Special Issue on Basis of Applied Sciences and Its Development in the Contemporary World
Published in Association with
Department of Technology and Organization of Construction, Samarkand State Architectural and Civil Engineering Institute, Uzbekistan
Department of Mechanization of livestock, Samarkand Institute of Veterinary Medicine, Uzbekistan
Novateur Publication India's International Journal of Innovations in Engineering Research and Technology [IJIERT]
ISSN: 2394-3696, Website: www.ijiert.org, 15th June, 2020

EXPERIMENTAL WORK ON STABILIZED SOIL BLOCKS

Tushar Molekar,

Professor, Department of Civil Engineering, TSSM'S BSCOER Polytechnic, Pune, India

Ajinkya Bhalerao

Student, Department of Civil Engineering, TSSM'S BSCOER Polytechnic, Pune, India

Abstract: Since ancient times bricks are prime building material with utility value for thatched houses as well as for multi-storeyed buildings. However, the demand and supply ratio for bricks cannot be maintained due to the ever increasing population and the subsequent need for housing requirements. Theere is a rise in the movement against non-eco-friendly practices today has awakened us to adapt to and incorporate practices that are pro-earth i.e. ecofriendly materials. We have realized that the smaller steps taken today, have a larger impact on our tomorrow. Ecofriendly practices in the construction industry can contribute towards a better and greener tomorrow if we adopt green technologies & green materials. Construction using CSEB's are one of the many ways we can solve this problem, to reduce negative impact on our mother earth significantly.

CSEB blocks they are composed of dry inorganic subsoil, non-expansive clay, and Portland cement. CSEB's are an environmentally friendly alternative to clay bricks that most of the residential construction in India today uses.

Keywords: CESB Blocks, Environmentally friendly, Green practices.

I. INTRODUCTION

Now a day's use of bricks in the construction industry has been reduced because it uses fertile soil which puts a large amount of stress on our natural resources. To these bricks there is a new alternative in the market the known as CSEB blocks which are a more eco-friendly and financially economical alternative to conventional bricks which have various drawbacks.

The first attempts for compressed earth blocks were tried in the early days of the 19th century in Europe. The architect François Cointreau precast small blocks of rammed earth and he used hand rammer to compress the wet soil into a small wood mould held with the feet.

The first steel manual press which has been made in the world in the 1950's was the Cinvaram. It was the result of a research programme for a social housing in Colombia to improve the hand moulded & sun dried brick (adobe) i.e. soil + dry straw. This press could get regular blocks in shape and size, denser, stronger and more water resistant than the common adobe. Since then many more types of machines were designed and many laboratories got specialized and skilled to identify the soils for buildings. Many countries in Africa as well as South America, India and South Asia, Middle East have been using a lot this technique.

The soil, raw or stabilized, for a compressed earth block is slightly moistened, poured into a steel press (with or without stabiliser) and then compressed either with a manual or motorized press. CEB can be compressed in many different shapes and sizes. For example, the Auram press 3000 proposes 18 types of moulds for producing about 70 different blocks.

2. OBJECTIVES

The aim is to study the compressive strength & durability of CSEB blocks using various ratios of cement as a stabalizing material i.e. 3%, 6%. To study benefits of CSEB block over CEB block in terms of improvement in compressive strength & rigidity of block.

3. Materials

A. Cement

The cement used in all of the CSEB blocks excluding the CEB block was commercially available Ordinary Portland Cement (OPC) of 53 grade manufactured by Birla Cement confirming to IS 269.

B. Soil

Red laterite organic soil purchased from local store.It is having specific gravity of 2.47. The

soil is having liquid limit 35%, plastic limit 22.61, OMC 12%, MDD 1.475.

C. Water

The water used for experiments was potable water conforming as per IS: 1077 – 1992.

4. EXPERIMENTAL PROCEDURE

Mix design done for the CEB & CSEB blocks using reference from research journals, the CEB & CSEB were cured for 28 Days in potable water. For CEB block no cement is used & for CSEB 3%, 6% ratios cement is used. Wooden mould is used for block making.

Table 4.1 Observations and Calculations for Specific Gravity of Soil

Sr No.	**Particular**	**Observation No**		
	Sample No	**1**	**2**	**3**
1	Mass of Empty Pycnometer M1 gm	598	598	598
2	Mass of pycnometer with dry soil M2 gm	1092	1176	1094
3	Mass of pycnometer + dry soil + water M3	1801	1848	1798
4	Mass of container + water M4	1504	1504	1504
5	Specific Gravity = G = (W2-W1)÷(W4-W1)-(W3-W2)	694÷2.50	578÷2.50	496÷2.50

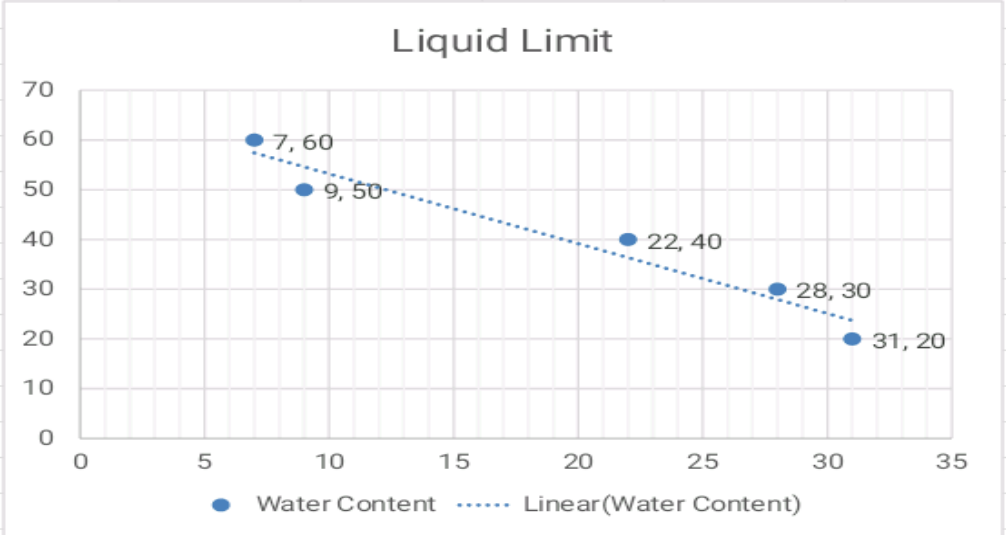
Avg specific gravity 2.47.

Table 4.2 Liquid Limit Datasheet

Sr No	**Particular**	**Observations**				
		1	2	3	4	5
1	No of blows	31	28	22	9	7
2	Container No	D5	A9	D2	A2	D1
3	Mass of empty container with lid W1 gm	16	16	16	17	17
4	Mass of empty container with wet soil W2 gm	21	21	23	26	24
5	Mass of empty container with dry soil W3 gm	19	19	21	22	21
6	Mass of water W4 = W2-W3	2	2	2	4	3
7	Mass of dry soil W5 = W3-W1	3	3	5	5	4

From the liquid limit graph WL = 35%

& Plasticity Chart WP = 22.61



IP = WL - WP = 35 - 22 = 12.39

So we can interpret this soil type as low compressible clay.

Fig. 1.1 Liquid Limit Graph

Table 4.3 Plastic Limit Datasheet

Sr No	Particular	Observation No		
		1	**2**	**3**
1	Container No	A1	A2	B6
2	Mass of empty container with lid W1 gm	14	16	17
3	Mass of container with lid & moist soil W2 gm	24	20	27
4	Mass of container with lid & dry soil W3 gm	21	20	25
5	Mass of water Ww = W2 - W3	3	0	2
6	Mass of dry soil Ws = W3 - W1	7	4	8
7	Water content in w% = ww/ws x 100	42.85	0	25

Average value of plastic limit test = 22.61

5. RESULTS

Field test on cement:

1) Colour Test of Cement

The colour of cement was found to be uniform it was grey colour with a light greenish shade.

2) Presence of Lumps

The cement was found to be free from any kind of hard lumps. These lumps are formed by the absorption of moisture from the atmosphere.

3) Cement Adulteration Test

The cement felt feel smooth when rubbed in between fingers by hand. When it is feels rough & harsh then it indicates adulteration with sand such kind of cement shall not be used.

4) Float Test

In this test small quantity of cement is thrown in a bucket of water, the particles should float for some time before it sinks. The Birla OPC 53 grade cement we bought gave us satisfactory result for this test.

Field test on CEB & CSEB Blocks:

1) Hardness Test on Blocks

The good block should resist scratches against sharp objects. For this test a sharp tool is used to make scratch on block. If there is no scratch impression on brick then it is said to be hard block. All of our blocks performed well in this test.

2) Shape and Size Test on Blocks

The blocks were tested for shape & size & they all had uniform shape and size. For this test scales were used. Shape and size of blocks is a very important consideration while selecting blocks. All blocks used for various construction related works should be of same size i.e. uniform. The shape of blocks should be rectangular in shape with sharp edges or corners. Most common block size consists of length x breadth x height as 29cm x 14cm x 10cm respectively.

3) Soundness Test of Blocks

The soundness test on blocks shows the nature of blocks against sudden impact & how well it

is able to handle it. In this test, any 2 blocks are chosen randomly and struck with one another. The sound produced should be clear bell ringing sound also blocks should not break. When blocks produce bell ringing sound & do not crack then & then only they are said to be good blocks. All of our blocks performed very well in this test.

Sr No	Specimen No	Soil Content %	Cement Content %	Compressive Strength in N/mm²
1)	1	100	0	0.72 N/mm²
2)	2	100	0	0.75 N/mm²
3)	3	100	0	0.73 N/mm²
4)	4	97	3	1.35 N/mm²
5)	5	97	3	1.33 N/mm²
6)	6	97	3	1.30 N/mm²
7)	7	94	6	2.79 N/mm²
8)	8	94	6	2.81 N/mm²
9)	9	94	6	2.86 N/mm²

Test 5.1 Results on compressive strength of CEB & CSEB blocks:

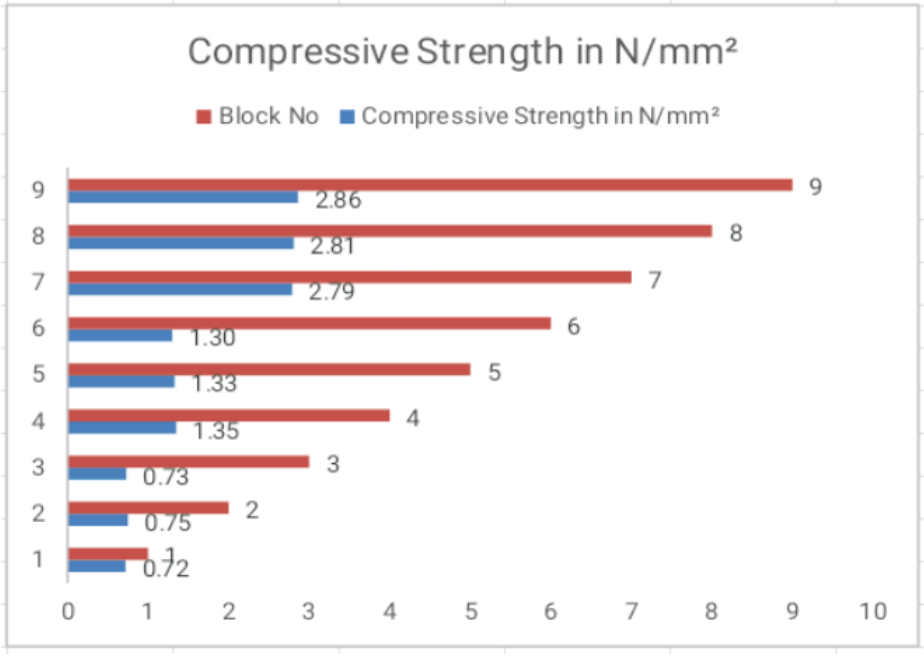


Figure 1.2 Compressive Strength in N/mm² Graph

6. RESULT & DISCUSSION

The compressive strength of 0%, 3%, 6% CEB & CSEB blocks cement & soil mix for different percentage of cement as shown in table 5.1 are the results for various percentages & they are discussed below:

1) For CEB block without any cement the compressive strength after 28 days of curing is 0.72 N/mm², 0.73 N/mm², 0.75 N/mm² the strength of blocks without cement is very less as compared to the strength of blocks with cement. Also the blocks without cement are not very tough in nature as compared to blocks containing cement.

2) For CSEB block with 3% cement compressive strength after 28 days of curing is 1.35 N/mm², 1.33 N/mm², 1.30 N/mm². The blocks containing 3% cement have more compressive strength than the soil only CEB blocks. They are also more rigid in nature as compared to CEB soil blocks.

3) For CSEB block with 6% cement compressive strength after 28 days of curing is 2.79 N/mm², 2.81 N/mm², 2.86 N/mm². The 6% cement blocks are the strongest blocks as compared to CEB soil only block & 3% cement containing CSEB block, this block is also the most rigid as compared to the other two kinds of blocks because it is having more cement content which not only increase the density of block but also its compressive strength.

4) A gradual increase by 3% from 0% showed improvement in various properties. Also from 3% cement to 6% cement increase in the 6% CSEB block showed many improvements in many properties of 6% CSEB block such as improved compressive strength, more hardness more defined edges i.e. good shape & size etc.

7. CONCLUSION

This research work has helped us to better understand the environmental concerns regarding the soil block making industry & processes & made us more environmentally conscious. It has also helped us to broaden the horizons of our knowledge on how to make CSEB blocks & how to estimate their cost, determine their strength. The results show clearly that as the

content of cement in CSEB block increases the compressive strength of the CSEB block also increases.

The main conclusion is as followed,

- For CEB block without the stabilizing cement material average compressive strength was found to be 0.73 Kn.
- For CSEB block with 3% stabilizing cement material average compressive strength was found to be 1.32 Kn.
- For CSEB block with 6% stabilizing cement material average compressive strength was found to be 2.82 Kn.

REFERENCES

[1] Shubham Raj etal.,"Coconut fibre-reinforced cement-stabilized rammed earth blocks", Department of Civil Engineering, National Institute of Technology Agartala, Agartala, India. (2017)

[2] Abid Ahmad Sofi etal., "Cement stabilized earthblocks (CSEB): An economic and eco-friendly building material.", Civil Engineering Deptt., NITSrinagar. (2016)

[3] Jijo James etal.,"Cement Stabilized Soil Blocks Admixed with Sugarcane Bagasse Ash", Civil Engineering, Tagore Engineering College, Chennai 600127, India. (2016)

[4] Kunasegaram Sajanthan etal., "Prediction of Compressive Strength of Stabilized Earth Block Masonry", Department of Civil Engineering, Faculty of Engineering, University of Jaffna, Ariviyal Nager, Killinochchi, Sri Lanka. (2019)

[5] Dhamotharan.R, "Comparative Study on Black Cotton Soil Bricks using FlyAsh and Crusher Waste", Department of Civil Engg, Oxford Engineering College, Tiruchirapalli, Tamilnadu, India. (2018)

[6] B. N. Patowaryetal., "Study of Compressed Stabilised Earth Block", Department of Civil Engineering, Assam downtown University, Guwahati, Assam, India. (2015)

[7] P. Sivakumar etal., "EXPERIMENTAL INVESTIGATION ON CEMENT STABILIZED SOIL BLOCKS", Structural Engineering Research Centre-CSIR campus, Chennai, India. (2014)

[8] I. B. Muhit, "Evaluation of Stabilized Soil Blocks with the inclusion of 'Plastic Fibre' as Sustainable Building Material: A Complete Review", Department of Civil Engineering, Chittagong University of Engineering & Technology, Chittagong-349, Bangladesh. (2013)

[9] M. S. Islam etal., "CONSTRUCTION OF EARTHEN HOUSES USING CSEB: BANGLADESH PERSPECTIVE", Department of Civil Engineering, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh. (2016)

[10] Abhijeet D. Patiletal., "Compressed Stabilized Earth Blocks by using Lime", Rajarambapu Institute of Technology, Sakharale (MH), India. (2015)