DURABILITY OF LIGHTWEIGHT CONCRETE BY PARTIAL REPLACEMENT OF RICE HUSK AS FINE AGGREGATE AND BRICK BATS AS COARSE AGGREGATE

[1] VINAYA SHYAM D, [2]NAVEEN KUMAR, [3]VIRANGOUDA G PATIL, [4]NAVYA K M, [5]SONALI G
[1] ASSISTANT PROFESSOR, [2]STUDENT, [3]STUDENT, [4]STUDENT, [5]STUDENT
[1]DEPARTMENT OF CIVIL ENGINEERING
[1]SHRI DHARMASTHALA MANJUNATHESHWARA INSTITUTE OF TECHNOLOGY, UJIRE, INDIA

Abstract: The project is to study the possibility of utilizing the waste over burnt brick and durability of the light weight concrete, where the light weight concrete is produced by replacing the brick bats as coarse aggregates, and Rice husk as fine aggregate. We are going to test durability of concrete based on strength criteria. In this project the Brick bat is replaced 5%, 10%, 15% & 20% and strength of the cubes are tested on 7, 14, 28, 56, 90, 180 & 359 days. Fine aggregate is replaced by 5% of Rice husk to reduce the density of concrete. Normally the density of the concrete is in between 2100 to 2200kg/m^3 for brick bats replaced concrete, hence it is called as medium light weight concrete. In this Project the strength and the density trends with increase in the Curing period. The reuse of materials like this brick bats and rice husk would contribute to sanitize our environment from its hazardous effects. The relationship between compressive strength and curing period, compressive strength and replacement of brick bats helps to analyze the durability of concrete. The density of cubes decreases and compressive strength increases with increase in curing period.

Index Terms – Durability, Brickbats, Rice husk.

I. INTRODUCTION

Concrete is the base material for construction industries. It is strong in compression and week in tension, the main constituents of concrete is cement, sand, coarse aggregate and water, replacing some of these materials makes significant changes in cost and some of its properties. Coarse aggregate filled about 70% of volume in concrete, the cost of coarse aggregate is rapidly increasing and the availability is getting reduced. The major cost of concrete is due to aggregate. The Over Burnt Brick available abundantly in Indian Brick Industries. The brick bats have less specific gravity compared to coarse aggregate it reduces density of the concrete. Environmental aspect replacement of brick bat in concrete will reduce the conservation in the natural resource.

Another predominant material in concrete is fine aggregate, as cost of sand is increasing in present days. Partial replacement of Rice Husk as fine aggregate will reduce the cost of concrete. Rice Husk is the abundantly available Agro waste from Paddy Industries. The chemical composition of rice husk is similar to most of the natural fibers. Hence, it acts as fiber reinforcement. The exterior of rice husk is composed of dentate rectangular elements, which themselves are composed mostly of silica coated with a thick cuticle and surface hair. It contains of cellulose 40-50%, Lignin 25-30%, and moisture 8-15%. No other plant except paddy husk is able to retain such a huge proportion of silica in it. The primary objective of this project is to study the influence of partial replacement of Over Burnt Brickbats and Rice Husk as coarse and fine aggregate respectively, and to compare it with compressive strength of conventional concrete of M_{20} grade. Brick bats are considered as waste material. So, replacing brickbats partially will reduce pollution to a great extent.

II. MATERIALS USED

The composition of concrete is mainly consist of Coarse aggregate, Fine aggregate, cement and water, the property of these materials change the property of concrete. In this project we used brick bats as coarse aggregates which helps to reduce the density, Rice husk is replaced partially by Fine aggregate which is acts as fibre in concrete and also helps to reduce the density. The properties of these materials is as follow

Table 2.1: Properties of Materials

Materials	Water absorption	Specific gravity	Size
Rice husk	20.77%	-	-
Brick bats	30.67%	-	< 20mm
Coarse aggregate	-	2.685	<20 mm
Fine aggregate	-	2.65	< 4.75mm

Cement	-	3.104	< 90 microns

The brick bats used in this concrete are 20mm passing and the water absorption of the brick bats is 30.67% of its weight. These brick bats has unit weight of 850 to 900 kg/m^3. The brick bats are collected from brick manufacturing unit Harihara, Karnataka, India. Then we also used rice husk as a partial replacement for fine aggregate. The chemical composition of rice husk is similar to most of the natural fibers. The exterior of rice husk is composed of dentate rectangular elements, which themselves are composed mostly of silica coated with a thick cuticle and surface hair. The rice husk is collected from Vinayaka Rice mill Belthangady, Karnataka, India. It contains of cellulose 40-50%, Lignin 25-30%, and moisture 8-15%, no other plant except paddy husk is able to retain such a huge proportion of silica in it. The mix proportion for the M_{20} Concrete is 1:1.7:2.7.

III. METHODOLOGY

The materials we use for this project are Cement (PPC), Coarse aggregate, Sand, Water, Brick bat (over burnt), Rice husk (Agro waste) collected from different places. The Rice husk and Brick bat will be used for partial replacement of fine aggregate and coarse aggregate respectively. The general tests on the materials are conducted like Specific gravity test, Water absorption test, Dry density test, Bulking of Sand test etc. The design of mix proportion will be calculated according to Indian Standard Code IS10262:2012. The mould of size 150mm cubes are used to cast the blocks. The cubes are casted by partial replacement of over burnt brickbats of 0%, 5%, 10%, 15% and 20% with coarse aggregate, and 5% replacement of rice husk with fine aggregate. The blocks are then kept for curing for the duration of 7, 14, 28, 56, 90, 180 and 359days. The dry density is calculated after curing period of each block and the tests on these blocks are conducted in Universal Testing Machine (UTM) to check the compressive strength of the blocks casted on their respective days. The test results are taken for the further study of our project. The total of 105 cubes are tested and results obtained.

IV. DISCUSSION

The cubes of different proportions which consist different amount of brickbats and 5% of Rice husk are tested. 3 cubes for every different proportion is tested, and the result is taken as an average of 3 cube strengths. The below table shows the compressive strength of different proportion of brick bat used cubes with respect to curing period.

Table 4.1: Compressive strength of Conventional concrete and Medium light weight concrete

Curing period (days)	Compressive strength (N/mm^2)				
	Conventional concrete	5% brick bats	10% brick bats	15% brick bats	20% Brick bats
7	29.67	8.75	9.54	7.97	6.62
14	28.12	10.05	9.3	10.28	10.02
28	29.88	8.9	9.17	10.44	10.17
56	28.54	10.97	11.02	10.22	9.62
90	29.88	11.54	14.6	12.47	10.09
180	28.12	10.82	12.25	12.96	13.06
359	29.67	15.87	16.62	13.68	12.14

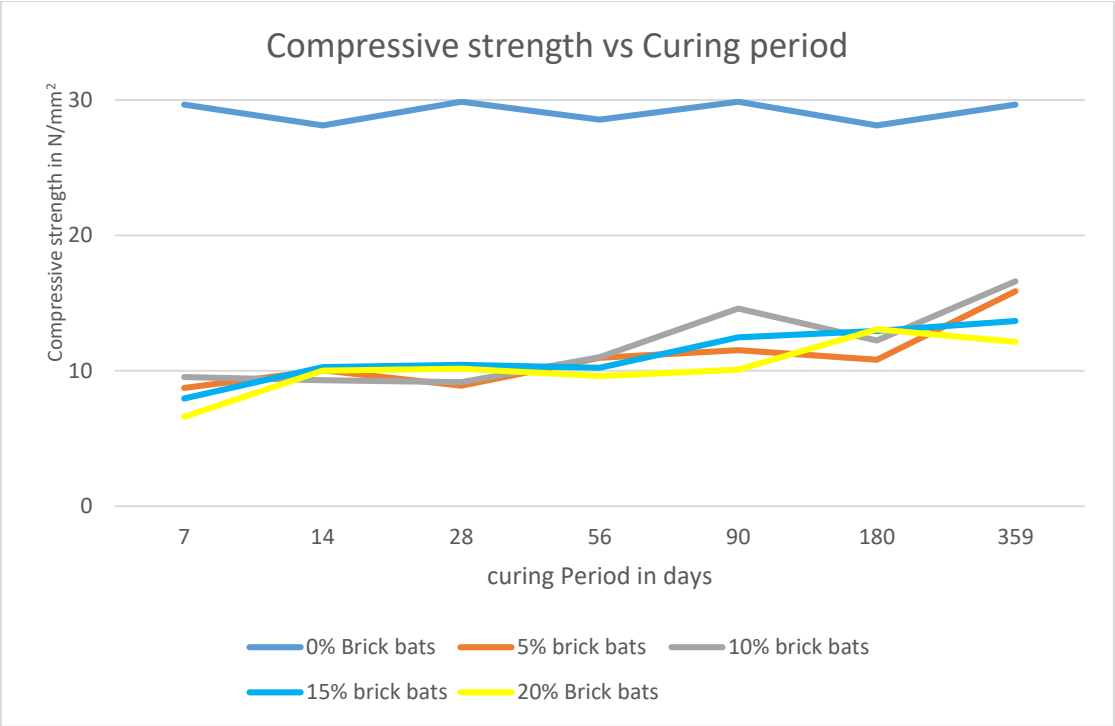

Fig 1: Compressive strength vs Curing period Graph

After testing the cubes of different proportion of brick bats we got variation in density and compressive strength. The optimum percentage at which the compressive strength increase is 10% of brick bat and 5% Rice husk replacement later its goes on decreasing. For Example in 5% replacement of brickbats the strength of the cube goes on increasing with curing period. The density of the concrete goes on decreasing with increase in curing period.

Table 4.2: Density of conventional concrete and Medium light weight concrete

Curing period (days)	Density (Kg/m^3)				
	Conventional concrete	5% Brick bats	10% Brick bats	15% Brick bats	20% Brick bats
7	2502.79	2225.2	2233.08	2234.07	2210.25
14	2478.01	2220.11	2215.79	2232.09	2202.46
28	2477.01	2212.34	2213.58	2220.82	2193.6
56	2465.2	2195.54	2210.3	2210.56	2136.27
90	2484.44	2211.33	2174.8	2195.64	2143.2
180	2470.69	2189.46	2190.61	2195.64	2142.41
359	2386.16	2181.28	2170.96	2190.37	2130.59

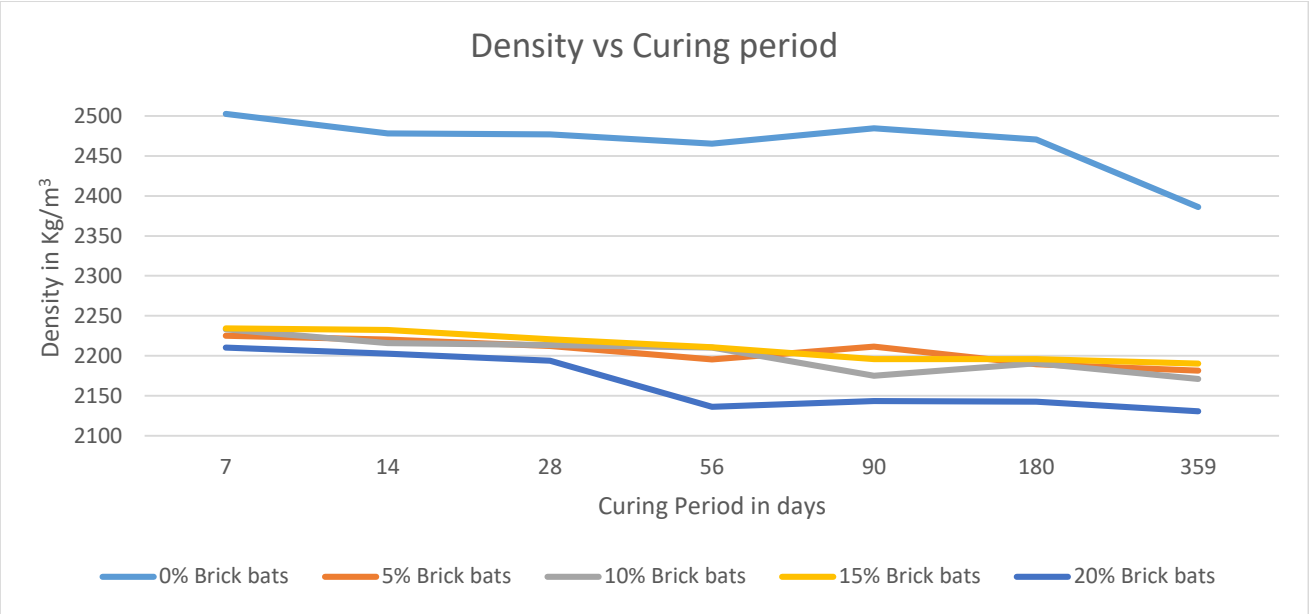

Fig 2: Density vs Curing period Graph

In Fig 2 represents the plot of density vs curing period. The density of the cubes is goes on decreasing with increase in curing period.

The density of these cubes are around 2100Kg/m^3 to 2200 Kg/m^3. Hence it is called as medium light weight concrete.

V. CONCLUSION

From all the results of these cubes which clearly shows that the compressive strength of the cubes decrease with increase in the amount of brick bats. The compressive strength of 10% replaced brick bat concrete gives satisfactory result, also the strength of the concrete increases with curing period. The density of the cubes decrease with increase in the curing period.

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