Experimental Investigation on Properties of Concrete Using Over Burnt Brick Aggregate As A Partial Replacement of Course Aggregate

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Abstract- *Concrete is the base material for 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. The study was conducted to analyze compressive, split tensile strength and flexural strength of concrete when convention coarse aggregate was replaced with 12.5 % , 25 % , 37.5 % , 50 % of over burnt brick aggregate. The use of brick aggregate as a replacement of coarse aggregate resulted reductions in unit weight. The 25% replacement of over burnt bricks is considered as the best in view of strength and economy, hence we use it in moderately loaded structures. 37.5 % replacement of over brunt brick can be used wherever load coming chances are less.*

Keywords- Over burnt brick, Compressive strength, Splitting tensile strength, Flexural strength

I. INTRODUCTION

Concrete is the base material for construction industries. It is strong in compression and weak in tension, the main constituent of the concrete in cement, sand, coarse aggregate and water, replacing some of these material 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 over burnt brick bat (OBB) wastes 20-30mm size having available in the brick manufacturing industries. In recent research, the OBB wastes were replaced with concrete. This OBB maintains strength and performance to the concrete also reduce the weight of the concrete. Strongly OBB replaced with concrete can be performed in the mass concrete filling area. In environmental aspects replacement of OBB 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. This over consumed block fills in as waste in the development business and needs to amass some place during the time spent reusing.

II. OBJECTIVE OF PROJECT

i. To study the property of fresh concrete.
ii. To study The Compressive strength, flexural strength, tensile strength of concrete by replacing coarse aggregate with over burnt bricks.
iii. Cost analysis of concrete with over burnt brick will be studied.

III. LITERATURE REVIEW

Apebo, N. S., Agunwamba, J. C., Ezeokonkwo, J. C. studied suitability of crushed over burnt bricks as alternative coarse aggregates for concrete production. Tests were carried out to determine the physical properties of the crushed over burnt bricks aggregates.

Kuldeepak dwivedi observed the suitability of the alternate materials such as over burnt brick chips and demolished concrete waste as a partial replacement of coarse aggregate because these materials are easily available at very low cost as compared to conventional coarse aggregates. The study was conducted to analyze the compressive and split tensile strength of concrete when conventional coarse aggregate was replaced

with 10 to 50% of over burnt brick chips and 10 to 50% of demolished concrete waste separately.

Dr. M. N. Hiremath and Mr. Sanjay S J carried out experimental study on replacement of coarse aggregate by demolished brick aggregate The only variable considered in this study was the volumetric replacement (0%, 25%, 50%, 75%, and 100%) of stone aggregate by brick aggregate. The use of brick aggregate as a replacement of stone aggregate.

DR. S. O. Abuobha intends to investigate the performance clay based aggregates in concrete with a view of achieving the target compressive strengths specified in concrete mix design. The author will also explore the performance of clay based aggregates in comparison with the normal granitic aggregates. Particular emphasis being recovery of clay waste from the manufacturing industries such as Kenya Clay Products LTD etc.

S Kanchidurai, G Bharani and K Saravana Raja Mohan studied the partial and complete replacement of over burnt brick bat (OBB) 20-30mm as coarse aggregate in the concrete. The series of tests are conducted to study the effect of 0%, 25%, 50%, 75% and 100% replacement of coarse aggregate with over burnt bricks.

Mr. G. S. Patil and Mr. P. B. Autade studied 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 or Zama brick. This material was chosen because of their availability. The burn brick is available from brick manufacturing area. This project presents the effects of Jhama Class Brick inclusion on the mechanical properties of concrete matrix in wet and hardened state properties.

G. N. Shete, Bidve Ganesh Shivkanth 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 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 over burnt brick bat to coarse aggregate.

IV. METHODOLOGY

SUMMARY OF TEST RESULT OF MATERIAL :-

Summary of test result material

Sr. No.	Material	Test	Result
i.	Cement	Specific gravity	3.15
		Fineness	1.3%
		Standard Consistency	35%
		Initial and final setting time	32 &290 minutes
ii.	Fine aggregate	Specific gravity	2.70
		Water absorption	2.98%
		Fineness modulus	2.45
iii.	Coarse aggregate	Specific gravity	2.74
		Water absorption	0.20%
		Fineness modulus	3.27
		Aggregate impact value	16.45%
iv.	Over burnt bricks	Specific gravity	3.07
		Water absorption	3.56%
		Fineness modulus	5.16

Final Mix Proportional :-

Water	Cement	Fine Aggregate	Coarse Aggregate	Water cement ratio
191.6 kg/m^3	399.125 kg/m^3	645.99 kg/m^3	1097.24 kg/m^3	0.48

V. EXPERIMENTAL RESULT AND ANALYSIS

COMPRESSIVE STRENGTH TEST:-

Compression Strength test result for M_{20} grade of concrete for 7 and 28 days in N/mm^2

Sr. No	Mix	7 days Compressive strength (N/mm²)		Avg	28 days Compressive strength (N/mm²)		Avg	Increase in Compressive strength (%)
i.	OBB 0%	16.50	16.44	16.53	26.00	27.12	26.60	–
		16.68			26.7			
ii.	OBB 12.5 %	19.18	19.50	19.23	27.9	28.5	28.20	6.01
		19.00			28.2			
iii.	OBB 25 %	20.5	21.2	20.66	29.5	29.3	29.66	11.50
		20.3			30.2			
iv.	OBB 37.5 %	14.22	14.40	14.44	25.66	25.44	25.57	-3.87
		14.60			25.63			
v.	OBB 50%	11.5	12.3	11.8	18.8	18.9	19.00	- 28.57
		11.8			19.3			

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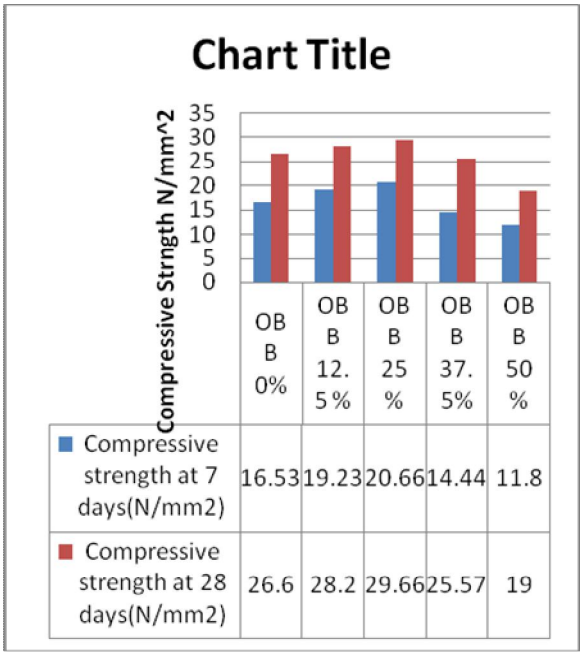
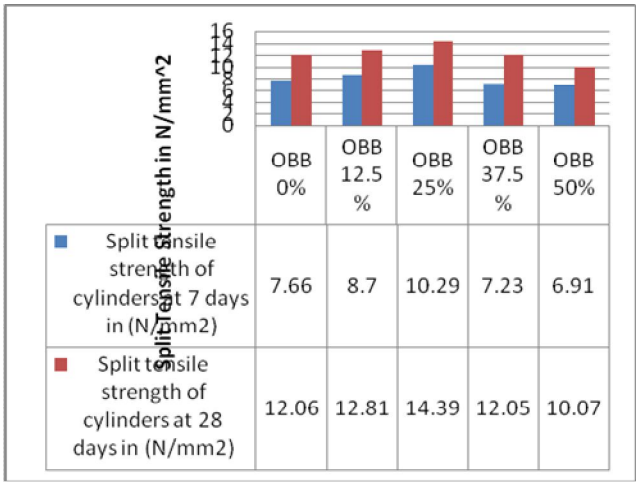


Comparison of compressive strength at 7 days and 28 days for 0% to 50% in N/mm^2

SPLIT TENSILE STRENGTH TEST :-

Sr.No	Mix	7days Split tensile strength (N/mm²) (N/mm²)	Avg	28days Split tensile strength (N/mm²)	Avg	Increase in Split tensile strength (%)
i.	OBB 0%	8.57	8.60	12.50	12.06	--
		9.00		11.44		
		8.24		12.24		
ii.	OBB 12.5%	8.55	8.70	12.88	12.81	6.21%
		9.12		12.44		
		8.44		13.12		
iii.	OBB 25%	10.30	10.29	14.24	14.39	19.32
		9.68		14.40		
		10.90		14.54		
iv.	OBB 37.5%	7.23%	7.23	12.50	12.05	-0.08
		7.22%		12.22		
		7.26%		11.44		
v.	OBB 50%	6.50	6.91	10.30	10.07	- 16.50
		7.24		10.24		
		6.99		9.67		

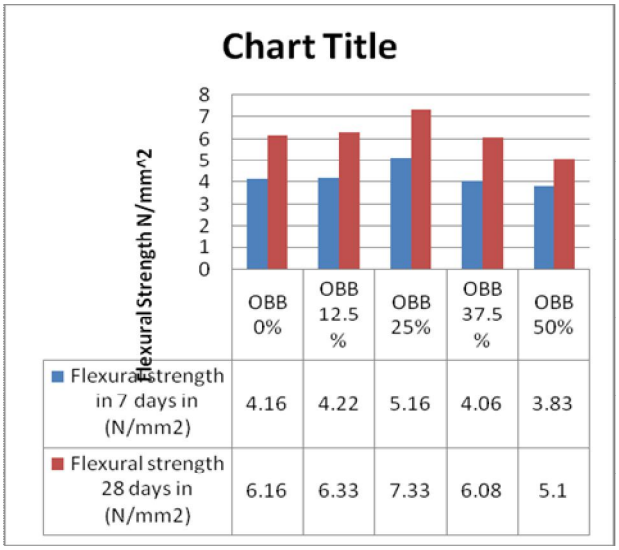


Comparison of spilt tensile strength at 7 days and 28 days for 0% to 50% in N/mm^2

FLEXURE STRENGTH TEST:-

Flexural Strength test result for M_{20} grade concrete for 7 and 28 days in N/mm^2

Sr.No	Mix	7 days Flexural Strength (N/mm^2)		28 days Flexural Strength (N/mm^2)		Increase in Flexural Strength (%)
		Flex.Str. (N/mm^2)	Avg.	Flex.Str. (N/mm^2)	Avg.	
i.	OBB 0%	4.50 4.00 4.00	4.16	6.00 6.50 6.50	6.16	--
ii.	OBB 12.5 %	4.22 4.24 4.21	4.22	6.00 6.50 6.50	6.33	2.75
iii.	OBB 25 %	5 5.5 5	5.16	7 7.5 7.5	7.33	18.99
iv.	OBB 37.5 %	4.20 4.00 4.00	4.06	6.00 6.12 6.12	6.08	-1.29
v.	OBB 30%	3.8 3.8 3.9	3.83	5.0 5.3 5.0	5.10	-17.20



Comparison of flexural strength at 7 days and 28 days for 0% to 50% in N/mm^2

COST COMPARISON :-

Cost comparison for $1m^3$Quantity of Concrete with over burnt brick

Sr. No	Material	Rate	Unit	0 %		25 %	
				Quantity in Kg	Amount	Quantity in Kg	Amount
1	Cement	6	Kg	399.125	2394.75	399.125	2394.75
2	Fine aggregate	2	Kg	645.99	1291.98	645.99	1291.98
3	Course aggregate	0.76	Kg	1097.24	817.94	822.93	625.42
4	OBB	0.2	Kg	0	0	274.31	54.86
Total Cost				4504.67		4367.01	
Percentage Difference				3 %			

It has been seen that there is a saving of 3 % of money if coarse aggregate is replace by OBB. The saving would be more if the C.A. availability is at greater distance.

VI. CONCLUSION

- It is observed that with increases in percentage of over burnt brick up to 25% it gives medium workability, and workability decreases for 37.5% & 50 % replacement , it gives low workability.
- 6.01% to 11.50 % increment in the compressive strength is found for 12.5% to 25 % replacement of coarse aggregate by over burnt brick aggregate, and strength decreases by 3.87% & 28.57 % when the 37.5% & 50 % of coarse aggregate replaced by over burnt brick aggregate.
- Split tensile strength of over burnt brick based concrete was higher by 6.25% & 19.32% than that of conventional concrete for replacement of 12.5% & 25%, for further increase in the percentage of replacement up to 37.5% & 50% ,t he split tensile strength decrease by 0.08% & 16.50% respectively.
- Flexural strength of over burnt brick based concrete was higher by 2.75% & 18.99% than that of conventional concrete for replacement of 12.5% & 25%, for further increase in the percentage of replacement up to 37.5% & 50% , flexural strength decrease 1.29% & 17.20 % respectively.
- There is 3% saving in money if conventional concrete is replaced by over burnt brick aggregate by 25%

REFERENCES

[1] Apebo, N. S., Agunwamba, J. C., Ezeokonkwo, J. C ' Sutability of crushed over burnt bricks as coarse aggregate of concrete,' International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 3, Issue 1, January 2014.

[2] Bidve Ganesh Shivkanth, G. N. Shete,' Experimental Study on Effect of Partial replacement of coarse aggregate by over burnt brick bats, International Journal of Research in Engineering, Science and Management volume Issue-4, April-2019.
[3] Dr. M. N. Hiremath Mr. Sanjay S J, 'Replacement of Coarse aggregate by Demolished Brick Waste in Concrete, IJSTE - International Journal Science Technology & Engineering | Volume 4 | Issue 2 | August 2017.
[4] IS 456: 2000, Indian Standard Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards.
[5] IS 10262: 2009, Indian Standard Recommended Guidelines for Concrete Mix Design. Bureau of Indian Standards
[6] . Mirjana Malesev,Vlastimir RadonjaninSneana Marinkovic "Recycled concrete as aggregate for structural concrete production."sustainability 2010
[7] Nilesh K. Vasoya,Dr. Harishkumar R. Varia'Utilization of various waste material in concrete a literature review.International Journal of Engineering research and technology. April-2015