iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** V **Month of publication:** May 2023

DOI: https://doi.org/10.22214/ijraset.2023.51937

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue V May 2023- Available at www.ijraset.com

Mechanical Properties of Concrete by Partial Replacement of Fine Aggregate with Glass Powder for M40

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***Abstract:** Since the concrete industry is one of the biggest consumers of natural resources, its sustainability is in jeopardy. Concerns over the economy and ecology are the main challenges facing the concrete sector. To address issues of economic and environmental significance, this study investigates the use of discarded glass as a partial replacement for fine particles in concrete. At weight percentages of 0, 10, 15, 20, and 25%, waste glass powder was used in the M25 mix as a replacement for fine aggregates. After measuring the concrete specimens compressive strength and splitting tensile strength after 28 days, 56 days, and 90 days, the results were compared to those of conventional concrete. The results indicate that the use of discarded glass powder as a substitute for fine aggregate up to 15%.*
***Keywords:** Glass powder, Compressive strength, Split tensile strength test.*

I. INTRODUCTION

Globally, concrete is a substance that is used extensively. In this barren setting, there is an abnormally high demand for a wide range of products manufactured from industrial waste. The region's natural sand has previously been produced from a number of sources. In a similar manner, used glass garbage from stores is collected. When crushed into sand-like consistency, the collected glasses can serve as a partial substitute for real sand. In other words, when employed efficiently as a finer combination, glass can turn into a useful resource.

II. OBJECTIVES

The study's objectives are as follows:

1) To determine how well glass powder works as a partial replacement for fine aggregate in concrete.
2) To investigate and compare the effectiveness of glass powder concrete with regular concrete.
3) To comprehend the utilisation of glass powder for increasing strength

III. MATERIALS

Glass powder, cement, fine aggregate, coarse aggregate, and water are the raw materials needed to complete the current work's concreting procedures.

A. Cement

The ingredients are crushed, mixed in certain amounts, and then burned in clinker at temperatures between 1300 and 1500 °C depending on their purity and composition. At this temperature, the ingredients partially fuse and sinter to create clinker with a nodular shape. After being combined with 3 to 5% gypsum, the clinker is allowed to cool before being milled into a fine powder. Cement is produced as a by-product of the aforementioned process. Standard Portland cement was used to construct this project. It uses 53-grade cement. The degree of fineness, consistency, and initial and ultimate setting times of cement have all been tested.

B. Fine Aggregate

Fine aggregates are any broken stone fragments that are 14" or less in size, similar to natural sand. This particular aggregate's size, or grading, is described by the term 1/4'" minus, which is widely used to refer to it. River sand is found in zone II.

C. Coarse Aggregate
However, their normal diameter ranges from 3/8 to 1.5 inches. Coarse aggregates are defined as objects larger than 0.19 inches. Crushed stone makes up the majority of the remaining coarse aggregate, which is primarily formed of gravel.

D. Water
A chemical compound comprised of hydrogen and oxygen is called water. exists in three states: liquid, gas, and solid.

E. Glass Powder
For this experiment, glass debris was purchased from a Coimbatore glass recycling company. The experiment's waste glass was produced using crushing and milling techniques using recycled glass from a Coimbatore company. The glass powder used in this investigation was made by milling and crushing. Glass is ground to produce glass powder, an extremely fine powder. High precision machining equipment are needed to prepare it because it needs to be uniform and consistent all throughout. Depending on the applications and level of grinding, the price varies.

IV. EXPERIMENTAL INVESTIGATIONS

A. Compressive Strength Results
The results of the compression tests for the cast and cured specimens' compressive strength are provided in Table 1.

Table 1: Compressive strength of concrete with percentage of Glass powder

S.No.	% of glass powder	Compressive strength, N/mm^2		
		28 days	56 days	90 days
1	0	49.71	54.09	58.15
2	10	64.68	70.43	75.61
3	15	68.09	74.21	79.58
4	20	66.37	72.38	77.54
5	25	64.15	69.72	74.93

B. Split Tensile Strength Results
The split tensile strength tests were performed using a flexural testing machine on cast and cured specimens, and the results are provided in Table 2.

Table 2: Split tensile strength of concrete with percentage of Glass powder 7.4

S.NO	% of glass powder	Split Tensile Strength, N/mm^2		
		28days	56 days	90 days
1	0%	4.88	5.32	5.83
2	10%	6.37	6.94	7.44
3	15%	6.75	7.35	7.89
4	20%	6.58	7.18	7.64
5	25%	6.42	6.73	7.52

V. CONCLUSION

1) The normal concrete of copression strength result 49.71 N/mm^2 ,54.09 N/mm^2 and 58.15 N/mm^2 for 28 days,56 days and 90 days.
2) The normal concrete of split tensile strength result 4.88 N/mm^2, 5.32 N/mm^2 and 5.83 N/mm^2 for 28 days,56 days and 90 days.
3) The maximum compressive strength found to be 68.09 N/mm^2 ,74.21 N/mm^2 and 79.58 N/mm^2 for 28 days, 56 days and 90 days by 15% partial replacing of glass powder.
4) The maximum split strength found to be 6.75 N/mm^2 , 7.35 N/mm^2 and 7.89 N/mm^2 for 28 days, 56 days and 90 days by 15% partial replacing of glass powder.

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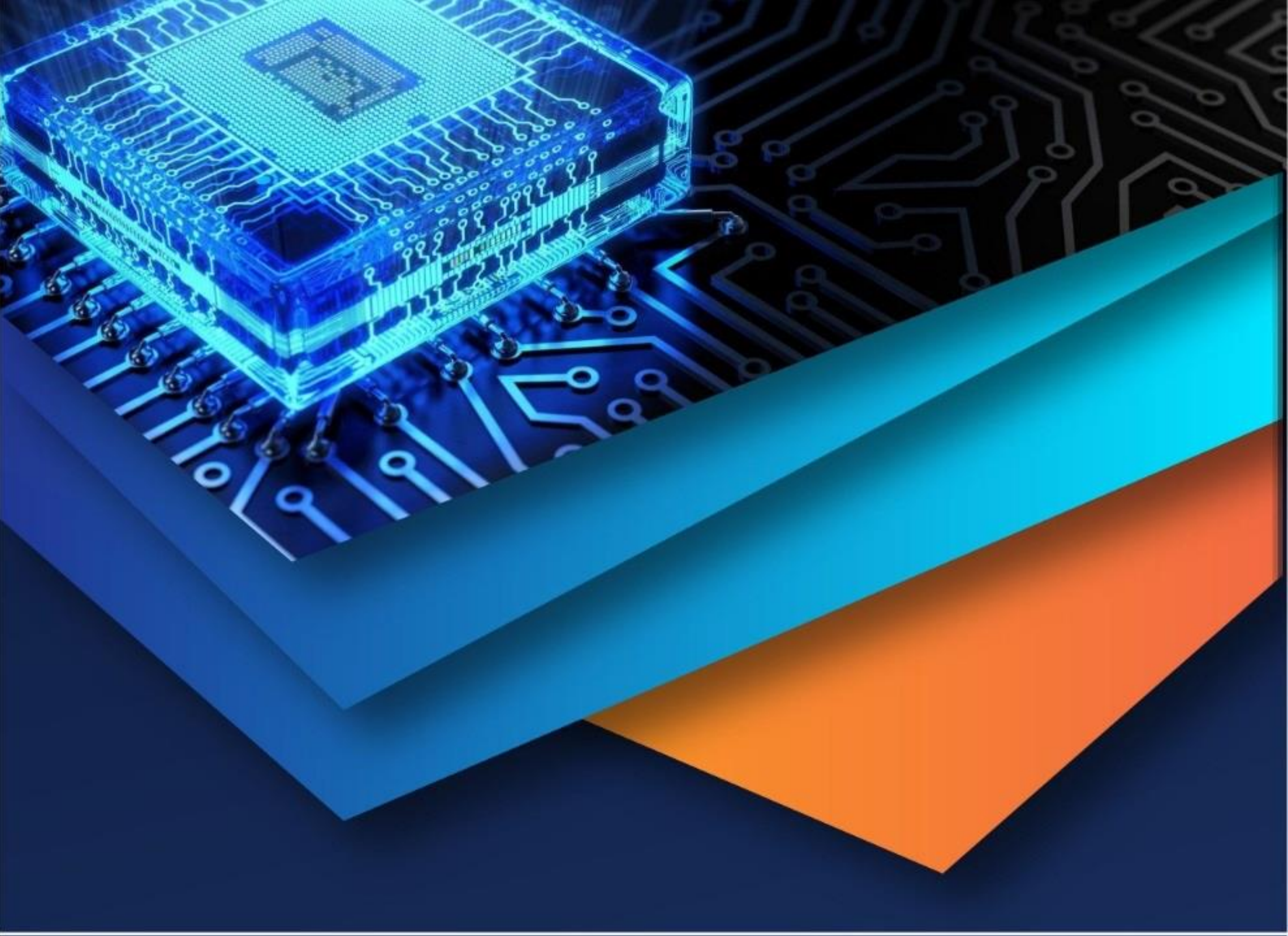

doi crossref
10.22214/IJRASET

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