

Eco-friendly Bricks Construction Using Waste Material

Prof. Shahrukh Kureshi¹ , Mohit Gedam², Pratik Shahare³ ,Ujwal Barapatre⁴

Arya Gajbhiye⁵.

¹Department of Civil Engineering, JD College Of Engineering, Nagpur, India.

ABSTRACT

Reducing greenhouse gas emissions during the manufacture of building materials is the primary goal of many studies, as sustainable development is a key problem. From a sustainability perspective, this percentage is undesirable because cement manufacture contributes to global warming by generating tons of carbon dioxide, even when cement is employed as fly ash stabilizer in ratios of no more than 10%. Using fly ash bricks results in both environmental protection and the preservation of natural resources. The primary goal of using plastic is to reduce pollution, as it produces a significant amount of air pollution when burned. Plastic trash is used to make bricks with increased bulk density, porosity, compressive strength, and light weight rather than burning brick.

The goal of this research is to create environmentally friendly bricks. Utilizing plastic and fly ash as industrial byproducts to reduce the amount of cement used, as well as researching the mechanical, chemical, and physical characteristics of the material to create eco-friendly bricks.

keywords- Eco-friendly brick, Plastic waste, Fly ash byproduct and Cement.

1. INTRODUCTION

One of the most significant trends in the construction sector nowadays is green building. Actually, a large portion of the global energy waste is caused by buildings, and the construction industry is one of the main contributors to climate change. Bricks are the primary and most crucial element in sustainable and green building. The earliest known examples of brick manufacture date around 7000 BCE, when they were made as sun-dried blocks. Since then, numerous changes have been made to the composition of bricks and the processes used in their production. Brick is therefore regarded as one of the most sought-after building materials in the world today for usage in a variety of civil engineering projects. Clay bricks are the oldest building material used in the construction business and were really the first to be made by humans. Bricks are one of the most often utilized masonry units as building materials in the construction industry today. India produces the second-most bricks worldwide. Three materials are used in this study paper. to create the eco-friendly brick. as cement, fly ash, and plastic. One of the biggest new products in the building sector is fly ash. One byproduct that is frequently utilized in brick manufacturing facilities is flyash. Fly ash reduces the amount of cement while also addressing a number of drawbacks. In short, it's a step toward a more environmentally friendly world. The amount of plastic that is produced daily is enormous. The population of plastic garbage is closely correlated with the number of people on Earth, which in turn drives the demand for plastic. Recycling plastic garbage is therefore crucial to lowering environmental population and preventing resource waste. Plastic trash can be incorporated into eco- friendly bricks to lessen their impact on the environment. Bricks are made stronger and more durable by using plastic. Bricks' structural stability can be enhanced by combining plastic with other materials. Bricks made from plastic waste divert plastic from the environment and lessen its harmful effects. In the process of making bricks, cement material can be partially substituted and has a smaller environmental impact. Low-carbon or environmentally friendly cement, which produces fewer greenhouse gases during production, is used in some eco-friendly brick. Because the production of cement is energy-intensive and contributes significantly to carbon dioxide emissions, less traditional Portland cement is used in the making of bricks. In this study, eco-friendly bricks were made. The building sector must transition to using more environmentally friendly and sustainable bricks. Ecofriendly bricks are manufactured from waste materials without polluting the surrounding area. From the perspective of society, eco-friendly brick is the most beneficial. The cost of environmentally friendly bricks is less than that of traditional clay bricks. The average cost of clay bricks is currently rising daily. The cost of the environmentally friendly bricks is less for that solution than it is for regular clay bricks.

MATERIAL AND METHODS

1.1 MATERIALS

1.1.1 CEMENT

The primary function of cement in bricks is to give them strength and structural stability. The materials used to make the bricks, including fly ash and plastics, are held together by cement, which serves as a binding agent. When making bricks, cement is used sparingly in order to balance strength and environmental impact. Bricks become less porous as a result of cement, which makes them less likely to absorb water. During the brick-making process, cement aids in achieving exact dimensions and a uniform appearance. Bricks are made considerably more durable and compressive when cement is added.

1.1.2 FLY ASH

The major goal of using fly ash to make bricks is to lessen the environmental impact of the process while improving the bricks' cost, sustainability, and quality. Fly ash has the ability to increase the workability of brick-making materials, which facilitates the molding and shaping of bricks during the production process. By lowering the need for virgin clay, the use of fly ash in brickmaking contributes to the preservation of natural resources. Fly ash can often be used in place of some of the traditional binding material, allowing brick manufacturers to produce bricks at a lower cost—making them more affordable for construction.

1.1.3 PLASTIC

The primary goal of using plastic to make bricks. Incorporating plastic into the brick-making process offers a sustainable substitute for conventional clay bricks while also lessening the negative environmental effects of plastic pollution. Bricks made from plastic have the potential to be an environmentally friendly building material because they are lighter, more resilient, and frequently have superior insulating qualities.

1.2 INDIAN STANDARD RECOMMENDATION

The material selection as per IS code provision that give specification of material used in manufacturing of bricks.

CEMENT

The physical analysis of Ordinary Portland Cement as per IS 8112:2013

FLY ASH

The fly ash governed by IS 3812 (part 1) 2003.

PLASTIC

The Indian Standard Code for plastic is IS 4985:2000. This standard covers the plastics.

1.3 NEED FOR STUDY

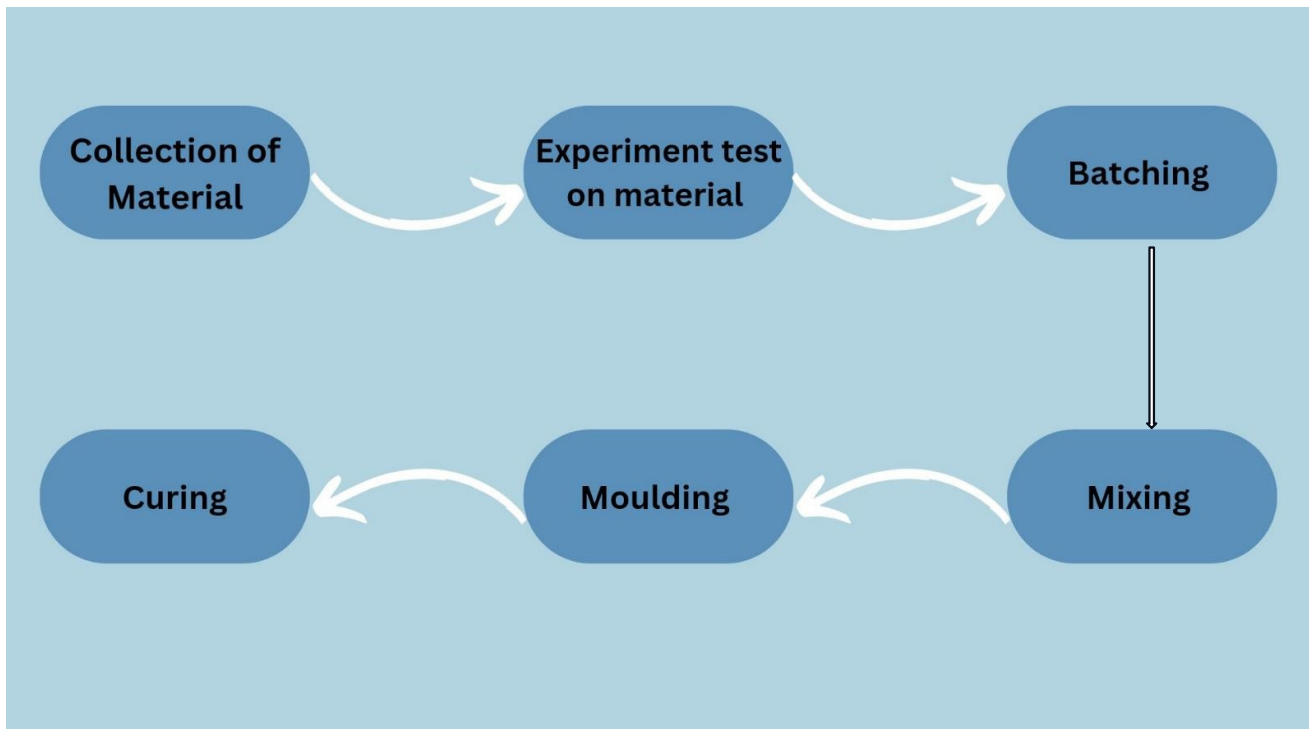
Eco-friendly brick reduces waste and addresses pollution issues by diverting waste materials from landfills, such as fly ash and plastic, through their use in brick production. Eco-friendly brick typically emits fewer emissions, improving air quality and lowering pollution levels in the environment. Eco-friendly brick is compatible with green and sustainable building techniques. In order to support sustainable building practices, they assist homeowners and builders in meeting environmental certification and standards like LEED (Leadership in Energy and Environmental Design). Recycled or waste materials, such as fly ash and recycled plastics, are frequently used in eco-friendly bricks, lowering the demand for virgin resources. This lessens the energy needed for resource extraction and contributes to the preservation of natural resources. Innovation in the construction sector is driven by the development and application of environmentally friendly brick materials, promoting the creation of innovative, environmentally friendly building techniques. The demand for these environmentally friendly bricks is driven by the desire to lessen the negative effects of construction on the environment, resource conservation, and environmental awareness. This brick addresses a number of environmental and financial issues while providing a more responsible and sustainable method of construction.

1.4 OBJECTIVES OF THE STUDY

In the present study the main objectives are

- To reduce natural resources in brick making by utilizing waste material as a substitute.
- To develop a sustainable and environmentally friendly solution for the construction industry by reducing waste and greenhouse gas emissions.
- To determine the chemical and physical properties of this eco-friendly brick and compare them with conventional bricks or normal bricks. Estimating the cost of eco-friendly bricks.

1.5 METHODOLOGY



1.5.1 COLLECTION OF MATERIAL

- 1) COLLECTION OF PLASTIC MATERIAL : The plastic material should be collected from the footpath, industries waste and also food packages. The plastic should be clean.
- 2) COLLECTION OF FLY ASH : The fly ash should be collected from the thermal power plant. Fly ash is the byproduct of thermal power plant.
- 3) COLLECTION OF CEMENT : The cement should be collected from the shop.

1.5.2 EXPERIMENTAL TEST ON MATERIAL

Physical and chemical test perform on cement and fly ash to acquire knowledge about parameter and to decide weather that is good for brick making or not.

1.5.3 BATCHING

Batching is the process of combining plastic measurement materials to create bricks. Following material collection, we sort the different kinds of plastic and eliminate any additional waste that mayhave been included.

1.5.4 MIXING

For brick to be produced that is both uniform and strong, material must be mixed. The goal of the mixing process must be to make the mass homogenous, uniform in consistency, and color. There are two main methods of mixing: mechanical mixing and hand mixing. For this project, hand mixing was used. Until all of the ingredients—such as plastic, fly ash, cement, and water—necessary for producing environmentally friendly brick in a particular mix proportion are added.



		Mix Ratio	
For 1 Brick	1:3:6	2:3:5	1:2:7
For 4 Brick	4:7:10	6:7:9	4:6:11

1.5.4 MOULDING

Moulding after completion of proper mixing the place mix into required mould. In these project use the normal brick sizes (21×10×7cm). After 2 days remove the brick from the mould and then done curing. The test specimens after moulding were allowed to dry for a period of 24 hours.

1.5.5 CURING



This picture depicts the environmentally friendly fly ash bricks curing. Bricks are frequently submerged in water or kept moist for three days with constant spraying. The water's slow absorption and appropriate hydration of the materials, including the cement and plastics in the bricks, are made possible by this curing process.

1.6 SCOPE OF PROJECT

- 1) Adding more material to increase their strength.
- 2) Recycling plastic and applying it as a building material.
- 3) Environment protection.
- 4) Because they are lightweight, eco-friendly bricks are being used in more construction projects

1.7 RESULT

1. Compression Test



Fig 1

Before use of compressive Testing Machine



Fig 2

Eco-friendly cement brick specimen in CTM

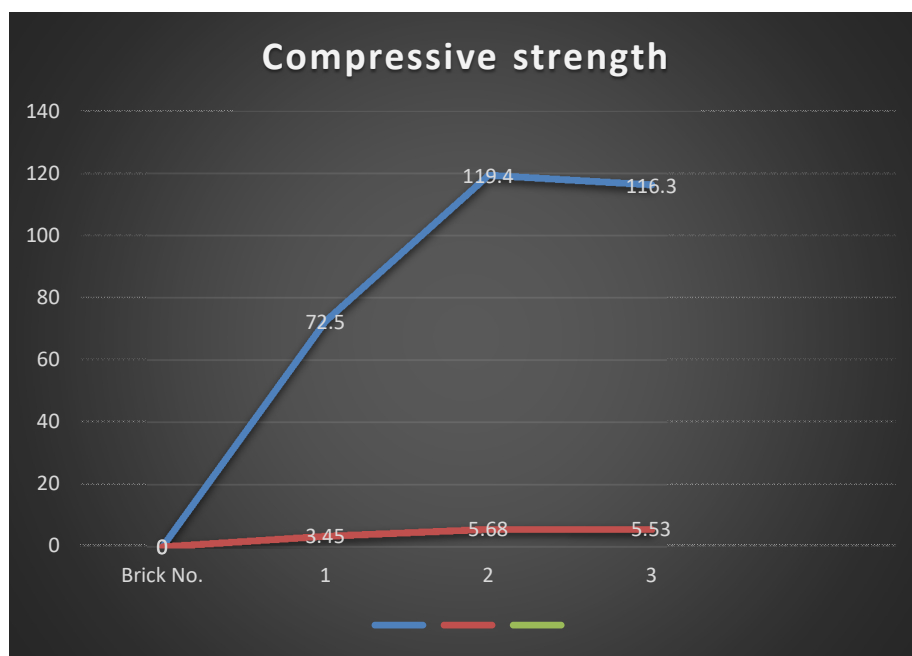


Fig 3

Eco Friendly brick after the compression test.

1.2 Compressive Strength Performed on Eco-bricks

Brick No.	Maximum Load (KN)	Compressive Strength (N/mm ²)
1	72.5	3.45
2	119.4	5.68
3	116.3	5.53



Peak Load

Compressive strength

Brick no

Chart 1: Compressive Strength of Eco-brick

1.3 Compressive Strength Performed on normal bricks

Brick No.	Maximum Load	Compressive Strength
1	62.6	2.98
2	92.3	4.39
3	101.9	4.85

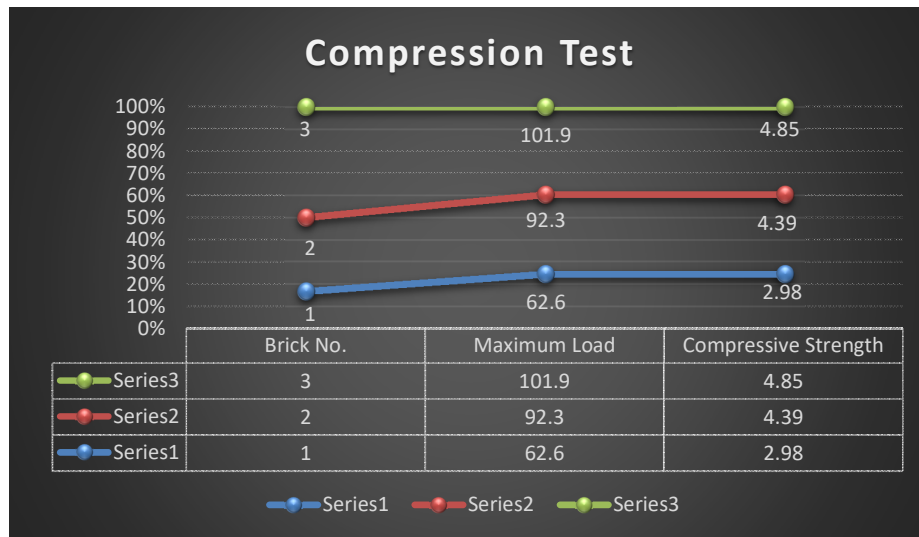


Chart 2: Compressive Strength of Normal brick

1.4 Compare between normal brick and eco-brick

Brick no	Normal Brick (21×10×7 Cm)	Eco-Friendly Brick (21×10×7 Cm)
1	2.98	3.45
2	4.39	5.68
3	4.85	5.53

The compressive strength of normal brick are found 2.98 N/mm^2 , 4.39 N/mm^2 & 4.85 N/mm^2 and Eco-bricks are found 3.45 N/mm^2 , 5.68 N/mm^2 , 5.53 N/mm^2 .

2. Shape and Size Test

One of the most crucial brick parameters is size and shape, which is tested on eco-friendly cement bricks. The bricks used in this experiment were cast in a purely rectangular shape with sharp edges, measuring 210 x 100 x 70 mm.

3. Falling Test

According to BIS 10719-9557 and 1970, a fall test is performed on brick specimens. Specifically, the environmentally friendly brick is permitted to descend from a height of one meter and its ability to shatter is evaluated..



Fig 4

Performing Falling test



Fig 5

After Falling Test

4. Hardness Test

After scratching on brick there where not developed any impact of that brick.



Fig 6

Performing hardness test on brick

5. Water Absorption Test

A brick will be considered as a good quality if it does not consume more than 25% water by its weight.

Bricks no.	Water absorption (in %)
B1	16.02
B2	12.90
B3	15.98
B4	18.22
B5	14.51

1.7 CONCLUSION

- 1) Using plastic and fly ash to make bricks is an environmentally friendly process.
- 2) Bricks manufactured with 55–60% fly ash have a beneficial effect on compressive strength.
- 3) Brick manufacturing uses 25–30% plastic, which helps to lower pollution.
- 4) Bricks made with fly ash have lower manufacturing costs than non-eco-friendly bricks.
- 5)

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- [5] S.V. Giri Babu (Research Scholar, JNTUA, Ananthapuramu and Senior Lecturer in Civil Engineering, Govt. Polytechnic, Vijayawada, AP, India).
- [6] Dr.S.Krishnaiah(Professor, Department of Civil Engineering, JNTUA, Ananthapuramu, Andhra Pradesh, India.
- [7] Mohammed Jalaluddin (Jayaprakash Narayan College of Engineering, Indian)
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- [10] Oko John Ameh (Department of Building, University of Lagos, Akoka, Lagos, Nigeria)
- [11] Alaa.A.Shakir, Sivakumar Naganathan, Kamal Nasharuddin Bin Mustapha (Department of Civil Engineering, University of Tenaga Nasional, Jalan IKRAM-UNITEN, 43000, Selangor, Malaysian)
- [12] Dr.Thippeawammy H.N(Professor & HOD, Department of Civil Engineering City Engineering College, Bengaluru 2, 3, 4, 5 City Engineering College, Bengaluru)