SPATIAL INVESTIGATION FOR THE COMPATIBILITY OF GLASS SAND AS FINE AGGREGATE IN CONCRETE AS A REPLACEMENT OF SAND

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Abstract: with the rapid development there is instant increase in the consumption of concrete for the construction of building and other structure and this cause the increase in the demands of other construction material such as course aggregate, fine aggregate and cement. The course aggregate and fine aggregate are the natural sand gone through the process of cutting and grinding to make them in a desired size and usable. While cutting of big and huge stone cause the loss of ecosystem and disturbance in ecology and cause the environmental degradation. Due this major problem there is requirement of replacement of aggregate with other material.

Index Terms: Waste glass, concrete, compressive strength test, specific gravity.

I. INTRODUCTION

Concrete is a largely used construction material in the world which is composed of course aggregate such as natural stone of standard size, fine aggregate such as sand and cement with water. Concrete is not only the largest used material but by this a large amount of natural resource is consumed annually which is of 12.6 billion tons (Mehta, 2002). The building material used for making concrete are naturally extracted except cement like course aggregate, fine aggregate The extraction of these natural aggregate are from non-renewable resources which ultimately harm environment and ecology. Various research work has been started by the researchers for the proper development and for more sustainability of concrete in India as well as worldwide with an aim to decrease the effect on ecology and environment and to save the raw materials. 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 aim of the research work were mainly in concrete practices and they are the complete replacement of fine aggregate with crushed glass sand and to investigate the feasibility of sustainable reuse of waste glass crushed into concrete and the last is to obtain high strength concrete by using glass sand in concrete.

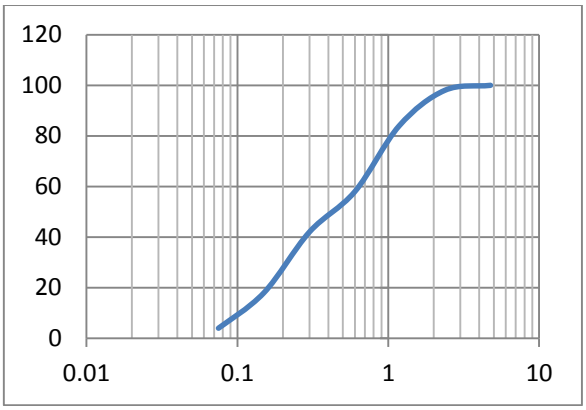
II. MATERIALS & METHODS

Material: - To pursue the present research work building material is required such as course aggregate which include the stones which can pass from 20 mm sieve and retain at 4.75 mm sieve. Fine aggregate was also required they are basically sand which can pass from 4.75 mm sieve. Cement was used as a binding material while making concrete. Here in the study the normal cement fly ash based was used. Waste glasses were used in the present research work which was used as the replacement of fine aggregate when crushed into small particles.

Methods: - The methodology adopted in the present work was divided into four parts namely crushing of glass, testing on glass, concrete cube casting as well as curing and testing on concrete cube.
After the sampling of glass they were cleaned and the crushed into small pieces with the help of rammer and after that all the crushed glass was passed from 4.75 mm sieve. Then geotechnical parameter were investigated such as Specific gravity, Bulk density, Grain Size analysis, Fineness Module and Water Absorption. After investigating these parameter the M20 grade concrete was prepared and concrete cubes were casted by mixing crushed glass as fine aggregate in the quantity of 25%, 50%, 75% and 100% of fine aggregate by weight. The concrete cube were casted and cured for 3, 7, 14, 21 and 28 days and then final investigation is done by performing Compressive strength test on them.

III. RESULTS

The Specific gravity of the glass sand was performed twice and the average of the result were taken in consideration and the average of the specific gravity of the glass sand sample was 2.429. As far as bulk density is concerned the value for the bulk density was 1.55 g/ml^3.
The result for Grain Size Analysis was interpreted on the basis of plotted semi logarithmic graph and the value of Cu & Cc was found to be 2.27 & 1.016



The fineness module was found to 3. Results of water absorption was found to be 0.131%.
The compressive analysis test were performed on the concrete cube on the specified days and then the values were plotted on the table below.

Sand ratio / Testing days	25 %	50%	75%	100%
3 day	7.89 N/mm^2	7.54 N/mm^2	8.12 N/mm^2	7.93 N/mm^2
7 day	11.98 N/mm^2	12.27 N/mm^2	12.54 N/mm^2	12.82 N/mm^2
14 day	17.56 N/mm^2	17.04 N/mm^2	17.32 N/mm^2	18.09 N/mm^2
21 day	18.69 N/mm^2	18.71 N/mm^2	18.81 N/mm^2	18.73 N/mm^2
28 day	19.82 N/mm^2	19.93 N/mm^2	19.53 N/mm^2	19.98 N/mm^2

IV. CONCUSIONS

The specific gravity of the glass sand sample was 2.429 which is lying in the range as per Indian standard. The value for the bulk density was 1.55 g/ml^3 and according to Indian Standard the value of fine aggregate should be lye in the range of 1.52 g/ml^3 to 1.68 g/ml^3. On the basis of plotted semi logarithmic graph the crushed glass sample was found to be partially evenly distributed. Fineness Module was found to be 3 which puts it into the category of coarse sand. Results of water absorption was found to be 0.131% 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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