

An Experimental Investigation on Compressed Stabilized Interlocking Earth Block

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ABSTRACT: Conventional bricks are the most elementary building materials for houses construction. However, the rapid growth in today's construction industry has obliged the civil engineers in searching for a new building technique that may result in even greater economy, more efficient and durable as an alternative for conventional brick. These changes have led to improved constructability, performance, and cost as well. Several interlocking bricks has been developed and implemented in building constructions and a number of researches had studied the manufacturing of interlocking brick and its structural behaviour as load bearing and non load bearing element. This project aims to review the development of interlocking bricks and its structural behaviour. This paper also gives the results of an experimental investigation in which the compressive strength, water absorption, acid resistance test, carbonation. In this work we got the max compressive for 10% cement with 10% GGBS CSEB and also the acid resistance capacity is good and depth of carbonation is less for 10% cement and 10% GGBS CSEB.

KEYWORDS: CSEB, compressive strength, water absorption, acid resistivity, depth of carbonation.

I. INTRODUCTION

Housing is one of the basic human needs and is usually ranked third after food and clothing. In most developing countries housing is inadequate and the housing backlog has been increasing rapidly. One key reason for housing inadequacy is the increase in population due to the high pace of urbanisation and socio-economic factors that include the rise in prices of land and building materials, Those classified as poor are the majority and they cannot afford proper housing. The outcome of this can be seen by the poor quality of the houses of this majority in both urban and rural environments.

Compressed Stabilized Interlocking Earth Blocks are the construction materials which are very popular nowadays, the materials used for the manufacture of this blocks are clay and red soil, mixed with cement and water in the right proportions. Then compression moulding with dry compressed machine and cured in the presence of moisture for at least 7 days and let it coagulated. We will get strongly interlocking blocks and can be used in the bearing wall construction. Cement is the mainly material in construction activities. However, we have to destroy natural resources to get the cement. Moreover, it also results in several problems of environmental pollution. With the increase in material costs in the construction industry, there is a need to find more cost saving alternatives so as to maintain the cost of constructing houses at prices affordable to clients. The potential for using earth as an alternatives construction material have being seriously considered since earth has been used as a brick in house construction throughout the ages. The methods used from the traditional techniques are being further developed to improve the quality of earth stabilized block hence it will increase the potential for its application. Earth construction

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is very cost effective, energy efficient (excellent thermal properties and low energy input required for production), environmentally friendly, and safe, these are the qualities which are particularly relevant and important with the ever growing need for increased awareness to reduce energy consumption world-wide. Production techniques had been developed so as to achieve better quality block and reduce production costs.

PROPERTIES OF EARTH COMPRESSED STABILIZED MUD BLOCKS:

- Causes no direct environmental pollution during the whole life cycle.
- No binding material is required.
- Less water absorption.
- High durability.
- Good aesthetic view.
- Eco friendly.
- Economy.

II. MATERIALS AND METHODOLOGY

MATERIALS USED

Red soil, clay, cement, water, GGBS, lime if needed.

CEMENT

Cement is a vital component for soil-stabilized bricks, enhancing both strength and durability. Cement, an expensive element, can be kept down to the range of 3 to 10 % of the mix without compromising performance. Ordinary Portland cement of 53 grade is used in our work.

RED SOIL

Red soil is a type of soil that develops in a warm temperature, moist climate under mixed forest. It contains huge amount of iron oxides and hence the colour of the soil is red.

CLAY

Locally available natural clay is used in our work. 40% clay is used to manufacture the stabilized interlocking blocks.

GGBS

GGBS is the byproduct obtained from steel industry. In our work we have used this GGBS as a partial replacement for OPC. This GGBS is white finely powdered material and it is finer than cement.

Water

Potable water has been used for casting concrete specimens.

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LABORATORY TEST RESULTS

Cement

Table 1: Physical properties of Cement

SL NO	CHARACTERISTICS	RESULTS	SPECIFICATIONS
1	Specific gravity	3.12	IS:2720[part 3]
2	Standard consistency	29%	IS:4031[26-33%]
3	Fineness	4.5%	Not more than 10%
4	Initial setting time	35min	IS:4031[>30min]

Red Soil

Table 2: Physical properties of Red soil

SL NO	PROPERTIES	TEST RESULT
1	Specific gravity	2.60
3	Fineness modulus	3.02

GGBS

Table 3: Physical properties of GGBS

SL NO	PROPERTIES	TEST RESULT
1	Specific gravity	2.82
2	% particles retained on 90 μ sieve	-

IV. TESTS ON CSEB

The various tests are conducted to know the performance of CSEB by partial replacement of cement by GGBS

1. Compressive strength test
2. Water absorption test
3. Durability test such as acid resistivity, carbonation

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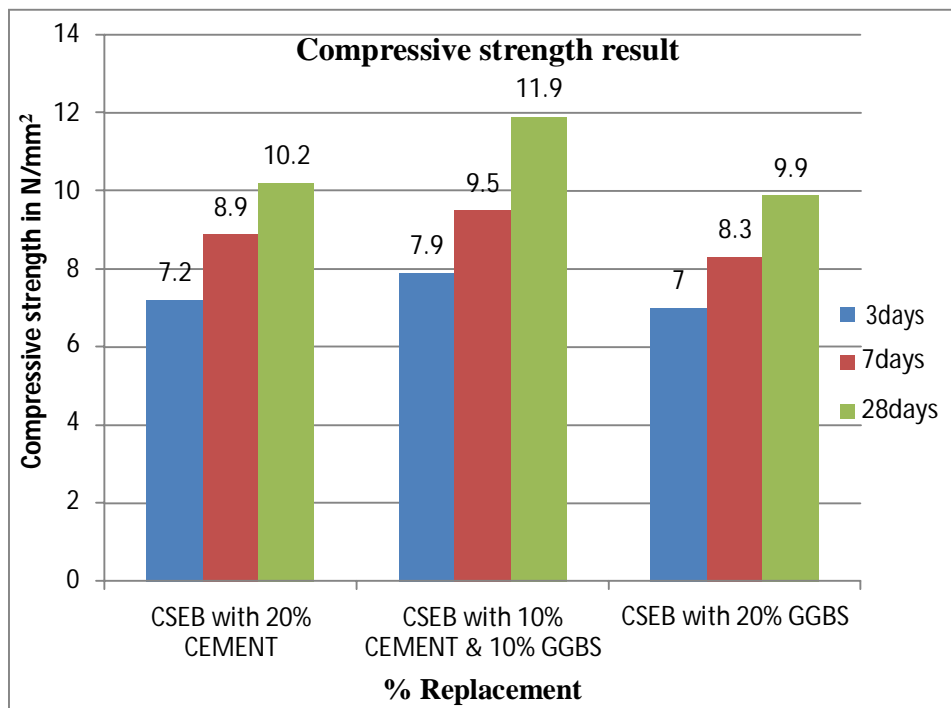
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COMPRESSION STRENGTH TEST RESULTS:

Table 4: Compressive strength test result of CSEB

% Replacement	Compressive strength in N/mm ²		
	3days	7days	28days
CSEB with 20% CEMENT	7.2	8.9	10.2
CSEB with 10% CEMENT & 10% GGBS	7.9	9.5	11.9
CSEB with 20% GGBS	7.0	8.3	9.9



Graph 1: compressive strength results of CSEB

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WATER ABSORPTION TEST RESULTS

Table 5: Water absorption test result of CSEB

%Replacement	Initial dry weight W ₁ in kg	Wet weight W ₂ in kg	%water absorption
CSEB with 20% CEMENT	12.780	12.910	1.01
CSEB with 10% CEMENT & 10% GGBS	12.800	12.900	0.78
CSEB with 20% GGBS	12.810	12.930	0.94

ACID RESISTANCE TEST RESULTS

Table 6: Acid resistance test result of CSEB

Specimen	Initial weight before acid attack in kgs	Weight after 10days acid attack in kgs	Weight after 20days acid attack in kgs	Weight after 30days acid attack in kgs	Compressive strength of the block after acid attack in N/mm ²
CSEB with 20% CEMENT	12.800	12.795	12.785	12.775	8.10
CSEB with 10% CEMENT & 10% GGBS	12.840	12.837	12.830	12.825	10.10
CSEB with 20% GGBS	12.820	12.810	12.800	12.790	7.80

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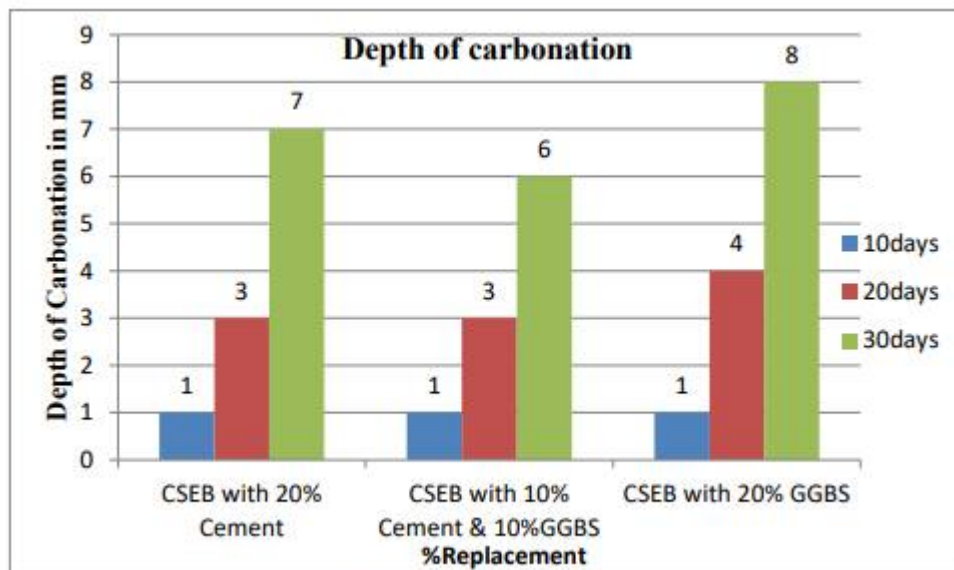
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DEPTH OF CARBONATION TEST RESULTS:

Table 7: Carbonation test result of CSEB

%Replacement	No of days the block were placed for carbonation test	Depth of carbonation in mm	Compressive strength in N/mm ²
CSEB with 20% CEMENT	10	1	9.10
	20	3	
	30	7	
CSEB with 10% CEMENT & 10% GGBS	10	1	10.90
	20	3	
	30	6	
CSEB with 20% GGBS	10	1	8.70
	20	4	
	30	8	



Graph 2: Carbonation result

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V. CONCLUSION

Following broad conclusions can be made from the experimental study on CSEB

1. Compressive strength of the compressed stabilized interlocking earth blocks are more compared to 1st class table mould burnt bricks.
2. Among the three replacements, i.e., CSEB with 20% cement, CSEB with 10% cement & 10% GGBS and CSEB with 20% GGBS, the second replacement, i.e., CSEB with 10% cement & 10% GGBS give more compressive strength.
3. In the present study, it can be observed that acid resistance strength is less for 1st class table mould burnt bricks compared to CSEB.
4. Depth of carbonation is also more for 1st class table mould burnt bricks compared to CSEB.
5. CSEB absorbs less water due to the absence of pores and voids. Hence the percentage of water absorption is less in CSEB compared to 1st class table mould burnt bricks.

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