EXPERIMENTAL STUDY ON THE FLY ASH BRICK

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Abstract: Fly ash is a fine, glass-like powder recovered from gases created by coal-fired electric power generation.. In this mix the quantity of fly ash replace with the dust, more addition of fly ash (60%) in the brick mix and quantity of dust is less with the addition of percentage as 20%, 15% and 10%.. The maximum compressive strength of the brick is 8.59 N/mm^2 at 40% F.A. and 30% dust. The compressive strength of the third mix is going to decrease as the percentages of fly ash are going to be increase. Quantity of fly ash is more in this mix so the strength is going to down. The maximum compressive strength of the brick is 4.26 N/mm^2 at 60% F.A. and 10% dust. The maximum compressive strength of the brick is 1.46 N/mm^2 at 20% F.A. and 50% dust. The compressive strength of second mix is going to increase as the percentages of fly ash are going to be increase. The maximum compressive strength of the brick is 8.59 N/mm^2 at 40% F.A. and 30% dust. The compressive strength of the third mix is going to decrease as the percentages of fly ash are going to be increase. Quantity of fly ash is more in this mix so the strength is going to down. The maximum compressive strength of the brick is 4.26 N/mm^2 at 60% F.A. and 10% dust. The optimum compressive strength is getting at 40% addition of fly ash.

Keywords: Fly ash, Compressive Strength, Brick

I. INTRODUCTION

Pulverized fuel ash commonly known as fly ash is a useful by-product from thermal power stations using pulverized coal as fuel and has considerable pozzolonic activity. This national resource has been gainfully utilized for manufacture of pulverized fuel ash-lime bricks as a supplement to common burnt clay buildings bricks leading to conservation of natural resources and improvement in environment quality.

Fly ash closely resembles with volcanic ashes used in production of the earliest known hydraulic cements about 2,300 years ago. Those cements were made near the small Italian town of Pozzuoli - which later gave its name to the term "pozzolan.". A pozzolan is a siliceous or siliceous / aluminous material that, when mixed with lime and water, forms a cementitious compound. Fly ash is the best known, and one of the most commonly used, pozzolan in the world. Fly ash is an inexpensive replacement for Portland cement used in concrete, while it actually improves strength, segregation, and ease of pumping of the concrete. Fly ash is also used as an ingredient in brick, block, paving, and structural fills.

In recent years more and more attention is being paid on the environmental impact of building materials. The constantly are increasing cost of energy and raw materials force the construction industry to think about alternatives such as renewable energy sources and raw materials, and the reduction of waste. Climate change and environmental pressures are major drivers for the promotion of sustainable building materials. Furthermore, this trend is spreading fast and the first international documents stating intent of being more eco friendly are present. In this paper study on the fly ash brick and check the compressive strength after 28 days of curing of water with the different dosages of fly ash and dust.

1.1 Properties of Fly Ash

Fly ash is a fine residue obtained from thermal power stations using ground or powered coal as boiler fuel. It can be utilized in various forms as building material. The thermal power stations in the country throw large quantities of fly ash which goes as waste but which could be effectively used as partial replacement of cement. BIS prescribes a fineness corresponding to specific area of 3200 sq-cm/gm but as the fly ash normally obtains is found to have a specific area of 2500 to 6000 sq-cm./gm. The ISI prescribes a minimum puzzolanic activity of 50 kg per sq-cm. and the fly ash normally obtained fully satisfies this stipulation.

II. COMPOSITION OF NORMAL CLAY BRICKS AND FLY ASH BRICKS

Fly Ash Bricks Normal Clay Bricks	Fly Ash Bricks Normal Clay Bricks
A) Fly ash- 60-65% Sand/Stone dust- 20-25% Hydrated lime- 8-12% Gypsum-5% B) Fly ash- 50% to 60% Sand/stone dust – 32%-40% Cement – 8-10%	Silica (sand) – 50% to 60% Alumina (clay) – 20% to 30% Lime – 2 to 5% Iron oxide – _ 7% Magnesia – less than 1%

2.1 Fly ash Lime Bricks Specification

Fly ash-lime bricks are generally manufactured by inter-grinding or blending various raw materials which are then moulded into bricks and subjected to curing cycles at different temperatures and pressures. On occasions, as and when required, crushed bottom ash or sand is also used in the composition of the raw material. Crushed bottom ash or sand is used in the composition as a coarser material to control water absorption in the final product. Fly ash reacts with lime in presence of moisture to form a calcium silicate hydrate which is the binder material. Thus fly ash-lime brick is a chemically bonded brick.

Figure 2.1: Fly ash Brick

III. PROPERTIES OF THE FLY ASH LIME BRICKS

Properties	Specifications
Size :	9" x 4.5" x 3" (230 x 110 x 70 mm)
Colour	Cement Gray
Bulk Density	1550 Kg/m3
Unit Weight	3.0- 3.2 Kg.

Water Absortion	15 -20%
Crushing Strength	100- 120 Kg/m2
Free lime content	Less Than 0.2%
As per CBRI Roorkee	
Brick Weight	2.5-3 Kg
Brick Size	Machine Made Modular size 20 cm x 10 cm x 10 cm

IV RESULT AND DISCUSSION OF THE FLY ASH BRICK

This is standard mix of the fly ash brick which is using on the fly ash brick plant. In this mix the quantity of dust and fly ash is more because the cost of these materials is very economical so the construction cost of the fly ash is also economical. The percentages and quantity of the fly ash, lime, Plaster of Paris (POP), Cement, and dust as shown in the following table. Load and compressive strength are as shown in Table 4.1.

Table 4.1: Control Proportions of the brick

Material Quantity by Percentages & Weight for Total Quantity of 4KG						
Fly Ash	**Lime**	**POP**	**Cement**	**Dust**	**Load (KN)**	**Com. Strength (N/mm^2)**
20 (%) 800gm	5 (%) 200gm	10 (%) 400gm	5 (%) 200gm	60 (%) 2400gm	10	**0.58**
20 (%) 800gm	10(%) 400 gm	10 (%) 400gm	5 (%) 200gm	55 (%) 2200	16	**0.93**
20 (%) 800gm	15 (%) 400 gm	10 (%) 400gm	5 (%) 200gm	50 (%) 2000 gm	25	**1.46**

In this mix the quantity of fly ash replace with the dust, more addition of fly ash in the brick mix and quantity of dust is less with the addition of percentage as 40%, 35% and 30%. The percentages and quantity of the fly ash, lime, Plaster of Paris (POP), Cement, and dust as shown in the following table. Load and compressive strength are as shown in Table 4.2. The compressive strength of the brick is going to increase with the addition of fly ash & dust because the fly ash has pozzolonic properties and enhance the strength of concrete. The maximum compressive strength is achieved at 40% fly ash and 30% dust.

Table 4.2: 40% Fly Ash and variation of dust in the mix

Material Quantity by Percentages & Weight for Total Quantity of 4KG						
Fly Ash	**Lime**	**POP**	**Cement**	**Dust**	**Load (KN)**	**Com. Strength (N/mm^2)**
40 (%) 1600gm	5 (%) 200gm	10 (%) 400gm	5 (%) 200gm	40 (%) 1600gm	85	**4.97**
40 (%) 1600gm	10(%) 400 gm	10 (%) 400gm	5 (%) 200gm	35 (%) 1400	118	**6.90**
40 (%) 1600gm	15 (%) 600 gm	10 (%) 400gm	5 (%) 200gm	30 (%) 1200 gm	147	**8.59**

In this mix the quantity of fly ash replace with the dust, more addition of fly ash (60%) in the brick mix and quantity of dust is less with the addition of percentage as 20%, 15% and 10%. The percentages and quantity of the fly ash, lime, Plaster of Paris (POP), Cement, and dust as shown in the following table. Load and compressive strength are as shown in Table 4.3. The compressive strength of the brick is going to decrease with the addition of fly ash & dust because quantity of the fly ash is more in the mix but as per the dust quantity is decreasing the compressive strength

is going to increase. Dust is not a good role play for the strength of the fly ash brick. The maximum compressive strength is achieved at 60% fly ash and 10% dust.

Table 4.3: 60% Fly Ash and variation of dust in the mix

Material Quantity by Percentages & Weight for Total Quantity of 4KG						
Fly Ash	**Lime**	**POP**	**Cement**	**Dust**	**Load (KN)**	**Com. Strength (N/mm^2)**
60 (%) 2400gm	5 (%) 200gm	10 (%) 400gm	5 (%) 200gm	20 (%) 800gm	38	**2.22**
60 (%) 2400gm	10(%) 400 gm	10 (%) 400gm	5 (%) 200gm	15 (%) 600	52	**3.04**
60 (%) 2400gm	15 (%) 600 gm	10 (%) 400gm	5 (%) 200gm	10 (%) 400 gm	73	**4.26**

Figure 4.1: Casting of the bricks

V. CONCLUSION

Followings are the conclusion of the study:

- The compressive strength of the control mix is less because the percentages of fly ash are less as comparison to dust. The maximum compressive strength of the brick is 1.46 N/mm^2 at 20% F.A. and 50% dust.

- The compressive strength of second mix is going to increase as the percentages of fly ash are going to be increase. The maximum compressive strength of the brick is 8.59 N/mm^2 at 40% F.A. and 30% dust.
- The compressive strength of the third mix is going to decrease as the percentages of fly ash are going to be increase. Quantity of fly ash is more in this mix so the strength is going to down. The maximum compressive strength of the brick is 4.26 N/mm^2 at 60% F.A. and 10% dust.
- The optimum compressive strength is getting at 40% addition of fly ash.

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