PERFORMANCE OF FLY ASH BRICKS USING WASTE MATERIALS

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ABSTRACT - *The most of the building material for construction of houses is the normal brick. The rapid growth in today's construction industry has obliged the civil engineers in searching for more efficient and durable alternatives far beyond the limitations of the conventional brick production. This paper presents the experimental investigation of Fly Ash Bricks using Quarry Dust, Red Soil and Cement. The Red Soil and Cement each 10% is used. The Quarry Dust is mixed as bricks 10%, 20%, 30%, 40%, and 50% of each mix proportions. The specimen were Casted and the Compressive Strength Test was carried out for standard days. To find materials properties, Water Absorption Test, Efflorescence Test, Soundness Test, Structure Test, Size and Shape Test, Density Test, Structural Strength and Acid Test were conducted.*

Key Words: **Fly Ash, Quarry Dust, Red Soil, Cement and Mechanical Properties.**

INTRODUCTION

Shelter is a basic human need and owing a house becomes a life long struggle as majority of Indians find housing costs prohibitively expensive. This problem becomes even more acute when considering the low income families who accounts for about 60-70% of Indian population. This brings out the need to reduce the cost of the housing and make it affordable for the booming population. Burnt clay bricks are being used extensively and the most important building material is the construction industry. In India the building industry consumes about 20000 million bricks and 27% of the total natural energy consumption for their production. The higher water absorption, high efflorescence, etc. which have forced engineers to look for better materials capable of reducing the cost of construction. In this contest search for an alternative building material to clay bricks, various government agencies and research institutions have repeatedly recommended the use of waste materials such as Fly Ash, Red Soil, Quarry Dust etc, as an alternative building materials in making bricks, blocks and tiles etc. Logically the unlimited use of clay is harmful to the society, as all the conventional clay bricks depend on good quality clay available from agriculture fields. Presuming a weight of 3kg per brick, the total clay is taken out from agriculture lands per year for such brick works out to over 300 million tonnes. The use of Fly Ash and other industrial wastes for making bricks is ecologically advantageous since apart from saving precious top agriculture soil, it meets the social objective of disposing industrial wastes otherwise are pollutants and nuisance.

2 .MATERIALS AND METHODS

2.1 Fly Ash

Fig-1: Fly Ash

Fly Ash is finely divided residue resulting from the combustion of powdered coal, transported by the flue gases and collected by electrostatic precipitators. Its proper disposal has been a cause of concern since long, which otherwise leads to pollution of air, soil and water.. It also improves workability and reduces internal temperature

2.2 Red Soil

Fig-2: Red Soil

Red soil generally derived from the crystalline rock. They are usually poor growing soils, low in nutrients and humans and difficult to cultivate because of its low water holding capacity.

The texture of red soil varies from sand to clay, the majority being loam.

2.3 Quarry Dust

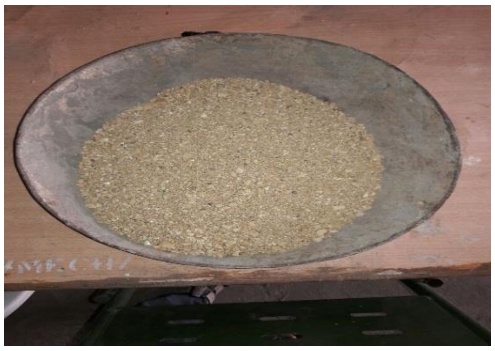


Fig-3: Quarry Dust

Quarry Dust is a waste product produced during the crushing process which is used to extract stone. It is a sand mostly in grey colour. It has mineral particles.

2.4 Cement

Fig-4: Cement

The cement is a binder, a substance that sets and hardens independently, and can bind other materials together. The cement used in this study is OPC 53 Grade.

3. RESULTS AND DISCUSSIONS

3.1 Compressive Strength Test

The determination of Compressive Strength of the bricks samples was carried out as per standard practice. The following Table 5.1 shows the Compressive Strength of various mix proportion of samples after testing. The specimen was tested after standard days of curing.

Chart-1: Compressive Strength

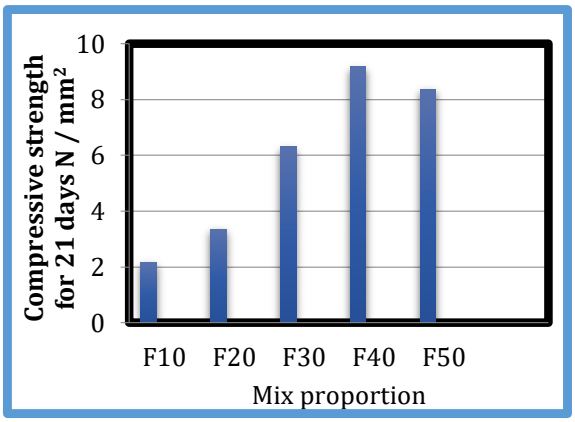


Table -1 Compressive Strength Test Result of Brick

Brick Specimen	Weight (kg)	Load (KN)	Compressive Strength (N/mm²)	Average Compressive Strength (N/mm²)
F0	2.51	39.9	1.81	
	2.56	41.6	1.89	1.89
	2.49	43.7	1.99	
F10	2.64	54.5	2.48	
	2.45	39.0	1.77	2.15
	2.53	45.2	2.05	
F20	2.62	82.2	2.98	
	2.45	84.4	3.17	3.35
	2.52	87.5	3.24	
F30	2.92	167.9	6.27	
	2.59	162.4	6.54	6.30
	2.65	165.6	6.91	
F40	2.79	196.1	8.91	
	2.83	207.4	9.43	9.17
	2.95	210.9	9.19	
F50	2.99	181.9	8.27	
	2.92	187.8	8.54	8.37

The chart discussed various mix proportion of Compressive Strength were carried.

The F10 Mix proportions is less than F20 mix proportions of Compressive Strength.

The comparison similarly, F40 Mix proportions to obtain higher Compressive Strength of this chart. The conventional mix F0 is less than other mix proportions.

3.2 Density Test

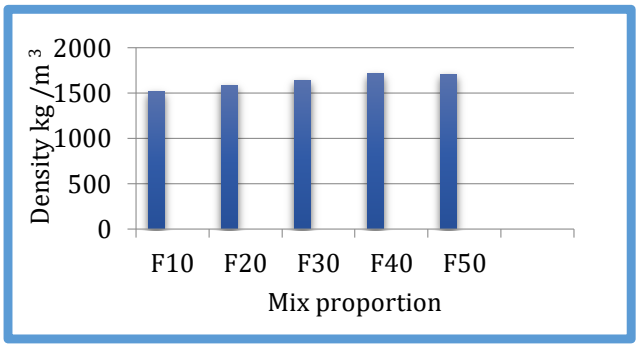
The determination of Density Test of the bricks samples was carried out as per standard practice. The following Table -2 shows the Density Test of various mix proportion of samples after testing. The specimen was tested after standard days of curing.

Table -2 Density Test Result of Brick

Brick Specimen	Weight (kg)	Volume of bricks(m^3)	Density (kg/m^3)	Average Density (kg/m^3)
F0	2.506	1.65		
	2.488	1.65	1507.88	1513.05
	2.495	1.65	1522.42	
F10	2.487	1.65	1507.27	
	2.636	1.65	1597.57	1534.94

	2.495	1.65	1512.12	
F20	2.506	1.65	1518.79	
	2.488	1.65	1507.88	1583.94
	2.370	1.65	1436.36	
F30	2.326	1.65	1409.69	
	2.790	1.65	1690.90	1644.85
	2.902	1.65	1758.78	
F40	2.810	1.65	1703.03	
	2.953	1.65	1789.69	1712.5
	2.775	1.65	1681.82	
F50	2.810	1.65	1703.03	
	2.953	1.65	1789.69	1703.02

Chart-2: Density Test



The chart discussed various mix proportion of Density Strength were carried.

The F10 Mix proportions is less than F20 mix proportions of Density Strength.

The comparison similarly, F40 Mix proportions to obtain higher Density Strength of this chart. The conventional mix F0 is less than other mix proportions.

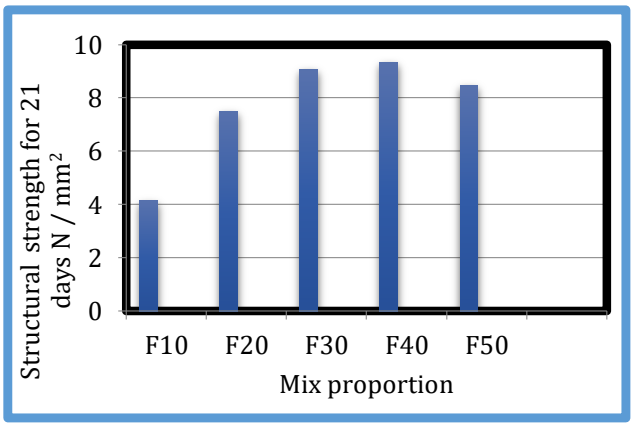
3.3 Structural Strength Test

The determination of Structural Strength of the bricks samples was carried out as per standard practice. The following Table 3 shows the Structural Strength of various mix proportion of samples after testing. The specimen was tested after standard days of curing.

Table -3 Structural Strength Test Result of Brick

Brick Specimen	Weight (kg)	Load (KN)	Structurl Strength (N/mm²)	Average Structural Strength (N/mm²)
F0	2.68			
	2.85	254	3.85	3.85
	2.42			
F10	2.62			
	2.45	265	4.15	4.15
	2.52			
F20	2.92			
	2.59	495	7.5	7.5
	2.65			
F30	2.51			
	2.53	598	9.07	9.07
	2.67			
F40	2.39			
	2.65	616	9.33	9.33
	2.89			
F50	2.96			
	2.92	372	8.46	8.46

Chart -3 Structural Strength Test



The chart discussed various mix proportion of Structural Strength were carried.

The F10 Mix proportions is less than F20 mix proportions of Structural Strength.

The comparison similarly, F40 Mix proportions to obtain higher Structural Strength of this chart. The conventional mix F0 is less than other mix proportions.

4. CONCLUSIONS

Bricks made with Cement, Fly ash gives a minimum compressive strength (N/mm$^{2)}$ and Red soil, Quarry Dust gives a maximum compressive strength is N/mm^2 (as per 1725 – 1982).

The percentage of fly ash bricks produced in various mix proportions are F10, F20, F30, F40, and F50.

The F40 Mix compressive strength were high, compared to other percentage of fly ash bricks. The compressive strength value is 9.17 MPa (45.5%) and the compressive strength value of conventional mix of brick is 1.89 MPa.

The water absorption value for F40 Mix is 6.57% which is low.

The water absorption value of conventional brick is 18.49% which is high

When the bricks are immersed in water and dried, white patches are not formed, so this test provided good efflorescence results.

The bricks when struck with each other, it gives clear ringing sound. So it is called good quality of bricks.

These Fly ash bricks can be utilised for the construction of low height walls where loads are less, construction of sheds, boundary wall and huts with roofs other than RCC.

The remaining Tests on Bricks will be carried.

5. REFERENCES

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