

Effect of Alccofine on strength characteristics of Concrete of different grades-A Review

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Abstract - In the present paper, the effect of alccofine on properties of concrete has been studied. The main aim of this study is to evaluate the strength or we can say high performance of concrete containing supplementary cementitious materials (SCM) such as Alccofine. In this paper literatures of various researchers who have researched on durability of high performance concrete with Alccofine are reviewed. Because of the demands in the construction industry, the necessity of high performance concrete is also increased. Over the past few years, the efforts which are made for improving the performance of concrete suggest that cement replacement materials along with the minerals and chemical admixtures can improve the strength and durability characteristics of concrete. The alccofine material is pozzolanic material which is becoming popular in the construction industry and has brought technical revolution in the field of Civil Engineering. For high strength, Alccofine is a new generation micro fine concrete material and which is important in respect of workability as well as strength. Also Alccofine is easy to use and it can be added directly with cement. The ultrafine particle of Alccofine provides better and smooth surface finish. As well as cost is concerned, for high strength concrete the cost of concrete mix prepared with alccofine is less than the concrete without Alccofine. The advantage of Alccofine other than strength is that it also lowers the water/binder ratio. Alccofine material increases the strength both in compression and flexure to a large extent.

1. INTRODUCTION

The most important construction materials are cement based materials and it is most likely that they will continue to have the same importance in the future. The construction and the engineering materials must meet new and higher demands. As far as productivity, economy, quality and environment is concerned, they have to compete with other construction materials too like plastic, steel and wood. The durability of concrete means it should have resistance to weathering action, chemical attack or any other process of deterioration. Durable concrete will retain its original form quality, and serviceability when exposed to environment. These materials include traditional Portland cement and other cementitious materials, such as Alccofine. Alccofine is either combined at the cement works or at the concrete

mixer when the concrete is being produced. Cementitious materials for concrete are fine mineral powders. When this material is mixed with water, they react chemically to form a strong rigid mass that binds aggregate particles together to make concrete. Alccofine is a new generation, micro fine material of particle size and is much finer than other hydraulic materials like cement, fly ash, silica etc. being manufactured in India. Alccofine has unique characteristics to enhance "performance of concrete" in fresh and hardened stages due to its optimized particle size distribution.

There are two types of Alccofine: -

- **Alccofine 1203:** - It is an alccofine with low calcium silicate. Alccofine 1200 series is of 1201, 1202, 1203 which represents fine, micro fine, ultrafine particle size respectively. Alccofine 1203 is a slag based SCM having ultra-fineness with optimized particle size distribution. Alccofine 1203 provides reduced water demand for a given workability, even up to 70% replacement level as per requirement of concrete performance
- **Alccofine 1101:** - It is an Alccofine with high calcium silicate. It is a micro finer cementitious grouting material for soil stabilization and rock anchoring. The performance of Alccofine is superior to all other admixtures used in India. Due to high calcium oxide (Cao) content

2. LITERATURE REVIEW

INTRODUCTION

Cement concrete has a large degree of physical and chemical complexity as it is complex material. The material reviewed useful for this research process has various resources. Some of the resources are closely associated with the present study. Some are sparsely related and others are remotely related and have been referred as the study gave the insight into the topic.

REVIEW OF LITERATURE

Concrete with high filling capacity was described by OZAWA (1990).

Defines that Concrete which have specified compressive strength of 6,000 psi or greater is known as high strength. High strength, high workability and high performance are the major characteristics of high performance concrete. HPC is a concrete in which certain characteristics are developed for particular application and environment. Durability is optional under the ACI definition and this has led to a number of HPC structures, which should theoretically have had very long services lives, exhibiting durability associated distress early in their lives.

ACI (AMERICAN CONCRETE INSTITUTE)

The objective of this study was to investigate that how chemical admixture such as super plasticizer and viscosity react with fresh concrete on the deformational and segregation. It also defines that without using any vibrator HPC can be filled into all corners. This study was done for developing the concrete with high filling capacity. It was found that there exists the suitable paste for improving not only the deformability but also the segregation resistance. The optimum mix proportions of super plasticizer and viscosity agent was clarified for the concrete with high filling capacity.

In discussing the meaning of HPC, AICTIN AND NEVILLE (1993)

Defines that concrete which have high strength, high workability and high durability is known as high performance concrete. For the use of seafloor tunnels, offshore and coastal marine structures durability is the principal characteristics for high performance concrete mixture. For the high performance concrete the principal or the important characteristics which are required are strength, dimensional stability, impermeability and high workability. In this paper an overview of the composition of concrete and its effect on the properties desired for high performance is given. In this paper a new procedure for mix proportioning is described.

MEHTA AND AITCIN (1990)

Stated that "In practical application of this type of concrete the emphasis has in many cases gradually shifted from the compressive strength to other properties of the material, such as high modulus of elasticity, high density, low permeability and resistance to some forms of attack".

The FEDERAL HIGHWAY ADMINISTRATION (FHWA)

Defines that if the concrete is properly mixed, made with appropriate materials, transported, consolidated, placed and cured, the concrete which will be obtained will give excellent performance in the structure in which it is used.

HPC was defined by FORSTER (1994)

Four different criteria for different performance grades of HPC were proposed by FORSTER. And these criteria are further expressed in eight performance characteristics which are strength, durability, elasticity, freezing/thawing, chloride permeability, abrasion resistance, scaling resistance, shrinkage and creep. High performance concrete may require different grade of performance for each performance characteristics depending upon specific application.

Siddharth P Upadhyay Prof. M.A. Jammu Studied "EFFECT ON COMPRESSIVE STRENGTH OF HIGH PERFORMANCE CONCRETE INCORPORATING ALCCOFINE AND FLY ASH".

In this study two different shapes of cubes were casted (cylindrical and cubical) and their strength was compared. The author partially replaced cement with ultra-fine slag Alccofine. Compressive strength between cylindrical and cubical concrete was compared and from the comparison following conclusion were drawn:

- With Alccofine hardened properties of concrete are increased or are improved.
- There were very nominal changes after 10% replacement of Alccofine.
- Cylindrical strength of concrete increases after addition of Alccofine but always less than its cubical counterpart.

Saurav, Ashok Kumar Gupta Studied "Experimental study of strength relationship of concrete cube and concrete cylinder using ultrafine slag Alccofine".

In this study cement was replaced with Alccofine and fly ash and also manufactured sand was used in place of natural sand. The concrete specimens were cured under normal atmospheric temperature for 3, 7, 28 days and after curing strength characteristics were observed. The alccofine shows an early strength and fly ash shows long term strength. The maximum compressive strength was achieved by using 10% of Alccofine and fly ash 30%. The strength gained up to 3 days was good, between 3 to 7 days' strength gained was excellent and 7 to 28 days the strength gain was comparatively slow or less. Alccofine increases the filling ability, passing ability and resistance to segregation. If cost is compared, the cost of Alccofine is cheaper than cement hence it is also economic with higher strength.

Abhijitsinh Parmar, Dhaval M Patel Studied "Experimental Study on High Performance Concrete by Using Alccofine and Fly Ash - Hard Concrete Properties".

In this paper author said that now a day's demand of high performance concrete is increasing day by day. A concrete can be made high performance by using SCM's. In this research work author replaced cement with Alccofine, GGBS and fly ash. The test's which were taken into consideration were compressive strength test, chlorides attack tests, sea eater test and accelerated corrosion test at the age of 28 and 56 days. The author concluded that the results shows that

concrete incorporating with alccofine and fly ash have higher strength and also alccofine has increased the durability of concrete have reduced the chloride diffusion. The compressive strength achieved by using Alccofine (8%) + fly ash (20%) is 54.89 Mpa at 28 days and 72.97 Mpa at 56 days.

Yatin H Patel, P.J. Patel, Prof. Jignesh M Patel, Dr. H S Patel Studied "Study on Durability of high performance Concrete with Alccofine and fly ash"

In this study author used fly ash, volcanic ash, volcanic pumice, pulverized fuel ash, blast slag and silica fume as cement replacement material. The main of this study was to have ecofriendly and economical high strength concrete. After curing, compressive strength test was carried out at 7, 28, 56 days and results shows that the compressive strength test at 7 days is excellent, between 7 to 28 days the strength gained was comparatively less and between 28 to 56 days' strength gain is high because of fly ash in m3 proportion. And according to IS 456-2000 table 7 clause 6.2.1 fly ash in m3 proportion get acceptable strength. It is found that initial compressive strength achieved by using fly ash (22%) and Alccofine (8%) is 42.33 Mpa and 66.64 Mpa at 7 and 28 days respectively, but after 28 days' strength gain is comparatively less.

M.S. Pawar, A.C. Saoji studied "Effect of Alccofine on Self Compacting Concrete"

In this study author concluded that the properties of SCC and fly ash are evaluated and compared with the properties of SCC with fly ash and alccofine. From the experimental investigations following conclusions were drawn.

- Filling ability, passing ability and resistance to segregation are the self-compatibility characteristic are increased by adding alccofine in SCC mixes.
- The properties such as fresh properties and harden properties of SCCs are superior with 10% alccofine as compared to the 5% and 15% of alccofine.

Rajesh Kumar S, Amiya K Samanta, Dilip K. Singha Roy Studied "An experimental study on the mechanical properties of Alccofine based high grade concrete"

In this paper author concluded that alccofine increases compressive as well as flexural strength to a large extent at 10% replacement. 7 days of compressive strength when compared and cement replaced by 10 % alccofine, strength is increased by 25.5% and when 28 days curing has been done it is found that the flexural strength is increased by 27.6%. it acts as a filler material if the percentage of alccofine is increased beyond that level and also it yields good workability to the concrete.

Ansari U.S, Chaudhri I.M, Ghuge N.P, Phatangre R.R. Studied "High Performance Concrete with Partial Replacement of Cement by Alccofine & Fly Ash"

In this study cement is partially replaced by Alccofine and fly ash for M70 grade of concrete. The compressive strength of concrete of OPC concrete and with Alccofine and fly ash is compared and it has been found that the strength of concrete got increased by 20% with partial replacement of cement by Alccofine. The author concluded that the compressive strength of concrete increases with increase Alccofine and fly ash content in HPC up to 15 - 20%. High density of the mix was achieved and subsequently higher packing value. It is found that Alccofine is cheaper than cement. So for better strength and durability of concrete it should be promoted in Indian Construction Industry.

3. CONCLUSIONS

This paper presents a review on effect of Alccofine on Properties of concrete. It was found that the addition of Alccofine shows an early strength gaining property long term strength. Alccofine concrete was found to increase the compressive strength of concrete on all age. From the experimental survey it was observed that the result of alccofine material increases the strength (both in compression and in flexure) to a large extent at approximately 10% replacement level of cement. It is seen that the 7 days' compressive strength when compared between control mix and cement replaced by 10 % alccofine an increase of 25.5 % is observed. If the percentage level of alccofine is increased beyond that level it acts as a filler material and yields good workability to the concrete. Since the materials are costlier than the cement, concrete cost will be higher but that can be adjusted during the execution/construction of structures. It is recommended to utilize the alccofine material with cement after checking its durability studies.

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