AN EXPERIMENTAL STUDY ON CONCRETE CONTAINING GGBFS, CCR WITH 1% STEEL FIBERS AND DEPTH VARIATION

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Abstract - *Lately, a few examinations and researches were accounted on GGBFS independently. The study revealed in the report presents experimental work on the strength parameters of GGBFS along with the Calcium Carbide Residue in concrete. The grade of concrete that modified by using this combination is M 40. Here GGBFS used as a partial replacement of cement (30% and 40% by weight of Cement replacement) and Calcium Carbide Residue as additional cement replacing material with GGBFS. The amount of CCR that used in present work is limited to 5% only by cement replacing material. Present work is dealing with compressive as well as flexural strength of mixes. To enhance the flexural strength of the mix 1% Steel fibers also used with depth variation of beam. Depth variation considering as 0.25d, 0.5d, 0.75d and full depth of beam d. The curing period consider in present study for concrete were 28 days and 56 days for compressive strength and 56 days for flexural strength.*

***Key Words*: GGBFS, CCR, flexural strength, compressive strength**

1.INTRODUCTION

The basis of the present study is to use of cement supplements and steel fibers into conventional concrete. The grade of concrete used as M 40 and the cement consider as OPC, Ordinary Portland Cement. The Cement supplement used GGBFS Ground Granulated Blast Furnace Slag as 30% and 40% by weight of Cement. Similarly the samples will be prepared with 30% and 40% GGBFS along with additional 5% calcium carbide residue. The beam samples for the following study is casted to evaluate the flexural strength. For studying the effect of fiber, concrete mixes the steel fibre content equal to 1.0% be made. Beam specimens of size 100 mm * 100 mm and 500 mm with different fibrous concrete depth 25, 50, 75 and 100 mm from the bottom were investigated.

1.1 MATERIALS USED IN RESEARCH

Ground-granulated blast-furnace slag GGBS is acquired via quenching molten iron slag from a blast furnace in water, to supply a glassy, granular product this is then dried and convert into a fine powder. GGBFS is used to make long lasting concrete structures in combination with normal Portland cement or other pozzolanic materials. GGBFS reacts like Portland cement whilst in touch with water.

Calcium carbide residue – Presently days a tremendous issue related in the field of development & Construction is the utilization of natural resources on the our planet, around 40 % natural resources fulfilled the demand in construction field. Then again the cement industries delivered a lot of non-rotting waste materials. Such sort of materials stays in the climate for many years and having a principle issue of arranged. Transparently unloading of such kind of materials adding to the climate issue. Calcium carbide residue (CCR) is an acetylene gas (C_2H_2) by product.

Steel fiber reinforced concrete (SFRC) is a composite material whose parts incorporate the conventional constituents of Portland cement concrete and a scattering of arbitrarily situated short discrete steel fibers. Similarly as with all FRC materials, contrasted with plain concrete.

2. DESCRIPTION OF RAW MATERIALS

Some of basic raw materials that used in present experimental study as shown in table 1

Table -1: Raw Materials Description

Raw materials	Description
Ordinary Portland Cement	OPC – 43
	Conforming to IS: 8112 – 1989
	Specific gravity = 3.15
Fine aggregate	Natural river sand
	Tested as per IS: 2386 – 1983
	Specific gravity = 2.66
Coarse aggregate	Specific gravity = 2.7

2.1 Tests on concrete (Fresh and Hardened State)

The following tests were conducted on concrete-Slump test, Compressive Strength, Flexural Strength

3. TEST RESULTS

3.1 Variation in Slump Cone test results of concrete cube specimens prepared with 30% GGBFS and 40% partial replacement of cement by GGBFS with or without additional 5% CCR added into the mix, are presented in Table

OPC	GGBFS	CCR	SLUMP
100	0	0	60
60	40	0	69
70	30	0	66
55	40	5	68
65	30	5	64

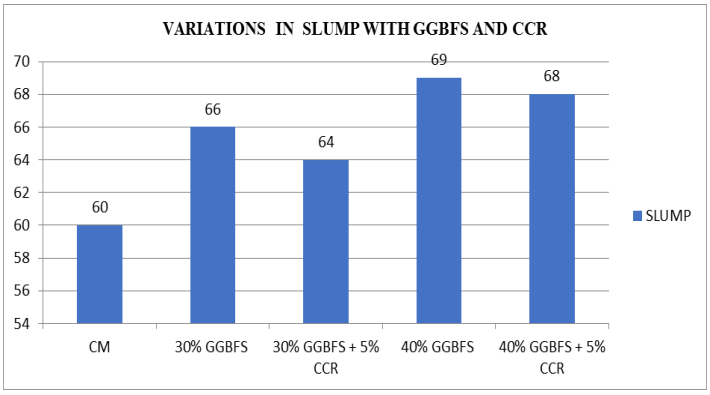


Chart -1: Slump Variation

3.2 Variation in Compressive strength test results of concrete cube specimens prepared with 30% GGBFS and 40% partial replacement of cement by GGBFS with or without additional 5% CCR added into the mix, are presented in Table below

OPC	GGBFS	CCR	COMPRESSIVE STRENGTH
100	0	0	50.79
60	40	0	54.76
70	30	0	52.14
55	40	5	53.2
65	30	5	51.76

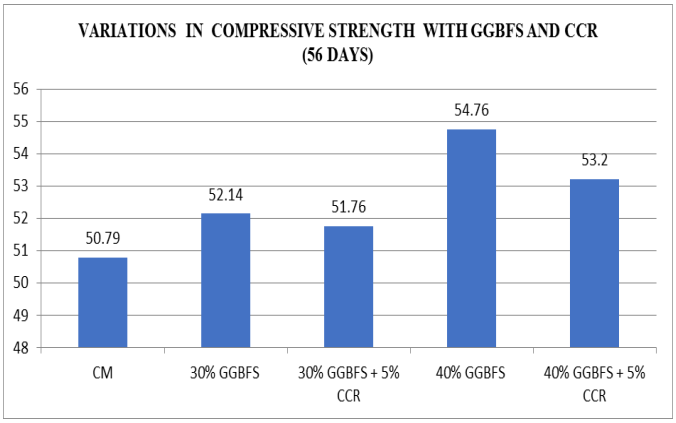
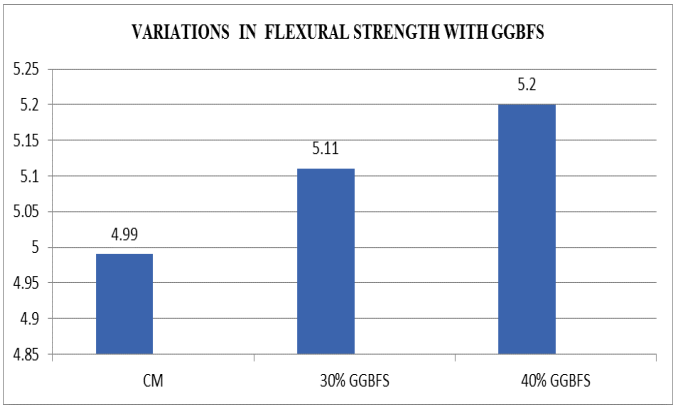


Chart -2: Compressive strength variation

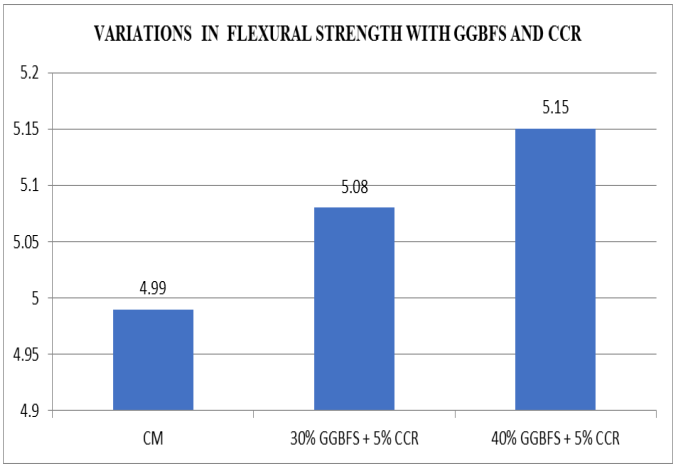
3.3 Flexural Strength

3.3.1 The Flexural strength test results of concrete beams specimens prepared with 30% and 40% partial replacement of cement by GGBFS At the age of 56 days are presented in Table

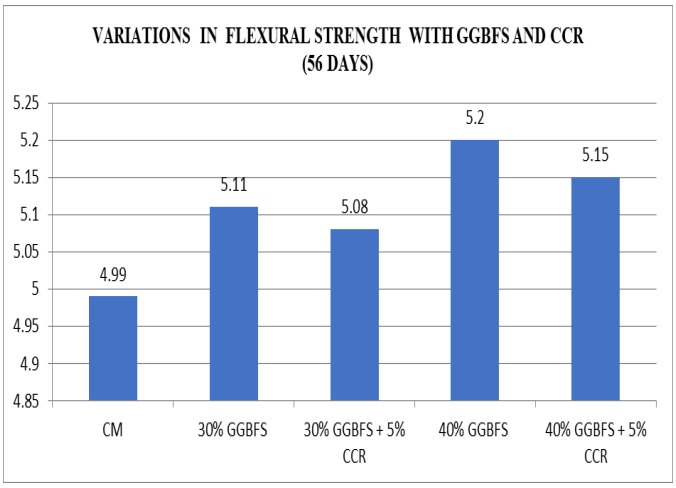
OPC	GGBFS	Flexural strength (N/mm²)
100	0	4.99
70	30	5.11
60	40	5.20



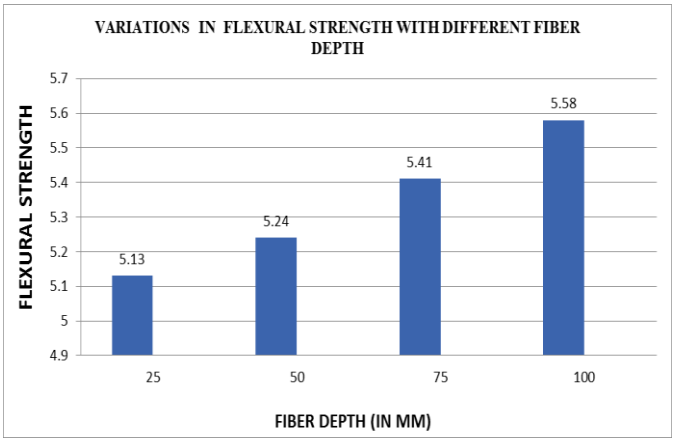
3.3.2 The Flexural strength test results of concrete beams specimens prepared with 30%GGBFS and 40% partial replacement of cement by GGBFS with an additional 5% CCR added into the mix, are presented in below chart.



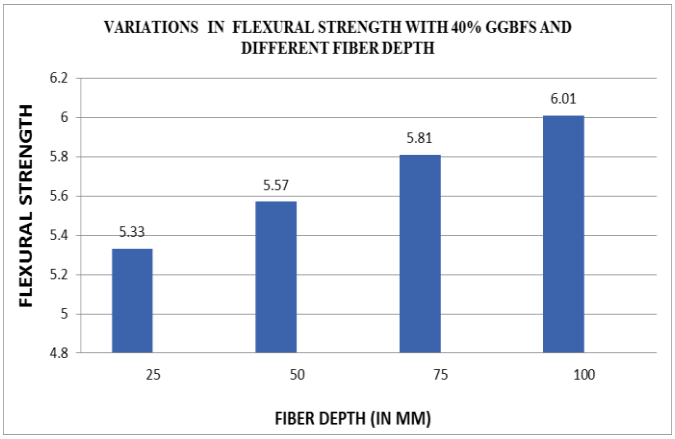
3.3.3 Variation in Flexural strength test results of concrete beams specimens prepared with 30%GGBFS and 40% partial replacement of cement by GGBFS with or without additional 5% CCR added into the mix, are presented in below chart.



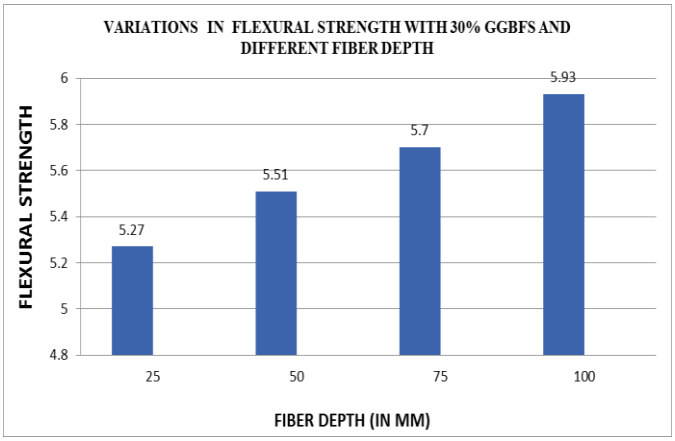
3.3.4 The Flexural strength test results of concrete beam specimens prepared with 1% Steel fibres and depth variation at the of 56 days are presented in chart below



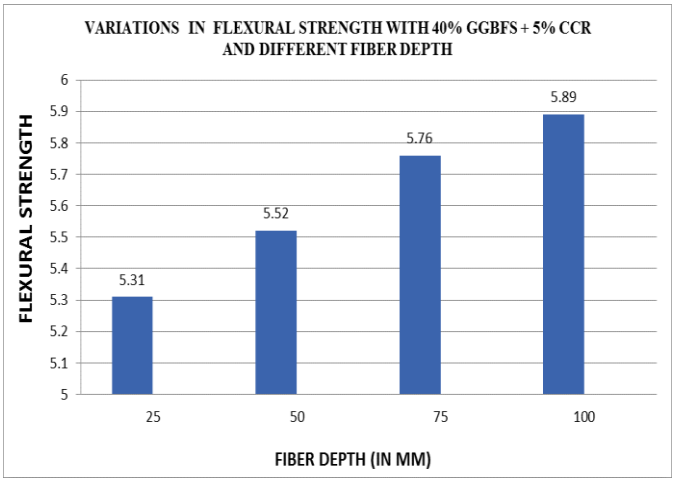
3.3.4 The Flexural strength test results of concrete beam specimens prepared with 40%partial replacement of cement by GGBFS and 1% fiber with depth variation at the of 56 days are presented in chart below



3.3.5 The Flexural strength test results of concrete beam specimens prepared with 30%partial replacement of cement by GGBFS and 1% fiber with depth variation are presented in below chart.

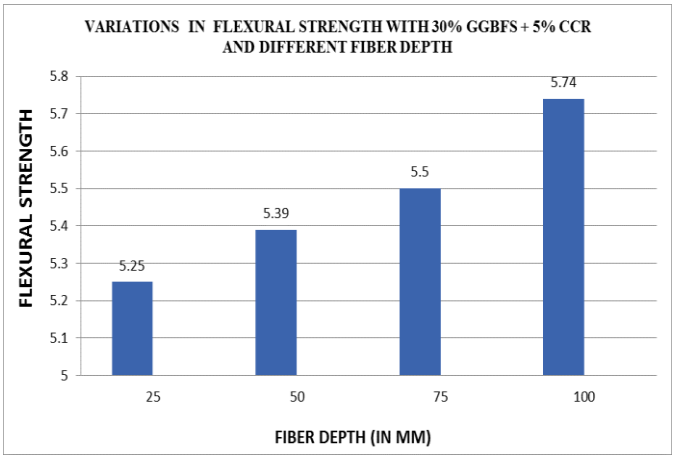


3.3.6 The Flexural strength test results of concrete beam specimens prepared40% GGBFS and 5% additional CCR along with 1% Steel fibers and depth variations are presented in chart.

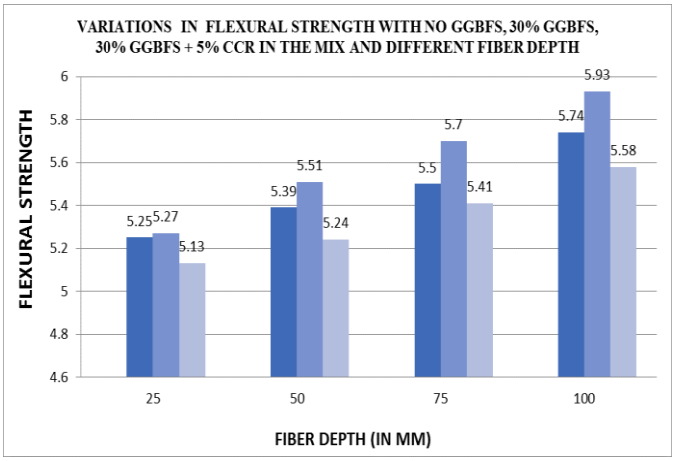


3.3.7 The Flexural strength test results of concrete beam specimens prepared 30% GGBFS and 5% additional CCR

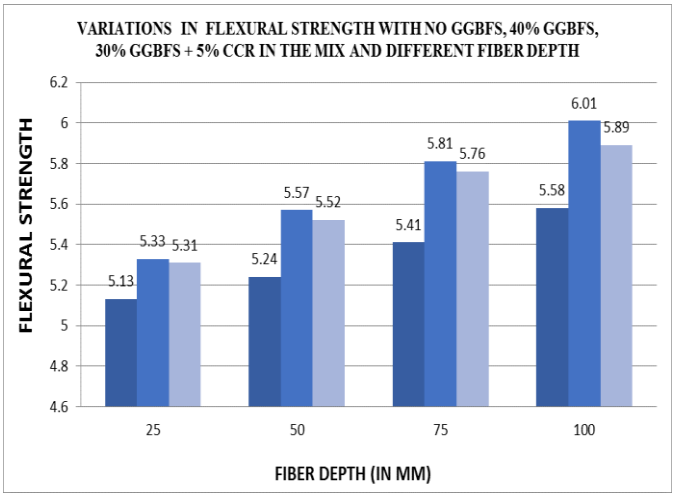
along with 1% Steel fibers and depth variations are presented in chart



3.3.8 Comparison in flexural strength with no GGBFS mix, mix with 30% GGBFS and mix with 30% GGBFS including 5% Calcium carbide residue.



3.3.8 Comparison in flexural strength with no GGBFS mix, mix with 40% GGBFS and mix with 40% GGBFS including 5% Calcium carbide residue.



4. CONCLUSIONS

4.1 Slump

According to the results of Slump cone test it is concluded that the highest slump value achieved with the combination of 40% GGBFS amongst all the mixes with 30% GGBFS or addition of 5% CCR in the mix. GGBFS mix gives better results but addition of 5% CCR exhibits comparatively lesser results.

4.2 Compressive Strength

In the mixes with GGBFS 30% and 40% replacement of Cement, the compressive strength gives best results with 40% replacement of cement by GGBFS. Another set that is prepared with GGBFS 30% and 40% replacement of Cement in addition of 5% CCR, the compressive strength gives satisfactory results with 40% replacement of cement by GGBFS in addition of 5% CCR. Amongst the best compressive strength test results there is slightly variation in strength. According to environmental friendly aspect, the combination of CCR with 40% GGBFS is suited as another waste material can be used as construction material however slightly compromises has to be done with the strength parameters.

4.3 Flexural Strength

4.3.1 Flexural Strength Without Steel fibers - In the mixes with GGBFS 30% and 40% replacement of Cement, the flexural strength gives best results with 40% replacement of cement by GGBFS. Another set that is prepared with GGBFS 30% and 40% replacement of Cement in addition of 5% CCR, the flexural strength gives satisfactory results with 40% replacement of cement by GGBFS in addition of 5% CCR. Amongst the best flexural strength test results there is slightly variation in strength around less than 1%. According to environmental friendly aspect, the combination of CCR with 40% GGBFS is suited as another waste material can be used as construction material however very slightly compromises has to be done with the strength parameters.

4.3.2 Flexural Strength With Steel fibers and Depth variations - The Flexural strength test results of concrete beam specimens prepared with the combination of 40% CCR ,1% Steel fibres and fibers is spread throughout the beam gives best flexural results at the ages of 56 days amongst the mixes 30% GGBFS, 30% GGBFS with 5% CCR and 40% GGBFS. The variation of depth was 0.25d, 0.5d, 0.75d and d.

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