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PERFORMANCE OF CONCRETE USING WASTE GLASS AS A PARTIAL REPLACEMENT OF FINE AGGREGATES

R. Nithiya[1], R. Subharanjani[2]

[1,2]*Assistant Professor, Department of Civil Engineering, Jerusalem College Of Engineering, Tamilnadu, India*

Abstract - *The high cost of building materials led to the usage of cheaper conservative materials. This study is about the partial replacement of fine aggregates with waste glasses. Both fresh concrete and hardened concrete properties were evaluated. The fresh concrete test includes Slump Cone test. Cube and Cylinder specimens were casted and tested for compressive and split tensile test respectively after 7 and 28 days of curing. Partial replacement of fine aggregates by waste glass upto 14% gives best results with no bleeding, segregation and thus provides good cohesiveness.*

Key Words: Waste Glass, Compressive Strength, Sustainability, Fine aggregates replacement

1. INTRODUCTION

Quantities of waste glass have been rising rapidly during the recent decades due to the high increase in industrialization and the considerable improvement in the standards of living, but unfortunately, the majority of these waste quantities are not being recycled but rather abandoned causing certain serious problems such as the waste of natural resources and environmental pollution. The main objective of this project is to study the Performance of concrete using waste glasses as a partial replacement of fine aggregates.

1.1 METHODOLOGY

The methodology in the form of flow chart for this present study is shown in Figure. 1.

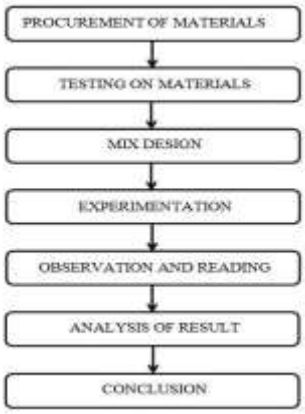

Fig -1: Methodology for the current study

2. MATERIALS USED

The materials used in the study are as follows :

- Cement
- Waste Glasses
- Fine Aggregate
- Coarse Aggregate
- Water

Fig – 2: Waste Glass

2.1 PROPERTY OF THE MATERIALS

Specific gravity test was carried out in Cement, Sand and waste glass and the results are tabulated in Table 2.

Table 2: Specific gravity of the materials

MATERIALS	SPECIFIC GRAVITY
Cement	3.15
Sand	2.6
Glass	2.8

3. EXPERIMENTAL ANALYSIS

The cube and cylinder specimens are casted and cured for 7 days and 28 days for M20 grade. The compression and split tensile tests are carried out as detailed below.

3.1 COMPRESSIVE STRENGTH

The compressive test on both conventional concrete and waste glass concrete is carried out. The test is conducted on concrete specimens of size 150mm x 150mm x 150mm. Cube is kept under the compressive testing machine and the

load is applied till the cube fails. The compressive strength of the specimen is calculated as follows

Compressive strength = P/A (N/ mm^2)
where,
P – Load applied (N)
A – Surface area of cube under loading (mm^2)

Fig -2: Testing of Cube

Table 3: Compressive Strength of Cube

Waste glass level (%)	Number of specimen	Compressive Strength (N/mm^2)	
		7 Days	28 Days
0	3	13.77	24.88
7	3	14.22	27.55
14	3	15.55	29.33
21	3	14.67	28.44
28	3	13.77	26.22
35	3	12.89	23.55

Chart -1: Compressive Strength of Cube

3.2 SPLIT TENSILE TEST

The split tensile test on both conventional concrete and waste glass concrete is carried out. The test is conducted on 150mm x 300mm. Cylinder is kept under the testing machine and the load is applied till the cube fails. The compressive strength of the specimen is calculated as follows

Split tensile strength = $\frac{2P}{\pi DL}$ (N/ mm^2)

where, P – Applied load in N, D – Diameter of cylinder in mm, L – Length of cylinder in mm

Fig -2: Testing of Cylinder

Table 4: Split Tensile Test of Cylinder

Waste glass level (%)	Number of specimen	Split Tensile Strength (N/mm^2)	
		7 Days	28 Days
0	3	2.12	2.40
7	3	2.26	2.68
14	3	2.55	2.97
21	3	2.40	2.54
28	3	2.12	2.40
35	3	1.98	2.26

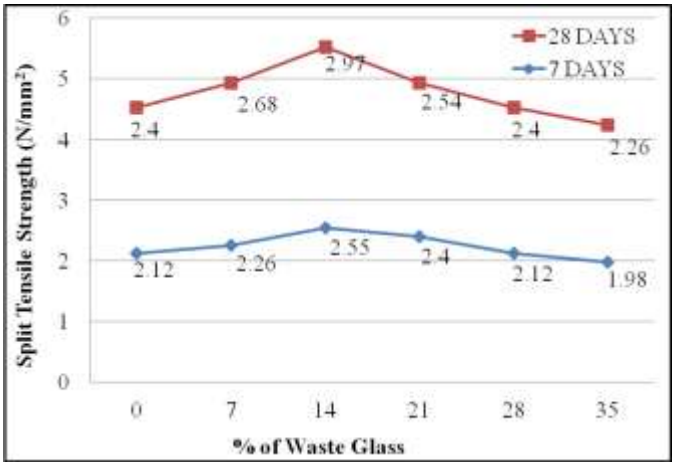

Chart -2: Split Tensile Test of Cylinder

3. CONCLUSIONS

1. The compressive strength decreases with the increase in the percentage of waste glass.
2. The desired compressive strength is achieved at 14% replacement of fine aggregates with waste glasses.
3. The split tensile strength increases with the increase in the percentage of waste glass.
4. Partial replacement of fine aggregates by waste glass upto 14% gives best results with no bleeding, segregation and thus provides good cohesiveness.

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