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Experimental Investigation of Bricks Made With Eco Sand and Foundry Sand, With Fly Ash Replacement for Part of the Cement

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Abstract : Eco sand and foundry sand are the definitive types of brick making these must continue to evolve sustainably and create competitive within the industries, while at same time being a long-term construction material, must have high energy efficient and cheap in cost. Eco sand and foundry sand were mixed with cement partial replacement of fly ash and water then cast into shape. Compression and water absorption of bricks were detected. The outcome illustrated that the test bricks had higher compressive strength and higher water absorption when placed after that to the presented masonry blocks. Sand from the environment and foundry sand are combined with cement, fly ash and water then cast into shape. To handle the ecological pollution we are using this variety of sand. Eco sand and foundry sand possess attractive properties and good strength. The results demonstrate that a mix of Eco sand, foundry sand, cement and Fly ash produces superior new bricks at a lower cost.

Keywords: Eco sand, Foundry sand, Fly Ash, Compression and Water Absorption.

1 INTRODUCTION

Bricks are the most often used building material; however tiles, refractory bricks, earthenware, and stoneware are all used for diverse construction purposes. Walls, columns, roofing, paving floors, and coarse aggregates for concrete construction in foundation under-floors are only a few of the applications for bricks.

- Bricks should have a consistent shape and size, and when knocked together, they should make a distinct ringing sound.
- Processes in industry the bricks should have a low thermal conductivity and be soundproof.

Convert industrial wastes into useable building and construction materials is a major challenged for Civil engineers, especially in the recent decade, due to a significant demand placed on the building material sector due to the getting higher population, this creates a constant scarceness of construction materials. Recycling trash into construction materials will be a more environmentally friendly alternative. The growing use of eco friendly, inexpensive, and light-weight construction materials in the manufacture sector demonstrates the necessity for recycling and reusing the resources. Bricks are classified into several types based on the raw materials used to make them. The materials used in bricks, as well as their characteristics and various testing, are detailed here. The index and chemical characteristics of Eco sand, Foundry sand, fly ash and cement vary greatly based on a variety of circumstances, including geographical location.

2 MATERIALS AND METHOD

2.1 Materials used

2.1.1 Cement

Throughout the investigation, locally available cement of the common Portland cement type (53 grade) was utilized, which was in accordance with IS 8112.

2.1.2 Fly ash

Fly ash brick is a type of construction material that includes class F fly ash is used to make masonry units. The specified compositions produce fly ash bricks with a strength of 7.5 to 10 MPa. Fly ash bricks are more durable than clay bricks, although they are heavier.

2.1.3 Eco sand

Eco sand is an extremely tiny particle that is a byproduct of cement manufacturing and may be utilized to enhance concrete efficiency. Its micro-filling action minimizes holes in concrete and so improves moisture resistance and durability. Its grade is more uniform than that of many extracted aggregates. Effective utilization of waste material, therefore cost effective, and performs similarly to naturally produced sand. The usage of eco sand as opposed to mined or dredged natural sand will assist designers and contractors in addressing sustainability concerns. Table 1 lists the index properties of eco sand.

Table 1: Index properties of Eco sand

S.NO	Constituent/Property	Value
1	Colour	White
2	Percent passing 75µ sieve	76%
3	Specific gravity	2.42
4	Fineness modulus	5.54

2.1.4 Foundry sand

As seen in Table 2, foundry sand is a variety of excellent silica sand with constant mechanical distinctiveness. Sand has been applying as a moulding material for millennia due to its heat conductivity, and It is considered as a possible source of the iron and non - ferrous metal fabrication sectors.

Table 2: Index properties of foundry sand

S.NO	Constituent/Property	Value
1	Colour of material	Gray
2	Percent passing 75µ sieve	21%
3	Specific gravity of material	2.52
4	Fineness modulus of sand	1.95

2.1.5 Water

Water is an indispensable component of brick manufacturing because it energetically contributes in oxidation processes involving cement. The strength of cement bricks is primarily due to the binding action of cement hydration. The amount of water needed, however, must be restricted to that essential for the substance reaction of un - hydrated cement, since surplus water would simply result in the creation of unwanted spaces or capillaries in the case-hardened cement paste in brick.

2.2 Method of Preparation

Different mix ratios were utilized in this investigation, as indicated in Table 3. 234 × 105 × 80 mm is the possible block size. Cement, fly ash, and Eco sand/ Foundry sand were placed in a mixing platform after well mixed add water content slowly: make the mixture without lumps. To compact the materials in the mould, a pressure of 10 MPa was applied for 2 minutes.

Following that, the produced brick samples were taken from the mould as soon as 1 minute and dried at room temperature for 24 hours. During the demoulding process, no damage to the bricks was detected.

Table-3: Mix proportions

Proportion	% Eco sand	% Foundry sand	% Cement	% Fly ash
Eco sand + Cement + Fly ash (MIX 1)	80	-	10	10
Foundry sand + Cement + Fly ash (MIX 2)	-	80	10	10
Eco + Foundry sand + Cement + Fly ash (MIX 3)	40	40	10	10

3 Results and Discussions

3.1 Water Absorption

It is weighted dry a brick. Then, as indicated in fig 1, it is submerged in water for 24 hours. It's weighed again, and the weight difference indicates how much water the brick absorbed. It should be no more than 20% of the dry brick's weight. Table 4 shows the water absorption of Eco sand and Foundry sand bricks after 28 days for various mix proportions. Graph no. 1 depicted the comparing findings.

Table 4: 28 days water absorption of Eco sand and Foundry sand bricks

Proportion	Water absorption (%)
Eco sand + Cement + Fly ash (MIX 1)	4.1
Foundry sand + Cement + Fly ash (MIX 2)	4.05
Eco + Foundry sand + Cement + Fly ash (MIX 3)	4.85

3.2 Compressive Strength

A compression testing apparatus is make use of find out the strength of compression. It's pushed till it snaps. The examples were made with Eco sand and Foundry sand with varying amounts of cement. Bricks must have a lowest amount compressive strength of 3.50 N/mm^2 according to BIS: 1077-1957. Figure 2 shows the bricks with compressive testing equipment. The compressive strength of bricks for various curing days was recorded in tables 5, 6, and 7, and a comparative study of compressive strength was presented in graphs 2.

Figure 1: Compression testing machine

Table 5: 7-days Compressive Strength of Eco sand bricks and foundry sand bricks for Different % Replacement of Cement.

S.NO	Proportion	Compressive strength (N/mm^2)		
		Trial 1	Trial 2	Trial 3
1	MIX 1	6	5.87	5.9
2	MIX 2	4.85	5.12	4.9
3	MIX 3	6.2	5.92	5.7

Table 6: 14days Compressive strength of Eco sand and Foundry sand bricks for Different % Replacement of Cement.

S.NO	Proportion	Compressive strength (N/mm^2)		
		Trial 1	Trial 2	Trial 3
1	MIX 1	9.51	10.17	9.47
2	MIX 2	12.62	13.02	12.87
3	MIX 3	12.62	12.82	13.01

Table-7: 28days Compressive Strength of Eco sand and Foundry sand bricks for Different % Replacement of Cement.

S.NO	Proportion	Compressive strength (N/mm^2)		
		Trial 1	Trial 2	Trial 3
1	**MIX 1**	12.25	12.64	12.87
2	**MIX 2**	10.11	9.88	10.51
3	**MIX 3**	14.62	13.55	13.87

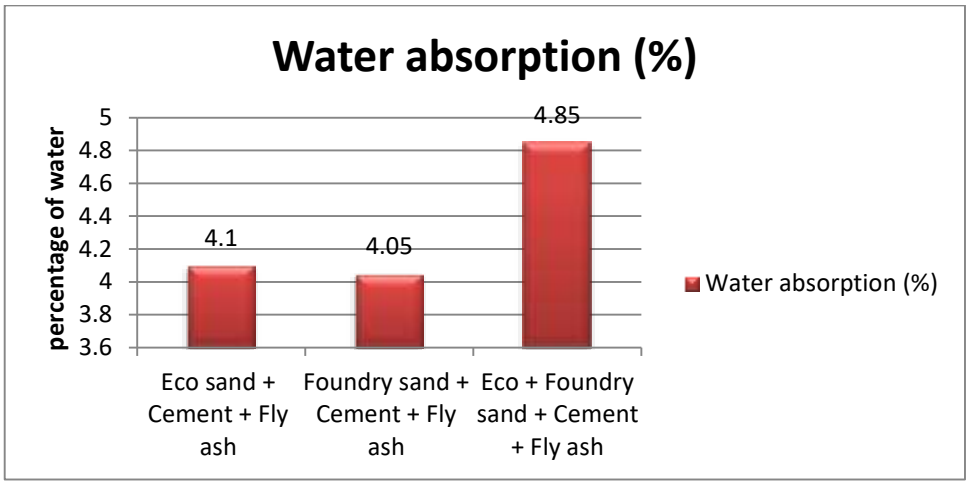

Figure 2: Water absorption of brick

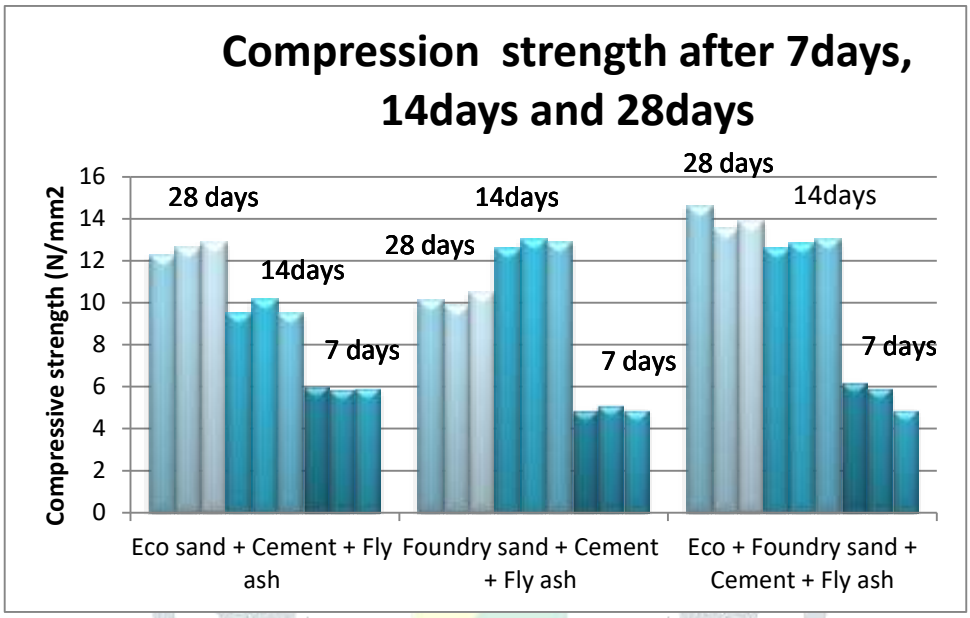

Figure 3: Compression strength of brick

4 Conclusion

According to the results of the bricks' testing research, the eco sand and foundry sand combination outperforms all others. The outcomes vary depending on the materials used to the cement. For example, combining eco sand with cement and fly ash produced an excellent result when compared to using foundry sand with cement and fly ash. The least amount of compressive strength of brick was determined to be 9.88 N/mm^2 in MIX 2 after 28 days of curing. MIX 3 yielded a maximum compressive strength of 14.62 N/mm^2, which is greater than the expected value of compressive strength of conventional brick. The expense of a brick has been predicted to be 20% higher than the price of a conventional solid block. The time it takes to make these bricks is shorter than it is to make normal bricks. It has been observed that the strength obtained improves as the proportion of cement replaced rises. It also shows that when the cement concentration rises, the amount of water absorbed falls.

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