Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 02, February-2016

Study on Self Compacting Concrete – A Review

K. Sathish Raja[1]
Assistant Professor,
Department of Civil Engineering,
Sri Ramakrishna Institute of Technology,
Coimbatore, India

Dinesh A
Assistant Professor,
Department of Civil Engineering,
Sri Ramakrishna Institute of Technology,
Coimbatore, India

Abstract **- Concrete is one of the versatile construction materials which are used worldwide. Self Compacting Concrete is a type of concrete which is capable of flowing into the form work uniformly, without segregation and bleeding, better finishes, easier placement, thinner concrete sections, no vibration, safer working environment without any application of vibration. Due to many advantages like faster construction, reduction in site for thinner concrete sections, improved durability, suitability for congested reinforcement; this concrete becomes popular in civil engineering construction. And also day by day the waste materials like fly-ash, silica fume, marble powder etc. from the industries is increasing in India. Hence, a review is presented to make use of those waste products in the self compacting concrete. This study mainly focuses on the self compacting concrete which is prepared by partially replacing cement with industrial by-products. To understand the behavior of the self compacting concrete, the fresh and mechanical properties along with the durability characteristics have been discussed.**

Keywords: Self compacting concrete, Industrial by-products, fresh properties, mechanical properties, durability

INTRODUCTION

SCC is basically a concrete which is capable of flowing into the form work, without segregation and bleeding, reduces manpower, better finishes, easier placement, better durability, thinner concrete sections, lesser noise levels, no vibration, safer working environment, to fill uniformly and completely every corner of it by its own weight without any application of vibration or other mechanism during placing of concrete. Due to many advantages like faster construction, reduction in site for thinner concrete sections, improved durability, suitability for congested reinforcement; this concrete becomes popular in civil engineering construction. The advantages of SCC make this concrete more desirable all over the world which includes faster construction. Such concrete should have low yield value to ensure high flow ability, a moderate viscosity to resist segregation and bleeding, and must maintain its homogeneity during transportation, and placing to ensure adequate structural performance and long term durability. It has three essential fresh concrete properties filling ability, passing ability and segregation resistance. SCC can save labour, eliminate consolidation noise and lead to innovative construction methods. The demand of Self Compacting Concrete (SCC) is growing rapidly due to the shortage of skilled labours; it is also proved to be more economical, durable and termed as high performance concrete. The quality of concrete construction is of utmost importance in order to have a durable concrete structure and one of the reasons to make a durable structure is proper compaction which requires skilled labors but due to shortage of skilled labors full compaction. The solution to this is the use of self-compacting concrete which compacts in every corner of formwork. The use of SCC is rising steadily over the years because of their advantages and many scientists and organizations carried out research on properties of SCC .It is the concrete which is fully compacted without segregation without external energy. SCC has economic, social and environmental benefits over conventionally vibrated concrete. SCC is made from the same basic constituents as conventional concrete but with the addition of a viscosity modifying admixture and high levels of super-plasticizing admixtures to impart high workability.

Review of Literature

Prof. Shriram H. Mahure (2014)[1] had studied about the fresh and hardened properties of self compacting concrete using Fly ash as partial replacement of cement in different percentages in addition to filler. The fresh properties have been determined by computing the Slump value, V-funnel value and L-box value and the hardened properties are determined by computing the Compressive strength, Flexural strength and Split tensile strength of the specimens. It is observed that the fresh properties of concrete shows an acceptable value upto 30% replacement of fly ash and also the hardened properties of concrete is significantly improved when compared to the conventional mix.

Sherif.A.Khafaga (2014)[2] had investigated about the fresh and hardened properties of self compacting concrete using recycled concrete aggregate as both coarse and fine aggregates. The concrete were prepared by replacing 25%, 50% and 75% of coarse and fine recycled aggregates. The study consisted of thirteen concrete mixes which reflect the key variables and their effects on the fresh and hardened properties of the produced SCC. The results indicated that the properties of the recycled aggregates SCCs have only a slight difference, in their properties from the natural aggregates SCC. The recycled concrete aggregate as both coarse and fine aggregates can successfully be used for making of SCC.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 02, February-2016

M.Iyappan (2014) [3] had investigated about the fresh and hardened properties of self compacting concrete in which the Portland cement is partially replaced with nano silica. In addition the durability properties of the concrete like acid resistance using HCL were also examined with three different percentages of nano-silica. He concluded that 2% and 4% replacement of nano silica results in improved hardened properties where as 6% replacement of nano silica results in reduction in hardened properties of concrete. He also obtained that 4% replacement of nano silica results in better acid resistance of the concrete.

B.H.V.Pai (2014)[4] had investigated about the self compacting concrete where Ground Granulated Blast furnace slag (GGBS) and Silica fume (SF) is partially replaced with cement. He concluded that the flowing ability and passing ability of the concrete were satisfied with the EFNARC guidelines. He observed that the GGBS based self compacting concrete exhibits improved mechanical properties compared to the SF based self compacting concrete. He also analyzed that GGBS can be replaced up to 80% to achieve strength of 30Mpa.

Rafat Siddique (2013) [5] investigated about the strength and durability properties of Self-Compacting concrete which is obtained by partially replacing natural sand with waste foundry sand (WFS). He replaced the Natural sand with WFS by 0%, 10%, 15% and 20% in terms of weight. He studied the fresh properties of concrete before computing the strength parameters. Compressive strength and split tensile strength test were obtained at the age of 7, 28, and 56 days and to determine the durability of the concrete, sulphate resistance was evaluated at the age of 7, 28 and 56 days and Rapid Chloride Permeability test was conducted at age of 28 days. Test results have shown that there is increase in compressive strength and split tensile strength of self-compacting concrete and also the durability properties have been improved by incorporating waste foundry sand as a replacement of Natural sand.

Prajapati Krishnapal (2013) [6] had studied about the self compacting concrete containing different percentages of fly-ash such as 10%, 20% and 30% as replacement of cement by its weight where the quantities of fine aggregate and coarse aggregate are kept constant. The fresh properties of the concretes such as slump value, V-funnel and L-box value which in turn used to determine the flow and passing ability of the concrete were obtained from EFNARC Guidelines. He observed that the addition of fly-ash in concrete results in decrease in super-plasticizer content for better workability. He concluded that with increase in fly-ash content in concrete results in decrease in strength of concrete at the age of 28 days.

Prof.Shriram.H (2013) [7] had studied about the fresh and hardened properties of self compacting concrete using kiln dust as partial replacement for cement. He had conducted slump flow test, V-funnel test and L-box test to determine the fresh properties of concrete and compressive strength test, split tensile test, flexural strength test to determine the hardened properties of concrete. He concluded that fresh properties of concrete show an acceptable value till 20% replacement of kiln dust and above 20% the values gets decreased. He also concluded that with the replacement of dust kiln the hardened properties of concrete such as compressive strength, flexural strength and split tensile strength had been increased at the age of 91 days compared to 28 day strength.

Abbas Al-Ameeri (2013)[8] had investigated about the self compacting concrete in which the steel fiber is partially replaced. He studied the fresh properties that comprise of flow ability, passing ability and viscosity and computed the hardened properties like compressive strength, split tensile strength and flexural strength of the specimens. He concluded that with the increase in fiber content the workability of the concrete is reduced. He also concluded that at an optimum percentage of 0.75% to 1% replacement of steel fibers, the compressive strength, split tensile strength and flexural strength characteristics of the self compacting concrete had been improved.

B.Beerlingegowda (2013)[9] had studied about the properties of self compacting concrete which is obtained by partially replacing cement with limestone powder. He computed the fresh properties and hardened properties of the concrete. He also found the durability characteristics of the concrete. In this study, he concluded that with 30% replacement of limestone powder in the concrete results in 20% increase in the workability and mechanical properties of the concrete. He also concluded that with 20% replacement of limestone powder results in increase in acid resistance and sulphate resistance of the concrete. He also observed that the chloride content in the specimen is decreased with increase in depth of the specimen.

Dhiyaneshwaran.S (2013)[10] had investigated about the workability and durability characteristics of self compacting concrete containing Viscosity modifying admixture and class F fly-ash. The workability of the concrete is determined by conducting slump flow, V-funnel, L-box and U-box tests and the durability of the concrete is computed using acid resistance, sulphate attack and saturated water absorption test. He concluded that 30% replacement of fly-ash is optimum. He observed that fresh properties, mechanical properties and the durability properties of the concrete have been improved compared to the convention mix of the concrete

J. Guru Jawahar (2012)[11] focused on finding the properties of self compacting concrete by replacing the aggregate with crushed granite stones of size 20mm and 10mm. The concrete is obtained by replacing the cement with the class F fly ash by 35% and 0.36 water/cementitious ratio by weight. The fresh properties of the concrete were obtained by conducting workability test, V-funnel and L-box test. The test is conducted for different type of mixes. The test reveals that some mixes are successful in slump flow test they were failed in V-funnel and L-box test. He also concluded about the range of coarse aggregate content suitable for particular coarse aggregate blending in self compacting concrete.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 02, February-2016

M.A.Farediwala (2012)[12] presented an experimental research on the workability and compressive strength of self-compacting concrete containing water binder ratios of 0.40 and 0.50. In addition the concrete is treated with different dosage of super-plasticizer based on carboxylic with fly-ash. To evaluate the passing ability of the self compacting concrete, slump flow test, V-funnel test and L-box test had been conducted. He also concluded that when the water cement ratio was lower, the effect of fly-ash and dosage of super-plasticizer should be higher to improve the compressive strength of the concrete. He observed that the compressive strength of concrete mixture containing new dosage of super-plasticizer could be estimated from the workability tests itself.

Benmounah Abdelbaki (2011)[13] had investigated about the effect of marble powder content in self-compacting concrete at the fresh and hardened state. The fresh properties of the concrete are identified by conducting the workability test, the V funnel flow test and viscosity test and the hardened properties are determined by computing the compressive strength of the specimen at the age of 28 days. The increase in marble powder in concrete shows an improvement in fresh properties of concrete with decreased v-funnel flow time and increased slump and viscosity values but with the increase in marble powder content in the concrete results in decrease in the compressive strength of the specimens.

O. Gencel (2011)[14] had studied about the fresh and hardened properties of SCC with fly ash reinforced with the type of monofilament polypropylene fibers. The water/cement ratio, fly ash content and admixtures were kept constant to determine the fresh and hardened properties of concrete. To evaluate the fluidity, filling ability and segregation risk of the fresh concrete, tests like Slump flow, J ring, V funnel and air content tests were conducted and to determine the hardened properties of concrete tests like compressive strength, splitting tensile strength, flexural strength, pulse velocity and elasticity modulus test were conducted. If there is uniform distribution of fibres, the problems in mixing and batching of concrete are minimized. He finally concluded that the usage of Polypropylene fibers in concrete upgraded the fresh and mechanical properties of SCC significantly.

Anant patel (2011)[15] had studied about the Compressive strength and Modulus of elasticity of self compacting concrete which contains admixtures and different content of cement and fly-ash. From the test results it is obtained that when water-powder ratio is lower, flow obtained for concrete is also lower. He observed that increase in cement content results in cohesive mix and high compressive strength of the specimens. He also concluded that modulus of elasticity of the concrete containing fly-ash is almost same as the modulus of elasticity of the conventional mix. Finally he observed that the effect of water-powder ratio, cement content and fly-ash plays a significant role in formation of self compacting concrete and its strength.

CONCLUSION

Self compacting concrete is the only type of concrete where the vibration effect is ignored, thus making the environment protection near the construction site and also reduce the exposure of workers to vibration. The advantage of SCC makes it desirable all over the world. Fifteen review papers on the usage of industrial waste products in the self compacting concrete had been discussed. From the review, it is concluded that the industrial waste products can be effectively used as a replacement material in self compacting concrete. It is also understood that different products exhibits different properties at the fresh and hardened state. It is also clearly evident that the durability characteristics of the concrete are significantly improved with the partial replacement of materials.

REFERENCES

[1] Rafat SIDDIQUE, Ravinder kaur SANDHU, “Properties of self compacting concrete incorporating waste foundry sand”, Leonardo journal of sciences, Issue 23, July-Dec 2013, pp105-124.
[2] Prof. Shriram H. Mahure, Dr. V. M. Mohitkar, Dr.K.Ravi, “Effect of fly ash on fresh and hardened properties of self compacting concrete” International Journal of Engineering sciences & Research Technology, Feb 2014, pp944-948.
[3] Bouziani Tayeb , Benmounah Abdelbaki, Bederina Madani and Lamara Mohamed, “Effect of Marble Powder on the Properties of Self-Compacting Sand Concrete”, the Open Construction and Building Technology Journal, 2011, 5, pp25-29
[4] O. Gencel, C. Ozel, W. Brostow and G. Mart´ınez-Barrera, ”Mechanical properties of self-compacting concrete reinforced with polypropylene fibres”, Materials Research Innovations,2011,Vol 15, No.3, pp215-225
[5] Sherif A. Khafaga, ”Production of High strength self compacting concrete using recycled concrete as fine and/or coarse aggregate”, World applied sciences Journal 29 (4): pp 465-474, 2014.
[6] Andreas Leemann, Frank Winnefeld, “The effect of viscosity modifying agents on mortar and concrete”, Cement & Concrete Composites, 29, 2007, pp 341–349.
[7] J.Guru Jawahar, M.M. Premchand, C.Sashidhar, I.V.Ramana Reddy and J.Annie peter, “Effect of coarse aggregate blending on fresh properties of self compacting concrete” International journal of advances in Engineering and Technology, May 2012, Vol 3, Issue 2, pp 455-466.
[8] Anant Patel, Prashant Bhuva, Elizabeth George, Darshana Bhatt, “Compressive strength and Modulus of Elasticity of self compacting concrete”, National conference on Recent trends in Engineering and Technology,2011.
[9] M.K. Rahman, M.H. Baluch, M.A. Malik, “Thixotropic behavior of self-compacting concrete with different mineral admixtures”, Construction and building materials, 50, 2014, pp 710-717.
[10] M.A.FArediwala, M.A.Jamnu, “Relation between workability and compressive strength of self compacting concrete”, International Journal of Advanced Engineering Research and studies, Vol I, Issue 3, pp 9-11.
[11] Prof.Aijaz Ahmad Zende, Dr.R.B.Khadirnaikar, “An overview of the properties of the self compacting concrete”, IOSR-JMCE, pp 35-43.
[12] Prajapati Krishnapal, Yadav.R.K. and Chandak Rajeev, “Strength Characteristics of self compacting concrete containing fly ash”, Research Journal of Engineering sciences, June (2013),Vol. 2(6), pp 1-5.
[13] M.Iyappan and Dr.A.Jagannathan, “High strength self compacting concrete with nano silica”, International Journal of Emerging Trends in Engineering and Development, 2014, Issue 4, Vol 5, pp 163-168.
[14] Prof. Shriram H.Mahure, Dr.V.M.Mohitkar, “Effect of mineral admixture on fresh and hardened properties of self compacting concrete”, International Journal of Innovative Research in Science, Engineering and Technology, 2013, Issue 10, Vol 2, pp 5585-5592.
[15] Abbas Al-Ameeri, “The effect of steel fiber on some mechanical properties of self compacting concrete”, American Journal of civil engineering, 2013, Issue 3, pp 102-110.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 02, February-2016

[16] B.Beerlingegowda, V.D.Gundakalle, "The effect of addition of lime stone powder on the properties of self compacting concrete" International Journal of Innovative Research in Science, Engineering and Technology, 2013,Vol 2, Issue 9, pp 4996-5004.
[17] B.H.V.Pai, M.Nandy, A.Krishnamoorthy, P.K.Sarkar and C.Pramukh Ganapathy, " Experimental Study on self compacting concrete containing Industrial by-products", European scientific Journal, April 2014, Vol.10, pp 292-300.
[18] Dhiyaneshwaran.S , Ramanathan,.P, Baskar.I and Venkatasubramani.R. " Study on durability characteristics of self compacting concrete containing fly-ash". Journal of civil Engineering2013,Vol. 7, Issue 3, pp 342-353.