

PERFORMANCE EVALUATION OF CONCRETE WITH PARTIAL REPLACEMENT OF OVER BURNT BRICK AGGREGATE

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ABSTRACT

The research work was conducted for possibility of crushed over burnt brick uses as partial replacement of natural course aggregate and silica fume replace 5% of cement in concrete. In this study works natural course aggregate replace in weight percentage by crushed over burnt bricks and silica fume replace 5% weight of cement. Analysis of concrete conducted in fresh state, hardened state and evaluates the different properties of concrete i.e. slump, compaction factor, compressive strength, split tensile strength, Flexural strength and durability. The course aggregate was replaced in 0%.10%.20%.30% and 40% by the crushed over burnt bricks. In this research work methodology adopted of casting cube of concrete and tested after 7 and 28 days and durability checks after 56 days. The result was compare with ordinary concrete.

Keyword: - experimental, over bunt brick, course aggregate, waste material.

1. INTRODUCTION

The over burnt bricks are of an irregular shape and dark colour. Bunt bricks are used as aggregate because over burnt bricks have compacted structure and they are stronger than first class brick, over burnt bricks are waste material, because of irregular shape its cannot be used in masonry works. Large numbers of over burnt bricks are rejected in kilns. Use of over burnt bricks reduced cost of concrete.

Availability of material in research work area around Rajkot city and including village area near about >500 bricks kilns are available. One kiln produced average 5000 bricks in period of manufacture. In bricks production 700 to 1000 bricks are rejected because of irregular shape and over burnt. Most of cases bricks irregular in shape because of over burning. Less number of bricks used in bottom layer of new kiln.

2 OBJECTIVES

To evaluate optimum value of content crushed over burnt bricks as course aggregate by testing of concrete in fresh taste and hardened taste.

To study various test of concrete to define properties of fresh and hardened concrete by Slump test, compaction factor test, compressive strength test 7 and 28 days, split tensile test 28 days, flexural test 28 days and durability test 56 days.

3 MATERIALS

Ordinary Portland cement 53 grades was used.53 grade cement provided consistently higher strength compare to other cement as per bureau of Indian standard (BIS).

Sr.no.	Properties	Result
1	Initial setting time	130 min
2	Final setting time	200 min
3	Consistency	29.5%
4	Sp. Gravity	3.15

Table 3.1 the physical properties of cement

Silica fume is a super pozzolanic material. Silica fume makes concrete durable and gives higher strength compressive strength.

Properties	Results obtained
Silica content	92.80
Alumina	0.60
Iron oxide	0.30
Magnesium oxide	0.60
Potash	0.001
Sodium oxide	0.003

Table 3.2 Chemical properties of silica fume

Properties	Results
Density	1.89 mg/m ³
Bulk density	317 kg/m ³
Sp. Gravity	2.63
Moisture	1.17%

Table 3.3. Physical properties of silica fume

Fine aggregate: fine aggregate which used locally available in market river sand. The fine aggregate was tested as per IS 2386:1963. The fine aggregate was sieved through 4.75 mm and remove particle greater than 4.75 mm.

Fine aggregate	Result
Sand zone	II
Sp. Gravity	2.83
Moisture content	Nil

Table 3.4 Properties of fine aggregate

Course aggregate: The course aggregate use as the crushed stone aggregate which passing through 20 mm sieve size and retained on 4.75 mm sieve was selected.

Test	Result
Sp. Gravity	2.52
Aggregate Impact value	7.9%
Aggregate Crushing value	19.68%
Water absorption	0.43%

Table 3.5 Properties of course aggregate

Crushed over burnt bricks of size passing through 20mm and retained on 12.5mm sieve was used and tested physical properties.

Test	Result
Sp. Gravity	2.34
Impact value	26.8%
Crushing value	24.6%
Water absorption	5.4%

Table 3.6 Properties of crushed over burnt bricks

4 EXPERIMENTAL PROGRAMS

Mix design: the proportioning of raw material is very important in concrete because of durability and quality of concrete. The mix design adopted for M25 and M30 grade of concrete as per IS 10262:2009 the water absorption of crushed over burnt bricks more than natural aggregate. Crushed over burnt bricks are used in surface dry condition and silica fume used weight percentage of cement.

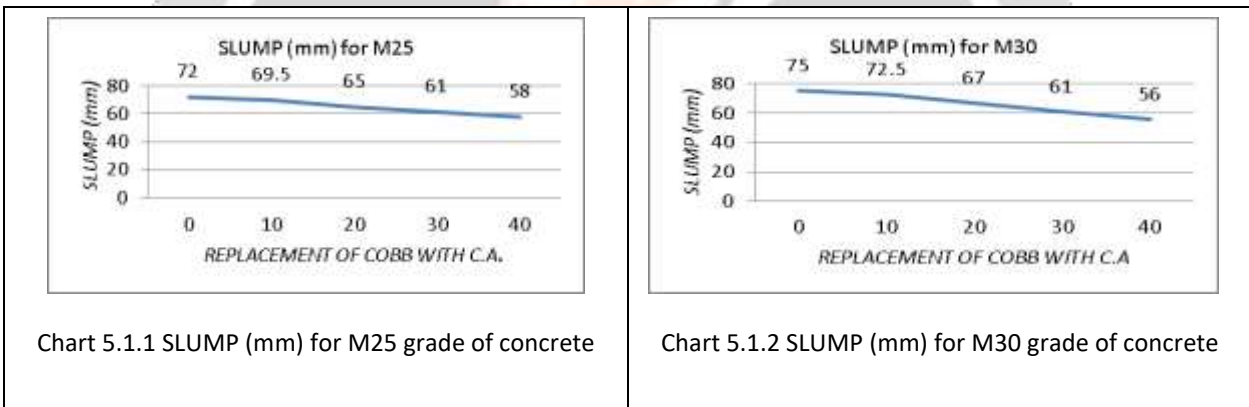
5 RESULTS AND DISCUSSION

5.1 FRESH CONCRETE TEST RESULTS

SR NO	REPLACEMENT OF COBB WITH C.A.	SLUMP (mm) for M25	SLUMP (mm) for M30
1	0	72	75
2	10	69.5	72.5
3	20	65	67
4	30	61	61
5	40	58	56

Table 5.1.1 Workability of concrete

From the results of workability the percentage of crushed over burnt bricks increase the slump value in all grade of concrete decrease.



SR NO	REPLACEMENT OF COBB WITH C.A.	comp. factor for M25	comp. factor for M30
1	0	0.90	0.94
2	10	0.86	0.91
3	20	0.836	0.85
4	30	0.80	0.80
5	40	0.78	0.76

Table 5.1.2 Compaction factor test results

From the value of compaction factor test the concrete mix at replacement of crushed over burnt bricks as natural course aggregate the percentage of value decrease with increase percentage of replacement ultimately decrease the workability of fresh concrete.

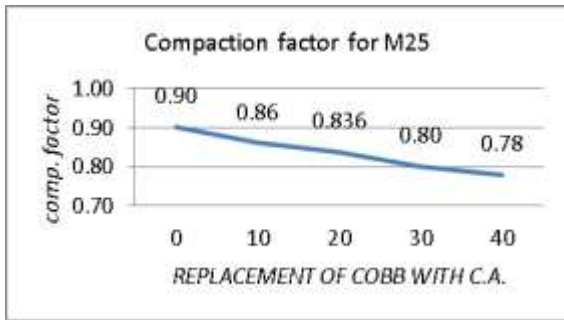


Chart 5.1.3 Compaction factor for M25 grade of concrete

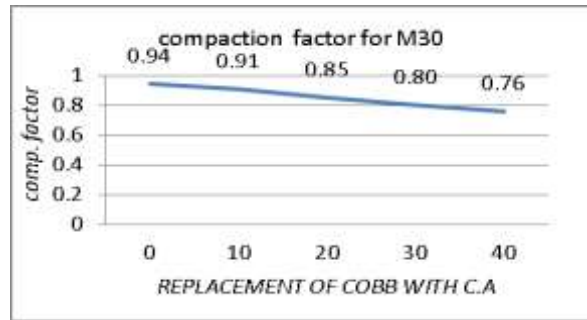


Chart 5.1.4 Compaction factor for M30 grade of concrete

5.2 HARDENED CONCRETE TEST RESULTS

COMPRESSIVE STRENGTH

Replacement % COBB	7th DAYS (COMP. STRENGTH)	28th DAYS (COMP. STRENGTH)
0	21.03	32.31
10	21.40	33.13
20	21.33	32.81
30	20.98	32.27
40	20.47	31.54

Table 5.2.1 Compressive strength M25 grade of concrete

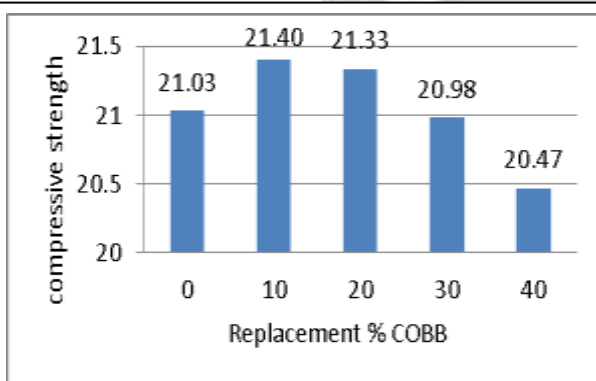


Chart 5.2.1 7th day's comp. strength results for M25 grade of concrete

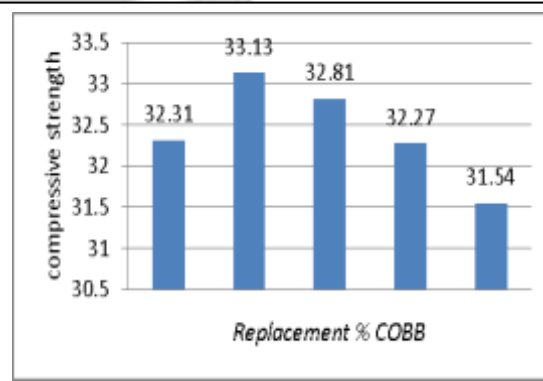
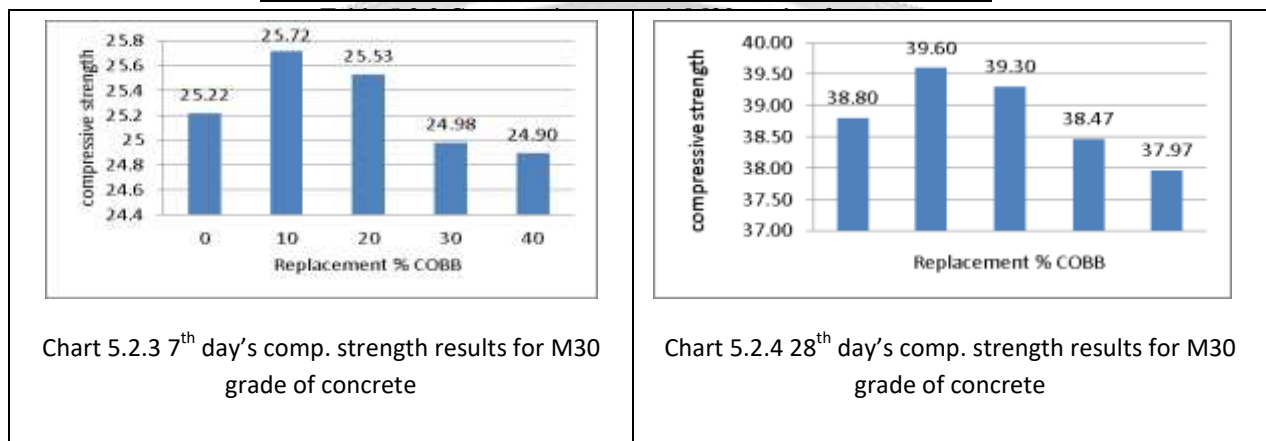


Chart 5.2.2 28th day's comp. strength results for M25 grade of concrete

Replacement % COBB	7th DAYS (COMP. STRENGTH)	28th DAYS (COMP. STRENGTH)
0	25.22	38.80
10	25.72	39.60
20	25.53	39.30
30	24.98	38.47
40	24.90	37.97



From above compressive strength results concrete grade M25 and M30 in replacement percentage 10, 20 and 5% of silica fume constant replace with cement gives very narrow difference with ordinary concrete. More than 20% of replacement compressive strength decrease

SPLIT TENSILE STRENGTH

Replacement % COBB	M25 SPLIT TENSILE STRENGTH	M30 SPLIT TENSILE STRENGTH
0	3.71	4.85
10	3.80	4.95
20	3.77	4.91
30	3.68	4.80
40	3.62	4.74

Table 5.2.2 28th days Split tensile strength results for M25 and M30 grade of concrete

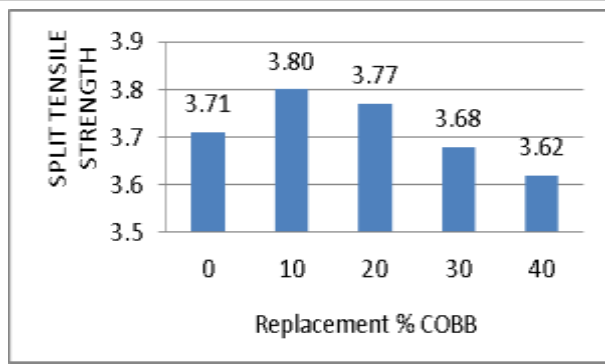


Chart 5.2.5 28th day's split tensile strength results for M25 grade of concrete

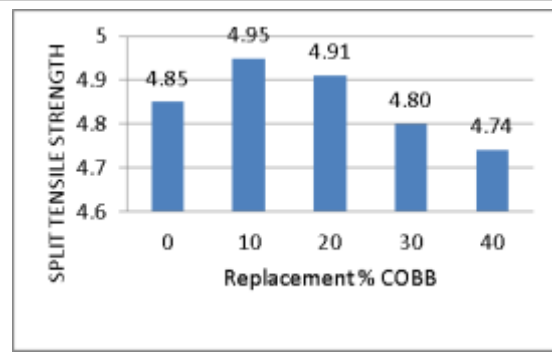


Chart 5.2.6 28th day's split tensile strength results for M30 grade of concrete

From the above results split tensile strength for M25 and M30 grade of concrete 30 and 40 percentages of replacement crushed over burnt bricks as course aggregate and 5% replacement of silica fume with cement results was decrease compare to ordinary concrete. And replacement of 10 and 20 percentage of crushed over burnt bricks results was increase compare to ordinary concrete.

REPLACEMENT % COBB	M25 GRADE FLEXURAL STRENGTH	M30 GRADE FLEXURAL TENSILE STRENGTH
0	4.84	8.60
10	4.96	8.80
20	4.92	8.68
30	4.82	8.49
40	4.73	8.37

Table 5.2.2 28th days flexural strength results for M25 and M30 grade of concrete

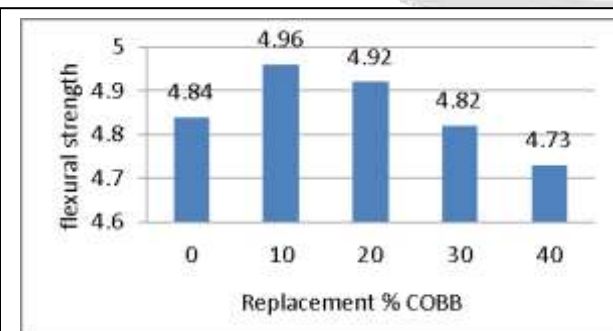


Chart 5.2.7 28th day's flexural strength results for M25 grade of concrete

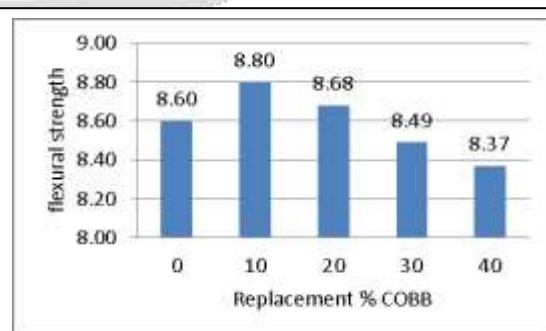


Chart 5.2.8 28th day's flexural strength results for M30 grade of concrete

From the above results clearly show that the percentage of replacement in crushed over burnt bricks as course aggregate and 5% silica fume constant replacement with cement the results was increase compare to ordinary concrete in 10 and 20 percentage of replacement the results was decrease 30 and 40 percentage replacement in both grade of concrete M25 and M30.

DURABILITY TEST

In durability test concrete cube was curing 28 days in normal water and then concrete cube immersed for 28 days in H₂SO₄ 5% of total water content, after total 56 days tested compressive strength of concrete cube in compressive testing machine.

REPLACEMENT % COBB	COMPRESSIVE STRENGTH for M25	COMPRESSIVE STRENGTH for M30
0	26.34	32.78
10	25.14	31.96
20	23.72	31.00
30	22.37	30.24
40	21.18	29.74

Table 5.2.3 56th day's compressive strength results for M25 and M30 grade of concrete

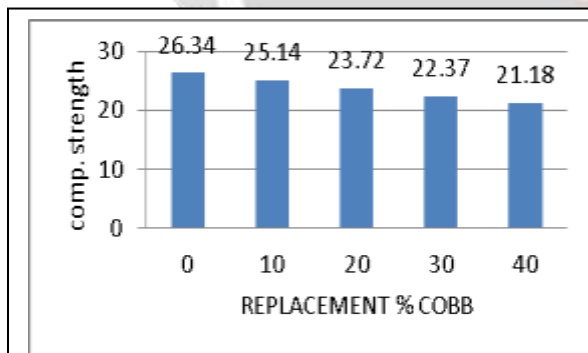


Chart 5.2.9 Compressive strength for M25 concrete cube in acid attack test

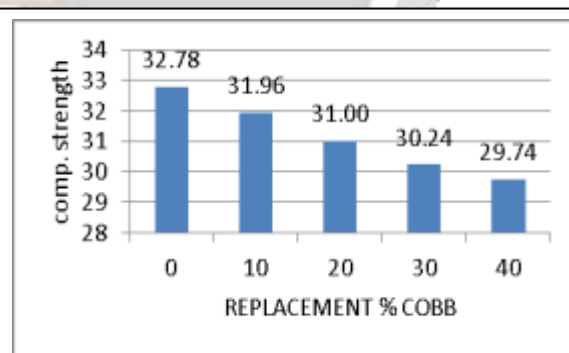


Chart 5.2.10 Compressive strength for M30 concrete cube in acid attack test

The results M25 and M30 grade of concrete after 28 days of curing in H₂SO₄ 5% of total water content, compressive strength was reduced in both grade of concrete.

Conclusion

From the experimental performance following observation made on the fresh taste and hardened taste of concrete.

The 10 and 20 percentage of crushed over burnt bricks and 5% of silica fume constant replacement with cement the results of compressive strength, split tensile strength and flexural strength was increase compare to the ordinary concrete. In more than 20 percentage results slightly decrease to compare to ordinary concrete.

In acid attack test for durability both the concrete grade M25 and M30 compressive strength was decrease percentage of crushed over burnt bricks increase, concrete was feeble in durability with increase of percentage of COBB in concrete.

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