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Review on weathering action resistance of fly ash based self compacting concrete using silica fume and quartz sand

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Abstract
This paper presents experimental investigations on the weathering action resistance of fly ash based self compacting concrete using different compositions.Also in this paper highlights the influence of parameters that affect the mechanical and structural properties of self compacting concrete in a comprehensive manner. In the construction industry, SCC used as a construction material through out the world. Self compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. A durable concrete is one that performs satisfactorily in the working environment during its anticipated exposure conditions during service. When exposed to environment durable concrete is likely to retain its original form, quality and serviceability during its lifetime.

Keywords: *self compacting concrete,durable,vibration*

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I. INTRODUCTION

Cement is one of most momentous construction material around the world, and its attributive have been changes through technological advancement. So far , numerous types of concrete have been flourished such as high strength concrete, high performance concrete , air entrained concrete , light weight concrete , self compacting concrete (SCC) etc. SCC is an instructional type of concrete that can flow through congested geometrical configurations under its own mass without vibration or segregation.Self compacting concrete is highly engineered concrete with much higher fluidity without segregation and is capable of filling every corner of formwork under its own self weight. As of the year 2000,SCC used for prefabricated products and ready mixed concrete in the European countries.

This chapter includes the results obtained for various tests conducted on self compacting concrete mixes in fresh and hardened state. The results of strength tests were discussed for fly ash based self compacting concrete, fly ash based self compacting concrete with varying percentage of silica fume and fly ash based self compacting concrete with optimum percentage of silica fume and quartz sand. The workability test results on fresh SCC showed that all specimens satisfy the SCC criterion.Hence this study is done to evaluate combined effect of silica fume and quartz sand in fly ash based SCC.

This combination may give better strength and durability properties for SCC.The silica fume in place of cement shall be very economical and can also help in the utility of Industrial wastes and in maintaining the ecological balance thus reducing the consumption of cement .Workability characteristics of self - compacting concrete withsilica fume at different percentages satisfies EFNARC recommended values. Quartz sand, most common of all minerals is composed of silicon dioxide, or silica, SiO2. It is an essential component of igneous and metamorphic rocks.

II. LITERATURE REVIEW

George Mathew and Mathews M. Paul.(2012)has conducted study about mix design methodology for laterized self compacting concrete and its behaviour at elevated temperature. Its gives a simple mix design procedure proposed for medium strength (M20 TO M40) laterized self compacting concrete. Itis said that self compactibility can be largely affected by the characteristics of materials and the mix proportion . Trial mixes

have been made for strength ranging from M20 TO M40 using the materials collected. Based on the observations made such as filling ability, stability , and strength properties , a mix design methodology is arrived for LSCC. In general, the fly ash content in SCC ranges from 8% to 60% of the total powder content and is one of the important ingredients in SCC to ensure proper flow characteristics. For the proposed mix design methodology of LSCC, the total powder content comesin the range of 670kg to 812kg with flyash content varying from 46% to 50%.The properties of self compacting concrete is assessed by the flowability and flow rate of LSCC in the absence of any obstruction were assessed by slump flow and T500 time tests, the viscosity and filling ability were measured using V-funnel and L-box tests respectively. In this project they arrived at certain conclusions which includes a simple mix design procedure for medium strength(M20-M40). LSCC require high percentage of fly ash (additives) to get the required flow parameters. The compressive strength of LSCC reduces with increase in temperature and showed comparatively less strength reduction against SCC. Air cooled specimens showed slightly higher strength than water cooled LSCC at elevated temperature.

Miguel Ángel Sanjuán , Cristina Argiz (2015) studied about the Effect of silica fume fineness on the improvement of Portland cement strength performance. This paper presents both a study on the effect of silica fume (SF) fineness on the pozzolanicity of blended cement and a method for improving coarse SF performance in making high-strength and high-performance concrete. The coarse SF, having a 45 micro meter sieve residue of 32.11%, yields a low pozzolanic reaction. In order to enhance its quality, the coarse SF was ground until the average particle size was reduced to a 45 micro meter sieve residue of 4.13% and 0.98%. Mortar made of silica fume that has a fineness of between 0.98% and 4.13% presented almost the same compressive strength at the curing ages after 28 days.

Dinesh. A , Harini.S,(2017) conducted study about the Experimental study on self compacting concrete. This project deals with the self- compacting concrete where the cement is partially replaced with fly-ash and silica fume. Here Ordinary Portland Cement is replaced with 5%, 10%, 15%, 20% and 25% of fly-ash and 2.5%, 5%, 7.5%, 10% and 12.5% of silica fume. From the experimental investigations, it is observed that there is increase in the fresh properties (workability) and increase in the hardened properties (split-tensile strength and compressive strength) for replacement of silica fume. Similarly, there is increase in the fresh properties (workability) and decrease in the hardened properties (split-tensile strength and compressive strength) for replacement of fly ash. It is evident from the experimental results that the compressive strength decreases with the increase in percentage of fly ash and increases with the increase in percentage of silica fume. The workability of concrete when replaced with 5%, 10%, 15%, 20% and 25% of fly ash is increased by 50%, 43.75, 37.5%, 31.25% and 25% respectively. The workability of concrete when replaced with 2.5%, 5%, 7.5%, 10% and 12.5% of silica fume is increased by 12.5%, 18.75, 25%, 43.75% and 50% respectively.

Kennouche.S, Zerizer.A (2013) has studied about Formulation and characterization of self compacting concrete with silica fume. Self-compacting concrete (SCC) have high fluidity; their implementation that allows concrete to be placed in complicate forms without any strain vibration and prohibit segregation. Self-compacting concrete (SCC) was elaborated using local materials and silica fume (SF) as admixture in 15% of cement quantity, two different Portland cements (PC) and two different superplasticizer that the chemical nature is polycarboxylate and plynaphtalene, the aggregates used are (AG 3/8 mm, AG 8/15 mm), coarse and fine sand (SC, SF) witch fineness modulus 3.2 and 1 in the order. In this paper, SCC elaborated from local materials (Algeria) based on Japanese formulation method. We fixed dosage of silica fume at 15% to cement content, the characterization of fresh concrete, given a good result. The diameter of the cake obtained is between 650 and 750 mm, the percentage of milt in the sieve stability is<15% and the L-box test, confirm that the SCC flow through without blocking in reinforcements with is explained by the high fluidity and absence of segregation. aluminates.

Raju Lokhande and Kirankumar Dindawar (2019)conducted study about the Role of Silica Fume in Producing High Strength Self-Compacting Concrete. Self-compacting concrete has a very important role in the construction of tall structure, because such structures are designed for higher grade concrete as well as higher grade of steel, with less dimensions of structural components. The main execution difficulty of normal concrete was raised due to congestion of reinforced in the structural components, where self-compacting concrete (SCC) is compacted under its own weight without compaction or vibration as well as it has excellent fresh state properties without segregation and bleeding. For present experimental work, first to adopt optimum dosage of superplasticizer is 2.5% and w/c ratio is 0.28 by trial and error method, with accepting fresh properties of SCC results. Later the study is carried by replacement of silica fume with cement 4, 8, 12, and 16% of silica fume by trial and error method. Silica fume is a feasible secondary mineral material. From the mixed studies, it is recommended that not to use more than 12% silica fume be replaced by mass. • Further, the flowability of concrete in SCC by silica fume can be developed by using combination type consisting viscosity modifying agents and chemical admixtures. • Among all trails, the proportion for high strength was 575:700:833 (cement: sand:aggregate) with 2.5% SP and w/c ratio 0.28 was the trail with high strength and also fulfilled the properties of SCC in fresh state.

K.Turk, P. Turgut , M. Karatas (2010) deals with the study Mechanical Properties of Self-compacting Concrete with Silica Fume/Fly Ash. This study, silica fume (SF) and fly ash (FA) were added separately as partial replacement of cement from 5% to 20% and from 25% to 40% at 5% intervals, respectively. In case, eight types of self-compacting concrete (SCC) were designed, in comparison with normal concrete (NC). Mechanical properties of NC and various SCC mixtures such as, compressive, splitting tensile strength, ultrasound pulse velocity (UPV) and the modulus of elasticity have been investigated. Tests were conducted for 3, 28 and 130 days whilst the elasticity modulus test was only performed for 28 days. Test results indicated that SCC specimens with SF/FA had higher the compressive and tensile strength than NC specimens for all ages whilst the compressive strength of SCC specimens decreased with an increase in both FA and SF content for 3 days. SCC specimens with SF/FA had in general higher compressive and tensile strength than NC specimens for all curing ages whilst the compressive strength of SCC specimens decreased with an increase in both FA and SF content for 3 days. SCC with SF15 had the highest compressive and tensile strength with 73.87 and 5.489 MPa for 130 days, respectively.

Gayathri Komati, Ravi Kumar Garre, conducted studied about the Effect of Mineral Admixtures and Quartz Sand on Workability and Compressive Strength Of Self Compacting Concrete.Self-compacting concrete is an advanced concrete over conventional concrete. SCC can be placed in form works with avoiding vibration. SCC is a flowing concrete and is able to consolidate under its own weight. SSC improves the filling capacity of highly congested structural members. The main objective of this investigation is of SCC by using partial pozzolanic admixtures i.e, Quartz powder along with Silica fume and with complete replacement of river sand with Quartz sand. The Experimental work involved in optimization of w/c ratio of concrete to be performed as M50 grade mix for SCC used in this investigation.

Dhanalakshmi , Dr. M. Shahul Hameed deals with the study of experimental Investigation of Self Compacting Concrete by Partially Replacing Fine Aggregate with Quartz Sand with Use of Recron Fibre. Self Compacting Concrete is a newly developed concrete in which the ingredients of the concrete mix are proportioned in such a way that it can flow under its own weight to completely fill the formwork and passes through the packed reinforcement without any segregation and self consolidate without any mechanical vibration. Efforts for improving the performance of concrete over the past few years suggest that fine aggregate replacement materials such as Mineral admixtures can improve the strength and durability characteristics of concrete.

Lisantono and J B Susanto conducted the study about the Utility of local quartz powder and silica fume to produce high early strength of self compacting high strength concrete. Generally concrete needs 7 to 14 days to reach minimum adequate compressive strength. Sometimes it is needed to get high early compressive strength of concrete for some reason. This research conduct an experimental program to make high early strength of self compacting concrete which is using local quartz powder and silica fume. Twenty one cylinder specimens were made and tested to get the compressive strength at age of 1 day, 3 days, 7 days, 14 days, 21 days, and 28 days. While the modulus elasticity of concrete were tested only at the age of 28 days. The cylinder specimen was using standard size of (150 × 300) mm2 . The experimental program shows that the average compressive strength of concrete in 1 day, 3 days, 7 days, 14 days, 21 days, and 28 days were 10.00 MPa, 27.16 MPa, 36.41 MPa, 40.93 MPa, 50.36 MPa, and 48.66 MPa, respectively.

III. CONCLUSION

By the wide evaluation of the above literature review this paper identifies several factors that significantly influences the durability behaviour of the concrete under the variance of different parameters.The workability of SCC is equilibrium of fluidity, deformability, filling ability and resistance to segregation.SCC is an excellent repair material for concrete encasement because of its ability to flow through narrow openings. The fluidity & segregation resistance of SCC ensures a high level of homogeneity, minimal concrete voids & uniform concrete strength in situ, providing the potential for a superior level of finish & durability to the structure. Now-a-days due to constant sand mining the natural sand is depleting at an alarming rate. Scarcity of good quality river sand due to depletion of resources and restriction due to environmental consideration has made concrete manufactures to look for suitable alternatives to fine aggregate.

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