STUDY THE PROPERTIES OF SELF COMPACTING CONCRETE USING FLY ASH AND SILICA FUME

Mohd Ishaq Mir[1], Mohd Zeeshan Khan[2]
[1]PG Student Construction Technology and Management, [2]Assistant Professor,
Department Of Civil Engineering, Al-Falah School Of Engg And Tech., Al-Falah University, Faridabad, Haryana-121004, India

ABSTRACT: A self -compacting concrete (SCC) is the one that can be placed in the form and can go through obstructions by its own weight and without the need of vibration. Since its first development in Japan in 1988. SCC has gained wider acceptance in Japan. The major advantages of this method is that SCC technology offers the opportunity to minimize or eliminate concrete placement problems in difficult conditions. It avoids having to repeat the same kind of quality control test on concrete, which consumes both time and labor. Construction and placing becomes faster and easier. It eliminates the need for vibration and reducing the pollution. It improves the filling capacity of highly congested structural members.

SCC provides better quality especially in the members having reinforcement congestion or decreasing the permeability and improving durability of concrete. The primary aim this study is to explore the feasibility of using SCC by examining its basic properties. An extensive literature survey was conducted to explore the present state of knowledge on the durability performance of self-consolidating concrete. However, because it usually requires a large content of binder and chemical admixtures compared to ordinary concrete, its material cost is generally 20-50% higher, which, has been major hindrance to a wider implementation of its use. There is growing evidence that incorporating high volume of mineral admixtures and micro fillers as partial replacement for Portland cement in SCC can make it cost effective. This research work consists of :

(1) development of a suitable mix for SCC that would satisfy the requirements of plastics state;

(2) casting of concrete samples and testing them for compressive strength at respective curing periods. Local aggregates, cement, admixtures and additives produced by the local suppliers were used by in this work.

I. INTRODUCTION

GENERAL

The development of new technology in the material science is processing rapidly. In last three decades a lot of research was carried out through out globe to improve the performance of concrete in terms of strength and durability qualities. Consequently concrete has no longer remained a construction material consisting of cement aggregate and water only, but has becomes a engineered custom tailored material with several new constituents meet the specific needs of construction industry. The growing use of concrete in special architectural configurations and closely spaced reinforcing bars have made it very important to produce concrete that ensures proper filling ability good structural performance and adequate durability .in respect years a lot of research was carried out throughout the world to improve the performance of concrete in terms of its most important properties,i.e.strength and durability.

Concrete technology has undergone from macro to micro level study in the enhancement of strength and durability properties from 1980s onwards.Till 1980 the research study was focused only to flow ability of concrete, so as to enhance the strength however durability did not draw lot of attention of the technologists. This type of study has resulted in the development of selfcompactingconcrete (SCC), a much needed revolution in concrete industry. Self Compacting Concrete is highly engineered concrete with much higher fluidity without segregation and is capable of filling every corner of form work under its self weight only. Thus SCC eliminates the needs of vibration either internal or external for the compaction of concrete without compromising its engineering properties.

Self compacting concrete is basically a concrete which is capable of flowing into the form work without segregation, to fill uniformly and completely every corner of it by its own weight without any application of vibrations or other energy during placing. There is no standard self compacting concrete. Therefore each self compacting concrete has to be designed for the particular structure to be constructed. However working on the perimeters which affect the basic properties of self compacting concrete such as plastic viscosity, deformability, flowability and resistance to segregation, self compacting concrete can be proportioned for almost any type of concrete structure.

To meet the concrete performance requirements, the following three types of SCC are available

1. Powder type of self compacting concrete : This is proportioned to give the required self-compactability by reducing water powder and provide adequate resistance. Super plasticizer and air entraining admixtures give the required deformability.

2. Viscosity agent type self compacting concrete: This type of proportioned to provide self compaction by the use of viscosity modifying admixture to provide segregation resistance. Super plasticizer and air entraining admixtures are used for obtaining the desired deformability.

3. Combination type of self compacting concrete: This type is proportioned so as to obtain self compactibility mainly by reducing the water powder ratio, as in the powder type and viscosity modifying admixture is added to reduce the quality

fluctuation of the fresh concrete due to the variation of the surface moisture content of the aggregates and their gradations during the production. This facilitates the production control of the concrete

II. SCOPE AND OBJECTIVES OF THE RESEARCH

To develop SCC with satisfactory fresh properties (i.e., flowability, filling and passing abilities adequate segregation resistance,), hardened properties i.e; concrete compressive strength.

Keeping in view this investigation is mainly focused on to study the fresh and hardened properties of self compacting concrete. As there is no availability of SCC mix design standards in particular for strength of concrete, this investigation is focused on the different mix proportions with different supplementary cementitious materials of SCC satisfying both SCC performance and the desired strength. As already known that the increased content of powder (fines), fly ash, silica fume and admixtures leads to higher sensitivity, strength and combination-type of self compacting concrete has been chosen in the self compacting concrete mix design so as to use moderate powder, fly ash silica fume and reasonable quantity of chemical admixtures such as conplast SP430 and Poly- Carboxylate Ether (PCE)

Also, keeping in view of the savings in cost and fresh, hardened and durability properties of SCC, the replacement level of silica fume and fly ash (FA) in the cement was kept SF25% and FA35% respectively, andthe combination of silica fume and fly ash in the cement was kept (SF15% + FA25%) with combinations of admixtures such as (conplast SP430 and PCE) throughout the study.

The field of concrete technology has been miraculous change due to the invention of various admixtures. The admixtures modify the properties of fresh concrete and offer many advantages to the user.

The main aim of this experimentation is to find out the effect of addition of fly ash and silica fume on the properties of self compacting concrete containing two reasonable admixtures (Conplast SP430 and Poly- Carboxylate Ether)

The flow characteristics and strength characteristics of self compacting concrete produced from different waste materials and the percentages of that materials are found. The percentage of fly ash used in experimentation is 35% and the percentage of silica fume used in experimentation is 25% and combination of silica fume and fly ash used in experimentation is (SF15% + FA25%).

This investigation further studies on the various curing methods of self compacting concrete for better understanding the corrections of properties self compacting concrete. SCC mix proportions and CC has been done and benefits of SCC over CC have been discussed in order to promote the SCC in the building constructions to a large extent. Based on the background, methodology and scope of this project, the research comprises of the following:

- Improved compaction around congested reinforcement.
- Potential to enhance durability through improved compaction of cover concrete
- Elimination of vibration leading to environment, health and safety benefits.
- Quicker and easier concrete placement.
- Effect of Supplementary Cementing Materials (SCMs) such as silica fume and fly ash on fresh properties of self compacting concrete
- Effect of Supplementary Cementing Materials (SCMs) such as silica fume and fly ash blending on hardened properties of self compacting concrete.
- To identify admixture(s) for self curing of SCC and develop self curingself compacting concrete (SCSCC) and consequently find mechanical properties namely compressive and tensile strength of SCSCC
- Identifying various curing techniques for concrete and its procedures
- To study the fresh properties of selected grade of self compacting concrete namely slump flow test, slump T50cm test and J-test
- To study the mechanical properties of selected grade of SCC namely compressive strength and split tensile strength of hardened SCC and find the effect of different techniques of curing on these properties

PROPERTIES OF SELF COMPACTING CONCRETE

The main three properties of SCC in plastic state are

- Filling ability (excellent deformability)
- Passing ability (ability to pass reinforcement without blocking)
- High resistance to segregation .

Filling ability :

Self compacting concrete must be able to flow into all the spaces within the formwork under its own weight. This is related to workability, as measured by slump flow or Orimet test. The filling ability or flowability is the property that characterizes the ability of the SCC of flowing into formwork and filling all the spaces under its own weight, guaranteeing total covering of the reinforcement. The mechanisms that govern this property are high fluidity and cohesion of the mixture.

Passing Ability:

Self compacting concrete must flow through tight openings such as spaces between steel reinforcing bars under its own weight. The mix must not block during placement.

The passing ability is the property that characterizes the ability of the SCC to between obstales-gaps between reinforcement, holes, and the narrow sections, without blocking. The mechanisms that govern this property are moderate viscosity of the paste and mortar, and the properties of the aggregates, principally, maximum size of the coarse aggregates. Stability or resistance to the segregation is the property that characterizes the ability the ability of the SCC to avoid the segregation of its components, such as the coarse aggregate. Such a property provides uniformity of the mixture during transport, placement and consolidation. The mechanism that govern this property are the viscosity and cohesion of the mixture.

High Resistance to segregation:
Self compacting concrete must meet the requirement of 1 and 2 while its original composition remains uniform. The key properties must be maintained at adequate levels for the required period of time (e.g. 20 min) after completion of mixing. It is the property 2 the passing ability and the property 3 resistance to segregation that constitute the major advance, form a merely super plasticizer fresh mix which may be more fluid than self compacting.
The above three key properties are to some extent related and inter-dependent. A change in one property will normally result in a change in one or both of the others. Both poor filling ability and segregation can cause insufficient passing ability, i.e. blocking. Risks of segregation increase as filling ability increases. SCC is actually a trade-off between filling ability and segregation resistance.

III. METHODOLOGY

Study of literature review:
- Identification of literature survey problems.
- Procurement and selection of material.
- Preliminary investigation of materials.
- Development of mix design
- Preparation on trail mix.
- Optimization of Fly Ash and Silica Fume in self compacting concrete.
- Conducting tests on fresh properties of SCC.
- Casting and Curing the specimens.
- Testing of specimens for hardened properties.
- Feasibility study on self compacting concrete.

Experimental program:
- Identification of materials and testing their properties
- Preliminary investigation of materials
- Optimization of FA and SF content in SCC
- Optimization of superplasticizer content in SCC
- Mix preparation on various trails using FA and SF
- Moulding of mix proportions and testing in fresh state such as slump flow test, T_{50} slump test and j ring test
- Study the effect of FA and SF on the fresh properties on SCC
- Casting and curing of concrete and testing in hardened state such as compressive strength
- Identify the effect of FA and SF on the hardened properties of SCC

3.3 Result analysis:
- Conducting the tests
- Correction errors of result
- Note the result readings
- Calculation of readings
- Finalize the result tabular form
- Finalize the result by showing in graphs

IV. MATERIAL AND TESTING ON MATERIALS

MATERIALS
The raw materials used in this experiment were locally available as a blinding agent, river sand as fine aggregates, crushed coarse aggregates and Portable tab water was used for mixing and curing throughout the entire work.

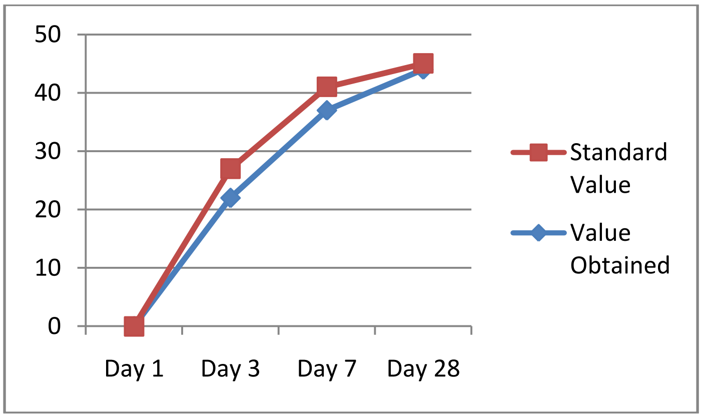
CEMENT
Use 43 Grade of cement of ordinary Portland cement (OPC).It is blended with water and materials. The different tests led on cement are as under given in Table

S.No.	Characteristics	Values Obtained	Standard Values
1	Normal Consistency	31%	-
2	Initial Setting Time	44 min.	Not be less than 30 minutes
3	Final Setting Time	269 min.	Not be greater than 600 minutes
4	Fineness	6.1 %	<10

Table: Physical properties of cement

1	3 days	22 N/mm^2	27 N/mm^2
2	7 days	37 N/mm^2	41 N/mm^2
3	28 days	44 N/mm^2	43 N/mm^2

Table of Compressive strength :- Cement: Sand(1:3)



Graph of Compressive Strength Vs Time

FINE AGGREGATES
The sand used for the experimental programme was locally. The sand was first sieved through 4.75mm sieve to remove any particles greater than 4.75mm. Properties of the fine

aggregate used in the experimental work are tabulated in Table (a). The aggregates were sieved through a set of sieves to obtain sieve analysis and the same is presented in Table (b).

Sr. No.	Characteristics	Value
1.	Bulk density	1.5 kg/m^3
2.	Fineness modulus	2.56 m^2/g
3	Water absorption	0.79%
4.	Grade zone (Based on percentage passing 0.60mm)	Zone III

Table(a): Physical Properties of fine aggregates

Sr. No.	Sieve size	Mass retained	Percentage Retained	Cumulative percentage Retained	Percent passing
1	4.75mm	4.0 g	0.4	0.4	99.6
2.	2.36mm	75.0 g	7.50	7.90	92.1
3.	1.18mm	178.0 g	17.8	25.70	74.3
4.	600µ	220.0 g	22.0	47.70	52.3
5.	300µ	274.0 g	27.4	75.10	24.9
6.	150µ	246.5 g	24.65	99.75	0.25
7.				£=256.55	

Table (b) :Seive analysis of fine aggregates

Total weight taken =1000gm

Fineness Modulus of sand =2.56

Thus the fine aggregates belonged to grading zone III.

COARSE AGGREGATE

The material which is retained on IS sieve no. 4.75mm is termed as a coarse aggregate.Locally available coarse aggregate having the maximum size of 10 mm was used in our work. The results of various tests conducted on coarse aggregate are given in Table (c)and Table (d)shows the sieve analysis result.

Sr. No.	Characteristics	Value
1.	Type	Crushed
2.	Total water Absorption	0.52
3.	Fineness Modulus	6.84

Table (c): Physical Properties of Coarse Aggregate

Sr. No.	Sieve Size	Mass Retained in gm	Percentage Retained	Cumulative percentage Retained	Percent passing
1.	20mm	0	0	0	100
2.	10mm	2512	83.7	83.7	16.3
3.	4.75mm	477	15.9	99.6	0.4
4.	PAN	11	0.36	£=183.3	

Table (d) : Sieve Analysis of Coarse Aggregate.

Total Weight taken =3000gm

Fineness Modulus of Coarse Aggregate= (183.3+500)/ 100 = 6.8

WATER

Water is the readily available most important component of SCC. The hydration of cement can take place only in the presence of water. Adequate water is required for the hydration of cement, leading to the formation of paste to bind the aggregates. In addition, water is required in conjunction with superplasticizer to achieve the self consolidation capacity of SCC.

Properties	Obtained values
Ph	8.0
Dissolved salts, mg/l	290
Suspended particles	Nil
Chlorides, mg/l	20

Table (e): Properties of water

SUPPLEMENTARY CEMENT MATERIALS

Fly Ash

Fly ash is the finely divided residue resulting from the combustion of coal. It is a pozzolanic material that is commonly used in cement-based materials & the particles are generally finer than cement particles.

The investigations was carried out on self compacting concrete using 35% of fly ash by weight of cement as partialreplacement of cement. Based on the investigation that concluded that addition of Fly ash resulted in a decreases of superplasticizer content for same or better workability. The addition of Fly ash resulted as decrease in 7 days and 28 days compressive strength. The 28 days compressive strength decrease to 22-23 % as the Fly ash content is increased to 35%. The reduction in 7 days strength is more as compared to 28 days strength.

Silica Fume

Silica Fume is a by-product obtained after reducing high-purity quartz with coal in electric arc furnace by heating up to 2000^{o}C (3632^{o}F) during the production of silicon

Role Of Silica Fume

The presence of silica fume (SF) in the concrete mix improves workability and makes the mix more mobile. This is the consequence of a better dispersion of the cementitious particles and due to the surface characteristics of the silica fume particles, which are smooth and absorb little water during mixing. The workability of concrete containing silica fume is more sensitive to variations in the water content of the mix than ordinary mix. The mix containing silica fume has very low penetrability and good resistance to penetration and thereby reduces freeze and thaw effect.

ADMIXTURES

Admixture is defined as a material, other than cement, water and aggregates, which is used as an ingredient of concrete and is added to the batch immediately before or during mixing. Additive is a material which is added at the time of grinding cement clinker at the cement factory. Various admixtures are categorized based on their function in the concrete namely Plasticizers, Superplasticizers.

Superplasticizer

Superplasticizer (SP) also called High Range Water Reducers (HRWR) is an essential component of SCC to provide the necessary workability. They reduce the yield stress and plastic viscosity of concrete by their liquefying action.

The main purpose of using a superplasticizer is to produce flowing concrete with very high slump that is to be used in heavily reinforced structures and in places where adequate consolidation by vibration cannot be readily achieved.. The new generation superplasticizerPoly- Carboxylate Ether (PCE) are based particularly useful for production of SCC.

Using PCE polymers, give excellent water reduction as compared to normal

plasticizers. This helps to reduce the w/c ratios and cement contents, even in normal concretes. Lower the w/c ratio, lower are the number of capillaries in concrete. It is also a well documented fact that PCE based admixtures do not have the side effects of retardation often seen with normal retarding superplasticizers. This is beneficial as workability time of concrete can be controlled

Conplast SP430

Conplast SP430 is a high range water decreasing admixture and is a chloride free, superplasticize. It is supplied as brown solution which instantly disperses in water.Conplast SP430 disperses the fine particles in the concrete mix, enabling the water content of the concrete to perform more effectively. The very high levels of water reduction possible allow major increases in the strength to be obtained.

MIX DESIGN AND TESTING

TYPICAL MIX PROPORTION

SCC has the same constituent materials as those for Conventional concrete but their relative proportions differ and need to be carefully selected. Generally speaking, lower coarse aggregate content and higher amounts of additions and cement, and admixtures (particularly superplasticizer) are required to achieve self compacting properties.

A simple mix proportioning system for SCC have proposed. The coarse and fine aggregate contents are fixed so that self compactability can be achieved easily by adjusting the cement, fly ash, silica fume andsuperplasticizer dosages. The mix design procedure is as follows:

1). The coarse aggregate content (all particles larger than 4 mm and smaller than 10mm) is fixed in the range of 28 to 35% of the concrete volume

2). The fine aggregate content (all particles larger than 0.125 mm and smaller than

4.75 mm) is fixed in the range of 40 to 50% of the mortar volume.

3) The W/P ratio is 0.45 (by mass), depending on the properties of the powder (i.e cement and filler having particles smaller than 0.125mm).

4). Thesuperplasticizer dosage and the final W/ P ratio are determined through trial

mixes so as to ensure self compactability using fresh properties tests.

5).The silica fume and fly ash percentages are determined through trial mixes, so as to ensure self compactability using fresh properties test.

The proposed mix proportions of SCC and recommended that workability tests should be conducted until consistent and compliant results are obtained. SCC tends to dry faster than conventional concrete because there is little or no bleed water at the surface

MIX PROPORTION

M25 = (1:1:2) NORMAL SELF COMPACTING CONCRETE (NSCC)

Wet volume of concrete for 1 cube = 0.15×0.15×0.15 = $0.003375m^3$

Dry volume = Wet volume × 1.54

Cement = $\frac{1}{4}$× 1.54 = $0.385m^3$ = 0.385 × 1440 = 554 kg

= 1870 gm

Sand = $\frac{1}{4}$× 1.54 = $0.385m^3$ = 0.385 × 1600 = 616 kg

= 2080 gm

Coarse Aggregatess =$\frac{2}{4}$× 1.54 = $0.77m^3$ = 0.77×1680 =1293 kg

= 4360 gm

Take W/Cratio = 0.45

Thereore water = 0.45×1.87

= 840 gm.

FIRST TRIAL TEST FOR CUBE SCC1(35%FA)

Total Powder Content = 1870 gm

Fly Ash = 35%

Fly Ash Content = 655 gm

Superplasticiser = 4%

Complast SP 430 =2% = 37 gm

Polycarboxylate Ether = 2% = 37 gm

Cement = 1870-(655+37+37)

= 1140 gm

Sand =2080 gm

Coarse Aggregatess = 4360 gm

Take W/Pratio = 0.45

Water = 840 gm

SECOND TRIAL TEST FOR CUBE SCC2(25%SF)

Total Powder Content = 1870 gm

Silica Fume = 25%

Silica Fume Content = 467 gm

Superplasticiser = 5%

Complast SP 430 =3% = 56 gm

Polycarboxylate Ether = 2% = 37 gm

Cement = 1870-(467+56+37)

= 1310 gm

Sand =2080 gm

Coarse Aggregatess = 4360 gm

Take W/Pratio = 0.45

Water = 840 gm

THIRD TRIAL TEST FOR CUBE SCC3F(25%FA+15%SF)

Total Powder Content = 1870 gm

Fly Ash + Silica Fume = 40%

Fly Ash = 25% = 468 gm
Silica Fume = 15% = 280 gm
Superplasticiser = 6%
Complast SP 430 =6% = 110 gm
Polycarboxylate Ether = 0% = 00 gm
Cement = 1870-(468+280+110)
= 1010 gm
Sand =2080 gm
Coarse Aggregatess = 4360 gm
Take W/Pratio = 0.45
Water = 840 g

Mix	Cement Gm	Water Gm	C.A Gm	Sand gm	FA gm	SF Gm	SP Gm
NSCC	1870	840	4360	2080	-	-	-
SCC1	1170	840	4360	2080	655	-	74
SCC2	1310	840	4360	2080	-	467	93
SCC3	1010	840	4360	2080	468	280	110

Table: proportioning of mix of all trails

TEST METHODS OF FRESH SELF COMPACTING CONCRETE

Slump Flow Test

The slump flow test is used to assess the horizontal free flow of SCC in the absence of obstructions. The basic equipment used is the same as use in conventional slump test. The test method differs from the conventional one. Figure shows Slump flow test.

The diameter of the spread of the concrete circle is a measure for the filling ability of the concrete. The slump flow test can give an indication as to the consistency, filling ability and workability of SCC.

In case of unstable mix, most of the coarse aggregateparticles main in the center of the flow and only cement mortar flows. It gives no indication of the ability of the concrete to pass between reinforcement without blocking, but may give some indication of resistance to segregation. The higher the slump flow value, the greater is its ability to fillformwork under its own weight. Acceptable range for SCC is from 650 to 800 mm.

T50SlumpFlowTest

The procedure for this test is same as slump flow test. When the slump cone is lifted, start the stop watch and find the time taken for the concrete to reach 500mm mark. This time is called T50time. This is an indication of rate of spread of concrete. A lower time indicates greater flowability. It suggested that T50time may be 2 to 5 secs

J-Ring Test

This test denotes the passing ability of the concrete. The apparatus is composed of a ring with 16 or 18 vertical reinforcing rods, a slump cone and a rigid plate. When the cone is lifted, the concrete has to pass through the reinforcing bars as it flows across the plate. The passing ability is expressed as the height difference between the concrete inside and outside the bars, called the step height.

Segregation resistance can be visually evaluated by observing the periphery after the concrete has stopped flowing. The number of bars has to be adjusted depending on the maximum size aggregate in the SCC mix. For SCC, maximum height difference up to 10 mm is considered as appropriate mix.

TEST METHODS OF HARDENED SELF COMPACTING CONCRETE

Compressive Strength

Self compacting concretes appear to develop in general higher compressive strength values as compared with conventional concrete of the same strength class. This is attributed to the changes in the interfacial transition zone (ITZ) caused by the different filler materials.

For SCC, achieving high strengths is not difficult, due to the presence of high powder content. However, achieving low and medium strength SCC is a difficult task. The paste volume had a predominant effect on the fresh concrete properties in comparison with water or powder content individually (for a given combination of aggregates).

V. RESULTS AND DISCUSSION

SLUMP FLOW TEST

Results of slump value of all mixes such as replacement of cement by 35% of fly ash, replacement of cement by 25% of silica fume, combination of fly ash & silica fume(FA25% +SF15%) and normal self compacting concrete (NSCC) are shown in table

Mix	Slump (mm)
SCC1(35%FA)	675
SCC2(25%SF)	690
SCC3(25%FA+15%SF)	705
NSCC	660

Table of Slump flow result of SCC

From the above result table of slump flow test shows that there is maximum slump of SCC3 , so we can say that by increasing the powder content the filling ability of concrete is also increased. The mix containing 25%FA and 15%SF shows slump flow value is increased by 3.3% to that of NSCC

T_{50} SLUMP FLOW TEST

A lower time indicates greater flowability. It is suggested that T50time may be 2 to 5 Secs. Results of T50 slump value of all mixes such as replacement of cement by 35% of fly ash, replacement of cement by 25% of silica fume, combination of fly ash & silica fume(FA25% +SF15%) and normal SCC are shown in table

Mix	T_{50cm} slump
SCC1(35%FA)	4.8
SCC2(25%SF)	4.5
SCC3(25%FA+15%SF)	4.0
NSCC	5

Table:T_{50m} slump value result

From the above result table of T_{50cm} slump flow test shows that there is maximum flowability of SCC3 , so we can say that by increasing the powder content the flowability also goes on increasing. The mix containing 25%FA and 15%SF shows T_{50} slump flow value is increased by one Sec or 11.1% to that of NSCC.

J RING TEST

This test denotes the passing ability of the concrete. The passing ability is expressed as the height difference between the concrete inside and outside the bars, called the step height. For SCC, maximum height difference up to 10 mm is considered as appropriate mix.

Mix	Diameter (mm)	h2-h1(mm)
SCC1(35%FA)	565	1.3
SCC2(25%SF)	571	2.2
SCC(25%FA+15%SF)	578	3.1
NSCC	553	1.6

Table of result of J ring test

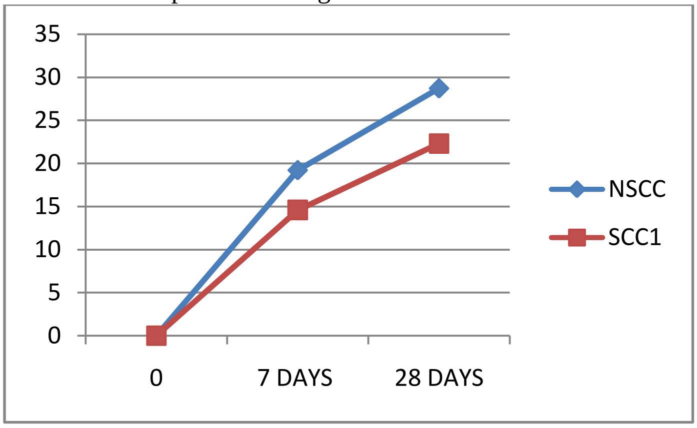
So we can say that by increasing the powder content the passing ability of concrete also goes on increasing. The mix containing 25%FA and 15%SF shows that passing ability is increased by 31% to that of normal self compacting concrete (NSCC).

COMPRESSIVE STRENGTH OF SSC1(35%FA) and NSCC

In order to study the effect of compressive strength when fly ash is added into self compacting concrete as cement replacement, the cubes containing 35% of fly ash (35%FA) with 4% of superplasticizer were prepared and kept for curing for 7days and 28days. The result of compressive strength of respectivescubes is shown in table and graph and is compare with the normal self compacting(NSCC)

Mix	Compressive Strength(N/mm^2)		Average Compressive strength (N/mm^2)	
	7days	28days	7days	28days
SCC1(35%FA)	15.6	22.6	14.6	22.3
	14.6	22.5		
	13.5	21.7		
NSCC	20.1	28.5		28.7
	19.4	29.7		
	18.2	28.1	19.2	

Table : compressive strength result of SCC1& NSCC



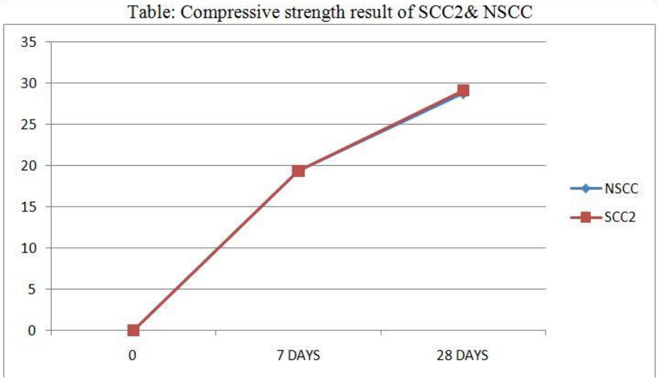
Graph: compressive strength result of SCC1and NSCC

COMPRESSIVE STRENGTH OF SSC2(25%SF) and NSCC

In order to study the effect of compressive strength when silica fume is added into self compacting concrete as cement replacement, the cubes containing 25% of silica fume (25%SF) with 5% of superplasticizer were prepared and kept for curing for 7days and 28days. The result of compressive strength of respectivescubes is shown in table and graphand is compare with the normal self compacting(NSCC).

Mix	Compressive Strength(N/mm^2)		Average Compressive strength (N/mm^2)	
	7days	28days	7days	28days
SCC2(25%SF)	19.4	29.6	19.3	29.1
	19.6	30.2		
	18.9	27.7		
NSCC	20.1	28.5	19.2	28.7
	19.4	29.7		
	18.2	28.1		

Table: Compressive strength result of SCC2& NSCC



Graph: compressive strength result of SCC2

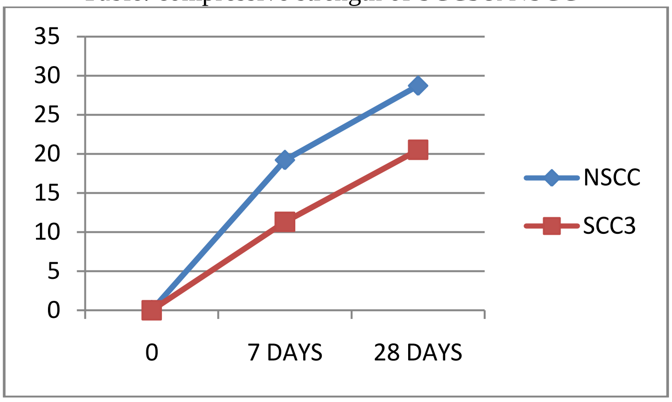
COMPRESSIVE STRENGTH OF SCC3(25%FA+14%SF)

In order to study the effect of compressive strength when fly ash and silica fume is added into self compacting concrete as cement replacement, the cubes containing 25% of fly ash (25%FA) and 15% of silica fume (15%SF) with 6% of superplasticizer were prepared and kept for curing for

7days and 28days. The result of compressive strength of respectivescubes is shown in table and graph and is compare with the normal self compacting(NSCC)

Mix	Compressive Strength(N/mm^2)		Average Compressive strength (N/mm^2)	
	7days	28days	7day s	28day s
SCC3(25%FA+15%SF)	11.7	20.2	11.3	20.5
	13.4	23.4		
	8.7	18.1		
NSCC	20.1	28.5	19.2	28.7
	19.4	29.7		
	18.2	28.1		

Table: compressive strength of SCC3& NSCC



Graph: Compressive strength of SCC3& NSCC

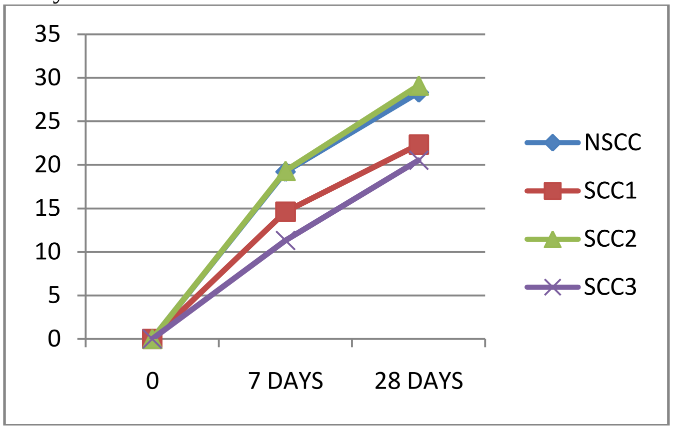
COMPRESSIVE STRENGTH OF ALL MIXES

In order to study the effect of compressive strength when fly ash and silica fume is added into self compacting concrete as cement replacement, the cubes containing 25% of fly ash (25%FA) and 15% of silica fume (15%SF) with different percentages of superplasticizer were prepared and kept for curing for 7days and 28days. The result of compressive strength of respectivescubes is shown in table and graph and is compare with the normal self compacting(NSCC)

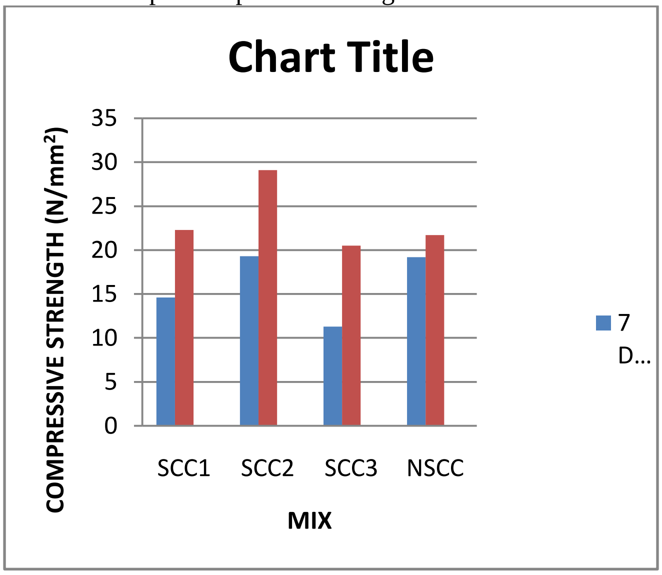
MIX	Compressive Strength (N/mm^2)		Average Compressive Strength (N/mm^2)	
	7days	28days	7days	28days
SCC1(35%FA)	15.6	22.6	14.6	22.3
	14.6	22.5		
	13.5	21.7		
SCC2(25%SF)	19.4	29.6	19.3	29.1
	19.6	30.2		
	18.9	27.7		
SCC3(25%FA+15%SF)	11.7	20.2	11.3	20.5
	13.4	23.4		
	8.7	18.1		
NSCC	20.1	28.5	19.2	28.7
	19.4	29.7		
	18.2	28.1		

Table: compressive strength of SCC1, SCC2 ,SCC3& NSCC

The above table shows that there in maximum comprerssive strength of mix which contain 25% of silica fume.Which is increased by 1% than that of NSCC at the curing period of 28days.



Graph: compressive strength of all mixes



Graph: compressive strength at different ages

VI. CONCLUSIONS

It has been observed that after 35% addition of fly ash in concrete, compressive strength starts decreasing, i.e. the compressive strength of self compacting produced with (conplast SP430 and PCE) is maximum when 35% fly ash is added. The compressive strength by 35% addition of fly ash is 14.6N/mm after the 7days of curing period and 22.3N/mm after the 28days of curing period.Thus, it can be concluded that maximum compressive strength of self compacting concrete with the combination of admixtures may be obtained by adding 35% fly ash.

It has been observed that after 25% addition of silica fume, the compressive strength starts decreasing i.e. the compressive strength of self compacting concrete produced with (conplast SP430 and PCE) is maximum when 25% silica fume is added. Thecompressive strength at 25%addition of silica fume is 19.3N/mm after the curing period of 7days and 29.1N/mm after the 28days of curing period. Thus, it can be concluded that maximum compressive strength of self compacting concrete with the combination of admixtures (conplast 430 and PCE) may obtained by adding 25% silica fume

It has been observed that after 25% addition of fly ash and 15% addition of silica fume, compressive strength starts decreasing, i.e. the compressive strength of self compacting produced with Conplast SP430 is maximum when 25% fly ash is added and 15% silica fume is added.The compressive strength by 25% addition of fly ash and 15% addition of silica fume is 11.2N/mm after 7days of curing and 20.5N/mm after 28days of curing. Thus, it can be concluded that maximum compressive strength of self compacting concrete with the combination of admixture conplast SP430 may be obtained by adding 25% fly ash and 15% silica fume

It has been observed that the compressive strength of normal self compacting concrete (NSCC) is 19.2N/mm^2 at age of 7days and 28.9N/mm^2 at the age of 28days.

At the end it is concluded that maximum compressive strength of self compacting concrete is achieved, when 25% of total powder content is replaced by silica fume(25%SF) and 5% of total powder conent is replaced by superplasticizer. Which shows that compressive strength is increased by 1% than that of NSCC at the age of 28days.

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