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Uniqueness of Mud Architecture

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Abstract - *Shelter is one of the primary needs of all the living beings. Especially for the humans it gives shield and protection in addition to comfort from the adverse weather conditions. Since ancient times people have been using locally available materials for construction of such shelters. Mud is one of the oldest known building material, a gift of God to mankind. It is used as a natural construction material and also acts as a good thermal insulation with additional qualities of fire resistance and sound proof. Constructing buildings with mud techniques brings comfort for humans and thereby providing healthy environment with aesthetic factor. It has undergone numerous transformations with respect to construction techniques as well as in expressing aesthetic values. This paper is an attempt to showcase the vernacular mud architecture developed by the Architects in diverse aspects in Indian context.*

Keywords: Mud, Earth construction, construction techniques, design features, case studies

1.INTRODUCTION

Sustainable human settlement is a vision. In India, technocrats and others are exploring many options towards clean and green construction processes. Designing energy efficient building with right choice of materials locally available is identified as a strategy towards sustainability. Mud is commonly used in constructing built forms from the ancient times. Least energy consumption by minimum fossil fuel energy and recyclability are the reasons for using mud as construction material. It is available in abundance in most parts of rural India. Hence the technology can be transferred easily to other areas. A huge deficit of housing demand in urban and rural areas can be minimized by usage of mud as building material [1]. But vulnerability of this material to exposure to rain etc., may lead to the imagination of huts with thatched roof, dark interiors, and damp walls that give rise to unhealthy and unhygienic living conditions. But it is not so. Though earthen material is very sensitive to water yet this drawback is also an advantage, since it can be easily recycled, obviously making it environmentally friendly [2]. In fact, it is not meant that this building material is suggested for innovation. It is because of the main reason that the construction industry is producing 1/3 of global emissions which is dominated by concrete jungle and also there is no naturally available environmental friendly material.

India is one of the ancient countries using mud for construction and land mark structures built with mud are dominating and still fabulously standing for thousands of years. The ecological advantages of minimizing on cement, the financial advantages of faster construction, the life cycle advantages of low maintenance and the visual advantages of aesthetics of earthy construction need to reach the masses [3]. Numerous organizations are now available that will lead earth construction in productive manner. In recent times, mud houses are supposed to be for the privileged, thorough with proper design simultaneously satisfying contemporary needs and wear with aesthetic look.

2. EARLIER STUDIES

Using mud bricks for reconstruction of destroyed homes in Palestine was considered shameful to live by locals at this age. However, concluding research suggests that making earth bricks eliminates the energy use and greenhouse emissions from transporting them. By choosing techniques and materials appropriate to a given situation, problems in construction could be overcome [4]. While examining the major benefits of houses constructed with local materials in a developing country, it is concluded that both benefits and problems occur with local materials in Ghana. However due to rising cost of modern building materials, recommendation for adoption and improvement of the locally available materials for building houses are made [5]. An analysis on Thermal comfort in Tamil Nadu rural mud house concludes that use of locally available building materials has certain advantages. For example, while the material is from same climatic conditions, it shows more adaptability, longer lifespan and better economic output [6].

This paper presents case studies of mud buildings designed by various architects by adopting easily available material with latest technology that withstand times in modern world.

3. METHODOLOGY

The qualitative exploratory study is adopted to gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formulate research studies); wherein the major emphasis is on discovery of ideas and insights, the research design most appropriate must be flexible enough to permit the consideration of many different aspects of a phenomenon. This flexible one explores the existing phenomenon of mud as construction building material from secondary sources like literature search. Additionally, this paper explores the existence and intent to focus on mud building through case studies revolving around Vitruvius three principles, structure (firmitas), function (utilitas) and aesthetics (venustas).

4. UNDERSTANDING OF MUD CONSTRUCTION

4.1 Structure of mud

From time immemorial tree branches used as structural framework were plastered with mud into different layers to ensure protection from sun and other adverse weather conditions. It was also proved to be sustainable through this process of experiment. Earth though oldest is not a single material but contains clay, slit, sand, gravel and a lot of organic matter. However, organic soil is not used for construction.

Due to restrictions such as penetration of water, maintenance, soil erosion and termite attack it is not used as such but these restrictions could be overcome by compressed stabilised earth blocks (CSEB) by manually pressing and using cement as stabilizer. Also non-erodible mud plaster actually repels the dampness in a huge way. The structure gains strength by following various construction techniques tabulated below.

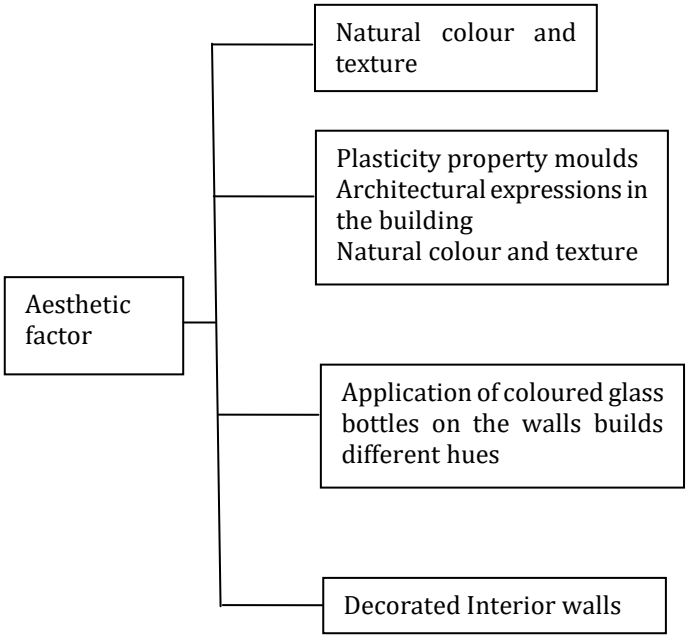
Table -1: Construction Techniques

Wall techniques	Description	Facade
Cob	A lump of rounded mass[1] .	Organic free flowing
Wattle and daub	Bamboo mat and merge with mud on both sides	Elegant
Rammed Earth	Modified soil placed between formwork	Naturally multi-coloured decorated feature.
Adobe	Scraped soil put into mould and form bricks	Rustic effect
Stabilized Mud block	Dense solid blocks compacted using a machine with a mixture of soil, sand, stabilizer (cement/lime) and water [8].	Exposed mud block respects the context and roots the building to the place.

4.2 Function and usage of mud through 5R concepts (Reduce, Reuse, Recycle, Refuse, and Respect)

Reducing use of concrete is good for environmental protection, reduction of pollution and energy consumption associated with the manufacture of materials, and it's also associated with economic and social benefits. Reuse of earth in built form by applying appropriate techniques, integrates the natural lighting and ventilation with the presence of jaalis, bamboo openings and skylights and comfort level seems to give air-conditioning effect. The building remains cool in summer and comfortably warm in winter. The characteristic of Recycled soil for construction remains the same [1]. Refusing to use unnecessary expensive things by simply saying 'No' just because it is forced down and lured us by way of advertisements in modern world. Rather use of cow dung flooring subject to its local availability, and non-toxic effect of smoothened plastered mud walls creates an authentic ambience. Respecting our art and culture, our ancestor 's traditional wisdom and sensibility by adapting a sustainable life style, remembering traditional ways of life that start with simplicity, and satisfaction with the available materials, we may decorate the walls with wall hangings made of terracotta and placing different art materials of terracotta at appropriate places.

4.3 Mud and Aesthetics



5. CASE STUDIES

Table -2: Case studies of mud buildings designed by various architects.

Case studies	Design features	Material/techniques used
Residence at Dindugal [9]. -Ar.Noel Jerald	Geometric rectangular fashion over three dimensions. The double height space differentiated through different levels and lit through sky lights and appropriately placed windows. A north courtyard garden, provides daylight and ventilation	Wall- Stabilised mud blocks Roofs- Filler slabs (Clay pot) Flooring-Clay tiles.
Residence for Mr.Joseph,Kottayam -Ar.Jose K.Mathew	Maintained the slope of the site as well as conservation of all its trees. Courtyards with water bodies have been placed on the west and south sides to cool rooms.	Internal walls –Stabilised with interlocked bricks. Roof- Filler slabs of recycled MP tiles
Govardhan Eco Village,Palghar -Ar.Chitra Viswanath	Soil got from excavating the ponds. Laid into clear recharge and discharge zones and buildings. Avoid locating buildings and roads in valleys. Cluster units with shared courtyards	Wall- CSEB Block CSEB tiles with precast elements. CSEB "U Blocks" for sill and lintel.
Green Design Residence,Vadodara -Ar.Kalpesh Dalwadi &Ar.Shreya Dalwadi [9].	Cube shape with a central courtyard letting in daylight and allowing wind movement in all the living spaces encircling it.	Wall-Compressed earth blocks. Roofs- Filler slab, mud pans as roof fillers. Natural stone masonry for courtyard walls.
Bodhi house,Kollam [9].	Two blocks are visually connected with courtyard [9].	Wall-Cob wall

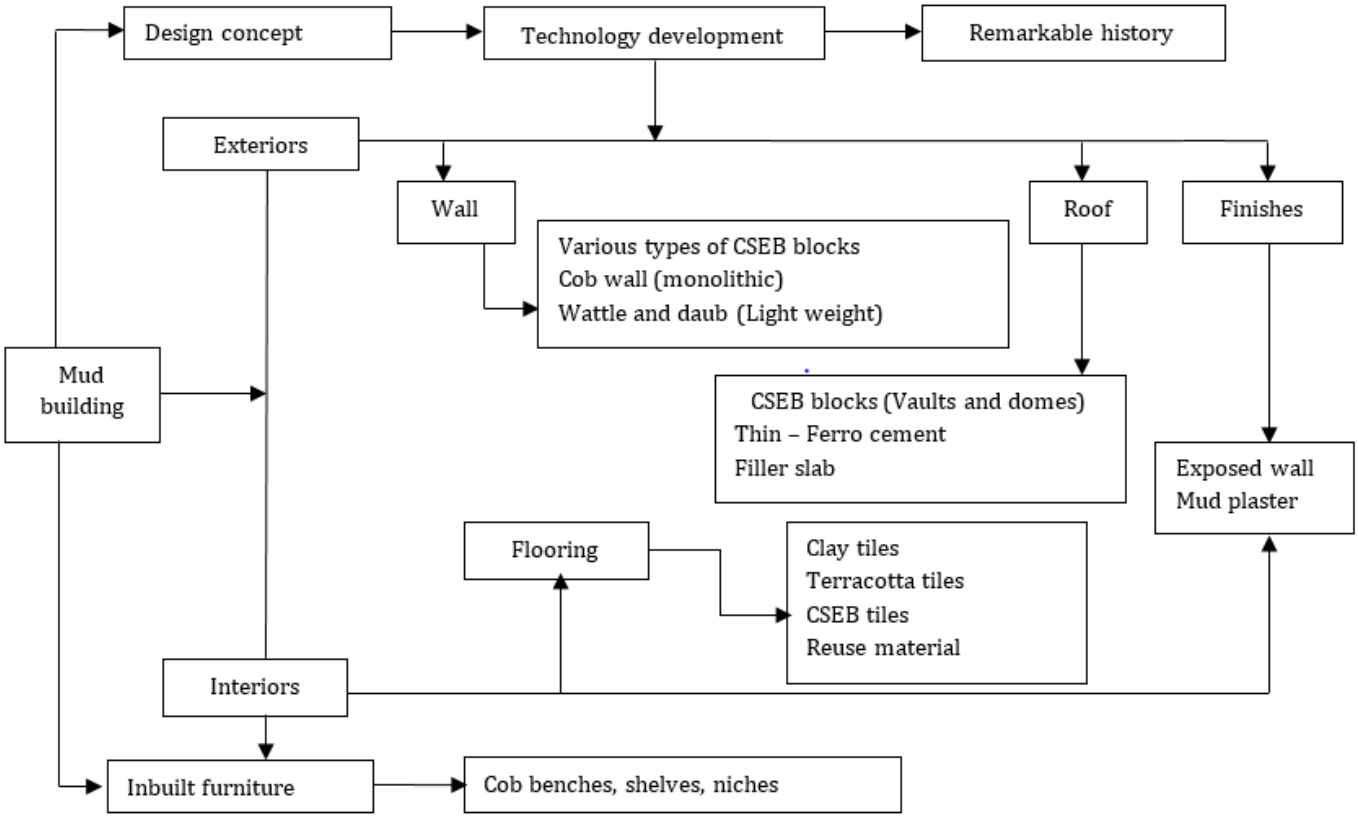
-Ar.Eugene N.Pandala	Openings in the top of the wall for escape of hot air out and to make the living space cool. Its gentle slopes and elegant curves evoke an eagerness to explore inside. Intricate jaalis and pedestals step out of the walls to make their presence felt. cobbed inbuilt furniture and niches.	Roof-Ferro cement sloped with clay tiles Flooring - terracotta tiles.
Shell House,Calicut -Ar. R.K.Ramesh Kumar	Parabolic vaulted roof resembles no distinct walls, its continuous roof in shell shape. Air spaces in the mud hollow blocks make thermal comfort.	Wall- mud hollow blocks Roof-hollow Blocks-Parabolic shell. .
St.George Orthodox Church,Mattanchery,Cochin,Kerala -Ar.Vinu Daniel	Concept of domes, vaults and arches rose from early symbols of Marthoma cross. Altar blessed by a "cross of light" by natural earth bricks.	Wall- compressed, stabilised mud blocks. Rammed earth foundation Using ancient Nubian technology of arch and vault Roof- CSEB laid for centenary vault.
Weaving walls, cottage,Thannal Hand Sculpted Homes [10]. -Ar.Biju Bhaskar	Comfortably enclosed but connected with the openness of the surrounding. Spaces in free flowing movement with broken tiles flooring and inbuilt furniture. Placed blue tinted glass bottles into the west side wall. The evening sun hits the glass bottle which was the cottage with a hue of blue.	Wall-wattle and daub construction The cobbed portion of the wall not only acts as the base of the structure but also flows into interiors to take form of seating, shelves and niches. Roof- Double layer roof, with Mangalore tile above that allows the heat to escape from the top. Green roof by having a layer of mud on top is one of the experiments. Flooring-broken tiles
Vikas Community, Apartment, Auroville [11]. -Ar.Satprem Maini	Four storeys building utilization with self-sufficient onsite soil. This extraction from soil allowed a perfect integration of the excavations with the buildings and landscape.	Foundations- Stabilised rammed earth Walls-CSEB Roof-CSEB (flat ,vaults and domes) These vaults and domes were built with, by using the "Free-spanning" technique Floorings- CSEB tiles

5.1 Inferences from the case studies

These studies highlight the techniques with variety of typologies like sloped tile roof, flat roofs, and vault roof with or without courtyard with natural ventilation. The naturally organic free flowing mud structures reveal the rustic environment with the advantages of modern life. Design approach allowed a proper integration in built forms and built environment.

6. FINDINGS

From the inferences it was observed that design evolution in mud building leads to technology development and reveals the remarkable history.



7. DISCUSSION & CONCLUSION

The unique character of mud is its plasticity, reusability and transformability. Experimental mud construction systems and techniques display the continuity of traditional character and expression connecting the past, present and the future. Even in many areas in India due to rapid urbanization and changing life style, the possibility of mud becoming an integral part of construction material seems to be challenging. These types of construction usually arouse emotional feelings and link us with the past generation. This also gives the satisfaction of affordable healthy living for the rest of the life. By and large, we may conclude that a need has now arisen to promote earth architecture with innovative initiatives by nongovernmental organizations, architects and other pioneers in the field who are supposed to facilitate by creating awareness about mud as a construction material and highlighting its health benefits which will ultimately redefine the character of the built forms and environments.

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