

Vernacular Mud Construction Techniques of Vidarbha Region -A Sustainable Approach

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Abstract—“Vernacular” - the simplest form of addressing human needs, is seemingly forgotten in modern architecture. Vernacular architecture is composed of local materials and derived from local customs, techniques that have been passed on from generation to generation. Mud construction techniques has been extensively used in almost all the regions of Vidarbha, but this vernacular architecture is disappearing slowly, because of new materials, techniques and wrong notion of people for modernity. Various schemes floated by government for housing is also one of the reasons for deteriorating the mud architecture. Hence this paper will showcase the vernacular architecture of various Agro Climatic Zones of Vidarbha region. It will further present the one case study from three zones-High Rainfall Zone, Moderate Rainfall Zone and Assured Rainfall Zone on the basis of the climate, agricultural waste product used in construction and most importantly the type of soil available for earthen construction. The paper will throw light on vernacular construction techniques adopted in that zone and its present scenario. This paper will finally discuss the recommendations which could be a step forward for conserving sustainable Vernacular Mud Architecture of Vidarbha Region.

1. INTRODUCTION

Vernacular architecture is a category of architecture based on local needs, construction materials and reflecting local traditions. Vernacular architecture is influenced by a great range of different aspects of human behavior and environment, leading to differing building forms for almost every different context. Vernacular architecture has been evolved through a process of trial and error for ages and also proved to be sustainable as it is still standing for the period of hundreds years on the same ground. Despite the variations in climate, material, construction techniques, every building is subject to the same laws of physics, and hence demonstrated significant similarities in structural forms. As far as construction techniques are concern they fulfill all the parameters of sustainability by using locally available resources proving it economical, having low environmental impact and involve local craft and skills which helps the communities to sustain. According to Edwards (2005, p1), the definition of sustainability is about creating spaces that is healthy, economically viable, and sensitive to social needs, respecting natural systems and learning from ecological processes, which is reflected on the three perspectives on sustainable design

(Fig.1).All these three perspectives are very well achieved vernacular architecture of Vidarbha region.



Fig. 1 Three perspectives of sustainable design

2. VERNACULAR ARCHITECTURE OF VIDARBHA

Vidharbha is the central part of India. Vidharbha region lies between Latitude: 21°12.575' North Longitude: 79°14.203' East in the eastern part of Maharashtra state (Fig.2). It consists of 11 districts. (Fig.3) According to the rainfall condition, Vidharbha region is sub divided into four zones (Fig.3),

- High rainfall zone - 1250mm to 1750mm
- Moderately high rainfall zone - 1076mm to 1460mm
- Moderate rainfall zone - 900mm to 1200mm
- Assured rainfall zone - 650mm to 700mm



Fig. 2 Maharashtra state



Fig. 3 Vidarbha Region



Fig. 4 Agroclimatic zones of Vidarbha

The rainfall condition in Vidharbha region is Gondia, Bhandara and part of Chandrapur majorly Tadoba forest area lies in high rainfall zone. Nagpur, Wardha, Yavatmal, Washim and part of Chandrapur lies in moderate rainfall zone and Amravati, Buldhana, Akola lies in Assured rainfall zone. The construction techniques which are identified in the respective region use locally available resources, agricultural waste and traditional skills. The villages chosen for the studies (Table.1) were identified on the basis of Agro Climatic Zone (Fig.4) which deals with the rainfall, agricultural products obtained in Vidarbha region and the type of naturally available soil at that particular zone.(Fig.5)

Table 1.Villages selected from agroclimatic zones

Sr.no	Agroclimatic zones of vidarbhs	Villages
1	High rainfall zone (1250mm to 1750mm)	Nandora, Dist.Bhandara Maharashtra
2	Moderate rainfall zone (900mm to 1200mm)	Rajani, Dist. Wardha Maharashtra
3	Assured rainfall zone (650mm to 700mm)	Sirasaon Korde, Dist. Amravati Maharashtra

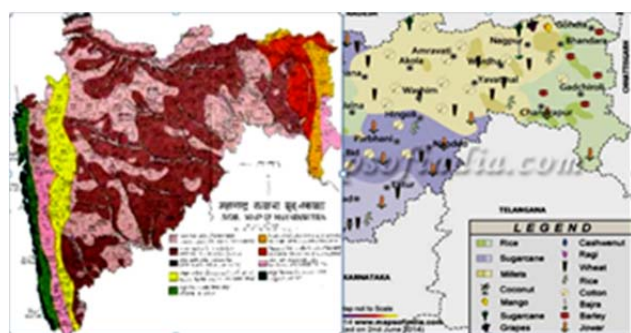


Fig. 5 Soil Map of Maharashtra and Agriculture of Vidarbha

3. CASE STUDY-I (HIGH RAINFALL ZONE)

Nandora, Dist.Bhandara, Maharashtra (Fig.6)

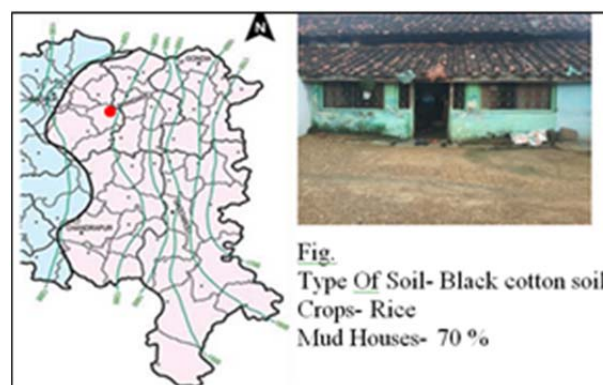


Fig. 6

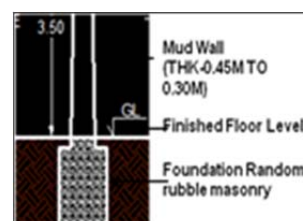
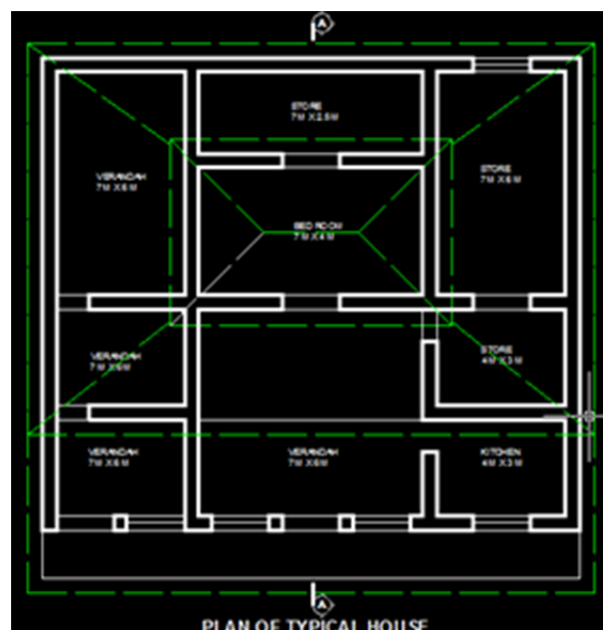
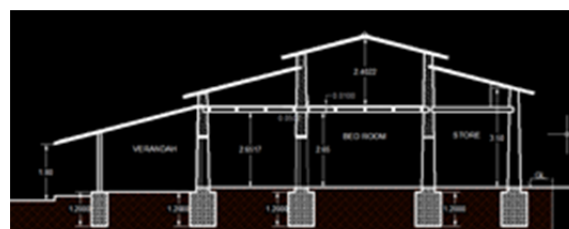


Fig. 7 Foundation Details

3.1 Foundation- is in random rubble stone masonry below the ground level and then construction of wall started from the ground level itself. Foundation is 0.75m up to 0.90 m in width.

3.2 Walling techniques - Cob Wall

Composition- dung, rice husk and mud in the ratio of 1:1:4 .Layers of 0.30m. to 0.45m are constructed only after the earlier layer has dried off.(Fig. 8)

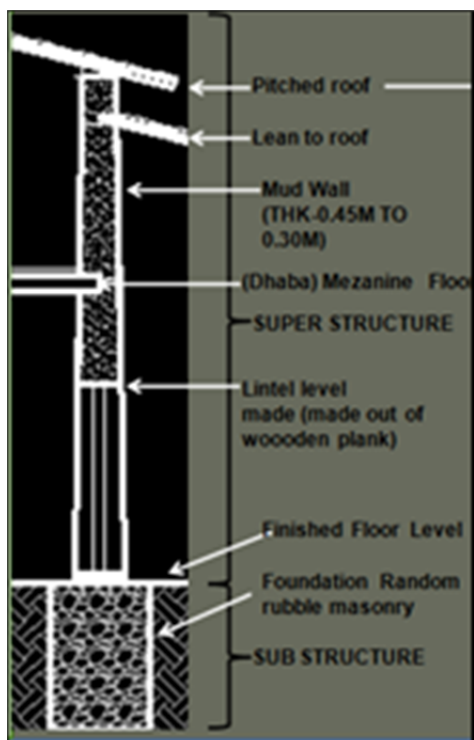


Fig. 8 Section through superstructure

3.3 Plastering- is done in single layer, a mixture of cow dung and mud in the ratio 1:2 in a 2 cm. thick layer was put on the mud wall which was finally finished with lime.

3.4 Mud Flooring- The area to be floored is first filled with mud taken out of trenches is then pressed and finished with final layer of cow dung and mud slurry. Timber floor were finished with mud which creates mezzanine floor used for storage.(Fig. 9)

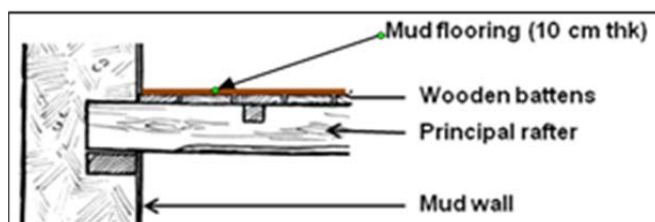


Fig. 9

3.5 Roof- Pitch roof supported by timber truss and country tiles were used as roofing material.

3.6 Lintel and door window openings are made of timber. They are of a lower width and height. The frame is fixed within the mud wall. Timber lintels swells when comes in contact with water results in damaging the structure.

4. CASE STUDY-II (MODERATE RAINFALL ZONE)

Rajani, Wardha District, Maharashtra (Fig.10 and Fig. 11)

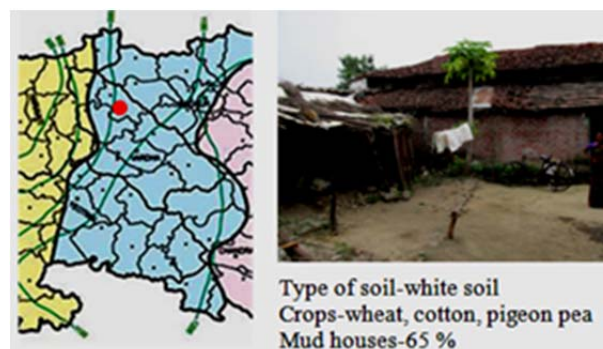


Fig. 10

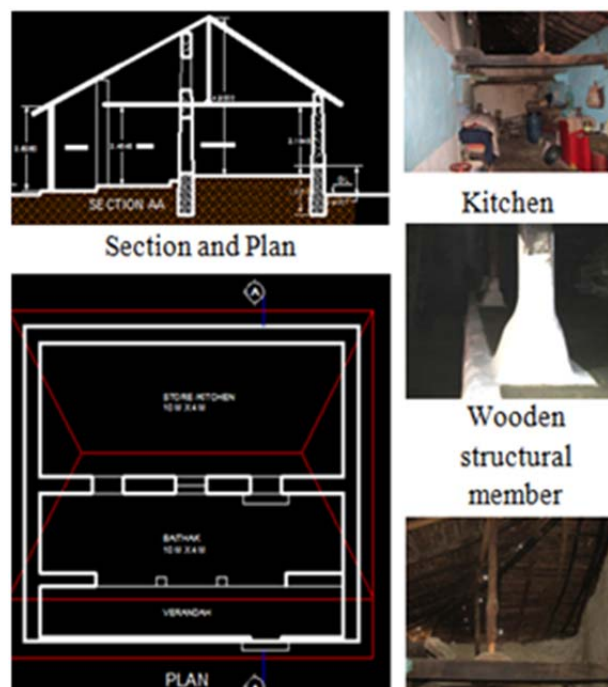


Fig. 11 Details of mud house

4.1 Foundation Trench of about 1.2m is dug -filled up with stone and mud as a binder. Random rubble masonry of the foundation is continued up to 0.60m to 0.90m above ground level and then construction of mud wall started.(Fig.12)

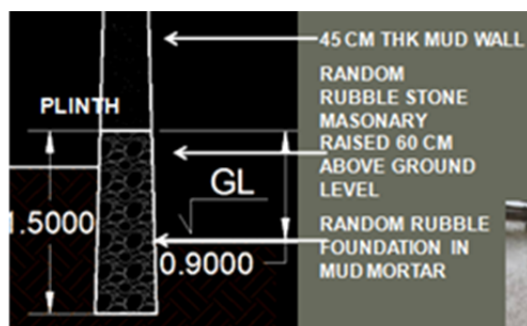


Fig. 12 Foundation Details

4.2 Walling techniques- -Adobe Wall in processed white soil.

Composition- dung, wheat straw and soil in the ratio of 1:1:4 .Layers of 0.30m. to 0.45m are constructed on the random rubble stone masonry of plinth. The wall gets tapered from below the ground to the upper level.

4.3 Plastering- Plastering is done in two layers; first one with a mixture of cow dung and mud, and second layer is of smooth cow dung for finishing.

4.4 Mud Flooring- The area to be floored is first filled with rubble and mud mixture. Then the floor is pressed and finished with final layer of cow dung and mud slurry. The locally available stone tiles were also noticed.

4.5 Timber floors were constructed with the help of wooden beams as a main member and then wooden battens were placed perpendicular to the tie beam. This space is usually utilized for storage called as 'mayali'.

4.6 Roofing supported by timber truss and country tiles or mangalore tiles are generally used as roofing material.

4.7 Lintel and door window openings are made of **timber**. (Fig.13)



Fig. 13 Roofing and wooden lintels

5. CASE STUDY-III (ASSURED RAINFALL ZONE)

Sirasgaon Korde, Dist.Amaravati,Maharashtra (Fig.14)

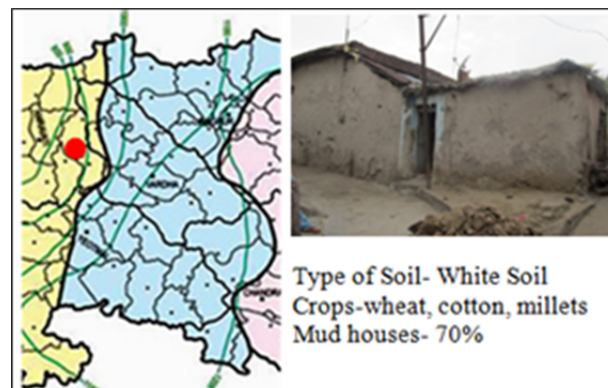


Fig. 13

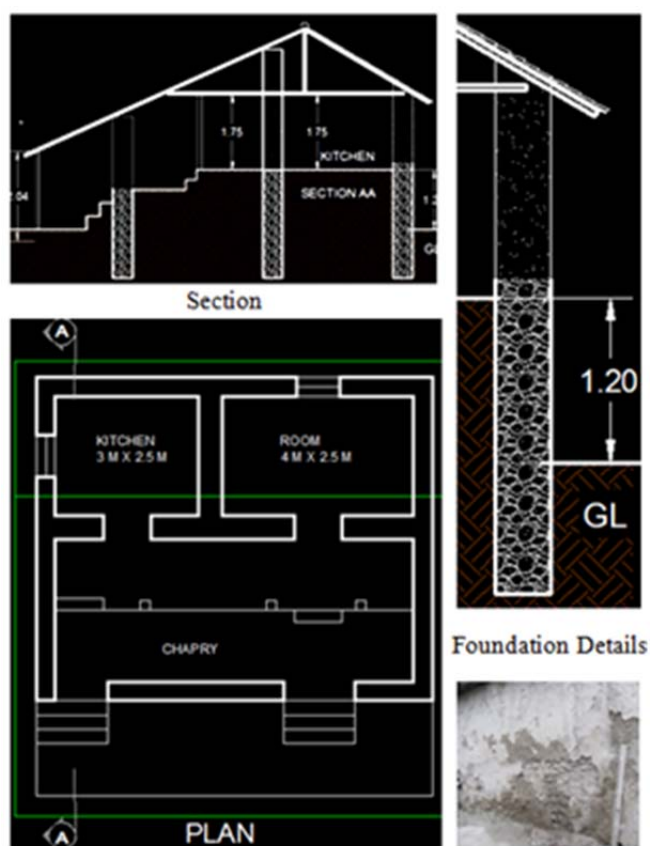


Fig. 15

Foundation is in random rubble masonry in basalt stone. Plinth is raised 1.20m to 1.50m above ground. As the village is at the bank of river it is used to flood every year in earlier time. Thus the rubble masonry prevent the mud to get flush off due to rain water.(Fig. 15)

Walling techniques - Cob Wall construction technique. Composition- cow dung, wheat straw, congress grass which is consider as weed for the farm was dried and mixed with mud in water in the ratio of 1:1:2:3.The grass act as an reinforcement for the load bearing wall.

Plastering- plastering is done with a mixture of cow dung and mud along with dried grass. Finally wall is plastered with white soil available nearby which gives the smooth finish.

Mud Flooring -The compacted floor was finished with layer of mud and cow dung.

Roofing- Pitch roof supported by timber truss and country tile. Tie beam and wooden rafters were used as main supporting members. (Fig.16)

Lintel, door and window openings are made of timber. They were of a small size embedded in mud wall.



Fig. 16

Thus the study had given an overview of the vernacular. Construction techniques prevailing in Vidarbha region, which is suitable to climate, place and to the community. Change in the crop pattern, type of soil available and the local skills are the governing factors. But will the scenario remains the same? Due to the newer materials in the market and the mentality of copying the modern concept of construction is deteriorating the beautiful rural fabric. Hence to revive this architecture is the need of the hour.

6. OUTCOMES

After doing the study of the selected village from each zone it is observed that

- The mud construction techniques had been extensively used from hundreds of years and the structure is still standing .The craft or skill of construction is being transferred from generation to generation hence it is socially sustainable.
- The agricultural waste has been used as a binder for mud thus utilizes the locally available resources hence environment friendly
- The thickness of the mud wall, the binders used and its properties maintains the temperature during summer as well as in winter hence it is climate responsive also.
- Thus the Vernacular –Mud construction technique of Vidarbha is sustainable.

7. CONCLUSION

- Though there is variation in rainfall, agricultural crops yielded, and the type of soil but the documented houses demonstrate significant similarities in structural forms.
- The construction techniques developed were time tested and proven best for the particular climate. There are certain constraints and limitations of mud but those can be overcome.
- The vernacular architecture of Vidarbha is evolved out of social needs, response to the climate, availability of resources, and through the local craftsmanship, which are all the important elements contributing to the sustainability.

But in today's scenario people don't want to build in mud. It is consider as the material of poor. Even the rural areas are deteriorating their fabric by switching over to the newer material which is more harmful to the environment. Here also our role starts as an architect - the concept of sustainability and eco friendly architecture can be introduced by designing certain modules as per the requirements and can be introduce to them at rural as well as urban level. Lot many well known architects are experimenting with mud in modern context. Another ways for the revival of vernacular mud construction techniques should be focused on.

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