Strength Analysis of Stabilized Mud Blocks

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***Abstract*:- Stabilized mud blocks (SMBS) are manufactured by compacting a wetted mixture of soil, sand and stabilizer in a machine into a high-density block. Such blocks are used for the construction of load bearing masonry. This paper focuses on strength properties of stabilized mud block masonry, the effect of the strength of three cement mortar mixes. A systematic experimental investigation was undertaken to know the parameters affecting the strength of masonry in cement mortar of different proportions. It is observed that the strength of mud block increases with the increase in the cement content.**

I. INTRODUCTION

Earth has always been the most widely used material for building and it is a part of its culture. Approximately 55% of all India homes still use raw earth for walls. Earth is now thought of as a poor man's material because of disadvantages such as high maintenance and low durability. Its major limitation is:

1. Water penetration
2. Erosion of walls at level by splashing of water from ground surfaces
3. Attack by termites and pests
4. High maintenance requirements

The compressed earth block over comes these limitations by an increase in block density through compaction using a mechanic process. The water content in soil is low for compaction as compared to the puddle clay required for mud bricks and ensures much greater dimensional stability. A block:

1. Has high density which varies between 1.8 and 2.1 gm/c.c., this gives more load bearing capacity and improved water resistance.
2. Is low cost
3. Is easy to manufacture locally by small group of people
4. Is low in energy consumption because no fuel is burnt for block making or transportation
5. Can use soil available at site
6. Has smooth surfaces

With these advantages a compressed earth block can be used for construction of houses. Greater design care and stabilization enable the construction of more ambitious structures that need less maintenance and are long lasting.

THE STABILIZED MUD BLOCK

Stabilized mud block may now be defined as mud which does not soften due to action of water by the use of a small quantity of a binding agents like cement, lime, cement and lime, organic binders are some of the typical stabilizers which can be used to produce a stabilized mud block. The performance of a soil based on building block depends to a considerable extent on its density. Low density block are rather porous and will not have good strength therefore it is necessary to density the soil. For this purpose soil should be subjected to adequate pressure at suitable moisture content this process is known as compaction. It is desirable to produce a stabilized mud with dry density 1.8 to 1.85 gm/cc. Thus, the process of block making has two steps. Firstly right type of soil has to be mixed with a specified amount of stabilizer and secondly it has to be compacted in to a high density block at suitable moisture. These blocks are 2.5 to 2.8 times bigger in volume when compared with locally available conventional burnt clay bricks.

OBJECTIVES

1. To upgrade the rural traditional Kutch houses.
2. To introduce cost effective and durability houses – an alternative of burnt bricks.
3. To demonstrate and popularize the technology of stabilized mud blocks using locally available soil/mud.
4. To uplift the poor people with standard houses of this technology.

II. LITERATURE REVIEW

Dr. S.Vimala1, Dr. K. Kumarasamy2 " **Studies On The Strength Of Stabilized Mud Block masonry Using Different Mortar Proportions"** International Journal of Emerging Technology and Advanced Engineering Volume 4, Issue 4, April 2014.

Studied the effect strength of stabilized mud block masonry, both dry and wet, the effect of the strength of five cement mortar mixes and two soil-cement mortars mixes using stack-bonded prisms. An experimental investigation was undertaken to know the parameters affecting the strength

of masonry in cement mortar of different proportions and soil-cement mortar.

Major findings are:

(a) The wet compressive strength of stabilized mud blocks and masonry prisms are less than the dry strength

(b) The wet and dry strengths of these prisms decrease with decreasing mortar strength.

Vinu prakash, Amal raj **"Studies on stabilized mud block as a Construction material"** International Journal of Innovative Research in Advanced Engineering (IJIRAE) Issue 01, Volume 3 (January 2016).

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 Neriamangalam) and stabilizers (cement, lime, straw fibre, coir fibre, plastic fibre), eleven 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. The investigation has revealed that, out of all block samples, blocks which are produced from10% cement (C10), 10% cement with 3% coir fibre (C10C) and 10% cement with 3% plastic fibre (C10P) have compressive strength and total water absorption values above the recommended minimum values for structural work.(IS 1725:1992)

III MATERIALS AND METHODS

The primary raw material for production of SCEB is raw earth or soil. OPC cement in small quantity and water coarse sand or stone dust may be added depending on soil quality. The grain size distribution of a soil determines its suitability for manufacture of SCEB.

Stabilized mud blocks can be prepared by compacting a moist mixture of soil, quarry dust and cement in a machine. A number of studies are available on the properties and use of soil cement blocks for building construction. Locally available soil was used. The block making process consists of mixing the cement and screened soil (<6mm) by hand and then mixing with water to get a near optimum moisture content.

TECHNICAL DETAILS OF MACHINE

Name: Technology and action for rural development TARA – Balram machine

1. Size of block:9*7.5*4.75inch
2. Weight of machine: 140Kgs
3. Type: Portable
4. Energy source: Power
5. Compaction: Compaction by pressure
6. Stabilization: 5-10% cement
7. Can make 500 to 600 blocks per day and can also produce block thinner than 10 cms.

Tests conducted on

1. Soil, Cement, And Stone dust

1. Index properties of Soil
   a. Specific gravity
   b. Liquid limit
   c. Plastic limit
   d. Grain size analysis
   e. Compaction
2. Physical properties of cement
   a. Compression strength
   b. Specific gravity
   c. Standard consistency
   d. Setting time
3. Physical properties of stone dust
   a. Compression strength
   b. Specific gravity
   c. Surface texture
   d. Particle shape

2. Stabilized mud blocks

Compression Strength

IV RESULTS AND DISCUSSION

Table 4.1Index properties of Soil

Sl No.	Test	values
1	Specific gravity	2.6
2	Liquid limit	58
3	Plastic limit	27
4	Grain size analysis	
	Sand (%)	5
	Silt (%)	36
	Clay (%)	59
5	Compaction	
	Optimum Moisture content (%)	22
	Maximum Dry Density (gm/cc)	1.6

Table 4.1 shows the results of index properties of soil

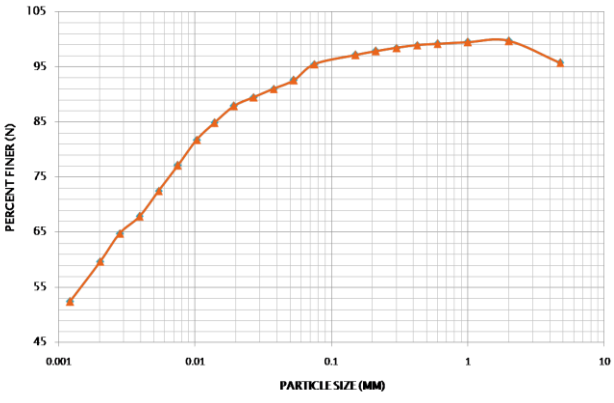

Fig. 4.1 Grain size distribution curve for Soil

Table 4.2 Physical properties of cement

Sl No.	Test	value
1	Compression strength (N/mm^2)	33.8
2	Specific gravity	3.10
3	Standard consistency (%)	32
4	Initial Setting time (Min.)	55
5	Final Setting time (Min.)	270

Table 4.2 shows the results of physical properties of cement.

Table 4.3 Physical properties of stone dust

Sl No.	Test	value
1	Compression strength (N/mm^2)	23.12
2	Specific gravity	2.5
3	Surface texture	Rough
4	Particle shape	Fine powder

Table 4.3 shows the results of physical properties of stone dust.

Table 4.4, 4.5, 4.6, 4.7, Shows the Compression strength values of mud blocks at 7, 14, 21, and 28 days respectively.

Table 4.4, 7 Days Compression Strength results on blocks

Sl No	Cement percentage	Compression Strength (N/mm^2)			
		Trail 1	Trail 2	Trail 3	Average
1	5	1.40	1.43	1.45	1.43
2	6	1.50	1.50	1.52	1.51
3	7	1.67	1.67	1.62	1.65

Table 4.5, 14 Days Compression Strength results on blocks

Sl No	Cement percentage	Compression Strength (N/mm^2)			
		Trail 1	Trail 2	Trail 3	Average
1	5	2.15	2.10	2.12	2.12
2	6	2.36	2.40	2.38	2.38
3	7	2.72	2.68	2.70	2.70

Table 4.6, 21 Days Compression Strength results on blocks

Sl No	Cement percentage	Compression Strength (N/mm^2)			
		Trail 1	Trail 2	Trail 3	Average
1	5	3.28	3.27	3.28	3.28
2	6	3.35	3.39	3.36	3.36
3	7	3.44	3.49	3.43	3.45

Table 4.7, 28 Days Compression Strength results on blocks

Sl No	Cement percentage	Compression Strength (N/mm^2)			
		Trail 1	Trail 2	Trail 3	Average
1	5	3.63	3.66	3.65	3.65
2	6	3.79	3.79	3.80	3.79
3	7	3.99	4.00	4.02	4.00

Table 4.8 Compression Strength Results at different age

Sl No	Cement percentage	Compression Strength (N/mm^2)			
		7 days	14 days	21 days	28 days
1	5	1.43	2.12	3.28	3.65
2	6	1.51	2.38	3.36	3.79
3	7	1.65	2.70	3.45	4.00

Table 4.8 represents the values of compression strength at different age of block with different percentages of cement.

Figure 4.3 represents the values of compression strength at different age of block with different percentages of cement. It is observed that the values of compression strength of Mud Block increases with the increase in cement content for all the ages.

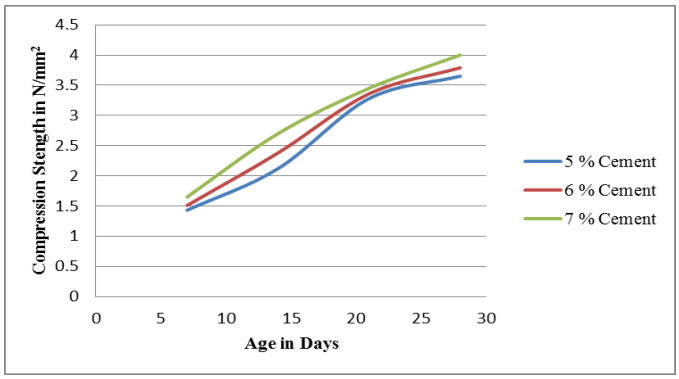

Fig. 4.3 The Graph of Compression Strength vs Age of Mud Block

CONCLUSIONS

1. Stabilization of mud concrete block using Portland cement fulfils a number of objectives that are necessary to achieve a lasting structure from locally available soil.
2. The 28days compressive strength of stabilized mud block with 7% cement is 4.01Mpa.It can be observed that the increase in cement percentage, the compressive strength is also increased.
3. The investigation of this thesis has revealed that many different factors are responsible for ensuring a good bond between the cement and the particles mixed within it. These requirements not only affect the components of the mixture used, how it is prepared, delivered into its final state, but also

subsequent curing times and environmental conditions of the finished product.

4. The amount of water for soil cement mixture needs to be carefully controlled. There needs to be sufficient moisture for the cement to fully hydrate but no excess of water which would reduce the final density, increase porosity and reduce final strength. The moisture absorption capacity of the block could be significantly correlated to its durability.
5. The cost and technical performance has revealed that stabilized mud block is interesting by the social and economic impact it will bring to local people.

SCOPE FOR FUTURE WORK

This study may be extended by including following aspects

1. By adding more soil tests ex. Proctor Test , Vane Shear Test.
2. To take research on utilization of locally available building materials for low cost housing.
3. Dissemination of technology.

REFERENCES

[1] Dr. S.Vimala1, Dr. K. Kumarasamy2 " **Studies On The Strength Of Stabilized Mud Block masonry Using Different Mortar Proportions"** International Journal of Emerging Technology and Advanced Engineering Volume 4, Issue 4, April 2014.

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[3] Dr.L. Dinachandra Singh and Sarat Singh **"Low cost housing using stabilized mud blocks"** The T T – State S&T Programme Dept. of Science & Technology, Technology Bhavan, New Mehrauli Road New Delhi – 110016.

[4] B. V. Venkatarama Reddy **"Sustainable building technologies"** Department of Civil Engineering & Centre for Sustainable Technologies, Indian Institute of Science, Bangalore 560 012, India.

PHOTOS OF WORK

Sieving

Mixing

Preparing Mud Block

Mud Blocks

Curing of Mud Blocks