

Comparison of Black Cotton Soil Brick with Normal Clay Brick

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Abstract :- This investigated is conducted to review the impact of adding varied form of admixture in black cotton soil with the increasing of population and therefore the reduction of building and alternative technology structures got to be dispensed on weak or soft soil. As a result of such soil of poor shear strength and high swelling & shrinkage. Black cotton soil is one among the most important soil deposits of Asian nation. They exhibit high swelling and shrinkage. Once exposed to changes in wetness content and thus are found to be most hard from engineering concerns. Over a past few decades, there area unit wide ranges of alternatives obtainable within the field of construction with the dynamic within the staple for the particulars. As concern with the brick there area unit some invention like ash brick, concrete blocks and brick. Here we have a tendency to area unit mistreatment black cotton soil as a staple for the bricks and conjointly mistreatment black cotton soil as a staple for the bricks and conjointly mistreatment some admixture to change the properties of the black cotton soil. This analysis study describes the practicability of mistreatment black cotton soil as a staple with some extra stabilizer within the brick production as partial replacement of clay in Indian context.

Keywords-Black cotton soil, Clay brick, Normal clay, Black cotton soil brick, Compressive strength, Water absorption.

I. INTRODUCTION

A brick is most artefact want to build walls pavements and parts in masonry construction. Usually brick area unit stacked along or set as brick work exploitation numerous quite mortar to carry the along and build a permanent structure. Within the world Asia produces eighty seven of the overall production of the brick. Moreover the Bharat and china area unit are the main client countries of the brick. Brick are the unit generally made in common or normal size in bulk quantities they need been considered one in all the longest enduring and strongest artefact employed in twentieth century. Manufacturing of bricks produces harmful gases which end in substantial pollution. Bharat produces over sixty billion clay bricks annually leading to sturdy impact on erosion and unproducessd emission. Ancient technologies used in firing the brick result in important native pollution. The quality size of brick provided by IS:2212 (1991) in (19cm×9cm×9cm).Bricks area unit arranged in horizontal courses, generally dry and wet mortar. In some instances equivalent to adobe the brick is simply dried. Additional typically it's discharge in a very oven of same type to form a real ceramic. Clay bricks area unit employed in a good vary of buildings from housing to factories and in a very construction of a tunnels. Waterways, bridges, etc.Their properties vary per purpose that they are supposed, however clays have provided the essential material of construction for hundreds of years. The most common used ingredients of brick area unit are clay, lime, magnesia, silica, alumina and iron oxide. So the brick is made on a bigger scale out there. The brick production graph endless

result of mercantilism the on top of ingredients from outside which can leading to higher cost. So as to satisfy the ever increasing demand for the energy economical building construction material there's a desire to adopt price effective, environmentally acceptable technologies and upgrade ancient techniques without their native materials. This trend attracts scientist to seek out probable resolution of this downside with victimization completely different materials like ash, black cotton soil, concrete blocks agro, waste, etc.Very few researches area unit on brick created up from black cotton soil is found in major portion of geographic region West M.P, Gujarat, U.P etc. The black cotton soil posses a meter modification with the dynamical within the wetness content, however it provides strength with additives. No construction is feasible while not brick. Since several centuries brick creating has been practiced by men, presently, bricks area unit simply created by victimization machines new technologies. Usually 2 short of bricks area unit factory made by victimization machines for creating interlocking brick area unit ash, sand, lime, iron oxide. Sludge quarry, waste etc. It is largely found in areas equivalent to Gujarat, M.P, and Maharashtra. It is additionally found in state like province. Black soil is very fine and clay. Has the capability to loads of wetness. It becomes sticky within the season and develops cracks and dry. It is dirt containing a high quantity of montmorillonite .It is dark in color and sensible for growing cotton. It possesses high swelling and shrinkage of properties and low shear strength.

II. LITRATURE REVIEW

Shakir Alaa A., Naganathan S. and Mustapha K. N. (2013) found from their analysis work that, the assorted wastes that are presently recycled in bricks producing are reviewed. The results of hose wastes on the bricks properties are reviewed. Enhance performance in terms of constructing additional environmental and a cost-effective bricks neither consumes energy resources nor emits waste production gases offers a cost effective choice to style the inexperienced building. Sure bricks are made while not firing that is in term of low embodied energy material. The study successively is helpful for varied resources persons concerned in mistreatment industrial or agriculture waste to develop property construction material.

Muthyalu P. V. and Ramu K. (2012) analysis that, the Expansive soils, similar to black cotton soils square measure primarily liable to damaging volumetrical changes, with changes in wetness. This behaviour of soil is attributed to the presence of mineral montmorillonite, that presence of mineral montmorillonite that has an increasing lattice. Understanding the behaviour of expansive soil and adopting the suitable management measures are nice task for the geotechnical engineers. In depth

of analysis goes on to search out the solutions to black cotton soil. There appropriate control measures have been great task for the geotechnical engineers. Extensive research is going on to find the solutions to black cotton soils. There are several strategies out the solution to black cotton soil. Treating the expansive soil with electrolytes is one in every of the techniques to enhance the behaviour of the expansive ground.

Dr. Smt B. K. Shah, Patel A., Salla S., and Prof. Pitroda J. analysis that, because the share of the jute fibre in brick increase, the compressive strength of the brick increase. During this experimental work 0.5% fibre addition within the brick offers the utmost strength 8,051 N/mm² once 21 days. Because the compressive strength of the brick increases, the water absorption of the brick decreases. In this experimental work maximum compressive strength after 21 days is 8,061 N/mm², wherever minimum water absorption is 10.236% once 21 days in jute fibre ash brick. He conjointly suggests that use of ash and natural fibre facilitate in fibre to bar of environmental degradation and use of agriculture land used clay brick production.

Subir Shri Singh (2012) found that, the utilization of environment- friendly technologies. Minimize transportation of fabric. Maximize the utilization of native material and resources. Utilization of commercial and mine waste for production of building material.

III. RAW MATERIAL USED

A. Normal clay-Clay is an earthy natural material that is plastic when moist but hard when fired, that is composed mainly of fine of hydrous aluminum silicates and other minerals, and that is used for brick, tiles, and pottery, etc. Soil composed chiefly of this material having particles less than a specified size.



Fig1-natural clay

B. Black cotton soil-“Black cotton soil is one of the major soil deposits of India. They exhibit height rate of swelling and shrinkage when exposed to changes in moisture content and hence have been found to be most troublesome from engineering consideration. It’s just a general name for a dark soil good for growing cotton.



Fig2-Black cotton soil

C.Lime- Lime is a calcium-containing inorganic mineral in which oxides, and hydroxide. It is also the name of the natural mineral. It should be present in a finely powdered state and not in lump.Lime prevents shrinkage of raw brick.Sand alone is infusible.But it slightly fuses at kiln temperture in presence of lime.Excess of lime causes the

brick to melt and hence, its shape is lost. Lumps of lime after burning and this quicklime after burning and this quicklime slakes and expands in presence of moisture. Lime is a purely natural material formulated from the oceanic environment to form a sustainable lime paint or plaster. Its natural stickiness gently binds which provide good adhesion for other surfaces and applications.



Fig3-Lime

D. Cement- Cement is an extremely ground having adhesive and cohesive properties which provide a binding medium for the discrete ingredients. In this process used to the 53 Grade OPC, it is higher strength cement to meet the need of the consumer. As per BIS requirement the minimum 28 days compressive strength of 53 Grade OPC should not be less than 53 MPa.



Fig4-OPC cement

E. Potable water used (PH \leq 6)-

IV. METHODOLOGY

A. Manufacturing of bricks

- Preparation of bricks material soil
- Moulding of bricks
- Drying of brick

Burning of bricks- size of a mould for brick making was selected such that considered shrinkage effect of soil take in mind. Bricks will shrink when drying, so the mould size chose larger than the intended finished brick. The slop moulding technique was adopted.

Moulding

There are two type of molding

- 1) Hand molding
- 2) Machine molding

Drying of bricks-

The prepared bricks from the moulding contain 7 to 30 percentage moisture content so the process of drying of bricks is required. Most of drying of bricks is done by heat of sun at atmospheric temperature. The drying of bricks is contently supervised by labor or supervisor.

Burning of brick- It is very important step in manufacturing of bricks; it removes water from the earth completely and provides hardness and strength to bricks. The bricks are burnt by two methods:

- 1) Clamp burning
- 2) Kiln burning

B. Preparation brick soil material

❖ **Clay preparation:** For the preparation of ordinary black cotton soil was taken from local area of the black cotton soil region. The debris and unnecessary particles removed from the soil. Tempering is adding water to the soil in order to make it more workable which takes 5 to 7 days in the case of black cotton soil.

❖ **Mixing:** Mixing is done to make the clay soil homogeneous and smooth. There are different techniques that can be used for mixing, including using animal power or letting humans mix the clay with their feet. Different admixtures such as coal or sawdust were added to the clay for two beneficial reasons:

- 1) Reduce cracking during drying.
- 2) Reduce fuel usage during firing.

Moulding

The mould of size for brick making was selected such that considered shrinkage. In slop moulding, a wet clay mixture is used- the mix is put into a rectangular form without a top or bottom. The mould was selected in size of 190mm x 90mm x 90mm height with a frog 10 to 20 mm deep on one of its flat side. The limitation with this technique is that because the mix is so wet, the brick may deform under its own weight and the surface can be marked easily. Often this method produces poor quality

bricks because of the excess water used both in the mixing of the clay and the wetting of the mould. The clay mixture becomes so wet and soft that the newly made brick begins to deform under its own weight. Once placed on the ground, it cannot be moved because it is so soft. Often the brick is marked or deformed if accidentally touched or moved before the brick dries properly. The excess water can also cause the brick to crack and break during drying. Slop moulded bricks can be imprinted with the brick makers name, called a "frog," on the flat side of the brick. This helps the brick dry and fire better, and is a good form of advertising.

4. Drying

Water was added during clay preparation to increase workability of the mixture, but in drying it is removed for several reasons. First, there will be less cracking in fired bricks with less water content. Second, additional fuel is needed, beyond what is used for firing, to dry the bricks in the kiln. Proper drying of bricks will involve rotating the bricks for different exposures to ensure even drying rates. For best results, drying should be done slowly. This will help with more even drying. Also, the best drying technique may change from location to location, so the brick makers must gain experience to determine the best way to dry bricks for each production process. We dry the bricks under the normal atmospheric temperature (25°C).

5. Firing

A clamp is a field kiln built from the green bricks that will be fired. Clamps vary with size and shape and must be oriented with respect to wind direction. Once a clamp is laid out and constructed, it must be insulated. Finally, the process of firing the clamp will take place in several steps. First, pre-heating, or water-smoking, will remove the water leftover from the drying process. This process is still physical. The second stage is firing, where the clay bricks will vitrify through a chemical process. The temperature must remain constant at this stage for complete verifications. Finally, for the cooling stage, the temperature must be slow and steady. A clamp may take two weeks to cool.

6. Curing

The stabilized bricks after moulding are further hardened by curing. The chemical changes occur in the bricks mix contents after moulding and heat of hydration are evolved. The rate of the effect of heat of hydration is mitigated and lowered with sufficient water and alkali solution is provided to accelerate pozzolanic reaction. There are different processes of curing option.

1. Steam curing under high pressure
2. Steam curing under normal pressure

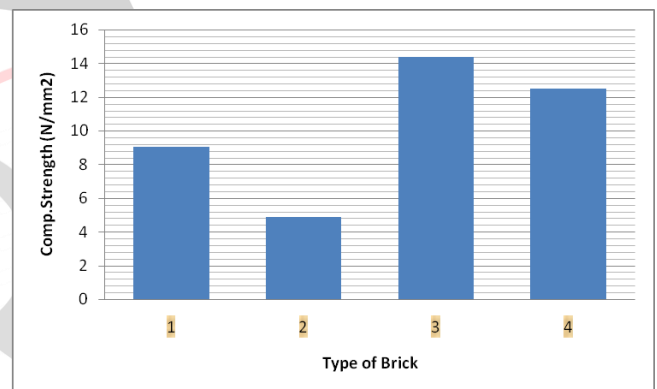
3. Hot water dip curing
4. Hot water air curing
5. Water tank curing
6. Water curing in the open air

V. RESULT AND ANALYSIS

Tests performed:

- Compressive strength test as per IS: 3495(Part1)1992

Sn no.	Material Used	Comp. Strength (N/mm ²)
1	Normal Soil	9.06
2	Black Cotton Soil	4.87
3	black Cotton Soil+cement	14.4
4	Black cotton soil+Lime	12.48



VI. CONCLUSION

The brick are normally produced by normal soil or red soil. But the researches on production of brick by black cotton soil, very rarely the brick which produced by black cotton soil. It is highly efficient when compared to red soil bricks. From the result of compressive strength of black cotton soil is 4.87 N/mm², black cotton+cement is 14.4N/mm², black cotton soil+Lime 12.48N/mm². By use of black cotton soil instead of clay in brick. Black cotton soil brick should be proved, one of the economical solutions for the construction work, basically where soil locality is black cotton soil.

VII. ACKNOWLEDGMENT

We would like to express my special thanks of gratefulness to my Guide **Ms. Kshama Singh** as well as our HOD **Mr. Dhirendra kumar singh** they gave me the golden chance to do this wonderful research paper on the topic "Comparision of Black cotton soil brick with Normal clay Brick" Which is also helped me in doing a lot of Research and I came to know about so some new things

and I am really thankful to them.

Also I would like to thank my parents and friends who helped me a lot in completing this research paper within the limited time frame.

REFERENCES

[1] Muthyalu P. V., Ramu K. et al “Study on performance of chemically stabilized expansive soil” International Journal of Advances in Engineering & Technology, Jan 2012 .

[2] Shakir Alaa A., Naganathan S. and Mustapha K. N. (2013); “Development of Brick from Waste material”; International Journal of Engineering and Technology, September-2013.

[3] Subir shri Singh; “Build welt with waste”; Envis newsletter feb-2012.

[4] Bogdan, Markovska I., Hristov Y. and Georgiev D. “Lightweight Material Obtained by utilized of Agricultural Waste”; Elsevier-2012.

[5] Giddel M. R. and Jivani A. P.; “Waste to Wealth potential of Rice Husk in India a Literature Review”; International Journal of Engineering Research and Application (IJERA).ISSN:2248-9622, Vol,2, Issue 5, September-October 2011, pp.1906-1910.

[6] Dr. Smt B. K. Shah, Patel A., Salla S., and Prof. Pitroda J.; “Comparative Study on Jute Fibre and Banana Fibre In Fly Ash Brick”; International Journal of Inventive Engineering And Sciences (IJIES) Journal In Jan-2013, India.

[7] Arora KR “Soil Mechanics and Foundation Engineering” Standard publishers Distributors Delhi.

[8] Chaunhan Rajiv, Jha J.N. and Gill K.S., (October 2009), “Strength improvement of Soil-Lime & Flyash Mix including Durability Aspects”, ASCGE2009, BITS Pilani, India, pp. 1-11

[9]. Guylaine Laforest and Josee Duchesne, “Stabilization of electric arc furnace dust by the use of cementitious materials: Ionic competition and long term m leachability”, Cement and Concrete Research 36, pp. 1628–1634.

[10] IRC 49-1973, “Recommended practice for the pulverization of black cotton soils for lime stabilization”.
[5] IRC 51-2000, “Guidelines for the use of soil-lime mixes in road construction”.

[11] IS: 2720 (Part III/ Sec-1)-1980, “Determination of specific gravity”

[12] IS: 2720 (Part IV)-1975, "Grain Size Analysis".

[13] IS: 2720 (Part XI)-1993, “Determination of the Shear Strength Parameters of a Specimen tested in Unconsolidated Undrained Triaxial compression without the Measurement of Pore Water.

[14] IS: 2720 (Part XL)-1977, "Determination of Free Swell Index of soil".

BIOGRAPHIES



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