Experimental Study on Effect of Partial Replacement of JHAMA Bricks as Coarse Aggregate in Concrete

Mr.N.Thirugnansambantham[1] Arun R[2] Dhamayanthi Malathi A[3] Manikandan K C[4] Vinothkumar P[5]

[1]Head of the Department [2,3,4,5]Student

[1,2,3,4,5]Department of Civil Engineering

[1,2,3,4,5]Shree Venkateshwara Hi-tech Engineering College, Othakuthirai, Gobi, India

Abstract— The concrete is very useful material and now a days it is not only used in the building construction work but it is also useful for the construction of the bridges, roads, dams and other important structures. The concrete is a composite material and conventional concrete is made of cement, fine aggregate, coarse aggregate and water. Since the use of concrete is very large and day by day the cost of the conventional concrete material also rises. So, it is advantageous to use the alternative materials for making the concrete. This project focuses on the coarse aggregate in concrete. In this project Jhama brick or over burnt brick is used to replace the coarse aggregate partially. This material was chosen because of their availability also possesses higher strength between 120 to 150 Kg/cm2. The jhama brick is available from brick manufacturing area. This project presents the effects of jhama class brick inclusion on the mechanical properties of jhama class brick based concrete used partially replace, ent jhama class brick to coarse aggregate ratios of 15%, 20%, 25% in M25 grade of concrete.

Keywords: Partial Replacement, JHAMA Bricks, Concrete

I. INTRODUCTION

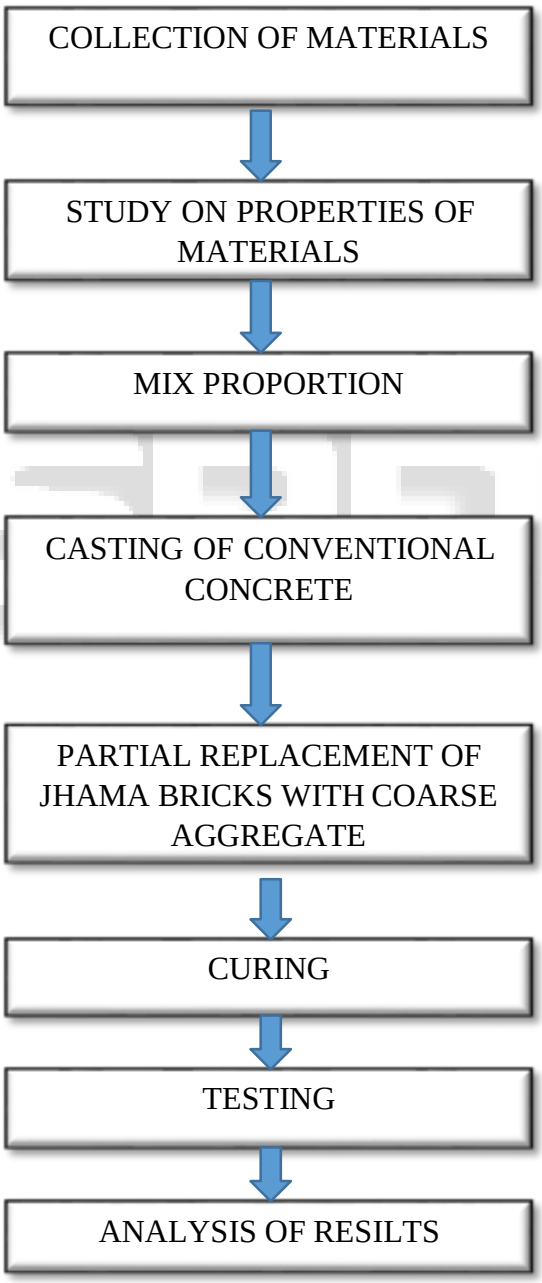
Concrete is considered as the world's most used construction material. The usual ingredients in concrete are cement, fine aggregate, coarse aggregate, and water. It was recognized long time ago that the suitable mineral admixtures are mixed in optimum proportions with cement improves the many qualities in concrete. With increasing scarcity of river sand and natural aggregate across the country, research began cheaply available material as an alternative for natural aggregate. Utilization of industrial waste or secondary material has increased in construction field for the concrete production because it contributes to reducing the consumption of natural resources.

In this project, the jhama bricks are used to replace the coarse aggregate with the percentages of 15%, 20%, & 25% by weight of coarse aggregate in M25 grade of concrete. Concrete cubes and cylinders for different curing ages to be tested at the age of 7, 14 and 28 days.

In India, there is great demand of aggregate mainly from civil engineering industry for road and concrete constructions. But, now a days it is very difficult problem for availability of coarse aggregates. So, researches developed waste management strategies to apply for replacement of coarse aggregates for specific need.

Natural resources are depleting worldwide while at the same time the generated wastes from the industry are increasing sustainable development for construction involves the use of non- conventional and innovative materials, and recycling of waste materials in order to compensate the lack of natural resources and to find alternative ways conserving the environment.

II. METHODOLOGY



III. MATERIAL SPECIFICATION CEMENT

Cement is fine, gray powder is mixed with water and materials such as sand, coarse aggregate to make concrete. The cement and water from a paste tat binds other materials together as

concrete. In this present work Ordinary Protland Cement (OPC) cement of 53 grade was used from casting the cubes and cylinders. Cement was uniform in color i.e, gray with a light greenish shad.

Particulars	Values
Grade	OPC 53
Specific gravity	3.13
Standard consistency %	32%
Fineness %	3.11%
Initial setting time (mins)	30
Final setting time (mins)	600

Table 1: Properties of cement

A. Fine Aggregate

These are the aggregate which have a size less than 4.75mm. in the laboratory, they are classified as the aggregate which passes through the BIS sieve no.480. usually natural sand is used as fine aggregate. At place where natural sand is not available crushed stone is used as fine aggregate.

- Specific gravity of fine aggregate is 2.63
- Fineness % of fine aggregate is 2.45
- Bulk density of fine aggregate is 1.71

B. Coarse Aggregate

The size of aggregate between 20mm and 4.75mm is considered as coarse aggregate. Laboratory tests were conducted on coarse aggregate to determine the different physical properties as per IS 2386 (Part III) – 1963. This test was conducted for 20mm size aggregate. This method is useful for finding the particle size distribution of aggregate. They were considered as per IS 383-1970.

- Specific gravity of coarse aggregate is 2.72
- Fineness % of coarse aggregate is 7.17
- Bulk density of coarse aggregate is 1.594

C. Water

Water is a key ingredient in the manufacture of concrete. Attention should be given to the quality of water used in concrete. The good quality concrete can be made with water which should be clean and portable. Water should be avoided if it contains large amounts of dissolved solids, or appreciable amounts of organic materials.

- Specific gravity of water is 1
- PH value of water is 7 to 9

D. Jhama Bricks

When the bricks excessively up to the temperature 1100-1200 degree centigrade it turns into over burnt bricks. These bricks are also known as jhama bricks. Due to over burnt, the bricks become black and its edges are also become curved. Due to this the bricks are sold at cheaper rate. Therefore, one of the cheaper alternatives for coarse aggregate.

Particulars	Values
Specific gravity	2.67
Crushing value	35.97
Bulk density	2.32
Impact value	19.14

Table 2: Properties of jhama bricks

IV. EXPERIMENTAL RESULT COMPRESSIVE STRENGTH

A. Compressive Strength of Hardened

Concrete id done by cube test. Compressive strength of concrete on hardened concrete is determined using compressive test. The compressive test is carried out on specimen cubical in shape. The cube of size 15 x 15 x15 cm are used. Metal mould preferably steel or cast iron are selected, cleaned and inner layer of specimens are applied with crude oil. Concrete prepared in the ratio 1:1:2 and is filled into the mould in layers approximately 5cm deep. Each layer is compacted either by hand or by vibration.32

After the top layer has been compacted the surface of the concrete is brought to the finishing level using a trowel. When compacting is done by hand, the standard tamping bar is used and the strokes of the bar are distributed a uniform manner over the cross section of the mould.

Compressive strength of concrete =Maximum compressive load / cross sectional area

$\sigma = P/ bh$ for cube

$\sigma = P/ \pi r^2 h$ for cylinder

σ = Compressive strength of specimen p = Load applied to the specimen

b = Breadth of the cube specimen h = Height of the specimen

r = Radius of the cylinder

Size of cubes = 150 mm x 150 mm x 150 mm

Grade of concrete = M25 grade specimen

B. Compressive strength test values

s.no	%	7 days N/mm^2	14days N/mm^2	28days N/mm^2
1.	0%	20.20	25.20	31.60
2.	15%	20.50	25.15	32.81
3.	20%	20.73	23.20	33.30
4.	25%	20.86	24.91	32.25

Table 3: Compressive strength of jhama bricks

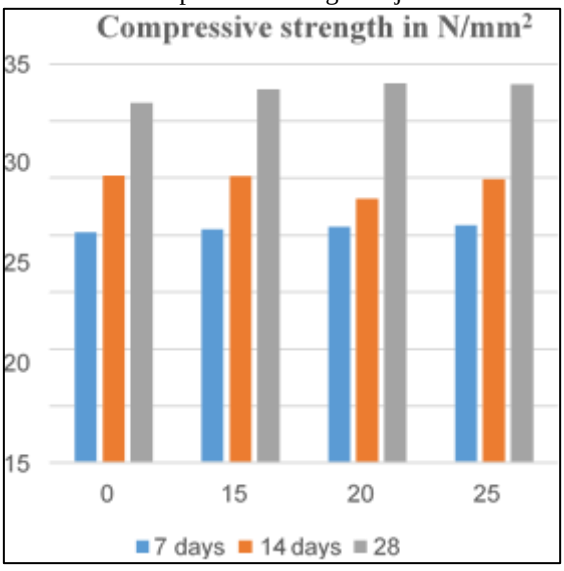


Fig. 1: Compressive strength test

V. SPLIT TENSILE STRENGTH TEST

This test was developed in Brazil in 1943. The splitting test is simple to perform and gives more uniform result than other

tension test. Strength determined in the splitting test is found to be nearest to the tensile strength of concrete.

The test is carried out by placing a cylindrical specimen of 15cm and length 30cm loading in a compressive testing machine. The load is applied until failure of the cylinder which occurs along the diameter.

$$Fbt = Pl/(bd^2)$$

Where,

P = Compressive strength at failure l = load of cylinder
b = Width of cylinder d = Diameter

A. Split Tensile Strength Test Value

S.no	%	7days N/mm^2	14days N/mm^2	28days N/mm^2
1.	0%	2.11	2.22	3.02
2.	15%	2.15	2.25	3.09
3.	20%	2.17	2.20	3.07
4.	25%	2.10	2.17	3.06

Table 4: Split tensile test for jhama bricks

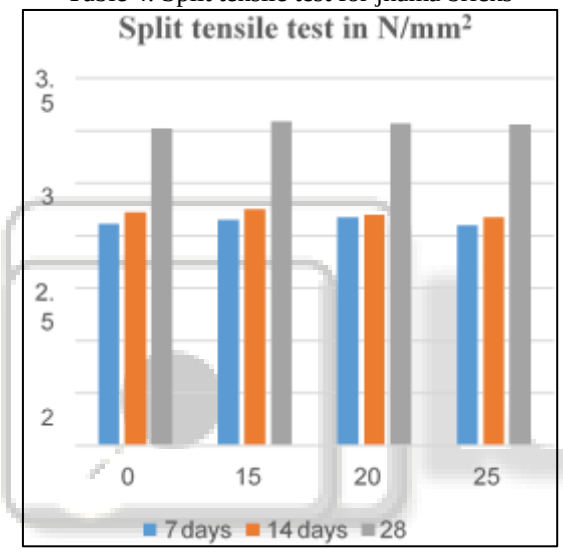


Fig. 2: Split tensile test

VI. Discussion

It can be seen that there is increase in strength with the increase in jhama bricks percentages. The highest compressive strength was achieved by 20% replacement of jhama brick, which was found to be about 33.30 Mpa.

The compressive strength of concrete is increased as jhama brick content increase up to 20%, beyond that compressive strength decreases in the strength of almost 5% compared to the control mix.

It is recommended that up to 20% of jhama brick can be use as replacement of coarse aggregate.

The highest split tensile strength was achieved by 15% replacement of jhama brick, which was found to be about 3.09 N/mm2. This means that there is an increase in the strength of almost 3% compared to the control mix at 28 days.

VII. Conclusion

We concluded that the strength of concrete increased by the replacement of coarse aggregate by 20% of jhama brick, save concrete materials costs. Here we are using OPC of 53 grade, well graded coarse and fine aggregate.

Among different percentage mixes of concrete 20% showed maximum compressive strength at later ages.

The compressive strength was found to be about 4% higher than control mix when the coarse aggregate is replaced by 15%.

The compressive strength was found to be about 3% higher than control mix when the coarse aggregate is replaced by 15%.

The cost analysis indicates that percent of coarse aggregate reduction decrease the cost of concrete, but at the same time strength also increase. The mix is the most economical and gives high strength compared to control mix.

Reference

[1] Ashit Kumar., Dr. Anil Kumar Saxena., (2016), "Use of jhama brick dust as an alternative material for fine aggregate in concrete". International Journal of Advanced Technology in Engineering and Science, ISSN: 2348 – 7550, Vol No.4, Issue No.11.

[2] Apebo., N.S. Agunwa,ba., J.C., Ezeokonkwo., (2014), " The suitability of crushed over burnt bricks as coarse aggregates for concrete". International Journal of Engineering Science and Innovative Technology, ISSN: 2319-5967, ISO 9001 : 2008, Volume 3, Issue 1.

[3] Ahmad S.I., Roy s., (2012), " Creep behavior and its prediction for normal strength concrete made from crushed clay brick as coarse aggregate". Journal of Mterial in Civil Engineering, Vol, - 24, pp.30.

[4] Ataullah' , mohammad adil, waqau ahmad, attur rabaman. For the investigation for the partial replacement of coarse aggregate by jhama brick in concrete is studied.

[5] Bidve ganesh shivkanth, G.N Bidve Engineering College, latur India (2019), concrete is considered the world's most used construction material. Typical concrete mixtures are comprised of water, sand, cement and an aggregate of rock.

[6] Nilesh Kumar., Anil Kumar Saxena., Gourav Soni., (2017), "Analysis on concrete made from over burnt bricks". International Journal of Advance Research, Idea and Innovations in Technology, ISSN: 2454- 132X, Impact factor: 4.295, Volume 3, Issue 6.

[7] Tariq Ali., Nouman Iqbal., Muhammad Ali Khan., Dr. Menboob Ali., Dr. Khan Shanhzada., (2014), "Evaluation of Flexure Strength behavior of over burnt bricks ballast aggregate concrete". Tariq Ali et al Int. journal of Engineering Research and Applications, ISSN: 2248-9622, Vol.4, Issue 1 (Version 1).

[8] Mr. Gs. Pathil, Mr. p. b. autade concrete is considered the world's most used construction material.

[9] Dr. M.N.Hiremath Mr.Sanjay s.j Ms poornima coarse aggregate is one of the essential ingredients apart of water and cement in concrete production.

[10] Dr. M.N.Hiremath Mr.sanjay s.j Ms pooornima coarse aggregate is one of the essential ingredients apart of water and cement in concrete production.

