



## EXPERIMENTAL STUDY ON HIGH PERFORMANCE CONCRTE (M80) WITH PARTIAL REPLACEMENT OF CEMENTY BY FLY ASH AND FINE AGGREGATE BY GLASS POWDER

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### ABSTRACT

*This paper deals with an experimental study on High Performance Concrete (HPC) with partial replacement of fine aggregates by Glass Powder and cement by Fly Ash. An attempt has been made to find the strength parameters of M80 grade concrete with constant water cement ratio and partial replacement of fine aggregate by Glass Powder and cement by Fly Ash. With increasing environmental pressure to reduce solid waste and to recycle as much as possible, the concrete industry has adopted a number of methods to achieve this goal by design, replacement and consolidation technique. Therefore, replacement of waste glass with fine aggregate should deeply investigation. The strength of concrete i.e., compressive strength, split tensile strength and flexural strength at 7days and 28days were obtained. The workability and durability has also been carried out. The materials like glass powder and fly ash are mainly using in these experiment to reduce the CO<sub>2</sub> and sand mining.*

**Keywords:** High performance concrete, compressive strength, durability, glass powder and fly ash.

### I INTRODUCTION

As we know that now day, most of developing country facing shortage of post consumers disposal waste site and it's become very serious problems. For this reason, regenerating and using waste product as resources and prevent environmental pollutions. High-performance concrete is defined as concrete that meets special combinations of performance and uniformity requirements that cannot always be achieved routinely using conventional

constituents and normal mixing, placing, and curing practices. High Performance Concrete HPC is a construction material which is being used in increasing volumes in recent years due to its long term performance and better rheological, mechanical and durability properties than Conventional. A high-strength concrete is always a high performance concrete, but a high-performance concrete is not always a high-strength concrete. Specifying a high-strength concrete does not ensure that a durable concrete will be achieved. It is very difficult to get a product which simultaneously fulfills all of the properties. Glass is an amorphous material with high silica content making it potentially pozzolanic when particle size is less than 75µm. The main problem in using crushed glass as aggregate in Portland cement concrete are expansion and cracking caused by the glass aggregate due to alkali silica reaction. Due to its silica content ground glass is considered a pozzolanic material and as such can exhibit properties similar to other pozzolanic material. In this study, finely powdered waste glasses are used as a partial replacement of cement in concrete and compared it with conventional concrete. The main reason of this study is to create a better environment that free from polluted space and also to find a better solution for concrete mixture that can give higher strength to concrete from the waste glass product .Even it may gives less cost of using this kind of admixture rather than buying expensive

admixture to get great and higher strength in concrete as now days it's the admixture that in market are very expensive and often increase the cost of the construction.

## II EXPERIMENTAL STUDY

### 2.1) Materials

The material as per codes IS: 12269 confirming to 53 grade of ordinary Portland cement. Course aggregates sizes are used in 12.5mm and 20mm. sand are used in these study locally available river sand and sand zone-II confirming according to IS: 383. the bulk density of course aggregate 1700 kg/m<sup>3</sup> and the bulk density of fine aggregate 1650 kg/m<sup>3</sup>. waste glass powder collected from locally in hyderabad and consisting of waste windows glasses. Waste glass powder an important on this study improving the strength parameters of concrete particularly early ages. Fly ash also used in study locally available in the waste material by product of coal fired power plants. In present study chemical admixture of Glenium B233 also using in water reducing purpose. The others chemicals of Sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) and Hydrochloric acid (HCL) also used in durability test purpose. Water also using the casting and curing purpose.

Table 1: values for the mix design\

Material	Specific gravity	Fineness modulus
Cement	3.16	283(m <sup>2</sup> /kg)
Fine aggregate	2.50	3.09
Course aggregate	2.70	3.57
Fly ash	2.04	–
Waste glass powder	2.41	–

### III EXPERIMENTAL PROGRAM

The design of mix according to as per ACI 211.1-91. the mix ratio are fixed in as

shown in fig. Table 2; mix proportion of M80 grade concrete

Grade	Mix ratio	Water cement ratio
M80	1:0.85:1.8	0.33

Fly ash 10% by weight of cement and waste glass powder 30% by weight of fine aggregate constant for all mixes. After partial replacement of cement by fly ash and fine aggregate by waste glass powder varying 0%, 10%, 20%, 30%. mix proportion of concrete below fig.

Table 3; mix proportions of concrete

Mix name	Mix description	Cement (kg)	Fine aggregate (kg)	Course aggregate (kg)	F A (kg)	W GP (kg)
CM	Control mix	600	563	1088	0	0
HP C1	FA10%+W GP30%	520	394	1088	60	169
HP C2	FA15%+W GP35%	510	366	1088	90	197
HP C3	FA20%+W GP40%	480	338	1088	120	225
HP C4	FA25%+W GP45%	450	310	1088	150	253

### IV EXPERIMENTAL PROCEDURE

The standard dimension of cubes 150mmx150mmx150mm is casted after to

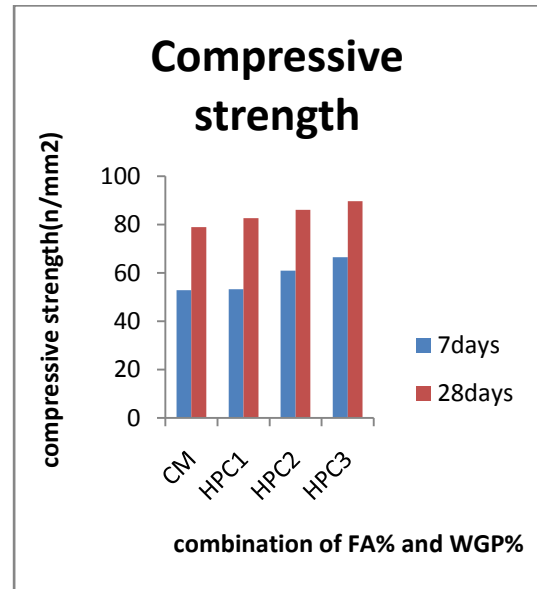
find out the compressive strength for 7days and 28days. The standard dimension of beams 500mmx100mmx100mm is casting after to find out the flexural strength for 7days and 28days. The standard dimension of cylinders 300mmx150 is casting after to find out the split tensile strength for 7days and 28days. For these specimens are casting and removed for after one day. The removed specimens are placing the water for 7days and 28days in curing purpose. After water cured specimens are taken and allowed to dry under shade and then these specimens are tested for compressive strength, flexural strength and split tensile strength for 7days and 28days.

The size of cubes 100mmx100mmx100mm is casting after to find out the durability of concrete. For durability test for cubes placed in water 28days and after allowed to dry and same specimens are immersed in 5% concentrated HCL and 5% H2SO4 for 60days after durability values observed. The specimens are weight loss and strength also loss due to acid and sulphate immersed was noted.

**V RESULTS AND DISCUSSION**

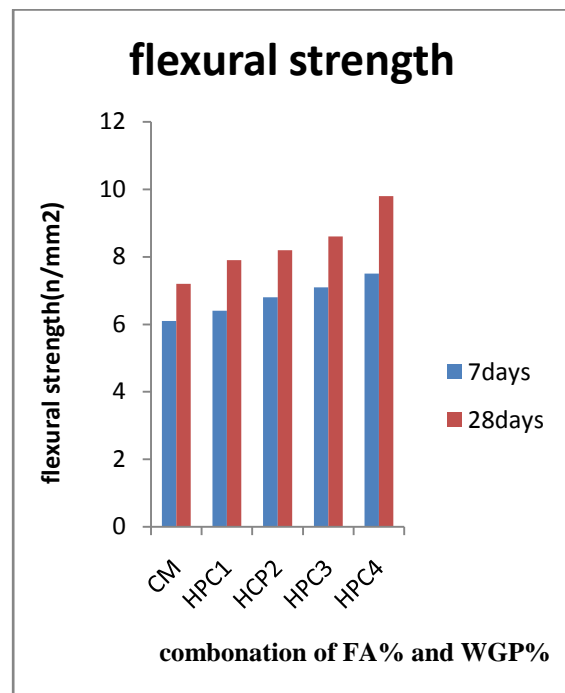
The present study partial replacement of cement by fly ash and fine aggregate by waste glass powder varying 0%, 10%, 20%, 30% gives required strengths.

**5.1 compressive strength**



**Fig1; Compressive Strength Of FA And WGP**

**5.2 flexural strength**



**Fig 2; Flexural Strength Of FA And WGP**

### 5.3 Split Tensile Strength

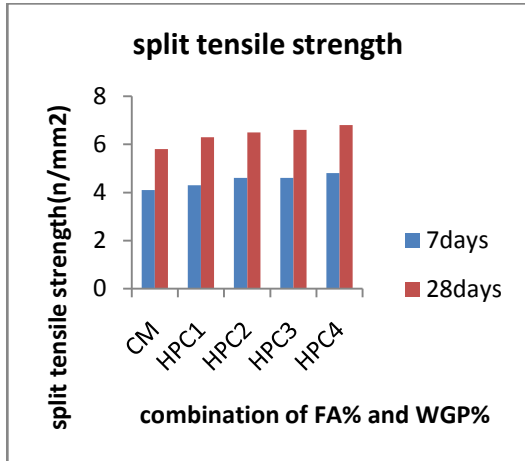


Fig 3; Split Tensile Strength Of FA And WGP

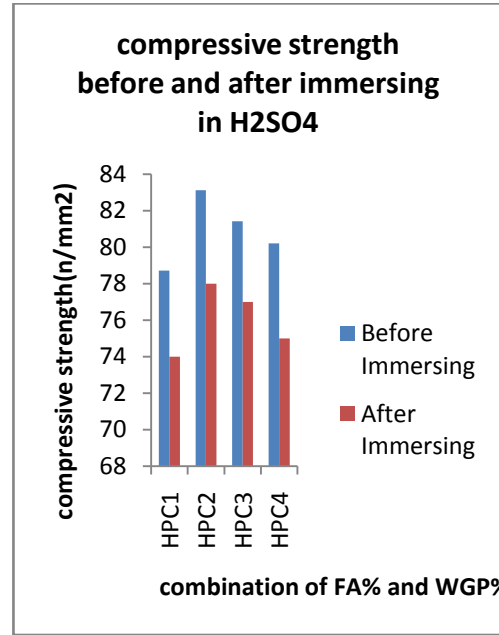
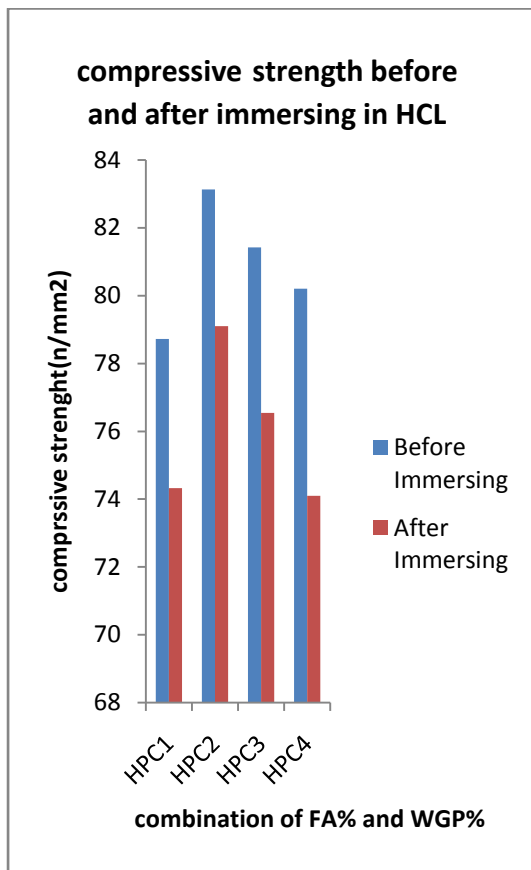


FIG:4 Cube Strength Immersed H<sub>2</sub>SO<sub>4</sub>

### 5.4) Durability Test Cube Strength Immersed In HCL



### V) CONCLUSIONS

1. The compressive strength is increased by 20% optimum percentage partial replacement of cement by fly ash and 30% partial replacement of river sand by waste glass powder individually.
2. The flexural strength and split tensile strength also increased by combination of 25% cement by fly ash and 45% river sand by waste glass powder.
3. It can be concluded that the weight loss due to HCL and H<sub>2</sub>SO<sub>4</sub> solutions for 15% cement by fly ash and 35% river sand by waste glass powder

## REFERENCES

(1) S.P. Gautam, Vikas srivastava and V.C. Agarwal, "use of glass wastes as in fine aggregate in concrete", *journal of artificial intelligence research* vol. 1(6) November (2012)

(2) M.Iqbal Malik, Sajad Ahmad "study of concrete involving use of waste glass as partial replacement of fine Aggregate", *IOSR journal of engineering* VOI.3, Issue 7 July(2013)

(3) M.S Kuttimarks, R.Sruthi "Experimental studies on replacement of fine aggregate with glass and fly ash", *international journal of emerging engineering research and technology* vol2, Issue 2, May (2014)

(4) Rekha shinde "utilization of glass powder and fly ash in concrete production", *international journal for scientific research and development* vol.2, Issue 03,(2014)

(5) J.A.peter, M.neelamegham "Utilization of fly ash as cement replacement material to produce high performance concrete" *structural engineering research centres (CSIR) Chennai*.

(6) *Experimental investigation on partial replacement of cement with fly ash in design mix concrete*, *international journal of advanced engineering and technology*. (7) M.Adaway, Y.Wang "Recycled glass as a partial replacement for fine aggregate in structural concrete-effects on compressive strength" *electronic journal of structural engineering* Issue 14(I), 2015

(8) T.Phani Madhavi, P.Gunashekar "Partial replacement of cement and fine aggregate by using fly and glass aggregates", *international journal of research in engineering and technology*.

(9) Dr.V.Ramesh, N, Deepak "study on strength parameters for composite concrete by using fly ash aggregate and glass powder", *international journal of civil and structural engineering research*.vol.3.Issue1, April-Septmeber2015.

(10) Arora.Rishabh "determination of compressive and flexural strength of concrete using waste glass powder", *international journal of engineering trends and technology*.vol 19 no.3 2015