INVESTIGATION OFGLASS SAND AS FINE AGGREGATE IN CONCRETE

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***Abstract*—**Scarcity of sand and environmental hazards caused due to the depletion of sand has led to the discovery of new materials for its replacement. Many materials have been discovered to replace sand and have yielded positive results. Glass is one such material that can be used to replace sand. Glass used in concrete making leads to greener environment. Recently many sheet glass cuttings go to waste, which are not recycled at present and usually delivered to landfills for disposal. Also natural resources are being depleted for collecting sand. Using glass powder in concrete is an interesting possibility for economy on waste disposal sites and conservation of natural resources. This project examines the possibility of using glass powder as a replacement in fine aggregate for a new concrete. Natural sand was partially replaced (10%, 25% and 50%) with glass powder. Compressive strength, Tensile strength and Flexural strength were compared with those of concrete made with natural fine aggregates. Also durability tests such as RCPT, acid attack and Sulphate attack were conducted on glass powder concrete to study the durability properties. The test results showed an increase in strength for glass powder concrete. This indicates that it is possible to manufacture concrete containing glass powder with characteristics similar to those of natural sand aggregate concrete.

***IndexTerms*—Waste glass, concrete, compressive strength test, specific gravity.**

I. INTRODUCTION

The amount of waste materials generated by various industrial sectors is permanently increasing and causing a huge environmental problem. It has been agreed that re-using waste and recycled materials is the best available way to reduce the amount of solid wastes that may end up in disposal sites with all the disastrous environmental consequences and economical loss generated. Glass, with all its varieties, is one of these waste product that is classified as a non-biodegradable material and has substantial environmental impact. Park et al. (2004) concluded that the majority of waste glass is not being recycled but rather abandoned, and is therefore the cause of certain serious environmental problems. Over the last decades, several types of waste aggregates such as recycled concrete aggregate (RCA), ceramic tiles, red bricks, and waste glass, rubber tires and many other solid waste

materials have been used as a partial or full replacement of natural aggregate in concrete production. Recent researches have proved that RG can replace up to 20% of natural aggregates with an appropriate mechanical properties of concrete. The predominant shape of glass grain when crushed is angular regardless of color of the waste glasses which could severely affects the workability concrete and reduces its slump Sustainability and stability in concrete can be achieved by successfully replacing the building material by other alternative. Which will decrease the ill effect cause by extraction of these materials, on environment. Building material include course aggregate, fine aggregate and cement they can be replace by industrial waste, recyclable material or by product from industry. The main objectives of this research project is to investigate the feasibility of using window waste flat glass in concrete mix at different replacement proportions. The key mechanical and properties of glass concrete were examined.

MATERIALS & METHODS

Material: - To pursue the present research work building material is required IS Portland cement Type I with a specific gravity of 3.14 was used. Crushed limestone with a specific gravity of 2.8 and water absorption of 0.92 % as combination of two aggregate fractions of 50% 10 and 50% 20 mm coarse aggregate. Natural sand used had a specific gravity of 2.71 and a water absorption of 3.71% while the crushed fine glass had a specific gravity of 2.49 and a water absorption of 0.06%. A polynaphthalenesulphonate-based superplasticizer (SP) was used at the appropriate dosage to achieve the targeted slump 60 ± 10 mm.

Methods: - The methodology adopted in the present work was divided intofour parts namely

- crushing of glass,
- testing on glass,
- concrete cube casting and curing
- Testing on concrete cube.

The glass was crushed just after the sampling was done and sieve from 4.75 mm sieve. Furthermore the investigation were done from several aspect such as geotechnical testing etc. the cubes were made by using concrete grade M20, which is a good grade for testing furthermore after curing testing was done on it on specific days and the result were obtained.

RESULTS

Results for geotechnical properties

- The Specific gravity of the glass sand is 2.039
- The Bulk density of the glass sand is 1.672 g/ml^3.
- The result for Grain Size Analysis is, Cu & Cc was found to be 2.039 & 1.127
- The fineness module is 3.5.
- The water absorption is 0.1%.

Result for compressive analysis test

Sand ratio / Testing days	25 %	50%	75%	100%
3 day	7.08 N/mm^2	7.50 N/mm^2	7.92 N/mm^2	7.02 N/mm^2
7 day	11.83 N/mm^2	11.52 N/mm^2	11.59 N/mm^2	11.03 N/mm^2
14 day	17.00 N/mm^2	17.28 N/mm^2	17.17 N/mm^2	17.90 N/mm^2
21 day	18.09 N/mm^2	18.42 N/mm^2	18.31 N/mm^2	18.13 N/mm^2
28 day	18.92 N/mm^2	19.03 N/mm^2	19.43 N/mm^2	19.62 N/mm^2

II. CONCUSIONS

The specific gravity, bulk density of the glass sand sample is 2.039 & 1.672 which is lying in the range as per Indian standard. On the basis of sieve analysis test the crushed glass sample was found to be partially evenly distributed. Fineness Module was found to be 3.5 which puts it into the category of coarse sand. Results of water absorption was found to be 0.1% which is very low and negligible.

The M20 grade concrete cube are casted and are tested at 3, 7, 14, 21 and 28 days of curing. The compressive strength test results shows that the sample containing 50% and 100% glass sand content show good compressive strength on 28 days but on comparing test results of both the sample, sample containing 100% glass sand is showing better result than other one.

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