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ALCCOFINE STEEL FIBER SELF-COMPACTED CONCRETE

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ABSTRACT

In this experimental work is mainly concerned with the study of behavior of cement concrete by using mineral admixture- Alccofine and steel fiber as addition to cement.

Alccofine were added upto 25% by weight of cement in the respective courses of 5%, 10%, 15%, 20%, and 25% for producing concrete. Alccofine and steel fiber has high pozzolanic reactivity and low price. It reduces free drying shrinkage and restrains the shrinkage cracking width. It also helps in enhancing the compressive strength and durability of concrete.

ALCCOFINE1203 performs in superior manner than all other mineral admixtures used in concrete within India. Due to its inbuilt CaO content, ALCCOFINE1203 triggers two way reactions during hydration

• Primary reaction of cement hydration.

• Pozzolanic reaction: ALCCOFINE 1203 also consumes by product calcium hydroxide from the hydration of cement to form additional C-S-H gel, similar to pozzolans.

This results in denser pore structure and ultimately higher strength gain.

This review paper discusses the effects of silica fume and Alccofine on the concrete properties such as strength, modulus, ductility, permeability, chemical attack resistance, corrosion, creep rate. Characterization of silica fume and Alccofine as well as its physical and chemical properties will also be reviewed in this paper.

Keywords: *Self-compacting concrete, Alccofine, Steel fibre, workability.*

I. INTRODUCTION

General:

Self-compacting concrete (SCC) is considered as a concrete which can be placed and compacted under its self-weight with little or no vibration effort and which is at the same time cohesive enough to be handled without segregation or bleeding. It is used to facilitate and ensure proper filling and good structural performance of restricted areas and heavily reinforced structural members. SCC was developed in Japan in the late 1980s to be mainly used for highly congested reinforced structures in seismic regions. Recently, this concrete has gained wide use in many countries for different applications and structural configurations. SCC can also provide a better working environment by eliminating the vibration noise. There are many advantages of using SCC, especially when the material cost is minimized. These include:

1.Reducing the construction time and labor cost;

2.Eliminating the need for vibration;

3.Reducing the noise pollution;

4.Improving the filling capacity of highly congested structural members.

5.Facilitating constructability and ensuring good structural performance.

Such concrete requires a high slump that can easily be achieved by super plasticizer addition to a concrete mixture. However, for such concrete to remain cohesive during handling operations, special attention has to be paid to mix proportioning. To avoid segregation on super plasticizer addition, a simple approach consists of increasing the sand content at the cost of the coarse aggregate content by 4% to 5% by weight. But the reduction in aggregate content results in using a high volume of cement which, in turn, leads to a higher temperature rise and an increased cost. An alternative approach consists of incorporating a viscosity-modifying admixture to enhance stability.

Chemical admixtures are, however, expensive, and their use may increase the materials cost. Savings in labor cost might offset the increased cost, but the use of mineral admixtures such as fly ash, blast furnace slag, or limestone filler could increase the slump of the concrete mixture without increasing its cost.

Plain concrete possess a very low tensile

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strength, limited ductility and little resistance to cracking. Internal micro cracks are inherently present in the concrete and poor tensile strength is due to the propagation of such micro cracks, eventually leading to brittle fracture of the concrete. In plain concrete and similar brittle material, structural cracks develop even before loading, particularly due to drying shrinkage or other causes of volume change. The width of these initial cracks seldom exceeds a few microns, but their other two dimensions may be of higher magnitude.

When loaded, the micro cracks propagate and open up and owing to the effect of stress concentration, additional cracks form in places of minor defects. The structural cracks proceed slowly or by tiny jumps because they are retarded by various obstacles, changes of direction in bypassing the more resistant grains in matrix. The development of such micro cracks is the main cause of inelastic deformations in concrete.

It has been recognized that the addition of small, closely spaced and uniformly dispersed fibers to concrete would act as crack arrester and would substantially improve its static and dynamic properties. This type of concrete is known as Fiber Reinforced Concrete. Hence Alccofine Steel Fiber Self Compacted Concrete can be defined as a composite material consisting of mixtures of cement, mortar or concrete and discontinuous, discrete, uniformly dispersed Steel fibers and Alccofine 1203.

Necessity:

ASFSCC offers several economic and technical benefits; the use of steel fibres extends its possibilities. Steel fibres acts as a bridge to retard their cracks propagation, and improve several characteristics and properties of the concrete. Fibres are known to significantly affect the workability of concrete. Therefore, an investigation was performed to compare the properties of plain normal compacting concrete (NCC) and SCC with steel fibre and alccofine.

Fly ash has high pozzolanic reactivity and low price as compared to silica fume and fly ash as it is a manufactured product. It reduces free drying shrinkage and restrains the shrinkage cracking width. It also helps in enhancing the compressive strength and durability of SCC.

The objective of this study is to optimize the ASFSCC in the fresh and in hardened state.

1.5 Alccofine

ALCCOFINE 1203 comply with:

- IS 12089:1987 – Specification for Granulated Slag for the manufacture of Portland slag cement.
- IS 456:2000 (Clause no.5.2.2) – Plain and Reinforced concrete code of practice.
- ASTM C 989 99 – Standard specification for ground Granulated blast furnace slag for use in concrete and mortar.

ALCCOFINE 1203 is a specially processed product based on slag of high glass content with high reactivity obtained through the process of controlled granulation. The raw materials are composed primary of low calcium silicates. The processing with other select ingredients results in controlled particle size distribution. The computed blain value based on PSD is around 12000cm^2/gm. and is truly ultra-fine. Due to its unique chemistry and ultra-fine particle size, ALCCOFINE1203 provides reduced water demand for a given workability, even up to 70% replacement level as per requirement of concrete performance. ALCCOFINE 1203 can also be used as a high range water reducer to improve compressive strength or as a super workability aid to improve flow.

Packing Effect of Alccofine:

Effectiveness of packing depends upon difference in particle size between cement and additives and extent of hydrated product generated during hydration .the secondary hydrated product formed due to pozzolanic and cementitious hydration reaction fills the pores. This reduces the permeability of hydrated product to a great extent. 'PACKING EFFECT' retards ingression of aggressive agents in concrete even by diffusion and thus enhances durability of concrete. Many deterioting effects like corrosion, carbonation, sulphate attack etc. may be minimized or stopped.

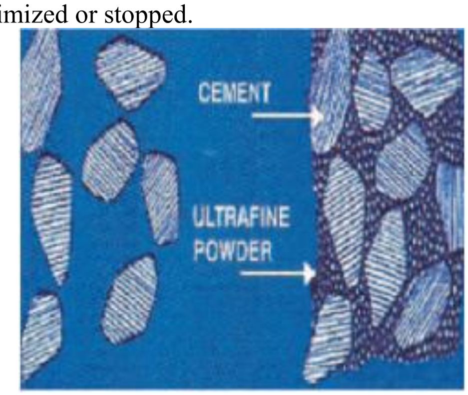

Figure 1: Packing Effect of Alccofine

Optimize particles size distribution

Use of Alccofine enhances the performance

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of concrete in terms of durability due to its superior particle size distribution. Alccofine is well graded particle size smaller than cement and higher than Micro Silica. It is generally considered that fineness of cement or/and cementitious materials have influence on strength. Besides fineness, the particle size distribution shape, surface nature, chemical composition etc. play significant role in strength and performance. Alccofine has particle range 0.1 to 17 microns, average particle size is 4 microns.

Characteristics and Properties

As can be seen in the chemical composition and physical characteristics listed in Table, ALCCOFINE 1203 has got the unique chemical composition mainly of CaO 32-34% and SiO2 33-35%. Physically the product is unique with regards to its particle size distribution, demonstrates the comparative particle size distribution analysis.

Table 1. Characteristics and Properties of alccofine

Chemical Analysis	**Mass %**
CaO	32-34
Al_2O_3	18-20
Fe_2O_3	1.8-2
SO_3	0.3-0.7
MgO	8-10
SiO_2	33-35

Physical analysis	**Range**
Bulk Density	600-700 kg/m3
Surface Area	12000 cm2/gm
Particle shape	Irregular
Particle Size	-
d10	< 2 μ
d50	< 5μ

Effects of alccofine on concrete

i. Improved durability

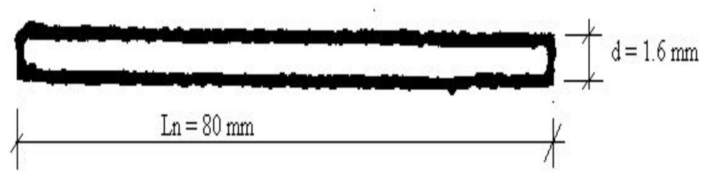
Alccofine results in to having a dense pore structure which restricts the chloride and Sulphate ions ingress. It also makes concrete more alkaline which protects the reinforced steel in concrete and provides the durable structure.

ii. Improved strength gain

Alccofine results in to formation of dense pore structure and inbuilt C_aO provides increased secondary hydrated product because of which improved strength gain at early as well as later ages is observed.

iii. Improved workability and cohesiveness

Alccofine have better particle size distribution compared to other Supplementary Cementitious Materials which provide dense matrix pore structure resulting in to reduced water content and better workability.



iv. Better retention of workability

Alccofine has ultrafine smooth sub rounded particles and dispersing effect property. This brings in better workability, segregation resistance and workability retention properties in fresh concrete.

v. Reduced segregation

Alccofine increases the theology of concrete by virtue of filling voids of cement particles by property distributed particles whereby it reduces the bleed water and resulting in to homogeneous concrete with reduced segregation.

vi. Lowers the heat of hydration

Alccofine has lime content about 34% which provides more quantum of secondary hydrated product. This result in prolonged chemical reaction and responsible for, reduced heat liberated by the hydration process.

vii. Improved flow ability

Alccofine has better packing which results in to increased rheology resulting in to improved flow ability

Steel fibre

Crimped type steel fibers is high tensile steel cold drawn wire with crimped types, glued in bundles & specially engineered for use in concrete. Fibers are made available from Kasturi Composite Pvt. Ltd.; Amravati (Maharashtra).

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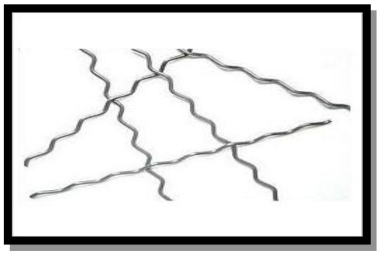

Fig 2.Crimped types steel fiber

Crimped type steel fibers conforming to ASTM A 820 type-I are used for experimental work. CR 50/30 is high tensile steel cold drawn wire with crimped types, glued in bundles & specially engineered for use in concrete. Fibers are made available from Kasturi Composite Pvt. Ltd.; Amravati (Maharashtra) in the literature is given in Table

iii) Straight Steel Fiber

Rounded type steel fibers **is** high tensile steel cold drawn wire with crimped types, glued in bundles & specially engineered for use in concrete. Fibers are made available from Kasturi Composite Pvt. Ltd.; Amravati (Maharashtra) .

Fig 2: Straight type steel fiber

Physical Properties of Steel Fibers

Sr. No.	**Property**	**Values**
1.	Diameter	0.6 mm
2.	Length of fiber	30 mm
3.	Appearance	Bright in clean wire
4.	Average aspect ratio	50
5.	Deformation	Continuously deformed circular segment
6.	Tensile strength	1025 MPa
7.	Modulus of Elasticity	200 GPa
8.	Specific Gravity	7.5

II.

III. METHODOLOGY

The present project work is experimental and requires preliminary investigations in a methodological manner.

Material properties:

Cement

The cement used in this experimental work is "**Ulttratech 53 grade Ordinary Portland Cement**". All properties of cement are tested by referring IS 12269 - 1987 Specification for 53 Grade Ordinary Portland Cement. Test results are presented in Table (

Sr. No.	Description of Test	Results
01.	Fineness of cement (residue on IS sieve 90- micron sieve)	5 %
02.	Standard consistency of cement	30%
03.	Setting time of cement a) Initial setting time b) Final setting time	74 min. 385 min.
04.	Compressive Strength of Concrete a) 3 days b) 7 days	34.50N/mm^2 58.00 N/mm^2
05.	Soundness test of cement (with Le-Chatelier's mould)	1.0 mm

Water:

Potable water available in laboratory is used for mixing & curing of concrete.

Tests Conducted On Aggregates:

Natural sand from Pravra river confirming to IS 383-1970is used. Various tests such as specific gravity, water absorption, impact strength, crushing strength, sieve analysis etc. have been conducted on C.A. & F.A. to know their quality & grading. The above said test results are shown in Tables.

Sr. No.	**Property**	**Results**
01.	Fineness Modulus	2.806
02.	Specific Gravity	2.75
03.	Aggregate Moisture Content	4.16%
04.	Surface moisture	Nil

Sr. No.	**Property**	**Results**
01.	Fineness Modulus	6.013

02.	Aggregate crushing value	20%
03.	Specific Gravity	2.70
04.	Water absorption	1.2%
05.	Aggregate Impact Value	14%
06.	Surface moisture	Nil

Properties of Super Plasticizer (SP):

The properties of SP supplied by the manufacturer Sika India Pvt. Ltd., Mumbai in the literature is given in Table (3.4) which compiles IS: 9103- 1999 (Amended 2003).

Sr. No.	Properties	Description
01.	Color	Brownish
02.	Basis	Aqueous Solution of Modified Poly- Carboxylate
03.	Density	1.10 Kg/Lit
04.	pH Value	6.50
05.	Chloride content	Nil
06.	Air Entrainment	Nil
07.	Nitrate content	Nil

Properties of Viscosity Modifying Agent (VMA):

The properties of VMA supplied by the manufacturer Sika India Pvt. Ltd., Mumbai in the literature is given in Table

Properties of Viscosity Modifying Agent

Sr. No.	Properties	Description
01.	Color	Brownish
02.	Basis	Biopolymer
03.	Density	1.01 Kg/Lit
04.	pH Value	7.0 ± 1.0
05.	Chloride content	Nil
06.	Air Entrainment	Nil
07.	Nitrate content	Nil

Properties of Fly Ash:

Fly Ash (FLA) is available in dry powder form and is procured from Dirk India Pvt. Ltd., Nashik. It is available in 30Kg bags, color of which is light gray under the product name "Pozzocrete 60". The chemical & physical properties of FLA are shown in Table

Table 3: Physical Properties of Fly Ash

Sr. No.	Physical Properties	Fly Ash	Requirements as Per IS- 3812: 2003
01.	Fineness – Specific Surface, m^2/kg (By Blains permeability method)	437	320 Minimum
02.	Retention in 45 microns, percent	2.1	34 Maximum
03.	Lime reactivity – Average Compressive strength MPa	4.8	4.5 Minimum
04.	Compressive strength at 28 days, as percent of strength of corresponding plain cement mortar Cube	86	No less than the 80 Percent of strength of corresponding plain cement mortar cubes
05.	Soundness by autoclave Expansion, percent	0.04	0.8 Maximum

Table 4: Chemical Properties of Fly Ash

Sr. No.	Physical Properties	Fly Ash	Requirement as Per IS- 3812: 200

01.	$SiO_2+Fe_2O_3+Al_2O_3$, Percent Weight	92.45	70 Min
02.	Silica as SiO_2,percent by weig	57.31	35 Min
03.	Magnesium oxide MgO, percent by weight	0.46	5 Max
04.	Sulphur as SO_3; percent by weight	Traces	3.0 Max
05.	Alkalies	-	1.5 Max
06.	Sodium oxide Na_2O	0.08	-
07.	Potassium oxide K_2O	1.11	-
08.	Total Chloride, percent weight	0.017	0.05 Max
09.	Loss of Ignition, Percent weight	1.06	5.0 Max

Physical Properties of Steel Fibers:

Crimped Type Steel Fiber: (CR 50/50):

Crimped type steel fibers conforming to ASTM A 820 type-I are used for experimental work. **CR 50/50 is** high tensile steel cold drawn wire with crimped types, glued in bundles & specially engineered for use in concrete. Fibers are made available from Kasturi Composite Pvt. Ltd.; Amravati (Maharashtra) in the literature is given in Table (3.8).

Table 5: Physical Properties of Steel Fibers

Sr. No.	Property	Values
1.	Diameter	0.6 mm
2.	Length of fiber	30 mm
3.	Appearance	Bright in clean wire
4.	Average aspect ratio	50
5.	Deformation	Continuous deformed circular segment
6.	Tensile strength	1025 MPa
7.	Modulus of Elasticity	200 GPa
8.	Specific Gravity	7.5

Test conducted on ASFSCC:

In present study cube compression test, flexural test on beams and Cylindrical split tensile test on self compacting concrete with constant fraction of steel fiber were carried out.

i)Compressive Strength Test:

A cube compression test is performed on standard cubes of plain self scc and scc with alccofine of size 150 x 150 x 150 mm after 3, 7 and 28 days of immersion in water for curing. The compressive strength of specimen is calculated by the following formula:

$f_{cu} = P_c / A$

Where

P_c = Failure load in compression, KN

A = Loaded area of cube, mm^2

ii)Split Tensile Test:

The split tensile test is well known indirect test used to determine the tensile strength of concrete. Due to difficulties involved in conducting the direct tension test, a number of indirect methods have been developed to determine the tensile strength of concrete. In these tests, in general a compressive force is applied to a concrete specimen in such a way that the specimen fails due to tensile stresses induced in the specimen.

150mm dia. concrete cylinder

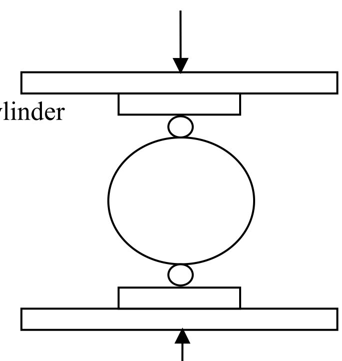

Fig 3.2: Cylinder split tensile test setup

The tensile strength at which failure occurs is the tensile strength of concrete. In this investigation, the test is carried out on cylinder by splitting along its middle plane parallel to the edges by applying the compressive load to opposite edges. The arrangement for the test is shown in photo with the pattern of failure. The split tensile strength of cylinder is calculated by the following formula,

$$f_t = 2P / \pi LD$$

Where,

f_t = Tensile strength, MPa

P = Load at failure, N

L = Length of cylinder, mm

D = Diameter of cylinder, mm

iii)Flexural Test:

Standard beams of size 150 x 150 x 700mm are supported symmetrically over a span of 400mm and subjected two points loading till failure of the specimen. The deflection at the center of the beam is measured with sensitive dial gauge on UTM. The two broken pieces (prisms) of flexure test are further used for equivalent cube compressive strength.

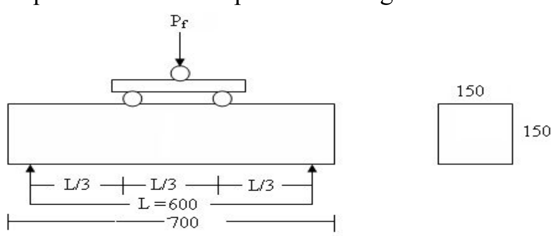

Fig 3.3: Two point loading setup in flexure test

(All Dimensions are in mm)

The flexural strength is determined by the formula

$$f_{cr} = P_f L / bd^2$$

Where,

f_{cr} = Flexural strength, MPa

P_f = Central point through two point loading system, KN

L = Span of beam, mm

b = Width of beam, mm

d = Depth of beam, mm

Test conducted on SCC :

Tests Details for Verifying the Properties of Fresh SCC:

Test to be conducted for verifying the flow characteristics of Fresh SCC are

i) Slump flow
ii) V-Funnel
iii) L Box
iv) U Box
v) J Ring

Slump flow

The fresh concrete is poured into a mould in the shape of a frustum of a cone. When the cone is withdrawn upwards, the distance the concrete has spread provides a measure of the consistency of the concrete.

V-Funnel Test and V Funnel Test at $T_{-5\ minutes}$:

Though the test is designed to measure flow ability the result is affected by concrete properties other than flow. The inverted cone shape will cause any liability of the concrete to block to be reflected in the result, if for example there is too much coarse aggregate. High flow time can also be associated with low deformability due to a high paste viscosity, and with high inter-particle friction.

L-Box Test :

The fresh concrete is poured in the vertical part of the L-box. When the sliding gate is lifted the concrete spared provides a measure of the filling ability and the passing ability of the concrete.

U-Box Test Method :

This is a simple test to conduct, but the equipment may be difficult to construct. It provides a good direct assessment of filling ability this is literally what the concrete has to do-modified by an unmeasured requirement for passing ability. The 35 mm gap between the sections of reinforcement maybe considered too close. The question remains open of what filling height less than 30cm, is still acceptable.

J-Ring Test:

The fresh concrete is poured into a mould in the shape of a frustum of a cone placed centrally in the J-ring. When the cone is withdrawn upwards, the distance the concrete has spread and the blocking provides a measure of the filling ability and the passing ability of the concrete.

Table6 Requirements of Workability

Sr. No.	Method	Unit	Typical Ranges of Values	
			Min	Max
01.	Slump flow by	Mm	650	800
02.	$T_{50\ cm}$ Slump	Sec	2	5
03.	J-ring	Mm	0	10
04.	V-funnel	Sec	8	12
05.	V-funnel at T_5	Sec	0	+3
06.	L-box	H_2/H_1	0.8	1.0
07.	U-box	(H2-H1)	0	30

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08.	Fill-box	%	90	100
09.	Orimet	Sec	0	5

Types of Steel fiber	Alccofine (%)	Compression Test	Flexure test	Split Test
		28 days	28 days	28 days
0	00	3	3	3
CR-50/50	5	3	3	3
CR-50/50	10	3	3	3
CR-50/50	15	3	3	3
CR-50/50	20	3	3	3
CR-50/50	25	3	3	3

Table 7 Workability Properties of SCC and Alternative Test Methods (as given by EFNARC)

Property	**Test Method**		
	Lab(Mix Design)	**Field (QC)**	**Modification according To max. aggregate sizes**
Filling ability	1. Slump flow 2.T-50cm slump flow	1. Slump flow 2. T-50cm slump	Max 20mm
Passing Ability	1. L-Box 2. U-box 3. Fill box	1. J-Ring	Different openings in L-box and J-ring
Segregation Resistance.	1.GTM Test 2. V-Funnel Test	1.GTM Test 2. V-Funnel Test at T-5 minutes	None

Schedule of Specimen Preparation for specimen

Details of Test Specimens for Tests on Hardened Self Compacted Concrete were same as Tests on Hardened Normal Concrete.

Types of steel fiber = CR-50/50 having aspect ratio 50

FlY ash (BWC) = 0.3

Water cement ratio = 0.408

Steel fiber content=1%

Mix Design for Self Compacting Concrete:

Initially Mix design for M30 grade concrete was done by using IS-10262 method of Mix design. This mix is then further modified for relative proportions of fine and coarse aggregates with addition of filler materials like as Fly ash and super plasticizer to m ake it SCC. For Mix design of SCC guidelines given by “Rational SCC Mix Design Method” developed by Okamura and Ozawa.

Table6 Requirements of Workability

Table7: Guidelines for Mix Design of SCC as per Rational SCC Mix Design Method

Constituent	**Typical range by Mass (kg/m^3)**	**Typical range by volume (liters/m^3)**
Powder	380-600	
Paste		300-380
Water	150-210	150-210
Coarse Aggregate	750-1000	270-360
Fine Aggregate (Sand)	Contents balance the volume of the other constituents, typically 48-55% of total aggregate weight.	
Water/Powder ratio by Vol.		0.85-1.10

The mix Design is based on approach Outlined below:

1) Determination of desired air content.

2) Determination of Coarse aggregate content

3) Determination of sand content

4) Determination of optimum water: powder ratio and super plasticizer dose.

5) Finally the concrete properties are assessed by standard tests.

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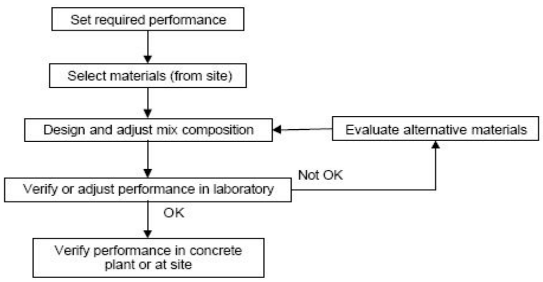

Fig.3.11: Mix Design Procedure chart

Actual Mix Design:

Selecting Vol. of water / Vol. of powder=0.9
Volume of Water=0.203m^3
Hence, Volume of cement= 0.203÷0.9
= 0.226 m^3
Wt. of cement= 0.226×31.5 (considering Sp.Gr. of Cement=3.15)
= 711.9 Kg.

Quantities for One Cubic Meter Concrete:

1) Weight of Cement = 498.3 kg
2) Weight of Fly Ash = 213.6kg
3) Sand(Taking fine Aggregates 55% of total Aggregate Content) = 55⁄100× (569.29+1076.06)
= 904.94 kg.
4) Weight of coarse aggregate
= 740.41 kg
5) Super plasticizer (1% bwc)
= 4.983 kg
6) VMA (0.5% bwc)
= 2.492 kg

***bwc**=by weight of cement

Proportion:

Cement	Flyash	sand	Coarse aggregate	water
1	**0.3**	**1.814**	**1.48**	**0.408**

IV. RESULT AND DISCUSSIONS

Table8: Slump Cone Test by Abrams Cone

Alcco fine(%)	Steel Fiber (%)	Slump Flow By Abrams Cone (mm)	
		Horizontal Slump (mm)	T_{50} -Time (Sec.)
0	0	612.5	4
5	1	590	3.5
10	1	550	3
15	1	540	2
20	1	532	2.8
25	1	505.8	3

Table 9: V-Funnel Test

Sr. No.	Alccofine (%)	V-Funnel Test
		Flow Time (Sec.)
1.	0	15
2.	5	70
3.	10	80
4.	15	95
5.	20	107
6.	25	121

Table 10: L Box Test

Alcco fine (%)	L Box Test				
	T_{20} Time (Sec)	T_{40} Time (Sec)	H_1 (mm)	H_2 (mm)	H_1/H_2 Ratio
0	5	10	5	3	1.66
5	10	16	7	3	2.33
10	25	36	6.2	2.1	2.95
15	47	55	8	1.7	4.7
20	51	58	8.7	1.3	6.69
25	63	67	9.5	0.9	10.55

Table 11: U Box Test

Alccofine (%)	**U Box Test**		
	H_1 (mm)	**H_2 (mm)**	**H_1-H_2 (mm)**
0	380	320	60
5	390	310	80
10	430	220	210
15	580	120	360
20	600	100	500
25	650	50	600

Table 12: J Ring Test

Alccofine (%)	**J Ring Test**		
	H_1 (mm)	**H_2 (mm)**	**H_1-H_2 (mm)**

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0	10	8	2
5	13	6	7
10	10	7	3
15	12	6	6
20	11	7	4
25	10	6	4

Table 13: compressive strength at 28 days

Alcco fine (%)	Fiber (%)	Load (KN)	C/S AREA (mm^2)	Comp. Strength (N/mm^2)	Av co Streng (N/mı
0	**0**	547	22500	24.31	24.
		538		23.91	
		545		24.22	
1	**1**	578	22500	25.69	25.(
		594		26.4	
		561		24.93	
2	**2**	603	22500	26.8	26.4
		595		26.44	
		588		26.13	
3	**3**	648	22500	28.8	28.2
		625		27.78	
		631		28.04	
4	**4**	585	22500	26	25.8
		611		27.15	
		550		24.44	
5	**5**	569	22500	25.29	24.7
		545		24.22	
		558		24.8	

V. CONCLUSION

The present investigation has shown that it is possible to design alccofine and steel fibre in self-compacting concrete incorporating fly ash. The SCCs have a slump flow in the range of 505.5-612.5 mm, a flow time ranging from 2 to 4 s, V-funnel flow in the ranging from 15 to 121 sec ,a L-Box ratio ranging from 1.66 to 10.55, U box test value ranging from 60 to 600mm and a J-Ring test value ranging from 2 to 6mm. It was observed that it is possible to achieve self compaction with different percentage of alccofine and constant volume fraction steel fiber i.e. 1% inclusion.

Although results obtained from all of the mixes satisfy the lower suggested by EFNARC, all mixes had good flow ability and possessed self-compaction characteristics.

The SCC developed compressive strengths ranging from 6.75 to 14.68Mpa at the end of 3 days, from 10.84 to 14.68Mpaat the end of 7 days and from 19.37 to 30.88Mpa, at the end of 28 days.

The SCC developed split tensile strengths ranging from1.61 to2.50Mpa at the end of 28 days.
The SCC developed flexural strengths ranging from 3.45 to 6.7Mpa at the end of 28 days.

The strength of SCC is increase up to 15%, beyond 15% of alccofine the strength get reduced. Addition of superplastisizer in SCC to maintain flow ability gives proper compaction of concrete which enhance all properties of SCC. Also the addition of fly ash in SCC improves microstructure of concrete that also helpful to enhance all mechanical properties with the durability of concrete.

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