ISSN 2277 – 5528
Impact Factor- 4.015

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

ANALYSIS OF GGBS CONCRETE COLUMN

Bhor S.S.[*1] , Chilap P.D.[2],Sable P.D.[3], Shelke S.S.[4] & Maid N.S.[5]

[*1,2,3&4]Student, Department of Civil Engineering, Jaihind Polytechnic, Kuran, Pune, India

[5]Lecturer,Department of Civil Engineering, Jaihind Polytechnic, Kuran, Pune, India

ABSTRACT

The increasing search for an alternative sustainable and eco-friendly construction materials has led to research on various replacement materials in concrete that have properties similar to that of cement. Ground Granulated Blast Furnace Slag (GGBS) has inbuilt cementing properties which can be used as a partial replacement of cement in concrete. In this paper we have mainly focused on the analysis of M25 grade concrete by partial replacement of cement by GGBS. Cubes and Columns are tested for compressive strength after 7days and 28 days of curing. Water cement ratio for preparing concrete is 0.45. Percentage of cement replaced by GGBS are 25,50,75. It is found that normal M25 grade concrete fails to sustain the compressive strength as compared to the M25 grade concrete prepared by partial replacement of cement by GGBS.

Keywords*: GGBS, cementing properties, sustainable and eco-friendly*

I. INTRODUCTION

The product manufactured by burning and crushing to powder an intimate and well proportion mixture of calcareous and argillaceous material is called as cement. Cement is the main ingredient in construction material "Concrete". Concrete is a uniform mixture of cement, sand and aggregate along with water in fixed proportions and the strength of concrete is mainly due to cement.

Ground Granulated Blast Furnace Slag (GGBS) can be used as a partial replacement material in concrete as it has properties similar to that of cement. GGBS is a by-product from the blast furnace which is used to make iron. The blast furnace operates at a temperature of about 1300-1500 degree centigrade. This blast furnace is fed with a mixture of iron ore, coke and limestone. The mixture of iron ore, coke and limestone is reduced to iron and the remaining materials form a slag that floats on the top of the iron reduced. The slag is periodically brought to a condition for letting out liquid and it is to be used for the manufacturing of GGBS.

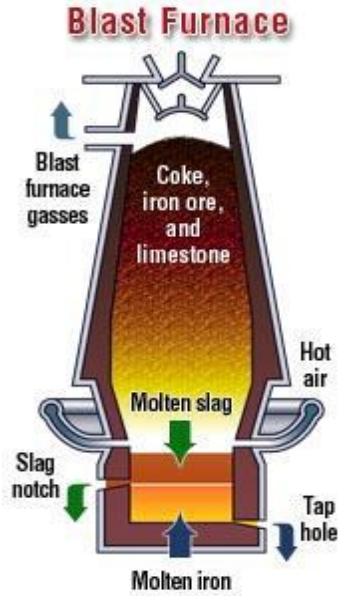

Fig 1 : Blast furnace

ISSN 2277 – 5528
Impact Factor- 4.015

II. CHEMICAL COMPOSITION OF GGBS

The chemical composition of a slag changes considerably depending on the composition of the raw materials in the process of manufacturing of iron. A combination of Silicate and aluminate impurities from the ore and coke present in the blast furnace with a flux which lowers the viscosity of the slag. In the blast furnace the slag floats on the top surface of the iron produced and is allowed to flow for separation.

Chemical properties of GGBS

Following table shows chemical properties of GGBS

Table 1 : Chemical Composition of GGBS.

Constituent	Composition (%) GGBS
CaO	30-50
SiO_2	28 – 38
Al_2O_3	8 – 24
MgO	1 – 18
Fe_2O_3	0.9 - 1.2

Physical properties of GGBS

Following table shows Physical properties of GGBS.

Table 2 : Physical Composition of GGBS

Test Name	Value of GGBS
Colour	Off White
Water absorption	4.35
Specific Gravity	2.43

III. MATERIALS AND METHOD

Selection of material

Ordinaly Portland Cement (OPC) 53 grade was used. The aggregates used werenatural crushed basaltic rock obtained locally. Thecoarse aggregates used were angular crushedaggregates having a maximum size of 20mm. Thefine aggregates used were washed river sandwith a size range 0-4mm. Tap water was used formixing the raw materials. The GGBS used in thisstudy was unprocessed and obtained from a localsupplier.

Concrete Mixes

Four concrete mix designs were prepared. The control mix A consisted of 100 % OPCIn mixes B, C, and D the cement was partially substituted with 25%, 50%and 75% of GGBS by weight respectively. The fineaggregate content was kept constant for all mixes.

ISSN 2277 – 5528
Impact Factor- 4.015

Casting and Curing

Three cubes and three columns of 100% OPC were casted. Seven columns each consisting of 25% partial replacement of GGBS, seven column each consisting of 50% replacement of GGBS, and seven column each consisting of 75% replacement of GGBS. The size of cube mould was 150X150X150 mm. the size of column mould was 150X150X750 mm. The specimens were de-moulded and cured in water at room temperature till the date of testing.

Compressive Strength Test on Column

The Columns were removed from curing period of 28 days. Columns were tested for Compressive strength under universal testing machine with different end conditions. The capacity of Universal Testing Machine(UTM) was 400KN. The compressive strength of concrete column with diff percentage of GGBS is found out.

Fig 2 :Compressive Strength Test on Columns

Table 3 : Compressive Strength Test on M25 Grade

Types	Days	Compressive Strength in (N/mm^2)			
		Normal	25% GGBS	50% GGBS	75% GGBS
Cube	7	26.5	29.2	34.7	31.8
	28	32.3	35.9	41.4	38.6
Column	28	35.4	39.7	43.3	40.9

ISSN 2277 – 5528
Impact Factor- 4.015

IV. CONCLUSION

The aim of this paper was to determine the effect of partially replacing OPC with 25% , 50% and 75% of GGBS on the fresh and hardened properties of concrete. The main conclusions are as follows:
Compressive strength of concrete was found to be increased.

The partial replacement of cement by GGBS, not only provides the economy in the construction but it also facilitates successful utilization of the GGBS which is generated in huge quantities from the steel industries.

REFERENCES

1. *Huiwen Wan, Zhonghe Shui, Zongshou Lin, "Analysis of geometric characteristics of GGBS and their influences on cement properties" Cement and Concrete research 34 (2004) 133-137*
2. *Folarin T. Olorunsogo• and Peter J. Wainwrighe," Effect of GGBFS Particle-Size Distribution on Mortar Compressive Strength", ASCE*
3. *Prof Siddharth, Prof. Seetharam.Munnur," Experimental Study on Strength Properties of Concrete using Steel Fibre and GGBS as Partial Replacement of Cement", International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181Vol. 4 Issue 01,January-2015*
4. *M. Pavan Kumar, Y. Mahesh, "The Behaviour of Concrete by Partial Replacement of Fine Aggregate with Copper Slag and Cement with GGBS - An Experimental Study" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 12, Issue 3 Ver. III (May. - Jun. 2015), PP 51-56.*