Utilization of Glass Powder in Concrete Production

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Abstract— Glass industry is a very big industry and its generated waste are not widely used. There are many product of glass from which waste is generated like glass bottles, glass sheets, glassware etc. Many scholar and scientist is working on utilization of glass in concrete as fiber, fine aggregate replacement, coarse aggregate replacement, cement replacement etc. In this article, study of glass powder has been done. Particles of glass powder which passes from 90 micron IS sieve is partially replaced by cement and particle of glass powder which retained on 90 micron IS sieve and passes from 4.75 mm IS sieve is partially replace d by fine aggregate in concrete. All mix is prepared, green concrete is checked for its workability and hardened concrete checked for compressive strength.
Key words: Concrete Production, Glass Powder

I. Introduction

Glass is a transparent material produced by melting a mixture of materials such as silica, soda ash, and $CaCO_3$ at high temperature followed by cooling where solidification occurs without crystallization. Glass is widely used in our lives through manufactured products such as sheet glass, bottles, glassware, and vacuum tubing. Glass is an ideal material for recycling. The use of recycled glass saves lot of energy and the increasing awareness of glass recycling speeds up focus on the use of waste glass with different forms in various fields. One of its significant contributions is the construction field where the waste glass was reused for concrete production. The application of glass in architectural concrete still needs improvement. Several study have shown that waste glass that is crushed and screened is a strong, safe and economical alternative to sand used in concrete. During the last decade, it has been recognized that sheet glass waste is of large volume and is increasing year by year in the shops, construction areas and factories.

II. Material and Methods

Glass particles which is collected from local glass industries is crushed and then sieved particle which retain on IS 90 micron IS sieve passes from 4.75 mm IS sieve is fine aggregate and glass particle which passes from 90 micron IS sieve is used as cement replacement, with specific gravity 2.30 and fineness modulus 3.50.

S. No.	Glass Powder Content	Mix Name (Cement Replacement)	Mix Name (Fine Aggregate Replacement)
1	0%	CC	CC
2	10%	G1	G4
3	20%	G2	G5
4	30%	G3	G6

Table 1: Mix Designation

OPC cement with specific gravity 3.11 and fineness modulus 1.70 along with crushed stone with specific gravity 2.62, water absorption 0.5% and fineness modulus 6.75 and natural river sand with specific gravity 2.60, water absorption 0.7% and fineness modulus 5.23 is used. Here glass powder is partially replaced by fine aggregate and cement up to 30% at interval of 10. On fresh concrete workability test is performed and on concrete cubes compressive test is performed. M40 concrete is designed as IS 10262: 2009. Mix designation is given in table 1.

III. Result and Discussion

Graph 1 and graph 2 shows compressive strength of the concrete when cement is partially replaced by glass powder and it has been observed that when glass powder is partially replaced by cement, it decreases the compressive strength of the concrete when it is compared to controlled concrete. Graph 3 and graph 4 shows compressive strength of the concrete when fine aggregate is partially replaced by glass powder and it has been observed that glass powder does not affect much when it is partially replaced by fine aggregate.

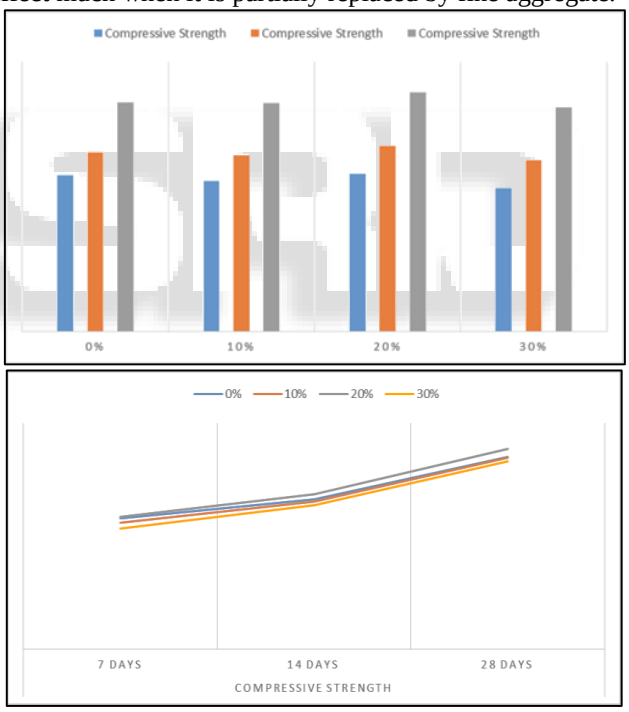
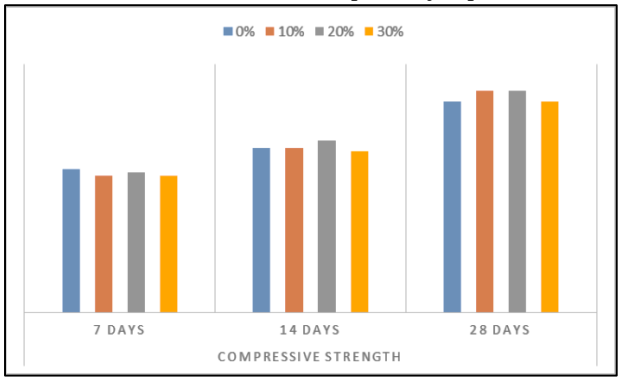


Fig. (1) & (2): Compressive Strength of glass powder concrete when cement is partially replaced



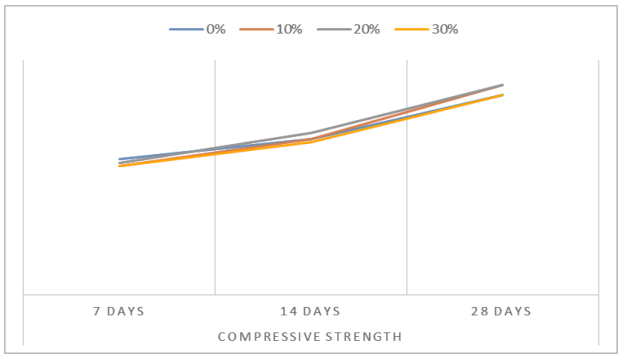


Fig. (3) & (4): Compressive Strength of glass powder concrete when fine aggregate is partially replaced

IV. CONCLUSION

By the present study it is clear that glass powder is a versatile material. Which can be used both as fine aggregate replacement and also cement replacement, where glass powder decreases compressive strength but all this mix are acceptable and useable.

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