

Comfort Living Due to Thermal Balance in House by Using Mud and Brick

Prof. Pravin K. Patil

Assistant Professor,

Department of Civil Engineering,

Padmashree Dr. V.B. Kolte College of Engineering, Malkapur India

Abstract

Different building materials like mud and brick respond differently to climatic conditions due to their inherent properties. The thermal properties of building components such as walls, ceiling and floors together determine the energy consumption patterns and comfort conditions in an enclosed space. The aim of this study is to the thermal performance of naturally ventilated mud house and brick house, typical in the villages of India. The objective is to build efficient construction techniques suitable for rural settlements. This is pursued by analyzing mean radiant temperature, Inter-zonal heat gain and comfort level within buildings constructed from traditional and modern materials. The study focuses on single storied houses with wall materials are traditional mud walls and brick wall with plastered surface. The thermal behavior and comfort, the patterns of energy use of mud wall and brick wall are analyzed, compared and discussed. How a building balance the temperature in winter and summer. This research will contribute to the promotion of comfort living for a body of peoples towards a sustainable future.

Keywords: *Mud house, Brick house, Thermal-performance, concrete house*

I. INTRODUCTION:

The traditional houses of India are regarded as a good representative of warm humid tropical houses which are adaptable to local climate and well harmonized with local believe and tradition as well as local materials. As the social changes taking place, civil engineer will play a decisive role in the future development of India. The village elite are building in bricks; the government or non-government organizations have buildings made out of brick or concrete; and the same applies to the temples and mosques. The hierarchy of materials is very clear. The perfect home seems to have nothing in common with the traditional house in earth, bamboo or mud. Traditional built forms of the rural area often includes thermal solution for climatic problems. According to user experience, traditional houses of India are less hot during the daytime, but it becomes comfortable within a short time after sunset. Although these traditional building materials are highly sustainable, people are seeking for materials such as bricks, concrete, and corrugated iron sheets that are supposedly more durable. Therefore, the question arises on how the traditional house of India can afford to control natural climate.

II. OBJECTIVE

This study is the thermal performance of mud and brick houses in India to show that mud and brick houses are better suited for the naturally ventilated rural houses and provide a comfortable living condition.

III. METHODOLOGY

Relevant published documents as well as researches previously conducted on the thermal performance of mud house structure, thermal mass of a building material, the distinct advantages of mud construction in hot- dry climate, traditional mud housing technology of India and potential of mud construction in terms of thermal comfort have been extensively studied.

The study of mud housing which used known thermal resistance values of the various layers of building materials, to calculate the overall thermal resistance of the system. Hourly values of incident and diffused solar radiation and outdoor temperature were used to compare hourly temperature, mean radiant temperature and inter-zonal heat gain. The comparisons were performed with recorded weather data for India.

The thermal properties of the constructional elements were varied in order to measure the effect of these changes on the thermal comfort of the occupants. It should be noted here that for mud and brick wall construction room temperature will be low as compared to concrete building.

IV. RESULTS AND DISCUSSION

3.1 Temperature in comfort zone:

The thermal comfort range is dependent on various factors like humidity, wind speed, solar radiation. Keeping these factors in mind, for summer season and 0.5 m/s wind speed, the comfort band is selected between 18.0-26.0 °C. For comfort living in houses, the following results are obtained. In India the highest temperature is near 47°C. Particularly in Vidhabha region the average temperature is more than 35.0 °C. So in this region this type of houses are more effectively for living and also these houses are very economical.

3.2 Field Results:

Field work is conducted with data loggers to find out the actual temperature difference in mud and brick walled house to concrete house. The data was compared with the simulation results.

Table: 01 Temperature difference (Mud & Brick)

Temperature In mud and brick house	Interior wall temperature in Summer	Exterior wall temperature in Summer	Temperature difference
1.Rajendra Patil	28°C	38°C	10°C
2. Kishore Patil	24°C	39°C	15°C
3.Janardhan Talole	24°C	39°C	15°C
4.Madhukar Tekade	25°C	39°C	14°C
5. Sudhir Patil	22°C	39°C	17°C

Table: 02 Temperature difference (Concrete house)

Temperature In mud and brick house	Interior wall temperature in Summer	Exterior wall temperature in Summer	Temperature difference
1.Dilip Patil	32°C	38°C	6°C
2. Krishna Patil	34°C	39°C	5°C
3.Pravin Talole	31°C	39°C	8°C
4.Manu Tekade	33°C	39°C	6°C
5. Nitin Dahake	31°C	39°C	8°C

The recorded data from Data Loggers were compiled and plotted in graph. From the table, it is seen that the maximum temperature recorded in the mud and brick house was 28°C while for concrete house it was 32 °C. The maximum temperature recorded in mud and brick house as well as concrete was at 3:06:12 PM, The table also shows that in Mud and Brick house, temperature and humidity fluctuation is less than Concrete wall house resulting in a more comfortable living condition.

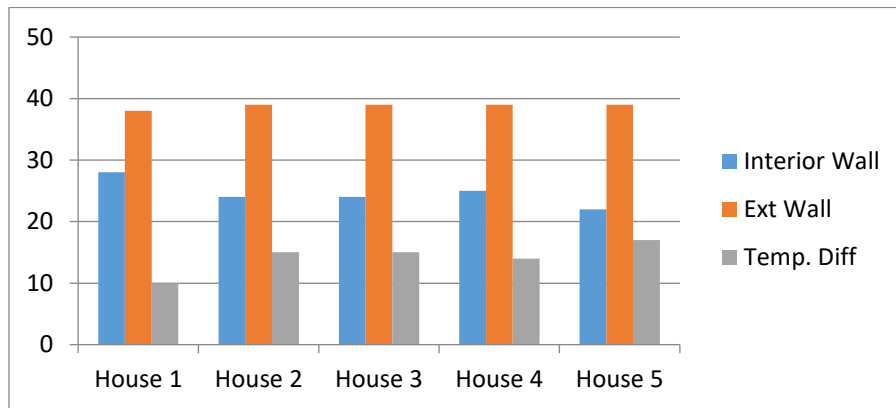


Chart 01: Temperature difference (Mud & Brick) wall

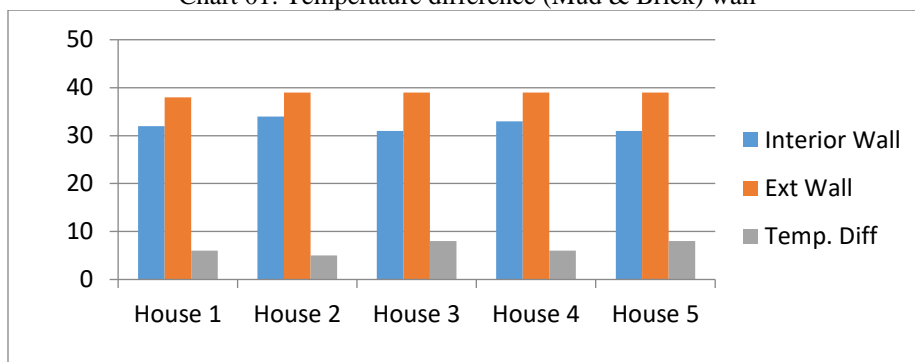


Chart 02: Temperature difference (Concrete) wall

From above charts it is seen that the temperature difference is low in Mud and Brick house as compared to concrete house. For human well comfort is achieved in Mud and Brick house.

3.3 Findings and remarks:

From results, it can be seen that the indoor temperature in a Mud and brick walled house will remain within comfort range more than that of a Concrete walled house. The amount of passive heat gain is much higher in Mud and Brick walled house compared to a Concrete walled house.

From field data, it was observed that Mud and Brick house showed lower temperature compared to Concrete house. The study was conducted only for Mud and Brick houses with Mud as roofing. By using Mud and Brick as building material we can promote a sustainable living environment and reduce thermal stress.

V. CONCLUSIONS:

The comparisons between mud walled and brick walled house reinforced the fact that mud as a building envelope keeps the inside of the hut cooler in summer than outside and warmer than outside in winter in comparison with concrete wall. However the cooling effect of these traditional mud houses can be further improved and thermal comfort conditions inside the houses improved by proper design considerations.

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