AN EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF CEMENT BY GLASS POWDER IN COMPARISON WITH NORMAL CONVENTIONAL CONCRETE

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Abstract: Concrete is an extensively used construction material for its various advantage such as low cost, availability, fire resistance etc. Due to increased construction activities for different regions and utilities scaring of natural resources is being forced due to its over exploitation. In this paper we presents at first, all cubes beams and cylinders are casted with traditional method for M 25 and M 30 grade of concrete. Later same are casted by replacing cement with 3%, 6%, 9%, and 12% glass powder .The studied were carried out with the compressive, flexure, split tensile and workability test with two grades of concrete M25 and M30. The behavior of the specimen has to be studied and compared with each other

Keywords: concrete, Glass Powder, partial replacement, compressive strength, crushing loads, Flexural strength

1. INTRODUCTION

Concrete is the most ordinarily utilized man-made development material on the planet, and is second just to water as the most used substance on earth. It is fundamentally made out of two parts glue and aggregate. The glue contains concrete and water and some of the time different cementious and synthetic admixtures, while the aggregate contains sand and rock or squashed stone. The glue ties the aggregates together. The aggregates are generally inactive filler materials which involve 70% to 80% of the concrete and in this manner expected to have impact on its properties. The extent of these segments for example glues and the aggregate is constrained by the quality and toughness of the ideal concrete, alongside the usefulness of the new concrete.

Concrete which is one of the parts of concrete assumes an extraordinary job; however is the most costly and ecologically disagreeable material. Common Portland concrete is perceived as a significant development material all through the world, it is second most devoured material in the nation, next just to water. Be that as it may, the creation of Portland concrete, a basic constituent of concrete, prompts the arrival of noteworthy measure of CO2. Expanding worry for natural security, energy protection with negligible effect on economy have been rousing specialists to search for different options for concrete in the concrete business and zeroing in on methods of using either modern or Agricultural waste, as a wellspring of crude materials for industry which are ecologically sheltered, steady, more strong and low in cost. This waste, usage would not exclusively be efficient, however may likewise bring about unfamiliar trade profit and natural contamination control. In this way prerequisites for practical and more natural cordial establishing materials have broadened enthusiasm for other solidifying materials that can be utilized as halfway substitution of the typical Portland concrete. Heater slag, fly debris, silica rage, and so on has been utilized effectively for this reason.

OBJECTIVES OF THE THESIS

The overall targets of this examination work is to discover the properties of new and solidified concrete for M25 and M30grade of concrete at different concrete substitution rates of 0%, 3%, 6%, 9%, 12%, from glass powder. In this trial study compressive quality , split elasticity , flexural quality and functionality of concrete has been discovered.

Specific objectives

- The particular goals of this examination work can be expressed quickly as follows:
- To decide ideal portion of supplanting material glass powder by performing distinctive routine research center test on concrete.
- Assessment of the presentation of glue and mortar made of glass powder as a substitution material by directing consistency tests on the new concrete
- Assessment of the functionality of concrete on field.
- Assessment of the compressive quality of solidified concrete for M25 and M30 Evaluation of the rigidity of solidified concrete for M25 and M30 Evaluation of the flexural quality of solidified concrete for M25 and M30

II. LITERATURE REVIEW

Ahmed Omran, Arezki Tagnit-Hamou. [1] have studied that the mixed coloured glass cannot be recycled and is normally disposed of in landfills, causing obvious environmental problems. So if this glass after grinding to same fineness as cement allows its use as supplementary cementitious materials specially it has pozollanic behaviour. The study reported on herein demonstrates the in situ performance of concrete containing glass powder used as a partial replacement of cement at various construction sites including interior and exterior slabs and structural wall elements. In addition to the environmental benefits the concrete made with 10% glass powder replacement showed

increases in 91-days compressive strength (7%). 28-days tensile strength (35%) and 28-days flexure strength (4%) compared to reference mixtures without glass powder. A significant increase in resistance to chloride-ion penetration can be obtained when using glass powder concrete.

Ali A. Aliabdo, Abd Elmoaty M. Abd Elmoaty, Esraa M. Auda. [2] have find the use of marble dust in concrete production as cement replacement or as sand replacement (cement addition) gradually enhances both of the Mechanical and Physical properties of concrete especially with lower w/c ratio. Marble dust showed a filler effect in concrete and had no noticeable role in the hydration process. Yet concrete made with marble dust as sand replacement achieved better performance compared to concrete made with marble dust as cement replacement.

Lavanya M.R, et al [3]:-

Activities are rising worldwide to find some kind of harmony between the advancements in framework and avoidance of the climate from pollution by reusing the mechanical squanders. The possibility of utilizing Sugarcane Bagasse Ash (SBA), a finely ground side-effect from the sugarcane business, as halfway substitution for concrete in traditional cement is checked. The tests were directed according to Bureau of Indian Standards (BIS) codes to assess the reasonableness of SBA for halfway substitutions up to 30% of concrete with various water concrete (w/c) proportion .The physical properties of SBA were contemplated. Compressive qualities (7, 14 and 28 days) were resolved. The outcomes demonstrated that the expansion of sugarcane bagasse debris upgrade the qualities in all cases. The greatest increment is occurs at 15% with 0.35 w/c proportion.

- In the examination it was demonstrated that Compressive quality increments with the expansion in the level of Sugarcane Bagasse Ash up to expansion of 15% by weight of concrete.
- Concrete needs a rough increment in water concrete proportion because of increment in level of SBA. Since SBA is profoundly permeable material.
- The functionality of SBA concrete has been found to diminish with increment in SBA substitution.
- It was discovered that Sugarcane Bagasse Ash when copied at high temperature, delivered measure of silica (over 60%). For which it gives great warm protection.

Kawade U.R. (2013) [4] :-

With expanding request, need and utilization of concrete, analysts and researcher are searching forward for creating substitute folios that are eco-accommodating less ecological unsafe and contribute towards squander the board. The use and

Streamlining of modern and rural waste created by mechanical cycles has been the primary spotlight on squander decrease. One of the agro squander sugarcane bagasse debris (SCBA) which is a stringy natural byproduct acquired from sugar processes as side-effect. After the extraction of Juice sugar stick is singed and afterward debris created by consuming bagasse in uncontrolled condition and at extremely high temperature. In this paper SCBA has been artificially and genuinely described and mostly supplanted in the level of 0%, 10%, 15%, 20%, 25% and 30% by weight of concrete in concrete. The properties for new cement are tried like droop cone test and for solidified cement compressive quality at 7, 28, 56 years' old and 90 days. The test outcomes shows that the quality of solid increment up to 15% SCBA supplanting with concrete.

- The results show that the SCBA concrete had higher compressive quality contrast with that of the solid without SCBA.
- It is seen that the concrete could be advantageously supplanted with SCBA up to greatest level of 15% and at some point less. In spite of the fact that, the ideal degree of SCBA content was accomplished with 15.0% substitution.
- Partial substitution of concrete by SCBA expands functionality of new concrete; consequently utilization of super plasticizer isn't fundamental

III. MATERIAL & TESTS

A.GENERAL:- In this examination an endeavor has been made to think about the impact of Glass powder on properties of concrete. The methodology took after, tests directed for determination of configuration blend is examined in this part .The properties considered in this investigation are zone of sand, assimilation limits of aggregates, surface dampness of aggregates ,mass thickness of aggregates, fineness of concrete .the trial program is comprehensively grouped into following classes, viz.

CEMENT

PPC creates lessened warmth of hydration and that too at low rate. PPC being better than OPC and furthermore due to pozollanic activity, it enhances the pore estimate appropriation and furthermore lessens the smaller scale splits at the progress zone. In this test work the Ordinary Portland pozollanic cement with 43 reviews affirming to Indian Standard IS12269-1987 was utilized.

Table .1 Composition of Ordinary Cement

Ingredients	Desired Range of Percentage
Lime (Cao)	62 to 67
Silica (SiO_2)	17 to 25
Alumina (Al_2O_3)	3 to 8
Calcium Sulphate ($CaSO_4$)	3 to 4
Iron Oxide (Fe_2O_3)	3 to 4
Magnesia (MgO)	0.1 to 3
Sulphur (S)	1 to 3
Alkalies	0.2 to 1

Coarse Aggregate

Machine crushed broken stone angular in shape was used as coarse aggregates. Two fraction of coarse aggregates were used, 20mm size having specific gravity of 2.85, and 10mm Size having specific gravity of 2.85.

Fine Aggregate
The fine aggregates used in this investigation was Narmada River sand passing from 4.75 mm sieve having specific gravity of 2.64. The grading zone of fine aggregates was zone II as per Indian standard specification.

Blending water
Ordinary tape water which is clean, potable and free from suspended particles and chemical substances was used for both mixing and curing of concrete.

Glass Powder
In this study waste glass powder was used from locally available market. Glass waste is very hard material. Glass is a solid that is often transparent and has widespread practical, technological, and decorative usage in for example, window panes, tableware and optoelectronics. The term glass, in popular usage, is often used to refer only to this type of material, which is familiar from use as window glass and in glass bottles.

A very clear and durable quartz glass can be made from pure silica, but the high melting point and very barrow glass transition of quartz make glassblowing and hot working difficult. In glasses like soda lime, the compounds added to quartz are used to lower the melting temperature and improve work ability, at a cost in the toughness, thermal stability, and optical transparency, which gives rise to one of silicate glasses primary uses as windowpanes. Glass will transmit; reflect light these qualities can be enhanced by cutting and polishing to make optical lenses, prisms, fine glassware, and optical fibers for high speed data transmission by light. Glass can be colored by adding metallic salts, and can also be painted and printed with vitreous enamels.

IV. RESULT & DISCUSSION

4.1 CONSISTENCY OF CEMENT TEST

S.No.	Percentage of glass powder	Consistency (%)
1	0	32.5
2	3	32.5
3	6	32.5
4	9	33.0
5	12	33.5

Figure 6: Normal Consistency of Cement

4.2 Workability of concrete
Table 3. Workability of Cement with Different Properties of Different Material

S. No.	Percentage variation	Slump in mm (M25)	Slump in mm (M30)
1	0	78	76
2	3	126	118
3	6	176	163
4	9	182	179
5	12	196	189

Compressive strength of OPC-GP
The compressive strength of mortar for OPC were tested and analyzed. The average results of the laboratory tests for OPC-GP mortars are as discussed below:

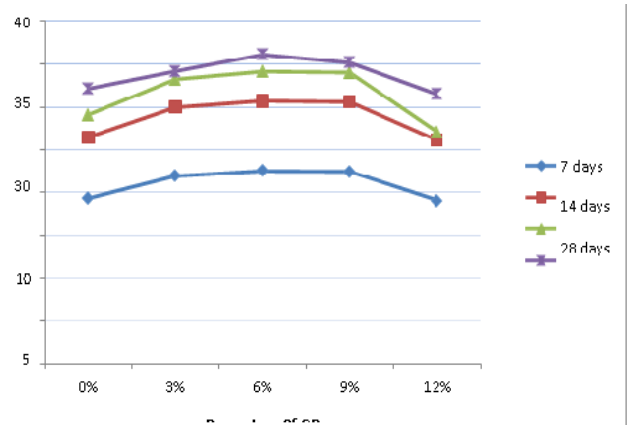


Figure 1: Compressive Strength of M25 Grade Contain of GP

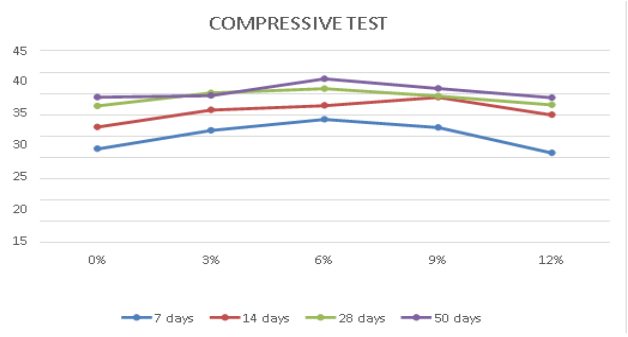


Figure 2: Compressive Strength of M30 Grade Contain of GP

6 SPLIT TENSILE STRENGTH TEST

The result of the Split tensile strength determine by compression testing machine, with the fractional replacement of silica fume and quarry dust by cement with level of 10%, 20% and 30% with result determine the age of 28 days are appeared in the fig. 11 for M-30 concrete.

4.3.6.1 Split Tensile strength of cylinder concrete contain wood ash and silica fume

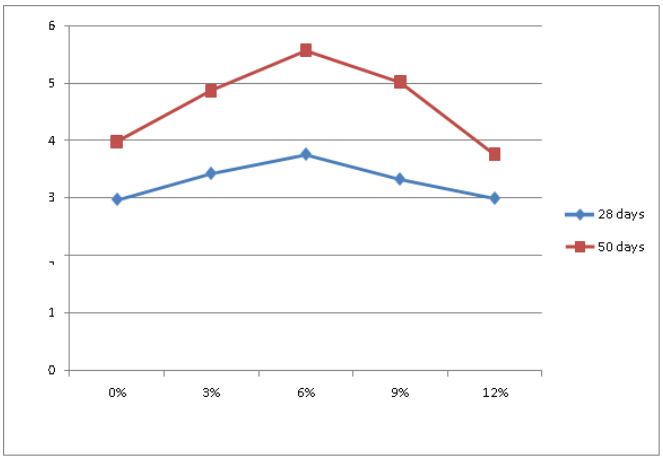


Figure 3: Split Tensile strength test results for M25

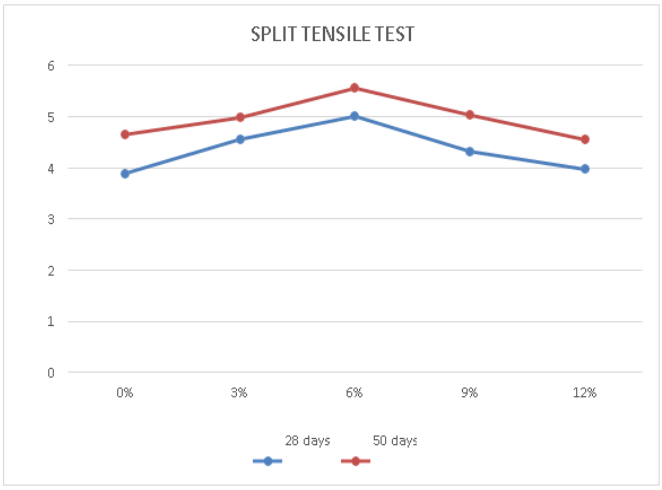
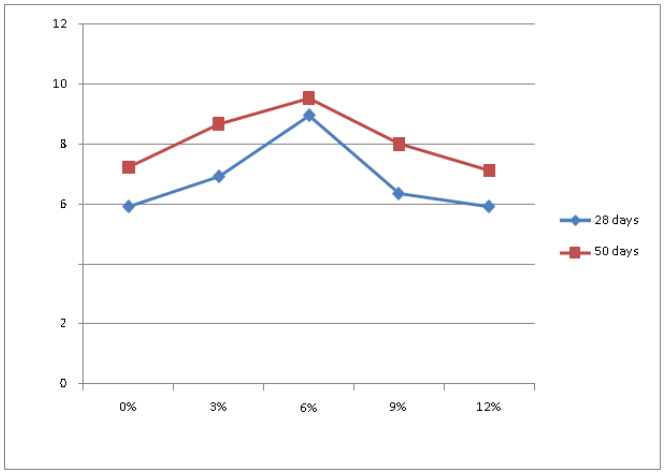


Figure 4: Split Tensile strength test results for M30

FLEXURAL STRENGTH TEST CONTAINING GLASS POWDER

Flexural power furthermore called as modulus of satisfaction. In solid flexure is the bowing moment brought about by the applied burden, wherein a solid pillar has pressure at top and elastic concern at the base side. Shafts on testing will bomb in strain in light of its property and shear will appear on concrete



. Figure 5: Flexural Strength test results for M25

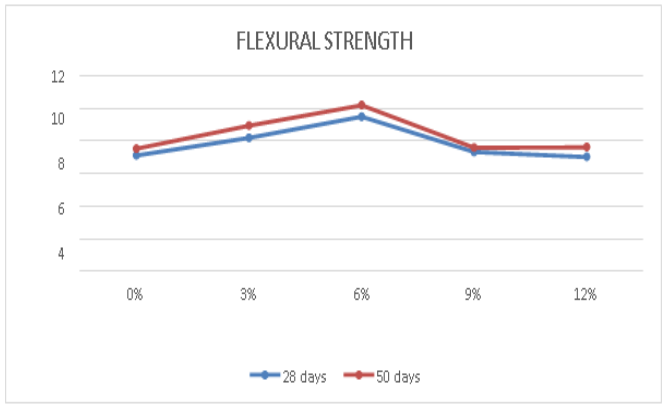


Figure 6: Flexural strength test results for M30

CONCLUSION

In this experimental study we have used GP as an alternative material for cement for M25 and M30 grade of concrete and from various tests on fresh and hardened concrete we have concluded following results:

As we increase the percentage of GP workability of concrete also increases for M- 25(Maximum 196mm at 12%) and M-30(Maximum 189mm at 12%).

- The compressive strength results represents that as the percentage of GP increases compressive strength also increases up to 6% of GP and after that it decreases for M- 25 and M-30. For M25 the maximum compressive strength were 22.51, 30.72, 34.16, and 36.12 N/mm2 and for M30 compressive strength were 28.9, 32.15, 36.12, and 38.42 N/mm2 at 6% for 7, 14, 28 and 50 days respectively. It was also observed that at 3% and 9% the strength for M30 were same as on 14days and 28 days results with of 50days test results.
- The flexural strength results represents that as the percentage of GP increases flexural strength (28 days and 50 days) also increases up to 6% of GP and after that it decreases for M-25 and M-30. The flexural strength results represents that as the percentage of SBA increases flexural strength also increases up to 6% of GP and after that it

decreases for M-25 and M-30. For M25 the maximum flexural strength was 8.95and9.53N/mm2 and for M30 flexural strength were 9.5, and 10.21, N/mm2 at 6% for 28 and 50 days respectively.

- The split tensile strength results represents that as the percentage of GP increases split tensile strength (28 days and 50 days) also increases up to 6% of GP and after that it decreases for M-25 and M-30. The split tensile strength results represents that as the percentage of GP increases tensile strength also increases up to 6% of GP and after that it decreases for M-25 and M-30. For M25 the maximum tensile strength was 3.75 and 5.56N/mm2 and for M30 flexural strength was 5.01 and 5.56N/mm2 at 6% for 28 and 50 days respectively.

Future scopes:

- In this experimental study we have partially replaced cement with GP, in future work we can partially replace the fine aggregate with GP.
- In this experimental work has been done for M25 and M30 concrete, in future work different grades of concrete can be used.
- In future work we can partially replace cement for high strength of concrete with GP.

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