

Use of Partial Replacement of Over Brunt Brick and Demolish Brick Bats as a Coarse Aggregate in Hardened Concrete

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ABSTRACT: In this investigation using of over brunt brick bat from brick manufacture industry area & waste brick from demolish structure, so called as demolish brick in concrete. The partially replaced over brunt brick & demolish brick bats to coarse aggregate in ratios 15%, 30%, 45% and 60% in M35 grade of concrete and study its effect on the mechanical properties of concrete matrix in hardened state properties. In this research it is observed that workability decreasing with increasing percentage replacement of coarse aggregate. The Compaction factor observed as 0.91, 0.901, 0.89, 0.86 and 0.84 with ratio of percentage replacement of coarse aggregate by over brunt brick & demolish brick bat in concrete. The compressive strength of over brunt & demolish brick concrete increase the strength by partially replacement of over brunt & demolish brick to coarse aggregate ratios 15% and 30% increases over the conventional concrete about 2.55%, 3.8% for 7 days, 0.68%, 2.47% for 14 days and 1.51%, 3%, for 28 days. And ratio 45% and 60% increases over the conventional concrete about the strength gradually decreases of cured cube specimen to 4.88%, 5.69% for 7 days and 4.09%, 6.39% for 14 days and 2.57%, 12.70% for 28 days by partially replacement of over brunt & demolish brick to coarse aggregate. Split tensile strength of over brunt brick and demolish brick bats concrete increases 0.25%, 0.49% at replacement of 15% and 30% and are decreases 3.04%, 25.33% at replacement of 45% and 60%. Flexural strength of over brunt brick and demolish brick bats concrete increases 0.37% at replacement of 15% and decreases 0.87%, 19.71% 31.93% at replacement of 30%, 45% and 60%.

KEYWORDS: Compressive strength, Split tensile strength, Flexural strength, Conventional, Coarse aggregate etc.

I. INTRODUCTION

Concrete is one of the material worldwide used construction materials in large amount and has a very long history of use. Coarse aggregate is most important ingredients apart of water and cement in concrete production. The consumption of natural resources as an ingredient of concrete, cost high as well as it is on verge of extent. The cost of concrete material and its proportion were depends on related to aggregate used. The proportion of concrete aggregate maximum portion is coarse aggregate which are obtained naturally or crushing rocks mechanically up to the required size and shape. The incorporation of aggregate in concrete reduces its drying shrinkage properties and improves many other properties such as compressive strength etc. The main part of construction cost of concrete increases for those area where the less sources and deficiency of coarse aggregate due to the transportation cost of coarse aggregate excess. And the last it becomes difficult to construction of low cost houses and structure, so local sources are helpful to reduce the cost of transport, but due to geographical constraints this is not available at all places on earth, therefore it essential research other sources these problems force us to recover the natural resources or to find as alternative source from local region to overcome this problem.

Now a day, the most commonly material used coarse aggregates for concrete production is the river washed gravel mainly due to the presence of River and its deposits. But these are not easily available because some local government areas which are not serviced by the river. And the other cost of transporting gravel to the areas outside the catchment of the river for crushing tends to increase the cost of construction even at relatively cheap labor. This is required to the use of alternative material of coarse aggregates which are locally available. One of such coarse aggregate is replace to over burnt bricks & demolish brick obtained from the production of over burnt bricks and demolish brick because lot of structure in stage of demolish. This material is available and selected because in brick making, a large number of bricks are rejected due to non-conformity is the distorted form of brick produced due to high temperature near about

more than 10000 C in the kiln. Due to this the brick over brunt and shrink and loose its shape, color becomes reddish and its appearance look like reddish to blackish gradient stone.

A. OBJECTIVES

In this research study main objective is to find out the properties of concrete by replacing the percentage of over brunt bricks & demolish brick bat aggregate to natural occurring coarse aggregate in concrete.

1. To identify and study of the effects of replacement percentage 15%, 30%, 45% and 60% of over brunt bricks and demolish brick to coarse aggregate in concrete comparing the result with conventional concrete.
2. To study the economic feasibility of concrete by replacing the over brunt brick and demolish brick as coarse aggregate in concrete.
3. To identify and study the properties of hardened concrete of replacement percentage of over brunt bricks & demolish brick concrete such as compressive strength test, split tensile strength test and flexural strength test.

II. LITERATURE REVIEW

General: This research is basically studied to the development, the manufacture and physical the properties of the concrete made by over brunt bricks & demolish brick as a coarse aggregate. From this chapter present the environment which upraises the utilization of some alternative material of coarse aggregate in concrete at the time of brick manufacturing maximum number of brick are rejected due to non-conformity with the required specification. And the other such major non- conformity is the distorted form of brick produced due to the uneven temperature controlled in the kiln. Other alternative source from demolish structure waste material like good strengthen bricks. This rejected and waste brick can also be a potential source of coarse aggregate.

Effect of partial replacement of coarse aggregate by Jhama class brick in concrete has studied by Mr. G S Patil and Mr. P B Autade et.al (2015), Under this research the experimental study was conducted on effect of salient parameters that affects the properties of Jhama class brick based concrete and various test were carried on fresh and harden concrete with partial replacement on Jhama class Brick as coarse aggregate as various proportion under this research they found the replacement of coarse aggregate 80% compressive strength decreases at initial and final cube test , also as split tensile and flexural test.

The properties of new and recycled clay brick aggregate for use in concrete has studied by Fouad M. Khalaf and Alan S. Devenny et.al (2002). Under this investigation the various test occur on aggregate like impact value test, porosity, water absorption test was carried out to finding the physical and mechanical properties of new and recycled crushed clay brick aggregate. To study the physical and mechanical properties, in that research selects eight different types of aggregate and determine out both these properties. After getting result, compare it with the granite aggregate that has been proved to be a best natural aggregate for production Portland cement concrete. From the research researchers concluded that the relative densities of new and recycled crushed brick aggregate were considerably less than the density of the granite aggregate.

The mechanical properties of new and recycled aggregate concrete has investigated by Khaldoun Rahal et.al. (2005). For this investigation the author selects ten mixes of concrete with target compressive strength ranging from 20 to 50 MPa cast use normal and recycled coarse aggregate and takes the test at the edge of concrete 1, 3, 7, 14, 28 and 56. Strain at maximum compressive stresses and modulus of elasticity and tested by using cylinder of concrete at 28 days. After getting result, researcher compare that the compressive strength of cubes and cylinders at 28 days of recycled aggregate concrete on an average 90% of those of natural coarse aggregate with same mix proportion. Researcher also examine that for the concrete cylinder compressive strength 20 and 30 MPa modulus of elasticity of recycled aggregate concrete was only 3% less than that of nominal aggregate concrete. Hence researcher concludes that the compressive strength of RAC is not limited to the strength of the demolished concrete used to produce the recycled concrete.

The brick chips as a coarse aggregate in standard concrete had studied by Gopinandan Dey and Joyanta Pal et.al (2013). Under this investigation the researcher done an experimental study and conducted to examine the various strength parameter, workability, fire resistant and water absorption by potential of use of replacement of brick chips as a coarse aggregate in standard concrete. Cubes and cylinders were cast tested for compressive strength and split tensile strength after a curing period of 28 days. After this experiment the result shown that strength and properties of concrete

made by using brick chips as a coarse aggregate is satisfactorily good as compared to the concrete made by using natural coarse aggregate concrete.

The recycling of demolished masonry rubble as a coarse aggregate in concrete review had studied by Fouad M. Khalaf and Alan S. Devenny et.al (2004). Under this investigation the researcher was taken the reviews of work done by previous covering the use of demolished waste, especially in case of crushed brick as a coarse aggregate in new concrete. The getting result express that economic of recycling is a very critical issue that has not been create issue in depth because in case of demolished waste the cost of sorting, screening, crushing, transportation is nearly same as that of natural coarse aggregate. Hence researcher suggested that if use of demolish the structure simultaneously in step, the process of screening, sorting, crushing, transportation etc. gets economical and due to this the cost of demolished waste is reduced.

III. METHODOLOGY

General:-This chapter represents the experimental work that is to be carried on effect of replacement percentage of over brunt brick and demolish bricks on compressive strength, split tensile strength and flexural strength of concrete.

A. Compressive Strength Test

The compression strength conducted on concrete required the cubes (150mm X 150mm X 150mm) size. After casting the cube specimens are place in curing tank. The curing period is over then left from tank before one day of testing. The specimens are placed in machine in such a way that the load is applied on the Forces perpendicular to the direction of casted cube. In Compression testing Machine, the upper surface of machine is fixed and load is applied on the lower surface of cube specimen. Compression tests are conducted to examine behaviour of material under loading of machine. The rate of loading is uniform and failure (crushing) load is recorded. Also the failure pattern is important to observe precisely. The test result is the average of at least of three standard cured strength specimens made from the same concrete sample and tested at the same age. In most cases strength requirements for concrete are at an age of 28 days only. The concrete cubes, after 7, 14 and 28 days are tested for their compressive strength.

Compressive strength (f_c) = P/A

Where,

P = Load at failure in N

A = Surface area of cube in mm.



Fig. 1. Arrangement Compressive Strength of cube

B. Split Tensile Strength Test

To determine the tensile strength of concrete is ability of concrete to resist tensile stress applied on it. For the split tensile test the size of cylinder specimens are 150mm in diameter & 300mm in length are placed between the two plates of Compression Testing Machine. The load is applied at a uniform rate without shock and break till the specimen failed by a fracture along vertical diameter. It is method consists of a applying a diametric compressive force along the length of a concrete cylindrical specimen. This loading induces tensile stresses on the plane containing the applied load. In this test the tensile failure occurs rather than compressive failure. The maximum load is divided by approximate geometrical factors to obtain the splitting tensile strength of concrete. A compressive load is then applied along the length of the cylinder specimen until it fails because Portland cement concrete is much weaker in

tension as compare to compression, the cylinder specimen will typically fail due to horizontal tension and not vertical compression.

$$\text{Split Tensile Strength (T)} = 2P/\pi LD$$

Where,

T = Split tensile strength in N/mm²

P = Maximum load at failure in N.

L = length of the cylindrical specimen in mm.

D = diameter of cylindrical specimen in mm.



Fig. 2. Arrangement of Spit Tensile Strength

C. Flexural Strength Test

The flexural strength is measure the tensile strength of concrete. To know the concrete is relatively strong in compression and weak in tension. This method for measuring the behaviour of materials subjected to simple beam loading. It is also known as a transverse beam test with materials. Maximum stresses and maximum strain are calculated for increasing load. However, tensile stresses are to develop in concrete because of drying shrinkage, rusting of steel, temperature gradient and many other reasons. Hence forth, knowledge of tensile strength of concrete is of importance. A beam test is examine dependable to calculate flexural strength properties of concrete same is applied for replacement percentage of over brunt brick & demolish brick bat concrete. In the test comparison is made of between Portland cement concrete and over brunt brick & demolish brick bat based concrete by taking the same size of beam 100 X 100 X 500 mm. Test specimen of both concrete are immersed in curing tank for 28 days and then kept at room temperature before test of one day and tested at the age of 28days.

$$\text{Flexural strength (F)} = PL/bd^2$$

Where,

F - Flexural strength of concrete in N/mm²

P - Maximum load at failure in N

L - Length of the beam specimen in mm

b - Width of the beam specimen in mm

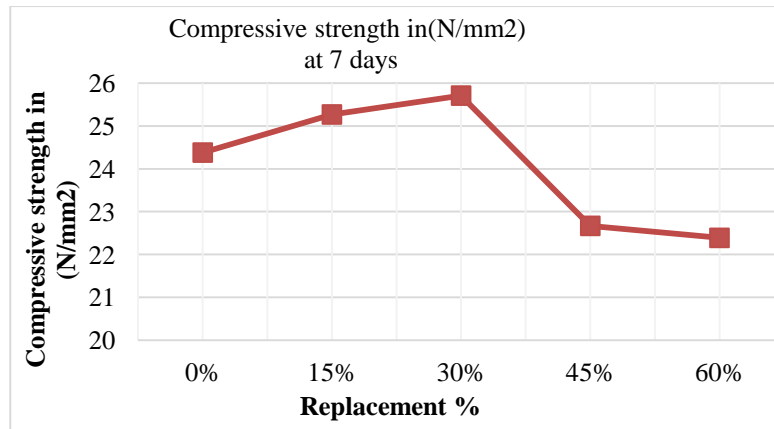
d - Thickness of the beam specimen in mm

IV. EXPERIMENTAL RESULTS

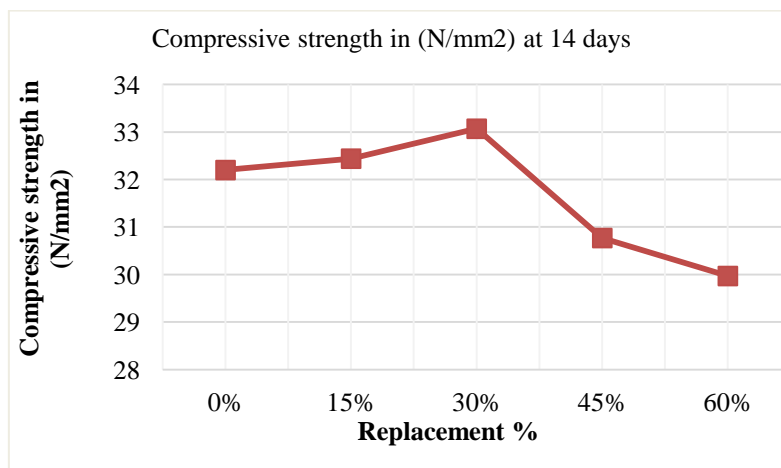
A. Compressive Strength Test

Sr. No.	Percentage of Replacement	Compressive strength in (N/mm ²)		
		7days	14days	28days
1	0%	24.38	32.2	39.93
2	15%	25.27	32.44	40.46
3	30%	25.71	33.07	40.98
4	45%	22.67	30.77	39.03
5	60%	22.39	29.97	35.49

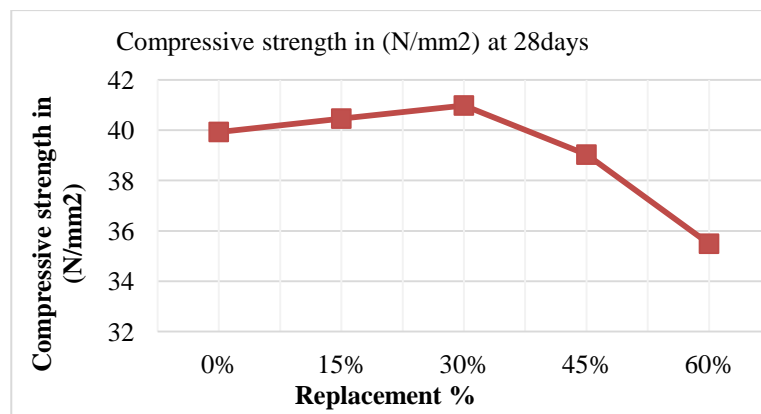
Table 1:- Result of Compressive strength



Graph 1. Result of Compressive strength at 7 Days



Graph 2. Result of Compressive strength at 14Days

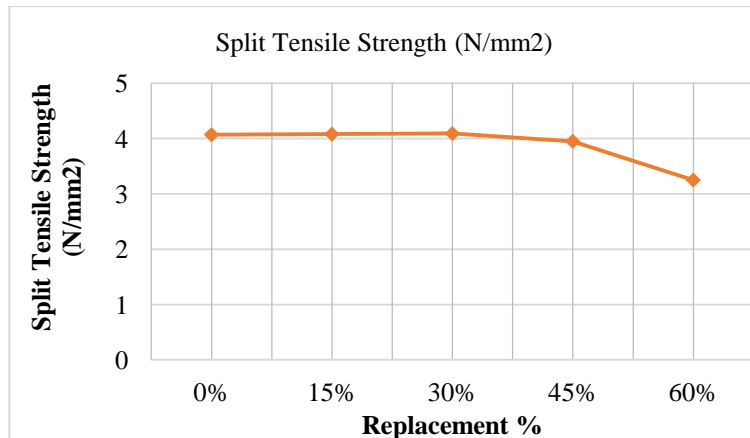


Graph 3. Result of Compressive strength at 28Days

B. Split Tensile Strength Test

Replacement %	0%	15%	30%	45%	60%
Split Tensile Strength (N/mm ²)	4.07	4.08	4.09	3.95	3.25

Table 2:- Result of Split Tensile strength



Graph 4. Result of Split Tensile Strength at 28Days

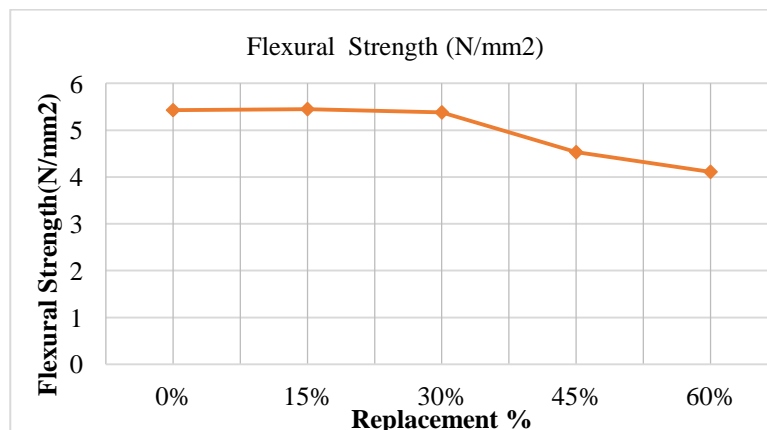


Fig. 3. Failure Pattern of Cylinder

C. Flexural Strength Test

Replacement %	0%	15%	30%	45%	60%
Flexural Strength (N/mm ²)	5.43	5.45	5.38	4.53	4.11

Table -3:-Result of Flexural strength



Graph 5. Result of Flexural Strength at 28Days

V. CONCLUSION

- 1) Concrete mixture by replacing the coarse aggregate by using over burnt brick & demolish brick, initially the given result were maximum compressive strength for the replacement 15% and 30% and after the percentage of replacement increases of 45% and 60% the strength was to decreases gradually.
- 2) The compressive strength is express maximum when the coarse aggregate replace by over burnt brick & demolish brick aggregate 15% and 30% respectively than conventional concrete were 2.55%, 3.8% increases for the age of concrete 7 days.
- 3) The compressive strength is express minimum when the coarse aggregate replace by over burnt brick & demolish brick aggregate 45% and 60% respectively than conventional concrete were 4.88%, 5.7% decreases for the age of concrete 7 days.
- 4) The compressive strength is express maximum when the coarse aggregate replace by over burnt brick & demolish brick aggregate 15% and 30% respectively than conventional concrete were 0.68%,2.47% increases for the age of concrete 14 days.
- 5) The compressive strength is express minimum when the coarse aggregate replace by over burnt brick & demolish brick aggregate 45% and 60% respectively than conventional concrete were 4.09%,6.39% decreases for the age of concrete 14 days.
- 6) The compressive strength is express maximum when the coarse aggregate replace by over burnt brick & demolish brick aggregate 15% and 30% respectively than conventional concrete were 1.15%, 3% increases. And further increase the percentage of replacement of 45% and 60% the compressive strength was decreased by 2.57% and 12.7% respectively for the age of concrete 28days.
- 7) Split Tensile strength of over burnt brick & demolish brick based concrete was maximum by 0.25% and 0.49% than that of conventional concrete for the replacement of 15% and 30% at the age of concrete 28 days. For further increased in the percentage of replacement up to 45% and 60%, the Split Tensile strength was decreased by 3.04% and 25.23% respectively.
- 8) Flexural strength of over burnt brick & demolish brick based concrete was maximum by 0.37% than that of conventional concrete for the replacement of 15% at the age of concrete 28 days. For further increased in the percentage of replacement up to 30%, 45% and 60%, the Flexural strength was decreased by 0.87%, 19.71% and 31.93% respectively.
- 9) The unit weights of concrete also decreased as the percentage of replacement of over burnt brick & demolish brick increased with comparison of conventional concrete.

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