AN EXPERIMENTAL INVESTIGATION ON SELF COMPACTION CONCRETE BY PARTIAL REPLACEMENT OF CEMENT BY GGBS

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Abstract

Self-compacting concrete is a concrete which gets compacted under its self-weight. SCC can save up to 50% in labour costs due to 80% faster pouring and reduced wear and tear on formwork. SCC are often characterized as concrete that has superior flow ability under maintained stability (no segregation). SCC is concrete that can be placed and compacted under its own weight without any vibration effort, assuring complete filling of formwork even when access is hindered by narrow gaps between reinforcement bars, the primary objective of this study is to make use of ground granulated blast furnace slag (GGBS) as a replacement of cement and understand its effects on the fresh properties, compressive strength weathering. Test were conducted for V-Funnel, U-Box, L-Box and strength were studied. The workability of self-compacted concrete is increased as content of GGBS increased. In this investigation the cement is replaced by GGBS of various proportion 0%, 5% ,10% , 15%&20%. In this investigation to study the mechanical properties such as compressive strength, split tensile strength, flexure strength 7&28 days strength of SCC.

Keywords: Ground granulated blast furnace slag (GGBS), SCC (self compacted concrete), super plasticizer, viscosity modify agent.

I. INTRODUCTION

Concrete technology has under gone from macro to micro level study in the enhancement of strength and durability properties from 1980 onwards. Till 1980 the research study was focused only flow ability of concrete, so as to enhance the strength however durability did not draw lot of attention of concrete technologies. This type of study has resulted in the development of self compacting concrete (SCC), a much needed revolution in concrete industry. Self compacting concrete with much higher fluidity without segregation and is capable of filling every corner of form work under its self-weight only (okamura1997). Thus SCC eliminates the need of vibration either external or internal for the compaction of the concrete without compromising its engineering properties.

SCC has been described as “the most revolutionary developments in concrete construction for several decades”. Originally developed in Japan to offset a growing shortage of skilled labour, it has proved to be beneficial from the following points.

- ✓ Faster construction
- ✓ Improved durability
- ✓ Easier placing
- ✓ Better surface finish
- ✓ Greater freedom in design
- ✓ Thinner noise level
- ✓ Reduction in site manpower
- ✓ Safe working environment

OBJECTIVE

1. To reduce the Co2 emission by adding Ground granulated blast furnace slag and coarse aggregates in SCC.
2. No bleed water or aggregates segregation, placed being easier.
3. According, the aim of this work is to determine the strength at various percentage of GGBS (0%, 5%, 10%, 15%, 20%) levels

for making M30 grade high strength concrete.

SCOPE OF OUR PROJECT

1. The scope of the study is restricted to the following aspects. The workability, compressive strength, split tensile strength of GGBS in SCC of different mix proportions with constant w/c ratio have been investigated.
2. SCC can save up to 50% in labour cost.

2. METHODOLOGY

Materials used Cement

Table 2.1.1 Physical properties of OPC 53 grade cement

S.No	Test for Cement	Apparatus	Value Obtained
1.	Standard consistence test	Vicat apparatus	26.5%
2.	Initial setting time	Vicat apparatus	30 minutes
3.	Final setting time	Vicat apparatus	230 minutes
4.	Specific gravity test	Conical flask	3.092

Fine Aggregate

Table 2.1.2 Physical properties of fine aggregates

S.No	Test for fine aggregates	Apparatus	Value obtained
1.	Fineness modulus	Sieve	2.39
2.	Specific gravity	Pycnometer	2.45
3.	Water absorption	-	0.38%

Coarse Aggregate

Table 2.1.3 Physical properties of coarse aggregates

S.No	Test for coarse aggregates	Apparatus	Value obtained
1.	Fineness modulus	Sieve	6.73
2.	Specific gravity	Cylindrical container	2.60
3.	Water absorption	-	0.7%
4.	Impact value	Impact testing machine	10%

GGBS

Table 2.1.4 Physical properties of GGBS

S.No	Characteristics	Experimental value of GGBS
1.	Specific gravity	2.86
2.	Bulk density loose (kg/m^3)	1000kg/m^3
3.	Fineness modulus	352m^2/kg
4.	Water absorption	-

3. MIX DESIGN

3.1Concrete mix proportion

The mixes were designated in accordance with IS 10262- 2009 mix design method. Based on the results, the mix proportions M30 was designed. Concrete mix with w/c ratio of 0.45 was prepared. The details of mix proportions for 1m3 of concrete are given in Table below

Mix proportions for M30 Grade of Concrete (Kg/m3)

Grade	Cement	FA	CA	Water
Mix 30	425.73	804.85	888.95	191.61
	1	1.89	2.08	0.45

4. TESTING OF SPECIMENS

FRESH CONCRETE TEST

Slump flow test

Table No 4.1.1 Slump flow test

Sl .No	Sample	Status
1.	SCC+ 0% of GGBS	Collapse
2.	SCC+ 5% of GGBS	Collapse
3.	SCC+ 10% of GGBS	Collapse
4.	SCC+ 15% of GGBS	Collapse

L- Box test

Table No 4.1.2 L-Box test

SI. NO	SAMPLE	HEIGHT DIFFERENCE(MM)
1	SCC + 0% of GGBS	0.6
2	SCC+ 5% of GGBS	0.65
3	SCC+ 10 % of GGBS	0.7
4	SCC+ 15% of GGBS	0.72
5	SCC+ 20% of GGBS	0.79

V-Funnel test

Table No 4.3 V-Funnel test

SI.NO	SAMPLE	FLOW TIME (SEC)
1	SCC+ 0 % of GGBS	6
2	SCC+ 5 % of GGBS	7.5
3	SCC+ 10 % of GGBS	8
4	SCC+ 15 % of GGBS	10
5	SCC+ 20 % of GGBS	12

U- Box test

Table No 4.4 U- Box test

Sl. No	SAMPLE	HEIGHT DIFFERENCE(mm)
1.	SCC+ 0% of GGBS	0.57
2.	SCC+ 5% of GGBS	0.59
3.	SCC+ 10% of GGBS	0.56
4.	SCC+ 15% of GGBS	0.6
5.	SCC+ 20% of GGBS	0.65

HARDEN CONCRETE TEST

Compressive Strength test

Table 4.2.1 Compressive Strength test for 7 days

S.No	% of GGBS	Compressive Strength
1.	0	19.85
2.	5	20.14
3.	10	20.44
4.	15	21.33
5.	20	20.48

Table 4.2.1 Compressive Strength test for 28 days

S.No	% of GGBS	Compressive Strength
1.	0	30.22
2.	5	30.21
3.	10	30.66
4.	15	31.40
5.	20	30.36

SPLIT TENSILE STRENGTH TEST

Table 4.2.1 Split tensile strength test for 7 days

S.No	% of GGBS	Split tensile strength
1.	0	1.98
2.	5	2.26
3.	10	2.4
4.	15	2.54
5.	20	2.44

Table 4.2.1 Split tensile strength test for 28 days

S.No	% of GGBS	Split tensile strength
1.	0	2.88
2.	5	3.29
3.	10	3.44
4.	15	3.58
5.	20	3.39

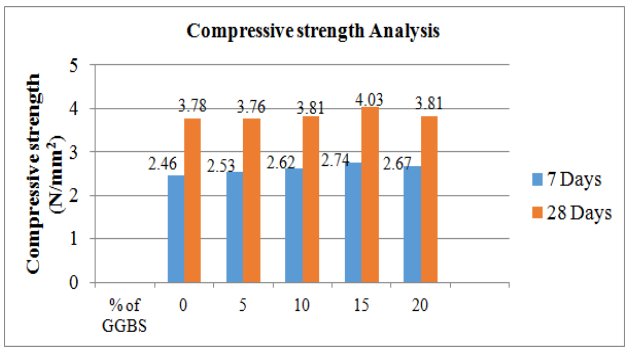
4.2.2 FLEXURAL STRENGTH TEST

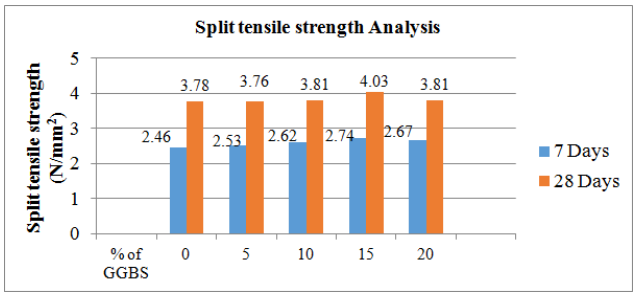
Table 4.2.1 Flexural strength test for 7 days

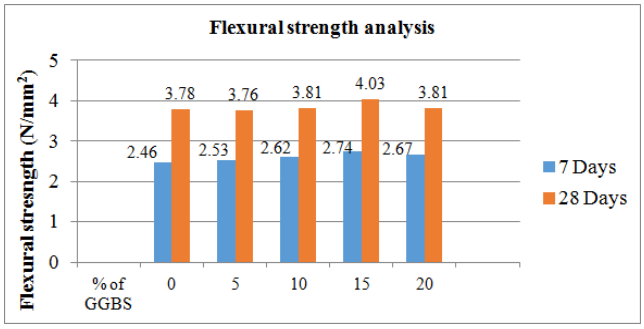
S.No	% of GGBS	Flexural strength
1.	0	2.46
2.	5	2.53
3.	10	2.62
4.	15	2.74
5.	20	2.67

Table 4.2.1 Flexural strength test for 28 days

S.No	% of GGBS	Flexural strength
1.	0	3.78
2.	5	3.76
3.	10	3.81
4.	15	4.03
5.	20	3.81







5. CONCLUSION

When compare to previous paper tests's on replacing GGBS above 15% the compressive strength, Split tensile strength and Flexural strength have reduced, for every interval of replacing 5%. Added conplast sp430 as super plasticizer and maintained w/c ratio is kept constant throughout the investigation as 0.45.

From this project we can conclude that the mix proportion 20% GGBS and we got the optimum results

Mechanical and Durability properties of concrete of the following mix was taken as optimum i.e. 20% GGBS, if we increase the percentage again the strength decreases.

REFERENCE

1] E.Sreenivasulu&A. Ramakrishnaiah "Experimental Investigation On Durability Properties Of Self Compacting Concrete By Partial Replacement Of Fly Ash And GGBS"

2] R.Anuraag & B. Muralikrishna "Experimental Study Of SCC Using GGBS

As A Admixture At Various Percentages For Standard Concrete"

3] G.Pavan kumar&N.R.Gowthami "Experimental Investigation On Mechanical Properties Of Self Compacting concrete By Partial Replacement Of Fly ash And GGBS"

4] CH. Rajesh&C. Rajamallu " Experimental Investigation Of Self Compacting Concrete (SCC) With Confinement By Partial Replacement Of cement With GGBS, Lime stone And Fine aggregate With Pond ash"

5] B.Mangamma&Dr N.Victor babu,P.hD " An Experimental Study on Behavior of Partial Replacement of Cement with Ground Granulated Blast Furnace Slag"

6] Kasu naveena&K. Anantha lakshmi " Partial Replacement of Cement with GGBS in Concrete"

7] Kuruba Anil&P. Lakshmaiah Chowdary " Study on Strength Properties of Self Compacting Concrete using GGBS and Lime stone powder as Mineral Admixtures"