

COMPARATIVE STUDY ON STRENGTH OF M-SAND BRICK

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Abstract - As many project are done with partial replacement of cement and sand used in the brick but here 100 % replacement is carried on. It is necessary to check the properties of M-Sand and cement, some lab test like specific gravity, fineness, consistency test should take and then proper design mix calculation are made and casting of brick of different market size, it is kept for initial setting time of 24 hours. Finally curing is take place for 28 days to attain the maximum strength. Conclude the project by comparing the strength of M-sand brick with burnt clay and fly ash brick.

Key Words: M-Sand, Cement, Burnt clay brick, Fly ash brick, Strength.

1-INTRODUCTION

Nowadays fly ash bricks are widely used instead of burnt clay brick. So the demand for fly ash is also increasing in the construction industries. This problem can be overcome by introducing M sand brick in the construction industry.

Main purpose of this project is to make bricks which are having good strength, economical and use M-sand dust, which is a waste material produced in the manufacture of M-sand. Use of these M-sand bricks in thermal power plants and nuclear power plants play an important role in absorbing heat and helps to avoid environmental pollution.

2-NEED FOR THE STUDY

As we have progressed in technology, we have been able to develop a more advanced form of bricks. As bricks are made from clay excavated from the earth, availability of good brick earth is becoming less whereas the demand for construction of bricks is increasing.

Motive of this study is to prepare material used for low cost housing project without compromising with the durability and compressive strength. It will reduce the cost of construction without compromising the strength of construction.

3-OBJECTIVE OF THE STUDY

1. To determine the properties of materials such M-Sand, and cement.
2. The objective is to determine the properties of M-Sand brick based on various test results according to IS 12894:2002 and IS 3495:1992.
3. To compare the strength properties of M-Sand brick with burnt clay and fly ash brick.

4-METHODOLOGY

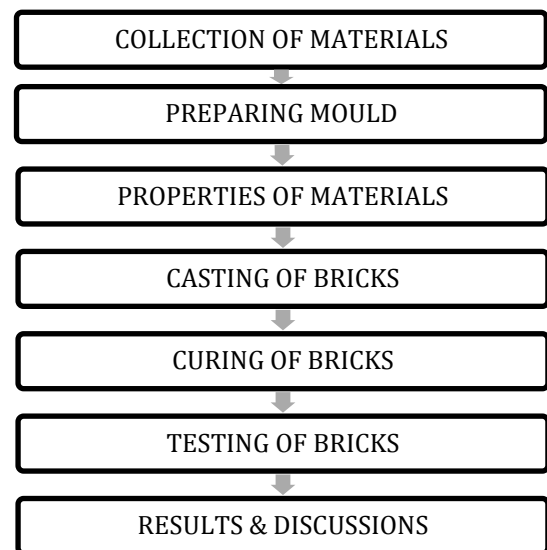


Fig 1.1 Methodology

5-MATERIALS AND TESTS

1. Cement
2. M-Sand

5.1 Cement

Cement of grade 53 ordinary Portland cement (OPC) was procured from the local suppliers is used. The tests were conducted in the laboratory to calculate the specific gravity and fineness of cement.

5.1.1 Fineness test

Table 5.1 Fineness of cement

Weight of cement taken in g (w1)	Weight of cement retained in 90µm sieve in g (w2)	Fineness (%)
100	0.1	99.9
100	0.1	99.9
Fineness of Cement		99.9%

As per the code, the residue on the 90µm sieve for the cement is nearest **0.1%**

5.1.2 Specific gravity test

Table 5.2 Specific gravity of cement

Weight of cement taken(g)	Initial reading of Le-chateliers flask (ml)	Final reading of Le-chateliers flask (ml)
60	0	19

Specific gravity of cement

$$= \frac{\text{weight of cement taken}}{\text{Final reading}-\text{Initial reading}}$$

Specific gravity of cement = 3.15

(As per code specific gravity=3.1 to 3.16)

5.2 M-Sand

M-Sand was procured from local suppliers is used. The tests were conducted in the laboratory to calculate the specific gravity and fineness modulus of M-Sand.

5.2.1 Specific gravity test

$$\text{Specific gravity of M-sand} = \frac{(W2-W1)}{(W2-W1)-(W3-W4)}$$

$$= \frac{(1.214-0.486)}{(1.214-0.486)-(1.856-1.390)}$$

Specific gravity of M-sand = 2.78

As per code, Specific gravity ranges from 2.73 to 4.66

5.2.2 Sieve analysis

Table 5.3 Sieve analysis of M-Sand

IS sieve (mm)	Weight of M-Sand retained (g)	% retained	Cumulative % retained (g)	% of passing (M-sand)
4.75	9	1.8	1.8	98.2
2.36	21	4.2	6	94
1.18	82	16.4	22.4	77.6
0.6	124	24.5	46.9	53.1
0.425	108	21.6	68.5	31.5
0.300	85	17	85.5	14.5
0.150	51	10.2	95.7	4.3
0.075	13	2.6	98.3	1.7
pan	5	1	99.3	0.7

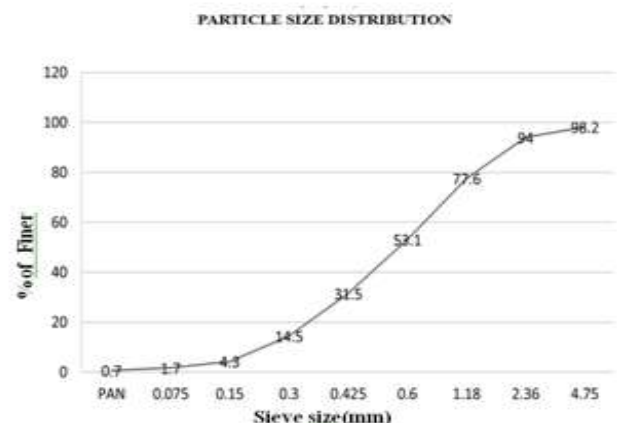


Fig 5.1 Particle size distribution

$$C_u = \frac{D_{60}}{D_{10}} = \frac{0.74}{0.2} = 3.7$$

C_u - Coefficient of uniformity

$$C_c = \frac{D_{30}^2}{D_{10} \times D_{60}} = \frac{0.420^2}{0.74 \times 0.2} = 1.2$$

C_c - Coefficient of curvature (1 to 3)

6-MIX PROPORTIONS

Based on material test results, materials quantity calculated below. Here mix ratio used for the M-Sand brick is 1:4(1 part of Cement and 4 parts of M-Sand). W/C = 0.45 (From IS 456-2000).

Cement quantity for 4 bricks = 5.283 kg
 M-Sand quantity for 4 bricks = 21.13 kg

Water quantity for 4 bricks,

$$W/C = 0.45$$

$$W / 5.283 = 0.45$$

$$\text{Water} = 2.38 \text{ litre}$$

Quantity of water ~ 2.4 litre of water required for 4 bricks.

7-CASTING AND CURING OF BRICKS

Casting is the manufacturing process in which estimated quantity of materials at properly mixed and poured into the mould and its allows to solidified. Hand mixing process is used for casting.

Wooden mould with size of 225x15 x80mm is taken for casting the brick. And its thickness is about 1cm. The brick was designed according to the quantity estimation derived from the ratio 1:4 mentioned above.

Remoulding the brick after 24hours of casting. The remoulded bricks is taken for curing. Curing of bricks helps in minimizing the crack formed on the surface of M-sand brick and helps in achieving the strength. M- sand bricks are immersed in water for curing period of 28days in laboratory.

8-TESTS ON BRICKS

After 28 days of curing the bricks are taken out and different tests has been conducted in the laboratory. The conducted tests are mentioned below.

- Dimension and Color.
- Hardness test.
- Soundness test.
- Efflorescence test.
- Compressive strength test.
- Water absorption test

8.1 RESULTS ON BURNT CLAY BRICKS

Table 8.1 Results on burnt clay bricks

PROPERTIES	BURNT CLAY BRICK
Dimension	220x100x75mm
Color	Red
Hardness	Hard brick
Soundness	Metallic ringing sound
Efflorescence	Slight
Compressive Strength	5.79N/mm ²
Water Absorption	13.3%

8.2 RESULTS ON FLY ASH BRICKS

Table 8.2 Results on fly ash bricks

PROPERTIES	FLY ASH BRICK
Dimension	230x110x70mm
Color	Grey
Hardness	Hard brick
Soundness	Metallic ringing sound
Efflorescence	Slight
Compressive Strength	11.82N/mm ²
Water Absorption	10.28%

8.3 RESULTS ON M-SAND BRICKS

Table 8.3 Results on M-Sand bricks

PROPERTIES	
Dimension	225x115x80mm
Colour	Grey
Hardness	Hard brick.
Soundness	Metallic ringing sound
Efflorescence	No deposition- Nil.

Compressive Strength	16.1N/mm ²
Water Absorption	8.6%

8.4 COMPARISON OF WATER ABSORPTION OF BRICKS

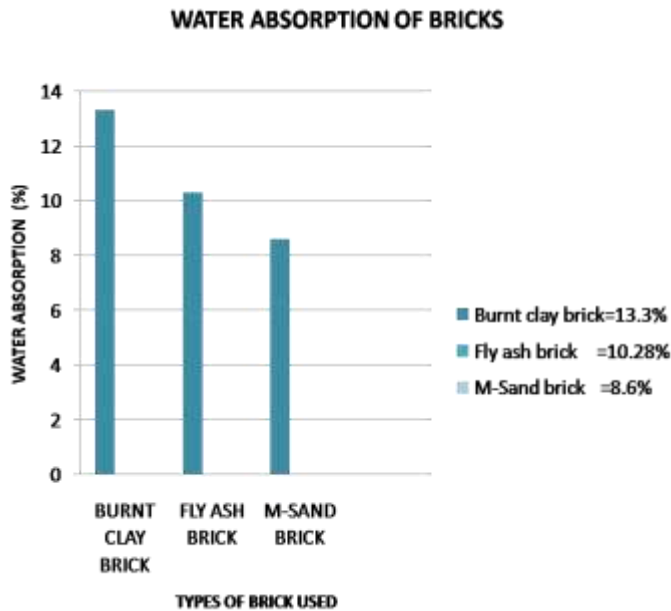


Fig 8.1 Comparison of water absorption of bricks

8.5 COMPARISON OF COMPRESSIVE STRENGTH OF BRICKS

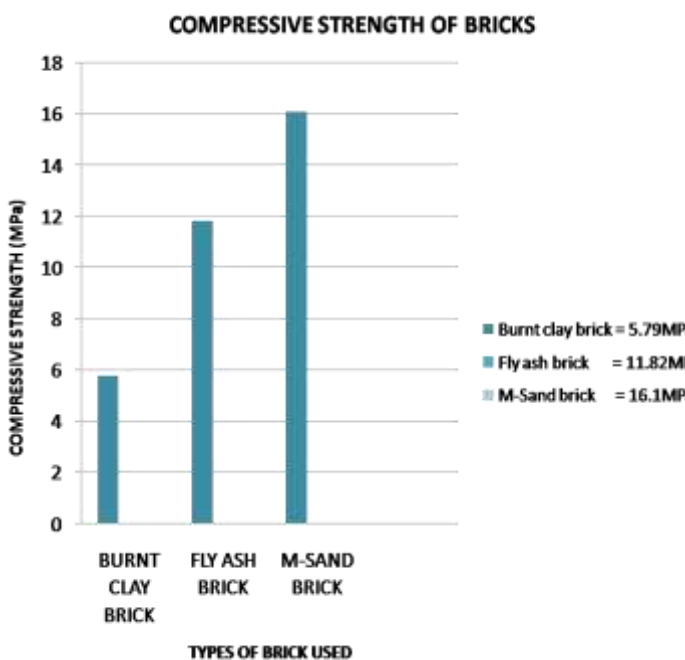


Fig 8.2 Comparison of compressive strength of bricks

9-CONCLUSIONS

This project is carried out to determine the properties of the M-Sand brick by the several tests are carried out for the bricks.

Compressive test, Water absorption test, Efflorescence test, Soundness test, Hardness test are the test for determining the physical and strength properties of the M-Sand brick. These properties are also tested for the burnt clay brick and fly ash brick.

Then the results are calculated for all the tests of these three bricks. Finally, the results of M-Sand brick with Burnt clay brick and Fly ash brick are compared.

1. The dimension of M-Sand bricks is 225x115x60mm and the color of the M-Sand bricks are grey.
2. The M-Sand brick is a hard brick and give metallic ringing sound when struck with one another.
3. The efflorescence of the brick is nil because no patches are found on the surface of the brick.
4. The compressive strength of M-Sand brick is 16.1MPa which is more than the strength of the fly ash Brick of 11.82MPa and burnt clay brick of 4.78MPa. The compressive strength of the M-Sand brick is 26.6% higher than the Fly ash brick and 62.9% higher in strength than the Burnt clay brick.
5. The water absorption of M-Sand brick is 8.6% which is within the limit. Water absorption of the M-Sand brick is 35.33% less than the Burnt clay brick and 16.34% less than of Fly ash brick.

The strength of the M-Sand bricks is comparatively higher than the other bricks, So M-Sand bricks are preferable to use in the construction industries.

REFERENCES

[1] Aakash Suresh Pawar, Devendra Bhimrao Garud (2014), "Engineering Properties of Clay Bricks with Use of Fly Ash", International Journal of Research in Engineering and Technology, Vol.3, Pg 75 to 80.

- [2] Halesh Kumar B T and Anusha H S (2017), "Replacement of Fine Aggregate by M-Sand", International Journal of Science Technology & Engineering, Vol.no.3, pp.223-227.
- [3] Ravi Kumar and Vandana Patyal (2014), "Study of Properties of Light Weight Fly Ash Brick", International Journal of Engineering Research and Applications National Conference on Advances in Engineering and Technology, pp.49-53.
- [4] A.Sumathi, K.Saravana Raja Mohan (2014-2015), "Compressive Strength of Fly Ash Brick with Addition of Lime, Gypsum and Quarry Dust", International Journal of ChemTech Research, Vol.7, No.01, pp 28-36.
- [5] K.Suseela and Dr.T.Baskaran,(2017) "Strength Analysis on Concrete with M-Sand as a Replacement of Fine Aggregate", International Journal of Civil Engineering and Technology, Vol.no.8, pp.583-592.
- [6] Dr.J.Thivya and A.Aarthi(2018), "Comparative Analysis Of River Sand, MSand And Quarry Sand", International Research Journal of Engineering and Technology, Vol.6, Issue 5, pp.923-927.