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Partially Replacement of Fine Aggregate with Waste Glass in Concrete

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ABSTRACT :- As we know, concrete requires huge amount of natural components and these are in very limited quantity hence it is essential do discover some alternate material. Now days , the concrete industry facing biggest challenge of environment and economy. In this paper, suitability of use of waste glass powder as partial replacement of Fine aggregate concrete is observed. so that issues concerned with environment will get some alternative. Fine aggregate was replaced by waste glass powder as 0 %, 10 %, 15 %, 20 % respectively in M20 mix. The concrete specimens were tested for compressive strength, at 7, 14 and 28 days of age and the results obtained were compared with those of normal concrete. The results concluded the permissibility of using waste glass powder as partial replacement of Fine aggregate at 15% by weight.

Key words :- compressive strength, sustainability, permissibility, Partially replacement, fine aggregate

I. INTRODUCTION

Most of the raw glass materials used in this study were beer glass. The first step is to crush the glass to prepare coarse aggregate. The second step in preparing the glass aggregate was sieve analysis for the glass particles. The specific gravity of glass aggregate is found by experimental procedure.

up of molecules of silicon dioxide, which is also called We are using glass as a engineering material from ancient time. But in resent time, because of the rapid progress made in glass industry the glass has come out as the most adaptable engineering material of the present times. The first glass object made by man was of natural glass such as obsidian and rock crystal. Manufacturing of glass requires high degree of technical knowledge and skills. In the first quarter of the first golden age B.C. the historical site evidences proof the occurrence of various glass.

The glass is made up of combination of a number of metallic silicates, one of which is usually that of an alkali metal. It is an amorphous, transparent or translucent. The raw material commonly used to manufacture the glass is includes small grains of quartz crystals, made as silica.

II. PLAN OF EXPERIMENTATION

The Experimental procedure is planned as follows. .

1. Obtain Mix proportions of OPC concrete for M20 by IS code - (456-2000).
2. Calculate the mix proportion with partial replacement such as 0%, 10%, 15% and 20% of crushed glass.
3. Prepare the cube of concrete specimen for testing purpose.
4. Cure the specimens for 7, 14 and 28 days respectively.
5. Perform test on specimen such as compressive strength test, slump cone test etc.
6. Evaluate and compare the results.

III. MIX PROPRTION (As Par IS 456:2000)

The concrete mix design was proposed by using IS code 456-2000.M20 grade of concrete was used with water cement ratio of 0.45. The average dry weight of concrete cube specimen containing 0%, 10%, 15% and 20% of glass powder in place of fine aggregate, was compared with average dry weight of normal M-20 concrete.

The mixture proportions used in laboratory for experimentation are given below.

Glass powder %	cement kg	fine aggregate kg	coarse aggregate kg	w/c ratio	glass powder %
0	1.38	2.408	4.181	0.55	0
10	1.38	2.167	4.181	0.55	0.248
15	1.38	2.046	4.181	0.55	0.384
20	1.38	1.926	4.181	0.55	0.504

Table 3.1 mix proportion

3.1. COMPRESSIVE STRENGTH TEST

The compressive strength of material is the uniaxial compressive stress reached when the material fails completely. A set of three cube were tested in each case and the average value of three was reported.

Sample of all cubes were tested for compressive strength at 7, 14 and 28 days.

Figure 3.1, Cube Testing (Compressive Strength Test)

Figure 3.3, R.M.C Plant

3.2 SLUMP CONE TEST

The concrete slump test is to measure the consistency of fresh concrete before it sets. To find out the workability of freshly made concrete, and hence to know the ease with which concrete flows

Figure 3.2, Slump Cone Test

Figure 3.4, CUBE CASTING

Figure 3.5, Mixing of Glass with Fine Aggregate

IV. RESULTES AND ANALYSIS

4.1 COMPRESSIVE STENGTH 0F M20 CONCRETE

4.1.1 COMPRESSIVE STRENGTH OF CEMENT CONCRETE BLOCK WITH 0% CRUSHED GLASS.

CURING PERIOD IN DAYS	COMPRESSIVE STRENGTH OF CONCRETE BLOCK (N/MM²)			
	BLOCK 01	BLOCK 02	BLOCK 03	AVERAGE STRENGTH
7 days	22.2	22.67	21.5	22.05
14 days	22	23	22.5	22.50
28 days	24.5	26	19.5	23.33

4.1.2 COMPRESSIVE STRENGTH OF CONCRETE BLOCK WITH 10% OF CRUSHED GLASS.

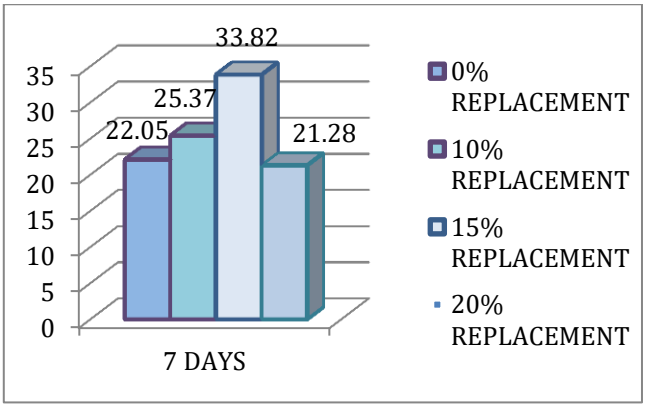
CURING PERIOD IN DAYS	COMPRESSIVE STRENGTH OF CONCRETE BLOCK (N/MM²)			
	BLOCK 01	BLOCK02	BLOCK 03	AVERAGE STRENGTH
7 days	25.30	25.82	25	25.37
14 days	36.6	36	33	35.50
28 days	56	57.06	55.4	56.15

4.1.3. COMPRESSIVE STRENGTH OF CONCRETE BLOCK WITH 15% OF CRUSHED GLASS.

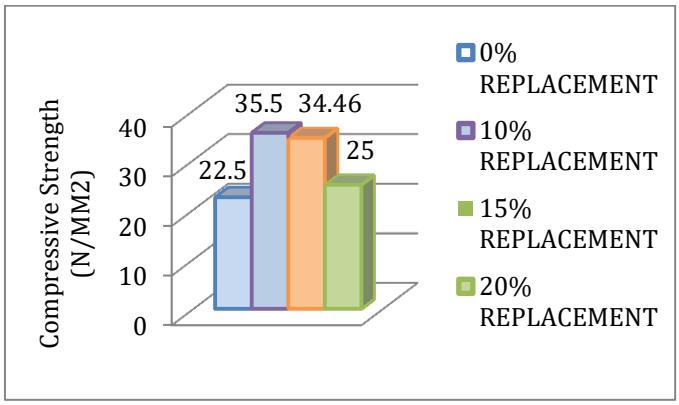
CURING PERIOD IN DAYS	COMPRESSIVE STRENGTH OF CONCRETE BLOCK (N/MM²)			
	BLOCK 01	BLOCK 02	BLOCK 03	AVERAGE STRENGTH
7 days	33	33.47	35	33.82
14 days	34.5	35	33.9	34.46
28 days	60	61.62	60.85	60.82

4.1.4. COMPRESSIVE STRENGTH OF CEMENT CONCRETE WITH 20% OF CRUSHED GLASS.

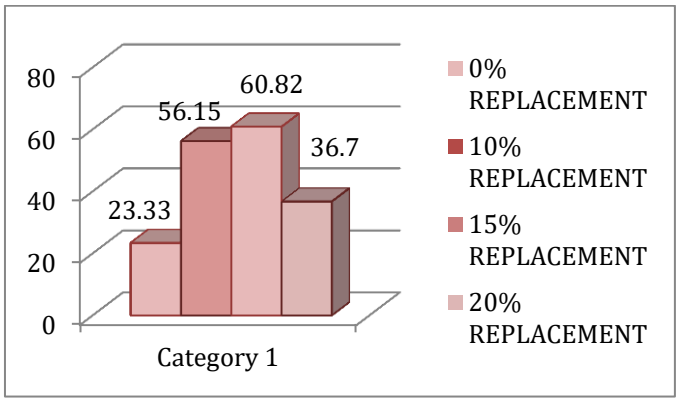
CURING PERIOD IN DAYS	COMPRESSIVE STRENGTH OF CONCRETE BLOCK (N/MM²)			
	BLOCK 01	BLOCK02	BLOCK 03	AVERAGE STRENGTH
7 days	20	21.15	22.70	21.28
14 days	25.4	24	25.6	25.00
28 days	36.5	38.35	38.25	36.70



Comparison of Compressive Strength (Curing Period – 7 days)



Comparison of compressive strength (Curing Period – 14 days)



Comparison Of Compressive Strength (Curing Period – 28 days)

V. ADVANTAGES

1. Glass does not absorb water, hence the percentage of absorption decrease it cause partially light weight concrete.
2. Use of waste glass having great potential in concrete. According to EECO (environmental council of concrete organization), and can be used in support layers, sub-bases and such as permeable base and unsterilized bases.
3. With successful use of waste glass, there will be less demand for natural and crushed aggregates.
4. Produce job opportunities in the local area & around and also a financial benefit for business like, local council engineers, concrete subcontractors, specialist of civil works, demolition contractors, recycling material plants etc.

VI. DISADVENTAGES

1. There is no ductility. Ductility is a solid material's ability to deform under stress and its maintenance can be highly challenging.
2. The use of excess amount of waste glass will also lead to failure of any concrete structure and will prevail concrete cracks in structure.
3. In such projects, the only disadvantage is bulk mass of the waste glass obtained from waste site.

VII. CONCLUSIONS

As results shows, 15 % replacement of fine glass with coarse aggregate gives highest strength in concrete and results better compressive strength as compare to conventional concrete block. Due to replacement of waste glass with coarse aggregate, it is economical

Up to 15% addition of glass, strength increase but as we increase percentage of glass more than 15% then strength decrease. Hence to achieve highest strength we can use crushed glass up to 15%.

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