Experimental Investigation of Concrete Made With Quarry Dust and Partially added of Cement by Lime Sludge

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Abstract— **In experimental study presents the variation in the strength of concrete when replacing sand by quarry dust from 0% to 100% in steps of M25 grades of concrete. The demand of natural sand in the construction industry has increased a lot resulting in the reduction of sources and an increase in price. Thus an increased need to identify a suitable substitute, that is eco-friendly and inexpensive quarry dust being extensively used as an alternative to the sand in the production of concrete. The compressive strength of concrete cubes at the age of 7 and 28 days were obtained at room temperature. This result gives a clear picture that quarry dust can be utilized in concrete mixtures as a good substitute for natural river sand giving higher strength. The best way to deal with these environmental concerns is to use waste or recycled material, as substitute for natural river sand. This paper deals with replacement of sand used in concrete as fine aggregates by the waste generated by the stone quarry industry. his study has made an attempt to partially replace quarry dust in place of sand in M25 grade concrete.**

Keywords—Quarry Dust, Concrete, replacement of river sand, comressive strength.

I. INTRODUCTION

Concrete is the most widely used composite material today. The constituents of concrete are coarse aggregate, fine aggregate, binding material and water. Rapid increase in construction activities leads to acute shortage of conventional construction materials.

It is conventional that sand is being used as fine aggregate in concrete. For the past two years, the escalation in cost of sand due to administrative restrictions in India, demands comparatively greater cost at around two to three times the cost for crusher waste even in places where river sand is available nearby.

The function of the fine aggregate is to assist in producing workability and uniformity in the mixture. The river deposits are the most common source of fine aggregate. Now-a-days the natural river sand has become scarce and very costly. Hence we are forced to think of alternative materials. The Quarry dust may be used in the place of river sand fully or partly.

A comparatively good strength is expected when sand is replaced partially or fully with or without concrete admixtures.

It is proposed to study the possibility of replacing sand with locally available crusher waste without sacrificing the strength and workability of concrete.

A. Testing of cement

1. *Fineness Test of Cement*

Correctly 100grms of cement was weighed and taken in a standard IS sieve no.9 (90 microns).The lumps were broken down and the material was sieved continuously for 15 minutes using sieve shaker. The residue left on the sieve was weighed .This weight does not exceed 5% for ordinary cement. Percentage of residue left on sieve = (weight retained/weight taken) x 100

Result: Percentage of residue left on sieve = 0.4

2. *Consistency Test of Cement*

500 grams of cement was taken and a paste was prepared with 24% quantity of water. After completely filling the mould, shake the mould to expel the air. A standard plunger 10mm diameter and 50mm long was attached and brought down to touch the surface of the paste in the test block and

quickly released allowed it to sink to the paste by its own weight. The depth of penetration of plunger was noted down. The second trail was conducted by 25% of water and the depth of penetration was found out. Similarly number of trials was conducted till the plunger penetrates for a depth of 33 to 35mm from top.

Result: Consistence of given sample of cement = 34 %

B. Testing of Quarry Dust

1. Sieve analysis of Quarry Dust

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed
Fineness modulus =2.80
Zone conformation = Zone-II

2. Specific Gravity Test of Quarry Dust

The pycnometer was dried thoroughly and weighed as W_1 gram. 200 gram of fine aggregate was taken in the pycnometer and weighed as W_2 gram. The pycnometer was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the pycnometer was completely filled with water up to the mark. The outside of pycnometer was dried with a clean cloth and it was weighed as W_3 grams. The pycnometer was cleaned thoroughly. The pycnometer was completely filled with water up to the top. Then outside of the pycnometer was dried with a clean cloth and it was weighed as W_4 grams.
Result: Specific Gravity of Fine Aggregate (G) = 2.63

C. Testing of Coarse Aggregate

1. Sieve Analysis of Coarse Aggregate

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed and achieved successively on the appropriate sieves starting with the largest size sieve.
Result: Fineness modulus =4.46

2. *Specific Gravity Test of Coarse Aggregate*

The container was dried thoroughly and weighed as W_1 gram. 800 gram of fine aggregate was taken in the container and weighed as W_2 gram. The container was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the container r was completely filled with water up to the mark. The outside of container r was dried with a clean cloth and it was weighed as W_3 grams. The container was cleaned thoroughly. The container was completely filled with water up to the top. Then outside of the container was dried with a clean cloth and it was weighed as W_4 grams.

Result: Specific Gravity of Coarse Aggregate (G) = 2.62

II. Mix Design

The mix design of concrete is a trial and error method. These guidelines gives the range for coarse aggregate and fine aggregate content and based on the limit the approximate mix design for M30 grade of concrete is obtained.
Proportion:

Cement = 1 (499/499)

F.A = 1.01 (507.04/499)

C.A = 2.25 (1121.93/499)

Therefore ratio =1 : 1.05 : 2.25

W/C = 0.43

III. MATERIALA USED

CEMENT

The ordinary Portland cement conforming to IS: 4031 was used for the preparation of the test specimens.

QUARRY DUST

The quarry Dust used in experimental investigation was quarry sand confirming to zone I of IS: 383 – 1970.

COARSE AGGREGATE

Crushed granite aggregate particles passing through 20mm and retained on 4.75 mm I.S sieve used as natural aggregates which met the grading requirement of IS: 383 – 1970.

LIME SLUDGE

Lime sludge is also known as paper industry waste. It is the byproduct of the paper waste. This hypo sludge contains low calcium and minimum amount of silica. Lime sludge behaves like cement because of silica and magnesium properties.

CHEMICAL PROPERTIS OF LIME SLUDGE

The Chemical Properties of Lime Sludge is added in the concrete Lime sludge is also known as paper industry waste. It is the byproduct of the paper waste. This hypo sludge contains low calcium and minimum amount of silica.

V.*EXPERIMENTAL INVESTIGATION*
MIX PROPORTION OF NORMAL CONCRETE

TYPES OF CONCRETE	CEMENT	QUARRY DUST	COARSE AGGREGATE	W/C RATIO
CONVENTIONAL CONCRETE	2.2	1.9	4.1	0.43

LIME SLUDGE ADDED IN CONCRETE
MIX PROPORTION OF LIME SUDGE
Table.2A MIX PROPORTION FOR LIME SLUDGE

% of Partially Added in Lime Sludge	CEMENT	LIME SLUDGE	QUARRY DUST	COARSE AGGREGATE	W/C RATIO
10%	1.98	0.22	1.9	4.1	0.43
20%	1.76	0.44	1.9	4.1	0.43
30%	1.54	0.66	1.9	4.1	0.43
40%	1.32	0.88	1.9	4.1	0.43

A. Compression Test

The compressive strength test is a mechanical test measuring the maximum amount of compression load a material can bear before fracturing. Due to compression load, the cube or cylinder undergoes lateral expansion owing to poisons ratio effect.

B. Flexural Strength Test

The splitting test is simple to perform and gives more uniform results than other tension tests. Strength determine in the splitting test is believed to be closure to the true tensile strength. Splitting strength gives about 5 to 12% higher value than the direct tensile strength.

It is a method of determining the tensile strength of mortar using a cylinder which splits across the vertical diameter .It is expresses as the minimum tensile stress (force per unit area) needed to split the material apart. The specimen used was 100×200 mm cylinder. The test was performed at 7 and 28 days.

Split tensile strength = $2P/\pi DL$

Where,

P= Compressive load in Kn
L= Length of specimen in mm
D= Diameter of specimen in mm

VII.RESULT AND DISCUSSION

A.GENERAL

In this study of concrete and compressive strength of partially added in solid block.

B.MECHANICAL PROPERTIES

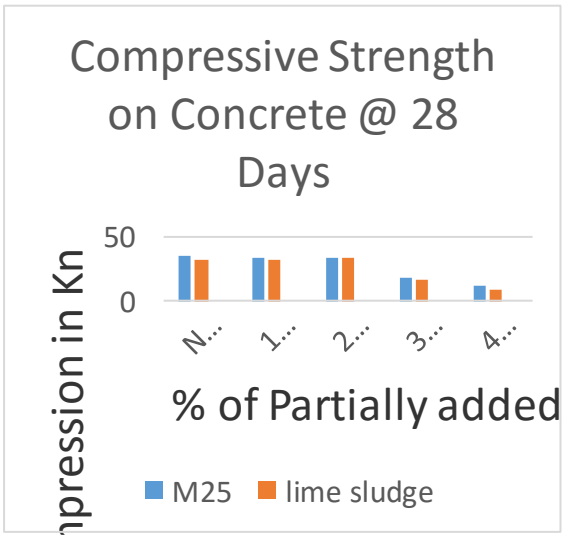
The results of tests were conducted on cement concrete cube and cylinder at 28 days water curing compressive strength, split tensile strength.

C.COMPRESSIVE STRENGTH

Table 4 Compressive strength of concrete

The compressive strength test is a mechanical test measuring the maximum amount of compression load a material can bear before fracturing. Due to compression load, the cube or cylinder undergoes lateral expansion owing to poisons ratio effect

SAMPLES	CUBE
% of Partially Added in Lime sludge	Compressive Strength in Kn
10%	32.88
20%	32
30%	33.77
40%	16
50%	8.9



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