© 2018 IJSRSET | Volume 4 | Issue 4 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

High Strength Tertiary Brand Concrete

Vaibhav Ippar, Prashant Bingale, Akshay Jadhav, Bapu Dhondge, Nikita Kulthe
Department of Civil Engineering,Loknete Gopinathji Munde Instituteof Engineering and Research, Nashik, Maharashtra, India

ABSTRACT

Concrete is the most important engineering material in construction industry because of its inherent strength properties. However, the addition of some other materials may change the properties of concrete. With increase in trend towards the wider use of concrete for pre-stressed concrete and high rise buildings there is a growing demand of concrete with higher compressive strength. Micro-silica, also called as silica fumes is produced in electric arc furnace as a by-product of the production of elemental silicones or alloys containing silicon.. Its handling and disposal is a point of concern because of the environment concerns. Silica fume is usually categorized as a supplementary cementations material. These materials exhibit pozzolanic properties, cementations properties and a combination of both properties. Due to these properties, it can affect the concrete behaviour in many ways. Significant amount of international research are going on with different alternative cement binders in recent years to develop optimum mixture. The mineral admixtures with pozzolanic properties such as fly ash (FA), silica fume (SF), ground blast-furnace slag (GGBS) and met kaolin (MK) are commonly used as a partial substitution of Portland cement during construction. These admixtures are often added to modify the physical and chemical properties of cementations mixes, performances and engineering properties of the concrete,. In comparison to ordinary Portland cement, the collection of GGBS as a by-product requires less energy and it produces less greenhouse gases. Thus, GGBS blended concrete is a more environmentally friendly concrete compared to OPC concrete.

Cement can be replaced with the by products which are cementations in nature. Materials such as fly ash, slag are preferably being used; this will help to reduce the cement content and also provides the use of waste products as a replacement. This mixture will give proper bond with durability and strength also reducing the content of cement to greater extent

Keywords: Fly Ash, Micro silica, GGBFS

I. INTRODUCTION

Fly ash, ground granulated blast-furnace slag, silica fume, and natural pozzolans, such as claimed shale, claimed clay or met kaolin, are materials that when used in conjunction with Portland or blended cement, contribute to the properties of the hardened concrete through hydraulic or pozzolanic activity or both. A pozzolan is siliceous or alumina siliceous material that, in finely divided form and in the presence of moisture, chemically reacts with the calcium hydroxide released by the hydration of Portland cement to form calcium silicate hydrate and other cementations compounds.

The practice of using supplementary cementations materials in concrete mixtures has been growing in North America since the 1970s. There are similarities between many of these materials in that most are by product of other industrial processes; their judicious use is desirable from not only the national environmental and energy conservation standpoint but also for the technical benefits they provide concrete. Supplementary cementations materials are added to concrete as part of the total cementations system. They may be used in addition to or as a partial replacement of Portland cement or blended cement in concrete, depending on the properties of the materials and the desired effect on concrete. Supplementary cementations materials are used to improve a particular concrete property, such as resistance to alkali-aggregate reactivity. The optimum amount to use should be established by testing to determine:

(1) whether the material is indeed improving the property

(2) the correct dosage rate, as an overdoses or under does can be harmful or not achieve the desired effect.

Supplementary cementations materials also react differently with different cements. Traditionally, fly ash, slag, claimed clay, claimed shale, and silica fume were used in concrete individually. Today, due to improved access to these materials, concrete producers can combine two or more of these materials to optimize concrete properties. Mixtures using three cementations materials, called ternary mixtures, are becoming more.

Materials

Material analysis is done to test the variety of material that be used in making concrete cubes. We planned the mix proportion for the equipment and arranged the concrete cubes.

Cement

We have used ordinary Portland cement (OPC) of grade 53. It is higher strength cement to meet the needs of customer for higher strength concrete. OPC 53 grade should surpass the requirements of IS: 12269-1987 grade. Ordinary Portland cement is used throughout the experiment work.

Coarse Aggregate

Aggregate were first consider to simply be filler for concrete to reduce the amount of cement require Aggregate can be broadly classified into four different categories: these are heavyweight, normal weight, lightweight an ultra-light weight aggregates.

Fly ash

It is also known as "pulverized fuel ash" in the United Kingdom, is one of the residues generated by coal combustion, and is composed of the fine particles that are driven out of the boiler with the flue gases. Ash that falls in the bottom of the boiler is called bottom. Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys of coal-fired power plants, and together with bottom ash removed from the bottom of the boiler is known as coal ash. Depending upon the source and makeup of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO_2) (both amorphous and crystalline), aluminium oxide (Al_2O_3) and calcium oxide (CaO), the main mineral compounds in coal-bearing rock strata. Two classes of fly ash are defined by ASTMC618: Class F fly ash and Class C fly ash. The chief difference between these classes is the amount of calcium, silica, alumina, and iron content in the ash. The chemical properties of the fly ash are largely influenced by the chemical content of the coal burned.

Ground Granulated Blast Furnace Slag (GGBS):

Ground granulated blast furnace slag (GGBS) is a by-product from the blast-furnaces used to make iron. These operate at a temperature of about 1,500 degrees centigrade and are fed with a carefully controlled mixture of iron-ore, coke and limestone. The iron ore is reduced to iron and the remaining materials form a slag that floats on top of the iron. This slag is periodically tapped off as a molten liquid and if it is to be used for the manufacture of GGBS it has to be rapidly quenched in large volumes of water. The quenching, optimises the cementations properties and produces granules similar to a coarse sand. This 'granulated' slag is then dried and ground to a fine powder. Although normally designated as "GGBS" in the UK, it can also be referred to as "GGBFS" or "slag cement

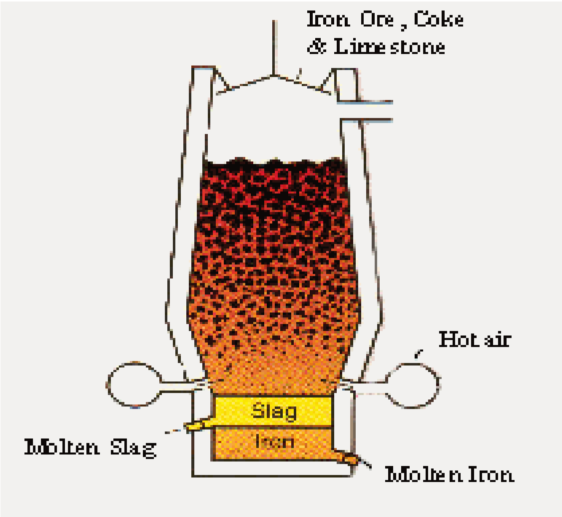


Figure 1. Blast furnace slag

Micro Silica (silica fume)

Silica fume, also known as micro silica, is an amorphous (non-crystalline) polymorph of silicon dioxide, silica. It is an ultrafine powder collected as a by-product of the silicon and ferrosilicon alloy production and consists of spherical particles with an average particle diameter of 150 nm. The main field of application is as pozzolanic material for high performance concrete. Silica fume is an ultrafine material with spherical particles less than 1 μm in diameter, the average being about 0.15 μm. This makes it approximately 100 times smaller than the average cement particle. The bulk density of silica fume depends on the degree of densification in the silo and varies from 130 (undensified) to 600 kg/m^3. The specific gravity of silica fume is generally in the range of 2.2 to 2.3. The specific surface area of silica fume can be measured with the BET method or nitrogen adsorption method. It typically ranges from 15,000 to 30,000 m^2/kg. Micro silica is used in concrete. When it is used in concrete, it acts as filler and as a cementations material

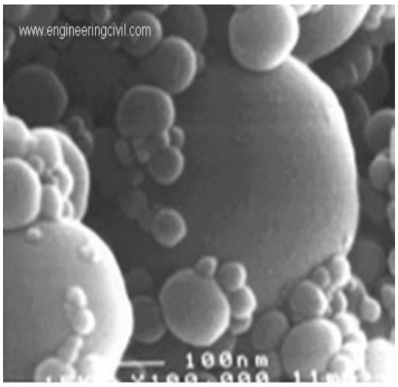


Figure 2. Silica fume

Table 1

SR.NO	**Actual quantities required**
1	Actual water content required= water content+ absorption capacity of both F.A & C.A. moisture content of both F.A & C.A. Water content = 137 liters
2	Dimensions of cube= 0.15m x 0.15m x 0.15m
3	Volume of cube = 0.003375 m3
4	No of cubes to be tested= 54
5	Total volume= 0.18225 m^3

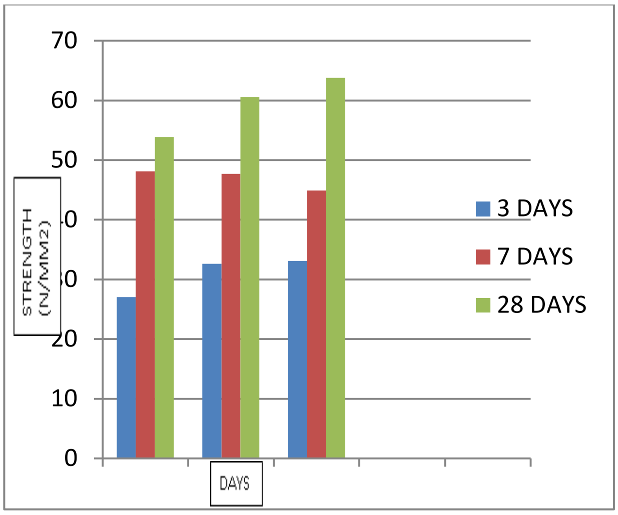
II. RESULT

4.1 FLY ASH + MICRO SILICA + CEMENT

Table 2

Sr no	**% (Micro silica)**	**3 days (N/mm^2)**	**7 days (N/mm^2)**	**28days (N/mm^2)**
1	0%	**27.06**	**48.13**	**60.57**
		32.62	**47.68**	**63.77**
		33.12	**43.58**	**53.88**
	AVE	**30.93**	**43.58**	**59.4**

0 % MICROSILICA + FLYASh



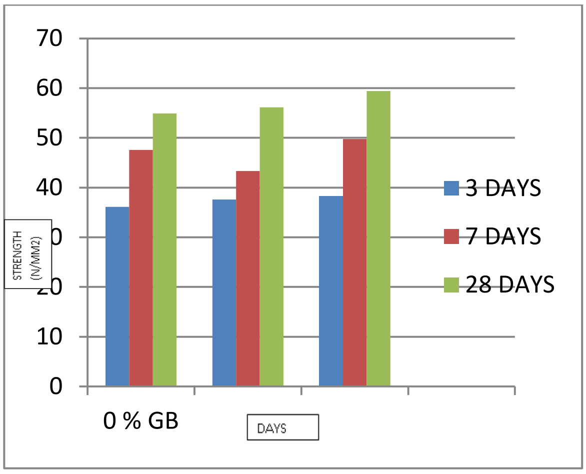
Graph 1. 0 % MICROSILICA + FLYASH

2 GGBFS + MICROSILICA + CEMENT

Table 3

Sr no	% (Micro silica)	3 days (N/mm²)	7 days (N/mm²)	28days (N/mm²)
1	0%	**36.09**	**57.46**	**54.93**
		37.57	**53.2**	**56.13**
		38.32	**54.4**	**60.40**
	AVE	**37.33**	**56.69**	**58.82**

A) 0% MICRO SILICA +GGBFS



Graph 2. 0% MICROSILICA + GGBFS

FLY ASH + MICRO SILICA + CEMENT

Table 4

Sr no	% (Micro silica)	3 days (N/mm²)	7 days (N/mm²)	28 days (N/mm²)
1	0%	30.93	43.58	59.4
2	7%	32.49	51.5	60.61
3	10%	45.85	66.24	71.98

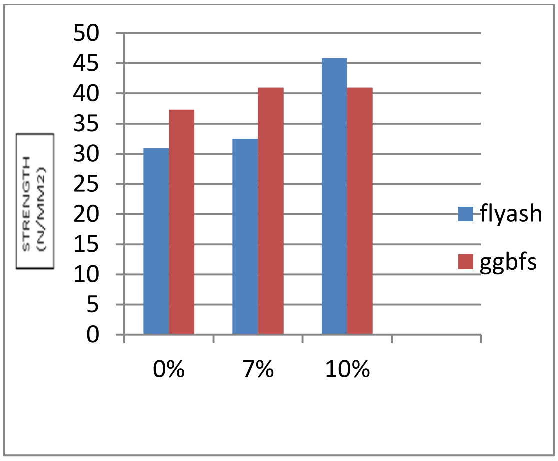
2 GGBFS + MICROSILICA + CEMENT

Table 5

Sr no	% (Micro silica)	3 days (N/mm²)	7 days (N/mm²)	28days (N/mm²)
1	0%	37.33	56.69	58.82
2	7%	40.96	57.84	59.88
3	10%	40.38	58.73	66.43

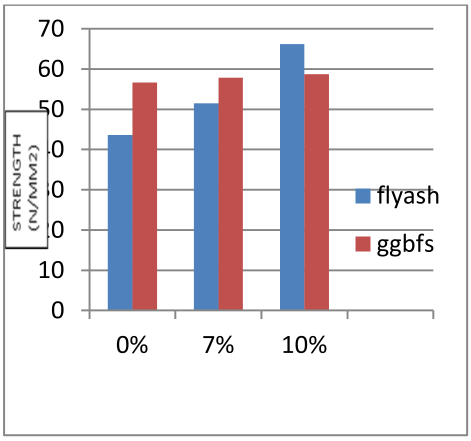
4.3 COMPARISON BETWEEN FLY ASH AND GGBFS RESULTS-

A) 3 DAYS-



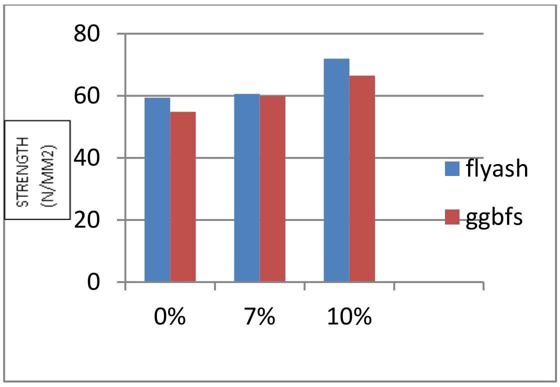
Graph 3. Days comparison for Fly Ash and GGBFS

B) 7 DAYS-



Graph 4. Days comparison for fly ash and GGBFS

C) 28 DAYS-



Graph 5. Days comparison for Fly Ash and GGBFS

The results for GGBFS are higher than that of fly ash up to 7 days but further at 28 days curing period the results of fly ash are observed to be satisfactory than the GGBFS results

III. CONCLUSION

1. Other materials than cement containing cementations properties can be effectively used as a replacement of cement giving required results for the mix.
2. For initial high strength of concrete GGBFS as a partial replacement can be used for the satisfactory results
3. Fly ash is more prominently used material with cement as it proves to be a good binding agent with cement, giving required specified designation of concrete.
4. Micro silica can be added upto 10% of the total cement content to increase the strength of the mix effectively.

IV. REFERENCES

[1]. A.H.L.Swaroop, K.Venkateswararao, P Kodandaramarao, "Durability Studies On Concrete GGBFS", International Journal of Engineering Research and Applications, Vol. 3, Issue 4, Jul-Aug 2013, pp.285-28.

[2]. Ajay Verma, "Effect of Micro Silica on The Strength of Concrete with Ordinary Portland Cement", Research Journal of Engineering Sciences, Vol. 1(3), 1-4, Sept. (2012) pp. 55-75.

[3]. Alaa M. Rashad," Effect of Silica Fume and Slag on Compressive Strength and Abrasion Resistance of HVFA Concrete", International Journal of Concrete Structures and Materials ,Vol.8, No.1, pp.69–81.

[4]. Bhanja Santanu, and Sengupta, Bratish, (2003) "Optimum Silica Fume Content and its Mode of Action on Concrete," ACI Materials Journal, V (100), No. 5, pp. 407-412 Majiduddin, Experimental Investigation On The Effect Of Physical, Chemical And Mechanical Properties Of Fly Ash And Ground Granulated Blast Furnace Slag(GGBFS) On Concrete", International Journal of Engineering Research and Applications, vol 08 March, 2015, pp. 50-94.

[5]. C. M. modi, A. N. vyasarao Microfine ground granulated blast furnace slag for high performance concrete Concrete International, (Dec. 2001), pp 53-59

[6]. D Dilip Kumar Singha Roy and AmitavaSil , "the effect of Partial Replacement of Cement by Silica Fume on Hardened Concrete" The Indian concrete Journal, September 2004, pp. 57-60.

[7]. Faseyemi Victor Ajileye, "Micro silica (Silica Fume) As Partial Cement Replacement in concrete Cement and Concrete Research", Vol. 30, 2000, 1501-1505

[8]. Frieda, Bernd –"micro silica– characterization of an unique additive". November 15-18, 2006 São Paulo – Brazil. Elkem AS, Materials, P.O. Box 8126 Vaagsbygd, 4675 Kristiansand, Norway.

[9]. K Ganesh Babu and V. Sree Rama Kumar, "Efficiency of GGBS in Concrete", Cement and Concrete Research, Vol. 30, 2000, 1031-1036.

[10]. K. C. Biswal Suresh Chandra Sadangi ,Associate Effect of super plasticizer and silica fume on properties of concrete Vol. 20, 1998, 103-112V. Mallikarjuna.Reddy , Prof. M V SeshagiriRao. "Comparative study on the effect of Packing Factor on Workability and study Mechanical Properties of High Strength Self Compacting (M70) with different mineral admixtures". e-ISSN No.2349-9745, Date: 2-4 July, 2015