



# **iJRASET**

International Journal For Research in  
Applied Science and Engineering Technology



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# **INTERNATIONAL JOURNAL FOR RESEARCH**

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

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**Volume: 7      Issue: III      Month of publication: March 2019**

**DOI: <http://doi.org/10.22214/ijraset.2019.3299>**

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# Experimental Study on GGBS based Concrete block

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**Abstract:** Concrete blocks containing GGBS and rice husk ash should be promoted as a new construction materials to replace the existing blocks in market.

**Properties of the materials used must be better understand first to obtain the desired concrete block.** The compressive strength, water absorption and impact test are conducted in M40 grade concrete. Physical test of recently preparing mix are also carried out 390mm\*190mm\*190mm concrete blocks are cast and compacting the blocks for 7,14,28 at 0,10,15&20 percent replacement level. In conclusion the high performance of masnory blocks can be produced using rice husk ash and GGBS a cement replacement material.

**Keywords:** GGBS, M40, Rice husk ash, Concrete block, strength improvement.

## I. INTRODUCTION

GGBS is a mineral admixture used for alternative materials for cement. Rice husk is also known as rice hull is a by product of rice milling product demand for rice have increased due to population growth that exceed every year. Therefore the pressure of silica in this pozolonic materials makes possible in case of RHA to replace part of cement the important of quality properties of block namely strength, durability and fire resistance.

In optimum level of RHA is 5% is referred in international journals. Structural members are to be designed to satisfy the requirements of serviceability and safety limit state for various environmental conditions. A structure could also be said to be a complex entity constructed from the arrangements of several parts. In engineering and architecture a structure is a body or assembly of the body elements to form a system capable of resisting loads.

The effects of loads on physical structure are determined through structural analysis. Structures can also be categorized by the type of material used for its construction. Structural engineering depends on the knowledge of materials and their properties in order to understand how different materials support and resist loads. However the objectives of these research are to study on GGBS based concrete block with addition of rice huskash as a alternative material for cement.

## II. LITERATURE REVIEW

Wang Ling al Analyzed the performance and the effects of GGBS on fresh concrete and hardened concrete. The strength of GGBS concrete is high and heat of hydration is low and it is resistant to chemical corrosion.

S.Arivalagan studied the effects of partially replacing cement with 20%,30%&40% GGBS at different age of strength and strength efficiency factor of hardening concrete.

The specimen showed increase in compressive strength when tested 7 and an 28 days, for 20% replacement of cement. Split tensile strength and flexural strength of concrete also increased at 20% cement replacement.

Atul Dubeyet. al. examined the effects on compressive strength of concrete by partial replacing of cement with 5 to 30 % of BFS. The test was conducted on cubes made of standard size of 150 mm x 150 mm x 150 mm at 7, 14 and 28 days. He concluded that the strength of concrete decreases as the percentage of BFS increase. The depreciation in 28 days compressive strength is being near about only 5 % on replacement of OPC with 15% blast furnace slag powder

## III. MATERIAL COLLECTION

### A. Cement

Ordinary Portland cement(53 grade) cement confirming to IS 8112 was used. Various laboratory tests were conducted on cement and the properties such as standard consistency, initial and final setting time, were determined as per IS 4031 and IS 269-1967. The results confirm to the IS recommendations.



Fig:1 OPC grade 53 Cement

*B. Fine Aggregate*

River sand zone II was used in this study.

*C. Coarse Aggregate*

The coarse aggregate particles passing through 12.5mm and retained on 4.75mm IS sieve used as the natural aggregate which met the grading requirement of IS 383-1970



Fig 2:Coarse aggregate(10mm)

*D. Water*

Ordinary portable water

*E. Ground Granulated Blast Slag*

GGBS were used



Fig 3: Ground granulated blast slag

#### F. Rice Husk Ash

Rice husk is also known as rice hull is a by product of rice milling product the optimum.



Fig 4: Rice husk ash

Table 1: Physical and chemical properties RHA:

S.NO	Oxide composition	RHA
1	SiO <sub>2</sub>	88.32
2	Al <sub>2</sub> O <sub>3</sub>	0.46
3	Fe <sub>2</sub> O <sub>3</sub>	0.67
4	CaO	0.67
5	MgO	0.44
6	Na <sub>2</sub> O <sub>3</sub>	0.12
7	Specific gravity	2.11

Table 2: physical and chemical properties of GGBS

S.NO	Oxide composition	GGBS
1	CaO	40
2	SiO <sub>2</sub>	35
3	Al <sub>2</sub> O <sub>3</sub>	12
4	Fe <sub>2</sub> O <sub>3</sub>	0.2
5	MgO	10
6	Specific gravity	2.9

## IV. MIX DESIGN

Mix design (as per code IS 10262-1982)

Grade of concrete (M40)

#### A. Target Mean Strength

$$f_{ck}' = f_{ck} + 1.65S$$

$$= 48.25 \text{ N/mm}^2$$

#### B. Selection of w/c Ratio

The free water cement ratio required for the target strength 48.25 N/mm<sup>2</sup> is 0.45

Max w/c ratio = 0.45

#### C. The Selection Of Water And Sand Content

For 10mm nominal size of aggregate and sand confirming to grading zone II.



Water content per m<sup>3</sup> of concrete=208kg

Required water content = 208+(208\*6/100)

Cement content=551.2kg

Determination of FA=793.40kg

Determination of CA=700.90kg

Mix ratio=1:1.439:1.27

Table 3: Combination used based GGBS and rice husk ash:

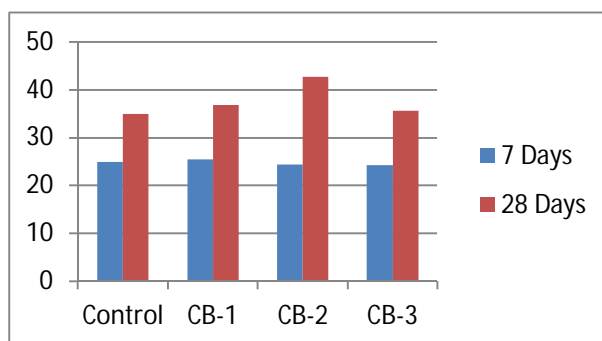
Specimen	1	2	3	4
Cement	100%	85%	75%	65%
FA	100%	100%	100%	100%
CA	100%	100%	100%	100%
GGBS	-----	10%	20%	30%
RHA	-----	5%	5%	5%
W/C ratio	0.4	0.4	0.4	0.4

## V. RESULTS AND DISCUSSIONS

### A. Compressive Strength Test

Table 4: Compressive strength test based on GGBS and RHA Concrete block:

S.NO	Combination	Compressive strength of concrete N/mm <sup>2</sup>	
		14 Days	28 Days
1	Control	24.93	34.93
2	CB-1	25.42	36.75
3	CB-2	24.35	42.71
4	CB-3	24.20	35.6



X-Axis=Days  
Y-Axis=Strength N/mm<sup>2</sup>

Fig 5: Graphical representation of compressive strength obtained at 14 days and 28 days

### B. Water Absorption

Table 5: Water Absorption Test

S.no	Combination	Dry weight	Wet weight	Percentage of water absorption
1	Control	29.730	30.200	1.6
2	CB-1	29.570	30.480	3.07
3	CB-2	29.820	30.280	1.54
4	CB-3	29.760	30.190	1.44

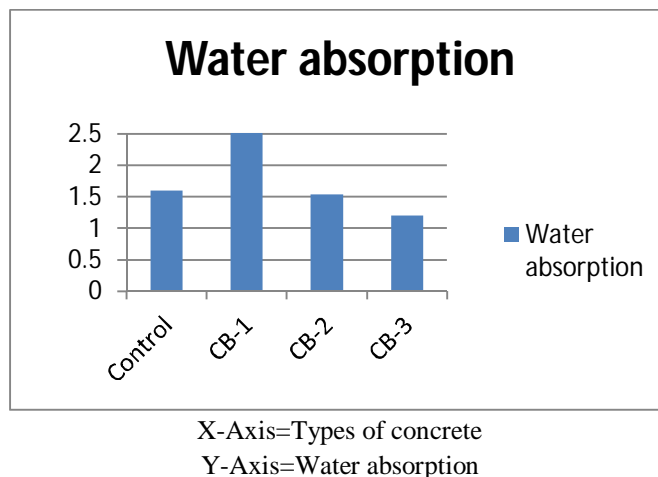


Fig 6: Graphical representation of water absorption

### C. Impact Test

Table 6: Impact test

Specimen No	Control	CB-1	CB-2	CB-3
First crack resistance	1	1	1	2
Ultimate resistance	5	5	4	9
Percentage increase in resistance from FCR to UR	20	20	25	22.22

## VI. CONCLUSION

In this research which is based on the replacement of cement with GGBS and rice huskash in concrete block. This concrete blocks are used exhibited good result in compression test, Impact test and water absorption. The results obtained varied based on the percentage of GGBS like 10%,20% and 30%. Which was replaced with cement. The rice huskash kept constant at the optimum level of 5%. The optimum result for compression test, Impact test and water absorption of concrete block was obtained at 20%. Its very economical when compare to other types of block. We recommended the blocks are used to residential buildings, office buildings and apartments also. Its contain high strength and durable concrete blocks.

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