

Stabilized Mud Blocks Using Alccofines and GGBS

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Abstract: The indiscriminate infrastructural growth is leading to rapid environmental degradation. Sand, cement, coarse aggregate for manufacturing of bricks and used for large construction activities are energy intensive as well as causing environmental pollution during their entire life cycle. In order to quantify the energy and savings potential by applying best available technologies like Stabilized mud blocks for engineering applications. Even though the strength of SMB is less compared to cement blocks, we can use the SMB by stabilizing it by using cement, lime. But in this project we are trying stabilize the blocks by using waste materials like GGBS and Alccofines. In this study we are utilizing the behavior of Stabilized Mud Block with alccofines and GGBS by conducting various tests like the compressive, water absorption and weathering test. We can use the stabilized mud blocks for non structural elements as it meets the strength requirements as per IS codes. And these blocks are purely eco friendly as it is made up of waste materials.

Key Words: Stabilized mud blocks, compression strength, GGBS, Alccofines, Eco Friendly Materials.

1. INTRODUCTION

Earth as mud bricks has been used in the construction of shelters for thousands of years. Approximately 30% of the world's population still lives in earthen structures. Compressed soil masonry blocks formed using moist soil compacted mechanically to improve physical characteristics have aimed popularity recently. Benefits of earth in this manner include improved strength and durability as compared to adobe while maintaining significantly low embodied energy levels than alternative materials. However problems arise from the materials low tensile strength, brittle behavior and deterioration in the presence of water. Stabilization by a hydraulic binder such as cement or lime or a combination of the two can significantly improve water resistance and strength to some extent. Also waste materials can be used as a stabilizer in the stabilized mud blocks. We have used materials like GGBS and alccofines as a stabilizer in this project. Theoretical models were also developed on composite soil blocks with these stabilizers subjected to shear.

GGBS is a waste produced in blast furnace by quenching molten iron blast furnace slag immediately in water or stream to produce a glassy product that is then dried and grounded into product. It is a waste that is produced in blast furnace and its disposal is a very big problem in recent days because in these days lot of land is getting waste due to disposal. When we use this as a binder in concrete construction we can produce high performance concrete and cement. So we are trying to use this waste in production of stabilized mud blocks and so we can reduce the pollution causing by it into atmosphere.

Alccofine 1203 is a slag based supplementary cementitious materials having ultra-fineness, low calcium silicate product with optimized particle size distribution. Due to ultra-fineness it penetrates into tight joints, fissures and pore spaces which impart greater water tightness.

2. MATERIALS USED

2.1 Soil: A locally available red soil which is suitable for the manufacturing of mud blocks is been selected and used. Physical characteristics of soil are shown in table 1. Tests has be conducted as per IS 2920, IS 2720 and confined as per IS 1725.1982.



Fig. 1 Red Soil

Table 1: Physical characteristics of Soil

Sl. No.	Properties	Test as per code	Test Results	Limitations As Per IS 1725.1982
1.	Moisture Content by Pyconometer method	IS 2920-1973 Part-2	3.23%	<10%
2.	Moisture Content by Oven Dry Method	IS 2920-1973 Part-2	5.96%	<10%
3.	Liquid Limit	IS 2720-1985 Part-5	28.42%	--
4.	Plastic Limit	IS 2720-1985 Part-5	37.77%	--
5.	Density of loosely filled soil	IS 2720-1985 Part-14	1.11gm/cc	--
6.	Density of Fully compacted Soil	IS 2720-1985 Part-14	1.45gm/cc	--
7.	Specific Gravity	IS 2720-1980 Part-3	2.53	--
8.	Standard Proctor	IS 2720-1980 Part-7	1.92g/cc 7%	--
9.	Vane Shear	IS 2720 Part-30	0.0668 kg/cm ²	--

2.2 Alccofine: Alccofine is slag with high reactivity and high lass content product specifically processed attained by the process of controlled granulation. The raw materials chiefly constitute small quantity of calcium silicates. The controlled particle size distribution is attained by processing with other select ingredients. Alccofine 1203 provides good workability and utilization as high range water reduces to increase compressive strength. Due the accurate procedure of this distribution of particle size, the alccofine gives the greater results and reduces the content of water. Table 3 indicates the chemical composition of alccofine.



Fig. 2 Alccofine

Table 2: Chemical composition of Alccofine (%)

CaO	SiO ₂	SO ₃	Al ₂ O ₃	Fe ₂ O ₃	MgO	Cl
61-34	21-23	2-2.4	5-5.6	3.8-4.4	0.8-1.4	0.03-0.05

2.3 GGBS: It is been using because of its overall economy in making and as worthy as their enriched performance is aggressive environments. It's obtained by quenching melted iron slag from a blast furnace in water to provide a granular glassy product. After that it is dried and grinded into the powder. Table 4 indicates the physical characteristics of GGBS.



Fig. 3 GGBS

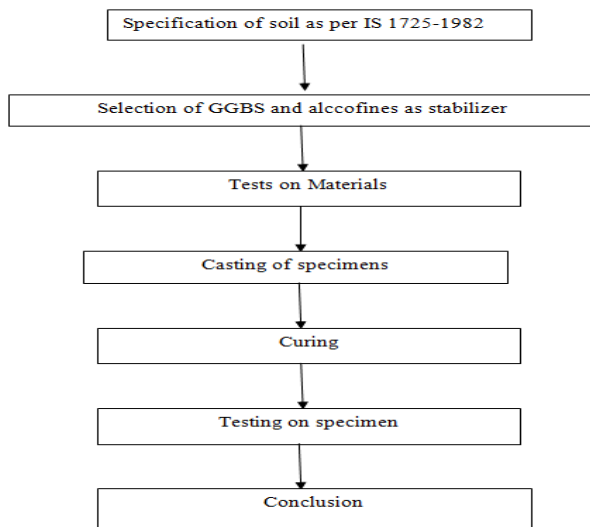
Table 3: Chemical characteristics of GGBS

Name of Chemical	% present in GGBS
Calcium oxide:	40%
Silica:	35%
Alumina:	13%
Magnesia:	8%

Table 4: Physical characteristics of GGBS

Sl. No	Physical Characteristics	GGBS
1.	Specific Gravity	1.64
2.	Fineness Modulus	2.79
3.	Bulk density (loose, compacted) (kg/m ³)	1346,1480

3. METHODOLOGY



4. MIX PROPORTIONS

4.1 Proportions for Making Stabilized Mud Blocks: Mix proportions used to make stabilized mud blocks id detailed in the table 5.

Table5. Mix Proportions

Soil	Stabilizer (Alccofine, GGBS)	Water
82%	10%	8%

Stabilized mud blocks have been casted as per IS codes specification with a stabilization of GGBS and Alccofines. Two sets of cubes had casted by using 10% stabilization of GGBS and Alccofines. These cubes are cured for 28 days (regular moisture curing is adopted) and tested the cubes as per IS codes.



Fig. 4 Casted stabilized blocks

5. Experimental investigations:

5.1 Compressive Strength: Strength of the blocks shall be tested using compressive strength testing machine. And requirements will be verified as per code IS: 1725-1982.

SL NO.	Stabilizer used in SMB	Average compressive strength (N/mm ²)
1.	Alccofine	2.63
2.	GGBS	4.09

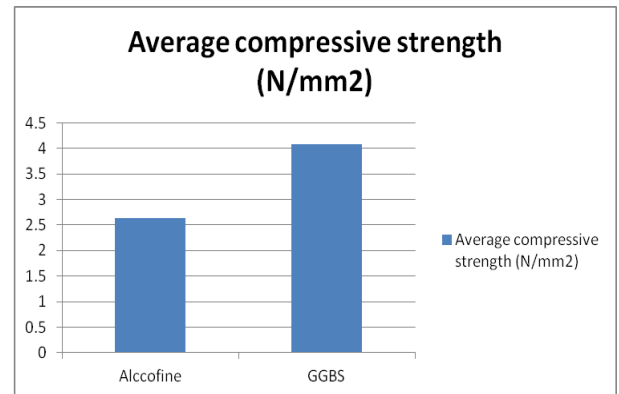


Fig.5 Compressive test results graph

5.2 Water Absorption Test of Stabilized Mud Blocks

Water absorption test were conducted as per codal provisions. Initially the dry weight of the blocks were taken and then the SMB Blocks were fully immersed in water for 24hrs and then after 24hrs it is taken out of water and its wet weight is noted down and percentage of water absorbed is calculated. Average of five blocks is taken and tabulated. And requirements will be verified as per code IS: 1725-1982.

Table7. Water Absorption test results

SL NO.	Stabilizer used in SMB	% of water Absorbed
1.	Alccofine	8.7%
2.	GGBS	6%

6. CONCLUSION

- The strength of the GGBS stabilized SMB is very good and when compared to the alccofine. This is shown in the graph.
- Considering recent global warming issues caused by increased CO₂ gas in atmosphere, a need for eco-friendly material is essential.
- We have seen in the experiment that the blocks have good water resistant capacity also.
- Alccofine and GGBS stabilized blocks can be used in compound wall construction and any other low application construction.
- Alccofine and GGBS stabilized blocks can be used instead of fired bricks so it reduces global warming issues.

Table6. Compressive test results

- SMB has very low embodied energy compared to other bricks, so it is very useful to eco-friendly environment.

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