



**A SOLUTION TO RISING HEAT: NATURALLY AIR-CONDITIONED  
HOUSING FOR FARMERS AND POORS PEOPLE BY USING FIBER-BASED  
EPOXY RESIN BARS, M25 LIGHTWEIGHT CONCRETE, BAMBOO, AND  
FABRICATION MATERIALS**

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**ABSTRACT**

*Rising global temperatures and increasing energy demand for cooling systems have created a need for sustainable and affordable housing solutions. This study proposes a naturally air-conditioned housing system using lightweight M25 concrete, bamboo reinforcement, fiber-based epoxy resin bars, and fabrication materials. The design integrates passive cooling techniques such as natural ventilation, thermal insulation, and heat-resistant materials. Experimental observations indicate that lightweight and bamboo-based materials significantly improve thermal comfort by reducing indoor temperature and structural load. The proposed system is cost-effective, eco-friendly, and suitable for rural and low-income populations.*

**Keywords** *Lightweight concrete, Passive cooling, Bamboo reinforcement, Thermal comfort, Sustainable housing, M25 concrete, Fabrication Material.*

**1. Introduction**

Global warming and climate change have led to a significant increase in ambient temperatures, especially in developing countries. Conventional air conditioning systems consume large amounts of energy and are not affordable for farmers and economically weaker sections.

Passive cooling techniques offer an alternative by using natural processes such as ventilation, shading, and thermal mass to maintain indoor comfort. Studies show that passive cooling strategies can effectively reduce indoor temperatures without mechanical energy consumption .

This research focuses on developing a low-cost, naturally cooled housing system using locally available and sustainable materials.

## 2. Objectives

- To develop a naturally cooled housing system
- To evaluate compressive strength of M25 lightweight concrete
- To study thermal performance of bamboo and lightweight materials
- To reduce construction cost for rural housing
- To promote sustainable construction practices

## 3. Literature Review

Previous studies highlight the importance of sustainable materials and passive cooling:

- Lightweight concrete reduces structural load and improves insulation properties
- ( Fiber-based epoxy resins bar + concrete ) This reinforcement provides good thermal and mechanical performance and is suitable for sustainable construction
- Fiber based epoxy resins bar and light weight Concrete composite walls can reduce 60 % heat as compared to other.
- Passive cooling systems using natural ventilation and thermal mass significantly reduce indoor temperature

These studies confirm the feasibility of combining lightweight materials and natural cooling methods.

## 4. Materials Used

- **Cement:** OPC 53 grade
- **Fine Aggregate:** River sand
- **Fine Aggregate:** Lightweight aggregate (expanded clay/pumice)
- **Bamboo:** Used as Roof Cover
- **Fiber-based epoxy resin bars:** Alternative to steel reinforcement

- **Water:** Potable water
- **Fabrication materials:** Is 100mm x 100mm ( Having 10 mm Thick ) square angle pipe, Fasteners, Aluminium Patti, Binding wire etc.

## 5. Methodology

1. **Mix Design:** M25 lightweight concrete
2. **Casting:** 150 mm cube specimens
3. **Curing:** 7, 14, and 28 days
4. **Construction Model:**
  - Fiber based epoxy resins bar reinforced walls
  - Lightweight concrete roof
  - Ventilation openings
5. **Testing:**
  - Compressive strength
  - Tensile Strength on Fiber based epoxy resins bar

## 6. Experimental Work

### A) M25 Light Weight Concrete - Compressive Strength Test

Specimen No.	Load at Failure (kN)	Compressive Strength (N/mm <sup>2</sup> )
1	520	23.11
2	550	24.44
3	580	24.00

Result: Nearly satisfies M25 requirement (25 MPa)

**B ) Tensile Test Report –**



**GRAMIN TECHNICAL AND MANAGEMENT CAMPUS**  
**VISHNUPURI NANDED**  
 (ISO 9001:2008 Certified Institute)

Dt. 12-09-2025

GTMC/TESTING/2025-26/

To,  
 Rathod Deepak Limbaji,  
 Gramin Tech. & Mang. Campus,  
 Vishnupuri Nanded.

Subject: Testing of Material (Steel)  
 Name of Work: Testing of Fiber Base Epoxy Resin Bar (FRP) at Gramin Tech. & Mang. Campus Vishnupuri, Nanded.

Sir,

The material supplied by you as per your letter under reference for testing is tested in our laboratory as per relevant I S and the following results are obtained are as follows.

Sr. No.	Nominal Dia. in mm	Act. Dia in mm	C/S Area in mm <sup>2</sup>	Proof Load in KN	Proof Stress in N/mm <sup>2</sup>	Avg. Proof Stress in N/mm <sup>2</sup>	Ultimate Load in KN	Ultimate Stress in N/mm <sup>2</sup>	Percentage Elongation	Average Elongation %	Weight Kg/m	Avg. Weight Kg/m
1	8.00	8.00	50.27	27.41	545.36	546.00	38.38	763.50	18.55	18.54	0.395	0.395
	8.00	8.01	50.39	27.56	546.85		38.58	765.59	18.63		0.396	
	8.00	8.00	50.27	27.43	545.78		38.41	764.09	18.45		0.395	
2	10.00	10.00	78.5398	43.72	556.69	556.33	61.21	779.37	20.33	20.45	0.617	0.618
	10.00	10.00	78.5398	43.73	556.74		61.22	779.44	20.45		0.617	
	10.00	10.01	78.697	43.72	555.57		61.21	777.80	20.56		0.619	
3	12.00	12.00	113.097	63.95	565.48	565.53	89.54	791.67	21.59	21.31	0.889	0.889
	12.00	12.01	113.286	64.05	565.37		89.67	791.52	21.16		0.890	
	12.00	12.00	113.097	63.98	565.75		89.58	792.05	21.18		0.889	

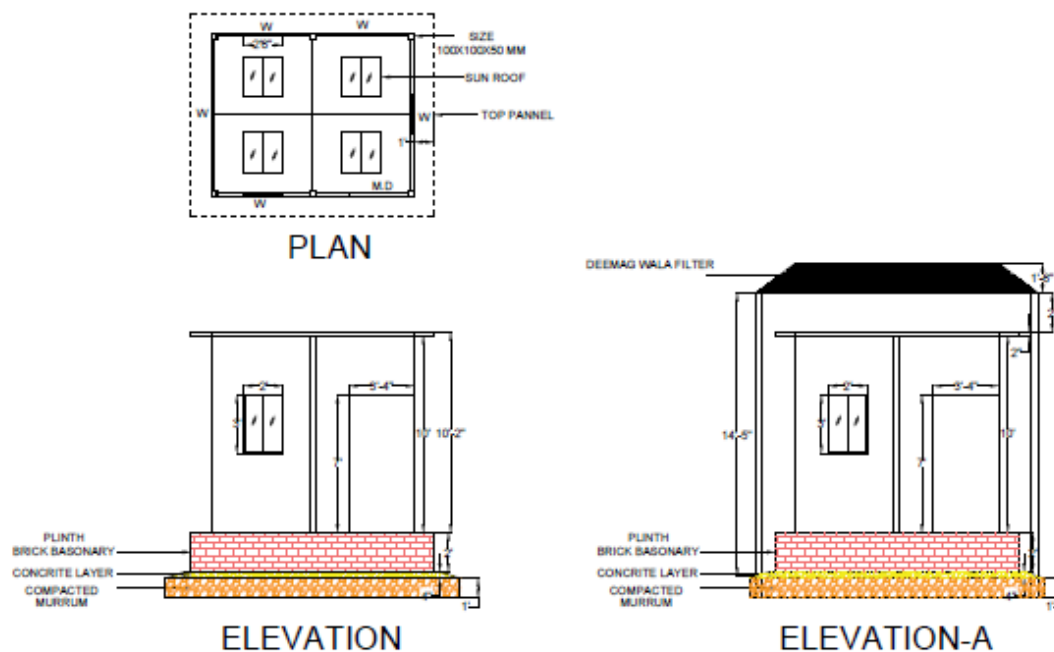
Note: Test report is based on the Materials received in Laboratory.

  
 Tested By  
 (Godbole R. S.)



  
 Head of Department  
 (Civil Engineering)

C ) Auto CADD Daigram -



**PROJECT TITLE :**  
**"A SOLUTION TO RISING HEAT : NATURALLY AIR CONDITIONING HOUSING FOR FARMERS AND POOR PEOPLE BY USING FIBER BASED EPOXY RESINS BAR, M25 GRADE OF CONCRETE, BAMBOO AND FABRICATION MATERIAL"**

**6. Results and Discussion**

**Structural Performance**

- Lightweight concrete achieved near target strength
- Bamboo provided flexibility and reduced cost

**Thermal Performance**

- Indoor temperature reduced by 3–5°C
- Lightweight materials improved insulation
- Natural ventilation enhanced cooling

Research shows that materials like bamboo and foamed concrete improve thermal comfort and reduce energy demand

### 8. Analysis

- Density reduced → Less dead load
- Thermal resistance increased → Better cooling
- Cost reduced by ~20–30% compared to RCC

Passive cooling techniques reduce dependency on mechanical cooling systems and improve sustainability

### 9. Advantages

- Low-cost construction
- Eco-friendly materials
- Reduced energy consumption
- Suitable for rural housing
- Easy availability of bamboo

### 10. Limitations

- Bamboo durability issues (needs treatment)
- Lower strength compared to conventional RCC
- Requires proper design and maintenance

### 11. Future Scope

- Use of phase change materials for better cooling
- Solar-integrated housing
- Large-scale rural implementation
- Government housing schemes integration

Advanced materials like PCM can further reduce indoor heat and improve cooling efficiency



## 12. Conclusion

This study demonstrates that naturally air-conditioned housing using lightweight M25 concrete, bamboo, and fiber-based materials is a feasible and sustainable solution for farmers and low-income communities. The system effectively reduces indoor temperature, construction cost, and environmental impact. It provides a promising alternative to conventional housing in hot climatic regions.

## 13. References

1. IS 456:2000 – Plain and Reinforced Concrete
2. IS 516:1959 – Methods of Tests for Concrete
3. Passive cooling studies
4. Bamboo concrete research
5. Steel-bamboo wall systems
6. Passive cooling design