

Effect of Glass Powder in High Strength Concrete

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Abstract— Concrete is a versatile building material and it is used all over the world. Concrete is a word which makes revolutionary change in the construction industry in all over the world. Concrete is a material which is can be molded in any shape and size due to this property of concrete it is accepted in all over the world. Where concrete has such a big advantages and being accepted all over the world. At the same time concrete has some disadvantages too, like when we mix water in the ingredient of concrete it go through the hydration process due to cement present in it. When this hydration process goes on it liberate some poisonous gases, there poisonous gases will affect the environment and harm the ozone layer, to reduce this effect on the environment some scientist and researchers concluded that cement which is major ingredient of concrete is partially replaced by waste material like Glass Powder. Basically Glass Powder is a by-product of Glass factories. Glass Powder is present on a satisfactory scale in India and also it shows a great pozzolanic properties, due to this Fly ash we can used as a partial replacement of cement. For this project High strength M60 concrete is designed by IS 10262 and M60 concrete cubes is casted and all mix is prepared, after mixing concrete cube is casted then these cubes is tested for compressive strength and flexural strength.

Key words: Glass Powder, Cement, flexural Strength, Concrete

I. INTRODUCTION

Concrete is a versatile building material and it is used all over the world and also it makes revolutionary change in the construction industry in all over the world. It is a material which is can be molded in any shape and size due to this property of concrete it is accepted in all over the world. Where concrete has such a big advantages and being accepted all over the world. At the same time concrete has some disadvantages too, its ingredient like aggregate which is naturally available but sometimes these aggregate are not locally available and transportation cost increase the total cost of the project. Generally naturally occurring river sand is used as fine aggregate in concrete, so in this project cement aggregate is partially replaced by waste material like Glass Powder. Basically Glass Powder is a by-product of Glass factories, after replacing cement by Glass Powder concrete will be checked for compressive strength and flexural strength upto 30% at an interval of 10%.

II. MATERIAL AND METHODS

A. Material Used

1) Cement

The cement used in this study was 43 grade Ordinary Portland Cement (OPC) confirming to IS 8112-1989.

2) Fine Aggregate (Sand)

In the study natural river sand is used having grading zone II and specific gravity 2.65.

3) Water

In this study portable water is used confirming to IS 456: 2000.

4) Aggregate

Crushed stone having particle size 20 mm with specific gravity 2.59.

5) Glass

Glass powder collected from local vendors and when it is check in laboratories it is found that specific gravity of glass powder is 2.32, fineness modulus 7.4%.

6) Admixture

Sika is used for this project as admixture 1.15% by the weight of cement, which increases workability of the concrete.

B. Mix Design

Mix of concrete of grade M60 (high Strength) is design as per IS10262 : 2009. There 6 mix is prepared which contain glass powder 0-50% of glass powder. Mix designation of concrete of different mix is given in table 1.

S. No.	Glass Powder Content in Mix	Mix Name (Cement Replacement)
1	0%	T0
2	10%	TC10
3	20%	TC20
4	30%	TC30
5	40%	TC40
6	50%	TC50

Table 1: Mix Designation

III. RESULT AND DISCUSSION

When glass powder is introduced in the composition of high strength concrete (M60) as a cement replacement, it has been observed that glass increases compressive strength of high strength concrete upto 20% then compressive strength is decreased. Table 1 and Graph 1 - graph 2 shows compressive strength of the concrete when cement is partially replaced by glass powder in high strength M 60 concrete, T0 mix which contain 0% glass powder possess 62.54 MPa compressive strength after 28 days curing which increases to 64.33 MPa in T20 mix and decreased to 60.74 in T50 mix. Table 2 and Graph 3 - graph 4 shows compressive strength of the concrete when cement is partially replaced by glass powder in high strength M 60 concrete, T0 mix which contain 0% glass powder possess 5.69 MPa flexural strength after 28 days curing which increases to 5.77 MPa in T20 mix and decreased to 5.61 in T50 mix.

S. No.	Mix Name (Cement Replacement)	Compressive Strength (MPa)		
		7 Days	14 Days	28 Days
1	T0	48.94	53.21	62.54
2	TC10	47.94	52.67	62.43
3	TC20	49.28	54.36	64.33

4	TC30	46.64	51.82	61.52
5	TC40	45.65	50.67	60.94
6	TC50	44.74	49.45	60.74

Table 2: Result of Compressive Strength of glass powder concrete

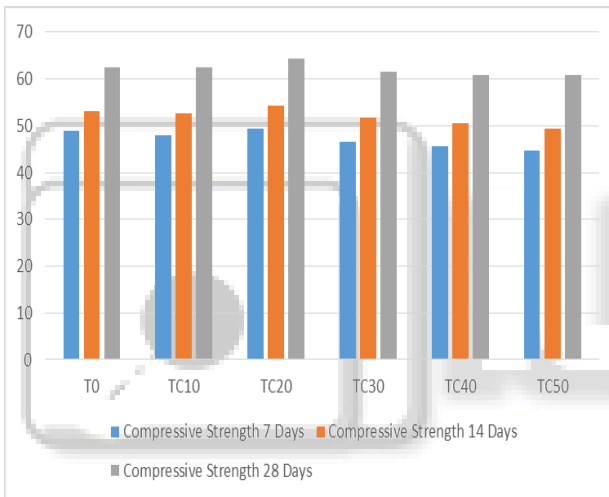
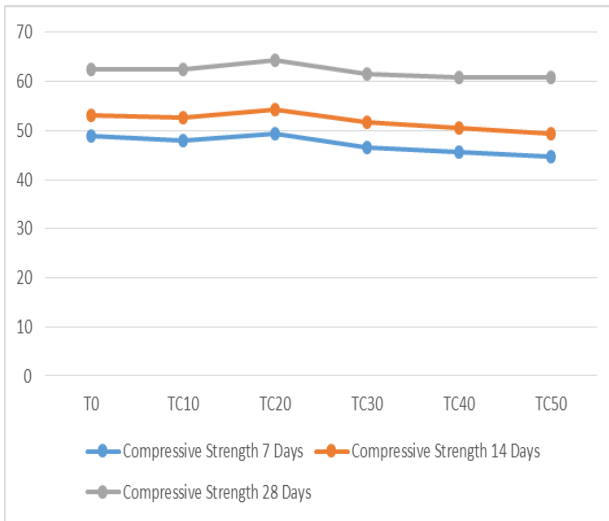


Fig. 1&2: Result of Compressive Strength of glass powder concrete

S. No.	Mix Name (Cement Replacement)	Flexural Strength (MPa)		
		7 Days	14 Days	28 Days
1	T0	4.97	5.11	5.69
2	TC10	4.92	5.08	5.69
3	TC20	4.98	5.16	5.77
4	TC30	4.85	5.04	5.65
5	TC40	4.80	4.98	5.62
6	TC50	4.75	4.92	5.61

Table 3: Result of Flexural Strength of glass powder concrete

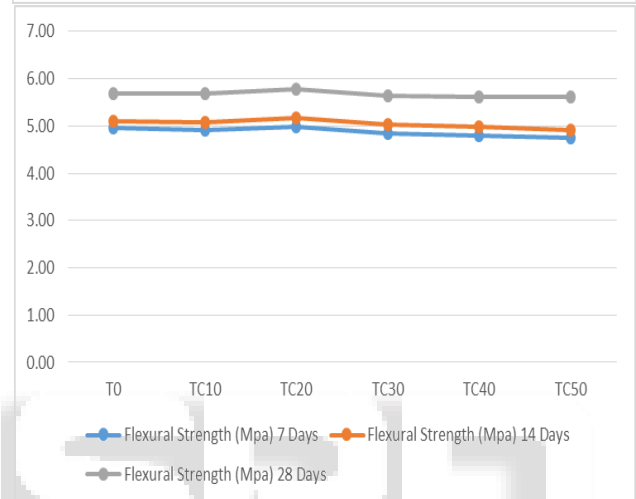
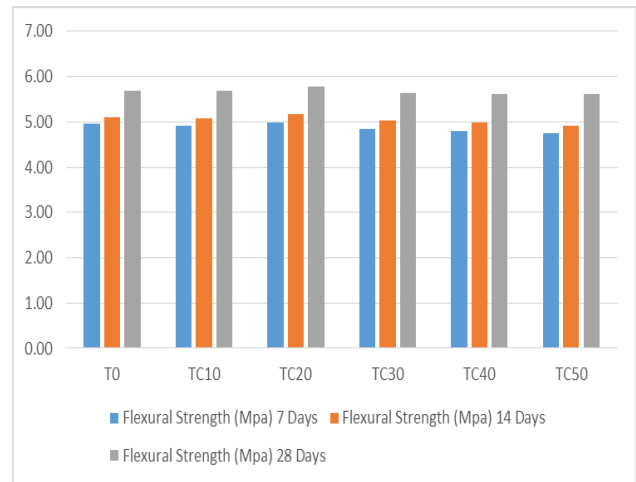


Fig. 3&4: Result of Flexural Strength of glass powder concrete

IV. CONCLUSION

From the current study it is concluded that glass powder is a material which can replaced cement in high strength concrete. Conclusions carried out from this study are as follows.

- 1) Glass powder increase in compressive strength in T20 mix which have 20% glass powder by partial replacement of cement, T20 mix shows increment in compressive strength approx. 2.78 % as compare to control mix. Glass added in concrete by partial replacement of cement in concrete, it shows a decrement in first mix then it increases but again compressive strength decreases for the further mixes.
- 2) Likewise compressive strength, flexural is also decreases in first mix then in second mix it increases and then in further mixes flexural strength is decreases.
- 3) Optimum percentage of glass powder which can replace cement in high strength concrete is 20% for both compressive and flexural strength.

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