THE PERFORMANCE STUDY ON PROPERTIES OF HIGH STRENGTH CONCRETE BY USING GGBS AND RUBBER WASTE

U.Gopinath[1], S.Mounika[2], S.Narendra[3], Ch.SaiKumar[4], and LKamala[5]

***[1]B.Tech, Dept of Civil Engineering, MVR College of Engineering and Technology**
***[2]Asst.Prof., Dept of Civil Engineering, MVR College of Engineering and Technology**
***[3]B.Tech, Dept of Civil Engineering, MVR College of Engineering and Technology**
***[4]B.Tech, Dept of Civil Engineering, MVR College of Engineering and Technology**
***[5]B.Tech, Dept of Civil Engineering, MVR College of Engineering and Technology**

ABSTRACT:

High strength concrete is defined as concrete with considered characteristic cube strength above 40 Mpa. Environmental concerns both in terms of damage caused by the extraction of raw material and carbon dioxide emission during cement manufacturing also reduce cement consumption by the use of supplementary materials. Applications of high strength concrete are bridges, aqueducts, high rise buildings, off shore structures, dams etc.

The study involves the replacement of cement with ground granulated blast furnace slag, replacement of addition of rubber and also replacement of cement with ground granulated blast furnace slag. Using different percentages of supplementary materials .GGBS 20% replacement in cement is satisfactory target strength is achieved, for M60 grade concrete with glenieum $B2_{33}$ as super plasticizer and the strength properties were studied after 7 days, 28 days.

Key words: HSC, GGBS,rubber, super plasticizer, workability, compressive strength, split tensile strength, flexural strength, and durability tests.

I. INTRODUCTION

GENERAL

High strength concrete is defined as concrete with considered characteristic cube strength above 40 Mpa**.** Generally, now a day's importance of high strength concrete is increased. To make a high strength concrete used as a supplementary cementineous materials in partially replaced by weigh of cement and also Environmental concerns both in terms of damage caused by the extraction of raw material and carbon dioxide emission during cement manufacturing also reduce cement consumption by the use of supplementary materials. In case of cement production, it contributes significant amount of green house gas, because the production of one ton of Portland cement also releases about one ton of CO_2 gas in to the atmosphere.Admixtures are used as ingredients of concrete and added to the batch immediately before or during mixing.

In view of the global sustainable development, it is imperative that supplementary cementing materials should be used to replace large proportions of cement in the construction industry. In such cases alternatively utilization of supplementary cementation materials is well accepted & these materials replace the by weight of cement, it useful for to change properties of normal concrete and affects it produces high strength as well as high durability.Ground granulated blast furnace slag is obtained by quenching molten iron slag (a by-product of iron and steel making) from a blast furnace in water (or) stream , to produce a glassy , granular product that is then dried and ground into a fine powder.The rubber waste also used in

addition of concrete , rubber have some properties like specific gravity , abrasion resistance, tear resistence , compression set , resilience , elongation , tensile modulus , tensile strength.

II. EXPERIMENTAL INVESTIGATIONS

Materials

Portland cement

Opc of 53 grade was used for making a HSC, used a fresh and free from lumps and it satisfies the requirements of IS: 12269-1987 specifications.

Coarse Aggregate

It was collected from local quarry of crushed granite and coarse aggregate was used in the experimental investigation of 20mm and 12.5mm as per IS: 2386-1963(I, II, III) specifications

Fine Aggregate

Locally available river sand was used as fine aggregate and confirmed to grading zone –II as per IS-383-1970 specifications.The material s used in making high strength concrete mixing along with their various properties have been given in table 1.

Table.1.

Materials	Specific gravity	Fineness modulus	Grade/type	Compressive strength(N/mm2)	Source
cement	3.15	-	53(opc)		KCP
F.A	2.70	3.2	Zone-ll		Krishna river(local spot)
C.A	2.78	5.6	60%-20mm 40%-12.5mm	22.2%	Locally available
Rubber	2.68	2.40			
GGBS	2.85				
SP	1.09		Glenium $B2_{33}$(Polycarboxylic ether polymer)		BASF chemical company Ltd. Mumbai

III. EXPERIMENTAL PROGRAM

Mix Proportions

Mix proportions of M-60 grade HSC mix was obtained by making certain modifications in the mix proportion arrived by using a guidelines of ACI 211.1-91 code method. The mix proportion was without considering any replacement of mineral admixture are GGBS, RUBBER. after several trials, a cement content of 346kg/m3 and water/cement ratio of 0.30 were used along with optimum contents of high reactivity of GGBS used as mineral admixture after carrying out several preliminary mix trails, the optimum contents of GGBS at 20%, 1% of rubber waste and a super plasticizer dose at 0.34% both by weight of cement, were found to give desired workability and strength properties and also durability . The final mix proportion was arrived at by altering ratio is expressed as parts of cement: fine aggregate: coarse aggregate: water (1:2.537:3.092:0.35)

4.2 Preparation of HSC Mix

The required quantities of all the ingredients were taken by weight batching. a reference mix was prepared using a water/cement ratio 0.30 and sp (Glenium B233) content (by weigth of cement) in order to get desired workability. The workability of the concrete was studied by conducting slump test (IS: 1199:1959). Considered all HSC mixes were prepared using same mix proportion, W/C ratio and glenium dose .workability, strength and durability properties are studied.

IV. TESTING AND RESULTS

Workability and Compressive Strength Test

Table 2: Test results for workability & compressive strength of GGBS

GGBS (%)	SLUMP(mm)	SP(%)	COMPRESSIVE STRENGTH (N/mm2)	
			7-days	28-days
0	50	0.34	46	52
5	50	0.34	47	54
10	50	0.34	48	54
15	50	0.34	49	66.7
20	50	0.34	48	54

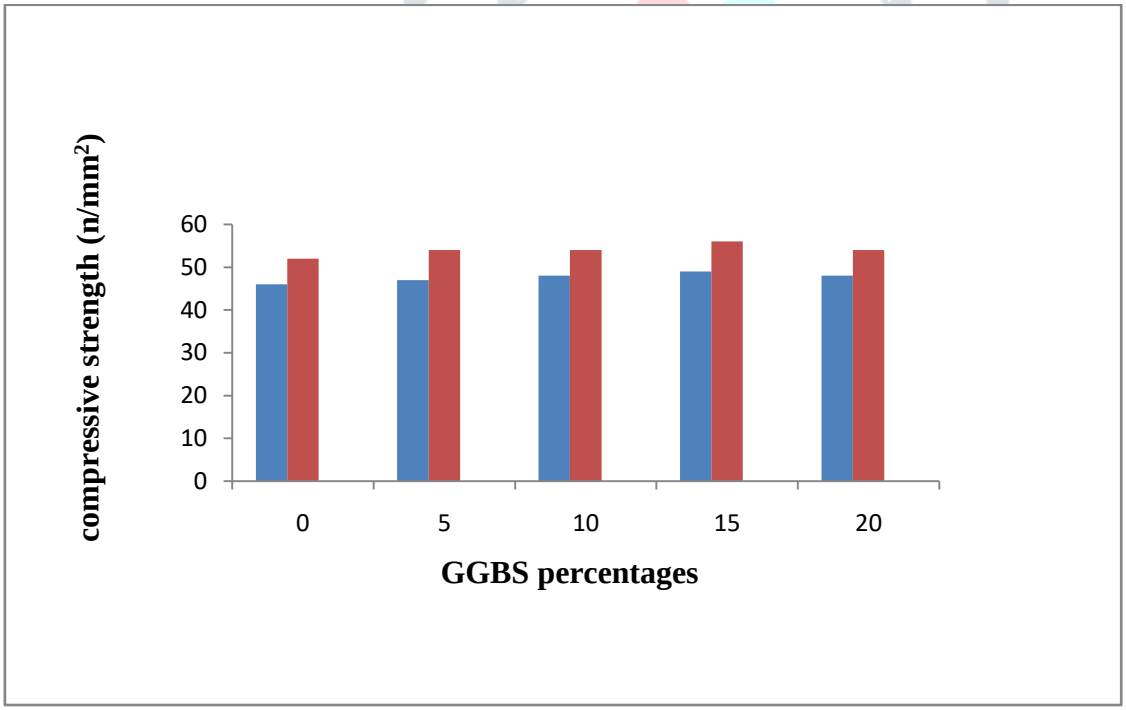

Figure.1.compressive strength

Table.3. Test results for split tensile strength of GGBS

GGBS (%)	SP (%)	SPLIT TENSILE STRENGTH (N/mm2)	
		7-days	28-days
0	0.34	4.5	5.54
5	0.34	4.6	5.94
10	0.34	4.71	6.02

15	0.34	4.8	6.12
20	0.34	4.65	6.02

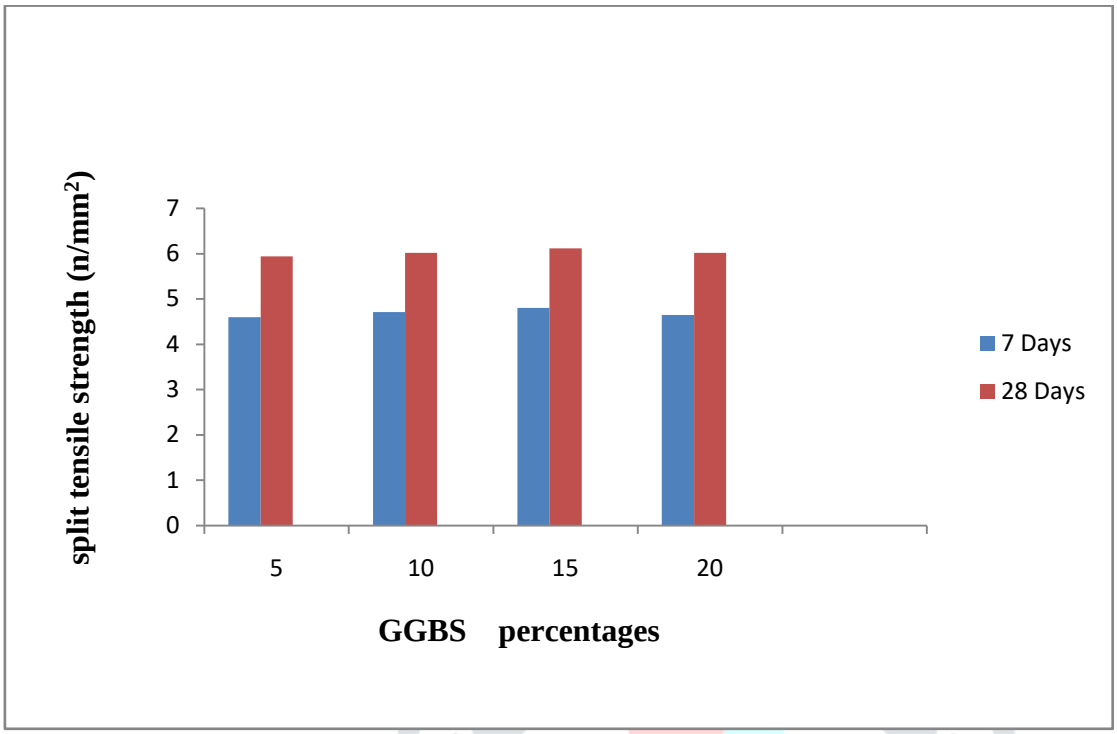

Figure.2. Split tensile strength

Table .4.Test results for split tensile strength combination of (GGBS+RUBBER)

(GGBS+RUBBER)(%)	SP (%)	SPLIT TENSILE STRENGTH(N/mm2)	
		7-days	28-days
0%+0%	0.34	4.6	5.94
5%+1%	0.34	4.84	6.1
10%+2%	0.34	4.92	6.20
15%+3%	0.34	4.94	6.20
20%+4%	0.34	4.92	6.10

Table .5. Test results for flexural strength of (GGBS)

GGBS (%)	SP (%)	FLEXURAL STRENGTH(N/mm2)	
		7-days	28-days
0	0.34	5.2	5.6
5	0.34	5.3	5.8
10	0.34	5.6	5.9
15	0.34	5.7	6.10
20	0.34	5.6	5.9

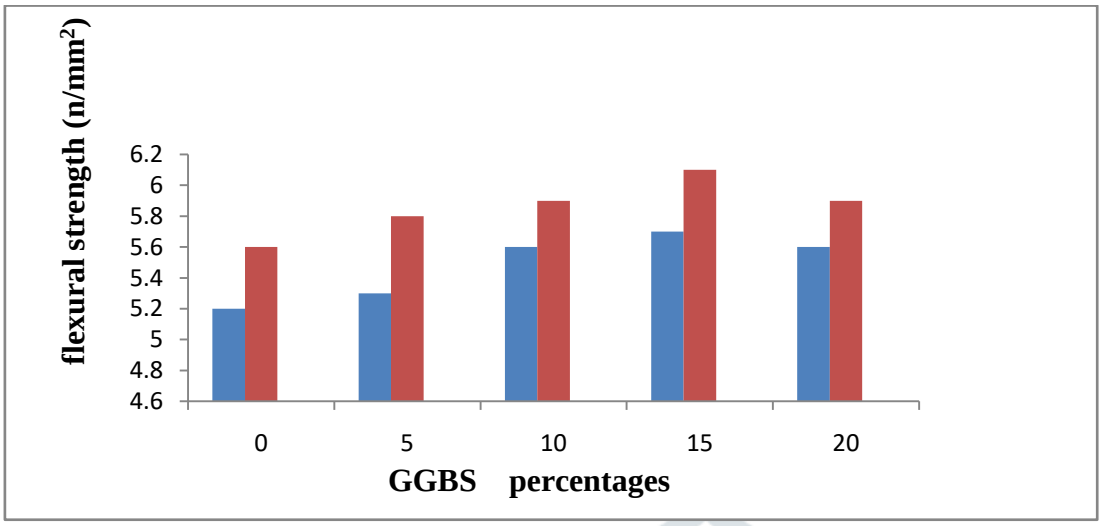

Figure .3. Flexural strength

V. CONCLUSIONS

- It was **o**bserved that rubber has been achieved maximum strength at 3% and GGBS at 15% in the grade of M60
- Added Glenium B233 increased the workability of concrete by reducing the water content
- The increase in compressive strength for rubber is 2%greater than GGBS and combination of rubber and GGBS is getting 2% more strength compared with rubber
- From the above results it was proved that combination of GGBS and rubber can be used as a alternate material for cement and safe to environment.
- Excessive usage of admixtures above the specified optimum percentages results in strength reduction. Comparative researches can be carried out with using different admixtures with combinations.
- The split tensile strength of cylinders are increased with partial replacement of GGBS 15%.

VI. REFERENCES

1. (S. Arivalagan) Sustainable Studies on Concrete with GGBS As a Replacement Material in CementIJRET 2014
2. Latha K.S, Rao M.V.S, and Reddy V. S. "Estimation of GGBS and HVFA strength efficiencies in concrete with age", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Vol. 2, Issue 2, December (2012)
3. Dubey A, Chandak R, and Yadav R.K. "Effect of blast furnace slag powder on compressive strength of concrete", International Journal of Scientific & Engineering Research. ISSN 2229-5518, Vol. 3, Issue 8, August (2012)
4. Pathan V.G, Ghutke V.S, and Pathan G. "Evaluation of concrete properties using ground granulated blast furnace slag", International Journal of Innovative Research in Science, Engineering and Technology Vol. 1, Issue 1, November (2012) [4]
5. Gudissa W, and Dinku A. "The use of limestone powder as an alternative cement replacement material: An experimental study", Journal of EEA. Vol. 27, (2010)
6. rubber as aggregate and rubber as filler in concrete, First International Conference on Sustainable
7. Topcu, I. B., and Demir, A. (2004). Durability of rubberized mortar and concrete. Journal of Materials

8. Huang, B., Li, G., Pang, S., and Eggers, J. (2004) Investigation in to waste tyre rubber-filled concrete.

9. Malladi, K. S. (2004). Studies on rubberized cement concrete. Master Thesis in Structural Engineering,