STUDIES ON STABILIZED MUD BLOCK AS A CONSTRUCTION MATERIAL

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Abstract-*Soil as a building material is available in most areas of the world. In developing countries, earth construction is economically the most efficient means for house construction with the least demand of resources. Investigation is carried out to find the suitable proportion of locally available materials such as soil , coir , straw etc. with cement as stabilizers for improving the strength of locally available mud blocks and thus to provide affordable housing. Using soil (from areas of Kulathupuzha, Kerala) and stabilizers (cement,straw fibre, plastic fibre), different types of samples were prepared. Tests were conducted on these samples in order to evaluate their performance such as compressive strength and total water absorption on which the durability of the blocks depend.*

Keywords: Stabilizers, compressive strength, water absorption, affordable housing.

1. INTRODUCTION

Adequate shelter is one of the most important basic human needs. Currently, the majority of developing countries are faced with a problem of providing adequate and affordable housing in sufficient numbers. In the last few decades, shelter conditions have been worsening: resources have remained scarce, housing demand has risen and the urgency to provide immediate practical solutions has become more sensitive.

For providing low-cost housing, we must rely on locally available raw materials. Home brick-makers have long been using fibrous ingredients like straw to improve the tensile strength of mud bricks. However, they have not had a chance to do scientific experimental investigation on the balance of ingredients and the optimisation of this production. The fibres, which are connected together by mud, provide a tensile strength in mud bricks. The fibres provide a better coherence between the mud layers. The stress–strain relation of mud bricks under compression is very important. The compressive strength of fibre reinforced mud brick has been found to be higher than that of the conventional fibreless mud brick, because, fibres are strong against stresses. Furthermore, such materials are abundantly available and renewable in nature. Local soil has always been the most widely used material for earthen construction in India. However, such type of construction has some serious drawbacks such as, i) Water penetration ii) Erosion of walls at the plinth level/ lower level by splashing of water from ground surfaces. iii) Attacks by termites and pests. iv) High maintenance requirements. v) Low durability.

Mudbrick has several advantages over conventional fired clay or concrete masonry. Mud bricks perform

considerably better, in environmental terms, then fired bricks. They have significantly less embodied energy, contribute fewer CO2 emissions and help to promote the local economy and local labour. At first glance they appear to be an ideal candidate for an economically viable sustainable construction material. However, the major drawback of unfired mud bricks is that they tend to be less durable than their fired counterparts and are more susceptible to water damage. Traditionally, unfired mud bricks have been stabilised with cement to overcome these short comings but the use of cement and other stabilizers reduces the environmental differential between unfired bricks and fired ones. Research into alternative stabilisers is both relevant and necessary to ensure unfired mud bricks remain a competitive alternative to modern construction methods. They have high thermal mass and sound absorbing property. Stabilized mud blocks can be produced easily without any skilled labour and sophisticated machinery.Relevance of the project includes providing a low cost alternative to the contemporary building materials. Especially in the areas of low rainfall, stabilized compacted earth blocks are a better alternative considering cost as a factor. Since India is a tropical country, mud blocks preserves a good living atmosphere inside the houses, it prevents too much heat from entering the building.

The present investigation attempts to study the effect of various stabilizers on the strength of mud block masonry. The effect of altering important variables such as cement, lime, straw fibre, coir, plastic fibre content on the properties and performance of stabilized earth blocks were studied. The percentage of stabilizer and the most effective stabilizer was analyzed.

2. MATERIALS AND METHODOLOGY

2.1 Collection of Samples and Sieve Analysis

Different soil samples were collected from Kulathupuzha of Kollam district. All the samples were properly dried. Sieve analysis was done on the samples to get different fractions of gravel, sand, silt and clay. A good soil sample for mud block construction should have 10-15% gravel, 50-75% sand, and 15-30% silt & clay.

2.2 Mould

Moulds were prepared with dimensions 254 mm X 127mm X 76 mm size. And the mould was prepared with wood.

The various proportions of stabilizers used are:

TABLE 1: STABILIZER PROPORTION:

PROPORTIONS SELECTED	DESCRIPTION
S	Soil only
C5	Cement-5%
S	Soil only
C5P	Cement-5%,Plastic-2%
S	Soil only
C5S	Cement-5%,Straw fibre-2%
S	Soil only
C5PS4	Cement-5%,Plastic-1%,Straw fribre-4%

2.3 Compression Test

Compressive strength of each mud blocks were tested in the compression testing machine, initially the self-weight of the compression testing machine was balanced. The maximum compressive strength value obtained was 2.56 N/mm^2 for the mud block with 5%cement and 3% straw fibre. As per IS 1725,the compressive strength range is between 2-3 N/mm^2.

2.4 Water Absorption Test

Initially the weight of each of the mud block specimen was taken (W1), then mud block specimen were soaked in water. After 24 hours of water absorption, specimens were taken out, wiped and weighed (W2).The % water absorption can be calculated as :-

Percentage water absorbed = $((W2 - W1) / W1) \times 100$

3. RESULTS AND DISCUSSION

In order to test the effectiveness of different stabilizers, the compressive strength test and water absorption tests of the mud block was conducted. The results of these tests are summarized in table 2 and table 3. Analyses based on these data are presented in following sections.

3.1. Compressive strength of Mud Block

Results of compression test are shown in Table 2.For mud blocks with cement as stabilizing agent showed more compressive strength. The maximum compressive strength value was obtained as 2.38N/mm2 for mud block with 5% cement and 3% straw fibre.

For mud blocks which are reinforced with straw fibre showed more compressive strength than the plastic fibre for the same proportion of stabilizer. Mud block with 5% cement & 3% straw fibre showed more compressive strength than the mud block reinforced with plastic fibre (3%). The size of fibre used in the experiment for straw fibre and plastic fibre were 2.5 cm.

TABLE 2- RESULTS OF COMPRESSION TEST

ITEM	WEIGHT (KG)	f_{ck}(N/mm^2)
S	3.6	1.06
C5	3.63	1.33
C5P	3.65	1.9
C5S	3.86	2.38

3.2. Water Absorption of Mud Block

As per IS specification the maximum allowable percentage of water absorption is 15 percentage. Some of the bricks failed in the test, since the water absorption rate of the bricks were higher than the allowable value. Results of water absorption test are given in Table 3. The mud block with 5% cement and 3% plastic fibre showed maximum reduced water absorption rate of 12.50% .

TABLE 2- RESULTS OF WATER ABSORPTION

ITEM	% WATER ABSORPTION
S	23.61
C5	19.83
C5P	12.50
C5S	19.56

4. CONCLUSION

It is evident from the studies that partial replacement of sand with cement, plastic and straw fibres is viable. as a maximum strength of 2.56 N/mm^2 is obtained which clearly lies in the limit (2-

$3N/mm^2$) as per IS 1725.Increase in cement content could be a more effective method of increasing compressive strength values than increase in fibres. The results of the study thusindicate scope foreco-friendly low cost construction.

5. REFERENCES

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