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Experimental investigation on Low-Cost bricks by adding suitable additives

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Abstract - This paper presents an experimental study carried out on bricks made from fly ash and Manufactured Sand (M-sand). This investigation also aims to use waste materials effectively since fly ash is a waste obtained from thermal power plants and plastic is a waste from the plastic crushing industry. The properties of the fly ash bricks are investigated by conducting various tests like the Compressive strength test, and water absorption test. 10%,20%, and 30% fly ash, and Plastic Waste have been added for testing and validation of new forms of brick.

KEYWORDS: Fly ash, Plastic waste, Compressive Strength, Water absorption capacity, Compression test machine.

I. INTRODUCTION

In the olden days brick is fired bricks. Fired brick is one of the longest-lasting and strongest building materials, sometimes referred to as artificial stone, and has been used since 5000 BC. Air-dried bricks also known as mudbricks, have a history older than fired bricks and have an additional ingredient of a mechanical binder such as straw. Bricks are laid in courses and numerous patterns known as bonds, collectively known as brickwork, and may be laid in various kinds of mortar to hold the bricks together to make a durable structure. Raw bricks were sun-dried before being fired. Fired bricks are burned in a kiln which makes them durable. Modern fired clay bricks are formed in one of three processes soft mud, dry press, or extruded. Normally, brick contains the following ingredients, Silica (sand) 50% to 60% by weight Alumina (clay) 20% to 30% by weight Lime 2 to 5% by weight Iron oxide less than or equal to 7% by weight Magnesia less than 1% by weight.

The soft mud method is the most common, as it is the most economical. It starts with raw clay, preferably in a mix with 25–30% sand to reduce shrinkage. The clay is first ground and mixed with water to the desired consistency. The clay is then pressed into steel molds with a hydraulic press. The shaped clay is then fired (burned) at 900–1000°C to achieve strength.

1.1 Hybrid materials

Hybrid materials are composites consisting of two constituents at the nanometer or molecular level. Commonly one of these compounds is inorganic and the other one is organic. Thus, they differ from traditional composites where the constituents are at the macroscopic (micrometer to millimeter) level. Mixing at the microscopic scale leads to a more homogeneous material that either shows characteristics in between the two original phases or even new properties.

Many natural materials consist of inorganic and organic building blocks distributed on the nanoscale. In most cases, the inorganic part provides mechanical strength and an overall structure to the natural objects while the organic part delivers bonding between the inorganic building blocks and the soft tissue. Typical examples of material are bone.

1.2 Failure in brick

Failures in bricks are large because of not proper manufacturing, improper workmanship, and load-bearing capacity of building on site. Many problems occur such as shear, water permeability, and failure due to load. If the brick cannot withstand the

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load acting on it, leads to shear failure. On brick, water can be absorbed for a long time then permeability takes place then cracks will occur.

That problem can be only curable by changing the raw material and quality of the material. Raw material can be changed by Quarry dust because the water absorption capacity is low. Fiber can be used to carry the load acting on material due to its flexibility.

II. Proportioning

The ratio of the brick is 1:4 according to the M25 grade of concrete. The cement used in the bricks is partially replaced by plastic and fly ash in 10%, 20%, and 30% of the three samples.

Table -1: Proportioning of Brick

S.no	% of plastic and fly ash	Cement in Kg	M Sand in Kg	Plastic in Kg	Fly Ash in Kg
1	10	0.892	2.55	0.049	0.049
2	20	0.793	2.55	0.099	0.099
3	30	0.694	2.55	0.148	0.148

The usage of M-Sand is preferably constant, only the cement is replaced by plastic and fly ash in the proportion of 10%,20%, and 30%. The brick is generally brittle, so the strength of the brick is tested under the compression test by using a compression test machine. We propose the quality of the brick by comparing the compressive strength of each specimen.

The following graph shows the compression strength of the brick.

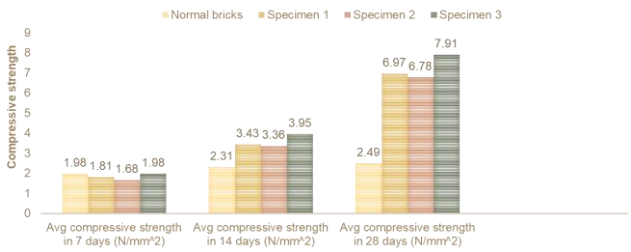

Chart -1: Compressive strength

The compressive strength of the brick increase with an increase in the weight of the plastic, by which we can conclude that the strength of the brick is directly proportional to time and proportioning of the fly ash and plastic waste.

The failure of the brick is due to compressive load, it shows the shear failure which is parallel to the lateral or transverse direction of the brick. However, the water absorption capacity of the brick plays a vital role in the strength of the brick which is inversely proportional to the strength of the material.

Fig -1: Name of the figure

III. CONCLUSIONS

The study was conducted to find the optimum percentage of fly ash brick. However, the brick specimen of size 230mm x 110mm x 90mm were cast for different mix percentages of fly ash and plastic added as 10%, 20%, and 30% for the replacement of cement. However, the percentage of the specimens has been tested for three mixed proportions. The mechanical properties such as compressive strength were studied for different mix proportions, at different curing ages. From the results, it was inferred that, among the three proportions the maximum optimized compressive strength is obtained for the optimal mix percentage of plastic and fly ash as 7.91N/mm^2.

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