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Experimental Study on Development of High Strengh Concrete Using Alccofine1108

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ABSTRACT: *This experimental study based on using alccofine1108 enhance early strength in concrete. The experimental work is carried out to evaluate mechanical properties such as compressive strength, split tensile strength and flexural strength for high strength concrete. High strength concrete is made by replacing alccofine1108 by weight of cement various percentage 0%, 5%, 7% , 9%, 11%, 13%, using constant water cement ratio 0.45a for M40 concrete. Casting specimen is cured in atmospheric temperature and hardened properties for 7, 14 and 28days.*

KEYWORDS: *ALCCOFINE1108, High strength concrete, Compressive strength, split tensile strength and flexural strength.*

I. INTRODUCTION

All manuscripts Concrete is the one of the mainly used material throughout the globe in the various field, which basically consists of cement, sand and crushed quarry stones are locally and naturally available, then sand and crushed stone are use as a filler material in concrete and cement is used for bonding and strength parameter of the concrete. Therefore concrete is used extensively, it has many disadvantage for the production of one tone of concrete nearly one tone of co2 is to be released which effect the environment. And also the concrete can withstand compressive loads are effected but it failure for tensile loads as well as in flexure. To enhance the tensile and flexural strength of concrete, number of experimental studies and investigations are to be carried out.

The strength of concrete at least 40 MPa is said to be high strength concrete. While concrete is used in different place such as compression member like piles, pillar column, etc. If the high strength concrete is used in the compression member, it will useful to reduce the dimension of the compression member. As consider high strength concrete has several advantages over the conventional concrete, since the strength of concrete increases which will makes the compression member size will be decrease.

Then the structure becomes more economical also, the strength of high strength concrete is prepared by mixing supplementary cementing material those have a Pozzolanic property it fills in between the cement pores in concrete, it reduce the pores and improves the strength of concrete. Generally mineral admixture is finer then cement During the past few years, high-strength concrete (HSC) has been generating increased interest amongst civil and structural engineers. The expanding commercial use of this relatively new construction material can be explained partially by the life cycle cost-performance ratio it offers, as well as its outstanding engineering properties, such as higher compressive and tensile strengths, higher stiffness and better durability, when compared to the conventional normal strength concrete (NSC). From a historical point of view, in the middle of the 20th century concrete with characteristic strength (fck) of 25MPa was considered high-strength. In the 1980s, 50MPa concrete was considered high-strength. About two decades ago, HSC was mostly specified for projects as an alternate design. But today, HSC is being specified in the preliminary design stage as a sensible solution for concrete construction. Nowadays, technology for producing HSC has sufficiently advanced such that concretes with compressive strengths of up to about 120MPa are commercially available, and strengths much higher than that can be produced in the laboratories.

II. LITERATURE REVIEW

Before The Inference that are been from the literature review.

Parmar et al., (2009) have studied "Utilization of Pond Fly Ash as a Partial Replacement in Fine Aggregate with Using Fine Fly Ash and Alccofine in HSC Hards Concrete Properties" to get the economical and eco friendly High Strength Concrete(HSC).The fresh concrete test carried out for finding properties of this concrete at fresh stage. In 1970's compressive strength more than 40 N/mm2 known as high- strength concrete. Later 60-100 N/mm2 compressive strength classified as High-strength concrete. As per M60 Mix design in this research the Alccofine and fine fly ash partially replaced with cement and pond fly ash as a replacement of fine aggregates. In mix G1, G2 and G3 cement replaced by Alccofine 4% and fine fly ash 26% and pond fly ash varies

10%, 20%,30% as replacement of fine aggregates. Similarly in mix G4, G5 and G6 fine fly ash 24% and pond Fly ash same as 10%, 20% and 30%.The tests conducted on fresh concrete are slump test , vee bee consistency, flow test and compaction factor test. The workability measured in terms of compaction factor, decreases with the increase of the replacement level of the fine aggregates with the pond ash. It can be due to extra fineness of pond ash as the replacement level of fine aggregates is increased. It concluded that the workability of concrete decreased with the increase in pond fly ash content due to the increase in water demand, which is incorporated by increasing the dosage of super plasticizer.

Patel et al., (2013) have studied "Study on Durability of High Performance Concrete with Alccofine and Fly ash" to evaluate the performance of concrete (HPC) containing supplementary cementitious materials such as Fly ash & Alccofine. The necessity of high performance concrete is increasing because of demands in the construction industry. Efforts for improving the performance of concrete over the past few years suggest that cement replacement materials along with Mineral & chemical admixtures can improve the strength and durability characteristics of concrete. Alccofine (GGBS) and Fly ash are pozzolanic materials that can be utilized to produce highly durable concrete composites. This study investigates the performance of concrete mixture in terms of Compressive strength, Chloride Attack tests, Sea water test and Accelerated corrosion test at age of 28 and 56 days. In addition find out the optimum dosage of Alccofine and fly ash from given mix proportion. It concluded that the concrete incorporating Alccofine and fly ash have higher compressive strength and Alccofine enhanced the durability of concretes and reduced the chloride diffusion. An exponential relationship between chloride permeability and com pressive strength of concrete is exhibited.

Prasanna et al., (2015) have studied Experimental Study on Development of Normal Strength Concrete and High Strength Concrete Using Alccofine to evaluate mechanical properties such as compressive strength, split tensile strength and flexural strength for normal strength concrete and high strength concrete. Normal concrete and High strength concrete is made by replacing alccofine by weight of cement various percentage 0% ,9%, 10% , 11% ,12% ,13%, 14%.using constant water cement ratio 0.45and 0.30 for M30 and M70 concrete respectively, super plasticizer are used for required degree of workability. Casting specimen is cured in atmospheric temperature and hardened properties for 7, 14 and 28days.It concluded that Using alccofine1203 enhance early strength in concrete

Parmar et al.,(2015) have research that Effect of Alccofine and Fly Ash Addition on the Durability of High Performance Concrete the results of an experimental investigation that was carried out to evaluate the effectiveness and performance of concrete with OPC cement in addition of Alccofine 1203. In this project we will replace the Alccofine with OPC cement and check the optimum dosage of Alccofine and Fly ash in mix design. Check the various dosage of Alccofine with 4% to 14%. And check the various dosage of Fly ash with 20% to 29%. We also find the different properties of cement, Alccofine, CA, FA, and chemical Admixture Glenium sky-874. Then we prepare the mix design with optimum dosage of Alccofine and Fly ash respectively 8% and 20% with OPC cement. The project results indicate that the performances of concrete using OPC cement and Pozzolanic material Alccofine 1203. Concrete is more durable due to pozzolanic action of Alccofine leading to pores refinement and denser concrete matrix. We were casted the concrete cube, cylinder and disk for the testing of Durability of concrete. Concrete cubes investigated and tested for Compressive strength for ages of 7, 28 and 56 days. This concrete cube, cylinder, and disk were tested with Durability test like RCPT test, Accelerated corrosion test, Sorptivity, Aci test like sea water test, sulphate test, chloride test, with respect to 28 Days strength, 56 Days strength with accelerated curing.

Saurav et al.,(2014) have studied "Experimental study of strength relationship of concrete cube and concrete cylinder using ultrafine slag Alccofine" presents a comparison between cubical strength and cylindrical strength of normal concrete and with partial replacement of cement with ultra fine slag (Alccofine). Ultra fine slag materials are very much important for improving the durability and workability of concrete to sustain a longer life span and producing a greener and quality concrete. Incorporating ultra fine slag as a mineral admixture improves the workability and pump ability of fresh concrete. The ultra fine slag acts as filler thus also reduces permeability. In this paper mechanical strength development of high strength concrete (M50) with partial replacement of cement by ultra fine slag (alccofine) is carried out. Comparison is done between cubical strength and cylindrical strength of M50 grade concrete using ultra fine slag.

Suthar et al.,(2013) have research "Study on Strength Development of High Strength Concrete Containing Alccofine and Fly-Ash" presents the results of an experimental investigation carried out to evaluate the compressive strength of High strength concrete. It is apparent that ternary cementitious blends of Ordinary Portland cement, Alccofine, and fly ash offer significant advantages over binary blends and even greater enhancements over plain Portland cement. The combination of Alccofine and fly ash is complementary: the alccofine improves the early age performance of concrete with the fly ash continuously refining the properties of the hardened concrete as it matures. In terms of durability, such blends are vastly superior to Ordinary Portland cement concrete.

Nayak et al.,(2014) have research that Hardened Properties of Concretes made with Micro Silica and Alccofine-A Performance Optimization based Comparative Study Large scale production of cement is causing environmental problem on one hand and depletion of natural resources on the other hand. This threat to ecology has lead to research to use industrial byproducts as supplementary cementitous materials in making concrete. In the present study, an attempt has been made to investigate the hardened properties of concrete by using micro silica and alccofine in varied proportions. The main parameters investigated in this study is addition of micro silica and alccofine, by keeping maximum cement content 450kg constant and water content constant 144 kg for all mixes. The slump of concrete was practically kept around 100 ± 10mm for all the concrete mixes considered in this study. Both Micro Silica as well as Alccofine were added to concrete mixes in the following incremental proportions as addition to cement content, namely by 0.0, 3.34, 6.68, 10.02, 13.36 and 16.70% respectively. This thesis presents a detailed comparative experimental study using micro silica and alccofine, on hardened properties like compressive strength, flexural strength, splitting tensile strength and impact test.

Patel et al.,(2013) have studied Utilization Of Pond Fly Ash As A Partial Replacement In Fine Aggregate With Using Fine Fly Ash And Alccofine In HSC to get the economical and eco friendly High Strength Concrete(HSC).The fresh concrete test carried out for finding properties of this concrete at fresh stage.In 1970's compressive strength more than 40 N/mm2 known as high- strength concrete. Later 60-100 N/mm2 compressive strength classified as High-strength concrete. As per M60 Mix design in this research the Alccofine and fine fly ash partially replaced with cement and pond fly ash as a replacement of fine aggregates. In mix G1, G2 and G3 cement replaced by Alccofine 4% and fine fly ash 26% and pond fly ash varies 10%, 20%,30% as replacement of fine aggregates. Similarly in mix G4, G5 and G6 fine fly ash 24% and pond Fly ash same as 10%, 20% and 30%.The tests conducted on fresh concrete are slump test , vee bee consistency, flow test and compaction factor test. The workability measured in terms of compaction factor, decreases with the increase of the replacement level of the fine aggregates with the pond ash. It can be due to extra fineness of pond ash as the replacement level of fine aggregates is increased. The workability of concrete decreased with the increase in pond fly ash content due to the increase in water demand, which is incorporated by increasing the dosage of super plasticizer.

III. EXPERIMENTAL INVESTIGATION

A. MATERIALS USED

Water
Cement
Fine aggregate (river sand)
Coarse aggregate (20mm size)
Alccofine 1108

B. TEST RESULTS OF MATERIALS USED IN PRESENT WORK

a. Cement

IS mark 53 grade cement (Brand-Penna cement) was used for all concrete mixes. The cement used was fresh and without any lumps. Testing of cement was done as per IS: 8112-1989. The various tests results conducted on the cement are reported in Table 1.

Table 1. Properties of cement

a. Coarse aggregates

Locally available coarse aggregates having the maximum size of 20mm were used in the present work. Testing of coarse aggregates was done as per IS:383-1970. The 10mm aggregates used were first sieved through 10mm sieve and then through 4.75 mm sieve and 20mm aggregates were firstly sieved through 20mm sieve. They were then washed to remove dust and dirt and were dried to surface dry condition. The results of various tests conducted on coarse aggregate are given in Table 2.

Table 2. Properties of Coarse Aggregate

S.No	Characteristics	Value
1.	Type	Crushed
2.	Maximum size	20mm

3.	Specific gravity	2.75
4.	Total Water absorption	0.3%
5.	Fineness modulus	7.68

b. Fine Aggregate

The sand used for the experimental programme was locally procured and conformed to grading zone III as per IS: 383-1970.The sand was first sieved through 4.75 mm sieve to remove any particles greater than 4.75 mm and then was washed to remove the dust. Properties of the fine aggregate used in the experimental work are tabulated in Table 3.

Table 3. Properties of fine aggregates

S.No	Characteristics	Value
1.	Type	Uncrushed
2.	Specific gravity	2.7
3.	Total Water absorption	7.5%
4.	Fineness modulus	2.9
5.	Grading zone	III

a. Alccofine 1108

Alccofine is a specially processed product based on slag of high glass content with high reactivity obtained through the process of controlled granulation. Alccofine have used conforming to ASTM C989-99. Physical and chemical properties.

Table 4. Physical properties of Alccofine

Physical properties		
Fineness (cm^2/gm)		>12000
Specific gravity		2.9
Bulk density (kg/m^3)		700-900
Particle distribution	d 10	1.5 micron
	d 50	5 micron
	d 90	9 micron

Table 5. Chemical properties of Alccofine

Chemical properties	
Cao	61-64%
So_3	2-2.4%
Sio_2	21-23%
Al_2o_3	5-5.6%
Fe_2o_3	3.8-4.4%
Mgo	0.8-1.4%

IV. TESTING ON CONCRETE SPECIMENS

a. Compressive strength

The cubes that are to be tested were taken out from curing tank for 7, 14 and 28 days respectively wiped and left to dry in sunlight. Once it's gotten dry the specimens were shifted to the testing place where the compression testing machine is located and the dimensions of the specimen were noted. It consists of 3 parts namely pumping unit, straining unit and the load-measuring unit. The upper compression plate is of steel surface that can be adjusted to touch the specimen. The pressure comes through lower plate from the pressure cylinder at the bottom of the machine. The applied load can be measured with a pressure gauge mounted on the front panel. The machines cube holder is cleaned and the dial is calibrated to zero before testing.

The compression testing machine has a maximum capacity of 3000 kN. When testing the face of cube which was exposed from the start or the face which was named before demoulding was kept in a horizontal position. The cube was placed at the centre of the loading plates so that the load will be parallel.

Once finished placing the cube the machine door is closed and it is started the dial gradually rises for increasing in load and stops at the failure load, the loading plate is released, reading is noted and the cube is removed. Three cubes of same design were tested and the average of them is chosen as final compression strength.

The load is calculated by,

Compression strength (N/mm2) = Load at failure / Cross section area of specimen

.

b. SPLIT TENSION TEST

The cylindrical specimens are allowed to cure for 7 and 28 days respectively then were taken out of curing tank before the day of testing, the surfaces are cleaned and left for drying. The specimens after dried were taken to the testing place where the compression testing machine is located.

Before testing the loading plates of the machine were cleaned and the concrete cylinder was kept horizontally where the named face is facing the person in front. Once the specimen was positioned for test the machines door was closed and operated. As the load increases the specimen splits at the failure load.

The dial on the top of machine shows the failure load at which the cylinder splitted. Three specimens of the same mix are tested and the average of the failure load is taken into account and the stress was calculated. The tensile stress was calculated using the below formulae.

Spilt Tensile strength (N/mm2) $= 2P / \pi DL$

Where,

P = Load at Failure (kN)

D = Diameter of Specimen

L = Length of Specimen

c. FLEXURAL STRENGTH TEST

The Specimens are allowed to cure for 14 and 28 days respectively and then brought to the testing site. The bearing surfaces of the supporting and loading rollers are wiped clean, and any loose sand or other material removed from the surfaces of the specimen where they are to make contact with the rollers. The specimen is then placed in the machine in such a manner that the load is applied to the uppermost surface as cast in the mould, along two lines spaced 20.0 or 13.3 cm apart.

The axis of the specimen is carefully aligned with the axis of the loading device. The load is increased until the specimen fails, and the maximum load applied to the specimen during the test is recorded. The appearance of the fractured faces of concrete and any unusual features in the type of failure is noted.

The flexural strength of the specimen is expressed as the modulus of rupture fb which if 'a' equals the distance between the line of fracture and the nearer support, measured on the centre line of the tensile side of the specimen, in cm, is calculated to the nearest 0.05 MPa as follows:

Flexural Strength (fb) = Pl / (b x d2)

where,

d = measured depth in cm of the specimen at the point of failure,

b = measured width in cm of the specimen.

l = length in cm of the span on which the specimen was supported

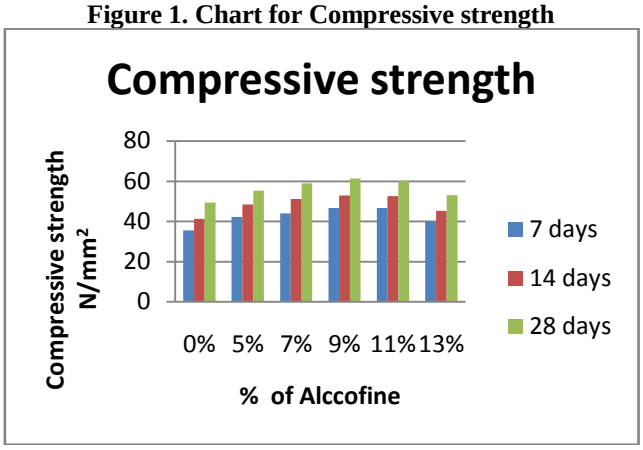
V. RESULTS AND DISCUSSION

a. COMPRESSIVE STRENGTH

Compressive test is a very significant test to know mechanical property of concrete. This test is conducted for various percentage of Alccofine is replaced to the cement. Optimum percentage of alccofine for high strength concrete is 9% .

Table 6. Compressive Strength

Figure 1. Chart for Compressive strength



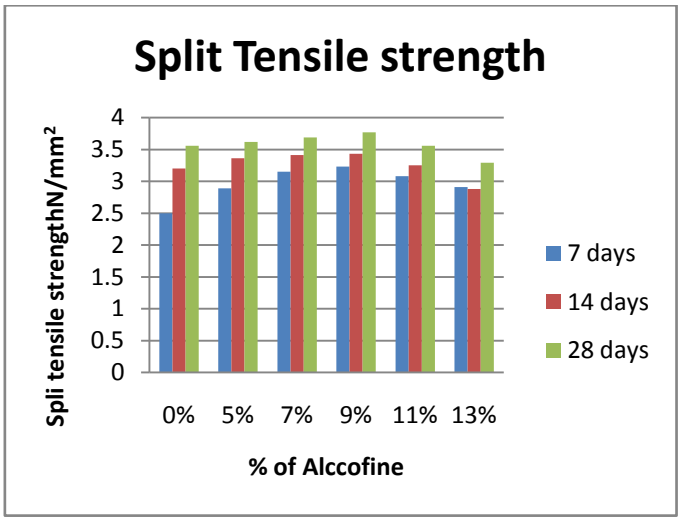
b. SPLIT TENSILE STRENGTH

Split tensile strength of concrete criteria is difficult measure directly. That's why, placing cylinder horizontally then applying the compressive load until the cylinder fail. It gives the strength indirectly to cylinder. Optimum strength is obtained at 9% high strength concrete.

Table 7. Split Tensile Strength

S.No	Name of the Specimen	% of Alccofine	Split tensile strength for M40 concrete (N/mm^2)		
			7 days	14 days	28 days
1.	C0	0%	2.50	3.20	3.56
2.	C1	5%	2.89	3.36	3.62
3.	C2	7%	3.15	3.41	3.69
4.	C3	9%	3.23	3.43	3.77
5.	C4	11%	3.08	3.25	3.56
6.	C5	13%	2.91	2.88	3.29

FIGURE 2. CHART FOR SPLIT TENSILE STRENGTH



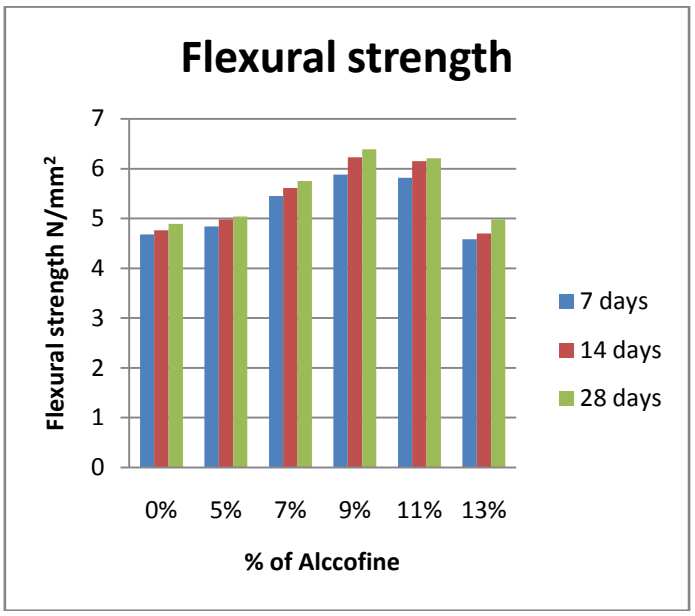
c. FLEXURAL STRENGTH

S.No	Name of the Specimen	% of Alccofine	Flexural strength for M40 concrete (N/mm^2)		
			7 days	14 days	28 days
1.	C0	0%	4.68	4.76	4.89
2.	C1	5%	4.84	4.98	5.04
3.	C2	7%	5.45	5.61	5.75
4.	C3	9%	5.88	6.23	6.39
5.	C4	11%	5.82	6.15	6.21
6.	C5	13%	4.58	4.70	4.98

S.No	Name of the Specimen	% of Alccofine	Compressive strength for M40 concrete (N/mm^2)		
			7 days	14 days	28 days
1.	C0	0%	35.5	41.23	49.46
2.	C1	5%	42.3	48.44	55.33
3.	C2	7%	44.01	51.08	58.98
4.	C3	9%	46.77	52.87	61.28
5.	C4	11%	46.67	52.58	60.12
6.	C5	13%	39.82	45.30	53.11

S.No	Characteristics	Values obtained	Standard value
1.	Normal Consistency	31%	**Table 8. Figure 3. Chart for Flexural strength** **Flexural Strength -**
2.	Initial setting time (minutes)	170 mins	Not less than 30
3.	Final setting time (minutes)	241 mins	Not greater than 600
4.	Fineness (%)	3.5%	Less than 10
5.	Specific gravity	3.13	-

Flexural strength is one of the important criteria for finding the mechanical property of concrete. Flexural strength is maximum at 9% high strength concrete.



VI. CONCLUSIONS

1. Experimental work are carried out various percentages of Alccofine replaced to the cement in control mix from 5% - 13% and both the fresh and hardened properties
2. Using the alccofine as mineral admixture get early strength in concrete
3. The fresh properties and hardened properties of concrete with alccofine are enhanced compared control mix.
4. The hardened properties like Compression strength, split tensile strength and flexural strength of concrete is obtained at 9% in high strength concrete.
5. We observed in the above experimental work the alccofine increases the strength of high strength concrete (hardened properties) at 9% then decreased for the increased percentage of alccofine.

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REFERENCES

[1]. Abhijitsinh Parmar, Dhaval Patel, Dron Chaudhary, "Utilization of Pond Fly Ash as a Partial Replacement in Fine Aggregate with Using Fine Fly Ash and Alccofine in HSC Hards Concrete Properties", ISSN: 2321-9939| January 2009.
[2]. Pairpex - Indian Journal of Research, Volume : 2 | Issue : 3 | March 2013 ISSN- 2250-1991"Study on Strength Development of High Strength Concrete Containing Alccofine and Fly-Ash" Suthar Sunil B, Dr. (Smt.) B. K. Shah.
[3]. Patel et al, International Journal of Advanced Engineering Research and Studies E-ISSN2249–8974 IJAERS/Vol. II/ Issue III/April-June,2013/154-157 "Study on Durability of High Performance Concrete with Alccofine and Fly ash" Yatin H Patel, P.J.Patel, Prof. Jignesh M Patel, Dr. H S Patel.
[4]. Jay Patel, Kunal Patel, Gaurav Patel, Utilization Of Pond Fly Ash As A Partial Replacement In Fine Aggregate With Using Fine Fly Ash And Alccofine In HSC Volume: 02 Issue: 12 | Dec-2013

[5]. International Journal of Engineering Research & Technology (IJERT) Vol. 3 Issue 1, January - 2014 ISSN: 2278-0181 Effect of Alccofine and Fly Ash Addition on the Durability of High Performance Concrete Abhijitsinh Parmar,Dhaval M Patel, Dron Chaudhari, Harpalsinh Rao.

[6]. International Journal of Scientific & Engineering Research, Volume 5, Issue 5, May-2014 ISSN 2229-5518 "Experimental study of strength relationship of concrete cube and concrete cylinder using ultrafine slag Alccofine" Saurav, Ashok Kumar Gupta.

[7]. International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com Volume 10, Issue 8 (August 2014), PP.01-09 Hardened Properties of Concretes made with Micro Silica and Alccofine-A Performance Optimization based Comparative Study Praveen Nayak S, H. S. Narashimhan, Raghunandan V.Kadaba

[8]. International Research Journal of Engineering and Technology (IRJET)e-ISSN: 2395 -0056 p-ISSN: 2395-0072Volume: 02 Issue: 05 | Aug-2015 Experimental Study on Development of Normal Strength Concrete and High Strength Concrete Using Alccofine Prasanna T.M, Sandya D.S, Arjun.

[9]. IS: 1199-1959. Indian standard method of sampling and analysis of concrete Bureau of Indian standards, New Delhi.

[10]. IS: 456-2000 Plain and Reinforced Concrete , Code of Practice.