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EXPERIMENTAL EVALUATION OF STRENGTH CHARACTERISTICS OF MASONRY BLOCKS MANUFACTURED FROM M-SAND DUST AND CEMENT

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Abstract - *In our country bricks are known as one of the most important building material and brick manufacturing industry is one of the most traditional industry normally related to rural areas. In this project we are studying the manufacture of bricks from M-sand dust. The main purpose of this project is to make bricks which are having good strength and economical. The bricks are made of M-sand dust which is main purpose because dust is a waste material. By the study of strength characteristics of bricks, we can use bricks for various purposes.*

1.INTRODUCTION

The 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 bricks in thermal power plants and nuclear power plants play an important role in absorbing heat and helps to avoid environmental pollution.

1.1 Methodology

- Collecting all raw materials
- Calculating materials required
- Proper mixing of ingredients
- Moulding of bricks
- De-moulding and curing of bricks
- Testing of bricks and analyse the results

NOTE

In this report we are using some notations which are explained as below

- D 1:3 – 1 unit of cement, 3 units of m-sand dust.
- D 1:4 – 1 unit of cement, 4 units of m-sand dust.
- D 1:2 – 1 unit of cement, 2 units of m-sand dust.
- S 1:4 or S 1:2:2 – 1 unit of cement, 2 units of m-sand, 2 units of m-sand dust.
- S 1:3 or S 1:1.5:1.5 – 1 unit of cement, 1.5 unit of m-sand, 1.5 unit of m-sand dust.
- S 1:2 or S 1:1:1 – 1 unit of cement, 1 unit of m-sand, 1 unit of m-sand dust.

2. Preliminaries of Project

2.1 Tests on Bricks

2.1.1 Water absorption test

Water Absorption of D 1:3 proportion brick = $\frac{3800-3430}{3430} \times 100$ = 10.787 %

This shows the bricks with large amount of dust absorb more water and the water absorption capacity of dust is more.

2.2 Tests on Cement

SL No.	Property of cement	Test results
1	Consistency of cement	29%
2	Initial Setting Time	155 Minutes
3	Final Setting Time	219 Minutes
4	Soundness	0.5 mm
5	Sieve Analysis	3% (retained on 90 mm sieve)
6	Specific Gravity	2.79

Table 1 Test on cement and their properties

2.3 M-Sand dust

Preliminary tests on m-sand dust and m-sand

Fineness Modulus of M-sand dust is = $\frac{459.5}{100}$ = 4.595

Specific gravity of m-sand dust= $\frac{1170-645}{(1170-645)-(1775-1530)}$ = 1.857

Moisture content of M-Sand dust = $\frac{29.52-27.48}{27.48} \times 100$ = 7.423 %

2.4 Process

- Calculating the ingredients required for the bricks as for one brick and total materials required for making all bricks.
- Weighing ingredients for accurate which will get from the calculation of materials and collecting in one large pan and all mixing equipments should be present before only.
- Pouring M-sand dust first after that if M-sand is using then it should pour after that cement is poured on it and all those materials are mixed till uniform colour will get.
- Adding measured water content to it and mixing with mixing equipments till it mix completely and no water should be left in pan.
- Arrangements of brick moulds are to be done before only, then pouring the cement mortar into the brick moulds in three layers and lightly compacted with tamping rod with 25 blows given for each layer.
- Levelled off the top layer of the bricks and the moulds are going to be removed before it becomes hard and then again the same process will be done for another ratio.
- After 24 hours the bricks will be kept in water tank for curing upto 7 days and 28 days after that the bricks are test at 7 and 28 days and the results are tabulated.
- Compressive strength of the bricks will be computed at 7 and 28 days and the outcomes will be analysing by comparing with other bricks.
- This process will be repeated for different ratios of material as 1:3, 1:4, 1:1.5:,1.5, 1:2:2, ratios in which 1 is cement content, 1.5, 2, 3, 4 are nothing but M-sand Dust content, 1.5, 2 are the M-sand content.
- This process also repeated for various water content in which water content will be increasing by 10%, 20%,..... etc like that and also for SBR Latex variation bricks are to be made for analysing the results.

2.5 Calculation of ingredients for one brick

2.5.1 For 1 : 3 proportion (D 1:3)

SL. No	Materials	Quantity for 1 Brick
1	Cement	1162 gms
2	Dust	3486 gms
3	Water	500 ml

Table 2 Materials required for 1 brick for D 1:3 proportion

2.5.2 For 1:4 proportions (D 1:4)

SL. No	Materials	Quantity for 1 Brick
1	Cement	930 gms
2	Dust	3720 gms
3	Water	500 ml

Table 3 Materials required for 1 brick for D 1:4 proportion

3. RESULTS AND ANALYSIS OF RESULTS

3.1 Bricks of D 1:3 and D 1:4 Proportion with Normal Mix

	SL NO.	7 days in N/mm²	28 days in N/mm²
D 1:3	1	9.917	11.983
	2	10.743	12.396
	3	10.330	12.809
	4	10.330	11.983
		10.330	12.293

Table 4 Strength of bricks of D 1:3 proportion

	SL NO.	7 days in N/mm²	28 days in N/mm²
D 1:4	1	5.371	7.024
	2	4.958	6.611
	3	5.371	6.611
	4	5.371	7.024
		5.268	6.818

Table 5 Strength of bricks of D 1:4 proportion

Again the tests are done for the 1:3 brick proportions of cement and dust D 1:3 and D 1:4 proportions and water is added to this mix using consistency of cement and the obtained results are as 10.330 N/mm² strength at 7 days and 12.293 N/mm² at 28 days.

As comparing the results with latex mixed bricks the normal mix bricks having 45% increase in 7 days strength for 1% latex mix and 25 to 30% increase for 1.5% latex at the same 7 days only then considering the 28 days strength for 1% latex about 50% increase in strength and for 1.5% latex around 35% of strength increasing. So comparing this D 1:3 normal mix will be best and from this it comes to know that higher dosages of polymer addition to cement mortars it will decrease bonding strength.

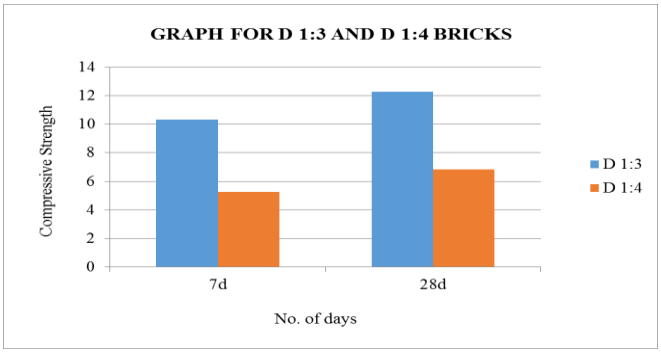

Figure 1 Comparison of strength of D 1:3 and D 1:4 proportion bricks

3.2 Bricks of D 1:3 Proportion with Variation of Water Content

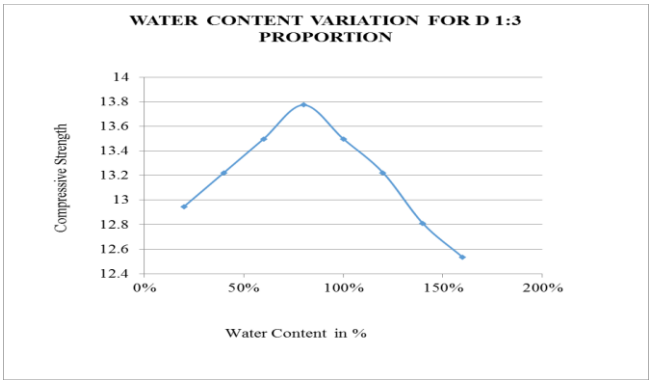

Figure 2 Impact of water substance on strength of D 1:3 proportional bricks

In the graph of D 1:3 bricks strength varied as shown in graph , the percentage of variation of water content in this are 20%, 40%,.... 160%, the strength also shows a variation by water content and it shows that water content will play main role in strength of bricks. As at first point the line is at low and again it is goon increasing with increase in water percentage and at a certain value the strength is maximum and again after increase in water content results the strength goes on decreasing with respect to the water content.

From this graph we can conclude that the dust will absorb more water content as compared to normal sand and if the water content is low the dust cannot shows a good strength and the water content should be

in a certain limit and after which if water content is more the dust will going to lose its strength instantaneously.

SL No.	% of Water Content	Average Compressive strength in N/mm²
1	20%	12.947
2	40%	13.223
3	60%	13.498
4	80%	13.774
5	100%	13.498
6	120%	13.223
7	140%	12.809
8	160%	12.534

Table 6 Strength of D 1:3 proportional bricks with varying water content

3.3 Bricks of D 1:4 Proportion with Variation Water Content

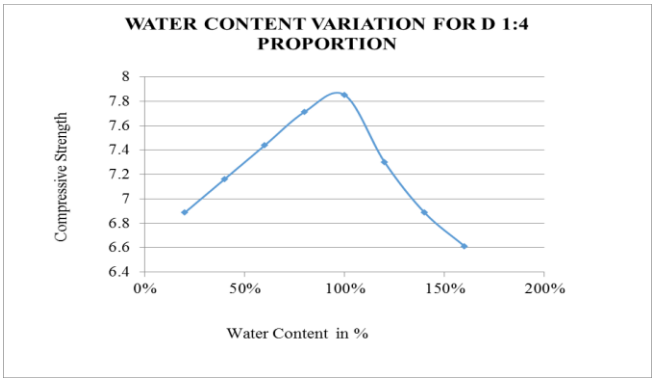

Figure 3 Impact of water substance on strength of D 1:4 proportional bricks

In this graph the strength maximum got as nearly 7.8 N/mm² which is less compared to D 1:3 and in this variation of water content is done and the bricks used in this are of D 1:4 which are of having more dust content compared to the previous mix D 1:3, as from the graph it shows at first the strength at middle of 6.8 and 7 N/mm² but after as the water content get varied that is increase in water content results increase in compressive strength of bricks in which the variation of graph line is like parabolic variation which is also same as D 1:3 bricks, after adding water to the mix the strength goes on increasing and upto a certain limit that is at 100% water content the strength reaches a maximum value after that again increase in water content results in lowering of strength of bricks.

SL No.	Percentage of Water Content	Average Compressive strength in N/mm²
1	20%	6.887
2	40%	7.162
3	60%	7.438
4	80%	7.713
5	100%	7.851
6	120%	7.300
7	140%	6.887
8	160%	6.611

Table 7 Strength of D 1:4 proportional bricks with varying water content

3.4 ESTIMATION OF BRICKS

3.4.1 Cost of 1 Brick for D 1:3 Proportion

SL. No	Materials	Cost (in Rs)
1	Cement + Labour cost	8
2	Dust	Nil
3	Water	Nil
	Total Amount	8

Table 8 Estimation of 1 brick for D 1:3 proportion

3.4.2 Cost of 1 Brick for D 1:4 Proportion

SL. No	Materials	Cost (in Rs)
1	Cement + Labour cost	7
2	Dust	Nil
3	Water	Nil
	Total Amount	7

Table 9 Estimation of 1 brick for D 1:4 proportion

3.5 SCOPE OF STUDY

- Strength of brick is high as compared with standard clay brick.
- Economically same cost as compared to conventional bricks.

- Reduces the problem of disposal of m-sand dust which is a waste material.
- Easily produced in m-sand manufacturing plants.

4. CONCLUSION

- The cost of bricks similar to conventional bricks.
- M-Sand dust is a waste material which is reused and hence it reduce the problem of disposal of dust.
- River sand is costlier no a days and clay availability is also less, so by using m-sand dust we can produce good bricks.
- The strength of D 1:4 (1 unit cement, 4 units dust) bricks is suitable for construction of building because it having a strength of 6.818 N/mm^2 which is more than normal brick strength as the minimum brick strength required for any construction walls of buildings is 3.5 N/mm^2.
- D 1:4 bricks are having enough strength to construct compound walls which sustain loads coming on compound walls.
- The strength of the bricks can be increased by varying the water content and by this it gives the correct water content for different proportional bricks as the strength for brick D 1:3 at 80% water content is 13.774 N/mm^2, for D 1:4 at 100% water is 7.851 N/mm^2, for S 1:3 at 40% water is 17.630 N/mm^2 and S 1:4 at 40% water is 15.564 N/mm^2 which all are shows10 to 20% more strength as compared with normal mixes, so by this we can conclude that water plays a main role in strength of bricks.

REFERENCES

- Radikesh Nanda, Ameeya Daas, Moharna N.C., "Stone crusher dust as a fine aggregate in concrete for paving blocks", IJCSE Vol 1, Pages 613 - 620, No. 3, 2010.
- T. Shanmugapriya, R. N. Uma, "Optimization of partial replacement of M-Sand by Natural Sand in High Performance Concrete with Silica Fume", IJESET, Vol II, Issue II, Pages 73 - 80, June 2012.
- Abhishek Kulakarani, Kalyaani Bhutaada, Ajay Shelorakar, "Determination of Mechanical Strength of High Grade Concrete by Replacement of Artificial Sand", IJIRSET, Vol 3, Issue V, Pages 12380 – 12386, May 2014.
- G. Saarangapani, H. S. Sureshachandra and B. G. Nareshkumar, "Experimental Investigation on the Effect of Replacement of Sand by Quary Dust in Hollow Concrete Block for Different Mix Proportions", IJESD, Vol 5, No. 1, Pages 15 – 19, February 2014.

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