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Influence of Water-Cement Ratio on Compressive Strength of burnt bricks

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Abstract: *The study was conducted to study the effect of water-cement ratio on the compressive strength. Trial mixes were prepared using coarse aggregates only (control), at water – cement ratios of 0.4, 0.45, 0.5 and 0.55. Cubes were prepared and tested to study the compressive strength in relation to the water-cement ratio. The results indicate that the concrete having over burnt bricks as aggregates reducing the water-cement ratio from 0.55 to 0.4 increases the compressive strength from by more than 30%.*

Keywords: *Aggregates, concrete, compressive strength, water-cement ratio, crushed over burnt bricks*

I. Introduction

Concrete consist of cementing substance, aggregates, water. The strength is developed from the hydration due to the reaction between cement and water. Concrete is stronger in compression than in tension, for structures required to carry only compressive loads such as massive gravity dams and heavy foundations, reinforcement is not required and the concrete is consequently called plain concrete.

At present, the most commonly used coarse aggregates for concrete is the river washed gravel due mainly to the presence of River Benue and its deposits. But these are not readily available in some local government areas which are not serviced by the river. The cost of transporting gravel to the areas outside the catchment of the river tends to increase the cost of construction even at relatively cheap labour. This necessitates the use of alternative coarse aggregates which are locally obtained. One of such coarse aggregate is crushed over burnt bricks obtained from the production of burnt.

In many countries, the need for locally manufactured building materials is an imbalance between the demands for housing and expensive conventional building materials coupled with the depletion of traditional building materials. To address this situation, attention has been focused on low-cost alternative building materials.

II. Materials and Method

The sand used for this project was obtained at the River. The burnt bricks samples were collected at a bricks production site. The maximum size of aggregate used was 20mm. Ordinary Portland cement was used as binding agent. The concrete was batched and mixed according to standards. Slump test was carried out on the fresh concrete to determine the workability of the various proportions of the gravel to crushed burnt bricks.

Table 1: Specific gravity of Materials

Material	Specific Gravity
Cement	3.05
Sand	2.65
Gravel	2.72
Crushed bricks	2.15
Water	1.00

III. Results and Discussions

3**.1 Sieve Analysis** The result of the particle size distribution carried out and is presented in Tables.

Table 2 Fine Aggregate

Sieve Size	Mass Retained (g)	% Retained	% passing
4.75	5	2	98
2	55	7	91
0.6	420	45	46
0.2	380	40	6
0.06	35	6	0
Pan	4	0	0

Table 3 Coarse Aggregate

Sieve Size	Mass Retained (g)	% Retained	% passing
37.5	0	0	100
25.4	0	0	100
19.05	320	10	90
12.70	1740	45	45
9.5	950	27	18
6.7	570	10	8
4.75	110	5	3
Pan	70	3	0

3.2 Compressive Strength

The compressive strength results are presented in Figures. The 7 day strength increases as the proportion of burnt bricks increases and the water content reduces, reaching the highest value of 30.0 N/mm^2. This corresponds to proportion of 2:1 (gravel to burnt bricks). Beyond this ratio of 2:1 the strength decreases with increasing burnt bricks content, but increases as water content decreases. The 14th and 28th day strength also produces same result. The 28th day strength gives a maximum value of 35.2 N/mm^2 for gravel – crushed over burnt bricks ratio of 2:1 and water – cement ratio of 0.4

Table 1: Compressive Strength Test Results

Ratio	W/c	Comp. St (N/mm^2)		
		7 day	14 day	28 day
3:0	0.4	26.6	36.8	39.5
	0.45	25.2	30.2	35.4
	0.5	23.1	26.5	28.2
	0.55	20.2	24.2	25.4
2:1	0.4	30.2	34.3	35.2
	0.45	29.7	31.2	30.6
	0.5	27.4	29.8	27.4
	0.55	22.4	24.4	25.2
1:2	0.4	29.8	30.2	31.4
	0.45	28.6	29.1	30.5
	0.5	26.5	28.5	29.6
	0.55	25.4	27.2	28.4
0:3	0.4	27.6	29.2	30.2
	0.45	26.4	28.4	29.3
	0.5	25.4	26.3	27.4
	0.55	24.3	25.5	26.3

Fig.1 Compressive Strength at 3:0

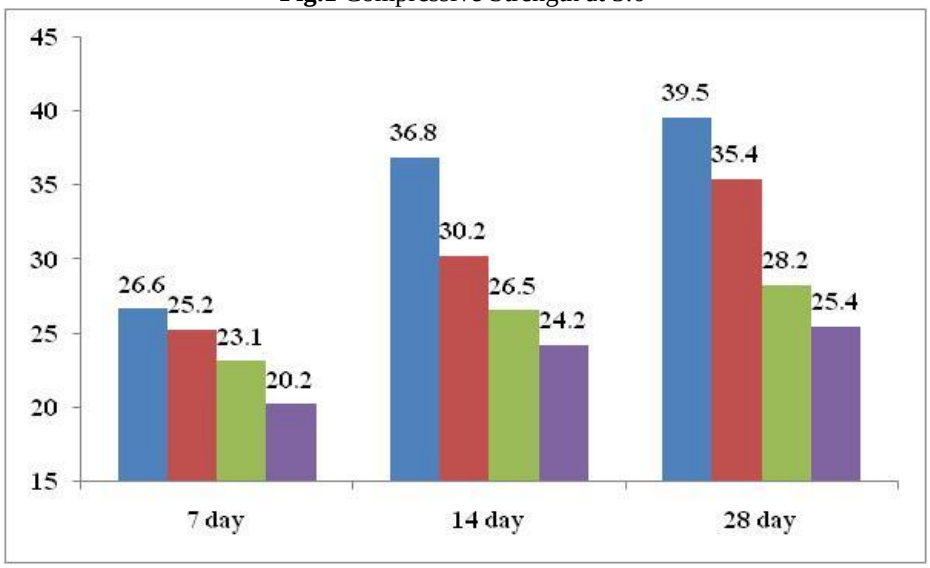


Fig.2 Compressive Strength at 2:1

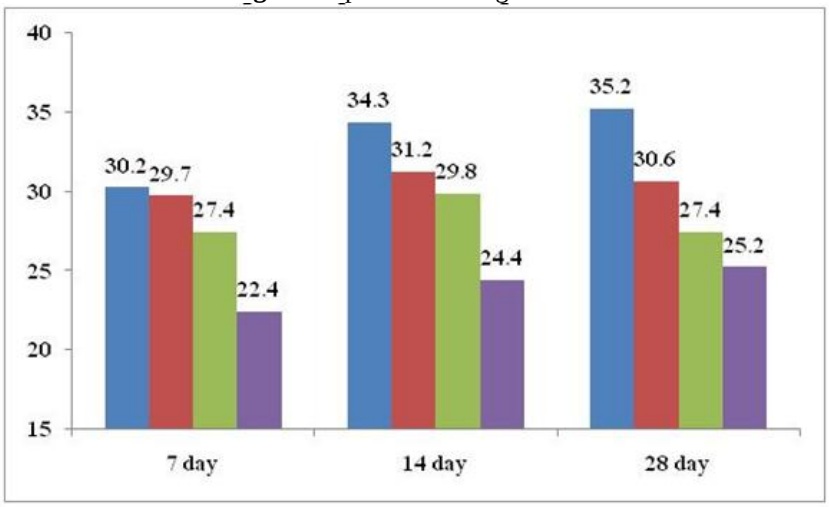


Fig.3 Compressive Strength at 1:2

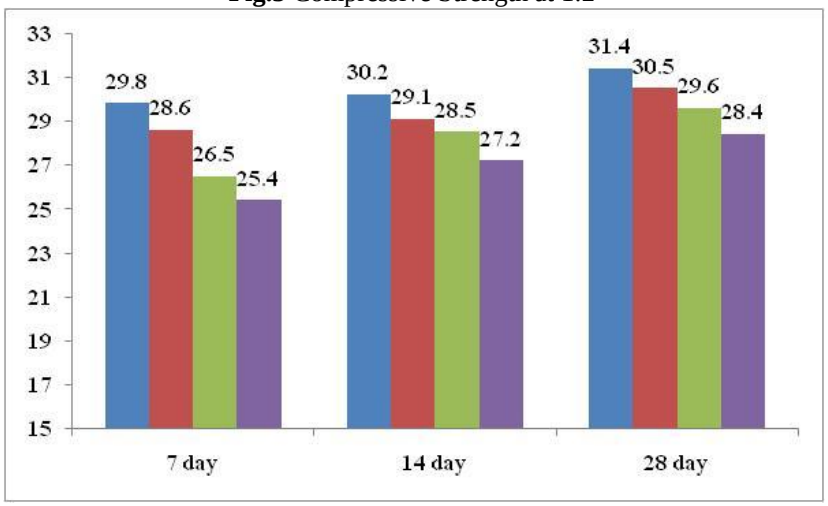
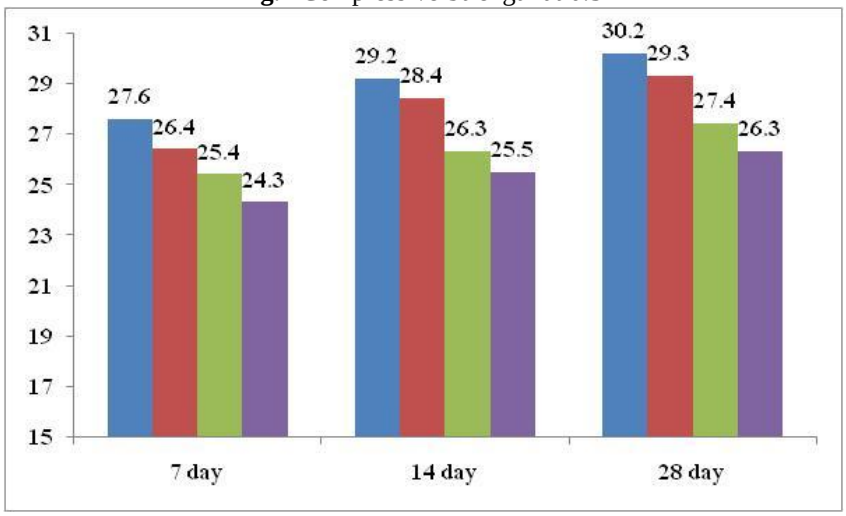


Fig.4 Compressive Strength at 0:3



IV. Conclusion

1) Crushed bricks concrete production.
2) Crushed bricks produce higher strength with reduction in weights
3) Reducing the w/c ratio increases the compressive strength.

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