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A Study on Self Compacting Concrete

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Abstract : ***Self-compacting concrete (SCC) may be manufactured using a variety of mineral additives and fibres, as detailed in this study. Demand for massive and complicated buildings in the construction industry has resulted in challenging concreting circumstances. To guarantee that a reinforced concrete (RC) element is completely compacted without any voids or honeycombs, a substantial amount of strong reinforcement must be inserted in the concrete. The use of manual or mechanical vibraators to compact material is next to impossible in this condition. That led to the development of self-compacting concrete, a new form of concrete (SCC). This kind of concrete is easy to deal with since it flows readily over the reinforcing steel and into the formwork. As the name suggests, a self-compacting concrete is a kind of concrete that can be compacted without the need of vibration. High performance self-compacting concrete is another name for this kind of material, which is often referred to as self-consolidating concrete. There are no imprisoned air or rock pockets, and it can easily flow around obstructions and fill all of the crevices and crannies of a structure without separating out the mortar or other concrete elements. Compaction is unnecessary with this concrete mix, which saves both labour and resources. Fibers and other mineral admixtures are discussed in this review study, which describes the features of Self-Compacting Concrete. Mineral Admixtures, Fibers, Longevity, Workability, Self-Compacting Concrete, Mix Design***

1. Introduction:

SCC's Background: SCC was introduced in Japan in the late 1980s as a response to a lack of uniform and thorough compaction in concrete structures, which had been recognised as the fundamental cause of poor performance in concrete buildings. Full compaction of concrete on a site could never be ensured by any practical means, thus the emphasis shifted to eliminating the need to compress, whether by vibration or any other method. As a result, researchers Okamura and Ouchi [1] at the University of Tokyo created the first practical SCC. Full compaction of the SCC is possible without vibrating it, as its name implies. Additionally, there is a decrease in on-site repairs and a reduction in construction time as a result, as well as a reduction in total expenditures. SCC mixes include large amounts of fine-grained inorganic materials, which may be used to dispose of "dusts," which are presently waste items that have no practical use and are expensive to dispose of. Large and complicated buildings are being built at an increasing rate in India, which sometimes results in severe concreting circumstances. Vibrating concrete in busy areas may provide a danger to workers, as well as a source of noise pollution. There is always scepticism regarding the long-term viability of structures constructed in these kind of places. As a result, if at all feasible, vibration should be eliminated in the workplace. SCC expertise has progressed from research to implementation in nations like Japan, Sweden, Thailand, the UK, and so on. The awareness of this in India, on the other hand, is expected to be widely diffused.

2. Literature Review:

Plain self compacting concrete has been examined extensively, but fibre reinforced self compacting concrete has not been till now, according to the work of Professors S.A. Bhalchandra et. al.

[8]. Research by Prof. Aijaz Ahmad Zende et. al [2] compared SCC to conventional concrete (NC). Every country on Earth is experiencing an acute shortage of trained construction workers, and Special Concretes are becoming more important in a world where the usage of concrete is so close to water. Special Concrete refers to concrete that is capable of meeting certain performance and performance standards that may not be attainable with ordinary materials and typical concreting procedures. Special concrete, such as Self Compacting Concrete, flows and solidifies under its own weight, making it easier to place concrete in challenging situations and faster to place big sections. It also has higher strengths and longer lifespans than regular concrete. Among the topics covered in this article are the materials and mix design, several testing techniques such as the V-funnel test, the L-Box test, and the performance characteristics and qualities of fresh and hardened SCC. An experimental approach for designing self-compacting concrete mixtures was devised by Paratibha Aggarwal et al [9]. Slump flow, J-ring, V-funnel, and L-

Box acceptance characteristics of self-compacting concrete are provided in the test findings. Also included here are the data for compressive strength at the ages of 7, 28, and 90 days.

The fresh and hardened characteristics of Self-Compacting Concrete have been examined by Esraa Emam Ali et al [10] utilising recycled glass trash as a partial substitute for fine aggregate (SCC). Different cement amounts (350, 400, and 450 kg/m3) at a W/C ratio of 0.4 were used to make 18 concrete mixes. It was used to replace fine aggregate with recycled glass in a variety of percentages, from 0% to 100%. Slump flow increased as recycled glass content rose in the experiments, according to the findings. When recycled glass (SCC) content increased, it resulted in higher compressive strength and split-tensile strength, but lower flexural strength and static modulus of elasticity. Self-compacting concrete may be made using recycled glass aggregate, according to the findings of this study. It was determined that the optimal content of fibres (steel and polypropylene) for usage in scc was researched by Mounir M. Kamal et.al [11]. Various fibres were tested for their fresh and hardened qualities. Fiber reinforced self-compacting concrete's compressive strength, flexural strength, and impact strength were examined experimentally. For steel and polypropylene fibres, the optimal dose was 0.75 percent and 1 percent, respectively, of the cement content. Due to the use of fibres, the impact performance was also enhanced. It was found that the control mix specimen failed in flexure and impact, but the fiber-containing counterparts failed more slowly and were followed by many fractures.

It was found that self-compacting concrete (scc) without limestone filler had a higher porosity than other scc and conventional concrete (nvc). With the same w/c ratio, several concretes were created. Using these two characteristics as a guide, an expression can be developed to predict how much air is in a given scc sample based on its flowability and viscosity. Scc has a lower water permeability than nvc because its porous structure is finer and more tortuous. When water enters by capillary action in the absence of pressure, results from the various concrete types are fairly comparable, with just a 3.5 percent variation between them. SCC and NVC have almost identical content in holes larger than 0.5 lm, while smaller pores, which can only be reached when water is introduced under pressure, have more noticeable variances in porosity. On the other side, the use of more fluid combinations allowed for more impermeable concrete to be produced. Although the overall volume of holes is unaffected, using viscosity-modifying additive in lieu of limestone filler results in a slightly more coarse porous microstructure, resulting to concretes with a little greater water penetration depth under pressure (around 4 mm).

The rheological and mechanical characteristics of self-compacting mortar (scm) and self-compacting concrete (scc) have been researched by A.S.E. Belaidi et al [13]. (scc). Different quantities of pozzolana and marble powder (10–40 percent) were used to partly replace ordinary portland cement (opc). Slump test, v-funnel flow time test, j-ring, l-box, and sieve stability tests were used to assess the workability of fresh scc. The compressive strength of prisms was measured at seven, 28 and 56 days of age. The findings show that adding pozzolana and marble powder improves the workability of scc. However, even with 40% (natural pozzolana + marble powder) natural pozzolana, the SCC strength after 28 and 90 days shows that it is possible to obtain a sufficient level of compressive strength.

Self-compacting concrete (scc) containing Metakaolin was researched by Rahmat madandoust et al (MK). A total of fifteen mixes were created, each with a w/b ratio of 0.32, 0.38, or 0.45, and a range of mk contents (0–20 percent by weight of cement). Slump flow, visual stability index, t50, v-funnel, and l-box were used to examine fresh characteristics. The effect of hauling time on slump flow was also taken into account. Testing included compressive strength, splitting Tensile Strength (TSS), upv velocity (up), initial and final absorption and electrical conductivity. Although no viscosity modifying agent was required, new concrete test results showed that appropriate quantities of MK may be substituted in scc to obtain adequate workability and rheological qualities. Within the first 14 days after MK insertion, the compressive strength of scc increased by 27 percent. Multiple regression analysis may also be used to estimate the upv-based compressive strength of scc using mk. In terms of tensile strength and electrical resistivity, the mk-containing scc was up to 11.1 percent and 26% stronger than the control scc. MK mixtures of "good" concrete quality may achieve modest absorption rates (less than 3% at 30 minutes). In overall, it seems that 10% MK concrete may be regarded a good substitute in terms of economic efficiency, fresh and hardened qualities of MK concrete. 10 percent MK concrete.

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3. Materials Used:

As in normal concrete, SCC uses the same materials but for the addition of fine particles and chemical admixtures to achieve a higher strength. In addition, a viscosity-modifying agent (VMA) will be needed since the SCC will become unstable if the water or slurry content of the aggregate or sand is changed even little. It is composed of fly ash and quartz filler and silica fumes as well as lime stone powder and glass filler. The SCC flows better when pozzolanic elements are used.

The most important considerations in material selection are:

1. The number of aggregates utilised.

2. Variable modulus abrasives (VMAs) and superplastizers

3. The percentage of powder in the concrete mix. 'water/cement ratio,

4. Cement**:**Ordinary Portland Cement (OPC) conforming to IS: 12269 to be used. The physical and chemical property of cement is to be identified. Local river sand is utilised as fine aggregate in this project. It was necessary to dry the sand before using it to prevent the

problem of bulking.

Quarry granite with a size range of 20 to 8 millimetres and smaller was utilised as coarse material..

Water:

Concrete is mixed and dried using potable water.

Mineral Admixtures:

While improving concrete's fresh and hardened qualities, mineral admixtures lower the cost of concrete supplies. Additional fine materials are added to increase viscosity and prevent segregation. For example, silica fume or lime stone powder or rice husk ashes or glass filler or quartzite filler may all be employed as fine materials.

Chemical Admixtures:

When it comes to making SCC, a variety of chemical admixtures, such as super plasticizers and

Viscosity Modifying Agents (VMA).

Mix Design:

To meet the demands of both conventional and high-strength SCC, an estimated mix percentage will be determined. The solidified aggregate binding the paste gives SCC its strength, while the fresh binding paste gives it its workability. The approach shown in Figure 1 may be used to choose and alter the mix design. Flow diagram illustrating the design process for SCC mix

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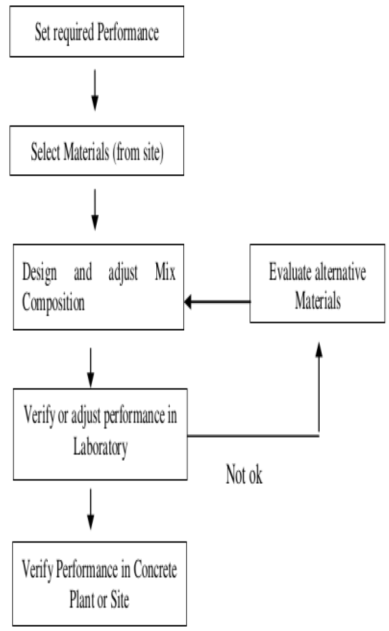

Figure 1: SCC Mix Design Procedure (EFNARC, 2005) [3].

4. Properties of Fresh Scc:

Filling, passage, and segregation resistance are just few of the important features that fresh SCC must have. Under its own weight, SCC may flow into every nook and cranny of a mould. There must be no air trapped in the concrete or on its surface if SCC is to fill any formwork gaps and flow horizontally and vertically without disturbing the concrete. Under its own weight, the SCC is able to pass through small areas, such as the gaps between steel reinforcing bars. It is necessary to have the capacity to pass barriers in order to maintain a uniform distribution of the SCC components. As a result, the SCC's resistance to segregation stays constant throughout the transit and re-creation process.

placing. The European Federation of Specialist Construction Chemicals and Concrete Systems (EFNARC) has developed test methods to meet these specifications...

Table 1. List of test methods for workability properties of SCC by EFNARC [3]

S.No	Methods	Property
1	Slump-flow by Abrams cone	Filling ability
2	T50cmslumpflow	Filling ability
3	J-ring	Passing ability
4	V-funnel	Filling ability
5	V-funnel at T 5 minutes	Segregation resistance
6	L-box	Passing ability
7	U-box	Passing ability
8	Fill-box	Passing ability
9	GTM screen stability test	Segregation resistance
10	Orimet	Filling ability

Workability criteria for the Fresh SCC:

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Upon ordering, you must meet these conditions. Production should take into consideration any changes in workability during shipment.. Table 2 shows typical acceptance requirements for self-compacting concrete with a maximum aggregate size of 20 mm.

Table 2: Acceptance criteria for Self-compacting Concrete.

S. No	Method	Unit	Typical range of values	
			Minimum	Maximum
1	Slump flow by Abrams cone	mm	650	800
2	T50cmslumpflow	sec	2	5
3	J-ring	mm	0	10
4	V-funnel	mm	6	12
5	Time increase, V-funnel at T5minutes	sec	0	+3
6	L-box	h2/h1	0,8	1,0
7	U-box (h2-h1)	(h2-h1) mm	0	30
8	Fill-box	%	90	100
9	GTM Screen stability test	%	0	15
10	Orimet	sec	0	5

Hardened Concrete Properties of Scc:

As admixtures are used in the SCC the hardened characteristics of the SCC may be examined, such as Compressive strength, Split tensile strength, Flexural strength, Durability and so on

5. Conclusions:

However, outside of Japan, nations like Canada, Denmark, Sweden, Thailand, the United Kingdom, and others employ Self-compacting concrete for ordinary building despite the fact that there is a dearth of public understanding of the material's many advantages. It's not apparent whether current structural concrete design regulations can be applied to self-compacting concrete. A high-range water-reducing agent and a viscosity-modifying agent must be used in tandem to manage flowability and segregation. Understanding SCC's rheology and the interplay of its fines, super plasticizers, and VMA has made it simpler for scientists and engineers to determine the mechanical properties of SCC in its hardened stage, particularly its stress strain characteristics. Researchers have devised a few approaches for the mix design of self-compacting concrete, although many institutes, RMC; enterprises are employing their own methods with one or more constraints. As a result, a generic approach may be devised that takes into account all of the variables. You may save time and money by using self-compacting concrete (SCC), which is environmentally friendly.**1.** Due to its ability to guide itself into every nook and cranny in the form, SCC can produce nearly nil defects concrete. Number of pouring points can be reduced, thus eliminating the cumbersome activity of pipe laying over the pour**.**

2. The cost of the concrete may be considerably decreased by substituting 40 to 50 percent of the cement content with components such as fibres. Many experienced supervisors, engineers, vibrators and pipe fitters may be eliminated. Using formwork more than once is not a problem. Repairing the building will be less expensive since the number of flaws will be much decreased.

3. Self-consolidation and access to hard-to-reach locations in moulds eliminates the need for human intervention in putting and compacting concrete. Defect-free, high-quality concrete constructions result from this component.

References:

1. ***"Self-Compacting Concrete," by H. Okamura, in Journal of Advanced Concrete Technology, Volume 1 Number 1, April 2003, pp. 5–15.***
2. ***Dr. R. B. Khadirnaikar "An Overview of Self-Compacting Concrete's Properties" Journal of Mechanical and Civil Engineering, eISSN: 2278-1684, pISSN: 2320-334X, 2014, pp. 35-43.***
3. ***Concrete Self-Compacting Specification and Guidelines, EFNARC, February 2002.***

4. *Rathish Kumar, 1 2 S. Venkateswara Rao, 1 2 3P. Rathish Kumar 1 2 3 "Standard and High Strength Self Compacting Concrete" Journal of Applied Sciences Research, 6(5): 433-442, 2010.*
5. *Study on the Influence of Aggregate Particle on the Rheological Property of Fresh Concrete by N. Mishima, Y. Tanigawa, H. Mori, Y. Kurokawa, K. Terada, and T. Hattori was published in the Journal of the Society of Materials Science in Japan, Vol. 48, No. 8, 1999, pp. 858-863.*
6. *Working with Self-Consolidating Concrete: A Review of Workability, Testing, and Performance, ACI Materials Journal, Vol. 96:3, May-June 1999, pp.346-354.*
7. *"Strength and Durability of High-Volume Fly-ash Self-compacting Concrete" by Mattur C. Narasimhan, Gopinatha Nayak, and Shridhar K.C. in the ICI Journal, January-March 2009, pp. 7-16.*
8. *International Journal of Computational Engineering Research, Volume 2, Issue 4, July 2012. Dr. Mrs. S.A. Bhalchandra, Pawase Amit Bajirao, Dr.*
9. *Rafat SIDDIQUE, Yogesh AGGARWAL, Surinder M GUPTA "Leonardo Electronic Journal of Practices and Technologies" ISSN 1583-1078 Issue 12, January-June 2008, p. 15-24.*
10. *Esraa Building Materials 35 (2012) 785–791: "Recycled glass as a partial substitute for fine aggregate in self-compacting concrete" by Emam Ali and Sherif H. AlTersawy*
11. *Self-compacted fibre concrete mixes have mechanical qualities that are superior than those of conventional concrete, according to a study published in the Housing and Building National Research Center Journal.*
12. *Materials for Construction and Building Construction and Building Materials 28 (2012): 122–128 (M. Valcuende et al.).*
13. *"Effect of natural pozzolana and marble powder on the characteristics of self-compacting concrete," in "Construction and Building Materials" 31 (2012) 251–257, A.S.E. Belaidi, L. Azzouz, E. Kadri, and S. Kenai*
14. *Self-compacting concrete containing metakaolin has both fresh and hardened qualities, according to a study published in Construction and Building Materials.*