COMPRESSIVE STRENGTH OF FLY ASH BRICKS

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Abstract – fl*y ash is fine solid particles of ashes, dust, and soot carried out from burning fuel (such as coal or oil). It is a fine powder that is a by-product of burning pulverized coal in electric generation power plants. Fly ash is a substance containing aluminous and siliceous material that forms cement in the presence of water. When mixed with lime and water, fly ash forms a compound similar to Portland cement. This makes fly ash suitable as a prime material in blended cement, mosaic tiles, and hollow blocks, among other building materials. When used in concrete mixes, fly ash improves the strength and segregation of the concrete and makes it easier to work. Fly ash can be used as prime material in many cement-based products, such as concrete block, and brick. One of the most common uses of fly ash is in Portland cement concrete pavement or PCC pavement. Road construction projects using PCC can use a great deal of concrete, and substituting fly ash provides significant economic benefits*

1. INTRODUCTION

The main aim of this paper is to compare compressive strength of flyash bricks of different compositions. These bricks can be used as a building material, specifically masonry units.

Main ingredients include fly ash, water, quicklime, river sand and gypsum. Gypsum acts as a long term strength gainer. The finished product is a lighter Block less than the weight of conventional Bricks, while providing the similar strengths.

FLYASH BRICKS

Fly ash brick requirements of IS: 12894.

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Bricks classified into following groups in our project –

- Flyash lime bricks
- Flyash cement bricks
- Flyash red iron oxide bricks
- Flyash banana fibre brick

Flyash lime bricks

In presence of moisture, fly ash reacts with lime at ordinary temperature and forms a compound possessing cementitious properties. After reactions between lime and fly ash, calcium silicate hydrates (C-S-H) are produced which are responsible for the high strength of the compound. This process involves homogeneous mixing of raw materials (generally fly ash, sand and lime), moulding of bricks and then curing of the green bricks.

Some technologies call for usage of chemical accelerator like gypsum. These processes are almost similar and vary slightly from water curing . Bricks made by mixing lime and fly ash are, therefore, chemically bonded bricks. These bricks are suitable for use in masonry just like common burnt clay bricks. These bricks possess adequate crushing strength as a load-bearing member and are lighter in weight than ordinary clay bricks. Generally, dry fly ash available from power plants meets the properties specified in IS: 3812 and is suitable for manufacture of Fly Ash – lime bricks in accordance with the requirements of IS: 12894

Flyash cement bricks

In this Mix design, gypsum and lime are replaced with cement. This mix ratio is not so popular and not a profitable design for entrepreneurs. Cement is more expensive than Gypsum and Lime, hence this formula is useful only during non-availability of gypsum and lime

Flyash banana fibre bricks

Banana fibers are widely available worldwide as agricultural waste from Banana cultivation. Banana fibers are environmentally friendly and present important attributes, such as low density, light weight, low cost, high

LENGTH Mm	WIDTH mm	HEIGHT mm
190	90	90
190	90	40

tensile strength, as well as being water and fire resistant. This kind of waste has a greater chance of being utilized for different application in construction and building materials. This focused on the use of banana fiber and its compressive strength .

Flyash red iron oxide bricks

In the construction industry, iron oxide is the most commonly employed pigment for producing colored and/or decorative concrete, and for good reason; not only can iron oxide produce a range of color possibilities in the earthtone family.

REQUIREMENTS OF FLY ASH BRICKS AS PER IS 12894 : 2002

GENERAL REQUIREMENT:

Visually the bricks shall be sound, compact and uniform in shape. The bricks shall be free from visible cracks, war-page and organic matters.

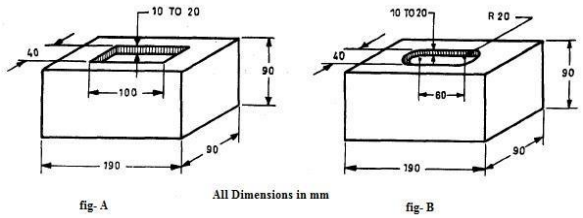


FIG.BRICKS DIMENSIONS

Hand-moulded bricks of 90 mm or 70 mm height shall be moulded with a frog 10 to 20 mm deep on one of its flat sides; the shape and size of the frog shall conform to either Fig. 3A or Fig. 3B. Bricks of 40 or 30 mm height as well as those made by extrusion process may not be provided with frogs.

The bricks shall be solid and with or without frog 10 to 20 mm deep on one of its flat side. The shape and size of the frog shall conform to either Fig. 3A or Fig.3B.

The bricks shall have smooth rectangular faces with sharp corners and shall be uniform in shape and colour.

DIMENSIONS AND TOLERANCES:

The standard ***modular sizes*** of pulverized fuel ash-lime bricks shall be as following table:-

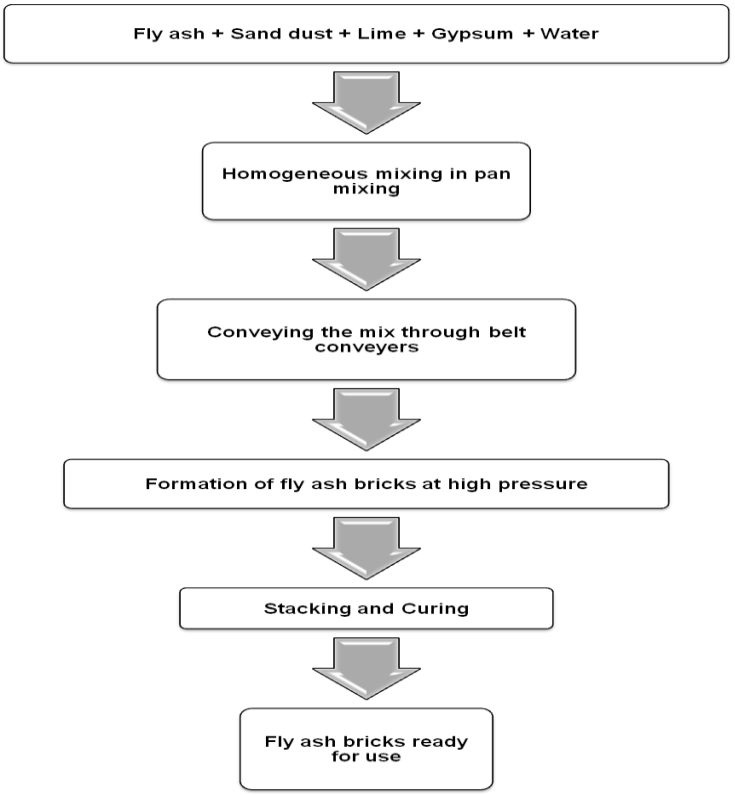
The following ***non-modular sizes*** of the bricks may also be used

LENGTH Mm	WIDTH mm	HEIGHT mm
230	110	70
230	110	30

2.MATERIALS REQUIRED

- Flyash
- Gypsum
- Lime
- River Sand

METHODOLOGY OF WORK



s.no	Dimension			Area of bed (mm^2)	Max. load at failure (KN)	Compressive strength (N/mm^2)
	Length (mm)	Width (mm)	Height (mm)			
1.	225	107	70	15750	87	5.496
2.	225	107	70	15750	88	5.602
						5.549

TESTING OF FLYASH BRICKS

Compressive Strength (N/mm^2)

S.no	Dimension			Area of bed (mm^2)	Max. load at failure (KN)	Compressive strength (N/mm^2)
	Length (mm)	Width (mm)	Height (mm)			
1.	225	107	75	16875	87	5.153
2.	225	107	75	16875	94	5.546
						5.3495

$$\frac{\text{Max.Load at Failure in N}}{\text{Avg.Area of Bed face in mm2}}$$

S,no	Dimension			Area of bed (mm^2)	Max. load at failure (KN)	Compressive strength (N/mm^2)
	Length (mm)	Width (mm)	Height (mm)			
1.	225	107	75	16875	169	10.06
2.	225	107	70	15750	155	9.86
						9.96

FOR SAMPLE 1 (FLYASH LIME GYPSUM BRICK)

The avg. compressive strength of this sample is **5.4** N/mm^2

S.no.	Dimension			Area of bed (mm^2)	Max. load at failure (KN)	Compressive strength (N/mm^2)
	Length (mm)	Width (mm)	Height (mm)			
1.	225	107	75	16875	74	4.37
2.	225	107	70	15750	78	4.96
						4.665

FOR SAMPLE 2 (FLYASH CEMENT BRICK)

The avg. compressive strength of this sample is **9.9N**/mm^2

FOR SAMPLE 3 (FLYASH RED OXIDE BRICK)

The avg. compressive strength of this sample is **4.6** N/mm^2

FOR SAMPLE 4 (FLYASH BANANA FIBRE RED OXIDE BRICK)

The avg. compressive strength of this sample is **5.5** N/mm^2

RESULT:-

The avg. compressive strength of flyash lime brick is **5.4** N/mm^2

The avg. compressive strength of flyash cement brick is **9.9** N/mm^2

The avg. compressive strength of flyash banana fibre brick is **5.5** N/mm^2

The avg. compressive strength of flyash red iron oxide brick is **4.6** N/mm^2

CONCLUSION

- The compressive strength of brick is maximum as the cement is added as a replacement of gypsum and lime.
- The compressive strength of brick is minimum as the red oxide is added as a replacement of gypsum and lime.
- The cost of fly ash cement brick goes up as the cement is costly compared to the fly ash.
- The use of fly ash for manufacturing of bricks is useful as it is economical and eco-friendly.

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