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A Review on Self Compacting Concrete

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Abstract: Self compacting concrete (SCC) is an innovative concrete that does not require vibration for placing as it becomes dense due to its own self weight. SCC is a high performance concrete (HPC) which meets special performance and uniformity requirements that cannot be always achieved by using only the conventional materials and normal mixing, placing, and curing practices. SCC has excellent deformability and resistance to segregation of aggregates in its fresh state. High workability and control of slump, toughness, volume stability, service life, Low water binder ratio, Low bleeding and low plastic shrinkage, through a tight and refined pore structure of the cement paste are the improvements in performance requirements. The hardened concrete is dense, homogenous and has the same engineering properties and durability as vibrated concrete.
Keywords- Self compacting concrete, Compressive Strength, Durability, Fresh properties

I. INTRODUCTION

The present day, world is witnessing the construction of very complicated and difficult engineering structures. Concrete being the most important and widely used material is called upon to possess very high strength and sufficient workability properties. Efforts are being made in the field of concrete technology to develop such concrete with special performance characteristics.
Self compacting concrete (SCC) was first developed in 1986 in Japan to achieve durable concretes structures. SCC is defined as a category of high performance concrete that has excellent deformability in fresh state and resistance to segregation and bleeding that can be placed and compacted under its own weight without applying vibration. The use of SSC facilitates the placement of concrete in densely reinforced members through restricted sections. Such concrete must achieve excellent deformability, low risk of blockage and good

A. Stability of formwork to ensure high filling capacity.

SCC has a low yield stress and a moderate viscosity to ensure high filling ability and segregation resistance, proper resistance segregation is essential to prevent blockage and ensure homogeneous deformation of the concrete through congested reinforcement. High-Performance Concrete is being widely used throughout the world and to produce them it is necessary to reduce the water/binder ratio and increase the binder content.
Concrete is considered a brittle material, primarily because of its low tensile strain capacity and poor fracture toughness. For a long time concrete was considered to be very durable material requiring a little or no maintenance. The assumption is largely true, except when it is subjected to highly aggressive environments. The build concrete structures in highly polluted urban and industrial areas, aggressive marine
Environments, harmful sub-soil water in coastal area and many other hostile conditions where other materials of construction are found to be non-durable. One of the main reasons for deterioration of concrete in the past is that too much emphasis is placed on concrete compressive strength. As a matter of fact, advancement in concrete technology has been generally on the strength of concrete. It is now recognized that strength of concrete alone is not sufficient, the degree of harshness of the environmental condition to which concrete is exposed over its entire life is equally important.

II. SPECIFICATIONS OF INGREDIENTS

Generally a good quality of cement like 53 grade cement is preferred but it may vary according to the grade of SCC needed. The maximum size of the aggregates depends on the particular application and is usually limited to 10-12 mm. the particles smaller than 0.125 mm contribute to the powder content. The moisture content in the aggregates should also be closely monitored and must be taken into account. Suitability is established for mixing water and for recycled water from concrete production conforming that the minerals and other elements do not affect the properties of concrete
Admixtures used shall comply with EN 934-2:2000 (including annex A), where appropriate super plasticizer is an essential component of SCC to provide the necessary workability. Other types may be incorporated as necessary, such as Viscosity

Modifying Agents (VMA) for stability, air entraining admixtures, retarders for control of setting etc. Super plasticizer like Glenium b 232, Structro 100 is found to be more effective. Fly ash is a fine inorganic material with pozzolanic properties, which can be added to SCC to improve its properties and also as a substitute of cement to certain extent. In addition to all the above ingredients, some other pigments and admixtures shall also be used according to the working conditions and requirements.

III. ADVANTAGES OF USING SCC

SCC has got many advantages over normal concrete. It can even be cheaper than normal concrete if fly ash is locally available and a suitable viscosity modifying agents is used.

A. Advantages of SCC over NC are as follows

1) *Faster construction:* By using SCC, the production of concrete can be more industrialized. The evolving ready mix concrete is easily possible by using the property pump ability.
2) *Reduction in site man power:* he man power used for the vibration and for compaction of concrete is saved.

B. Better surface finishes

The Self Compacting Concrete has a high percentage of fines, and the property of fallibility enables the concrete to give a better surface finish.

C. Easier placing

The SCC unlike the normal conventional concrete can be placed easily. The SCC can also be poured inside the reinforcement.

D. Reduced noise levels in work site

The noise produced by the compactors and vibrators is avoided. This enables better communication in the work site.

E. Safer working environment

As there is less man power required in the site, the problems resulting from congestion etc.., are reduced, this results in a safer working environment.

F. Economical construction

In SCC the cementitious materials like fly ash can be used, which is a waste product in thermal power plant. Fly ash costs very less compared to other building materials, ultimately resulting in economical construction.

G. Improved filling capacity through highly congested reinforcement

The SCC has a higher filling and flowing ability when compared to the conventional concrete thereby it enables to fill through the congested reinforcement. This eliminates the difficulty of vibrating through the congested reinforcement.

H. Time of construction is minimized

As the production of SCC can be industrialized, the time required for the construction is reduced.

IV. LITERATURE REVIEW

Yatin H Patel et.al. (2014) [1]. The performance of concrete mixture in terms of Compressive strength, Chloride Attack tests, Sea water test and Accelerated corrosion test at age of 28 and 56 days was tested in this study by them along with the optimum dosage of Alccofine and fly ash from mix proportion given. It was shown in the results that concrete incorporating Alccofine and fly ash have higher compressive strength and Alccofine enhanced the durability of concretes and reduced the chloride diffusion. An exponential relationship between chloride permeability and compressive strength of concrete is exhibited.

P. J. PATEL. (2013) [2] studied effect on Compressive and Flexural Strength of High-Performance Concrete Incorporating Alccofine and Fly ash. Compressive strength was tested up to 90 days. In all mix proportions strength gain up to 7 days is excellent, between 7 to 28 days strength gain is comparatively less, but between 28 to 56 days strength gain is high because of fly ash. The slump was more than 150 mm for all mix. After testing flexural strength test of beam was getting maximum flexural strength of 7.02 MPa in M4 mix (fly ash-20% and alccofine-10%).

Sunil Suthar. (2013) [3]. Study the effect of Alccofine and Fly ash addition on the Mechanical properties of High performance Concrete. The combination of alccofine and class F fly ash is complementary: In terms of durability, such blends are vastly superior to plain portland cement concrete Fly ash increases long-term strength development of silica fume concrete. Alccofine increases the particle packing and it increases the strength of concrete. Fly ash offsets increased water demand of silica fume. The addition of 8% AL to different FA replacements has a high compressive strength than 10% SF. The optimum and high strength concrete can be obtained with 8% AL

Shriram **(**2013) [4]. carried out an experiment on mineral admixture and hardened properties of self-compacting concrete by partial replacement of cement by cement kiln dust (CKD). CKD is the waste product from the production of cement. Four mix designs are prepared by varying percentage (10%, 20% and 30%) of replacement including normal SCC along with addition of super plasticizer in order to obtain the flow properties and workability. To fix the water powder ratio, flow properties are determined as per EFNARC guidelines. Flow properties show a better improvement up to 20% partial replacement of cement by CKD and decreased above 20% replacement. An increase of 2% was observed in compressive strength at a partial replacement of CKD at 20%, whereas the split tensile strength and flexural strength shows a slight marginal increase of 3% compared to normal SSC.

Dhiyaneshwaran, S et.al. (2013) [5] quoted that SCC was made by usual ingredients such as cement, fine aggregate, coarse aggregate, water and mineral admixture fly ash at various replacement levels (10%, 20%, 30%, 40% and 50%). The super plasticizer used was Glenium B233 and the viscosity modifying agent used was Glenium Stream 2. The experiments are carried out by adopting a water-powder ratio of 0.45. Workability of the fresh concrete is determined by using tests such as: slump ^{flow}, T50, V-funnel, L-Box and U-box tests. The durability of concrete is tested by acid resistance, sulphate attack and saturated water absorption at the age of 28, 56 and 90 days. In this research it has been explored that with the increase in super plasticizers dosage the workability s increased. So, the required slump value fulfilling the criteria of EFNARC can be obtained. For 30% fly ash replacement, the fresh properties were good as compared to 10% 20% 40% and 50% fly ash replacement. The results of the mechanical properties have shown significant performance differences, and higher compressive strength has been obtained for fly ash replacement. The acid resistance of SCC with fly ash was higher when
compared with the concrete mixes without fly ash at the age of 28, 56, 90 days. As fly ash content is increased the compressive strength decreased. When the specimen is immersed in sodium sulphate solution for 28, 56 and 90 days respectively, the average reduction in weight increases and the weight increases and the weight is decreased when the fly ash content is increased in concrete.

Raharjo. D; et.al. (2013) [6] carried out a research where some trial mixtures containing fly ash, silica fume, policarboxilate based of super plasticizer , and iron slag have been performed that directs to determine the SCC's optimal composition and meet the EFNARC requirement. The cylindrical sample of 10 cm in diameter and 20 cm in height of hardened SCC was also tested at 3, 7, 14, 28 and 56 days of concrete age. There were 33 variation of concrete mixture using 495 samples total mixture have been tested. Each composition contained various super plasticizer dosages from 0.5 to 1.8% of cementations weight. The dosage of silica fume was also varied 0%, 10% and 20% of fly ash weight. The main objective of this research is to determine the optimum mix design containing fly ash, silica fume, slag and iron for producing a high compressive strength of SCC with a competitive price. This obtained formula is valid for the used data in this research, since the accuracy of some of data is questionable due to the environment temperature, air moisture, scale of measuring materials, etc; therefore this formula needs to be proved using other composition for further research.

Pawar1 M. S. (2013) [7] . the use of Self-Compacting Concrete (SCC) eliminates the need for external vibration, eradicating the problem of unskilled labour. The use of the Alccofine powder to increase the amount of the fines and hence achieve self – compatibility was also discussed in this study. It focuses on comparison of the properties of SCC with fly ash and Alccofine to that of standard one with fly ash. The main variable is proportion of Alccofine keeping cement, fly ash, water, coarse aggregate, fine aggregate and super plasticizer contents constant. The addition of Alccofine in SCC mixes increases the self compatibility characteristic like filling ability, passing ability and resistance to segregation. Fresh Properties and harden Properties of SCCs with 10% Alccofine are superior to SCCs with 5% and 15% of Alccofine.

Arivalagan S. (2013) [8]. carried out research and the results of experiment point towards producing and evaluating SCC made with high volumes of fly ash. Nine SCC mixtures and one control concrete were considered in this study. The content of the cementations materials was maintained constant (400 kg/m3), while the water / cementations material ratios ranged from 0.35 to 0.45. The self-compacting mixtures had a cement replacement of 40, 50 and 60% by Class F fly ash. Tests were carried out of hardened concretes such as compressive strength .The self-compacting concretes developed a 28- day compressive strengths ranging from 26 to 48 MPa. It was concluded that an economical self-compacting concrete could be successfully

developed by incorporating high-volumes of Class F fly ash. The fresh properties of SCC containing varying amounts of fly ash with that containing commercially available admixture were main areas of concern in his study. The result authenticates the practicability to develop low cost SCC using Class F fly ash. The self-compacting concrete developed compressive strengths ranging from 15 to 31 MPa and from 26 to 38 MPa, at 7 to 28 days with no extra cost. The present investigation has shown that it is possible to design a self-compacting concrete incorporating high-volume of Class F fly ash. The utilization of fly ash in SCC solves the problem of its disposal thus keeping the environment free from pollution.

B.Beeralingegowda . (2013) [9] . this paper is based on an experimental study on SCC with replacement of cement content with different percentage of limestone powder. The different mix combinations made were with 0%, 5%, 10%, 15%, 20%, 25% and 30% replacement of cement with limestone powder. Test results exhibited compressive strength ranging from 41.93 MPa to 49.37 MPa for 0% to 20% replacement and 46.37 MPa and 42.96 MPa for 25% and 30 % replacement respectively. It was resulted that up to 20%, the partial replacement of cement content with limestone powder improves compressive strength for SCC but it reduces on further enhancing the replacement %age of cement with limestone powder.

Ali Hussein Hameed . (2012) [10]. this paper discusses the outcomes of an experimental investigation into the properties of self-compacting concrete mixes having varying dosage of high-performance super plasticizer (Glenium 51) (0.5%-3.0%) litre per 100 kg of cement material. The properties considered are workability on the fresh state of concrete by using one mix with five super plasticizer dosages (0.5%, 1.0%, 1.5%, 2.5% and 3.0%) is used. The workability was assessed using three tests according to the specification of self-compacted concrete (slump flow, L- box differential height and V-funnel tests. The three dosage (1.0%, 1.5% and 2.5%) comply with requirement for production of SCC while 0.5% and 3.0% don't comply with specification requirement .Dosage of super plasticizer need to produce self-compacted concrete range between (1.0%-2.5%) L/100 kg of cement according the condition and material used in this paper. It has been verified that by using the slump flow, L-box, U-box and V-funnel tests, SCC (produced by using lo

Self-compact ability under its own weight, without any external vibration or compaction. The workability of studied mix (Tr1) is poor, with slump flow diameter less than to 500 mm, blocking ratio less than (0.80), and flow times less than 6 to 12sec., Therefore it does not satisfy the properties of self-compacting concrete. The workability of studied mixes (Tr2, Tr3and Tr4) is excellent according to EFNARC limitation, with slump flow diameter greater than or equal to (500 mm), blocking ratio greater than or equal to (0.80), and flow times range (6 to 12sec.) On the fresh properties from the statistical analysis and the empirical relationships formulated in this study, it can be concluded that the slump flow test is enough to evaluate the SCC with maximum size of coarse aggregate equal to 12.5mm.

Dubey Sanjay Kumar; et.al. (2012) [11] in this paper self-compacted was developed concrete by using Portland Pozzolana cement, hydrated lime and silica fume. Lime is used as filler material. SF improved aggregate-matrix bond resulting

from the formation of a less porous transition zone in concrete. The test results for acceptance characteristics of self-compacting concrete such as slump flow; V-funnel and L-Box are presented. Further, compressive strength at the ages of 7, 28, and 60 days was also determined and results were concluded, 8% replacement of cement by silica fume have best effect on compressive strength of concrete. Addition of silica fume and lime develop filling and passing ability of concrete. There is continuous gain of strength up to sixty days due to slow pozzolanic reactions of Portland Pozzolana cement. Different types of SCC having different compressive strength can be prepared by different combination of cement, lime and silica fume.

V. CONCLUSION

Till the date study is mainly focused on the self-compacting concrete having strength up to M70. Efforts for designing self-compacting concrete of strength greater than M70 would help in casting high strength structural members for high rise building and reducing size of structural member for same loading, thus saving valuable space for effective use. There is insufficient research on high strength self-compacting concrete.

REFERENCES

[1] Yatin H Patel, P. J. Patel, Prof.Jignesh M Patel, Dr. H S Patel, "Study on Durability of High Performance Concrete with Alccofine and Fly Ash". International Journal of Advanced Engineering Research and Studies, Vol. 2, Issue 3, pp. 154-157, April-June,2013.

[2] P. J. Patel & H. S. Patel, "Effect on compressive and flexural strength of high performance concrete incorporating Alccofine and Fly Ash , International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD)ISSN 2249-6866Vol. 3, Issue 2, 2013, 109-114.

[3] Suthar, B.K.Shah and P.J.Patel , "Study on Effect of Alccofine and Fly Ash Addition on the Mechanical properties of High Performance Concrete"International Journal for Scientific Research and Development pp 464-467 vol.1,issue 3,2013 ISSN(online) : 2321-0613 .

[4] Mayur B. Vanjare, Shriram H. Mahure, "Experimental Investigation On Self Compacting Concrete Using Cement Kiln Dust",Department of Civil Engineering, Babasaheb Naik College of Engineering Pusad, Amravati University, India, International Journal of Engineering Research and Applications (IJERA) Vol. 2 Issue 1, January- 2013, ISSN: 2278-0181

[5] hiyaneshwaran, S., Ramanathan, P., Baskar, I. and Venkatasubramani, R., "Study on Durability Characteristics of Self-Compacting Concrete with Fly Ash", Jordan Journal of Civil Engineering, Vol. 7, No. 3, 2013.

[6] Raharjo. D, Subakti. A, Tavio "Mixed Concrete Optimization Using Fly Ash, Silica Fume and Iron Slag on the SCC's compressive strength", The 2nd International Conference on Rehabilitation and Maintenance in Civil Engineering, Vol. 54, pp. 827 – 839, 2013.

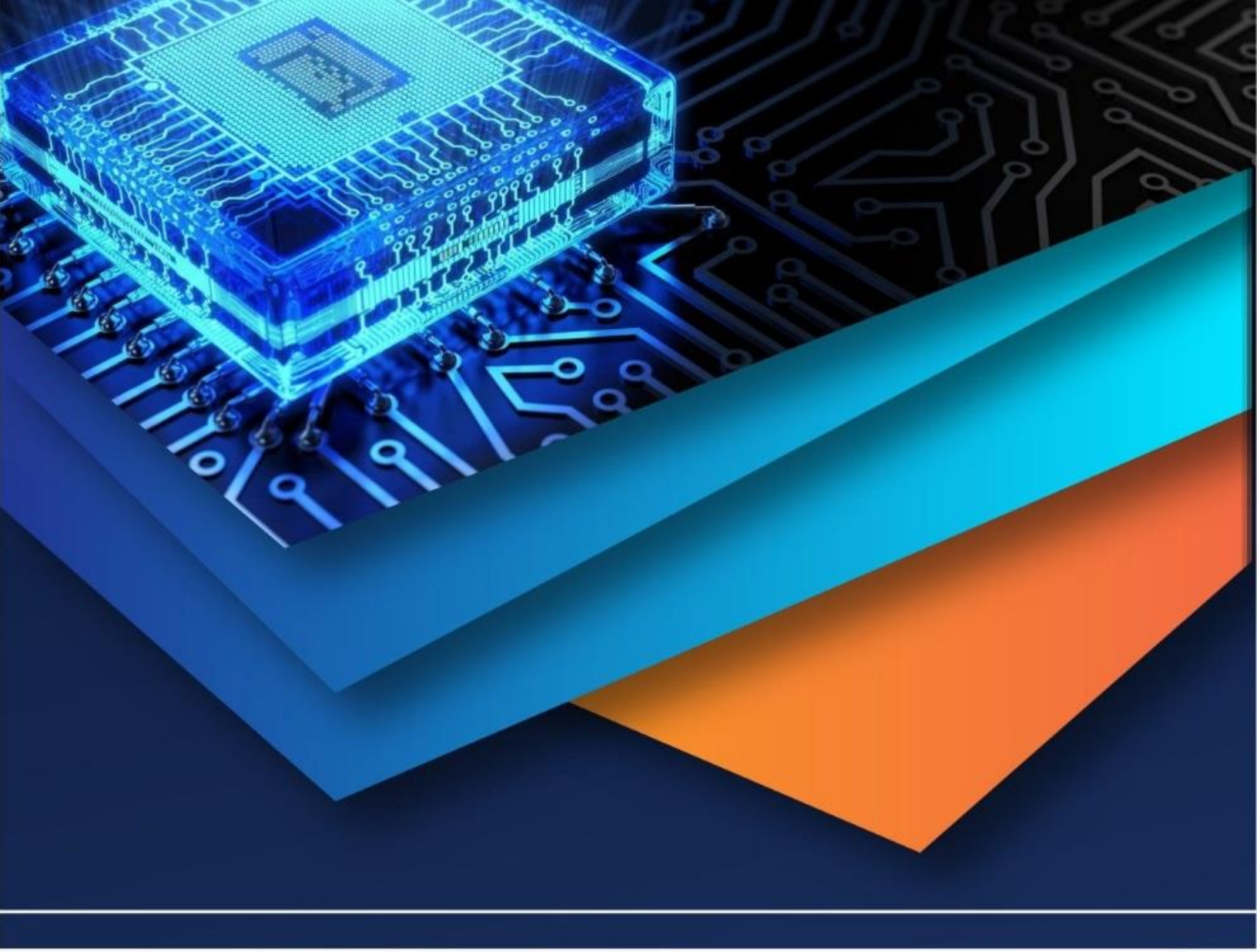
[7] M.S. Pawar1, A.C. Saoji,"Effect of Alccofine on Self Compacting Concrete",The International Journal Of Engineering And Science (IJES), Vol. 2,Issue 6,pp. 05-09, 2013

[8] Arivalagan S,"Experimental Analysis of Self Compacting Concrete Incorporating different range of High-Volumes of Class F Fly Ash", Scholars Journal of Engineering and Technology (SJET), Sch. J. Eng. Tech., Vol. 1(3), 104-111, 2013.

[9] BernardinusHerbudimana and AdhiMulyawan Saptajia,."Self-Compacting Concrete with Recycled Traditional Roof Tile Powder", The 2nd International Conference on Rehabilitation and Maintenance in Civil Engineering Procedia Engineering, Vol. 54, pp. 805 – 816, 2013.

[10] Ali Hussein Hameed, "Effect of Super plasticizer Dosage on Workability of Self Compacting Concrete", Diyala Journal of Engineering Sciences, Vol. 05, No. 02, pp. 66-81, December 2012.

[11] Dubey Sanjay Kumar and Chandak Rajeev, Dept. of Civil Engineering, Jabalpur Engineering College, Jabalpur, India, "Development of Self Compacting Concrete by use of Portland Pozzolana Cement, Hydrated Lime and Silica Fume", ISCA Journal of Engineering Sciences ISCA J. Engineering Sci.,Vol. 1(1), pp. 35-39, July (2012).



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