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FLY ASH BRICK: GLASS FIBRE THE INNOVATIVE CONCEPT FOR GETTING HIGHER STRENGTH BRICK

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Abstract: **Experiments have been carried out by several materialslike Fly ash, lime, sand, Kheda dust, Glass fibre for the manufacturing of the brick.The fly ash of 'F' category was used as a raw material for making fly ash bricks. The combination of fibre fly ashbrick have different percentage of theGlass fibre adding like 0.2%, 0.4%, 0.6%, 0.8%, 1.0%. In the testing of the fibre fly ash brick there are main two type of the testing is done compressive strength test and water absorption test after 7, 14, 21days. With Changing (increasing) in the percentage of the Glass fibre of compressive strength of the fibre fly ash brick is increase and water absorption is decrease.**

Key words: Class 'F' Fly ash, Fibre fly ash brick, Compression, Water absorption

I INTRODUCTION

Energy requirements for the developing countries in particular area get energy from coal. The disposal of the increasing amounts of thermal waste from coal-fired thermal power plants, this disposal of the thermal waste is called fly ash. Fly ash is composed of the non-combustible mineral portion of coal consumed in a coal fuelled power plant.Fly ash is a powdery substance obtained from the dust collectors in the electrical power plants that use coal as fuel. There are two basic type of fly ash Class F and Class C.

Glass fibre is a material consisting of numerous extremely fibres of glass. Fibre glass is a light weight, extremely strong material. These fibres are commonly used in the construction industries for high performance. Their particular characteristic is their high strength. Glass is mainly made from silicon (SiO_2) with a tetrahedral structure (SiO_4). Some aluminium oxides and other metallic ions are then added in various proportions to either ease the working operations or modify some properties

II EXPERIMENTAL MATERIALS

[1] Fly ash (Class F)

The burning of anthracite and bituminous coal typically produces Class F fly ash which contains less than 10% lime (CaO).This ash has pozzolanic properties. In the presence of water and free lime, the ash will react into cementitious compounds.

Fig 1: Class F fly ash

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Source: Rudraksh Brick Work, Jay Maharaj Construction, Napad

TABLE 1
PROPERTIES OF CLASS F FLY ASH

Sr No	Properties	Class F Fly ash
1	SiO_2 +Al_2O_3+Fe_2O_3,min%	70%
2	Sulfur trioxide (SO_3),max%	5%
3	Moisture content , max%	3%
4	Loss of ignition , max%	6%

Source:http://www.google.com/patents/EP2176186

[2] Lime

Lime is produced by heating limestone which is more or less pure calcium carbonate. The lime is not generally found in the nature in the Free State but it is obtained by burning one of the following materials

- Limestone found in limestone hills.
- Limestone builders found in the beds of Old River.

Fig 2: lime
Source: Rudraksh Brick Work, Jay Maharaj Construction, Napad

[3] Sand

Sand is one type of the natural material. The composition of sand is highly variable, depending on the local rock sources and conditions, but the most common constituent of sand is silica (Silicon dioxide, or SiO_2), usually in the form of quartz.There are three types of the sand as per ISO 14688 the range are as under.

TABLE 2
PARTICLE SIZE DISTRIBUTION

Sr No	Types of sand	Particle size
1	Fine	0.06mm to 0.2mm
2	Medium	0.2mm to 0.63mm
3	Coarse	0.63mm to 2.0mm

Fig 3: Sand

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Source: Rudraksh Brick Work, Jay Maharaj Construction, Napad

[4] Kheda dust

Kheda dust is a onetype of the fine sand. In the manufacturing of the brick Kheda dust is used for making finished bricks.

Fig 4: Kheda dust
Source: Rudraksh Brick Work, Jay Maharaj Construction, Napad

[5]Glass fibre

In this experimental work alkali resistance glass fibres used in different percentage like 0.2%, 0.4%, 0.6%, 0.8%, 1.0%. Alkali-resistant glass containing 16% zirconia was successfully formulated in the 1960's and by 1971 was in commercial production in the UK. Other sources of alkali-resistant glass were developed during the 1970's and 1980's in other parts of the world. Glass fibre is available in continuous or chopped lengths. 12-mm lengths are used in this work.

TABLE 3
PROPERTIES OF GLASS FIBRE

Properties	Value
Specific gravity	2.68 g/cm3
Softening point	860-1580^{0}c
Electrical conductivity	Very low
Chemical resistence	Very high
Tensile strength	1700 Mpa
Moisture	0.3%
Filament dia	14µm

Source: Material data sheet of CEM-FIL Company

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Fig 5: Glass fibre

III MIX PROPORTION

Different mix proportion of the fibre fly ash brick in percentage are as under.

TABLE 4
MATERIAL MIX PROPORTION

Sample code	Fly- ash	Lime	Sand	Kheda dust	Glass fibre
GF (0%)	60%	10%	15%	15%	0%
GF (0.2%)	60%	10%	15%	15%	0.2%
GF (0.4%)	60%	10%	15%	15%	0.4%
GF (0.6%)	60%	10%	15%	15%	0.6%
GF (0.8%)	60%	10%	15%	15%	0.8%
GF (1.0%)	60%	10%	15%	15%	1.0%

IV EXPERIMENTAL METHOD

[A] Crushing strength test

Preconditioning:

Remove unevenness observed in the bed faces to provide two smooth and parallel faces by grinding. Immerse in water at room temperature for 24 hours. Remove the brick and drain out any surplus moisture at room temperature. Fill the frog and all void in the bed face flush with cement mortar. Store under the damp jute bags for 24 hours followed by immersion in clean water for 3 days. Remove the brickfrom the water and used for checking the strength.

Procedure:

Place the brick with flat faces horizontal, and mortar filled face facing upwards between two plywood sheets each of 3mm thick and carefully cantered between plates of the testing machine. Apply load axially at a uniform rate of 14 N/mm2 per minute till failure occurs and note the maximum load at failure. The load at failure at which the specimen fails to produces any further increase in the indicator reading on the testing machine.

Fig 6: Compressive strength testing

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TABLE 5
COMPRESSIVE STRENGTH TEST RESULTS

Sample	Compressive strength (N/mm²)		
	7 Days	14 Days	21 Days
GF (0%)	2.12	2.62	2.99
GF (0.2%)	2.35	3.32	3.34
GF (0.4%)	2.77	3.86	4.01
GF (0.6%)	3.19	4.26	4.48
GF (0.8%)	3.55	4.66	5.16
GF (1.0%)	3.97	5.04	5.86

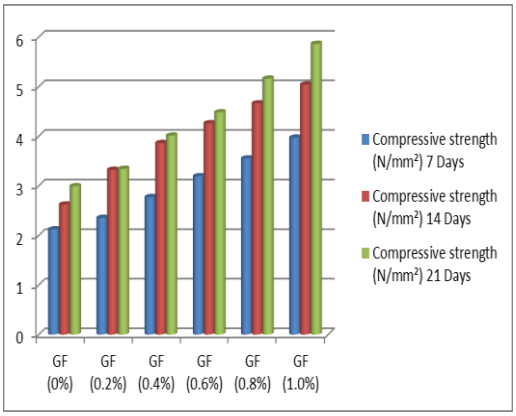

Fig 7: Compressive strength graph at 7, 14, 21 days

[B]Water Absorption test

Preconditioning:

Dry the brick before weighting.

Procedure:

In the water absorption test procedure first dry the brick and obtain the weight (M1) then after a brick is put in the water pond for 24 hours. After 24 hours bricks are removed from water and after 3 minutes the weight of the brick is measured. The measured weight is called the weight (M2)

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Fig 8: Water absorption test

TABLE 6
WATER ABSORPTION TEST RESULTS

Sample	Water absorption in %		
	7 Days	14 Days	21 Days
GF (0%)	16.88	14.54	13.36
GF (0.2%)	15.28	14.09	14.40
GF (0.4%)	14.74	13.47	12.16
GF (0.6%)	14.17	13.45	12.08
GF (0.8%)	13.63	13.8	12.53
GF (1.0%)	13.26	12.65	12.32

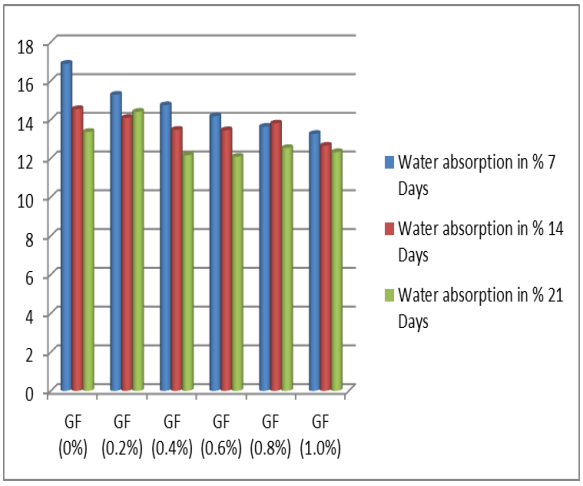

Fig 9: Water absorption graph at 7, 14, 21 days

V COST ANALYSIS

Sr. No	Types of brick	Cost of one fly ash brick
1	0% Glass Fibre Fly ash brick	2.40
2	0.2% Glass Fibre Fly ash brick	4.10
3	0.4% Glass Fibre Fly ash brick	6.00
4	0.6% Glass Fibre Fly ash brick	7.90
5	0.8% Glass Fibre Fly ash brick	9.70
6	1.0% Glass Fibre Fly ash brick	11.40

VICONCLUSION

After all the efforts and learning of local technologies and practices and with the help of experimental investigation, the following observations are made by adding Glass fibre in fly ash bricks with different percentage and also minimize impacts on the environmental by utilization of Class Ffly ash in the manufacturing of bricks.

(a) Increase the percentage of the fibre in brick the compressive strength of the brick is increase and the water absorption of the brick is decrease. In this experimental work 1% fibre addition in the brick gives the maximum strength 5.86 N/mm^{2}after 21 days.

(b) Increase the compressive strength of the brick the water absorption of the brick is decrease. In this experimental work maximum compressive strength after 21 days 5.86 N/mm^2 in this time minimum water absorption 12.32% after 21 days.
(c) Increase the percentage of glass fibre strength of the brick is increase but the cost of the brick is also increase. The maximum higher strength brick cost is 11.4 Rs. per number of brick.
(d) Cost of this brick is high but if we use this brick mix for the replace as PCC (Plain Cement Concrete, BBCC (Brick Bat Cement Concrete), RCC (Reinforced Cement Concrete) at plinth level and also it can be used in compressive element so the cost of the PCC, BBCC and RCC is decreases.
(e) After this experimental study it proves that the Class F fly ash is used for the manufacturing of bricks.

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