Analysis & Compressive Strength Study of Eco-Friendly Concrete by Partial Replacement of Recycle Brick with Over-Burnt Brick Aggregate

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Abstract- The study & research was experimentally done to identify the suitability of crushed over burnt bricks taken as alternative coarse aggregates for concrete properties. In this study blocks of clay are pulverized into coarse aggregates for concrete, forming basic lightweight concrete. Concrete is the most important and widely used construction material now a days. Concrete is that material which is synthesized and used for the ground that all civil designing structure is developed with concrete. Utilization of mud blocks as a coarse aggregate material was used with a dosage & by Netting on them by 15%,30%,45% the concrete strength for M15, M30 & M40 grade, Concrete was used as reference mix and it is tested by aggregate weight in concrete with in 7 & 28 days and most appropriate percentage of replacements is made and strength of material and workability parameters are studied and the outcomes of result were analyzed .compressive strength, tensile strength, flexural strength and workability physical properties material was used with a dosage of 15%, 30% and 45% in concrete with the age of 7, 28 days of curing. Over Burnt bricks were tested for compressive strength, tensile strength, flexural strength, and workability. The general properties of fresh and hardened concrete were tested and the outcomes of result were analyzed. On the basis of analysis & compressive strength study and research data the use of crushed over burnt brick of coarse aggregate for structural concrete structure has strongly recommended strength, flexural strength, and workability. The general properties of fresh and hardened concrete were tested and the outcomes of result were analyzed. On the basis of analysis & compressive strength study and research data the use of crushed over burnt brick of coarse aggregate for structural concrete structure has strongly recommended.

Keywords-Brick Ballast, Compressive Strength, Flexural Strength, Over Burnt Bricks, Slump, Workability.

I. INTRODUCTION

Concrete is widely used for making architectural structures, civil structures like foundation construction, retaining structures, pavement construction, highways, runways, parking structures, dam, construction, reservoirs formation, pipes and poles. Concrete is made by mixing cement, sand, coarse aggregate and water into a composite material that can be formed into any shape. Pile with critical volume and with aggregates. The idea of aggregates in concrete lowers its drying shrinkage properties and elevates various properties, for example compressive quality, etc. Even though, it is excessive to ship, so local sources are relied upon to reduce the cost of the vehicle, it is not available in all places due to the need for land, so it should be searched and nearby by various sources, option is required. Various materials are used as alternative hotspots to regular coarse aggregates, reuse of low-quality crushed block, reuse of coarse aggregate, coconut shell, reuse of plastic aggregate, too many extended blocks, etc. Select a jhama class block for this job as an alternate hotspot for the course total, this material was chosen on the basis that in block making, a large number of blocks are rejected due to non-symmetry, it is the inclined block made due to the high temperature control in the radiator. These rejected blocks can also be potential sources of coarse aggregates. Concrete by general definition is a composite material so by abusing the condition for a wider network, this paper demonstrates the test that is performed on concrete when the trademark coarse aggregate is not completely replaced by jhama class block aggregate. Aggregates are essential components in concrete composites that help reduce shrinkage and enable economy concrete construction. A broad class of aggregates used have traditionally been aggregates, for example squash shakes, shakes and sands which are usually deceptively natural or inert when reinforced with concrete. Recovery of brick units from masonry constructed with Portland cement mortar is impractical for reuse because the bond is too strong. Therefore, they are mostly crushed and used with mortar impurity. A selective screening is also possible to obtain ceramic materials. Apparently, the waste material from manufacturing plants does not have this problem. Today recycled brick is used as an overlay material in tennis courts and tracking areas, and as a plant substrate. In civil engineering applications, it can be used in unbound systems such as drainage blankets, sub bases in road construction, or filling materials in embankments. On the other hand, the use of a higher grade such as an ingredient in concrete or asphalt is also possible. Portland cement in Germany is known to have used crushed brick aggregate in concrete in 1860. Systematic investigations on the use of crushed brick aggregate date back to 1928. However, the first significant practical application was in Germany after World War II where cities were destroyed in rubble. A total of about 11.5 million cubic meters of crushed brick was used to build 175,000 homes.

Apebo, et. al. (2014) [2] & Victoria (2013–14) Reported the suitability of crushed over burnt bricks as coarse aggregates for concrete. The research was conducted to study the suitability of crushed over burnt bricks as alternative coarse aggregates for concrete production. Tests were carried out to determine the physical properties of the crushed over burnt bricks aggregates.Values of 22.8%,28.2% and 4.4% were obtained for aggregate crushing value, aggregate impact value and aggregate water absorption respectively. The concrete mixes were prepared using crushed over burnt bricks as coarse aggregates at water – cement ratios of 0.40,0.50,0.55 and 0.60. Cubes of concrete were prepared and tested to study the compressive strength. The results were compared with concrete made with river wash gravel as coarse aggregates which at present is the only coarse aggregate in Makurdi, Nigeria, and its environs. The results indicate that crushed over burnt bricks – sand concrete is medium light weight concrete having a density between 2000-2200 kg/m3 and compressive strength of up to 29.5 N/mm2 compared to grave l –sand concrete having a density between 2300-2400 kg/m3 and compressive strength of up to 30.8 N/mm2. It was concluded that by reducing the water-cement ratio from 0.60 to 0.40 the compressive strength of crushed over burnt bricks – sand concrete and gravel – sand concrete increased by more than 30%. Use of broken over burnt bricks as coarse aggregate for structural concrete was recommended when natural aggregate was not easily available, high strength of concrete was not required and the bearing capacity of the soil was low.

Fig. 1 Manufacturing process of bricks

II. LITERATURE REVIEW

Tariq Ali (2013) Generated a study on concrete which incorporated Over Burnt Brick Ballast Aggregate partially due to their abundance. 5%,10%,15% and 20% (M05, M10, M15, M20) incorporation was used as partial replacement of natural coarse aggregate in concrete. Analysis of incorporated concrete was done in fresh state as well in hardened state to evaluate different properties of concrete i.e., slump, compaction factor test, unit weight, and compressive strength are evaluated. From all the results and experimental approach, it was concluded that concrete formed with over burnt brick ballast aggregate showed beneficial performance as compared with the concrete made up of natural aggregate obtained from local resources. The over burnt brick ballast aggregate showed 14.75% increase in compressive strength for 20% replacement. The investigation discovered decline in the unit weight, adequate gain in compressive strength. Therefore, Split Tensile strength and Flexural Strength of concrete incorporating over burnt brick ballast aggregate need to be evaluated.

G. S. Patil and P. B. Autade (2015) [1]The effect of partial replacement of coarse aggregate by Jhama class brick in concrete. This project presents the effects of Jhama Class Brick inclusion on the mechanical properties of the concrete matrix in wet and hardened state properties. For checking mechanical properties of Jhama Class Brick bat-based concrete used partially replacement Jhama class brick to coarse aggregate ratios 20%,40%, 60% and 80% in M40 grade of concrete. It is observed that workability decreased with the replacement of coarse aggregate. The Compaction factor observed as 0.92,0.899,0.88,0.87 and 0.85 with varying percentage replacement of coarse aggregate by Jhama class brick bat as 0%, 20%,40%,60% and 80% respectively. The compressive strength of Jhama Class Brick bat-based concrete used with partially replacement Jhama class brick to coarse aggregate ratios 20%, 40%, increased over conventional concrete about 6.08%, 10.02% for 3 days and 9.23%, 12.08% for 7 days and 10.02%, 11.95% for 28 days. If further increased in the percentage of replacement up to 60% and 80%, the strength was decreased by 3.73% and 8.16% respectively for 3 days and 5.69%, 9.25% for 7 days and 2.72%, 6.87% for 28 days cured cube specimen respectively. The Split Tensile and Flexural Strength of this concrete increases with 5.26%, 8.68%, and 2.74%, 4.76% respectively over plain concrete for the replacement 20% and 40% and decreased with 3.94%, 12.1% and 3.16%, 7.5% for the replacement 60% and 80%.

III. MATERIAL USED AND TEST

General-

This test has attempted to consider the effect of wire mesh recycled bricks and non-coated over-burnt bricks on the properties of concrete. The methodology followed, the tests directed to the determination of the configuration mixture, are examined in this section.

A. Specific gravity Test

(a) Specific gravity Test for cement
(b)Specific gravity Test for fine aggregates
(c) Specific gravity Test for coarse aggregates

B. Water absorption Test

a) Water absorption test for fine aggregates
b) Test for coarse aggregates
c) Sieve analysis
d) Surface moisture Test
e) Bulk density Test
f) Water adsorption
g) Fineness of cement Test.

C. Material Used

a) Cement

Cement is a fine, gray powder. It is mixed with water and materials such as sand, gravel and crushed stone to make concrete. Cement and water form a paste that binds the other materials together as the concrete hardens. Ordinary Portland cement with a 28 days compressive strength of 46 MPa (ASTM 1994) was used for the preparation of all concrete cubes. The effect of different types of coarse aggregates in concrete is investigated using one type of cement.

TABLE I: CEMENT -PHYSICAL PROPERTIES TEST

S. No.	Characteristics	Values obtained	Standard values	Test Method
1	Normal	35%	5-7mm	IS 4031

	consistenc y			(Part 4)
2	Initial Setting Time	45 min	Not less than 30 min.	IS 4031 (Part 5)
3	Soundness	-	Not more than 10mm	IS 4031 (Part 3)
4	Final Setting Time	486 min.	Not Greater than 600 min.	IS 4031 (Part 5)
5	Specific Gravity	3.12	3.15	-
6	Fineness	4.8	-	IS 4031 (Part 2)

b) Fine Aggregate

The sand used for the pilot program was procured locally 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 washed to remove dust.

TABLE II: FINE AGGREGATE-PHYSICAL PROPERTIES TEST

S. No.	Physical Properties	Value	IS Requirement
1	Water absorption, %	1.68	0.1-3%
2	Specific Gravity	2.65	2.4-3.0

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 the maximum size of 20 mm was used in our work. The aggregates were washed to remove dust and dirt and were dried to surface dry condition. The aggregates were tested as per Indian Standard Specifications IS: 383-1970.

TABLE III: COARSE AGGREGATE -PHYSICAL PROPERTIES TEST

S. No.	Physical Properties	Value	IS Requirement
1	Water absorption, %	1.64	0.1-2%
2	Specific Gravity	2.64	2.4-3.0
3	Abrasion Value, %	31.89	-
4	Impact Value, %	23.02	-

d) Bricks

The investigation used only one type of unreinforced clay bricks of 240 x 115 x 70 mm working size, before the bricks were crushed into a coarse aggregate, their uneven compressive strength produced by crushing them into a coarse aggregate. was recorded for comparison with the total. The compressive strength of the entire brick is found to be 12.75 MPa.

e) Recycle brick

The term brick refers to a ceramic masonry unit produced by firing clay. Recycled clay bricks are defined as waste materials that can be obtained from dismantled masonry or non-standard discarded products at the end of the construction process.

f) Sources of Recycled Brick

The two major sources from which recycled clay brick can be obtained are construction and demolition waste, and clay brick/tile manufacturing plants. Construction and demolition waste (CDW) includes unwanted left-over material from any construction activity that may be new construction, refurbishment or demolition.

IV. RESULT AND DISSCUSSION

A. *Consistency of cement test*

The general consistency of cement is characterized as the level of water required to express a bonding paste of standard consistency. For confirmation, the stability of the mill is taken to be the water content at which the plunger of the vicat enters from the base of the frame position of vicat 5 to 7 mm. When we add water to the bond, the paste starts to solidify and acquires quality. The basic point is to find the amount of water required to make a safety paste of standard consistency as may be: 4031 (Part 4)-1988.The control stick had a normal consistency of 36%.

B. *Workability of concrete*

A slump test can be used to measure the workability of concrete. Immediately after mixing each batch of concrete should be tested for consistency by one of the techniques indicated in IS: 1199-1959.

TABLE IV: TEST OF WORKABILITY OF CONCRETE

S. No.	Percentage of variation	Slump in (mm) over burnt bricks	Slump in (mm) recycle bricks
1	0	77	77
2	15	86	85
3	30	131	94
4	45	151	106

C. *Compressive Strength of Concrete Cube Sample*

Despite the fact that it is easy to perform pressure testing on concrete, test results are trying to argue up to the actual quality which is affected by many components. A large number of essential properties of concrete such as modulus of ductility, protection from shrinkage and compatibility of strength increase with expansion in compressive quality.

Compressive Strength Reading for M-30 Grade having Normal Composition with recycle bricks different Composition

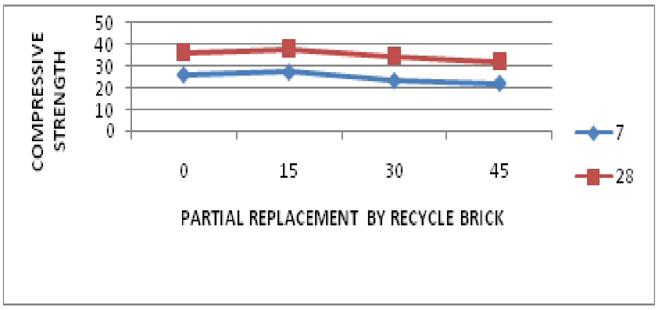

Fig. 2 Compressive Strength of Concrete M-30 Grade on recycles bricks

Compressive Strength Reading for M-30 Grade having Normal Composition on over burnt bricks different Composition

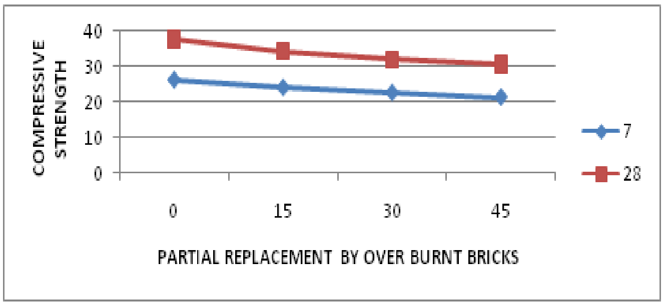

Fig. 3 Compressive Strength test of ConcreteM-30 Grade on over burnt bricks

D. Tensile Strength of Concrete Cylinder

The split tensile strength of concrete material is attempted by making barrel of size 150mm x 300 mm and is reliably cured for 28 days testing. Totally 24 chambers were throwing for standard M35, grade and for 15%, 30% and 45% by weight fractional replacement of recycle aggregate & non coated over burnt bricks aggregate for coarse aggregate. Three illustrations are attempted and the ordinary regards are taken as tensile strength of concrete. The estimations of split tensile strengths are showed up in table.Tensile Strength Results of M-30 Grade having Different Composition of over burnt / recycle bricks

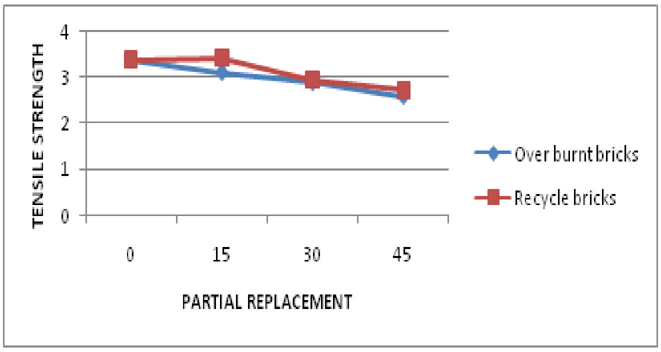

Fig. 4 Tensile Strength test of M-30 Grade on overburnt/recycle bricks

3. Flexural Strength of Concrete

Flexural power additionally called as modulus of break. In this test works absolutely 24-beams of size 700 x 100 x 100 are casted of M30, grade and for 15%, 30% and 45% by weight fractional replacement of recycle aggregate & non coated over burnt bricks aggregate for coarse aggregate. At that point analyze the estimations of both plan blends. The flexural estimations of various blends as shown.Flexure Strength results of M-30 Grade having Different Composition of over burnt / recycle bricks

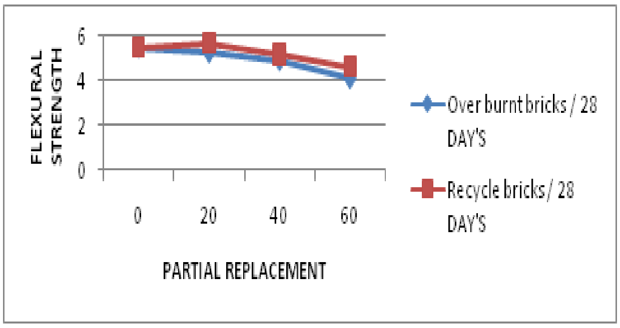

Fig. 5 Flexural Strength Test with M-30 Grade

V. CONCLUSION

Following are the main findings of the study: -

1. In this exploratory trial we have used high consumption/reuse blocks as a fractured replacement (15,30 and 45%) of an alternative material of concrete for M30 audit of concrete and various tests on new and cemented concrete. From the tests we have stopped after the result.
2. The general consistency of cement is characterized as the level of water required to convey a cement paste of standard consistency. For confirmation, the stability of the mill is taken to be the water content at which the plunger of the vicat enters from the base of the frame of the vicat to a position of 5 to 7 mm. When we add water to cement, the paste starts to solidify and acquires quality. The basic point is to find the amount of water required to make a safety paste of standard consistency as may be 4031 (Part 4)-1988.The control stick had a normal consistency of 36%.
3. Recession shows that workability increases with expansion in sections/reuse rates of over 15, 30, and 45% with M-30 audits of concrete.
4. It can be seen from the figure that the compressive strength at 7- and 28-days results in partial replacement 15% higher than that of use, and then 30 and 45% for recycled bricks compared to the strength of recycled brick aggregate. Coarse aggregates with M-30 grade of concrete. We should compare 15, 30 and 45% partial replacement to find that the 15% partial replacement is higher than the 30 and 45% partial replacement for coarse aggregates in the concrete sample.
5. It can be seen from the diagram that compressive strength results in less than 7 and 28 days of use as a partial replacement of over-burnt bricks with levels 15, 30, and M-30 grades of concrete with 45% utilization. We should compare 15,30 and 45% partial replacement to find that the 15% partial replacement is higher than the 30 and 45% partial replacement for coarse aggregates in the concrete sample.

6. We can see that the tensile strength is increased with 15% (recycle brick total) and increased by 30% and strength is reduced by 45%, then with the comparison of 15 coarse by reuse/over-consumption blocks used as a fragmented replacement of aggregates % higher after the 30 to 45% level, especially less than showing at about 28 days of age.
7. We can see that the flexural strength is lower when the dosage of burnt/recycled bricks is increased by 15 to 45% more than when used as partial replacement of coarse aggregates by more burnt/recycled bricks, So other construction beams appear differently with respect to cases with a lifespan of 28 days.

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