

STUDY ON STRENGTH AND DURABILITY PROPERTIES OF STEEL FIBRE REINFORCED SELF COMPACTING CONCRETE

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Abstract In this present study the durability characteristics of Steel fiber reinforced Self compacting concrete (SFRSCC) is determined for M30 and M40 grade concrete mixes. Along with durability strength and sportivity is carried out and comparison is made with Plane self compacting concrete (SCC) by chemical resistance, Initial Surface Absorption Test (ISAT).

In the present study, the rational mix design procedure for self-compacting concrete is used. SCC mixes contains large quantity of powder (material whose parcel size is 0.125 mm) to maintain the plastic yield of the properties of fresh concrete as per the general guidelines for design of SCC mixes given in the EFNARC (2005). The present project consists of two phases. In the first phase, SCC mixes for different grades are developed without steel fibers and with steel fibers. The mechanical properties like compressive strength of the different grades were studied. In the second phase, based on the experimental results, durability properties were studied with the using of specimens of size 100 mm × 100 mm × 100 mm. Durability studies like Acid attack factors, Acid-Durability factors, Sulphate attack factors, Sorptivity are studied for the Plain SCC and steel Fiber Reinforced SCC and a comparison is made.

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I INTRODUCTION

Self-compacting concrete (SCC) become first brought in Japan at some point of 1980's, given that then it has been the difficulty to severa investigations so as to attain the preferred homes of contemporary concrete structures. At the same time the producers of components have developed greater and greater sophisticated plasticizers and stabilizers tailored for the precast and the geared up-blend industry.

Concrete generation has made remarkable strides within the beyond decade. Concrete is now not a cloth consisting of cement, aggregates, water and admixtures but it is an engineered fabric with several new elements acting satisfactorily beneath one of a kind publicity situations. Concrete today may be a tailor made for particular applications and it carries unique substances like micro silica, colloidal silica and lots of different binders, fillers and pozzolonic materials. The development of specifying a concrete according to its performance and necessities, as opposed to the ingredients and ingredients have opened innumerable possibilities for manufacturers of concrete and users to layout concrete to in shape their specific necessities. One of the maximum wonderful advances within the concrete era inside the last decade is "self compacting concrete" (SCC).

Self compacting concrete (SCC) has developed as an revolutionary era, capable of attaining the popularity of being an terrific advancement within the field of concrete era. No vibration is vital for SCC which could flow around obstructions, encapsulate the reinforcement and fill up the formwork absolutely under its very own self weight. Making concrete systems with out vibration were executed inside the beyond. For instance, placement of concrete under water is performed via the usage of tremie without vibration.

Objectives of the study

SCC does not show any segregation and bleeding. Self-Compacted ability is largely affected by the characteristics of the materials and mix proportions. In the present study, it is proposed to study the strength and durability properties Self-compacting fibre reinforced concrete with available materials in the laboratory. Coarse aggregate with nominal size 10 mm was used. Viscosity Modifying Admixtures (VMA) is used to increase the suspension of power of aggregates and also to eliminate possible segregation. Fine powdered materials like fly ash is also used for eliminating the possible segregation. Super 65 plasticizer is used to enhance flow of mix.

In the present study, hooked end Steel fibres are used. Durability studies like Acid attack factors, Acid-Durability factors, Sulphate attack factors, Sorptivity are studied for the Plain SCC and Steel Fibre Reinforced SCC and a comparison is made.

II LITERATURE REVIEW

Kazumasa Ozawa (1989)

Completed the primary prototype of self compacting concrete the use of materials already in the marketplace. By the use of different varieties of outstanding plasticizers, he studied the workability of concrete and evolved a concrete, which become extra attainable. It turned into appropriate for fast placement and had a excellent permeability. Ozawa (1989) executed experiments by using focusing at the have an effect on of mineral admixtures, like fly ash and blast furnace slag, at the flowing capacity and segregation resistance of self-compacting concrete. He discovered out that the flowing capacity of the concrete advanced remarkably whilst Portland cement become partially replaced with fly ash and blast furnace slag. After attempting exclusive proportions of admixtures, he concluded that 10-20% of fly ash and 25-45% of slag cement, by using mass, confirmed the quality flowing capacity and strength traits.

Narayana P.S.S, SrinivasaRao. P, Swami.B.L.P(2004)

The development in 28 days compressive electricity is 20% greater with 5% addition of micro silica compared with 0% addition. With the addition of micro silica the resistance of concrete to the assault of acids and sulphates advanced. The percent of weight loss could be less at 20% addition of micro silica, while immersed in H₂SO₄, HCl and Na₂SO₄.

III MATERIALS USED

Cement

In this present investigation, the Ordinary Portland Cement OPC 53 Grade available in the local market was used. To conduct a various test properties according to IS: 4031-1988 and found to confirming to IS: 12269-1987.



OPC 53 Grade Cement

Coarse aggregates

The mixture of length more than 4.75mm is taken into consideration as coarse combination. Regarding the traits of different sorts of combination, crushed aggregates tend to enhance the strength due to the interlocking of the angular particles, whilst rounded aggregates improve the go with the flow due to

decrease internal friction. More coarse combination content can cause blockage and decrease the flowability of the concrete mix, because of contact between coarse aggregates. Locally to be had crushed granite combination passing thru 12.5mm and preserving on 4.75mm become used for all the mixes of SCC.



Coarse aggregates

Fine aggregates

Aggregate of size much less than 4.75mm is considered as quality aggregate. All normal concreting sands are suitable for SCC. Both crushed and rounded sands / Siliceous and calcareous sands may be used. The first-rate aggregate content material must be in the range of one/4th to one/third of the full volume of the combination. It improves the workability. Fine mixture plays a very essential role in the discount of segregation.



Fine aggregates

Water

Generally, cement calls for approximately 3/10 of its weight of water for hydration. Water is an vital aspect of concrete because it actively participates in chemical response with cement. It also improves the workability. Since it helps to shape the electricity giving cement gel, the quantity and first-rate of water required is to be seemed carefully. This addition of water ought to be kept to the minimal. Adding too much water reduces the energy of concrete and additionally causes segregation and bleeding. If an excessive amount of water is introduced to the concrete, the extra water together with cement come to the floor via capillary motion and this water combination bureaucracy a scum or athin layer of chalky material known as laitance.

Super Plasticizer

Super Plasticizer with Sulphonated Napthalene Formaldehyde (SNF) of Conplast SP430 DIS was confirming to IS: 9103-1999 used in this investigation.



Super plasticizer SP430

Viscosity Modifying Admixture (VMA)

ROOF PLAST VMA2 is ready-to-use, liquid, organic, Viscosity Modifying Admixture (VMA) specially developed for producing concrete with enhanced viscosity and controlled rheological properties.

ROOF PLAST VMA2 is used as a Viscosity modifying agent from a standard agency confirming to standard specifications was also used.



Viscosity Modifying Agent

Water

Portable water confirming to IS: 3025-1986 part 22 & 23 and IS: 456-2000 was used in the investigation.

Steel Fibers

Hooked end steel fibers of 0.4mm diameter and Aspect ratio of 30 and 12 mm length were used.



Steel Fibers

IV MIX DESIGN AND TRAIL MIX PROPORTIONS OF SELF COMPACTING CONCRETE

The principal period of exploration zeroed in on creating different SCC mixes utilizing fly debris and synthetic admixtures for various sorts of low strength standard grade and high evaluation concrete (M30 and M40), just as examining their new and solidified properties. The Nan-Su arrangement of SCC blend development in with fly debris as the mineral admixture was utilized to create different SCC blends of various evaluations of low force standard grade and high evaluation concrete, i.e., M30 and M40. At long last, SCC blends in with satisfactory new properties and vital compressive strengths were picked and shipped off be explored further.

Grade	Cement Kg	FA Kg	CA Kg	Fly ash Kg	Water Kg	SP %bwcf	VMA % bwcf	Steel fiber % volume	Designation
30	360	885	700	345	210	1.5	0.05	-	SCCP
	0.4	885	700	345	210	1.5	0.05	0.4	SFRSCC
40	468	884	700	350	240	1.5	0.05	-	SCCP
	468	884	700	350	240	1.5	0.05	0.4	SFRSCC

Tests to be conducted on SCC

- Workability
- Strength
- Durability

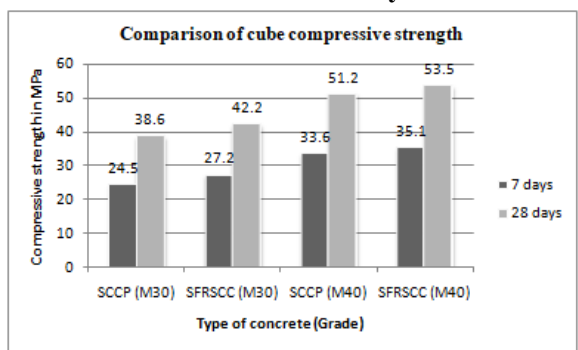
V RESULTS AND ANALYSIS

Workability

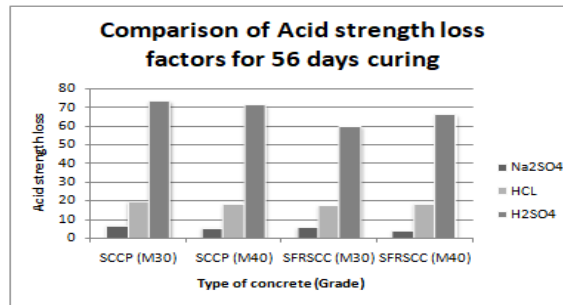
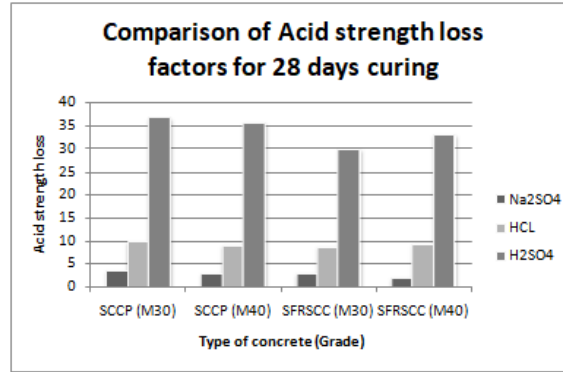
Fresh and Hardened Properties of SCC and SFRSCC

Grade	Fresh properties			Remarks	Designation
	Slump flow T50 cm Test Sec	V- Funnel Test Sec	L- Box Test H2/H1		
30	2.23	6.17	0.73	RNS	SCCP-1
	2.78	8.23	0.78	RNS	SCCP-2
	2.70	6.76	0.94	RS	SCCP
	3.20	7.58	0.915	RS	SFRSCC
40	3.59	7.53	0.956	RS	SCCP
	3.98	7.98	0.88	RS	SFRSCC

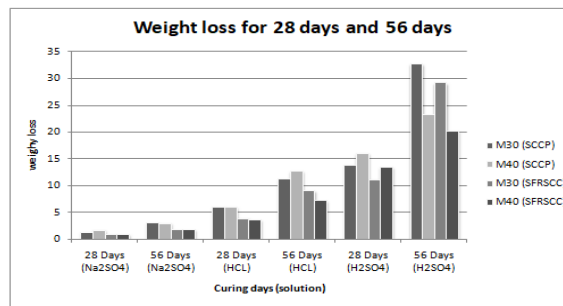
Hardened Properties of SCC and SFRSCC at 7 and 28 days



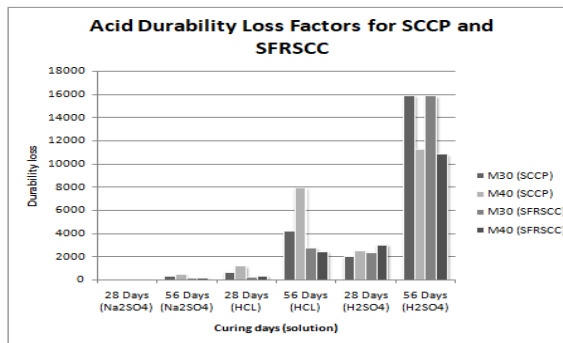
STUDIES ON DURABILITY OF SCC AND SFRSCC



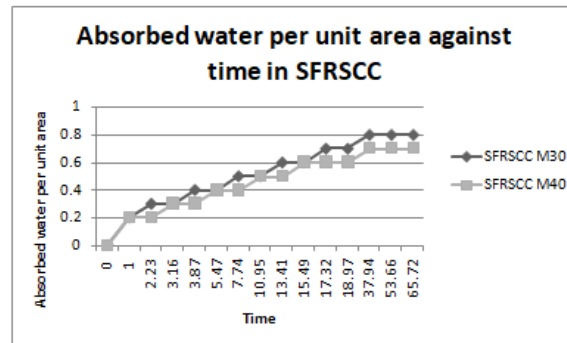
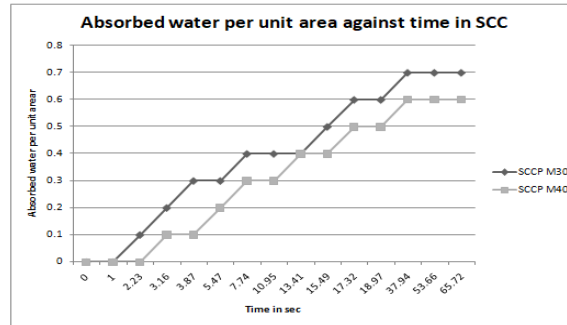
Acid Attacking Factor



Acid Durability Loss Factor



Sorptivity Study on SCC and SFRSCC



VI CONCLUSIONS

The examination of the durability properties depends on research facility work performed on SCC and SFRSCC mixes of different evaluations. This test research yielded the accompanying fundamental ends:

1. Steel strands can be joined into fiber built up self-compacting concrete to build its consistency. Be that as it may, keeping up the new properties of self-compacting concrete requires the utilization of a sufficient portion of super plasticizer and thickness changing specialist.
2. The viewpoint proportion is extremely basic, and it was found that more limited filaments with a 12mm length and a perspective proportion of 30 work better.
3. Through properly changing the measurement of admixtures, a dose of 31 kilo grams of filaments/m3 of concrete is utilized as the ideal dose for Steel strands.
4. Different concrete evaluations, like M30 and M40. The compressive strength of Steel Fiber Reinforced Self-compacting Concrete was discovered to be higher, shifting from 2% and 10%. In contrast with customary self-compacting concrete.
5. Workability decreases as fiber measurements is expanded. The expansion of superplastizers and VMA to concrete will address the issue of workability and stream properties.
6. Steel Fiber Reinforced SCC sorptivity diminished as concrete evaluation expanded, and plain SCC sorptivity diminished also.
7. The measure of water ingestion per unit territory in SFRSCC diminishes as the concrete evaluation rises.
8. The ASLF expanded as the time span spent in an acidic air expanded. Both SCCP and SFRSCC is liable of this. For a similar evaluation of concrete, SCCP and SFRSCC detailed a practically identical rate misfortune in weight.
9. There was harm to the concrete at the sides of the customary block as the hour of drenching in 5% groupings of acids like Na₂SO₄, HCl, and H₂SO₄ expanded, and such obliteration in SFRSCC was not exactly in SCCP, recommending unrivaled soundness of SFRSCC.

10. When contrasted with HCL and H₂SO₄, Na₂SO₄ has a lower AWLF. When contrasted with basic SCC, SFRSCC has exhibited 10% - 13% more protection from weight reduction when lowered in H₂SO₄, 15% - 20% more opposition in HCl, and 16 percent - 20% more obstruction in Na₂SO₄. With expanding concrete evaluation, the corrosive weight reduction factor is seen to diminish.
11. Inventive+ stating When contrasted with HCl and Na₂SO₄, H₂SO₄ has a more prominent absence of measurement soundness. When contrasted with plain SCC, SFRSCC showed 1% - 3% more protection from measurement solidness when lowered in H₂SO₄, 5% - 7% more opposition in HCl and Na₂SO₄
12. With expanding concrete evaluation, the deficiency of measurement soundness is seen to diminish.
13. As contrasted with HCl and Na₂SO₄, H₂SO₄ has a higher extent of corrosive power misfortune. When contrasted with basic SCC, SFRSCC showed 5% more protection from strength misfortune when lowered in H₂SO₄, and 9% more opposition in HCl and Na₂SO₄.
14. With expanding concrete evaluation, the level of corrosive strength misfortune is seen to diminish.
15. With expanding concrete evaluation, the corrosive life span disappointment factor diminishes. The SFRSCC was discovered to be more impervious to acids and sulfate when contrasted with the straightforward SCC.

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