An Audit of Self-Compacting Concrete

Bilal Ahmad[1], Deepak Kumar[2], and Rahul Kumar[3]
[1]*Scholar, Sanskar College of Engineering and Technology, Ghaziabad, Uttar Pradesh, India*
[2]*Assistant Professor, Sanskar College of Engineering and Technology, Ghaziabad, Uttar Pradesh, India*
[3]*Assistant Professor, Sanskar College of Engineering and Technology, Ghaziabad, Uttar Pradesh, India*

***Abstract*- Following research paper gives a report or review on the Self-Compacting Concrete (SCC) so that can be made useful along with fibers and admixtures and also reduces the noise level that is occur due to the vibration in case of conventional or normal concrete. At current scenario of the construction fields, industries due to the demand of construct large 7 complex structure, they face the major problem related to the concrete. That's why we give an audit about the self-compacting concrete to explain and derives the beneficial fundamentals of self-compacting concrete as compared to the conventional concrete. As we all know that the emergence and adoption of self-compacting concrete has been considered as one of the most important innovations in the construction area for concrete. Also, when the heavy and large quantity of reinforcement is to be placed in RC member, it is quite hard to ensure the fully compaction of concrete without any air voids. Compaction of concrete becomes very tough in this case to remove the air voids. That's why there is a new termed of concrete introduced as "self-compacting concrete". This type of concrete flow easily around the r/f and fill up the formwork. Self-compacting concrete also called as "Self-consolidating concrete". This type of concrete mix does not require any compaction or vibration to fill the formwork and also it saves time and construction can be done quickly. This research paper explains the applications of self-compacting concrete.**

Index Terms*- *Self-compacting concrete, durability, workability, L-B0x, U-box, V-funnel, compaction, segregation, stability, self-consolidating concrete, lubricating, voids, dosage strength, re-design, filling ability, passing ability, viscosity, etc.

I. INTRODUCTION

Self -Compacting Concrete (SCC) is also known as "self-consolidating concrete". The emergence of the self-compacting concrete has considered as one of the most significant innovations in the construction industry in the recent years. There is no need of any compaction and vibration process with this concrete during the casting phase to effectively fill the pores between reinforcements and the corners of the molds. The utilization of the self-compacting concrete can be done in the both cases such as pre-cast as well as on-site placement of concrete. The purpose of the utilization of self-compacting concrete is to construct long-lasting structures with reduced labor cost and pollution levels related with the consolidating processes. The self-compacting concrete has various applications and advantages such as its self-compacting nature to fill up the forms. Self-compacting concrete is concrete that eliminates the need of any compaction because it can easily fill their form work due to its own weight. There has been a revolution in the concrete industry by the advent of self-compacting concrete (SCC). The utilization of the self-compacting concrete during placement and compaction technique can result into the reduction noise level because there is no need of any compacting and placing equipment. The use of the SCC can reduces the time period of construction process along with it can easily capable of filling the most challenging and difficult forms. The self-compacting concrete also increases the durability by reducing the air voids or pores.

II. HISTORY OF SELF-COMPACTING CONCRETE

Self-compacting concrete was first developed in 1988 in oreder to achieve the durable concrete structures. As compared to the normal vibrated concrete, the self-compacting concrete (SCC) usually contains a better durability potential, even when the mixtures have larger water contents in concrete. The permeability of the self-compacting concrete is typically lower than the ordinary concrete.

There were no practical methods by which fully compaction of a concrete was ever to be completely obtained on a site. Okamura and Ouchi at the University of Tokyo developed the first SCC that can be practicable. These type of concrete includes the comparatively better quality of concrete. It also reduces the On-site repairs and provide quick construction at a reasonable costs. Now, at current stage there is an increase in the large and complex structures in India. Hence, conventional concrete requires vibration and vibrating concrete in the congested construction locations leads to noise pollution as well as risky for the labour. At these places there is also a fluctuation in the durability as well as strength of concrete. There are various countries like Japan, United Kingdom, Sweden etc; where the knowledge of self-compacting concrete has been developed far better. But in India, this knowledge has to be developed and widespread.

III. COMPOSITION OF SCC

1. CEMENT: Ordinary Portland Cement(OPC)

2. FINE AGGREGATE: Locally available fine aggregate is used.

3. COARSE AGGREGATE: Locally available granite (8mm to 20mm)and down used as a coarse aggregate

4. WATER: Portable water is used for mixing and curing of concrete.

5. CHEMICAL ADMIXTURES: Various types of chemical admixtures are used in the production of SCC, superplasticizers etc.

6. MINERAL ADMIXTURES: Mineral admixtures are used to improve the fresh, hardened properties of concrete. Various fine materials such as fly ash, silica fume, lime stone powder, etc.

7. MIX DESIGN: Designing an approx. mix proportion to suit the needs of standard, HSC with different types of aggregates to be developed.

Figure: A self-compacting concrete

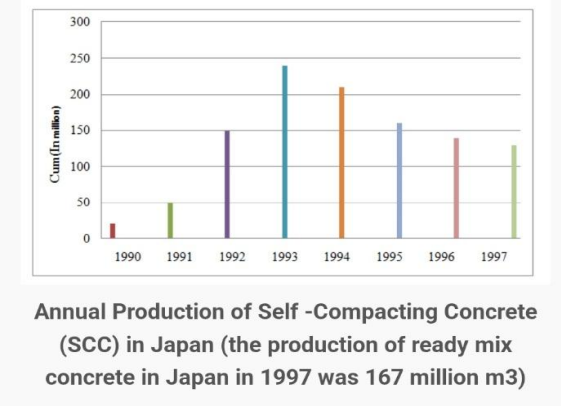
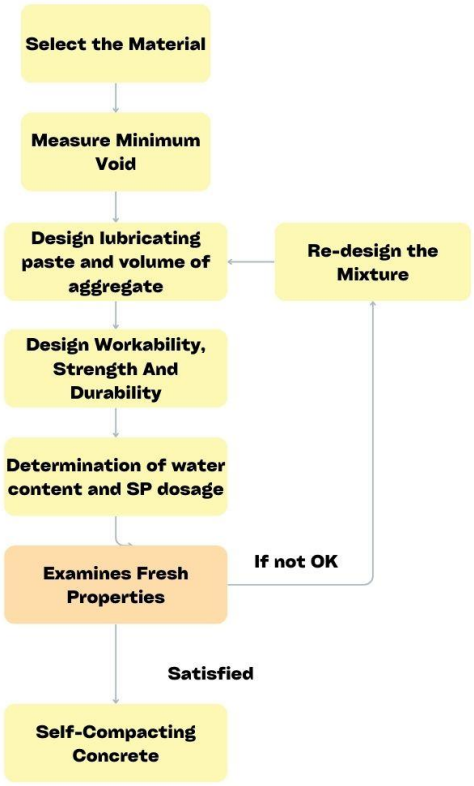


Figure: Annual production of self-compacting concrete in Japan.

IV. PROCEDURE FOR DESIGNING OF SCC MIX



V. LITERATURE REVIEW

1. Dr Mrs. SA Bhalchandra et.al had studied the performance of steel fiber SCC as plain SCC, they studied in the depth but FRCC is NOT studied to that length.

2. Belaidi, A.S.E, Azzouz, etc (2012) they studied about effect of natural pozzolana and marble powder to check the properties of Self-compacting concrete, CBM, 31, 251-257.

3. Alyousef, A., Khadimalla, M.A, Soussi etc. (2018), did experimental and theoretical study of the new technique is mixing S.C.C with marble sludge grout.

4. ASE Belaidi et.al has evaluated the effect of substitution of cement with natural pozzolana, etc on rheological and mechanical properties of Self-compacting Mortar and S.C.C…..

5. Professor Aijaz Ahmad Zende et.al has studied on S.C.C and compare it with conventional concrete. Almost all countries in the world are facing a decline in the availability of skilled labour in the construction industry. Addition special concrete become very important in the world where the use of concrete is just next to the water. This paper talked about various aspects of self-compacting concrete (S.C.C) such as mix design & material also various test methods such as L-Box test, V-Funnel test etc; alongwith performance characteristics and properties of fresh hardened concrete.

6. EFNARC Specifications (2002) some guidelines for the self-compacting concrete (S.C.C). London, United Kingdom: Association House, 32, 34.

7. Domone, P.L. (2006), Self-compacting concrete (s.c.c): An analysis of eleven years of the case study. Cement and Concrete Composites, 28(2), 197-208.

8. Mehta, P.K (1986), Properties and Materials. Concrete Structures, 26-27.

9. M Valcuende et.al they did the analysis about the porosity in Self-compacting concrete (SCC) made without mixing limestone filler and comparing the results with the other Self-compacting concrete (SCC) also with the concrete that is normally vibrated.

10. Mastali, M., Dalvand, A. (2016) did the analysis about the use of silica fume and the recycled steel fibers in the self-compacting concrete (S.C.C). Construction & Building Material, 196-209.

11. Rahmat Madandoust et.al did the experimentation analysis about the fresh and hardened Properties of S.C.C that contains Metakaolin. The fresh properties were investigated by visual stability index, slump flow, T50, V-Funnel, L-Box etc. The hardened Properties were investigated to check the splitting tensile strength, comprehensive strength, ultra-sonic pulse velocity, electrical resistivity, initial and final velocity absorption.

12. Mattur C. Narasimhan, Shridhar KC, Gopinatha Nayak, studied about the topic of "Durability and Strength og High-Volume fly ash S.C.C.", Indian Concrete Institute Journal (2009), PP 7 to 16.

13. Mounir M. Kamal, Mohammed A. Safan, Zeinab A. Etman, etc. had studied about the topic of the

"Mechanical properties of selfcompacted fiber concrete mixes", Housing and Building National Research Center Journal, 2014.

VI. RESULTS AND DISCUSSION

Properties of SCC:

Fresh SCC possess the properties such as its ability to fill formworks, its passing ability, resistant to segregation at required levels.

The filling ability of Concrete is the ability to SCC to flow into the pores of given formworks due to its own weight.

Without any need of vibration of Concrete, the self-compacting concrete has fill any pores within the formworks. It has to flow in horizontal as well as vertical without keeping air entrapped in the concrete.

Passing ability of self-compacting concrete is its ability to flow through congested openings such as spaces between reinforcing bars under its own weight. Passing ability is necessary to provide a homogeneous distribution of self-compacting concrete into the required places.

Now, the resistance to segregation is defined as the resistance of SCC is to separate and remains uniform throughout the process of transportation and placement.

1. Slump Flow Test

2. J-Ring Test

3. V-Funnel Test

4. L-Box Test

S. no.	Methods	Properties
01	V-Funnel	Filling Ability
02	Slump Flow by Abrams Cone	Filling Ability
03	J-Ring	Passing Ability
04	Orimet	Filling Ability
05	L-Box	Passing Ability
06	GTM Stability Test	Segregation Resistance
07	T50cms Slump Flow	Filling Ability
08	U-Box	Passing Ability
09	V-Funnel @ T5 Minutes	Segregation Resistance
10	Fill-Box	Passing Ability

Table: Test methods for workability of SCC by EFNARC

Table: Acceptance Criteria for SCC

S No.	Methods	Unit	Typical Range of Values	
			Minimum	Maximum
01	V-Funnel	mm	6	12
02	J-Ring	mm	0	10
03	U-Box (h2-h1)	h2-h1 (mm)	0	30
04	Slump Flow by Abrams Cone	mm	650	800
05	GTM Screen Stability Test	%	0	15
06	Orimet	Sec	0	5
07	T50CMS	Sec	2	5

	Slump Flow			
08	L-Box	h2/h1	0.8	1.0
09	V-Funnel @ T5 Minutes	Sec	0	+3
10	Fill-Box	%	90	100

Hardened Properties of SCC:- The hardened Properties of self-compacting concrete including compressive strength, flexural strength, durability, tensile strength, etc.; can be evaluated by the use of admixtures in Self-compacting concrete.

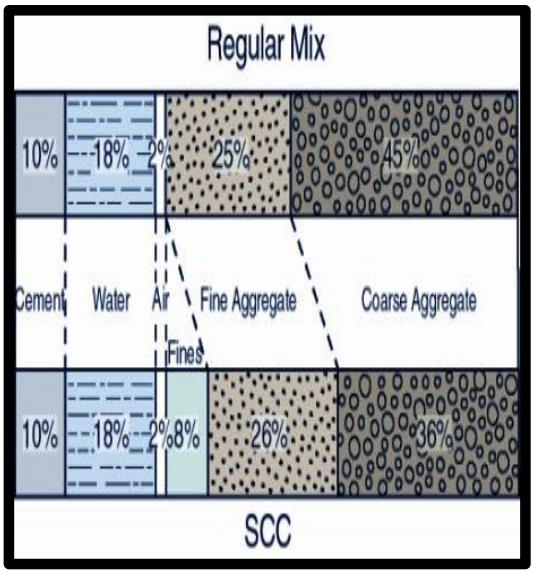


Figure: Regular Mix vs SCC

VII. CONCLUSION

In India, the utilization of Self-compacting concrete (SCC) for routine construction is NOT much this is because of the lack of awareness. Whereas, in other countries such as Sweden, United Kingdom, Canada, Thailand, etc.; apart from Japan, the self-compacting concrete is used for the regular construction and by using the available research data, awareness can be spread in order to utilize or apply the various positives of the self-compacting concrete or material. But it is not fully clear that the use of self-compacting concrete also gives the similar results to that of conventional concrete. Since by using various viscosity modifying agents with water reducing agent (high-range) is very important for the segregation control and flowability. To clearly understanding the rheology of the self-compacting concrete, has made easier to understand the functions of fines, VMA, super plasticizers in self-compacting concrete. Still, there is NO standard codes are available for the mix design of SCC apart from few methods that are developed by the scientists, institutions, researchers, professionals etc. But on the other hand also, some generalized methods can be developed (such as some own methods of RMC companies with one or another limitations) taking into the account of all such aspects.

VIII. REFERENCES*:*

[1] S. Venkateswara Rao, M.V. Seshagiri,et.al "Effect of size of Fines and aggregate on standard and high strength SCC" Journal of applied sciences research,433-442,2010.

[2] Mehta, P.K (1986), Properties and Materials. Concrete Structures, 26-27.

[3] Mastali, M., Dalvand, A. (2016) did the analysis about the use of silica fume and the recycled steel fibers in the self-compacting concrete (S.C.C). Construction & Building Material, 196-209.

[4] Esraa Emam Ali, Sherif h. "Research glass as a partial replacement of fine aggregate in S.C.C, CBM 35(2012) 785-791.

[5] Rahmat Madandoust, S. Yasin Mousavi, "fresh and hardened properties of S.C.C conataining Metakaolin", CBM 35 (2012) 752-760.

[6] Domone, P.L. (2006), Self-compacting concrete (s.c.c): An analysis of eleven years of the case study. Cement and Concrete Composites, 28(2), 197-208.

[7] M. Valcuende, C. Parra, E. Marco, A. Garrido, etc.(2012) "Construction and Building Materials" 122-128

[8] EFNARC Specifications (2002) some guidelines for the self-compacting concrete (S.C.C). London, United Kingdom: Association House, 32, 34.

[9] Mounir M. Kamal, Mohammed A. Safan, Zeinab A. Etman, etc. "Mechanical properties of selfcompacted fiber concrete mixes", Housing and Building National Research Center Journal, 2014.

[10] Belaidi, A.S.E, Azzouz, etc (2012) they studied about effect of natural pozzolana and marble powder to check the properties of Self-compacting concrete, CBM, 31, 251-257.

[11] L. Azzouz, ASE Belaidi, Ekadri,, S kenai, "Effect of marble powder and natural pozzolana on properties of S.C.C."Construction and Building Materials" (2012) 251 to 257.

[12] H. Okamura, "Self-Compacting Concrete" Journal of advanced concrete technology Vol 1, (2003), PP 35-43.

[13] Khayat K.H, "Workability, performance & testing of self-compacting concrete", ACI Materials Journal, Vol 96, (1999), PP 346-354.

[14] Dr Mrs. SA Bhalchandra et.al had studied the performance of steel fiber SCC as plain SCC, they studied in the depth but FRCC is NOT studied to that length.

[15] Mattur C. Narasimhan, Shridhar KC, Gopinatha Nayak, studied about the topic of "Durability and Strength og High-Volume fly ash S.C.C.", Indian Concrete Institute Journal (2009), PP 7 to 16.