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Analysis the characteristic behaviour of quarry and furnace waste kerb stone

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ABSTRACT

Quarry Dust and the crushed stone as alternative aggregates for concrete production for low-cost housing since it is clear that the rising cost of concrete materials coupled with environmental degradation has impaired the construction industry. The following tests were carried out to determine the physical properties of these materials; density tests, silt content, water absorption, sieve analysis, specific gravity, flakiness index and aggregate crushing value. The research was conducted by testing concrete cylinder and cubes specimens at ages of 7, 14 and 28 days concrete with concrete mix ratios 1:1.5:3 with a target strength of 25N/mm2 and 1:2:4 with a target strength of 20N/mm2. Samples of concrete specimens were made using varying contents of quarry dust and laterite as fine aggregate. India is a developing contrary due to there is a huge need for infrastructure that is why construction is very important. In the construction the main material his problem we are making Kerb stone using this. This Kerb stone is stronger economical and effective than the clay Kerb stone. This process also helps in converting the industrial waste material into quality building material.

Keywords— *Quarry dust, Kerb stone, Furnance, Concrete*

1. INTRODUCTION

In normal Kerb stone, the weight of Kerb stone is one of the parameters to compare with the weight of Quarry & Furnace Waste Kerb stone. This heavy self-weight makes an uneconomical structural material compared to the low self-weight of Quarry & Furnace Waste Kerb stone. In order to produce Kerb stone of desired density to suit the required application, the self-weight of structural and nonstructural members are to be reduced. Hence economy is achieved in the design of supporting structural elements which lead to the development of Kerb stone. Lightweight Kerb stone is defined as a Kerb stone that has been made lighter than the normal Kerb stone by changing the material composition or production method. Lightweight Kerb stone is the Kerb stone made by replacing the usual material with light weight material. Quarry & Furnace Waste Kerb stones are made of Quarry & Furnace Waste, lime, gypsum cement and sand. These can be extensively used in all building constructional activities similar to that of common burnt clay Kerb stones. The Quarry & Furnace Waste Kerb stones are comparatively lighter in weight and stronger than common clay Kerb stones. Since Quarry & Furnace Waste is being accumulated as waste material in large quantity near thermal power plants and creating serious environmental pollution problems,

2. EXPERIMENTAL PROGRAM

The main objective of this experimental program is to study and compare the compressive strength and water absorption of Quarry & Furnace Waste Kerb stone with the normal Kerb stone. The present study also involves the sieve analysis test of fine aggregate and physical property test of the cement.

2.1 Testing of materials

The basic properties and strength of the specimens depend on its constituents materials. It is, therefore, necessary to carry out tests as recommended by IS, on constituent materials namely cement, sand and Kerb stones.

2.2 Testing of cement

Ordinary Portland cement of grade 43 was used for making the Kerb stone mortar. The quality of cement was checked through various tests and was compared with specifications given IS 269-1976 for OPC. The properties of cement used are given in

2.3 Specific gravity of cement

The object of conducting this test was to determine the specific gravity of cement. It is normally defined as the ratio between the mass of the given volume of material to the mass of the equal volume of water. The method used for determining the specific gravity of cement is by the use of water free from kerosene which does not react with cement. A specific gravity bottle was employed for this task.

2.4 Standard consistency of cement

The object of conducting this test was to find out the amount of water to be added to the cement to get a paste of normal consistency that is paste of certain standard solidity, which is used to fix the quantity of water to be mixed in cement before performing tests for the setting time, soundness and compressive strength. Vicat's needle apparatus was used to calculate the standard consistency of the cement. Determine the specific gravity of cement. It is normally defined as the ratio between the mass of the given volume of material to the mass of the equal volume of water. The method used for determining the specific Gravity of cement is by the use of water free from Kerosene which does not react with cement. A specific gravity bottle was employed for this task.

2.5 Fineness of cement

The fineness of cement was calculated by taking a sample of 1 kg cement and passing it through IS 90 micron sieve by shaking it thoroughly for 5 minutes. The matter passed through it was then weighed and its percentage calculated to know the fineness of cement.

2.6 Initial and Final setting time of cement

The aim of these tests was to calculate the initial and final time of cement. It is necessary to know the initial setting time of cement. It is necessary to know the initial setting time in order to place the mortar or concrete in a position conveniently. Hence it should not be less and after laying of concrete in a position conveniently. Hence it should not be less and after laying of concrete or mortar hardening should be rapid so that the structure can be made use of as early as possible. Initial setting time is a stage in the process of hardening after which any crack, which may appear and will not reunite the concrete or mortar is said to be set finally when it has obtained sufficient strength and hardness. Vicat's needle apparatus was used to calculate the initial and final setting tine of cement.

2.7 Soundness of cement

The object of this test was to find out the soundness of cement by using le-chatlier's apparatus. Excess of free lime and magnesia present in the cement slakes very slowly and cause an appreciable change in volume after setting. In consequence, cracks, distortion, and disintegration resulting effect on concrete and reinforcement. This defect is known as soundness. Limiting the quantities of free lime and magnesia in cement prevent the expansion. The test was designed to accelerate the slaking process by application of heat and to measure the expansion and to see if this expansion is within the specified limit indirectly, this test gives the extent of free lime and magnesia present in the cement.

Table 1: Physical properties of ordinary Portland cement used

S. No	Characteristics	Value obtained Experimentally	Value specified in IS: 8112-1989
1	Specific Gravity	3.18	3.15
2	Fineness by sieve through IS 90 micron standard sieve	303	225
3	Setting Times (minutes) (i) Initial (ii) Final	 81 483	 >30 <600
4	Compressive strength(N/mm²) (i) At 3 day (Average 3 samples) (ii) At 7 day (Average 3 samples) (iii) At 28 day (Average 3 sample	 28.9 38.94 47.95	 >23 >33 >43

Table 2: Sieve Analysis of fine Aggregate

Size of Sieve	Weight Retained in IS Sieve (gm)	Cumulative Weight Retained in IS Sieve	Percentage Retained	Percentage passing	Grading Limit according to IS :383-1970
10mm	0	0	0	100	Zone-III
4.75mm	0	0	0	100	
2.36mm	11	6	2.1	97.9	
1.18mm	34	30	4.5	95.5	
600 micron	165	195	21	79	
300 micron	622	832	83.2	16.8	
150 micron	98	930	93	7	

3. COMPRESSIVE STRENGTH TEST

The red and Quarry and Furnace Waste Kerb stones were tested on the compressive testing machine of capacity 100 tones which read to the nearest 0.5 tonnes. The load was applied steadily and uniformly. 3 number Kerb stones of each type were tested for compressive strength.

Table 3: Compressive strength of normal Kerb stone

Specimen No	Load at failure (KN)	Compressive Strength (Kg/cm²)	Average Compressive Strength (Kg/cm²)
1	220	96.80	92.87
2	198	89.70	
3	207	92.10	

Table 4: Compressive strength of quarry & furnace waste kerb stone (2% Cement)

Specimen No	Load at failure (KN)	Compressive Strength (Kg/cm^2)	Average Compressive Strength (Kg/cm^2)
1	277.8	125.8	126.1
2	287.3	127.9	
3	280.3	124.8	

Table 5: Compressive strength of quarry & furnace waste kerb stones (3% Cement)

Specimen No	Load at failure (KN)	Compressive Strength (Kg/cm^2)	Average Compressive Strength (Kg/cm^2)
1	380.7	141.4	141.2
2	314.7	139.9	
3	319.72	142.2	

Table 6: Compressive strength of quarry & furnace waste kerb stones (5% Cement)

Specimen No	Load at failure (KN)	Compressive Strength (Kg/cm^2)	Average Compressive Strength (Kg/cm^2)
1	338.1	150.3	152.1
2	345.1	153.5	
3	343.3	152.6	

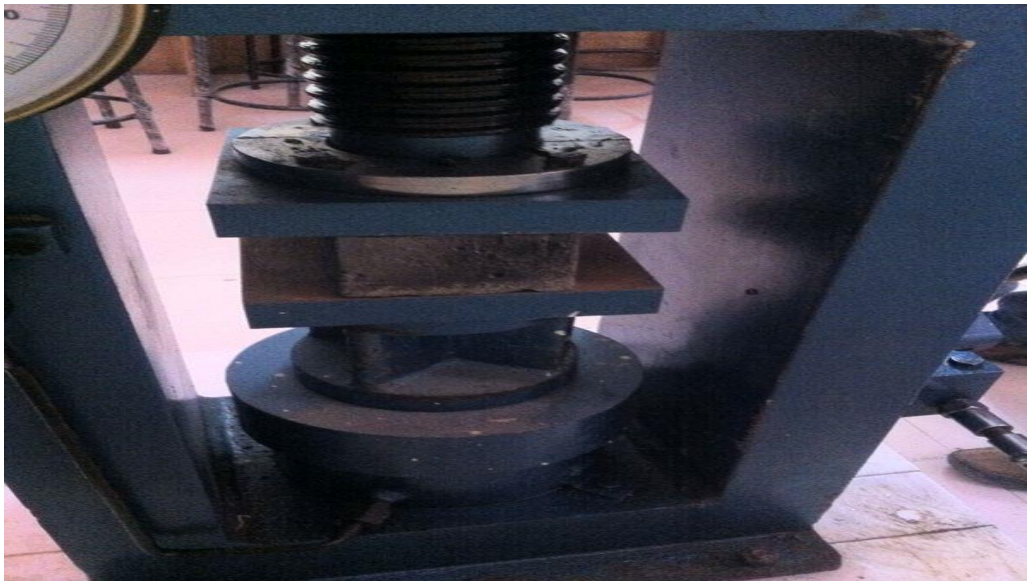

Fig. 1: Compressive strength test of quarry & furnace waste kerb stone

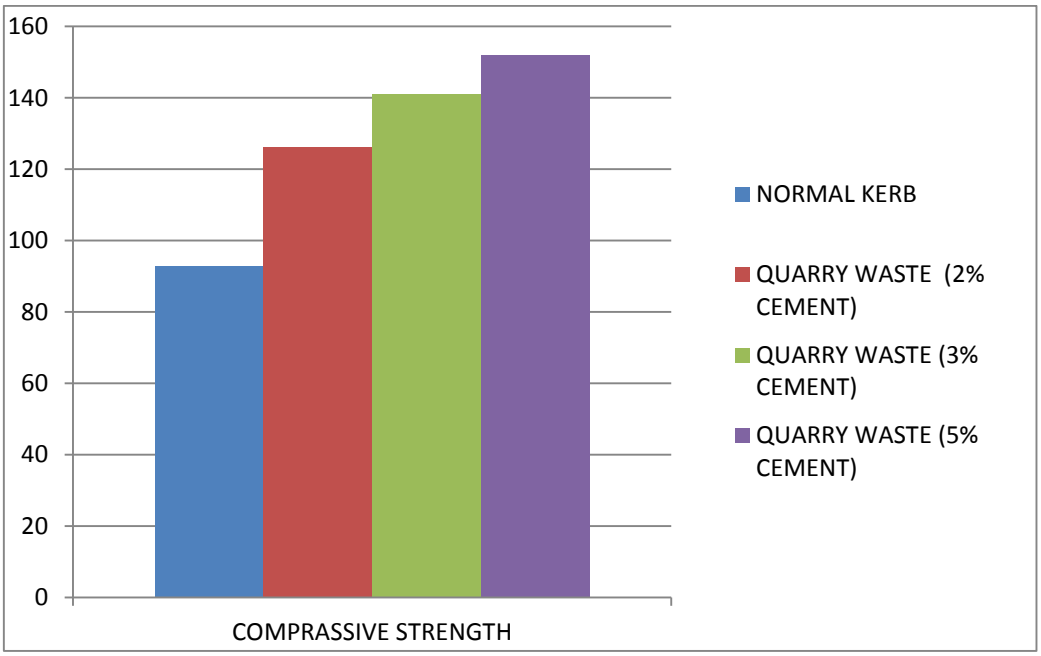

Fig. 2: Compressive strength graph

4. WATER ABSORPTION TEST

The red and Quarry and Furnace Waste Kerb stones were dried and weighted. These were then immersed in water for 24 hours and then weight again. The Kerb stones were tested in accordance with the procedure laid down in IS 3495 (Part-II) 1976 (36).

Table 7: Water absorption test of normal Kerb stone

Specimen No	Dry Weight (Kg)	Moist Weight (Kg)	Water Absorption in %	Average Water Absorption %
1	31.12	32.43	5.93	6.46
2	31.21	33.06	6.25	
3	31.33	33.52	7.20	

Table 8: Water absorption test on quarry & furnace waste Kerb stones (2 % Cement)

Specimen No	Dry Weight (Kg)	Moist Weight (Kg)	Water Absorption in %	Average Water Absorption %
1	26.10	27.21	4.25	5.05
2	25.50	26.95	5.68	
3	25.80	27.15	5.23	

Table 9: Water absorption test on quarry & furnace waste Kerb stones (3 % Cement)

Specimen No	Dry Weight (Kg)	Moist Weight (Kg)	Water Absorption in %	Average Water Absorption %
1	26.60	27.75	4.32	4.24
2	26.80	27.90	4.10	
3	26.70	27.85	4.30	

Table 10: Water absorption test on quarry & furnace waste Kerb stones (5 % Cement)

Specimen No	Dry Weight (Kg)	Moist Weight (Kg)	Water Absorption in %	Average Water Absorption %
1	27.75	28.70	3.42	3.81
2	27.90	29.05	4.12	
3	28.10	29.20	3.90	

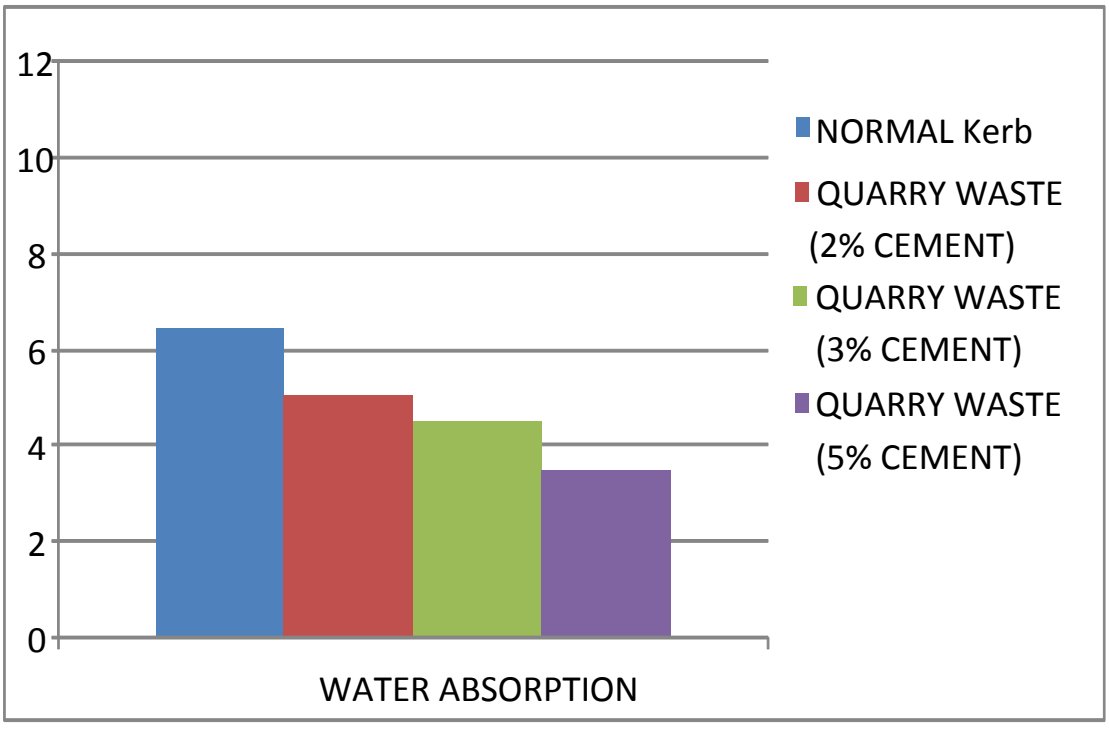

Fig. 3: Water Absorption test graph in %

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