GREEN CONCRETE BY UTILIZATION OF WASTE GLASS POWDER & INDUSTRIAL WASTE SAND FOR CONSTRUCTION INDUSTRY

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ABSTRACT

In present paper we are considering five design mixes at 7days, 28 days, 54 days and 90 days strength comparison with and without curing compound.

In an effort to utilize Industrial Waste Sand (IWS) in large volumes, research is being carried out for its possible large-scale utilization in making concrete as partial replacement of fine aggregate.[1]Glass powder exhibits pozolanic properties but is dependent upon fineness of the powder.[2] It is recommended that the utilization of waste glass powder in concrete as cement replacement is possible.[3] When glass is used in fine particle size (13 µm) as partial replacement for cement in concrete, it is estimated to undergo pozolanic reaction that results in improved microstructure of recycled aggregate concrete through improvement in the quality of remnant mortar/paste attached to the surface of recycled aggregate that subsequently forms interface between recycled aggregate and new mortar in recycled aggregate concrete.[4][5]

In present paper I am investigating the role and effects of Foundry Waste sand's use in concrete to improve its strength & other durability factors. Also usages of waste glass powder as partial replacement of Portland cement. Replacing cement by pozolanic material like waste glass powder in concrete, reduces the workability. Therefore, the concrete containing waste glass powder (GP) needs to be investigated.

Industries are facing huge problem to dispose the byproduct out of there factory reach. Same waste is considered as the raw material for the construction industry to solve the scarcity of natural fine and course aggregate. Glass powder shows the same pozolanic action when grinded below 13 µm. As the size is very small it act as the infill for the fine aggregate and further increases the density along with the C-H-S gel formation which provides the strength to the structure in long run.

Keywords – Concrete, Design Mix, Foundry Sand, Waste Glass & Curing Compounds

I. INTRODUCTION

In present paper we are considering five design mixes at 7days, 28 days, 54 days and 90 days strength comparison with strength.

The paper is focusing on the strength and usability of the ISW and GP as the inputs for the partial replacement of aggregates in concrete. Finely powered glass less than 13 µm. acts as filler between the fine aggregates and hence increase the strength.[6]

Used foundry sand (UFS) represents the highest amount of solid waste generated by foundries. The waste material was physically and chemically characterized and then it was added to mortars as fine aggregate replacement at dosage rates of 0%, 20%, and 30% sand by weight. At the dosage of 20%, an addition of previously washed UFS was also considered. The resulting washing water was used to manufacture cement pastes in order to investigate the effect of soluble UFS ions on the hydration kinetics of cement by thermo gravimetric analysis. The obtained results showed that the addition of UFS decreases the compressive strength of mortars by about 30%, regardless of the addition rate, and has an accelerated setting effect on cement paste hydration. These undesirable effects are partially mitigated by using previously washed foundry sand. [1]

An attempt has been made to find out the workability of concrete produced by replacing the cement with waste glass powder in various percentages ranging from 5% to 40% in increments of 5%. Higher strength was achieved when 20% cement was replaced by glass powder in concrete. [7] [3].

All the purpose behind this is to use alternative material in concrete to utilize the waste of one industry as the raw material or an alternative reusable or material to replace the very quantity of concrete.

It has been estimated that several million tons of waste glasses are generated annually worldwide. The key sources of waste glasses are waste containers, window glasses, window screen, medicinal bottles, liquor bottles, tube lights, bulbs, electronic equipments etc. Only a part of this waste glass can be used in recycling. The remaining waste glass cannot be used for any purposes. But recently the research has shown that the waste glass can be effectively used in concrete either as glass aggregate (as fine aggregate or as coarse aggregate) or as a glass pozzolana. The waste glass when grounded to a very fine powder shows some pozzolanic properties. Therefore the glass powder to some extent can replace the cement and contribute for the strength development. In this paper an attempt is made to find out the effect of industrial waste sand on the properties of concrete containing waste glass powder as partial pozzolanoic replacement.

II.OBJECTIVES OF PROPOSED WORK

The objectives of the proposed work are as follow which can be elaborated as

2.1 Investigate the performance of fresh & hardened concrete containing waste glass powder in partial replacement of cement & foundry waste sand in partial replacement fine aggregate.

2.2 Investigate effect of waste glass powder as cement replacement & foundry sand as fine aggregate replacement on the compressive strength, porosity, sulphate attack on concrete.

2.3 Compare compressive strength of concrete containing waste glass powder & industrial waste sand with water curing & curing compound.

2.4 Identify and establish environmentally beneficial uses for waste glass powder & foundry waste sand that would otherwise become useless landfill.

2.5 Study the effect of waste glass powder & foundry waste sand on mechanical properties of concrete.

2.6 Study the effect of curing compound on various design mixes.

III.DESIGN MIXES

In this paper we investigate the performance of concrete containing glass powder (GP) as partial substitution of cement. This glass powder is mixed with constant proportion as 20 % replacement of OPC. Industrial waste sand/ foundry sand (IWS) is increased from 0% to 30 % at an interval of 10% for the replacement of natural sand. Curing compound is used to study the effect of chemicals on the mix of different proportion.

3.1	Normal Mix	Base Mix as per IS 10262
3.2	GP Mix	Normal Mix + 20% GP (Cement Replacement)

3.3 Mix 1 GP Mix + 10% IWS (Aggregate Replacement)

3.4 Mix 2 GP Mix + 20% IWS (Aggregate Replacement)

3.5 Mix 3 GP Mix + 30% IWS (Aggregate Replacement)

IV. FIGURES AND TABLES

1.1 TABLES

TABLE 1 NORMAL CURING DESIGN MIX RESULTS

Sr. No	Design Mix	Average Compressive Strength				Average Strength			
		7 Days	28 Days	54 Days	90 days	7 Days	28 Days	54 Days	90 days
		N	N	N	N	Mpa	Mpa	Mpa	Mpa
1	Normal Mix	266.82	713.25	717.70	770.64	11.85	31.70	31.70	34.16
2	GP Mix	430.00	550.00	683.33	715.04	19.11	24.44	30.37	31.69
3	Mix 1	310.00	396.67	716.67	758.34	13.78	17.63	31.85	33.61
4	Mix 2	386.67	523.33	613.33	690.72	17.19	23.26	27.26	30.61
5	Mix 3	270.00	443.33	470.33	520.42	12.00	19.70	20.89	23.07

1.2 FIGURES

Graphical representations are performed to study the tabulated loads.

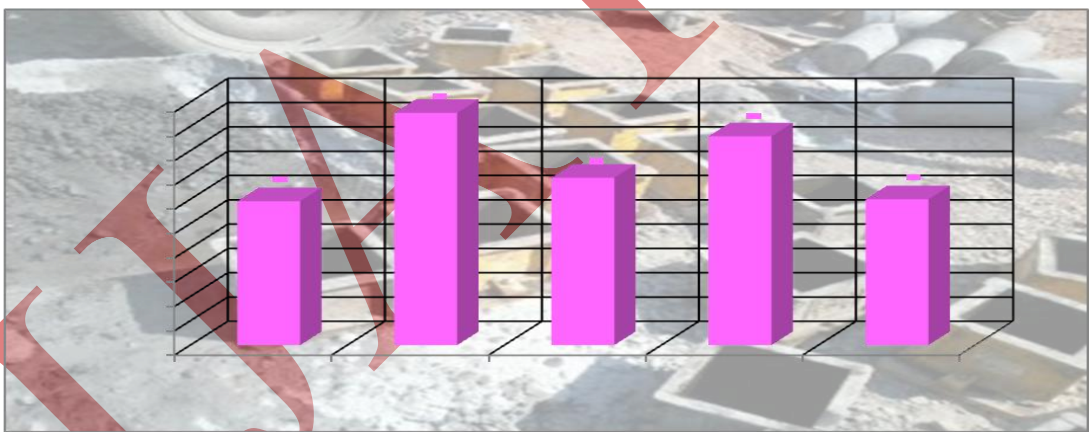

Figure 4.2.1: 7 Days strength

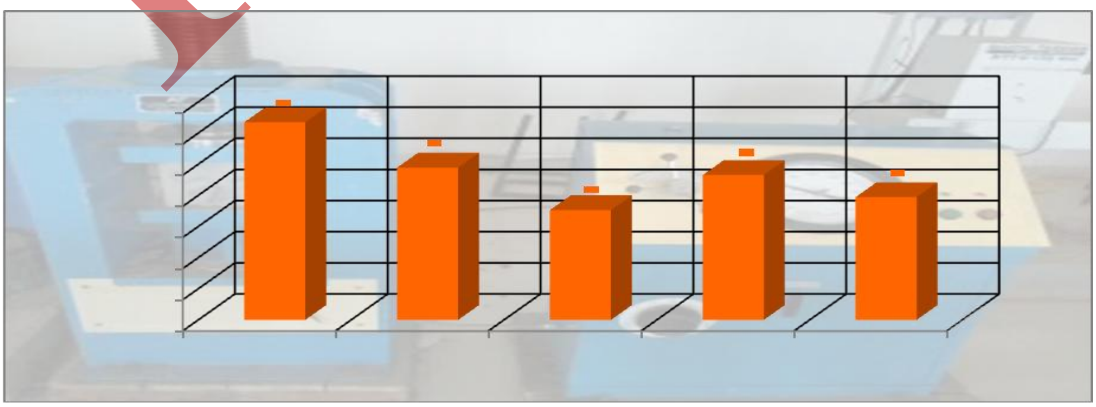

Figure 4.2.2: 28 Days strength

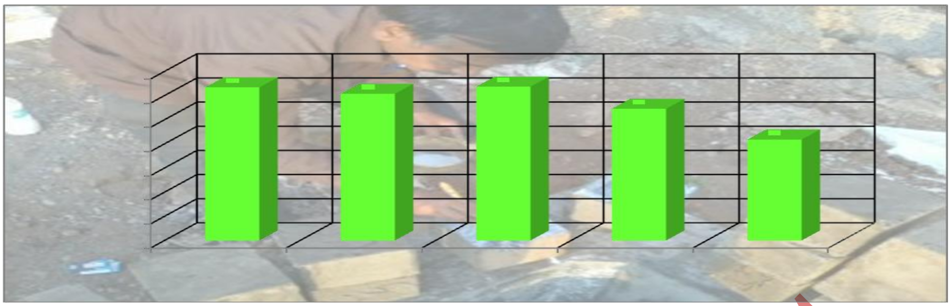

Figure 4.2.3: 54 Days strength

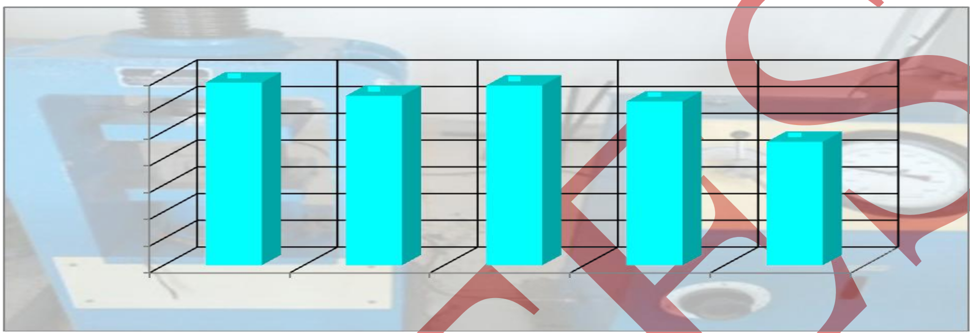

Figure 4.2.4: 90 Days strength

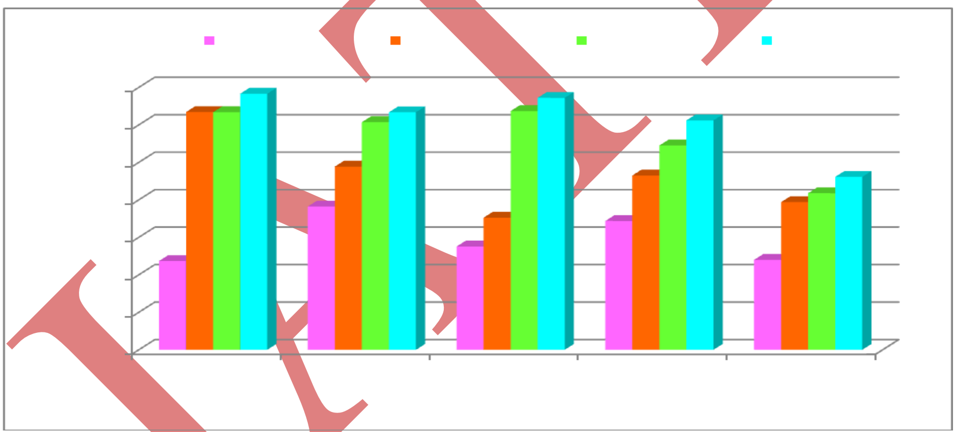

Figure 4.2.5: 7 to 90 Days strength combined graph

V. CONCLUSION

5.1 Figure4.2.1 (7 Days) shows glass powder, passing from 600μ sieve, reacts chemically as cementatious material and increases the initial strength in 7 days by 61.28%, where as adding industrial sand as in mix 1, mix 2 & mix 3 as 16.27, 45.02 & 1.27 percent respectively.

5.2 20 % replacement Glass powder shows high early days strength proving its involvement in C-H-S action.

5.3 Figure4.2.2 (28 Days) shows that though glass powder reacts chemically as cementatious material, decreases strength in 28 days by 22.94 % is seen, where as adding industrial sand as in mix 1, mix 2 & mix 3 further decreases as 44.42, 26.68 & 37.89 percent respectively.

5.4 Figure4.2.3 (54 Days) It is seen that strength building of GP Mix, Mix 1and Mix 2 continue due to presence of Glass Powder where as Mix 3 does not show considerable increment in strength.

5.5 Figure4.2.4 (90 Days) Final strength is considered for 28 days strength but higher age strength shows difference in strength gain due to add mixtures in normal mix. Mix 1 and mix 2 shows promising results then mix 3.

5.6 Figure4.2.5 (Design Mix Summery All) It is seen that strength building of GP Mix (95.75%), Mix 1(100.50 %) and to some extent Mix 2(86.00%) continue due to presence of Glass Powder where as Mix 3 (65.85%) does not show considerable increment in strength.

5.7 Over all the design mixes and the results are purely on compressive strength and other test results considering split tensile strength etc, are going on to draw final result.

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