iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** IV **Month of publication:** April 2018

DOI: http://doi.org/10.22214/ijraset.2018.4170

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

Experimental Investigation on Utilize Stabilized Adobe Masonry Construction Material

Bhanulatha G N[1], Vijaya Kumar A S[2], Sreenivasullu Reddy[3], Dr. Y Ramalinga Reddy[4]
[1]*Asst Prof, School of Civil Engineering, REVA University, Yelahanka, Bangalore- 560064*
[2]*Asst Prof,Shri Pillappa college of Engineering , M S Palya Bangalore-560089*
[3, 4]*Asst Prof Director, School of Civil Engineering REVA University, Yelahanka, Bangalore- 560064*

Abstract: ***The construction practices of today demands for production of alternative building materials which consume less energy and can be used for construction. One such material is stabilized adobe blocks. In the present work, the adobes are prepared using the locally available soil in the nearby region in Bangalore. Since blocks purely made of soil are prone to shrinkage it is required to stabilize these blocks. Hence an attempt is made to stabilize these blocks using cement in varying proportions. The variation in properties like Dimension, Initial rate of absorption, Water absorption & Compressive strength are studied and compared. The main objective of this project is to analyze the various engineering properties of adobe bricks using cement as a stabilizer so as to establish the potential of these blocks as an alternative to traditional bricks. The present work aims at cement as stabilizer to adobe block mixes commonly used in Bangalore region. The results obtained ascertain that these can be used as a masonry unit in construction industries replacing other traditional materials which contain a lot of embodied energy.***

Keywords: Stabilized adobe; soils; compressive strength; water absorption.

I. INTRODUCTION

Mud masonry is one of the most popular materials for housing construction due to its useful properties such as durability, relatively low cost, good sound and heat insulation, acceptable fire resistance, adequate resistance to weathering and attractive appearance. Soil as a building material is available everywhere and it is the oldest material used by man. The common methods used for earth construction are cob, wattle and daub, rammed earth, and adobe. Approximately 55% of all Indian homes still use raw earth for walls. Adobe is one of the oldest building material and one of man's most important inventions. Adobe is one of the building materials which is strong when it is dry but lacks structural integrity when exposed to moisture. The stabilizer such as cement is added into the adobe mixture to protect the adobe against moisture decomposition. Once the chemicals are added and the mixture is formed into a brick, a stabilized adobe is formed. Stabilized Adobe, means stabilized sundried mud blocks. Stabilized adobe making involves placing and compacting the mud into mould which, after initial drying, are removed to allow the bricks to dry slowly (not in direct sun). Mould can be made from metal that can be shaped to provide the desired size of 230*150*100mm for the blocks. These have several advantages such as:

A. As the size will be more, it reduces the total number of bricks needed. Reduction in number of bricks reduces the number of joints.
B. Adobe blocks require simple tools and less labour.
C. Adobe blocks encourage self help construction.
D. Adobe blocks saves energy because these blocks are sun dried mud blocks.
E. Adobe blocks balances and improves indoor air humidity and temperature which ensures thermal comfort.
F. Adobe blocks are very good in fire resistance.

II. STABILIZED ADOBE RESEARCH STATUS

An experimental ivestigation was done by Razia Begum. et. al[1] on adobe bricks stabilized with cement & natural rubber latex. Chemical additives such as cement and natural rubber latex are added into the adobe mixture to protect the brick against moisture decomposition. Once the chemicals are added and the mixture is formed into a brick , a stabilized adobe brick is formed. This study explores that cement and natural rubber latex in adobe brick effects optimum compressive strength and low water absorption. The results provide a guideline for producing adobe brick containing cement and natural rubber latex with improved compressive

strength and low water absorption.. Grytan Sarkar[2] conducted an experimental investigation on materials for Lime Stabilized Adobe, workability, stability and strength. In this study, basic physical properties of unsterilized adobe were clarified. In this work, effect of lime stabilization on adobe brick by addition of lime and sand is being investigated. It is expected that there is a possibility of both strength improvement and dimensional stability by adding small amount of lime. Subhas Basu et.al[3] studied on stabilized adobe made of using soil of Bangalore area. A typical red soil from Bangalore (Indian institute of science campus) has been considered here. It has 48.8% sand, 22.2% silt and 29% clay. The beneficial effect of sand addition may be seen. Such proportions of cement, soil and sand lead to an expensive stabilized adobe. Grace Ying Yu Chen[4] investigated on analysis of stabilized adobe in rural east Africa. They investigated on reducing the amount of cement to produce an economical and stabilized brick. After testing those bricks by water jet, submersion, modulus of rupture, and compression, the 5% cement+5% lime mix and the 7% lime with clay mix proved to be viable options for economical and durable bricks.

From the above literature review, a number of conclusions can be made. The literature review shows that earth technologies like adobe, rammed earth, wattle daub, have been successful. The main agents that weaken the block are: water, temperature and chemical action within the block. The literature review also shows that when soil is stabilized with cement, lime etc, it increases the strength of the blocks to some extent. Also the literature shows that quality control is an important factor which attributes to the strength of the block. Factors like soil testing, gradation, optimum amount of clay in the soil, optimum amount of water while making the blocks, compression pressure applied and curing conditions all lead to increase in the strength of the blocks.

III. OBJECTIVES & METHODOLOGY

A. The objectives of this Present study are As Follows

1) This project investigates cement as a stabilizer to adobe using brick mixes.

2) Effect of curing period on development of compressive strength, water absorption and density for the adobe blocks made with stabilizer as cement with different percentage.

3) This thesis defines sustainability as using locally available and cost effective resources; while cement is an available resource, obtaining cement may not be affordable, which is why finding a minimum quantity of cement to stabilize adobe bricks is important.

4) To introduce cost-effective and durability houses as an alternative of burnt bricks.

5) To demonstrate and popularize the technology of stabilized adobe blocks using locally available soils/mud.

The methodology involves the various tests which are conducted on both the basic materials and on the stabilized adobe blocks. Methodology of the present study is shown in the below figure.

B. Process of Making Stabilized Adobe Blocks

1) Soil digging and preparation

2) Proportioning and mixing of stabilizer, quarry dust and water

3) Filling and compacting the soil in the mould

4) Ejection, stacking and curing of blocks

[1]

[2]

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

[3]

[4]

IV. EXPERIMENTAL INVESTIGATION

It is necessary to test the ingredient materials before used to make stabilized adobe to suit the requirements of various IS codes specifications. The various materials required are soil, quarry dust, cement and water.

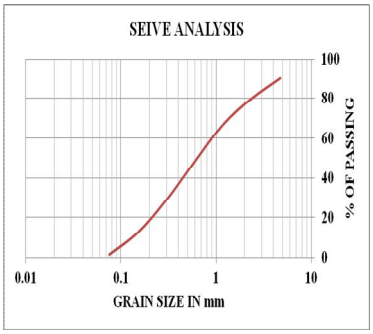
A. Tests on Soil

1) Wet sieve analysis

Wet Sieve Analysis Test Results Table

Sample taken	% of sand content	% of fines (silt & clay)
Only soil	54.5%	45.5%
Soil + quarry dust	70%	30%

2) Sieve analysis



IS sieve in mm	% finer
4.75	90.1
2.36	79.7
1.18	66.6
0.600	48.5
0.300	28.7
0.150	12.4
0.075	1.4
Pan	0

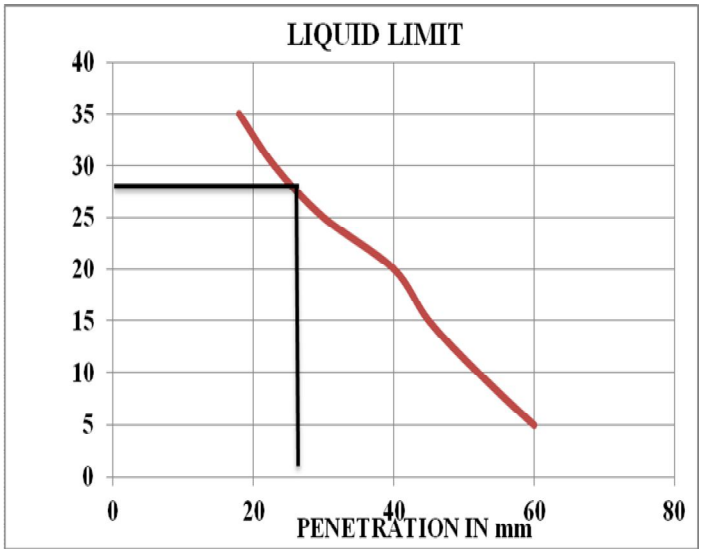
Fig. 3. Sieve Analysis

3) Specific Gravity of soil as per IS :2720-part-3

Specific Gravity of soil sample = 2.62

4) Liquid Limit of soil sample as per IS 2720-(PART-5)-1985.

Liquid limit of given soil sample is (W_L) = 28



5) Plastic limit and plasticity index asper (IS 2720-(PART5)-1985

Plastic limit of soil sample is 18%.

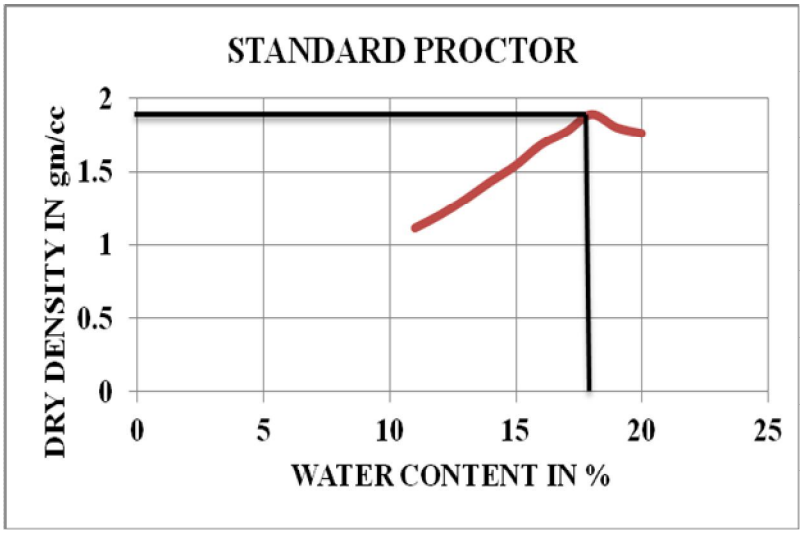
Plasticity index (Ip) = 28 – 18

Ip = 10%

6) Standard proctor compaction test as per IS 2720 (PART - 7) – 1980

Standard Proctor Compaction Test Results Table

Water content (%)	Dry density (gm/cc)
16.12	1.68
17.39	1.77
18.18	1.89
20	1.76



Result; MDD = 1.895 gm/cc

OMC = 18%

Fig 2 Plastic limit ; Liquid limit; Standard proctor

Tests on Cement

Sl. No	PROPERTY	VALUES OBTAINED	REQUIREMENT AS PER IS 8112;1989
1	Consistency (%) (as per IS:4031, part 4 1988)	32	No standard value
2	Setting time (as per IS:4031, part 5,1988) (min) a. Initial b. final	 35 567	 Not less than 30 minutes Not more than 600 minutes
3	Fines retained in IS 90 micron sieve (as per IS 4031, part 1 – 1988) (% by weight)	2.5	Not more than 10 percent
4	Specific gravity (as per IS:4031 part 11-1988)	3.15	No standard value
5	Compressive strength of cement (as per IS 4031, part 6 - 1988) (N/mm^2)	3 days- 22.53 7 days -34.20 28 days- 46.27	Minimum 43 N/mm^2 after 28 days of curing

Tests on quarry dust

Sl. No.	Characteristics	Value	Unit
1	Specific Gravity	2.5	-
2	Bulk Density • Loose QD density • Compacted QD density	 1.456 1.737	gm/cc gm/cc
3	Bulking of QD	36	%
4	Fineness modulus of QD	3.36	-

B. Tests on adobe blocks

1) Dimensionality test: The dimensionality test was conducted using IS-1077 (1992) specifications.

	Length (mm)	Width (mm)	Height (mm)
Adobe bricks used for the study	4650	2895	1920
IS – 1077 (1992) specifications	4600 ± 80	2900 ± 40	1900 ± 40

2) Initial Rate of Absorption (IRA) : rate of absorption or IRA is defined as the number of grams of water absorbed in one minute over 3mm of block bed area (ASTM C67). Acceptable values range from 10 to 30 grams.

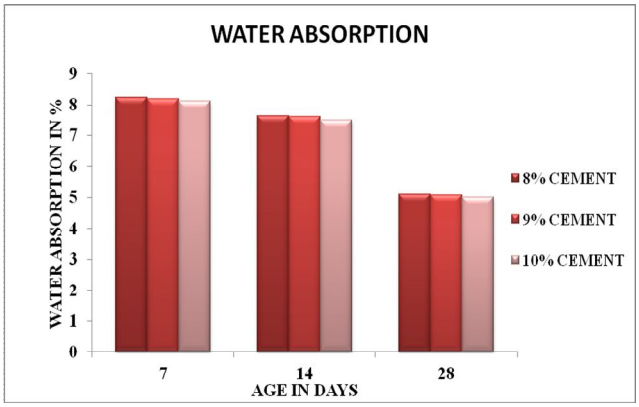
Fig 3. Water Absorption

% of cement	IRA [kg/m^2/min] sample
8%	0.929
9%	0.869
10%	0.809

C. Water Absorption Test

Water absorption test on block is done as per IS 3495 (Part 2): 1992.

Age in days	Water absorption in % for different % of cement content		
	8%	9%	10%
7	8.23	8.19	8.11
14	7.627	7.60	7.50
28	5.1	5.08	5.02

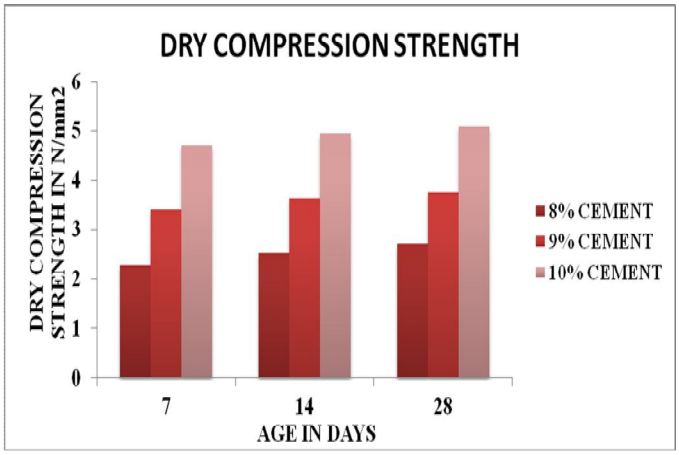


V. COMPRESSIVE STRENGTH

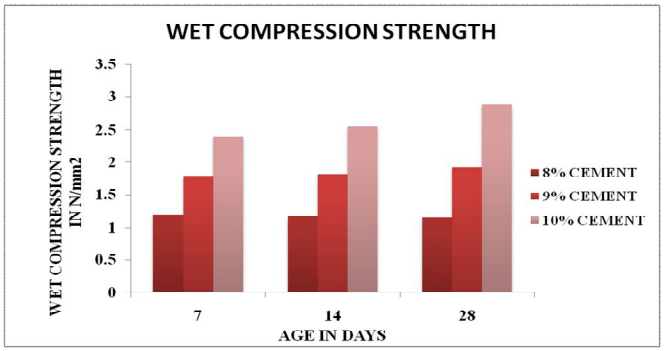
THE BLOCKS ARE TESTED IN WET & DRY CONDITION ACCORDANCE WITH THE PROCEDURE LAY DOWN IN IS 3495 (PART 1): 1992.

Fig. 4. Adobe blocks under compression

Age in days (dry)	Compressive strength (N/mm^2) for different % of cement content		
	8%	9%	10%
7	2.29	2.53	2.713
14	3.418	3.621	3.778
28	4.707	4.943	5.082



Age in days (wet)	Wet Compressive strength (N/mm^2) for different % of cement content		
	8%	9%	10%
7	1.199	1.173	1.154
14	1.784	1.821	1.919
28	2.398	2.558	2.878



VI. CONCLUSION

A. From the Experimental Analysis and Obtained Results, the Following Conclusions Are Drawn

1) The astronomical rise in building materials has leads to the search for ones that are cheap and locally available, especially in poor countries of the world. An adobe block has been used in rural areas. In order to improve the quality of the adobe, the addition of cement to the soil has been examined.

2) As expected the compressive strength increases with increasing cement content.

3) The soil sample has significant characteristics that make it suitable for cement stabilization with plasticity index of 10%.

4) The strength of sample increased with increasing stabilization level from 8% to 10%.

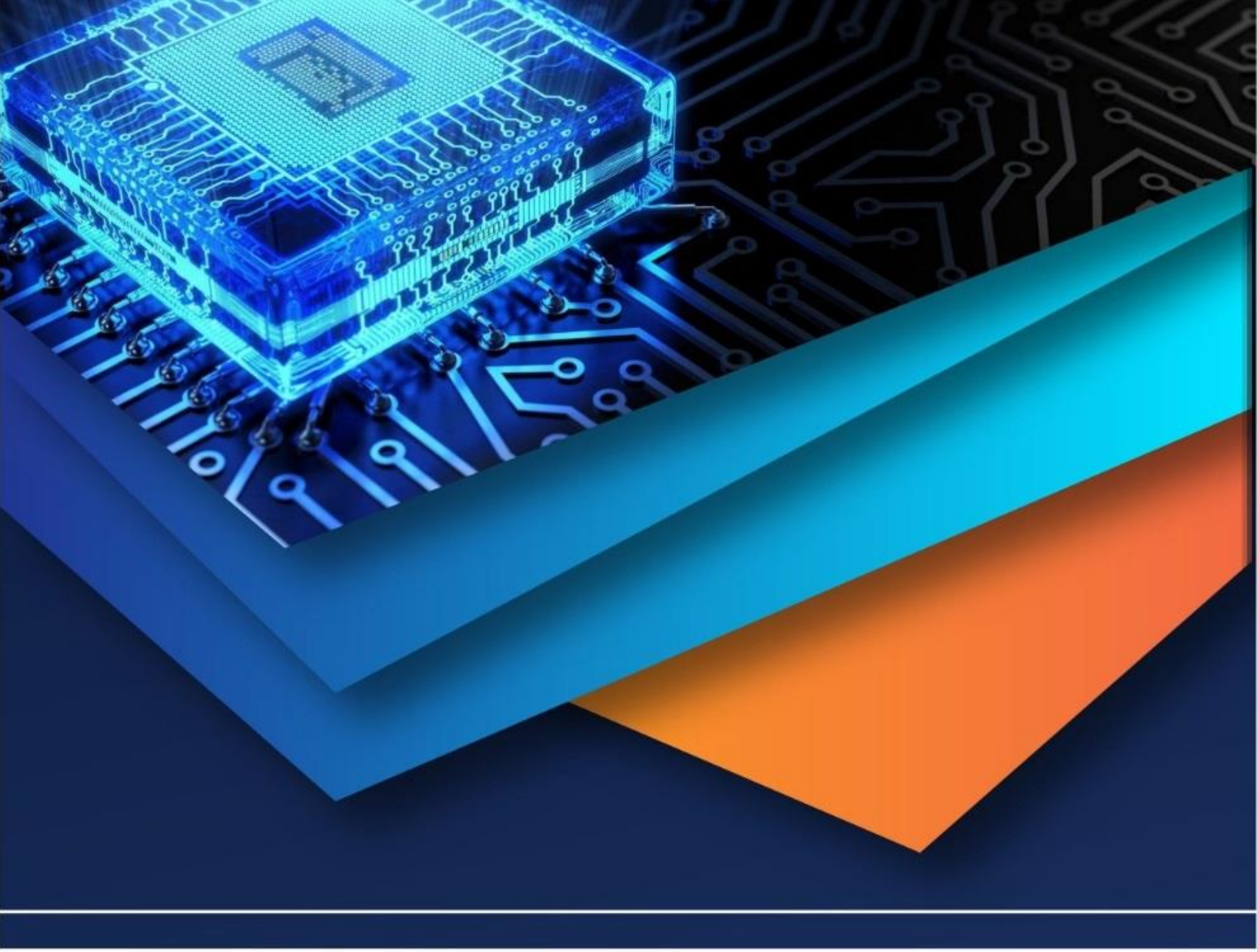
5) Incorporation of cement in adobe mixture has significant effects on the properties of adobe namely water absorption and compressive strength.

6) Strength and water absorption is an important factor that influences brick durability. A brick with low water absorption and high strength can be expected to have greater durability and resistance to the natural environment.

7) Results obtained from the dimensionality test were according to the codal provisions and the IRA varies from 0.8 to 1 Kg/m/min for the sample.

REFERENCES

[1] Razia Begum, Ahsan Habib, Hosne Ara Begum, " Adobe Bricks Stabilized With Cement and Natural Rubber Latex", International Journal of Emerging Science and Engineering (IJESE) ISSN: 2319– 6378, Volume-2, Issue-4 February 2014.
[2] Grytan Sarkar, Jisu Saha and Rokonuzzaman, "Fundamental Study on Materials for Lime Stabilized Adobe; workability, stability and strength", ISSN 0974-5904, Volume 05, No. 05 (01), October 2012, P.P. 1338-1344.
[3] Subhas Basu, K.S Gumaste and K.S Jagadish, " The stabilized adobe", lecture notes on earth construction technologies, KSCST, Bangalore, 1991.
[4] Grace Ying Yu Chen, " Analysis of stabilized adobe in rural east africa", california polytechnic state university, sanluis obispo, December 2009.
[5] Yaser Khaled Abdulrahman Al-Sakkaf, "Durability properties of stabilized earth blocks", universitisains malaysia, january 2009 .
[6] Maher O. Amin," Effect of Gypsum Stabilization on Mechanical Propertieas of Compressed earth Blocks", Tikrit Journal of Engineering Sciences/Vol.20/No.3/March 2013, (87-93)
[7] Jagadish K.S, Nanjunda Rao B.V &.Venkataram Reddy, "Alternative Building Materials & Technology",. New Age International, 2007
[8] Reddy, Gupta at al (2006) :Strength and Elastic properties of stabilized mud block masonry using cement-soil mortars.
[9] G. Sarangapani, Studies on the strength of brick masonry, Ph.D. Thesis, Dept. of civil Engineering, Indian Institute of Science, Bangalore 560 012,May 1998.
[10] G Sarangapani ., Venkatarama Reddy B. V. and Jagadish K. S., "Brick-Mortar Bond and Masonry Compressive Strength", Journal Of Materials In Civil Engineering © Asce / March/April 2005.
[11] IS : 1725 – 1997(Clause 5.3), specification for soil based blocks used in general building construction.
[12] ASTM C 1072-13 Standard Test Methods for Measuring Of Masonry Flexural Bond Strength
[13] IS 3495 - 1992 : Methods of tests of burnt clay building bricks, Bureau of Indian standards, New Delhi, India.
[14] IS 1905-1987: Code of practices for structural use of unreinforced masonry, Bureau of Indian standards, New Delhi, India.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY