ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 08, Issue, 11, pp.24195-24197, November, 2018

ORIGINAL RESEARCH ARTICLE OPEN ACCESS

TO STUDY THE PARTIAL REPLACEMENT OF CEMENT BY FA AND RHA AND NATURAL SAND BY QUARRY SAND IN CONCRETE

***Vivek D. Sheware**

Department of Civil Engineering, D.Y.P.I.E.T., Talegaon, Ambi,Pune, India

ARTICLE INFO

Article History:
Received 18th August, 2018
Received in revised form
15th September, 2018
Accepted 12th October, 2018
Published online 30th November, 2018

Key Words:
Admixture, Cement,
Fly Ash(FA),
Quarry sand(QS),
Rice Husk Ash(RHA),
Compressive Strength,
Split Tensile Strength and Flexural Strength.

ABSTRACT

Large scale exploitation of natural sand creates environmental impact on society. River sand is most commonly used fine aggregate in concrete but due to acute shortage in many areas, availability, cost & environmental impact are the major concern. To overcome from this crisis, partial replacement of sand with quarry sand can be an economic alternative. Quarry sand has been used in different construction purposes but replacement technology has emerged as an innovative development to civil engineering material. Design mix of M20 grade concrete with replacement of 0%, 15%, 30%, 45%,60% of quarry sand have been considered for laboratory test i.e slump test, compressive strength, split tensile strength, flexural strength, permeable voids and acid attack. (Cubes, cylinders, beams sample). The detailed study is on the effect of partial replacement of cement with Rice Husk Ash and Fly Ash on concrete. In this project different combination of Fly Ash and Rice Husk Ash as a partial replacement of cement and river sand by quarry sand is carried out. The composition of 7.5% Rice Husk Ash + 22.5% Fly Ash with 60% of quarry sand gives maximum strength results.

Citation: Vivek D. Sheware, 2018. "To study the partial replacement of cement by FA and RHA and natural sand by quarry sand in concrete", *International Journal of Development Research*, 8, (11), 24195-24197.

INTRODUCTION

Concrete is the most widely used construction material in civil engineering industry because of its high structural strength, stability and malleability. Recent technological developments have shown that these materials can be used as valuable inorganic and organic resources to produce various useful value-added products. The concrete industry is constantly looking for supplementary cementitious material with the objective of reducing the solid waste disposal problem. Rice husk ash (RHA), Fly Ash (FA) and quarry sand (QS) are among the solid wastes generated by industry. Substantial energy and cost savings can result when industrial by-products are used as partial replacements for the energy- intensive Portland cement. High quality sand is in short supply in India; thus an increasing demand for cement and concrete can be met by partially replacing cement with RHA and FA same as sand with QS respectively. This investigation is done to study the feasibility of using locally available RHA, FA and QS as partial replacements for cement and sand in concrete. In this project materials are added fly ash, rice husk, and quarry sand with using admixture to obtain concrete of desired property. In this project, first phase is to replace natural sand by quarry sand at different proportion of 15% interval upto 60% and in second phase we have taken the combination of FA and RHA with the above combination of natural sand and quarry sand i.e done in phase first. we have started proportion form as 30% FA and 0% RHA mix together in concrete by replacement of cement with the increase of RHA by 5% and simultaneously decrease of FA by 5% ,last proportion taken 22.5%FA and 7.5% RHA. The tests on hardened concrete are destructive test while the destructive test includes compressive test on concrete cube for size (150 x 150 x 150) mm, Flexural strength on concrete beam (500 x 100 x100) and split tensile strength on concrete cylinder (150 mm ø x 300mm) and permeable voids (200 x 100 x100) mm as per IS: 516 – 1959, IS: 5816 – 1999 and ASTM C642-97 respectively. The work presented in this project reports is an investigation on the behaviour of concrete produced from blending cement with FA and RHA and sand with Quarry Sand (QS).

- *Fly ash* used was obtained from Koradi Power Plant Nagpur. The fly ash, also known as pulverised fuel ash, is produced from burning pulverized coal in electric power generating plants.

Corresponding author: **Vivek D. Sheware,**
Department of Civil Engineering, D.Y.P.I.E.T., Talegaon, Ambi,Pune, India.

- *Rice husk ash* was obtained from Ellora Paper Plant located in Tumsar, Bhandara. Rice husk is an agricultural residue obtained from the outer covering of rice grains during milling process
- *Quarry Sand* was obtained from Sidheshwar quarry, Pachgaon. Plant: 360, Surgaon, Nagpur. The cheapest and the easiest way of getting substitute for natural sand is by crushing natural stone to get artificial sand of desired size and grade which would be free from all impurities is known as Quarry Sand.

Need of Research

The less amount of suitable river sand for use as fine aggregate, in construction applications, and the recent construction has led to a dramatic increase in the price. The various government agencies have put restrictions on sand to conserve this diminishing natural resources. This problem has given engineers to look for alternate materials that are cheaper while possessing similar characteristics. One such alternative is the use of stone dust a by product of crushers. Rice husk ash is an agricultural waste which is produced in millions of tons. Waste managers have found it difficult over the years to dispose this agro-waste. Rice husk ash (RHA) is obtained by the combustion of rice husk and has been found to be super pozzolanic. RHA is a highly reactive pozzolanic material suitable for use in lime pozzolana mixes and for Portland cement replacement. RHA is very reach in silicon dioxide which makes it very reactive with lime due to its non-crystalline silica content and its specific surface. In the construction sector, the fly ash is used in the production of cement as an additive-material, in production of concrete instead of some of the cement or instead of some of the fine aggregate, as a base and sub-base material in highway construction, as a filling material in dams, in retaining walls, and for production of light construction materials. The fly ash, similar to other pozzolans, affects the technical properties of the concretes and mortars by its pozzolanic characteristics and filler effect. It is known that the filler effect of the fly ash is more effective than the pozzolanic characteristics when affecting the properties of concrete.

MATERIALS AND METHODS

This standard covers two methods of petrographic examination of aggregates for concrete.

Method I: This test involves visual inspection, and a segregation of the constituents of coarse and fine aggregates according to petrographic and chemical differences.

Method II: This recommended practice outlines procedures for the petrographic examination of samples representative of materials proposed for use as aggregates in concrete. The specific procedures employed in the petrographic examination of any sample will depend to a large extent on the purpose of the examination and the nature of the sample.

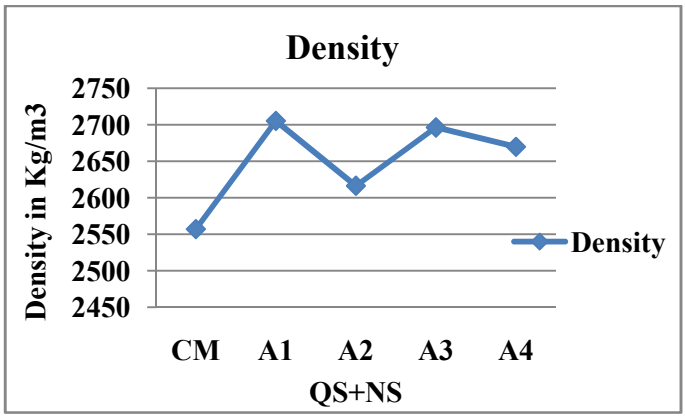
RESULTS

Testing methods: Experimental investigation of fresh mix properties of Fly Ash, Rice Husk Ash, and Quarry Sand concrete was conducted based on IS: 516 – 1959 using a slump cone. Compressive and Flexural strength of each specimen was determined using IS: (516 – 1959) and splitting tensile strength of each specimen was determined using IS: 5816 – 1959. Length change was measured according to IS: 516 - 1959. Compressive strength were measured 7, 28, 56 and 90 days and flexural tensile strengths were measured 28 days of testing. Splitting tensile strengths were measured at 28 days. Specimens were cube with a 150 mm side for compressive strength, beam with dimensions of 150 x 150 x 500 mm for flexural tensile strength, cylinder with 150 mm diameter and 300 mm height for splitting tensile strength.

Density:

Table 1. Various percentage and their Densities for M20 grade of concrete

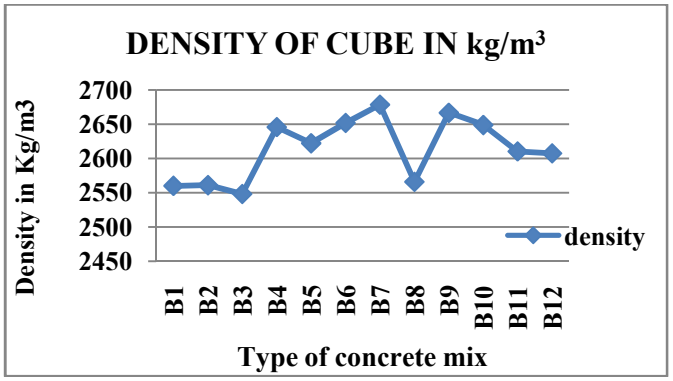
S.No	Sand	Quarry Sand	M20 Density Kg/m3
A	100	0	2669.62
A1	85	15	2696.29
A2	70	30	2705.18
A3	55	45	2616.29
A4	40	65	2557.03



Graph 1. Density of Cube of QS+NS

Table 2. Various percentage and their Densities for M20 grade of concrete

S.No	RHA	Fly Ash	Quarry Sand	Sand	M20 Density Kg/m3
B1	0	30	15	85	2560
B2	5	25	15	85	2561
B3	7.5	22.5	15	85	2548.14
B4	0	30	30	70	2645.92
B5	5	25	30	70	2622.22
B6	7.5	22.5	30	70	2651.85
B7	0	30	45	55	2678.51
B8	5	25	45	55	2565.92
B9	7.5	22.5	45	55	2666.67
B10	0	30	60	40	2648.88
B11	5	25	60	40	2610.37
B12	7.5	22.5	60	40	2607.40



Graph 2. Density of Cube

Compressive Test on Cube As per IS 516-1959: (Size: 150x150x150): The specimens for each are cast with different percentages of RHA, FA and Quarry sand with gradual increase of 2.5% of RHA, gradual decrease of 2.5% of FA by replacing the cement by weight and gradual increase of 15% of QS by replacing the natural sand. Table 4.3.2 shows that the strength of RHA, FA concrete initially does not match with the strength of control specimen at 7days and but it nearly matches at 28 days and improves at 56 days. Further addition of QS the strength improves and rises more than the control specimen. The graph shows that the addition of RHA, FA & QS improves the compressive strength up to 7.5 % addition of RHA, 22.5 % of FA and 60% of QS respectively after that no considerable improvement is observed.

Conclusion

Based on the results presented above, the following conclusions can be drawn:

1. The percentage of water cement ratio is depends on quantity of RHA and QS used in concrete. Because RHA is a highly porous material.
2. Compressive strength increases with the increase in the percentage of Fly ash and Rice Husk Ash up to replacement (22.5%FA and 7.5% RHA) of Cement in Concrete for different mix proportions.
3. Compressive strength increase by addition of quarry sand in addition to FA and RHA.

Future scope

1. Fly ash and Rice husk ash can be used with admixtures for increasing strength of concrete with partial replacement of cement.
2. Partial replacement of cement by Fly ash and Rice husk ash reduces the density of concrete and thus adding it reduces the dead load on the structure.
3. Using of Fly ash and Rice husk ash helps in reducing the environment pollution during the disposal of excess Fly ash and Rice husk ash.
4. It can predominantly used in members that take flexural load and tensile load.
5. Rice Husk ash contains considerably higher percentage of silica than other replacement material.
6. Cement and Sand are costly and scarce so the partial replacements of these materials by Rice husk ash and Quarry sand respectively.
7. Rice Husk & Fly Ash can be used as plasticizers, admixtures & super plasticizers.

REFERENCES

Lohani T.K., M. Padhi, K. P. Dash, S. Jena, 2012. Associate Professor, Civil Engineering Department, Orissa Engineering College. "Optimum Utilization Of Quarry Dust As Partial Replacement Of Sand In Concrete" Journal Of Applied Int. Sciences And Engineering Research, Vol. 1, No. 2.

Manguriu, G.N., Karugu, C.K., Oyawa, W.O., Abuodha, S.O. And Mulu, P.U. 2013. Department of Civil, Construction and Environmental Engineering Jomo Kenyatta University of Agriculture & Technology, "Partial Replacement Of Natural River Sand With Crushed Rock Sand In Concrete Production".

Ilangovana R., N. Mahendrana and K. 2008. Nagamanib, Department of Civil Engineering, PSNA College of Engineering, Dindigul, India. "Strength And Durability Properties of Concrete Containing Quarry Rock Dust As Fine Aggregate" *ARPN Journal of Engineering and Applied Sciences,* VOL. 3, NO. 5.

Rajendra Prasad D. S., S. M. Maheshwarappa, S. Suresh, 2014. Department of Civil Engineering, S.I.T., Tumkur . "Effect on Compressive Strength of Replacing Cement by Fly-ash and RHA with CO2 Curing"X.L. Lai, S.M. Wang, W.M. Ye, Y.J. Cui, "Experimental investigation on the creep behavior of an unsaturated clay", *Canadian Geotechnical,* 51(6): 621-628.

Ozlem Celik, Erdem Damc and Sabriye Piskin, Department of civil Engg, 2008. Istanbul university, Istanbul, Turkey. "Characterization of fly ash and its effects on the compressive strength properties of Portland cement.", IJEMS, Vol.15(5).

Sivakumar and Prakash M. 2011. Department of civil engineering, Vellore Institute of Technology (VIT) University, India."Characteristic studies on the mechanical properties of quarry dust addition in conventional concrete" *Journal of Civil Engineering and Construction Technology*, Vol. 2(10), pp. 218-235.

****