

## EXPERIMENTAL STUDY OF LIGHT WEIGHT BLOCK BY USING WASTE PAPER

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**Abstract:-** In this experimental work we have approached for making a light weight concrete block by replacing coarse aggregate with paper pulp for reducing dead load of structure as in current scenario high rise buildings are being preferred which exert a great amount of load. A nature has estimated that the world has 3.04 trillion trees. Almost 4 billion trees worldwide are cut down each year for manufacturing paper. The construction industry is known as one of the largest consumers of non-renewable resources. On the other hand, more waste paper ends up in landfill or dump sites than those recycled. The purpose of this research is to determine the weight, compressive strength, water absorption capacity and Efflourances of light weight blocks of size 150x150x150 by using waste papers (newspapers, invitation cards, magazines etc.) in order to determine their aptness for use as a building construction material. Making light weight block with paper pulp, sand, cement, fly ash and waterproofing agent weighed 60% less than conventional block which will ultimately result in reducing dead load of the structure.

### I. INTRODUCTION

Light weight building blocks in place of conventional or concrete blocks could reduce the dead load of structure. Use of wastepaper in concrete can become an economical and profitable substitute for conventional Building blocks. According to a research, more than 450 million tons of papers are produced worldwide every year. It is estimated that by 2020, paper mills will be producing 500 million tons of paper and paperboard each year [1]. We obviously need this product and a reduction of use is not in the prospect. Pulp and paper is the 3rd largest industrial polluter of air, water and soil. In recent year, paper and paperboard constitute a greater portion of many countries' municipal solid waste generation.

Since large demand has been placed on building material industry especially in the last decade owing to the increasing population which causes a chronic shortage of building materials. 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 block as a building material.

In this paper light weight concrete block is a material consisting of waste paper, Portland cement, Sand and Fly ash. Waste paper is soaked in water and paper pulp is made out of it. Paper pulp is mixed with cement, sand, fly ash and is put in a mould. The specimen is dried and can be used as durable building material.

Light weight building blocks can be used for interior walls in high-rise buildings in seismically active areas.

The purpose of present research is to utilize the waste materials like paper and to replace the costly and rare conventional building blocks which satisfies the following characteristics: Required, Cost effective, Environmental friendly, less weight, Inflammable, Easily available

## **II. LITERATURE REVIEW**

To initiate with this experimental work we have took reference of the following paper which helped us to decide the materials and proportions for our experimental work.

Dr. Sandeep Kumar Srivastava & Dr. Abhilasha Asthana, (2017) 'Study of Ecofriendly Light Weight Bricks using waste Paper Review' In this research paper author studied about , six different mix proportions were computed by utilizing the Paper pulp and industrial by products like Fly ash, Rice husk ash. And also, due to the addition of paper pulp the bricks have low thermal conductivity, and it reduces the energy requirement for temperature control. Therefore these bricks will reduce the dead weight of the structure to considerable amount. So it changes our design and building as economical point of view.

On the basis of the experimental work it is concluded that the papercrete bricks are suitable for non-load bearing walls only. The weight of this brick is 1/3rd to 2/5th lesser than conventional clay brick. Due to less weight of these bricks.

Umarfarook H. Momin & Firoj Y. Sayyad, (2017) 'Highly compressed fly ash based papercrete brick' In this work experimental approach is carried out to analyze the feasibility of papercrete brick in practical field. In past research we found that researchers conclude that water absorption for papercrete brick is nearly about 35% which is not accepted.

It is evidently concluded that the flyash based papercrete building bricks can be used for the construction of external walls, partition walls, infilled walls, compound wall, basement, etc. in nonearthquake prone area. The water absorption of papercrete brick is 18.95% which is less than clay conventional brick and satisfies the IS code recommendation (IS 3495 Part2).

Atthikumarann,bragadeeswaran t ,karvendhan, (2017) 'Experimental Investigation of light weight Bricks using paper sludge' In this project a parametric experimental study which investigates the potential use of paper waste for producing a low-cost and light weight composite brick as a building material. These alternative bricks were made with papercrete

The results shows that the effect of high-level replacement of paper wastes does not exhibit a sudden brittle fracture, and it reduces the unit weight dramatically and to the current conventional bricks and concrete blocks in the market. This innovative cost effective bricks can be used for walls, wooden board substitute and best alternative for conventional bricks.

Rohit Kumar Arya & Rajeev Kansal ,(2013) 'Utilization of Waste Papers to Produce Ecofriendly Bricks'The purpose research is to utilize the waste materials like paper and to replace the costly and rare conventional building brick which satisfies the following characteristics : Cost effective ,Environmental friendly ,Less weight ,Inflammable ,Easily available.

Result shows that the water absorption capacity of papercrete brick was found to be more than 20%, which makes it not suitable for water logging and external walls.

Myriam Marie Delcasse, Rahul V, Abhilash C, Pavan M K, Gangadhar,(2017) 'Papercrete Bricks - An Alternative Sustainable Building Material' Papercrete is a new composite material comprising of waste papers and cement. In this investigation, an attempt is made to produce an alternative material using waste papers. This could help eradicate a few of the environmental hazards caused by the construction industry.

A Papercrete brick consists of recycled material and therefore cost is low compared to conventional bricks.

Papercrete has good fire resistance. Admixtures can also be added to improve setting and bonding properties.

K.Anandaraju, B.Jose Ravindra Raj & R.VijayaSarathy, (2015) 'Experimental Investigation of Papercrete Brick' As natural sources of aggregates are becoming exhausted, it turns out urgent to development. The majority of abandoned paper waste is accumulated from the countries all over the world causes certain series environmental problems. This project deals a parametric experimental study which investigates the potential use of paper waste for

producing a low-cost and light weight composite brick as a building material

- Papercrete bricks are suitable for non-load bearing walls only.
- The weight of this brick is 1/3rd to 2/5th lesser than conventional clay brick
- Using the papercrete brick in a building, total cost will be reduced from 20% to 50%.

From the above papers referred, we concluded that fly ash can be used with paper pulp, cement and sand as a construction material for building blocks

### **III. MATERIALS**

#### **1. CEMENT**

Cement is one of the binding material in this research. 53 grade Ordinary Portland Cement (OPC) confirming to IS: 8112-1989 cement used.

#### **2. WASTE PAPER**

In this study, paper is the main constituent material. Different types of Papers are like Newspapers, practical sheets, old newspapers. Paper is nothing but wood cellulose, which is considered as a fibrous material. Cellulose is the second most abundant material on earth after rock. Cellulose is a natural polymer with a long chain of linked sugar molecules i.e.,  $\beta$ -D-glucose. The cellulose chain bristles with polar -OH groups. These groups form many hydrogen bonds with -OH groups on adjacent chains, bundling the chains together. The hydrogen bonding forms the basis and strength.

#### **3.SAND**

Sand particle are mainly made up of silica ( $\text{SiO}_2$ ). Sand are made up by weathering and erosion of rocks. The sand here used was obtained from river bed and was sieved through 475 micron IS sieve.

#### **4. FLY ASH**

Fly ash is a residue resulting from combustion of pulverized coal or lignite in thermal power plants. About 80% of total ash is in finely divided form.

#### **5. WATER PROOFING AGENT**

Dr. Fixit is used as a water proofing agent. It makes concrete cohesive, reduces porosity & improve water tightness. Meets the requirements of IS: 2645 – 1983 standard. As an effective pore filler, helps to fill capillaries and pores to prevent water seepage. Most economical water proofing additive, reduces water absorption

### **IV. METHODOLOGY**

According to research, up to now, there is no hard and fast rule for formal mix design of papercrete, and in that respect no hard procedure for casting the blocks. Thus, in this research, some laboratory tests were performed to obtain some mechanical properties of papercrete.

#### **1. Mould Preparation**

After collecting all the materials, a mould was prepared. A mould was prepared of size 150mm X 150mm X 150mm. Joints were made without any hole or gap to avoid any leakage.

## 2. Pulp Generation

The papers, which were collected, cannot be utilized immediately. It should be made into a paper pulp before mixing with other ingredients. Firstly cut all the paper into small pieces and then papers were kept in the tank for 3 to 4 days, otherwise until the papers degrade into a paste-like form. Then the paper was taken out of the water and taken to the mixer machine to make it as a paper pulp.



## 3. Mixing

Mixing was done after all the ingredients were ready. In this project, mixing was done manually.

A tried combination of cement: sand: paper sludge: fly ash was used in this project. After the mixing, it should be put in the mould within 30 minutes and tamped with tamper and the surface of the block should be finished by shovel or tamper. The casted papercrete block should be allowed for sun drying for 21 days. There is no such special care needed for curing of blocks because the paper used in blocks itself hold water for a long time.

## V. TRIAL MIX PROPORTION

MIX NO.	CEMENT	FLY ASH	SAND	PAPER PULP
M1	1	1.5	2.5	2
M2	1	1.5	4	2
M3	1	1.5	3	2



**Fig: Sun Drying of Blocks**

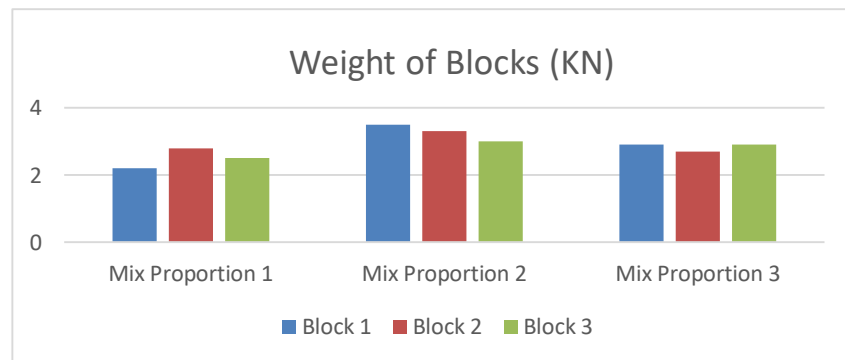
## VI. RESULT AND DISCUSSION

After casting the blocks they were analyzed for using as a blocks. For this, various tests were conceded out to confirm the properties of blocks and the results of the test were analyzed by the existing and standard results. The following tests were carried out to check the strength of the block.

### 1. WEIGHT

Lightweight blocks are also the important objective of this study. So, all the blocks were tested whether they are light weight or not. All the blocks were weighed in a well-conditioned electronic weighing machine. The ordinary conventional blocks weight varies from 8-10 KN. but the papercrete blocks weight varies from 2 to 3 KN. The maximum weight is less than 3 KN only. So this block are light weight because we have replaced coarse aggregate with Paperplub and it will also reduce total cost of construction due to the reduction in dead load.

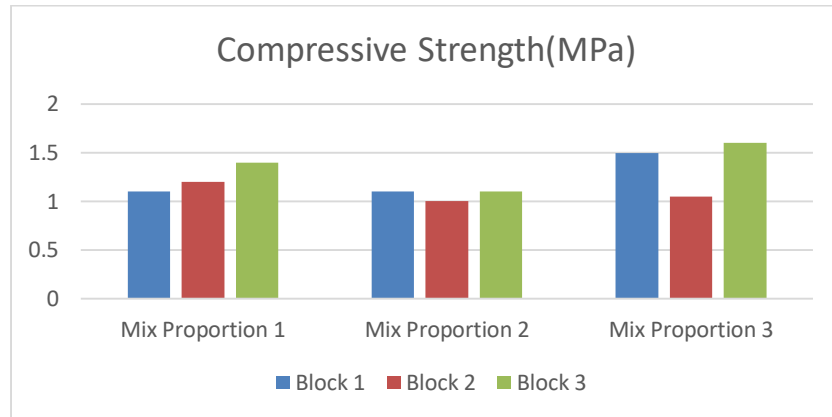
MIX	WEIGHT ( KN )
1	2.2
	2.8
	2.5
2	3.5
	3.3
	3
3	2.9
	2.7
	2.9



**2. COMPRESSIVE STRENGTH**

The test was carried out by a compression testing machine. This test was conducted on the 21th day from the date of casting the papercrete blocks. While testing the papercrete block, great care must be taken because papercrete block never failed catastrophically, it just compressed like squeezing rubber. When papercrete block failed at the higher load, the structure was not fully collapsed. Only the outer faces cracked and peeled out. The papercrete blocks are having elastic behaviour and less brittleness.

MIX	Compressive Strength (MPa)
1	1
	1.2
	1.4
2	1.1
	1
	1.1
3	1.5
	1.05
	1.6



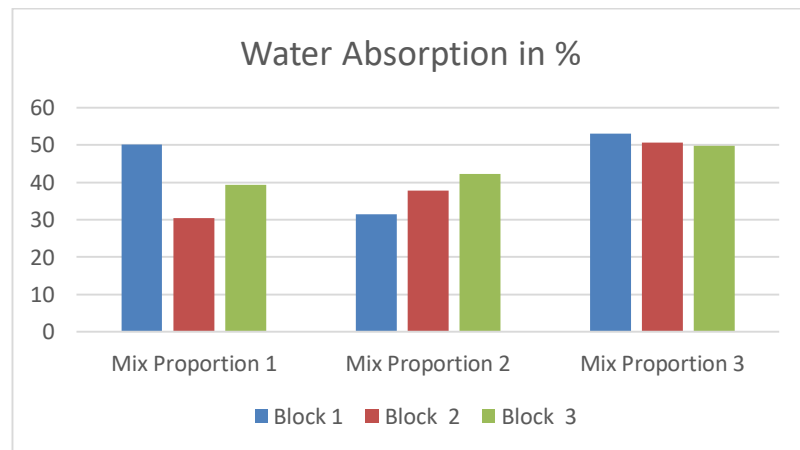
**3. EFFLORESCENCE TEST**

This test was conducted to know the presence of any alkaline matter in papercrete blocks. The block samples immersed under water were taken out after 24 hours and allowed to dry in shade. Grey or white deposits were not found on the blocks surface which concludes that the blocks are free from soluble salts.

**4. WATER ABSORPTION TEST**

Water Absorption Test is used to find out the water absorption ratio. Because the blocks, which are absorbing more water cannot be used in water logging area or exterior walls which is open to sky. The blocks from all the proportion were tested. As per standard, the blocks should not absorb water more than 20% of its weight, but from the results, blocks exceeded water absorption ratio more than 20%. In this, the mix that contains only paper and cement absorbs water more than its weight. So these blocks are not suitable for water logging walls. These blocks can be used for interior partition walls only.

MIX	Water Absorption (%)
1	59.09
	30.35
	39.35
2	31.42
	37.84
	42.28
3	53.10
	50.69
	49.83







**Fig: Water Absorption Test**

### **CONCLUSION**

From the above experimental studies we can conclude that

- It is evidently concluded that the fly ash based papercrete building blocks can be used for the construction of partition walls, infilled walls, compound wall, basement, etc.
- Papercrete blocks are suitable for non-load bearing walls and nonstructural wall only.
- The weight of this blocks is 1/3rd to 2/5th lesser than conventional blocks. Due to less weight of these blocks, the total dead load of the building will be reduced. Since, these blocks are relatively light weight.
- Due to lesser weight and more flexibility, these blocks are potentially ideal material for earthquake prone regions.
- A Papercrete blocks consists of recycled material and therefore cost is low compared to conventional blocks.
- These blocks are environmentally friendly, it simply means having a lifestyle that are better for the environment. By using paper in buildings we can significantly decrease amount of paper landing in the landfills. Using the concept of recycling of waste materials, papercrete is not only reducing the amount of cement using but also making it environmentally friendly
- As per research the blocks should not absorb water more than 20%. The water absorption capacity of papercrete b was found to be more than 20%, which makes it not suitable for water logging and external walls. However, by providing a waterproof coating (Geobond or silicon based waterproofing) it can also be used as external wall.

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