Compressed Stabilized Earth Blocks by using Lime

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Abstract:- **To keep the wattle in good condition, it have to be prevented from ravage. To improve the durability of soil should be essential by the research of research institutions in Khaertoum area; from the use of it the fastness of soil can be increased. In some of the cases the properties of CSEB is not up to the requirement. By achieving the preferable property and by mitigating production expenditure, the use of stabilized bricks can be extended to overall types of classes. It combines inherited process of sun dried brick and rammed earth. Providing the homes for lower class people is the big issue for growing regions. So incumbrance to disentangle is the adversity. Generally indigenous carnals must not be distrust for low-cost homes. Furthermore, such materials must be abundantly available and be renewable in nature. The carnals which are indigenously accessible are largely used for earthen frames.**

Keywords - Wattle, Ravage, Indigenous Carnal, Earthen Frames.

I. INTRODUCTION

Earth is an old material. From the time of evolution of man, earth is used for constructing the structures. The fresh process for earthen construction has been come into practice which is Compressed Stabilized Earth Blocks. CBRI Rurkee has done the research on CSEB in India. At most of the period, CEB are made by lime. For the cases of sleazy walls, CSEB are mostly used. It is a new development in modern times, as it combines inherited process of sun dried brick and rammed earth.

Soil stabilization can be described as improving soil properties by means of chemically or physically in order to increase engineering quality of the soil. To keep the wattle in good condition, it has to be prevented from ravage. To improve the durability of soil should be essential by the research of research institutions in Khaertoum area; from the use of it the fastness of soil can be increased. In some of the cases the properties of CSEB is not up to the requirement.

By achieving the preferable property and by mitigating production expenditure, the use of stabilized bricks can be extended to overall types of classes. It combines inherited process of sun dried brick and rammed earth. Providing the homes for lower class people is the big issue for growing regions. So incumbrance to disentangle is the adversity. Generally indigenous carnals must not be distrust for low-cost homes. Furthermore, such materials must be abundantly available and be renewable in nature. The carnals which are indigenously accessible are largely used for earthen frames.

II. LITERATURE REVIEW

A. Dr. E. A. Adam and Prof. A. R. A. Agib

Providing the homes for lower class people is the big issue for growing regions. The outlay for buying the glebe is much more than the anticipated. So residential schemes should be followed by regimes to increase accessibility of housing ownership by low class peoples.

There is a need to look for creeds for mitigate formation expenses peculiarly for lower outlaying homes as well as suggesting crushy remedies for amendment. By taking in to consideration flivver and stout carnals, such intentions can be accomplished. The unemployment can be reduced also agrestic areas should be developed also imports can be reduced to great extent.

B. Satprem Maini Architect:-

Research And Development By The Auroville Earth Institute (Avei)

To couple the inherited tradition with latest processes of stabilized earth, The Auroville Earth Institute has given the hefty assistance. For framing latest and innocuous habitat, ore as attaching carnal can be used according to the Auroville Earth Institute. Compressed Stabilized Earth Blocks (CSEB) is today the technology used the most in Auroville. The Auroville Earth Institute attempts to giving people the possibility to build them.

III. PRINCIPLES OF SOIL STABILIZATION

A. Definition and aim

The stabilization of soil implies modification of properties of soil-air-water system in order to obtain lasting properties and strength when the soil gets wet. Silt and clay, which are binders of earth, are not stable when they get saturated. Therefore the aim of soil stabilization is to stabilize silts and clays against water. So that they can maintain some mechanical properties when saturated.

The objectives of stabilization are:

- To reduce the volume of interstitial voids so as to reduce porosity and increase the density.
- To increase the bond between the grains especially when the soil is wet.
- To increase the cohesion and the mechanical characteristics.

B. Three procedures

- *Mechanical*
  - The soil is compacted and the actions and effect on the soil are:
  - Density and mechanical strength are increased.
  - Conflict against water can be maximized.
  - The permeability and porosity are decreased.
- *Physical*

  The actions and effect on the soil are:
  - To get the fine particles the soil should be accurately sieved.
  - For the best architectural view, the different types of soils may be used.
  - To make strong brick sand or gravel may be added.
  - The clay should be made accurately to bind the materials to each other.
- *Chemical*

  Processed products, which are active materials, are added to the soil. There will be either a physio-chemical reaction with the grains or the creation of a matrix which bind the coarse grains.
  - The reaction helps binding the grains of the earth.
  - Conflict against water can be maximized.
  - The permeability and porosity are decreased.

C. General:-

When soil is wizened, water will not be emitted, so loam within a soil exemplar reacts to humidify. Superficies cleave can be shown due to such motility. Crumble of superficies causes due to such locomotion. To accrue soil conflict to erosive upshot including diversification in temp., spatter water, soil stabilization is must.

To accumulate twist vigor of soil as much as greater than hundred percentages and to foster its conflict attrition, optimum stabilization technique should be selected.

By using 1 of following creed, Attrition for decent protest can be attained:

Incrementing luxuriance of soil, to tie with soil corn mixing agent should be added, which is not a permeable tool that stabilizing agent should be added.

IV. Materials required for CSEB

A. Black Cotton Soil:-

Due to the presence of titanium oxide in short assiduity, black colour appears in black cotton soil. It is easily available at rural areas. The cost effectiveness is greater as compared to red brick. But the fineness is low as compared to red. So the cost which can be avoided for plastering may not be possible in case of black cotton soil. The availability of the structure which is not minor montmorillonite in formation, the Black Cotton soil has a bluff quantum of clay. When humidity clobber of soils is accrue, expansive soils will smudge. For expansive characteristics of soil loam mineral montmorillonite is chiefly liable. When progenitor material is largely used the black cotton soils are greatly available. The expansive soils are also called as swelling soils.

B. Lime:-

Lime has a pozzolanic reaction with clay. The change in the property of being plastic should be happened so most probably the lime is used. Therefore lime is better suited for clayey soils than sandy soils. The pozzolanic reaction is first one to happen with clay in the soil. The modification of clay is due to plasticity index. Lime will have more effect on clays high plasticity. The reason behind not increase in sinuousness is the calcium ions from lime. Because of quality of latter, velocity and aspersity for change of plasticity is countered.

C. Water:-

It is a transparent fluid. It should not contain any dust particles.

V. PREPARATION OF BLOCK

A. Sieving:-

The production of brick is only possible by fine grained materials. The appropriate sieves should be used for minimizing oversized materials as a special process. For small content of soil the hand sieves may be used .The ten sieves are kept at one the other. So the particles will be grained smoothly. Due to the coarse aggregates the proper mixing can't be achieved. This results in the reduced strength of the brick.

The steel framed wire net should be greatly used for sieving which is inclined at approximately 45º to the ground. The screen is made up of chicken mesh, tiny carnal should be passes through and additional sized material runs down the front. The steel mesh may be kept horizontally from a pit. This method is only suitable for simple sites. Because effectiveness is minimum in such cases. The various types of sieves are used for sieving. They kept systematically as per the IS recommendations. The larger sieve should be kept at top while the sieve which has small holes should be kept at bottom. The bucket should be kept at the bottom of all sieves. So the residuals may be stored at it. The water must be added at each sieve constantly. So the process should be done quickly and softly.

B. Proportioning:-

For the making of best property bricks tests should be completed before dawn production. For the better mixing of the product appropriate proportions should be taken. To assure uniformity in the compressed stabilized earth blocks produced, the weight or volume of each material used in the block making process should be measured at the same physical state for subsequent batches of blocks. The important factor is to calculate length breadth and depth of soil and multiply it to calculate the volume in wizened pathogen.

The device should be selected accurately for measuring purpose. The standard cases should select for measuring purpose which is approximately equal to the standard measures. The soil should be fully pored. So the accurate measurements can be taken Because of half pouring the results may affect greatly. The iron circular mould should be used generally. The water should be kept in transparent mould. The jar should be used widely. The height should be longer as compared to its diameter. So the volume of block

should be greatly dependent on the output of the overall process.

C. Mixing:-

The mixing should be done appropriately. The use of long bar or similar dimensional material must have to be used. In some cases, hand mixing may be done, for greater accuracy, machine mixing should be adopted. The lime should be mixed by using hand gloves. The proper precautions should be taken for whole process. For small quantity, hand mixing should be economical. The lime used for our experiment is 10 %. So the calculation should be done for our raw material. The water should be minimum as compared to other mixes. The lime is quite dangerous for use. The smell is quite dangerous. The two to three persons are required for whole process. It may be quite difficult for single person. Because of groggy mixing the blocks may not be stronger as compared to the well mixed block. The binding of material between each other is an important factor in mixing. The removal of air voids should have to be done. So the brick can perform its maximum strength. The finishing should also matter at the time of examining it. The cost for plastering can minimize by keeping the leveled surface.

VI. ACTUAL PROCEDURE

Fig. 1: The Blocks made for Testing

The materials which are used for making the brick should be kept to the air so the porosity should be kept optimum. Then the soil should be kept at the air dried oven which is electrically operated for 24 hours. After taking the soil, its temperature is high as compared to normal temperature so for 1 hour kept it as it is. After 1 hour start the actual process. Then take the weight of soil and calculate its optimum moisture content. Then decide the content of lime. The gravity of water should be checked which should be approximately equal to moisture content of soil which was earlier calculated by experiment. The content of water should be selected by taking various proportions to attain max. MDD of brick. The sprinkling technique is used for adding the water. The mixing should be done by using rammer. The blows should be rammed on it. So the air voids can be removed. For our experiment take 2kg of black cotton soil and its 25% water which is its moisture content. Due to gravitational force the soil should settled down. The ninety five percent concising should have to be achieved after one day so according to it blows content should be calculated. The sackcloth vesica should be used for pouring water into it. The process should be continued for seven days. Due to sack cloth the water should be continually poured into it. So the sprinkling time should be prevented. Because of this the time required for supervision and pouring water should be avoided. At the both times the weight should be calculated. I.e. Before curing and after curing. There are three tests are carried for block first is water absorption. Second is for compressive strength and third is for block density. The samples tested should be of three numbers and it should be kept at normal condition. Regular curing should have to be done. Since, the blocks were cast, cured and tested under controlled conditions; the single block testing should give the compatible results. The testing should be permitted of only 3 specimens not for 5 in BIS code _IS: 5454 – 1974 5.

VII. TESTS PERFORMED ON BLOCKS

A. Block Density

Density is the ratio of mass to the volume of block. It should be calculated for the comparing it with other standard bricks. So the properties can be compared. The two types of mixes are used as ten percent and five percent lime content, results are 2.09gm/cc to 2.22 gm/cc respectively. At some extent, the density of brick remains fix when lime is increased. It is mostly depends on the weight or mass of block. Adding stone dust to the mix, decreases the block density.

B. Compressive strength

Fig. 2: Compression Test on Block

Universal testing machine is used for calculating compressive strength. After completing 7 days curing, the strength must have to be known for the further application of the blocks. So the accurate procedures of testing must be followed by one. The soft side of the block should be kept for the upper and lower side. So it gives accurate results. Absence of proper placing results in failure of final results. For important cases, the testing should be done under. Because of testing the percentage of lime should be calculated. Also for which percentage the block gives maximum strength. Also the cost for the particular block must be taken into consideration. So we take it as a optimum mixing materials. The strength given by machine must be equal to the 80% of the strength calculated. Lime is a binding material. So by changing its percentage the strength will also changes. For maximum lime content, the strength will also maximum. But the cost analysis is important for such cases.

The optimum lime content should be taken. The lime content which gives maximum strength with minimum cost can be taken as optimum or suitable content. For the 10% lime content it gives 5.00MPa strength after 7 days curing.

Test results are as given below:

Sample	Strength Compressive	Average
S1	4.03	5.00MPa
S2	7.04	
S3	3.93	

VIII. CASE STUDIES OF CSEB

A. *Mayotte as a best model with CSEB*

- It is a French region in Indian Ocean has seen an ideal development with CSEB since 1978-79
- At that place, more than thirty millions of blocks have been made to build many of houses and public buildings.

B. *Chitra Vishwanath Architects*

- It's aim is to design ecological spacs not just physical spaces.
- They have made structures to response to climate and by conserving natural resources expertly.

C. *Global Pagoda*

- It is the largest dome in the world located at Mumbai with a diameter of 85.15m.
- It is the meditation hall of global Vipassana Pagoda
- It is built by Engineer Mahesh Varma from Nandadeep Building Centre.

IX. ADVANTAGES

1. An easy availability:-
The material will be available at closure to site itself. So it will minimize the cost required.
2. A bio-degradable material:-
It can sustain against all of the troubles like snow fall, flood, heavy rain and all of the similar problems.
3. Deforestation should be minimized:-
The trees can be saved by using CSEB. Because raw material required to make it doesn't include the trees.
4. Resources can be managed:-
All of the materials should be utilized effectively. So the waste management problem will not occur.
5. The power can be saved:-
The power consumption should made from five to fifteen times less than flamed blocks. The part which is emitted will be less than flamed blocks.
6. A part of low cost housing:-
The un skilled labour can made the blocks and it may available in critical areas also, the minimum cost will require for its production.
7. Conversion can be made:-
The carnals should be improved to various needs: technical, social, cultural habits.
8. A Minimization of Unemployment:-
It invites the job opportunity to labours which are not skilled.

X. LIMITATIONS OF CSEB

[1] Technical accomplishment is low as compared to the concrete.
[2] The labours are not trained so they produce low quality products.
[3] Because of nescience over-stabilization may happen, implying cruel Under-stabilization.
[4] Non usable production techniques.
[5] 5. The people will not accept due to adverse results (By unskilled people, or bad soil & equipment).
[6] The soil should be properly identified; in some of the cases the soil may be unavailable.
[7] Resources should be managed consciously.
[8] The staples should not be used.

XI. CONCLUSIONS

The following conclusions can be drawn from the results:
Due to maximum lime content Maximum dry density will also increases. The block density increases with increase in lime content, and it varies with aeon. As expected, by increasing lime content, compressive strength also increases; after completing the curing of 7 days, it gives 80 % strength. The compressive strength increase by blending stone dust in to soil also applicable demeanour was also improved; though it decreased the block density. By using local resources, experimental investigation and feasibility study on CSEB should be done. For 10 % lime content, 0.5 percent and 1.0 percent increased the compressive strength by 60.54 percent, 95.92 percent and 115.30 percent respectively. As discussed earlier the optimum lime content is that which gives maximum strength at low cost which is taken as 10%.It doesn't satisfy the BIS recommendations. But then also it is the most economical option.

REFERENCES

1) Dr. E. A. Adam, "Compressed Stabilized Earth Block Manufacture In Sudan",
2) Auroville Building Centre, Auroshilpam, Auroville, Tamil Nadu, India.Manual Of "Compressed Earth Blocks (CEB)".
3) Satprem Maïni, Architect (2008), Auroville Earth Institute (Avei), "Compressed Stabilized Earth Blocks And Stabilized Earth Techniques".
4) Ankit Sing Negi (2013), "Soil Stabilization Using Lime".Published in International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 2, ISSN: 2319-8753.
5) Dr. R. Kumutha, Professor & Dean, Sona College Of Technology, Salem,Tn, India., "Feasibility Study On Utilization Of Stabilized Earth Blocks".
6) Joseph O. Arumala and Tariq Gondal(2007), "Compressed Earth Building Blocks For Affordable Housing" Proceedings published by RICS Georgia Tech and the contributors (ISBN 978-1-84219-357-0).
7) J.B.Oza, "Study of black cotton soil characteristics with cement waste dust and lime" published in volumw no.51 (2013) 110–118.
8) Iyambo Ipinge(July 2012), "Durability Of Compressed Stabilised Earth Block" published in M.Sc. Desertation In Faculty Of Engineering And The Built Environment, School Of Civil And Environmental Engineering, University Of The Witwatersrand.
9) H.N.Ramesh, A.J.Krishnaiah and S.Shilpa shet (April. 2013),"Effect of Lime on the Index Properties of Black Cotton Soil and Mine tailings mixtures" published in IOSR Journal of Engineering (IOSRJEN) e-ISSN: 2250-3021, p-ISSN: 2278-8719 Vol. 3, Issue 4.

10) Int. J. Engg. Res. & Sci. & Tech. 2014 Dilip Shrivastava et al., 2014, Dilip Shrivastava, A K Singhai and R K Yadav (May, 2014)," Effect Of Lime And Rice Husk Ash On Engineering Properties Of Black Cotton Soil", published in International Journal of Enginering Research and Science & Technology. ISSN 2319-5991 Vol. 3, No. 2.
11) Pankaj R. Modak, Prakash B. Nangare (May 2012), "Stabilisation Of Black Cotton Soil Using Admixtures". Published in International Journal Of Engineering And Innovative Technology ISSN: 2277-3754 Volume 1, Issue 5.
12) "Lime-Treated Soil Construction Manual Lime Stabilization & Lime Modification" published by National Lime Association(Jan. 2004).