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Glass Fibre Insulated with self-Compacting Concrete

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Abstract: This project describes fiber glass insulation using self-compacting concrete. Self-compacting concrete Is a high-performance concrete that flows under its own weight to completely fill the form work and self-compact without mechanical vibration. In general, concrete has strong compressive strength and weak tensile strength. In this study for increasing the tensile strength of concrete, glass fibers were added in an amount of 1kg perm 3 of concrete. Various applications of fiber glass demonstrated in research, experimental test results show the great potential of fiber glass as an alternative building material to improve the durability of materials. This is a new generation of fiber glass aimed at improving processes
Key Word: Tremen do us potential, Imperable Material, Durability, Tensional property, Self consolidates.

I.INTRODUCTION

Self compacting concrete

In recent development in the construction industry, involves manufacture cretes day by day. Among that Self-compacting concrete plays an major role in recent days. Because of its high strength, low labor requirements, ease to handle, transport and place increased durability, and pollution control. Due to poor homogeneity of poured concrete due to poor compaction or segregation can significantly reduce the on-site performance of mature concrete. SCC is designed to facilitate proper compaction and placement of concrete in heavily reinforced structures and restricted areas. The high flow ability and high segregation resistance of SCC are achieved by:

A larger quantity of fine particles, i.e.,a limited coarse aggregate content.

1. With a lower w/c ratio
2. Utilization of plasticizer.

SCC consists of the same components as conventional vibratory ordinary concrete: cement, aggregates, water, additives, and ad mixtures. However, a large amount of super plasticizer to lower the yield point and improve work ability, a higher percentage of powder used as a "lubricant" for coarse aggregates, and a thickener to increase the viscosity of concrete should be considered. Figure 2.1 shows the basic principle of SCC manufacturing.

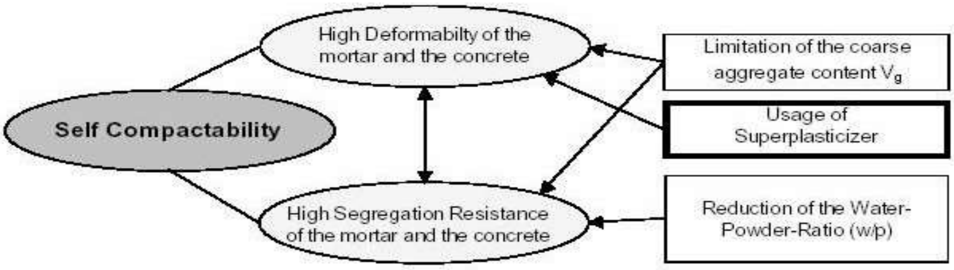


Figure 2.1 production of SCC

The following methods is already implemented to achieve self-compression of SCC.

1. Aggregate content Is Limited To (50% Coarse aggregate of concrete volume and 40% Sand of mortar volume),
2. Lower water/Cement ratio and
3. Application Of high-Dose super plasticizer

The ability of the SCC to flow under its own weight into all voids in the formwork. Tests such as Slump Flow, V-Funnel, etc. are used to determine the filling capacity of ready-mixed concrete.

- Passability: The ability of the SCC to move through narrow openings under its own weight. B. Space between flowing rebars.
- Passing eligibility can be determined using the U-Box,L-Box,Fill-Box,and J-Ring test methods.
- Separation Tolerance: The SCC must meet fill ability and pass ability with uniform composition throughout the transportation and placement process.

Scope and objectives

The primary aim of our project is to develop Self Compacting Concrete with Glass Fibre and to study their work ability & strength characteristics.

II.LITERTURE REVIEW

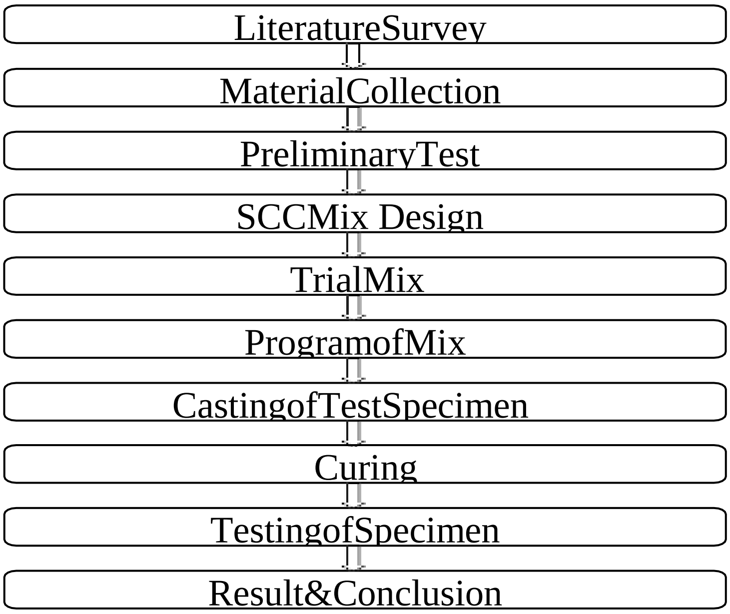
Proper compaction is necessary to achieve an acceptable concrete structure for complete packing of the mixture and even distribution with minimal segregation. His one solution to obtaining acceptable concrete structures regardless of construction quality is the use of SCC.SCC eliminates the need for internal or External vibrations, thus reducing labor and noise pollution.

Sesha dri Sekhar. T, Dr.Srinivasa Rao. P, February(2008), "Strength Properties of Glass Fiber Self-Compacting Concrete"Vol.

Experimental studies on the characteristics of Suresh Babu.T & Rama Seshuc.D,(2008),"Mechanical Properties of Self Compacting Concrete with and without Glass Fibers".

"Asian Journal of Civil Engineering", Vol. Describes the experimental work on the development of fiber glass SCC and the study of its properties. They concluded that incorporation of 0.03% glass fiber, or 600g/m3 of concrete, increased strength by 2.0 to 5.5% in compression,3.0 to 7.0% intension, and 11.0 to 20.0% in bending after 28 days.

III.MATERIAL AND METHODS



Details of investigation

Raw Materials Used in work

Cement	-Ordinary Portland cement of 53 grade Fine Aggregate-Natural rivers and
Coarse Aggregate	-Aggregate of size 12.5 mm passing Mineral admixtures-Flyash Chemical admixtures
Super plastizer	- Conplast SP230
Glass Fibers	-anti-crack glass fibers
Water	-Ordinary Potable water

Cement

OPC of 53 grade confirming to IS-12269 with specific gravity of 2.88.

Fine Aggregates

River sand confirming to IS-383 zoneII with specific gravity of 2.66.

Coarse Aggregate

Crushed granite angular aggregate of size 12.5mm passing confirming to IS-383 having specific gravity2.88.
Chemical admixtures:

Super plasticizer

Super plasticizers is essential for SCC,Poly carboxylated ether-based super plasticizer–Conplastsp230 is used.
The super plasticizer is required

- To provide work ability
- To reduce W/C ratio
- To increase flow ability–High slump

- To reduce Bleeding

Glass Fibers

Cem-FIL anti-crack high dispersion glass fiber were used,Properties of Glass fiberused

- Length 12mm
- Diameter 14micron
- Specific Gravity 2.6
- No of fibers 212 million/kg

The addition of Glass fibersin SCC can improve

- Ductility
- Post crack resistance
- Energy absorption capacity
- Bleeding resistance

IV.RESULT

Preliminary Tests

Tests Forcement

4.1.A. Specific Gravity Test

S.No	Description	T-I	T - II	T - III
1.	Wtof empty bottle (W1)(g)	26.8	26.8	26.8
2.	W to f bottle+water(W2)(g)	75	75	75
3.	W tofbottle+Kerosene(W3)(g)	65.5	65.5	65.5
4.	W tof bottle+Cement+Kerosene(W4)(g)	74.5	73.5	74.8
5.	Weight of cement(W5)(g)	12.5	11.5	12.5

Table4.1SpecificGravityof Cement

4.1.B. Initial Setting Time Test

SI.NO.	Timein minutes	Pointer reading from bottom
1.	0	0
2.	5	0
3.	10	0
4.	15	0
5.	20	0
6.	25	0
7.	30	0
8.	35	0
9.	40	0
10.	45	0
11.	50	0
12.	55	0.5
13.	60	0.5
14.	65	0.5
15.	70	0.5
16.	75	0.5
17.	80	1.5
18.	85	1.5

19.	90	1.5
20.	95	2.
21.	100	2.0
22.	105	2.5
23.	110	3.0
24.	115	3.5
25.	120	4.5
26.	125	6.0

4.1.C. Final Setting Time Test

S.NO	Time in(MIN)	Pointer reading From Top
1.	140	37.5
2.	170	38
3.	200	39
4.	230	40
5.	260	40

Table4.3FinalSettingTime

Needle with annular collar used: - 1mmSquareAmountof water added:-O.85P=123 ml

4.1.D. Fineness Modulus Test

S.No	OBSERVATION	TrialI	TrialII	TrialIII
1.	Weight of sample taken	100	100	100
2.	Weight of material retained after sieving	2.8	2.85	2.9
3.	% of Residue left on the sieve on 90µ	2.8	2.85	2.9

Table 4.4Fineness Modulus of Cement Calculations:

Percentage of residue left on sieve=(weight retained/weight taken)x 100
Fineness Modulus of Cement =2.85

Tests for fine aggregate

4.2.A. Specific Gravity Test

SI.No	OBSERVATION	TrialI	TrialII	Trial III
1.	Weight of pycnometer W1(g)	450	450	450
2.	Weight of pycnometer+SandW2(g)	828	846	928
3.	Weight of pycnometer+Sand+WaterW3(g)	1484	1486	1538
4.	Weightofpycnometer+WaterW4 (g)	1242	1242	1242

Table 4.5 Specific Gravity of Fine Aggregate

4.2.2.B. Sieve Analysis Test

Sl.no	IS Sieve Nomm	Wt retained	%of weight retained	%weight Passing	Cumulative %weight retained	Sand Confirming Zone
1.	4.75mm	5	0.5	99.5	0.5	I,II,III,IV
2.	2.36mm	21	2.1	97.4	2.6	II,III,IV
3.	1.18mm	10	1	96.4	3.6	III,IV
4.	600 □	102	10.2	86.2	13.8	III
5.	300 □	580	58	28.2	71.8	II,III,IV
6.	150 □	236	23.6	4.6	95.4	I,II,III,IV
7.	Pan	46	4.6	0	100	-

Table 4.6 Sieve Analysis for Fine Aggregate

4.2.1 Tests for coarse aggregate

4.2.1.A. Specific Gravity Test

SI.No.	OBSERVATION	TrialI	TrialII	TrialIII
1.	Weight of Container(W1)	450	450	450
2.	Weight of Container + Sand(W2)	862	844	812
3.	Weight of Container + Sand + Water(W3)	1512	1498	1478
4.	Weight of Container +Water (W4)	1242	1242	1242

Table 4.7 Specific Gravity of Coarse Aggregate

4.2.1.B. Fineness modulus Test

Sl.No.	IS Sieve No mm	Weight retained	% of weight retained	%weight Passing	Cumulative %weight retained
1.	12.5	0	0	100	0
2.	11.2	76	7.6	92.4	7.6
3.	10	206	20.6	71.8	28.2
4.	9.5	195	19.5	52.3	47.7
5.	8	290	29.0	23.3	76.7
6.	6.3	185	18.5	4.8	95.2
7.	5.6	16	1.6	3.2	96.8
8.	4.75	18	1.8	1.4	98.6
9.	Pan	14	1.4	0	100
				Total	550.8

Table 4.8 Fineness modulus for coarse aggregate

4.2.2 Tests for Fly ash

4.2.4.A Specific Gravity Test

S.No	DESCRIPTION	TrialI	TrialII	Trail III
1.	Weight of empty bottle (W1)(g)	26.8	26.8	26.8
2.	Weight of bottle +water(W2)(g)	75	75	75
3.	Weight of bottle + Kerosene (W3) (g)	65.5	65.5	65.5
4.	Weight of bottle+ Cement+ Kerosene (W4) (g)	73	73.5	73.2
5.	Weight of cement(W5)(g)	10	10	10

Table 4.9 Specific Gravity of Flyash

4.2.4.B Fineness Modulus Test

S.No	OBSERVATION	TrialI	TrialII	TrialIII
1.	Weight of sample taken	100	100	100
2.	Weight of material retained after sieving	1.75	1.9	1.8
3.	% of Residue left on the sieve on 90µ	1.75	1.9	1.8

Table 4.10 Fineness Modulus

Concrete mix design

Mix design can be define as the process of selecting suitable ingredient so f concrete and determining the rerelative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible finding the proportions, we preferred ACI method for design the mix.

ACI Method of Design for M30 Concrete Data:

Compressive Strength required = 30 N/mm^2
Max size of Aggregate=12.5 mm
Specific Gravity of cement =2.90
Specific Gravity of Fine aggregate = 2.66
Specific Gravity of Coarse aggregate=2.88
Fineness Modulus of fine aggregate = 2.80

Design:

1. Required Slump =150–180 mm
2. Max size of Aggregate= 12.5 mm
3. From ACI, Table A1.5.3.3 For slump 150 - 180 mm, 12.5mm CA & Air Entrapped – 2%WaterContent =205kg/m^3
4. From ACI, Table A 1.5.3.4 (a) For M30,2% Air Entrapped Water Cement ratio (W/C)=0.45
5. Required Cement Content= 205/0.45=455.56 kg/m^3
6. From ACI, Table A1.5.3.6 For 12.5 mm Aggregate & fineness modulus – 2.8 Volume of Coarse Aggregate per unit volume of Concrete=0.55 Weight of CA =0.55 x1600 =880 kg/m^3
7. For 12.5mm Aggregate Density of fresh concrete for air entrained concrete=2235 kg/m^3
8. Weight of Water=205 kg/m^3
   Weight of Cement = 455.56 kg/m^3
   Weight of Coarse Aggregate=880kg/m^3
   Weight of Fine Aggregate=2235– (205 +455.56+880)=694.44kg/m^3
9. Absolute volume basis:

S.no	Materials	Weight (kg/m^3)x10-3	Absolute volume(m^3)
1.	Cement	455.56 / 2.9	0.157
2.	Water	205 / 1	0.205
3.	Coarse aggregate	880 / 2.88	0.306
4.	Air	(2 / 100)x10^3	0.02

   Total absolute volume=0.687 m^3
   Absolute volume of fine aggregate=(1 – 0.687)=0.312 m^3
   Weight of Fine aggregate =(0.312x2.66)x10^3=830.89 kg/m^3

10. Total free surface moisture in Fine Aggregate =(2/100) x 830.89=16.6kg/m^3
    Weight of Fine aggregate in field condition= 830.89+16.6=847.5 kg/m^3
    Coarse Aggregate absorbs 1% water Quantity of water absorbs byCA = (1/100)x880=8.8 kg/m^3
    Weight of Coarse Aggregate in field condition= 880–8.8=871.20kg/m^3
    Weight of Water in field condition =205– (16.6- 8.8)=197.2 kg/m^3

Cement	**FA**	**CA**	**W/P**
455.56	847.5	871.2	197.2
1	1.86	1.91	0.43

11. Replacing 30% of cement by Fly ash
    Weight of Fly ash=0.3x455.56=136.67 kg/m^3
    Weight of Cement = 455.56– 136.67=318.89 kg/m^3
12. Absolute volume basis:

S.no	Materials	Weight (kg/m^3)x10-3	Absolute volume(m^3)
1.	Cement	318.89 / 2.9	0.1099

2.	Fly ash	136.67 / 2.5	0.055
3.	Water	205 / 1	0.205
4.	Coarse aggregate	880 / 2.88	0.306
5.	Air	(2/ 100) x10^3	0.02

Total absolute volume =0.696m^3
Absolute volume of fine aggregate=(1–0.696)=0.3048m^3
Weight of Fine aggregate =(0.3048x2.66)x10^3=810.77 kg/m^3

13. Total free surface moisture in Fine Aggregate=(2/100)x810.=16.22kg/m^3
Weight of Fine aggregate in field condition =810.77 +16.22=826.95 kg/m^3
Coarse Aggregate absorbs 1% water Quantity of water absorbs by CA = (1/100)x880=8.8 kg/m^3
Weight of Coarse Aggregate in field condition= 880–8.8=871.20kg/m^3
Weight of Water in field condition = 205–(16.22-8.8)=197.58 kg/m^3
14. Super plastizer–Conplast:1% of Powder material (Cement+Flyash)(1/100)x455.56 =4.56 kg/m^3
15. Mix Ratio:

Cement	Fly ash	FA	CA	W/P	SP
318.89	136.67	826.98	871.2	197.58	4.5
1	0.43	2.59	2.73	0.43	1%

Table5.1MixRatio

Experimental programme

Program of mix

Experiment al test were carried out on series of mixes to evaluate the work ability and strength characteristic based on the following mix ratios.

CC –Cement + F.A + C.A + Water
SCC –CC+Flyash+Super plasticizer
SCC1–SCC + 0.02 % of Glass Fiber
SCC2–SCC + 0.03 % of Glass Fiber
SCC3–SCC + 0.04 % of Glass Fiber

Result and discussions

Tests were carried out on each mix to evaluate the work ability characteristics. As the results the work ability of nominal concrete is very poor, after the addition of super plasticizer the work ability of concrete increases and it gradually decreases when the addition of Fibers.

Work ability test results

S.No	Mix	Slump Flow (mm)	T50 Test (Sec)	V–Funnel Test (Sec)	L box Test (h2/ h1)	V–Funnel@ T5 Min(Sec)
1.	SCC	735	3	10	0.9	13
2.	SCC1	720	3	11	0.85	15
3.	SCC2	715	4	12	0.83	15
4.	SCC3	695	4	14	0.8	16

Table 8.1 work ability test results

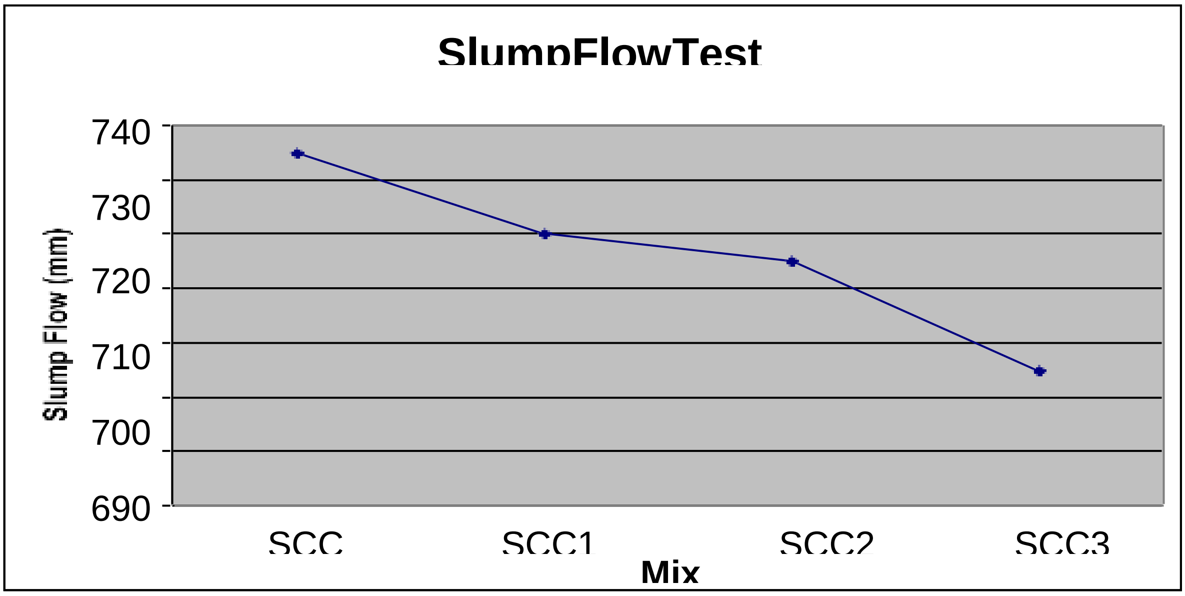


Figure 8.1 Slump Flow Test

6.2 Strength test:

6.2.1 Compressive strength test:

Compressive strength for different concrete strengths Since concrete is primarily intended to with stand compressive stresses, the determination of compressive strength has received a great deal of attention. Cubes, cylinders, and prisms are three types of compression specimens used to determine compressive strength. Cubes are typically 100 mm or 150 mm on a side and cylinders are 150 mm in diameter and 300 mm high. The prism used in France is 100mmx 100 mmx 500mm. Samples are cast, cured and tested according to the standards prescribed for such testing. If cylinders are used, they must be properly capped prior to testing. This step is not necessary when testing her types of specimens. Different specimens of the same concrete mix report different compressive strengths. Cylinders and prisms with a height or length to transverse dimension ratio of 2 can provide about 75- 85% of the cubic strength of normal strength concrete. It was observed that a maximum compressive strength of 33.92N/mm 2 was obtained with a glass fiber addition of 0.03%. Tensile strength is one of the fundamental and important properties of concrete because concrete is stress-relaxed. Due to it slow tensile strength and brittleness, concrete is usually not expected to with stand direct stress.

MIX	**7 Days Compressive Strength (Mpa)**				
	%of Glass Fiber	**Specimen I**	**Specimen II**	**Specimen III**	**Average**
CC	-	28	25.8	27.5	27.09
SCC	-	27.1	26.67	26.2	26.66
SCC1	0.02 %	28	27.1	26.2	27.1
SCC2	0.03 %	28.89	28.4	27.5	28.8
SCC3	0.04 %	26.67	26.72	28	26.96

Table 8.27 days compression test results

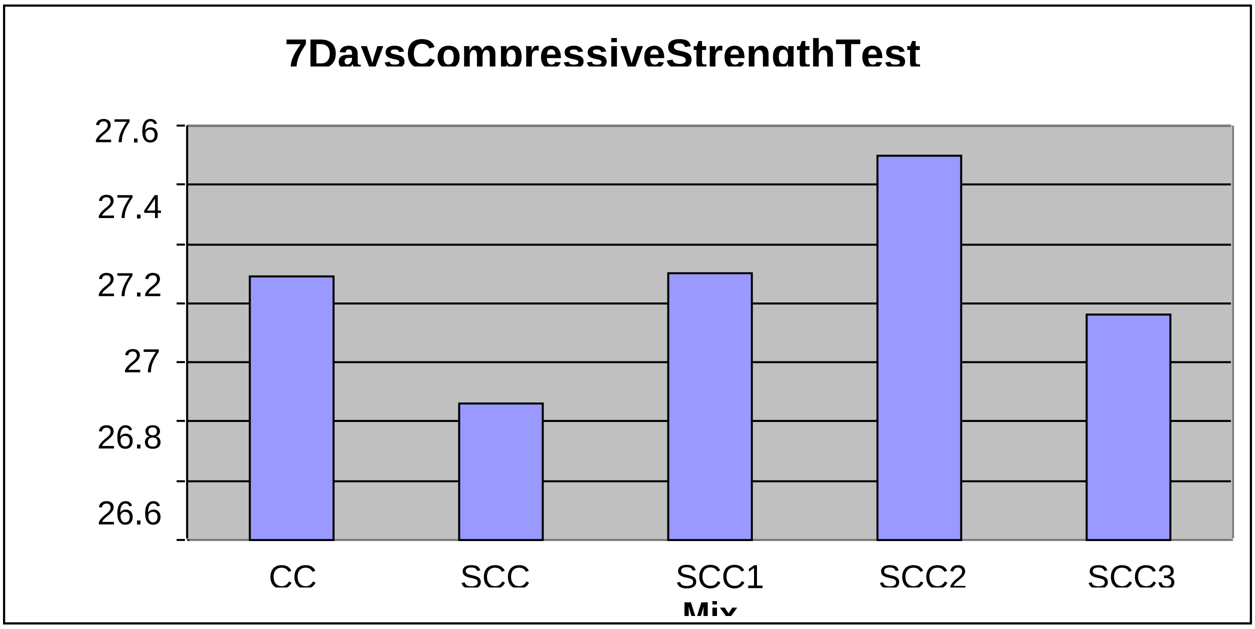


Figure 8.67 Days Compressive Strength Test

MIX	28 Days Compressive Strength (Mpa)				
	% of Glass Fiber	**Specimen I**	**Specimen II**	**Specimen III**	**Average**
CC	-	32	31.1	33.3	32.1
SCC	-	31.56	33.78	32	32.45
SCC1	0.02 %	32.4	35.1	32.8	33.46
SCC2	0.03 %	32.88	35.56	33.33	33.92
SCC3	0.04 %	31.56	33.33	35	33.3

Table 8.328 days compression test Results

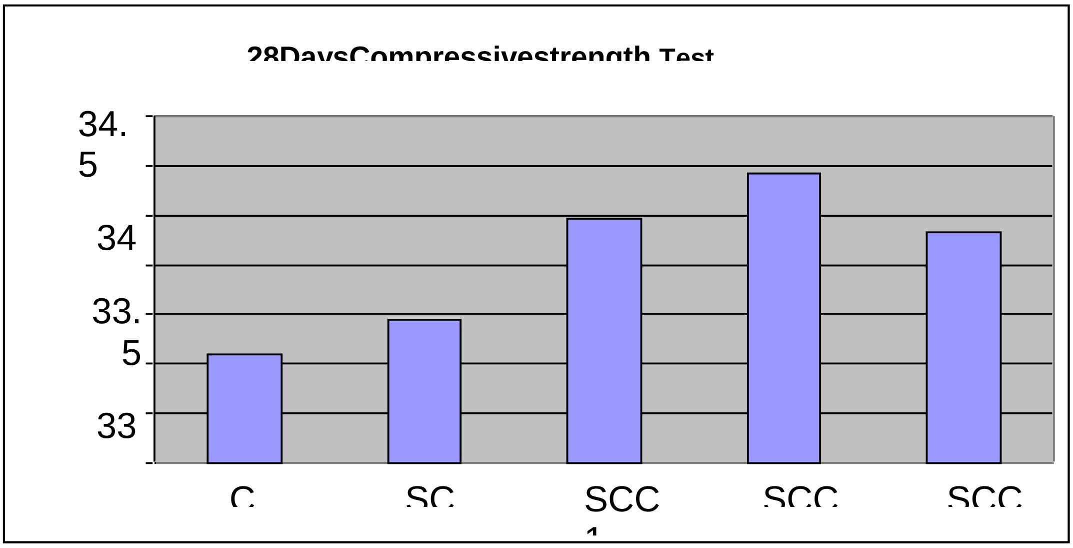


Figure 8.728 Days Compressive Strength Test

4.4 Flexural test

Determination of flexural strength is essential for estimating the loads that cancause concrete members to crack. The tensile strength of concrete is calculated in a bending test as it is measured differently than in a direct tensile test. Therefore, bending strength ormodulusofruptureisdeterminedandusedasappropriate.Hisknowledgehelpsinthedesignof pavings labs and run ways where bending stress is important. The modulus of rupture was tested on a150mmx 150mmx 700mm standard specimen with as pan of600mm or a100mmx 100mmx 500mm with as pan of 400mm under symmetrical H is two point loading. Is determined by The modul us of rupture is determined from the moment of failure as fr=M/Z. Determining the flexural strength is essential forest imating the loads that can cause concrete members to crack. The tensile strength of concrete is calculated in a bending test as it is measured differently than in a direct tensile test. Therefore, bending strength or modulus of rupture is determined and used as appropriate.

MIX	**28DaysFlexural Strength(Mpa)**				
	% of Glass Fiber	**Specimen I**	**Specimen II**	**Specimen III**	**Average**
CC	-	7.6	7.4	6.6	7.2
SCC	-	7.2	8	5.6	6.9
SCC1	0.02 %	6.4	6.8	8.8	7.33
SCC2	0.03 %	7.6	7.2	9.2	8.0
SCC3	0.04 %	8	6.8	8.6	7.8

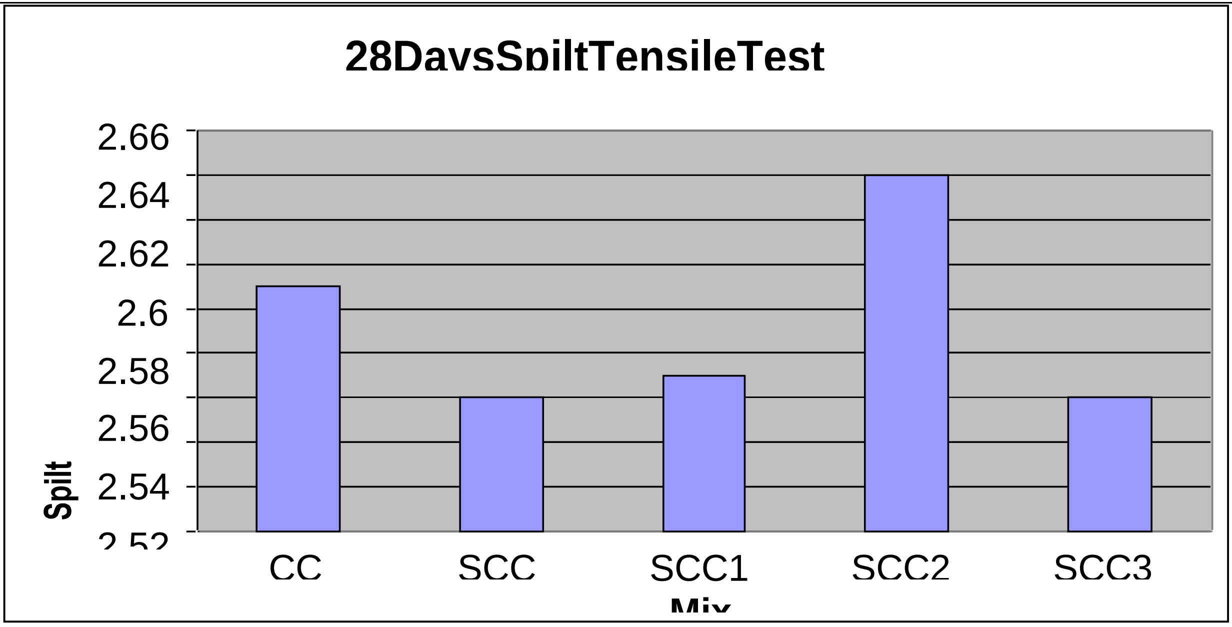
Table8.4flexural Testresults

Split tensile test:

A concrete split test is used to determine the tensile strength of concrete. In general, concrete has low tensile strength values, in this project we will add fibers to increase the tensile strength of concrete, thereby reducing the post-cracking of concrete. After 28days of curing, remove the wet sample from the water and wipe the water off the surface of the sample. Draw a diameter line on both ends of the sample to ensure they are in the same axial position. Be careful. Set the compression tester to there quired range. Hold the strip of plywood on the bottom plate and place the sample. Align the sample so that the line marked on the edge is vertical and centered on the bottom plate. Place another strip of plywood on top of the sample. Lower the top panel so that it touches the plywood strips. Apply load continuously without impact. Note the breaking load.

MIX	**28DaysSplitTensileStrength(Mpa)**				
	% of Glass Fiber	**Specimen I**	**Specimen II**	**Specimen III**	**Average**
CC	-	2.12	2.83	2.68	2.54
SCC	-	2.83	2.26	2.59	2.59
SCC1	0.02 %	2.56	2.69	2.41	2.55
SCC2	0.03 %	2.68	2.4	2.83	2.64
SCC3	0.04 %	2.55	1.98	3.12	2.54

Table8.5splittensiletestresults



V.CONCLUSION

The structural behavior of self-compacting glass fiberre in forced concrete was studied by adding different volumes of glass fiber from 0.02%to0.04%andusing1%s upper plasticizer and 0.8%VMAincement.Referringtotheresultsofthisstudy,the following conclusions were drawn. The work ability of concrete decreases with increasing fiber content. All received concrete mixes are viable, even with reduced values. A maximum compressive strength of 33.92N/mm2was achieved by adding0.03%fiberto the concrete. The improvement in compressive strength compared to the reference concrete is 5.66%.A maximum split strength of 2.64N/mm 2 was achieved by adding 0.03%fiber to the concrete. The improvement in split strength compared to the reference concrete is 3.94%.A maximum flexural strength of 8.0N/mm 2was achieved by adding 0.03%fibers to the concrete. The improvement in flexural strength compared to the reference concrete is11.12%. After this experimental investigation, it must be concluded that the incorporation of 0.03%glass fibers in to concrete increased strength by5.66%incompression,3.94%intension and 11.12% in bending after 28days. Finally, we concluded that 0.03%glass fiber addition to the concrete was optimal and the in corporation of glass fiber should increase the flexural strength relative to the compressive and tensile strength.

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