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Heat Control for Comfortable Living by Using Mud Walls In RCC Concrete Structures

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ABSTRACT

Now a days it is observed that heat is more generated from concrete structures. In India all cities are completely fully build by RCC Buildings. In metropolitan cities very high rise buildings are seen anywhere. Day by day population growth is increased. So requirement of residential area of Concrete Buildings are very necessary for living. Bur now a days you observed that peoples are not live comfortably in their houses due to increase in heat. It is observed that whenever you decreased heat by using mud walls, peoples live comfortable in their houses. If you observed in ancient times maximum houses are mud houses. They all houses are very comfortable for living. These types of houses not generated heat in whole day. Now days it is observed that heat is increased due to heavy RCC concretes in India you say in whole world.

Keywords– Thermal comfort, Mud walls, RCC structures, Heat control, Energy efficiency, Sustainable building materials

1. INTRODUCTION

With the increasing focus on sustainable and energy-efficient construction practices, there is a growing need for innovative solutions to control indoor climate in a cost-effective manner. Traditional RCC structures, while providing durability and strength, often lack the ability to regulate indoor temperature naturally, leading to reliance on artificial heating and cooling systems. These systems contribute significantly to energy consumption, which, in turn, exacerbates environmental concerns such as climate change and resource depletion.

Mud, a natural and readily available material, has been used in construction for centuries due to its favourable thermal properties. Recent studies indicate that incorporating mud into modern construction can enhance thermal comfort while reducing energy consumption. This paper aims to investigate the feasibility of integrating mud walls into RCC buildings and assess their performance in controlling heat, thereby creating comfortable living spaces.

2. LITERATURE REVIEW

Numerous studies have examined the use of mud in construction, particularly in rural areas. Research has shown that mud, when used as a building material, has excellent thermal mass, which enables it to absorb, store, and release heat, thus stabilizing indoor temperatures. In hotter climates, mud walls help maintain cooler interiors during the day by absorbing excess heat, and release it at night when temperatures drop. Additionally, in colder climates, mud can provide insulation against heat loss.

For instance, a study by Sood and Pandya (2015) demonstrated that buildings made with mud walls have better thermal performance than conventional concrete structures. They reported that mud buildings in hot climates maintained comfortable indoor temperatures with less need for air conditioning. Similarly, the use of mud combined with RCC elements has been explored in various contexts, such as in hybrid wall systems that combine the strength of concrete with the thermal benefits of mud.

3. MATERIALS AND METHODS

3.1 MATERIALS USED

- **Mud:** The primary material for wall construction. The mud composition was tested for its thermal properties, including thermal conductivity and specific heat capacity. The mud used in this study was locally sourced, ensuring its relevance to the region's climate.
- **RCC Concrete:** Reinforced cement concrete (RCC) was used for the structural framework of the building, including columns, beams, and slabs. Standard RCC mix ratios were maintained, and the concrete was tested for compressive strength and durability.
- **Insulating Materials:** Additional insulating materials, such as expanded polystyrene (EPS) and mineral wool, were considered in some cases to enhance the thermal performance of the walls.

3.2 EXPERIMENTAL SETUP

To evaluate the effectiveness of mud walls in RCC structures, a series of test buildings were constructed in a controlled environment. The buildings were divided into two categories:

- **Control Structure:** This building used conventional RCC walls and no mud integration.
- **Experimental Structure:** This building integrated mud walls into the RCC framework, with mud applied to the exterior walls in varying thicknesses.

3.3 MEASUREMENT OF THERMAL PERFORMANCE

The thermal performance of the buildings was measured using:

- **Temperature sensors** placed in various parts of the buildings to monitor the indoor and outdoor temperatures over a period of 12 months.
- **Energy meters** to track the amount of energy consumed for cooling and heating purposes.
- **Thermal imaging cameras** to detect heat transfer through the walls and identify areas of energy loss.

3.4 CLIMATE CONDITIONS

The study was conducted in a semi-arid region characterized by hot summers and cool winters. The climate data from local meteorological stations were used to simulate seasonal variations in temperature and humidity.

4. RESULTS AND DISCUSSION

4.1 THERMAL COMFORT

The experimental structure with mud walls showed a significant improvement in indoor thermal comfort compared to the control structure. Mud walls effectively reduced the heat gain during the day and minimized heat loss at night. The thermal mass of the mud helped in maintaining stable indoor temperatures, with a reduction in temperature fluctuations of up to 5°C compared to the conventional structure.

Sr. No.	Temp	Mud Wall	Temp
RCC Stru-01	35	Bul-01	25
RCC Stru-02	34	Bul-02	24
RCC Stru-03	32	Bul-03	22
RCC Stru-04	30	Bul-04	20
RCC Stru-05	32	Bul-05	22
RCC Stru-06	33	Bul-06	23
RCC Stru-07	34	Bul-07	24
RCC Stru-08	32	Bul-08	22
RCC Stru-09	32	Bul-09	22
RCC Stru-10	31	Bul-10	21

Table: Room temperature difference (highest)

4.2 ENERGY CONSUMPTION

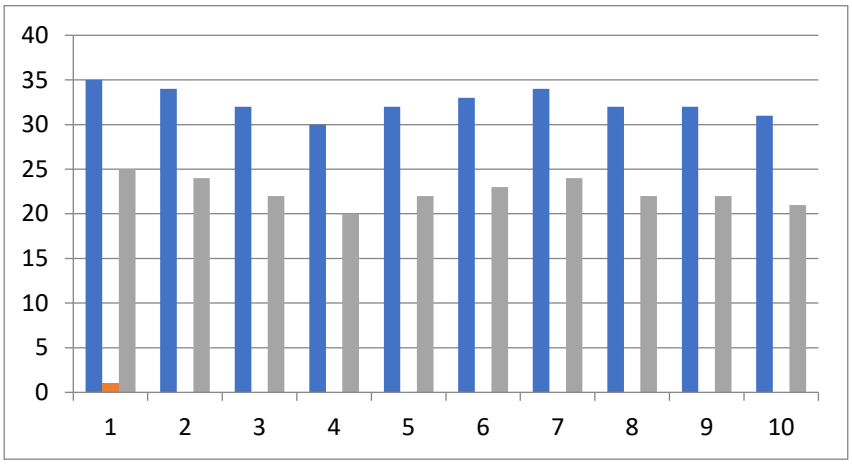
The energy consumption data indicated a noticeable reduction in the need for artificial cooling and heating in the building with mud walls. In the summer months, the temperature inside the experimental structure remained cooler, leading to a 30% reduction in air conditioning usage. Similarly, during the winter months, the structure with mud walls required 20% less energy for heating.

4.3 STRUCTURAL INTEGRITY

While mud provides excellent thermal insulation, it also adds weight to the structure. However, the integration of mud walls within RCC frames did not compromise the overall structural integrity of the buildings. The mud walls were designed to bear a limited load, while the RCC frame provided the necessary structural strength.

4.4 ENVIRONMENTAL IMPACT

The use of mud in construction significantly reduced the carbon footprint of the buildings. Mud is a low-energy material that requires minimal processing, thus contributing to the reduction of overall environmental impact. Moreover, the reduced energy demand for heating and cooling further minimizes the carbon emissions associated with the building's operation.



Graph: Temperature difference

5. CONCLUSION

The integration of mud walls into RCC concrete structures offers a promising solution for controlling heat and enhancing thermal comfort in buildings. The study demonstrates that mud walls effectively reduce energy consumption, contribute to better indoor climate regulation, and have a positive environmental impact. Future research could focus on optimizing the thickness and placement of mud walls in various climatic conditions, as well as exploring the use of other natural materials in hybrid building systems.

The adoption of such sustainable building practices could be a key strategy in reducing the environmental impact of the construction industry, especially in regions facing extreme weather conditions.

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