

Experimental Investigation on Partial Replacement of Cement With Glass Powder in Concrete

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Abstract- Due to rapid industrialization large amount of glass wastes are produced. So recycling of a glass wastes is not more economical. Sore using of glass wastes is more economical than recycling of glass wastes. The glass powder is the material which substitutes in the place of cement. The main objective of this investigation is to find a concrete mix proportion which gives better results than the normal concrete cube (compressive strength and tensile strength), and to study the properties, such as workability, compressive strength and tensile strength of glass powder replaced concrete. Then its properties are compared with M20 grade conventional concrete. The cement is partially replaced with 20%, 40% and 60% of glass powder. From the experimental Investigations, the hardened properties of the conventional concrete and the concrete partially replaced with glass powder are determined at different days of curing.

Keywords- Cement, Compression, Concrete, Curing, Glass powder, Tensile

I. INTRODUCTION

In a building construction, concrete is used for the construction of foundations, columns, beams, slabs and other load bearing elements. There are different types of binding material is used other than cement such as lime for lime concrete and bitumen for asphalt concrete which is used for road construction. we use glass powder as a replacement for cement.

1.2 SUSTAINABLE CONSTRUCTION

Sustainable construction means a construction that does not cause any harms to the environment and uses the resources efficiently. The main principle of sustainable construction is reducing SSS the usage of virgin materials, use the renewable energy materials and reuse the materials

II. IDENTIFY, RESEARCH AND COLLECTIDEA

MATERIALS AND TESTS

CEMENT

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Cement is a binding material used in a concrete to bin coarse aggregate and fine aggregate. It is a common material used in all over the world.

COARSE AGGREGATE

Coarse aggregate are aggregates those retained on the sieve size of 4.75 mm a retained on the sieve size of 7.55 cm.

FINE AGGREGATE

Fine aggregates are the aggregate material those who are retained on the sieve size of 4.75mm.

GLASS POWDER

Clear glass powder made from leaded crystal glass and ground into fine powder can be used in all media to give colours added luminosity or to create textural effects on the surface of paintings.

III. WRITEDOWNYOUR STUDIESANDFINDINGS

3.4.1 PRELIMINARY TEST ON MATERIALS

Empty weight of W1 Container	=	0.630 kg
Weight of container + W2 1/3 rd of container filled with fine aggregate	=	1.125 kg
Weight of container + W3 1/3 rd of container sand+ Water	=	1.933 kg
Weight of container + W4 Container full of Water	=	1.622 kg

Specific Gravity= $W2-W1 / (W4-W1)-(W3-W2)$

Specific Gravity=2.75

3.4.2 SPECIFIC GRAVITY TEST ON COARSE AGGREGATE

Empty weight of Container	W1	0.620 kg
Weight of container + 1/3 rd of container	W2	1.110 kg
Weight of container + 1/3 rd of container + Water	W3	1.726 kg
Weight of container + Container full of Water	W4	1.522 kg
Specific Gravity = $\frac{W2 - W1}{(W4 - W1) - (W3 - W2)}$		

mould and is compressed between platens of a compression testing machine by gradually applied load.

GLASS POWDER REPLACED CONCRETE CUBES:

Volume of cement replaced by glass powder for concrete cubes

% REPLACED BY GLASS POWDER	CEMENT (kg)	FINE AGGREGATE (kg)	COARSE AGGREGATE (kg)	GLASS POWDER (Kg)
20	4.304	11.39	15.34	1.06
40	3.23	11.39	15.34	2.15
60	2.15	11.39	15.34	3.23

3.4.3. FINENESS MODULUS OF FINE AGGREGATE

Fine aggregate sample = 1000g

Sieve size	Weight retained (g)	Cumulative weight retained (g)	Cumulative percentage weight retained (%)
4.75mm	0	0	0
2.36mm	100	100	10
1.18mm	250	350	35
0.6mm	350	700	70
0.3mm	200	900	90
0.15mm	100	1000	100
Total			275

COMPRESSION TEST

Compression test for the both conventional concrete cubes and glass powder replaced concrete cubes are taken for 7 days, 14 days and 28 days.

CURING DAYS OF CUBES	COMPRESSION STRENGTH OF ORDINARY CONCRETE CUBES (N/mm ²)	COMPRESSION STRENGTH OF GLASS POWDER REPLACED CONCRETE CUBES (N/mm ²)		
		20%	40%	60%
7 DAYS	13.8	13.5	12.9	11.5
14 DAYS	18.1	17.6	17.4	16.7
28 DAYS	21.1	21.4	20.2	19.8

3.4.4 FINENESS OF CEMENT

SAMPLE TAKEN -100 g
FINENESS OF SAMPLE -2%

3.4.5 FINENESS OF GLASS POWDER

SAMPLE TAKEN -100 g
FINENESS OF SAMPLE - 3.37%

TESTING COMPRESSIVE STRENGTH OF CONCRETE:

It is a mechanical test measuring the maximum amount of compressive load of material which it can stand before fracturing. The concrete used to test can be made in cube, prism or cylinder shaped by using its respective

TESTING SPLIT TENSILE STRENGTH OF CONCRETE:

It is used for determining the tensile strength of concrete using a cylinder which splits across vertical diameter. It is indirect method of testing tensile strength of the concrete.

GLASS POWDER REPLACED CONCRETE CYLINDER

%REPLACED BY GLASS POWDER	CEMENT (kg)	FINE AGGREGATE (kg)	COARSE AGGREGATE (kg)	GLASS POWDER(Kg)
20	5.4	10.74	19.29	1.35
40	4.05	10.74	19.29	2.7
60	2.7	10.74	19.29	4.05

SPLIT TENSILE TEST

%REPLACED BY GLASS POWDER	CEMENT (kg)	FINE AGGREGATE (kg)	COARSE AGGREGATE (kg)	GLASS POWDER(Kg)
20	5.4	10.74	19.29	1.35
40	4.05	10.74	19.29	2.7
60	2.7	10.74	19.29	4.05

IV. CONCLUSION

From the test conducted on glass powder replaced for cement in concrete shows that utilization of partial replacement of glass powder can be used up to some extent only. Further increase of glass powder in concrete decrease the both compressive and Split tensile strength. The compressive strength of concrete is gradually increase up to 20% replacement beyond that strength is suddenly decreased. Similarly, split tensile strength also decreases beyond 20% of glass powder. Replaced concrete mix. But the split tensile strength of 20% replacement of concrete gives better value compared to conventional concrete.

REFERENCES

- [1] Malik, I. M., Ahmad, S., Tariq, T., Bashir, M. and Chowdhary, U. (2015) "Prospect of partial utilization of waste glass powder and waste paper sludge ash in concrete", International Journal of Civil Engineering and Technology, Vol.6, No.9, 160-174.
- [2] Biver, N. B., Kumar, D. M., Babu, D. P. and Sathish kumar, V. (2016) "Experimental studies on RC beam by partial replacement of coarse aggregate by crushed waste glass and RCA", International Journal of Research and Reviews in Applied Sciences and Engineering, Vol.8, No.2, 320-335.
- [3] Srivastav, A. K. (2016) "Partial replacement of fine aggregates by using waste glass", International Journal of

New Innovations in Engineering and Technology, Vol.4, No.3, 7-11.

- [4] Topçu, B. I., and Canbaz, M. (2004) "Properties of concrete containing waste glass", Cement and Concrete Research, Vol.34, No.2, 267-274.
- [5] Hong, L., Huiying, Z., and Ewan, A. B. (2007) "Use of waste glass as aggregate in concrete", UK Chinese Association of Resources and Environment, 7th UK care Annual General Meeting, Greenwich.
- [6] Ammash, H. K., Muhammed, M. S., & Nahhab, A. H. (2009). Using of waste glass as fine aggregate in concrete. Al- Qadisiya Journal For Engineering Sciences, 2,430-450
- [7] Al-Jabri KS, Hisada M, Al-Oraimi SK, Al-Saidy AH. Copper slag as sand replacement for high performance concrete. Cement and Concrete Composites, 31, pp. 483 – 488, 2009, Elsevier Ltd.
- [8] atayneh M, Marie I, Asi I. Use of selected waste materials in concrete mixes. Waste Management, 27, pp. 1870 – 1876, 2007, Elsevier Ltd.
- [9] de Larrard F, Belloc A. The influence of aggregate on the compressive strength of normal and high-strength concrete. ACI Materials, 94, pp. 417 – 426, 1997.
- [10] Demirboga R, Gul R. Production of high strength concrete by use of industrial by- products. Building Environment, 41, pp. 1124 – 1127, 2006, Elsevier Ltd.
- [11] Jeba Samuel K. and Lova Raju "Experimental Study on Partial Replacement of Fine Aggregate by Waste Glass Powder and CNC Lathe Waste", (IJSRD) Vol. 6/Issue 10/2018/14