,000	65,640
7	Finishing works	7,655	4,000	1,000	12,655
8	Ext. Development	576	-	-	576
9	Electrical	12,800	2,000	-	14,800
	Total	121,341	65,500	10,500	197,341
	Add cost of toilet				12,000
	Cost of Construction including toilet				209,341
	Total Area of Construction (Initial Built A)			Rs	421.3
	Rate of Construction			Rs/sft	497
	Pro-rata cost of Built area of 25 square metres				133,713

Odisha





Odisha is the 9th largest state of India. The state is divided into 30 districts, 58 sub-divisions, 314 blocks and 103 urban local bodies. The varied geography of Odisha includes extensive hill ranges clad with forests, rolling uplands, coastal plains, extensive river systems and brackish waters and mangroves. On the basis of homogeneity, physiographical characteristics and ecosystems of the region, Odisha has four major regions - Coastal plains in the east, Central plateaus, Northern uplands and South western hilly region. The hills and mountains of Eastern Ghats cover more than half of the area of Odisha, with steep eastern slope running through.

The diverse set of conditions in Odisha pose different constraints and, in some cases, incentives for the rural housing sector. The state can be classified into 4 different zones, each with its own predominant characteristics. The zones may not necessarily be contiguous - there will be similar conditions present in different parts of the state. There are parameters for zoning of housing practices in Odisha such as Vulnerability to disaster, Geography and climate and Prevalent building practices.

ZONE A

The coastal plains till about 50km inland from the sea - covering Kendrapara, Jagatsinghpur, Puri, Ganjam and parts of Cuttack, Jajpur and Balasore. Very high vulnerability to wind and cyclone and flooding - prone to cyclonic storm surges accompanied with strong rain and high velocity winds in the range of 30 m/s (severe cyclonic storm) to 45 m/s (very severe storm).

ZONE B

The coastal plains covering Kendrapara, Jagatsinghpur, Puri, Balasore, Bhadrak Cuttack and parts of Cuttack. The deltaic river basins of Mahanadi, Burha Balanga, Baitarani, Brahmani and Subarnarekha are the most flooding prone areas. Vulnerability to regular flooding 2-4 times in a year resulting in inundation till about 300mm above plinth for up to 24 hours. There is severe flooding once in 1 or 2 years resulting in inundation of more than 900mm above plinth level for a period of 24-72 hours.

ZONE C

Predominantly consist of hilly areas of the Schedule V districts of Odisha - Mayurbhanj, Sundargarh, Koraput, Rayagada, Nagarangpur and Malkangiri and also parts of Kandhamal, Gajapati and Keonjhar. Although, there is a good rainy spell from June to September, there is high water run-off due to the hilly terrain and therefore mostly no flooding. There is low risk of earthquakes.

ZONE D

Predominant parts of Koraput, Nabarangpur, Kalahandi, Bolangir, Baragarh, Sambalpur, Jharsuguda and Sundergarh. Mostly, this region has low vulnerability to earth quake and high velocity winds. However, the region is vulnerable to heat waves as it experiences very hot and dry summers, with temperatures shooting above 45 degrees in Balangir, Sambalpur, Jharsuguda and Koraput. Also, there is risk of eco-system degradation and physical displacement from industrialization.

ZONE-A

Zone A includes 6 districts:

1. Kendrapara
2. Puri
3. Gunjam
4. Cuttack
5. Jajpur
6. Balasore

Resources Available:

- Alluvial and lateritic soil Stable soil such as 'moorum'.

Zone A has two typologies

OD-A-01

OD-A-02



OD-A-01

- 2 rooms staggered in plan, so as to create 2 semi-open spaces at front & back.
- The verandah is kept small as the staircase can be incorporated externally. low height walls provided for the kitchen enclosure.



OD-A-02

- Precast roofing technology.
- Foundation is to be provided for both rooms at the initial stage.
- Walls are mostly constructed in brick masonry in cement mortar.

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
Mostly 2 rooms with a veranda on the front. There is a large concentration of tribes in the region and there is a clear preference for mud houses on foundations of random rubble masonry. In some cases, stepped footings in brick masonry are used. 300-450mm thick mud walls with colourful plasters, often derived from natural sources, are a common practice.	High Plinth level recommended	Light Weight Roof Recommended. Clay tiles on a wood and bamboo understructure are commonly used in roofs.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • Reinforced brick pedestal • The pedestal is provided at not more than 6' spacing. The structure is tied at the plinth level with a minimum 6" deep plinth beam. 	<ul style="list-style-type: none"> • Brick pedestal of 10"x10" size and 5' depth, reinforced with 1 No. 12mmbar. • In case of cohesive soils, such as clayey/ silty clay/ clayey silt, reinforced.
Plinth	<ul style="list-style-type: none"> • Minimum 30 cm and 30 cm projected from the walls to protect the foundation and provide stability to the structure. 	
Wall	<ul style="list-style-type: none"> • 2 brick thick column with rat trap bonded brick wall . • Reinforcing bars embedded in brick masonry at the corners of all the rooms 	<ul style="list-style-type: none"> • Fly ash bricks of minimum 35 kg/cm2 strength in 1:4 cement mortar. Seismic bands provided at sill level, lintel level and ceiling level.
Wall Finish	<ul style="list-style-type: none"> • No wall finish required 	
Roof Structure	<ul style="list-style-type: none"> • Ferrocement roofing channel 25 mm thick, 200mm rise, 750mm wide • Concrete 1:2:4 in valleys between channels till half depth and brick bat (75mm thickness) placed in the reinforcement grid. 	<ul style="list-style-type: none"> • Roofing channels concrete for remaining depth laid to slope and finished with terracing • RCC filler slab 150mm thick using brick filler, provided as a pair of bricks



ODISHA

ZONE - A

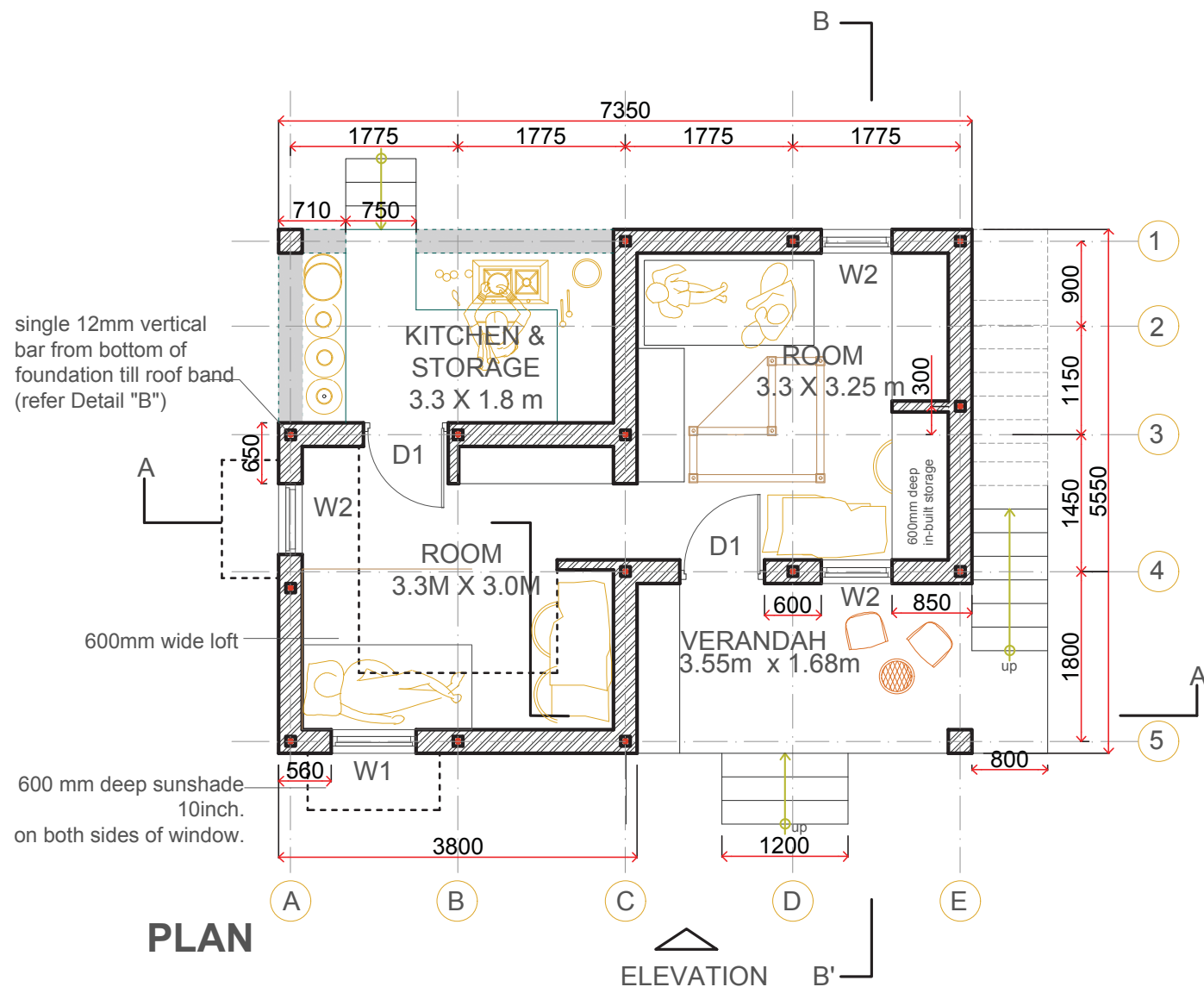
OD-A-01

- 2 rooms staggered in plan, so as to create 2 semi-open spaces at front & back.
- The verandah is kept small as the staircase can be incorporated externally. low height walls provided for the kitchen enclosure.
- Precast roofing technology.
- Foundation is to be provided for both rooms at the initial stage.
- Walls are mostly constructed in brick masonry in cement mortar.

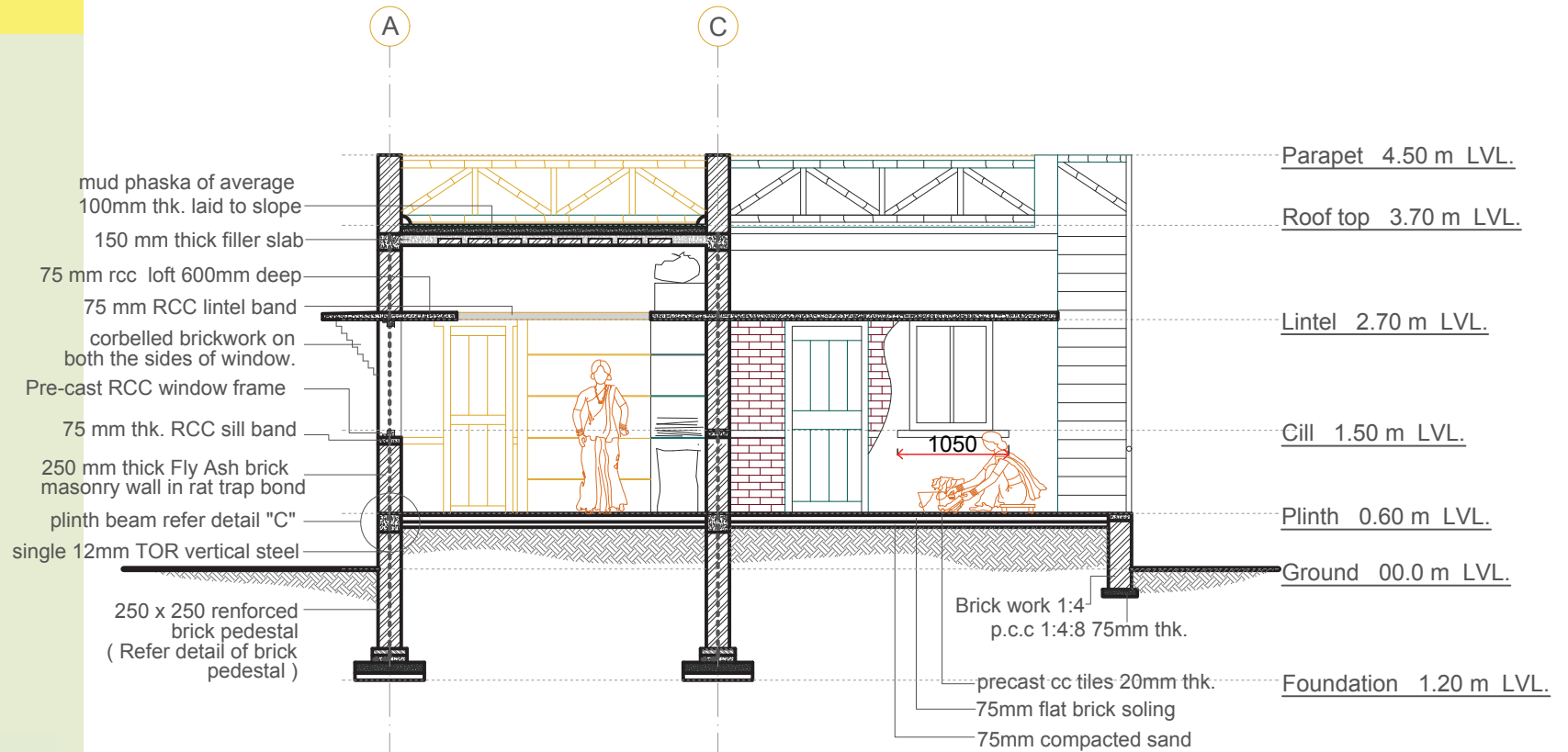
Total Cost ₹ 157,854/-



ODISHA



ZONE - A OD-A-01



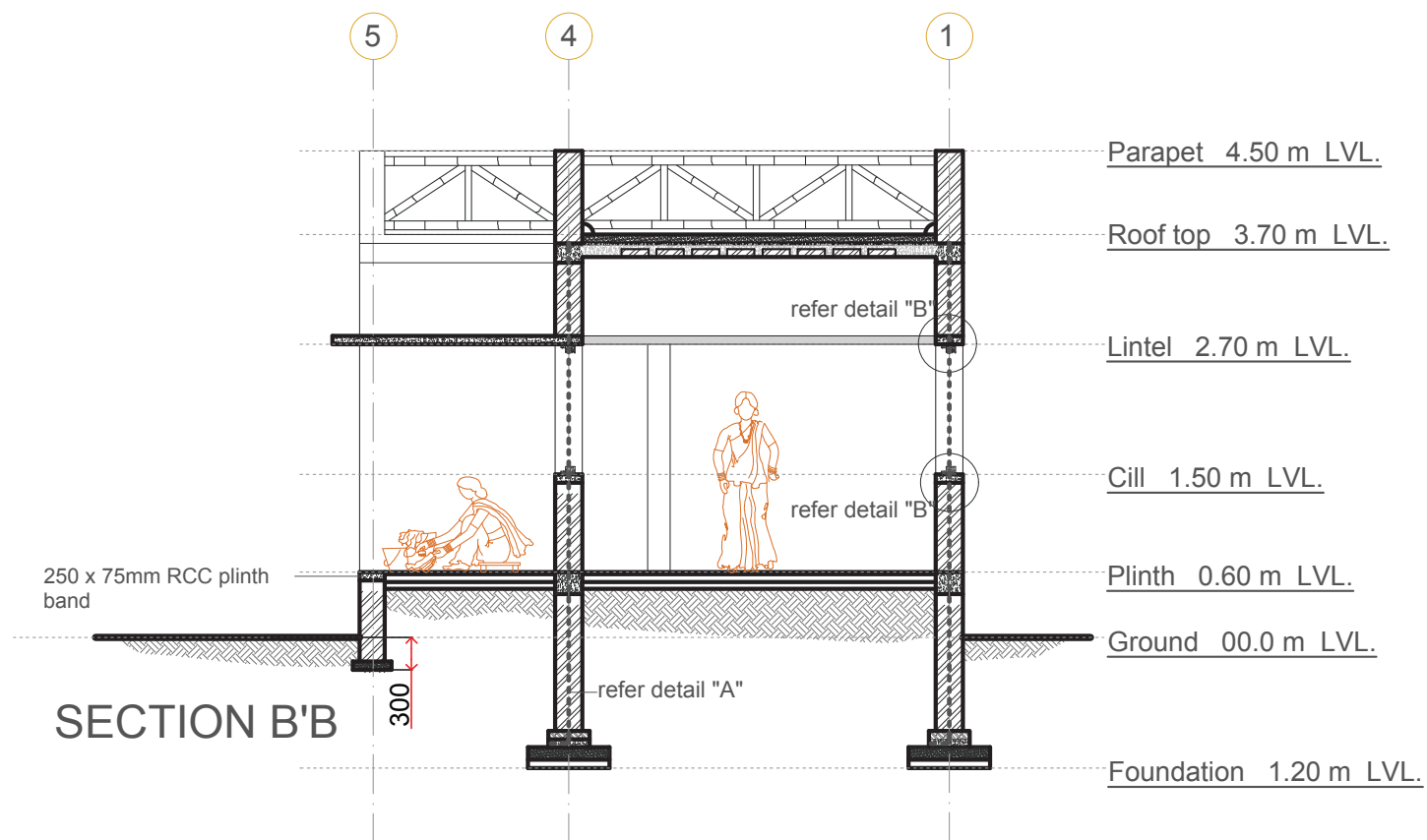
SECTION AA'



ODISHA

SECTION AA'

ZONE-A OD-A-01



SECTION BB'

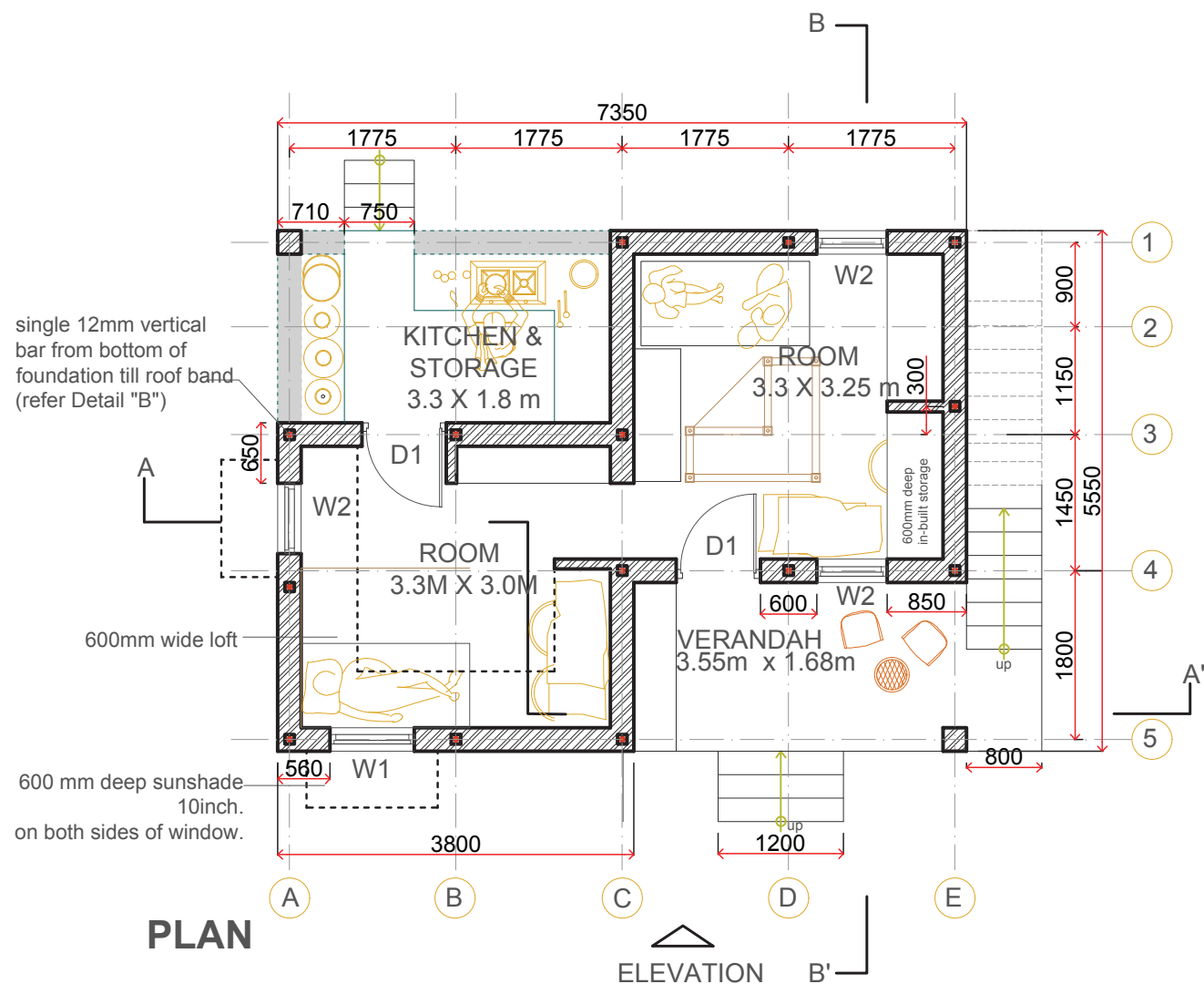


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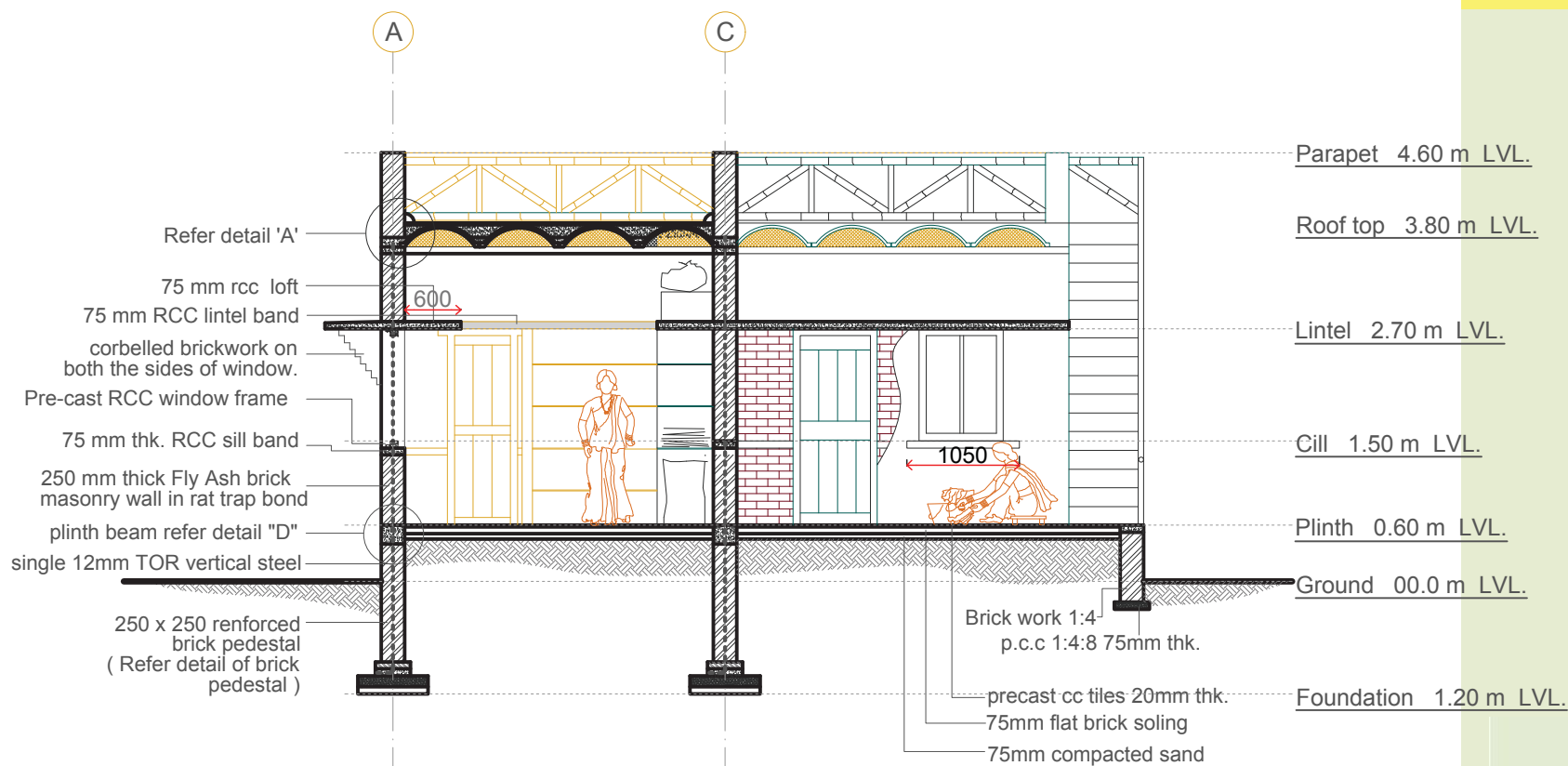
ZONE - A OD-A-02



ODISHA



ZONE-A OD-A-02



SECTION AA'

SECTION AA'

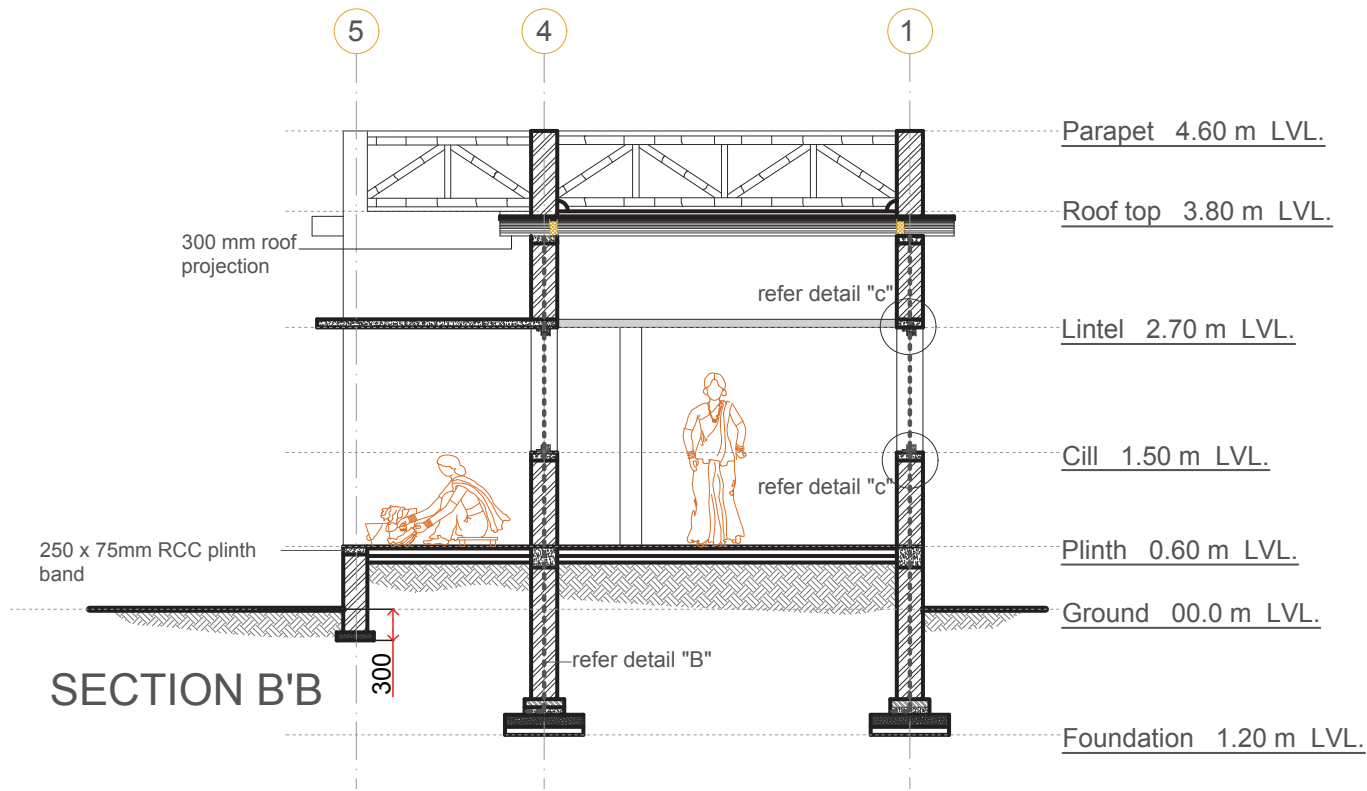


ODISHA

ZONE - A
OD-A-02



ODISHA



SECTION BB'

Cost Estimate for ZONE-D Design 01 and Design 02

S.No	Item	Quantity	Unit	Rate	Amount
1	Excavation for brick pedestal 1.2m depth	15	cu.m	80	1200
2	Brickwork with burnt clay bricks in foundation upto plinth				
2a	Brick pedestal in cement mortar 1:4	1.5	cu.m	3000	4500
2b	Brick wall between ground level and plinth beam in cement mortar 1:6	3.5	cu.m	2700	
2c	Brick Khoa 0.75mx0.75m, 75mm thick	1	cu.m	1800	1800
3	Brickwork in superstructure using Flyash bricks of min wet compressive strength of 50 kg/cq.cm - in rat-trap bond, in cement mortar 1:4	17	cu.m	3200	54400
4	Plain Cement Concrete in foundation				
4a	Mix 1:4:8	0.6	cu.m	2700	1620
4b	Mix 1:2:4	0.2	cu.m	3000	600
5	Reinforced cement concrete of 1:1.5:3 mix in superstructure				
5a	Plinth beam of 0.25mx0.25m size	1.7	cu.m	4500	7650
5b	Sill level band	0.5	cu.m	4500	2250
5c	Lintel level band	0.5	cu.m	4500	2250
5d	Roof level band	0.5	cu.m	4500	2250
5e	Front verandah roof	0.5	cu.m	4500	2250
5f	Concrete core of 100mmx100mm in corners and mid span of walls	0.7	cu.m	3000	2100
6	Steel				
6a	In Plinth beam	165	kg	58	9570
6b	In Sill band	33	kg	58	1914
6c	In lintel band	33	kg	58	1914
6d	In front verandah roof	45	kg	58	2610
6e	single 12mm bar in concrete core	62	kg	58	3596
7	Ferrocement channel roof using precast channels of width 750mm, thickness 25mm and 3500mm length, cast in 1:2 cement mortar, reinforced with chicken mesh and weldmesh				
7a	Precast ferrocement channel	8	No.	2000	16000
7b	In-fill concrete 1:2:4 in valleys between channels	1.5	Cu.m	3000	4500
7c	Manpower for lifting and placing				

ZONE - A OD-A-01 & 02

Cost breakup

Item	Cost (INR)
Excavation	1,200/-
Brickwork with burnt clay bricks in foundation up to plinth	6,300/-
Brickwork in superstructure	54,400/-
PCC Foundation	2,220/-
RCC 1:1.5:3	18,750/-
Steel	23,604/-
Ferrocement Channel Roof	20,500/-
Openings	13,300/-
Flooring	16,800/-
Total	157,854/-



ODISHA

ZONE - A
OD-A-01 & 02



ODISHA

	channels and finishing in-situ valley concrete				
	Skilled mason	2	Mandays	500	1000
	Labour	15	Mandays	250	3750
8	Openings				
8a	precast RCC door-window frames 60mmx100mm	22	R.M	115	2530
8b	Door shutter - solid core panel door 35mm thick	2.2	sq.m	1500	3300
	Window shutter - local timber	0.15	cu.m	50000	7500
9	Flooring				
	Rooms - CC tiles 300x300x15 on a 20mm cement mortar bed, sub-base of compacted brick bats	20	sq.m	450	9000
	Verandah - Cement Concrete flooring - base floor of 1:2:4 concrete and finishing layer Of 1:2 cement mortar	12	sq.m	650	7800
				Total	157854
				cost/sq.m	4510



OD-B-01



OD-B-02

- RCC frame structure on pile foundations with 300mm grade beam and 150mm lintel bands are constructed.
- Walls are mostly constructed in brick masonry in cement mortar

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
Rectangular structure and liner in the arrangement of their interior spaces. Entry to the building is from longer side. Open to sky verandah is provided in one long side. Future expansion proposed vertically. Future expansion proposed vertically.	High Plinth level recommended.	Light Weight Roof Recommended.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Alternatively, the earthen plinth can be plastered with a cement-sand (by volume of soil) RCC grade beam of 1:1.5:3 mix. 	<ul style="list-style-type: none"> Toe wall in brick masonry in cement mortar 1:6 till plinth level. Alternatively, laterite blocks can be used as strip footing.
Plinth		
Wall	<ul style="list-style-type: none"> Rat-trap bond masonry in 1:4 cement-mortar using burnt clay bricks of minimum 35 kg/cm² strength. 3" thick RCC bands to be provided at sill, lintel and roof level. 	<ul style="list-style-type: none"> The frame is braced with diagonal bamboo from plinth to attic level at wall corners.
Wall Finish	<ul style="list-style-type: none"> The wall is plastered with a mud plaster made with clayey soil, sand, straw, dung and rice husk ash. 	<ul style="list-style-type: none"> Wherever affordable, the external plaster can be a cement-sand plaster
Roof Structure	<ul style="list-style-type: none"> Precast RCC planks of size 1500 x 300 x 30mm placed adjacent to each other supported on RCC joist 150 x 150mm (upto a length of 3.5m) and wall. 	<ul style="list-style-type: none"> Corrugated Galvanized Iron sheet of minimum 0.35mm thickness tied to bamboo understructure through J bolts with galvanized and bitumen washers.
Roof Cover	<ul style="list-style-type: none"> Country Tiles with Timber Understructure. 	<ul style="list-style-type: none"> Woven reed mats can be used below the tiles as false ceiling for thermal insulation.

ZONE-B

Zone B comprise 6 districts :

1. Kendrapara
2. Jagatsinghpur
3. Puri
4. Balasore
5. Bhadrak Cuttack
6. Parts of Cuttack

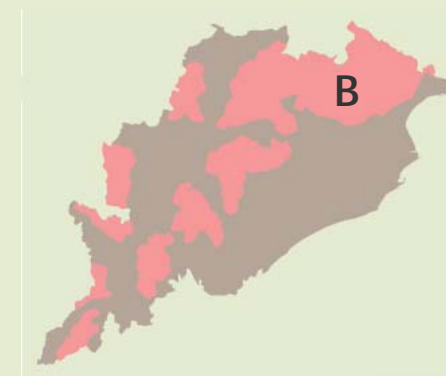
Resources Available:

- Flat tracks of alluvial soil River deltas of varied sizes formed by Mahanadi, Burha Balanga, Baitarani, Brahmani Subarnarekha and Rushikulya

Zone B has two typologies

OD-B-01

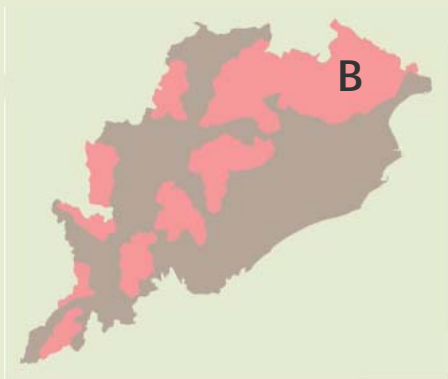
OD-B-02



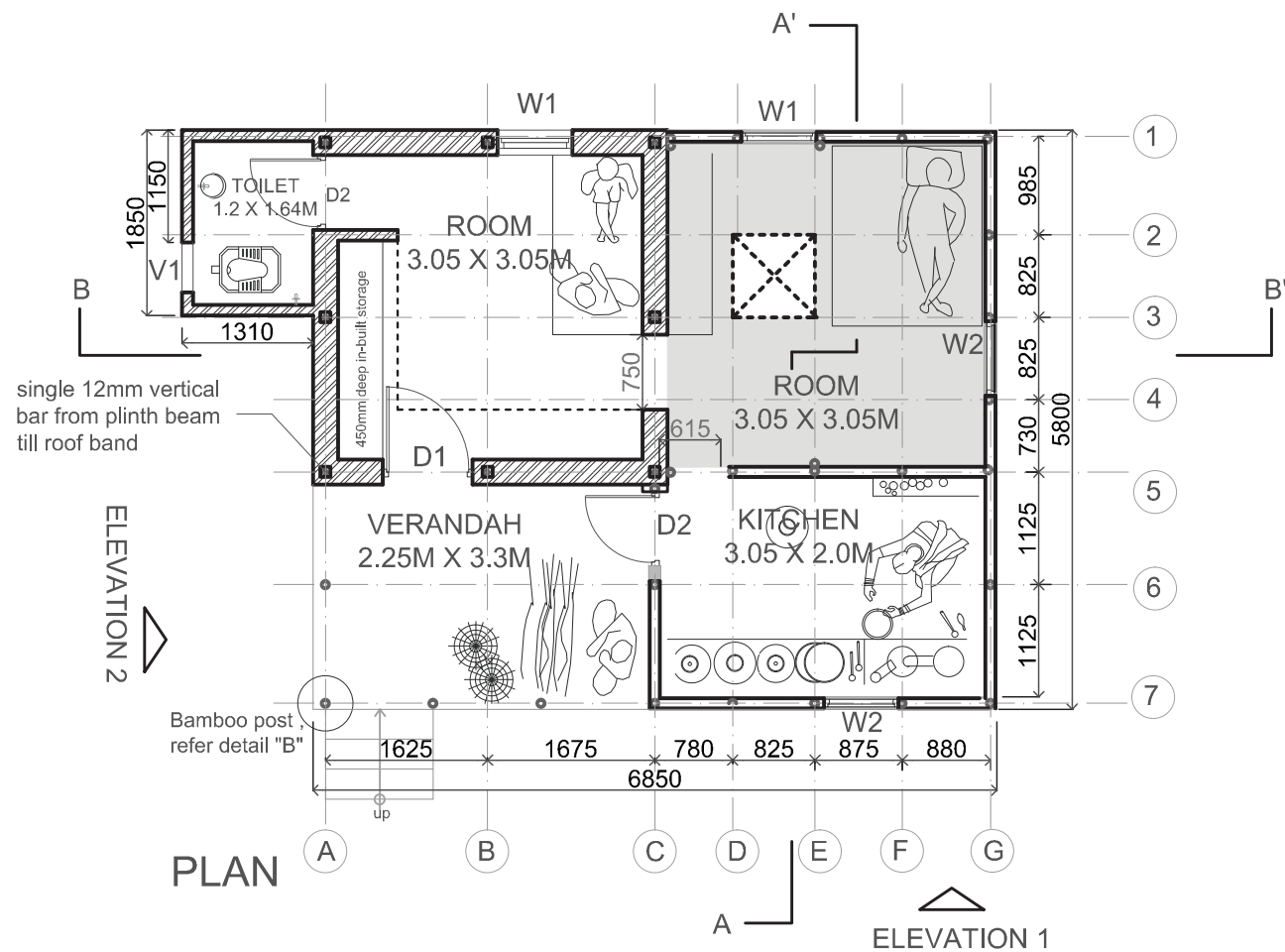
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ZONE-B OD-B-01

Total Cost ₹ 158,088/-

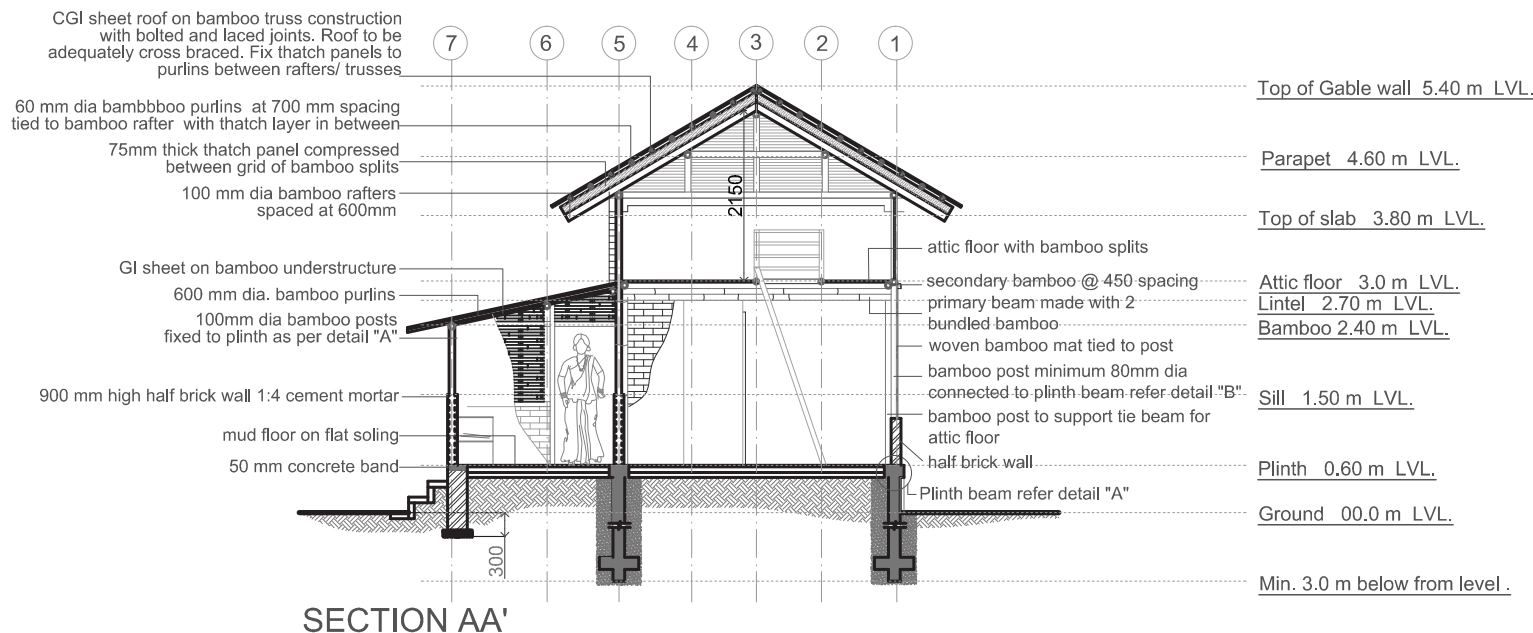


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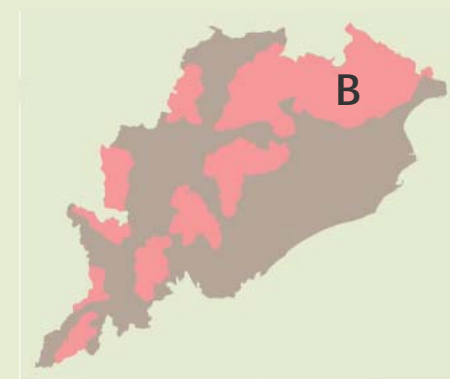


ZONE - B

OD-B-01

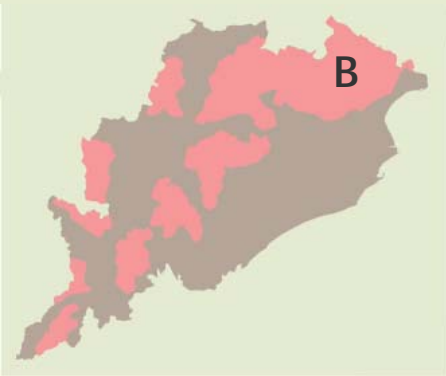
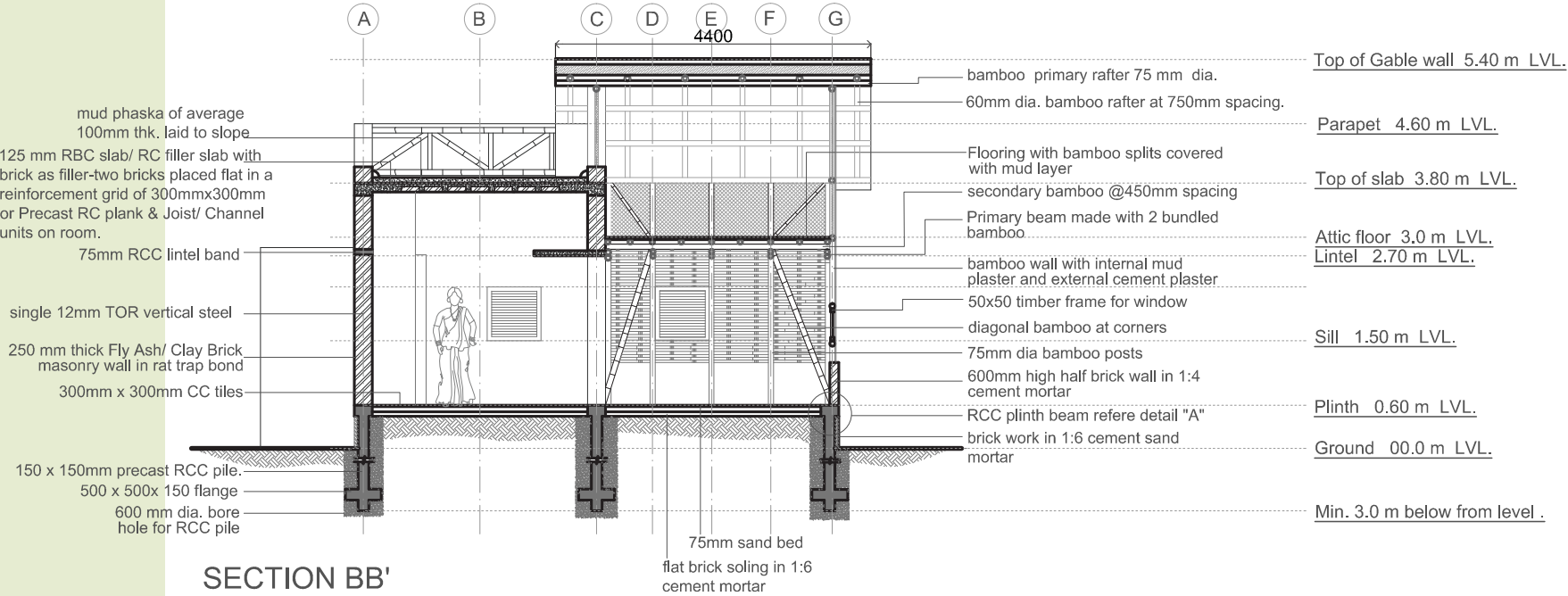


SECTION AA'



ODISHA

ZONE-B
OD-B-01



ODISHA

SECTION BB'

Cost Estimate for ZONE-B Design 01

S.No	Item	Quantity	Unit	Rate	Amount
1	Excavation				
	For both rooms with pile foundation	12	cu.m	80	960
	For kitchen, verandah and toilet	3	cu.m	80	240
3	Sand fill and compaction	2	cu.m	450	900
4	Concrete work				
4a	PCC 75mm thick in foundation masonry, Mix 1:4:8	0.75	cu.m	2700	2025
4b	Mix 1:2:4 in concrete base 0.1x0.1x0.45 to support bamboo posts	0.1	cu.m	2700	270
5	RCC work, mix 1:1.5:3				
5a	Plinth beam, 0.25mx0.15m	1	cu.m	4500	4500
5b	Lintel band, 75mm thick	0.25	cu.m	4500	1125
5c	Filler slab over one room with bricks used as filler material	1.4	cu.m	5500	7700
5d	Precast piles of section 0.15mx0.15mx3m, with a 0.5mx0.5m flange	12	No.	1000	12000
6	Brickwork in cement mortar				
6a	Brickwork in 1:6 cement mortar in between piles upto plinth	3.5	cu.m	3000	10500
6b	Brickwork upto plinth in 1:6 CM for verandah and toilet	2.4	cu.m	3000	7200
6c	Brickwork 0.25m thick in superstructure in 1:4 cement mortar	8.7	cu.m	3500	30450
6d	Half brickwork till 600mm height in cement mortar 1:6	10	sq.m	550	5500
6e	Brickwork in parapet	0.3	cu.m	2500	750
7	Reinforcement steel				
7a	Steel in Plinth beam	132	kg	58	7656
7b	Steel in Lintel band	16	kg	58	928
7c	Steel in filler slab roof	72	kg	58	4176
8	Wattle and daub wall - bamboo frame and weave with mud plaster				
8a	75-100mm dia bamboo - for main frame in rooms, kitchen and verandah				
	Vertical frame	16	No.	130	2080
	Horizontal bamboo at attic level and top of kitchen	4	No.	130	520
	For diagonal ties	6	No.	130	780

ZONE - B OD-B-01

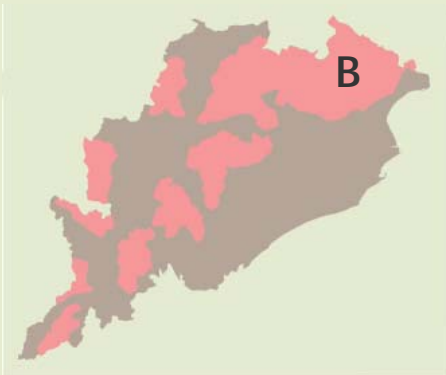
Cost breakup

Item	Cost (INR)
Foundation	18,056/-
Flooring	36,950/-
Walls	63,034/-
Attic & Roof	30,806/-
Doors & Windows	9,242/-
Total	158,088/-



ODISHA


ZONE-B
OD-B-01



ODISHA

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Total Cost ₹ 140,010



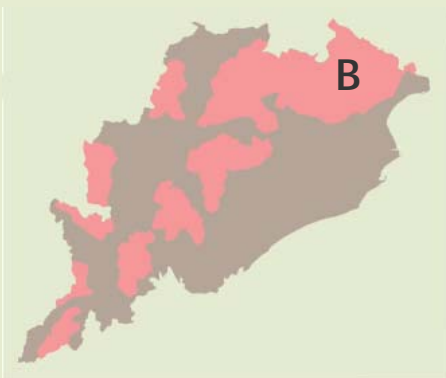
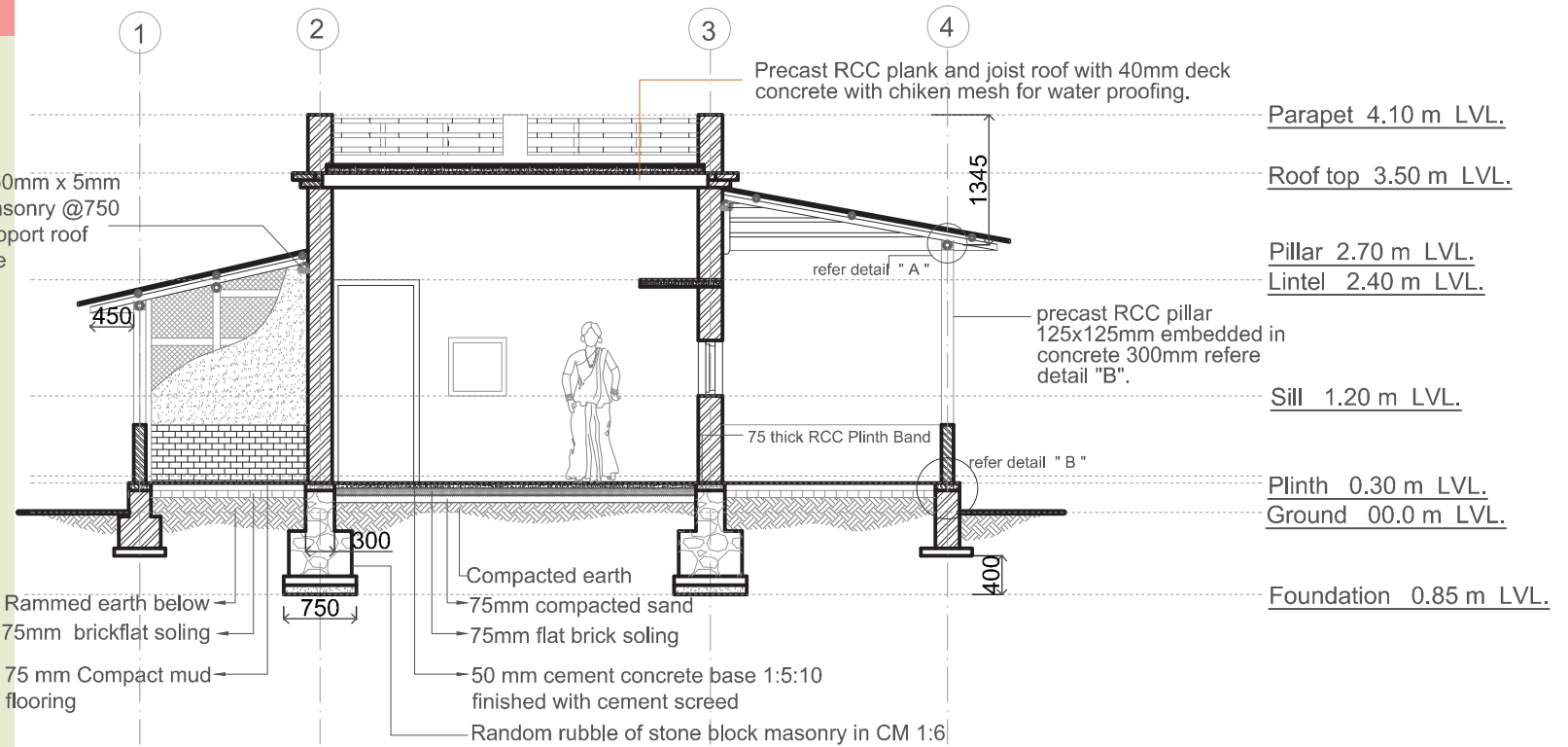
ODISHA



ODISHA

ZONE-B OD-B-02

metal clamp 60mm x 5mm
inserted in masonry @750
spacing to support roof
understructure



ODISHA

SECTION AA'

Cost Estimate for ZONE-B Design 02

S.No	Item	Quantity	Unit	Rate	Amount
1	Excavation				
	For room and 600mm high half brick walls	14	cu.m	80	1120
	For precast columns	0.5	cu.m	80	40
2	Random rubble stone masonry in mud mortar - foundation of room	5	cu.m	1200	6000
3	Sand fill and compaction	2	cu.m	450	900
4	Concrete work in foundation				
4a	PCC, Mix 1:4:8	2.2	cu.m	2700	5940
4b	Damp proof course 50mm thick in 1:2:4 concrete	3.6	sq.m	250	900
5	Brickwork in cement mortar				
5a	Brickwork in 1:6 cement mortar with burnt clay bricks in foundation upto plinth	0.6	cu.m	3000	1800
5b	Brickwork in superstructure in 1:6 cement mortar	10.5	cu.m	3500	36750
5c	Half brickwork till 600mm height in cement mortar 1:6	11	sq.m	550	6050
5d	Brickwork in parapet	0.3	cu.m	3500	1050
6	RCC				
6a	Concrete 1:1.5:3 in RCC loft	0.3	cu.m	4500	1350
6b	Steel in RCC loft	22	kg	58	1276
6c	Precast RCC post of size 0.125mx0.125m, length 2.5m, mix 1:1.5:3, 5kg steel in 1 post	10	No.	800	8000
7	Roof with precast RCC plank and joist				
7a	Precast RCC planks of size 1.5mx0.3m, with 1.6 kg 6mm steel per plank	24	No.	275	6600
7b	Precast RCC beam of size 0.15mx0.15m, 3.6m length	1	No.	2500	2500
7c	In-situ concrete mix 1:1.5:3 on top of planks and joist	0.25	cu.m	4500	1125
7d	Steel in in-situ concrete	13	kg	58	754
7e	Manpower				
	Mason	2	mandays	500	1000
	Labour	12	mandays	250	3000
	Bar bender	1	mandays	500	500
8	GCI sheet roof - 0.5mm thick for verandah and kitchen				

ZONE - B OD-B-02

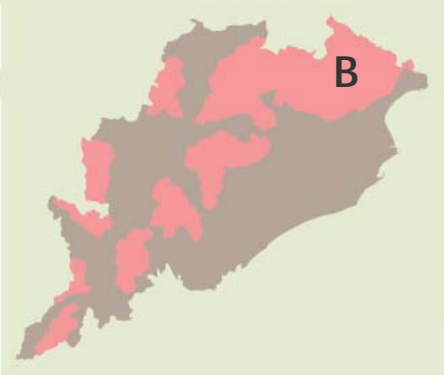
Cost breakup

Item	Cost (INR)
Excavation	1,200/-
Brickwork with burnt clay bricks in foundation up to plinth	6,300/-
Brickwork in superstructure	44,400/-
PCC Foundation	2,220/-
RCC 1:1.5:3	18,750/-
Steel	19,604/-
Ferrocement Channel Roof	17,436/-
Openings	13,300/-
Flooring	16,800/-
Total	140,010/-



ODISHA

ZONE-B
OD-B-02



ODISHA

8a	size 2740 x 900 (9'x3')				13	No.	500	6500
8b	size 2135 x 900 (7'x3')				6	No.	425	2550
8c	Bamboo understructure							
	75-100mm dia bamboo				35		130	4550
	50-60mm dia bamboo				10		100	1000
8d	Manpower							
	Skilled artisan/carpenter				3	mandays	500	1500
	Labour				6	mandays	250	1500
8e	Nails and hardware					lumsum		2000
9	Mud plastered bamboo wall - 1.5 m high, total surface area 15sq.m, 100mm thick							
9a	75-100mm dia bamboo				8	No.	130	1040
9b	50-60mm dia bamboo				25	No.	100	2500
9c	Clayey soil for mud plaster				2	cu.m	500	1000
10	Openings							
10a	precast RCC door-window frames 60mmx100mm				15	R.M	115	1725
	Door shutter - solid core panel door 35mm thick				2	sq.m	1500	3000
	Window shutter 30mm thick - local timber				0.06	cu.m	50000	3000
11	Flooring							
11a	Rooms - CC tiles 300x300x15 on a 20mm cement mortar bed, sub-base of compacted brick bats				11.2	sq.m	450	5040
11b	Verandah - Cement Concrete flooring - base floor of 1:2:4 concrete and finishing layer Of 1:2 cement mortar				23	sq.m	650	14950
11c	Earthen floor using red clayey soil stabilized with rice husk ash				10	sq.m	150	1500
							Total	140010
							cost/sq.m	2917



OD-C-01



OD-C-02

- 1 room is proposed for construction in rat-trap bong masonry, with a flat RCC filler slab as an accessible roof.
- Masonry is tied together with RCC at the plinth & lintel level.

- The veranda & kitchen are provided at the front side with a single continuous CGI sheet roof.
- A strong foundation using precast RCC piles & plinth beams is provided in rooms.

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
Mostly 2 rooms with a veranda on the front. 300-450mm thick mud walls with colourful plasters, often derived from natural sources, are a common practice.		Clay tiles on a wood and bamboo understructure are commonly used in roofs.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	• In areas where soil with minimum 10T/sq.m bearing capacity is found at shallow depths, strip foundations in brick masonry 2'6" wide at base may be used.	• The structure is tied at the plinth level with a minimum 6" deep plinth beam.
Plinth		
Wall	• 450mm thick earthen walls in traditional cob technique. • Bamboo frame using minimum 80mm dia-bamboo posts and bamboo splits.	• The frame is braced with diagonal bamboo from plinth to attic level at wall corners.
Wall Finish	• The wall is plastered with a mud plaster made with clayey soil, sand, straw, dung and rice.	• Wherever affordable, the external plaster can be a cement-sand plaster.
Roof Structure	• Gable roofs of at least 25 degree slope on timber rafters and bamboo split purlins.	• Primary rafters to rest on wall plate fixed to a brick course or a cement concrete base.
Roof Cover		
Floor	• 30mm concrete base 1:4:8 on flat brick soling, finished with cement screed.	• Earthen floor using red clayey soil stabilized with rice husk ash or 7%.

ZONE-C

Zone C comprise 7 districts :

1. Mayurbhanj,
2. Sundargarh,
3. Koraput,
4. Rayagada,
5. Nagarangpur
6. Malkangiri
7. Parts of Kandhamal, Gajapati and Keonjhar.

Resources Available:

- Red and yellow soil with good clayey fraction.

Zone C has two typologies

OD-C-01

OD-C-02



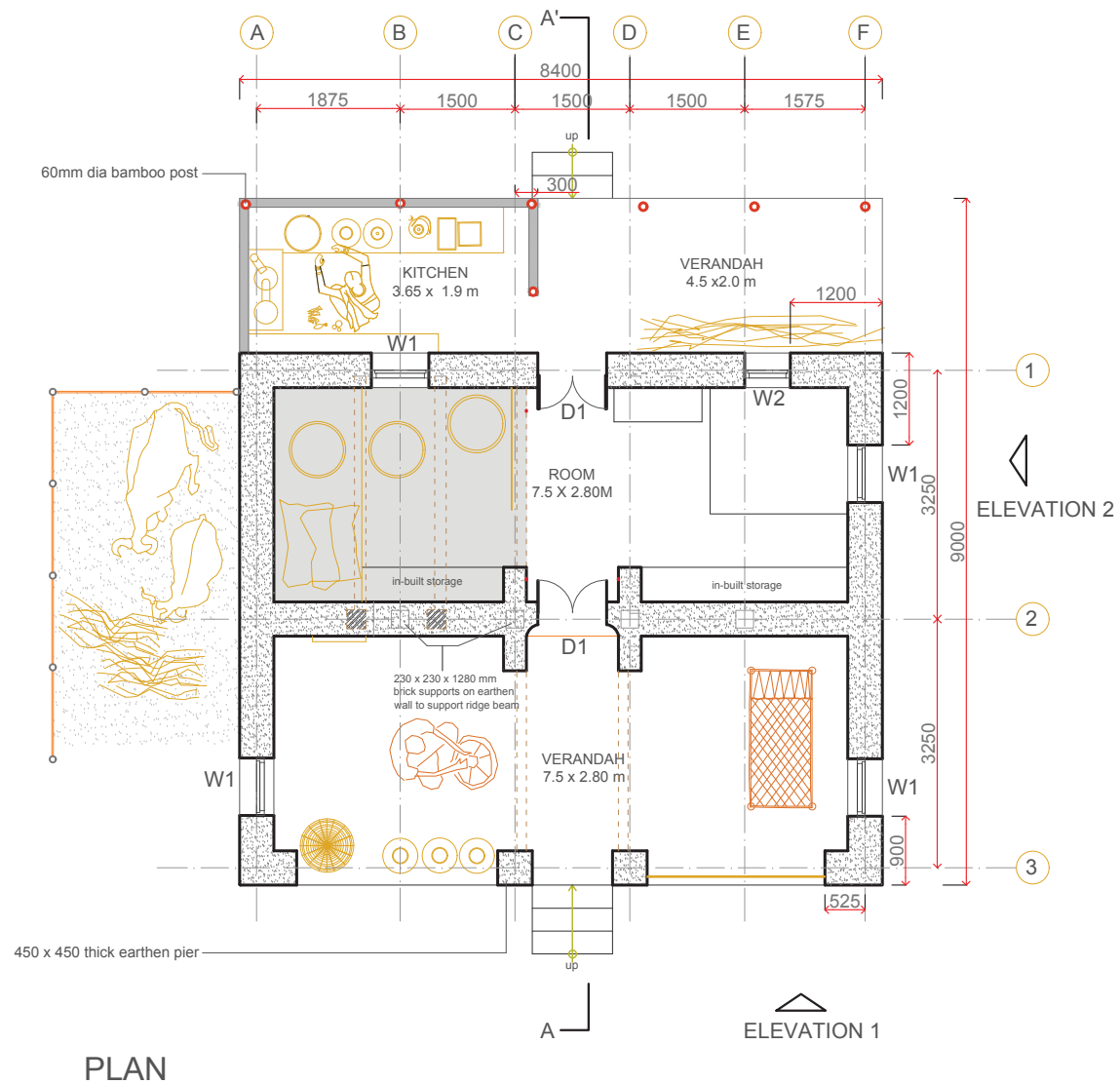
ODISHA

ZONE - C OD-C-01

Total Cost ₹ 159,945/-



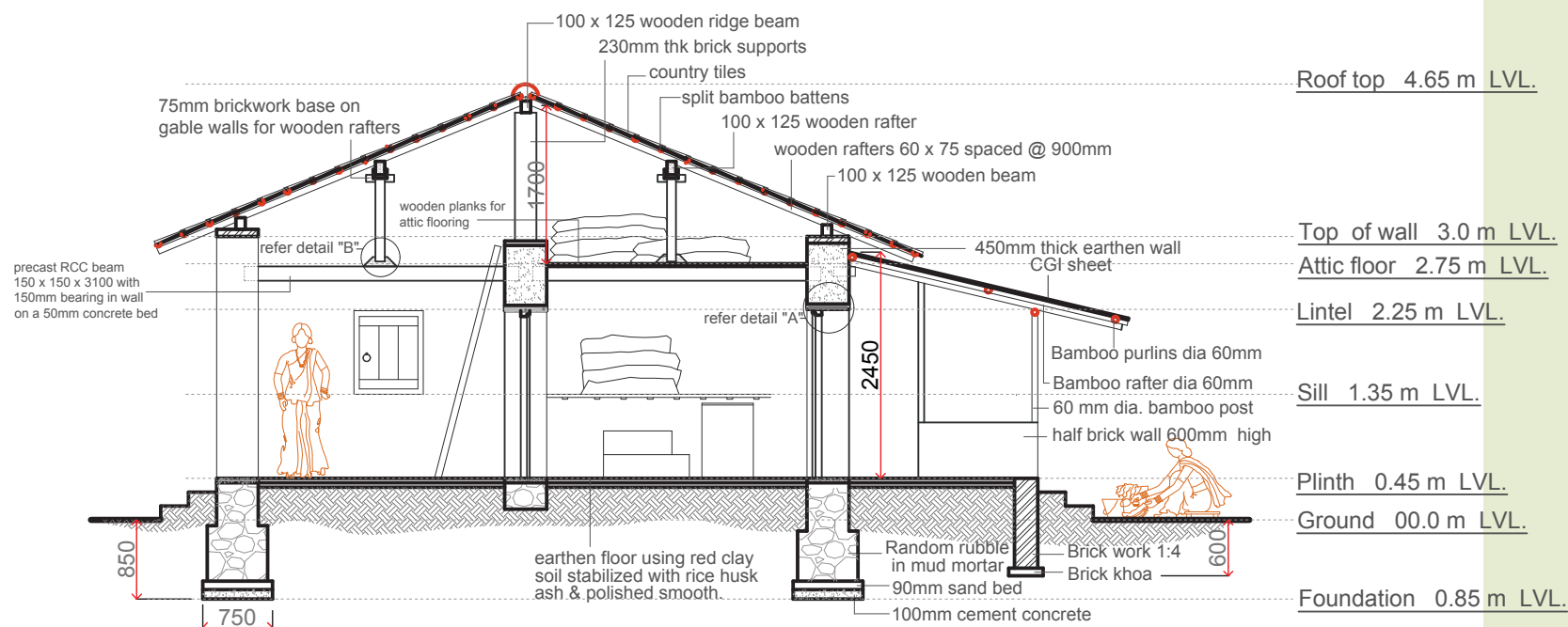
ODISHA



TYPICAL PLAN

ZONE-C

OD-C-01



SECTION AA'

SECTION AA'



ODISHA

ZONE - C
OD-C-01

Cost breakup

Item	Cost (INR)
Foundation	44,835/-
Flooring	6,750/-
Walls	36,000/-
Attic & Roof	64,860/-
Doors & Windows	7,500/-
Total	159,945/-



ODISHA

Cost Estimate for ZONE-C Design 01

S.No	Item	Quantity	Unit	Rate	Amount
1	Excavation in soft soil upto 1 metre depth	12	cu.m	80	960
2	Random rubble masonry in mud mortar till plinth level	25	cu.m	1200	30000
3	Plain Cement Concrete 1:4:8 in foundation	3	cu.m	2750	8250
4	Providing a sand bed below random rubble masonry	2.5	cu.m	450	1125
5	Damp proof course 50mm thick in 1:2:4 concrete	18	sq.m	250	4500
6	Earthen walls 0.45m thick, using locally available soil - using clayey sandy soil with 10% gravel content, including labour and self-help from family	60	cu.m	600	36000
6	Precast RCC beam of mix 1:1.5:3, cross section 150x150mm, 3m long	6	No.	1200	7200
7	Clay tile roof(area 76 sq.m)				
7a	Clay tiles, semi-cylindrical shape of approx.size 0.4mx0.25m	900	No.	10	9000
7b	Wood - for roof understructure				
	0.1mx0.125m, less than 3.5m length -for primary rafters	0.6	cu.m	25000	15000
	0.1mx0.1m, for vertically supporting the primary rafter in its span	0.05	cu.m	25000	1250
	0.06mx0.075m, 4.5m length for secondary rafter	0.5	cu.m	25000	12500
	bamboo splits for roof purlins, made from 50mm dia bamboo	35	No.	100	3500
7c	Manpower				
	Carpenter	2	mandays	500	1000
	Labour	4	mandays	250	1000
7d	Nails and hardware		lumsum		1500
8	Attic floor				
	Wooden planks - size 300mm x 1000mm, 75mm thick for attic floor	30	No.	400	12000
9	CGI sheet roof over verandah				
9a	Bamboo posts of min 80mm dia, 2.5 m high	7	No.	130	910
9b	Bamboo rafter min 60mm dia for CGI sheet roof	5	No.	100	500

9c	Manpower				
	Skilled artisan	1	mandays	500	500
10	Openings				
10a	Door-window frame in non-sal timber 80x60mm	0.12	cu.m	25000	3000
10b	Shutter of wooden planks 30mm thick	0.07	cu.m	50000	3500
11	Flooring - Earthen floor using red clayey soil stabilized with rice husk ash	45	sq.m	150	6750
				Total	159945
				cost/sq.m	2121

ZONE-C OD-C-01



ODISHA

ZONE - C OD-C-02

Total Cost ₹ 164,560/-

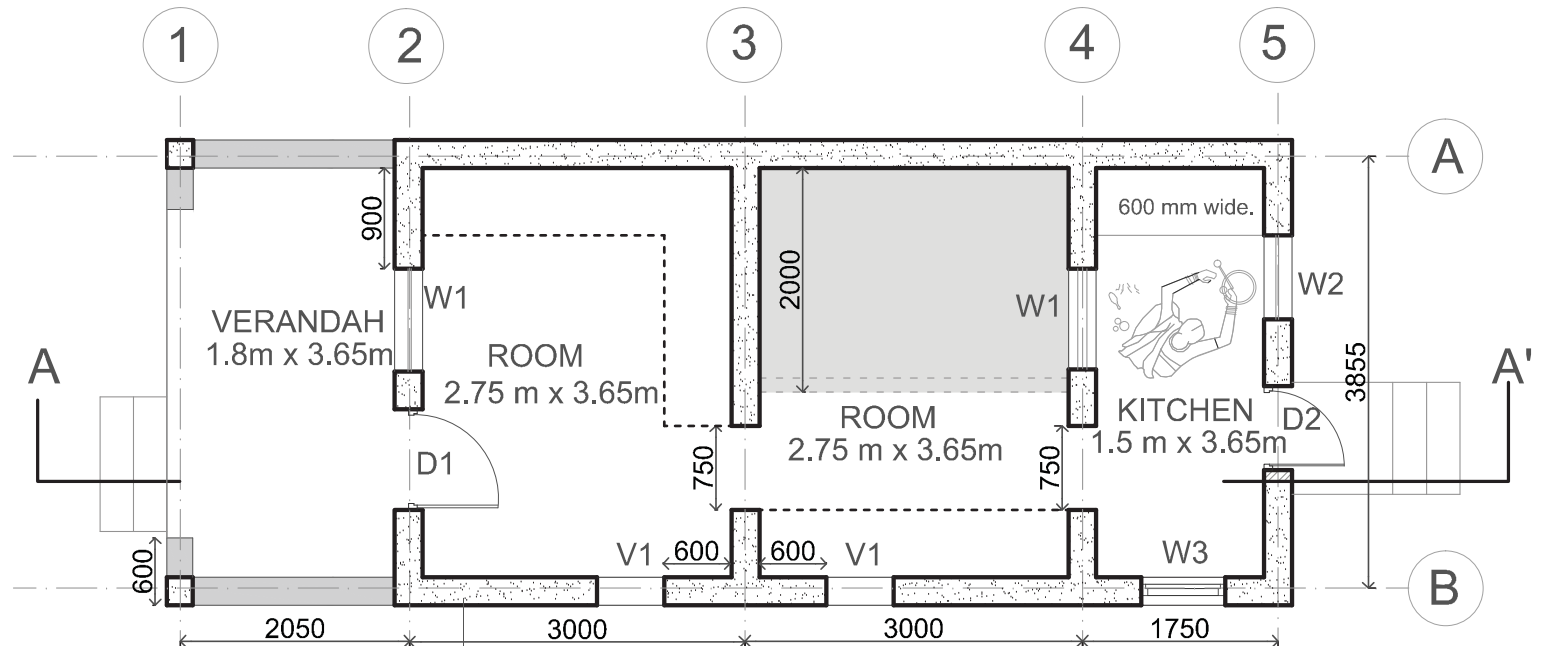
ELEVATION 2

PLAN

ELEVATION 1

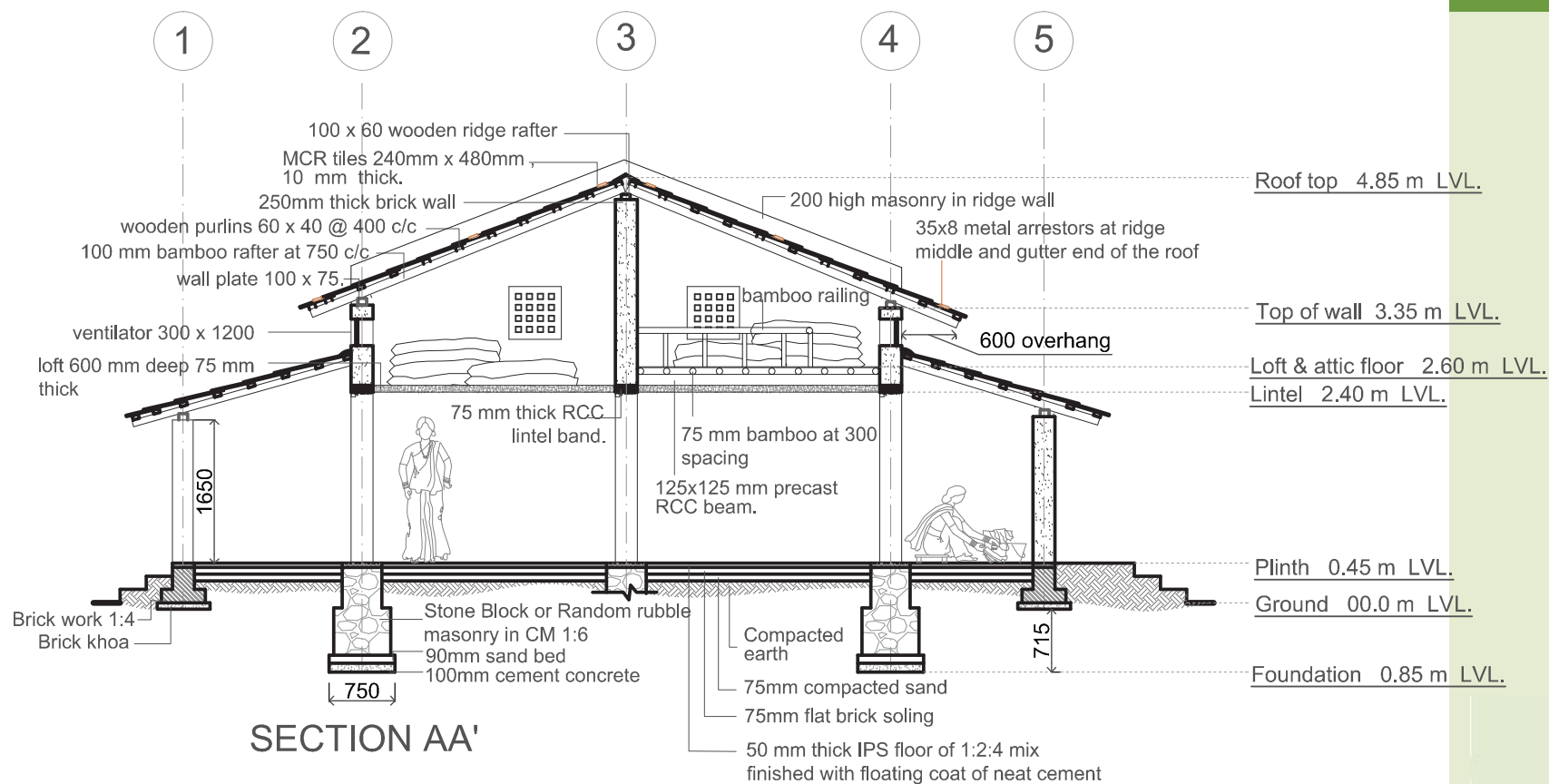
200mm stone block masonry in CM 1:4 till sill level,
above 150mm stone block masonry in CM 1:4
Alternative: CSEB with 7% cement stabilisation
with RCC Lintel and Roof bands

TYPICAL PLAN



ODISHA

ZONE-C OD-C-02



SECTION AA'



ODISHA

ZONE - C
OD-C-02

Cost breakup

Item	Cost (INR)
Excavation	1,832/-
Sand Fill and Compaction	450/-
Concrete Work	8,447/-
Random Rubble Masonry	10,200/-
Pointing in 1:3 Cement Mortar External	1,080/-
Burnt Brick Masonry	9,000/-
Cement Stabilized Earth Block Masonry	61,250/-
R.C.C.	5,175/-
Steel In Band	4,060/-
Roof	31,895/-
Attic Floor	4,100/-
Door and Windows	11,570/-
Flooring	15,500/-
Total	164,560/-



ODISHA

Cost Estimate for ZONE-C Design 02

S.No	Item	Quantity	Unit	Rate	Amount
1	Excavation				
	For both rooms	17.5	cu.m	80	1400
	For kitchen,verandah	5.4	cu.m	80	432
2	Sand fill compacted	1	cu.m	450	450
3	Concrete work				
4a	PCC 1:4:8 75mm thick in foundation masonry, Mix 1:4:8	1.8	cu.m	2700	4860
4b	DPC 1:2:4, 50mm thick				
	Two rooms	10.6	sq.m	250	2650
	Verandah , kitchen	3.75	sq.m	250	937.5
5	Random rubble masonry in mud mortar in foundation, till 0.45m plinth	8.5	cu.m	1200	10200
6	Pointing in 1:3 cement mortar external, above ground	9	sq.m	120	1080
7	Burnt brick masonry till plinth in 1:6 cement mortar	3	cu.m	3000	9000
8	Cement Stabilized Earth Block masonry in superstructure - English bond masonry in 1:2:6 cement-soil-sand mortar. Blocks are stabilized with 7% (by weight) cement				
	Two rooms	20	cu.m	2500	50000
	Verandah, kitchen	4.5	cu.m	2500	11250
9	RCC work -1:1.5:3				
	Concrete in lintel band	0.5	cu.m	4500	2250
	Concrete in 0.6m wide loft	0.65	cu.m	4500	2925
10	Steel in lintel band	30	kg	58	1740
	Steel in loft	40	kg	58	2320
11	Roof in Micro Concrete Roofing(MCR) tiles of size 240mmx480mm on wooden purlins and bamboo understructure				
11a	MCR tiles	750	No.	14	10500
11b	Timber wall plate 100mmx60mm	0.125	cu.m	25000	3125
11c	Timber purlins @400mm spacing, 60x40mm	0.35	cu.m	25000	8750
11d	Bamboo 80-100mm dia for roof understructure	24	No.	130	3120
11e	Manpower				

ODISHA

ZONE-D

Zone D comprise 8 districts:

1. Koraput
2. Nabarangpur
3. Kalahandi
4. Bolangir
5. Baragarh
6. Sambalpur
7. Jharsuguda
8. Sundergarh

Resources Available:

- The soil is a predominantly Red soil.
- Stones are abundantly available in the region due to the geology of the region.

Zone D has one typology

OD-D-01



- One large room of 20m.sq partitioned by 2-3
- Hipped roof.
- The front of the house has a lean-to-roof & serves as a verandah

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
<ul style="list-style-type: none"> Mostly 2 rooms with a veranda on the front and a rear kitchen along with other services such as drying space, toilets, hand-pumps, etc. Often, the houses have a linear design and arranged in rows, sharing one wall with the adjacent house. 		<ul style="list-style-type: none"> Gable roofs using asbestos roofing sheets are the most common roofing material

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> In areas where soil with minimum 10T/sq.m bearing capacity is found at shallow depths, strip foundations in brick masonry 2'6" wide at base may be used. 	<ul style="list-style-type: none"> The structure is tied at the plinth level with a minimum 6" deep plinth beam.
Wall	<ul style="list-style-type: none"> Rat-trap bond masonry in 1:4 cement-mortar using burnt clay bricks of minimum 35 kg/cm² strength. 3" thick RCC bands to be provided at sill, lintel and roof level. The masonry should be strengthened with single 12mm bars at corners, T-junctions and mid-span of walls. 	<ul style="list-style-type: none"> Rat-trap bond masonry in 1:4 cement-mortar The frame is braced with diagonal bamboo.
Wall Finish	<ul style="list-style-type: none"> The wall is plastered with mud plaster made with clayey soil, sand, straw, dung and rice husk ash. 	<ul style="list-style-type: none"> Wherever affordable, the external plaster can be a cement-sand plaster.
Roof Structure	<ul style="list-style-type: none"> Corrugated Galvanized Iron sheet of minimum 0.35mm thickness tied to bamboo understructure through J bolts with galvanized and bitumen asher 	<ul style="list-style-type: none"> An underlayer of premade panels of bamboo mat (indicative size 1200x1800)



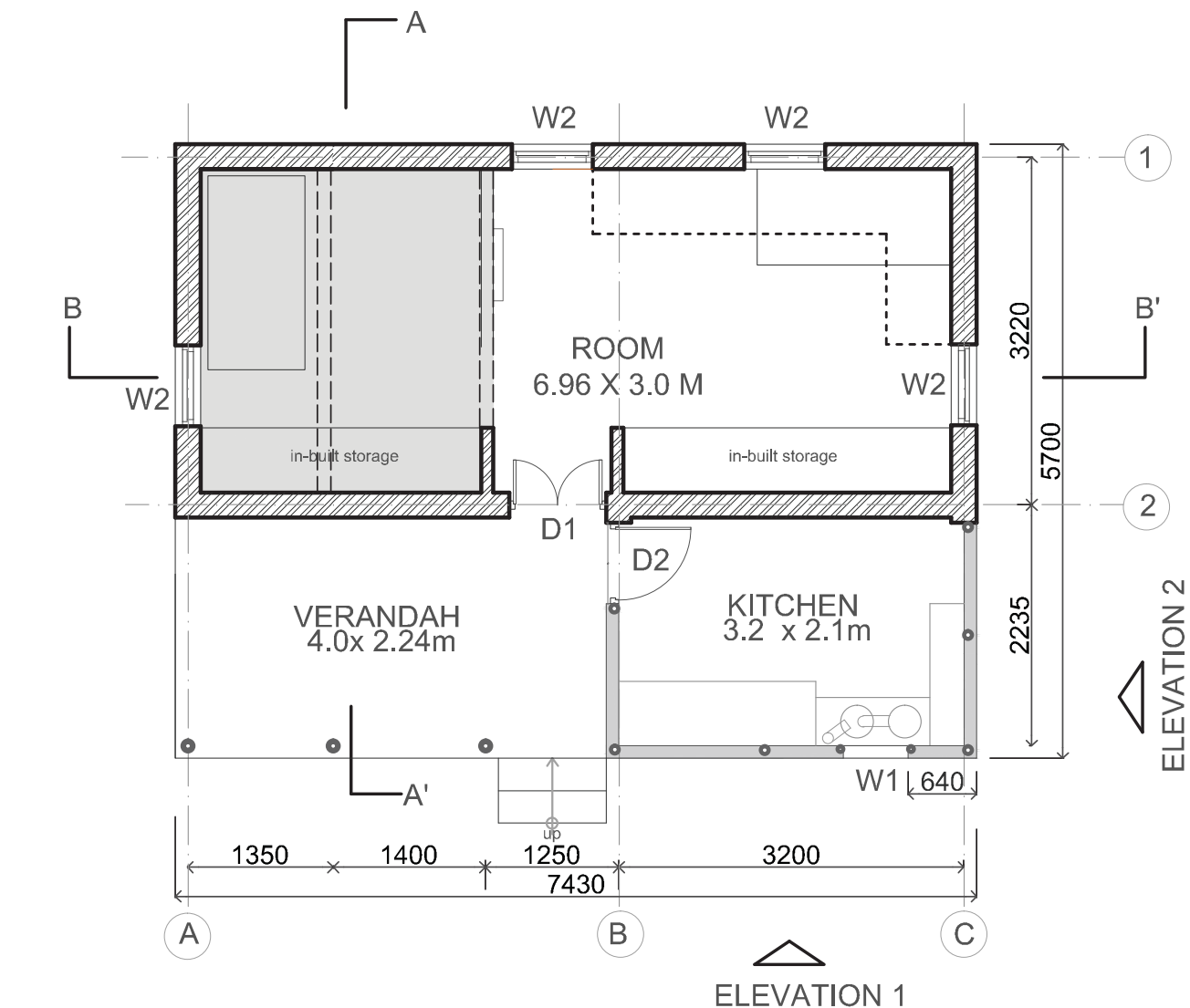
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ZONE - D OD-D-01

Total Cost ₹ 153,520/-



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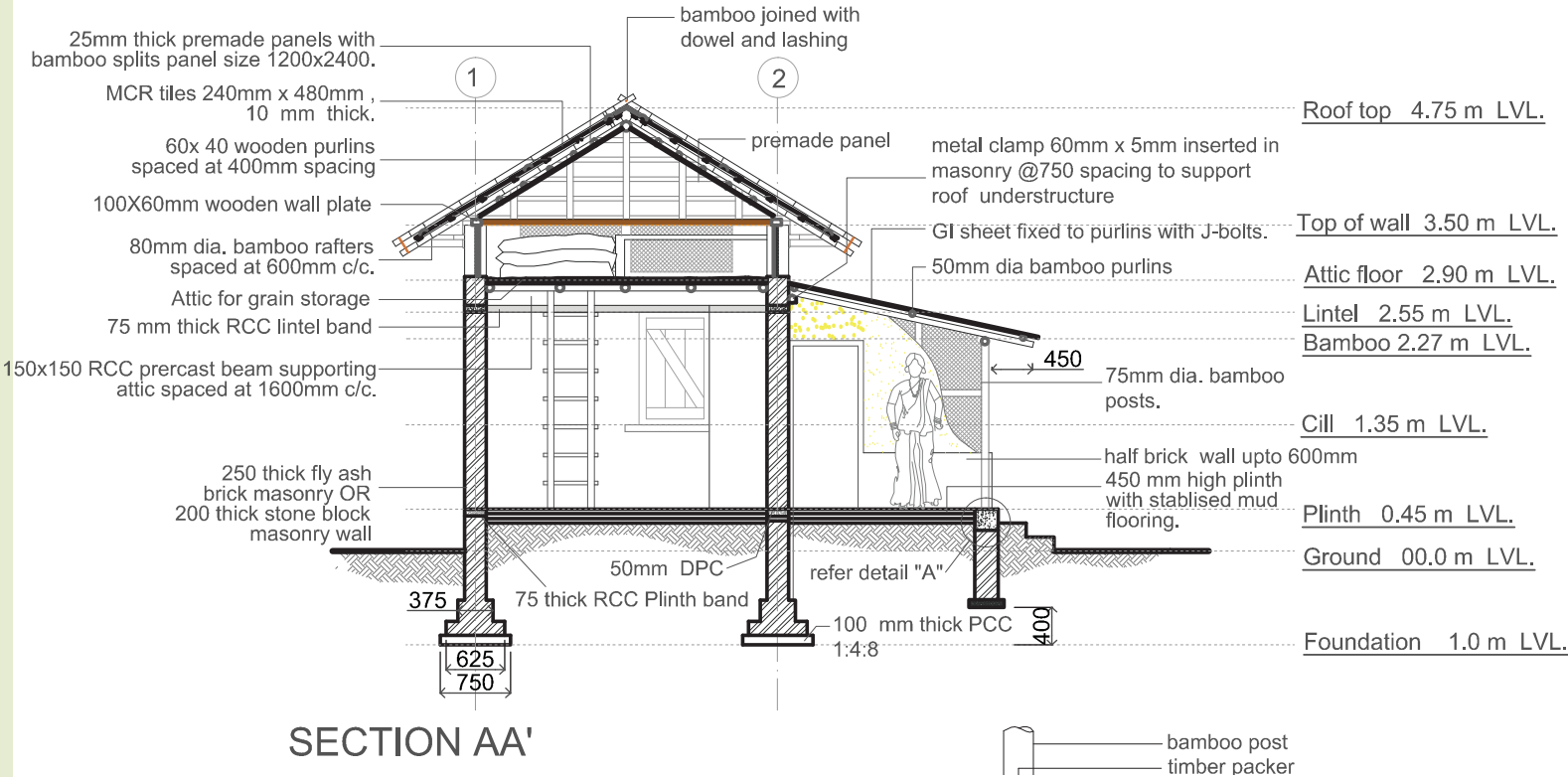


TYPICAL PLAN

ZONE - D
OD-D-01



ODISHA



SECTION AA'

Cost Estimate for ZONE-D Design 01

S.No	Item	Quantity	Unit	Rate	Amount
1	Excavation				
	Room	12	cu.m	80	960
	Kitchen,verandah	2	cu.m	80	160
2	Sand fill in foundation and plinth	4	cu.m	450	1800
3	PCC 1:4:8 100mm thick in foundation				
	Room	1.6	cu.m	2700	4320
	Kitchen,verandah	0.4	cu.m	2700	1080
4	Burnt brick masonry in foundation till plinth in 1:5 cement mortar				
	Room	8	cu.m	3000	24000
	Kitchen,verandah	2.7	cu.m	3000	8100
5	DPC 1:2:4, 50mm thick				
	Room	5.3	sq.m	250	1325
	Kitchen	2	sq.m	250	500
6	Superstructure masonry				
	Rat-trap bond masonry in 1:4 cement mortar using fly ash bricks of min 50kg/sq.cm strength				
	Room	14.65	cu.m	3200	46880
	Kitchen	1.15	cu.m	3200	3680
7	Roof in Micro Concrete Roofing(MCR) tiles of size 240mmx480mm on wooden purlins and bamboo understructure				
7a	MCR tiles				
	Room	600	No.	14	8400
	Kitchen,verandah	300	No.	14	4200
7b	Bamboo 80-100mm dia for roof understructure				
	Room	35	No.	130	4550
	Kitchen,verandah	2	No.	130	260
7c	Timber purlins @400mm spacing, 60x40mm				
	Room	0.35	cu.m	25000	8750
	Kitchen,verandah	0.15	cu.m	25000	3750
7d	Bamboo 50-60mm dia for rafters				
	Single slope roof in kitchen,verandah	5	No.	100	500
7e	Manpower				
	For Room				
	Carpenter	2	Mandays	500	1000

ZONE - D OD-D-01

Cost breakup

Item	Cost (INR)
Excavation	1,120/-
Sand Fill and Compaction	1,800/-
P.C.C.	5,400/-
Burnt Brick MASONRY	32,100/-
D.P.C.	1,825/-
Superstructure Masonry	50,560/-
Flooring	13,000/-
Doors, Windows & Walls	47,715/-
Total	153,520/-



ODISHA

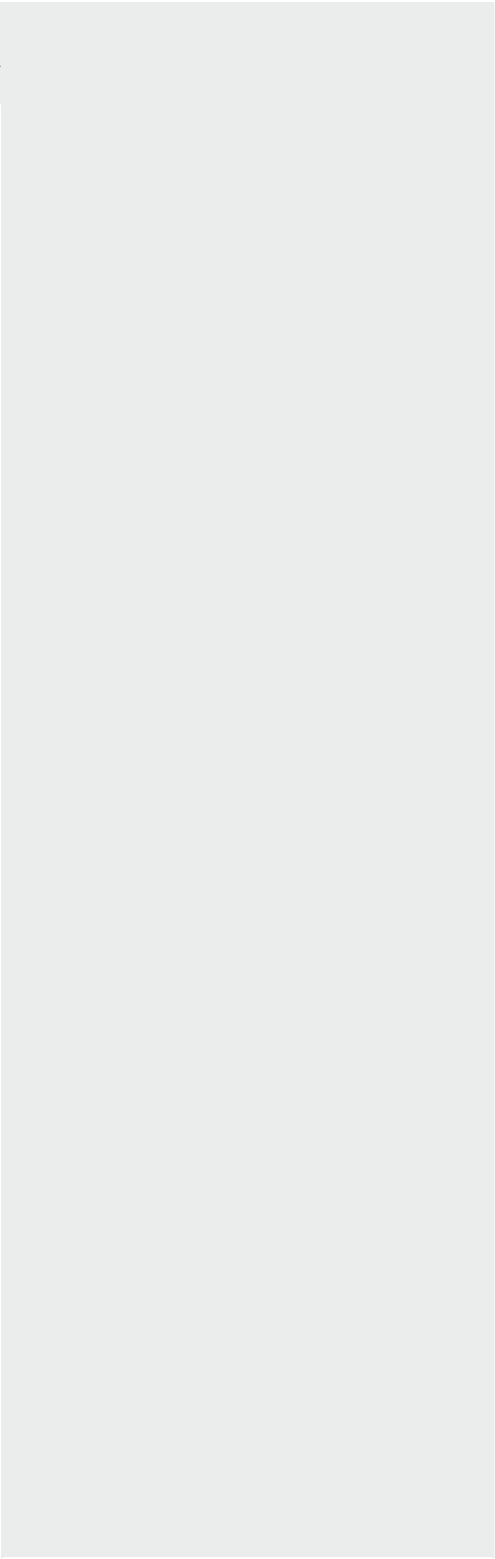
ZONE - D
OD-D-01



ODISHA

	Skilled mason	4	Mandays	350	1400
	Labour	4	Mandays	250	1000
	Kitchen, verandah				
	Carpenter	1	Mandays	500	500
	Skilled mason	1	Mandays	350	350
	Labour	2	Mandays	250	500
7f	Nails, binding wire and hardware		lumsum		2500
8	Doors and windows				
8a	Room				
	precast RCC frame 60mmx100mm	20.7	R.M	115	2380.5
	Door shutter 35mm solid core panel	1.8	sq.m	1500	2700
	Window shutter 30mm - local timber	0.1	cu.m	50000	5000
	precast concrete jaali 0.3mxm0.3m	6	No.	150	900
8b	Kitchen				
	precast RCC frame 60mmx100mm	5	R.M	115	575
	Door shutter 35mm solid core panel	1.5	sq.m	1500	2250
	Window shutter wooden plank 30mm thick	0.01	cu.m	50000	500
14	Flooring				
	Room				
14a	Cement Concrete flooring - base floor of 1:2:4 concrete and finishing layer Of 1:2 cement mortar	20	sq.m	650	13000
	Kitchen, verandah				
14b	Earthen floor using red clayey soil stabilized with rice husk ash	15	sq.m	150	2250
				Total	153520.5
				cost/sq.m	3655

Rajasthan





Based on the field study, the recommendation recognizes the need for convergence of schemes to fulfill the basic shelter need of the people of the above mentioned districts based.

ZONE A

This type design is recommended for in districts Barmer, Pali Jodhpur, and Jaisalmer. Based on the field study, the proposal recognizes the need for convergence of schemes to fulfill the basic shelter need of the people of the above mentioned districts based.

ZONE B

This type design in districts Dungarpur, Udaipur, Bhilwara, Pratapgarh, Banswara Sirohi. Based on the field study, the proposal recognizes the need for convergence of schemes to fulfill the basic shelter need of the people of the above mentioned districts based.

ZONE C

This type design is recommended for districts Alwar, Bharatpur, Dausa, Jaipur, Dhaulpur, Karauli, Sawai Madhopur, Tonk, Bundi, Kota, Baran, and Jhalawar. Based on the field study, the proposal recognizes the need for convergence of schemes to fulfill the basic shelter need of the people of the above mentioned districts based.

ZONE D

This type design is recommended for districts Ganganagar, Hanumangarh, Churu, Bikaner, Jhunjhunun, and Sikar. Based on the field study, the proposal recognizes the need for convergence of schemes to full fill the basic shelter need of the people of the above-mentioned districts based.

ZONE - A

RJ-A-01

Zone A includes 6 Districts :

1. Barmer District
2. Jodhpur District
3. Jaisalmer District
4. Pali District
5. Nagaur District
6. Jalor District

Resources:

Stone and steel

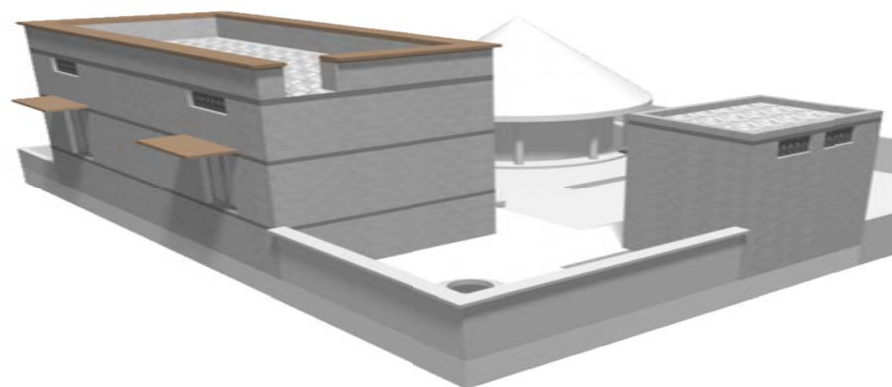
Zone A has two typologies

RJ-A-01

RJ-A-02



RAJASTHAN



RJ-A-01

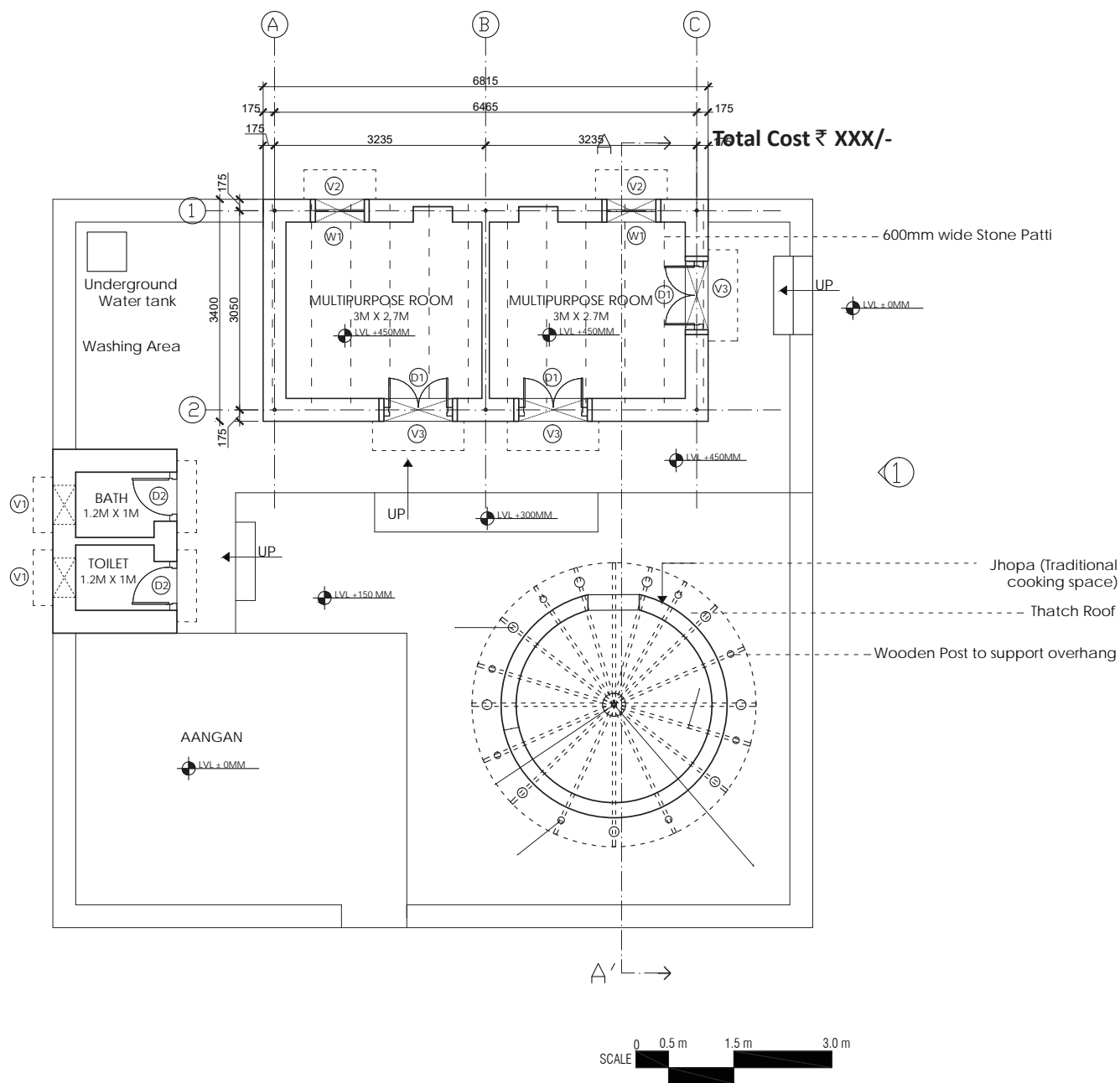
- The spaces are arranged in L-shape around the aangan to provide a sense of enclosure. This typology is observed in areas where houses are built in isolated clusters. Ventilators are provided above the door openings for effective cross ventilation. Aala, a traditional feature observed as being widely used, is provided on both sides of the door.
- The house is proposed to be provided with detached toilet in a manner that which encloses the aangan from one side. Water can be stored in underground water tank. Seismic bands are proposed at plinth, lintel and roof level.
- It is observed that traditional jhopa is widely used as kitchen which is detached from the main house. The entrance of jhopa is facing the house and hence maintains the privacy of women while using this space. The space between the Jhopa and house is serving as extended cooking space, space for leisure activities etc. While recognizing the jhopa as an integral part of the homestead, the cost of jhopa is not included in the proposed type design for PMAY-G.

Recommendations for Built Form

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
A compact symmetrical rectangular layout has been proposed which is a typical layout for timber houses within the state. The shape of the core house is rectangle and is accessed through a semi covered verandah.	Normal Plinth Design	

Recommendations for construction systems

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Isolated footings with large stone pieces and cement soil mixture. 	<ul style="list-style-type: none"> Used primarily as protection and weight transfer for bamboo/timber supports.
Bracings	<ul style="list-style-type: none"> Bracings are provided at the stilt level and between the timber frames of the walls as per detail. 	
Wall	<ul style="list-style-type: none"> Wooden frame structure as per specifications. Infill material- improved bamboo dap, Ekra, play board (internal partitions), CGI sheet, bamboo board. 	
Wall Finsih	<ul style="list-style-type: none"> Cement plaster with pointing. 	
Roof Structure	<ul style="list-style-type: none"> Timber under structure as per detail. Joinery of the roof to the main structure is provided using metal/wooden clamps/cleats as per specifications. 	
Roof Cover	<ul style="list-style-type: none"> CGI sheet roofing as per specifications 	
Floor	<ul style="list-style-type: none"> Wooden Plank flooring as per detail 	
Door and Windows	<ul style="list-style-type: none"> Wooden frame and shutter as per specifications 	
Tie Beams	<ul style="list-style-type: none"> Tie-Beam is provided at the floor level as per detail. 	



TYPICAL PLAN

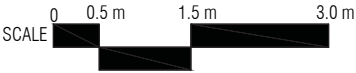
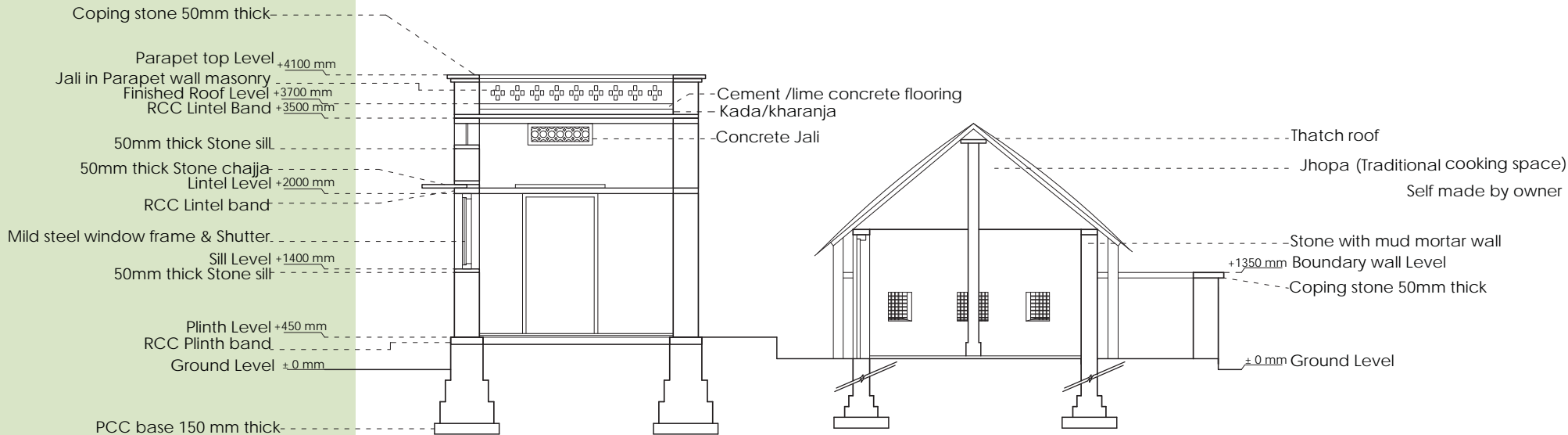
ZONE-A RJ-A-01

Total Cost ₹ 167343/-



RAJASTHAN

ZONE-A
RJ-A-01



RAJASTHAN

SECTION

Cost Estimate for ZONE-A Design 01

S. NO.	BUILDING COMPONENT	LABOR COST(₹)	TOTAL (LABOR +MATERIAL) (₹)
1.	Foundation	8390	39979
2.	RCC wall bands	1448	10883
	Plinth , Lintel and Roof band		
3.	Walling	11640	53373
4.	Roof structure	9336	28289
5.	Roof finish		
6.	Doors and windows	766	12895
7.	Chajja (Shading device)	959	2793
8.	Flooring	928	12835
9.	Wall finishes	2356	6296
		35824	167343
	ESTIMATED COST OF CORE HOUSE		167343
	Toilet block (Toilet + Bath)		36000

ZONE - A RJ-A-01

Cost breakup

Item	Cost (INR)
Foundation	39979/-
Walls	70552/-
Roof	28289/-
Doors,Windows and Chajja	15688/-
Flooring	12835/-
Total	167343/-



RAJASTHAN

ZONE-A
RJ-A-02



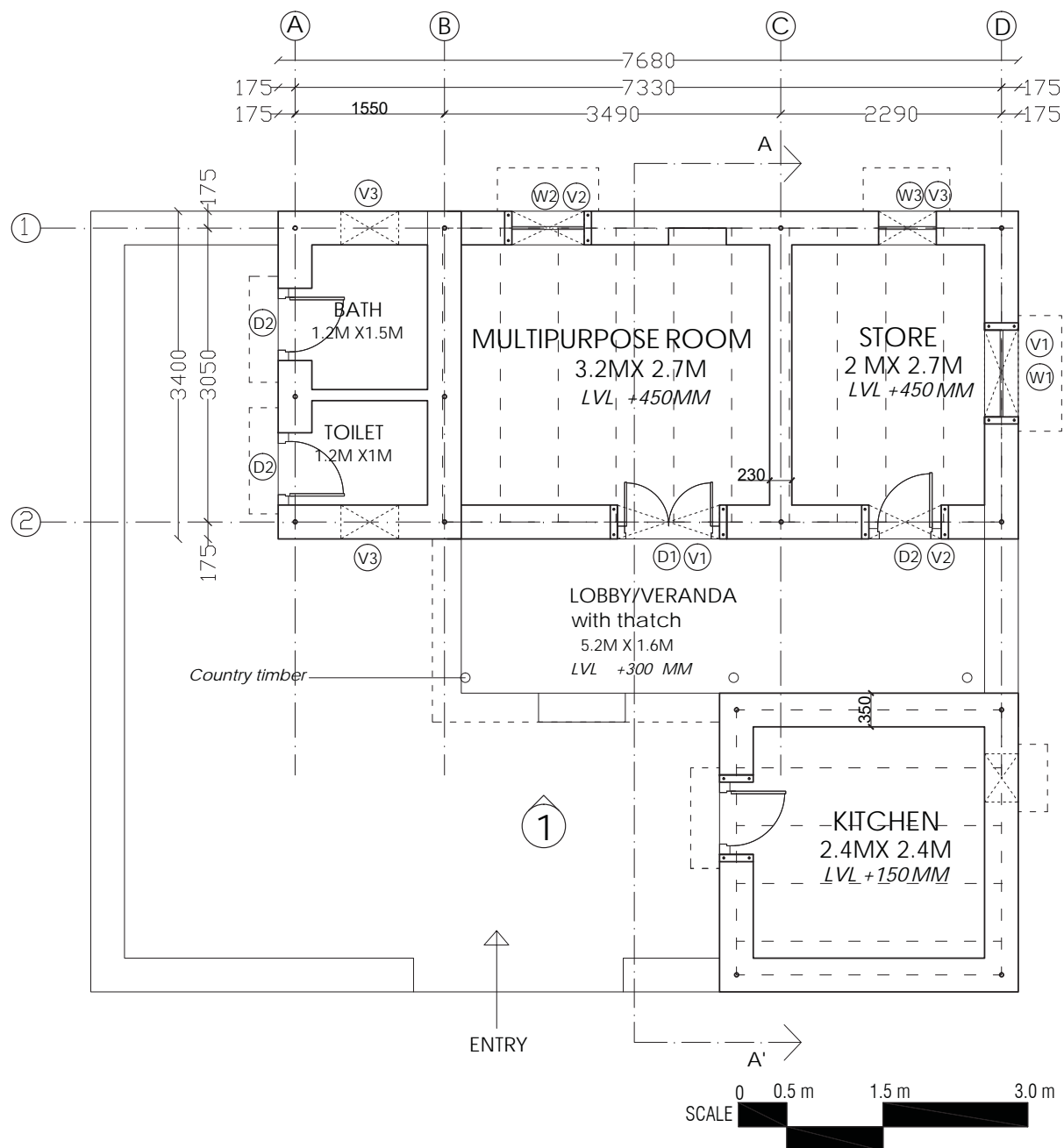
RJ-A-02

- Organization of space around the open space for sense of enclosure is critical in this region where population is sparsely populated. Spaces arranged in L-shape around the open space were observed in villages of Jodhpur and Jaisalmer.
- Covered kitchen was observed in parts of Jodhpur, Jaisalmer & Bikaner. This space attached to the house, sharing a common wall and can be accessed from the open space. Comparatively big openings are observed in this space which is covered with jali for ventilation.
- Visitors are entertained outside the house in a semi-covered space provided in aangan to maintain the privacy of the women of the household while performing household chores.
- Underground water tank for storage of water was observed in most of the houses in this region.
- Concrete Jali was observed covering the opening above door and window for ventilation of the inside spaces.
- Dressed/semi-dressed stones are predominantly used in this area for construction of masonry walls with stone patti roof with cement mortar.



RAJASTHAN

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none">Continuous Coursed Rubble foundation in cement-sand mortar as per specifications.	
RCC Wall Bands	<ul style="list-style-type: none">Plinth bands1. 100 mm RCC Plinth band is provided at plinth level as per specifications.Eave Bands1. 75 mm RCC Plinth band is provided at eave level as per specifications.	
Wall	<ul style="list-style-type: none">Compressed Stabilized Earth block wall in mud mortar as per specifications	
Wall Finsih	<ul style="list-style-type: none">Cement pointing on external surfaces and cement plaster on internal wall surfaces as per detail.	
Roof Structure	<ul style="list-style-type: none">C.G.I. Steel tubes as per specifications.	
Roof Finish	<ul style="list-style-type: none">CGI sheets tied to purlins with J/U hooks.	
Floor	<ul style="list-style-type: none">Unpolished kota stone/ Karegi flooring as per detail.	
Door and Windows	<ul style="list-style-type: none">Mild Steel frame and shutter as per specifications.	
Tie Beams	<ul style="list-style-type: none">Tie-Beam is provided at the floor level as per detail.	



TYPICAL PLAN

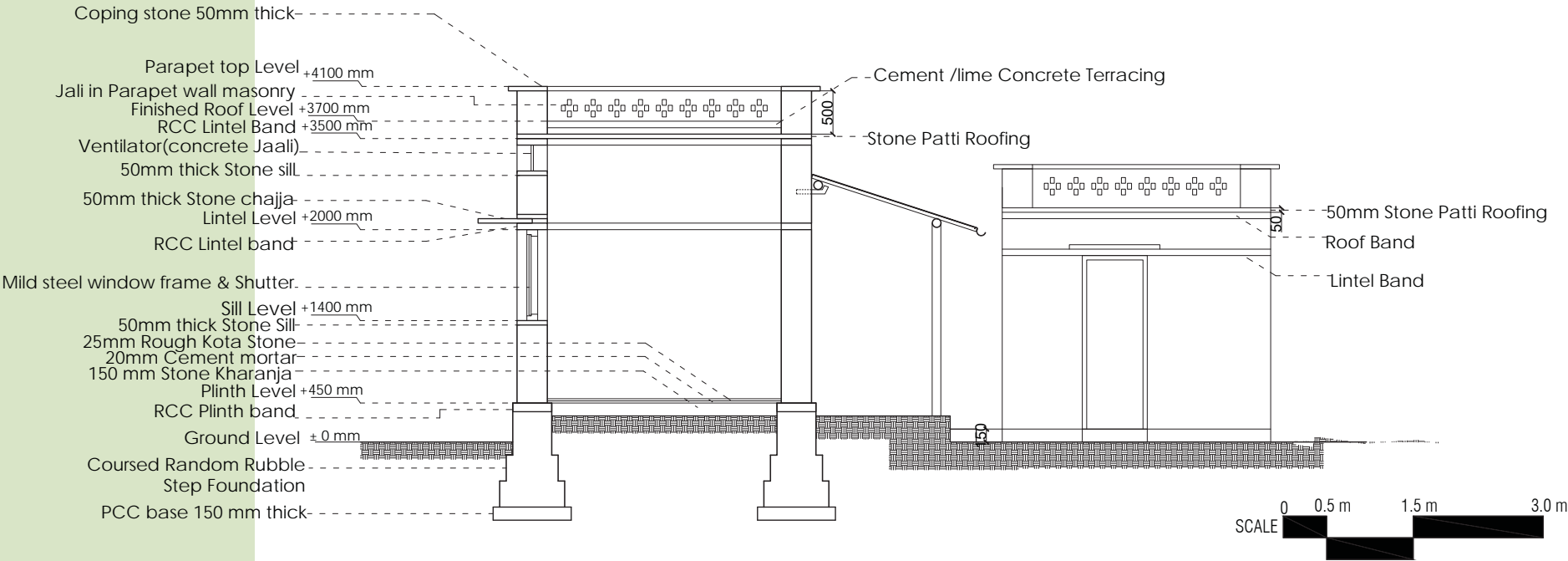
ZONE-A RJ-A-02

Total Cost ₹ 159146/-



RAJASTHAN

ZONE-A
RJ-A-02



RAJASTHAN

SECTION

Cost Estimate for ZONE-A Design 02

SL. NO.	BUILDING COMPONENT	LABOR COST(₹)	TOTAL (LABOR +MATERIAL) (₹)
1.	Foundation	7282	34083
2.	RCC wall bands	1332	11361
	Plinth band		
	Lintel band		
	Roof band		
3.	Walling	7839	48369
4.	Roof structure	347	18933
5.	Roof finish	3103	7452
6.	Doors and windows	408	10028
7.	Chajja (Shading device)	57	368
8.	Flooring	1401	8702
9.	Wall finishes	5937	19349
10.	Embellishment		500
		27705	159146
	ESTIMATED COST OF CORE HOUSE		159146

ZONE - A RJ-A-02

Cost breakup

Item	Cost (INR)
Foundation	34083/-
Walls	79079/-
Roof	26385/-
Doors,Windows Chajja and Embellishments	10896/-
Flooring	8702/-
Total	159145/-



RAJASTHAN

ZONE - B
RJ-B-01

Zone B includes 9 Districts :

- 1. Dungarpur District
- 2. Udaipur District
- 3. Bhilwara District
- 4. Pratapgarh District
- 5. Banswara District
- 6. Sirohi District
- 7. Rajsamand District
- 8. Chittaurgarh District
- 9. Ajmer District

Resources Available

- Stone and steel

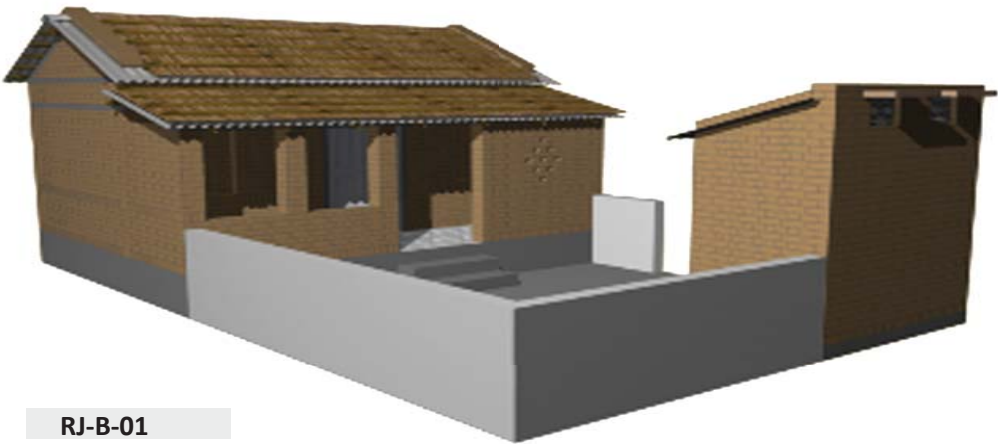
Zone B has two typologies

RJ-B-01

RJ-B-02



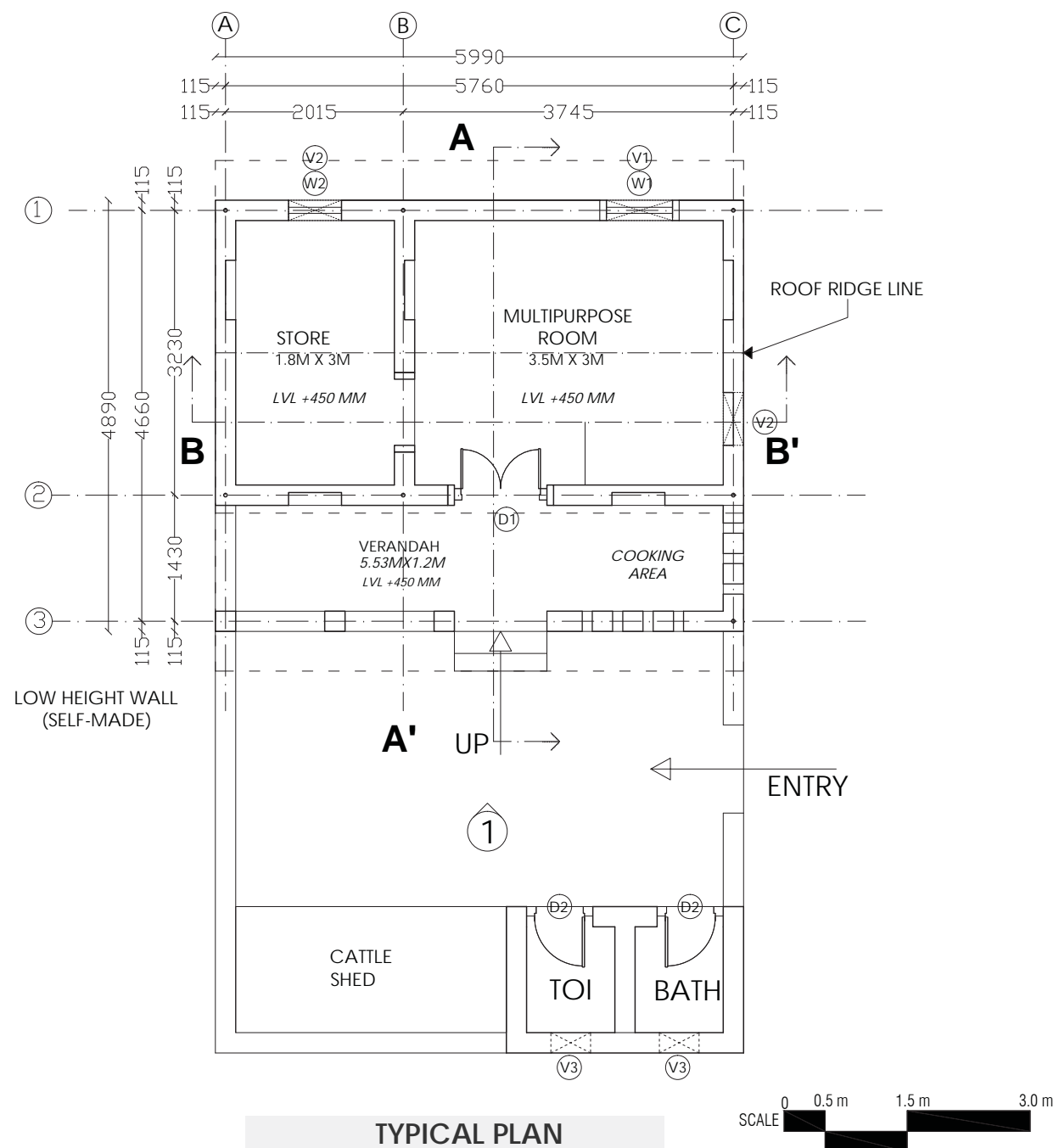
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RJ-B-01

- The prototype design has a semi-covered enclosed verandah acting as buffer space between the house and outside. Cooking space is proposed in the verandah which is enclosed from three sides. Jali, which is also a traditional building element in Rajasthan, is provided for ventilation of this cooking space. This jali wall also maintains the privacy of the women working in the cooking area.
- The entrance to the main living area, which is also a multipurpose space, is aligned with the entrance to the verandah. A small storage space is proposed which can be accessed from the multipurpose room.
- The entrance to the main living area, which is also a multipurpose space, is aligned with the entrance to the verandah. A small storage space with no window opening is proposed at the end of the house which only households can access. It is the interior most part of the house as observed in traditional houses. Space for cattle/fodder storage is proposed inside the core house which can be accessed from the aangan.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none">• Continuous Coursed Rubble foundation in cement-sand mortar as per specifications.	
RCC Wall Bands	<ul style="list-style-type: none">• Plinth bands1. 100 mm RCC Plinth band is provided at plinth level as per specifications.• Eave Bands1. 75 mm RCC Plinth band is provided at eave level as per specifications.	
Wall	<ul style="list-style-type: none">• Compressed Stabilized Earth block wall in mud mortar as per specifications	
Wall Finsih	<ul style="list-style-type: none">• Cement pointing on external surfaces and cement plaster on internal wall surfaces as per detail.	
Roof Structure	<ul style="list-style-type: none">• C.G.I. Steel tubes as per specifications.	
Roof Finish	<ul style="list-style-type: none">• CGI sheets tied to purlins with J/U hooks.	
Floor	<ul style="list-style-type: none">• Unpolished kota stone/ Karegi flooring as per detail.	
Door and Windows	<ul style="list-style-type: none">• Mild Steel frame and shutter as per specifications.	
Tie Beams	<ul style="list-style-type: none">• Tie-Beam is provided at the floor level as per detail.	



ZONE-B RJ-B-01

Total Cost ₹ 163762/-

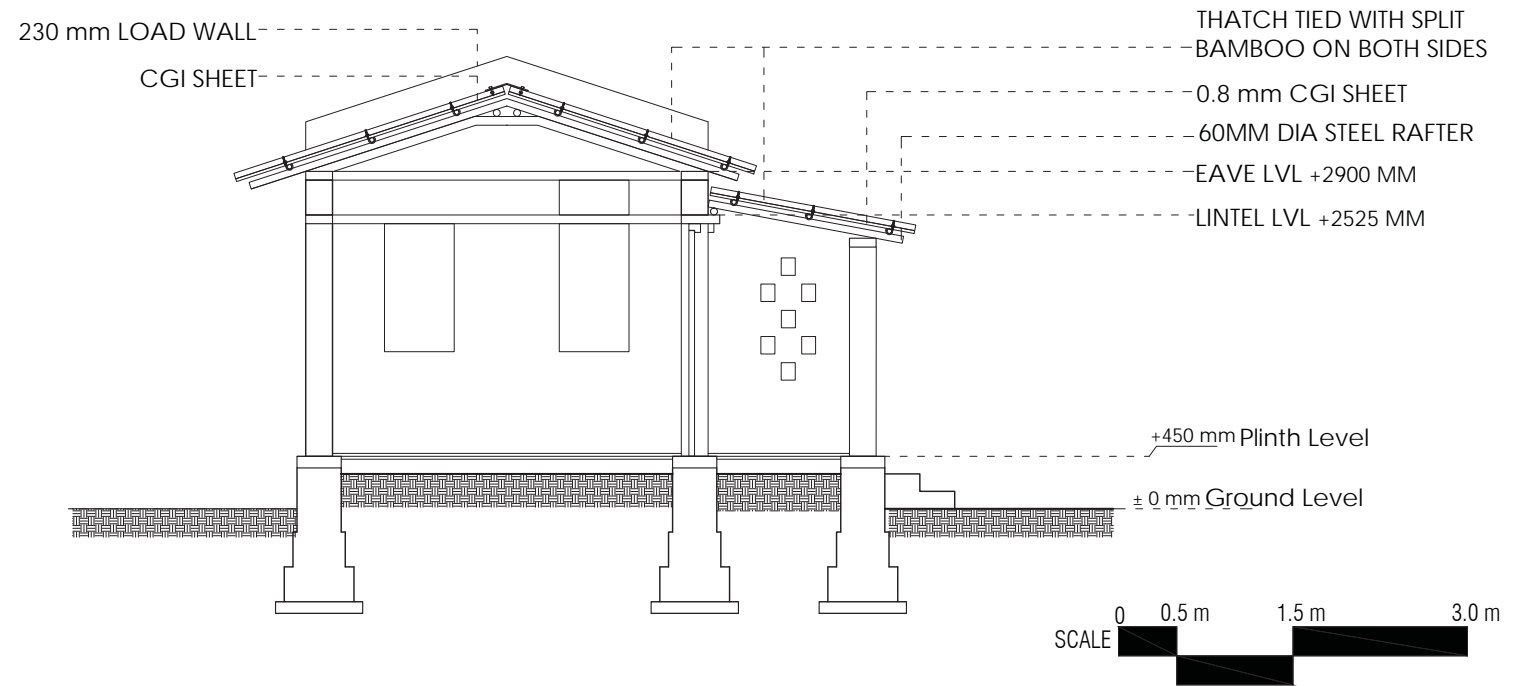


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ZONE-B RJ-B-01

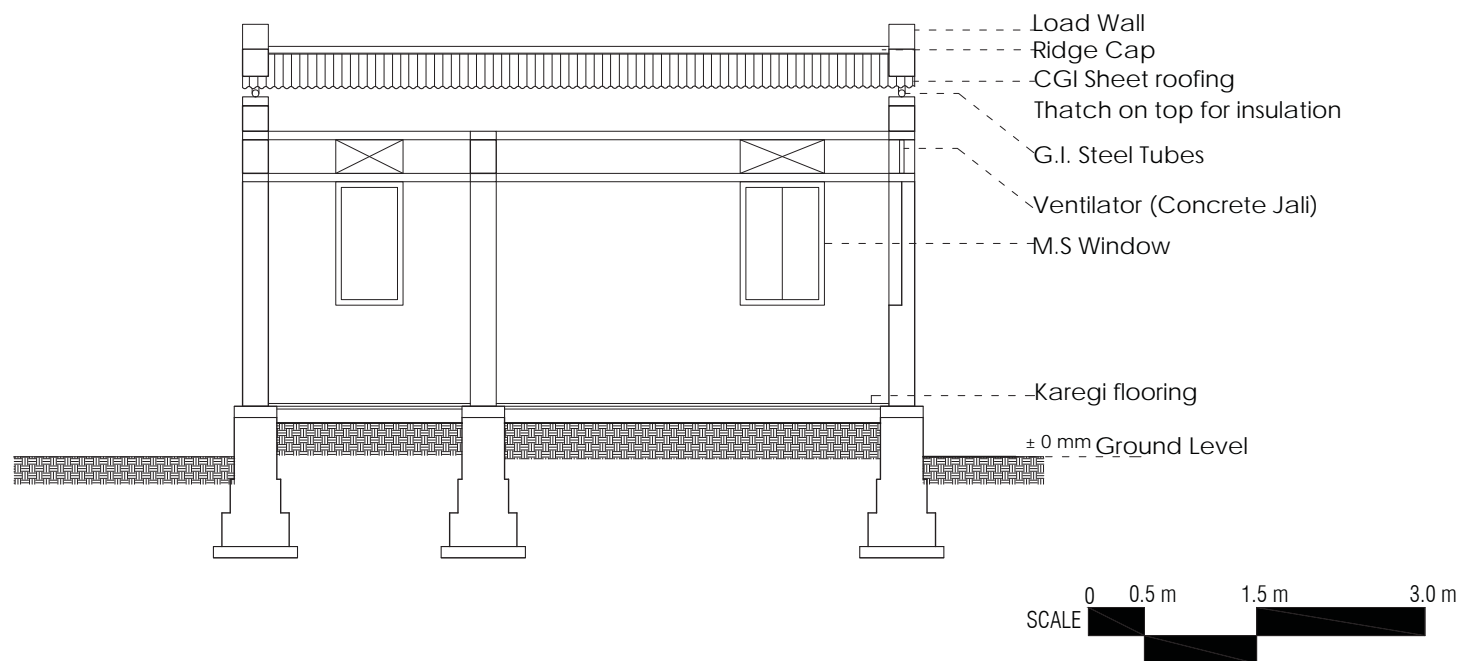


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SECTION AA'

ZONE-B RJ-B-01



SECTION BB'



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ZONE-B
RJ-B-01

Cost breakup

Item	Cost (INR)
Foundation	56427/-
Walls	56458/-
Roof	32438/-
Doors, Windows and Embellishments	12098/-
Flooring	6341/-
Total	163762/-



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Cost Estimate for ZONE-B Design 01

S. NO.	COMPONENT	LABOR COST (₹)	TOTAL(LABOR +MATERIAL) (₹)
1.	Foundation	9704	56427
2.	RCC wall bands	1313	11148
	Plinth band		
	Lintel band		
	Roof band		
3.	Walling	6595	36590
4.	Roof structure	747	10943
5.	Roof finish	1389	21495
6.	Doors and windows	1288	8298
7.	Flooring	1221	6341
8.	Wall finishes	6312	8720
9.	Embellishment		3800
		28570	163765
	ESTIMATED COST OF CORE HOUSE		163765



RJ-B-02

- Organization of space around the open space for sense of enclosure is critical in this region where population is sparsely populated. Spaces arranged in L-shape around the open space were observed in villages of Jodhpur and Jaisalmer.
- Covered kitchen was observed in parts of Jodhpur, Jaisalmer & Bikaner. This space attached to the house, sharing a common wall and can be accessed from the open space. Comparatively big openings are observed in this space which is covered with jali for ventilation.
- Visitors are entertained outside the house in a semi-covered space provided in aangan to maintain the privacy of the women of the household while performing household chores.
- Underground water tank for storage of water was observed in most of the houses in this region.
- Concrete Jali was observed covering the opening above door and window for ventilation of the inside spaces.
- Dressed/semi-dressed stones are predominantly used in this area for construction of masonry walls with stone patti roof with cement mortar.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Continuous Coursed Rubble foundation in cement-sand mortar as per specifications. 	
RCC Wall Bands	<ul style="list-style-type: none"> Plinth bands 1. 100 mm RCC Plinth band is provided at plinth level as per specifications. Eave Bands 1. 75 mm RCC Plinth band is provided at eave level as per specifications. 	
Wall	<ul style="list-style-type: none"> Compressed Stabilized Earth block wall in mud mortar as per specifications 	
Wall Finish	<ul style="list-style-type: none"> Cement pointing on external surfaces and cement plaster on internal wall surfaces as per detail. 	
Roof Structure	<ul style="list-style-type: none"> C.G.I. Steel tubes as per specifications. 	
Roof Finish	<ul style="list-style-type: none"> CGI sheets tied to purlins with J/U hooks. 	
Floor	<ul style="list-style-type: none"> Unpolished kota stone/ Karegi flooring as per detail. 	
Door and Windows	<ul style="list-style-type: none"> Mild Steel frame and shutter as per specifications. 	
Tie Beams	<ul style="list-style-type: none"> Tie-Beam is provided at the floor level as per detail. 	

ZONE-B

RJ-B-02



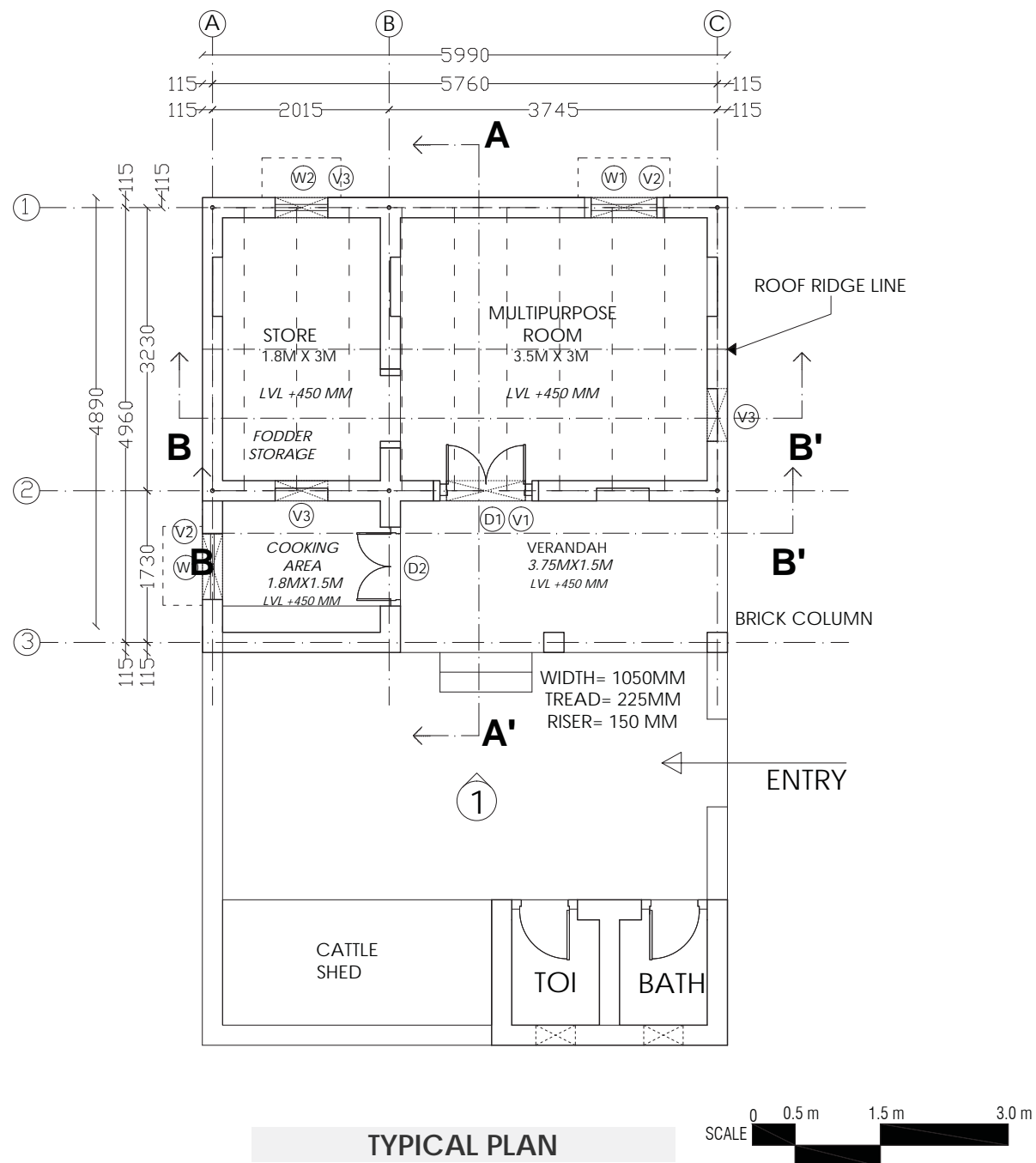
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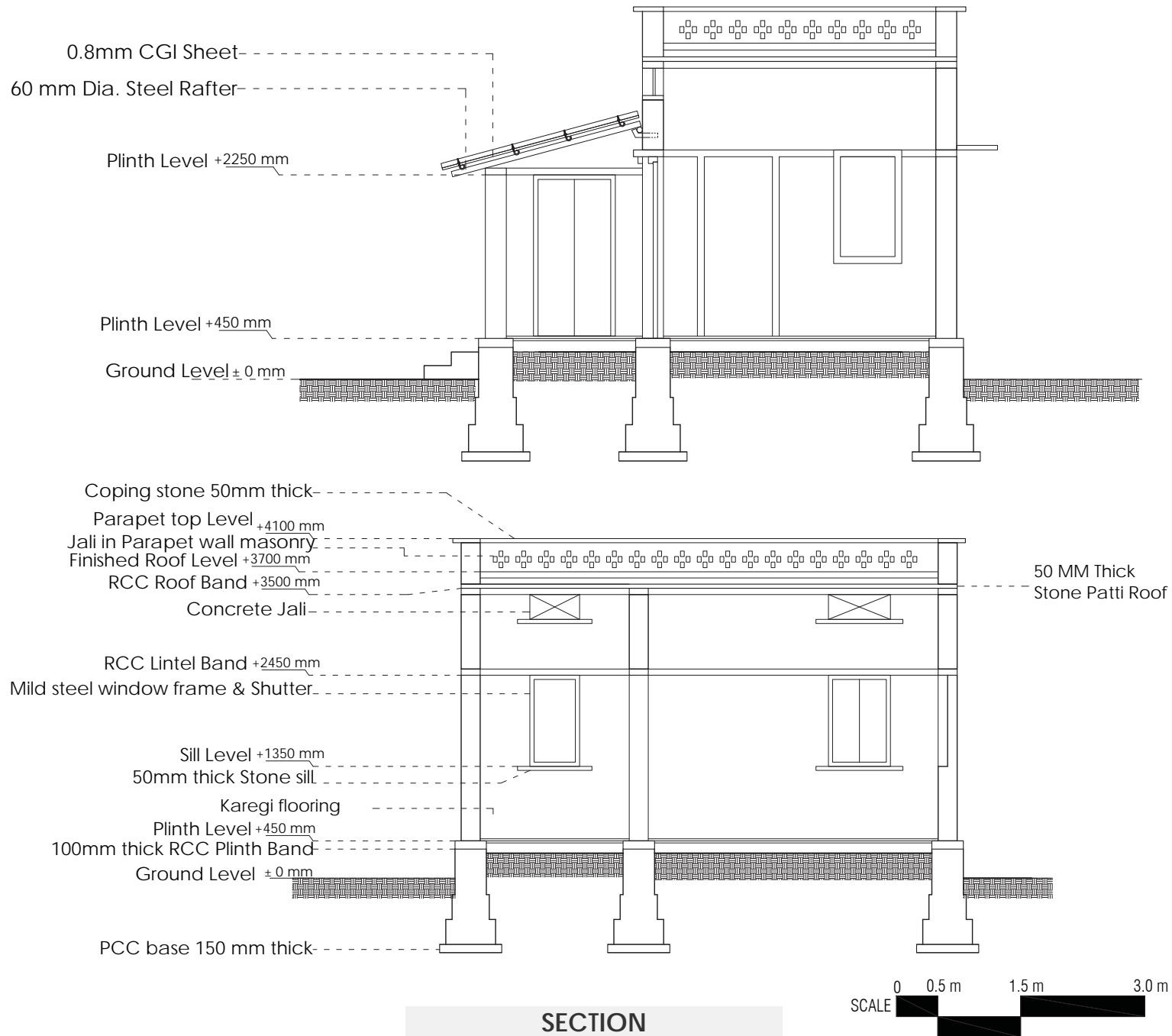
ZONE-B RJ-B-02

Total Cost ₹ 148285/-



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ZONE-B
RJ-B-02



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ZONE-B
RJ-B-02

Cost breakup

Item	Cost (INR)
Foundation	33023/-
Walls	69295/-
Roof	26369/-
Doors, Chajja, Windows and Embellishments	10896/-
Flooring	8702/-
Total	148285/-



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Cost Estimate for ZONE-B Design 02

S. NO.	BUILDING COMPONENT	LABOR COST (₹)	TOTAL (LABOR +MATERIAL) (₹)
1	Foundation	7052	33023
2	RCC wall bands	1011	8922
	Plinth band		
	Lintel band		
	Roof band		
3	Walling	3198	41715
4	Roof structure	346	18921
5	Roof finish	3101	7448
6	Doors and windows	408	10028
7	Chajja (Shading device)	57	368
8	Flooring	1401	8702
9	Wall finishes	5725	18658
10	Embellishment	0	500
		22298	148285
	ESTIMATED COST OF CORE HOUSE		148285



RJ-C-01

- The recommended type design is compact inform with two rooms and a semi-covered verandah. The house is proposed to be provided with attached toilet which can be accessed from the aangan in front of the house. Two posts at the verandah edge are marking the entrance to the house. The access to the rooms is aligned with the verandah entrance. Cooking space is provided at one side of the verandah whereas the other side can be used to store fodder/firewood.
- Lean to roof is proposed over verandah for easy drainage of the rainwater. Rain water harvesting system can also be incorporated with the house. The low height wall in verandah is proposed to have jali for effective ventilation of the cooking space and to provide a sense of enclosure. Jali in parapet wall enhances the aesthetics of the house. Other aesthetic features which are incorporated in the type design are coping stone on top of parapet and verandah enclosure wall.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Fly ash arch foundation in cement-sand/cement-lime-sand mortar as per specifications 	
RCC Wall Bands	<ul style="list-style-type: none"> Plinth bands <ol style="list-style-type: none"> Plinth band 75 mm RCC Plinth band is provided at plinth level as per specifications Lintel Bands <ol style="list-style-type: none"> 75 mm RCC Plinth band is provided at lintel level as per specifications Roof Bands <ol style="list-style-type: none"> 75 mm RCC Plinth band is provided at roof level as per specifications 	
Wall	<ul style="list-style-type: none"> Fly ash rat trap wall in cement mortar's per Specifications 	
Wall Finsih	<ul style="list-style-type: none"> Cement pointing on external surfaces as per detail. 	
Roof Structure	<ul style="list-style-type: none"> RCC Filler slab with fly ash brick as filler material. CGI sheet over steel under-structure in verandah. 	
Roof Finish	<ul style="list-style-type: none"> China mosaic laid on P.C.C/ lime terracing as per detailed specifications 	
Floor	<ul style="list-style-type: none"> Unpolished kota stone/ Karegi flooring as per detail. 	
Door and Windows	<ul style="list-style-type: none"> Mild Steel frame and shutter as per specifications. 	
Tie Beams	<ul style="list-style-type: none"> Tie-Beam is provided at the floor level as per detail. 	

ZONE-C

RJ-C-01

Zone C includes 12 Districts :

1. Alwar district
2. Bharatpur district
3. Dausa district
4. Jaipur district
5. Dhaulpi district
6. Tonk district
7. Sawai Madhoper district
8. Bundi district
9. Baran district
10. Kota district
11. Jhalwar district
12. Karauli district

Resources Available

- Fly ash

Zone C has two typologies

RJ-C-01

RJ-C-02



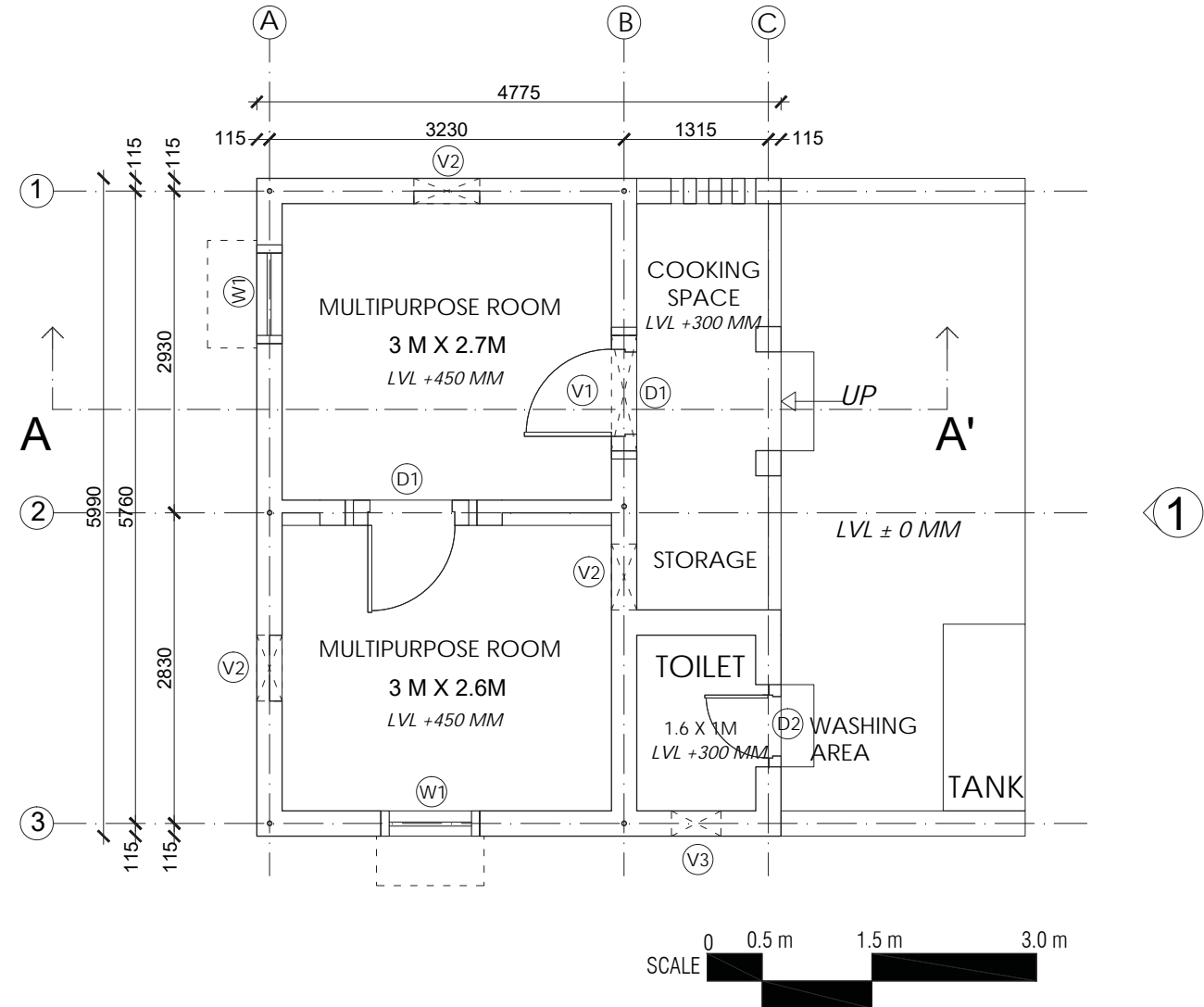
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ZONE-C RJ-C-01

Total Cost ₹ 163252/-

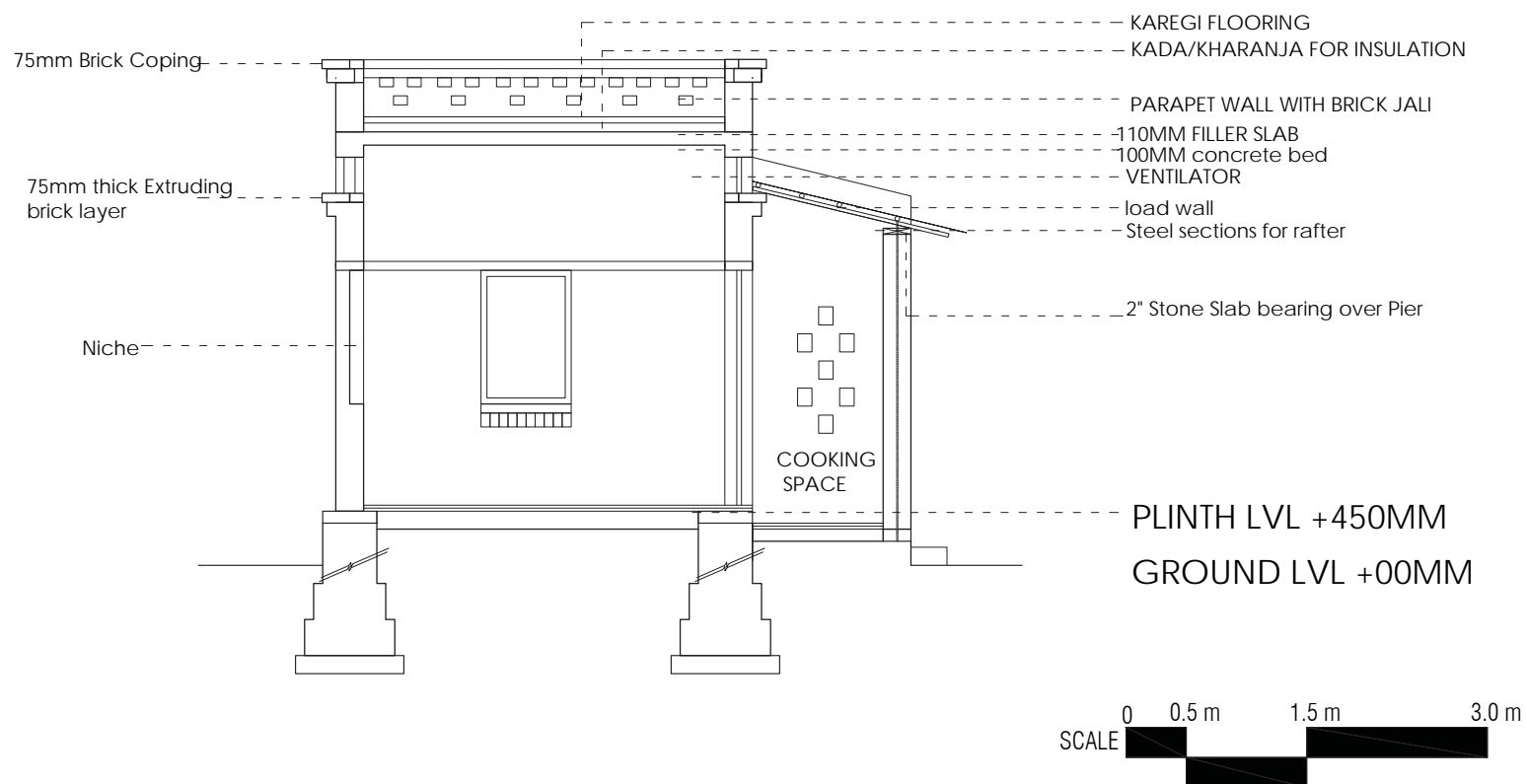


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TYPICAL PLAN

ZONE-C RJ-C-01



SECTION



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ZONE - C
RJ-C-01

Cost breakup

Item	Cost (INR)
Foundation	32670/-
Walls	76606/-
Roof	32034/-
Doors, Chajja, Windows and Embellishments	15144/-
Flooring	6798/-
Total	163252/-



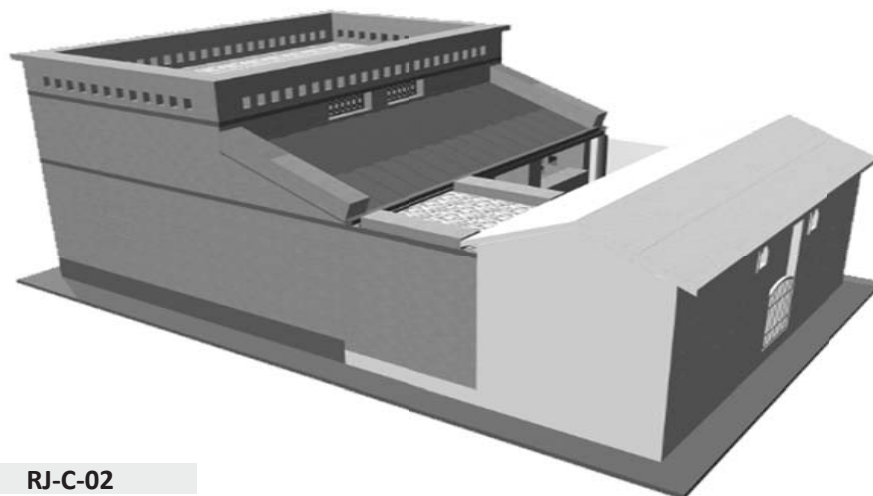
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Cost Estimate for ZONE-C Design 01

S. NO.	COMPONENT	LABOR COST (₹)	TOTAL (LABOR +MATERIAL) (₹)
1	Foundation	7029	32670
2	RCC wall bands	800	9754
	Plinth band		
	Lintel band		
3	Walling	3980	43759
4	Roof structure	1776	22415
5	Roof finish	3719	9619
6	Doors and windows	565	11921
7	Chajja (Shading device)	22	141
8	Flooring	801	6798
9	Wall finishes	7105	23093
10	Embellishment	576	3076
		26371	163244
	ESTIMATED COST OF CORE HOUSE		163244

ZONE-C

RJ-C-02



RJ-C-02

- The type design is developed by taking cue from the traditional housing typology observed where separate sitting space is provided at the entrance to receive visitors. The house is proposed to be provided with attached toilet and bathroom which can be accessed from the semi-covered space in front.
- The access to the core house aligns with the entrance to the plot. The two rooms in the core house are provided separate entrances from the semi-covered verandah. Cooking space is provided on one side of the verandah and fodder can be stored on the other side. Ventilators are provided above the door openings for effective cross ventilation. Aala, a traditional feature observed as being widely used, is provided on both sides of the door.
- The semi-covered space in front, before entering aangan, acting as false façade is observed in many traditional houses. While recognizing this space an integral part of the homestead to maintain the hierarchy of spaces, the cost of this space is not included in the proposed type design for LAY.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Brick arch foundation in cement-sand/ cement-lime-sand mortar as per specifications 	
RCC Wall Bands	<ul style="list-style-type: none"> Plinth bands <ol style="list-style-type: none"> Plinth band 75 mm RCC Plinth band is provided at plinth level as per specifications Lintel Bands <ol style="list-style-type: none"> 75 mm RCC Plinth band is provided at lintel level as per specifications Roof Bands <ol style="list-style-type: none"> 75 mm RCC Plinth band is provided at roof level as per specifications 	
Wall	<ul style="list-style-type: none"> Coursed rubble masonry in cement/cement-lime-sand mortar as per specifications 	
Wall Finish	<ul style="list-style-type: none"> Cement pointing on external surfaces as per detail. 	
Roof Structure	<ul style="list-style-type: none"> Stone patti with cement-sand pointing 	
Roof Finish	<ul style="list-style-type: none"> China mosaic laid on P.C.C/ lime terracing as per detailed specifications 	
Floor	<ul style="list-style-type: none"> Unpolished kota stone/ Karegi flooring as per detail. 	
Door and Windows	<ul style="list-style-type: none"> Mild Steel frame and shutter as per specifications. 	
Tie Beams	<ul style="list-style-type: none"> Tie-Beam is provided at the floor level as per detail. 	



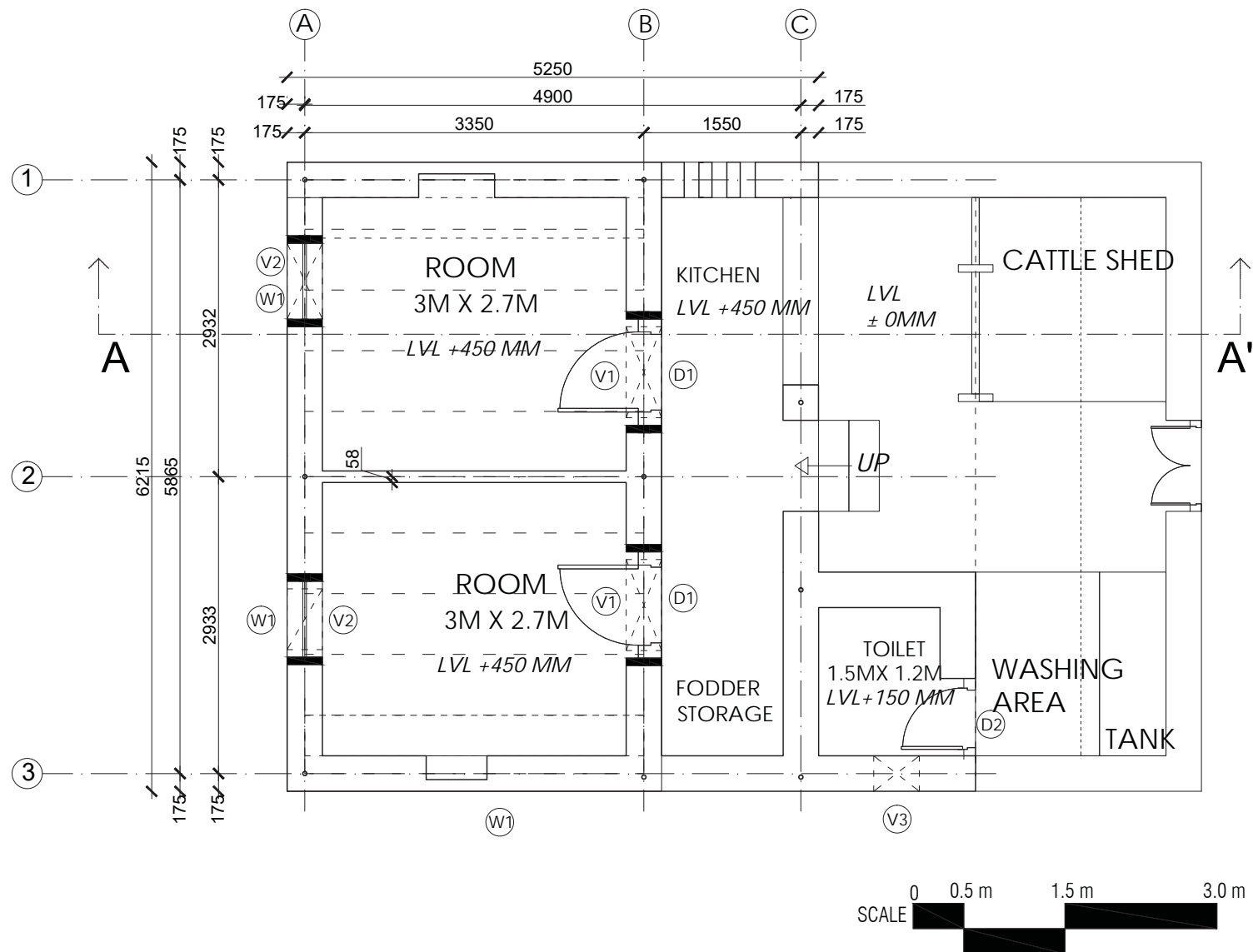
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ZONE-C RJ-C-02

Total Cost ₹ 171846/-

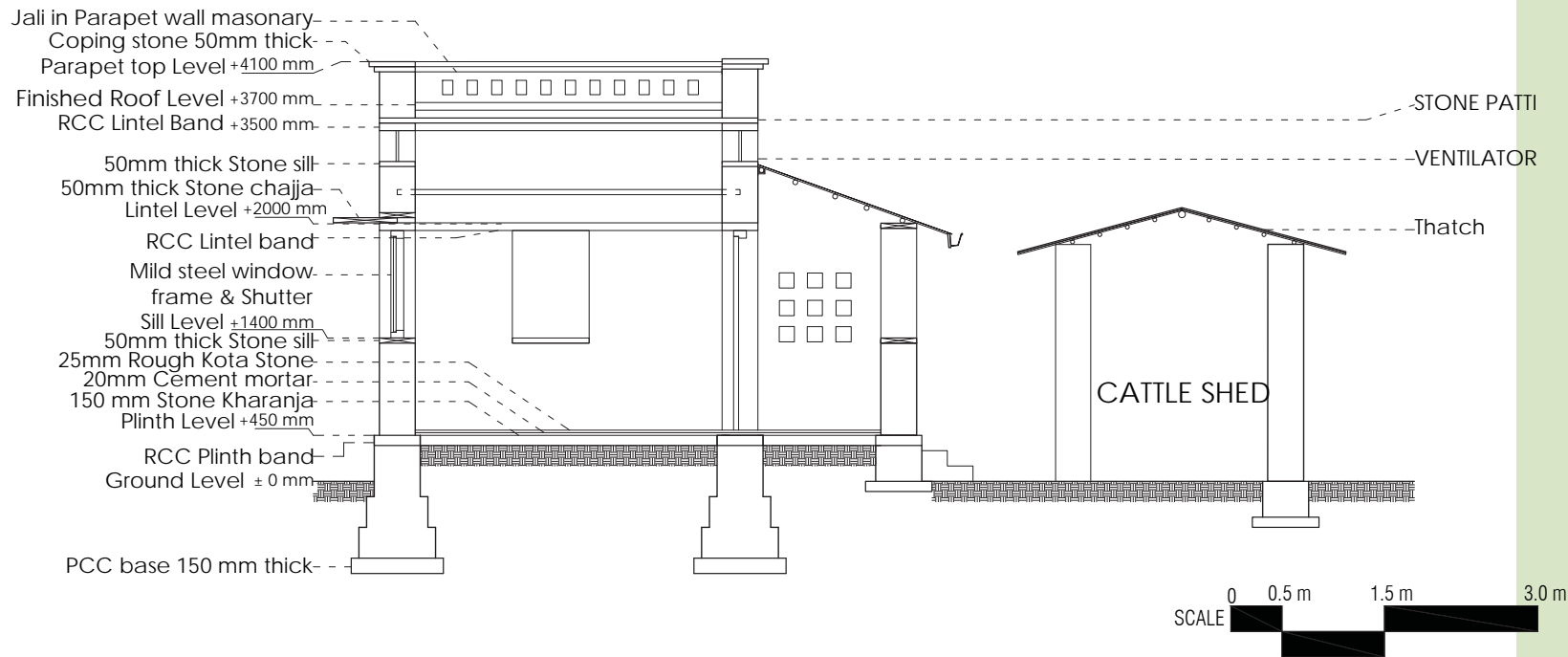


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TYPICAL PLAN

ZONE-C RJ-C-02



SECTION



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ZONE - C
RJ-C-02

Cost breakup

Item	Cost (INR)
Foundation	39836/-
Walls	74480/-
Roof	34252/-
Doors, Chajja and Windows	10443/-
Flooring	12835/-
Total	171846/-



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Cost Estimate for ZONE-C Design 02

S. NO.	COMPONENT	LABOR COST (₹)	TOTAL (LABOR +MATERIAL) (₹)
1	Foundation	8385	39836
2	RCC wall bands	1432	10727
	Plinth band		
	Lintel band		
	Roof band		
3	Walling	13073	57205
4	Roof structure	7936	23708
5	Roof finish	4503	10544
6	Doors and windows	546	9489
7	Chajja (Shading device)	328	954
8	Flooring	928	12835
9	Wall finishes	2450	6548
		39581	171844
	ESTIMATED COST OF CORE HOUSE		171844
	Toilet block (Toilet + Bath)	7505	36054



RJ-D-01

- The type design is developed by taking cue from the traditional housing typology where cooking space is kept outside in open with a low height wall enclosure. The core house is a simple rectangle in shape with two rooms having access from the open space (aangan) in front.
- Ventilators- jaali are provided above door and window openings for effective cross ventilation. Aala, The house is proposed to be provided with detached toilet in one corner of the plot. Water can be stored in underground water tank. Seismic bands are proposed at plinth, lintel and roof level.
- The cooking space in aangan is observed to have a low height wall enclosure. The cost of this wall is not included in the proposed type design for PMAY-G. The beneficiary can use any suitable local material available to build this enclosure.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Continuous stepped brick foundation in cement-sand/cement-lime-sand mortar as per specification 	
RCC Wall Bands	<ul style="list-style-type: none"> Plinth bands <ol style="list-style-type: none"> Plinth band 75 mm RCC Plinth band is provided at plinth level as per specifications Lintel Bands <ol style="list-style-type: none"> 75 mm RCC Plinth band is provided at lintel level as per specifications Roof Bands <ol style="list-style-type: none"> 75 mm RCC Plinth band is provided at roof level as per specifications 	
Wall	<ul style="list-style-type: none"> 9" thick Rat trap brick wall with cement-sand/ cement-lime-sand mortar as per specification 	
Wall Finish	<ul style="list-style-type: none"> Cement pointing on external surfaces as per detail. 	
Roof Structure	<ul style="list-style-type: none"> Brick Jack Arch roof with Iron girders as primary structural members 	
Roof Finish	<ul style="list-style-type: none"> China mosaic laid on P.C.C/ lime terracing as per detailed specifications 	
Floor	<ul style="list-style-type: none"> Unpolished kota stone/ Karegi flooring as per detail. 	
Door and Windows	<ul style="list-style-type: none"> Mild Steel frame and shutter as per specifications. 	
Tie Beams	<ul style="list-style-type: none"> Tie-Beam is provided at the floor level as per detail. 	

ZONE-D

RJ-D-01

Zone D includes 6 Districts :

- Ganganagar district
- Hanumangarh district
- Bikaner district
- Churu district
- Jhunjhunun district
- Sikar district

Zone D has two typologies

RJ-D-01

RJ-D-02



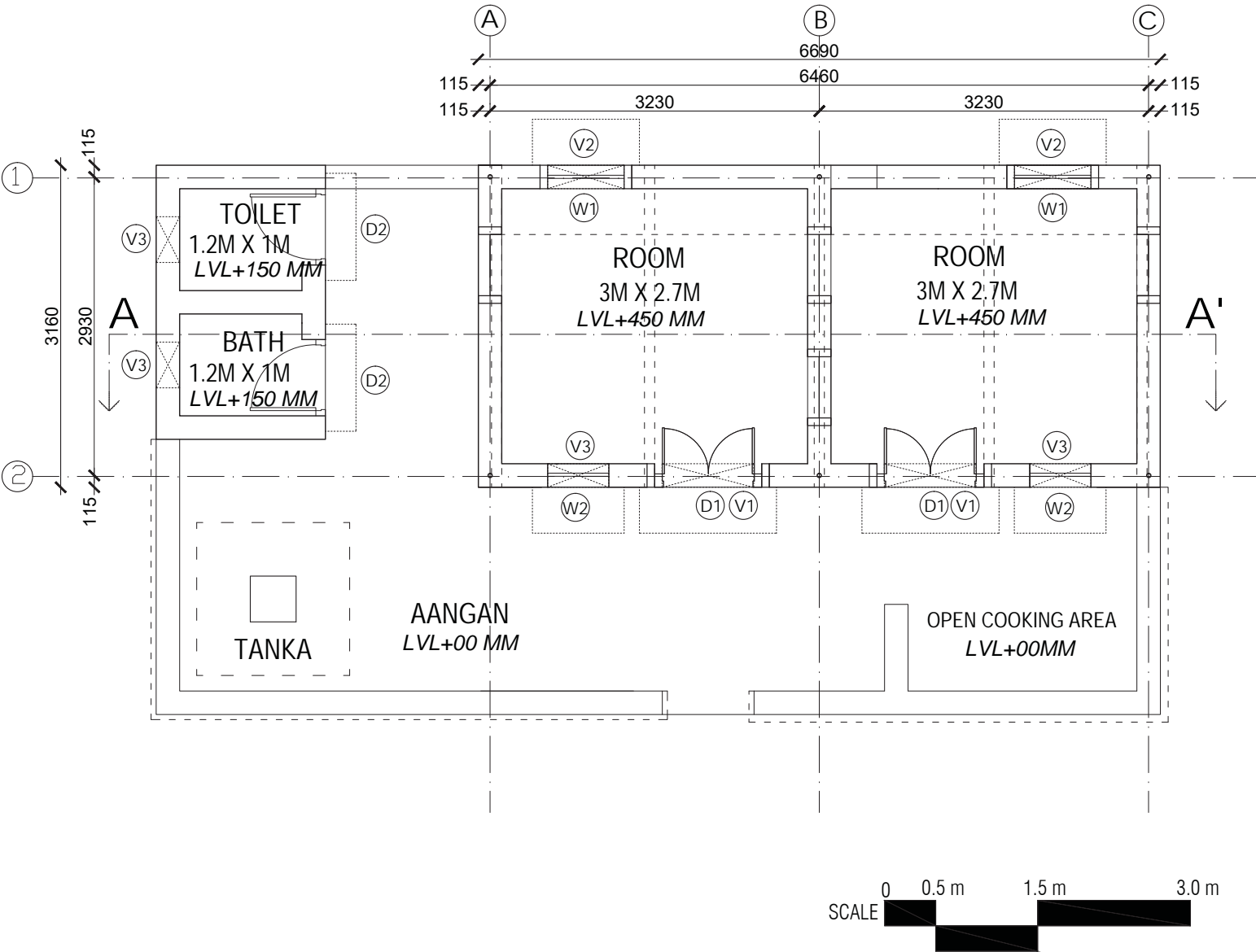
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ZONE-D
RJ-D-01

Total Cost ₹ 136204/-

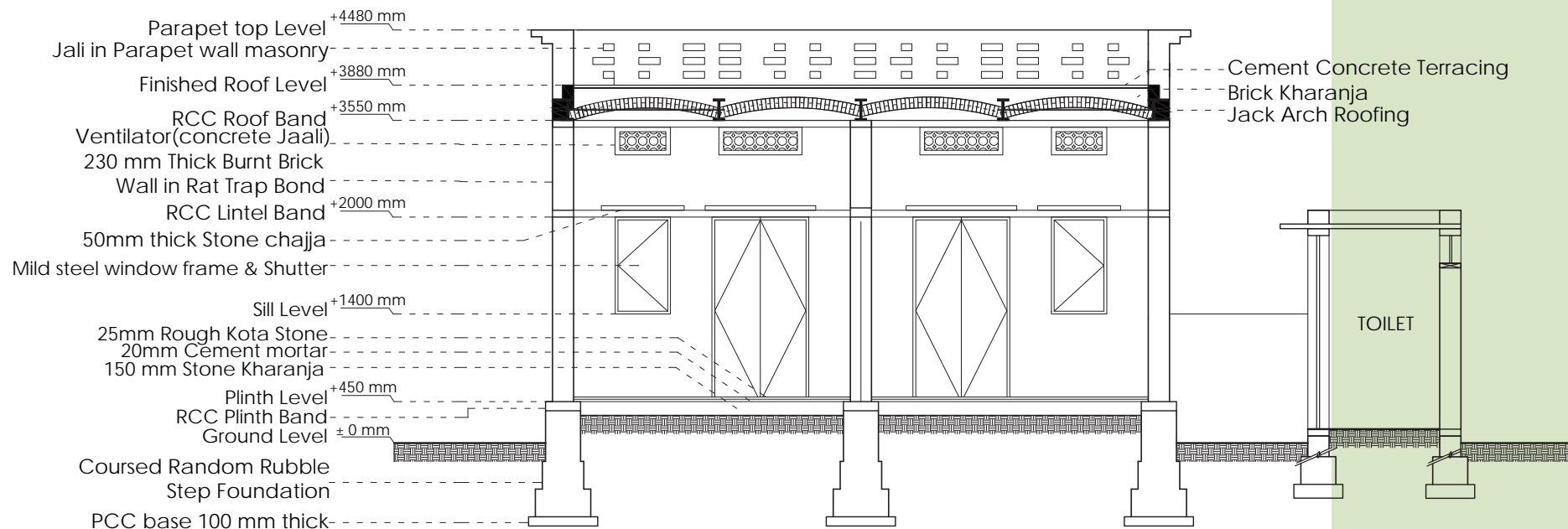


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TYPICAL PLAN

ZONE-D RJ-D-01



SECTION



RAJASTHAN

ZONE-D
RJ-D-01

Cost breakup

Item	Cost (INR)
Foundation	22169/-
Walls	49207/-
Roof	43056/-
Doors, Chajja and Windows	15285/-
Flooring	6487/-
Total	136204/-



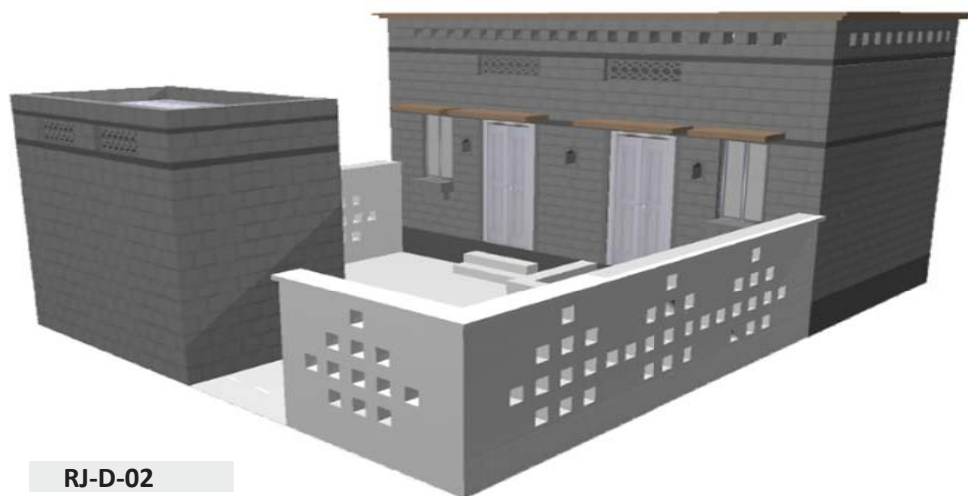
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Cost Estimate for ZONE-D Design 01

S. NO.	COMPONENT	LABOR COST (₹)	TOTAL (LABOR +MATERIAL) (₹)
1	Foundation	10618	22169
2	RCC wall bands	1341	9978
	Plinth band		
	Lintel band		
	Roof band		
3	Walling	9325	33022
4	Roof structure	6350	31526
5	Roof finish	1246	11530
6	Doors and windows	698	11678
7	Chajja	1469	3607
8	Flooring	1700	6487
9	Wall finishes	5294	6207
		38041	136204
	ESTIMATED COST OF CORE HOUSE		136204
	Toilet block (Toilet + Bath)	14511	32771

ZONE-D

RJ-D-02



RJ-D-02

- The type design is developed by taking cue from the traditional housing typology where cooking space is kept outside in open with low height wall enclosure. The core house is a simple rectangle in shape with two rooms having access from the open space (aangan) in front.
- Ventilator and jaali is provided above door and window openings for effective cross ventilation. Aala, a traditional feature observed as being widely used, is provided on both sides of the door. The house is proposed to be provided with detached toilet in one corner of the plot. Water can be stored in underground water tank. Seismic bands are proposed at plinth, lintel and roof level.
- The cooking space in aangan is observed to have a low height wall enclosure. The cost of this wall is not included in the proposed type design for LAY. The beneficiary can use any suitable local material available to build this enclosure.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Continuous Coursed Rubble foundation in cement-sand/ cement-lime-sand mortar as per specifications 	
RCC Wall Bands	<ul style="list-style-type: none"> Plinth bands <ol style="list-style-type: none"> Plinth band 75 mm RCC Plinth band is provided at plinth level as per specifications Lintel Bands <ol style="list-style-type: none"> 75 mm RCC Plinth band is provided at lintel level as per specifications Roof Bands <ol style="list-style-type: none"> 75 mm RCC Plinth band is provided at roof level as per specifications 	
Wall	<ul style="list-style-type: none"> Precast stone filler block wall in cement/cement-lime-sand mortar as per specifications 	
Wall Finish	<ul style="list-style-type: none"> Cement pointing on external surfaces as per detail. 	
Roof Structure	<ul style="list-style-type: none"> Stone patti with cement-sand pointing 	
Roof Finish	<ul style="list-style-type: none"> China mosaic laid on P.C.C/ lime terracing as per detailed specifications 	
Floor	<ul style="list-style-type: none"> Unpolished kota stone/ Karegi flooring as per detail. 	
Door and Windows	<ul style="list-style-type: none"> Mild Steel frame and shutter as per specifications. 	
Tie Beams	<ul style="list-style-type: none"> Tie-Beam is provided at the floor level as per detail. 	



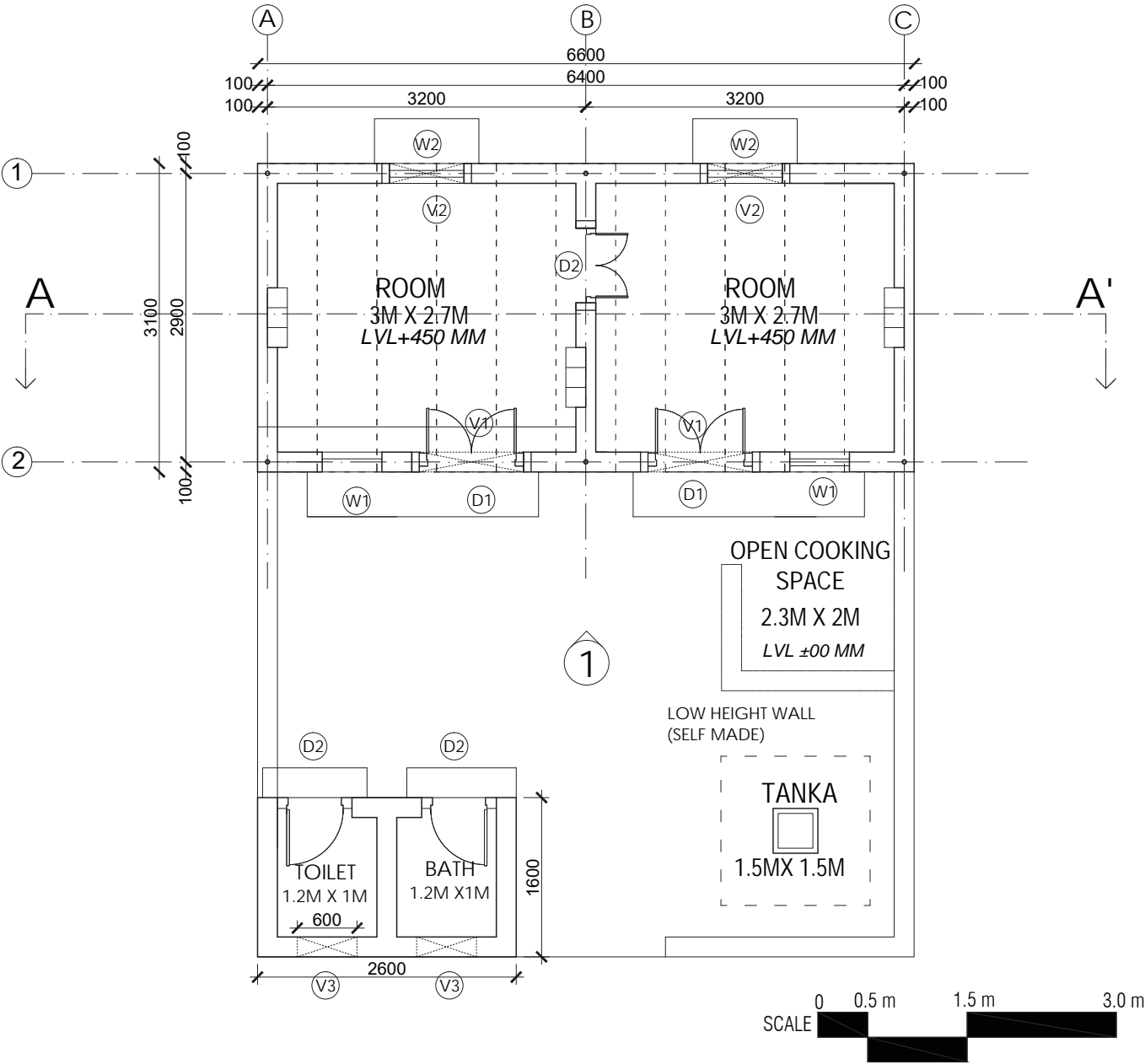
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ZONE-D
RJ-D-02

Total Cost ₹ 166209/-

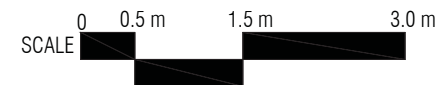
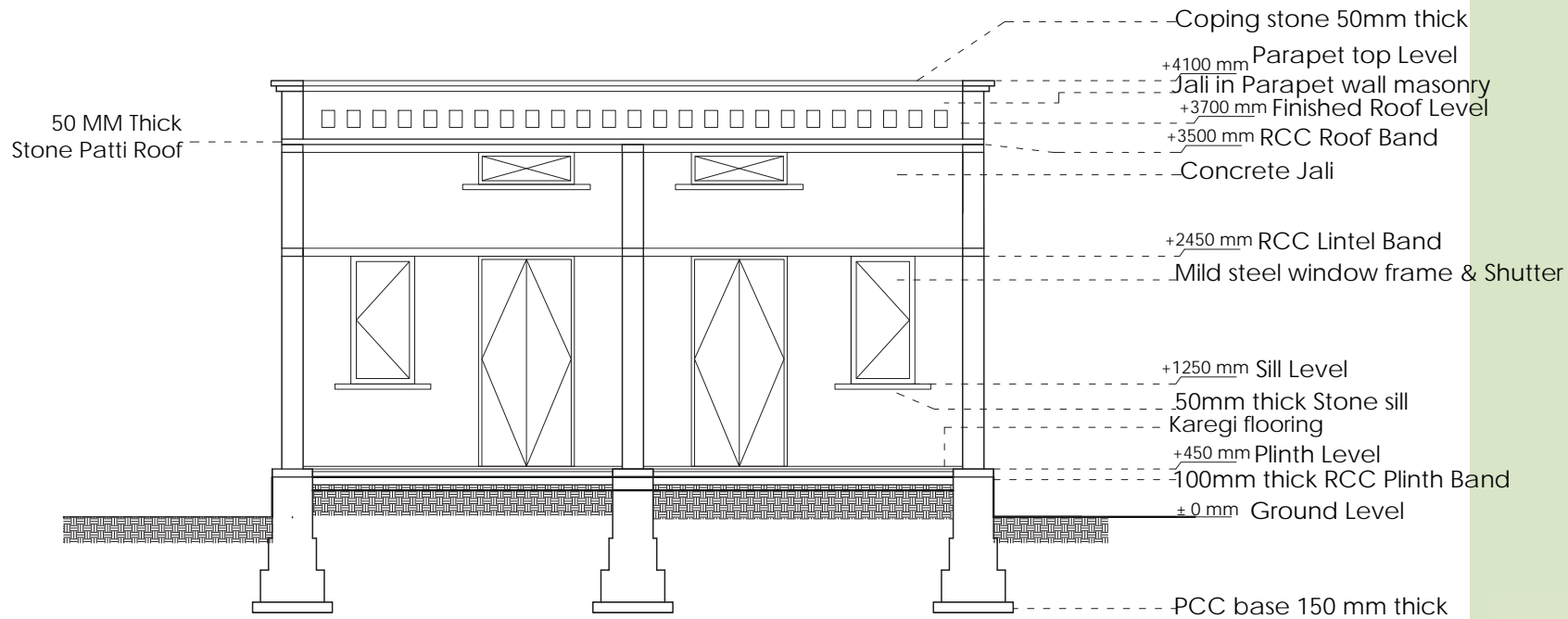


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TYPICAL PLAN

ZONE-D RJ-D-02



SECTION



RAJASTHAN

ZONE-D
RJ-D-02

Cost breakup

Item	Cost (INR)
Foundation	44808/-
Walls	57637/-
Roof	37222/-
Doors, Chajja and Windows	16023/-
Flooring	10519/-
Total	166209/-

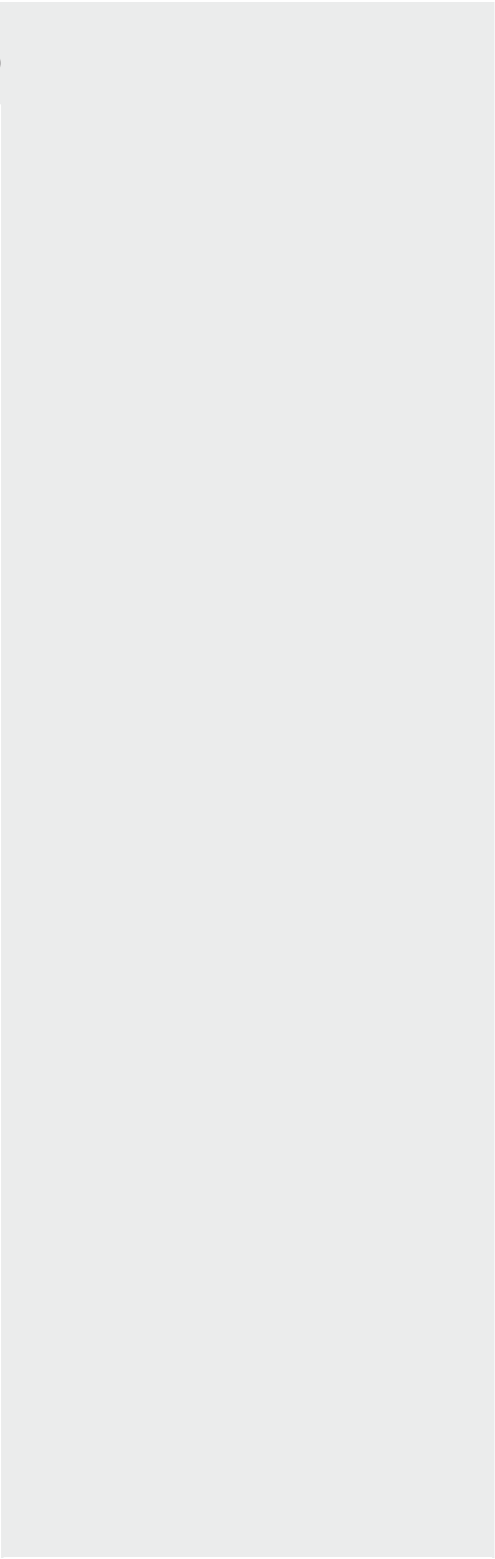


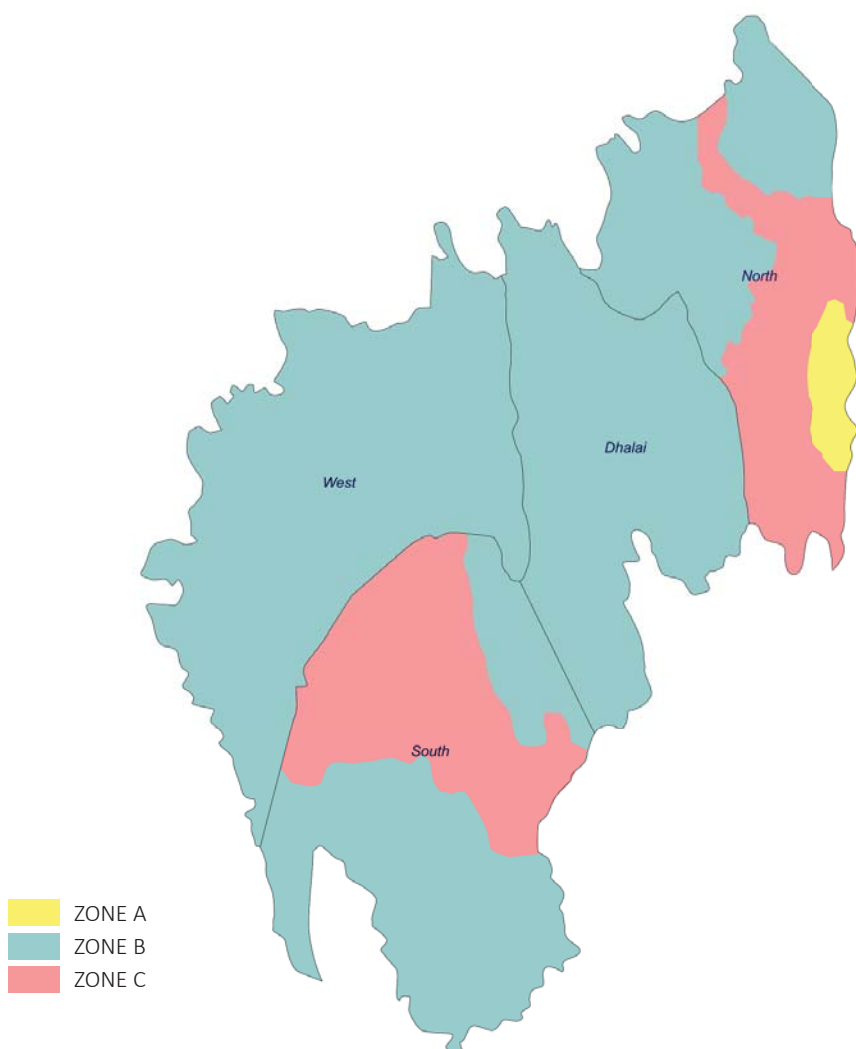
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Cost Estimate for ZONE-D Design 02

S. NO.	COMPONENT	LABOR COST(₹)	TOTAL (LABOR +MATERIAL) (₹)
1.	Foundation	9184	44808
2.	RCC wall bands	1348	9553
	Plinth band		
	Lintel band		
	Roof band		
3.	Walling	8093	34779
4.	Roof structure	6955	24115
5.	Roof finish	1480	13107
6.	Doors and windows	3780	12939
7.	Chajja	1388	3084
8.	Flooring	2404	10519
9.	Wall finishes	10179	13305
		44811	166208
	ESTIMATED COST OF CORE HOUSE		166208
	Toilet block (Toilet + Bathing space)	8912	34482

Tripura





The third-smallest state in the country. Forests cover more than half of the area, in which bamboo and cane tracts are common. Tripura has tropical weather, marked by heat and humidity. It has three distinct seasons, viz., summer, winter and monsoons.

The physiography is characterised by hill ranges, valleys and plains. The state has five anticlinal ranges of hills running north to south, from Boromura in the west, through Atharamura, Longtharai and Shakhan, to the Jampui Hills in the east. The intervening synclines are the Agartala–Udaipur, Khowai–Teliamura, Kamalpur–Ambasa, Kailasahar–Manu and Dharmanagar–Kanchanpur valleys.

ZONE A

The hilly areas such as Jampui Hills fall in this zone. Design type TR-A-01 and TR-A-02 have been recommended for this zone.

ZONE B

This type design is recommended for the Non-Hilly areas for all tribes and Bengalis. Design type TR-B-01 to TR-B-04 are recommended for this zone.

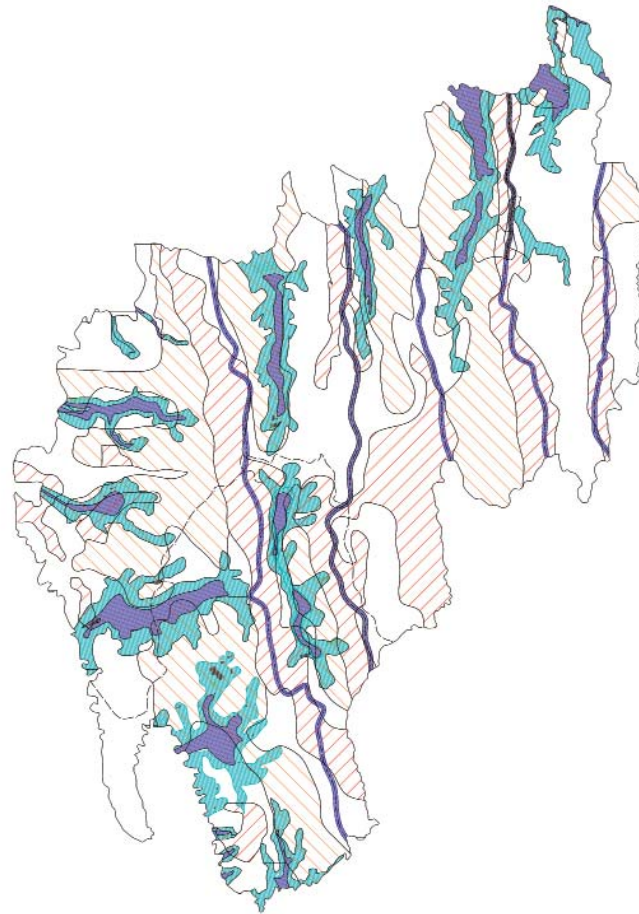
ZONE C

Tong Ghars have been observed in this zone. This is preferred by the Chakmas, Reangs and the Darlongs. Design type TR-C-01 has been recommended for this zone with modifications (solid plinth).

One of the unique shelter types in Tripura is Tong Ghar (house on stilt). These are preferred by the Reangs, Chakmas and the Darlongs. Otherwise all the dwelling units in the non-hilly areas had linear and L type plans that maximize ventilation. Many preferred L-type. Other than Jampui hills, the rest of Tripura has undulating low rise landform. The traditional zoning of the state is hilly and non-hilly areas. While there are places where good numbers of specific tribes live, e.g., Chakmas in Laljuri, Debbarmas in Jampuijola, etc, others in the same places live as well. Therefore, among the surveyed settlements in the eight districts, a clear cut social zoning could not be done. Based on the desktop research, state level data and the resource mapping, the following zoning has been done for Tripura based on topography/climate and social pattern.

MULTI-HAZARD

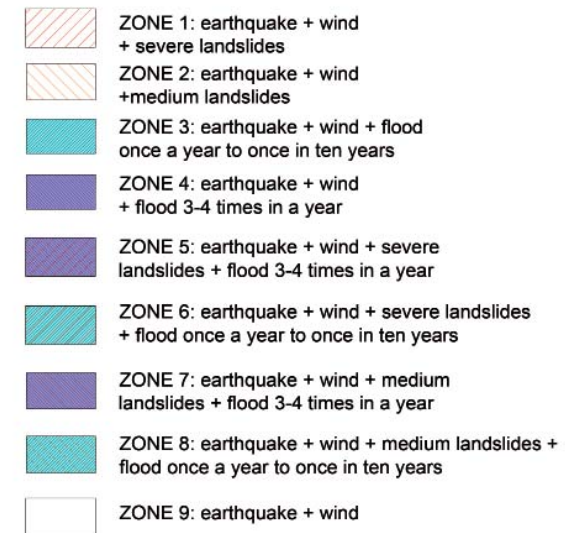
The typologies proposed for the state of Tripura indeed are proposed with housing zones in mind but the designs have been proposed stressing on the multi-hazard point of view.



The purpose of defining 'housing zones' in Tripura is to suggest suitable designs and technologies for the PMAY-G beneficiary houses, keeping in mind the multi-hazards, climate, available materials and construction skills etc. The extensive list of factors considered for zoning are as follows:

- Climate: Monsoon, summer, winter, sun path, humidity, temperature, air movement, etc.
- Geology/soil type
- Multi-Hazards/Earthquake, Wind, Flood, Landslide, etc
- Ethnic and living pattern
- Language
- Religion
- Locally available skills
- Construction material
- Existing traditional construction practices

However, this is different for multi-hazard safety of a building where all factors should be considered simultaneously. Therefore, for multi-hazard situation, a superimposed map has been used for zoning.



TRIPURA

BUILT FORM



TRIPURA

Overall Recommendations for Built Form		
Components	Types of Component	Description
Ceiling and attic		Provide adequate roof projection on all sides to protect the upper part of wall from rains. Success lies in the design of bamboo member joints. Detail the joints so that any damaged member could be replaced without jeopardising the structural safety. Use bunch of bamboos with metal straps to create deep beam effect
Openings	O1	Phenol bonded or equivalent CK shutter framed with split bamboo/ local timber.
	O2	GCI with timber frame
	O3	O1 or O2 with 25x25 MS angle frame
	O4	O1 or O2 with 65x90 precast RCC frame
		General Points : All CK items should be painted with fire retardant paint. Window overhang – Use the twuikaloi (Mondai) style
Floor	FL1	Plastic sheet as rising dampness stopper + 75mm sand bed + 300x300x16mm precast CC tiles (produced at local building centre or RDD store at block level)
	FL2	Cement floor on flat brick soling
	FL3	Bamboo floor in stilt house
Plinth and Steps		<p>General Recommendations</p> <p>Seismic safety: Since the entire state falls in Seismic Zone 5, bands (at plinth, lintel and roof), corner reinforcement, windows and doors (location and size), shear walls must be carefully detailed make sure that the following points are complied with</p> <ul style="list-style-type: none"> Architectural/structural configuration to be symmetrical and not irregular in plan Are there provisions for physically challenged-friendly access to the buildings and functional areas Masonry Structure to have vertical reinforcements & horizontal bands in walls according to code. <p>Unreinforced masonry has proven very vulnerable in strong shaking. To improve seismic performance of masonry buildings one needs to provide, reinforcements at all wall corners and RCC or bamboo reinforces bands at plinth, window sill and lintel level.</p>

Overall Recommendations for Built Form		
Components	Types of Component	Description
Foundations	F1	Wall footing in the soil with SBC 10tons /sqm.
	F2	Precast RC stub with metal plate with holding down bolts.
	F3	F2 type foundation with plinth on stilt in black cotton soil area or high flood area.
Wall	W1	250-300mm thick 5-10% cement stabilized rammed earth wall.
	W2	600mm high rammed earth wall as per above specifications + CK plastered in 10% stabilized mud mortar on both sides.
	W3	600mm high rammed earth wall as per above specifications + CK plastered in 1:5 cement mortar on both sides.
	W4	75mm thick brick wall upto 600mm high in 1:4 cement mortar + CK plastered in 10% stabilized mud mortar on both sides.
	W5	75mm thick brick wall upto 600mm high in 1:4 cement mortar + CK plastered in 1:5 cement mortar on both sides.
	W6	Same as W1 + small local pebbles on the outside wall
	W7	Split bamboo walls (CK) as in Tong house
	W8	Partition wall in CK
ROOF		General notes: All CK walls should be painted with fire retardant paint. Corrugated CK may also be used.
	R1	GCI with crimp curve with least number of treated bamboo understructure
	R2	GCI sheet (do-chala) with treated bamboo understructure
	R3	GCI roof (Samoa type) in very high wind area – local specific
	R4	Micro concrete tile roof with wind arresters
	R5	Thatch over GCI sheet for modified Tong house

ZONE-A

Zone A comprises of Hilly areas classified as Jampui Hills

Resources

- Bamboo
- Mud
- Timber
- Stone

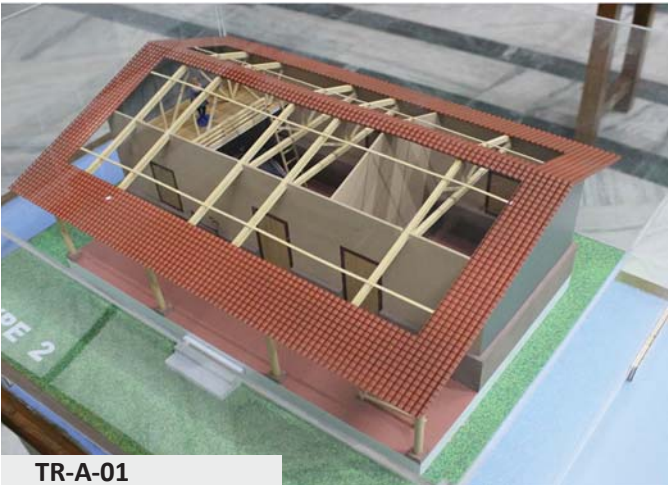
Zone A has two proposed designs

TR-A-01

TR-A-02



TRIPURA

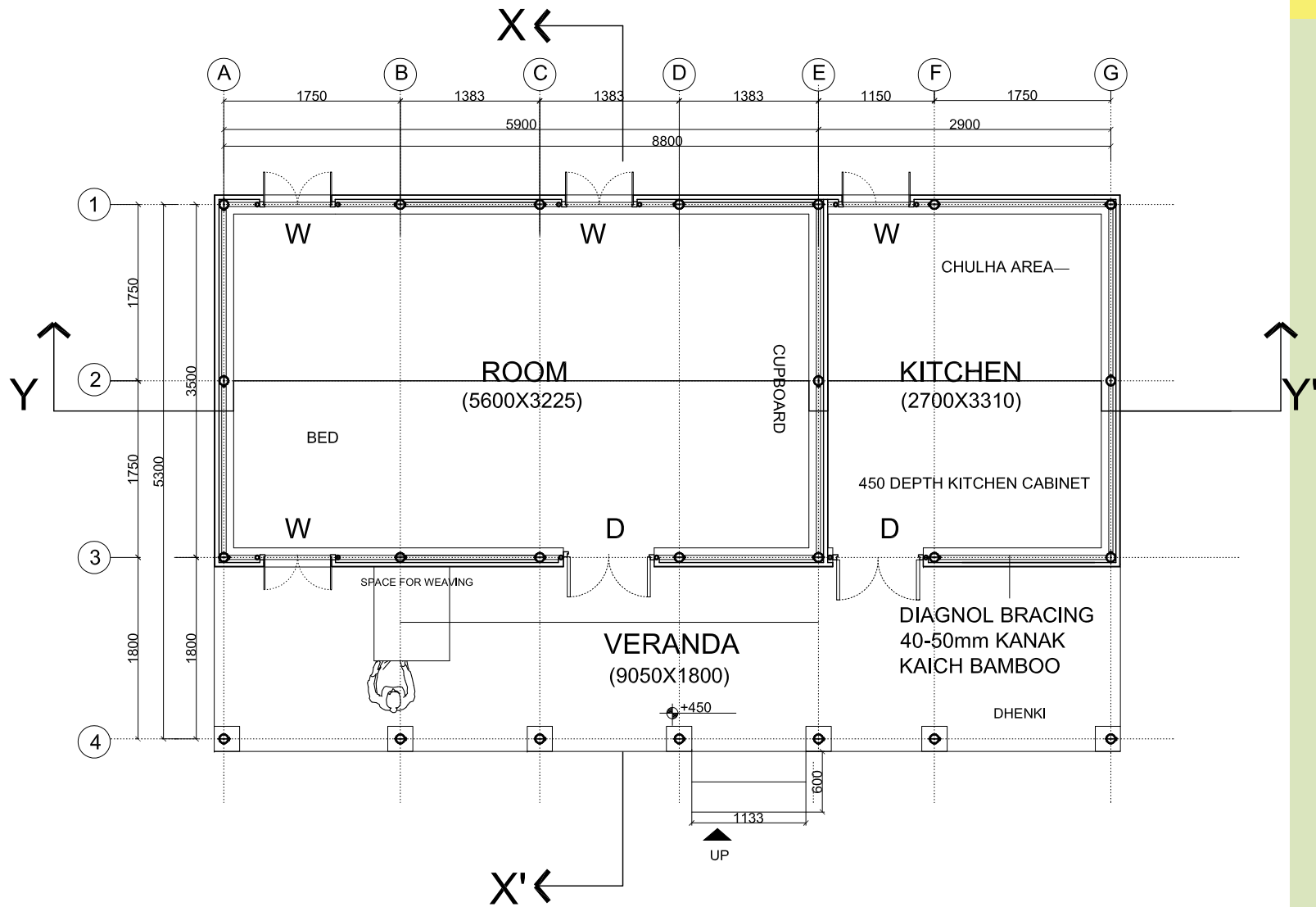


HIGHLIGHTS OF TR-A-01 AND TR-A-02

- 3 bays have been provided (1 bed space, 1 multipurpose space , kitchen) having minimum width of 2.7 m following the existing trend.
- Verandah space on either ends.
- Activities like hand loom, clothes drying area and dhenki as seen from the surveyed houses can be done here in these verandahs.
- One verandah can be done in incremental basis and the user will have an option to increase the length of one room up to the verandah in the future without much alteration in the design.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none">• 250 x 250 Brick Stub 20 Nos on 75 CC (1:5:10)• R.C. Band at GL and wall top (50x250)	
Wall	<ul style="list-style-type: none">• Brick pillars 250 x 250 10 in No plus end walls 75 brick work in 1:3 cement mortar.• Veranda side is part 75 mm brick wall.	
Wall Finish	<ul style="list-style-type: none">• Cement Stabilized mud	
Roof	<ul style="list-style-type: none">• GCI Sheet (Do-Chala) with treated bamboo under structure/ or micro concrete tile roofing	
Floor	<ul style="list-style-type: none">• Plastic Sheet as rising dampness plus 75 mm sand bed plus 300 x 300 x 16 mm precast concrete tiles or flat bricks soling in 1:3 cement mortar	
Opening	<ul style="list-style-type: none">• Phenol Bonded or equivalent shutter framed with split bamboo / local timber• Alternatively use GCI shuttering framed with split bamboo/local timber.	

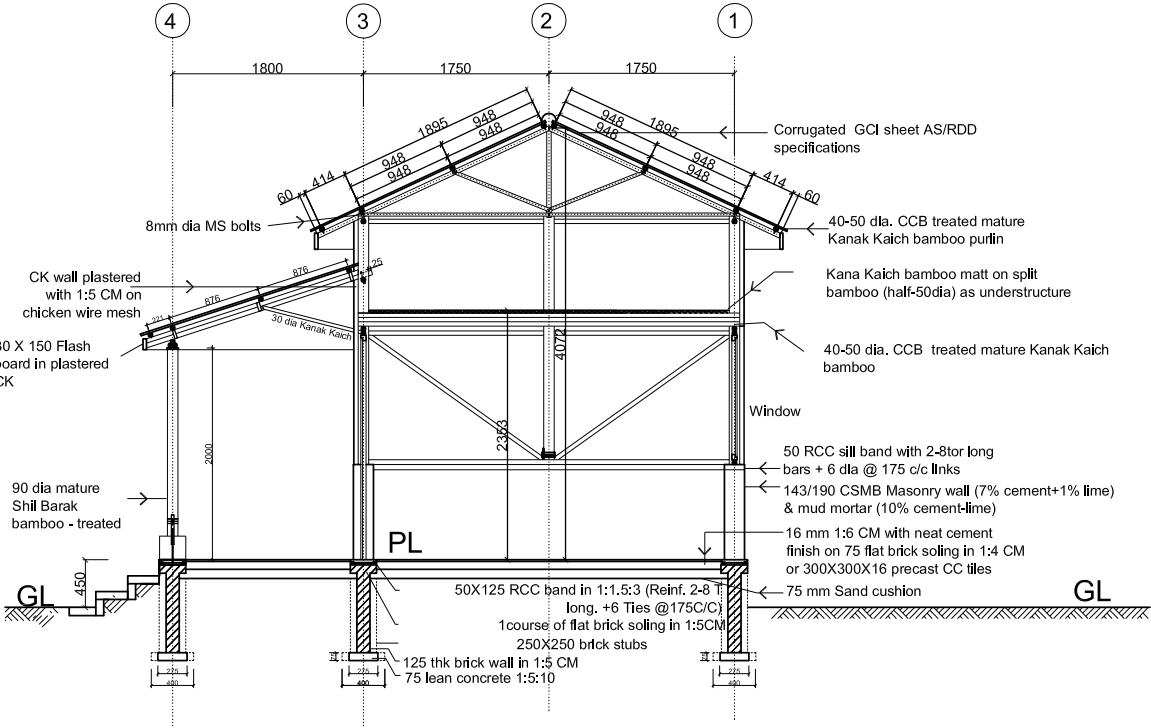
ZONE - A
TR-A-01



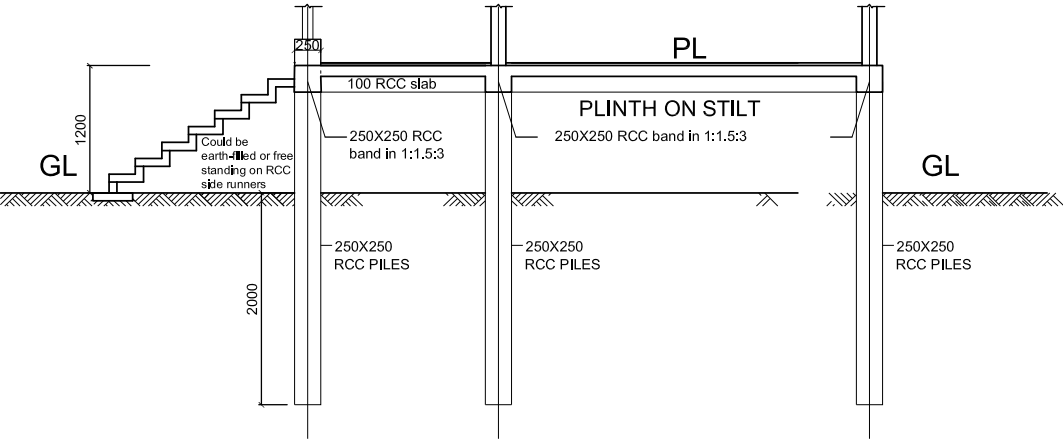
TYPICAL PLAN

TRIPURA

ZONE- A
TR-A-01



Note: Alternatively Local Timber of 50X 25mm section to be used to make the truss.



TRIPURA

Cost Estimate for ZONE- TR-A-01

S.NO	DESCRIPTION	QUANTITY	UNIT	UNIT RATE (₹)	AMOUNT
1	Excavation in foundation	8.333	cu.m.	142.32	1185.96
	Backfill 1/3rd of excavation	2.778	cu.m.	52.00	144.44
	Plinth filling	15.202	cu.m.	52.00	790.49
2	Lean concrete 1:5:10 in Foundation	0.893	cum	4761.51	4254.13
3	Brick masonry in Foundation	0.938	cum	4101.58	3845.23
4	125mm Wall in 1:4 CM	4.029	cum	4101.58	16526.42
5	RCC band at PL (50x250) M20 concrete in Foundation with 6mm dia@ 300 c/c steel bars	0.500	cum	6847.05	3422.24
	Reinforcement for the above @200kg/cum	99.963	kg	55.78	5575.91
6	Anchor bar 10mm dia Steel Rod from plinth beam to top of toe wall	18.000	m	55.78	684.76
		12.276	kg		
7	Sand cushion under Flooring	3.300	cum	51.78	170.87
8	Flat brick soling in 1:4 CM in Flooring	3.456	cum	51.78	178.95
9	Neat Cement Finish with 1:6 CM in Flooring	44.146	sqm	331.82	14648.46
10	1:4 CM plastering on Plinth wall	4.937	sqm	117.56	580.37
11	7% cement+1% lime stabilized Rammed Earth	4.591	cum	3213.05	14751.79
12	250x50 Brick stubs in Wall	0.208	cum	4101.58	854.41
13	Brick Masonry in Veranda	0.070	cum	4101.58	287.11
14	Supporting 100mm Barak bamboo in walls	57.930	m	28.75	1665.49
15	100mm Kanak Kaich bamboo in walls (Horizontal supporting structure)	99.864	m	28.75	2871.09
16	75mm Diagonal Bracing in walls	20.118	m	28.75	578.39
17	50mm Bamboo for door & window frame in walls	15	m	28.75	431.25
18	30mm Bamboo for window & door	76.08	m	28.75	2187.30
19	50mm Bamboo for door	13.2	m	28.75	379.50
20	Champa Kampa in Windows	1.153	sqm	336.98	388.54
21	Champa Kampa in Wall	62.933	sqm	468.48	29482.82
22	1:4 CM plastering on plinth wall	14.321	sqm	117.562	1683.58
23	75 mm Kanak Kaich Bamboo for Attic frame	20.856	m	28.75	599.61

ZONE- A TR-A-01

Cost breakup

Item	Cost (INR)
Foundation	50,744/-
Flooring	15,683/-
Walls/Floors/Windows	40,808/-
Attic and Roof	60,048/-
Total	1,67,619/-



TRIPURA

ZONE- A
TR-A-01

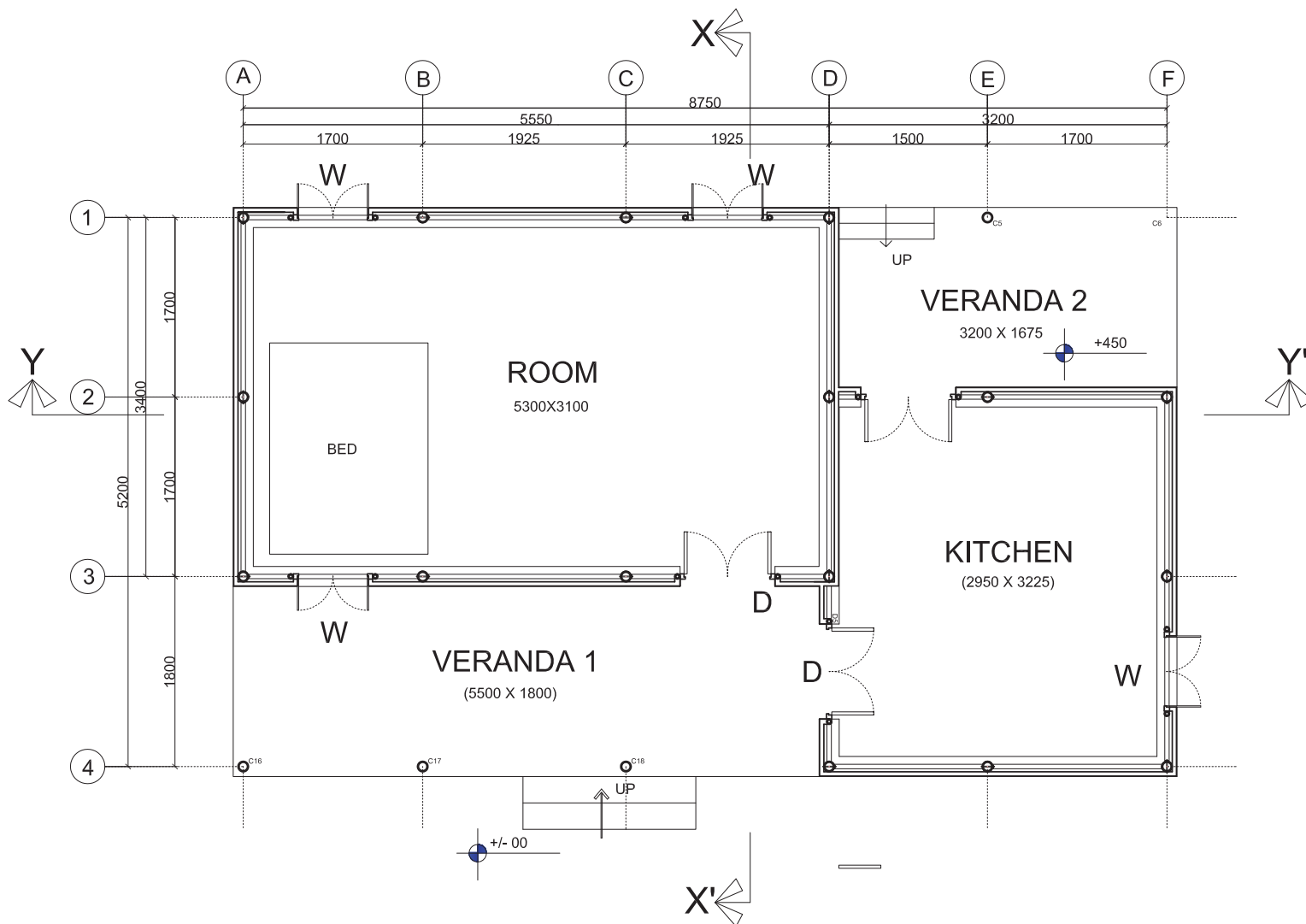
Cost breakup

Item	Cost (INR)
Foundation	50,744/-
Flooring	15,683/-
Walls/Floors/ Windows	40,808/-
Attic and Roof	60,048/-
Total	1,67,619/-



TRIPURA

S.NO	DESCRIPTION	QUANTITY	UNIT		UNIT RATE	AMOUNT
24	Half Bamboo Understructure of 50mm dia in Attic Floor	151.3	m		28.75	4349.88
25	Bamboo matt in Attic floor	7.954	sqm		426.98	3396.36
26	GCI roof sheeting (0.43)	75.695	sqm		495.00	37468.78
	Fabrication				64.36	4871.94
27	Bamboo under structure in roof					
	100mm dia bamboo required	29.892	m		28.75	859.40
	50mm dia bamboo required	43.248	m		28.75	1243.38
	50mm dia bamboo required	13.332	m		28.75	383.30
	purlin required in roof understrcture	79	m		28.75	2271.25
	Bamboo under structure in roof LEAN to	13.446	m		28.75	386.57
	Purlin in roof understructure for Lean to	29.625	m		28.75	851.72
28	Add 15% for bamboo works					3368.17129
	Total					167,619.84



FLOOR PLAN

TYPICAL PLAN

ZONE - A
TR-A-02

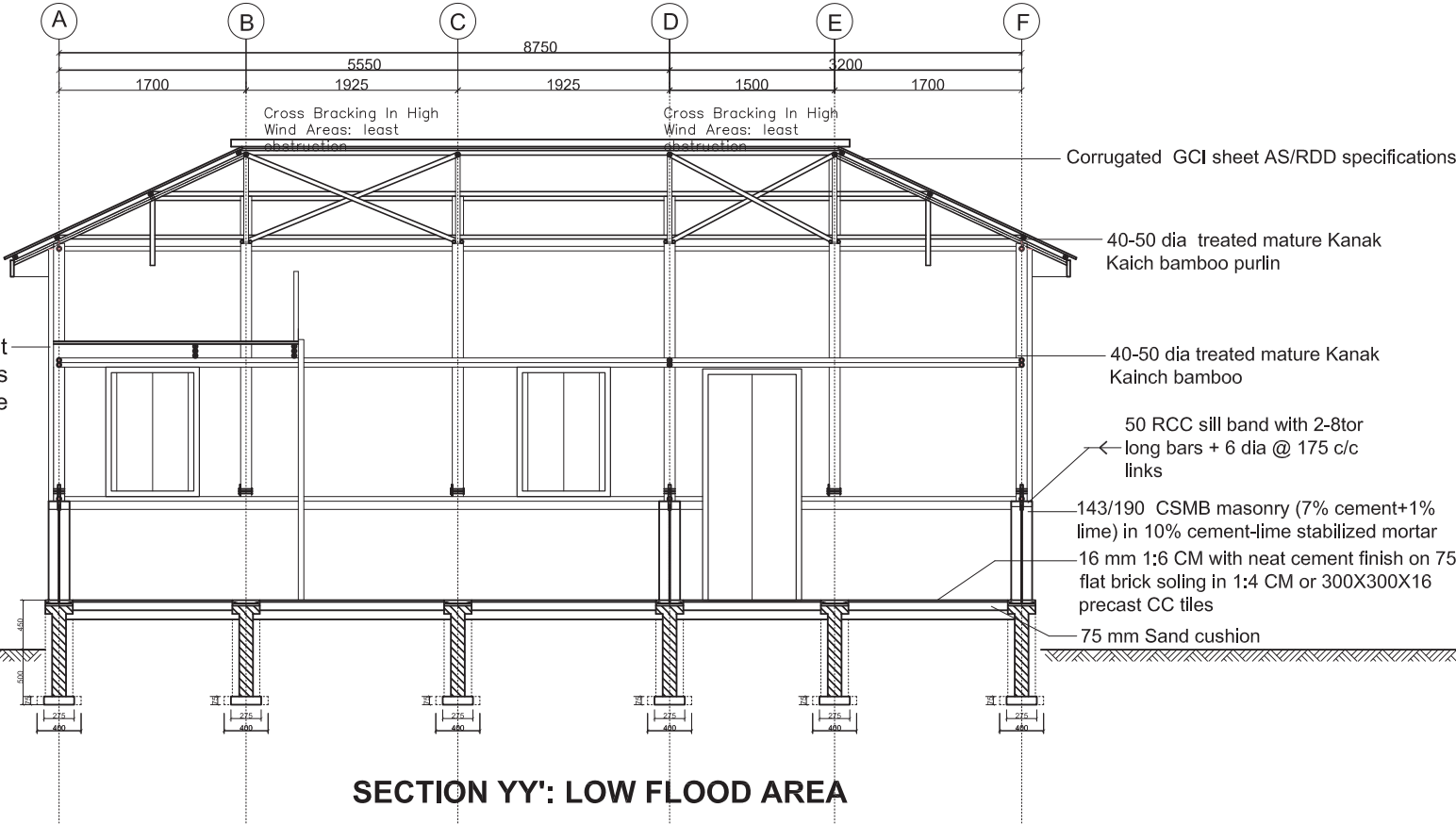
Total Cost ₹ 1,81,987/-



TRIPURA

ZONE- A
TR-A-02

Bamboo matt on split
bamboo (half) as
understructure



A

TRIPURA

SECTION YY'

Cost Estimate ZONE- A Design 02

S.NO.	DESCRIPTION	QUANTITY	UNIT	UNIT RATE (INR)	AMOUNT (INR)
1	Excavation in foundation	11.802	cu.m.	142.32	1679.62523
	Backfill 1/3rd of excavation	3.934	cu.m.	52.00	204.568
	Plinth filling	14.578	cu.m.	52.00	758.03
2	Lean concrete (1:5:10) in Foundation	0.910	cu.m.	4761.51	4334.46
3	Brick Masonry in Foundation				
	250X250 Post in 1:5 CM from base conc to underside of brick flat course at PL	1.031	cu.m.	4101.58	4229.75
	Total volume of Brick Masonry in Foundation	3.988	cu.m.	5032.00	20068.245
4	RCC band at PL (50x250) M20 concrete in Foundation	0.512	cu.m.	6847.05	3504.83372
	Steel for the above @ 200kg/cum	102.375	kg	55.78	5710.4775
5	10mm Dia. Steel Rod in Foundation	18.000	m.		
		11.160	kg	55.78	622.5048
6	7% cement and 1% lime stabilized Rammed Earth Wall	5.943	cu.m.	3213.05	19093.6787
7	Flooring	43.390	sqm	331.82	14397.7594
8	Champa Kampa for Walls with both sides plastered in CM 12mm (with CWM)	63.807	sq.m.	468.48	29892.3961
9	1:4 CM on plinth wall	13.651	sq.m.	117.56	1604.80947
10	Brick Masonry (250x250 Post) in Veranda	0.070	cu.m.	4101.58	287.1106
11	Horizontal 100 mm Kanak Kaich Bamboo in the Wall	114.61	m.	28.75	3294.89375
12	Vertical 100 mm Barak Bamboo in the Wall	59.7	m.	28.75	1717.1225
13	Vertical 50 mm Barak Bamboo for Window and Door Frame	35.7	m.	28.75	1025.202
14	30mm Bamboo for window & door	102.48	m	28.75	2946.3
15	50mm Bamboo for door	19.8	m	28.75	569.25
16	Diagonal 75 mm Kanak Kaich Bamboo Members	23.27	m.	28.75	669.14

ZONE- A TR-A-02

Cost breakup

Item	Cost (INR)
Foundation	60,205/-
Flooring	14,398/-
Walls/Floors/Windows	42,006/-
Attic and Roof	65,378/-
Total	1,81,987/-



TRIPURA

ZONE- A
TR-A-02



TRIPURA

S.NO.	DESCRIPTION	QUANTITY	UNIT	UNIT RATE (INR)	AMOUNT (INR)
17	Roofing GCI Sheet	105.4	sq.m.	495.00	52185.05
18	Truss (Kanak Kaich Bamboo)	34.4	m.	28.75	988.30
	Total length of 50mm for Tie Members	16.7	m.	28.75	479.08
	Total length of 50mm for Raking Members	49.735	m.	28.75	1429.89
	Total length of 50mm for Purlins	112.1	m.	28.75	3223.59
	Lean To (Kanak Kaich Bamboo)	13.212	m.		
	Total length of 50mm for Lean To	15.2	m.	28.75	436.82
	Purlins	7.455	m.		
	Total length of 50mm for Lean To Purlins	8.6	m.	28.75	246.48
	Total length of 100mm Kanak Kaich Bamboo for Truss	34.4	m.	28.75	988.30
	Total length of 50mm Kanak Kaich Bamboo for Truss	202.3	m.		
19	Attic				
	Item no. 15.1 Half Bamboo length for Attic flooring	80.8	m.	28.75	2321.97938
	Area of Bamboo Mat for Attic Flooring	7.5	sq.m.	28.75	215.74
20	* All the bamboo lengths are increased by 15%.				2862.70736
	Total				181,988.11

**TR-B-01**

- Open elongated plan shapes with a single row of rooms to allow cross ventilation-
- Use veranda for shading and rain protection
- use reflective roof with false ceiling

**TR-B-02**

- Open elongated plan shapes with a single row of rooms to allow cross ventilation-
- Use veranda for shading and rain protection
- use reflective roof with false ceiling

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • 250 x 250 Brick Stub 20 Nos in 1:5 CM on 75 CC (1:5:10) • R.C. Band at GL, lintel and wall top (50 x 250) as horizontal seismic bands. 	
Wall	<ul style="list-style-type: none"> • Walls 30 mm thk. ck wall plastered on external face in 1:4 cement mortar. • 143 Thk .cement stabilized mud block masonry in 10% stabilized mud mortar with 14 nos rc posts as vertical seismic bands. • 190mm thick 7% cement stab. • Mud brick in stab mud mortar (10%) wall till 900mm + ck plastered in 10% stabilized mud on both sides. 	<ul style="list-style-type: none"> • The brick specifications can differ as per site and house type falling under different multi hazard zones.
Roof	<ul style="list-style-type: none"> • GCI Sheet (Char-Chala) with treated bamboo under structure/ or micro concrete tile roofing 	
Floor	<ul style="list-style-type: none"> • Plastic Sheet as rising dampness-stopper plus 75 mm sand bed plus 300 x 300 x 16 mm precast CC tiles or flat brick soling in 1:3 CM. 	
Opening	<ul style="list-style-type: none"> • Phenol Bonded or equivalent ck shutter framed with split bamboo / local timber • Alternatively use GCI shuttering framed with split bamboo/local timber. 	

ZONE-B

ZONE II Non Hilly areas
All tribes and Bengalis

Resources

- Bamboo
- Mud
- Timber
- Stone

Zone B has two proposed typologies

TR-B-01

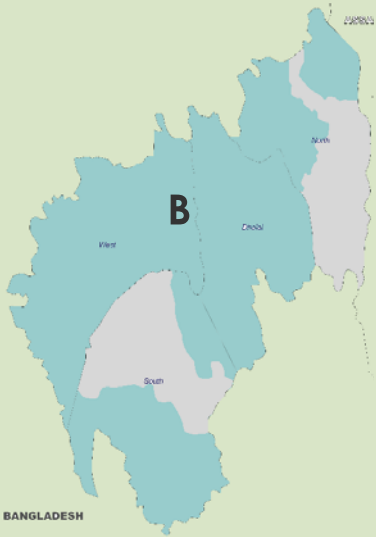
TR-B-02

These typologies are also applicable to zone A and Zone C



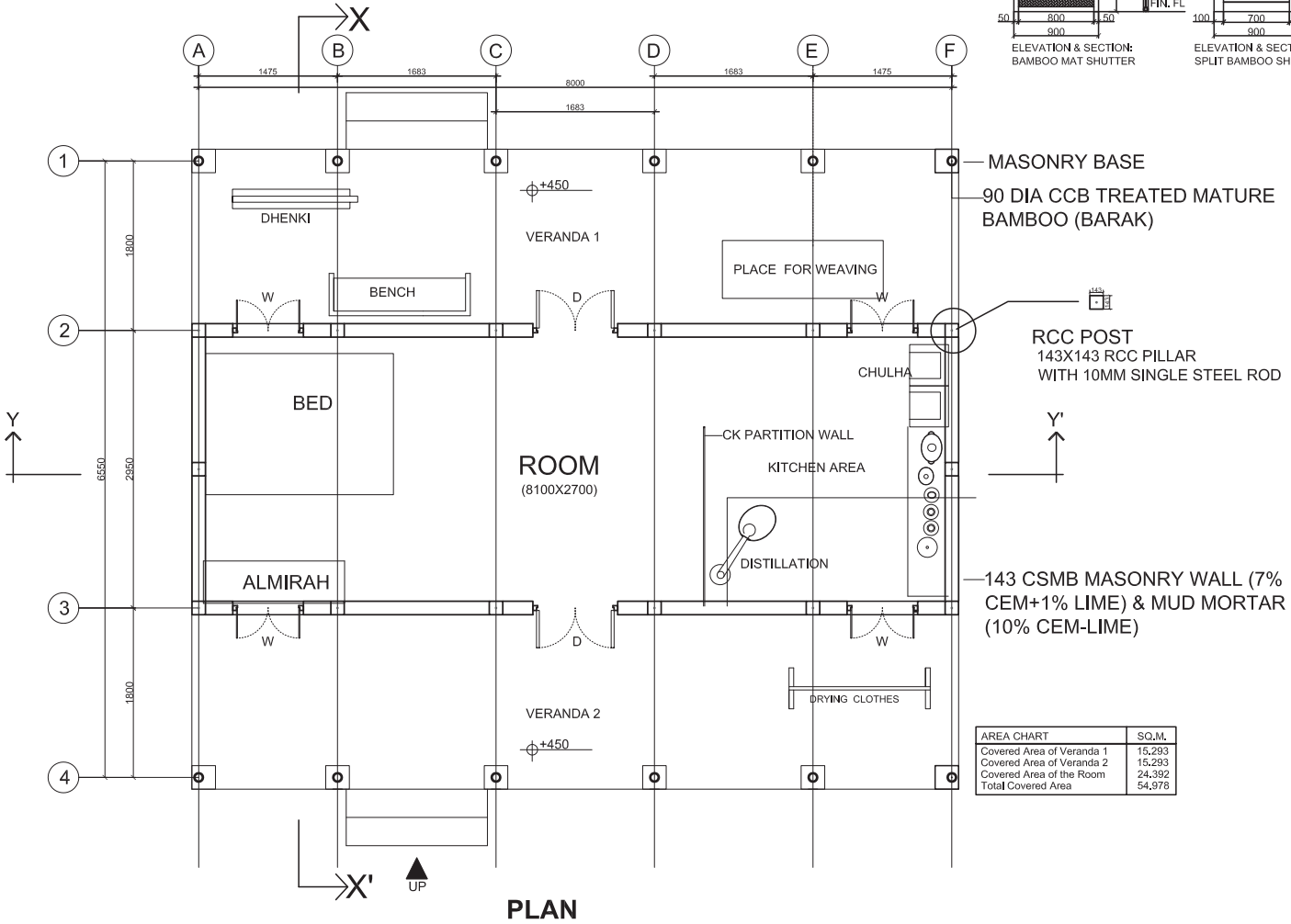
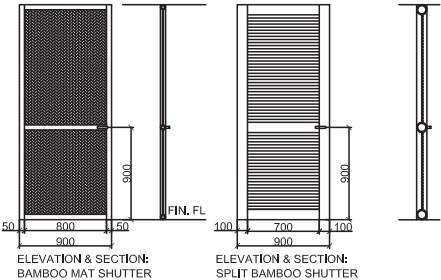
TRIPURA

ZONE-B
TR-B-01



TRIPURA

DOOR WINDOW SCHEDULE					SPECIFICATIONS
NAME	SIZE	SILL	LINTEL	QUANTITY	PHENOL BOND OR EQUIVALENT CK SHUTTER FRAME WITH SPLIT BAMBOO/ LOCAL TIMBER ALT. USE GC1 SHUTTER FRAMED WITH SPLIT BAMBOO/ LOCAL TIMBER OR SPLIT BAMBOO JAALI IN CHAMPA KAMPA INSTEAD OF WINDOW
W	1332 x 750	900	2257	4	
D	2232 x 1000		2257	2	

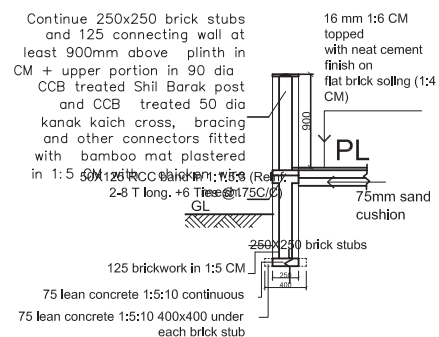


TYPICAL PLAN

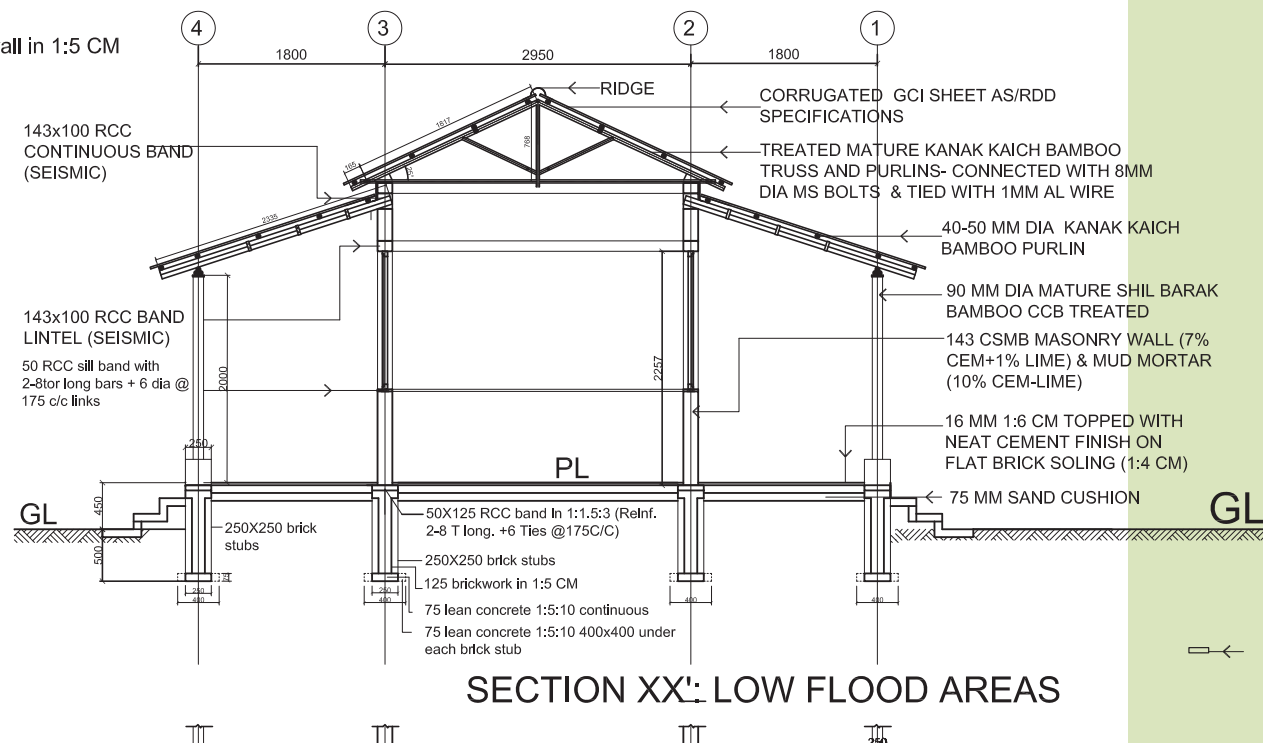
ZONE-B
TR-B-01

Special Note:

the toe wall could be in rat trap bonded brick wall in 1:5 CM wherever brick of strength 6 PMA is available



Section Thro' wall: Alternative supporting system



SECTION XX': LOW FLOOD AREAS

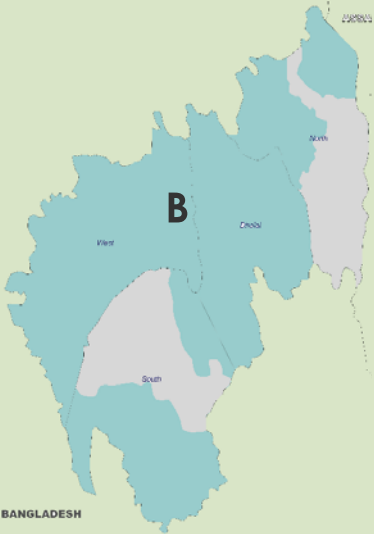
TRIPURA

SECTION XX'

ZONE-B
TR-B-01

Total Cost ₹ 152,888/-

Item	Cost (INR)
Room	88,859
Front veranda	32,014
Rear veranda	32,014
Total covered area	152,888



TRIPURA

Cost Estimate ZONE- TR-B-01

S.No.	DESCRIPTION	QUANTITY	UNIT	UNIT RATE	AMOUNT
1	Excavation in foundation	9.303	cu.m.	142.32	1323.98
	Backfill 1/3rd of excavation	3.101	cu.m.	52.00	161.25
	Plinth filling	17.020	cu.m.	52.00	885.03
2	Lean concrete (1:5:10) in Foundation	0.216	cu.m.	4101.58	885.94
	total volume of Lean Concrete in foundation	0.765	cu.m.	5032.00	3850.42
3	Brick Masonry in Foundation				
	250X250 Post in 1:6 CM from base conc to underside of brick flat course at PL	0.928	cu.m.	4101.58	3806.78
	75x250 MM Flat Brick	0.752	cum	5133.33	3859.63
4	Total volume of Brick Masonry in Foundation	4.266	cu.m.	5032.00	21464.63
5	Plastering on plinth wall in 1:4 CM	14.495	sqm	117.56	1704.11
6	RCC band at PL (50x250) M20 concrete in Foundation with 6mm dia@ 300 c/c steel bars				
	Over 250x250 MM Stubs	0.056	cu.m.	6847.05	385.15
	total volume of RCC Band (M 20 Conc.)	0.501	cu.m.	6847.05	3432.08
	Steel for the above @ 200kg/cum	111.500	kg	55.78	6219.47
7	100x100 MM RCC Posts	0.303	cu.m.	6876.83	2083.68
	Steel for the above @ 200kg/cum	60.600	kg	55.78	3380.27
8	Flooring	55.08	sqm	331.82	18276.65
9	Champa Kampa for Walls 12mm stabilized CM plaster	15.761	sq.m.	468.48	7383.64
10	Champa Kampa in Windows	0.578	sqm	468.48	270.78
11	1:3 Cement plaster on Wall	15.761	sq.m.	117.56	1852.87
12	75 MM Brick Wall with 1:3 CM	0.990	cu.m.	5133.33	5083.54

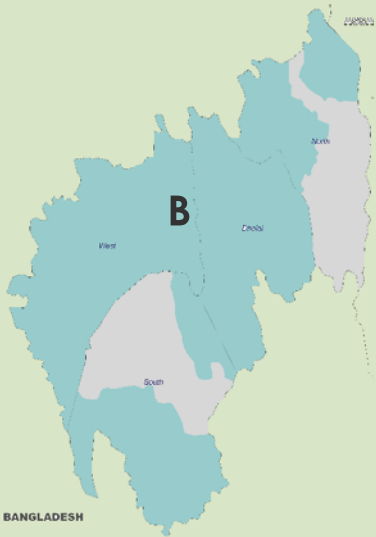
ZONE - B
TR-B-01

13	Brick Masonry (250x250 Post) in Veranda	0.045	cu.m.	4101.58	184.57
14	150x100 MM RCC Continuous Band	0.344	cu.m.	6847.05	2351.96
	Steel for the above @ 200kg/cum	68.700	kg	55.78	3832.086
15	100x100 MM RCC Piece Lintel over Opening	0.048	cu.m.	6847.05	328.6584
	Steel consumption	12.000	kg	55.78	669.36
16	Horizontal 100 mm Kanak Kaich Bamboo	18.6	m.	28.75	616.11
17	Vertical 100 mm Barak Bamboo in the Veranda	13.3	m.	28.75	440.66
18	Vertical 50 mm Barak Bamboo for Window and Door Frame	21.0	m.	28.75	694.31
19	30mm Bamboo for door & window	64.04	m	28.75	2117.32
20	50mm Bamboo for door	13.2	m	28.75	436.43
21	Vertical 50 mm Barak Bamboo near Columns	29.4	m.	28.75	972.04
22	Roofing GCI Sheet	77.3	sqm	495.00	44018.96
23	Truss (Kanak Kaich Bamboo)				
	Total length of 100mm for Rafter	20.1	m.	28.75	662.90
	Total length of 50mm for Tie Members	13.1	m.	28.75	432.50
	Total length of 50mm for Raking Members	34.230	m.	28.75	1131.73
	Total length of 50mm for Purlins	74.3	m.	28.75	2456.21
24	Lean To (Kanak Kaich Bamboo)				
	Total length of 50 mm for Lean To Members	17.6	m.	28.75	581.37
	Total length of 50mm for Lean To Purlins	80.8	m.	28.75	2669.80
	Add 15% of the bamboo works				1981.71
25	* All the bamboo lengths are increased by 15%.				152,888.57

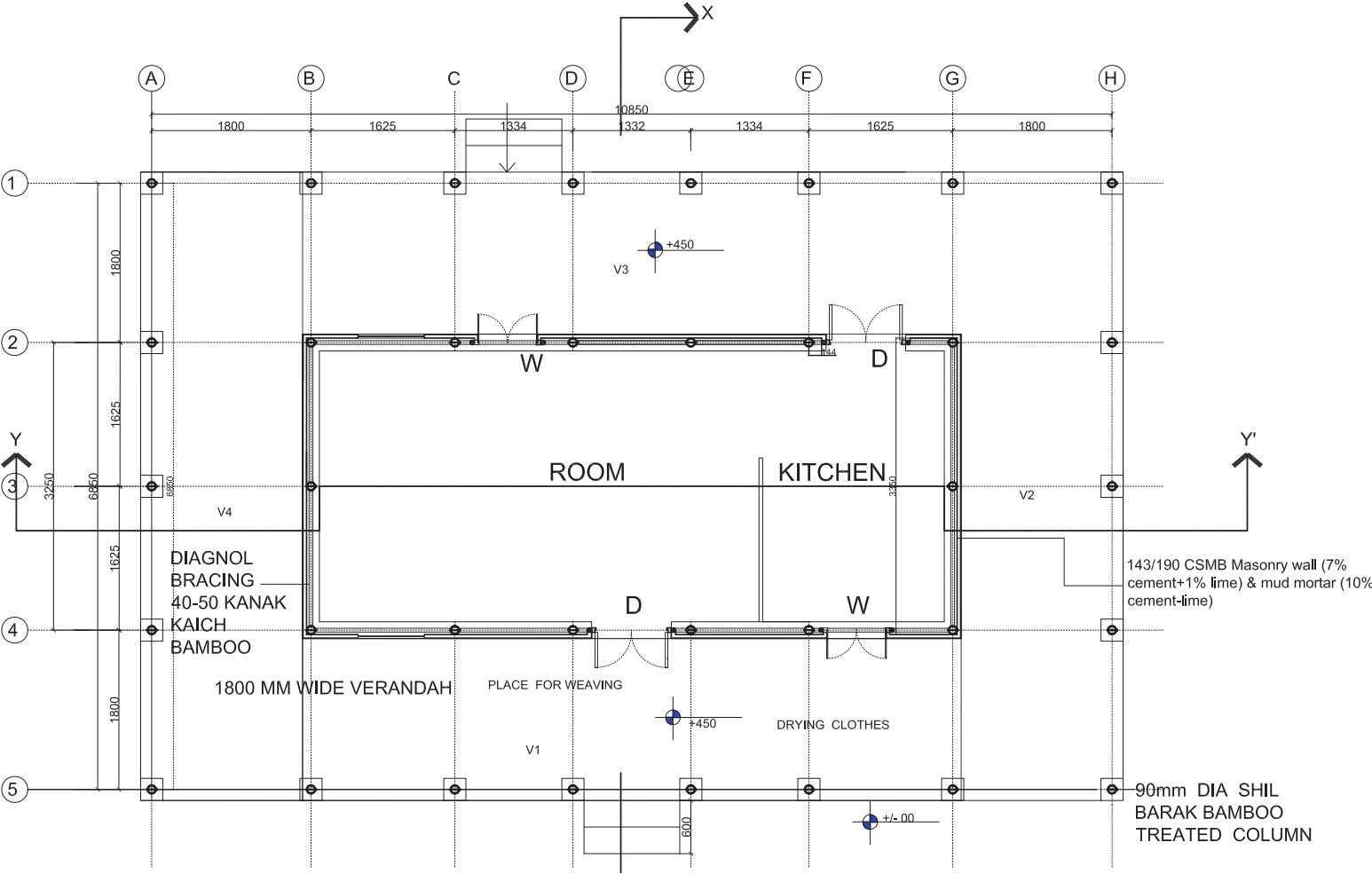

TRIPURA

ZONE-B
TR-B-02

Total Cost ₹ 1,91,512/-

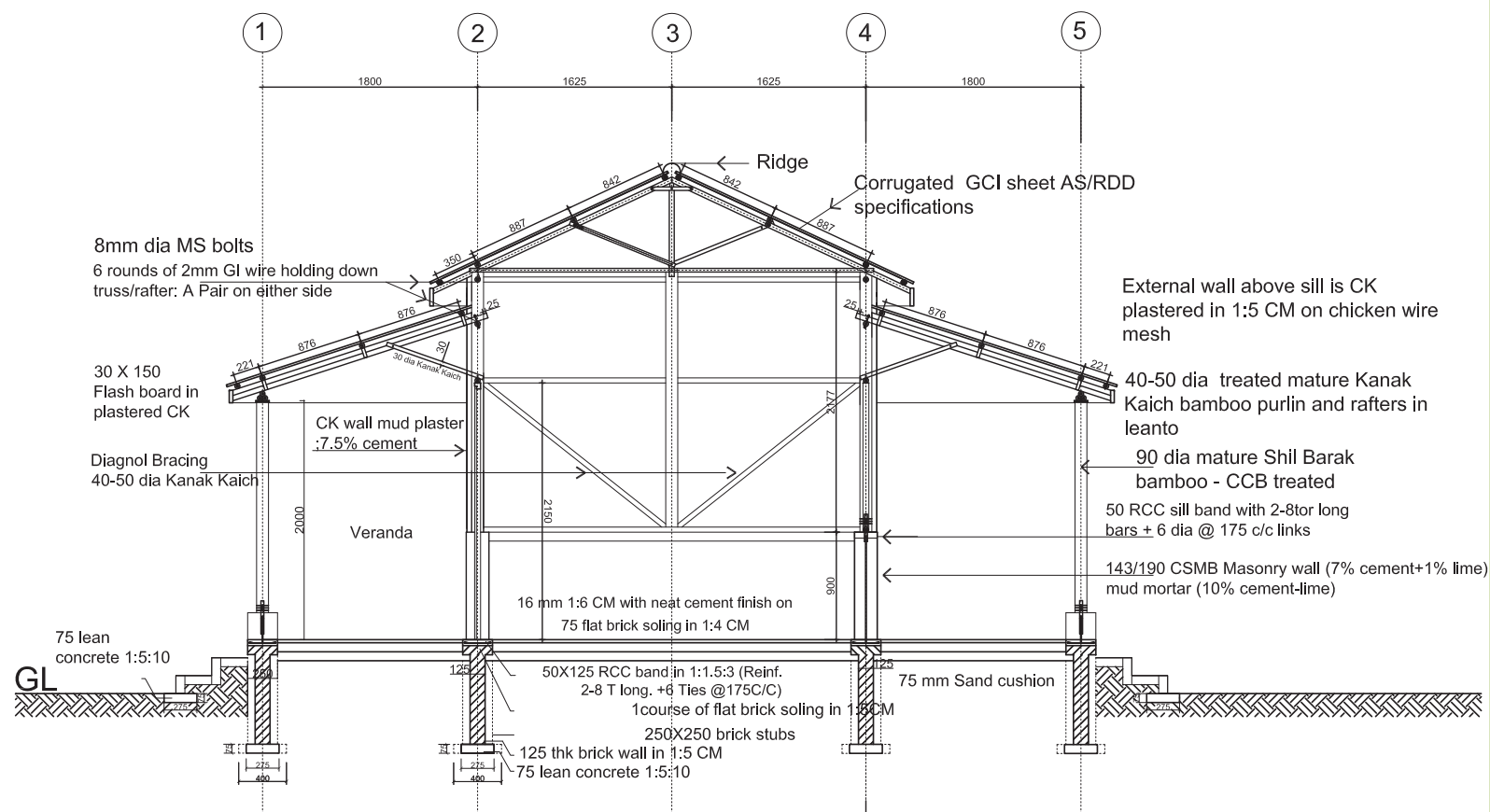


TRIPURA

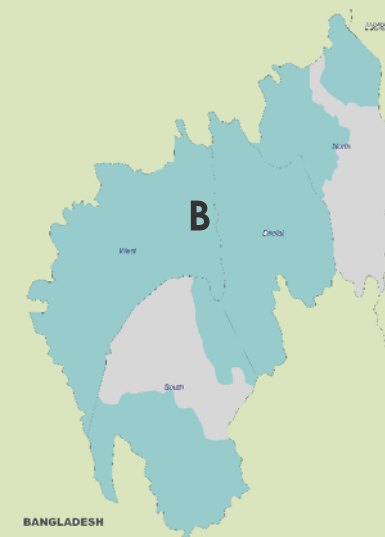


TYPICAL PLAN

ZONE-B TR-B-02



SECTION XX'

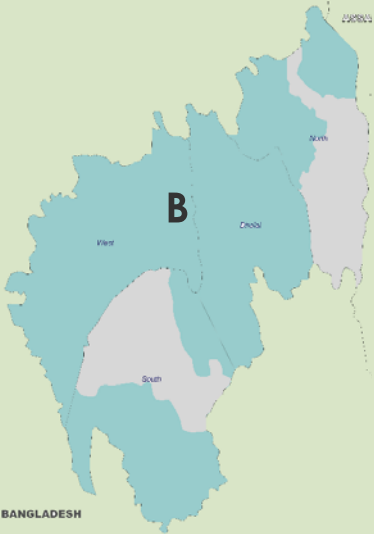


TRIPURA

ZONE-B
TR-B-02

Cost breakup

Item	Cost (INR)
Foundation	60,597/-
Flooring	27,542/-
Walls/Doors/ Windows	40,231/-
Roof	63,141/-
Total	1,91,512/-



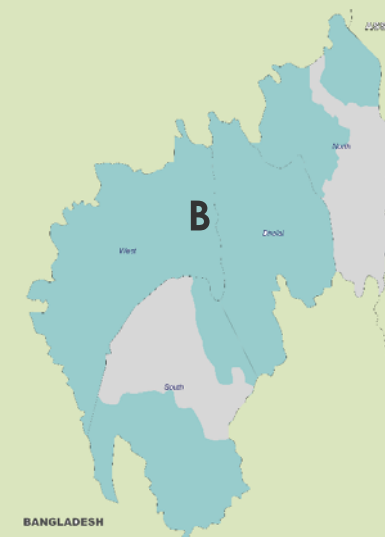
TRIPURA

Cost Estimate ZONE- B Design 02

S.NO.	DESCRIPTION	QUANTITY	UNIT	UNIT RATE	AMOUNT
1	Excavation in foundation	11.844	cu.m.	142.32	1685.66
	Backfill 1/3rd of excavation	3.948	cu.m.	52.00	205.30
		21.536	cu.m.	52.00	1119.85
2	Lean concrete 1:5:10 in Foundation	1.234	cum	4761.51	5873.73
3	Brick masonry in Foundation				
	250X250 Post in 1:5 CM from base conc to underside of brick flat course at PL	1.500	cum	4101.58	6152.37
4	125mm Wall in 1:4 CM	5.325	cum	5133.33	27333.08
5	RCC band at PL (50x250) M20 concrete in Foundation with 6mm dia@ 300 c/c steel bars	1.013	cum	6847.05	6932.64
	Reinforcement for the above item @200kg/cum	202.500	kg	55.78	11295.45
6	10mm dia Steel Rod as anchor to bamboo posts	19.200	m		
		11.904	kg	55.78	664.01
7	Neat Cement Finish with 1:6 CM in Flooring	74.699	sqm	331.82	24786.66
8	1:4 cement plastering on Plinth wall	17.785	sqm	117.56	2090.83
9	7% cement+ 1% lime stabilized Rammed Earth in Wall	4.418	cum	3213.05	14195.18
10	250x50 Brick stubs in Wall	0.200	cum	5133.33	1028.99
11	Brick Masonry in Veranda	0.281	cum	5133.3333	1442.47
12	Supporting 100mm Barak bamboo in walls	53.040	m	28.75	1524.90
13	100mm Kanak Kaich bamboo in walls (Horizontal supporting structure)	96.699	m	28.75	2780.10
14	75mm Diagnol Bracing in walls	12.41	m	28.75	356.79
15	50mm Bamboo for door & window frame in walls	10	m	28.75	287.50
16	30mm Bamboo for door & window frame	76.08	m	28.75	2187.30

ZONE - B
TR-B-02

S.NO.	DESCRIPTION	QUANTITY	UNIT	UNIT RATE	AMOUNT
17	50mm Bamboo for door	13.2	m	28.75	379.50
18	Champa Kampa in Windows	1.153	sqm	468.48	540.16
19	Champa Kampa in Wall	31.548	sqm	468.48	14779.84
20	40 mm Jaali in Wall	2.500	sqm	291.67	729.17
21	GCI roof sheeting (Gz 18)	98.702	sqm	495.00	48857.27
22	Bamboo under structure in roof				
	Normal Truss				
	100mm dia bamboo required	12.384	m	28.75	356.04
	Raking member of 50mm dia	4.56	m	28.75	131.10
23	Tie member of 50mm dia	22.608	m	28.75	649.98
24	Purlin in roof understructure for scissor truss	92.272	m	28.75	2652.82
25	Bamboo under structure in roof				
	Rafter of 100mm dia	10.52	m	28.75	302.45
	Raking member of 50mm dia	6.586	m	28.75	189.35
26	Tie Member of 50mm dia	3.112	m	28.75	89.47
27	Bamboo under structure in roof LEAN to	42.716	m	28.75	1228.09
28	Purlin in roof understructure for Lean to	151.728	m	28.75	4362.18
29	Add labour for bamboo work 25%				4322.05
					191512.25


TRIPURA

ZONE - C
TR-C-01

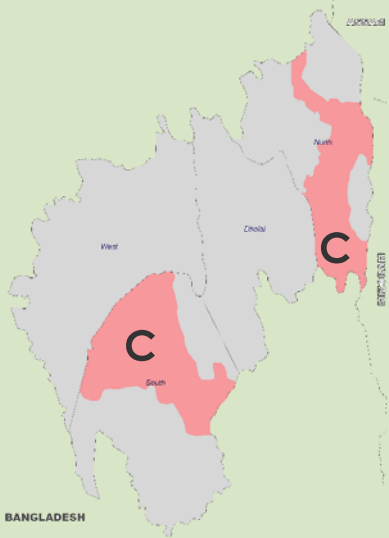
Zone C comprises areas of Chakma, Reang and Darlongs

Resources

- Bamboo
- Mud
- Timber
- Stone

Zone C has one typology
TR-C-01

Besides this, the designs from other zones could be used here too. As the designs are based on multi-hazards.



TRIPURA

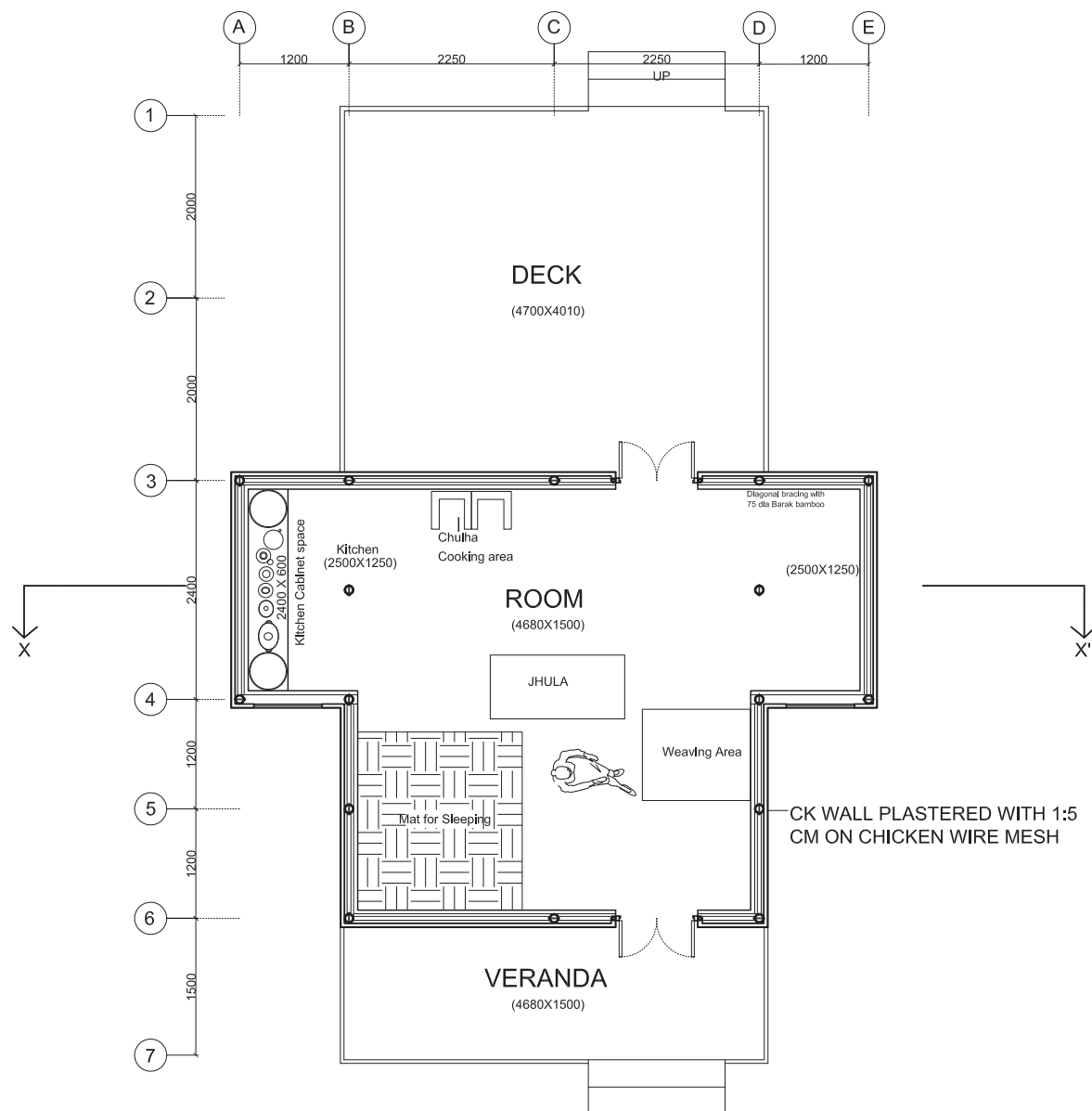


TR-C-01

HIGHLIGHTS OF TR-C-01

- Revitalized vernacular form with CSMB wall and GCI hipped roof on bamboo
- Solid high plinth- spaces and hierarchy of spaces same as the traditional style

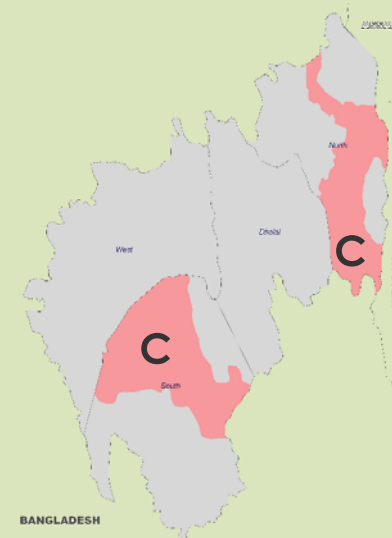
Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none">• 250 x 250 Brick Stub 20 Nos in 1:5 CM on 75 CC (1:5:10)• R.C. Band at GL, lintel and wall top (50 x 250) as horizontal seismic bands.	
Wall	<ul style="list-style-type: none">• Walls 30 mm thk. ck wall plastered on external face in 1:4 cement mortar.• 143 Thk .cement stabilized mud block masonry in 10% stabilized mud mortar with 14 nos rc posts as vertical seismic bands.• 190mm thick 7% cement stab.• Mud brick in stab mud mortar (10%) wall till 900mm + ck plastered in 10% stabilized mud on both sides.	<ul style="list-style-type: none">• The brick specifications can differ as per site and house type falling under different multi hazard zones.
Roof	<ul style="list-style-type: none">• GCI Sheet (Char-Chala) with treated bamboo under structure/ or micro concrete tile roofing	
Floor	<ul style="list-style-type: none">• Plastic Sheet as rising dampness-stopper plus 75 mm sand bed plus 300 x 300 x 16 mm precast CC tiles or flat brick soling in 1:3 CM.	
Opening	<ul style="list-style-type: none">• Phenol Bonded or equivalent ck shutter framed with split bamboo / local timber• Alternatively use GCI shuttering framed with split bamboo/local timber.	



TYPICAL PLAN

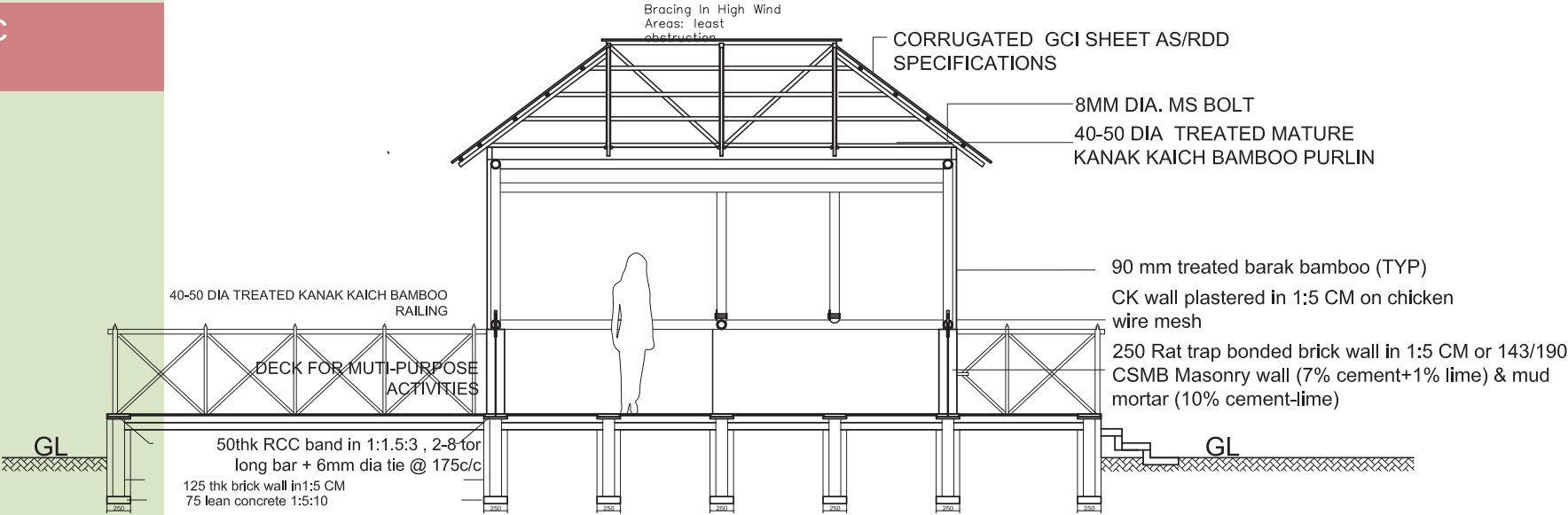
ZONE-C TR-C-01

Total Cost ₹ 1,23,972/-



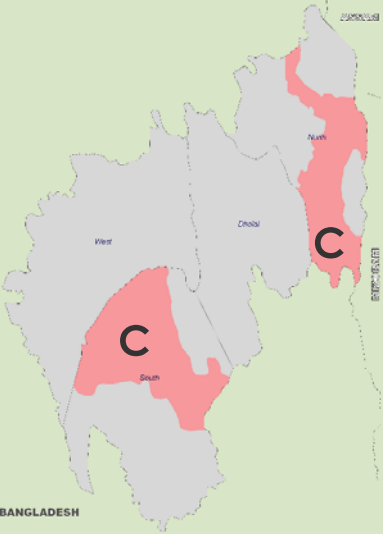
TRIPURA

ZONE-C
TR-C-01



SECTION YY': LOW FLOOD
AREAS

SECTION YY'



TRIPURA

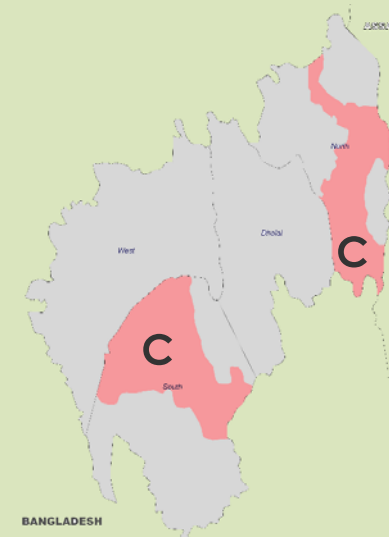
Cost Estimate ZONE- C Design 01

S.NO.	DESCRIPTION	QUANTITY	UNIT	UNIT RATE INR	AMOUNT INR
1	Excavation in foundation	10.122	cu.m.	142.32	1,440.53
	Backfill 1/3rd of excavation	3.374	cu.m.	52.00	175.45
	Plinth filling	16.910	cu.m.	52.00	879.30
	Lean concrete (1:5:10) in Foundation	1.059	cu.m.	5548.5575	5,878.00
2	Brick Masonry in Foundation	1.134	cu.m.	4271.4713	4,845.45
3	125 MM Brick Wall in 1:4 CM	4.290	cu.m.	5032.00	21,587.28
4	RCC band at PL (50x250) M20 concrete in Foundation	0.329	cu.m.	6847.05	2,250.97
	Reinforcement for the above item @200 kg/cum	65.750	kg	55.78	3,667.54
5	10 MM Dia. Steel Rod in Foundation	10.912	kg	55.78	608.67
6	7% cement+1% lime stabilized Rammed Earth Wall	3.825	cu.m.	3213.05	12,290.79
7	Flooring				
	Flooring room- from ACAD dwg	25.361	sqm	331.82	8,415.29
	Deck + Front veranda	25.046	sqm	82.955	2,077.69
8	Champa Kampa for Walls				
	Item no. 7 total area of Champa Kampa	30.270	sq.m.	468.48	14,180.93
9	1:4 Cement stabilized mud wash on toe wall	137.976	sq.m.	10	1,379.76
10	Horizontal 100 mm Kanak Kaich Bamboo in the Wall	67.192	m.	28.75	1,931.78
11	Vertical 100 mm Barak Bamboo in the Wall	46.938	m.	28.75	1,349.48
12	Vertical 50 mm Barak Bamboo for Door Frame	9.7	m.	28.75	277.73
13	Diagonal 75 mm Kanak Kaich Bamboo Members	25.121	m.	28.75	722.22
14	30mm Bamboo for door	51.2	m.	28.75	1,472.00
15	50mm Bamboo for door	13.2	m.	28.75	379.50
16	40 mm Jaali in Wall	2.500	sqm	28.75	71.88
17	Roofing GCI Sheet	61.3	sq.m.	495.00	30,323.07

ZONE-C TR-C-01

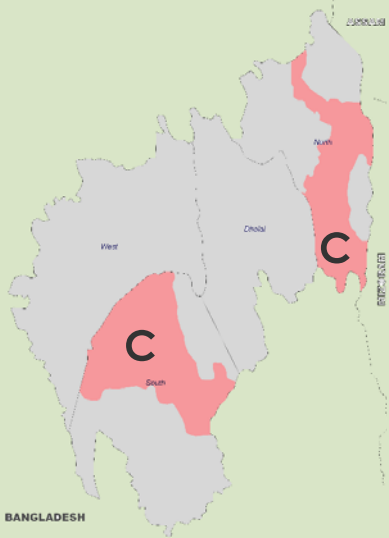
Cost breakup

Item	Cost (INR)
Foundation	41,335/-
Flooring	22,784/-
Walls/Floors/ Windows	21,764/-
Roof	38,091/-
Total	1,23,972/-



TRIPURA

ZONE - C
TR-C-01



TRIPURA

S.NO.	DESCRIPTION	QUANTITY	UNIT	UNIT RATE INR	AMOUNT INR
18	Truss (Kanak Kaich Bamboo)				
	Total length of 100mm for Rafter	29.6	m.	28.75	849.57
	Total length of 50mm for Tie Members	2.5	m.	28.75	72.08
	Total length of 50mm for Raking Members	14.803	m.	28.75	425.58
	Total length of 50mm for Purlins	55.9	m.	28.75	1,606.11
19	Lean To (Kanak Kaich Bamboo)				
	Total length of 50mm for Lean To	10.7	m.	28.75	307.48
	Total length of 50mm for Lean To Purlins	57.2	m.	28.75	1,643.21
20	Support Truss				
	Total length of 100mm for Rafter	15.4	m.	28.75	443.83
	Total length of 50mm for Raking Members	7.503	m.	28.75	215.70
	Total length of 50mm for Purlins	41.4	m.	28.75	1,190.78
	Total length of 100mm Kanak Kaich Bamboo for Truss	45.0	m.		
	Total length of 50mm Kanak Kaich Bamboo for Truss	189.9	m.		
21	add 15% for bamboo works				1013.15072
					123,972.78

DEMONSTRATION HOUSES IN TRIPURA

FOR PMAY BENEFICIARIES



THE COMPLETE HOUSES: TRIPURA



NALCHHAR BLOCK



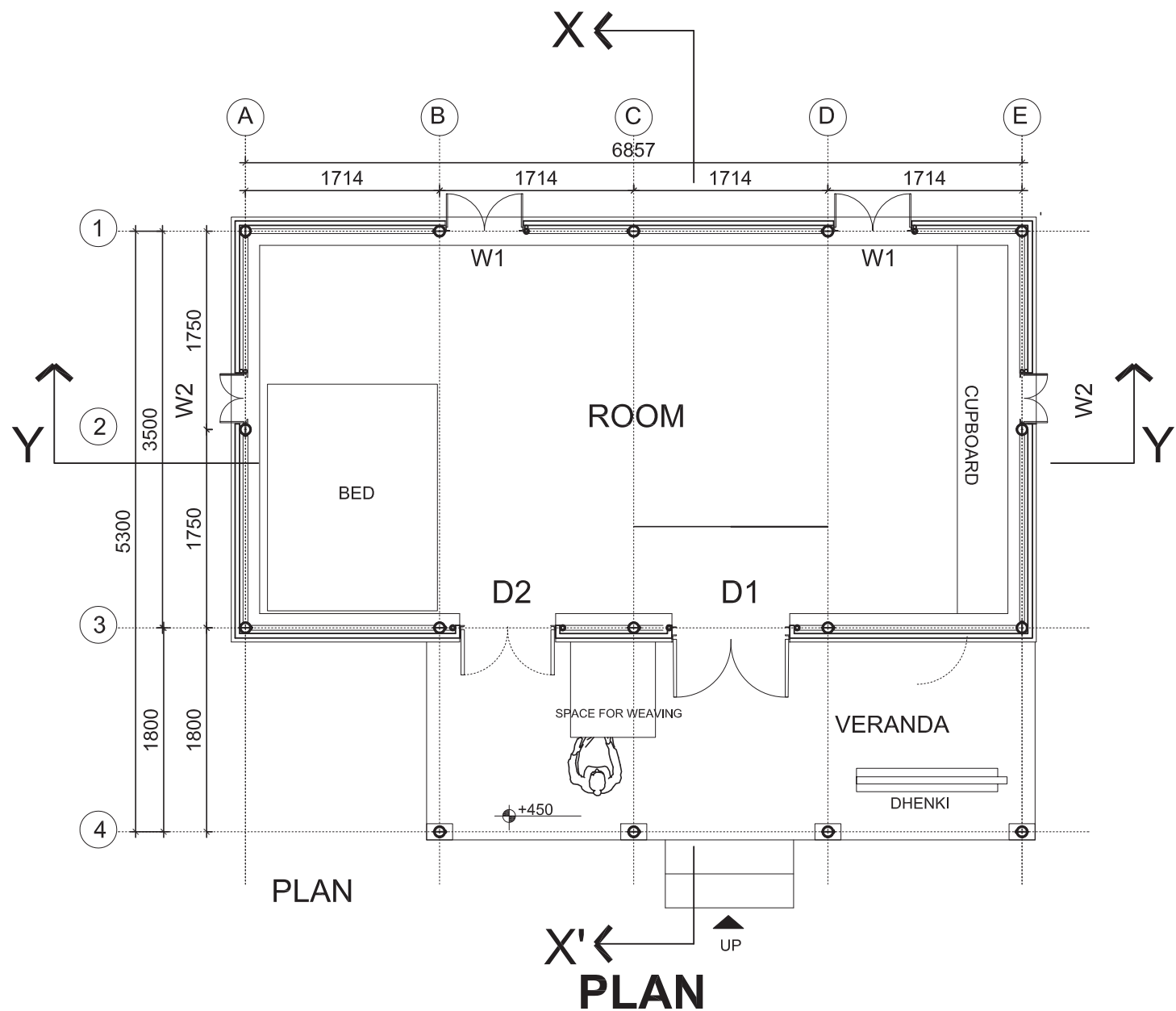
MOHANBHOG BLOCK



JAMPUIJOLA BLOCK



NALCHHAR BLOCK



TYPICAL PLAN

DEMONSTRATION HOUSE BENEFICIARY-SUDHAN DEBBARMA ZONE- B JAMPUIJOLA BLOCK

Technologies

Foundation: Brick Stub
Wall: toe wall in rat trap brick wall;
super structure in treated bamboo
mat plastered with 1:5 CM
Roof CCB treated bamboo truss +
CGI sheet

Area=36.33 sqm (391 sft)

Cost= Rs 1,22,863/-



TRIPURA

DEMONSTRATION HOUSE
BENEFICIARY-SUDHAN DEBBARMA
ZONE- B
JAMPUIJOLA BLOCK

Technologies

Foundation: Brick Stub

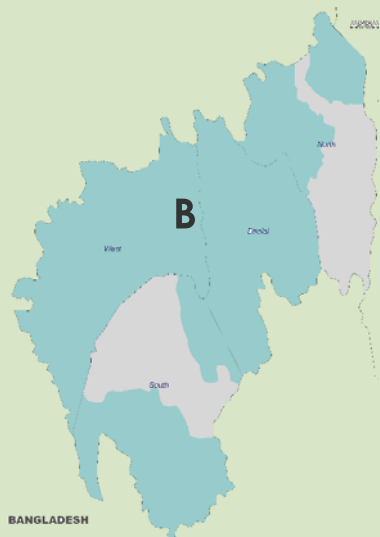
Wall: toe wall in rat trap brick wall;
 super structure in treated bamboo

mat plastered with 1:5 CM

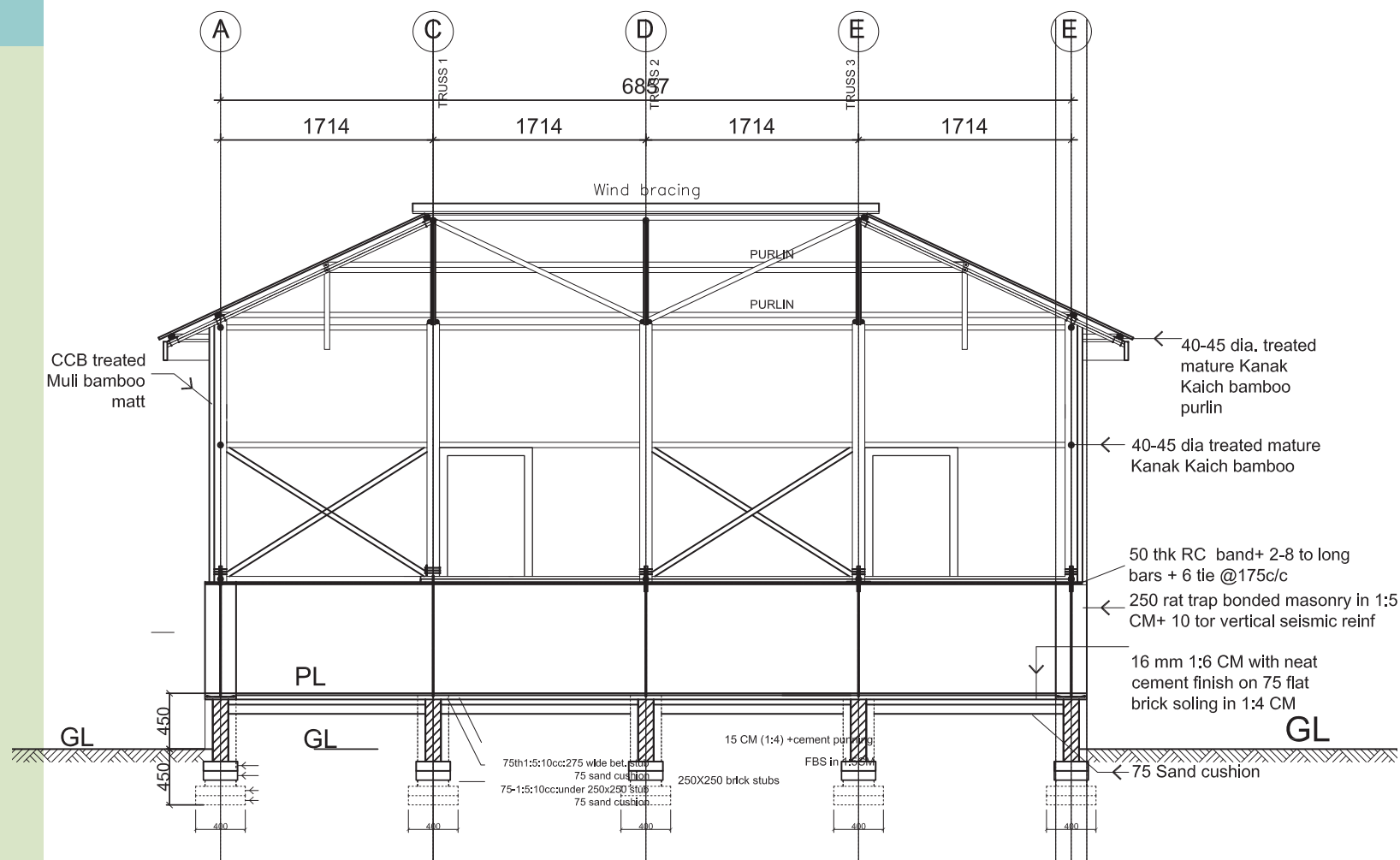
Roof CCB treated bamboo truss +
 CGI sheet

Area=36.33 sqm (391 sft)

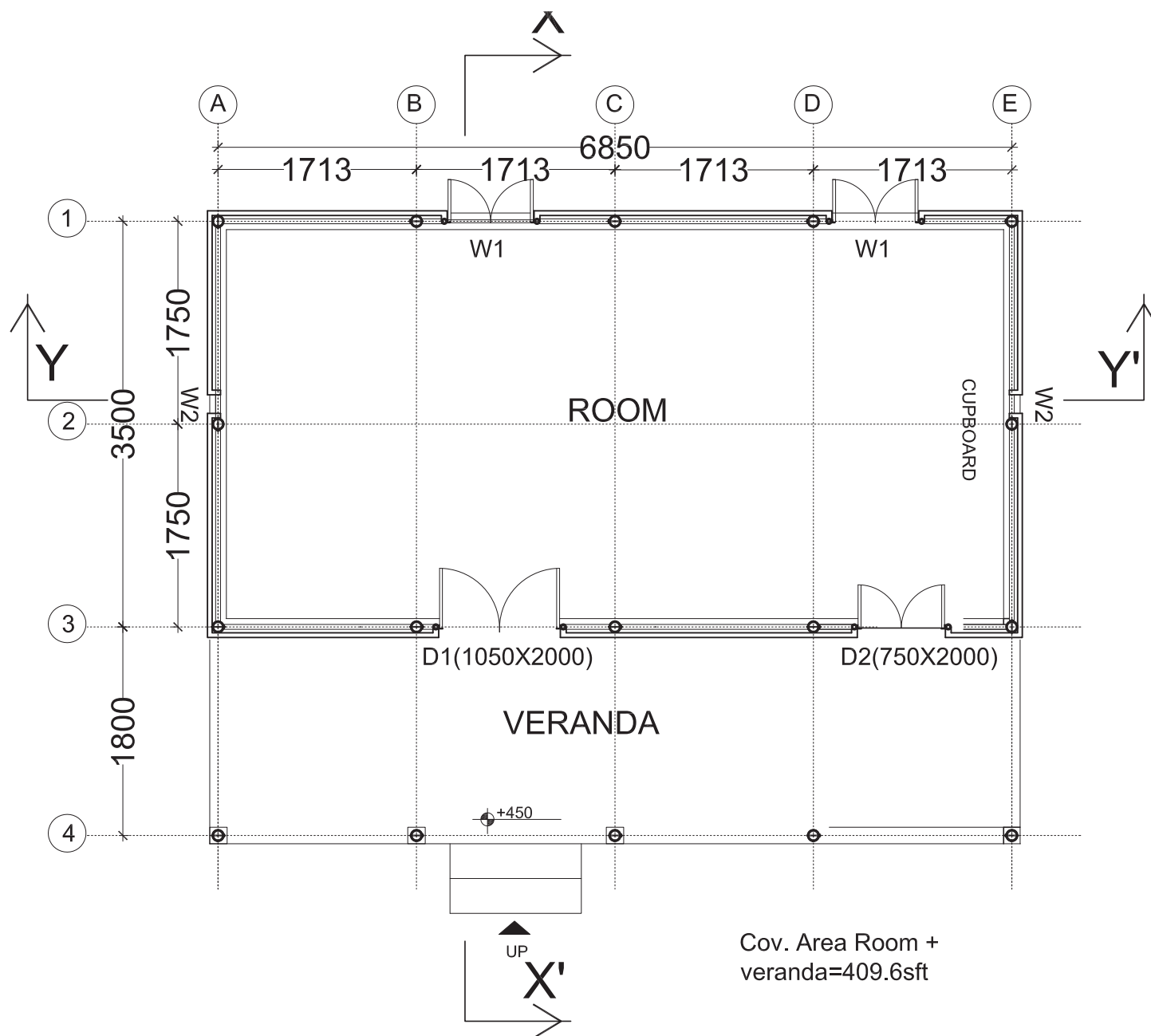
Cost= Rs 1,22,863/-



TRIPURA



SECTION XX\'



TYPICAL PLAN

Cov. Area Room +
veranda=409.6sft

DEMONSTRATION HOUSE
BENEFICIARY-KAJOL SUTRADHAR
ZONE- B
MOHANBOG BLOCK

Technologies

Foundation: Brick Stub

Wall: toe wall in cement stabilized
mud block; super structure in treated
bamboo mat plastered with 1:5 CM
Roof CCB treated bamboo truss + CGI
sheet

Area=38.07 sqm (409 sft)

Cost= Rs 1,07,529/-



TRIPURA

DEMONSTRATION HOUSE
BENEFICIARY-KAJOL SUTRADHAR
ZONE- B
MOHANBOG BLOCK

Technologies

Foundation: Brick Stub

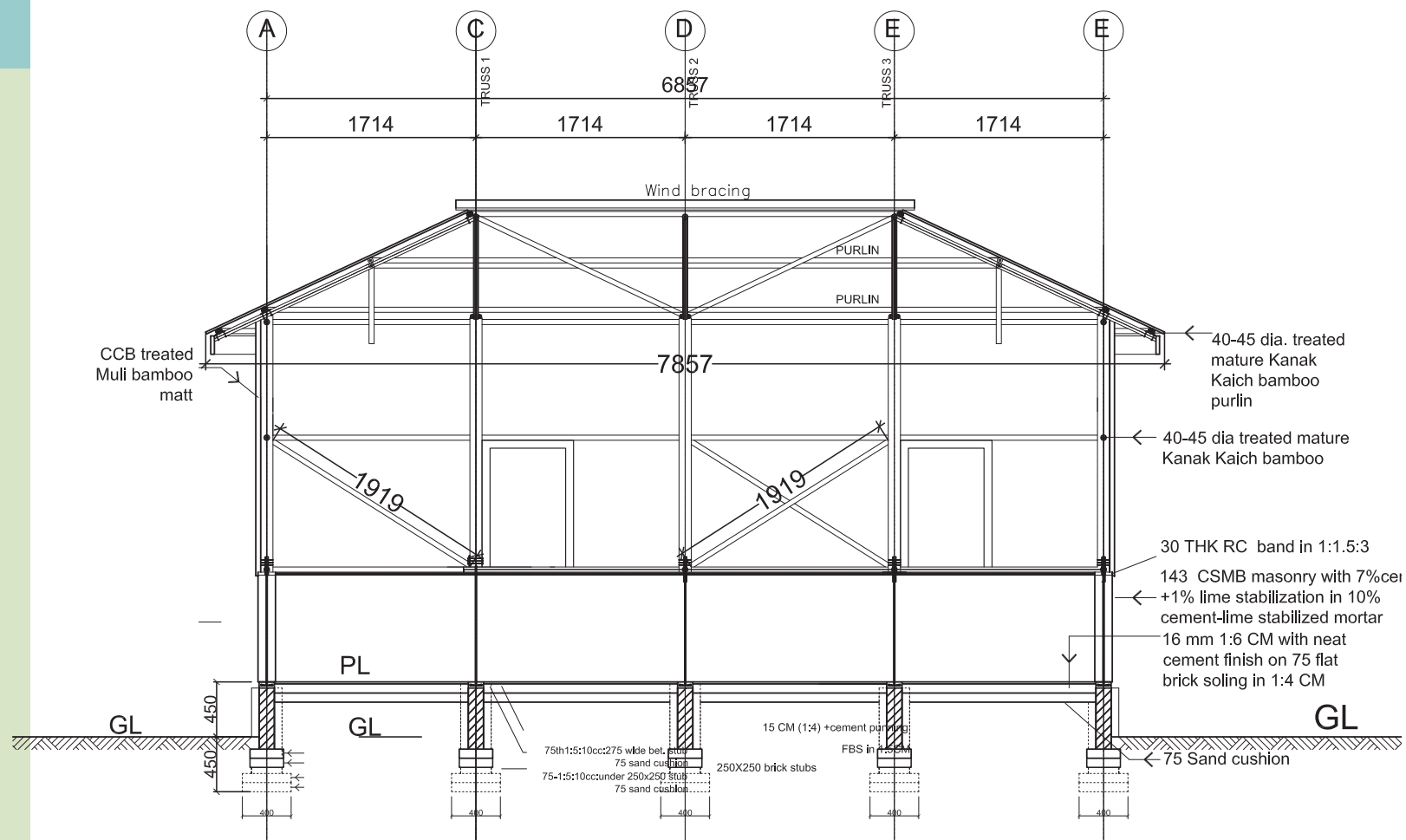
Wall: toe wall in cement stabilized mud block; super structure in treated bamboo mat plastered with 1:5 CM
 Roof CCB treated bamboo truss + CGI sheet

Area=38.07 sqm (409 sft)

Cost= Rs 1,07,529/-



TRIPURA



SECTION XX'

DEMONSTRATION HOUSE
BENEFICIARY-CHINU GHOSH
ZONE- B
NALCHHAR BLOCK

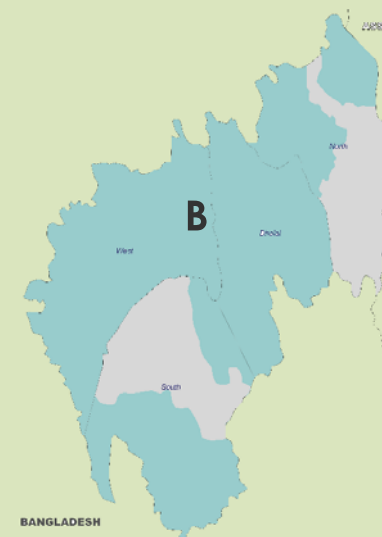
Technologies

Foundation: Brick Stub

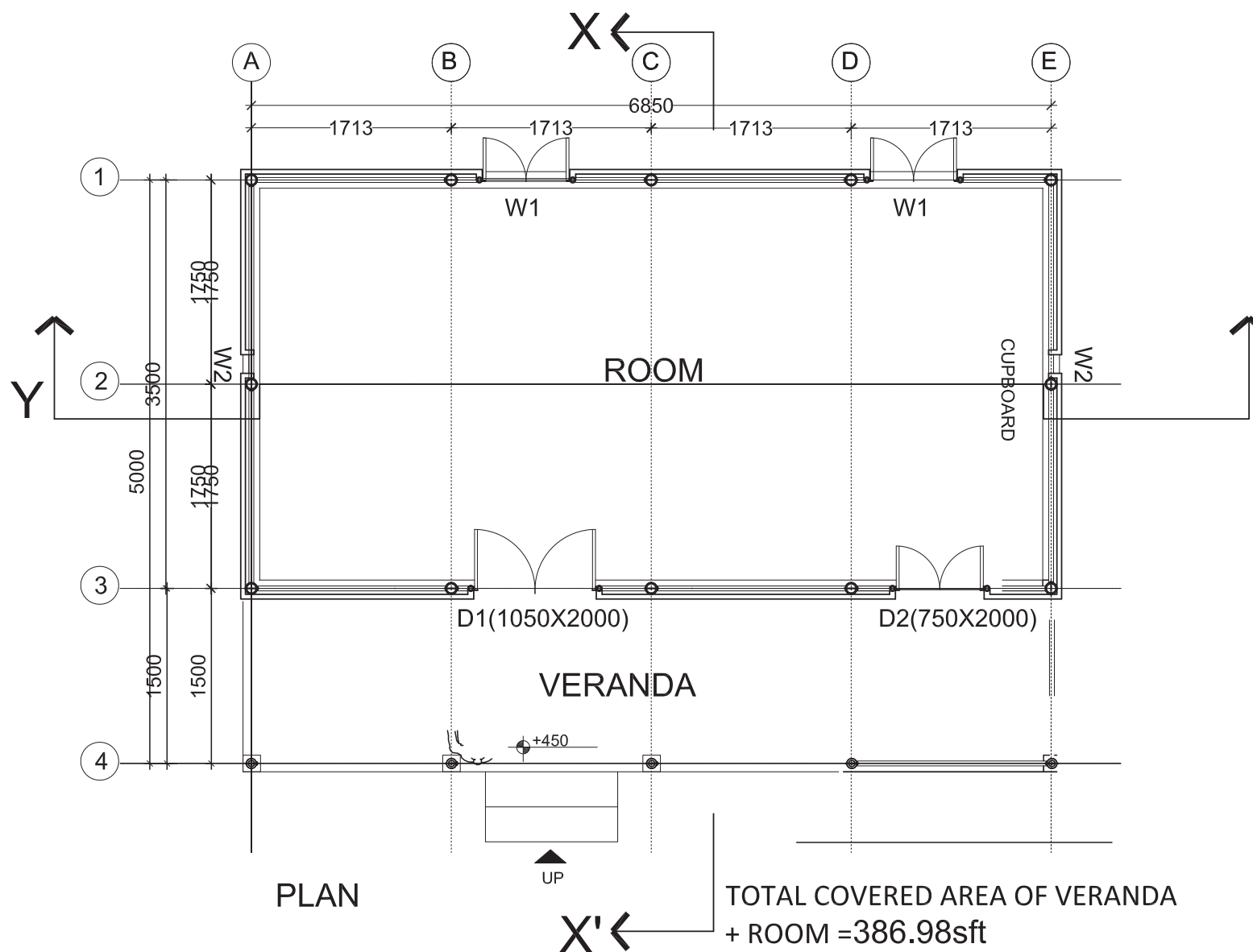
Wall: toe wall in cement stabilized mud block; super structure in treated bamboo mat plastered with 1:5 CM
 Roof CCB treated bamboo truss + CGI sheet

Area=35.96 sqm (387sft)

Cost= Rs 1,26,319/-



TRIPURA



DEMONSTRATION HOUSE
BENEFICIARY-CHINU GHOSH
ZONE- B
NALCHHAR BLOCK

Technologies

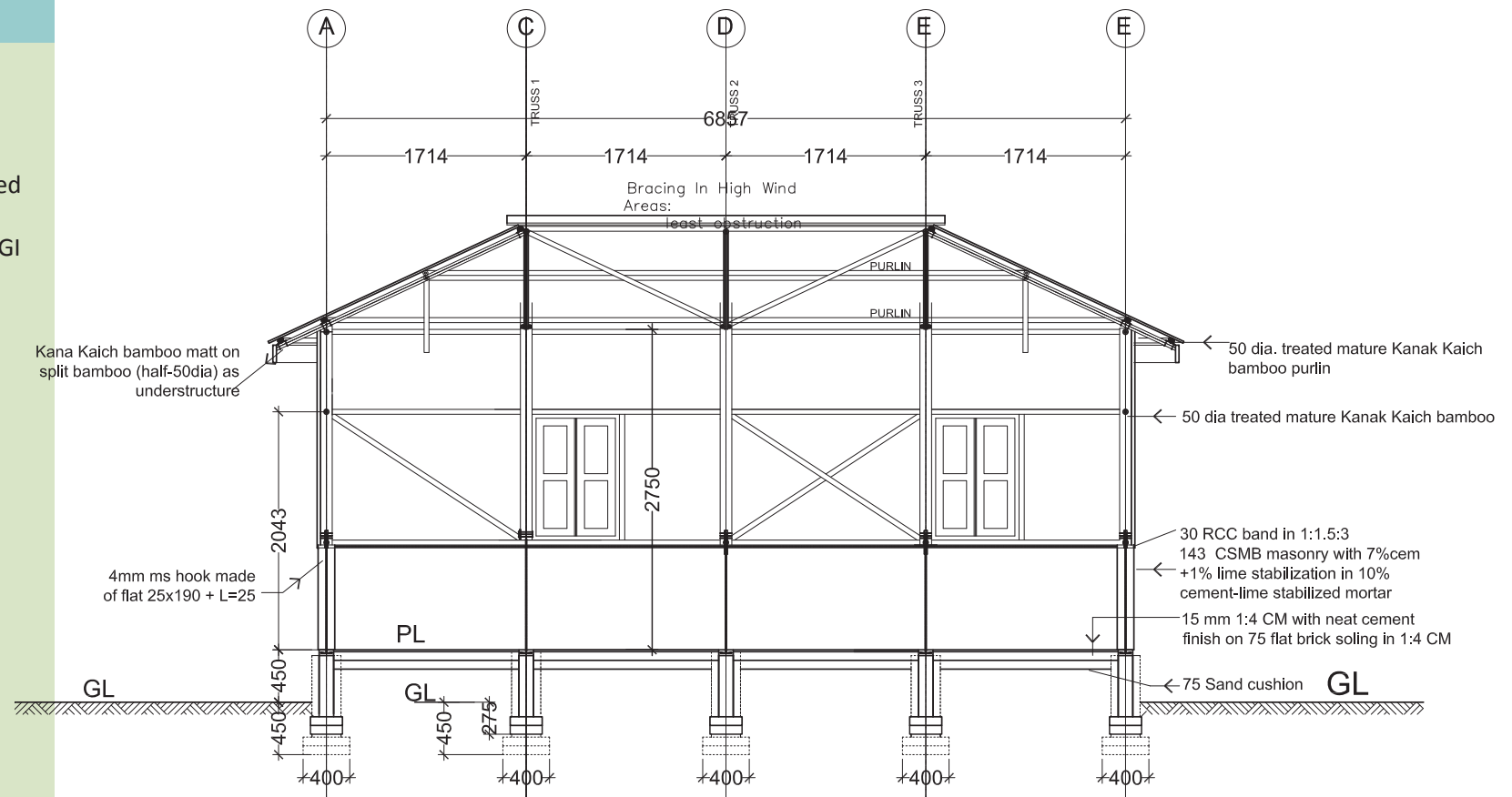
Foundation: Brick Stub

Wall: toe wall in cement stabilized mud block; super structure in treated bamboo mat plastered with 1:5 CM
Roof CCB treated bamboo truss + CGI sheet

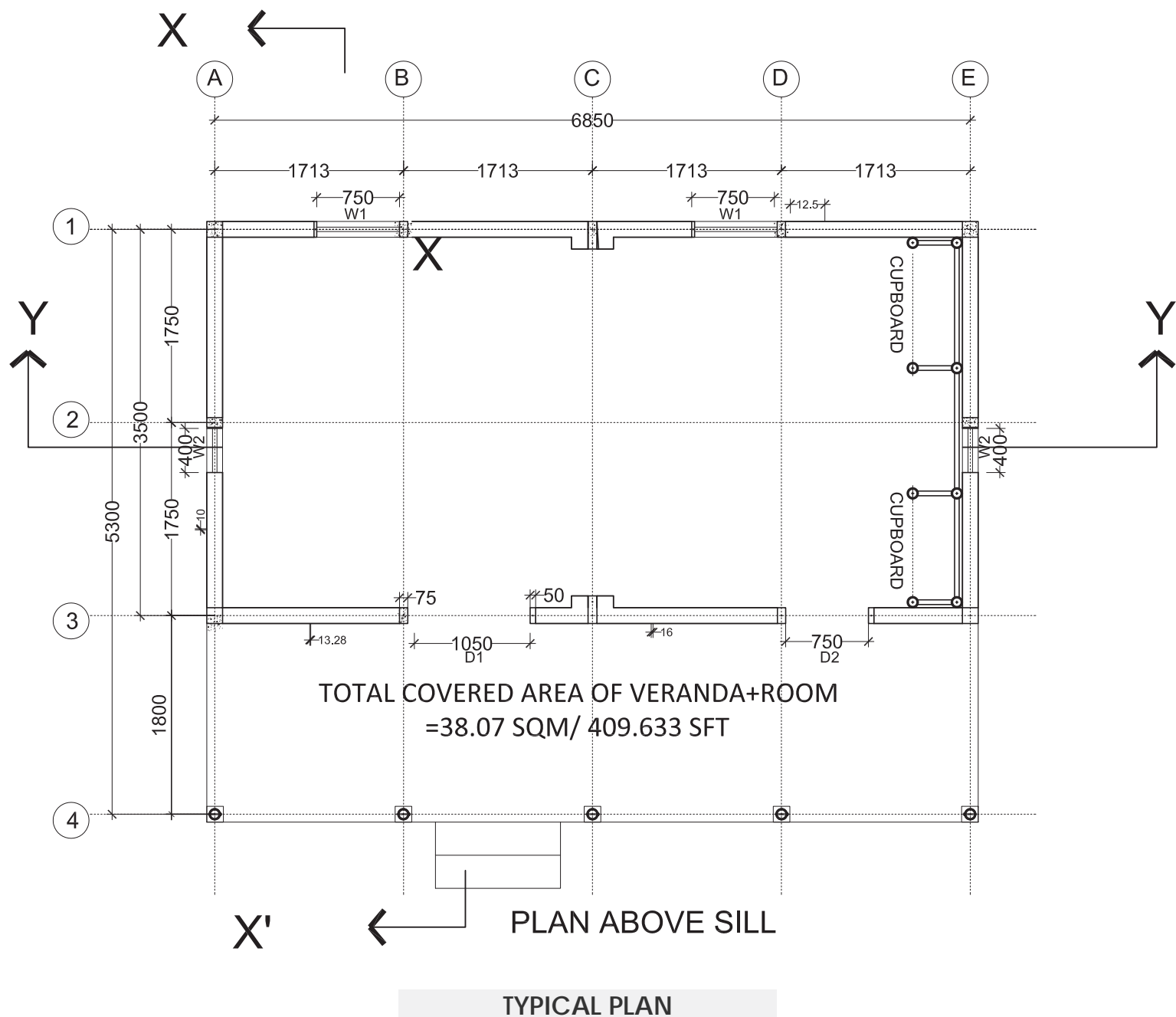
Area=35.96 sqm (387sft)

Cost= Rs 1,26,319/-

TRIPURA



SECTION XX'



DEMONSTRATION HOUSE

BENEFICIARY-JHARNA DAS

ZONE- B

NALCHHAR BLOCK

Technologies

Foundation: Brick Stub

Wall: Full wall in cement stabilized mud block with seismic bands and vertical reinforcements

Roof CCB treated bamboo truss + CGI sheet

Area=38.07 sqm (409 sft)

Cost= Rs 1,51,543



TRIPURA

DEMONSTRATION HOUSE

BENEFICIARY-JHARNA DAS

ZONE- B

NALCHHAR BLOCK

Technologies

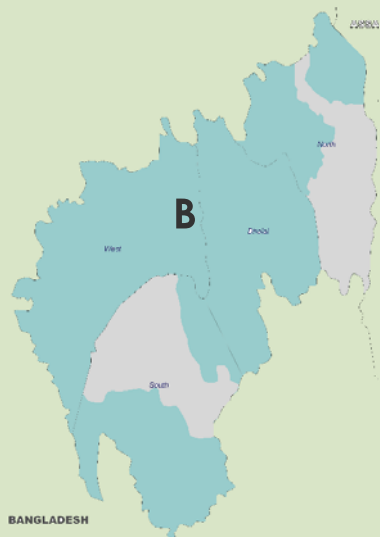
Foundation: Brick Stub

Wall: Full wall in cement stabilized mud block with seismic bands and vertical reinforcements

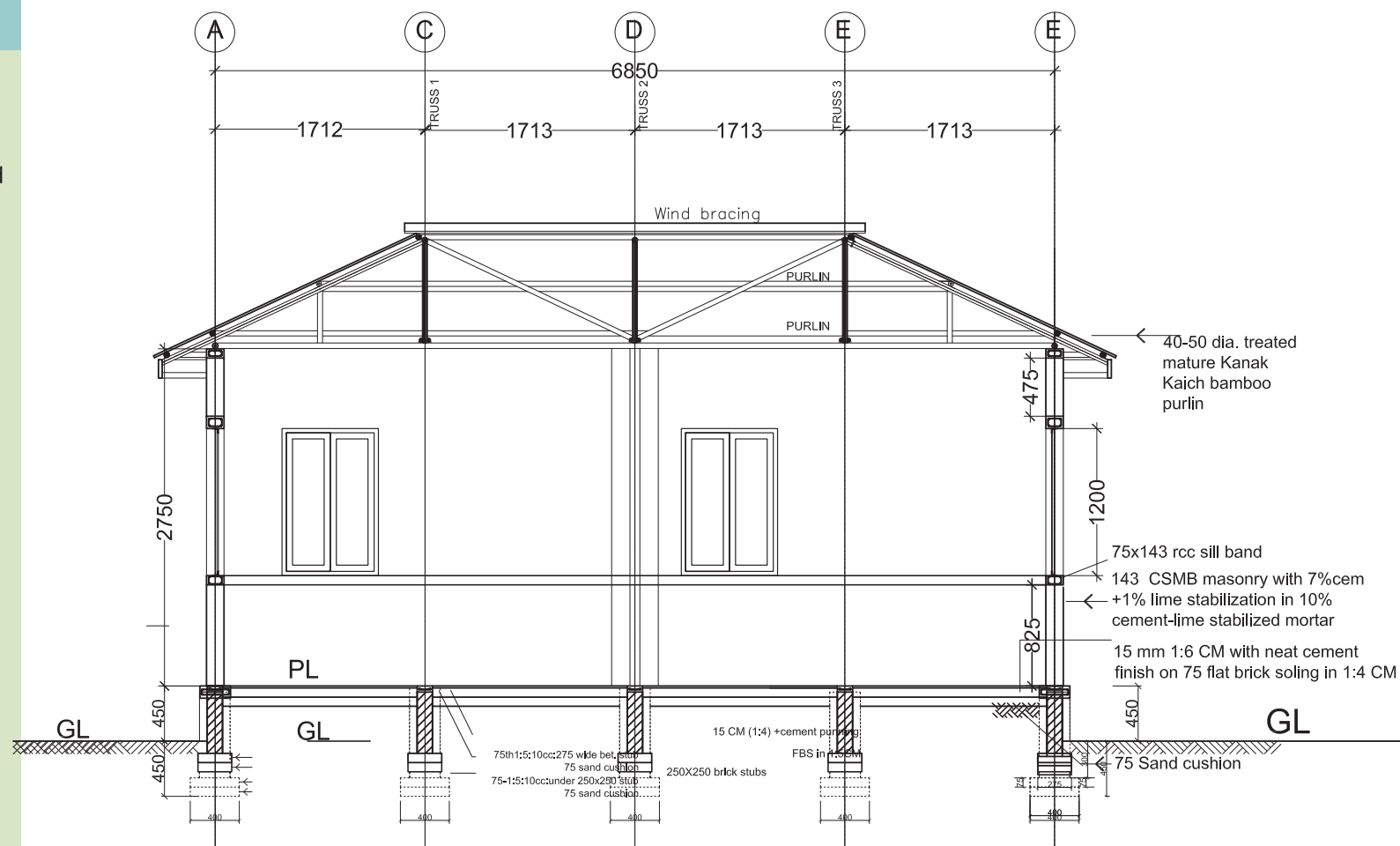
Roof CCB treated bamboo truss + CGI sheet

Area=38.07 sqm (409 sft)

Cost= Rs 1,51,543



TRIPURA



SECTION XX'

DEMONSTRATION HOUSE

SUMMARY OF COSTS

ALL BENEFICIARIES

SUMMARY OF COSTING: FOUR MODEL HOUSES

	ROOM + VERANDA AREA	COST OF ROOM + VERANDA	UNIT COST	SPECIFICATIONS	PEOPLE WHO TOOK THE LEAD ROLE
CHINU GHOSH	35.964 SQM/ 386.98 SFT	RS. 1,03,326+ RS. 22,993= RS. 1,26,319	RS. 326.427/ SFT	CSMB toe wall + CCB treated bamboo super structure with bamboo mat plastered in 1:5 CM + bamboo truss+ GCI roof	BDO, B B DAS JE SUDHNGSHU BHOWMIK, TA NARAYAN CHANDRA DAS, MASON PARIMAL DAS
JHARNA DAS	38.07 SQM/ 409.633 SFT	RS 1,27,207 + RS 24,336= RS 1,51,543	RS 370/ SFT	CSMB full wall + 4 seismic bands at plinth, sill, lintel and roof level+ corner reinf. + CCB treated bamboo truss+ GCI roof	BDO, B B DAS JE SUDHNGSHU BHOWMIK, TA NARAYAN CHANDRA DAS, MASON PARIMAL DAS
SUDHAN BENBARMA	36.325 SQM/ 390.867 SFT	RS1,01,931+20,932 + RS = RS1,22863	RS 314.33/ SFT	Rat trap bonded toe wall + CCB treated bamboo super structure with bamboo mat plastered in 1:5 CM + bamboo truss+ GCI roof	BDO, MOLSOM JE PRANA DEBBARMA, MASON SANJIT DEBBARMA
KALOJ SUTRADHAR	38.07 SQM/ 409.633 SFT	RS1,07,529.29	RS. 262.5/ SFT	CSMB toe wall + CCB treated bamboo super structure with bamboo mat plastered in 1:5 CM + bamboo truss+ GCI roof	BDO, ARINDAM DAS GRAM PRADHAN TAPAN CHAKRABORTY MASON KANU DAS

All Costs Are As Per SoR 2015-16 And Some Items As Per Market Rate

All Estimates Have Been Prepared Directly With The Help Of The JEs

Chinu And Sudhan Took Active Part In Unskilled Works

Kajol Sutradhar's Contribution To The Project Was The Most Commendable- She Made The Highest Contribution. The Gram Pradhan Tapan

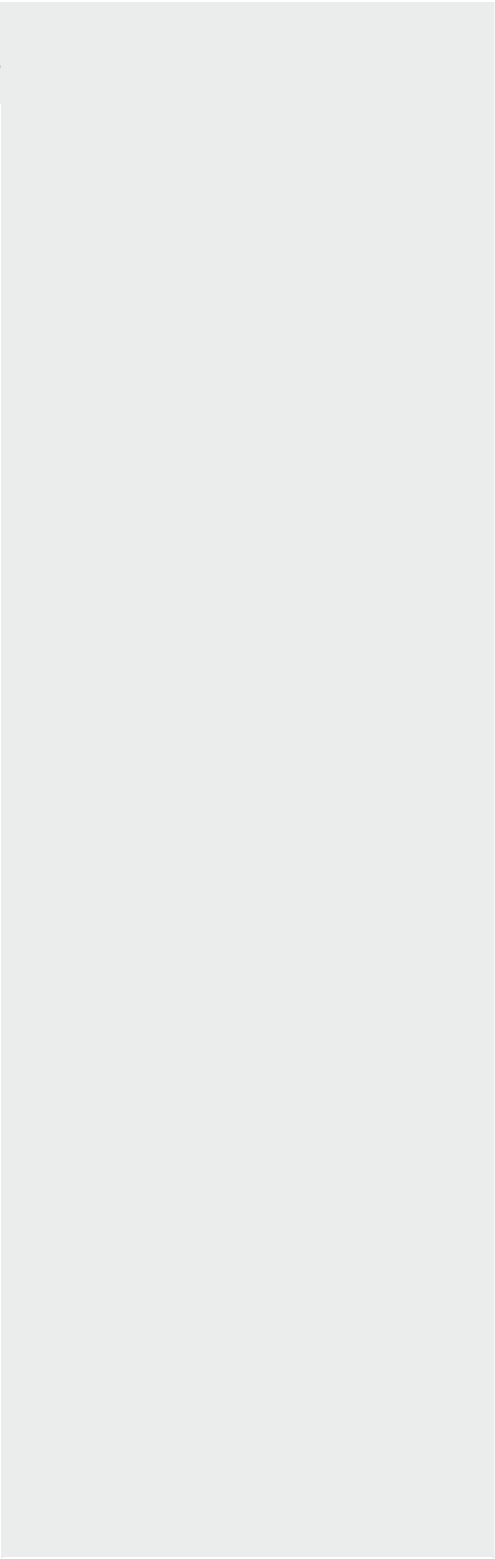
Chakraborty Helped In Materials And Masons' Rates.

Dr Selim Reza And Team Treated The Bamboos

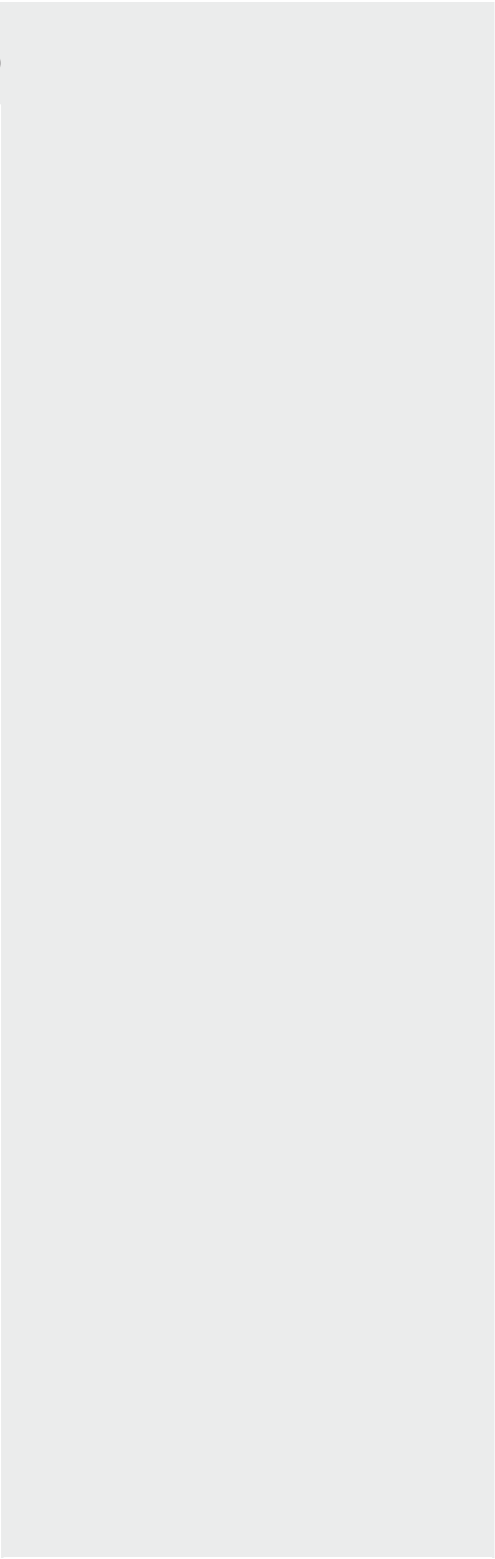
Special thanks to: The PS, RDD, JS, RDD, DM, Sepahijola and the ADM Sepahijola provided all the supports for the successful implementation of the project.

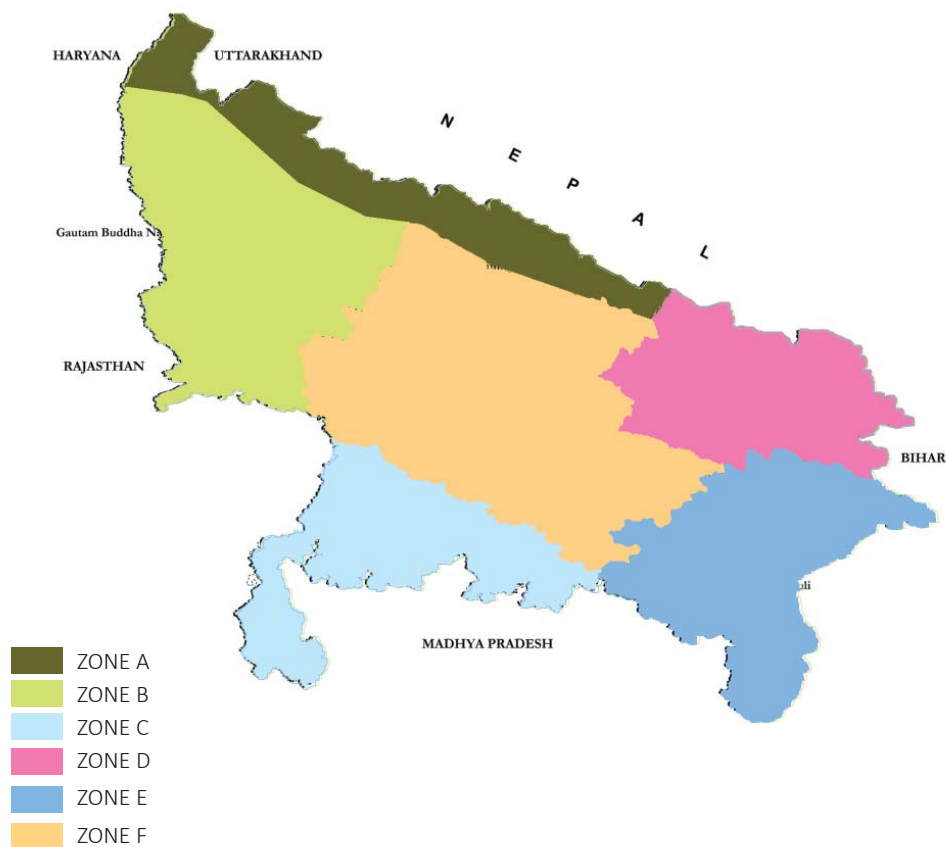


TRIPURA



Uttar Pradesh





The state of Uttar Pradesh has distinct yet wholesome characteristics that make this state, one of the biggest in India, a unique state. Flanked by Himalayas in North, criss-crossed by rivers in the centre while the head of Bundelkhand plateau lies in its south, Uttar Pradesh has rich diversity throughout the state and it reflects in the buildings and communities construct.

While the team started off with taking 7 historic zones as a base, there are 6 housing zones Uttar Pradesh can be classified into. There are characteristics that are distinct for some regions that do not necessarily fall into these historic zones. For example, the Tarai region, which lies in the foothills of Himalayas and has numerous tributaries flowing through the area has very distinct housing typologies, such as extensive use of bamboo, mud, grass and straw in various construction elements. On the other hand, the area under Lower Doab and Awadh has similar characteristics, and hence, can be treated as one region.

Zone A

Since Zone 1 falls under the highest category of seismic zone and high damage risk zone for wind/ cyclone, therefore lot of attention is given in incorporating the earthquake resistant features. Horizontal seismic bands and vertical reinforcement bands in the wall are provided as per Indian Standard Earthquake Resistant Design and Construction of Buildings Code of Practice (IS 4326: 1993; Reaffirmed 2003; Edition 3.3).

Zone B

Since zone 2 lies in seismic zone III and most readily available material after mud is stone, therefore attention is given to judicious use stone and mud together in the construction technique for this zone.

Zone C

Bundelkhand lies in seismic zone II and does not have any flood hazard in the region. In most parts of the region, stone is dominant natural building material for construction.

Zone D

Since major areas of the region lies in flood prone zone, seismic zone V and high damage risk zone of cyclone, therefore, it becomes essential to incorporate all the safety features to prevent damage during any natural calamity. Most of the traditional houses of the region have sloping and light weight roofs, where the solution to tackle earthquake and cyclone risks lies.

Zone E

The region lies in the flood hazard zone and also have seismic zone II and III. The region has many rivers flowing across and has very rich soil which are reflected in the vernacular houses, which are mainly built from mud. In some parts of the region, stone is also used as the major natural building material.

Zone F

Zone 6 lies in seismic zone III and II at the same time some regions are prone to flood hazards. Here, the attention is given in exploring the use of brick and benefiting from the soil condition of the flat plains of Awadh and Lower Doab.

UTTAR PRADESH

ZONE-A

Zone A comprises 8 districts:

1. Saharanpur
2. Bijnor
3. Rampur
4. Bareilly
5. Pilibhit
6. Kheri
7. Bahraich
8. Shravasti

Resources Available

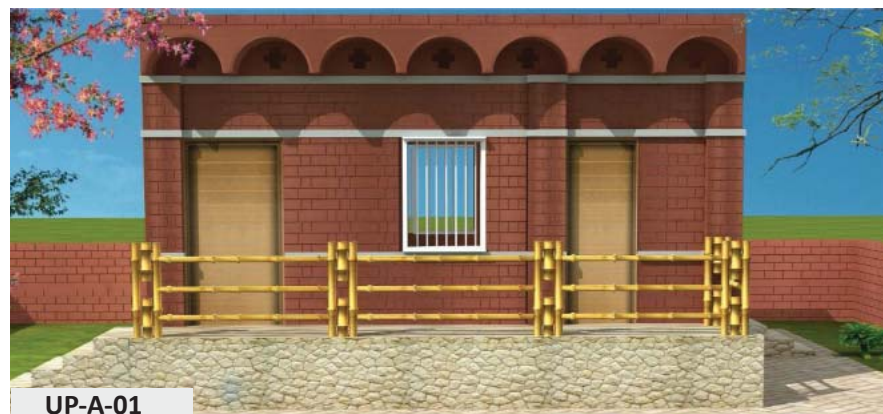
- Mud
- Due to large number of river flowing through this region, lot of pebbles and boulders are available in this region.

Zone A has one typology

UP-A-01



UTTAR
PRADESH



- Column framed structure proposed without using RCC structure, thus minimizing the use of steel and concrete.
- Suggested construction technique for wall not only provide resistance to seismic disaster but at the same time saves up material consumption when compared with English bonded brick wall.
- Ferro Cement roofing channel provide about 60% reduction in dead weight as compared to RCC as its unit weight 50 kg per meter length.

Recommendations for Built Form

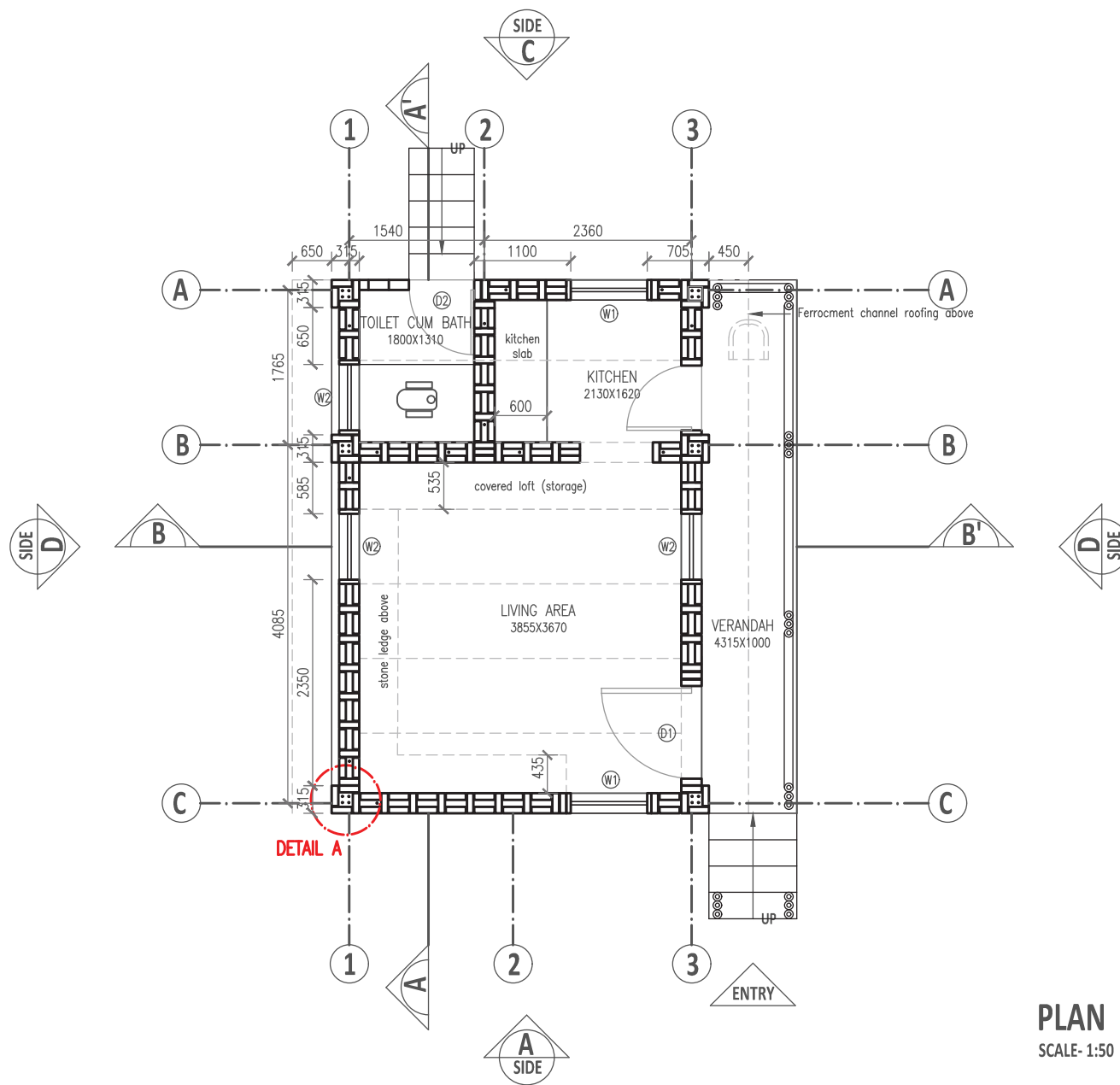
Plan Layout	Plinth/Floor	Roof Profile
Rectangular structure and liner in the arrangement of their interior spaces. Entry to the building is from longer side. Open to sky verandah is provided in one long side. Future expansion proposed vertically.	High Plinth level recommended	Light Weight Roof Recommended.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • Brick pedestal foundation with cement mortar under the 2 brick thick column at super structure • Strip footing with large dressed stone with cement mortar till plinth level. 	<ul style="list-style-type: none"> • Reducing the usage of concrete by recommending alternative to RCC framed structure.
Plinth	<ul style="list-style-type: none"> • Steel Reinforced RCC plinth beam at 750mm height from the ground. 	
Wall	<ul style="list-style-type: none"> • 2 brick thick column with rat trap bonded brick wall. • Reinforcing bars embedded in brick masonry at the corners of all the rooms • Seismic bands provided at sill level, lintel level and ceiling level. 	<ul style="list-style-type: none"> • Reinforcing bars recommended for openings larger than 0.6 m in width.
Wall Finish	<ul style="list-style-type: none"> • No wall finish required 	
Roof Structure	<ul style="list-style-type: none"> • Prefabricated reinforced concrete beam at roof level to support the load of the roof. 	
Roof Cover	<ul style="list-style-type: none"> • Precast Ferro cement roofing channel. 	
Floor	<ul style="list-style-type: none"> • Plain Cement flooring 	

ZONE - A UP-A-01

Total Cost ₹ 164,039/-



TYPICAL PLAN

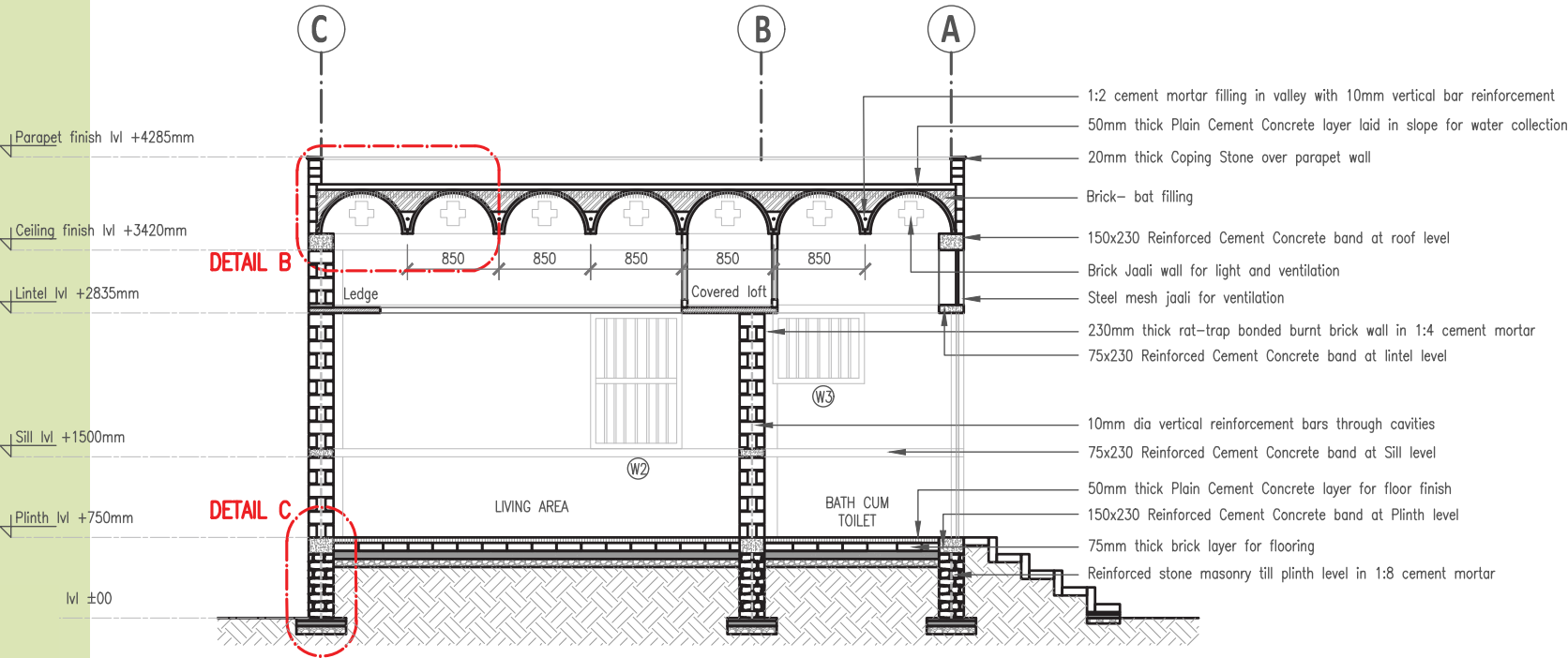


UTTAR PRADESH

ZONE - A
UP-A-01

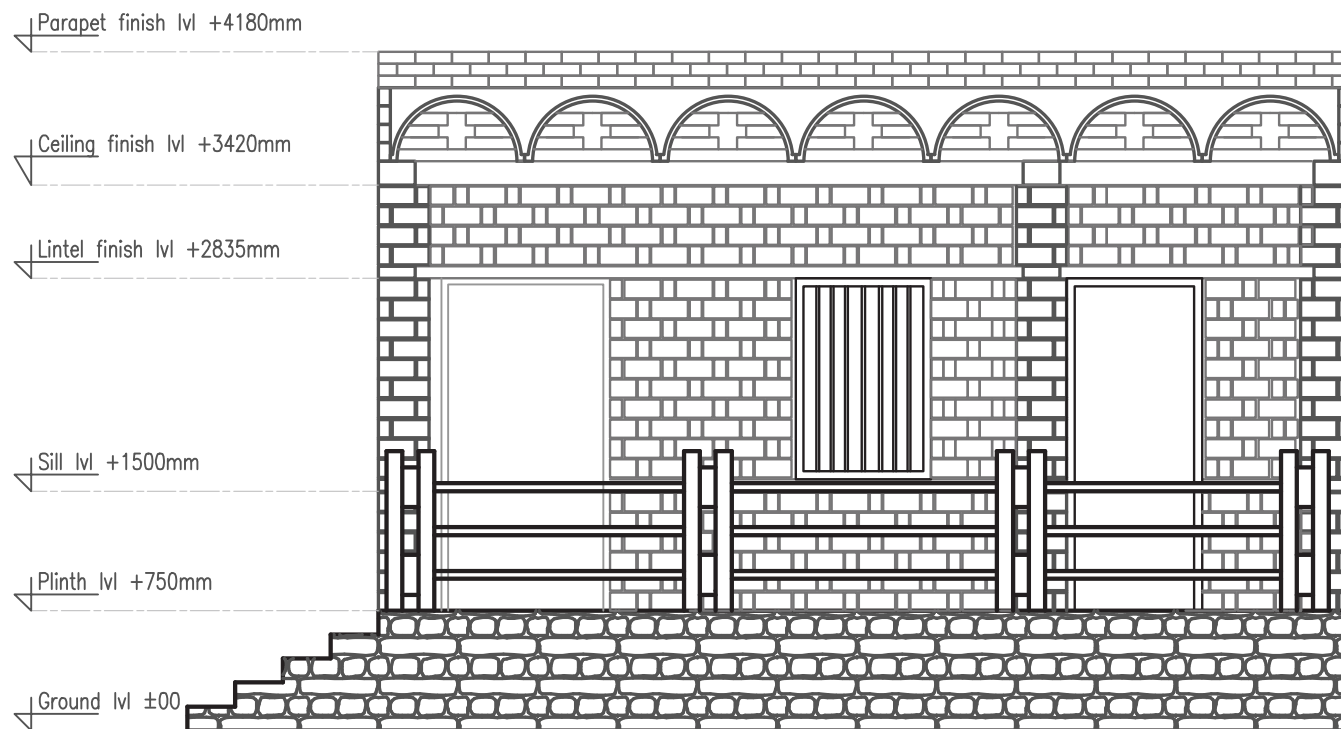


UTTAR
PRADESH



TYPICAL SECTION AA'

ZONE - A
UP-A-01



TYPICAL - ELEVATION SIDE D

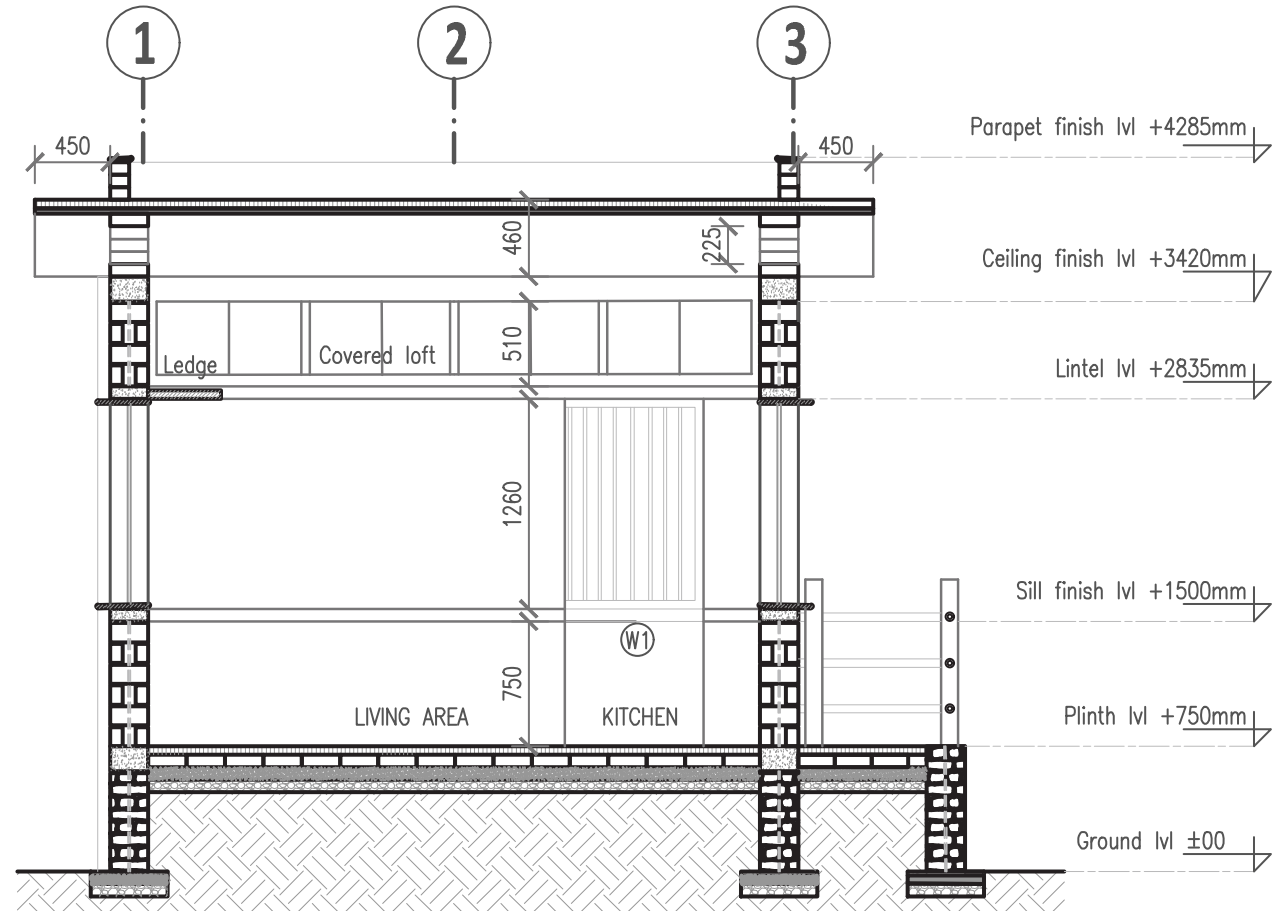


UTTAR
PRADESH

ZONE - A UP-A-01



UTTAR
PRADESH



TYPICAL - SECTION BB'

Cost Estimate for UP-A-01

S. No.	ITEM	UNIT	QUANTITY	RATES (INR)	AMOUNT
FOUNDATION					
1	Site clearance and layout	LS	1.00	100.00	100.00
2	Earth work in excavation of foundation, levelling the bottom of the trench etc. complete (750mm wide and 750mm deep)	cum	15.13	228.38	3454.31
3	Providing and laying P.C.C. in foundation 100mm thick with 1:5:10 (12mm nominal size aggregates)	cum	2.18	2511.25	5465.74
4	Providing Random Rubble Masonry with cement mortar in foundation up to plinth level, including setting of block, mixing of mud with appropriate qty. of	cum	3.31	1240.37	4101.05
5	Providing 1.5 thick brick column with cement mortar in pedestal foundation	cum	2.40	4704.01	11289.62
6	Providing and laying D.P.C. 25mm thick with 1:2:4 cement concrete and WPC powder.	sqm	6.01	92.88	558.41
7	Providing and laying RCC plinth beam 150mm thick with 1:2:4 cement concrete	cum	0.69	3835.46	2646.47
8	Earth work in back filling of foundation	cum	15.06	114.19	1719.95
TOTAL					29335.56
SUB STRUCTURE					
9	Brick work in veranda in normal bond with 1:6 cement dust mortar	cum	0.83	4704.01	3904.45
10	Bamboo fencing in veranda (100mm dia)	rm	15.00	50.00	750.00
11	Bamboo fencing in veranda (50mm dia)	rm	16.25	26.00	422.50
12	Brick work in steps with 1:6 cement dust mortar	cum	1.20	4704.01	5644.81
13	Earthwork in excavation of soak pit and inspection chamber	cum	2.71	228.38	619.35
14	Honeycombed brick work in soak pit and plaster work in inspection chamber	cum	0.68	1001.12	676.95
15	Cement concrete floor with brick ballast	sqm	25.51	112.25	2863.52
TOTAL					14881.59
SUPER STRUCTURE					
16a	Brick masonry with Rat trap bond in super structure with cement mortar 1:4	cum	17.08	4227.77	72228.81
16b	Brick work in normal bond with 1:6 cement dust mortar	cum	1.73	4704.01	8114.42
Deductions:					
16c	For door	cum	1.57	4227.77	6636.54
16d	For Windows	cum	0.94	4227.77	3969.67
Window		cum	0.11	4227.77	459.45
Ventilator		cum	0.11	4227.77	466.75
Total Brickwork		cum	16.08		68810.81
17	Corner vertical 8mm MS reinforcement for seismic zone	kg	58.80	50.00	2940.00
18	Providing and fixing R.C.C. door/window frames complete				
a White door frame		no.	3.00	950.00	2850.00
b Grey window frame		no.	5.00	400.00	2000.00
19	Providing and laying RCC sill band 75mm thick with 1:2:4 cement concrete	cum	0.35	3835.46	1323.23
20	Providing and laying RCC lintel band 75mm thick with 1:2:4 cement concrete				
		cum	0.35	3835.46	1323.23
21	Providing and laying RCC tie band 75mm thick with 1:2:4 cement concrete	cum	0.35	3835.46	1323.23
TOTAL					80570.52
ROOF					
22	Providing ferrocement channel roof of 850mm span	sqm	31.62	1033.87	32690.83
23	Providing stone slab in sill and window breaker	sqm	1.09	40.00	43.61
24	Providing Stone slab for loft/ storage	sqm	4.50	40.00	180.00
25	Brick work in parapet in normal bond with 1:6 cement dust mortar	cum	0.81	4704.01	3786.73
26	Providing PCC Gola complete	rm	18.58	51.33	953.80
27	Coping Stone	sqm	2.30	50.00	115.00
TOTAL					37769.97
PLUMBING AND OTHER FIXTURE FOR TOILET					
28	Indian sanitary Pan and water seal	no.	1.00	500.00	500.00
29	PVC pipe 4"	rm	3.60	120.00	432.00
30	PVC treeway tee 3"	no.	1.00	80.00	80.00
31	Plastic water tap	no.	1.00	70.00	70.00
32	Wash basin	no.	1.00	400.00	400.00
TOTAL					1482.00
TOTAL COST OF HOUSE (INR)					164039.63
AREA of HOUSE (SQM)					26.10
COST PER SQM (INR)					6285.04

ZONE - A UP-A-01

Cost breakup

Item	Cost (INR)
Foundation	29,335/-
Sub structure and Super Structure	95,453/-
Roof	37,769/-
Total	162,557/-



UTTAR PRADESH

ZONE-B

Zone B comprise 16 districts:

1. Muzaffarnagar
2. Baghpat
3. Meerut
4. Ghaziabad
5. Gautam Budhha Nagar
6. Bulandshahar
7. Aligarh
8. Mathura
9. Agra
10. Hathras
11. Firozabad
12. Etah
13. Kanshiram Nagar
14. Badaun
15. Moradabad
16. Jyotiba Phule Nagar

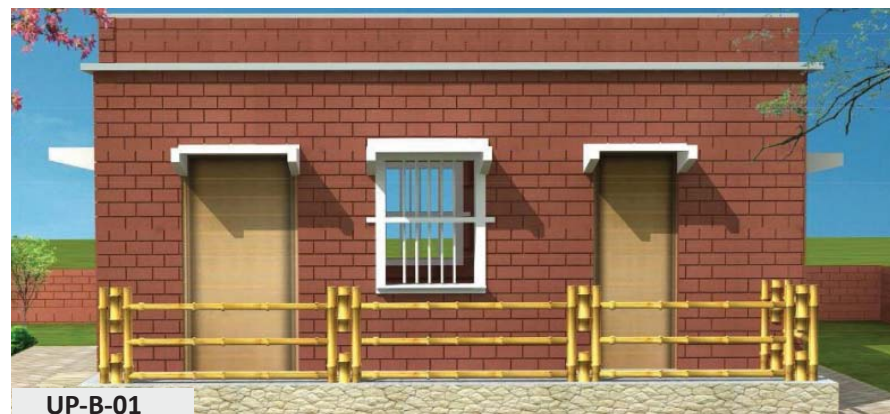
Resources Available

- Cob/Adobe, Stone, Cob, Fired Clay Stone,
- Bamboo
- Thatch

Zone A has one typology UP-B-01



UTTAR PRADESH



- Judicious use of stone and mud together in the construction technique for this zone which lies in seismic zone II.
- Since in this region neither mud nor stone is suitable for walling material, therefore, hollow interlocking CSEB is suggested for this region. The

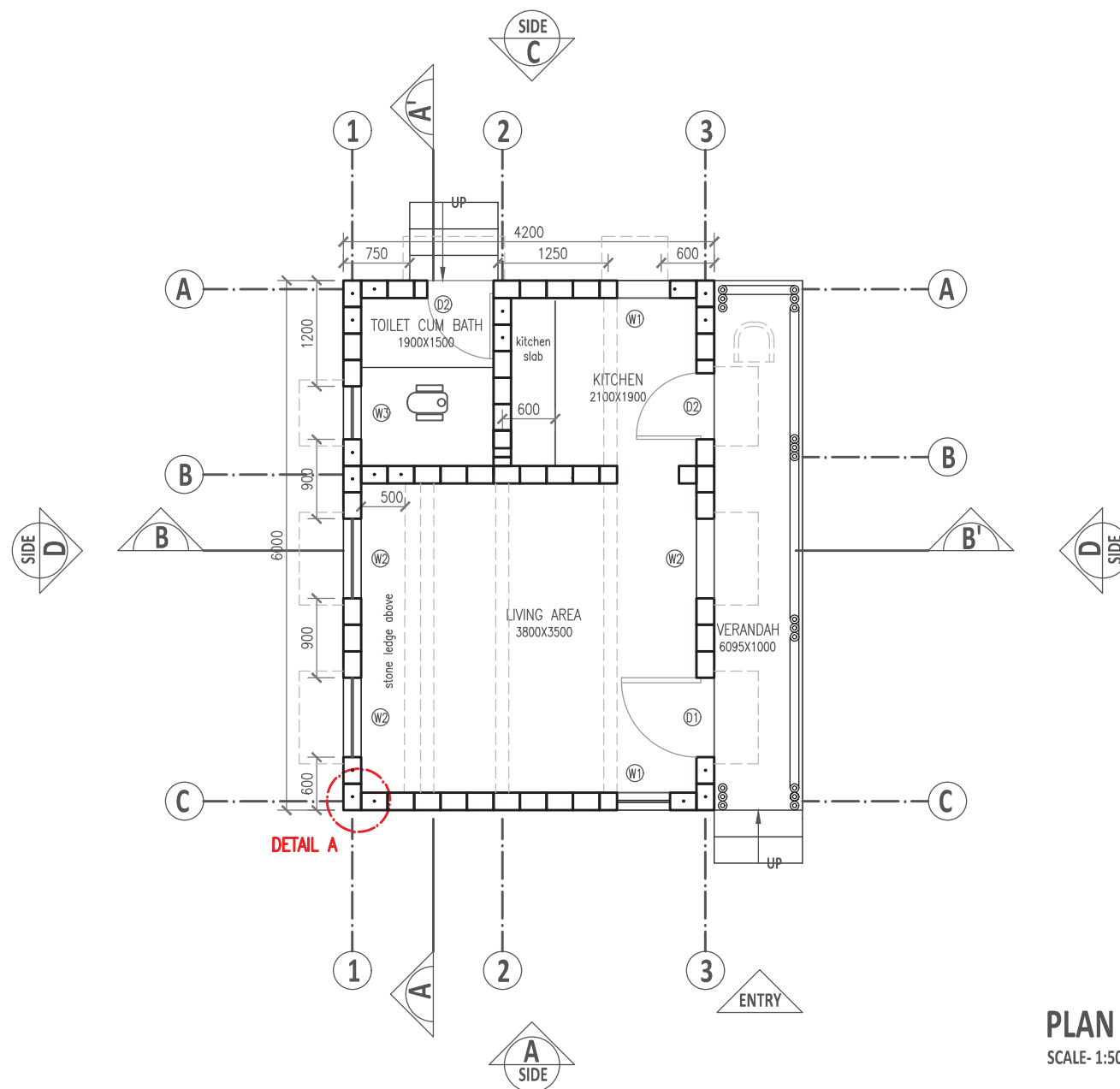
hollow spaces allow the necessary reinforcement in every corner of the room at the same time saves material consumption in the manufacturing process of the blocks. The unique interlocking feature of the block ensures extra safety for the earthquake.

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
Rectangular structure and linear in the arrangement of their interior spaces. Entry to the building is from longer side. Open to sky verandah is provided in one long side. Future expansion proposed vertically.	Low Plinth level recommended	Flat Roof with vernacular practice for roof

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> Reinforced Stone masonry with cement mortar in a strip foundation. "bond" stone or the "through" stone is recommended to be provided both horizontally (in every less than 1.2m intervals) and vertically (in every less than 0.6m intervals) 	<ul style="list-style-type: none"> Optimum use of local material. Mud mortar is replaced by cement mortar for earthquake safety.
Plinth	<ul style="list-style-type: none"> Reinforced RCC plinth beam at 450mm height from the ground 	
Wall	<ul style="list-style-type: none"> Hollow interlocking Compressed Stabilized Earth Block wall. Reinforcing bars embedded in wall at the corners of all the rooms Seismic bands provided at ceiling level 	<ul style="list-style-type: none"> Vertical MS reinforcing bars recommended for openings larger than 0.6 m in width.
Wall Finish	<ul style="list-style-type: none"> No wall finish required 	
Roof Structure	<ul style="list-style-type: none"> Prefabricated reinforced concrete beam at roof level to support the load of the roof. 	Bamboo reinforcements in the beam
Roof Cover	<ul style="list-style-type: none"> Stone patti with mud phuska as insulation. 	<ul style="list-style-type: none"> Improving the existing practice.
Floor	<ul style="list-style-type: none"> Plain Cement flooring finish over bricks. 	

ZONE - B UP-B-01

Total Cost ₹ 140,699/-



TYPICAL PLAN

PLAN
SCALE- 1:50

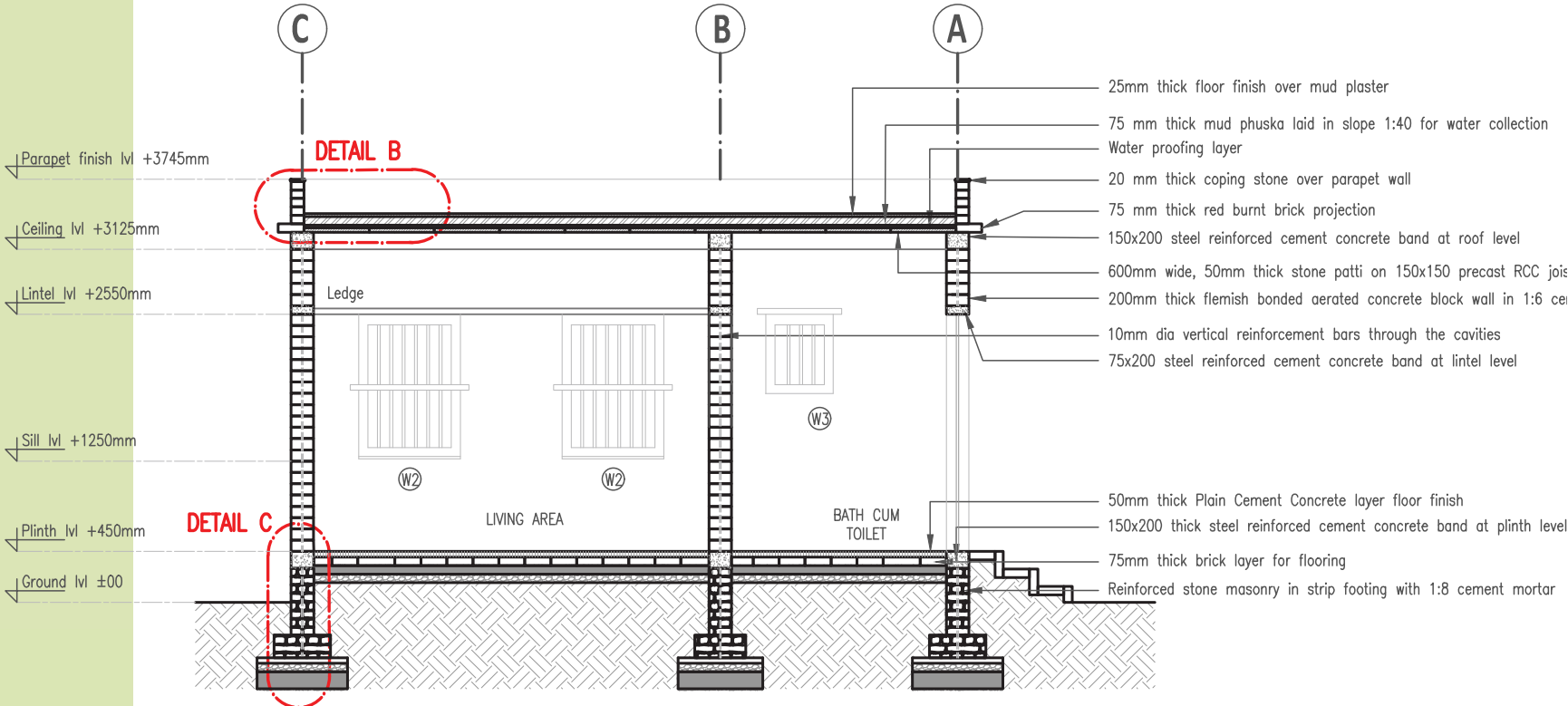


UTTAR PRADESH

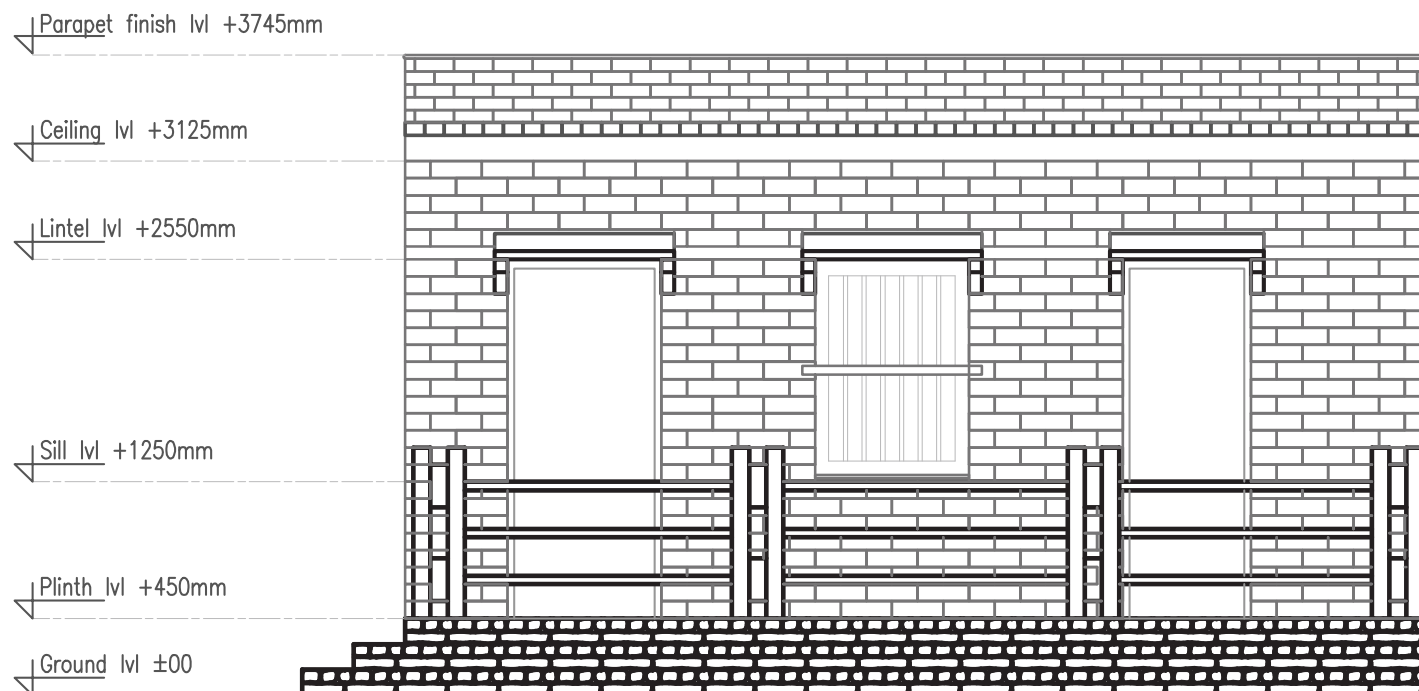
ZONE - B
UP-B-01



UTTAR
PRADESH



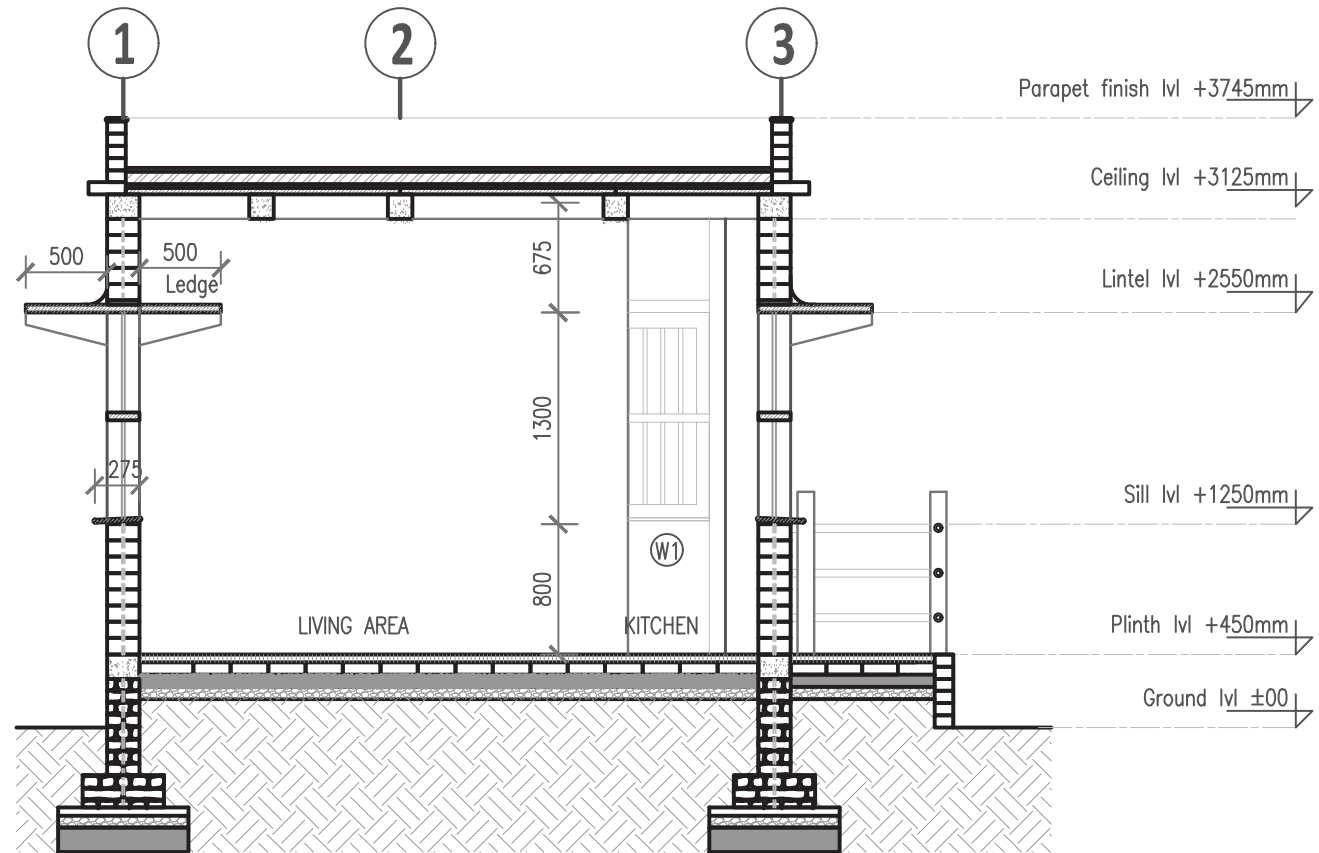
SECTION - AA'

ZONE - B
UP-B-01**ELEVATION SIDE D****UTTAR**
PRADESH

ZONE - B UP-B-01



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SECTION - BB'

Cost Estimate for UP-B-01

S. No.	ITEM	UNIT	QUANTITY	RATE (INR)	AMOUNT
FOUNDATION					
1	Site clearance and layout	LS	1.00	100.00	100.00
2	Earth work in excavation of foundation, levelling the bottom of the trench etc. complete (600mm wide and 600mm deep)	cum	14.60	228.38	3333.56
3	Providing and laying P.C.C. in foundation 100mm thick with 1:5:10 (12mm nominal size aggregates)	cum	2.11	2511.25	5288.69
4	Providing Random Rubble Masonry with cement mortar in foundation up to plinth level, including setting of block, mixing of mud with appropriate qty. of water etc.				
a	1st stepping	cum	4.42	1240.37	5484.00
b	2nd stepping	cum	1.85	1240.37	2291.56
5	Providing and laying D.P.C. 25mm thick with 1:2:4 cement concrete and WPC powder.	sqm	7.56	92.88	702.17
6	Providing and laying RCC plinth beam 150mm thick with 1:2:4 cement concrete	cum	0.86	3835.46	3313.84
7	Earth work in back filling of foundation	cum	8.40	114.19	959.35
TOTAL					21473.18
SUB STRUCTURE					
8	Brick work in veranda in normal bond with 1:6 cement dust mortar	cum	0.43	4704.01	2030.02
9	Bamboo fencing in veranda (100mm dia)	rm	15.00	50.00	750.00
10	Bamboo fencing in veranda (50mm dia)	rm	16.25	26.00	422.50
11	Brick work in steps with 1:6 cement dust mortar	cum	0.54	4704.01	2535.46
12	Earthwork in excavation of soak pit and inspection chamber	cum	2.71	228.38	619.35
13	Honeycombed brick work in soak pit and plaster work in inspection chamber	cum	0.68	1001.12	676.95
14	Cement conc floor with brick ballast	sqm	24.70	112.25	2772.60
TOTAL					9806.88
SUPER STRUCTURE					
15a	Brick work in super structure with hollow interlocking CSEB(300x150x100) in 1:10 cement mud mortar	cum	21.06	3274.53	
Deductions:					
15b	For door	cum	1.51	3274.53	
15c	For Windows/Ventilators	cum	1.79	3274.53	
	Window	cum	0.11	3274.53	
	Total Brickwork	cum	17.65	3274.53	57783.52
16	Corner vertical 8mm MS reinforcement for seismic zone	kg	58.80	50.00	2940.00
17	Providing and fixing R.C.C. door/window frames complete				
a	White door frame	no.	3.00	950.00	2850.00
b	Grey window frame	no.	6.00	400.00	2400.00
TOTAL					65973.52
ROOF					
18	Providing stone patti roof over precast concrete beam	sqm	19.44	987.48	19196.57
19	Brick bats and mud phuska finishing over roof with cement dust mortar	sqm	19.44	623.11	12113.21
20	Providing stone slab in lintel over doors and windows	sqm	3.75	40.00	150.00
21	Providing stone slab in sill and window breaker		1.17	40.00	46.80
22	Providing Stone slab for loft/ storage	sqm	1.88	40.00	75.00
23	Brick work in parapet in normal bond with 1:6 cement dust mortar	cum	1.99	4704.01	9347.81
24	Providing PCC Gola complete	rm	18.00	51.33	924.03
25	Coping Stone	sqm	2.21	50.00	110.40
TOTAL					41963.81
PLUMBING AND OTHER FIXTURE FOR TOILET					
26	Indian sanitary Pan and water seal	no.	1.00	500.00	500.00
27	PVC pipe 4"	rm	3.60	120.00	432.00
28	PVC treeway tee 3"	no.	1.00	80.00	80.00
29	Plastic water tap	no.	1.00	70.00	70.00
30	Wash basin	no.	1.00	400.00	400.00
TOTAL					1482.00
TOTAL COST OF HOUSE (INR)					140699.40
AREA of HOUSE (SQM)					25.20
COST PER SQM (INR)					5583.31

ZONE - B UP-B-01

Cost breakup

Item	Cost (INR)
Foundation	21,473/-
Sub structure and Super Structure	75,781
Roof	41,963/-
Total	139,217/-



UTTAR PRADESH

ZONE-C

Zone C comprise 7 districts

- 1. Lalitpur
- 2. Jhansi
- 3. Mahoba
- 4. Jalaun
- 5. Hamirpur
- 6. Banda
- 7. Chitrakoot

Resources Available

- Mud, Stone as the basic materials for construction.

Zone A has one typology
UP-C-01



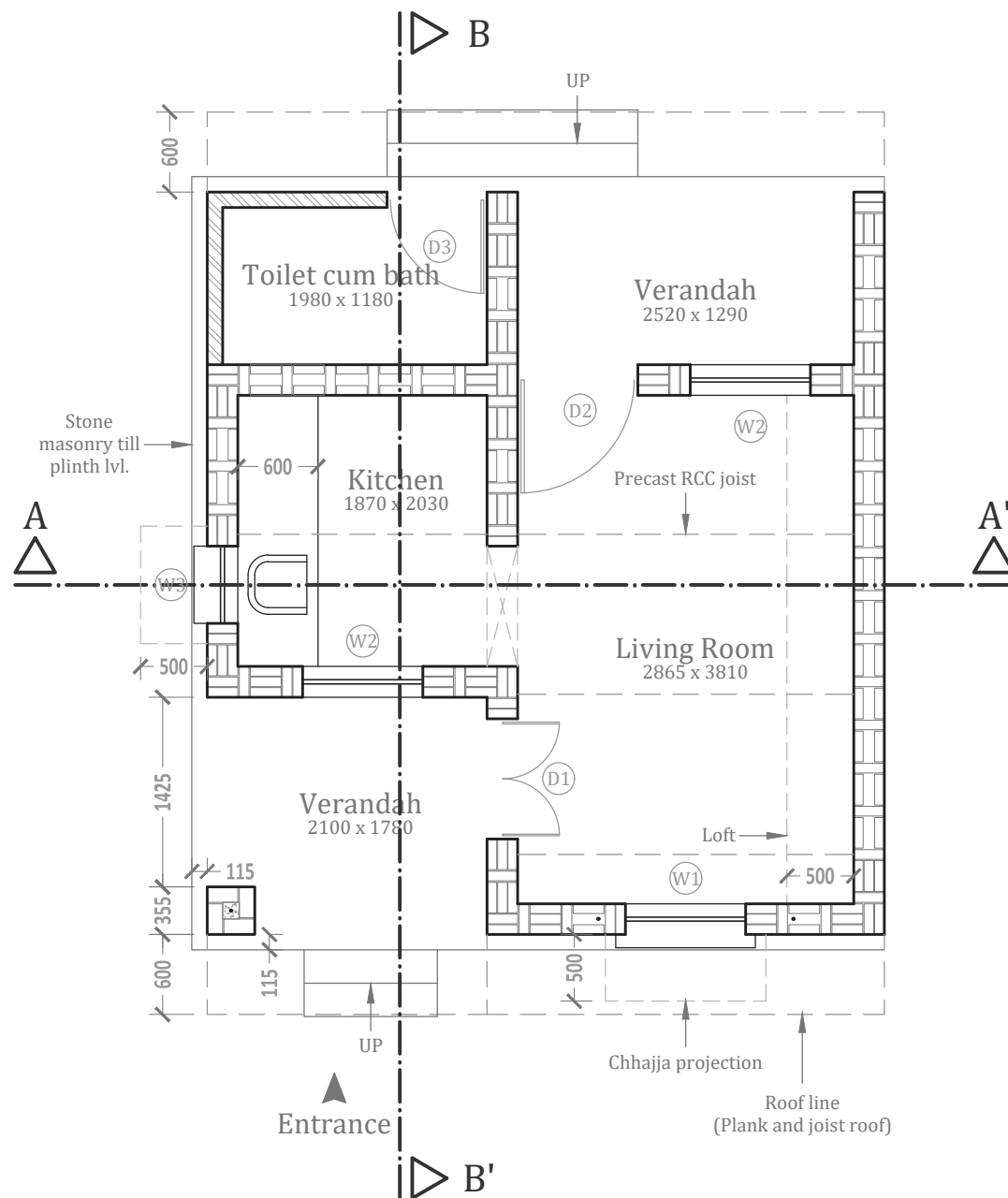
- Use of locally available resources such as fly ash for bricks and stones for laying foundation and other key elements of the house.
- Use of rat trap bond for wall saves 25% of the material required for wall and also prevents the heat transfer through it.
- Plank and joist is the precast module for roofing system which requires less reinforcement as compared to conventional RCC slabs and also saves construction. Mud phuska on top prevents the heat transfer through it.

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
Rectangular layout is planned considering the minimum footage of 6m. The house is built on one side of plot boundary and has welcoming entrance. Future expansion proposed towards the back side of the house	Average plinth height is recommended	Flat roof for closed spaces and sloping roof for semi open spaces.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none">• Random rubble stone masonry is proposed with cement mortar, bond stones and hooked links in regular intervals to hold the small stones together and prevent structural cracks in foundation.	<ul style="list-style-type: none">• Reducing the usage of concrete by recommending alternative to RCC framed structure.
Plinth	<ul style="list-style-type: none">• 500 mm high plinth level is recommended for the house.	
Wall	<ul style="list-style-type: none">• Rat trap bond wall with fly ash bricks.• Stone lintels and brick arches above the openings.• Loft and roof projections supported on stone brackets resting on walls.	<ul style="list-style-type: none">• Reinforcing bars recommended for openings larger than 0.6 m in width.
Wall Finish	<ul style="list-style-type: none">• No wall finish required	
Roof Structure	<ul style="list-style-type: none">• Prefabricated reinforced concrete beam at roof level to support the load of the roof.• Bamboo framework for MCR tile roofing.	
Roof Cover	<ul style="list-style-type: none">• Precast Ferro cement roofing channel.	
Floor	<ul style="list-style-type: none">• Plain Cement flooring finish over bricks.	



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TYPICAL PLAN

ZONE - C

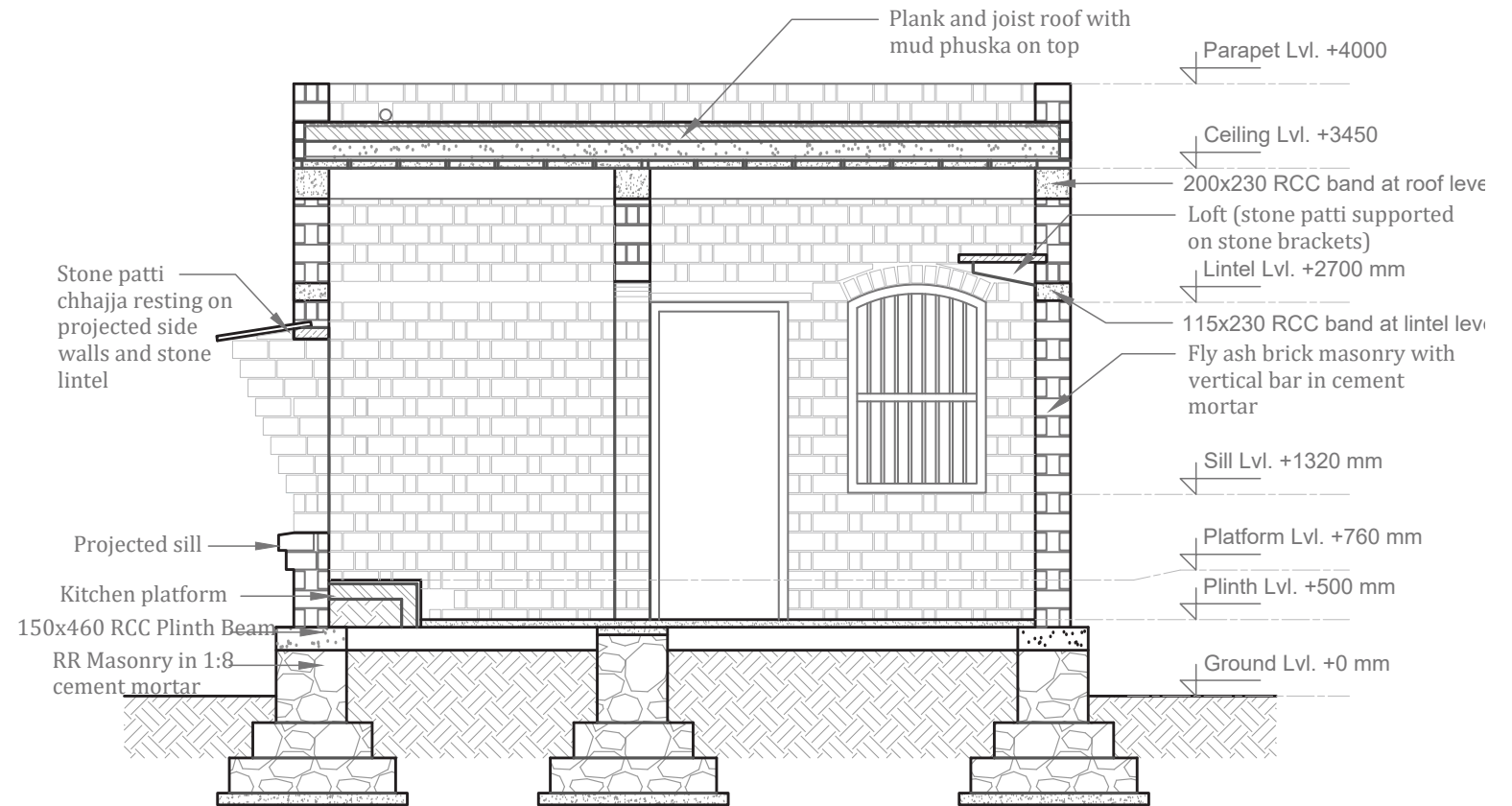
Total Cost ₹ 154,731/-

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ZONE - C UP-C-01

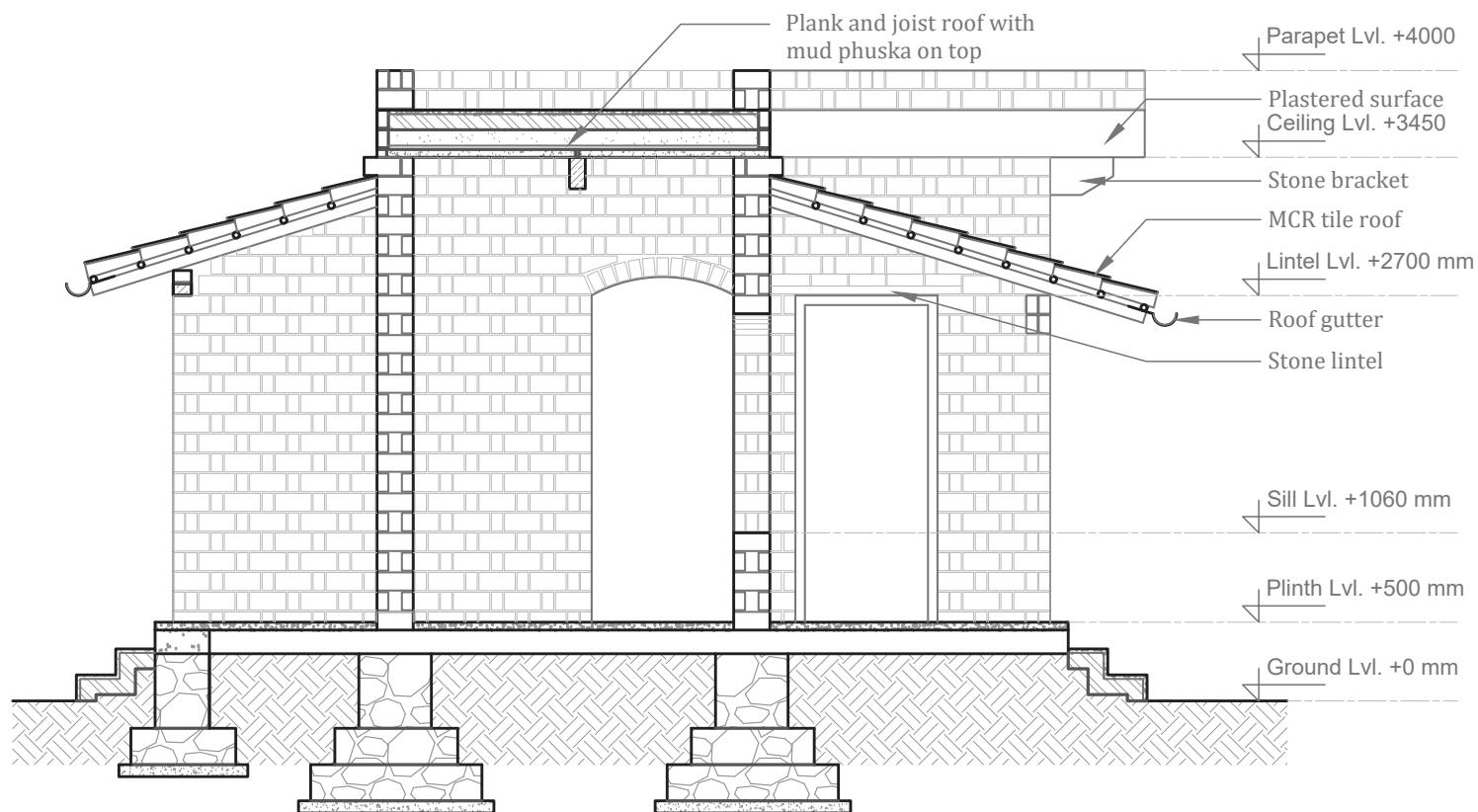


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SECTION - AA'

ZONE - C UP-C-01



SECTION - BB'



UTTAR PRADESH

ZONE - C
UP-C-01

Cost breakup

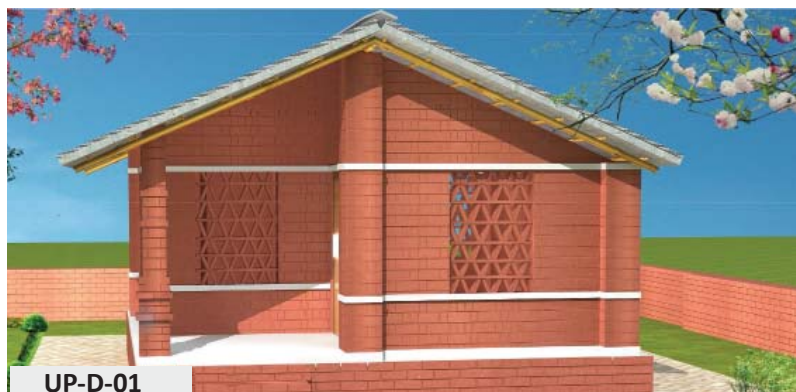
Item	Cost (INR)
Foundation	29,539/-
Sub structure and Super Structure	66,833/-
Roof	56,877/-
Total	154,249/-



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PRADESH

Cost Estimate for UP-C-01

S. No.	ITEM	UNIT	QUANTITY	RATE (INR)	AMOUNT
FOUNDATION					
1	Site clearance and layout	LS	1.00	100.00	100.00
2	Earth work in excavation of foundation, levelling the bottom of the trench etc. complete (750mm wide and 750mm deep)	cum	15.45	223.30	3449.65
3	Providing and laying P.C.C. in foundation 100mm thick with 1:5:10 (12mm nominal size aggregates)	cum	1.84	2434.00	4480.51
4	Providing Random Rubble Masonry with cement mortar in foundation up to plinth level, including setting of block , mixing of mud with appropriate qty. of water etc.	cum	9.04	1235.22	11161.79
5	Providing 1.5 brick thick column with cement mortar in pedestal foundation	cum	1.80	4662.30	8392.13
6	Providing and laying D.P.C. 25mm thick with 1:2:4 cement concrete and WPC powder.	sqm	6.23	89.15	555.24
7	Earth work in back filling of foundation	cum	12.54	111.65	1400.09
TOTAL					29539.41
SUB STRUCTURE					
8	Brick work in veranda in normal bond with 1:6 cement dust mortar	cum	0.79	4662.30	3692.89
9	Brick work in steps with 1:6 cement dust mortar	cum	0.72	4662.30	3356.85
10	Earthwork in excavation of soak pit and inspection chamber	cum	2.71	223.30	605.59
11	Honeycombed brick work in soak pit and plaster work in inspection chamber	cum	0.68	1001.71	677.36
12	Cement concrete floor with brick ballast	sqm	24.90	113.77	2832.89
TOTAL					11165.58
SUPER STRUCTURE					
13a	Brick masonry with Rat trap bond in super structure with cement mortar 1:4	cum	14.21	4217.98	50389.44
13b	Brick work in normal bond with 1:6 cement dust mortar	cum	0.11		
13c	Deductions: For door	cum	1.67		
13d	For Windows	cum	0.43		
	Window	cum	0.28		
	Total Brickwork	cum	11.95		
14	Providing and fixing R.C.C. door/window frames complete				
a	White door frame	no.	3.00	950.00	2850.00
b	Grey window frame	no.	3.00	400.00	1200.00
15	Providing and laying RCC lintel band 75mm thick with 1:2:4 cement concrete	cum	0.09	3854.83	333.81
16	Providing stone slab chhajja over windows	sqm	1.04	860.00	894.40
TOTAL					55667.65
ROOF					
17	Providing plank and joist roofing	sqm	19.75	927.89	18325.771
18	Brick bats and mud phuska finishing over roof with cement dust mortar	sqm	19.75	625.80	12359.503
19	Providing MCR tile roof with bamboo framework	sqm	19.24	876.68	16867.32
20	Providing Stone slab for loft/ storage	sqm	1.90	860.00	1634.00
21	Brick work in parapet in normal bond with 1:6 cement dust mortar	cum	1.43	4662.30	6669.34
22	Providing PCC Gola complete	rm	17.77	51.36	912.62
23	Coping Stone	sqm	2.04	53.20	108.72
TOTAL					56877.28
PLUMBING AND OTHER FIXTURE FOR TOILET					
24	Indian sanitary Pan and water seal	no.	1.00	500.00	500.00
25	PVC pipe 4"	rm	3.60	120.00	432.00
26	PVC treeway tee 3"	no.	1.00	80.00	80.00
27	Plastic water tap	no.	1.00	70.00	70.00
28	Wash basin	no.	1.00	400.00	400.00
TOTAL					1482.00
TOTAL COST OF HOUSE (INR)					154731.92
AREA of HOUSE (SQM)					28.20
COST PER SQM (INR)					5486.95



- Column framed structure proposed without using RCC structure, thus minimizing the use of steel and concrete.
- Suggested construction technique for wall not only provides resistance to seismic disaster but at the same time saves up material consumption when

compared with English bonded brick wall. The horizontal seismic bands have bamboo splits as the reinforcement.

- Being light weight, pressed thatch panels provide a suitable roofing option for high seismic zones. GI corrugated increases the durability of roof.

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
Rectangular layout planned considering the minimum footage of 6m. The house is built on one side of plot boundary and has welcoming entrance. Future expansion proposed towards the back side of the house	High plinth height is recommended	Light weight sloping roof is recommended.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • Brick pedestal foundation with cement mortar under the 2 brick thick column at super structure • Strip footing with burnt clay bricks and cement mortar till plinth level. 	<ul style="list-style-type: none"> • Reducing the usage of concrete by recommending alternative to RCC framed structure.
Plinth	<ul style="list-style-type: none"> • 150 mm thick reinforced RCC plinth beam at 650 mm height 	
Wall	<ul style="list-style-type: none"> • 2 brick thick column with rat trap bonded brick wall. • Reinforcing bars embedded in brick masonry at the corners of all the rooms • 75 mm thick seismic bands with bamboo reinforcement provided at sill level and lintel level. 	<ul style="list-style-type: none"> • Reinforcing bars recommended for openings larger than 0.6 m in width.
Wall Finish	<ul style="list-style-type: none"> • No wall finish required 	
Roof Structure	<ul style="list-style-type: none"> • Bamboo framework with 100 mm dia. Bamboos as purlins and 50 mm dia. Bamboos as batterns. 	
Roof Cover	<ul style="list-style-type: none"> • Pressed thatch panels with GIcorrugated sheet as roof cover 	
Floor	<ul style="list-style-type: none"> • Plain Cement flooring finish over bricks. 	

ZONE-D

Zone D comprise 11 districts

1. Gonda
2. Balrampur
3. Siddharth Nagar
4. Maharajganj
5. Kushinagar
6. Gorakhpur
7. Deoria
8. Sant Kabir Nagar
9. Basti
10. Faizabad
11. Ambedkar Nagar

Resources Available

- Mud and stone.
- Country tile

Zone A has one typology

UP-D-01



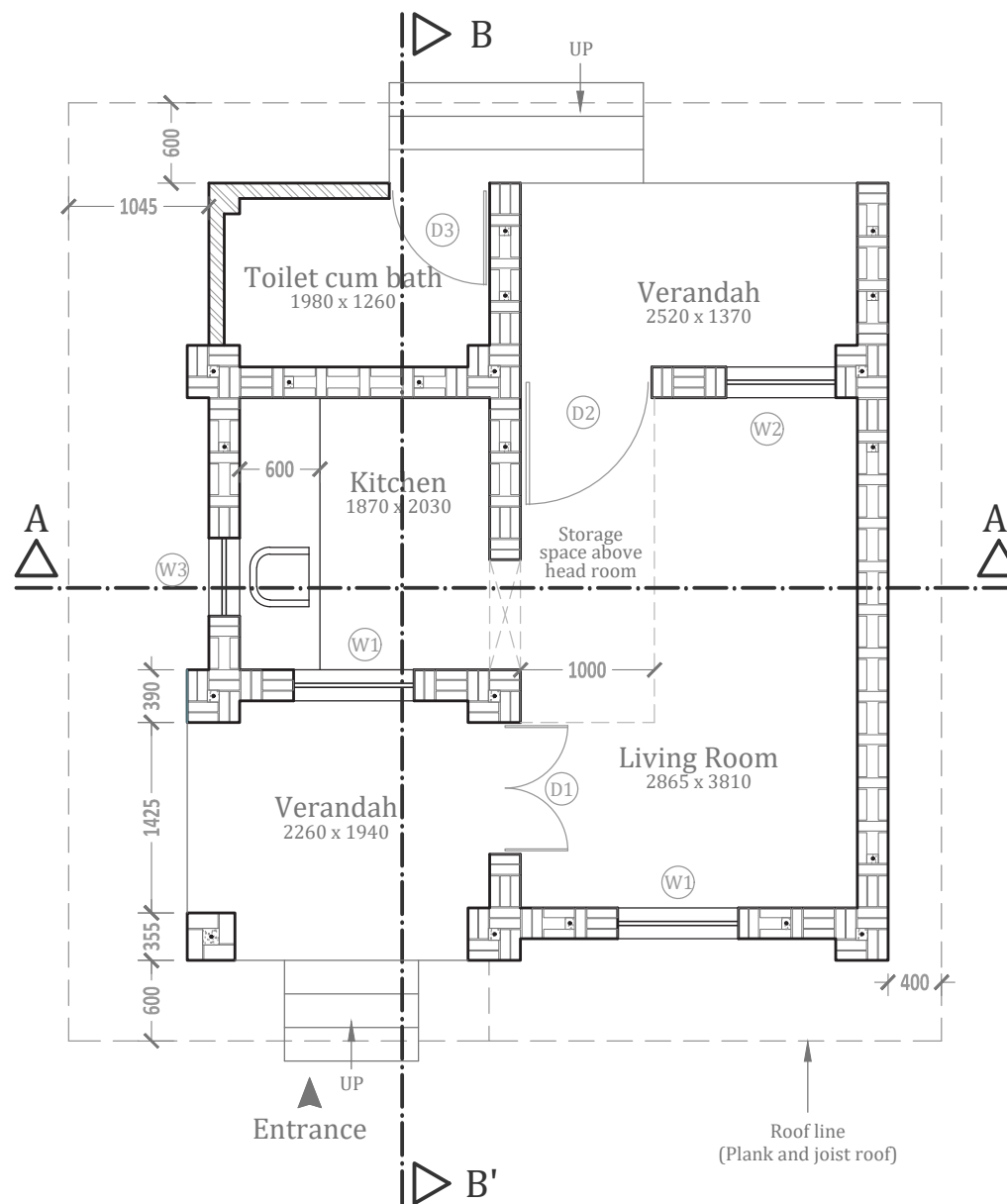
**UTTAR
PRADESH**

ZONE - D UP-D-01

Total Cost ₹ 154,731/-

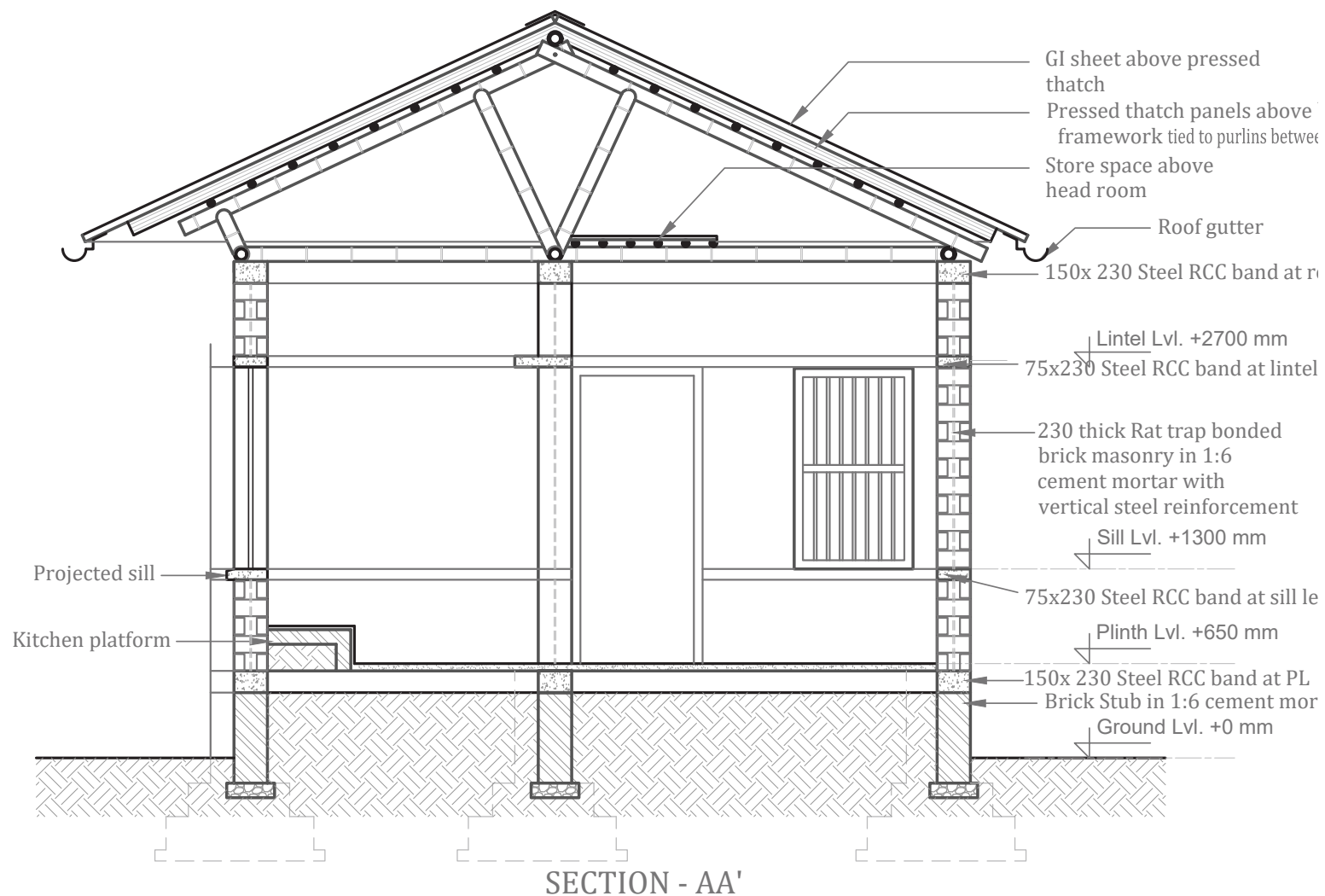


UTTAR PRADESH



TYPICAL PLAN

ZONE - D UP-D-01



SECTION - AA'

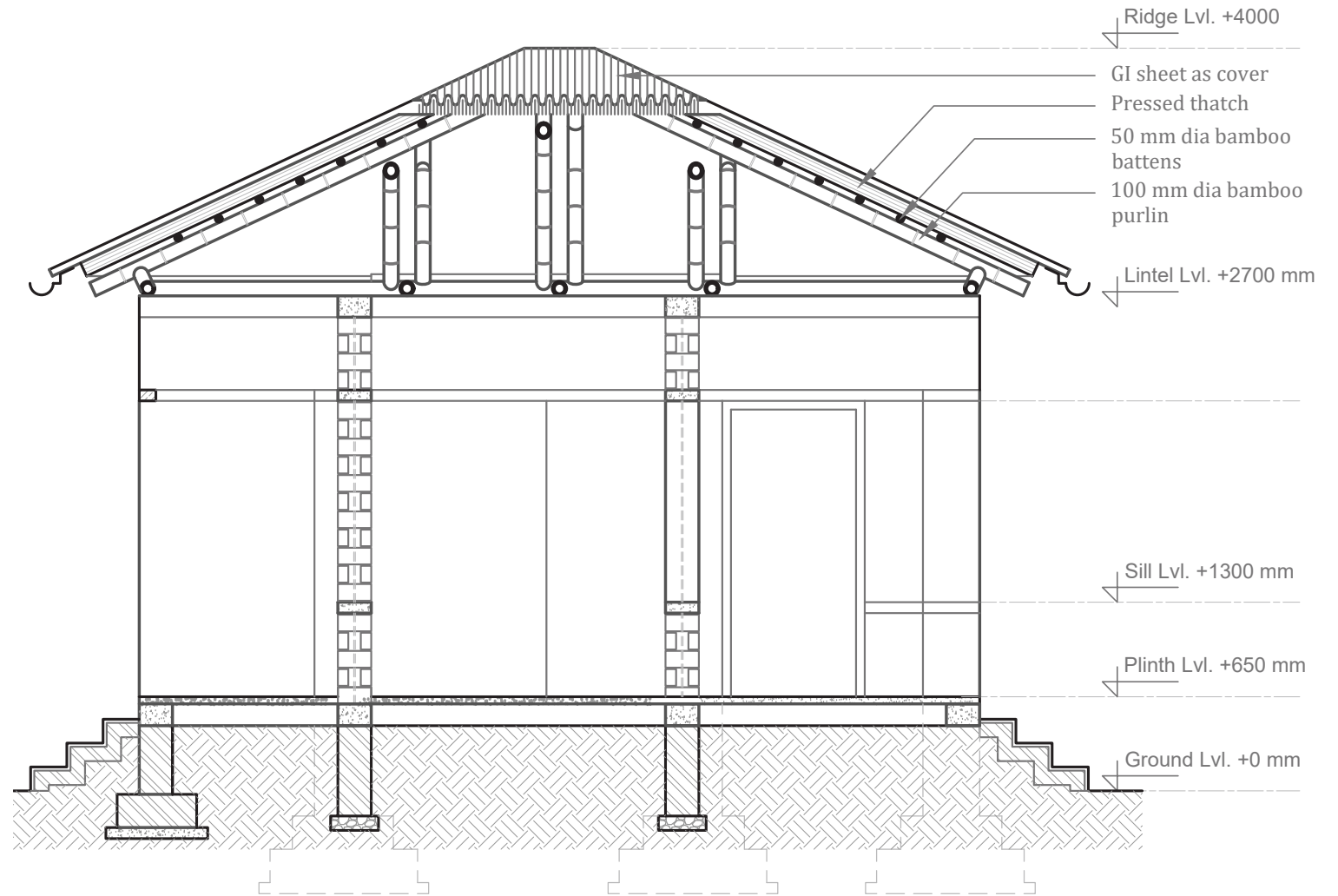


UTTAR PRADESH

ZONE - D UP-D-01



UTTAR
PRADESH



SECTION - BB'

Cost Estimate for UP-D-01

S. No.	ITEM	UNIT	QUANTITY	RATE (INR)	AMOUNT
FOUNDATION					
1	Site clearance and layout	LS	1.00	100.00	100.00
2	Earth work in excavation of foundation, levelling the bottom of the trench etc. complete (600mm wide and 600mm deep)	cum	10.31	228.38	2354.55
3	Providing and laying P.C.C. in foundation 100mm thick with 1:5:10 (12mm nominal size aggregates)	cum	1.57	2567.02	4030.22
4	Providing brick masonry pedestal foundation and footing with cement mortar up to plinth level, including mixing of mortar with appropriate qty. of water etc.	cum	6.94	4172.96	28960.36
5	Providing 400 mm thick brick column with cement mortar in pedestal foundation	cum	1.80	4172.96	7511.33
6	Providing and laying D.P.C. 25mm thick with 1:2:4 cement concrete and WPC powder.	sqm	6.23	102.77	640.08
7a	Providing and laying RCC plinth beam 150mm thick with 1:2:4 cement concrete	cum	0.77	4110.99	3144.91
7b	Bamboo split reinforcement in plinth beam	rm	108.32	10.00	1083.20
8	Earth work in back filling of foundation	cum	12.54	114.19	1431.91
TOTAL					49256.56
SUB STRUCTURE					
9	Brick work in veranda in normal bond with 1:6 cement dust mortar	cum	0.79	4365.55	3457.84
10	Brick work in steps with 1:6 cement dust mortar	cum	0.72	4365.55	3143.20
11	Earthwork in excavation of soak pit and inspection chamber	cum	2.71	228.38	619.35
12	Honeycombed brick work in soak pit and plaster work in inspection chamber	cum	0.68	1006.76	680.77
13	Cement conc floor with brick ballast	sqm	24.20	117.56	2844.98
TOTAL					10746.15
SUPER STRUCTURE					
14a	Brick masonry with Rat trap bond in super structure with cement mortar 1:4	cum	13.44	4172.96	56084.62
14b	Brick work in normal bond with 1:6 cement dust mortar	cum	3.27	4365.55	14275.36
Deductions:					
14c	For door	cum	1.78	4172.96	7437.35
14d	For Windows	cum	0.80	4172.96	3350.98
Total Brickwork					59571.65
15	Corner vertical 8mm MS bar reinforcement for seismic zone	kg.	22.00	50.00	1099.80
16	Providing and fixing R.C.C. door/window frames complete				
a	White door frame	no.	3.00	950.00	2850.00
b	Grey window frame	no.	3.00	400.00	1200.00
17	Providing and laying RCC sill band 75mm thick with 1:2:4 cement concrete	cum	0.40	4110.99	1658.69
18	Providing and laying RCC lintel band 75mm thick with 1:2:4 cement concrete	cum	0.47	4110.99	1920.37
19	Bamboo split reinforcement in sill and lintel band	rm	201.88	10.00	2018.80
TOTAL					70319.30
ROOF					
20	Bamboo framework to support roof				
a	100 mm dia. bamboos as main structural members	rm	60	50.00	3000
b	50 mm dia. bamboos as battens to support pressed thatch and GI sheet	rm	130	26.00	3380
21	Durable and fire retardant pressed thatch panel roof	sqm	44.80	40.00	1792
22	GI corrugated sheet as roof cover	sqm	60.00	280.00	16800.00
23	Providing storage space above head room with bamboo	sqm	2.42	220.00	532.40
TOTAL					25504.40
PLUMBING AND OTHER FIXTURE FOR TOILET					
24	Indian sanitary Pan and water seal	no.	1.00	500.00	500.00
25	PVC pipe 4"	rm	3.60	120.00	432.00
26	PVC treeway tee 3"	no.	1.00	80.00	80.00
27	Plastic water tap	no.	1.00	70.00	70.00
28	Wash basin	no.	1.00	400.00	400.00
TOTAL					1482.00
TOTAL COST OF HOUSE (INR)					157308.40
AREA of HOUSE (SQM)					28.20
COST PER SQM (INR)					5578.31

ZONE - D UP-D-01

Cost breakup

Item	Cost (INR)
Foundation	49,257/-
Sub Structure and Super Structure	81,065/-
Roof	25,504/-
Total	155,826/-



UTTAR PRADESH

ZONE-E

Zone E comprise 11 districts

- 1. Sonbhadra
- 2. Chandauli
- 3. Ghazipur
- 4. Ballia
- 5. Mau
- 6. Azamgarh
- 7. Jaunpur
- 8. Varanasi
- 9. Allahabad
- 10. Bhadohi
- 11. Mirzapur districts.

Resources Available

- Burnt clay bricks and mud.

Zone E has one typology
UP-E-01



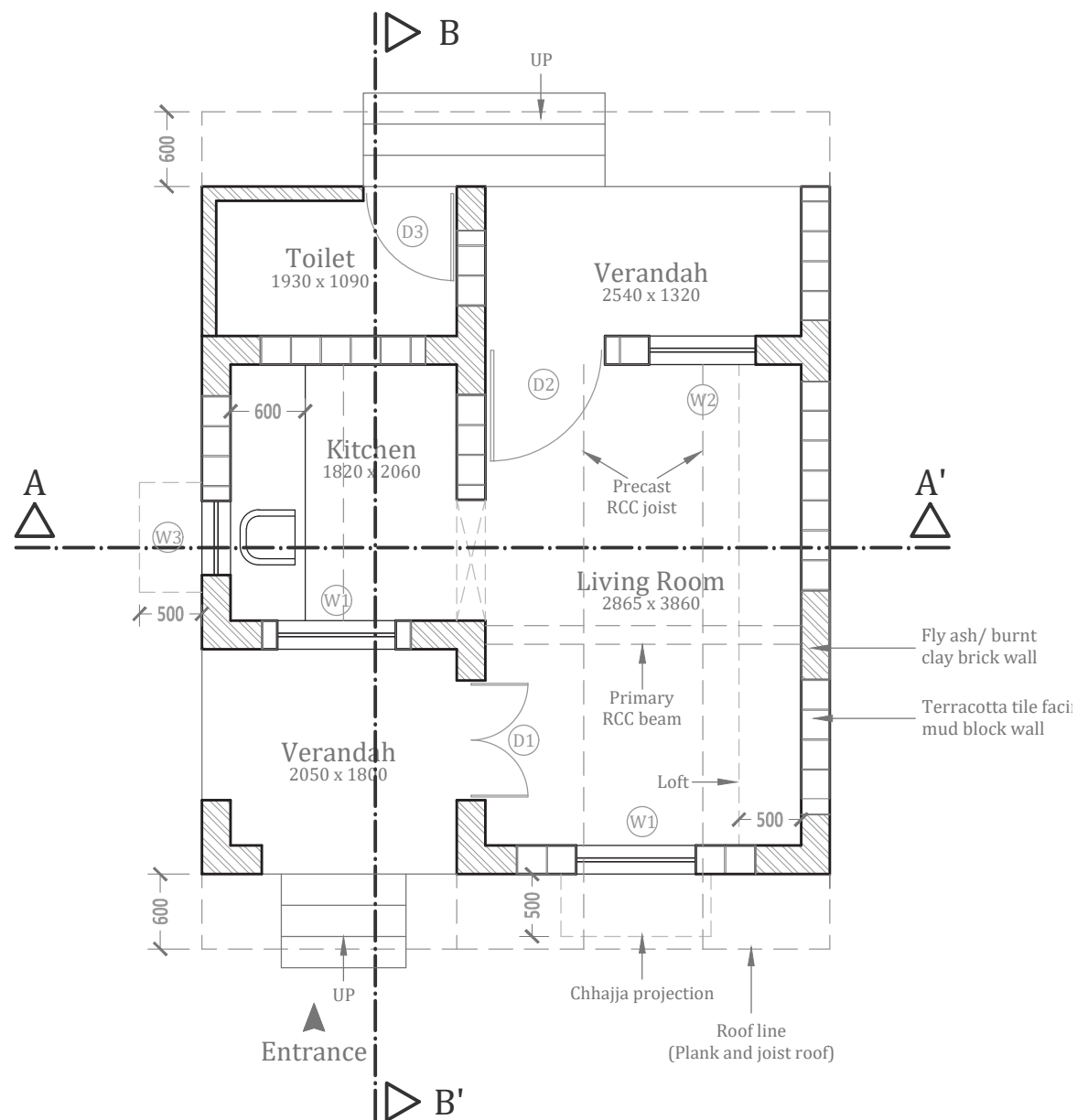
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- Corner of the walls in fly ash bricks with cement mortar acts as the main structural framework and takes the load of roof.
- Terracotta tile face mud block using mud mortar as binding material and cement mortar for pointing the outer surface of wall. Terracotta tile being on the outer surface, protects wall from outside weathering effects.
- Brick tile arch panel, being the precast modular elements, major scaffolding is not required and it also takes very less time in laying the roof.

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
Rectangular Structure and liner in the arrangement of their interior spaces. Entry to the building is from longer side. Open sky verandah is provided in one long side. Future expansion proposed vertically.	High plinth height is recommended	Combination of flat roof and sloping roof.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none">• Brick strip footing with cement mortar till plinth level.	<ul style="list-style-type: none">• Reducing the usage of concrete by recommending alternative to RCC framed structure.
Plinth	<ul style="list-style-type: none">• 650 mm high plinth level is recommended for the house.	
Wall	<ul style="list-style-type: none">• The corners in fly ash bricks and cement mortar, which acts as the main structural framework and takes the load of roof.• Terracotta tile face mud block using mud mortar as binding material and cement mortar for pointing the outer surface.	
Wall Finish	<ul style="list-style-type: none">• No wall finish required	
Roof Structure	<ul style="list-style-type: none">• Prefabricated RCC beam to support the load of the roof. Bamboo framework for MCR tile roofing.	
Roof Cover	<ul style="list-style-type: none">• Brick tile arch panel with mud phuska on top.	
Floor	<ul style="list-style-type: none">• Plain Cement flooring finish over bricks.	



TYPICAL PLAN

ZONE - E UP-E-01

Total Cost ₹ 159,256/-

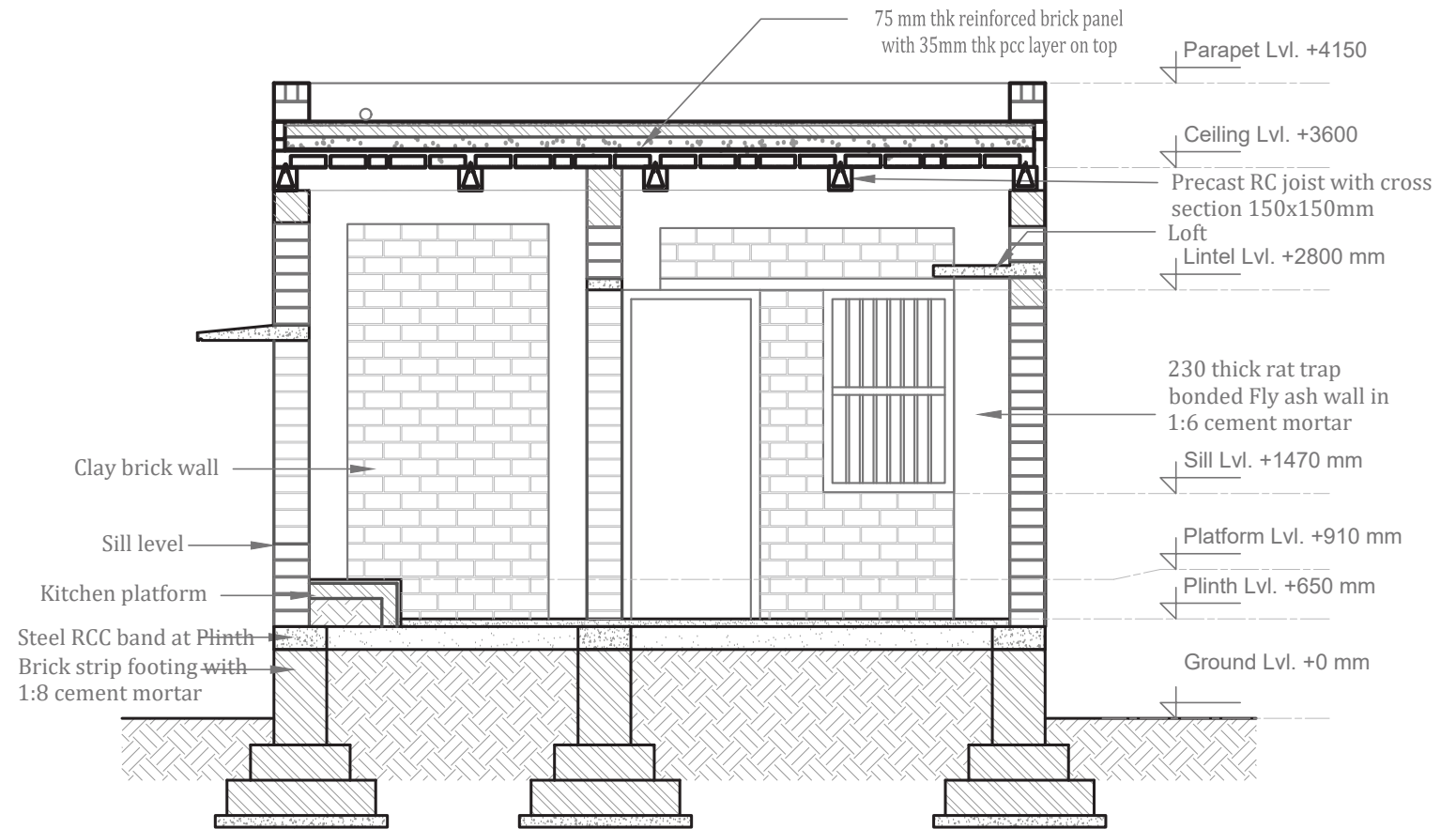


UTTAR PRADESH

ZONE - E UP-E-01



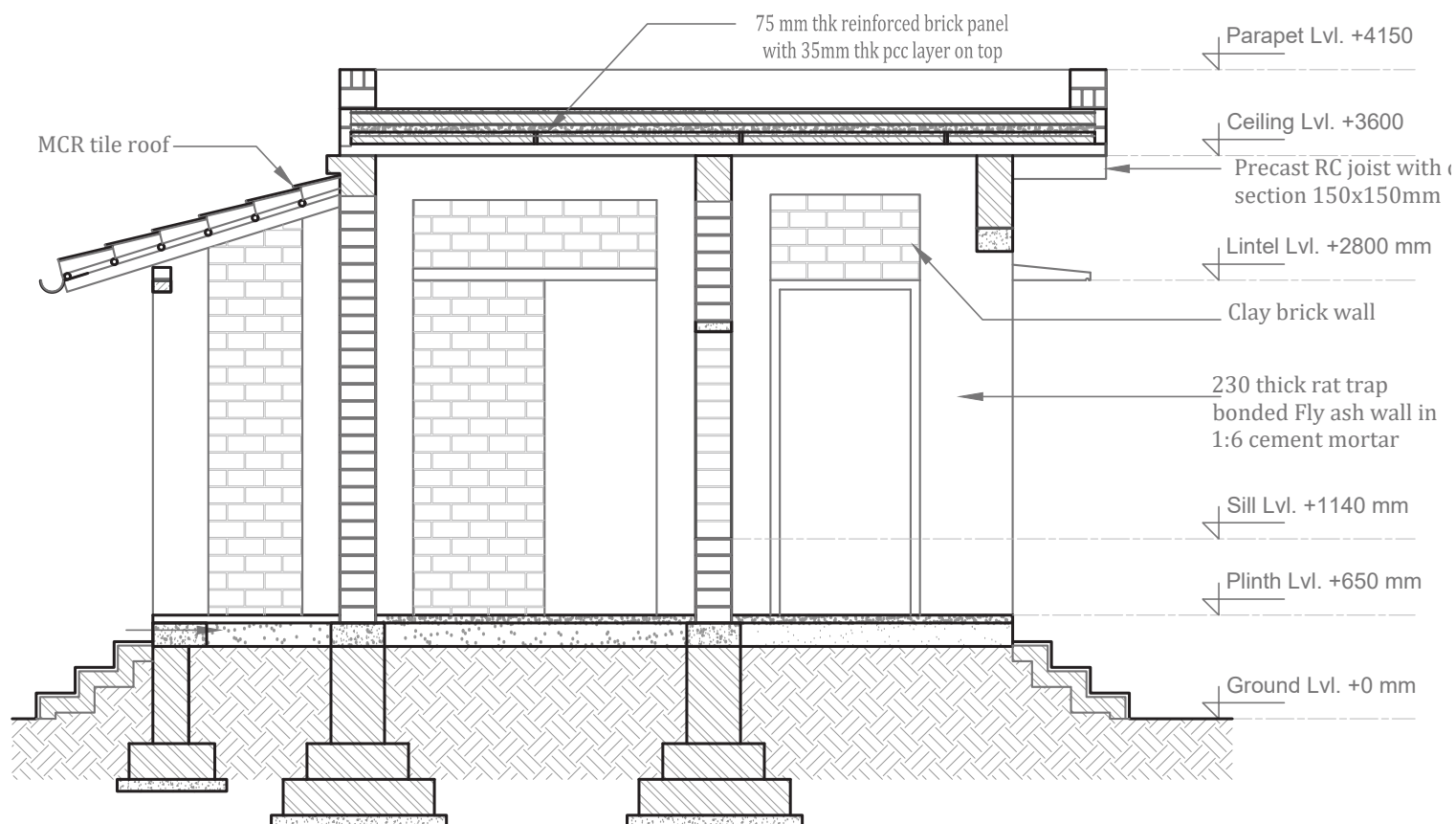
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SECTION - AA'

SECTION - AA'

ZONE - E UP-E-01



SECTION - BB'



UTTAR
PRADESH

ZONE - E
UP-E-01

Cost breakup

Item	Cost (INR)
Foundation	28,165/-
Sub Structure and Super Structure	65,076/-
Roof	64,533/-
Total	157,774/-



UTTAR
PRADESH

Cost Estimate for UP-E-01

S. No.	ITEM	UNIT	QUANTITY	RATE (INR)	AMOUNT
FOUNDATION					
1	Site clearance and layout	LS	1.00	100.00	100.00
2	Earth work in excavation of foundation, levelling the bottom of the trench etc. complete (750mm wide and 750mm deep)	cum	15.34	203.00	3113.21
3	Providing and laying P.C.C. in foundation 100mm thick with 1:5:10 (12mm nominal size aggregates)	cum	1.83	2343.00	4284.88
4	Providing Random Rubble Masonry with cement mortar in foundation up to plinth level, including setting of block , mixing of mud with appropriate qty. of water etc.	cum	15.05	1194.84	17982.35
5	Providing and laying D.P.C. 25mm thick with 1:2:4 cement concrete and WPC powder.	sqm	6.18	98.21	607.18
6	Earth work in back filling of foundation	cum	20.46	101.50	2076.69
TOTAL					28164.31
SUB STRUCTURE					
7	Brick work in veranda in normal bond with 1:6 cement dust mortar	cum	1.01	4615.12	4644.82
8	Brick work in steps with 1:6 cement dust mortar	cum	0.72	4615.12	3322.89
9	Earthwork in excavation of soak pit and inspection chamber	cum	2.71	203.00	550.54
10	Honeycombed brick work in soak pit and plaster work in inspection chamber	cum	0.68	969.99	655.91
11	Cement conc floor with brick ballast	sqm	24.90	108.04	2690.30
TOTAL					11864.44
SUPER STRUCTURE					
12a	Terracotta tile face mud block wall with cement mortar pointing in 1:3 and mud mortar as binding material	cum	9.01		
Deductions:					
12b	For door	cum	0.95		
12c	For Windows	cum	0.70		
	Total Brickwork	cum	7.36	2087.86	15364.45
13	Brick work in normal bond with 1:6 cement dust mortar	cum	7.20	4615.12	33228.87
14	Providing and fixing R.C.C. door/window frames complete	cum			
a	White door frame	no.	3.00	950.00	2850.00
b	Grey window frame	no.	3.00	400.00	1200.00
15	Providing and laying RCC lintel band 75mm thick with 1:2:4 cement concrete	cum	0.21	2343.00	483.38
16	Providing 500 mm projected RCC chhajja over windows	sqm	0.10	860.00	86.00
TOTAL					53212.71
ROOF					
17	Brick tile arch panel roof	sqm	24.8	1292.56	32055.525
18	Brick bats and mud phuska finishing over roof with cement dust mortar	sqm	24.8	617.55	15315.133
19	Providing MCR tile roof with bamboo framework	sqm	9.10	874.50	7957.91
20	Providing RCC slab for loft/ storage	sqm	1.90	860.00	1634.00
21	Brick work in parapet in normal bond with 1:6 cement dust mortar	cum	1.43	4615.12	6601.86
22	Providing PCC Gola complete	rm	17.77	48.50	861.84
23	Coping Stone	sqm	2.04	52.00	106.26
TOTAL					64532.54
PLUMBING AND OTHER FIXTURE FOR TOILET					
24	Indian sanitary Pan and water seal	no.	1.00	500.00	500.00
25	PVC pipe 4"	rm	3.60	120.00	432.00
26	PVC treeway tee 3"	no.	1.00	80.00	80.00
27	Plastic water tap	no.	1.00	70.00	70.00
28	Wash basin	no.	1.00	400.00	400.00
TOTAL					1482.00
TOTAL COST OF HOUSE (INR)					159256.00
AREA of HOUSE (SQM)					28.20
COST PER SQM (INR)					5647.38



UP-F-01

- Geographical conditions and occupation of people is the primary focus from which prototype for Zone 6 is derived.
- Benefiting from extremely suitable for construction soil, wall and roof are suggested to built from this soil.
- 3. Filler slab roofing is not only aesthetical in appearance which gives the owner of house sense of pride, but also results in cheaper cost of material as compared to cement concrete slab.

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
Rectangular Structure and linear in the arrangement of their interior spaces. Entry to the building is from longer side. Open sky verandah is provided in one long side.	High plinth height is recommended	Flat roof with use of local material for roof.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	Reinforced brick strip footing suggested. Non-erodible plaster finish of wall till plinth level of .60 m is suggested.	Zone is under flood hazard prone area, therefore high plinth level recommended.
Plinth	Seismic bands of cement concrete with bamboo reinforcement are suggested at plinth, sill and lintel level.	
Wall	Rat trap bonded brick wall with corner reinforcements is suggested for the seismic zone III of awadh region.	Premium quality of soil is available, thus good strength of bricks available.
Wall Finish	No wall finish required	
Roof Structure	Filler slab construction system is suggested where portions of RCC slab is replaced by filler material i.e. earthen pots, which results in cheaper cost of material as compared to cement.	Lot of pottery making is evident in many regions of this zone.
Roof Cover		
Floor	Plain Cement flooring finish over bricks.	

ZONE-F

Zone F comprise 19 districts

- Shahjahanpur
- Sitapur
- Bahraich
- Bara Banki
- Rae Bareilly
- Sultanpur
- Pratapgarh
- Kaushambi
- Fatehpur
- Kanpur
- Kanpur Dehat
- Unnao
- Lucknow
- Hardoi
- Kannauj
- Farrukhabad
- Mainpuri
- Etawah
- Auraiya

Resources Available

- Use of wood and mud for roofing.
- Mud

Zone E has one typology

UP-F-01

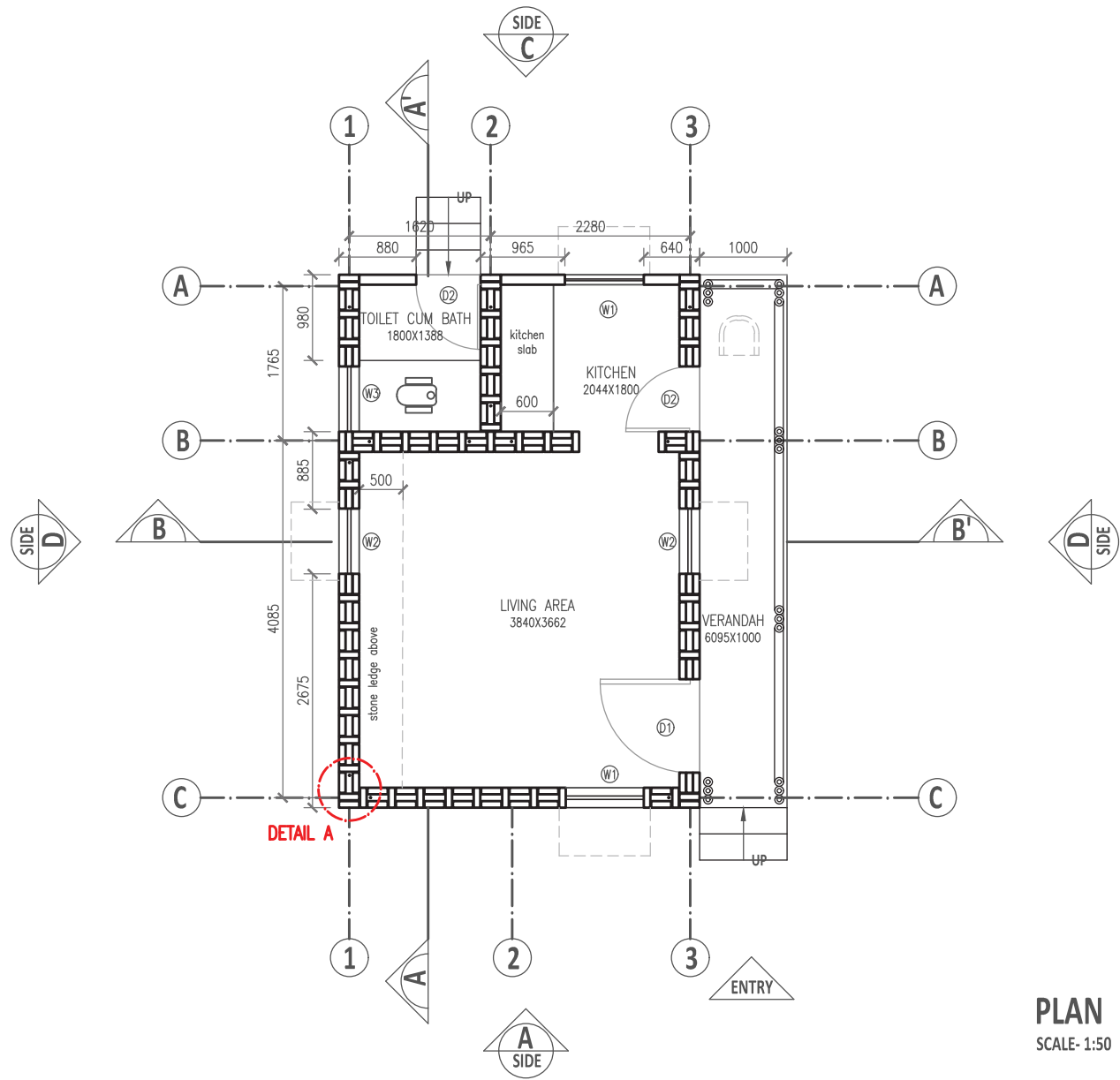


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ZONE - F
UP-F-01

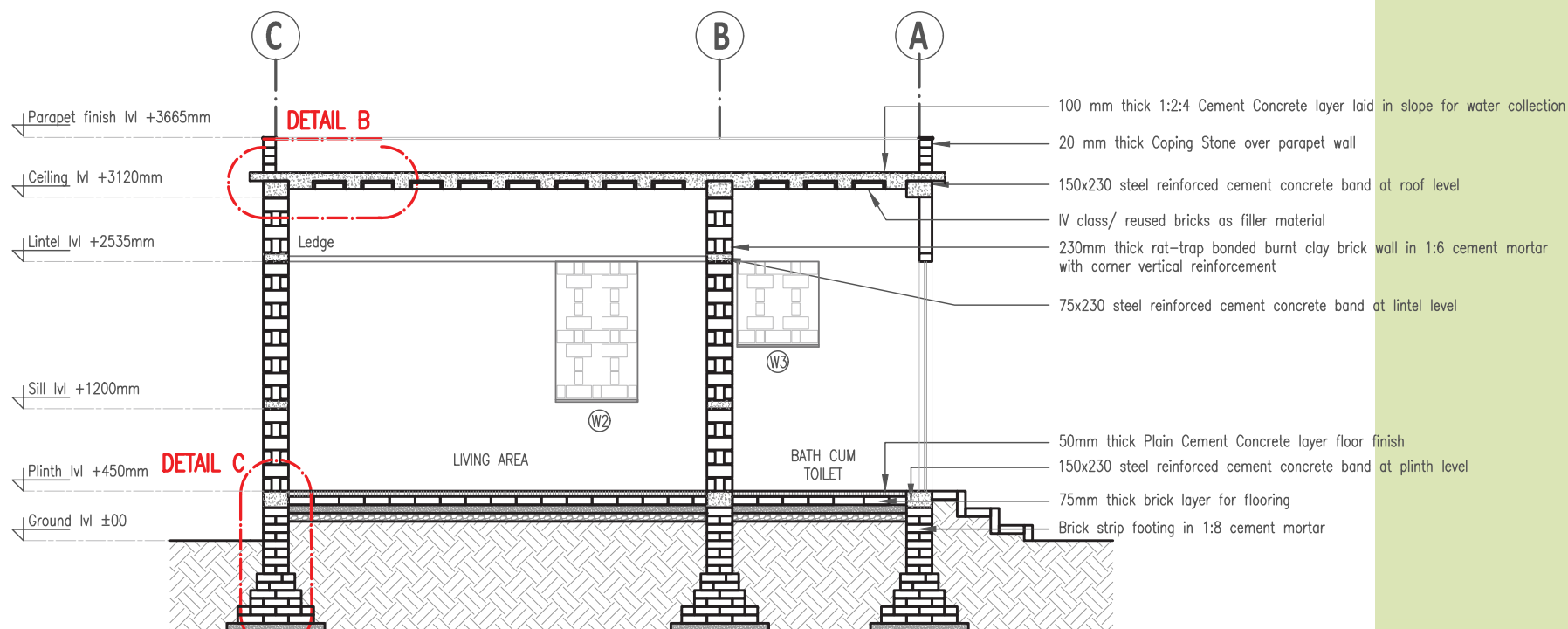


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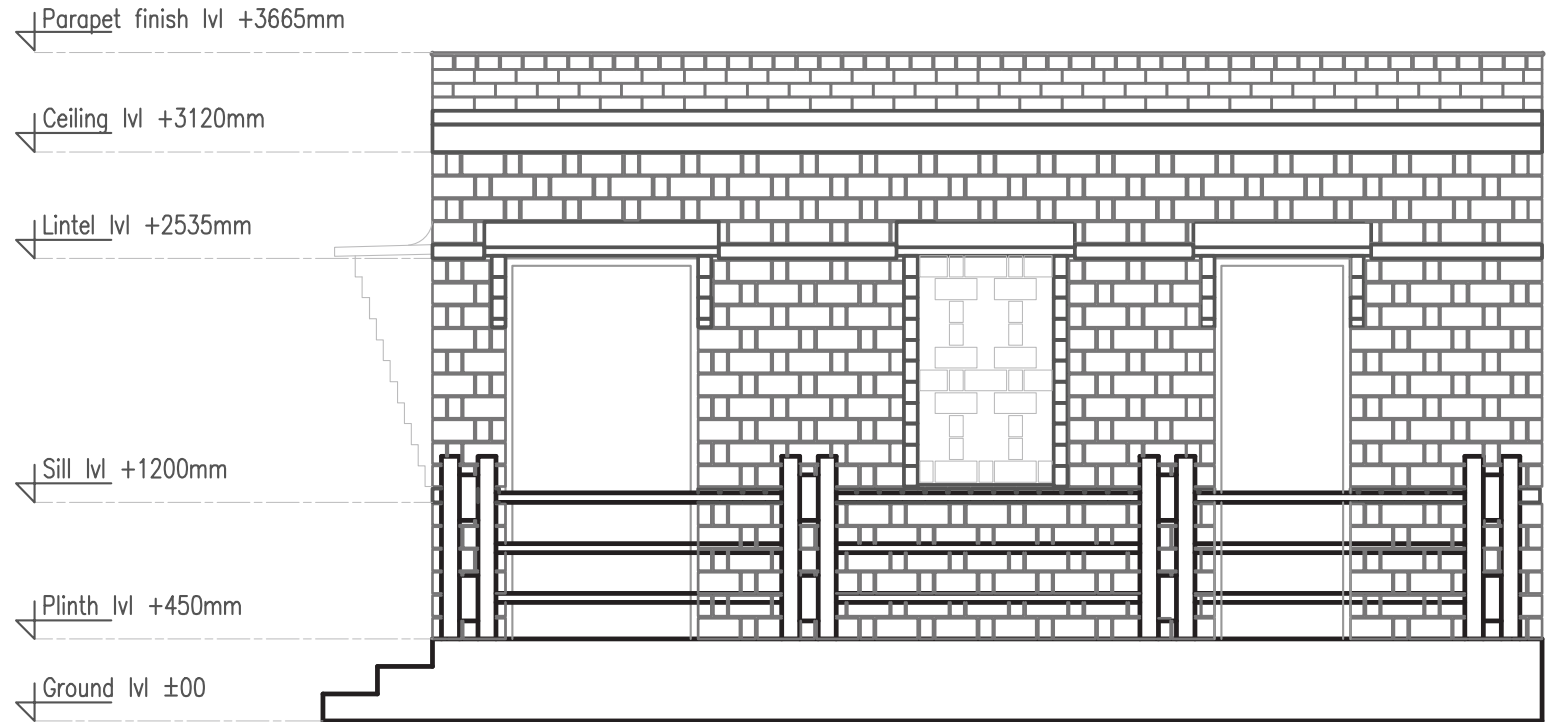


PLAN
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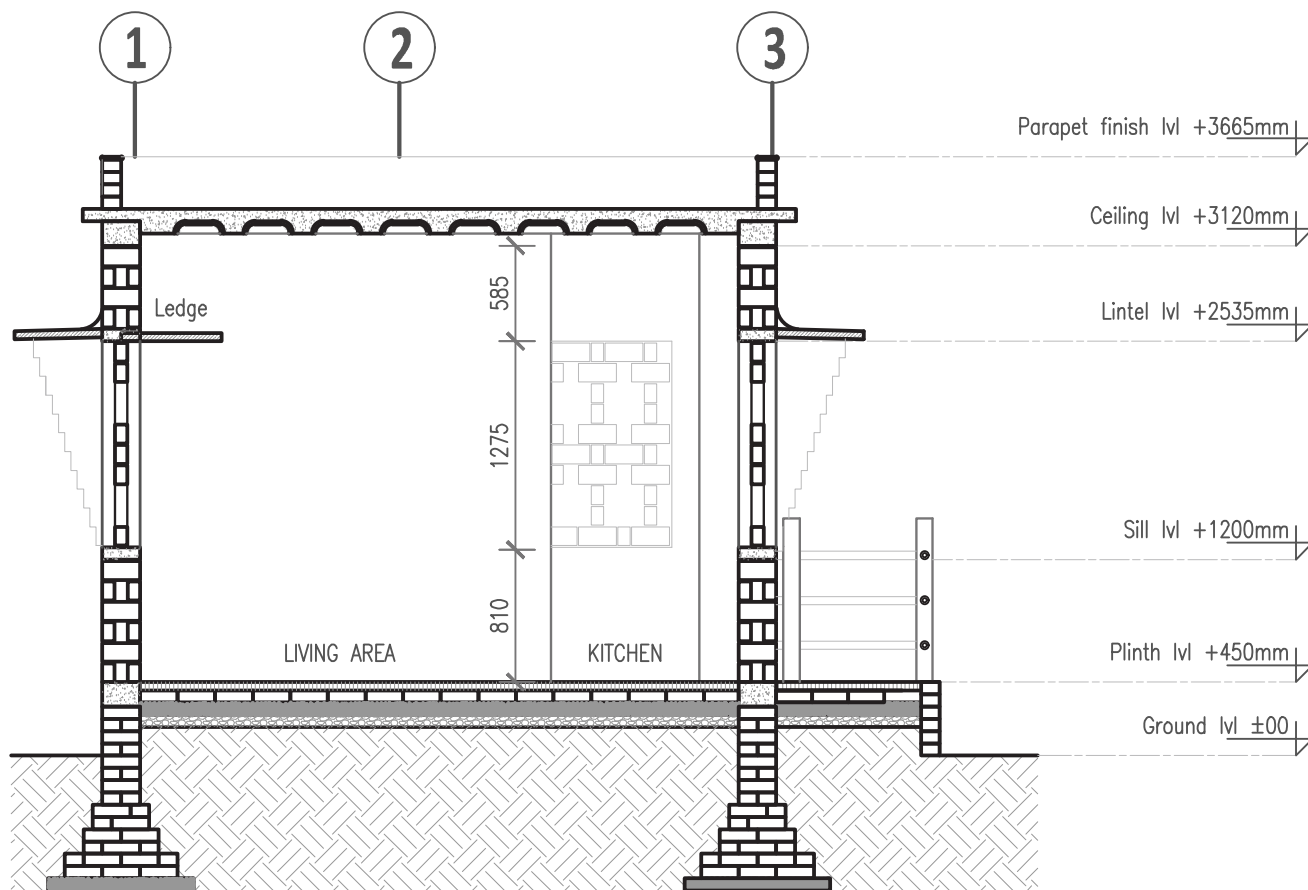
ZONE - F UP-F-01



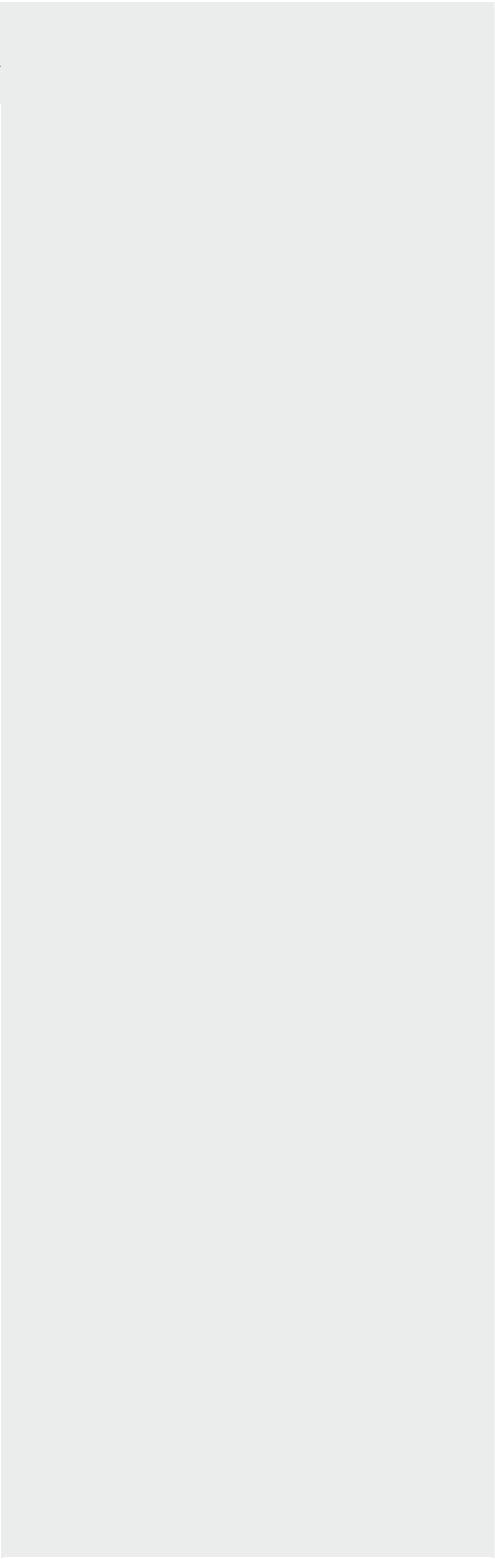
UTTAR PRADESH

ZONE - F
UP-F-01**Total Cost ₹ 163,513/-****UTTAR**
PRADESH**ELEVATION SIDE D**

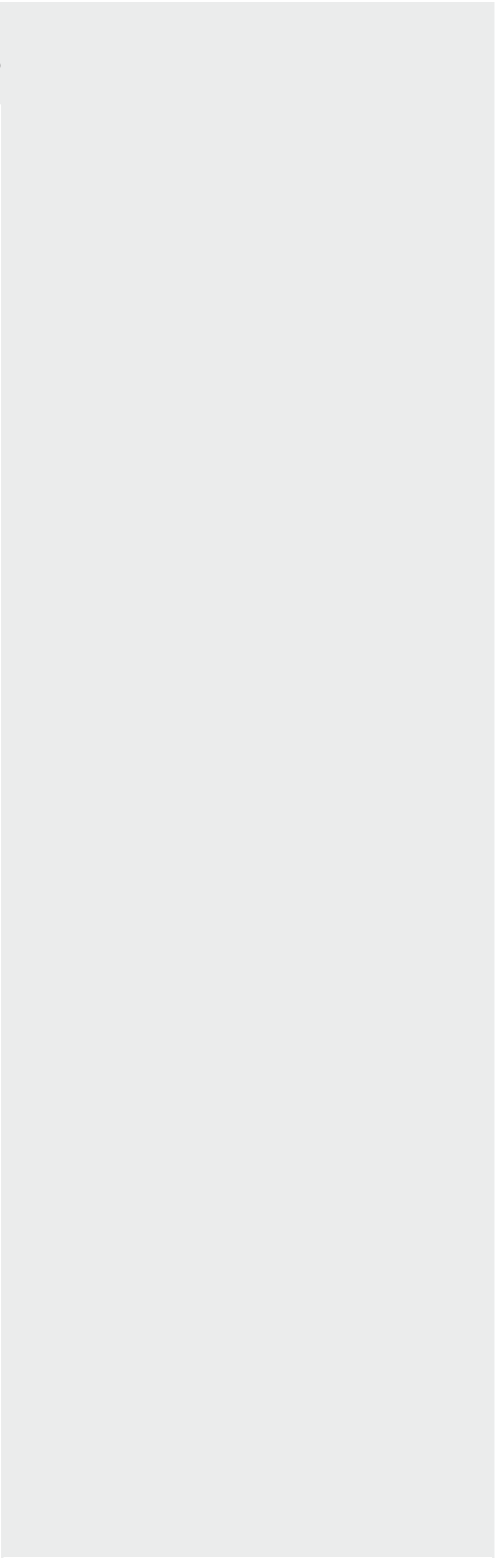
ZONE - F UP-F-01

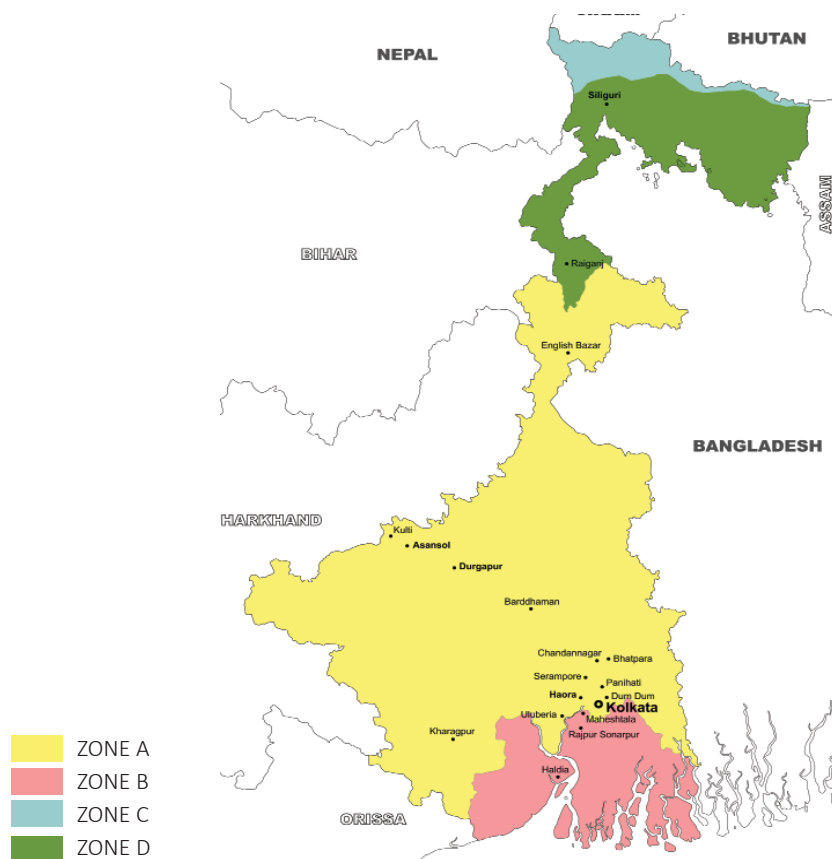


UTTAR
PRADESH



West Bengal





Dividing the state into housing typology zones is a system of categorization that takes into account various parameters. Primarily, these include geo-climatic conditions, vulnerability to disasters, availability of natural resources, communities of the region, their lifestyles, occupations and skill sets. The variations observed in building typologies largely correspond to the above mentioned premises and are therefore grouped together forming blurred frontiers between any two given regions.

The state of Bengal is extremely diverse in terms of its geographic conditions that naturally influence all other factors that affect housing typologies. Preliminary studies indicated 5 zones, namely; Coastal & Delta, East of Ganga, West of Ganga, Terai highlands and Hills.

This gave rise to four distinct housing typology zones, where the regions lying East and West of Ganga were merged to form the inland central portion of the state. Following are the descriptions of each Zone along with images of the different landscapes and terrain found within the region

Zone A

Building typology Zone A is characterized by its diverse climate, geography and vastness. The Zone lies predominantly in the Ganga flood plain with the far western region around Purulia district prone to drought. Most parts of the zone fall under high temperature areas and regions with close proximity to the Ganga are prone to flooding. The Zone falls under seismic zone 3.

Zone B

The physical & the climatic features as described earlier are key to deriving the design configurations & identifying the context of the same across the zone. the typical house comprises of a verandah wrapped around the house & generally a ground or ground with mezzanine level structure. The distinct differences in the plan types of this zone arises from the difference between the mainland coastal areas & the island areas of the Sundarbans.

Zone C

This zone lies in close vicinity of Bhutan, Nepal & Tibet. The hills are the eastern extension of the Himalayas & the Dooars. The people native to this region are the Lepcahs, Bhutias, Rai etc. basic plan comprises of a verandah in the front & rooms within. It is a ground structure & most prevalent. The verandah is generally a simple indent within the rectangular footprint of the built form. This is usually done to prevent the addition of an additional roof overhang.

Zone D

The forest villages were often relocated by the forest department.

Protection against wildlife was extremely important. This caused the protection from wildlife creating stilt structures.

The sizes of houses varied with different configuration of verandahs, interior rooms & position of staircase. The Terai region is fairly tucked away in the dooars & are accessible through hill roads. although commuting with roads is maintained, it is still relatively remote. Rich in natural resources.

WEST BENGAL

ZONE-A

Zone A comprise 9 districts:

Inland & central Bengal.

1. Paschim Mednipur
2. Bankura, Purulia
3. Bardhaman
4. Birbhum
5. Maldah
6. Dakshin Dinajpur
7. Murshidabad
8. Nadi
9. North 24 Parganas.

Resources Available

- Locally available Mud
- Stone
- Thach Roof

Zone A has one typology

WB-A-01



WB-A-01

- Intervention in structure & material solutions.
- R.C.C plinth, timber lintel & roof level ties provided to protect against seismic activities.
- Combination of GI sheet & thatch roof. Thatch acts as insulation & is protected by the GI sheet.
- Stabilized mud plaster for the exterior is an option.
- Mezzanine joints of bamboo extends to the outside to support addition of verandah roofs in incremental growth.

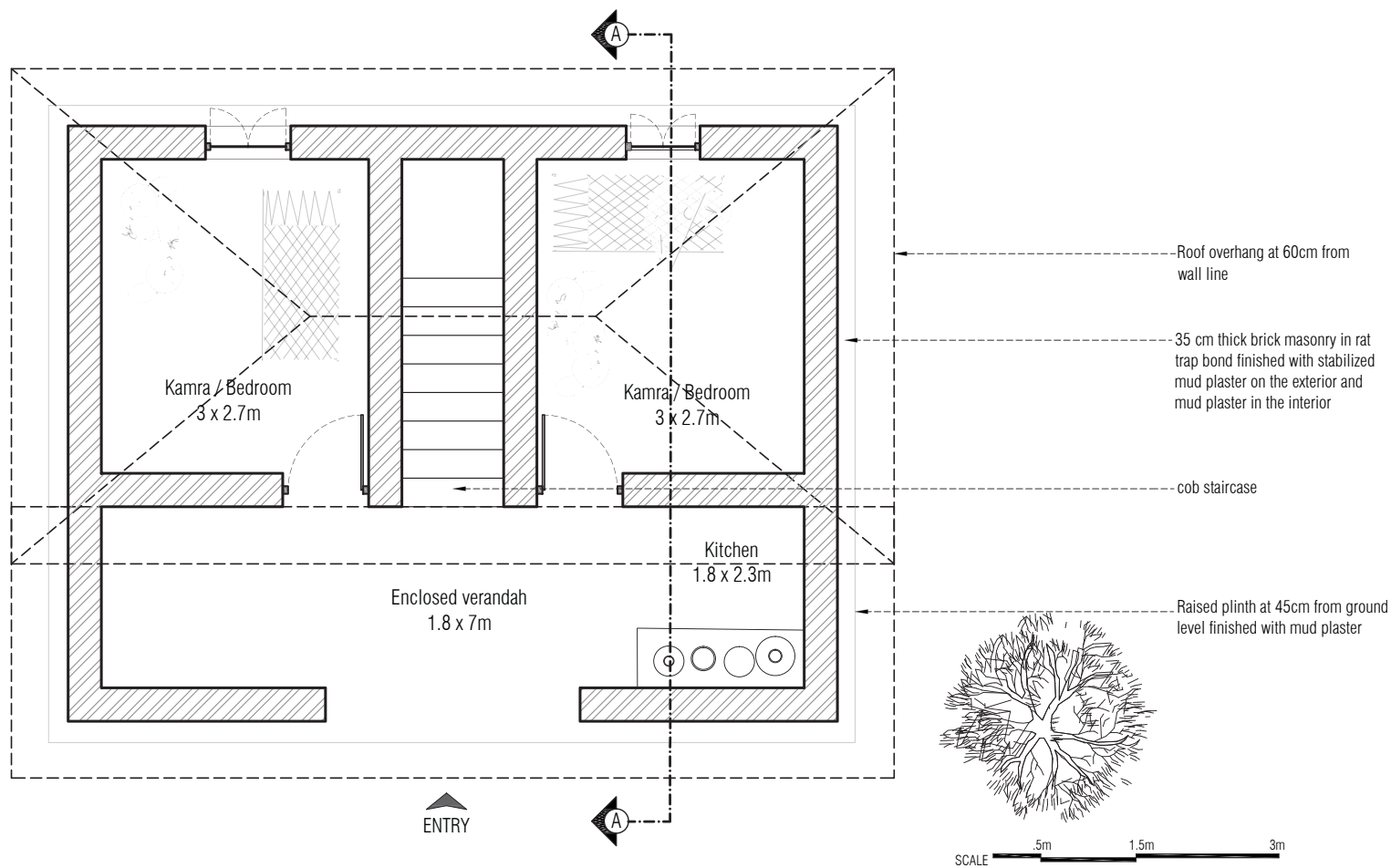
Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
This plan type includes a single room with a two way pitch roof extended over the open verandah in the front	Normal plinth design.	Sloped roof.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • Brick foundation • In case of black cotton soil should go to 60 cm, else minimum 45 cm. 	
Plinth	<ul style="list-style-type: none"> • Minimum 30 cm and 30 cm projected from the walls to protect the foundation and provide stability to the structure. 	
Wall	<ul style="list-style-type: none"> • Brick Wall with Chicken Mesh Reinforced Stabilized Mud Plaster 	<ul style="list-style-type: none"> • Wall plates should take loads of rafters and beams to further distribute the load on the cob walls.
Wall Finish	<ul style="list-style-type: none"> • Stabilised Mud Plaster 	
Roof Structure	<ul style="list-style-type: none"> • Roof slope angle – min 25 & max 33. • Covered with sheet & has treated bamboo understructure 	<ul style="list-style-type: none"> • Rigid connections between all roof members to increase stability.
Roof Cover	<ul style="list-style-type: none"> • Country Tiles with Timber Understructure. 	<ul style="list-style-type: none"> • Woven reed mats can be used below the tiles as false ceiling for thermal insulation.
Floor	<ul style="list-style-type: none"> • Mud Floor with cow dung 	

WEST BENGAL



TYPICAL PLAN

ZONE - A WB-A-01

Total Cost ₹ 176,940/-



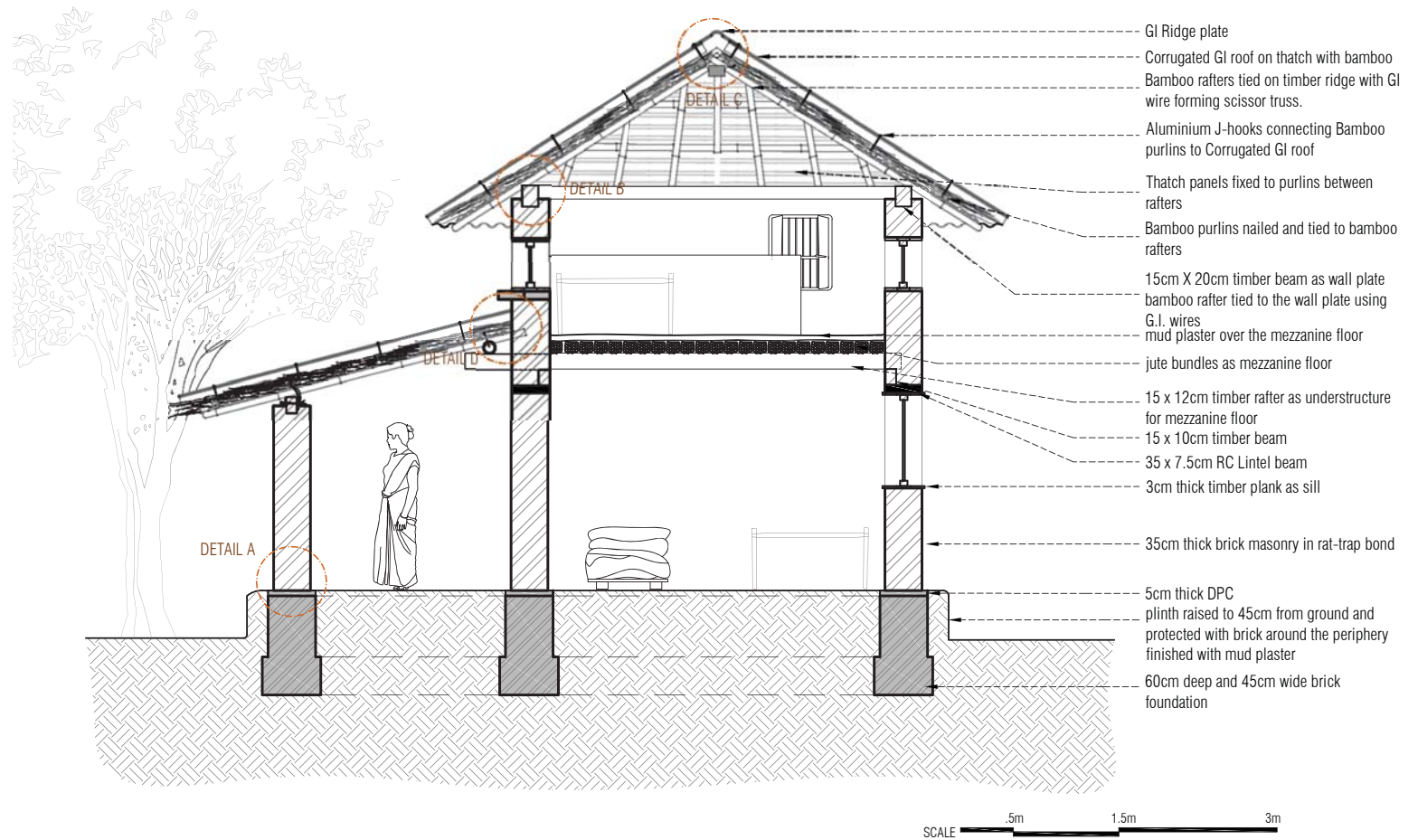
WEST BENGAL

ZONE - A

WB-A-01

A

WEST BENGAL



TYPICAL SECTION

Cost Estimate for WB-A-01

SR. NO.	Materials & Elements	CS Area	Length	width	ht/thk	Quantity	Volume	Volume	Area	Area	Material Cost	Rate	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	cft	sqm	sqft		Rs.		
1	FOUNDATION													
	DPC	0.023	41.58				0.95634				1000	₹ 8,000.00	per cum	
	Brick	0.24	41.58			9979.2	9.9792				69854.4	₹ 5.00	per brick	5000
W	TOTAL										70854.4			5000
2	WALLS													
	Cob wall verandah	8.93			1.75		15.6275				3125.5	₹ 200.00	per cum	
	cob wall	12.231			3.71		45.37701				9075.402	₹ 200.00	per cum	
	Wood for lintel band		0.9	0.35	0.03	12	0.00945	0.333585			2001.51	₹ 1,000.00	per cft	20000
	Doors					4					3600	₹ 500.00	per pc	
	Windows					5					2500	₹ 700.00	per pc	
X	TOTAL										20302.412			20000
3	MEZZANINE FLOOR													
	staircase						6.19				1238	₹ 200.00	per cum	
	timber lintel Beam	0.015	7.4				0.111				888	₹ 8,000.00	per cum	
	Timber beams	0.018	4.118			10	0.74124	26.16577			9158.0202	₹ 300.00	per cft	
	jute bundles	22.49			0.02		0.4498	15.87794			1000	₹ 300.00	per cft	
	mud plaster										500	₹ 15.00	per sqft	
Y	TOTAL										12784.0202			
4	ROOF													
	Structure								54.4		23000	₹ 720.00	per sqm	
	Thatch								54.4	585.344	5000	₹ 50.00	per sqft	
Z	TOTAL										28000			20000
	TOTAL (A + B)	176940.83									131940.8322			45000
											A(w+x+y+z)			B
	GRAND TOTAL (A + B)	176940.8	The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from on the urban center or source, geography, time, availability and accessibility to the local resources, etc.											
	AREA (sqm)	57												
	RATE OF CONSTRUCTION (per sqm)	3104.225126												
	AREA (sqft)	609.9												
	RATE OF CONSTRUCTION (per sqft)	290.1144978	The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.											

ZONE - A WB-A-01

Cost breakup

Item	Cost (INR)
Foundation	75,854/-
Walls	40,302/-
Mezzanine and Roof	60,784/-
Total	176,940/-



WEST BENGAL

ZONE-B

Zone B comprise 2 districts

Coastal & Deltaic parts.

1. Purab Medinipur
2. South 24 Parganas.

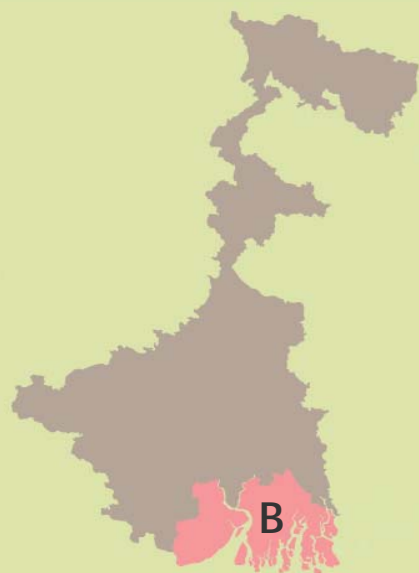
Resources Available

- Local available Mud
- Terra-cotta Tiles
- Stone

Zone B has two typologies

WB-A-01

WB-A-02



WEST BENGAL



WB-B-01

- Intervention in structure & material solutions.
- R.C.C plinth, timber lintel & roof level ties provided to protect against seismic activities.
- Combination of GI sheet & thatch roof. Thatch acts as insulation & is protected by the GI sheet.
- Stabilized mud plaster for the exterior is an option.
- Brink walls built to protect the raised mud plinth during water logging.



WB-B-02

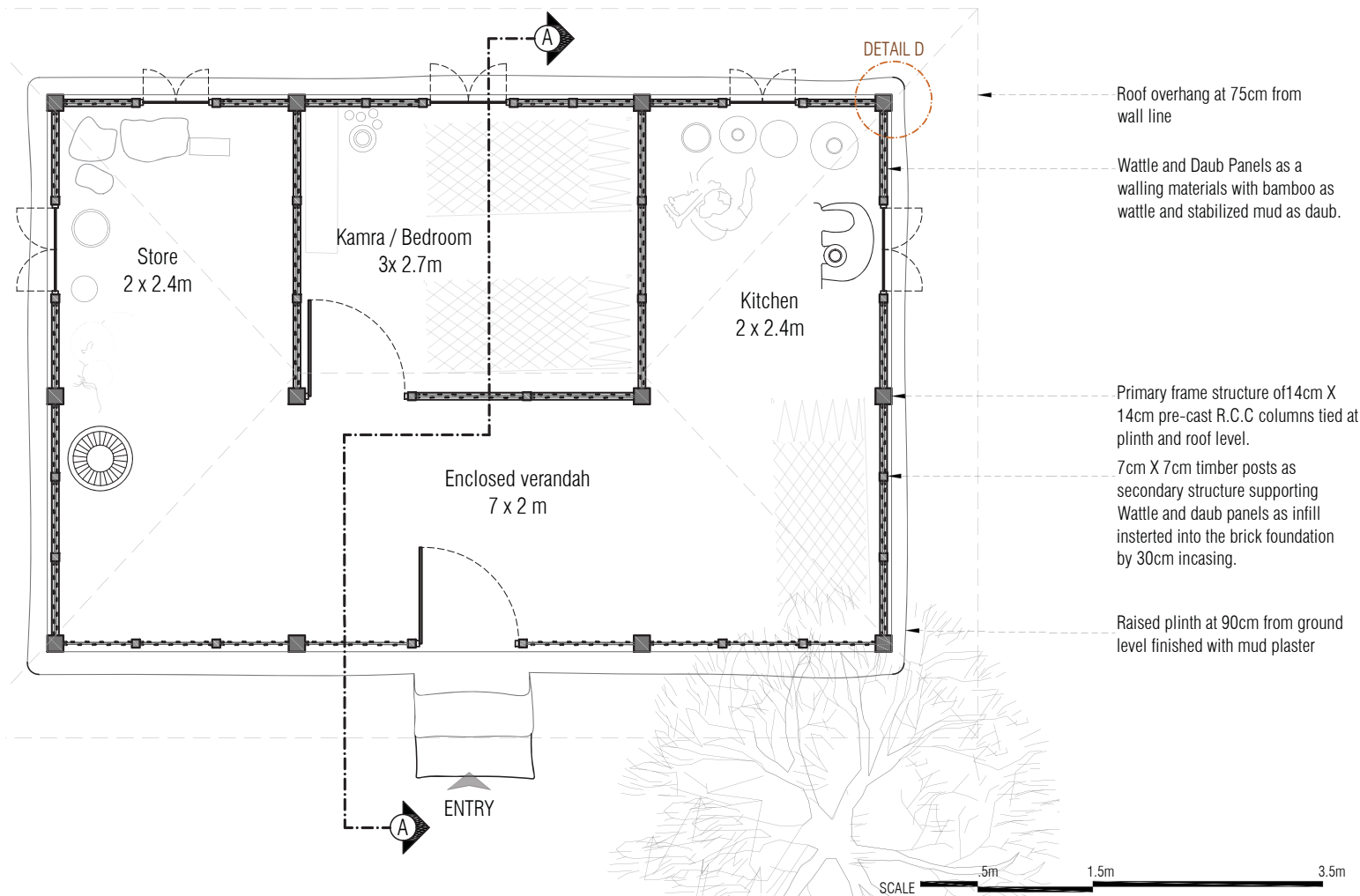
- Intervention in structure & material solutions.
- R.C.C plinth, timber lintel & roof level ties provided to protect against seismic activities.
- Combination of GI sheet & thatch roof. Thatch acts as insulation & is protected by the GI sheet.
- Stabilized mud plaster for the exterior is an option.
- Mezzanine joints of bamboo extends to the outside to support addition of verandah roofs in incremental growth.

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
Sundarbans style or single room on ground with a staircase on one side & verandah wrapped around on all sides.	Raised plinths. (4 ft. in heavy flood regions)	Pitched roof.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • 60 to 90 cm deep foundation. • Fired brick with mud/cement mortar. • Sand packed dry stone foundation 	<ul style="list-style-type: none"> • Cob/earth foundation, compressed earth blocks, adobe blocks.
Plinth	<ul style="list-style-type: none"> • Raised plinths. • RCC plinths & lintel bands. 	
Wall	<ul style="list-style-type: none"> • Fired brick & stone – mud/cement mortar • Adobe blocks, compressed earth blocks, rammed earth, cob with mud mortar. 	<ul style="list-style-type: none"> • Addition of plinth & lintel band.
Wall Finish	<ul style="list-style-type: none"> • Mud plaster with cow dung or lime/cement. • Coating of a bituminous mix of silt & burnt rubber with local adhesive. 	<ul style="list-style-type: none"> • Limewater over exposed masonry • Natural varnish & resin coating over wooden areas.
Roof Structure	<ul style="list-style-type: none"> • Timber, Bamboo, RCC, GI pipes- understructure. • Roof has an overhang for wall protection of 45-60cm. 	<ul style="list-style-type: none"> • Roof insulation. • Corrugated bamboo & GI sheets. • Roof anchorage to its under structure & wall.
Roof Cover	<ul style="list-style-type: none"> • Thatch, terra-cotta flat & country tiles, corrugated GI sheets. 	
Floor	<ul style="list-style-type: none"> • Mud plaster with cow dung. • Jute bundles with mud plaster. 	<ul style="list-style-type: none"> • Soorkhi • Lime crete



TYPICAL PLAN

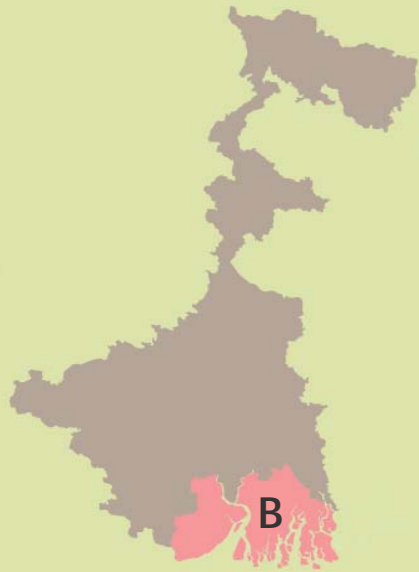
ZONE - B WB-B-01

Total Cost ₹ 183,813/-

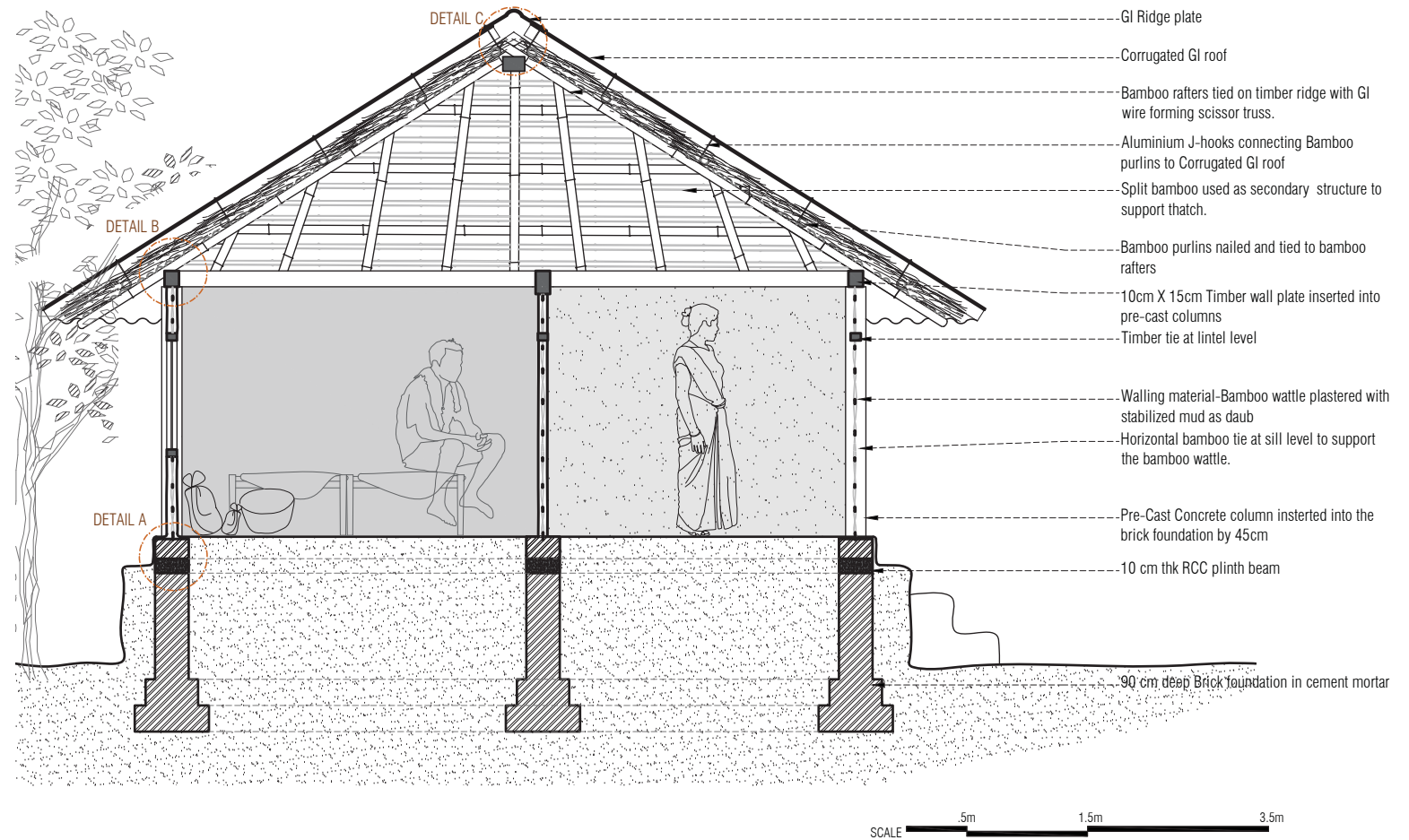


WEST BENGAL

ZONE - B WB-B-01



WEST BENGAL



TYPICAL SECTION

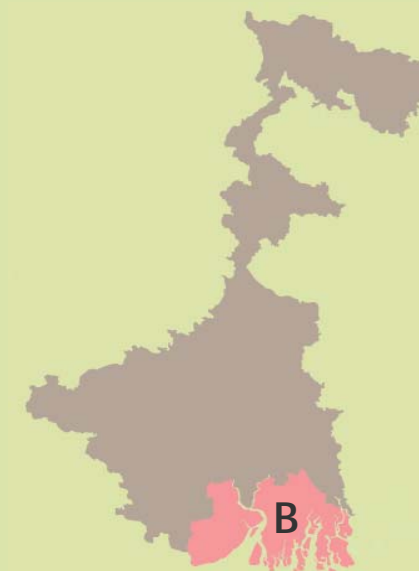
Cost Estimate for WB-B-01

SR. NO.	Materials & Elements	CS Area	Length	width	ht/thk	Quantity	Volume	Volume	Area	Area	Material Cost	Rate	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	cft	sqm	sqft		Rs.		
1	FOUNDATION													
	RCC Plinth Beam	0.023	24.2				0.5566				4452.8	₹ 8,000.00	per cum	
	Brick work	0.3	24.2			7260	7.26				36300	₹ 7.00	per brick	
W	TOTAL										40752.8			5000
2	STRUCTURE													
	Wood columns and bands		0.07	0.07	1.38	15	0.10143	3.580479			26853.5925	₹ 500.00	per cft	
	RCC Columns	0.0196			1.7	12	0.03332				3198.72	₹ 8,000.00	per cum	
X	TOTAL										30052.3125			5000
	WALLS													
	wattle pannels		25.2		1.7				42.84	460.9584	6914.376	₹ 15.00	per sqft	
	mud plaster for daub		33		1.7				56.1	603.636	9054.54	₹ 15.00	per sqft	
	Wood for lintel band		0.9	0.05	0.05	5	0.00225	0.079425			198.5625	₹ 500.00	per cft	
	Stabilised mud plaster for exterior		31		1.7				52.7	567.052	11341.04	₹ 20.00	per sqft	
	Doors					2					2000	₹ 1,000.00	per pc	
	Windows					5					3500	₹ 700.00	per pc	
Y	TOTAL										33008.5185			20000
4	ROOF													
	Structure & Corrugated sheet								53		30000	₹ 720.00	per sqm	
	Thatch								53	570.28	5000	₹ 50.00	per cft	
Z	TOTAL										35000			20000
TOTAL (A + B)		183813.63									138813.631			45000
											A(w+x+y+z)			B
GRAND TOTAL (A + B)		183813.6	The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from on the urban center or source, geography, time, availability and accessibility to the local resources, etc.											
AREA (sqm)		40												
RATE OF CONSTRUCTION (per sqm)		4595.340775												
AREA (sqft)		428												
RATE OF CONSTRUCTION (per sqft)		429.4711005	The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.											

ZONE - B WB-B-01

Cost breakup

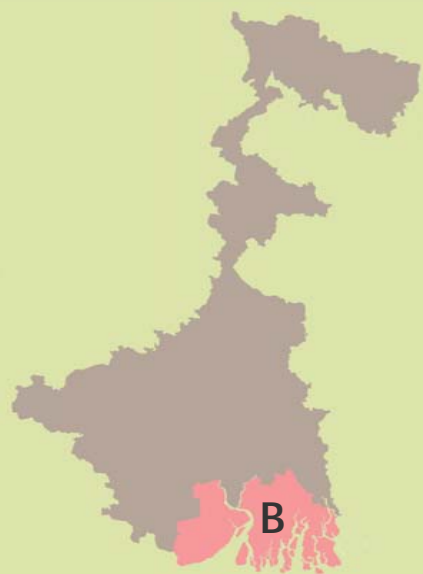
Item	Cost (INR)
Foundation	40,752/-
Framed Structure and Walls	88,061/-
Roof	55,000/-
Total	183,813/-



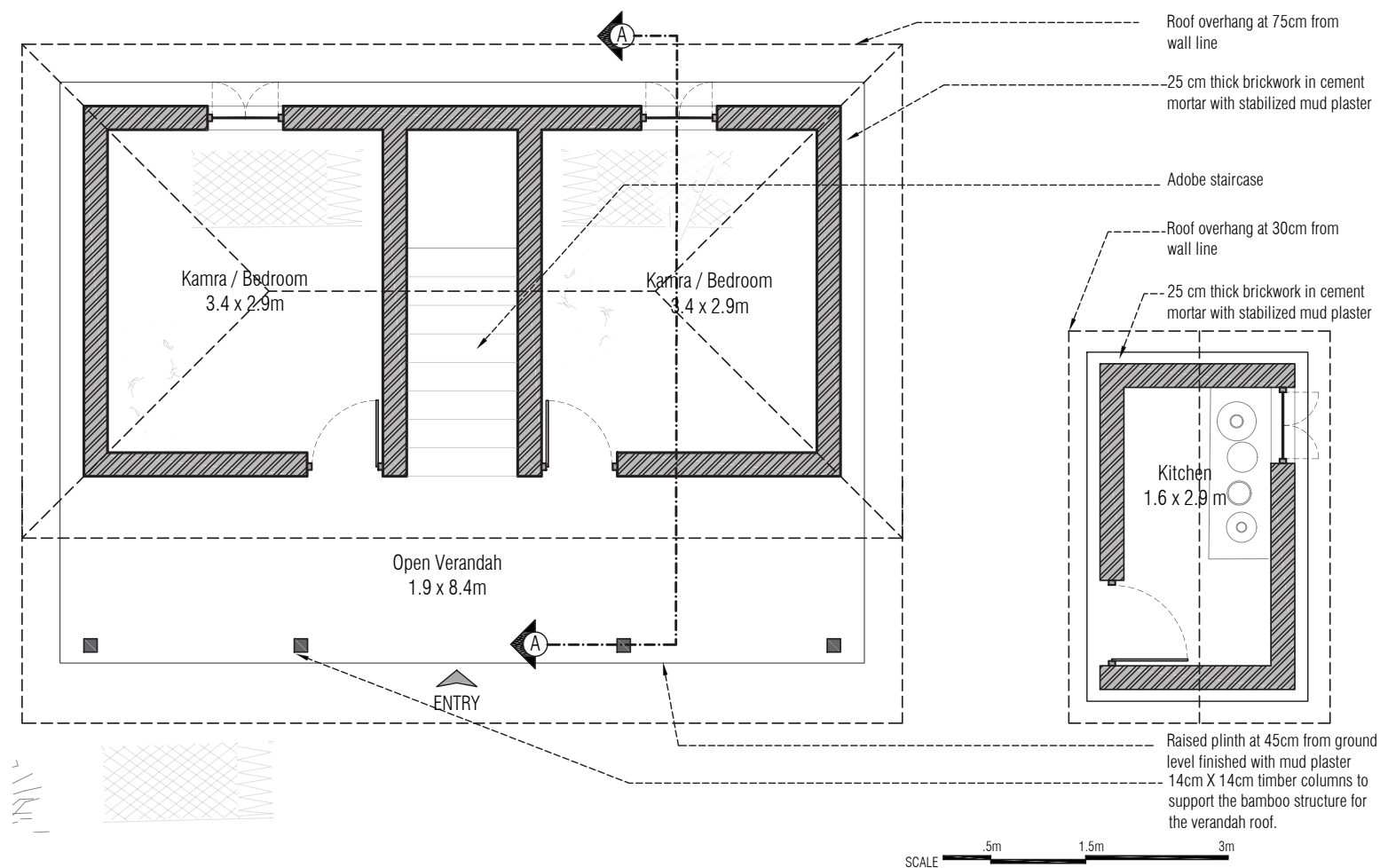
WEST BENGAL

ZONE - B WB-B-02

Total Cost ₹ 177,703/-

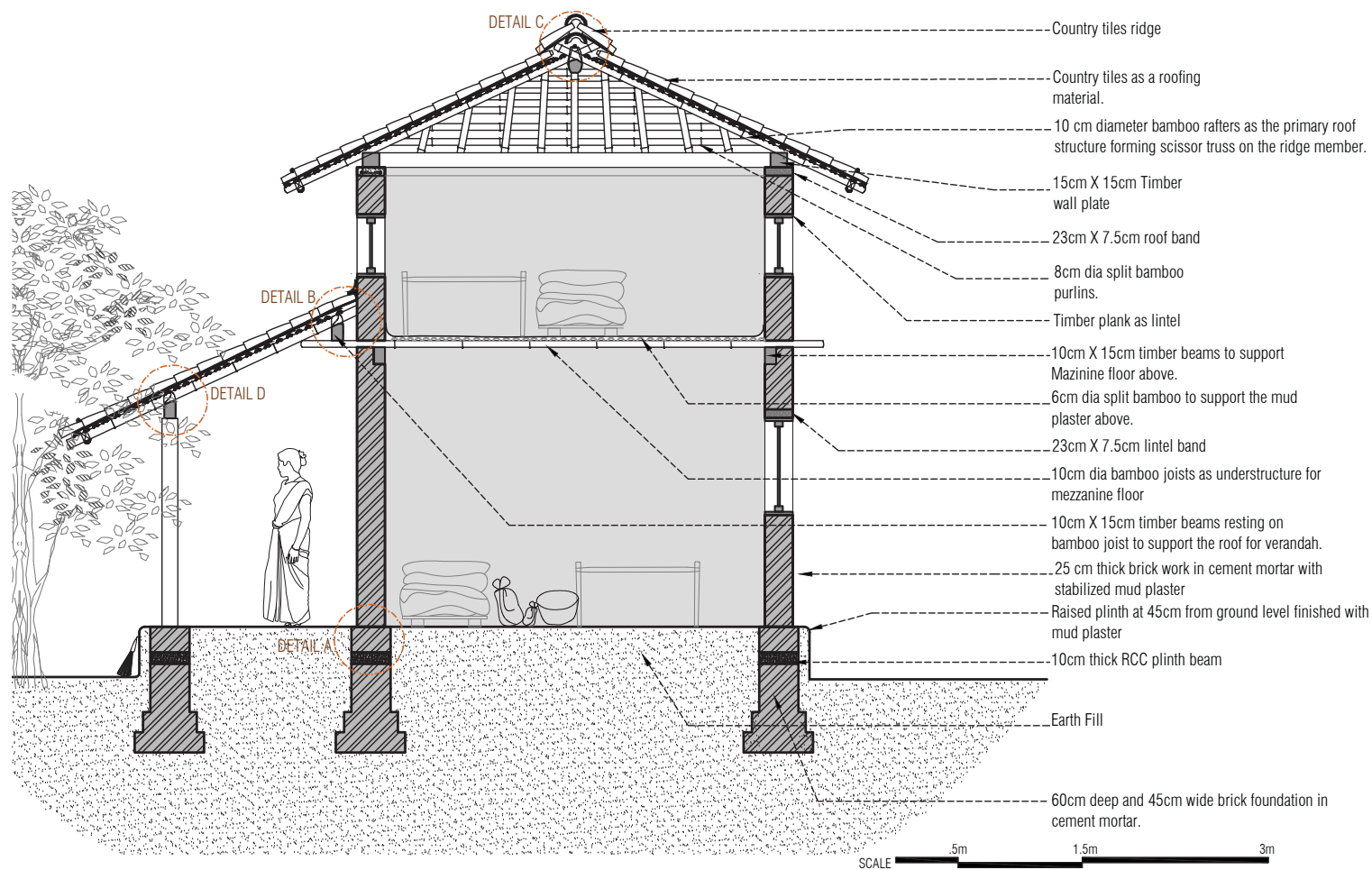


WEST BENGAL

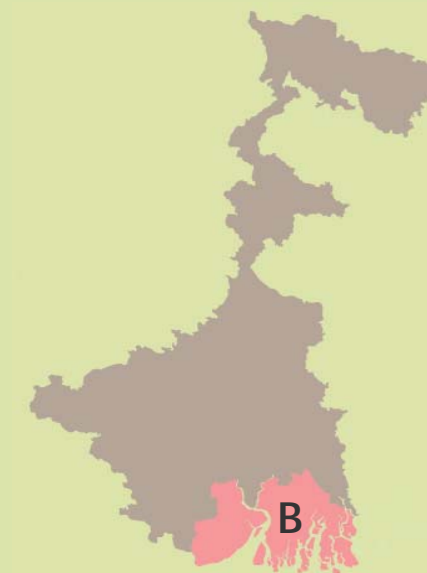


TYPICAL PLAN

ZONE - B WB-B-02



TYPICAL SECTION

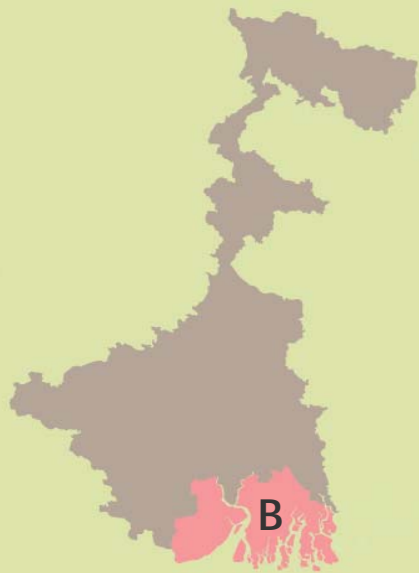


WEST BENGAL

ZONE - B
WB-B-02

Cumulative cost breakup

Item	Cost (INR)
Foundation	16,576/-
Walls and Mezzanine Floor	99,127/-
Roof	55,000/-
Total	170,703/-



WEST BENGAL

Cost Estimate for WB-B-02

SR. NO.	Materials & Elements	CS Area	Length	width	ht/thk	Quantity	Volume	Volume	Area	Area	Material Cost	Rate	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	cft	sqm	sqft		Rs.		
1	FOUNDATION													
	RCC Plinth Beam	0.023	40				0.92				7360	₹ 8,000.00	per cum	4500
	Adobe work	0.655			24		15.72				4716	₹ 300.00	per cum	
W	TOTAL										12076			4500
2	WALLS													
	Adobe wall house		32	0.35	4.1		45.92				13776	₹ 300.00	per cum	
	Wood for verandah columns		0.14	0.14	1.85	4	0.14504	5.119912			2559.956	₹ 500.00	per cft	
	Wood for sill band		0.07	0.07	1.6	3	0.02352	0.830256			415.128	₹ 500.00	per cft	
	Wood for linel band		0.07	0.07	1.6	3	0.02352	0.830256			415.128	₹ 500.00	per cft	
	Wood for verandah roof band	0.148	16				2.368	83.5904			41795.2	₹ 500.00	per cft	
	Doors					4					4000	₹ 1,000.00	per pc	
	Windows					6					4200	₹ 700.00	per pc	
X	TOTAL										67161.412			9000
	MEZZANINE FLOOR													
	Staircase						6.17				4936	₹ 800.00	per cum	
	Timber beams	0.015	24				0.36	12.708			6354	₹ 500.00	per cft	
	Bamboo joist	0.007	60				0.42	14.826			3706.5	₹ 250.00	per cft	
	Stabilised mud plaster								18.4	197.984	2969.76	₹ 15.00	per sqft	
Y	TOTAL										17966.26			5000
4	ROOF													
	Structure & tile								50		40000	₹ 800.00	per sqm	15000
Z	TOTAL										40000			15000
	TOTAL (A + B)	170703.67									137203.672			33500
	TOILET COST (C)	7000									A(w+x+y+z)			B
	GRAND TOTAL (A + B + C)	177703.7												
	AREA (sqm)	52												
	RATE OF CONSTRUCTION (per sqm)	3417.378308												
	AREA (sqft)	556.4												
	RATE OF CONSTRUCTION (per sqft)	319.3811503												

The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from on the urban center or source, geography, time, availability and accessibility to the local resources, etc.

The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, corelating with the farming activity.



WB-C-01

- It is a prevalent plan type which has been intervened with structural & material solutions
- It is framed structure with R.C.C posts & ferrocement in fill. The roof is a R.C.C understructure with corrugated bamboo sheet on top.
- The verandah provided is a key design feature & works as a buffer space.
- The traditional plan type has been resolved within a grid for the frame structure to distribute equal load.
- Ties are provided at plinth, mezzanine & roof levels.

Recommendations for Built Form		
Plan Layout	Plinth/Floor	Roof Profile
2 basic types – Bhutias & Lepchas.	Stilt structure or raised plinths.	Slopped roof. Roof anchoring.

Recommendations for construction systems		
Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • Fired brick with mud/cement mortar. • Sand packed dry stone foundation. • RCC (for plinth beam) 	<ul style="list-style-type: none"> • 60 to 90 cm deep foundation • Stone with mud/cement mortar. • Plum concrete with river boulders/stone.
Plinth	<ul style="list-style-type: none"> • Raised plinths. • Stilt structure. • Plum concrete. 	
Wall	<ul style="list-style-type: none"> • Fired brick & stone – mud/cement mortar • Timber, Bamboo precast RCC frame. 	<ul style="list-style-type: none"> • Addition of plinth & lintel band.
Wall Finish	<ul style="list-style-type: none"> • Mud plaster with cow dung or lime/cement. • Natural varnish & resin coating over wooden areas. 	<ul style="list-style-type: none"> • Lime wash over exposed masonry
Roof Structure	<ul style="list-style-type: none"> • Pitched roof/ • Timber, Bamboo, RCC, GI pipes- understructure. • Roof insulation. • Corrugated bamboo & GI sheets. 	<ul style="list-style-type: none"> • Roof has an overhang for wall protection of 45-60 cm. • Roof anchorage to it's under structure & wall.
Roof Cover	<ul style="list-style-type: none"> • Corrugated GI sheets with thatch/bamboo weave insulation , corrugated bamboo sheets or slate/stone shingles. 	
Floor	<ul style="list-style-type: none"> • Mud plaster with cow dung. • Soorkhi • Timber or Bamboo (for first floor) 	

ZONE - C

Zone C comprise 3 districts :

1. Uttar Dinajpur
2. Cooch Behar
3. The plains of Jalpaiguri & Alipurduar

Resources Available

- Stone
- Bamboo
- Timber
- Naturally available Mud

Zone C has one typology

WB-C-01



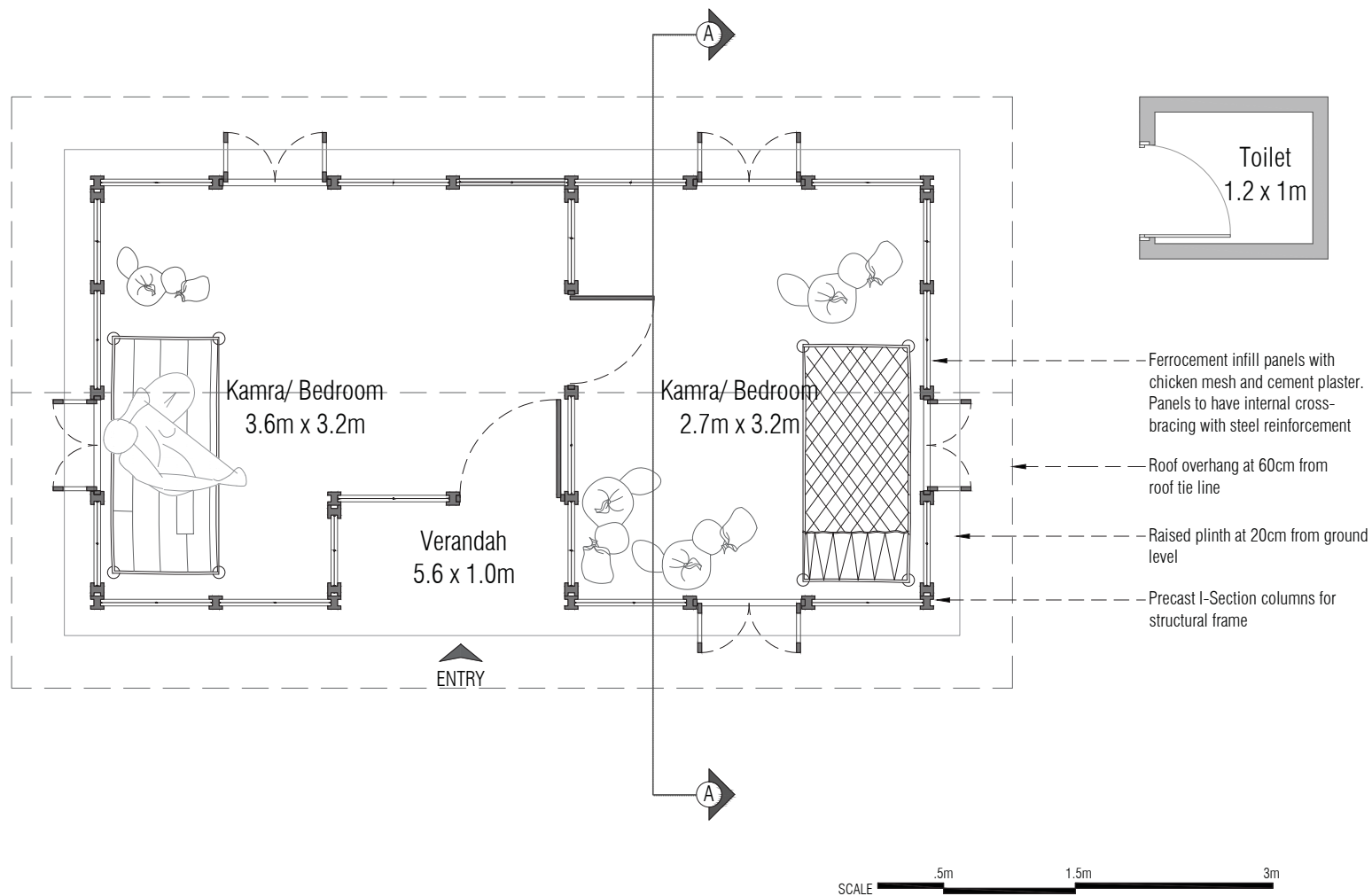
WEST BENGAL

ZONE - C WB-C-01

Total Cost ₹ 146,678/-



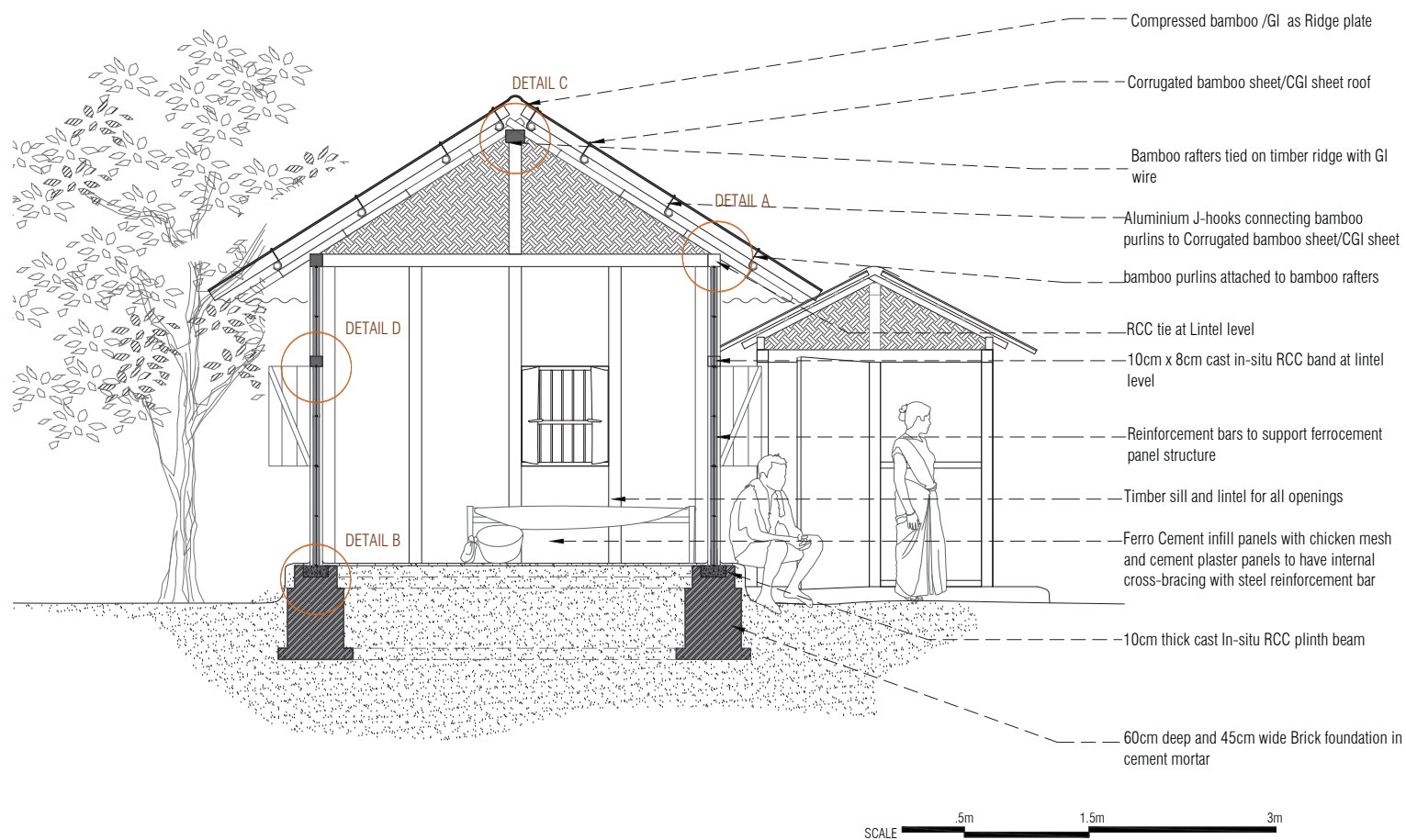
WEST BENGAL



TYPICAL PLAN

ZONE - C

WB-C-01



TYPICAL SECTION



WEST BENGAL

ZONE - C
WB-C-01

Cost breakup

Item	Cost (INR)
Foundation	39,951/-
Framed Structure and Walls	57,646/-
Roof	34,080/-
Total	131,677/-



WEST BENGAL

Cost Estimate for WB-C-01

[illegible]

**WB-D-01**

- It is a light framed structure in timber with ties at plinth, sill lintel & roof level for protection against seismic activity.
- Efficient use of material is achieved by using upstanding brickwork as in fill wall till sill.
- Raised plinth protected with brickwork on its periphery against water logging.
- Space for toilets, wash areas, common courtyard & entrance enclosure has been provided for.
- In fill walls are light.

**WB-D-02**

- Stilted level is made out of bricks piers with a reinforcement bar at its center. It is tied at the plinth and top level and anchored into the ground acting like a frame structure.
- In fill walls are light like bamboo sheets or timber.
- Space for toilets, wash area, common courtyard and entrance enclosure has been provided for efficient material use for in fill walls by using upstanding brickwork.
- Raised plinth protected with brickwork which goes up to sill protecting the house during waterlogging.

Recommendations for Built Form

Plan Layout	Plinth/Floor	Roof Profile
Rectangular linear plan flanked by a covered verandah or raised building structure to protect from wildlife.	Stilt structure or raised plinths.	Sloped roof pitched roof.

Recommendations for construction systems

Components	Recommended Specifications	Specific Comments
Foundations	<ul style="list-style-type: none"> • 60 to 90 cm deep foundation. • Fired brick with mud/cement mortar. • Sand packed dry stone foundation. • Stone with mud/cement mortar. 	<ul style="list-style-type: none"> • Cob/earth foundation, compressed earth blocks, adobe blocks.
Plinth	<ul style="list-style-type: none"> • Raised plinths. • Stilt structure. 	<ul style="list-style-type: none"> • Plum concrete.
Wall	<ul style="list-style-type: none"> • Fired brick & stone – mud/cement mortar • Timber, Bamboo precast RCC frame. 	<ul style="list-style-type: none"> • Addition of plinth & lintel band.
Wall Finish	<ul style="list-style-type: none"> • Mud plaster with cow dung or lime/cement. • Coating of a bituminous mix of silt & burnt rubber with local adhesive. 	<ul style="list-style-type: none"> • Limewater over exposed masonry • Natural varnish & resin coating over wooden areas.
Roof Structure	<ul style="list-style-type: none"> • Timber, Bamboo, RCC, GI pipes- understructure. • Roof has an overhang for wall protection of 45-60cm. 	<ul style="list-style-type: none"> • Roof insulation. • Corrugated bamboo & GI sheets. • Roof anchorage to its under structure & wall.
Roof Cover	<ul style="list-style-type: none"> • Thatch, terra-cotta flat & country tiles, corrugated GI sheets. 	
Floor	<ul style="list-style-type: none"> • Mud plaster with cow dung. • Stabilised mud with oxide. • Timber or Bamboo (for first floor) 	

ZONE-D

Zone D comprise 8 districts

1. Uttar Dinajpur & Cooch Behar
2. The plains of Jalpaiguri & Alipurdwar
3. Zone D has two typologies

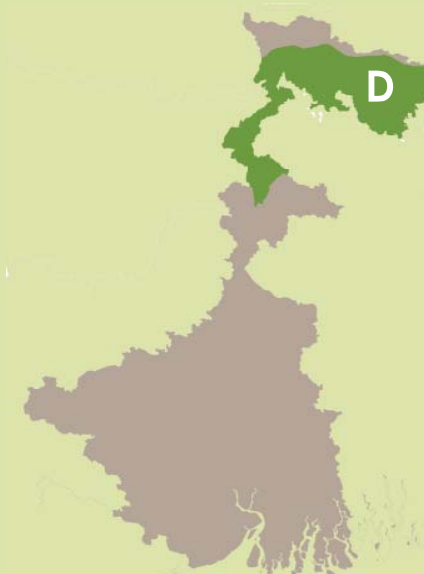
Resources Available

- Timber
- Bamboo
- Jute

Zone C has two typologies

WB-D-01

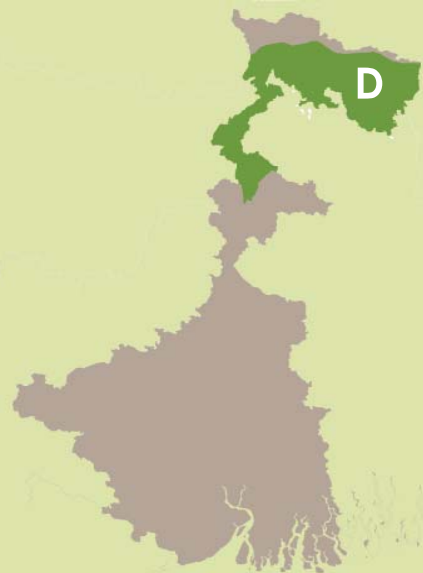
WB-D-02



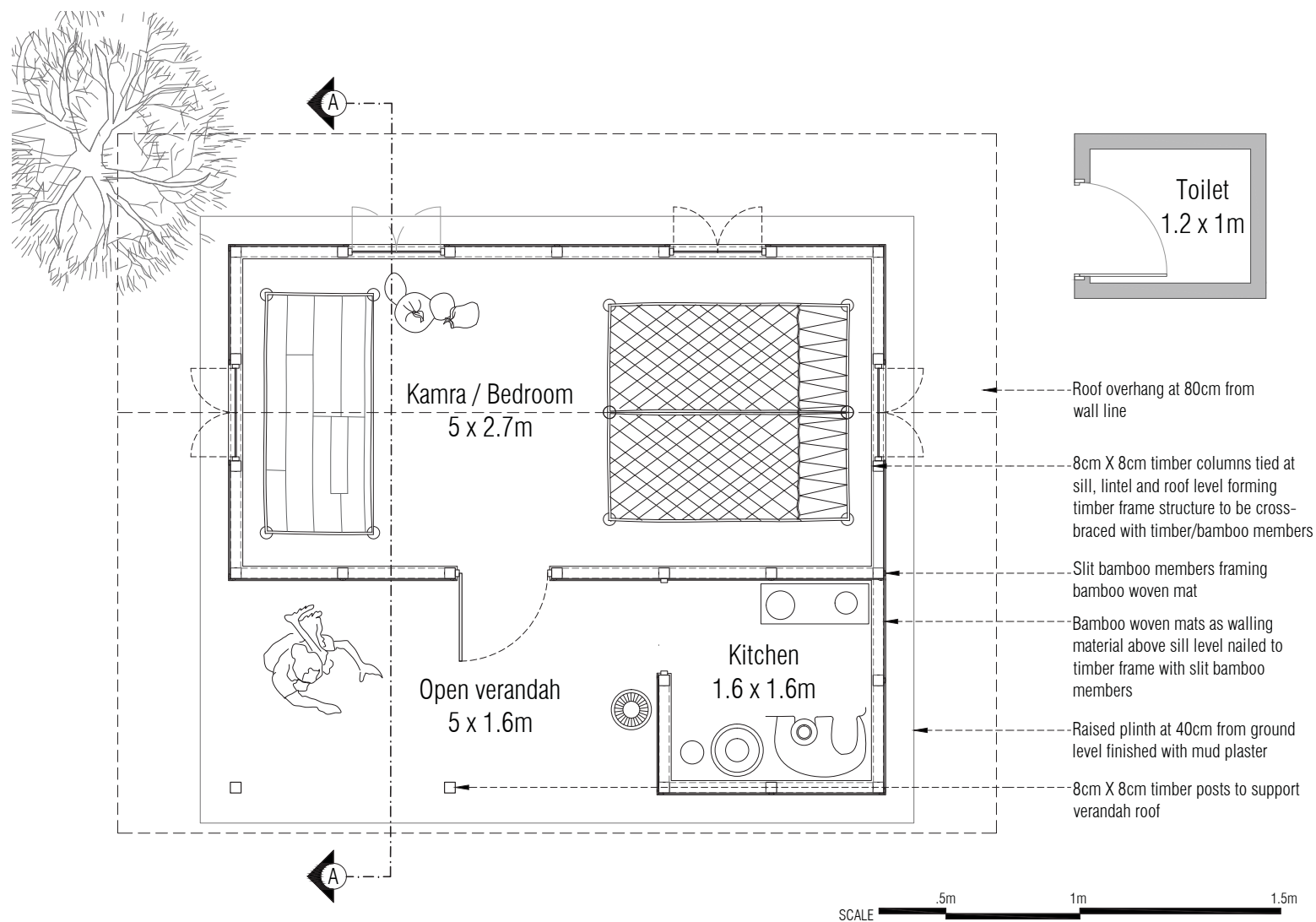
WEST BENGAL

ZONE - D WB-D-01

Total Cost ₹ 167,218/-

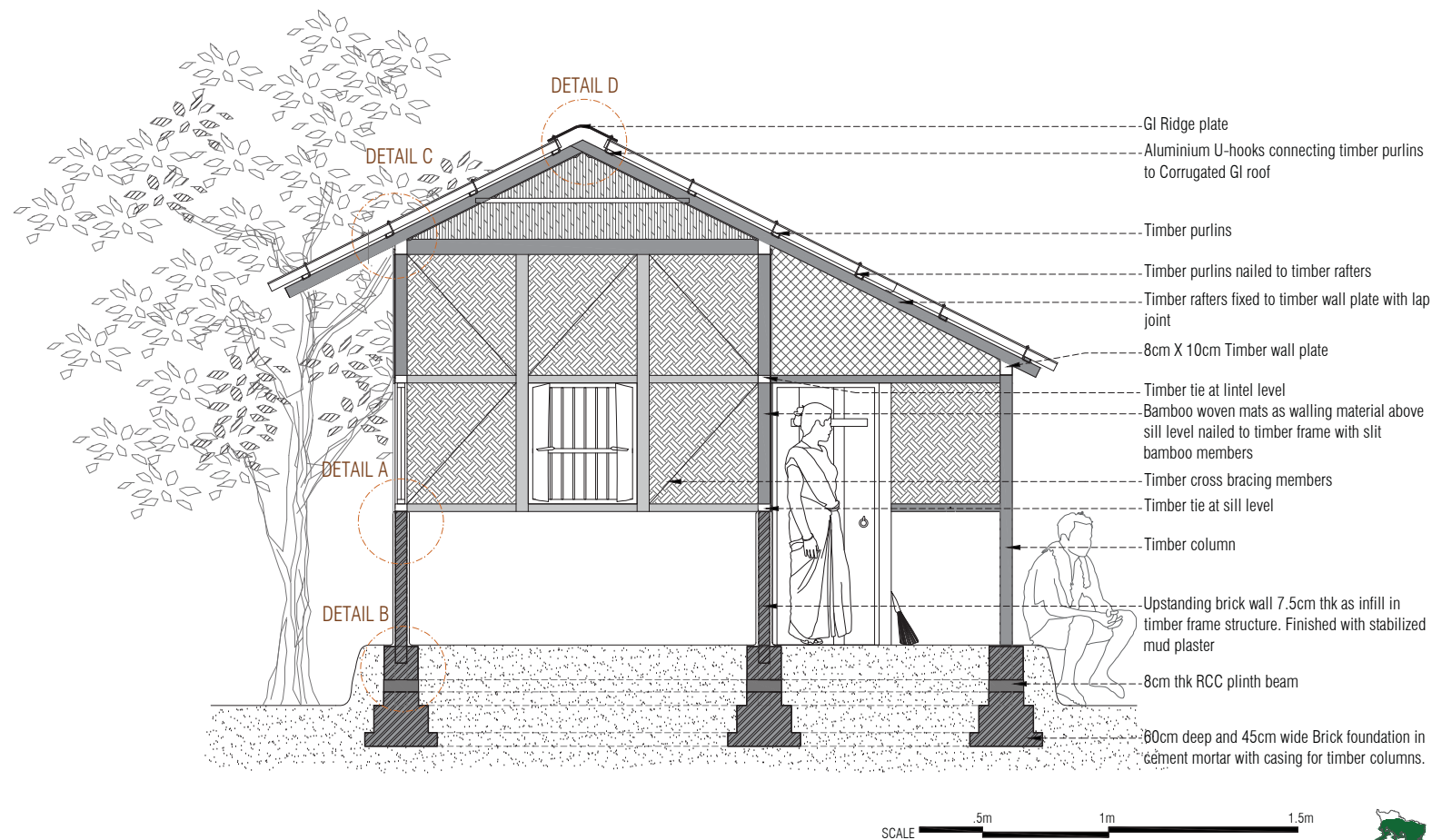


WEST BENGAL

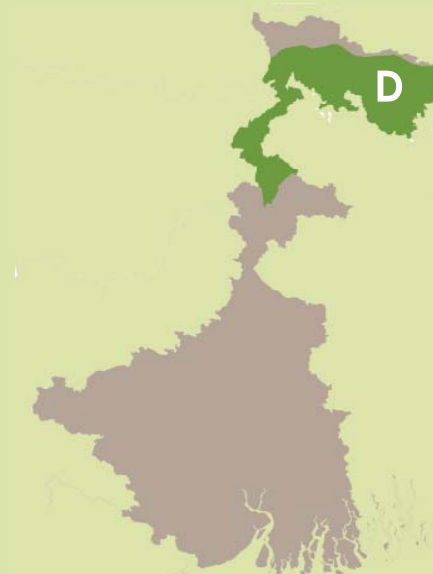


TYPICAL PLAN

ZONE - D WB-D-01



TYPICAL SECTION

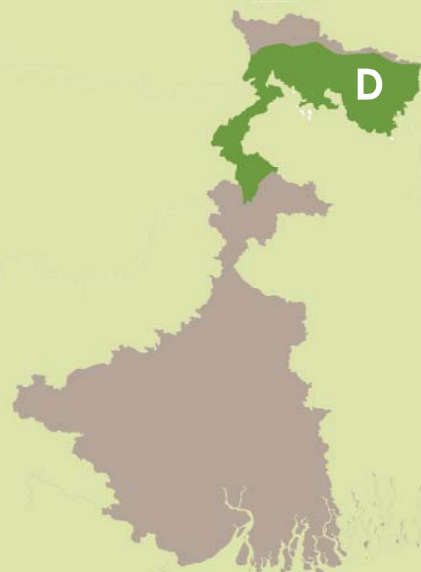


WEST BENGAL

ZONE - D
WB-D-01

Cost breakup

Item	Cost (INR)
Foundation	46,657/-
Framed Structure and Walls	55,442/-
Roof	65,119/-
Total	167,217/-



WEST BENGAL

Cost Estimate for WB-D-01

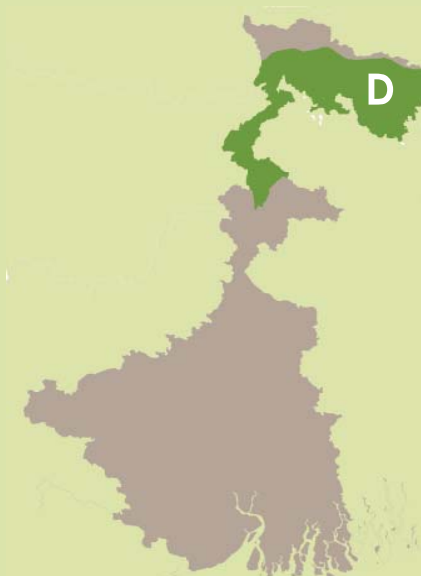
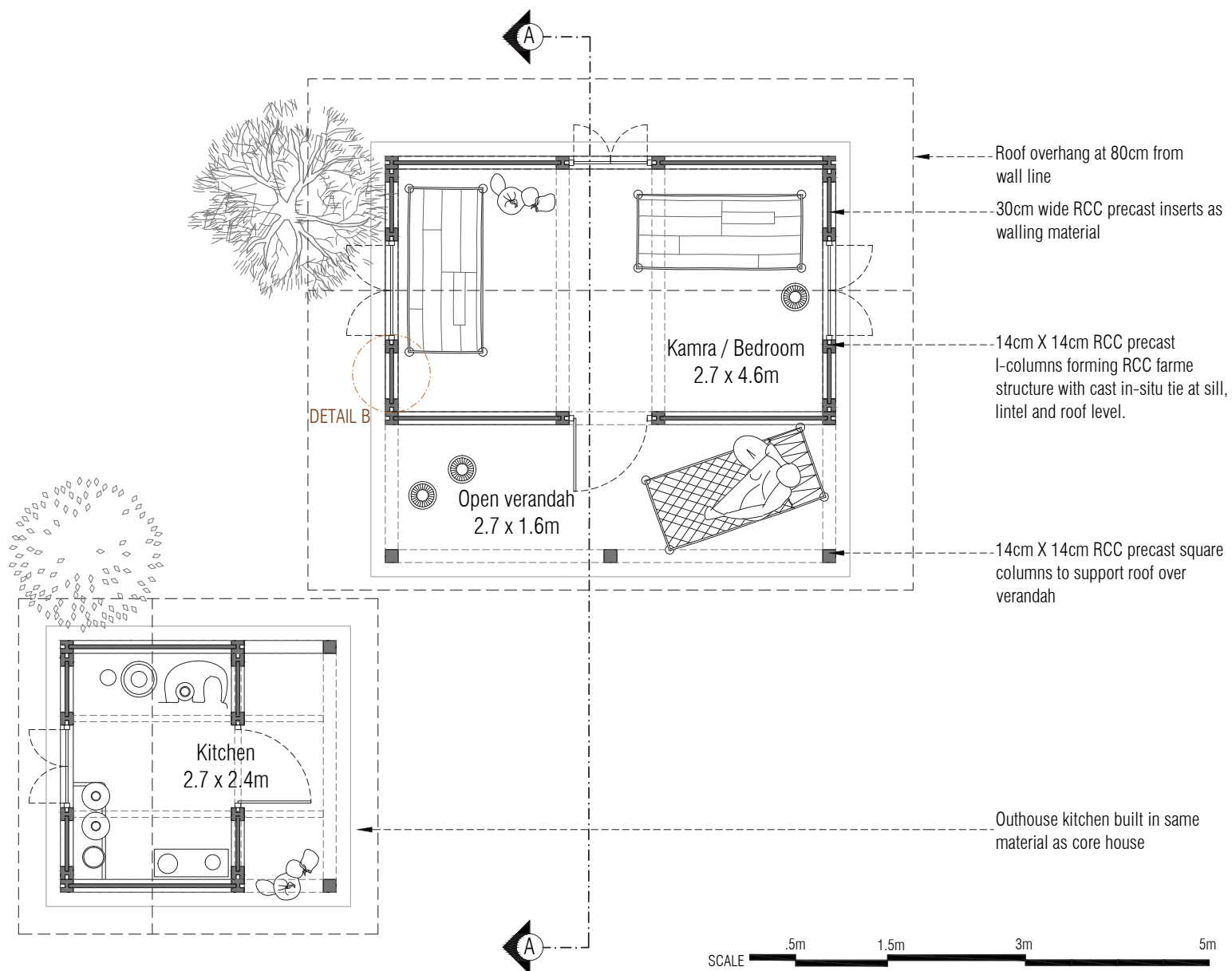
SR. NO.	Materials & Elements	CS Area sqm	Length m	width m	ht/thk m	Quantity Nos.	Volume cum	Volume cft	Area sqm	Area sqft	Material Cost	Rate Rs.	Unit	Labour cost
1	FOUNDATION													
	RCC Plinth Beam	0.021	22.6				0.4746				3796.8	₹ 8,000.00	per cum	10000
	Brick work	0.195	22.6			4407	4.407				30849	₹ 7.00	per brick	
	Mud work	25.14			0.4		10.056				2011.2	₹ 200.00	per cum	
W	TOTAL										36657			10000
2	FRAMED STRUCTURE													
	Wood for main columns		0.08	0.08	2.8	18	0.32256	11.38637			5693.184	₹ 500.00	per cft	15000
	Wood for verandah columns		0.08	0.08	2.4	7	0.10752	3.795456			1897.728	₹ 500.00	per cft	
	Wood for sill band		0.08	0.05	0.9	18	0.0648	2.28744			1143.72	₹ 500.00	per cft	
	Wood for linel band		0.08	0.05	1	5	0.02	0.706			353	₹ 500.00	per cft	
	Wood for roof band	0.008	21.06				0.16848	5.947344			2973.672	₹ 500.00	per cft	
X	TOTAL										12061.304			15000
	WALLS													
	Upstanding brick till sill	0.075	25			1875	1.875				13125	₹ 7.00	per brick	3150
	Bamboo weave mats full		10		2	0.764286			20	214	1146.428571	₹ 1,500.00	per 280sqft	5000
	Bamboo weave mats above lintel		8		1	0.305714			8	85.6	458.5714286	₹ 1,500.00	per 280sqft	
	Doors					2					2000	₹ 1,000.00	per pc	
	Windows					5					3500	₹ 700.00	per pc	
Y	TOTAL										20230			8150
4	ROOF													
	Timber rafters	0.47		0.05		12	0.282	9.9546			4977.3	₹ 500.00	per cft	20000
	Timber ties 1	0.04		0.02		12	0.0096	0.33888			169.44	₹ 500.00	per cft	
	Timber ties 2	0.21		0.07		12	0.1764	6.22692			3113.46	₹ 500.00	per cft	
	Timber ducth rafters	0.1		0.05		12	0.06	2.118			1059	₹ 500.00	per cft	
	Corrugated GI Sheet					22					30800	₹ 1,400.00	per pc	
Z	TOTAL										40119.2			25000
	TOTAL (A + B)	167217.5									109067.504			58150
											A(w+x+y+z)			B
	GRAND TOTAL (A + B)	167218												
	AREA (sqm)	24												
	RATE OF CONSTRUCTION (per sqm)	6967.396												
	AREA (sqft)	256.8												
	RATE OF CONSTRUCTION (per sqft)	651.1585047												

The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from on the urban center or source, geography, time, availability and accessibility to the local resources, etc.

The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year soan. corelating with the farming activity.

ZONE - D WB-D-02

Total Cost ₹ 205,564/-

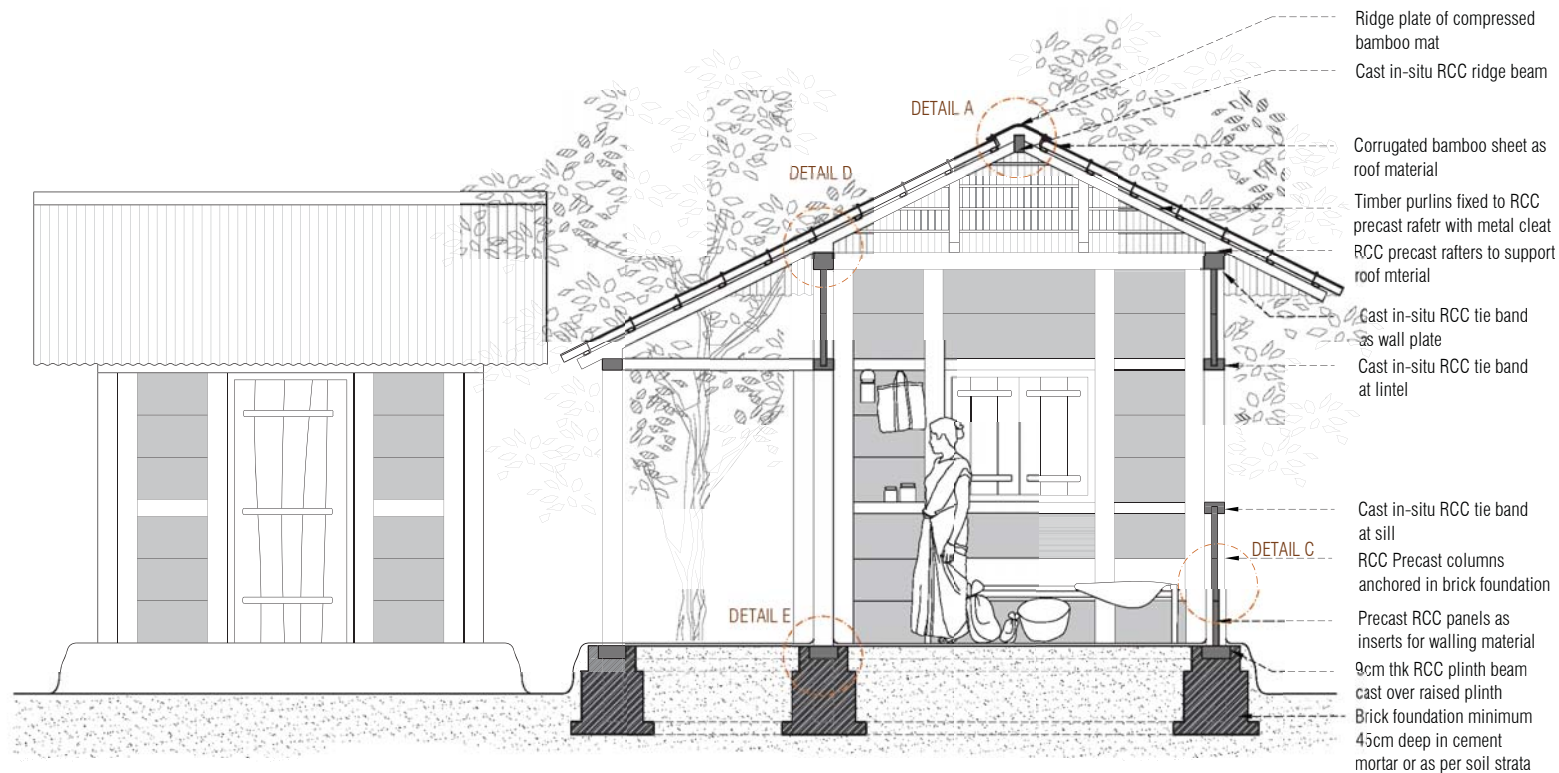


WEST BENGAL

ZONE - D WB-D-02



WEST BENGAL



TYPICAL SECTION

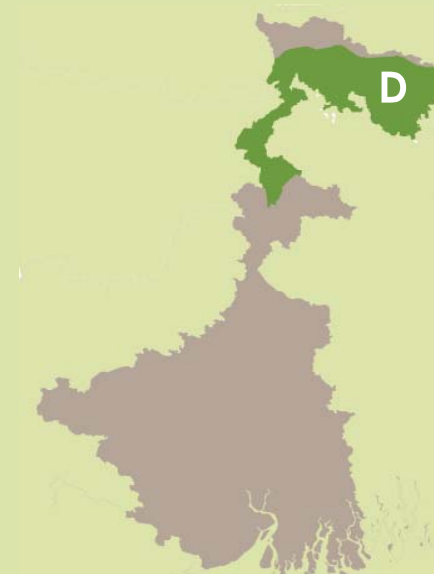
Cost Estimate for WB-D-02

SR. NO.	Materials & Elements	CS Area	Length	width	ht/thk	Quantity	Volume	Volume	Area	Area	Material Cost	Rate	Unit	Labour cost
		sqm	m	m	m	Nos.	cum	cft	sqm	sqft		Rs.		
1	FOUNDATION													
	RCC Plinth Beam	0.018	30				0.54				4320	₹ 8,000.00	per cum	
	Brick work	0.025	31			775	0.775				5425	₹ 7.00	per brick	8000
	Mud work	30			0.38		11.4				2280	₹ 200.00	per cum	
W	TOTAL										12025			8000
2	FRAMED STRUCTURE													
	10FTft ht main columns	0.016			3.2	16	0.8192				72089.6	₹ 6,000.00	per cum	
	6FT ht verandah columns	0.016			2.4	3	0.1152				1900.8	₹ 6,000.00	per cum	
	rcc for sill band	0.017	15				0.255				1530	₹ 500.00	per cft	12000
	RCC for linel band	0.017	15				0.255				1530	₹ 500.00	per cft	
	RCC for roof band	0.017	15				0.255				1530	₹ 500.00	per cft	
X	TOTAL										78580.4			12000
	WALLS													
	2ft X 6ft precast infill		1.8	0.3	0.04	32	0.0216	0.76248			3801.6	₹ 6,000.00	per cum	
	2ft X 4ft precast infill		1	0.3	0.04	15	0.012	0.4236			990	₹ 6,000.00	per cum	
	2ft X 2ft precast infill		0.6	0.3	0.04	32	0.0072	0.25416			1267.2	₹ 6,000.00	per cum	5000
	Doors					2					2000	₹ 1,000.00	per pc	
	Windows					4					2800	₹ 700.00	per pc	
Y	TOTAL										10858.8			5000
4	ROOF													
	Timber rafters	0.41			0.07	11	0.3157				19099.85	₹ 6,000.00	per cft	
	Timber purlins	0.001	4			30	0.12				10000	₹ 720.00	per cft	20000
	Corrugated GI Sheet										15000		lumpsum	
Z	TOTAL										44099.85			20000
	TOTAL (A + B)	190564.05									145564.05			45000
	TOILET COST (C)	15000									A(w+x+y+z)			B
	GRAND TOTAL (A + B + C)	205564	The rates are based on the data collected in the field visit. Average or most prevalent zone specific rate figure has been used, as it changes from region to region depending on the distance from the urban center or source, geography, time, availability and accessibility to the local resources, etc.											
	AREA (sqm)	34.5												
	RATE OF CONSTRUCTION (per sqm)	5958.378261												
	AREA (sqft)	369.15												
	RATE OF CONSTRUCTION (per sqft)	556.8577814	The labour rates are the general rates observed in the field visit overlaid with the amount of time taken in the construction of the building element. Though because of the high selfhelp component and people of the community helping each other in building it varies. The labour rates also depend on the time of construction in the year span, correlating with the farming activity.											

ZONE - D WB-D-02

Cost breakup

Item	Cost (INR)
Foundation	20,026/-
Framed Structure and Walls	106,438/-
Roof	64,100/-
Total	190,564/-



WEST BENGAL



सत्यमेव जयते

Ministry of Rural Development
Government of India