Self-Compacting Concrete Using Steatite Powder and Quarry Dust- A Review

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Abstract- *The present work is dealing with the effect of Steatite Powder & quarry dust on the Engineering properties of Self Compacting Concrete for the production of Green Concrete. The Slump Flow Test, V-funnel, and L-box test on fresh concrete and Compressive Strength Test has been conducted on the hardened concrete specimens. In present work Cement is replaced by 0%, 5%, 10%, 15%, 20% and 25% of Steatite Powder and Fine aggregate is replaced by 0%, 5%, 10%, 15%, 20% and 25% of Quarry dust for M25, M35 & M45 grade. water is replaced by Superplasticizer and VMA to increase viscosity of concrete. The Mechanical Property tests at 28 days and durability property are also observed for checking the feasibility of Steatite Powder & quarry dust in concrete.*

Keywords- Self-Compacting Concrete, Steatite Powder, Quarry Dust, Concrete, Compressive Strength.

I. INTRODUCTION

This type of High Performance Concrete has been used in situations where vibration is more difficult and reinforcing bars is Congested as in the case of the typical pre-stressed beam. There are well-established procedures for selection of materials, mix proportioning and quality curing for production of high performance concrete of materials. However, Much less control is Exercised on The concrete placement. In this regard, the development of self-compacting non segregating concrete utilizing HRWR is an important milestone towards achieving high performance concrete through automation.

Originally developed in Japan in the 1980 due to growing shortage of Skilled labour. This is made Possible by much Faster development of Superplasticizer for concrete. In this Technology the fine material is high as compare to conventional concrete like fly ash, limestone filler etc. and without changing the water content. These Variation in proportions change the rheological behavior of the concrete. An Extensive literature survey was conducted to explore the durability performance of self-consolidating concrete. Self Compacting Concrete requires a larger content of binder and chemical admixtures compared to Conventional concrete, Its material cost is generally 20-50% higher, which has been a major hindrance to a wider implementation of its use. There is growing evidence that incorporating high volumes of mineral admixtures and micro fillers as partial replacement for Ordinary Portland cement in SCC can make it cost effective.

Steatite Powder is type of metamorphic rock, largely composed of talc ore, rich in Magnesium. It is composed of Hydrated Magnesium Silicate: Mg3Si4O10(OH)2. Steatite is the soft known mineral and it is listed as 1 on the Mohs hardness scale. Its already used in paint industry, particularly in marine paints and protective coatings. This is used in ceramics due to its high resistivity, very low dielectricloss factor, and good mechanical strength. Addition of steatite powder increases the viscosity and mechanical properties of feed stock. The thermal properties of steatite are also good.

II. LITERATURE SURVEY

[1]K.Sudalaimani and M.Shanmugasundaram(2014) said that from that study it can be concluded that Cement is replaced by the Ultra Fine Natural Steatite Powder result in decrease of Initial Setting Time and Final Setting Time ,and mortar cube strength were stuided, When replacement at 5%, 10%, 15%, 20%, and 25% by mass of cement. From all the above discussion it is concluded that the suitable Steatite powder replacement percentage should not excced 20%. This shows the increase in requirement of water to produce cement paste.

[2]Padmanapa.M, N.Sakthieswaran(2015) In this study The experimentation is performed in M30 grade concrete, by nansu method for the volume fractions of Natural Steatite Powder and Silica Fume were 0 to 15% by weight of cement content with 1.8% of conplast 430 as superplasticizer in SCC. Many different fresh concrete test methods slump flow, V-funnel and L-box have been developed in attempt to characterize the property of Self-Compacting concrete. The specimens of size 150mm x 150mm cube, 150mm diameter with 300mm height cylinder and 100mm x 100mm x 500mm beam are used. Then the specimen is to tested on 7th and 28th days. The compressive strength, Split Tensile Strength and Flexural Strength are being determined. Admixture Affected the workability of SCC Adversely. The mechanical strength is gradual increase compare to controlled mix.

[3]A. Sheik Althaf Hussain, Dr. N. Sakthieswaran(2015) In This paper experiment is done to evaluate the flexural strength of concrete mixture the cement was partially replaced by Metakaolin and Steatite Powder (UFNSP) at the percentage of 7 and 15 by the weight of cement. Fine aggregate was replaced by fly ash and waste powder from building debris at the percentage of 20 and 30 by the weight of fine aggregate. Flexural strength test is performed test result indicate significant improvement in flexural strength of plain concrete by inclusion of metakaolin and Steatite powder is partial replacement of cement and fine Aggregate is partial replaced by fly ash and can be effectively used in structural concrete. The combination of 7% Metakaolin and 10% Steatite powder Partial replacement of Cement Leads to Strength Reduction.

[4]Khalid Najim, Ibrahim , Abdukhaliq (2016) In present study the cement kiln dust is replaced by the weight of cement at 10%, 20% and 30% and other material keeping constant. The final conclusion is that the Cement Kiln Dust decrease the dynamic modulus of elasticity and increase damping capacity. By replacing the Cement Kiln Dust with cement the Mechanical strength and Fresh property boyh are reduced. The porosity increase and Density decrease with CKD Replacement Increase Also the Mechanical Strength were Decrease with Cement Kiln Dust Replacement.

[5]Mucteba Uysal(2016) In this study, the Limestone powder , marble powder, and basalt powder is partial replaced by Weight of cement. The water to binder ratio is constant at 0.33 for all mixtures. They done Workability test like slump flow , T50 time, L-box test. Hardened concrete test like Compressive strength. From this study it should be concluded that the addition of mineral admixture has satisfactory results in fresh state and positive effect on workability. The marble powder is most effective the all of three. The mixture containing mineral admixture is also shown the satisfactory mechanical property for all the marble powder mixes. The compressive strength is obtain higher in all marble powder mixes. The Addition of Mineral admixture has decrease the Static and the Dynamic elastic moduli of the Self Compacting concrete.

[6]Ahmed fathi, Nasir Shafiq (2013) In this research paper the study on the cement is replaced by fly ash , silica fumes , and microwave incinerated rice husk ash on the mechanical strength and rehology of self compacting concrete. They done test like slump flow, v-funnel and L-box have , compressive strength, Split Tensile Strength and Flexural Strength From this paper conclude that silica fumes requires less water as compared to rice husk ash for achieving the fresh properties. 5% silica fumes & 30% fly ash mixes obtain highest compressive strength as compared to the normal mixes. The performance of rice husk ash is to replace the cement depends on the burning degree which will affect the microstructure of the binder.

[7]Brahim safi, Mohammed Saidi, Ahmwd Bellal, Ali Mechekak, Kamel Toumi(2015) had studied about use of seashells as partial replacement of fine aggregate for making Self compacting concrete. In this study they evaluate the fresh and mechanical properties like compressive strength, flextural strength, bulk density and elastic modulus of Self compacting concrete with partial and fully replacement of sand at different ratio 0%, 10%, 50%, and 100% by weight of sand. He concluded that the good adhesion between seashell and cement paste. The angular from of seashell is improved the distribution latter in the cementitious matrix.

[8]Dr. T. Bhagavathi Pushpa, S. Rajesh Kumar(2016) The interest in the use of fibers for the reinforcement of composites has incresed during the last several years. Use of fibers show considerable improvement in tensile properties of concrete and also reduce shrinkage and cracks. In this study, the results of the strength properties of concrete, setting time and pozzolonic activity of cement using polypropylene fiber and steatite powder have been presented. Steatite powder and polypropylene are used as a replacement for cement. Cement is replaced with steatite powder by 5%, 10%, 15% and 20% mass of cement and 0.5% of polypropylene fiber by weight of concrete is constantaly added for all mixes. Use of Fiber show considerable improvement in Tensile Properties of concrete also Reduced Shrinkage and Cracks.

[9]M. M. Rahman, M. H. Rashid, M. A. Hossain(2011) Self Compacting concrete is an innovative concrete that flow under its own self weight. Besides the composition of Self Compacting Concrete mixing time is a great influence on the mechanical properties of Self compacting concrete. They done compressive strength, splitting tensile strength on the concrete. These properties is vary with mixing time of 5min and extended time 90min and 180min. They concluded compressive strength and flexural strength decrease the amount of water is increase with mixing time increase. With long mixing time the pores are increased in concrete. So that the Chloride ion, permeability and water absorption increase with increase in mixing time.

[10]D.W.S Ho , A.M.M Sheinn(2002) This paper deal with the utilization of alternative material ,such as quarry dust and granite powder. From this paper conclude that the granite powder were finer than quarry dust. The granite fine is more flakier and elongated than quarry dust. So that the physical properties of these filler material affected the fresh properties

of concrete. The fineness of Granite fine could increase durability problem, like as Alkali-Silica Reaction.

III. CONCLUSIONS

(1) Ultra fine natural steatite powder with cement results in decrease of IST and FST, but the consistency of binding material increase.

(2) The silica fumes and Steatite powder gradual increase in compressive strength, split tensile strength and flexural strength for M30 grade of concrete at 7 days and 28 days when 5% and 10% partial replacement of cilica fumes and natural steatite powder with 1.8% of superplasticizer of SCC compare with controlled SCC.

(3) The replacing of Ordinary Portland Cement with Cement kiln dust Show the negatively effect on both rheological and mechanical properties.

(4) The addition of Mineral filler had positive effects on the Fresh property. MP is the most suitable for improving all of them.

(5) Silica fumes requires less water as compared to MIRHA for achieving the fresh properties.

(6) 5% Silica Fumes and 30% Fly Ash mixes obtain highest compressive strength as compared to the normal mix.

(7) The Fine aggregate replaced by crushed seashells has slightly decrease the fluidity of Self compacting mortar. The flow recorded for the mortar containing 100% crushed seashells, was 610mm. A very lighter decrease of compressive strength noticed.

(8) Based on test results, it was inferred that the percentage at which the addition of polypropylene fiber by weight of concrete with 15% constant replacement of cement by steatite powder had given the better result when compared the conventional concrete at 7, 14 and 28days of compressive strength, split tensile strength and 28 days flexural strength.

(9) The water applied to the cement, the Chemical reaction starts simultaneously between them. During long mixing time of SCC, some portion of water are used in the hydration of cement and some portion of water evaporate to the atmosphere and that's why, amount of added water is increased with long mixing time for maintaining constant workability.

(10) With long Mixing time , The Pores in concrete are increased. That is why the water absorption and the chloride ion permeability increase with increase in mixing time.

(11) Higher amount of mineral admixtures combined with small fraction of nano powder would be promising technique toward self compacting concrete as a key material along with energy saving in construction and building technology.

(12) The Granite fines is succefully used in Self compacting concrete compare to lime stone powder. The granite fine require more chemical admixture for same yield stress and fresh property.

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