Influence on Strength Properties of Concrete by Partial Replacement of Course Aggregates with Crushed Over Burnt Bricks

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Abstract- Concrete is the most widely used material in construction and aggregates are the major ingredients of concrete which occupies more than 70% of its volume. The demand for concrete resultantly rises the demand for aggregates. Over exploitation of natural aggregates by quarrying and sand mining leads to environmental problems. On the other hand, wastes produced by the industries pollute the environment. Hence an ideal solution is required to be found out to make use of the by-products from different industries in concrete as aggregates in order to decrease the exploitation of natural resources and pollution load on environment.

In this work, the coarse aggregate had been partially replaced with crushed over burnt brick aggregates. The material is selected because of their huge availability at brick kilns in the maximum regions of India. Also, in brick-making site, a large number of bricks are rejected due to non-conformity with the required specifications. These rejected bricks have more compacted structure and hence possess more compressive strength than normal bricks, so they could also serve as a potential source of coarse aggregate. With this process, we can use over burnt bricks in concrete as coarse aggregates by crushing them to desired size, rather than engaging in stacking and disposal issues.

Keywords – Concrete, Bricks, crush.

I. INTRODUCTION

Bricks are a versatile and durable construction material, with good load-bearing properties and mostly available in all over the country except hilly areas. Different kind of experimental works have been carried out on its properties like porosity, permeability and absorption of bricks. Other experimental investigation has been done to achieve concrete of high strength by using crushed over burnt brick aggregate. It has also been found that even recycled brick can be used as coarse aggregate in concrete. Concrete is considered stronger in compression than in tension, for structures required to carry only compressive loads like massive gravity dams and heavy foundations, reinforcement is not required and the concrete is consequently called plane concrete. Steel bars are embedded in the concrete, when the structure is to be subjected to tensile stresses.

The possibility of using crushed over burnt brick aggregate as an alternative for the conventional stone aggregates in hollow concrete blocks to reduce their cost and also the dead weight of structures. The study was carried out at 0%, 20%, 40%, 60%, 80% and 100% replacement with crushed over burnt brick aggregates. The comparative study among strength of mixes prepared at different replacement levels revealed that, crushed over burnt brick aggregates can be confidently used up to 69% replacement level of regular stone aggregates without compromising with strength[1].

In brick making various ingredients are required. even though their proportion changes from place to place even then the main part played by the following constituents so that the bricks should be sound, hard, well built with uniform shape, size, and color, homogenous in texture and free from flaws and cracks, and gives metallic ring when shrunk.

1.Alumina

2. Silica

Apart from this it should have less quantity of lime and alkalis. Alumina gives plastic quality and silica after reacting with alumina as silicate of alumina helps to retain its shape and durability. Lime help in fusion of sand at kiln temperature to bind the brick particles together. Alkalis gives plasticity to clay for better mixing and kneading. But excess of these will melt the sand clays and dislocates its shape, size and color and it gets unfit for standard use. This molten mass is overheated a lot and turned into over burnt bricks hard as stone that can't be used for brick work. It should either be

 DOI : 10.35291/2454-9150.2022.0053

discarded, dumped as waste or can be utilized for other purposes. in engineering practiced it can used for a cheap and durable ingredient for mass concrete where major part of the load gives compression effect. This over burnt material can be utilized on coarse aggregate in cement concrete after verifying certain facts and parameters. It has come as a cheap, durable and reliable material for the production of cheap and admirable concrete saving in cost and adding to the preservation of ecology etc.

Advantage of using over burnt bricks in Concrete

Safeguards the environment from pollution
Safeguards the lands and livelihoods
Reduces unwanted landfills and land reclamation
Ensures the global sustainability
Cost effective

II. EXPERIMENTAL WORK

Over Burnt Brick Aggregate

Over Burnt Bricks are distorted in shape and blackish in color. Due to excessive heating these bricks have hard and compacted structure and possess more compressive strength than the regular bricks and therefore serve as one of the cheaper alternative for brick foundation, floors, roads etc. Over burnt bricks have high compressive strength between 120 to 150 kg/cm^2 and hence they are sometimes found to be stronger than even the first-class bricks.

Fig. 1.1 (Manually Crushed Over Burnt Brick Aggregates)

Testing on Over Burnt Brick Aggregates

The Various tests are conducted on Over Burnt Brick Aggregate to compare their properties with natural coarse aggregates.

1. Specific Gravity & Water Absorption Test-The specific gravity of an aggregate is considered to be a measure of strength or quality of the material. Identification of stone is done with the help of the specific gravity test. The idea of strength of aggregate is given by water absorption. Over burnt brick aggregates with more water absorption are more porous in nature and are not considered suitable unless they are found to be acceptable based on input, strength and hardness tests.

CALCULATION - Specific gravity and water absorption shall be calculated as follows:

Specific gravity = C/B-A

Water absorption (dry weight percentage) = 100(B-C)/C

Where, A= weight in gm of saturated aggregate in water (A1-A2)

B = weight in gm of the saturated surface-dry aggregate in air

C = weight in gm of oven dried aggregate in air.

Results:

Table 1.1 Specific gravity and water absorption of Over Burnt Brick aggregates

Sr. No.	PARTICULARS	Values (g)
A	Weight of sample	1000
B	Weight of vessel + sample + water (A)	3365
C	Weight of vessel + water, (B)	2940
D	Weight of saturated and surface dry sample, (C)	994
E	Weight of oven dried sample, (D)	934
F	Sp. Gravity = D/(C-(A-B))	1.64
G	Water absorption%= (C-D/D)*100	6.42%

2. Sieve analysis of coarse aggregate-The test results of sieve analysis on 5kg sample of manually crushed over burnt brick aggregates are tabulated in Table 3.11and the Fineness modulus of the coarse aggregate was found as 7.5.

Table 1.2 Sieve Analysis of Over Burnt Brick Aggregate

Sr. No.	IS Sieve Sizes	Wt. Retained (kg)	Cumulative Wt. Retained (kg)	Cumulative % age Retained	% age of Finer Passing
1	25	0	0	0	100
2	20	2.93	2.93	58.6	41.4
3	10	1.64	4.57	91.4	86
4	4.75	0.43	5.00	100	0
5	2.36	--	--	100	0
6	1.18	--	--	100	0
7	600 micron	--	--	100	0
8	300 micron	--	--	100	0
9	150 micron	--	--	100	0

 DOI : 10.35291/2454-9150.2022.0053

Calculation: Fineness modulus =sum of cumulative % of weight retained / 100

= 750.01/100 = 7.501say 7.50

Result: The value of fineness modulus of Over Burnt Brick Aggregate = 7.50

3. Crushing Value Test-Test sample consist of aggregate passing a 12.5mm IS sieve and retained on a 10mm

is sieve. Sieve. The aggregate to be tested is dried in an oven for at least 4 hours before being used.

The cylindrical steel cup is filled with three equal layers of aggregate, which are tamped 25 times with the rounded end of the tamping rod and then knocked off then knocked off with the tamping rod as a straight edge The net weight of aggregate in the cylindrical steel cup is ca lculated to the closest gramme (WA) and utilised for the du plicate test on the same material. The cup is firmly secured on the machine's base, and the entire test sample is inserted in thirds, with each third receiving 25 strokes from the tamp ing rod.

The plunger is inserted horizontally on the surface once the surface has been levelled. The entire assembly is then placed between the platens of the testing machine and loaded at a consistent rate to achieve a load of 40 tonnes in less than 10 minutes. The load is subsequently released, and all aggregate from the cup is removed and sieved on a 2.36 mm sieve. IS sieve till no significant amount of water runs through in one minute. The weight of fines generated to the total sample weight in each test is represented as a percentage, to the first decimal place, and the fraction passing the sieve is weighed to an accuracy of 0.1 g (WB).

crushing value of aggregate = (WB/WA) × 100

= (858.88/2684) x100= 32%

The results of experimental study on over burnt Brick aggregate are tabulated in Table 3.13

Table 1.3 Properties of Over Burnt Brick Aggregates

S. No.	Test Conducted	Results
1	Crushing value	32%
2	Water absorption	6.36%
3	Specific gravity	1.82
4	Fineness Modulus	7.50

III. CONCLUSION

- Crushed over burnt brick aggregates can be used as partial replacement for natural coarse aggregates up to 20%, without any considerable loss for strength in concrete.
- Crushed over burnt brick aggregates are lighter than natural stone aggregates and hence lowers the weight of concrete.
- The Slump value of the concrete mix decreases as the percentage replacement of natural stone aggregates by over burnt brick aggregates increases in the concrete.
- The compressive strength of concrete containing 10% and 20% of over burnt brick aggregates was slightly less by 1.35% and 4.03% respectively other than conventional concrete at 28 days of curing period.
- The values for Flexural strength of over burnt brick aggregates 28 days is found decreasing in all replacement's proportions but up to 20% of substitution it gives the values well within the desired range.
- The values of compressive strength and flexural strength are more than target mean strength up to 20% replacement, and hence 20% is the optimum replacement level.

Scope of Study

- Crushed over bricks can be used as partial replacement for coarse aggregates in concern production.
- Crushed over burnt bricks can be used to produced concrete with less weight and hence lesser dead loads as such can be used on low bearing capacity soils.
- Crushed over burnt bricks can be used to produce concrete with sufficient compressive strength with reduced weight.
- Reusing of crushed over burnt bricks could help in sanitizing the environment.

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