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Effective Use of Granite Sand as Replacement for Natural Sand in Brick Manufacturing.

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ABSTRACT
The goal of this research is to employ granite sand in brick manufacturing to prevent environmental harm, increase brick quality by using granite quarry waste, and finally solve the problem of natural sand scarcity. In this study, granite sand is used as a complete replacement for natural sand in the manufacture of fly ash brick.Two sets of bricks measuring 230 X 110 X 70 mm and weighing 3 kg were prepared for this research. The first set includes 12 standard fly ash bricks,with a composition of 60% fly ash, 28% natural sand, and 12% cement, while the second set includes 12 modified fly ash bricks,with a composition of 60% fly ash, 28% granite fine sand, and 12% cement.OPC 43 cement with a specific gravity of 3.13 was utilised. The water-cement ratio was kept constant at 0.4. Granite has a specific gravity of 2.57.Both sets of samples were subjected to compressive strength and water absorption tests.These results clearly demonstrated that brick samplescontaininggranitefineshadsuperiorcharacteristics to ordinary brick.

Keywords: Granite waste, Natural sand, Fly ash, Cement Bricks.

I. INTRODUCTION

Granite is highly strong and durable, and it can tolerate harsh temperatures and weights. It is resistant to weathering, erosion, and chemical exposure, making it ideal for both indoor and outdoor use. The natural beauty of granite, with its unique patterns and wide range of colours, adds a touch of elegance to buildings. It can be polished for a sparkling, flawless surface or left natural for a rustic look. Granite can be used in a wide range of applications, including countertops, flooring, wall cladding, pavement, stairs, and many others. Because of its versatility, it can be used in both structural and ornamental applications.

The construction and mining industries have been noted as being responsible for excessive non-renewable resource consumption as well as significant solid waste production that pollutes the air and harms land and water.[1] Granite quarrying processes have a wide range of environmental impacts, including air pollution, water pollution, noise pollution, biodiversity loss, land degradation, occupational human health issues, and poor mining waste disposal.[2] To minimise and manage these wastes, sustainable and environment-friendly operations are performed. Also, these wastes can be utilised in effective ways in the construction industry.To lessen the environmental impact of this garbage, it must be removed economically.[3]

One of the most significant building materials is brick in the construction industry. Cement brick is one such example. Cement bricks have a number of advantages over clay bricks that make them a popular choice for building projects. They can be created from recycled materials like fly ash or slag, lowering their environmental effect. They also have a long lifespan, which adds to sustainability by reducing the need for replacements on a regular basis.

II. MATERIAL AND METHODOLOGY

The following materials are used:

1. Fly Ash: It is a fine, powdery by-product of thermal power plant coal burning.
   It comprises minerals including silica, alumina, iron oxide, and others. It is the main source of pozzolanic material in bricks, which increases their strength and longevity. The production uses 60% fly ash.
2. Cement: Ordinary Portland cement (OPC) is used as a binding material in fly ash bricks. The percentage of cement utilised is 12%. Birla Shakti OPC grade 43 cement was utilized.
3. Natural Sand: Sand is a fine aggregate used in the production of fly ash bricks. It increases the workability of the mixture and contributes to the overall strength and density of the bricks. Sand accounts for 28% of the material used in the manufacture of bricks.

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4. Granite Sand: Natural sand is completely replaced with granite sand. The specific gravity of granite used is 2.57.

For this study, two sets of brick samples, 12 in each set, were prepared of size 230 mm X 110 mm X 70 mm and weighed 3 kg. The first set is of standard brick with 60% fly ash, 28% natural sand and 12% cement composition. The second set is of modified brick with 60% fly ash, 28% granite sand and 12% cement. The raw materials are poured into the pan mixer and the required amount of water is added for homogeneous mixing. After mixing, the mixture was transported via a conveyor belt from the mixer to the automatic brick-making equipment, where it was pressed by a hydraulic press machine. Both sets of samples are prepared separately and tested for compressive strength and water absorption.

III. RESULTS AND DISCUSSIONS

- Compressive Strength Test Results

Table 1 For Standard Bricks

Sample	**Compressive Strength (N/mm^2)**
N 1	10.61
N 2	12.50
N 3	10.82
N 4	11.91
N 5	11.56
N 6	11.78

Table 2 For Modified Bricks

Sample	**Compressive Strength (N/mm^2)**
M 1	11.40
M 2	12.76
M 3	11.21
M 4	13.15
M 5	12.23
M 6	12.14

- Water Absorption Test Results

Table 3 For Standard Bricks

Sample	**Water Absorption (%)**
N 1	8.45
N 2	9.27
N 3	8.49
N 4	8.74

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N 5	9.15
N 6	8.48

Table 4 For Modified Bricks

Sample	**Water Absorption (%)**
M 1	7.20
M 2	6.52
M 3	7.75
M 4	7.79
M 5	6.31
M 6	7.51

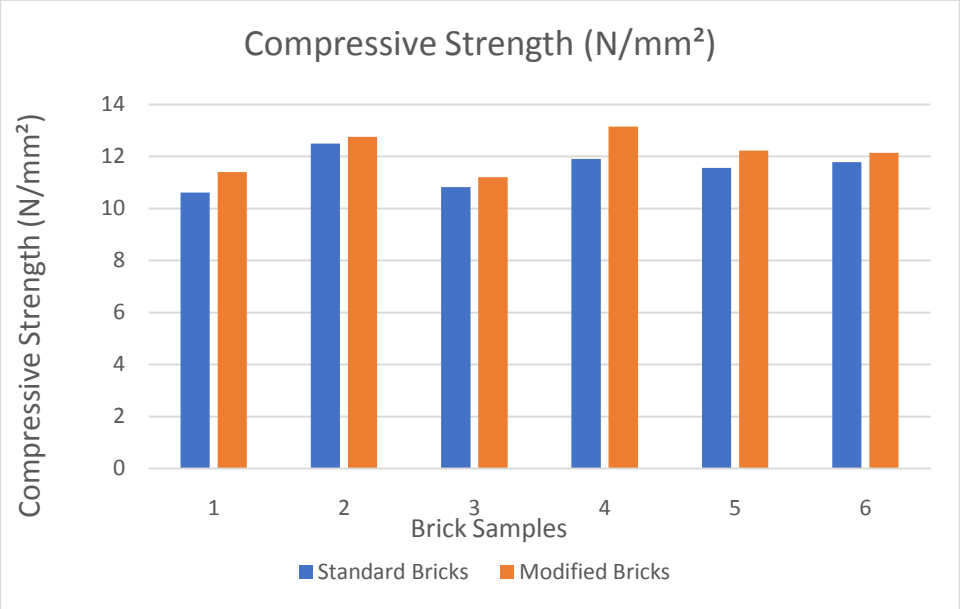

Fig 1. Comparison of Compressive Strength between Standard Brick vs Modified Brick

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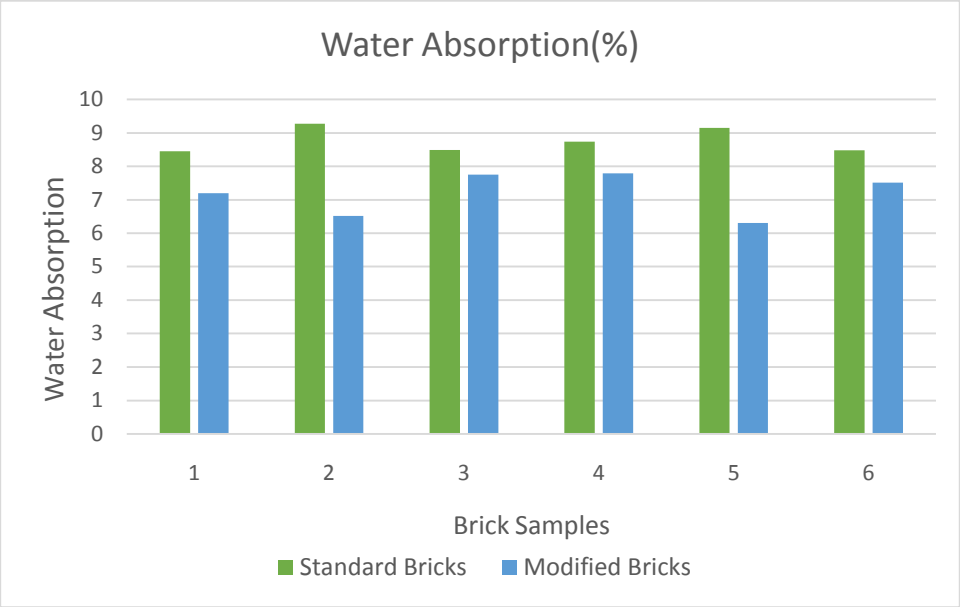

Fig 2. Comparison of Water Absorption between Standard Brick vs Modified Brick

IV. CONCLUSIONS

- It is observed that the compressive strength of the modified brick is 12.15 N/mm² and that of standard brick is 11.53 N/mm². This shows that by replacing natural sand with granite sand there is a 5.37% increase in compressive strength.
- It is observed that the water absorption of the modified brick is 7.18% and that of standard brick is 8.76%. This shows that by replacing natural sand with granite sand there is a 18.03% decrease in water absorption.
- Lastly, it can be concluded that a better quality of brick is produced. We can say that granite waste can be effectively used in brick manufacturing to reduce the environmental effects. This also solves the problem of exploitation of natural sand.

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