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Experimental Investigation on Bricks Manufacturing by Using RMC Waste Partial Replacement

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Abstract- In this project work has been made to study the behaviour of brick by taking proportions of Clay, Lime, and cement. In this project work takes four mix materials in two trails as Clay, Lime, cement are taking a percentage of 10%, 20%, 10% and 60% respectively and another one of 50%, 20%, 5% and 25% respectively. After casting the bricks are allowed to tests such as Compressive strength test, water absorption test were performed for the brick. The results show the variation of Compressive strength for brick at dry condition. The different dry ages are 1 day, 4 days, and 7 days.

Keywords: - Clay, Lime, and cement, dry condition etc.

I. INTRODUCTION

A brick plays a very important role in the field of construction industry. Concrete bricks are used widely in construction of load bearing sections of the building. Now a day's all the Manufacturing industries are emitting slag, dust, etc. as a solid waste material. These waste materials are dumped on the lands, which affects and pollutes the Environment adversely.

Replacing considerable amount of waste production in Clast brick manufacturing will reduce the amount of waste materials dumped on the agricultural lands. And also minimize the percentage usage of Cement and in the manufacturing.

Recognizing that a typical batch plant generates an average of 20 gallons of wash water discharge per cubic yard of ready-mixed production and that the average concrete production rate for a batch plant is 250 cubic yards per day, the proper disposition of the wash water presents an important issue. If this wash water can be reused, it has been estimated that the volume per cubic yard of production that will require special disposal handling can be reduced to 5 gallons.

II. MATERIAL USED AND CASTING OF BRICKS

1. Material Used:

The following materials were used for making the brick

- RMC waste = 80%
- Cement= 10%
- Lime= 7%
- Clay= 3%

2. RMC waste:

Disposal of waste water from Ready Mixed Concrete (RMC) operations is a great concern of the ready-mixed concrete producers. Most of the traditional disposal systems are no longer environmentally acceptable. Alternative solution is to recycle the waste. Every day $0.25m^3$ – $1m^3$ RMC wastes in sites. The ready mixed concretes are widely used in modern construction. It gives the high strength to the building.

3. Cement:

Ordinary Portland cement of 53grade is used in the investigation. The cement used has been tested for various proportions and found to be confirming to specifications given in IS 12269 – 1987.

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Table 1 Tested for various proportions.

Sl. No.	Characteristics	Values Obtained	Standard Values
1.	Normal Consistency	25%	-
2.	Initial Setting Time	32 Min	Not be less than 30 min
3.	Final Setting Time	600 Min	Not be greater than 600 min
4.	Fineness	8.68%	<10%

4. Lime:

Lime is a calcium-containing inorganic material in which carbonates, oxides and hydroxides predominate. Strictly speaking, lime is calcium oxide or calcium hydroxide. It is also the name of the natural mineral (native lime) CaO which occurs as a product of coal seam fires and in altered limestone xenoliths in volcanic ejects. The word "lime" originates with its earliest use as building mortar and has the sense of "sticking or adhering. These materials are still used in large quantities as building and engineering materials (including limestone products, concrete and mortar) and as chemical feed stocks, and sugar refining, among other uses.

5. Clay:

Clay is finely – grained natural soil material that combines one or more clay minerals with possible traces of quartz, metal oxides, and organic matters. Geological clay deposits are mostly composed of phyllo silicate minerals. The clay can appear in various colors from white to dull grey or brown to deep orange red.

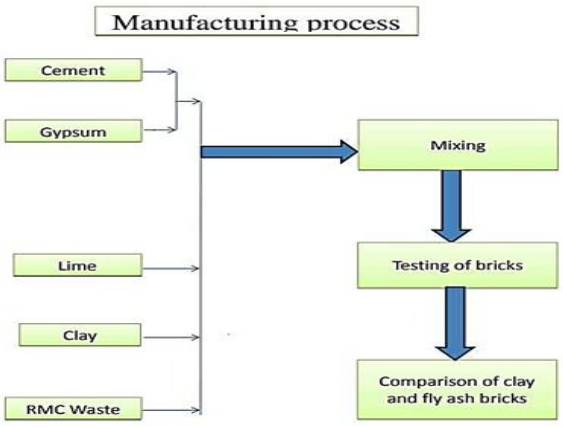

Fig 1. Manufacturing Process.

6. Manufacturing Process:

The following Flow chart describes the manufacturing process of this study.

6.1 Materials Used: Cement, Gypsum, Lime, Clay, RMC Waste.

7. Process:

- Mixing
- Testing of Brick
- Comparison of clay and fly ash brick

III. QUANTITIES OF MATERIALS FOR MAKING BRICK

1. Casting of Bricks:

Casting has been done with automatically operated brick mould machine but the mixing has been done manually. Here mould is made to the required size of the specimen (230x110x70mm) and adopted. The mix is filled individual and compacted automatically by the machine.

2. Curing of Bricks:

The bricks were cast and cured for 26 days. Water curing has been done for 1 Day, 4Days, 7Days and dry curing for 5 days. Water curing is done by spraying of water.

IV. TESTING AND INSTRUMENTATION

1. Tests on Bricks:

Different separate tests and experiments, all of which have direct bearing with the investigation of the effects of stabilization and molding pressure on the strength and performance of bricks, were selected and conducted. The tests include the compressive strength tests and the water absorption test. Although the compressive strength tests and the water absorption tests were conducted for RMC waste bricks.

1.1 Compressive Strength Test: The compressive strength of the bricks are most important property. The compressive strength values give an overall picture of the quality of the brick and are an indication of the hardness of the hydrated cement paste that binds the various particles together. The main aim of the compressive strength tests was to determine the wet compressive strength values of the bricks. It is the wet compressive strengthvalue,

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which is normally lower than the dry compressive strength, which is used in the structural design of buildings. The compressive strength test done is a standard test based on ASTM standards, Volume 04.08, Soil and Rock, 1996.

After the 21days curing period, the bricks of average dimension 230x110x70mm is measured and weighed. The main compression equipment used was the compression testing machine with a maximum load of 1000KN.

Figure 4.2 shows a photographic record of the compressive strength test taken during the dyes was obtained from animal, vegetable or mineral origin, with no or very little processing. So far the greatest source of dyes has been from the plant kingdom, notably roots, barriers, bark, leaves and wood, but only a few have ever been used on a commercial scale.

Table 2. Compressive Strength Test Results.

Sl. No	Curing	Load at Failure (kN)	Average Load at Failure (kN)	Compressive Strength (N/mm^2)
1	3Days	90	110	4.348
		100		
		110		
		120		
		130		
2	7Days	150	170	6.718
		160		
		170		
		180		
		190		
3	21Days	210	230	9.247
		220		
		230		
		240		
		250		

1.2 Water Absorption Test: The aim of the water absorption test was to determine the percentage moisture absorption capacity of the brick samples. Brick samples were weighed in the laboratory atmospheric condition (Wd) and, immersed in water for 24 hours, removed and weighed again (WW). An accurate electronic weighing machine was used in case, to an accuracy of 0.05g. The percentage moisture absorption by weight was calculated from the formula.

$$M_c = (W_w - W_d / W_d) \times 100(\%) \ldots\ldots\ldots (1)$$

Where,
M_c = Percentage moisture absorption (%)
W_w= Mass of wetted sample (g)
W_d = Mass of dry sample (g)

Table 3. Water Absorption Test Results.

Type of Specimen	Mean Dry Weight (kg)	Mean Moist Weight (kg)	Average Water Absorption (%)
3Days	3.21	3.39	5.6
7 Days	3.05	3.24	6.23
21 Days	3.04	3.29	8.22

Through the water absorption test, it should be possible to determine the ability and extent to which bricks can absorb moisture. Knowledge of the water absorption levels of bricks could serve as useful criteria for setting limits and for investigating possible ways of reducing the same in order to improve on the durability of bricks.

1.3 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°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 is reported as “effloresced”. If no difference is noted, the rating is reported as “not effloresced”. Percentage of white spot in the brick = Nil.

1.4 Hardness Test: In this test, a scratch was made on brick surfaces. While the scratch made with the help of finger nail on the bricks, very light impression was left on the brick surface. So this brick are less hard.

1.5 Structure Test: In this test, the bricks were broken and the structures of that bricks were examined, whether they were free from any defects such as holes, lumps etc., in this test fibrous concrete brick were cut into equal parts. The fibrous concrete brick piece structure was homogeneous, compact and free from defects and this brick pieces look like a cake piece.

1.6 Soundness Test: In this test two bricks from same proportion were taken out and they were struck with each other. The bricks were not broken and a clear ringing sound was produced. So the bricks are good

V. ANALYSIS OF TEST RESULTS

5.1 Compressive Strength:
The compressive strength of bricks cured under the mix proportion with various materials and tested using Universal Testing Machine.

5.2 Water Absorption Test:
The bricks were made to immerse in water for 24 hours before that initial dry weight should be noted. Then the bricks after 24 hours of immersion the final weight should be noted after water absorption. The weight of the brick should not exceed 15% of its initial weight. The water absorption of brick are not exceeding 15 % of initial weight of the bricks after 24 hours of immersion in water.

VI. CONCLUSION

The following could be concluded from the test result obtained in the investigation. Based on the experimental study, following conclusions can be drawn regarding.

However the brick specimen of size 230mm x 110mm x 70mm were cast for mix percentage and the specimens properties such as compressive strength were studied for results it was inferred that, among the proportions the maximum optimized compressive strength is obtained for optimal mix percentage of RMC Waste-70%, Lime-5%, Gypsum-3%, Cidomlit-7%, Cement 10%, Alumina 5%, 1 Day as 1.95 N/mm^2, 4 Days as 3.85 N/mm^2, 7 Days 4.51. We investigated that the bricks which manufactured by using partial replacement of RMC Waste can be used for two storied building & economical than normal bricks.

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