

# Light Straw Bale Construction

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**Abstract:** Many advancements have occurred in the field of technology and their disadvantages are creating a large impact on our environment. As a solution to various negative impacts on environment, people are preferring eco-friendly environment to live. Light straw clay construction can be an alternative for the countries where agriculture is considered as a source of income. Light straw clay includes a composition of straw and clay. Both these components are easily available and this is one of the advantages of light straw clay construction. The purpose of this paper is to present an eco-friendly construction technique which satisfies cost efficiency and local availability of materials of construction. Straw serves as a good thermal insulator. Straw is actually the waste of agriculture. These are either burned in bulk or buried in the soil which create environmental problems. In this study the potential of light straw clay is evaluated and investigation is carried on building construction, thermal insulation and transfer of heat.

**Keywords:** Cost efficiency, Eco-friendly, Light straw clay construction, Thermal insulator.

## 1. Introduction

Straw is a naturally occurring material which is the byproduct of agriculture. It is actually the waste generated after agriculture. In the countries where agricultural practice is most common, produce straw in bulk amount. Straw will take time to decay. As a result, the disposal of straw is a major threat to farmers. Straw is disposed either by burning or buried into the soil. It can lead to direct or indirect impacts on the environment. Burning of straw in bulk causes the emission of carbon dioxide gas and other pollutants to the atmosphere.

Cost of purchasing inorganic material is high when compared to organic materials. Straw being organic and available at cheap rate, it is a good alternative to inorganic construction materials. Also, straw has a good thermal insulation property.

In consideration with all the advantages of straw, problems associated with the disposal of straw and availability of clay, light straw clay construction, it is gaining worldwide attention.

## 2. Methodology

### A. Materials Required

Table 1  
Materials

S. No.	Materials	Property
1	Clay	Traditional Clay (Alluvial or Red Soil)
2	Sand	<9.55mm dia
3	Straw	Chopped to Length of 2-3cm

The physical properties of the above-mentioned materials are identified. Best quality materials are chosen.

#### 1) Straw

Its physical properties include heat capacity, bulk density and thermal conductivity. Rice straw bale having length 70 cm to 80 cm can have a bulk density ranging from 70 to 90kgm<sup>-3</sup>. Moisture content of straw should be considered.

#### 2) Clay

Alluvial soil shows good clay content. Tensile strength, porosity, plasticity and colour change after burning are the important properties should be considered during selection. Plasticity is the property of the clay which shows the permanent deformation of wetted clay without cracking. Straw shows high tensile strength.

#### 3) Sand

Major constituents of red sand are magnesium, silica, calcium and other valuable substances. River sand or natural sand is mostly adopted for brick moulding. It does not contain any hygroscopic salts.

### B. Procedure

Straw is chopped into small pieces. The size ranges from 2 to 3 cm. It should not exceed 5cm. Alluvial or red soil is taken. Alluvial soil has the best clay content. Clay, sand and straw is taken in the ratio 1:1:1.5(clay:sand:straw). Clay is mixed with sand and chopped straw thoroughly. The mix is transferred into mould of standard size. The casted brick is dried under sun for 4 to 5 days and then taken to the kiln. After burning, brick is taken out within 5 days.

## 3. Test Conducted

### A. Compressive Strength Test

It is the very first test to be conducted among different test on brick. This test is carried out to determine the compressive strength of brick and is done in compression testing machine. Load is divided by the cross-sectional area to get the compressive strength. The compressive strength of clay brick with straw is more than that without straw.

### B. Water Absorption Test

Water absorption in a brick depends upon the nature of clay and straw content present in it. The strength of the brick lowers when it is soaked in water. Water absorption rate of bricks after immersing them for 24 hours is noted.

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#### 4. Cost Efficiency

Straw and clay are cheaply and readily available materials. Straw is the byproduct of agriculture. Therefore, it is available in ample amounts. Use of straw avoids the use of costly inorganic materials of construction. Cost of one bundle of straw is Rs.30. With one bundle of straw 25 to 30 bricks can be made. Clay is easily available at a cheaper rate. Thus, in all total the cost of one brick will be equal to Rs. 7.

#### 5. Advantages

Light straw construction has a very good advantage of thermal insulation. This reduces use of energy and carbon dioxide emissions. Simple tools and technology are required for construction. Presence of skilled labour is not a must. It is an ecofriendly mode of construction technology.

#### 6. Test Results

Table 2  
Test results

Test	Result
Compressive Strength Test	11.73N/mm <sup>2</sup>
Water absorption Test	3.572Kg

In water absorption test, 15.9 % of water entered the brick when soaked in water.

#### 7. Conclusion

In this developing era people are in search of quality living and eco-friendly environment. Light straw clay construction

can be a good alternative for them. Straw can be chosen as a building material in the countries where agriculture is largely practiced and facing difficulties in disposal of large quantity of straw. Light straw clay construction is cost effective with many advantages. It provides a good thermal insulation and are ecofriendly. When straw clay brick is burned in kiln, it naturally provides resistance to moisture content. In other cases, admixtures can be added to withstand moisture absorption. On burning in kiln there is a chance for the straw to get burned. The rice straw ash is a very good partial substitute or cement. On burning only silica rich residues remains in the brick. Straw clay construction is durable and environment friendly. It can be easily adopted especially in countries practicing agriculture.

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