



# STUDY ON POROTHERM BRICK USING GRANITE POWDER

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## ABSTRACT

Construction industry is one of the most important sectors in the development of the country and it's GDP. Bricks are widely used in the construction industry. Porotherm bricks are mainly made off clay mixed with coal ash, rice husk ash, saw dust and fly ash. In this experimental study bricks are made off natural waste material like rice husk ash and granite powder. The main objective of the study is to reduce the quantity of clay with natural waste material. On the other hand proper and efficient management of natural solid waste disposal can be done. Here we are replacing granite powder and rice husk ash in appropriate proportions to make light weight brick with same compressive strength. This study helps to identify the average water absorption ratio and compressive strength.

**KEYWORDS:** Porotherm brick, rice husk ash, granite powder, compressive strength, light weight

## 1. INTRODUCTION

Porotherm clay bricks are widely used in the construction industry. These are horizontally and vertically perforated clay bricks. It is inexpensive to build. It helps in cost effective and environmental friendly construction. It has high strength, lighter in weight, durable and compactness. This brick has higher thermal efficiency i.e., cooler in winter and warmer in summer. It has better finish, and also helps in speedy construction without compromising the strength and durability. Less amount of workers are required.

Production of every metric ton of cement will emit one metric ton of CO<sub>2</sub>. So consumption of cement should be reduced to create eco-friendly houses and to save the environment. There is a great problem in the world about recycling industrial wastes and their utilization. Leaving waste materials directly to the environment may cause problems.

### 1.1 OBJECTIVE

The main objective of this study is.

- To compare the compressive strength of conventional brick with porotherm brick.
- To reduce the cost of construction.
- To study and understand the effects and use of granite powder in porotherm brick
- To make the efficient use of building material.

### 3. POROTHERM BRICKS

Porotherm clay bricks are horizontally or vertically perforated clay bricks. They are manufactured in variety of sizes (common size is 400×200×200 mm) from natural clay, coal ash, rice husk, granite slurry. The porotherm bricks are low weight, durable, strong, and possess satisfactory fire resistance. For instance, take watermelon on a summer day and you find the surface is hot. But when you cut into the fruit the flesh inside, it's cool. Porotherm bricks are environment-friendly, cost effective and easy to handle. It is not just a brick but a Smart Clay Brick.

The clay used for production is sourced from de-silting of dead water tanks and only natural additive's like coal ash, rice husk, and saw dust are used. Listed by IGBC (Indian Green Building Council) in the Green Product Category under energy efficient product, material with recycled content & use of regional material.

Porotherm HP provides excellent thermal insulation that is 45% higher than conventional walling material. This leads to direct savings in energy consumed through air conditioning and heating devices.

These bricks have exceptionally long life. It is naturally fire- resistance as it is fired at 1000 degrees and has a fire rating of F240 for 240 minutes for HP 200.

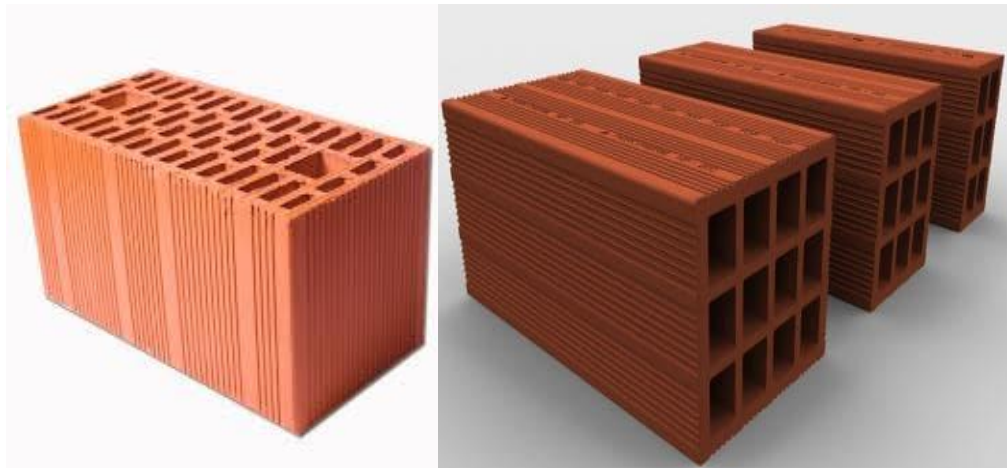


Fig 1- porotherm brick

### 4. MATERIALS USED

#### 4.1 CLAY SOIL:

Clay soils are compounds of silica and alumina. Calcareous clays have calcium carbonate and will burn to yellow or cream color. Non – Calcareous typically contain feldspar and iron oxides and will be burnt to brown, pink or red depending on the amount of iron oxide.

It is finely graded natural rock or soil material that combines one or more clay materials that combines one or more clay minerals with traces of metal oxides and organic matter. It is plastic due to their water content and become hard, brittle and non- plastic upon drying or firing.

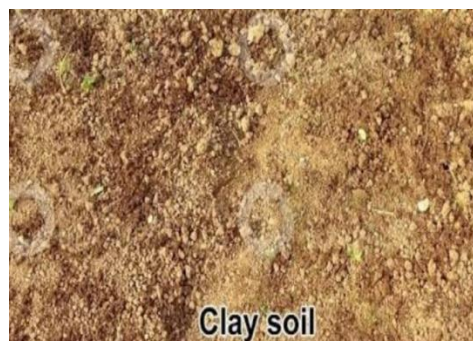


Fig 2- Clay

#### 4.2: GRANITE POWDER:

Granite powder is a byproduct produced in granite polishing industries while cutting into desired shapes. It belongs to the igneous rock family. Granite industry produces around 18 million tones waste per annum. The physical properties of granite powder is similar to the natural sand, hence it can be used in replacement of natural sand. Granite powder is locally available waste material hence it is possible to make economical brick.

Granite powder is a material which was taken from granite polishing industry. The percentage of granite powder added in the clay is 2%, 4% and 6%.



Fig 3-Granite powder

#### 4.3 RICE HUSK ASH:

Rice milling industry generates a lot of rice husk during of milling of paddy which comes from the fields. This rice husk ash is mostly produced by burning rice husk between 600-700 degree Celsius temperatures for 2 hours. Rice husk ash is about 25% by weight of rice husk when burnt in boilers. It is estimated that about 70 million tons of rice husk ash is produced annually worldwide.

This husk contains about 75% organic volatile matter and the balance 25% of the weight of this husk is converted into ash during the firing process, is known as rice husk ash (RHA). It consists of non-crystalline silicon dioxide.



Fig 4- Rice husk

#### 5. SPECIMEN TEST

It is necessary to check the quality of brick before using it in any construction activities. There are some field tests, that we can conduct in the field in order to check the quality of bricks. The tests are as follows:

- Water absorption test.
- Compressive strength test.

### 5.1 WATER ABSORPTION TEST:

The water absorption test on bricks is conducted to determine durability property of bricks such as degree of burning, quality and behavior of bricks in weathering. A brick with water absorption of less than 7% provides better resistance to damage by freezing.

The water absorption by bricks increase with increase in pores. The degree of compactness of bricks can be obtained by water absorption test, as water is absorbed by pores in bricks. So, the bricks, which have water absorption less than 3%, can be called as vitrified. This test provides the percentage of water absorbed by the brick and it should not exceed 20% of average weight of dry bricks.

$$\text{Water absorption} = \frac{\text{Wet Weight (W2)} - \text{Dry Weight (W1)}}{\text{Dry weight (W1)}}$$

Test results:

Table 1- Water absorption ratio for porotherm brick

Mix design ratio	Weight of brick (in Kg)	Weight of brick after absorbing water(in Kg)	% of water absorption
1% rice husk ash + clay	3.95	4.2	6.0
1% rice hush ash+ 2% granite powder + clay	4.0	4.45	10.25
1% rice husk ash+ 4% granite powder + clay	4.15	4.75	14.75
1% rice husk ash+ 6% granite powder +clay	4.3	4.9	16.2

Table 2- water absorption ratio for conventional brick

Mix design ratio	Weight of brick(in Kg)	Weight of brick after absorbing water(in Kg)	% of water absorption
Trial 1	3.0	3.25	12.2
Trial 2	3.25	3.5	12.4
Trial 3	3.5	3.7	12.6

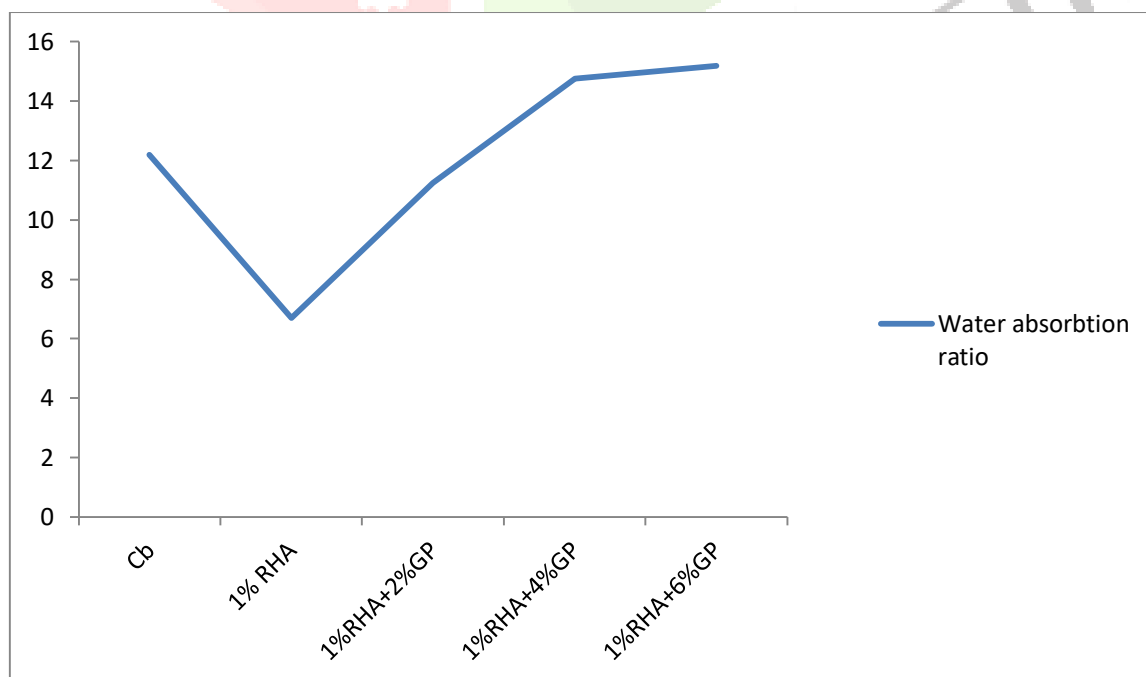


Chart 1- Water absorption ratio for conventional and porotherm brick

Cb- Conventional brick, RHA- Rice Husk Ash, GP- Granite powder

## 5.2 COMPRESSIVE STRENGTH TEST:

Compressive strength tests on bricks are carried out to determine the load carrying capacity of bricks under compression. This test is carried out with the help of Compression Testing Machine. Bricks are generally used for construction purpose hence it is important to know the Compressive strength to determine the sustainability of construction.

$$\text{Compressive strength (N/mm}^2\text{)} = \frac{\text{Maximun load at failure in N}}{\text{Avg.area of the bed faces in mm}^2}$$

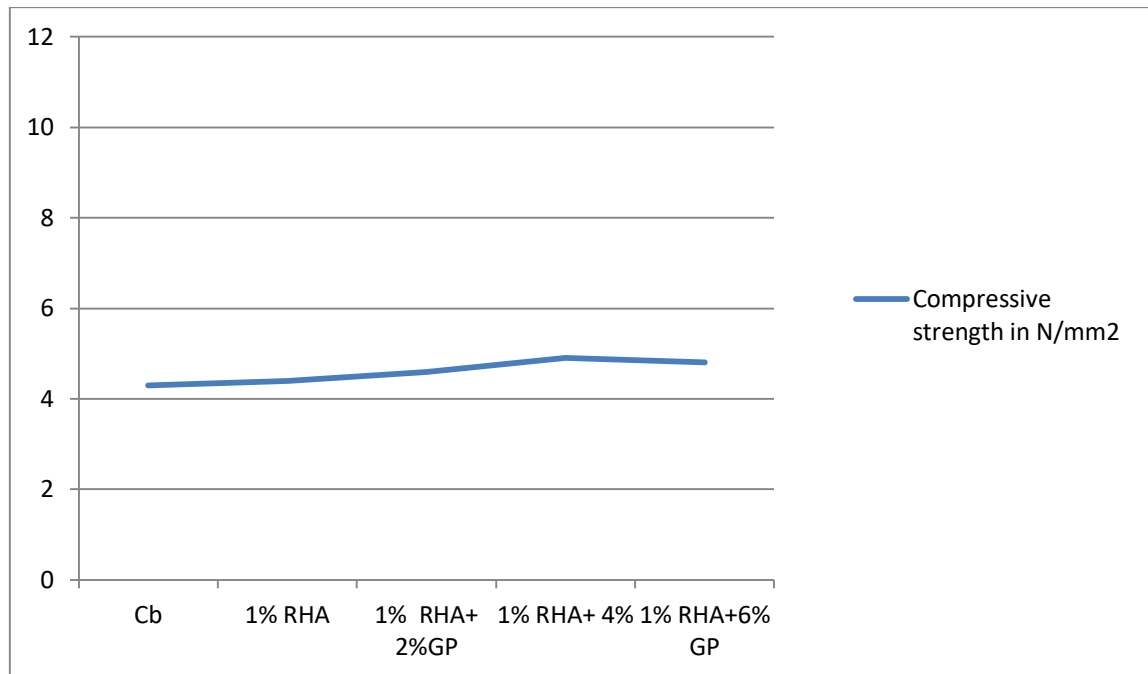
Test results:

**Table 3:** Compressive strength for porotherm brick

Mix design ratio	Load (in KN)	Compressive strength ( in N/mm <sup>2</sup> )
1% rice husk ash+ clay	3.95	4.2
1% rice husk ash+ 2% granite powder + clay	4.0	4.95
1% rice husk ash+ 4% granite powder + clay	4.15	4.8
1% rice husk ash+ 6% granite powder + clay	4.3	4.75

**Table 4:** Compressive strength for conventional brick

Mix design ratio	Load(KN)	Compressive strength( in N/mm <sup>2</sup> )
Trial 1	70	4.2
Trial 2	85	4.0
Trial 3	80	4.21



Cb – Conventional brick, RHA – Rice husk ash, GP- granite powder

## 6. CONCLUSIONS

In porotherm brick, it is possible to add granite powder and rice husk ash including water. Rice husk ash and granite powder is a good binding agent with clay. The weight of bricks can be reduced by adding rice husk ash and granite powder. Porotherm bricks have less water absorption compared to conventional brick. Porotherm bricks have more compressive strength as compared to conventional brick.

## 7. REFERENCES

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