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REINSTATEMENT OF MATERIALS IN CONCRETE WITH DIFFERENT SURROGATES

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Abstract: Materials in concrete such as cement, fine aggregate and coarse aggregate are the basic needs for construction. Due to the rapid growth of construction industry the requirement of these materials will be more. A good quality of sand is available near the river only. A good quality and quantity of sand is not available everywhere. If the sand is available in huge quantity, government made restrictions on excavation of sand. If the sand is excavated from a single place it posse's environmental problems. In the place of fine aggregate a naturally available quarry dust is partially replaced. Now a days the cost of the binding material in concrete i.e cement cost is very high. So an attempt has been made to discuss the properties such as workability and compressive strength of concrete prepared by replacing cement and fine aggregate with lime stone and with quarry dust at different levels of percentages.

Key words: cement, fine aggregate, compressive strength, quarry dust.

I. INTRODUCTION

Now a days, the construction of any building cement concrete is using all over the world. The materials in concrete is cement, fine aggregate and coarse aggregate along with the water. Major source of power generation in India are on coal based thermal power plants. In the process of power generation huge amount of fly ash produced. This fly ash is a by product of coal based power plants. Fly ash is used as a substitute material in the place of cement in concrete. Fly ash is a finely divided residue resulting from the combustion of powdered coal. The size of the fly ash particles ranging from 0.5µm to 300µm. River sand is not available everywhere. If available, the government made restrictions on overuse. And also the transportation of river sand to the far areas increases the cost. So as to maintain the economy as well as the strength the reuse of waste materials has been introduced.

II. LITERATURE REVIEW

1. M. Vaishnavi, M. Kanta Rao, "Durability of High Volume Fly Ash Concrete", International Journal of Engineering Research & Technology (IJERT) Vol. 3 Issue 8, August – 2014

2. R Ilangovan, K Nagamani and P Gopal Swamy, 2007, Recycling of Quarry Waste as an Alternative Material in Concrete Manufacturing, Indian Construction, vol 40, no 2, p 7.
3. Ilangovan R. and Nagamani K., 2006. Application of quarry Rock dust as fine aggregate in concrete construction. National Journal on construction Management: NICMR, Pune. December. pp. 5-13.

III. OBJECTIVES

1. To prepare most economical concrete.

2. To find the optimum strength with the replacement of substitute materials in concrete.

3. Maximum using of naturally available materials in local.

4. To compare the strength of normal concrete with the partial replaced concrete of lime, fly ash and quarry dust.

5. While manufacturing of cement, it will be heated at high temperature due to this some poisonous gases entered into the atmosphere. So we are trying to reduce the effect on environment by using the fly ash as a by product from coal based power plants.

IV. METHODOLOGY

The experiments conducted in laboratory for conventional concrete and also partially replaced concrete. The individual properties of materials were calculated. The methodology we fallowed is mix design to prepare the concrete as economical as possible. Mix design is the process of specifying the amount of ingredients to meet the anticipated properties of fresh and hardened concrete.
Fallowing tests were conducted:

1. Fineness.
2. Initial and final setting time of cement.
3. Specific gravity of cement
4. Sieve analysis on aggregates.
5. Specific gravity of aggregates.
6. Bulking of sand.
7. Workability.
8. Compressive strength and tensile strength.

V. MATERIALS USED

1. CEMENT

It is defined as a binding material in concrete works having both different materials in concrete.

TESTS ON CEMENT

(a). Field tests

Cement can be identified whether it is good or bad by conducting fallowing tests in the field.
1. The colour of cement should be greenish grey.

2. when you kept your hand inside of the cement bag, you should feel cool.

3. Take some amount of cement and throw in to the water it will float for sometime before sink.

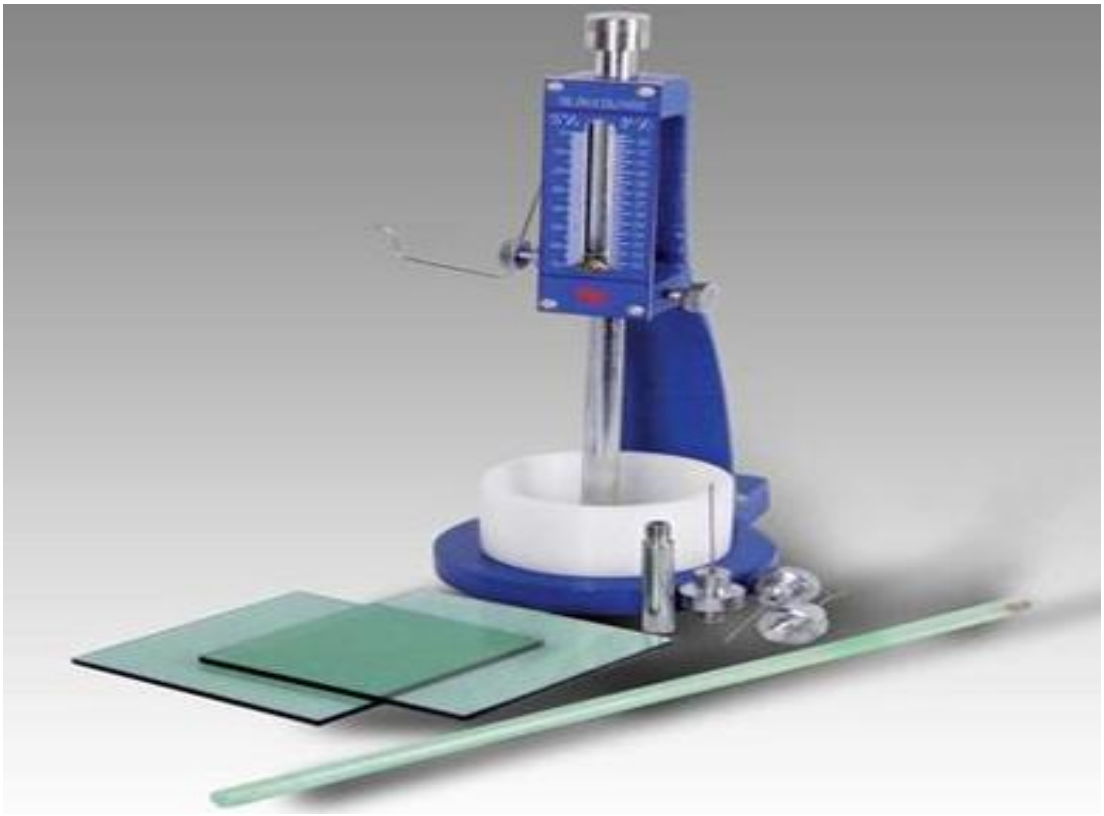
(b). LABORATORY TESTS

- Fineness test
- Initial and final setting time
- Specific gravity

INITIAL AND FINAL SETTING TIME OF CEMENT

Initial setting time of cement is the time required to delay the hydration process. So we have to complete mixing, transportation, placing and compaction within the initial setting time. Once the initial setting time is completed the heat of hydration starts. After sometime of hydration starting it should loses its plasticity in the earliest possible time. This time is termed as final setting time of cement.

Fig. 1



2. LIME

Lime has been used as a mortar, plaster and white washing etc. Lime is usually made by burning of lime stone. Lime is also called as quick lime. When excess quantity of water is added to the lime it turns into fluid, this is called slaking and the lime resulting is called slaked lime. Lime has less embodied energy than cement.

3. FLY ASH

Fly ash is also known as pulverized fuel ash. It finely divided residue resulting from the combustion of coal. Fly ash largely contains silicon dioxide and calcium oxide, can be used as a substitute material for Portland cement. Fly ash cement is also known as green concrete. Fly ash reduces the heat of hydration. Due to the spherical shape of particle reduces the friction between the inter particle.

5. QUARRY DUST

Quarry dust, a by-product from the crushing process during quarrying activities is one of such materials. The ideal percentage of replacement of natural sand with quarry dust in about 50-75% in case of compressive strength. The success of using quarry dust depends upon the economics. There is a huge variation in the price comparison of quarry dust with natural sand.

4. AGGREGATES

Aggregates are the major ingredients in the concrete. This will occupy 75% of the total volume of concrete. This will give strength to the structure. These are the economical void fillers. The aggregates may be sand, coarse aggregate, quarry dust, slag, geo-synthetic aggregate. The aggregates, which passes through 4.75mm sieve termed as fine aggregate. The size of the coarse aggregates is 20mm and 10mm.

TESTS CONDUCTED ON SAND

SIEVE ANALYSIS

Divide the sample in various fractions by sieving through the 4.75mm, 2.36mm, 1.18mm, 600µm, 300µm, 150µm and pan.

TESTS CONDUCTED FOR CONCRETE MIX

WORKABILITY

Workability is the property of concrete which determines the compaction effort. (Or) ease with which the concrete can be mixed, transported, compacted and finished. The following tests conducted to know the workability of concrete.

- Slump cone test.
- Compaction factor test.

Slump cone test

This test is conducted to know the consistency of freshly prepared concrete. Wetter mixes have high workable than dry mix. But the concrete of same consistency may vary in workability. Bottom diameter is 20cm, top diameter is 10cm and 30cm height.

Fig. 2

Fig. 3

RESULTS:

I. INITIAL AND FINAL SETTING TIME OF CEMENT

Table: 1

s. no:	Characteristics	Values obtained	Standard values
1.	Normal consistency	31%	33mm to 35mm
2.	Initial setting time	35min	Not be less than 30min
3.	Final setting time	480min	Not be greater than 600min

II.SIEVE TEST

Result: The fineness of ordinary Portland cement is observed to be 99.5%.

III. SOUNDNESS OF CEMENT BY LE-CHATELIER METHOD

Result: The average expansion of cement is observed to be 1mm.

IV. TESTS ON COARSE AGGREGATE

Crushed aggregates are used, with the maximum size of 20mm.

Table: 2

S. no:	Test	Value
1.	Specific gravity	2.41
2.	Water absorption	2.94
3.	Impact value	31.96

VI. TESTS ON QUARRY DUST

The quarry dust used in concrete is tested as per IS specifications. The following table gives the results:

Table: 3

s. no:	Characteristic	Value
1.	Type	Crushed
2.	Specific gravity	2.41
3.	Water absorption	3%
4.	Fineness modulus	5.2

VII. COMPRESSIVE STRENGTH

The determination of compressive strength of the concrete plays vital role because the concrete is primarily meant to withstand the compressive stresses. The tests on cubes and cylinders are conducted according to the IS. Tests were conducted on the universal testing machine. A gradual load is applied and the load at the failure is recorded. For each percentage three specimens were prepared. The following are the results of compressive strengths of all concrete mixes prepared by replacing cement by lime, fly ash and sand by quarry dust with various percentages. The compressive strength of all concrete mixes are determined at 7, 14 and 28 days of curing in water. The following tables show the results:

Results for M20 grade concrete at different curing ages:

Table: 4

s. no:	Material	Percentage of materials	Quantity of materials in Kg	Average strength in N/mm^2		
				7 days	14 days	28 days
1.	Cement	50	4.8	14.38	21.19	26.14
2.	Lime	15	1.44			
3.	Fly ash	35	3.36			
4.	Sand	60	8.64			
5.	Quarry dust	40	5.76			
6.	Coarse aggregate	100	28.8			

Results for M20 grade concrete at different curing ages:

Table: 5

s. no:	Material	Percentage of materials	Quantity of materials in Kg	Average Strength in N/mm^2		
				7 days	14 days	28 days
1.	Cement	40	3.84	12.23	19.14	22.34
2.	Lime	15	1.44			
3.	Fly ash	45	4.32			
4.	Sand	50	7.2			
5.	Quarry dust	50	7.2			
6.	Coarse aggregate	100	28.8			

CONCLUSION

- In order to protect the natural resources such as river sand , a suitable material will be replaced to give the same performance. And also the cost of the river sand is high. One of the material is quarry dust, which is available locally with free of cost. Based on the experimental investigations we found that quarry dust will also give the same results at some percentage of replacement.
- Standard consistency increased as amount of fly ash increases in cement fly ash mix. That means less quantity of water need to make cement fly ash mix paste. Fly ash increases the workability of concrete.
- Free lime absorbs carbon dioxide in the setting process of carbonation.
- The compressive strength of partially replaced concrete increases up to 35% of fly ash, 15% of lime in the cement and 40% of quarry dust in sand.

REFERENCES:

1) Ilangovan R. And Nagamani k., 2006. Application of quarry rock dust as fine aggregate in concrete construction. National journal on construction management: NICMR, pune. December. Pp. 5-13.
2) M. Shahul Hameed and A. S. S. Sekar, 2008, properties of green concrete containing quarry dust and marble sludge powder as fine aggregate. ARPN journal of engineering and applied science, vol. 3, no.5.
3) Study of properties of SSC using quarry dust and fly ash, M.V. Rama Raju, K.V.Vivek, Dr.T.Siva Shankar Reddy and P. Srinivasa Reddy, internation journal of engineering science research, vol 02, issue 04, august-September 2011.
4) A. Hmaid Mir, "Improved concrete properties using quarry dust as replacement for natural sand," International Journal of Engineering Research and Development, vol. 11, no. 3, pp. 46–52, 2015.
5) M. R. Chitlange and P. S. Pajgade, "Strength appraisal of artificial sand as fine aggregate in SFRC," ARPN Journal of Engineering and Applied Sciences, vol. 5, no. 10, pp. 34–38, 2010.