

Review On Alccofine: High Performance Concrete

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Abstract- The objective of present paper is to summarize the experience available today in the field of concrete. 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 minerals and chemical admixtures can improve the strength and durability characteristics of concrete.

Index Terms- HPC, Cao, Alccofine, SCM, SCC, HRWR, PSD

1. INTRODUCTION

The most important construction materials are cement based materials and it is most likely that will continue to have the same importance in future. Construction industry is a major contributor to economic development of the country. Infrastructure development through network of roads, bridges, tunnels, rail lines, air-ports, sea ports facilitates the easy transportation. To satisfy the increasing demand for energy, hydro power, thermal power, nuclear power & solar power generation facilities will be required. A common and basic factor in all above activities is concrete and concrete structures. Looking at a huge investment required in building up these facilities, durability of concrete structures will be a focus point. Over the period of time, concrete technology has also undergone a tremendous change. Term High Strength is being replaced by High Durability. Concrete satisfying all the durability parameters can also be high strength but reverse is not true! High performance concrete (HPC) has gained world-wide popularity in the construction industry since 1990. In practice, high performance concrete, are generally characterized by high cement factors and very low W/C ratios. Such concrete suffer from two major weaknesses. It is extremely difficult to obtain proper workability, and to retain the workability for sufficiently long period of time. High dosage of high range water reducing agents (HRWR) then become a necessity. Resulting Thixo tropic and sticky mixes are equally difficult to pump / place and com-pact fully and efficiently.

Usage of supplementary materials like fly ash has been in practice since long to achieve durable concrete mixes. The usage of micro fine materials like silica fume, meta kaolin, rice husk ash, etc. are being used to obtain high strength concretes. These micro fine materials work pozzolanically. They are used to fill up the inter particle spaces of cement grains and react with Ca(OH)_2 produced during

cement hydration process. Majority of the times, fly ash present in concrete react with Ca(OH)_2 and micro

fine materials work only as pore fillers. Micro fine materials, due to their very high specific surface area, tend to increase the water demand. This results in increased admixture dosage for low w/c ratio, increased heat of hydration and shrinkage cracks. Concrete mixes satisfying requirements of high durability & strength can be obtained by having Optimum Packing Density of cement paste. This can be achieved with proper selection of right micro fine additives. Important factor while selecting the right micro fine additive is not the fine ness but Particle Size Distribution (PSD). Similar to the importance of "all in grading" of fine & coarse aggregates; all in grading of all powder components in the mix is also important. It is desirable to have microfine additives with well graded PSD.

Ambuja Cements Ltd in collaboration with Alcon Group has launched Alccofine 1200 series as a range of micro fine mineral additives for concrete. Alccofine 1203 is a specially processed mineral additive of high glass content with high reactivity obtained through the process of controlled granulation. The raw materials are composed primary of low calcium silicates. The controlled particle size distribution (PSD) comprises of 0.1 to 17 microsize particles. The computed blain value based on PSD is around $12000\text{cm}^2/\text{gm}$ and is truly ultra-fine. Due to its unique chemistry and ultra-fine particle size, Alccofine 1203 provides reduced water demand workability. This results in either high values of slump or reduction in admixture dosage or reduction in w/c ratio. In turn this improves the compressive strength and compactness values of concrete mix. In addition to its unique PSD, Alccofine 1200 series, due its reactive contents, works Hydraulically in the concrete mix. It maintains alkalinity of the mix and helps in resisting chloride, sulphate and carbonation attack. Due to dual reaction nature (pozzolanic + hydraulic), coupled with unique Particle Size Distribution; Alccofine

1200 series is the best choice for economical, high strength, robust & durable concrete mixes. It helps in improving pump-ability of concrete mixes containing 100% crush sand. Alccofine additives are part of the concrete used in metro rail, tunnels, dams, roads, bridges, high rise constructions, etc. and is becoming a preferred choice as a premium micro fine mineral additive for modern day concretes.

There are two types of Alccofine

Alccofine 1203 :- It is an alccofine with low calcium silicates, alccofine 1200 series of 1201, 1202, 1203 which represents fine, micro fine, ultra fine particle size respectively. Alccofine 1203 is slag based SCM having ultra fineness with optimize particle size distribution. Alccofine 1202 provide reduces water demands 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 admixture used in India, due to high calcium oxide (CaO) content.

2. LITERATURE REVIEW

2.1 ACI (American Concrete Institute)

The objective of the study was to investigate that how chemical admixture such as super plasticizer and viscosity and react with fresh concrete on the deformational and segregation. It also define that without using any vibrator HPC can be filled into to all corners. This studies was done for developing the concrete with high filling capacity. It was found that their exists the suitable taste for improving not only the deformability but also the segregation resistance. The optimum mix 9 proportion super plasticizer and viscosity agent was clarified for the concrete with high filling capacity.

2.2 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 being used of sea floor tunnels, of shore and coastal marine structure durability is being principle characteristics for high performance concrete mixer. For the high performance concrete the principle or important characteristics which are required are strength, dimensional stability, impermeability and high workability. In this paper and overview of the

composition of concrete and its effect on the properties desired for high performance concrete is given. In this paper new procedure for mix proportioning is described.

2.3 M.S. Pawar, A.C. Saoji Studied "Effect of Alccofine on Self Composting Concrete"

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

Filling ability, passing ability and resistance to segregation are the self compatibility characteristics are increased by adding alccofine in SCC mixes.

The properties such as fresh properties and hardened properties of SCC are superior with 10% alccofine and compared to the 5% and 15% of alccofine.

2.4 G. Dhinakaran, S. Thilgavathi (1996)

Compressive Strength And Chloride Resistance Of Alccofine Concrete In the present research work, investigations were carried out to improve the performance of concrete in terms of strength and resistance to chloride-ion-penetration by The study was conducted for different water-to-cement alccofine ratio (w/cm) ratios of 0.32, 0.35, 0.4 and 0.5. The AF proportion was varied from 0 to 15% with an increment of 5% and ages of concrete from 3 to 90 days were considered and experiments performed accordingly in incorporating alccofine as mineral admixture in concrete. From the results, it was observed that AF concrete showed greater strength for higher w/cm ratios (0.4 and 0.5) and its resistance to chloride ion penetration was more or less consistent for all w/cm ratios and the optimal amount of AF resulted significant reduction in chloride ion penetration. effects of alccofine and silica fume on properties of concrete Alccofine-modified concrete showed a better workability than silica fume-modified concrete. As the replacement level was increased, the strength of the alccofine-modified concrete increased at all ages similarly to that of the silica fume-modified concrete. improving strength, drying shrinkage, and pore structure of concrete using alccofine The results revealed that the inclusion of AK remarkably reduced the drying shrinkage strain, but increased the strengths of the concretes in varying magnitudes, depending mainly on the replacement level of AF, w/cm ratio, and age of testing. It was also found that the ultrafine AK enhanced substantially the pore structure of the concretes and reduced the content of the harmful large pores, hence made concrete more impervious, especially at a replacement level of 20%

2.5 B.B.Patil And P.D.Kumbhar (1999)

Strength And Durability Properties Of High Performance Concrete Incorporating High Reactivity Alccofine The present paper deals with the study of properties namely workability, compressive strength and durability of M60 grade HPC mixes incorporating different percentages of high reactivity alccofine by weight of cement along with some suitable super plasticizer. The results of the study indicate that the workability and strength properties of HPC mixes improved by incorporating HRM up to a desirable content of 7.5% by weight of cement. effect of alccofine and fly ash on durability of high performance concrete The aim of this Study is 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 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. concrete with high filling capacity 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. 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 ultrafine slag Alccofine. Compressive strength between cylindrical and cubical concrete was compared and from the comparison 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 flyash 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.

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4. CONCLUSION

The conclusion from the paper can be drawn that alccofine being used as mineral admixture in concrete mix increase the initial strength than the ordinary concrete the posses high workability and retain the workability sufficient time. Alccofine is easy to used and can be added directly with cement, ultra fine particle of alccofine provide better and smooth surface finish. For high strength the cost of the concrete mix prepared with alccofine is lesser than the concrete without alccofine. It also lower the water / binder ratio.

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