

Wardha blocks: A Revolutionary Material for Composite Regions

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ABSTRACT

Human have been evolving since decades. Many changes have been adopted with many priority changes. But the priority that did not change over decades is food, shelter and clothes. Shelter has been evolved from caves to high-rise structures. But this evolution has a cost to pay in terms of temperature rise and climate change. As per the Forbes report of 5 April 2022, nearly 40% emission comes from real estate. The rise in temperature is an alarming risk. This scenario is no different in rural areas. Hence to lower the temperature in houses ‘Mud House technology’ which has been used from ages has to be adopted. But mud house technology is not enough to meet new challenges. Therefore, Centre of Science for Villages, Wardha had developed special technique of mud wall and clay tiles roofing system to meet the modern issues. This paper aims to study the impact of Wardha block construction to control the temperature. It also investigates the temperature difference in the convention housing (concrete homes) and Mud House. The methodology adopted was the comparative analysis of both types of houses. Through this research, author intends to suggest the technology to control the rising temperature in houses. The study undergoes experimental research.

KEYWORDS: Rising Temperature¹, carbon footprint², Mud houses³, Appropriate technology⁴, Rural areas⁵etc.

1. INTRODUCTION

Temperature change is an alarming issue in today's world. Almost every country is experiencing the rise in temperature. Different prospect of human intervention is responsible for the climate change. Carbon emission from different action contributes to climatic change. As per the Forbes Report of April 2022, 40% of the carbon emission is from the real estate. Though shelter forms the basic need of human, but now has become the luxury and reason for Temperature rise. Temperature change not only affect human outside but also inside the homes too. The most affected regions from this situation is the hot and dry regions or composite regions.

These regions experience little or no precipitations in 6-7 months of year. Afternoons become hard to survive without artificial ventilation. This situation is same in urban and rural areas.

The traditional mud houses could beat the harsh mercury rise. But with time the maintenance becomes either costly or unavailable or both. For the new age problem one needs new age solutions. Centre of Science and villages has dedicated their work on affordable and less impact houses.

2. AIM - To Study and understand the temperature difference in concrete house and Wardha Block House.

3. OBJECTIVES

- 1) Understand the Wardha house technology.
- 2) Compare and analyse the temperature difference between concrete homes and Wardha House
- 3) Understand and suggest the appropriate technology for composite climate region

4. METHODOLOGY

The study is an outcome of experimental research. The research is done at Dattapur Wardha of Maharashtra State. This study is based on Primary data collected first hand from the site. For comparative analysis residential house made from Wardha block and randomly selected concrete house is selected. They are 4 km apart from each other. Secondary data is also used to strengthen the primary data

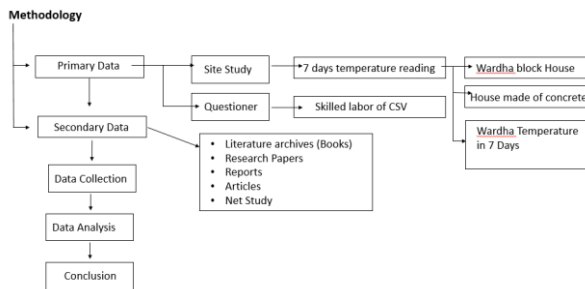
4.1. PRIMARY DATA

- The temperature is collected placing thermometer in each house.
- 7-day temperature is recorded with time morning 9-10, afternoon 2-3 and evening 7-8
- The analysis is made between concrete house, Wardha Block House and the outside temperature of each day.
- The temperature is recorded during May, hottest month of year.

4.2 INTERVIEW

The interview was taken of the skilled labor of CSV.

4.3 FLOW CHART OF METHODOLOGY



5. LITERATURE STUDY

CSV-Centre of Science for Village Wardha India

Centre of science for villages popularly known as CSV established in 1976 for the development of Village housing and sanitation condition. Based on Gandhian thoughts, CSV has achieved their goals.

Innovation by CSV

5.1 WARDHA BLOCK

As the name suggest, this block is named after the place of innovation. This block is the outcome trial and error method undertaken by CSV. The trials were first to protect the existing mud wall. But that process failed and new innovation took place which gave birth to Wardha Block.

Proportion

Wardha is Black Cotton soil area. Hence, Black cotton soil forms the biggest proportion in Wardha Block.

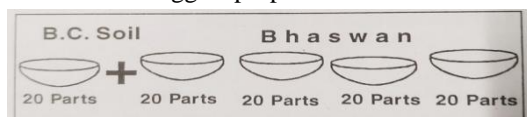


Fig1. Proportion of mud for Wardha Block

WARDHA BLOCK IS USED FOR TWO PURPOSES

- Exterior wall
- Interior (Common Wall)

a) Wardha Block for Exterior Wall

The block used in exterior part of building has facing of burnt clay tile. Tile is fixed with dovetailed detail shown in figure. This gives a good bond between the two.

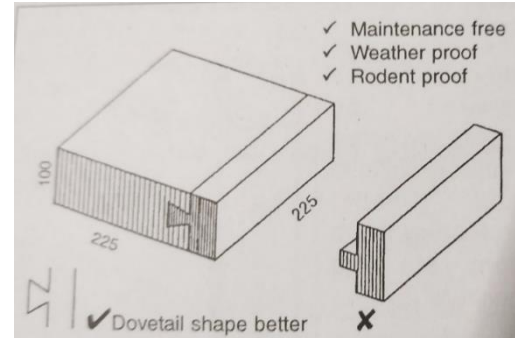


Fig2. Detail of Wardha Block with terracotta tile

Making of Face Tiles

Mould Box



Fig3. Terracotta Tile Mould

Fig4. Mould Box with Wooden Scantlings.



Fig5. Piled stack of Face Tile

The clear internal dimension should be 231 X 106 X 26. After the burning process dimension of finished tile will be 225 X 100 X 20.

Process of making Face Tile

- Place wooden scantling in mould and sprinkle powdered ash evenly to ensure easy ejection of tile.
- Put the prepared mud in mould with force to fill the gaps.
- Cut excess mud with wire to have smooth and levelled surface. For extra smooth face, use wet sponge. Place the mould upside down on dry platform in shadow. Easy off the tile with little push from holes

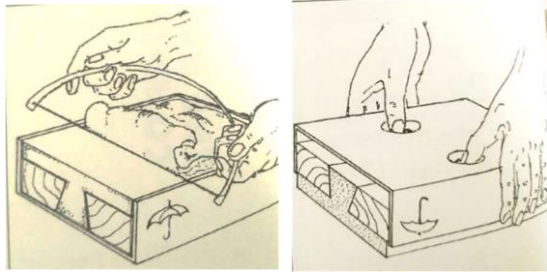


Fig 6 Fig 7
Fig 6 and Fig 7 showing the making of face tiles.

Making of Exterior Block

- 1) Put the face tile and clay mass in the mould.
- 2) Turning down side lift the box upward.
- 3) Allow the blocks to sun dry
- 4) Turn on each side to have even sun drying.



Fig 8 Fig 9

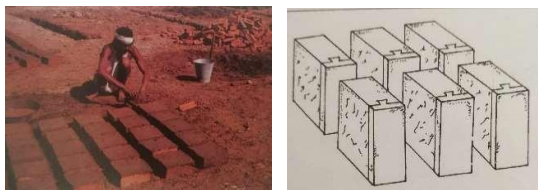


Fig 10 Fig 11

Figure 8,9,10 & 11 showing step wise making process of exterior Wardha Block.

b)Wardha Block for Interior (Common) Wall

These blocks will be used indoor hence do not need face tile. The size is 340 X 225 X 100. The process of drying is same as for exterior blocks.



Fig 12 Wet Wardha Block for Interior walls

5.2 ROOFING - GUNA TILES

The roofing tile is named as Wardha Tumbler or Guna Tiles. Tiles having tumbler shape.

Making of Tumbler (Guna Tiles)

- Prepare the clay.
- Put them on the potter's wheel make the shape. Dry them in sun for 3-4 hours. After drying put the tumbler upside down to open other side.
- Burn the tiles in traditional kiln.
- The Guna tiles have a tendency to shrink till 12 mm after burning. The figure, Shows full size.

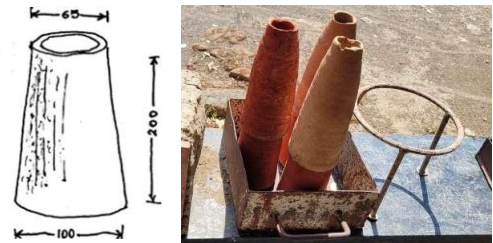


Fig 13 Guna Tiles

5.3 CONSTRUCTION OF CSV HOMES

5.3.1 WARDHA BLOCK CONSTRUCTION

The Wardha block is laid like any other brick wall. Laying begins from plinth as shown in figure.

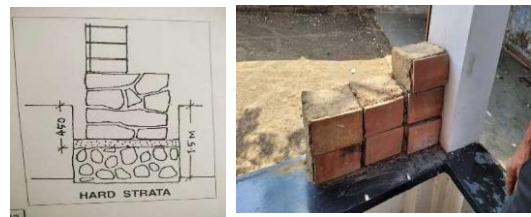


Fig 14 & 15 Laying of Wardha Block

Pointing for Water Proofing

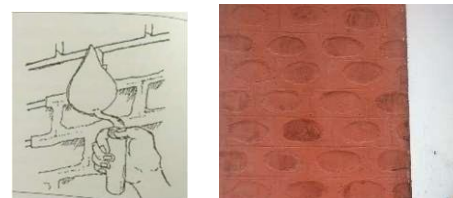


Fig 16 Cement pointing of 1:3 proportion of sand and cement is applied to cover the joints.

5.3.2 GUNA TILES

- For laying of Guna tiles centring is required.
- The Guna tiles are laid inserting with each other's making bow
- Each layer is opposite to each other to decrease the gaps.
- Once the layers of laid, they tied and a layer of cement mortar is applied
- Over cement mortar, a layer of china mosaic tile is applied to make it more water proof and pleasant looking.

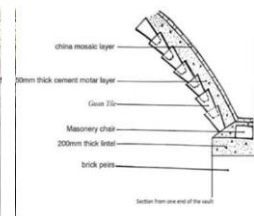


Fig 17 Laying of Guna Tiles Fig 18 Section showing



Fig 19. Tying of Guna Tiles Laying



Fig 20. Opposite of Guna Tiles

6. DATA COLLECTION

- 1) Wardha Block house, at Dattapur, Wardha
- 2) Concrete home at Wardha City

INTRODUCTION TO WARDHA CITY

Lying nearly in physical center of the country, Wardha is located on Deccan plateau. Gandhiji had spent some time here. The region is fairly fertile and prosperous on agricultural side. The climate of the region is composite. The region experience 47.3 degree centigrade during May month. Winters are cold and dry. Average rainfall is 1090 mm.

1) Wardha Block house, at Dattapur, Wardha

Table no.1 Temperature Records of Wardha Block House

Sr. No.	Day and Date	Time	Temperature recorded
1	Day 1 22/05/2023	Morning	31.3
		Afternoon	33.5
		Evening	35
2	Day 2 23/05/2023	Morning	32.5
		Afternoon	34
		Evening	35
3	Day 3 24/05/2023	Morning	33
		Afternoon	35
		Evening	32
4	Day 4 25/05/2023	Morning	32
		Afternoon	35.5
		Evening	36
5	Day 5 26/05/2023	Morning	31.5
		Afternoon	33.5
		Evening	32
6	Day 6 27/05/2023	Morning	31
		Afternoon	35
		Evening	33
7	Day 7 28/05/2023	Morning	32
		Afternoon	34.5
		Evening	34

Temperature recorded on thermometer with sequence of morning, afternoon and evening

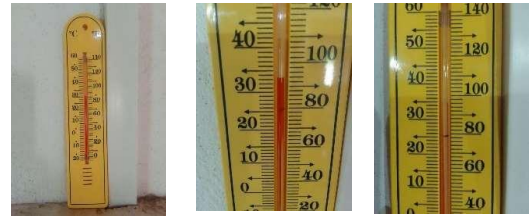


Fig 21 Temp. record of Day 1- 22/05/2023



Fig 22 Temp. record of Day 4-25/05/2023



Fig 23 Temp. record of Day 7-28/05/2023

2) Concrete home at Wardha City

Table no.2 Temperature Records of Concrete House

Sr. No.	Day and Date	Time	Temperature recorded
1	Day 1 22/05/2023	Morning	30
		Afternoon	40
		Evening	32
2	Day 2 23/05/2023	Morning	33.5
		Afternoon	41
		Evening	36
3	Day 3 24/05/2023	Morning	31.5
		Afternoon	41
		Evening	37
4	Day 4 25/05/2023	Morning	34
		Afternoon	42
		Evening	37
5	Day 5 26/05/2023	Morning	33
		Afternoon	42
		Evening	36.5
6	Day 6 27/05/2023	Morning	36
		Afternoon	40
		Evening	36
7	Day 7 28/05/2023	Morning	33
		Afternoon	41
		Evening	36

Temperature recorded on thermometer with sequence of morning, afternoon and evening in concrete home.



Fig 24 Temp. record of Day 1-22/05/2023

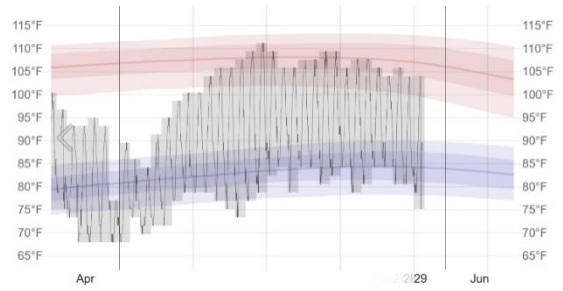


Fig 25 Temp. record of Day 4-25/05/2023



Fig 26 Temp. record of Day 4-28/05/2023

Fig28. Temperature recorded at Dr. Babasaheb



Ambedkar International Airport, Nagpur in May 2023
Fig 29 Hourly temperatures recorded at Dr. Babasaheb Ambedkar International Airport, Nagpur in May 2023

7.1 Temperature recorded Data

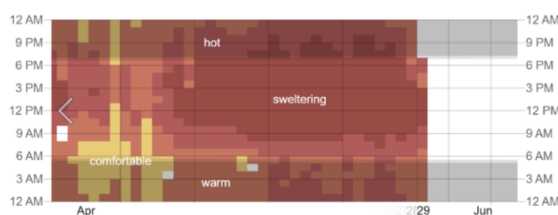
Table 3 Temperature Records

Date	Outside Temperature	Wardha Block Temperature	Concrete house Temperature
22-05-23	41°C	33.5°C	40°C
23-05-23	42°C	34°C	41°C
24-05-23	42°C	35°C	41°C
25-05-23	43°C	35.5°C	42°C
26-05-23	43°C	33.5°C	42°C
27-05-23	41°C	35°C	40°C
28-05-23	43°C	34.5°C	41°C

7. OUTSIDE TEMPERATURE DATA

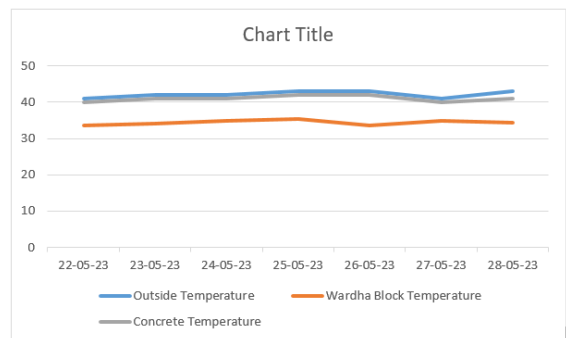


Fig 27 Temperature recorded each day in the month of May 2023



7.2 GRAPHICAL REPRESENTATION

Graph Showing Comparison between outside temperature, Temperature in Wardha block house and concrete house



Graph no.1

8. DATA ANALYSIS

Following is the finding of above data

- Wardha experience 30°C degree and above from the morning till evening in the month of May.
- Afternoon temperature is 36°C in mud house and 42°C in concrete house.
- It is the afternoon that are intolerable outside and inside the concrete home.
- In concrete house, artificial ventilation e.g Desert Cooler or AC is must. This lower down the temperature.

- Wardha block house need only fan to circulate the air.
 - Comparison between outside temperature, Temperature in Wardha block house and concrete house shows the temperature in concrete house is nearly to the outside temperature.
 - The graph shows, effective difference between Wardha block house and concrete house.
 - The afternoon temperature difference is between Wardha block house and concrete house is about 7°C.
- 4) Sandeep Kulkarni Int. Journal of Engineering Research and Application www.ijera.com ISSN : 2248-9622, Vol. 8, Issue3, (Part -2) march2018, pp.56-58
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 - 6) Wardha Climate Data- smartnet.niua.org



Fig 30 Wardha Block House



Fig 31 Wardha Concrete House

9. CONCLUSION

Composite climate shows hot and dry, warm and humid and cold climate in extreme manner. The summer season experience the highest temperature. Region like Wardha and Nagpur becomes intolerable during summers. Concrete house experience only 1-2 °C difference from the outside temperature. While Wardha Block House experience 8°C difference from outside temperature. Wardha Block House with the assembly of beam and column can go high rise. Thus Wardha Block House is the answer for composite climate areas for better living conditions for human beings. Such houses not only reduce the inside temperature but also decreases the electricity consumption. A very low artificial ventilation is needed.

10. REFERENCES

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