Experimental Investigation of Fly Ash Brick With Addition of Lime, Gypsum And Quary Dust

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Abstract- *Although the use of fly ash has many advantages, its low hydration at early stage causes the strength to be low. In this study, the experimental investigation was carried out to find the optimum mix percentage of fly ash brick. However the brick specimen of size 230mm x 110mm x 80mm . Since fly ash is being accumulated as waste material in large quantity near thermal power plants and creating serious environmental pollution problems, its utilization as main raw material in the manufacture of bricks will not only create sample opportunities for its proper and useful disposal but also control environmental pollution to a greater extent in the surrounding areas of power plants. Different mix percentage fly ash(60% to 35%) lime(12to26%), gypsum(3%) and quarry dust(25% to 35%) at various proportions. The are test water absorption, shape and size, density, weight, porosity, Hardness, Structure, and compressive strength of Fly Ash bricks compare with normal clay bricks that delivered good results. From the present study, it can be concluded that Fly Ash bricks used as an alternative to clay bricks.*

Keywords- fly ash, gypsum, quarry dust,compressive strength

I. INTRODUCTION

During the India day by days the growth of development is increased that requires of electricity generated from the thermal power plant and this plant gives residue in the form of Fly Ash in major quantity. The rate of generation of Fly Ash far exceeds the increasing growth rate of its user In the present scenario in the construction industry, use of economic and environmental friendly material is of a great concern. One of the main ingredients used is cement. It is observed from various studies that the heat emitted from cement accounts to a greater percentage in global warming. In the present work the attempt has made to find the optimum mix percentage of to obtain maximum compressive strength of fly ash brick admixed with lime, gypsum and quarry dust at various proportions. An economical alternative to conventional burnt clay bricks will be available if these materials can be used to make bricks of adequate strength.

II. LITERATURE REVIEW

Balamurugan and Perumal (2013)

Has suggested that maximum compressive strength, Tensile strength and flexural strength can be obtained at only 50% replacement of sand with quarry dust

Sumathi A and K. Saravana Raja Mohan (2015)

Reported changes in compressive strength of fly ash bricks by addition of fly ash quarry dust and lime.

Tapsh behl and Rachit (2015)

Has suggested that maximum compressive strength, tensile strength and flexural strength can be obtained only at 60% replacement of sand with quarry dust.

P.P. Gadling Dr. M.B. Varma (2016)

The absorption coefficient, shape and size,weight, thermal conductivity and compressive strength of Fly Ash bricks compare with normal clay bricks that delivered good results. From the present study, it can be concluded that Fly Ash bricks used as an alternative to clay bricks.

Arati shetkar and Moghal (2016)

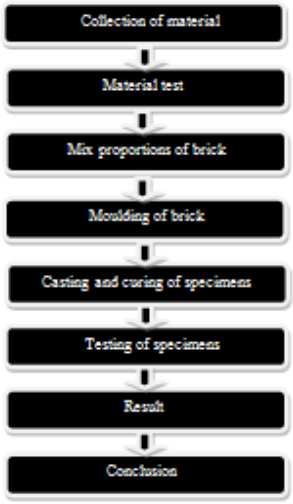
Have reported that strength of fly ash, lime mix increases only up to the addition of optimum lime content as higher content beyond the optimum may have deleterious effect.

OBJETIVES

- To provide higher safety to building and increase the strength of bricks
- To increase the strength and stability of bricks by adding fly ash
- To improve the compressive strength to estimate the stability and durability

- To maintain the uniform size and shape of fly ash brick

III. METHODOLOGY



MATRIALS USED

Fly Ash: The fly ash procured from Thermal Power Plant , Mettur, india. Fly ash is one of the numerous substances that cause air, water and soil pollution, disrupt ecological cycles and set off environmental hazards

Lime: Commercially available lime in the local market was used in the study. Lime is an important binding material in building construction. It is basically Calcium oxide (CaO) in natural association with magnesium oxide (MgO)

Gypsum: Commercially available gypsum in the local market was used in the study .Gypsum is a non- hydraulic binder occurring naturally as a soft crystalline rock or sand

Quarry dust: Stone dust was obtained from a local stone crushing site and was used in the study**.** It is residue taken from granite quarry Quarry dust is locally available.

IV. MIX PROPORTONS

Proportioning of raw materials in an important aspect of ensuring of quality of bricks .The proportioning will depend on the quality of raw material and the class of bricks required.

Mix Proportions	Fly ash (%)	Lime (%)	Gypsm (%)	Quarry dust (%)
I	60	12	3	25
II	55	15	3	27
III	50	20	3	27
IV	45	22	3	30
V	40	25	3	32
VI	35	26	3	35

V. MANUFACTURING OF BRICKS

The normal hand mould is used to cast the bricks with the standard size of 230mm x 110mm x 80mm.They were cast according to the standard procedure with various mix proportions arrived.

The required quantity of Fly ash, Lime, Gypsum, Quarry dust is calculated previously, according to that the materials mixed properly. Then required quantity of water was added. Then they mixed thoroughly.

Then the prepared mix was poured in to the mould and it is compacted. After compacting gets over then the mould is removed. Then the wet brick was kept under air curing for 2 days and then bricks were water cured for a period of 7,14,21 days.

Test are applied to bricks

Compressive Strength Test
Water absorption Test
Effloroscences
Hardness Test
Structure Test

VI. TEST ON BRICK

Compressive strength test

The compressive strength of flyash brick is three times greater than the normal clay brick. The minimum compressive strength of clay brick is 3.5 N/mm².So as the flyash brick has compressive strength of 10-12 N/mm². Bricks to be used for different works should not have compressive strength less than as mentioned above. The universal testing machine is used for testing the compressive strength of bricks. After the curing period gets over bricks are kept for testing. To test the specimens the bricks are placed in the calibrated Compression testing machine of capacity 3000 kN applied a load uniform at the rate of 2.9 kN/min. The load at failure is

the maximum load at which specimen fails to produce any further increase in the indicator reading on the testing machine. In that three numbers of bricks were tested for each mix proportion. Each brick may give different strength. Hence, average of three bricks was taken.

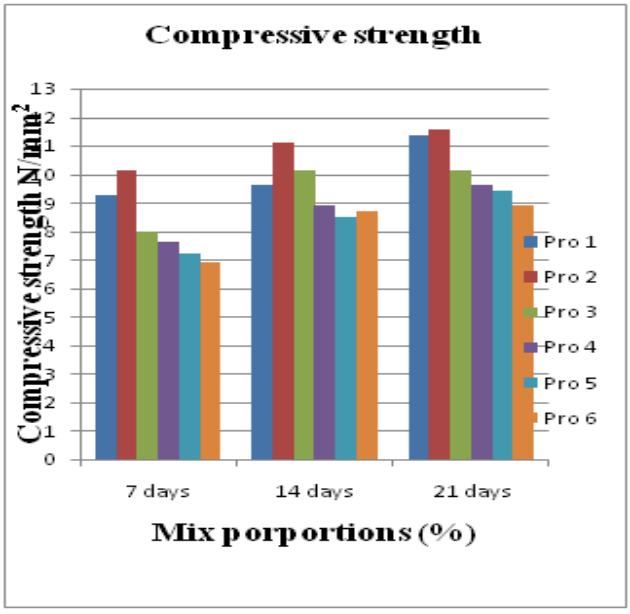
Compressive strength= $\frac{\text{Load}}{\text{Area}}$

Conventional of normal clay brick

Sample	Compressive strength in N/mm²		
	7 days	14 days	21 days
I	2.89	3.86	4.83
	2.65	3.62	5.31
	2.41	3.86	5.55

Special of fly ash brick

Mix Proportions	Compressive strength in N/mm²		
	7 days	14 days	21 days
I	9.25	9.6	11.35
II	10.14	11.11	11.59
III	7.97	10.14	10.14
IV	7.63	8.93	9.6
V	7.24	8.49	9.42
VI	6.90	8.69	8.93



Water absorption test

Fly ash Bricks should not absorb water more than 12%. The bricks to be tested should be dried in an oven at a temperature of 105 to 115° C till attains constant weight cool the bricks to room temperature and weight (W1). Immerse completely dried and weighed W1 brick in clean water for 24 hrs at a temperature of 27±20 Degree Celsius. Remove the bricks and wipe out any traces of water and weight immediately (W2).

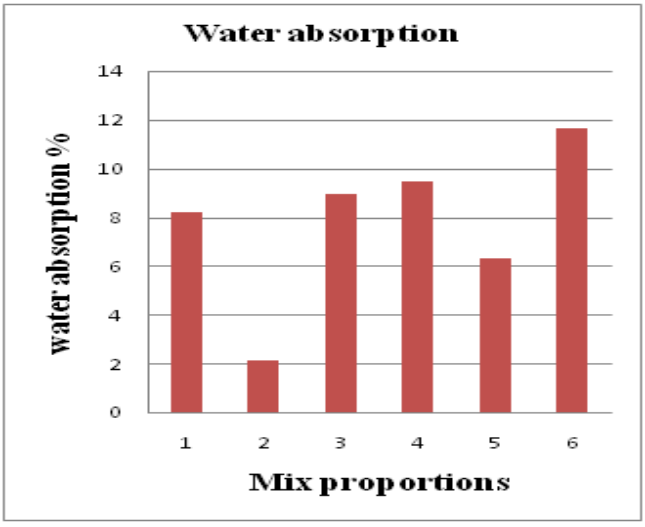
Water absorption in % = (W2 – W1/W1) x 100

Conventional of normal clay brick

Sample no	Dry weight	Wet weight	Water absorption
1	2.93	3.43	17.06
	2.96	3.41	15.2

Special of fly ash brick

Proportion	Dry weight W_1 (%)	Wet weight W_2 (%)	Water absorption (%)
I	2.227	2.410	8.210
II	2.237	2.320	2.100
III	2.071	2.256	8.930
IV	2.101	2.300	9.470
V	2.171	2.308	6.310
VI	2.190	2.445	11.640



EFFLORESCENCE

For this test, brick was placed vertically in water with one end immersed. The depth of immersion in water being 2.5 cm, then this whole arrangement should be kept in a warm-well-ventilated room temperature of 20-30 ^{0} C until all evaporates. When the water in the dish is absorbed by the brick and surplus water evaporates. When the water is completely absorbed and evaporated place similar quantity of water in dish and allows it to absorb and evaporate as before. Examine the brick after this and find out the percentage of white spots to the surface area of brick. If any difference is observed because of presence of any salt deposit then the rating reported as 'effloresced'. If no difference is noted, the rating is reported as 'not effloresence'. Percentage of white spot in the brick = Nil

Soundness

S.NO	Results
I	Clear metallic ringing sound and no damage caused while struck with other brick
II	Sound arose while struck with other brick, but its not highly audible one, and the brick has damage
III	No sound has got and edges of the bricks get damages
IV	No damage on brick but no sound arose while struck with other brick due to presence of high amount of plastic inside the brick
V	Minor damage on brick on brick while conducting the test
VI	Sides of the brick got broke while struck with other brick due to excessive plastic presence

Hardness test

In this test a scratch is made on brick surface with a hard thing. If that doesn't of any impression on brick then that is good quality brick**.**

Structure test

In this a brick is broken or a broken brick is collected and closely observed. If there are any flows , cracks or holes present on that broken face then that isn't good quality brick

VII. CONCLUSION

Masonry brick can be conventionally prepared economically by using industrial wastes like fly ash, lime, gypsum, quarry dust and low cost brick, easy manufacture. .Due to lover water penetration seepage of water through brick is considerably reduced. It no efflorescence .Due to uniform size of bricks mortar required for joints and plaster reduced by 50% and because of high strength practically there will be no breakage during transport and use

From the results it was inferred that, among the six proportions the maximum optimized compressive strength is obtained for optimal mix percentage of Fly ash-55%Lime-15 %Gypsum-3% Quarry dust- 27%as 11.59 N/mm^2.

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