

# Advanced Papercrete Brick

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*Abstract: Today the whole world is facing environmental problems such as global warming, forest destruction and lack of resources. To solve these problems, a resource recycling had been performed. Paper contributes to about 55% of the total solid waste. It was observed that all the educational institutes consumes large amount of paper for different purposes. After its consumption it is either burnt, used for landfill and very few amounts is recycled. Same case was observed in the college campus. So it was decided to use this waste paper to construct advanced papercrete brick. The brick which constructed had passed all the parameters of the traditional brick test. It was observed that this advanced papercrete brick reduces approximately 50% weight of brick. Therefore these bricks will reduce the dead weight of the structure to considerable amount. So it changes our design and building cost as in economical point of view. Similarly different construction material like papercrete tiles, ventilators can be made from papercrete.*

*In the present paper an attempt has been made to construct an economical and ecofriendly brick. We had done After investigating and experimental study it was decided to make potential use of paper waste for producing a low cost and light weight composite brick as a building material. We all dreamed of an ecofriendly structure which is aesthetically beautiful and also economical but it is not so easy, but papercrete construction materials had fulfilled all the above parameters. This advanced papercrete brick consist of recycled materials and therefore cost is very low as compared to conventional brick. The significance of papercrete brick had been mentioned in the detailed paper. An experimental investigation had been carried out to the optimization of mix for papercrete bricks depending upon the compressive strength and water absorption. and water absorption.*

**Keywords:** Papercrete bricks, ecofriendly, economical, light in weight, compressive strength

## I. INTRODUCTION

### A. GENERAL

A name of papercrete was derived from its materials. Generally it was made up of paper, cement and water. Now days the cost of soil has increased. So, the need of partial replacement for conventional brick emerged. Due to increased rate of soil the rate of bricks have also increased. So it was decided to do partial replacement of soil with paper pulp and other materials. It can be used to build environmental friendly house. The civil engineers have been challenged to convert the industrial wastes to useful building and construction materials. This experimental study investigates

the potential use of waste paper for producing a low-cost and light weight composite brick as a binding material. These alternative bricks were made with papercrete. The constant developmental activities in civil engineering and growing industrial activities have created a continuous demand for building material.

In the construction industry, building technology is heading towards an entirely new era because of the usage of industrial wastes in various forms of building material production. For instance the use of waste rubber, glass powder, industrial waste fibres, and wood sawdust waste in building material production has received diligent attention over the past few years. This is quite understandable because it is slowly but increasingly being recognized that the economic

progress in construction depends more on an intelligent use of materials and constant improvement of available materials.

**MATERIALS USED**

Sample1	Sample2	Sample3	Sample4	Sample5
Rice husk	soil	Paper pulp	clay	Paper - 60%
Fly ash	Paper pulp	flyash	Rice husk	Cement- 30%
soil	flyash	cement	water	Flyash - 10%
Paper pulp	water	Rice husk		water
water		water		

Table 1

**II. EXPERIMENTAL PROCEDURE**

**MANUFACTURING OF BRICKS**

There was no clear past details about the project. And there is no hard procedure for casting the bricks. So the procedure that is given below was followed by our own. And the equipments which were used in this project are for our convenience only.

**MOULD PREPARATION**

After collecting all the materials, a mould was prepared. The shorter sides of the mould are slightly projecting to serve as handle. And joints were made without any hole or gap to avoid leakage.

**PULP GENERATION**

The papers, which were collected, cannot be used directly. It should be made into paper pulp before mixing with other ingredients. The following are the steps involved in the generation of pulp

First the pins, threads and other materials in the papers were removed.

Then the papers were teared into small pieces of papers.

Then, a 20litre bucket was taken. And 2/3<sup>rd</sup> of it was filled with water.

Then the small pieces of paper were immersed in the bucket. The paper pieces were immersed individually not in a bulky manner in order to make the pieces completely wet. Before immersing it into the water. The papers were weighed. The figures shows the papers were being immersed in the bucket.

**MIXING**

After all the ingredients were ready, the mixing was done. In this project, mixing was done manually. The mixing process of fibrous concrete bricks and padobe bricks are different, and that processes are given below. The exact mix

proportions was not known so, trial proportions were used in this project.

Volume batching was carried out in this project. So the materials were measured in millimeters. According to the particular proportion the materials were measured first and kept separately. This was done just before the mixing starts.

Gloves, shoes masks were weared before the mixing.

Then, the non-water absorbing and smooth surface was made for mixing.

Water was sprinkled over that surface. And this mixing place was selected nearer to the casting place.

First the ingredients like rice husk were placed.

Then cement was placed over that ingredient.

These two were dry mixed with shovel thoroughly still uniform colour was formed.

Then the paper pulp, which was in a wet condition, was placed separately. paper pulp should contain less water. So the excess water was squeezed out.

**CASTING OF BRICKS**

After mixing, it should be placed in the mould within 30 minutes. So, two moulds were used at the time to make the process very fast. The bricks were moulded manually by hand and on the table. The following are the steps involved in moulding,

The mould was over a table

The lump of mix was taken and it was placed in the mould.

The casted papercrete bricks dried for 14 days

**III. TEST PROCEDURE**

**HARDNESS TEST**

In this test, a scratch was made on brick surfaces. While the scratch was made with the help of finger nail on bricks, very light impression was left on brick surface, so this results that the papercrete brick is relatively hard.

**SOUNDNESS TEST**

In this test two bricks from same proportion were taken and they were struck with each other.

The bricks were not broken and a clear ringing sound was produced. So the bricks are good.

**FIRE TEST**

A brick which is used for construction should not flammable in open flame, so this was carried out for the bricks. The bricks were held on a stove and it was observed that it did not burn with an open flame. They smouldered like charcoal. But this brick would be reduced to ashes after burning several hours.

## WATER ABSORPTION TEST

The water absorption of brick is not related directly to the porosity owing to the nature of pores themselves. More the water absorption capacity weaker is the brick and vice versa.

Dry the specimen in ventilated oven at a temperature of 105 C to 115 C till it attains sustainability constant mass. Cool the specimen to room temperature and obtain its weight (M1) specimen too warm to touch shall not be used for this purpose. Immerse completely dried specimen in clean water at a temperature of 27+2 C for 24 hours. Remove the specimen and swipe out any traces of water with damp cloth and weigh the specimen after it has been removed from water (M2).

**COMPRESSION TEST:** The test was carried out by a compression testing machine. This test was carried out on 7<sup>th</sup> day from the date of casting papercrete brick. While testing the papercrete brick great care must be taken, because papercrete brick never failed catastrophically, it just compressed like squeezing rubber. So load was applied up to half compression. When papercrete brick failed at the higher load, the structure was not fully collapsed. Only the outer faces cracked and peeled out. The papercrete brick are having elastic behaviour and less brittleness.

First the irregularities in the surface were removed.

The brick was placed centrally on the bottom plate of the universal testing machine.

Then the upper plate of the universal testing machine was lowered down up to the brick was hold tightly without any movement.

## IV. PAPERCRETE MIX RATIO

Sample 3	Amount of materials
Paper	50%
flyash	20%
cement	20%
Rice husk	10%

Table 2

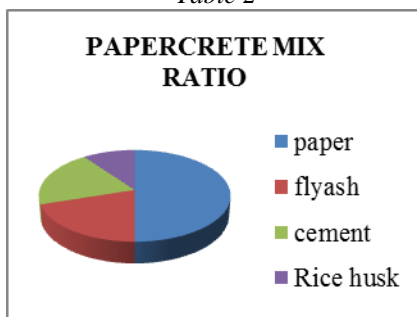


Figure 1

## V. APPLICATION OF PAPERCRETE BRICK

- Used in inner partition walls.
- Used for construction of compound wall.
- These bricks can be used in auditoriums.
- Can be used as a sound-proofing material.
- Sufficient for roof loads in low-height buildings.
- Different shapes to decorate houses, flower pots.

Papercrete could be used for simple furniture in homes provided that Different shapes to decorate house flower pots.

## VI. ADVANTAGE OF PAPERCRETE BRICK:

The weight of the papercrete brick is light as compared to conventional brick.

Using this papercrete brick in a building, total cost will be reduced from 20% to 50%.

The papercrete bricks are good sound absorbent.

It does not expand or contract.

If these bricks are used as partition wall, the carpet area is increased.

## VII. DISADVANTAGE OF PAPERCRETE BRICK:

These bricks are not suitable for water logging and external walls.

The compressive strength of this brick is moderate.

Not suitable for the rain forest or wet climates.

Moderate resistance to water.

## VIII. RESULTS

sample	1	2	3	4
Before drying weight.	272.2 gm	298.5 gm	323 gm	484 gm
After drying weight	274.5 gm	292.5 gm	286 gm	463.5 gm
Compressive strength	1.5MPa	2.9M Pa	3.6MPa	5.1M Pa
Before water absorption	39.5 gm	18.5 gm	24.5 gm	27 gm.
After water absorption	54 gm	29 gm	37.5 gm	33 gm.

Table 3

**Weight:** The ordinary conventional brick weight varies from 3 to 3.5 kg. The maximum weight of papercrete brick is less than 2kg only. Paper based bricks are having weight 2/3<sup>rd</sup> of conventional brick weight. As these bricks are light weight it will also reduce total cost of construction due to the reduction in dead load.

## IX. CONCLUSION

From the above experimental studies we can conclude that:

Papercrete bricks are suitable for non load bearing walls only.

Due to less weight of the bricks the total dead load of the building will be reduced.

Papercrete bricks are good sound absorbent hence can be used in auditoriums as insulating material.

The weight of this brick is 1/3<sup>rd</sup> to 2/5<sup>th</sup> lesser than conventional clay brick.

This brick are not suitable for water logging areas and external wall.

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