DEVELOPMENT OF CONCRETE BRICK USING RECYCLED PLASTIC AND GLASS WASTE

Akhil Mathai Varkey, Amaan Sajan,
Aparna B Prasad
B.Tech students
Dept. of civil engineering
Mangalam college of engineering
Kottayam India

Athira Jacob
Assistant professor
Dept. of civil engineering
Mangalam college of engineering
Kottayam India

***Abstract*— The management of garbage is a critical issue in the modern world, particularly with regard to plastic and glass waste. Thousands of tonnes of plastic and glass are thrown in the trash every day, yet there aren't enough treatment and recycling options. Every day, a significant amount of plastic is thrown away or burned, contaminating the ecosystem and the atmosphere. Plastic trash buildup in the environment poses a threat to both plant and animal life. Recycling plastic and glass garbage after their useful lives are through while generating economic value and causing the least amount of environmental harm is the secret to their sustainable management in a circular economy. Bricks are a common building material used to make masonry structures like walls and pavement. Numerous research has been conducted on concrete that has been saturated with waste plastic and glass fiber, with positive outcomes and many benefits. Numerous testing have been carried out to manufacture eco bricks, including compression tests and water absorption tests.**

Keywords—bricks*; *compression testing; water absorption testing

1.INTRODUCTION

One of the oldest and most common building materials is brick. Depending on their size, color, texture, origin, materials utilized, and forming process, the many varieties of bricks available on the market are employed. Bricks are an important component of industrial production processes in addition to being utilized in the construction of buildings. Plastic is a versatile, sturdy, and fairly priced material. These characteristics have led to the development of numerous products that are advantageous to society in terms of economic activity, employment, and level of living. Utilizing these waste materials is one way to address ecological and environmental problems. A such substance is glass, which is produced from raw materials like sand. Despite the fact that most glass debris is recycled in order to manufacture new glass products. Non-biodegradable and useful resource glass takes up valuable landfill space. In order to lessen the amount of glass waste dumped in landfills, alternative recycling techniques must be investigated. The use of plastic and glass in such materials not only promotes their utilisation but also decreases the cost of making concrete and has other indirect advantages, including cheaper landfill costs, energy savings, and environmental protection from potential pollution consequences. Only a very small portion of it is recycled, most likely as a result of a lack of funding or a low level of interest in recycled plastic garbage. As a result, the majority of it is often burned or deposited in landfills. Such actions have a damaging impact on the environment at a time when the globe is concentrating its efforts on combating pollution and environmental challenges like global warming.

2.OBJECTIVE

To contrast the compressive strength and water absorption of standard concrete brick with bricks constructed using glass and polypropylene waste.

3.MATERIALS

1.*Cement*: OPC grade 53 cement was used for the experimental work. According to IS standards, the cement was put through the following tests.

TABLE 1: Test on the cement

Sl. no	Tests	Result
1	Fineness	9%
2	Standard consistency	32%
3	Initial setting time	Less than 30 minutes
4	Final setting time	10 hrs
5	Specific gravity	3.06

2.*Fine aggregate*: In accordance with the IS standard, the aggregate was selected. Sizes of fine aggregate range up to 4.75mm.

TABLE 2: Test on fine aggregate

Sl.no	Tests	Result
1	Specific gravity	2.65
2	Particle size distribution	Zone3, Fineness modulus 2.76, Uniformity coefficient 2.5
3	Bulking of sand	Max bulking 35.2%, water content at max bulking 7%
4	Water absorption	1.25%

3.*Coarse aggregate*: The size range up to 20mm was chosen for coarse aggregate.

TABLE 3: Test on coarse aggregate

Sl.no	Tests	Results
1	Specific gravity	2.65
2	Grain size analysis	Fineness modulus 5 Uniformity coefficient 1.28
3	Water absorption	1.55%

4.*Water*: Drinkable water is used for blending and conditioning of concrete.

5.*Plastic wastes*: Due to its compactness and light weight, plastic has become the material of choice for reusable items in this period. In our study we used plastic.

Figure 1: Plastic

6.*Glass wastes*: Glass is amorphous (non-crystalline), which means it is more like a super-cooled liquid than a solid. Glass may be produced with exceptional uniformity in a range of shapes and sizes, from tiny filaments to large pieces.

Figure 2: Glass wastes

4.MIX DESIGN

M20 grade concrete was designed for the current investigation. The weight ratio of the mixture is 1:1.5:3, whereas the cement to water ratio is 0.5. It was suggested that the characteristics of brick be studied.

TABLE 4: Mix proportion

Proportion of plastic	Proportion of glass waste	Mix specification
0%	0%	Conventional mix
5%	5%	M1
10%	5%	M2
15%	5%	M3
20%	5%	M4

5.METHODOLOGY

Common Portland cement OPC of 53 grade fine aggregate, coarse aggregate, water, and polypropylene plastic and glass wastes are employed in the study. Based on Indian standards,the analysis takes into consideration the obtained values as well as the cement, fine aggregate, and coarse aggregate qualities.M20 mix with mix proportion 1:1.5:3 is adopted for the study. For testing compressive strength and water absorption at 7, 14, and 28 days, nominal concrete was cast. Concrete bricks manufactured from recycled polypropylene plastic in varying percentages of 5%, 10%, 15%, and 20% and recycled glass in a constant percentage of 5% are cast and set for curing. Water absorption and compressive strength were calculated.

Figure 3: Casting ,curing and strength testing of specimens

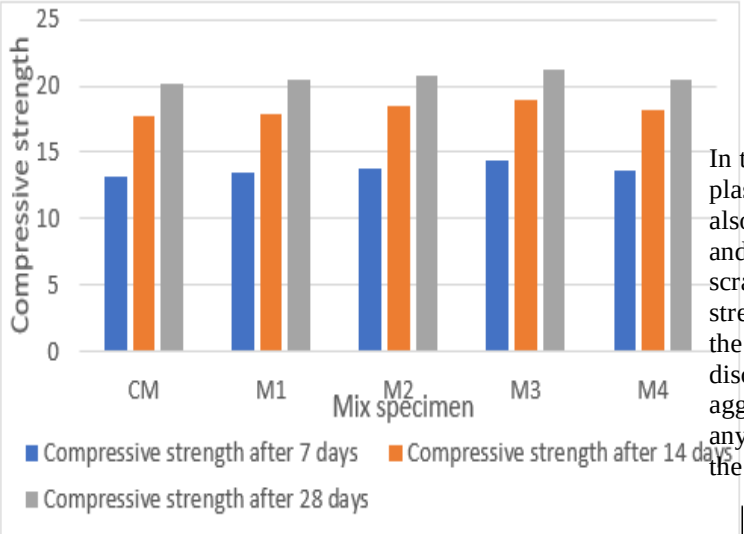
6.RESULT AND DISCUSSION

6.1 Compressive strength test

Compressive testing demonstrates how the material will respond under compression. Using the compressive strength method, concrete bricks with various amounts of plastic and glass particles were tested for strength after 7, 14, and 28 days. Bricks with measurements of 400x150x200mm are cast for testing.

TABLE 5: Compressive strength after 7,14, days

Sl.no	Mix specimen	7 days N/mm^2	14 days N/mm^2	28 days N/mm^2
1	M0	13.17	17.67	20.16
2	M1	13.5	17.91	20.5
3	M2	13.75	18.5	20.75
4	M3	14.33	19	21.16
5	M4	13.58	18.17	20.47



6.2 Water absorption test

An absorption test on the material is done to find out how much moisture a brick will take in under harsh conditions. By comparing the weights of dry and wet bricks, it is possible to calculate the quantity of water absorption. A brick should not absorb more water than 20% of its dry weight after being submerged in water for 24 hours.

TABLE 8: Water absorption

Sl.no	Brick(%)	Dry weight(kg)	Wet Weight(kg)	Water absorbed(%)
1	0	22.94	23.740	3.4
2	5	22.53	23.410	3.9
3	10	20.17	20.950	3.8
4	15	19.5	20.1	3.07
5	20	18.63	19.40	4.13

7.CONCLUSION

In this study, concrete brick development employing glass and plastic trash that has been recycled is discussed. This study also tries to appropriately utilize waste materials since plastic and glass are waste products that are bought from the local scrap market. Several studies, including as compressive strength tests and water absorption tests, are used to look into the characteristics of the plastic and glass bricks. It has been discovered that 15% is the ideal replacement rate for coarse aggregate when replacing it with plastic and glass waste; anything higher than 15% reduces the compressive strength of the brick.

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