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Experimental Investigation on Self Compaction Concrete

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ABSTRACT: This paper gives a review on Self Compacting Concrete (SCC) to be made using various Mineral Admixtures and Fibers. In current scenario of construction industries due to demand in the construction of large and complex structures, which often leads to difficult concreting conditions. When large quantity of heavy reinforcement is to be placed in a reinforced concrete (RC) member, it is difficult to ensure fully compacted without voids or honeycombs. Compaction by manual or by mechanical vibrators is very difficult in this situation. That leads to the invention of new type of concrete named as self-compacting concrete (SCC). This type of concrete flows easily around the reinforcement and into all corners of the formwork. Self-compacting concrete describes a concrete with the ability to compact itself only by means of its own weight without the requirement of vibration. Self – compacting concrete also known as Self-consolidating Concrete or Self Compacting High Performance Concrete. It is very fluid and can pass around obstructions and fill all the nooks and corners without the risk of either mortar or other ingredients of concrete separating out, at the same time there are no entrapped air or rock pockets. This type of concrete mixture does not require any compaction and it saves time, labour and energy. This review paper explains the utilization of fibers and various mineral admixtures in the properties of Self Compacting Concrete.

KEYWORDS : Self Compacting Concrete, Mix design, Compressive Strength.

1. INTRODUCTION

Self-compacting concrete (SCC), requiring no consolidation work at site or concrete plants, has been developed in Japan to improve the durability and uniformity of concrete in 1988 (Okamura and Ouchi, 1999). The mix composition is chosen to satisfy all performance criteria for the concrete in both the fresh and hardened states. There is no standard method for SCC mix design, and many academic institutions as well as admixture, ready-mixed, precast and contracting companies have developed their own mix proportioning methods. One of the most important differences between SCC and conventional concrete is the incorporation of a mineral admixture. Thus, many studies on the effects of mineral admixtures on the properties of SCC have been conducted. These studies show the advantage of mineral admixture usage in SCC, such as improved workability with reduced cement content (Poppe and Shutter, 2005). Since cement is the most expensive component of concrete, reducing cement content is an economical solution. Additionally, the mineral admixtures can improve particle packing and decrease the permeability of concrete. Therefore, the durability of concrete is also increased. Industrial by-products or waste materials such as limestone powder, fly ash and granulated blast furnace slag are generally used as mineral admixtures in SCC. Thereby, the workability of SCC is improved and the used amount of by-products or waste materials can be increased. Besides the economical benefits, such uses of by-products or waste materials in concrete reduce environmental pollution. Fly ash is an industrial by-product, generated from the combustion of coal in the thermal power plants. The increasing scarcity of raw materials and the urgent need to protect the environment against pollution has accentuated the significance of developing new building materials based on industrial waste generated from coal fired thermal power stations creating unmanageable disposal problems due to their potential to pollute the environment. Fly ash, when used as a mineral admixture in concrete, improves its strength and durability characteristics. Fly ash can be used either as an admixture or as a partial replacement of cement. It can also be used as a partial replacement of fine aggregates, as a total replacement of fine aggregates and as supplementary addition to achieve different properties of concrete.

II.LITERATURE REVIEW

DHIYANESHWARAN, S

Investigated the study of workability and durability characteristics of Self-Compacting Concrete (SCC) with Viscosity Modifying Admixture (VMA), and containing Class F fly ash. In this investigation, 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 were carried out by adopting a water-powder ratio of 0.45. Workability of the fresh concrete was determined by using tests such as: slump flow, T50, V-funnel, L-Box and U-box tests. The durability of concrete was tested by acid resistance, sulphate attack and saturated water absorption at the age of 28, 56 and 90 days.

RAISSA P. DOUGLAS

Investigating the behaviour of SCC containing Class F fly ash has been carried out. The fresh state properties of the concrete were assessed using methods of segregation and flow. Finally, some hardened state properties of the concrete were evaluated. The objective of this research was to improve the understanding of the properties of SCC containing Class F fly ash and to provide information that could be used towards the commercialisation of such a concrete. The results indicated that it is possible to develop a SCC containing Class F fly ash that is high performing in its fresh state. Furthermore, the addition of fly ash was shown to reduce superplasticizer dosage, increase workability, and increase overall chloride permeability resistance. In addition, it was determined that the difference of densities between the aggregate and matrix influence the results of a previously developed paste rheology model.

ARIVALAGAN S

Conducted an experimental program aimed at producing and evaluating SCC made with high volumes of fly ash. Nine SCC mixtures and one control concrete were investigated in this study. The content of the cementitious materials was maintained constant (400 kg/m³), while the water / cementitious 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. The results show that an economical self-compacting concrete could be successfully developed by incorporating high-volumes of Class F fly ash. The project investigated the making of self-compacting concrete more affordable for the construction market by replacing high volumes of Portland cement by fly ash. The study focused on comparison of fresh properties of SCC containing varying amounts of fly ash with that containing commercially available admixture. Test results proved the feasibility to develop low cost SCC using Class F fly ash.

R GETTU

Developed a mix design methodology self-compacting concrete such concretes based on four steps where simple test procedures were used. Self-compacting concrete with a 90-day compressive strength of about 100 MPa was obtained.

DEEPA BALAKRISHNAN .S

Investigated the production of high volume fly ash self-compacting concrete with 12.5%, 18.75%, 25%, and 37.5% of the cement (by mass) replaced by fly ash and 6.25%, 12.5% and 25% of the cement replaced by dolomite powder. For these mixtures compressive strength (cube) was studied at 7thday, 28th day and 90th days with same water powder ratio (0.33). The test results for acceptance characteristics of self-compacting concrete such as slump flow test, J-ring test, V-funnel test and L-box test were presented. The mixes were then tested for other mechanical properties like, cube compressive strength at 7th day, 28th day, and 90th day, cylinder compressive strength at 28th day, split tensile strength, and flexural strength at 28th day. For all levels of cement replacement concrete achieved superior performance in the fresh and mechanical tests compared with the reference mixture.

DR. SALAHALDEIN ALSADEY

Conducted an experimental investigation to determine the optimum dosage for the admixtures and to study the effect of over dosage of the mentioned admixtures. Concrete mixes with SP dosages of 600, 800, 1000 and 1200 ml/100kg of cement were prepared, together with one control mixes. After casting, normal curing was carried out on the concrete samples. Properties such as compressive strength were determined, besides determining the workability of the fresh concrete. However, compressive strength was improved by dosage 1.0 % of SP after 28 days curing was 55 N/mm², which is higher than that of control concrete.

TARUN R. NAIK

Presented a paper on development, properties, and advantages and disadvantages of using high-strength self-consolidating concrete in the construction industry. It also presents results of a study recently completed for manufacturing economical high-strength self-consolidating concrete containing high-volumes of fly ash. In this study, Portland cement was replaced by Class C fly ash in the range of 35 to 55% by the mass of cement. The results of fresh and hardened properties of concrete show that the use of high-volumes of Class C fly ash in self-consolidating concrete drastically reduces the requirements for superplasticizer (HRWRA) and viscosity modifying agent (VMA) compared with the normal dosage for such admixtures in self-consolidating concrete. The results further indicate that economical self-consolidating concrete with 28-day strengths up to 9,000 psi can be made using high-volumes of fly ash. Such concretes can be used for a wide range of applications from cast-in-place to pre-cast concrete construction.

LIANA IUREŞ AND CORNELIU BOB

Presented a paper on the characteristics of the self-compacting concretes, their advantages and disadvantages when they are used in buildings. Due to its properties and composition, the self-compacting concrete is described here as being one of the future friendly environmental materials for buildings. Tests concerning to obtaining a self-compacting concrete, together with the specific fresh concrete properties tests, are described.

N R GAYWALA, D B RAIJIWALA

Presented the progress of the research on different hardened properties of Self Compacting Concrete using the Ordinary Portland Cement of "Ultratech" make and low-calcium fly ash from Birla Glass, Kosamba, Gujarat, as binder materials in making the concrete mixes along with other ingredients locally available in Gujarat. The hardened properties like compressive strength, split tensile strength, flexural strength and impact strength were found in experimental work and were compared with M25 grade of concrete.

III. EXPERIMENTAL PROGRAM

A. Materials properties:

Cement

Cement has different properties and characteristics which depend upon their chemical compositions. By changing in fineness of grinding, oxide compositions cement has exhibit different properties and different kind of cement. The use of additives, changing chemical composition, and use of different raw materials have resulted in the availability of many types of cements.

Cement used in the experimental work is ORDINARY PORTLAND CEMENT of 43 grades conforming to **IS: 8112/1989**. The physical properties & chemical properties of the cement obtained on conducting appropriate tests are as per **IS: 269/4831** and the requirements as per **IS: 8112/1989**.

AGGREGATES

Aggregates are the important constituents in concrete. They give body to the concrete, reduce shrinkage and effect economy. The fact that the aggregates occupy 70-80 present of volume of concrete, it has some impact on various characteristics and properties of concrete. Earlier, aggregates were considered as chemically inert material but now it has been recognised that some of the aggregate are chemical active and also certain aggregates ere exhibit chemical bond at the interface of aggregate and paste.

COARSE AGGREGATE

Crushed granite of 12.5mm passing and 10mm retaining size are used as coarse aggregate. The sieve analysis of aggregates confirms to the specifications of **IS: 383-1970**.

FINE AGGREGATE

Fine aggregate which satisfied the required properties for experimental work and conforms to zone as per the specification of **IS: 383-1970**.

CHEMICAL ADMIXTURE

Polycarboxylate Ester based superplasticizer Aura mix – 300 (FOSROC) was used.



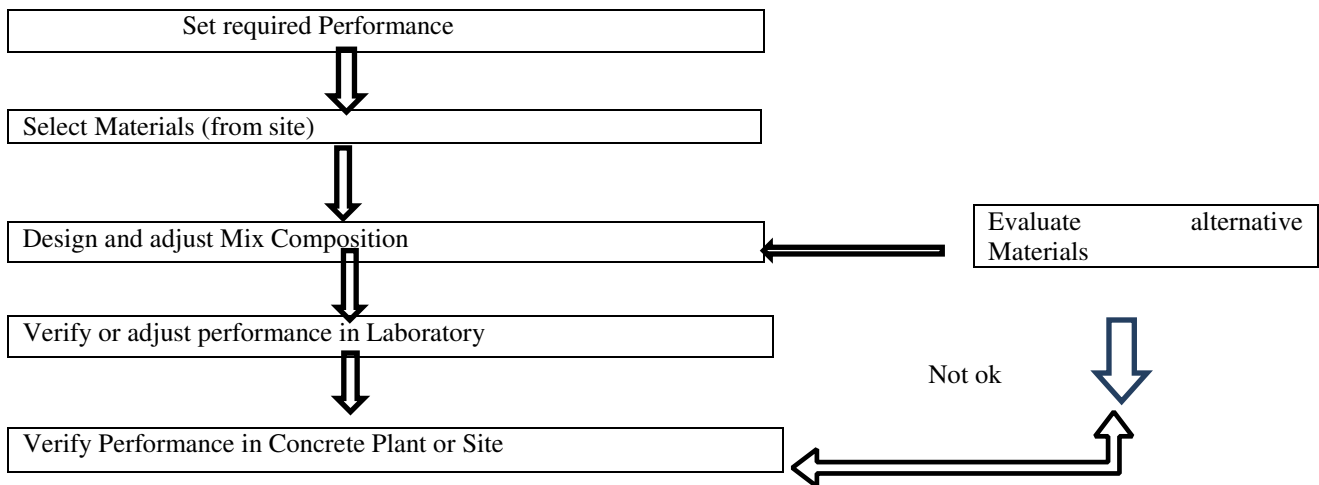
WATER

Potable water is used for mixing and curing of concrete

B.Mix Design:

Designing an approximate mix proportion to suit the needs of standard and high strength SCC with different types of aggregates is to be developed. The strength of SCC is provided by the aggregate binding the paste in the hardened state, while the workability of SCC is provided by the binding paste at fresh state.

Flow-chart describing the procedure for design of SCC mix



Properties of Fresh Scc:

Fresh SCC must possess the key properties including filling ability, passing ability and resistance to segregation at required levels. The filling ability is the ability of the SCC to flow into all spaces within the formwork under its own weight. Without vibrating the concrete, SCC has to fill any space within the formwork and it has to flow in horizontal and vertical directions without keeping air entrapped inside the concrete or at the surface. Passing ability is the ability of the SCC to flow through tight openings such as spaces between steel reinforcing bars, under its own weight. Passing ability is required to guarantee a homogenous distribution of the components of SCC in the vicinity of obstacles. The resistance to segregation is the resistance of the components of SCC to migration or separation and remains uniform throughout the process of transport and placing. To satisfy these conditions, The European Federation of Specialist Construction Chemicals and Concrete Systems. (EFNARC) has formulated certain test procedures.

List of test methods for workability properties of SCC by EFNARC

S.No	Methods	Property
i	Slump-flow by Abrams cone	Filling ability
ii	V-funnel	Filling ability
iii	V-funnel at T 5 minutes	Segregation resistance
iv	L-box	Passing ability
v	U-box	Passing ability

Workability criteria for the Fresh SCC:

These requirements are to be fulfilled at the time of placing. Likely changes in workability during transport should be taken into account in production. Typical acceptance criteria for Self-compacting Concrete with a maximum aggregate size up to 20 mm are shown in givenTable .



Acceptance criteria for Self-compacting Concrete.

S. No	Method	Unit	Typical range of values	
			Minimum	Maximum
i	Slump flow by Abrams cone	mm	650	800
ii	V-funnel	mm	612	
iii	Time increase, V-funnel at T5 minutes	sec	0+3	
iv	L-box	h2/h1	0,8	1,0
v	U-b (h2-h1)	(h2-h1)mm	0	30

Hardened Concrete Properties of Scc:

The hardened properties of SCC such as Compressive strength, Durability can be studied according to the use of admixtures in the SCC.

IV. EXPERIMENTAL RESULTS

TEST		RESULT
SLUMP FLOW TEST		T 50 = 4.567 SECOND SPREAD FLOW = 728mm
L BOX TEST		P _L = 0.833
V BOX TEST		T _V = 7 SECOND
U BOX TEST		H1 – H2 = 12mm
MECHANICAL STRENGTH TEST	7 DAYS	39.7 mpa
	14 DAYS	41.13 mpa
	28 DAYS	49.5 mpa

IV.CONCLUSION

Based on investigation conducted for the study of behaviour of SCC the following conclusion are arrived.

1. As no specific mix design procedures for SCC are available, mix design can be done with conventional BIS method and suitable adjustment can be done as per the guidelines provided by different agencies
2. Trail mixes have to be made for maintaining flow ability, self-compatibility and obstruction clearance.



REFERENCES

1. Dhiyaneshwaran, S., Ramanathan, P., Baskar, I. and Venkatasubramani, R.- 'Study on Durability Characteristics of Self-Compacting Concrete with Fly Ash' - Jordan Journal of Civil Engineering, Volume 7, No. 3, 2013.
2. Raissa P. Douglas – 'Properties of Self-Consolidating Concrete Containing Type F Fly Ash' - PCA R&D Serial No. 2619.
3. 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., 2013; 1(3):104-111.
4. Miao Liu – 'Wider Application of Additions in Self-Compacting Concrete' – Thesis submitted to University College London for the degree of Doctor of Philosophy.
5. R Gettu, J Izquierdo, P C C Gomes, A Josa – 'Development of high-strength self-compacting concrete with fly ash: a four-step experimental methodology' - 27th Conference on Our World in Concrete & Structures: 29 - 30 August 2002, Singapore. Article Online Id: 100027026.
6. Deepa Balakrishnan S., Paulose K.C. – 'Workability and strength characteristics of self-compacting concrete containing fly ash and dolomite powder' – American Journal of Engineering Research (AJER) e-ISSN: 2320-0847, p-ISSN: 2320-0936 Volume -2.
7. Dr. SalahaldeenAlsadey – 'Influence of Superplasticizer on Concrete' – International Journal of Research in Engineering and Technology (IJERT) Vol. 1, No. 3, 2012, ISSN – 2277 4378.
8. Tarun R. Naik, Yoon-moon Chun, Rakesh Kumar and Bruce W. Ramme – 'Development of High-Strength Self-Consolidating Concrete' – Report No. CBU-2003-14, REP-508, Department of Civil Engineering and Mechanics, College of Engineering and Applied Science, The University of Wisconsin – Milwaukee.
9. RužaOkrajnov-Bajić, DejanVasović – 'Self-compacting concrete and its application in contemporary architectural practise' – SPATIUM International Review UDK 666.97.033.14, No. 20, September 2009, P. 28-34 Review paper.
10. Okamura, Hajime, Ouchi, Masahiro – 'Self-Compacting Concrete' – Journal of Advanced Concrete Technology, 1(1): 5 – 15, 2003.
11. Liana Iureş and Corneliu Bob – 'The Future Concrete: Self-Compacting Concrete' – Bul. Inst. Polit. Iaşi, t. LVI (LX), f. 1, 2010.
12. Ms. Priyanka P. Naik, Prof. M. R. Vyawahare – 'Comparative Study of Effect of Silica Fume and Quarry Dust on Strength of Self-Compacting Concrete' – International Journal of Engineering Research and Applications (IJERA), ISSN: 2248-9622, Vol. 3, Issue 3, May-Jun 2013, pp.1497-1500.
13. Md nor Atan, Hanizam Awang – 'The Compressive and Flexural Strengths of Self-Compacting Concrete Using Raw Rice Husk Ash' – Journal of Engineering Science and Technology, Vol. 6, No. 6 (2011) 720 – 732.
14. Paratibha Aggarwal, Rafat Siddique, Yogesh Aggarwal, Surinder M Gupta – 'Self -Compacting Concrete - Procedure for Mix Design' – Leonardo Electronic Journal of Practices and Technologies ISSN 1583-1078 Issue 12, January-June 2008 p. 15-24.
15. ACM Centre, University of Paisley, UK – 'Measurement of properties of fresh self-compacting concrete' – European Union Growth Contract No. G6RD-CT-2001-00580, November 2001 – October 2004, Final Report, September 2005.
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