

A REVIEW OF TECHNO ECONOMIC STUDY OF USE OF ALCCOFINE AND GGBS IN CONCRETE BY USING CRUSHED SAND

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Abstract : Conservation of natural resources and preservation of environment is the necessary for sustainable development. Depletion of natural resources is a common phenomenon in developing countries like India due to rapid urbanization and industrialization, involving the infrastructure developments. India being second largest populated country in the world it has become very difficult to prepare a concrete by using natural resources to construct various structures such as Roads, buildings, bridges etc. Availability of natural sand in that is getting depleted and also it is becoming costly. To prevent exhaustion of natural resources such as natural stone, natural sand etc. an attempt is made to replace the natural materials by using waste crushed material along with Alccofine powder and Ground granulated blast furnace slag (GGBS).By using the waste and chemical compound with different proportions along with cement and with proper water cement ratio the suitability and performance of the above said materials is measured in this project.

IndexTerms - Alccofine, Ground granulated blast furnace slag, Crushed Sand, Compressive strength, M25 Grade.

I. INTRODUCTION

The construction industry is the second enormous industry in India after agriculture. It provides employment to large number of people and makes significant contributions to the national economy. For the construction of any structure the more important material required is concrete. Concrete is the second most used material in the world after water. The main ingredients required for preparation of concrete are cement, sand, aggregate and water. Pollution and Global Warming are the two most important problems the world is facing today. The excess use of natural resources such as Natural sand, aggregates and cement for the construction of any structure is affecting the Environment. In 2018 India was the second largest country for the production of cement in the world. The consumption of cement was around 270 Million metric tons per annum. India has emitted about 2,299 million tonnes of carbon dioxide in 2018 with increase of 4.8% compared to last year. The manufacture of cement contributes to 7% of global CO₂ emissions. The raw materials used for production of cement are Lime stone and Clay, these materials are extracted from quarries, which also results in environmental degradation In the last few years it has been observed that availability of good natural sand for the construction is decreasing, excess use of natural sand is leading to environmental degradation which affects the environment, also the cost of the Natural sand is increasing day by day due to its scarcity. To prevail over these problems, use of waste materials like Ground Granulated Blast Furnace Slag (GGBS), crushed sand and Alccofine can be used in Concrete.

II. LITERATURE REVIEW

A.C. Saoji et.al.[1] (2013)

The author investigated on Effect of Alccofine on Self Compacting Concrete. The study explores the use of the alccofine powder to increase the amount of the fines and hence achieve self – compatibility. The study focuses on comparison of the properties of SCC with flyash and alccofine to that of standard one with fly ash. The main variable is proportion of alccofine keeping cement, flyash, water, coarse aggregate, fine aggregate and super plasticizer contents constant. Cement-based materials are among the most important construction materials, and it is most likely that they will continue to have the same importance in the future. However, these construction and engineering materials must meet new and higher demands. When facing issues of productivity, economy, quality and environment, they have to compete with other construction materials such as plastic, steel and wood. For evaluation of performance of SCC using alccofine six different mixes were proposed. Various tests such as compressive strength, flexural strength were taken for various alccofine proportions. Results showed that by addition of alccofine in SCC mixes increases the self compatibility characteristic like filling ability, passing ability and .resistance to segregation. The author concluded that Fresh Properties and harden Properties of SCCs with 10% alccofine are superior than SCCs with 5% and 15% of alccofine

Ansari U.S. et.al [2] (2015)

The author studied on Concrete with Alccofine & Fly Ash an Economical & Environment Friendly Approach. In this paper cement is partially replaced by alccofine and fly ash for M70 grade of concrete. In this study alccofine 1203, 53 grade Ordinary Portland cement, Fly ash (or) pulverized fly ash which is a residue remains obtain from the combustion of pulverized coal collected by mechanical separators, from the fuel gases of thermal plants was used. 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 and the cost also reduced.

P. T. Ravichandran.et.al.[3] (2015)

The author studied on Use of M Sand in High Strength and High Performance Concrete. In this process an attempt was made by replacing of river sand with manufactured sand due to scarcity of the river sand. Super plasticizers were used to improve the workability of concrete at low water-cement ratio and increase the compressive strength by reducing it. In urban infrastructure development, the high strength concrete is mandatory to reduce the size of structural member, and to increase the utility space to carry heavier load. In this Paper M100 grade concrete mix was designed with replacement of OPC by different types of mineral admixtures using river sand and manufactured sand along with Polycarboxylate Ether (PCE) based super plasticizer. The Compressive strength, flexural strength and split tensile strength at various curing periods such as 28 and 56 days. From the experimental test results it was observed that, all the mixes were achieved the target mean strength, among these the alccofine with Manufactured sand combination has achieved 21% higher than the target strength at age of 56 days and other strength parameters such as split tensile and flexural strength also slightly increased in this combination comparatively.

Dr. K. Ravichandran et.al [4] (2016)

The author studied on Durability and Cementing Efficiency of Alccofine in Concretes. In this paper durability and cementing Efficiency of alccofine in concretes is checked by replacing the cement with alccofine of various percentages such as 5%, 10%, 15%, and 20%. Design mix is made for M20 grade and cubes were cast with various percentage of alccofine as said above. In this paper, all the durability studies were carried out as per Indian standards to determine the properties. From the results it was observed that 15% of alccofine replacement with the cement is yielding good strength as compared to other mix percentages and by increasing the percentage of alccofine in concrete as replacement of cement, the value of cementing efficiency increases. Also it was determined that the cementing efficiency of alccofine is good in earlier ages of concrete.

Dr. Jayesh Pitroda.et.al.[5] (2016)

The author studied on Study on effect of alccofine on the performance of the Concrete for Rigid Pavement Design and Analysis by using Kenpave Software. In this study Investigation was carried out for innovative use of alccofine in concrete making formula as a cement replacement material as an alternative to traditional concrete. To find optimum dosage of alccofine, Cement was replaced by alccofine in the range of 0%, 5%, 10%, 15%, 20%, 25% & 30% by weight for M-40 grade concrete. Concrete mixtures were produced, tested and compared in terms of compressive and flexural strength with the conventional concrete. The tests were carried out to evaluate the mechanical properties for 7, 14 and 28 days. From the results it was found that Compressive strength vary from 48.20 Mpa to 58.65Mpa. Higher value of compressive strength was obtained for a 15% replacement of cement for 7 days (44.16 Mpa) and 15% replacement of cement for 28 days (58.65 Mpa). It can be concluded that Maximum Compressive strength 58.65Mpa can be achieved by replacing 15% Cement with alccofine at 28 Days.

Dr. V. V. Karjinni et.al.[6](2016)

The author have investigated the Influence of mineral admixture (Alccofine-1203) on the Properties of Hybrid Fiber Reinforced Concrete. In this paper the contribution of mineral admixture i.e. Alccofine-1203 to the mechanical properties of hybrid fiber reinforced concrete with high strength and workability is investigated. It reduces thermal, shrinkage cracks and increases strength as compared to conventional concrete. Fiber volume fraction (VF) 1.5% by volume of concrete was added with Alccofine-1203 contribution of 5%, 7.5% and 10% by weight of cement. The objective of this study was to evaluate the mechanical properties of

fiber reinforced concrete, containing hybrid fibers mixture of steel fibers and non-metallic polypropylene fibers. The total dosage of fibers maintained as 1.5% by volume of concrete with Alccofine-1203 contribution of 5%, 7.5% and 10% by weight of cement to provide good workability. A comparative evaluation of various hybrid fibers concrete was made based on hardened concrete properties such as compressive strength and flexural strength. From the results it was found that Compressive strength is increased with increase in percentage of mineral admixture alccofine-1203 and noted maximum in case of 10%. Flexural strength of concrete was found maximum when they used 1.5% of fiber volume fraction (80% steel fiber and 20% polypropylene fiber) by weight of cement. From this study the author suggested that 7.5% replacement of cement with Alccofine-1203 and 1.5% hybrid fibers (80% steel fiber and 20% polypropylene fiber) resulted in best concrete compressive strength. Compressive strength was increased with increase in percentage of Alccofine-1203. The flexural strength of concrete with 7.5% replacement of cement with Alccofine-1203 and 1.5% hybrid fibers (80% steel fiber and 20% polypropylene fiber) resulted in maximum.

Malvika Gautam et.al [7] (2017)

The author studied on Effect of Alccofine on strength characteristics of Concrete of different grades In this paper, the effect of alccofine on properties of concrete has been studied. The main aim of this study was to evaluate the strength 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 were 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. From this paper 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. It was seen that the 7 days' compressive strength when compared between control mix and cement replaced by 10 % alccofine an increase of 25.5 % was 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.

Narender Reddy.et.al .[8] (2018)

The author have studied the Effect of Alccofine and Nano Silica on Properties of Concrete. In this paper literatures from few researchers were studied on strength and durability performance of concrete with Alccofine and Nano silica (NS). Alccofine and Nano silica are a new generation concrete material for high strength concrete which is important in respect of workability as well as strength. These materials are pozzolanic materials that are bringing technical revolution in the field of civil engineering. These materials are easy to mix and can be mixed directly with cement, ultrafine particle provide better and smooth surface finish. It was found that the results of these materials increase the strength to a large extent. Cement-based materials are the important construction materials and it is most likely that they will continue to have the same importance in the future. However, these construction and engineering materials must meet new and higher demands. When facing issues of productivity, economy, quality and environment, they have to compete with other construction materials such as plastic, steel and wood. The durability of cement concrete is defined as its ability to resist weathering action, chemical attack or any other process of deterioration. From the study it concluded that the influence of alccofine and nano silica improves in the mechanical properties. The strength is enhanced with Alccofine and Nano silica addition, especially at early stages.

III. PROBLEM STATEMENT

Present study focused on Techno economic Study of use of Alccofine and GGBS in concrete along with Crushed sand. The investigation aims in determining the mechanical properties of concrete as well as cost comparison with conventional concrete.

IV. OBJECTIVES OF STUDY

The main objective of this study is as follows

1. To study chemical properties of Alccofine and GGBS as a cementitious material.
2. To design Mix proportions for M25 concrete grade using alccofine, GGBS and Crushed sand.
3. To analyse techno economic performance of M25 Grade concrete using alccofine, GGBS and crushed sand.
4. To compare techno economical performance of conventional M25 Grade concrete with M25 Grade concrete using Alccofine, GGBS and Crushed sand.
5. To find economic mix proportion for M25 grade concrete using Alccofine, GGBS and Crushed sand.

V. METHODOLOGY

The Methodology for present work is

1. Collection of materials such as GGBS, Alccofine, Crushed sand etc.
2. Literature Survey to study chemical properties of GGBS and alccofine
3. Trial mix to prepare conventional M25 Grade concrete and M25 Grade concrete using GGBS and alccofine.
4. Conduction of lab test such as compressive strength, Flexural strength, Split tensile strength etc to analyse technical performance of conventional M25 Grade concrete and concrete of M25 grade using Alccofine, GGBS and Crushed sand.
5. Rate analysis of conventional M25 Grade concrete and concrete of M25 grade using Alccofine, GGBS and Crushed sand to analyse economic performance
6. Comparison of techno economic performance of conventional M25 Grade concrete and concrete of M25 grade using Alccofine, GGBS and Crushed sand.
7. Results and conclusions to find economical mix proportion.

VI. SCOPE OF THE STUDY

The main aim of this study was to achieve economy with better results using waste materials. The waste materials used were Ground Granulated Blast furnace Slag (GGBS) and Crushed sand. We recommend to extend this topic by using other waste products such as Fly ash, Silica Fume, Rice Husks ash, Pulverised Fuel ash, Coconut shells for partial replacement of aggregates etc. Also the use of Alccofine and GGBS for higher grades of concrete such as M30, M35 can be tested to achieve economy.

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