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An Experimental Study on Concrete using Cement with Glass Powder

Dr. G. Hathiram
Associate Professor & HOD,
Civil Engineering Dept.

B. Sriharish
Assistant Professor,
Civil Engineering Dept

KL. Harshath[1], S. Yogeswarrao[2], T. Balaraju[3]
[1,2&3] B.Tech (Civil Engg)
KLR COLLEGE OF ENGINEERING AND TECHNOLOGY.
PALWANCHA, TELANAGANA, INDIA

***Abstract*:- Cement manufacturing assiduity is one of the carbon dioxides emitting sources besides deforestation and burning of fossil energies. The global warming is caused by the discharge of greenhouse gases, similar as CO2, to the atmosphere. Among the greenhouse gases CO2 contributes about 65% of global warming. The global cement assiduity denotes about 7% of greenhouse gas withdrawal to the earth's aerosphere. Glass is used in numerous forms in day- to- day life. It has limited life span and after use it's either stock piled or transferred to tip Since glass is non- biodegradable, tip don't give an terrain friendly result. Hence, there's strong need to use waste spectacles. numerous sweats have been made to use waste glass in concrete assiduity as a relief of coarse total, fine total and cement. Its performance as a coarse total relief has been set up to benon-satisfactory because of retrogression and expansion due to alkali- silica response. The exploration shows that there's strength loss due to fine aggregate negotiation also. sweats have been made in the concrete assiduity to use waste glass as partial relief of course or fine summations and cement. In this study, finely pulverized waste spectacles are used as a partial relief of in concrete and compared it with conventional concrete. This work examines the chance of using Glass grease paint as a incomplete relief of cement for fresh concrete. Glass greasepaint was incompletely replaced as 5%, 10%. 20%, and 30% and tested for its compressive, Tensile and flexural strength up to 28 days of age and were compared with those of conventional concrete; from the results attained, it's set up that glass greasepaint can be used ascement relief material up to particle size lower than 75µm to help alkali silica response.**

Keywords: Experimental study, Concrete, Cement, Glass Powder.

INTRODUCTION

Concrete is a blend of cement, fine, coarse aggregate and water. The key factor that adding value to concrete is that it can be formulate to withstand grating surroundings significant role. Today global warming and biodegradable devastation have become manifest harms in recent years, concern about biodegradable issues, and a conversion from the public-waste, public -consumption, mass-production society of the past to a zero- consequence society is now viewed as noteworthy. Commonly glass does not harm the habitat in any way because it does not give off , contaminant but it can harm humans as well as animals, if not deal anxiously and it is less friendly to surrounding because it is non- biodegradable. Thus, the development of new automation has been required. The term glass contains some many chemical variations including soda-lime silicate glass, alkali silicate glass and borosilicate glass. These types of glass powder have been extensively used in cement and aggregate mix as pozzolana for civil engineering works. The establishment of waste glass in cement will increase the alkali content in the cement. It also helps in bricks and ceramic manufacture and it preserves raw materials, reduce energy consumption and volume of waste sent to landfill. As useful recycled materials, glasses and glass powder are mainly used in fields related to civil engineering, for example, in cement, as pozzolana (additional cementations' materials), and coarse aggregate. Their reprocess ratio is close to 100%, and it is also used in concrete without adverse reaction in concrete durability. Therefore, it is considered ideal for reprocess Recently, Glasses and its powder has been used as a construction material to decrease biodegradable problems. The coarse and fine aggregates could cause ASR (Alkali Silica Reaction) in concrete. But the glass powder could suppress their ASR tendency, an reaction similar to supplementary cemented materials (SCMs). Consequently, glass is used as a replacement of supplementary cementations' materials.

2.EXPERIMENTAL PROGRAMME

2.1Constitutuent materials

The component of concrete consists of cement, fine and coarse aggregates, water When the reaction of water with cement takes place moisten process is done and a hard material is formed. In this project work we used waste glass powder as a partial substitution of cement. The ingredients are used in proper proportion. Also, the cement is replaced at (0 %to 30 %) y glass powder. They are described in details with their possessions are as follows

2.2 Cement:

The Ordinary Portland Cement (OPC) 53 grade of Ultra tech brand used in the project work. This is used as main binder in the mixes. Cement is one of the binding materials in this project. Cement is the important building material in this day construction world 53 grade Ordinary gives the properties of cement used. Ordinary Portland cement, 53Grade conforming to IS: 269 – 1976.Ordinary Portland cement,

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33Gradewas used for casting all the Specimens. Different types of cement have different water essential to produce pastes of standard consistence. Different types of cement also will produce concrete have a different rates of strength expansion. The brand and type of cement is the most important to produce a good quality of concrete. The so many types of cement affect the rate of moisturize, so that the strengths at early ages can be considerably influenced by the particular cement used. It is also important to make sure similarity of the chemical and mineral admixtures with cement

Table 2.2: PROPERTIES OF CEMENT

Description of test	Test result obtained	Requirements IS:8112-1989
Initial setting time	65min	Min. 30minutes
Final setting time	270min	Max. 600minutes
Fineness (specific surface by Blaine's air permeability test)	412.92m²/kg	Min. 225m²/kg

2.3 FINE AGGREGATE AND COARSE AGGREGATE

Fine and coarse aggregate make up the bulk of concrete mixture Sand, natural gravel and crushed stone are mainly used for this motivation for fine aggregates natural sand is provided with maximum size of
4.75 mm coarse aggregates are used with size between 20mm-4.75mm

FINE AGGREGATE

Table 2.3 Properties of fine aggregate

Properties	Values
Specific gravity	2.65
Fineness modulus	2.25
Water absorption	1.5%

Nearby available river sand in line with to Grading zone II of IS: 383 1970. Clean and dry river sand available.Locally will be used Sand passing through IS4.75mm Sieve will be used for casting all the specimens

2.4 Coarse aggregate

Crushed granite aggregate with specific gravity of 2.77 and quick through 4. 75mm sieve and will be used for send out all specimens. Several analysis concluded that maximum size of coarse aggregate should be confined in strength of the composite. In addition to cement paste-aggregate ratio, aggregate type has a great influence on concrete dimensional solidity. Nearby available crushed blue granite stones conforming to graded aggregate of nominal size 20 mm as per IS 383-1970.Crushed granite aggregate with specific gravity of 2.77 and passing through 4.75 mm sieve and will be used for send out all specimens. Several considerations concluded that maximum size of coarse aggregate should be restricted in strength of the composite. In addition to cement paste aggregate ratio, aggregate type has a great control on concrete dimensional stability

Table 2.4 Property of coarse aggregate

S. No	PROPERTY	Values
1	Specific gravity	2.68
2	Size of aggregates	20mm
3	Fineness modulus	5.96
4	Water absorption	2.0%
5	Impact test	15.2%
6	Crushing test	22.5%

2.5 Water

Casting and curing of specimens were done with the potable water that available in the college premises

2.6 Glass powder

Glass is a crystalline clear material produced by melting an admixture of accoutrements similar as silica, soda pop ash, and $CaCO_3$(Calcium carbonate) at high temperature followed by cooling during which solidification occurs without crystallization. Glass is extensively used in our lives through manufactured products similar as distance glass, bottles, dinnerware, and VT vacuum tubing. The quantum of waste glass is relatively increased over the recent times due to an ever- growing use of glass products. utmost waste spectacles have been ditched into tip spots. The Land stuffing of waste spectacles is undesirable because they aren't environmental, which makes them environmentally less friendly. So, we use the waste glass in concrete to come the construction affordable as well as Eco-friendly. The glass greasepaint used in the present study is brought from Bharuch request. This material replaces the cement in blend proportion. Glass greasepaint is finely base glass. These fine glass patches remind you of talcum greasepaint, use extreme care when handling this dry greasepaint colour to help breathing the dust patches. Make sure you wear a gobbling mask when working area with this greasepaint, immaculately one that's NIOSH approved. Check to see that the greasepaint has the same COE (Measure of Expansion") as your other fusing glass. This will ensure that your systems won't have erected up stress, Greasepaint glass is so protean and useful. It can be bought in every colour of the rainbow. Glass is a rigid liquid i.e., super cooled liquid, static, not solid, not a gas but doesn't change molecular between melting and solidification in to an asked shape. Glass is one of the most flexible substances on earth used in numerous operations and in a wide variety of forms. Glass occurs naturally when gemstone high in silicates melt at high temperature and cool before they can form a crystalline structure. Obsidian or stormy glass is a well-known illustration of naturally being glass. When manufactured by human's the glass is an admixture of silica, beach, lime and other accoutrements. The rudiments of glass are heated to 9820 Celsius. eat can return the glass to a liquid and work suitable form, making it easy to exercise and reclaim

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Table 1 CHEMICAL COMPOSITION OF GLASS POWDER AND CEMENT

Sr. No	Chemical Composition	Glass powder (%)	Cement (%)
1	Sio2	70.22	23.71
2	CaO	11.13	57.27
3	MgO	-	3.85
4	Al2O3	1.64	4.51
5	Fe2O3	0.52	4.83
6	So3	-	2.73
7	Na2O	15.29	-
8	K2O	-	0.37
9	CL	-	0.0068
10	Loss on ignition	0.80	7.24

Table 2: PHYSICAL CHARACTERISTICS OF MATERIAL S

Sr. No	DESCRIPTION	Specific gravity
1	Glass powder	2.6
2	Cement (OPC)	3.15
3	Fine aggregate	2.62
4	Coarse aggregate	2.7
5	Water	1

Table 3.MIX PROPORTION

Water	Cement	F. A	C. A
186kg/m³	413kg/m³	706kg/m³	117kg/m3
0.45kg/m³	1kg/m³	1.71kg/m³	2.71Kg/m³
22.5lit/bag	50kg(1bag)	85.5kg/m³	135.5kg/m³

3.TESTING PROCEDURES

3.1General procedures

The exploration program concerning the development of mechanical parcels of an incompletely relief of cement by fly ash, incompletely placement of beach by nether most ash and glass is used reference concrete of grade M25(REF) was considered with the following composition, consequently. The w/ c- rate is0.43. Coarse summations were chosen, having a particular size substantially varying between 2 mm and 20 mm. An ferocious experimental program is performed to study the effect of internal curing on different types of concrete parcels(i) fresh parcels (depression and viscosity) ;(ii) mechanical parcels (compressive strength, flexural strength, unyoking tensile strength

3.2 Compressive strength test

When a case of material is loaded in such a way that it extends its aid to be in pressure. On the other hand, if the material compresses and shortens it said to be in contraction. On an infinitesimal position, the motes or patches are forced piecemeal when in pressure whereas in contraction they're forced together. Since patches in solids always try to find an equilibrium position, and distance between other patches, forces arise throughout the entire material which oppose both pressure or contraction. The sensations prevailing on an infinitesimal position are thus analogous. The" strain" is the relative change in length under applied stress; positive strain characterizes an object under pressure weight which tends to outstretch it, and a compressive stress that shortens an object gives negative strain. Pressure tends to pull small sideways diversions back into alignment, while contraction tends to amplify similar divagation into buckling. Compressive strength is measured on paraphernalia, factors, and structures. The compressive strength is generally attained experimentally by means of a compressive test. The outfit used for this trial is the same as that used in a tensile test. Still, rather than applying a uniaxial tensile weight, a uniaxial compressive weight is applied. As can be imagined, the case (generally spherical) is docked as well as spread indirectly. In the study of strength of paraphernalia, the compressive strength is the capacity of a material or structure to repel loads tending to reduce size. It can be measured by conniving usable force against distortion in a testing machine. Some paraphernalia fracture at their compressive strength limit; others distort irreversibly, so a given quantum of distortion may be considered as the limit for compressive weight. Compressive strength is a vital value for design of structures at the time of testing, each case must keep in compressive testing machine. The maximum weight at the breakage of concrete block will be noted from the noted values, the compressive strength may be calculated by using below formula.

(Compressive Strength = weight/ Area

Size of the test case = 150 mm x 150 mm x 150 mm

3.3 SPLIT TENSILE TEST

The size of cylinders 300 mm length and 150 mm periphery are placed in the machine similar that cargo is applied on the contrary side of the cells are casted. Align precisely and cargo is applied, till the instance breaks. The formula used for computation.

Split tensile strength- 2P/ pdl

3.4 FLEXURAL STRENGTH TEST

During the testing, the ray samples of size 7000mmx150mmx150mm were used. samples were dried in open air after 7 days of curing and subordinated to flexural strength test under flexural testing assembly. Apply the cargo at a rate that constantly increases the outside stress until rupture occurs. The fracture indicates in the pressure face within the middle third of span length.

3.5 EXPERIMENTAL WORK

The experimental work was carried out in our council concrete technology laboratory. In this study, aggregate of four groups of concrete composites were prepared in laboratory. First group was normal cement concrete blend. Second, third and fourth group was cement relief by fine glass greasepaint (GLP) flyspeck size from 90 micron to 150 micron with relief from 15, 20 and 25 independently.

4 COMPRESSIVE STRENGTH TEST

Casting and testing

Spots (Mix1, Mix2, Mix3 Mix 4 Mix5 Mix6 and Mix7) were prepared using cement replaced by glass cream at varying chance of 0,5 ,10, 15, 20 25 and 30.Twenty four number standard samples of confines 150 x 150 x150 mm were cast

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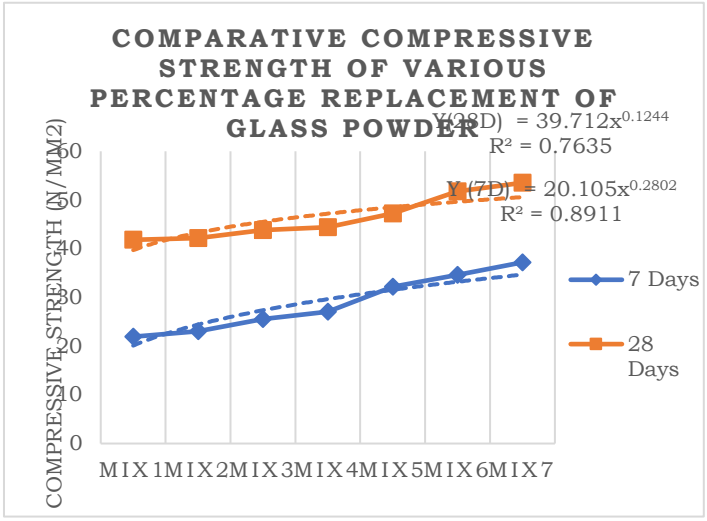
according to the mix proportion and cured in water at room temperature in the laboratory for 7 and 28 days. At the end of each curing period, three samples for each were tested for compressive strength and the average strength was recorded. The size of the case is as per the IS 100861986. The compressive strength test on both conversational and glass added concrete was performed on standard compression testing machine of 3000KN capacity as per IS 516-1959.

Ratios for concrete (extra Ingredient) various percentage of glass powder Ratio-1
GLASS POWDER -5% by replacement of cement
RATIO -2
GLASS POWDER -10% BY replacement of cement
RATIO -3
GLASS POWDER -15%BY replacement of cement
RATIO- 4
GLASS POWDER – 20%BY replacement of Cement
RATIO -5
GLASS POWDER -25% by replacement of cement
RATIO -6
GLASS POWDER -30% by replacement of cement

5. COMPARATIVE COMPRESSIVE STRENGTH OF VARIOUS PERCENTAGE REPLACEMENT OF GLASS POWDER WITH CEMENT

Sr. no	MIXTURE	Percentage of glass powder (%)	AVERAGE COMPRESSIVE STRENGTH [N/MM²] 7days 28days
1	MIX 1	0	21.93 41.82
2	MIX 2	5	23.04 42.24
3	MIX 3	10	25.53 43.8
4	MIX 4	15	27.04 44.44
5	MIX 5	20	32.22 47.26
6	MIX 6	25	34.61 51.78
7	MIX 7	30	37.24 53.53

GRAPH:



6. CONCLUSION & FUTURE SCOPE

- At the position of 30% relief of cement by glass powder meets advanced strength as compare to that of normal concrete and other chance of relief of cement on 28th days.
- Glass powder concrete increases the compressive strength effectively, when compared with conventional concrete
- . On GLP 7th day's rate of gain of strength is low but at 28th days it meets needed design strength.
- That rate of increase of strength is further for 15% glass powder added concrete compared to 20% and 25% glass greasepaint added concrete with respect to normal concrete for 7 days results. –
- Alkali- silica reactivity effect is controlled when glass greasepaint with high Na20 is used. farther disquisition can be done by using plasticizers to ameliorate the plasticity and strength
- . Also, continuity disquisition can be done to see the long-term effect of glass powder relief.
- The 7Days and 28days Compressive strength variation with different glass powder to cement proportions is linearly varying and it can be shown by following relations.

7 days Compressive strength can be related by , $Y(7D) = 20.105(x)^{0.2802}$, $R^2 = 0.8911$.
28 days Compressive strength can be related by $Y(28D) = 39.712(x)^{0.1244}$, $R^2 = 0.7635$.

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