# Experimental Investigation Of Bricks Using Flyash And Marbel Powder

**N.MAHAMOODULHASAN*, S.PREMKUMAR*, A.J.JEYA ARTHI**
***Assistant Professor, Rajalakshmi Engineering College, Chennai***

**Abstract:** The bricks have been used all over the world in every class and kind of building. At present, India has the production capacity to manufacture over 10000 crore bricks through about 45000 local kilns in the unorganized sector.[1] It is understood that about 65 per cent of the bricks in the world goes into dwellings and the balance into commercial, industrial and institutional buildings. This project is to optimize the usage of waste materials in manufacturing the bricks by partially replacing clay. Mixing Various proportions of Fly Ash(10 – 30% by weight, in ratio of dry fly ash to wet clay, at a step of 10% each) and Marble powder (5 – 15% by weight, in ratio of dry marble powder to wet clay, at a step of 5% each).These included water absorption capacity, compressive strength and efflorescence test. Fly ash clay brick and marble powder clay brick gives nil efflorescence. The values of these characteristics for fly ash clay bricks and marble powder clay bricks are excellent and have exceeded those pertaining to clay bricks.. This work presents the results of testing and the advantages gained by this type bricks over conventional clay bricks.

**Keywords:** ***Fly ash, Marble Powder, Compressive Strength Test***

## 1. INTRODUCTION

### 1.1 BRICKS

The bricks are obtained by moulding clay in rectangular blocks of uniform size and then by drying and burning these blocks. In India, the process of brick making has not changed since many centuries except some minor refinements.[11] There has been hardly any effort in our country to improve the brick-making process for enhancing the quality of the bricks.[2] The main reason for this attitude is that the production of bricks has been largely remained confined to the unorganized small sector. Some of the large mechanised brick plants came up in the past. The bricks have established as an age old material right from the thatched house to the multi-storeyed buildings. They were initially handmade and used as load bearing material for various structures.[4] With the passage of time and advent of cement and steel, the frames only are filled up with the burnt clay bricks. The production of burnt clay bricks on a scientific and modern basis including proper mining of clay can lead to the availability of quality bricks.[7]

### 1.2 Fly Ash

In each country utilization of fly ash depends on the local condition and has much to do with the fact that fly ash is multifunctional material and can be used for various purposes. In the building industry fly ash can be used in different ways for different products.[8] In concrete fly ash can be used as partially replacement of cement and/or sand to enhance workability of fresh concrete, to reduce heat of hydration and to improve concrete impermeability and resistance to sulphate attack. The main chemical compounds of class F fly ash are silica, alumina and iron oxide. Other minor constituents include oxides of calcium, magnesium, titanium, sulphur, sodium and potassium

### 1.3 Marble powder

Marble is a metamorphic rock resulting from the transformation of a pure limestone. The purity of the marble is responsible for its colour and appearance: it is white if the limestone is composed solely of calcite (100% $CaCO_3$). Marble is used for construction and decoration; marble is durable, has a noble appearance, and is consequently in great demand. Waste Marble dust (WMD) can be used to improve the mechanical and physical properties of the conventional concrete[6]. The possibility of utilizing WMD as an alternative very fine aggregate in the production of concrete will also induce a relief on waste disposal issues.

# 2. OBJECTIVE

- The main objective of this project is to find suitable replacement material for clay in brick manufacturing.
- To study and compare the characteristics of normal bricks and bricks which are partially material replaced instead of clay.

# 3. MANUFACTURE OF BRICKS

In the process of manufacturing of bricks, the following distinct operations are involved

1. Selection of brick field
2. Preparation of clay
3. Moulding
4. Drying
5. Burning

# 4. TESTING OF BRICKS

Testing of bricks is done to find the suitability for the construction works. According to IS 3495:1992, the method of tests of burnt clay building bricks is suggested. The following are the testing of

a) Compressive strength
b) Water absorption
c) Efflorescence

The following simple tests are also done to find the quality of bricks.

a) Hardness
b) Shape and size
c) Soundness
d) structure

### 4.1.1 Testing of compressive strength of bricks

The compressive strength of brick of brick is found out by placing it in a compression testing machine. It is pressed till it breaks. The minimum compressive strength of bricks is 3.5 $N/mm^2$. The bricks having compressive strength of 7-14 $N/mm^2$ are graded as A and compressive strength having above 14 $N/mm^2$ are graded as AA

### 4.1.2 Absorption test

A brick is taken and it is weighed dry. It is then immersed in water for a period of 24 hours. It is weighed again and difference in weight indicates the amount of water absorbed by the bricks. It should not, in case not exceed, 20 per cent of the weight of the dried bricks.

### 4.1.3 Efflorescence test

The soluble salts, if present in bricks, will cause efflorescence on the surface of bricks. For finding out the presence of soluble salts in a brick. It is immersed in water for 24 hours. It is then taken out and allowed to dry in shade. The absence of grey or white deposits on its surface indicates absence of soluble salts.

**4.1.6 Test Results**

**Water Absorption**

**Table 4.1: Water Absorption of Normal clay bricks and Marble clay bricks**

| Specimen | Water Absorption in percentage (Avg) |
|---|---|
| Normal clay Brick | 12.40 |
| Marble clay brick (5%) | 12.22 |
| Marble clay brick (10%) | 11.27 |
| Marble clay brick (15%) | 12.36 |

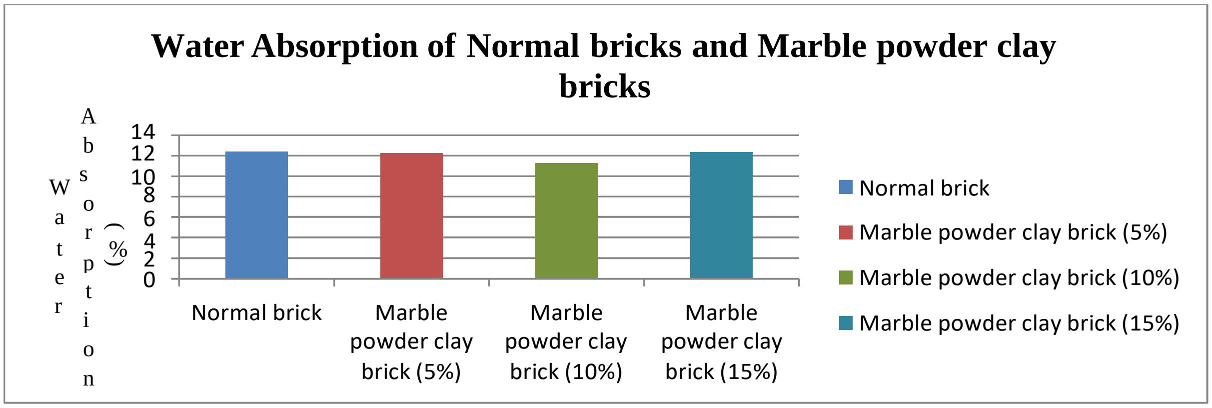


**Fig 4.1: Water absorption of normal clay bricks and Marble powder clay bricks**

**Table 4.2: Water Absorption of Normal clay bricks and Fly ash clay bricks**

| Specimen | Water Absorption in percentage (Avg) |
|---|---|
| Normal Brick | 12.40 |
| Fly ash clay brick (10%) | 13.72 |
| Fly ash clay brick (20%) | 13.24 |
| Fly ash clay brick (30%) | 12.79 |

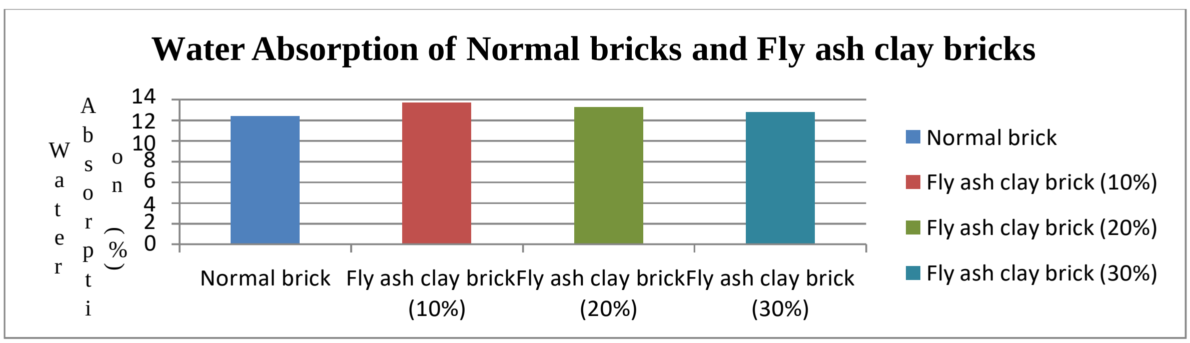


**Fig 4.2: Water Absorption of Normal bricks and Fly ash clay bricks**

**Table 4.17: Compressive strength of Normal clay bricks and Marble powder clay bricks**

| Specimen | Compressive Strength N/mm² (Avg) |
|---|---|
| Normal clay brick | 7.15 |
| Marble powder clay brick (5%) | 7.76 |
| Marble powder clay brick (10%) | 8.33 |
| Marble powder clay brick (15%) | 7.15 |

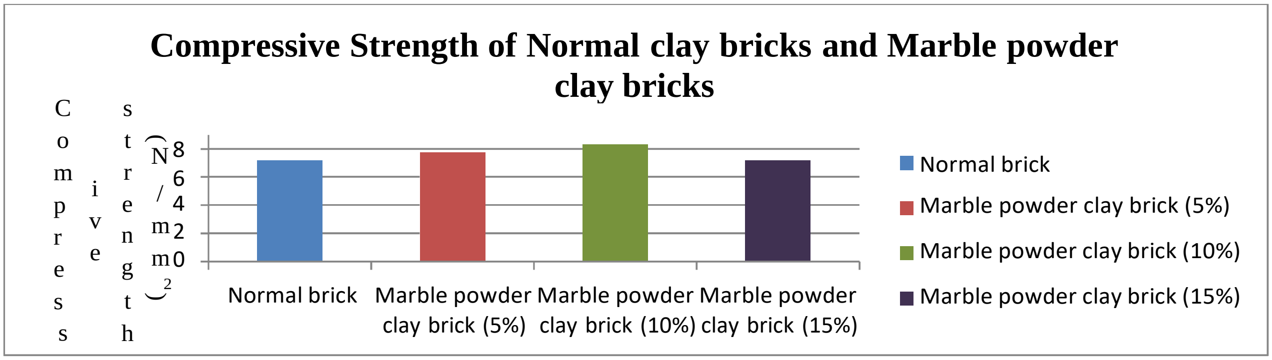


**Fig 4.10 : Compressive strength of Normal clay bricks and Marble powder clay bricks**

**Table 4.18: Compressive strength of Normal clay bricks and Fly ash clay bricks**

| Specimen | Compressive Strength N/mm² (Avg) |
|---|---|
| Normal brick | 7.15 |
| Fly ash clay brick (10%) | 7.55 |
| Fly ash clay brick (20%) | 7.88 |
| Fly ash clay brick (30%) | 8.46 |

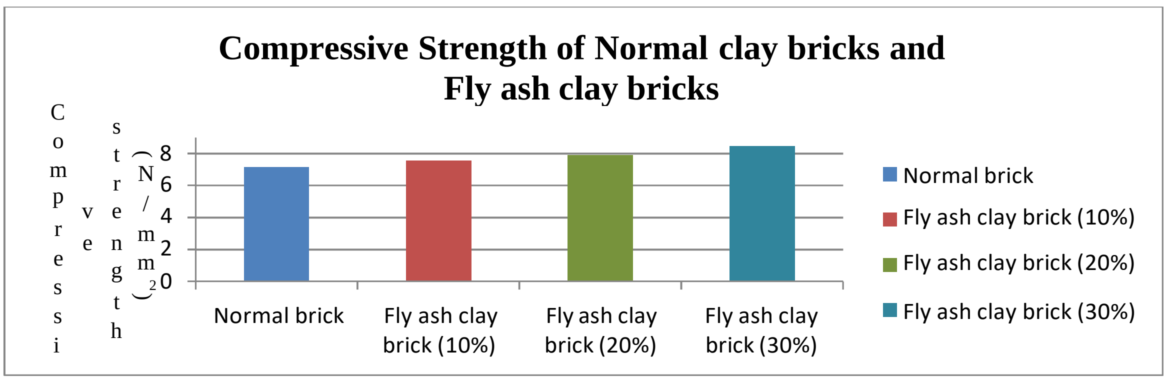


**Fig 4.11: Compressive strength of Normal clay bricks and Fly ash clay brick**

## 4.3 EFFLORESCENCE TEST

The soluble salts, if present in bricks, will cause efflorescence on the surface of bricks. For finding out the presence of soluble salts in a brick. It is immersed in water for 24 hours. It is then taken out and allowed to dry in shade. The absence of grey or white deposits on its surface indicates absence of soluble salts.

**Table 4.3.1: Efflorescence of normal clay bricks**

| S.NO. | %REPLACEMENT OF BRICKS | EFFLORESCENCE (%) | RESULT |
|---|---|---|---|
| 1. | **Normal clay bricks** | < 10 | NIL |
| 2. | **Marble powder clay bricks (5%)** | < 10 | NIL |
| 3. | **Marble powder clay bricks (10%)** | < 10 | NIL |
| 4. | **Marble powder clay bricks (15%)** | < 10 | NIL |
| 5 | **Fly ash clay Bricks (10%)** | < 10 | NIL |
| 6. | **Fly ash clay Bricks (20%)** | < 10 | NIL |
| 7. | **Fly ash clay Bricks (30%)** | < 10 | NIL |

From the above results, it has been identified that no efflorescence has been made on the bricks. Therefore all the bricks have been classified as **CLASS A** bricks.

### 4.4 SHAPE AND SIZE TEST

For this test 20 bricks have been selected randomly and they are stacked lengthwise, width and along height

**Table 4.4.1: Shape and Size test**

| S.NO | SPECIFICATIONS | MEASURED LENGTH(mm) | PERMISSIBLE LIMITS(mm) |
|---|---|---|---|
| 1. | LENGTH | 3847 | 3680-3920 |
| 2. | WIDTH | 1788 | 1740-1860 |
| 3. | HEIGHT | 1813 | 1740-1860 |

Since the results have been within permissible limits, the bricks has classified under good quality bricks.

### 4.5 HARDNESS TEST

No impression had been left on the surface, when a scratch was made on brick surface with the help of finger nail. Therefore the brick is treated to be sufficiently hard.

### 4.6 SOUNDNESS TEST

When two bricks were struck on each other, a ring sound has been produced without breaking of bricks. So, it is classified as good quality bricks.

### 4.7 STRUCTURE TEST

A brick is broken and its structure has been examined. On testing, it is noted that the bricks are homogenous and free from any defects such as holes, lumps, etc.

## 5. CONCLUSION

In this project, our main objective is to reduce the usage of clay in brick manufacturing by replacing clay with waste materials such as fly ash, marble powder, we have replaced clay with marble powder in percentage of 5- 15% and also clay with fly ash by percentage of 10 – 30%.The water absorption value for marble powder and fly ash replaced for clay bricks is 9.1% lesser than the normal clay bricks and fly ash clay bricks have 3.5% more absorption value than normal clay bricks. The partially material replaced bricks are lighter than normal bricks in weight. The compressive strength value for partially material replaced bricks was greater than the normal bricks as per IS 1077-1957, it is also comes under class A bricks.

In that maximum compressive strength was achieved for 10% partially replaced marble powder clay bricks which are about 16.5% more than normal clay bricks and 30% partially replaced fly ash clay bricks which is about 18.32% more than normal clay bricks.

## References


[1] M. Dondi, M. Marsigli, B. Fabbri, Recycling of industrial and urban wastes in brick production – A review, Tile Brick Int. 13 (1997) 218–225.

[2] M. Dondi, M. Marsigli, B. Fabbri, Recycling of industrial and urban wastes in brick production – A review (Part 2), Tile Brick Int. 13 (1997) 302–309.

[3] I. Demir, Effect of organic residues addition on the technological properties of clay bricks, Waste Manage. 28 (2008) 622–627.

[4] S.P. Raut, R.V. Ralegaonkar, S.A. Mandavgane, Development of sustainable construction material using industrial and agricultural solid waste: A review of waste-create bricks, Constr. Build. Mater. 25 (2011) 4037–4042.

[5] L. Zhang, Production of bricks from waste materials – A review, Constr. Build. Mater. 47 (2013) 643–655.

[6] P. Muñoz Velasco, M.P. Morales Ortíz, M.A. Mendívil Giró, L. Muñoz Velasco, Fired clay bricks manufactured by adding wastes as sustainable construction material – A review, Constr. Build. Mater. 63 (2014) 97–107.

[7] S. Neves Monteiro, C.M. Fontes Vieira, On the production of fired clay bricks from waste materials: a critical update, Constr. Build. Mater. 68 (2014) 599–610.

[8] C. Bories, M.E. Borredon, E. Vedrenne, G. Vilarem, Development of eco-friendly porous fired clay bricks using pore-forming agents: a review, J. Environ. Manage. 143 (2014) 186–196.

[9] I. Demir, M.S. Baspınara, M. Orhan, Utilization of kraft pulp production residues in clay brick production, Build. Environ. 40 (2005) 1533–1537.

[10] M. Sutcu, S. Akkurt, The use of recycled paper processing residues in making porous brick with reduced thermal conductivity, Ceram. Int. 35 (2009) 2625– 2631.

[11] D. Rajput, S.S. Bhagade, S.P. Raut, R.V. Ralegaonkar, S.A. Mandavgane, Reuse of cotton and recycle paper mill waste as building material, Constr. Build. Mater. 34 (2012) 470–475.

[12] M. Sutcu, J.J. del Coz Diaz, F.P. Alvarez Rabanal, O. Gencel, S. Akkurt, Thermal performance optimization of hollow clay bricks made up of paper waste, Energy Build. 75 (2014) 96–108.

[13] I. Demir, An investigation on the production of construction brick with processed waste tea, Build. Environ. 41 (2006) 1274–1278.

[14] K.Y. Chiang, P.H. Chou, C.R. Hua, K.L. Chien, C. Cheeseman, Lightweight bricks manufactured from water treatment sludge and rice husks, J. Hazard. Mater. 171 (2009) 76–82.

[15] D. Eliche-Quesada, F.A. Corpas-Iglesias, L. Pérez-Villarejo, F.J. Iglesias-Godino, Recycling of sawdust, spent earth from oil filtration, compost and marble residues for brick manufacturing, Constr. Build. Mater. 34 (2012) 275–284