Experimental Study on Mechanical Properties of Glass Waste and Glass Fiber Concrete

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Abstract- *Dumping of waste glass derived from vessel or packing glass, inland or tableware glass and constant filament glass fibers is one of the foremost environmental jobs. This job continues to increase with increasing the quantity of waste glass and decreasing the capacity of landfill planetary. This paper shows the use of glass waste as a partial replacement of fine aggregate and adding of glass fiber as a percentage of cement in concrete. Mechanical properties such as a Compressive strength test, Flexural strength test, and Tensile strength test have been studied at 3 and 28 days in M20, M25, M30 grade of concrete.*

Keywords- Glass Waste, Glass Fiber, Concrete, Compressive Strength, Flexural Strength, Tensile Strength

I. INTRODUCTION

Utilization of waste materials and byproducts is a partial solution to environmental and ecological problems. Use of these materials not only helps in getting them utilized in cement, concrete and other construction materials, it helps in reducing the cost of cement and concrete manufacturing, but also has numerous indirect benefits such as reduction in landfill cost, saving in energy, and protecting the environment from possible pollution effects.

Concrete is mostly used artificial material all over the world and has played main role in development of all countries.

For higher and higher requirements in last past few years many research has been done on concrete make it more durable and higher strength.

II. MATERIAL USED

2.1 Cement

Portland pozzolana cement used in this study, Which has specific gravity 3.15.

2.2 Glass waste

The specific gravity of glass is 2.41. Local available glass waste used as partial replacement of fine aggregate in concrete.

2.3 Glass fiber

Anti-crack, alkali resistant glass fiber has 12mm cut length used in this study. It has specific gravity 2.5-2.6.

2.4 Aggregates

Aggregate are the important constitutes in concrete. They give body to the concrete, reduce shrinkage and effect economy. The coarse aggregate passing through a 20 mm and retained in 10 mm sieve is used and also used passing through the 10 mm and retained in 4.75 mm sieve of 60:40 ratio. Good quality sand used as a fine aggregate confirming to Zone-III of IS: 383-1970 has a fineness modulus of 3.53 and a specific gravity of 2.44.

2.5 Water

Water is the most important and least expensive ingredient of concrete. Potable water free from organic substance is used for mixing as well as curing of concrete.

III. METHOD

Now a days we live in the world full of growth and enthusiastic for still more comfort and facilities. This leads to innovations and revolutions in each and every field, but on contrary it has harmful effect on environment as resources get depleted and pollution to different natural sources are occurred. Glass waste as a waste has properties which has bad

impact on the environment but when mix with concrete ingredients in some proportion it helps in improving the properties of concrete mix especially its strength. By adding Glass waste it can decrease the environmental pollutions and protect natural resources. According to the researches, it shows that Glass waste is give good impact in construction line.

1. Compressive test

The uniaxial compression test on cube specimens was performed with reference to IS-516 (Load increasing (@ 14 MPa/min.). Compressive loading was applied to the cube specimens 150 X 150 X 150. Three cubes were tested at each stage of curing for each type of mix design. In this paper the compressive strength demonstrated by concrete prepared 40% sand replacement and compared for three grades M20, M25, M30 at 28 days.

2. Flexural test

Beams of dimensions (15x15x70 cm) were prepared and tested under monotonic increasing loading to determine the flexural tensile strength. The rate of load application was 1.0 MPa/min in all cases. The flexural strength can be determined as PL/BD2 , where P is the maximum node applied (N), L is the span length (mm) that is the distance between the line of fracture and the nearest support measured from the center line of the tensile side of specimen, B is the width of the specimen (mm), d is the depth of specimen (mm). (When L is greater than 200mm for 150mm specimen or greater than 133mm for 100mm specimen). In this paper the flexural strength demonstrated by concrete prepared 40% sand replacement and compared for three grades M20, M25, M30 at 28 days.

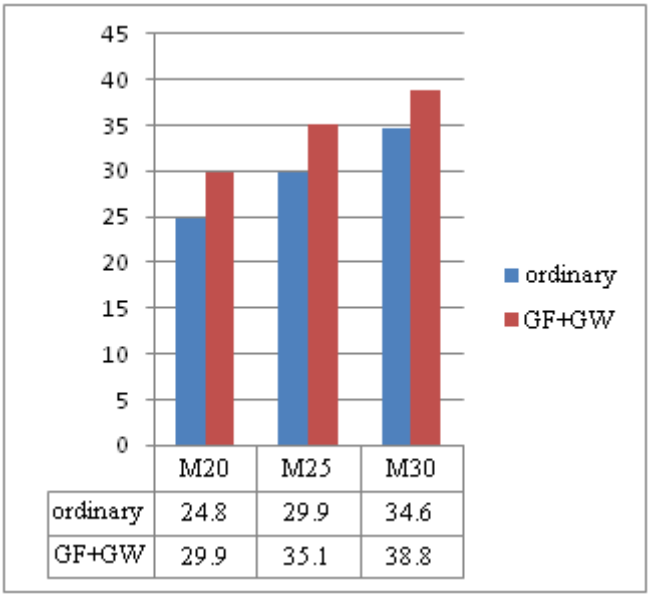
3. Split tensile test

Cylinders of 15 cm diameter and 30 cm length were prepared and tested under increasing loading @14 MPa/min. Three cylinders were tested at each stage of curing for each type of mix design. The Split Tensile Strength is determined by $2P/\pi ld$ Where P= Load at which sample fails, L= length of the specimen cylinder, D= diameter of the specimen cylinder. In this paper the flexural strength demonstrated by concrete prepared 40% sand replacement and compared for three grades M20, M25, M30 at 28 days.

IV. TEST RESULTS

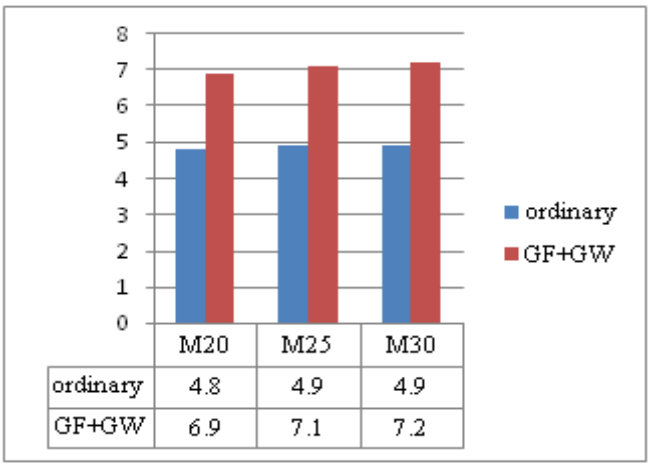
A series of test was carried out on the concrete to obtain the strength characteristics of concrete with and without waste glass as fine aggregate. The result of Compression tests, Flexural test and tensile test has been given below.

Chart no.1: Compressive Strength at 28 days



	M20	M25	M30
ordinary	24.8	29.9	34.6
GF+GW	29.9	35.1	38.8

Chart no.2: Flexural Strength at 28 days



	M20	M25	M30
ordinary	4.8	4.9	4.9
GF+GW	6.9	7.1	7.2

Chart no.3: Tensile Strength at 28 days

	M20	M25	M30
ordinary	2.5	2.6	2.9
GF+GW	3.5	4.1	4.61

V. CONCLUSIONS

1. Compressive strength in M20,M25,M30 sand replacement has higher than ordinary mix.
2. Flexural strength in M20,M25,M30 sand replacement has higher than ordinary mix.
3. Tensile strength in M20,M25,M30 sand replacement has higher than ordinary mix.
4. And all mechanical properties has results shows the higher in replacement mix and also higher in consequently grade have ordinary mix.

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