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Composite Block by Using Eco-friendly Materials

Prof. S. R. Patil ,Sachin S. Sawant, Karan P. Bangar, Ketan S. Mane, Vishal P. Jamadade.

Student B-tech, Dept. of Civil Engineering, SKN Sinhgad College Of Engineering, Korti,Pandharpur.

Abstract:

In this progress the development of composite block made from the eco-friendly materials such as Gypsum, Fly ash, cement, forming agent it's creating light weight durable and environmentally sustainable. The Foaming agent enhance the block lightweight nature. It will be interrupting the air and reduce the weight of the block. The cement is use as the binding material. This block is made from the Environmentally and ecofriendly materials. On these blocks we will perform various tests on it like Water Absorption Test, Compressive Strength.

***Keywords**: Fly ash, Gypsum, Foaming agent, Cement, etc.*

1 Introduction

Foam concrete is increasingly being considered as an alternative building material for tropical climates due to its excellent insulation properties, good thermal conductivity, and sound absorption capabilities when compared to traditional concrete. The use of innovative materials in construction, particularly for tropical buildings, is evolving rapidly, including the exploration of new wall materials. Research has also examined the impact of incorporating waste brick into mortar, which may present an opportunity for reusing materials in gypsum mortar, especially for the restoration of decorative features. The construction industry faces challenges beyond just waste, as many materials are derived from non-renewable resources and require energy-intensive production processes, contributing significantly to environmental pollution. Concrete bricks, which are typically made from sand, cement, and water, create a durable, stone-like material once they set. However, the widespread use of sand in construction has led to excessive mining activities, which disrupt the natural balance of ecosystems and can cause environmental degradation. [15,16]

1.1 Gypsum: - Fertilizer waste gypsum, a byproduct from the fertilizer industry, has been utilized in block production for several decades. Its application in brick manufacturing dates back to the 1960s when it was first introduced as a raw material. This byproduct, typically white or gray in color, primarily consists of calcium sulfate dihydrate and is a soft mineral that can be easily ground into a fine powder. Fertilizer waste gypsum possesses characteristics such as high compressive strength, low water absorption, and good fire resistance, which make it highly suitable for use in block production. These attributes are especially beneficial for bricks intended to endure severe weather conditions and fire exposure. In block manufacturing, small amounts of fertilizer waste gypsum are incorporated into the soil mixture, serving as a binding agent that helps the soil particles adhere to one another, resulting in a cohesive mass that can be easily shaped into blocks.

1.2 Foaming Agent:

Foaming agents are used to make lightweight concrete blocks, also known as cellular concrete or foamed concrete. They are a key component in the production of these blocks, which are used in many construction projects.

❖ **Benefits of foaming agents:**

Lightweight: Foaming agents make blocks lighter, which makes them easier to handle and install.

Insulation: Foaming agents make blocks with good thermal insulation properties, which makes them ideal for energy efficient buildings.

Durable: Foaming agents make blocks resistant to fire, pests, and moisture.

Environmentally friendly: Foaming agents can be made from fly ash, by product of coal fired power plant.

1.3 Fly Ash- Fly ash is a byproduct of coal-fired power plants and has been used in brick manufacturing for several decades. The

history of using fly ash in brick manufacturing can be traced back to the early 1900s when it was first used as a raw material for making bricks.

Fly ash is a fine, powdery substance that is composed of small, spherical particles. It is typically gray or tan in color and is produced when coal is burned to generate electricity. The properties of fly ash that make it suitable for brick or block manufacturing include its high compressive strength, low water absorption, and good insulation properties. These properties make it an ideal additive for blocks that are required to withstand harsh weather conditions and provide good insulation.

1.4 Cement:

Cement is the primary ingredient in concrete blocks, which are a key component in construction. The cement in concrete blocks is

usually Portland cement, which is a mixture of silicon, calcium, iron, aluminum, and other materials.

❖ **Concrete block uses:**

Concrete blocks are used to construct walls in residential, Commercial and Industrial building Concrete blocks are Strong and durable and can withstand harsh weather conditions.

Concrete blocks are fire resistant, making them a safe choice for buildings in areas prone to fire.

2. Mix Design:

Mix design for the Composite Block Materials (in %) such as Gypsum, Fly ash, Cement, Foaming agent, etc.

Table Mix Proportion

No of Trials	Gypsum (%)	Fly ash (%)	Cement (%)	Total (%)
1	40	30	30	100
2	50	25	25	100
3	60	20	20	100
4	30	35	35	100
5	45	10	45	100
6	40	20	40	100
7	35	35	30	100
8	30	30	40	100

3. Testing Programmer

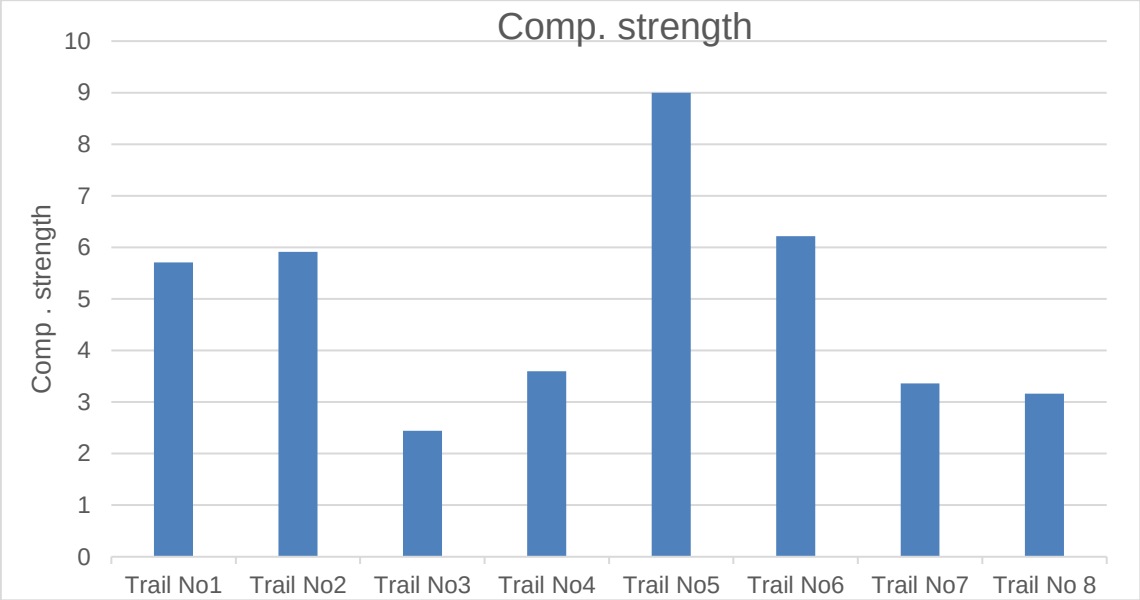
3.1 Casting

- **Cube**: The cube specimens measuring 70 mm * 70 mm * 70 mm were cast for testing purposes.
- **Block**: Rectangular concrete specimens with a size of 600 mm *150 mm* 200 mm for the casting and for the sample.
- **water Absorbing Capacity:**

A water immersion test was conducted to determine the water absorption capacity of the bricks in accordance with the IS 1077-1992 standard. The primary purpose of this test was to assess how much water the bricks could absorb. It was carried out specifically to measure the water absorption value of the bricks.

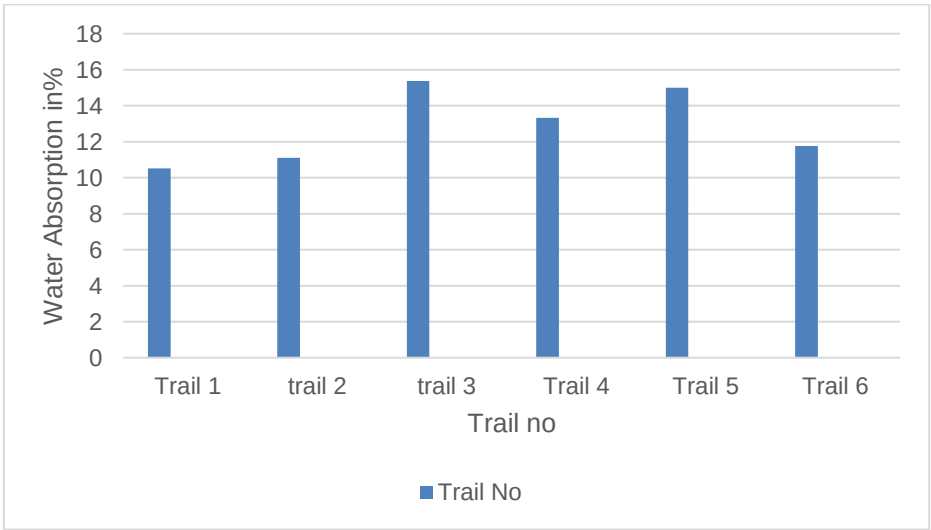
3.2 Compressive Strength for Cube:

No. of cube	Compressive Strength (MPa)
1	5.71
2	5.91
3	2.44
4	3.6
5	9.0
6	6.22
7	3.36
8	3.16



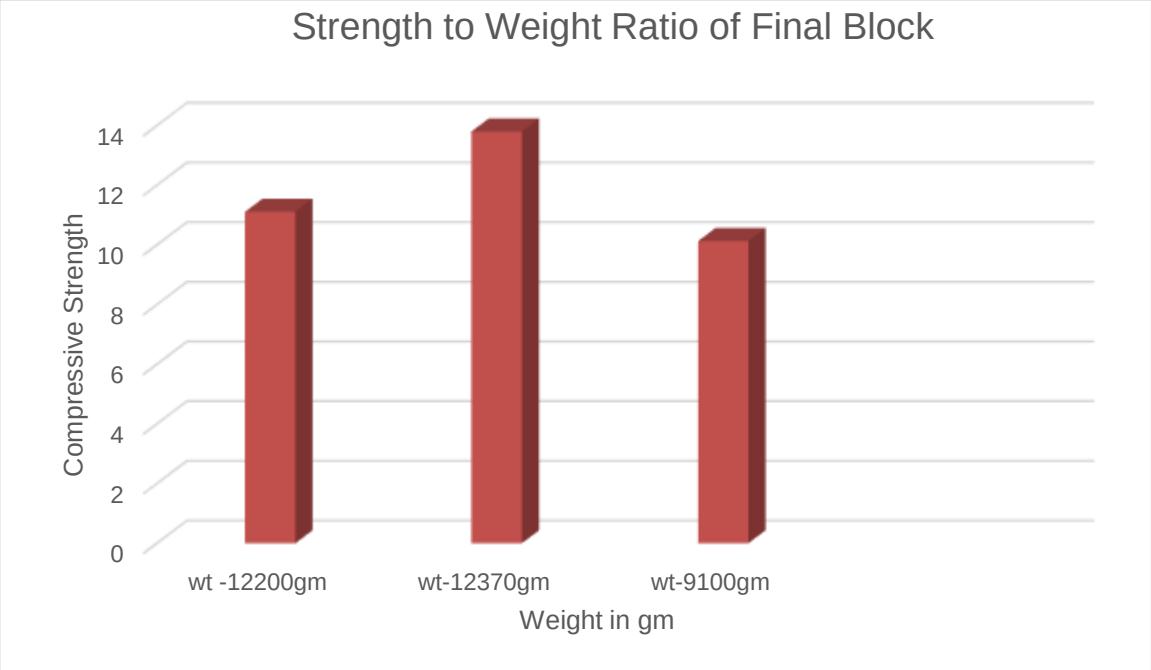
3.3 water Absorbing Capacity:

No. of Block	Water Absorption (%)
1	10.52
2	11.11
3	15.38
4	13.33
5	15
6	11.76



3.4 Weight analysis Chart & Graph:

Strength to Weight Ratio	
Weight (gm)	**Compressive Strength (N/mm2)**
12,200	11.11
12,370	13.8
9,100	10.13



Graph – Strength to Weight Ratio

4. Result:

- **Results of Comp. Strength:**

The compressive strength of soil bricks can be evaluated using a Universal Testing Machine (UTM). According to existing studies, a compression test measures how materials respond when subjected to crushing forces.

- **water Absorbing Capacity:**

A water immersion test was performed to determine the water absorption capacity of the bricks, following the IS 1077-1992 standard. The main objective of this test was to measure how much water the bricks could absorb. It was conducted specifically to obtain the water absorption value.

5. Conclusion

- Gypsum and Cement content are same but variation in content of fly ash shows changes in manner of strength, water absorption and strength to weight ratio in Composite blocks.
- For trial sample number 5 and 6 shows magnificent result in all manners.
- Compression strength of Trial no 5 is 9.00 N/mm2 which is 47 % more than Trial No.6.
- Strength to weight ratio (9.00/0.210) *100 of Trial no. 5 is 42.85%
- So composite blocks which are made from recycle material like Gypsum, Fly ash and foaming agent are shows suitable for building construction materials.

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