



Partial replacement of fine aggregate by glass powder in concrete

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Abstract—The main aim of this investigation is to compare the influence of glass powder on the strength properties of cement concrete. The concrete was made by using ordinary Portland cement. Glass is used in many form in day to day life. nowadays many researches are going in to replacement of Portland cement using many waste material like sludge, flyash, steel fibre etc. Like this we are using glass powder is also used as a binder with partial replacement of cement. now a days the construction industry is in need of finding effective material for increasing the strength in concrete. Glass powder finer then 600 micron pozzolanic behavior an attempt to made investigate on possible material as waste glass powder as the partial replacement of fine aggregate in concrete. Concrete with replacement of fine aggregate by waste glass powder such as 15%, 20% and 25% were produced. Cube, cylinder, prism specimens of each one 12 numbers were cast, cured and tested for 7, 14, 28 days for strength.

Key words- Glass powder, compressive strength, curing, replacement of fine aggregate.

I. INTRODUCTION

The concrete is a widely used material in the world based on the global usage it is placed at second position after water. It is the back drop of such a bleak atmosphere, There is a large demand for alternative materials from industrial water. Some

alternative material have already been used has a part of natural sand the river sand is one of the constituents used the protections of conventional concrete has become highly expansive and also scare. The interest of construction communities in using waste or recycled material in concrete is increasing because of emphasis placed on sustainable construction presently the waste glass in and around the small shop is is packed as waste and disposed as landfills. The glass is silica based material in the form of amorphous is used in the cement based materials sustainable construction practices means creation and responsible management for healthy building environment resource efficiency being versatile, economical and impact on environment.

II. OBJECTIVES

The utility of glass powder as a partial replacement of fine aggregate in concrete the performance conventional concrete and glass powder in concrete the effectiveness of the glass powder concrete in strength enhancement. The waste glass are collected from the shops are used the collected glasses are crushed to sand size and could be used an alternative material for natural sand as partial replacement the utilization of the glass as fine aggregate will turn this waste material into the valuable resource.

Experiments we conducted on concrete prepared by partial replacement of fine aggregate by waste glass powder of particle size 600 micron. The objectives of the investigation evaluate the effect of waste glass powder on the compressive strength and other physical properties of concrete

1. Partial replacement for fine aggregate
2. To investigate a structural behavior of such replacement concrete component.
3. The percentage of glass powder which gives maximum strength when compare to concrete.

III. EXPERIMENTAL PROCEDURE

A. Material used

Ordinary Portland land cement	-53grade
Fine aggregate (m-sand) size	- 4.75 mm
Coarse aggregate	-20 mm
Glass powder	-600 micron

IV. MATERIAL PROPERTIES

Specific gravity of cement	= 3.15
Specific gravity of fine aggregate	= 2.50
Specific gravity of course aggregate	= 2.80
Specific gravity of glass powder	= 2.45
Fineness of course aggregate	= 7.36
Fineness of fine aggregate	= 2.90

V. EXPERIMENTAL PLAN

In this work 15%, 20%, and 25% of fine aggregate is replaced by glass powder for M30 Grade concrete.

Cube specimen of size 150 mm X 150 mm X 150 mm

Cylinder specimen of size 150 dia x300 mm/L

Prism specimen of size 100mm x100 mmx 500 mm

Were casted for different proportion with glass powder and compared with the properties of concrete prepared without glass powder. Compressive Test was performed on the concrete after 7, 14 and 28 days.

VI. MIX DESIGN

The mix design for M30 grade concrete was made using IS456 :2000, IS1026: 2007 and IS 516: 1959

VII. MIX PROPORTIONS

The mix proportion was obtained for various percentages of glass powder such as 15%, 20% and 25% replaced for fine aggregate in this the water content was maintained constant.

TABLE I

DETAIL OF MIX PROPORTION FOR CUBE

GLASS POWDER (%)	CEMENT (KG)	FINE AGGREGATE (KG)	COARSE AGGREGATE (KG)	WATER CEMENT RATIO	GLASS POWDER
0	1.38	2.484	4.181	0.55	0
15	1.38	2.1	4.181	0.55	0.384
20	1.38	1.98	4.181	0.55	0.504
25	1.38	1.863	4.181	0.55	0.465

TABLE II

DETAIL OF MIX PROPORTION FOR CYLINDER

GLASS POWDER(KG)	CEMENT (KG)	FINE AGGREGATE (KG)	COARSE AGGREGATE (KG)	WATER CEMENT RATIO
0	7.38	12.484	23.181	0.55
15	7.38	11.236	23.181	0.55
20	7.38	10.612	23.181	0.55
25	7.38	9.987	23.181	0.55

VII. TEST OF SPECIMEN

All the casted specimen were demolded after 24 hours and were placed in curing tank for a period of 7, 14 and 28 days the specimen were tested in the compression test machine of 2000 KN capacity.

Three numbers of specimen in each Cube, cylinder and prism were tested and average value was calculated. The result were compared with that of control mix

The test setup and the failure pattern of specimens for compression test in shown in figure 1.



FIGURE 1 COMPRESSION TEST

IX. COMPRESSION STRENGTH

The overall Result of compressive strength for cube, cylinder and prism is respectively.

TABLE III COMPRESSIVE TEST RESULT FOR CUBE

S.NO	% OF REPLACEMENT	CUBE 7 DAYS (N/MM ²)	CUBE 14DAYS (N/MM ²)	CUBE 28DAYS (N/MM ²)
1	0	10.66	13.88	16.55
2	15	13.33	15.23	18.88
3	20	14.22	15.55	19.11
4	25	12.44	14.87	16.45

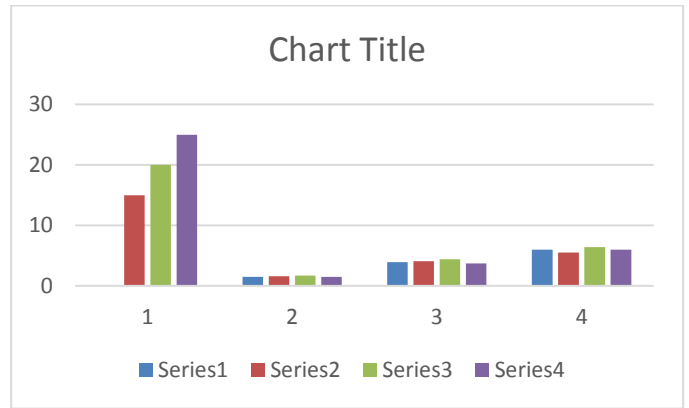
TABLE IV SPLIT TENSILE STRENGTH RESULT FOR CYLINDER

S.N O	%OF REPLACEMENT	CYLINDER 7 DAYS (N/MM ²)	CYLINDER 14DAYS (N/MM ²)	CYLINDER 28DAYS(N/ MM ²)
1	0	4.68	4.93	5.35
2	15	2.35	2.89	3.03
3	20	2.68	2.98	3.45
4	25	2.44	2.78	3

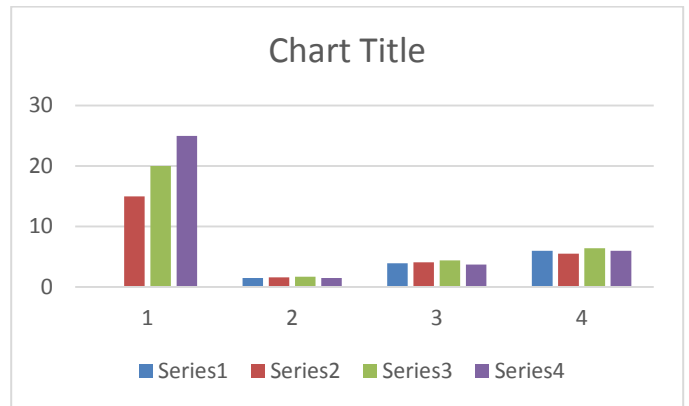
TABLE V FLEXURAL STRENGTH RESULT FOR PRISM

S.NO	% OF REPLACEMENT	PRISM 7 DAYS (N/MM ²)	PRISM 14DAYS (N/MM ²)	PRISM 28DAYS (N/MM ²)
1	0	1.5	3.9	6
2	15	1.6	4.1	5.5
3	20	1.7	4.4	6.4
4	25	1.5	3.7	6

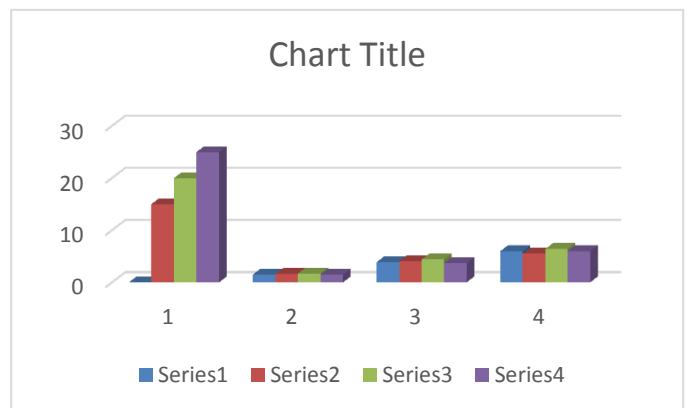
The graph variation of the compressive strength of specimen of cubes, cylinder and prism with different percentage replacement of fine aggregate by glass powder



GRAPH 1 COMPRESION TEST



GRAPH 2 SPLIT TENSILE STRENGTH



GRAPH 3 FLEXURAL STRENGTH

X. DISCUSSION FOR TEST RESULT

The influence of waste glass powder on the properties of concrete such as compressive strength, split tensile strength and flexural strength test. Average mix percentage 20% of

slow higher value when compared with conventional concrete.

An appreciable increase in the compressive strength is observed with the increase in percentage replacement of cement by glass powder from 15%, 20% and 25% replacement the increase in strength. as the replacement of glass powder compared effect is due to lower specific gravity of glass powder compared to that of cement. However, the strength increase has taken place because of pozzolanic action of glass powder. Since the glass powder acts as a pozzolanic material the affect of carbonation is reduced and the durability of concrete increases. The results confirms the statement made in reference, The smaller particle size of the glass powder has higher activity with lime present in the cement resulting in higher compressive strength in the concrete mix³. Slump was found to be 70 - 72mm. When the water cement ratio was maintained constant in the mix the slump was found to be increasing. The percentage water absorption decreased with increase in broken glass content. The lowest value of water absorption was found for concrete mix with 20% broken glass content.

XI. CONCLUSION

The influence of replacement of cement by glass powder has been studied. Based on the experimental work conducted, the following conclusions are drawn.

The replacement of cement by glass powder in concrete increases the compressive strength of concrete. Increase of 27% strength can be achieved when 20% cement was replaced by glass powder in concrete when water/ cement ratio was maintained constant. Slump test was carried out and the slump was found to be 70 to 72mm even with 20% replacement. With the increase in glass content, percentage of water absorption decreases. Considering the strength criteria, the replacement of cement by glass powder is feasible upto 20%. Usage of waste glass powder in concrete can prove to be economical as it is very much cheaper than cement. Use of waste glass in concrete will reduce the disposal problem of waste glass and prove to be environmental friendly thus paving for green concrete.

XII REFERENCE

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