

EXPERIMENTAL INVESTIGATION OF COMPRESSIVE BEHAVIOR OF STRAWBALE BRICKS

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Abstract – In India, generally bricks are made up of sand and clay, and now a days agriculture plays an important role. Straw bale acts as one of the best alternative for all kind of people for constructing a economic building with a sustainable material. Straw bale acts as the alternative of sand. The advancement in the field of technology have influence environment in utmost extend so everyone is worried about the environment and its tremendous impact in our life. It is also cost effective, thermal performance, light weight, ecofriendly in nature. The brick was manufactured of size 230mm×110mm×80mm. All the bricks are kept for drying for 3 days followed by 7 days wet curing and then 7 days sun drying. The test should be done are compressive strength test, water absorption test, impact test, soundness test, hardness test.

Key Words: straw bale, eco-friendly houses, high health, Sustainable material, aesthetic value.

I. INTRODUCTION

Straw is one of the natural fibers which we get as the byproduct from agriculture. It is the plant structure composed of cellulose, lignens, and silica. It is being produced by the process of photosynthesis, a natural and non-polluting process by solar energy. We could get this from wheat, rice, barley, oats .Use of straw for the construction of bricks would be obviously a eco-friendly in nature. It is annually renewable product which is being produced in most of the countries. The world largest straw producing countries are China, India and other agricultural country have not been able to utilize it for the productive work up till now. Mostly, in India, it is used for the paper factory for the production of papers and other purpose too. In those days they focus in stability of bale wall system, structural stability, plastering, and the moisture control. It is one of the best alternative sources for the building construction and also acts as the eco-friendly in nature and cost effective, since agriculture be the best income and production of straw bales are tremendous. Straw bale is simply a compressed of bundle like square, rectangle, round shape, attached with the wires and twins.

Burning of straw leads to the black cloud which causes serious chronic chest diseases and the carbon evolved from it would affect the environment. Straw bale bricks can be used for the partition wall which is more effective than the load bearing walls. Straw bale walls are light which means it weights 65% less than equivalent brick wall and 62% less than the concrete block wall.

II. SCOPE

- Study of straw bale shows that it is highly eco-friendly in the production of function, operation, maintenance of construction.
- Straw bale houses can be the best alternative for the country, where agriculture be the main source of income
- Straw bale construction will be economical for all kind of people.

III. LITERATURE REVIEW

Journal on “**Straw bale construction a revolutionary building material in low cost housing for rural areas**” submitted by Monika Shekar Gupta on January 30, 2014. This paper deals with the study of low cost agro waste construction material, example straw bale. The cost of construction material is increasing incrementally without compromising the affordability, quality and maintaining the component of the earth system has been a challenging task where straw bale can be one of the promising material that meet the overall housing needed and energy efficient goals of most of the developing countries like India, Nepal etc, where agriculture is the main source of income

Journal on “**A Comparative study of bricks and straw bale system from environment, economical, and energy perspectives**” submitted by Larisa Brojan, Alja Petric on December 30, 2016. The aim of the study is to compare bricks and straw bale wall systems from Global Warming Potential (GWP).

IV. OBJECTIVES.

- To evaluate the compressive strength of straw bale as a building materials.
- To assess the thermal insulating property of straw bale in building construction.
- To establish the ease at which straw bale material can be used in building construction.
- To make appropriate recommendation.

V. MATERIALS TO BE USED.

1. Straw bale.
2. Lime.
3. Clay.
4. Water.

1. STRAW BALE.

Straw bale construction is a building method that uses bales of straw (commonly wheat, rice, oats) as structural elements, building insulation or both. This construction method is commonly used in natural building or "brown" construction projects.

2. LIME.

Calcium oxide, commonly known as quick lime or burnt lime, is widely used chemical compound. It is a white caustic, alkaline, crystalline solid at room temperature. It is used as a building material as a replacement for the cement.

3. CLAY.

Clay is an earthy material that is plastic when moist but hard when fired, that is composed mainly of the fine particles of hydrous aluminium silicate and other minerals and that is used for bricks, tile and pottery.

4. WATER.

Water is an important ingredient of brick as it actually used for the manufacturing of brick. Since it helps to bind all the raw materials for giving proper mix.

VI. MATERIALS COLLECTION.

The principle raw material, Straw bale, was collected from villiyambakkam, Chengalpattu, India. In the boiler, straw bale bricks are burnt at the temperature of 240°C to 600°C, depending on the moisture content and feed off the straw bale. Straw bale are obtained from wheat, rice, barley, oats.

VII. PROCEDURE.

1. Required proportion of raw materials are taken separately.
2. Clay and water are mixed thoroughly.
3. After that, 30% of lime is added to it.
4. In order to get the homogenous mix, straw bale are added later according to their length.
5. The freshly prepared mix are then pressed into the mould.
6. As the most of the local manufactures are producing brick of dimensions 230mm×110mm×80mm. The same dimensions is adopted here for the production of bricks.
7. All the bricks samples are kept for drying for 3 days followed by 7 days wet curing and then 7 days of sun drying.
8. Compressive strength and water absorption test are to be conducted to fund the effective proportion of the raw materials.

VIII. BRICK MAKING PROCESS.



Fig1 – Mixing of ingredients



Fig2 – Mixing of Lime



Fig3 – Moulding of Bricks

XI. TEST TO BE PERFORMED

A. COMPRESSIVE STRENGTH TEST

The brick specimens are immersed in water for 24 hours. The specimen is placed in compression testing machine with 6mm plywood on top and bottom of it to get uniform load on the specimen. The load is applied axially at a rate of 14N/mm^2 . The crushing load is noted. Then the crushing strength is the ratio of crushing load to the area of brick loaded. Average of three specimens is taken as the crushing strength. The crushing load is noted for bricks named 1,2,3,4,5,6&7 (difference proportions).

B. WATER ABSORPTION TEST

A brick is taken and it is weighted dry. It is then immersed in water for 24 hours. It is weighted again and the difference in weight indicates the amount of water absorbed by the brick. It should not exceed 20 percent of weight of dry brick.

C. SHAPE AND SIZE TEST

In this test, a brick is closely inspected. It should be of standard size and shape should be truly rectangular with sharp edges. For this purpose, 3 bricks are selected at random and they are stacked length wise, along the width and along the height.

D. EFFLORESCENCE TEST

This test is carried out to obtain the presence of alkaline substances in bricks. First, bricks are fully submerged in fresh water for 24 hours. After 24 hours they are collected from water and let them to dry. After completely dried, the bricks are closely observed to find the presence of alkali. If a white patches are formed that brick should not be used.

E. IMPACT TEST

In this test, few bricks are dropped from 1m height. If bricks are broken it indicates low impact value and acceptable for construction work. Good quality bricks do not break at all.

F. SOUNDNESS TEST

In this test, two randomly selected bricks are hardy punched with each other. If they produce a clear metallic sound and remain unbroken then they are good quality bricks.

G. HARDNESS TEST

In this test, scratches are made on the surface of the brick by a one-rupee coin. If it does not leave any impression the brick surface then it will be considered as good quality bricks.

X. CONCLUSION

In this emerging world where the rising need of housing is increasing day by day due to tremendous growing of rural and urban population has been a pressuring issue. Without compromising the affordability, quality and the maintaining of component of earth system has been a challenging task where straw bale can be one of the promising building material that meet the overall housing need and energy efficient goal. From this study, we conclude that straw bale construction can be enhanced in the developing countries, land agricultural countries like India for effective implementation of straw bale house.

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