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INVESTIGATION ON STRENGTH CHARACTERISTICS OF CONCRETE BY USING FLYASH AND BRICK WASTE

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Abstract - *The increase cost of conventional construction materials affects an economy of structure and an availability of raw material is very less due to higher use of concrete. In developing country like India, use of concrete is higher in quantity but the availability of raw material is very less. Thereby, waste materials are used for replacing the construction materials. The use of waste materials not only helps in utilizing cement, fine aggregate, concrete and other materials in construction, but indirectly has numerous benefits namely decrease in land fill cost, energy saving, and protecting the environment from pollution effect. In this investigation, 100 % replacement of the natural sand by M-sand. The cement is partially replaced by fly ash and coarse aggregate is replaced by construction brick waste. The partial replacement is done for 20%, 25%, 35% and 40% replacement of materials. After mixing and curing is done, the concrete block is tested for its strength characteristics.*

Key Words: Flyash, Brickwaste, Compressive strength, Flexural Strength, M-sand.

1. INTRODUCTION

Concrete is a very and versatile building material that is used in nearly every aspect of developed countries. It is used in structural components such as beams, columns, floors, walls and dams. It is also used in pavement applications like parking lots, roads, and bridges etc., The high cost of conventional construction material affects economy of structure and also feasible of raw material is very less due to higher use of concrete. Because of this, Waste materials are used for replacing the construction materials. Use of the waste materials not only helps in getting them used in cement, concrete and other construction materials, but also has many indirect benefits such as reduction in land fill cost, saving in energy, and protecting environment from possible pollution effect. Manufactured sand is a substitute for river sand for concrete in construction. Manufactured sand is obtained from hard granite stone by crushing process. The crushed sand is of cubical shape with grounded edged, washed and graded to as a construction material.

Demolishment of old buildings produces waste material (brick blasts) which needs to be utilized in new construction. These waste materials usually dumped illegally or as landfill material, can be reused to reduce environmental issues and also can save some pennies. These demolished materials, which are usually brick blasts, can be used in making new concretes; this also makes possible to eradicate waste related problems. Furthermore reusing the brick blasts as coarse aggregate in concrete can significantly reduce the weight of concretes as well. Therefore the coarse aggregate is replaced by brick waste.

2. OBJECTIVES

To determine the suitability of waste materials as a replacement of concrete materials in concrete production, strength characteristics of brick waste concrete and to compare the performance between concrete with brick waste as coarse aggregate partial replacement and conventional concrete (control concrete). To determine the effect of waste brick aggregate as coarse aggregate replacement material in variable percentage by weight of aggregate in fresh properties of concrete.

3. MATERIALS AND THEIR PROPERTIES

Cement: Ordinary Portland cement (Ultra-Tech Cements of 53 grades) was used having 32.5% Consistency and Compressive strength 54 Mpa Fine Aggregate: Natural sand with maximum size of 4.75 mm was used (zone II) with specific gravity 2.6 and fineness modulus 2.89. Coarse Aggregate: Natural aggregates with maximum size of 40 mm were used with specific gravity of 2.7 and fine modulus 7.51. Fly ash: Fly ash is finely divided residue resulting from the combustion of pulverized coal and transported by the flue gases of boilers by pulverized coal. It was obtained from thermal power station, dried and used.

Table 1- Material quantity for conventional concrete

Materials	Quanti ty
Water(lit/m3)	180.42
Cement(Kg/m3)	360
Fine aggregate (Kg/m3)	584
Coarse aggregate (Kg/m3)	1223.8

M-Sand : Manufactured sand (4.75mm to 75 micron (0.2 to 0.003 in)) is used for partial replacement to natural sand. Natural and manufactured sand are from zone II (IS 383).

Brick waste: The brick waste aggregate are collected from the source demolished structures. The brick mortar debris were collected locally from different sources and broken into the pieces of approximately 40 mm size with the help of hammer .The foreign matters were sorted out from the pieces. Further, those pieces were mechanically sieved through sieve of 4.75 mm to remove the finer particles. The recycled coarse aggregates were washed to remove dirt, dust etc. and collected for use in concrete mix.

4. MATERIAL PARAMETERS

Grade of concrete – M20
Type of cement – OPC 53 Grade
Fine aggregate < 4.75mm
Coarse aggregate – 20 mm
Water cement ratio – 0.5

Table 2 - Compressive strength of conventional concrete

Compressive strength	Load (N)	Average load (N)	Stress (N/mm^2)	Average stress (N/mm^2)
7 days	294	**296**	13.07	**13.16**
	296		13.16	
	298		13.25	
14 days	404	**404**	17.96	**17.96**
	405		18	
	403		17.91	
28 days	453	**454.3**	20.13	**20.2**

From the experiment of conventional concrete the average stress at 7 days,14 days and 28 days are 13.16N/mm^2, 17.96 N/mm^2,20.2 N/mm^2.

Table 3- (Mix design combinations for 9 cubes and 9 beams)

The mix proportions for full replacement of natural sand by M-sand, 20%,25%,35% and 40% replacement of cement and coarse aggregate by fly ash and brick waste formed as follows,

fly ash and brick waste %	Cement (Kg)	Coarse aggregate (Kg)	Fly ash (Kg)	M-sand (Kg)	Brick waste (Kg)
0	76	228	-	114	-
20	60.8	182.4	15.2	114	45.6
25	57	171	19	114	57

30	53.2	159.6	22.8	114	68.4
35	49.4	148.2	26.6	114	79.8
40	45.6	136.8	30.4	114	91.2

Table 4 - Compressive strength of concrete by the replacement of flyash and Brickwaste

%0f replacement materials (both fly ash and brick waste)	Load (N)	Average load (N)	Stress (N/mm^2)	Average stress (N/mm^2)	Strength achieved in %
20	12	11.33	3.73	3.5	100%
	11		3.42		
	11		3.42		
25	9	10.33	2.8	3	94%
	10		3.11		
	10		3.11		
30	7	7.33	2.18	2.28	71%
	7		2.18		
	8		2.49		
40	6	6.33	1.87	1.97	61%
	6		1.87		
	7		2.18		

5. RESULTS AND CONCLUSION

The 7, 14 and 28 days compressive strength of conventional concrete is found as 13.02 N/mm2, 17.96 N/mm2 and 20.2 N/mm2.The 20% replacement of materials in concrete produces a compressive strength of 13.02 N/mm2 at 7 days. Hence it attains 65.1% strength when compared with conventional concrete in 7 days. Similarly, The 14 days and 28 days compressive strength are 17.9 N/mm2 and 20.25 N/mm2. Hence the 20 % replacement attains 92% and 100% compressive strength in 14 and 28 days. Hence the compressive strength attained at 20% replacement of materials produces 100% strength at 28 days. The flexural strength attained at 7, 14 and 28 days for conventional concrete is found as 2.18 N/mm2, 2.59 N/mm2 and 2.59 N/mm2. 20% replacement of concrete produces flexural strength at 7 days would be 1.97 N/mm2. Hence it gives 61% flexural strength in 7 days when compared with

conventional concrete. Similarly, The 14 days and 28 days flexural strength are 2.91N/mm2 and 3.5N/mm2. Hence the 20 % replacement attains 91% and 100% compressive strength in 14 and 28 days. Hence the flexural strength attained at 20% replacement of materials produces 100% strength at 28 days. So, we can fully replace the river sand with M-Sand. But the cement and coarse aggregate is replaced by 20% replacement of fly ash and brick waste.

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