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Effect on Compression Strength of Masonary Mortar by Replacing Fine Aggregates with Waste Glass

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Abstract: ***Eco- friendly, low-carbon, and energy-intensive materials are required for a accountable approach to sustainable development. Glass debris can be used to substitute fine natural aggregate in a constructive way. The effects of adding glass cullet to the mechanical characteristics of mortar were investigated for this purpose.***
The glass aggregate was created from recycled post-consumer waste glass (mainly bottles) from the food, medical, and cosmetics industries. Four different contents of fine glass cullet were used in this experiment (5, 10, 15, and 20 wt. percent of fine aggregate). Compressive, flexural, and split tensile strengths were all assessed. The modulus of elasticity and the Poisson coefficient were also calculated.
The inclusion of glass sand aggregate to mortar improves its mechanical qualities. The acquired improvement in split tensile strength was the least influenced when comparing the strengths. Rarely has the found effect for the increased examined attributes of the glass sandaggregate content been documented. Furthermore, it was discovered that increasing the recycled glass sand aggregate content in mortar reduced the density. The links between the properties of mortar containing glass sand aggregate were also investigated.
Keywords: Portland Pozzolana Cement (ultra-Tech), Drinking Water, natural sand, and waste glass replacement were used in the current experiment.

I. INTRODUCTION

The most often used construction materials are cement, masonry mortar, and concrete. According to current state-of-the-art masonry mortar, it is not just a three-component system of cement, water, and fine aggregates; many other materials, such as fly ash, silica fumes, waste glass, and stone dust, are successfully utilised in masonry mortar to improve its qualities. The natural resources of conventional material (Fine Aggregates) are decreasing at a faster rate as a result of increased usage. Any effort to conserve natural resources by utilising alternative materials, particularly readily available local waste (waste glass) from diverse industries, is greatly admired. The goal of this project is to see if there is a way to use locally available waste materials. claimed that one of the best solutions is to use waste materials instead of natural resources, and investigated the potential of using waste glass as a partial replacement for fine aggregates.

Many researches are being done on strength on masonry mortar stated that in any reinforced structural construction, the strength of mortar is a special anxiety to the engineer because mortar is responsible to give defense in the outer part of the structure as well as to the brick joint masonry wall system.

The present study aimed at utilizing waste glass as partial substitution of fine aggregates by weight.

Glass is a non-crystalline formless solid and is often transparent. It has widespread practical, technological and ornamental use. Scientifically glass can be defined in a broader sense, as every solid that possesses a non- crystalline (amorphous) structure in the atomic scale and that exhibitsa glass transition when heated towards the liquid state. The most familiar and the oldest types of glass are “silicate glasses”. Glass is used in day to day life and when they break. They are put in the rubbish and dumped on the ground. The most frequent method for disposing of waste glass and solid wastes is land filling. It is damaging to the environment because it affects soil quality and reduces fertility.

In this study, we replaced fine aggregates (FA) with waste glass by weight and investigated its physical qualities.Cubical specimens are cast after varied proportions are prepared, and their compressive strength is compared to control masonry mortar.

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II. MATERIALS USED

Portland Pozzolana Cement (ultra-Tech), Drinking Water, natural sand, and waste glass replacement wereused in the current experiment.

A. Cement

Fly ash-based Portland Pozzolana cement (ultra-Tech) complying to IS: 1489-1991 (Part 1). Thephysicalqualities of cement were determined through a series of tests.

B. Sand

Naturally sand is used which is passes through 4.75mm sieves.

C. Waste Glass

The broken window glass was used as waste which has supplied from glass market. The fine waste glass isused.

III. RESULT AND DI SCUSSION

The tests were carried out on cubes of hardened brick mortar. Destructive experiments on masonry mortar cubeswere performed on 45 cubes of masonry mortar.

This chapter covers the presenting of test results as well as a discussion of how the compressive strength of control masonry mortar develops over time. For each proportion, tests were conduction fresh masonry mortarand hardened masonry mortar.

The compressive strength of the sample masonry mortar was compared to that of a 1:3 grade Controlmasonry mortar.

A. Compressive Strength as per IS: 2250-1981

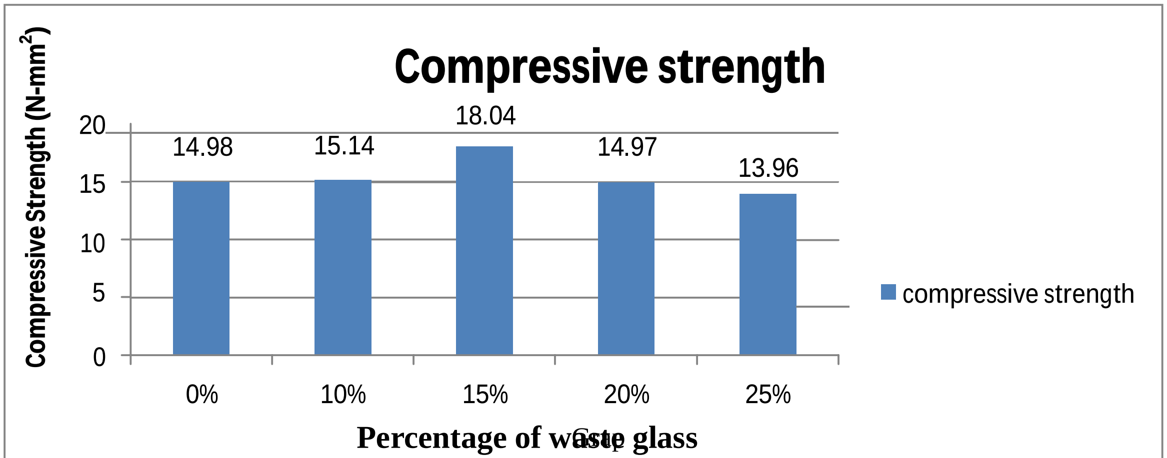
Compressive strength is the most important criterion for structural design. Compressive strength tests were performed at the ages of 7, 14, and 28 days to compare the strength development of masonry mortar to that of Control masonry mortar. The outcomes of the tests are as follows: Most concrete structures are built on the assumption that concrete has sufficient compressive strength, as shown in the table for masonry mortar management.

B. Compressive Strength at 7 days

Three cubes of each sample were cast and compared to standard masonry mortar to determine compressive strength after seven days. Table 4.1 shows the outcome values, while graph no. 4 shows the graphical depiction.

Table 4.1:- Compressive strength test result at 7 days

FA replaced	CTM reading(in KN)	Average load (KN)	Compressive strength (N-mm2)
0%	80 70 70	73.34	14.98
10%	72 75 86	77.67	15.14
15%	85 90 90	88.34	18.04
20%	70 75 75	73.34	14.97
25%	70 65 70	68.34	13.96

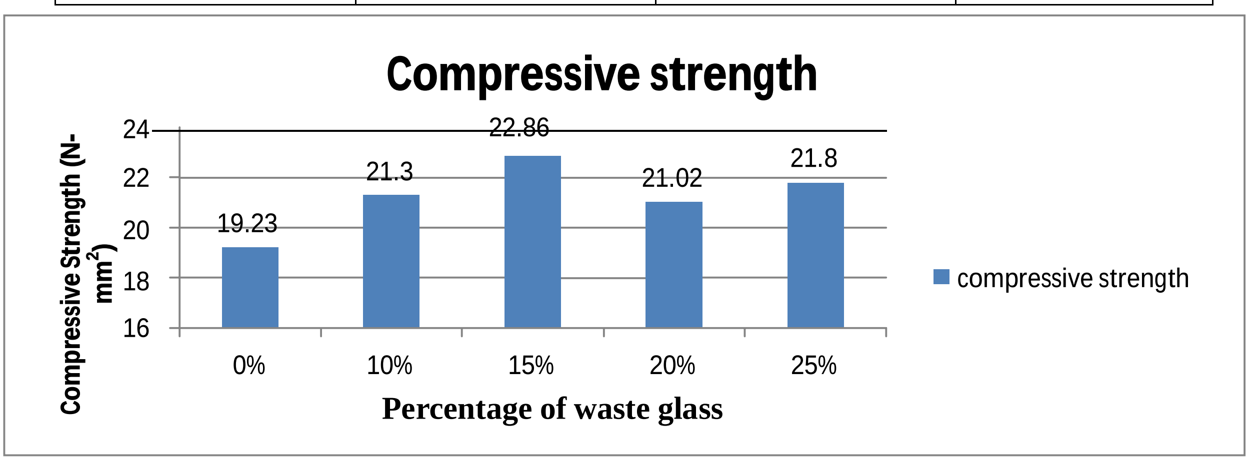


Graph No. 4:-Compressive strength test result at 7 days

C. Compressive Strength at 14 Days

Table 4.2:- compressive strength test result at 14 days

FA replaced	CTM reading (in KN)	Average load (KN)	Compressive strength (N-mm^2)
0%	82 100 100	94	19.23
10%	92 110 110	104	21.30
15%	112 112 110	111.34	22.86
20%	90 110 110	103.34	21.02
25%	100 110 110	106.67	21.80



Graph No. 5:-Compressive strength test result at 14 days

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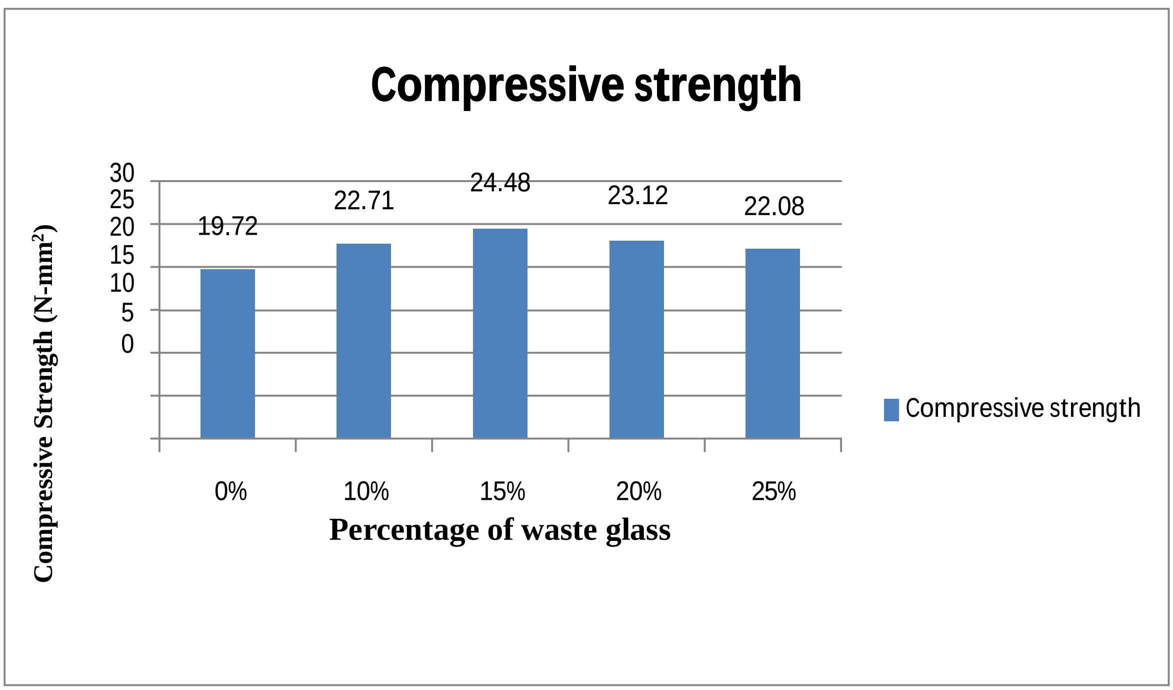
D. Compressive Strength at 28 days

Table 4.3:- Compressive strength at 28 days

FA replaced	CTM reading (in KN)	Average load(KN)	Compressive strength ($N-mm^2$)
0%	100 100 90	96.67	19.72
10%	110 108 116	111.34	22.71
15%	120 120 120	120	24.48
20%	110 110 120	113.34	23.12
25%	105 105 120	110	22.08



Graph No. 6:- Compressive Strength test result at 28 days

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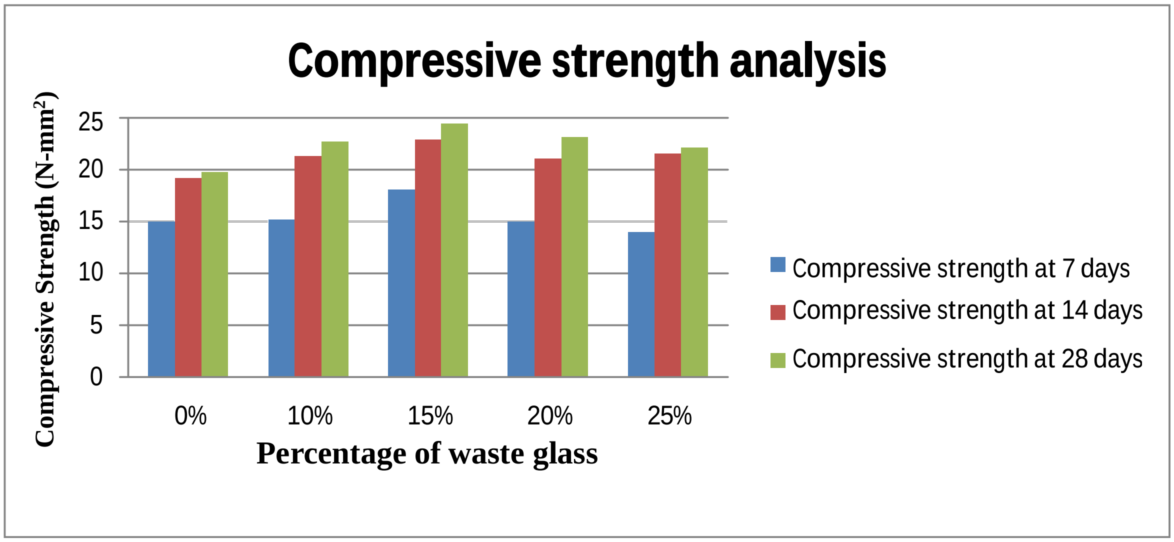
E. Compressive Strength Analysis

Combined compressive strength at 7days, 14 days and 28 days are shown in table below andgraphicalrepresentation of the same in graph no 7

Table 4.4:- Compressive strength result

FA replaced	7 days average Compressive strength(N/mm^2)	14 days average compressive strength(N/mm^2)	28 days average compressive strength(N/mm^2)
0%	14.98	19.23	19.72
10%	15.14	21.30	22.71
15%	18.04	22.86	24.48
20%	14.97	21.02	23.12
25%	13.96	21.80	22.08



Graph No. 7 Compressive strength analysis

IV. CONCLUSION

Following conclusion were made based on result obtained from the result

1) Based on the results of the entire study comparing control masonry mortar versus modified masonrymortar.
2) When trash is added as fine aggregates, the rate of strength gain is slow at first, but by 28 days, it has reached virtually the needed design strength.
3) At 7 days, 14 days, and 28 days, 15 percent WG is added to obtain the maximum compressive strength.
4) When compared to control mortar, the compressive strength of masonry mortar containing15% WG rose by
5) 20.42 percent after 7 days.
6) When compared to control mortar, the compressive strength of masonry mortar containing 15% WG rose by(18.87 percent) after 14 days.
7) The 28 days compressive strength of concrete containing 15% WG was increased by (24.13%) from controlmortar.
8) Waste glass with a size of less than 1.18 mm can be utilised as a partial replacement for fine particles inmasonry mortar.
9) The addition of WG to masonry mortar produces acceptable results.
10) Why Because glass is non-biodegradable and its decomposition is a challenge for the environment, usingWG will assist in resolving environmental issues associated with waste glass.

V. FUTURE SCOPE AND SIGNIFICANCE

Environmental pollution caused by the increased output of home and industrial waste is a serious issue in developing countries like India. Waste disposal has become a serious issue in India's urban centres, particularly the disposal of waste glass generated by the country's home and industrial sectors. Due to increased industrialization and a rapid development in the standard of living, the amount of waste glass has increased in recent years. As a result, it is vital and critical to find some environmentally acceptable alternatives.

One of the alternatives is to use waste glass. Other materials are being employed in the production of concrete to address the environmental issues generated by industrial waste. When waste glass is utilised in the creation of masonry mortar, it not only benefits the environment, but it also improves the performance of the mortar when used in the right amounts. Masonry mortar is a concrete matrix-based masonry compound. Binder and fine aggregates make up this mixture. It is a necessary component of every reinforced structural structure.

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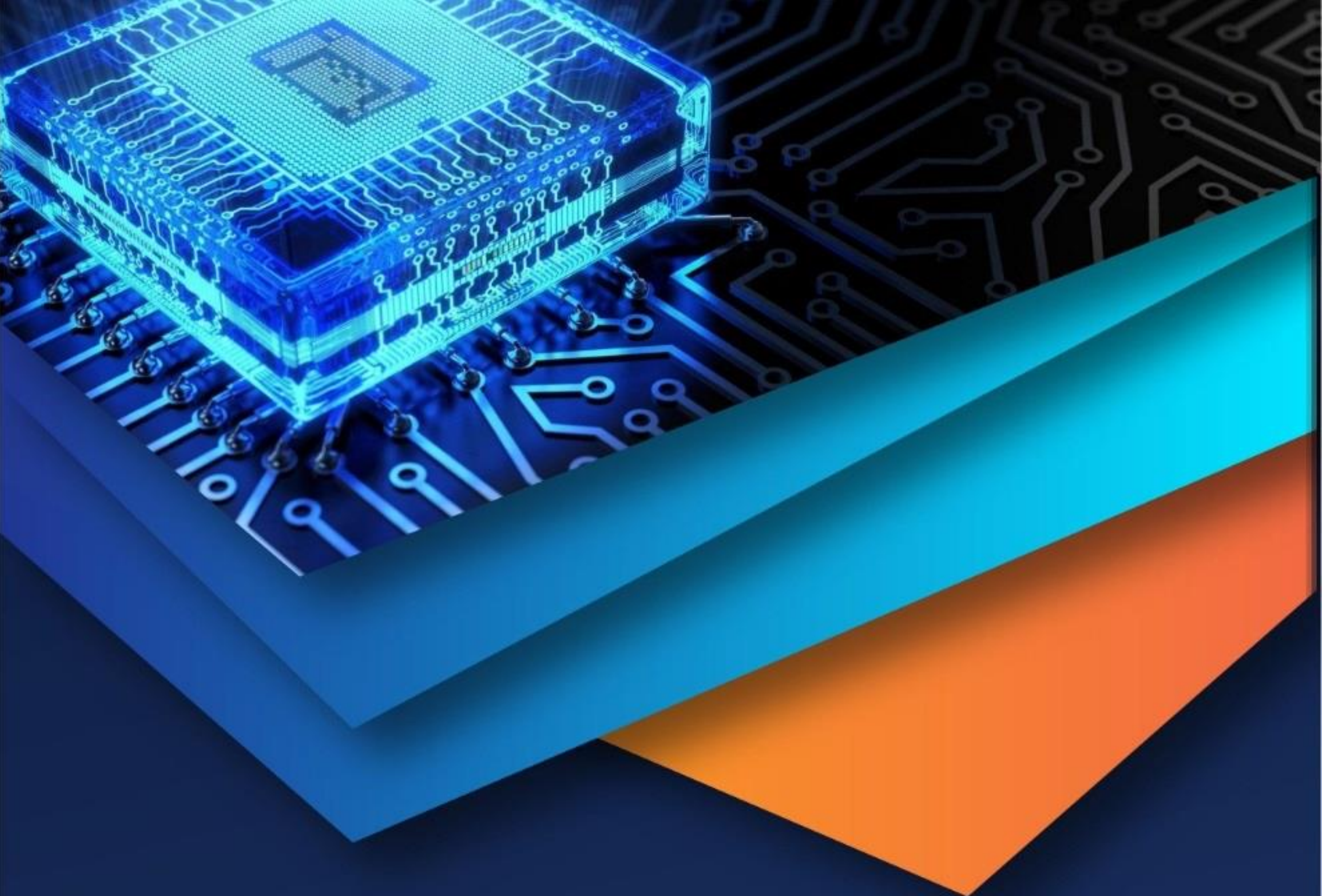

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