

Experimental Study on Effect of Partial Replacement of Coarse Aggregate by Over Burnt Brick Bats

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Abstract: concrete is considered the world's most used construction material. Typical concrete mixtures are comprised of water, sand, cement and an aggregate of rock. This project focuses on the coarse aggregate in concrete. The other material will be used to replace the coarse aggregate of rock in typical concrete. This will include burn brick. This material was chosen because of their availability. The burn brick is available from brick manufacturing area. Also in brick-making, a large number of bricks are rejected due to non-conformity with the required specifications. One such major nonconformity is the distorted form of brick produced due to the uneven temperature control in the kiln. These rejected bricks can also be a potential source of coarse aggregate. This would not only make good use of the otherwise waste material but would also help alleviate disposal problems. This project presents the effects of over burnt brick bat inclusion on the mechanical properties of concrete matrix in wet and hardened state properties. For checking mechanical properties of over burnt brick bat based concrete used partially replacement overburnt brick bat to coarse aggregate.

Keywords: over burnt brick bat waste, workability, compressive strength, tensile strength, flexural strength.

1. Introduction

Concrete is the base material for construction industries. It is strong in compression and weak in tension Concrete is produced by mixing cement, sand, coarse aggregate and water to produced material that can be molded into almost any shape. The main constituent of the concrete in cement, sand, coarse aggregate and water, replacing some of these materials makes significant changes in cost as well as performance. Coarse aggregate filled almost 70% of volume in concrete. The cost of coarse aggregate rapidly increasing also the availability of the aggregate is getting reduced. The major cost of the concrete is belonged to the aggregate. The overburnt brick bat available in the brick manufacturing industries. The over burnt brick bat wastes were replaced with concrete. This OBB maintains strength and performance to the concrete also reduce the weight of the concrete. Strongly over burnt brick bat replaced with concrete can be performed in the mass concrete filling area. In environmental aspects replacement of over burnt brick bat in concrete is reduce the conservation in the natural resources.

Raw material utilization can be diminished which at last spare time and vitality. 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 than 1000 degree centigrade it will shrink and changes 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 absorb less water. Over burnt bricks are produced by burning the raw materials along with good quality bricks. 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.

A. Why over burnt brick bats?

Over burnt bricks are produced by burning the raw materials along with good quality bricks. 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. Over burnt bricks are produced by burning the raw materials along with good quality bricks. Due to its distorted shape, over burnt bricks are considered as wastage. These over burnt brick bats mixed in cement slurry after 7 days curing these brick bats used as aggregate.

2. Material properties

A. Cement

Portland pozzolona cement of ultra tech brand was used and it was conforming to IS 1489-1991 properties of cement are tabulated in Table 1.

B. Fine aggregate

Fine aggregate includes the particles that all passes through 4.75 mm sieve and retain on 0.075 mm sieve. Locally available river sand will be used as fine aggregate. The sand

will first sieved through 4.75 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 1
Physical properties of cement

S. No.	Property	Test results
1	Normal consistency	28.25%
2	Specific gravity	3.15
3	Initial setting time	170 minutes
4	Final setting time	250 minutes
5	Soundness test	0.5

Table 2
Physical properties of fine aggregate

S. No.	Properties	Result	
1	Specific Gravity	2.63	
2	Fineness modulus	3.75	
3	Grading zone	II	
4	Bulk Density	Loose	1450 kg/ m ³
		Compacted	1710 kg/ m ³

C. Coarse aggregate

The broken stone is generally used as a coarse aggregate. Aggregate occupies most of the volume of the concrete.

Locally available coarse aggregate having nominal size 20 mm was used. The aggregates were washed to remove dust and dirt. Physical properties of coarse aggregate are tabulated in table 3.

Table 3
Physical properties of coarse aggregate

S. No.	Properties	Result	
1	Size	20mm	
2	Specific gravity	2.68	
3	Fineness modulus	7.20	
4	shape	angular	
5	Bulk Density	Loose	1350 kg/ m ³
		Compacted	1600 kg/ m ³

D. Water

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

E. Over burnt brickbat waste

The over burnt brick broken into pieces called as brick bats. these brick bats are mixed with cement slurry after 7days curing used as an aggregate in concrete. Physical properties of over burnt brick are tabulated in table 4.

Table 4
Physical properties over burnt brick

S. No.	Properties	Result
1	Size	20mm
2	Specific gravity	2.17
3	Fineness modulus	7.20
4	Shape	Angular

3. Experimental programe and setup

The main aim of this experimentation is to study the effect of partial replacement of course aggregate by over burnt brick on

the properties of concrete and check it,s compressive strength, flexural strength and workability of concrete. The experimental programme is divided in four phases.

1. Concrete mix design is done as per IS 10262-2009 for M30.
2. Casting of cubes and beams.
3. Curing of cubes and beams for 7 days and 28days.
4. Testing of cube in compression testing machine and Beam are tested in flexural testing machine.

Each test result plotted in the Figures or given in the Tables is the mean value of results obtained from at least three specimens.

4. Mix design

Concrete mix design is done as per IS 10262-2009 for M30 grade of concrete. Material quantity required for 1m³ volume of work are tabulated in table 5.

Table 5
Material quantity

Water	Cement	Fine aggregate	Coarse aggregate
186	413	609.9	1154
0.45	1	1.47	2.79
22.5	50	73.5	139.5

5. Methodology

A. Workability

The workability tests were performed using standard size of slump moulds as per IS;1199-1999.slump test was performed for each percentage of replacement i.e. 20%, 40%, and for 60%.

B. Compressive strength

The cube specimen of the size 150 x 150 x 150 mm was tested after curing for period of 7 and 28 days. Compressive strength is determine by using compression testing machine (CTM) of capacity 2000KN.

C. Tensile strength

The tensile strength of concrete is tested by using test specimens 150 x 150 x 150 mm. Tensile strength is determine by using compression testing machine.

D. Flexural strength

The flexural strength test was determined according to I.S. 516: 1959, 150 x 150 x 700 mm specimens were tested.

6. Results and discussions

A. Effect of overburnt brick on the workability of concrete:

It is observe that with increase in percentage of overburnt brick bat waste workability decreases. Obtained results are tabulated in table 6 and also in graph format.

B. Compressive strength

The result of compressive strength After 7 days and 28 days are recorded. Result indicate that as we increase percentage of over burnt brick bat waste from 0% to 20% it's compressive strength

increases but after further increment in percentage of over burnt brick bat waste there is loss in compressive strength.

Table 6
Slump value

% of coarse replaced by over burnt brick bat waste	Slump value (mm)
0%	45
20%	50
40%	47
60%	41

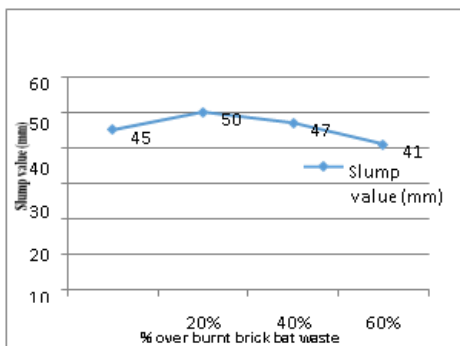


Fig. 1. Effect of over burnt brick on the workability of concrete

Table 7
compressive strength after 7 days and 28 days

S. No.	%of brick bat added	compressive strength in N/ mm ²	
		7 days	28 days
1	0%	19.3	31.6
2	20%	21.5	33.3
3	40%	20.39	30.65
4	60%	15.06	22.25

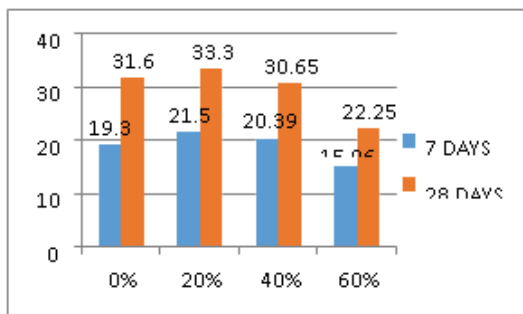


Fig. 2. Compressive strength after 7 days and 28 days

C. Tensile strength

Results obtained are tabulated in below table. 5.29% increment in the tensile strength is found for 20% replacement of coarse aggregate by over burnt brick bat waste and for 40% and 60% replacement of brick bat waste strength decreases.

Table 8
Tensile strength after 7 days and 28 days

S. No.	% of brick bat added	Tensile strength in N/ mm ²	
		7 days	28 days
1	0%	14.53	23.86
2	20%	16.23	25.12
3	40%	15.35	23.07
4	60%	11.34	16.75

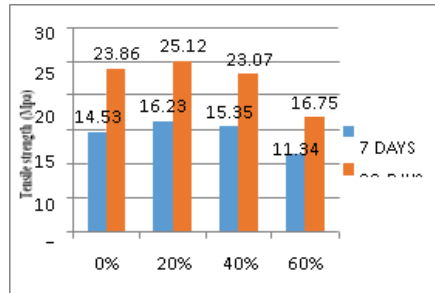


Fig. 3. Tensile strength After 7 days and 28 days

D. Flexural strength

The result of flexural strength were plotted in below table for 28 days. Result indicate that if we increase percentage of over burnt brick bat waste from 0 to 20% will give us good results and help to increase flexural strength of concrete.

Table 9
Flexural strength for 28 days

S. No.	%of brick bat added	Flexural strength in N/mm ²
		28 days
1	0%	6.84
2	20%	7.32
3	40%	6.63
4	60%	5.04

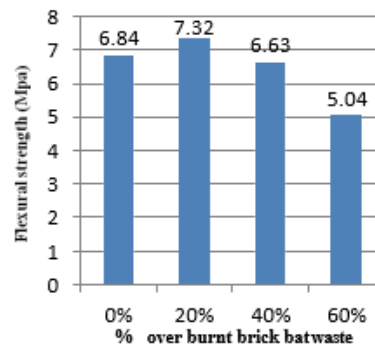


Fig. 4. Flexural strength for 28 days

7. Conclusion

Based on results and observation made in experimental research study. The following conclusions are drawn. It is observed that with increase in percentage of over burnt brick bat waste workability decreases.

- Brick bat concrete is cheaper than conventional concrete.
- 3% increment in the compressive strength is found for 20% replacement of coarse aggregate by over burnt brick bat waste and the strength decreases by 3.3% when the 40% of coarse aggregate is replaced by over burnt brick bat waste, by using aggregate cement ratio (A/ C) is 4.2 and water cement ratio (W/ C) is 0.45.
- Current study concluded that over burnt brick bat waste can replace coarse aggregate up to 20%.
- 5.3% increment in the tensile strength is found for 20% replacement of coarse aggregate by over burnt brick bat waste and the strength decreases by 12%

when the 40 % of coarse aggregate is replaced by over burnt brick bat waste, by using aggregate cement ratio (A/ C) is 4.2 and water cement ratio (W/C) is 0.45.

- 7.1% increment in the flexural strength is found for 20% replacement of coarse aggregate by over burnt brick bat waste and the strength decreases by 3.3% when the 40% of coarse aggregate is replaced by over burnt brick bat waste, by using aggregate cement ratio (A/C) is and water cement ratio (W/ C) is 0.45
- The use of over burnt brick bat waste in concrete is possible to improve its compressive strength, tensile strength and flexural strength.

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