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Study on Self Compacting Concrete with Polypropylene Fibers and Ground Granulated Blast Furnace Slag

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Abstract- **Self Compacting concrete adopted in various applications. Addition of fibers to SCC has been improved strength and durability of concrete. The study presents an investigation on compressive strength in polypropylene fiber reinforced SCC. Six mixes of concrete with varying percentage of fibers (1% and 2%) are considered. Strength Mix-S (100% Cement) has shown more strength when compared to Mix-S1(100% cement with 1%PPF) & Mix-S2(100% cement with 2%PPF) and Mix-SG (70% cement + 30% GGBS) shows greater strength when compared to all other mixes to Mix-SG1(70% cement + 30% GGBS with 1%PPF) & Mix-SG2(70% cement + 30% GGBS with 2%PPF).**

Key words- Admixtures, GGBS,Polypropylenefibers, Okamura& Ozawa.

I.INTRODUCTION

After water concrete is the second most devoured material on the planet. The popularity and extensive use of concrete for any type of construction has led to requirement of properties like self-compact ability,long service life, high durability, better serviceability, high fluidity,and high strengthof concrete structures. Manual placing and inadequate consolidation has led to the need for the development of concrete with high fluidity and no segregation.[5]This causes development of highly engineered concrete that addresses these requirements known as SCC. It was evolved around 1980 in japan, to increase serviceability of concrete. Fibers when added to SCC, it accomplishes the structure of concrete.

II.OBJECTIVES

The main experimental focus is to find the Compressive strength using 100% Cement and GGBS at 30% replacement of cement at 1% and 2% of polypropylene fibres.

III. METHODOLOGY

1. It includes a literaturecomprehensive survey and collection of data in the following areas,
    a. Fundamental requirements of SCC
    b. Fresh SCC properties.
    c. Test procedures of SCC
    d. Mix design procedure for SCC
2. Okamura mix design method is considered to achieve the optimized design mix. Based on the Okamura mix design, the required materials are calculated and procured the same.[3]
3. The design mix of SCC has been conducted in an expressive manner. Number of trials has been carried out to develop a 1% & 2% PP fibers.
4. The Concrete samples are cast, cured & test for 28, 56& 90 days. [1]

IV. EXPERIMENTAL INVESTIGATION

A. Material properties

For the present investigation materials used are Cement, FA, CA, GGBS, polypropylene fibers&chemical admixture such as glenium master sky 8233.

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B. Cement

53 grade Birla Super Cement is used for all specimens.

C. Fine Aggregate (FA-M- SAND)

The locally available M- SAND is used as FA and taken from,Tavara Mines &Minerals, Jigani Industrial area, Anekal Taluk, Bangalore, Karnataka.

Table 1: Fine aggregate (M- SAND) Physical Properties

SL.No	Physical Properties	Fine aggregate
1	Size	4.75 mm
2	Specific gravity	2.52
3	Fineness modulus	2.94
4	Loose Bulk density(g/cm^3)	1.44
5	Rodded Bulk density(g/cm^3)	1.55

D. Coarse Aggregate

The coarse aggregate used are taken from, Magadi road, Bangalore, Karnataka. The C.A of 12.5mm passing is used.

Table 2: Coarse aggregate Physical Properties

SI. No	Physical Properties	Coarse aggregate(CA)
1	Specific gravity	2.63
2	Size	12.5mm
3	Fineness modulus	7.24
4	Loose Bulk density(g/cm^3)	1.36
5	Rodded Bulk density(g/cm^3)	1.49

E. GGBS (Ground granulated blast-furnace slag)

The GGBS withdrawfrom RMC Ready mix (India), Kumbalagodu Industrial Area, Bangalore, Karnataka.

F. Polypropylene fibers:

Polypropylene fibers with special chemical treatment is done to ensure uniform dispersion on cement/ mortar/ concrete. In this study, polypropylene fibers of 12 mm length are used.

Table 3: Polypropylene Fibers characteristics

SI.NO	Properties	polypropylene fibers
1	Length	12mm
2	Diameter	30 µ
3	Slenderness ratio	400
4	Specific gravity	0.91
5	Melting point	165^0c
6	Acid resistance	High
7	Salt resistance	High

G.Chemical admixtures

GLENIUM MASTER SKY 8233 used for the present study.

V. MIX DESIGN FOR SCC

Design Mix of SCC proposed by Okamura and Ozawa. Different addition fibers are,

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A. First Three mixes cement is kept constant i.e. there is no replacement of cement.
B. Second Three mixes replacement of Cement with mineral admixture(GGBS) andfibers

Trials mixes Okamura method design mix were carried out for the following mix proportions to achieve the final mixes, which satisfies all the workability properties.

MIX –S : SCC containing 100% cement.
MIX –S1 : SCC containing 100% cement with 1% fibers.
MIX –S2 : SCC containing 100% cement with 2% fibers.
MIX –SG : SCC containing 70% cement and 30% GGBS.
MIX –SG1: SCC containing 70% cement and 30% GGBS with 1% fibers.
MIX –SG2: SCC containing 70% cement and 30% GGBS with 2% fibers.

A mix proportioning procedure for SCC has reached at by using proposed design mix of Okamura & Ozawa. Then the specimens (cubes) were caste and cured for 28,56&90 day.

VI.RESULTS AND DISCUSSIONS

In this experimental study, SCC compressive strength characteristicsare investigated by using mineral admixtures namely GGBS at 30% replacement of cement and 1% and 2% of polypropylene fibers added to cement. The samples (150X150X150mm)are cast and cured for 28, 56 & 90 days and finally tested for compressive strength. Load applied to smooth surface of the specimen till it fails. The compressive strength asshown in the Table 4

Table 4: 28, 56 &90 days Compressive Strength of 100% cement and PPF

Mix	Avg Compressive strength (N/mm^2)		
	28 days	56 days	90 days
S	62.81	66.50	67.50
S1	42.51	45.77	46.85
S2	26.07	26.21	33.47

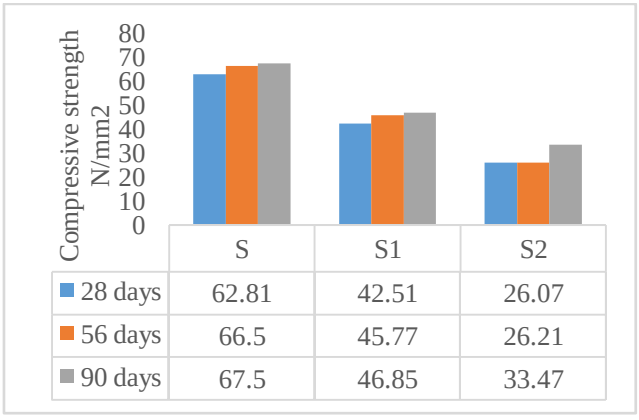

Fig 1: 28, 56 & 90 days Compressive Strength of 100% cement and PPF

Table 5: 28, 56 & 90 days Compressive Strength of 70% Cement +30% GGBS and PPF

Mix	Avg Compressive strength (N/mm^2)		
	28 days	56 days	90 days
SG	61.60	65.03	65.62
SG1	29.62	31.10	33.47
SG2	26.07	27.25	28.88

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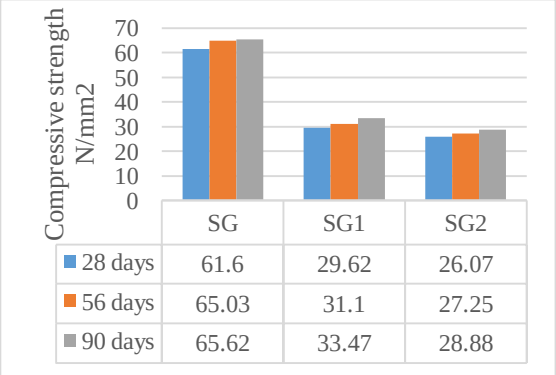

Fig 2: 28, 56 & 90 days Compressive Strength of 70% Cement +30% GGBS and PPF

VII. CONCLUSION

- In theFig No.1,it has been observed that Mix-S (100% Cement) has shown more strength when compared to Mix-S1(100% cement with 1%PPF) & Mix-S2(100% cement with 2%PPF).

- In theFig No.2, it has been observed that the mix containing Mix-SG (70% cement + 30% GGBS) shows greater strength when compared to all other mixes to Mix-SG1(70% cement + 30% GGBS with 1%PPF) & Mix-SG2(70% cement + 30% GGBS with 2%PPF).

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