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Experimental Investigation on Replacement of Quarry Dust by Iron Slag in Concrete Brick

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Abstract: ***The environmental problems are very common due to generation industrial product. Iron slag is one of the industrial by product from steel making industries. The iron slag waste is used for concrete brick. The replacement of quarry dust with waste iron slag to replace of 0%, 10%,20% and 30% weight of quarry dust. The test performed to evaluate the waste iron slag concrete brick include compressive strength test, water absorption test ant density test. The cubes are casted and tested for 7 days and 28 days.***

Keywords: Iron Slag, Compressive Strength, Water Absorption and Density Test.

I. INTRODUCTION

Brick is one of the primary building material and then most important material construction elements. The history of brick manufacturing goes back 8,000 years when the fabrication of the earliest sundried brick was discovered. After the days a brick is made of clay burnt in a kiln. The alternative method is the concrete brick is used the building material. Concrete brick is a very effective way to make a strong first impression. Concrete brick has more benefit then it is striking visual quantities. They deaden exterior noise providing a buffer from traffic noise, airplanes flying overhead and other various disruptions. Fire production is another benefit as is reduced maintenance. Finally, concrete brick walls can improve the thermal mass qualities of exterior walls, thus reducing energy bills. This project deals the effect of adding steel slag to conventional concrete brick. The effect of addition of steel slag in various percentages of concrete bricks such as compressive strength, water absorption and density test are investigated.

II. MATERIAL USED

A. Cement-(OPC 53)

OPC is generally second hand has binder material in concrete mix forms a solid matrix. Main aim of the OPC is increase the cohesive property inside the concrete constituents in order to make a good strength. Before use of this OPC all physical and chemical properties are examined for making the design mix like specific gravity finesse of cement consistency of cement is checked.

Table 1. Cement Properties

Properties of Cement		
1	Specific gravity	3.15
2	Initial setting time	30 min
3	Final setting time	600 min

B. Fine Aggregate- (Quarry Dust)

The aggregates most of which pass through 4.75mm IS sieve are termed as fine aggregates. In this experimental program, fine aggregate was locally procured and conformed to IS: 383-1970. The fine aggregate was sieved through 4.75mm sieve to remove any particles greater then 4.75mm and conforming to grading zone II it was light brown in colour.

Table 2. Fine aggregate (Quarry dust) properties

Physical Properties of Fine aggregate		
1	Specific gravity	2.7
2	Finesses modulus	2.8

C. Iron Slag

The iron slag is taken from the SSE Company located at Karamadai, Tamilnadu, India. Its black colour.

Table 3. Iron slag properties

Physical Properties of Iron slag		
1	Specific gravity	2.55
2	Finesses modulus	2.10

III. MATERIAL USED

A trial and error method were adopted to confirm a workable M20 mix. The mix proportion incorporate the as per IS 456-2000 and IS 10262-2009.

Table 4. Mix proportion – Control mix

Ratio	Cement	Quarry dust	Iron slag	Ratio (design mix) C: QD:IS: W/C
0%	1 kg	4.6 kg	0	1:4.6:0:0.5
10%	1 kg	4.14 kg	0.4 kg	1:4.14:0.4:0.5
20%	1 kg	3.68 kg	0.92 kg	1:3.68:0.92:0.5
30%	1 kg	3.22 kg	1.38 kg	1:3.22:1.38:0.5

IV. EXPERIMENTAL INVESTIGATION

Cubes were casted for both the control mix and mix with iron slag respectively.

Table 5. Total Number of Specimen's Casted

Specimen	Dimension	Total number
Cube	230 mm x 110 mm x 70 mm	9

V. EXPERIMENTAL PROGRAM AND RESULT

The experimental program is designed based on the percentage replacement of quarry dust by steel slag to study the mechanical properties of concrete at different grade of concrete. The replacement of quarry dust by steel slag for 0%, 10%, 20% and 30% are studied for compressive strength, water absorption test and density for curing period of 7 and 28 days.

A. Compressive Strength Test

The concrete brick specimen of dimension 230x110x70mm were prepared. They were tested on 2000kN capacity compression testing machine as per IS :516-1959 as shown in Fig.1

Fig1.Compressive testing machine

B. Compressive Strength Result

Table 6. Compressive strength result

Mix	Compression strength (N/mm$^{2)}$	
	7 days	28 days
0%	16.03	24.17
10%	27.27	32.85
20%	33.20	38.50
30%	35.96	39.20

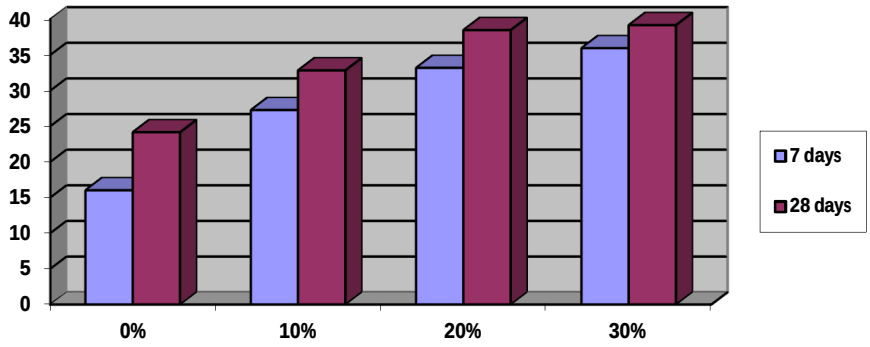

Chart 1. Compressive strength test result

C. Water Absorption Test

Bricks have pores in them. Due to porosity, the dry bricks when come into contact with water absorb water through these pores. Smaller the porosity lesser is the absorption as shown in Fig 2.

Fig 2. Water absorption test

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D. Water Absorption Test Result

Table 7. Water absorption result

Mix	Water absorption (%)	
	7 days	28 days
0%	0.600	0.550
10%	0.410	0.326
20%	0.330	0.218
30%	0.214	0.187

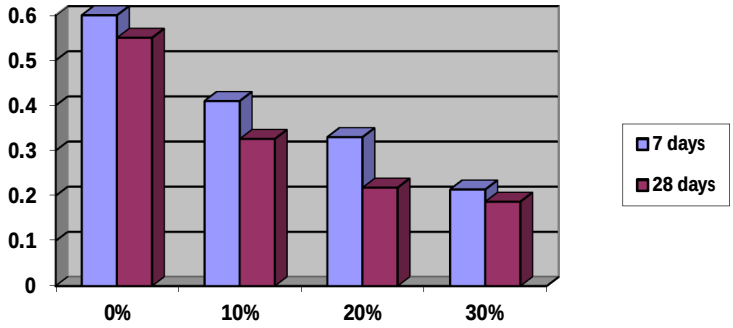

Chart 2. Water absorption test result

E. Density Test

Density test is one of the primary tests on bricks. This test shall be done for the both dry and wet bricks.

1) Density Test Result

Table 8. Density result

Mix	Density (kg/mm$^{3)}$	
	7 days	28 days
0%	2268.49	2303.78
10%	2328.05	2428.8
20%	2484.5	2660.92
30%	2708.9	2711.7

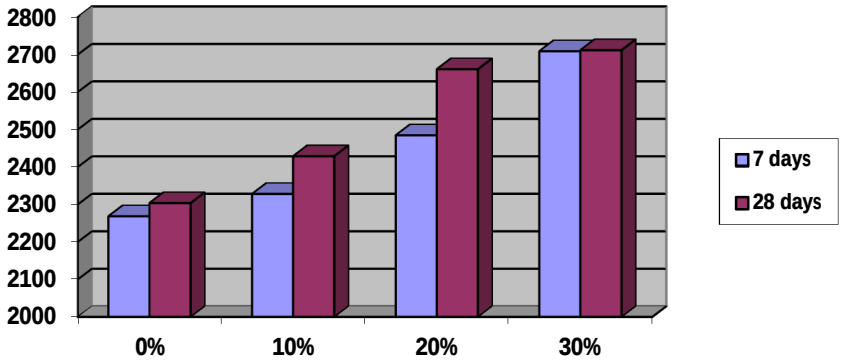

Chart 3. Density test result

VI. CONCLUSIONS

Based on the experimental investigation reported in this paper, following conclusions are drawn:

The compressive strength test is carried out on the concrete brick. The results of compressive strength test are given in Chart 1. On the addition of 30% iron slag. The compressive strength of the concrete brick specimen after 7 days and 28 days of curing has increased and reached a maximum value of 39.20 N/mm^2.

Which is greater than that required target strength. With the increase of percentage of iron slag in the concrete mix, the compressive strength also increased.

VII. ACKNOWLEDGEMENT

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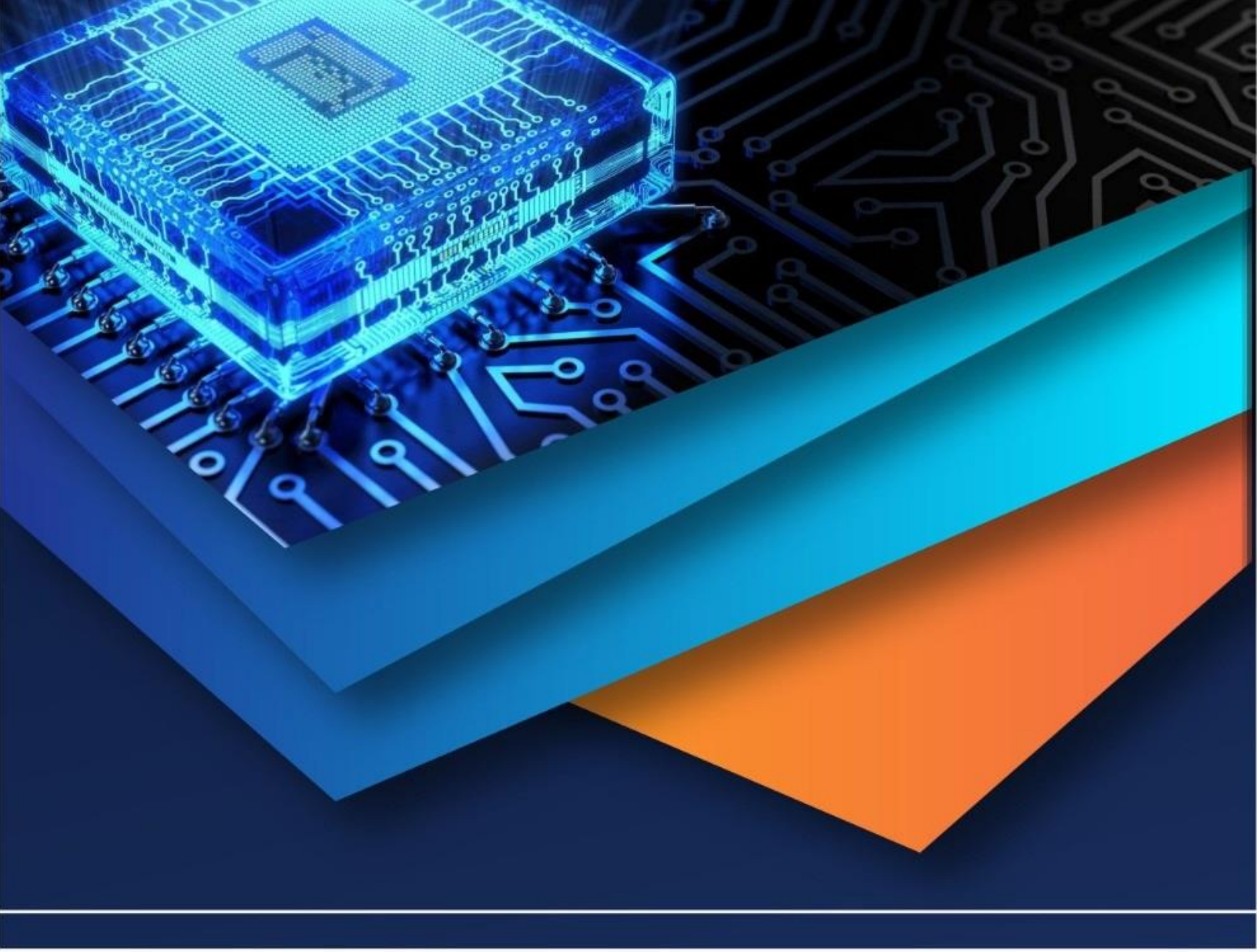

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