A Research on Replacement of Coarse Aggregate With Jhama Bricks

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Abstract- *The use of concrete is truly large and day by day the cost of the conventional material cost is also rising. So, it is beneficial to use the optional materials for making concrete. The project focuses on coarse aggregate in concrete. In this project work, the study has been done on the replacement of coarse aggregate with demolished brick aggregate known as jhama bricks. The optional source is jhama brick as a coarse aggregate. The jhama brick is available from brick manufacturing area. This would not only make good use of the otherwise material but would also help alleviate disposal problems. The research was conducted to study the suitability of crushed over burnt brick as alternative coarse aggregate for concrete production. The concrete cube of M-25 grade were thrown in this trail explore work and try to analyze different properties of concrete with crushed over burnt bricks as an alternative material. The physical properties like compressive strength & workability with alternative material were used with a dosage of 0%, 10%, 20% & 30% in concrete with the age of 7and 28 days of curing.*

Keywords- Jhama Brick, Workability, Compressive Strength, Water Absorption test, Flexural Strength.

I. INTRODUCTION

Concrete is one of the main Material in construction industries the main ingredient of which is cement, sand, coarse aggregate and water. Now a days this natural material can be replaced with other materials like waste or manufactured materials,making significant changes in performance as well as cost. A major part of concrete is filled with coarse aggregate. The construction industry is revolutionizing in two major ways. One way is the development of construction techniques, such as using automated tools in construction. The other is the advancement in high-performance construction materials, such as the introduction of high strength concrete. Concrete is one of the most extensively used construction materials in ultramodern days. The raw materials from which it's prepared; cement and aggregates, affect both the quality and cost of construction. Aggregates are generally cheaper than cement and constitute over 70% of the volume of concrete.

It has attained the status of the most favored material in ultramodern constructions. Whenever there's a demand for Strength, Fire resistance, and endurance, concrete is always preferred and considered the best material. The availability and nearness of aggregate to the construction locality also affect the cost of construction. Bricks are adaptable and durable edifice and construction materials, with good load-bearing properties. Various studies have been carried out on the porosity, permeability, and absorption of bricks. It's reported that the properties of concrete which use crushed bricks as a natural coarse aggregate partial substitute.

An experimental study has also been done to achieve progressive strength concrete using crushed brick aggregate. It has been found that even recycled brick can also be a substitute for coarse aggregate in concrete. This material was prioritized because, in brick making, many bricks are repudiated due to nonconformity with the deformed form of brick produced due to high-temperature control in the kiln. These rejected bricks can also be an implicit source of coarse aggregate. According to the general description, concrete is a composite material so by taking advantage of the situation for the people, this paper presents the exploration that's carried out on the concrete when natural coarse aggregate is partly replaced by jhama brick aggregate.

The coarse aggregate was replaced with 0%, 10%, 20%&30%of over burnt bricks by volume of concrete. The series of tests are conducted to study the effect of 0%, 10%, 20%&30%replacement of coarse aggregate with over burnt bricks. It started to produce lightweight concrete by using lightweight aggregates to develop lightweight concrete production in 20th century. These will diminish the measure of ozone harming substance era. The blocks which are close to the fire in the oven subjected to high warmth more than1000 degree centigrade will shrink and change in shape, the shading ends up noticeably ruddy and its appearance like rosy to blackish inclination stone. Brick bats are one of the types of aggregate used in certain places where natural aggregates are not available. Brick bats which are made from over burnt bricks used as coarse aggregate which is hard and absorbs less water.

Due to its distorted shape, over burnt bricks are considered as wastage. But there is a scope of using the over burnt bricks as a source of aggregate for construction. The over burnt brick aggregate can solve the problem of shortage of aggregate.

AIM OF THE STUDY

The main aim of this experimentation is to study the effect of partial replacement of course aggregate by jhama brick on the properties of concrete and check its compressive strength and workability of concrete.

SIGNIFICANT OF THE STUDY

- To reduce the space required for landfill of jhamabrick.
- To diminish the pressure on exploiting the natural resources
- These rejected jhamabricks can also be a potential source of coarse aggregate.

II. LITERATURE REVIEW

Mr. G. S. Patil (2015) This study investigated the effect of three different coarse aggregates on the mechanical properties, durability, and microstructure of concrete. Concrete specimens were made using aggregates obtained from three regions with different mineralogy.Effect of partial replacement of coarse aggregate by jhama brick in concrete,Unit weight of concrete decrease as the percentage of jhama brick increase. Concrete by using jhama brick initially gives higher compressive strength.

Daddan Khan et. (2017) Due to the abundant usage of concrete as a construction material, there is a fast-dwindling source of aggregates. There are regions where there is scarcity of coarse aggregate, so to resolve this problem, Bricks Aggregates can be used as coarse aggregate. A concrete mix ratio of 1:2:4 having characteristics strength of 3000 psi has been used in this experimental work. Compressive and tensile strength of concrete mix where 50% coarse aggregate is replaced with brick aggregate and concrete mix where 100% coarse aggregate is replaced with brick aggregate and addition of silica fume as a supplementary cernenting material have been evaluated at 7, 14 and 21 days of age. The experimental test results revealed the compressive and tensile strength of concrete where coarse aggregate is replaced at 50% is almost the normal concrete at the 7, 14, 21 & 28 days.

Nilesh Kumar (2017) The concrete cube beams and cylinders of M-25, M30, and M-35 grades were thrown in this trail to explore work and try to analyze different properties of concrete with crushed over burnt bricks as an alternative material. They found that the aggregate concrete derived from Over Burnt bricks aggregate attained lower strength than the regular concrete.

Sonu Kumar Gupta (2020) in this project, they replace the coarse aggregate with jhama class bricks bats up to 20% and 40% for M20 grade concrete, it is observed that workability decreased with the replacement of coarse aggregate. One main thing is that weight of concrete is decreased usingjhamabrick, and the cost of concrete is also decreased due to the use of jhama class brick.

Nitesh Bhardwaj (2020) In this investigation distinctive cement biends were set up by supplanting sand with jhamabrick powder from 10% to 30%. The evaluation of cement utilized in this examination is M25 according to IS arrangement. The fundamental goal behind this work is to utilize squander material for casting concrete specimens and decrease the utilization of normally accessible sand for sustainable and waste management of resources.

Ashit Kumar (2021) In this research, they use Jhama Brick Dust as an alternative material for the fine aggregate. The Jhama Brick Dust is a partial replacement of the sand from 0%, 10%, 20%, 30%, 40%, and 50%. Various tests are carried out such as Compressive strength, Flexural Strength, and Split Tensile Test at an age of 7, 14, and 28 days of curing. And the Grade of the concrete M25 the mix design is carried out as per IS provision. The main purpose of this research is to use the waste material for making concrete.

III. MATERIALS USED & PROPRETIES

3.1 MATERIALS USED

a) CEMENT:Cement is a fine, grey powder. It is mixed with water and materials such as sand, gravel, and crushed stone to make concrete. The cement and water form a paste that binds the other materials together as the concrete hardens. Ordinary Portland cement having 28 days compressive strength of 43 MPa was used for the preparation of all concrete cubes. By using one type of cement, the effect of varying the types of coarse aggregate in concrete is investigated.

b) FINE AGGRIGATE: The sand used for the experimental program was locally procured and conformed to Indian Standard Specifications IS 383-1970. The sand was first sieved through a 4.75 mm sieve to remove any particles

greater than 4.75 mm and then was washed to remove the dust. The sand used in this experiment was M sand.

c) COARSE AGGREGATE: The broken stone is generally used as a coarse aggregate. The nature of work decides the maximum size of the coarse aggregate. Locally available coarse aggregate having a maximum size of 20 mm and shape of angular was used in our work.The aggregates were washed to removedust anddirt and were dried to surface dry condition. The aggregates were tested as per Indian Standard Specifications IS 383-1970.

d) JHAMA BRICK: The bricks are burnt up to a temperature of 800-900℃ in the brick kiln. If the temperature in the brick kiln is uncontrolled then the bricks are burnt excessively up to the temperature of 1100-1200℃. Due to this, the bricks are sold at a cheaper rate as they become out of shape. Therefore, this type of brick is known as over burnt brick. These bricks are also known as Jhama bricks.

These bricks, however, possess higher strength than the normal burnt clay bricks. They are sometimes found to be stronger than even the first-class brick. Over burnt bricks have high compressive strength between 120 to 150 Kg/cm². However, they are in very poor shape. Brickwork using these bricks utilizes 40% more mortar than traditional brickwork.

e) WATER: Water is used for mixing, and the curing purpose should be clean, portable, fresh, and free from any bacteria. Water is a key ingredient in the manufacture of concrete.

3.2 MATERIALS PROPERTIES

A) CEMENT: - Ordinary Portland Cement of Ultra-tech of 43 Grade was used and it was conforming to IS 12269:1987 properties of cement are tabulated in table 1.

Table – 1 Test on Cement

Sr. No.	Properties	Test results
1	Specific gravity	3.15
2	Normal Consistency	34%
3	Initial Setting Time	40 min.
4	Final Setting Time	300 min.
5	Soundness Test	1.0

B) FINE AGGREGATE: -Fine aggregate includes the particles that all pass through the 4.75 mm sieve and retain in the 0.045 mm sieve to remove any particles greater than 4.75 mm and then washed to remove the dust. Properties of fine aggregate are tabulated in Table 2.

Table – 2 Test on Fine Aggregate

Sr. No.	Properties	Test Results
1	Type	Uncrushed
2	Specific Gravity	2.71
3	Water Absorption	1%
4	Fineness Modulus	3.52
5	Grading Zone	II

C) COARSE AGGREGATE: - The Coarse aggregate was tested as per Indian Standard Specification IS:383-1970.

Table – 3 Test on Coarse Aggregate

Sr. No.	Properties	Test Results
1	Type	Crushed
2	Maximum Size	20 mm
3	Specific Gravity	2.84
4	Water Absorption	0.631%
5	Fineness Modulus	6.56
6	Grading Zone	II

D) JHAMA BRICK: -TheJhama Brick is broken into pieces calledbricks;Properties of Jhama Brick are tabulated in Table 4.

Table – 4 Test on Jhama Brick

Sr. No.	Properties	Test Results
1	Maximum Size	20 mm
2	Shape	Angular
3	Specific Gravity	2.18
4	Water Absorption	11%

IV. METHODOLOGY

GENERAL: -This presents the details of development of the process of making Jhama Brick based concrete. Required materials were collected and preliminary tests were done on materials to construct mix design of M25 grade.

A) MIX DESIGN: - Concrete of grade M25 was prepared for this mix design. The mix design guidelines were carried out as par the IS10262-2019 & IS 456:2000. The Proportion for M25

grade Was taken as **1:1.278:3.07** by weight and their water cement ratio as 0.45 and Jhama brick replace 0%, 10%, 20% & 30%.

Table – 5 Mix Design

water	Cement	Fine Aggregate	Coarse Aggregate
191.6	425.78kg	544.36 kg	1306.46 kg
0.45	1	1.278	3.07

B) PROPORTIONING, MIXING AND CASTING OF SAMPLE: -The guidelines were as per the IS code specification for proportioning and proper attention and care had been taken while mixing and casting the samples. All material were batched with proper care and mixing was done in laboratory by concrete mixing by hand. After mixing all the materials properly, water was added. The cubes were cast as per the requirements of testing. The molds were levelled with the help of shovel and after 24 hours of casting, they were demolished and kept in casting tank up to the date of testing.

C) SPECIMEN DETAILS: - 6 Cubes were prepared for one mix. The dimension of cube, cast within the experiment was (150mm X 150mm X 150mm) respectively and total 24 cube casting, molds were conforming to the IS specification.

D)CURING: - All the molds were cured by immersing in a curing tank in the lab for 7 days & 28 days. The specimens were brought out than water roughly 24 hours before testing and kept at room temperature till testing laterfollowing test were performed on cube respectively and result were recorded.

Compressive Strength Test

V. RESULT AND DISCUSSION

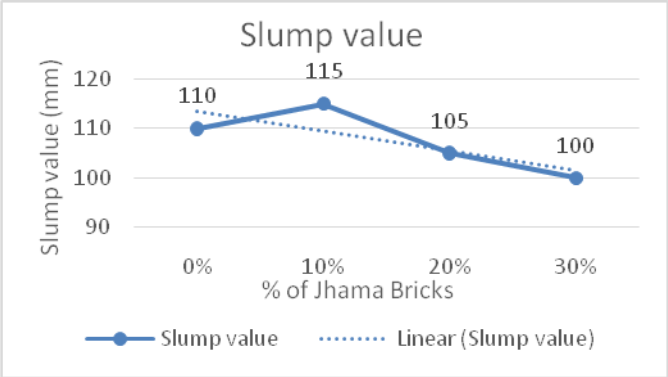
5.1) Workability Test: -

The Workability of M25 grade of concrete is measured by a widely used empirical test i.e. Slump Test with W/C ratio 0.45 for addition of different percentage Jhama Brick.

Table- 5 Slump values for different percentage of mix.

Sr.No.	% of Jhama Brick	Slump Value (mm)
1	0%	110
2	10%	115
3	20%	105
4	30%	100

Graph 1 : Slump Value



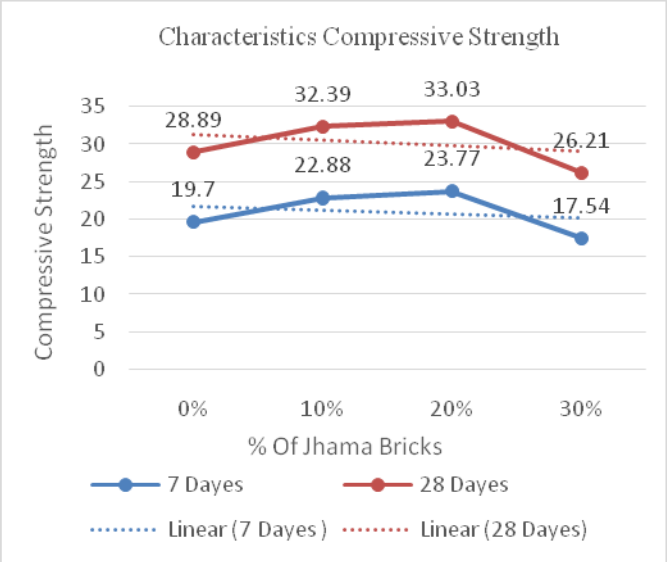
5.2) Compressive Strength Test

The Result of compressive strength after 7 days & 28 days are recorded Result indicate that as we increase percentage of Jhama Brick from 0%, 10%& 20% its compressive strength increases after further increment in percentage of Jhama brick there is loss in compressive strength. That means we can replace up to 20% natural coarse aggregate by Jhama Brick.

Table- 6Characteristics Compressive Strensth Test

Sr. No.	Replacement in %	characteristics Compressive Strength in N/mm²	
		7Days	28Days
1	0	19.7	28.89
2	10	22.88	32.39
3	20	23.77	33.03
4	30	17.54	26.21

Graph 2 :Compressive Strength at 7& 28 days



VI. CONCLUSION

Based on results and observation made in experimental research study. The following conclusions are drawn.

1. - It is observed that with increase in percentage of Jhama Brick i.e.for10%Workability increases by 4.54% and further increment in percentage of jhama brick i.e. for 20% & 30% workability decreases by 4.45% & 9.09% respectively.
2. - 12.11% & 14.33% increment in the compressive strength is found for 10% & 20% replacement of coarse aggregate by jhamabrick; The strength decreases by 2.56% when the 30% of coarse aggregate is replace by jhamabrick, by using and water cement ratio (w/c) is 0.45
3. – It is to be feasible in mass concrete filling area.
4. – Use of Jhama Brick helps to preserve natural aggregates source.
5. – Current study concluded that Jhama Brick can replace coarse aggregate up to 20%.
6. – The use of Jhama Brick in concrete is possible to improve its characteristics Compressive Strength.

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