CONDUCTING STUDIES ON CONCRETE WITH QUARRY DUST AND FLY ASH AS PARTIAL REPLACEMENT OF AGGREGATE

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Abstract - *Quarry dust or Common Aqueduct sand is precious due to the low cost of transportation from natural sources. Also large- scale reduction of these sources creates environmental problems. As environmental transportation and other constraints make the vacuity and use of conduit sand less attractive, a cover or relief product for concrete sedulity needs to be set up. River sand is most generally used fine aggregate in the product of concrete acts the problem of acute insufficiency in multitudinous areas. Whose use has started some serious problem environmentally as well as economically Same is the case with Fly ash currently fly ash is substantially used in construction as it gives much further strength and continuity to construction material substantially in concrete In such a situation the Chase dust can be a profitable volition to the conduit sand. Quarry Rock Dust can be outlined as remains, rolling or other non-voluble waste substance after the birth and processing of rocks to form fine patches lower than4.75 mm. Generally, Quarry Rock Dust is used in large scale in the highways as a face finishing material and also used for manufacturing of concave blocks and feathery concrete prefabricated rudiments. Use of Quarry rock dust as a fine aggregate in concrete draws serious attention of researchers and investigators etc*

Key Words: Quarry Dust ,Fly Ash, Aggregate, cement , concrete , Rcc ,sand etc

1. INTRODUCTION

Out of colorful cementing accoutrements , fly ash is the most extensively used material worldwide. Fly ash is the derivate of the combustion of pulverized coal in thermal power shops. Fly ash is defined as the fine residue that is acquired from combustion of coal .the combustion zone to the flyspeck junking system. " Worldwide, the estimated periodic product of coal ash in 1998 was further than 390 million tons. The main contributors for this quantum were China and India. Only about 14 percent of this cover ash was employed, while the rest was disposed of in tips.

By the time 2010, the quantum of cover ash produced worldwide is estimated to be about 780 million tons annually Fly ash, if not employed, may present environmental enterprises, and its storehouse/ disposal will be precious. The maturity of cover ash produced in India is low calcium cover ash. The use of cover ash as amalgamation in cement mortar/ concrete not only extends specialized advantages to the parcels of cement mortar/ concrete but also contributes to the environmental pollution control. likewise, Hundreds of gravestone crushing shops in our country induce several thousand tons of chase dust every day. This chase dust is considered to be solid wastematerial. However, also it'll break the problem of its disposal, If it's possible to use this in making mortar/ concrete by relief of swash beach. also, the application of chase dust, which can be called as manufactured beach after junking of microfines below 150 micron size by sieving, has been accepted in the industrially advanced countries of the West as the swash beach, which is one of the ingredients used in medication of cement mortar/ concrete, has come largely precious and scarce. operation of chase dust as partial relief to swash beach/ natural beach further modified by partial relief of pozzolanic accoutrements like cover ash is entering further attention these days as their use generally improves the parcels of cement/ concrete.

Compared to numerous other engineering paraphernalia similar as brand, rubber, etc., concrete requires lower energy input for its manufacture. presently, a large number of material combinations, which are desolate products of other assiduity, are being beneficially used in making quality concrete. therefore, from the consideration of energy and resource conservation and sustainability and terrain, concrete is the most favoured material

1.1 Literature And Review

Before The well known literature about the use of Quarry dust (Crusher dust) in concrete carried out in any part of the world has been reviewed and presented as under:

- (Dr. P.B.Sakthivel -2013) This paper deals with the replacement of natural sand used in concrete with quarry dust (waste produced from the stone quarry industry). In this study, sand has been partially replaced with quarry dust for M35 grade of concrete. Samples have been casted with 0%,10%,20%,30%,40% quarry dust in replacement with sand. On the basis of experiments, the paper concludes that M35 grade concrete shows optimum results on 10% replacement of sand with quarry dust. The authors of this paper had emphasised that this method will help to decrease the usage of natural sand in concrete which will decrease the cost of construction as well as trim down the level of prohibited withdrawal of sand from the river beds. It will definitely help to preserve the natural resources and resolve some sustainability issues.

- (G.Balamurugan -2013) This investigational study presented the deviation in the strength of concrete on use of crusher dust instead of sand from 0% to 100% at intervals of 10%. For this study, M20 and M25 grades of concrete were taken into consideration. Slump was in this study was kept as a 60mm. Concrete cubes were tested after 7 days and 28 days at room temperature for compressive strength. Concrete gains utmost raise in compressive strength at 50% replacement of sand. The %age increase in strength as compared to control concrete was obtained as 24.04 & 6.10 correspondingly for M20 and M25. The outcome gives an obvious image that quarry dust can be used in concrete mix as a fine option for natural river sand with larger strength at 50% replacement with quarry dust.

- (Lohani T.K-2012)This study deals with the utilisation of crusher dust in concrete as a partial substitute of sand. Utilisation of river sand on a huge scale produces ecological impact on society. Overall availability of river sand is fine, but it is most commonly used; Cost and environmental impact are the main factors to be considered (Ahmed et.al., 1989). To defeat this crisis, small substitution of sand with quarry dust, according to the study, can be an economical option. In this study, M1, M2, M3, M4 and M5 samples had been casted with 0%, 20%, 30%, 40%, 50% replacement of dust for M20 grade concrete design mix for laboratory analysis i.e. the idea is to test them correspondingly for compaction factor test, compressive strength (cubic, cylindrical sample), split tensile strength, flexural strength, water absorption of hardened concrete. Depending on the investigational results of this study, it has been concluded that on adding crusher dust physical and mechanical properties of concrete will improve. Use of 30% of quarry dust content increases the compressive strength of concrete, compressive strength gradually begins to decrease for more than 30% dust material. According to this study, maximum split tensile strength can be attained at 20% substitution of fine aggregate.

- (Radhikesh P. Nanda-2010) This investigational study is about preparation of paving blocks with crusher dust. Physical and mechanical properties of paving blocks are investigated with sand substituted by various %ages of quarry dust. The analysis reveals that the substitution of sand by quarry dust up to 50% by weight has a slight effect on the diminution of any physical, mechanical property whereas money can be easily saved till 56%. This also leads to the reduction of discarding crusher dust on earth to reduce the ecological contamination. The study concluded that substitution of sand by quarry dust up to 50% by weight will have a negligible effect on the drop of split tensile strength, compressive strength, flexural strength etc. Water absorption is lower than the limit according to Indian codes. Also, there is not any sort of variation in durability with use of crusher dust.

- (Dr. A.D. Pofale) In this experimental study an attempt has been done to change the usual sand with crusher dust in concrete design mixes that are having grade M25 and having grade M30, for slump value of 100 mm to 120 mm and this is attained by providing alternative of 30%, 40%, 50% and 60% using PPC. There was a reduction in the value of workability from 1 to 6% when quarry dust was used as an alternative. Result shows that strength was increased by 5-22% when the alternative of river sand known as quarry dust was used. In all the mixtures highest compressive strength was obtained for the mixture having replacement of 40% sand by crusher dust. This draws us to the conclusion that quarry dust can be successfully used instead of sand in above mentioned mixes at replacement from 30 to 60% cost-effectively leading to advancement

- (Joseph O. Ukpata-2012) This paper is a piece of study investigating the structural features of concrete by means of different proportions of

lateritic sand and rock dust as total substitution for natural sand(fine aggregate). The amount of lateritic sand was changed from 0% to 100% against rock dust at steps of 25%. Prepared samples of concrete were cured and checked for compressive strength. Tests for workability were conducted initially in this study to find out the optimum w/c ratios for diverse mixes, precisely for 1:1:2, 1:1.5:3 & 1:2:4. This paper concluded that at a water/cement ratio of 0.5 gives greater compressive strengths for a concrete mix of 1:1:2. The author of this paper had attained higher values of compressive strength for an arrangement of 25% lateritic sand with 75% quarry dust when used as fine aggregate in 1:1:2 mix.

- (R. Ilangovana-2008) this paper is all about the possibility of the utilization of rock dust as 100% substitute for natural sand in concrete. Natural sand is pricey because of extreme transportation cost. Also depletion of natural sources on larger scale creates ecological troubles. In such circumstances the rock dust can be a profitable option to the natural sand. For three grades of concrete mix design has been developed. Cubes and beams were casted and tested to learn the strength of concrete prepared with rock dust. The comparison of results was made with the concrete having natural sand. Durability of the concrete with quarry dust was also compared with natural sand concrete. The paper concludes that the flexural strength, compressive strength and durability studies for concrete having quarry dust

- Danish et al 2022 Strength appraisal of artificial sand as fine aggregate,"In this study partial replacement of sand with quarry dust was found. The sand was partially replaced in steps like 10% ,30% ,60% and 70% till the mixture achevid full strength

- M. Devi et al "Analysis of strength and corrosion resistance behavior of inhibitors in concrete containing quarry dust as fine aggregate

- Felekoglu et al. observed that the incorporation of quarry waste at the same cement content generally reduced the super plasticizer requirement and improved the 28 days' compressive strength of SCC. Normal strength SCC mixtures that contain approximately 300–310 Kg of cement per cubic meter can be successfully prepared by employing high amount of quarry waste.

- Sukumar et al. found that the relations have been established for the increase in compressive strength at premature ages of curing (12 h to 28days) for different grades of SCC mixes and are compared

- Muhit et al. determined that passing from 200 mm sieve is used as cement replacement whereas retaining from 100 mm sieve is used as sand replacement. Cement was replaced with stone dust in percentage of 3, 5, and 7 percent. Similarly, sand was replaced with stone dust in percentage of 15 to 50 with an increase of 5 percent. Test result gives that compressive strength of mould with 35% of sand and 3% of cement replacing dust increases to 21.33% and 22.76% in that order compared to the normal mortar mould at 7 and 28 days for tensile strength which increased to 13.47%.

- Ukpata and Ephraim identified the flexural and tensile strength properties compared with those for normal concrete. Hence, concrete proportion of lateritic sand and quarry dust can be used for construction provided the mixture of lateritic sand content is reserved below 50%. Both flexural strength and tensile strength are increased with increase in lateritic content.

- Soutsos et al. the physical characteristics of recycled destruction aggregates may unfavourably affect the properties of the blocks. However, levels of replacement of quarried stone aggregates with destruction recycled aggregates determined that it will not have significant harmful effect on the compressive strength.

- (SUDHIR S.KAPGATE-2013) Concrete plays an important role in construction and its large quantity is utilised in construction practices. Natural sand, one of the constituents of concrete, is expensive because of the high transportation cost from major sources. Diminution of sources creates environmental problems and to overcome this problem there is a requirement for cost-effective and creative solution materials. This paper deals with the use of quarry dust, a waste obtained during the extraction process, as a good filler instead of fine aggregate.M25 concrete mix design with 0%, 20%, 25%, 30% and 35% of quarry dust was used in this paper. In this experimental study different cubes were analysed for compressive strength, flexural strength and split tensile strength for concrete in hard form using quarry dust. Results from this study concludes that an increase in quantity of dust up to 30% increases compressive strength of concrete, if the %age of quarry dust is more than 30% the compressive strength starts decreasing gradually.

1.2 REVIEW ON COMPRESSIVE STRENGTH

The results of compressive strength of cubes for (7, 28) days curing are shown in table. It should be noted that in mix M1, M2 and M3 compressive strength increases as the days of curing are increased from 7 days to 28 days. But as the percentage replacement of quarry dust reaches the value 30%, compressive strength in mix M4, M5, M6 starts decreasing with the increase in days of curing from 7 days to 28 days.

2. DISCUSSION

(a) The compressive strength results of quarry dust concrete (cubes) were obtained in the first series, where M30 grade of concrete with 20, 25, and 30 percent replacement of quarry dust tested for 3 days, 7 days, 28 days, and 60 days is studied and the results are presented. The specimens were casted with conventional materials; that is, fine aggregate is natural river sand with M30 grade by using ordinary Portland cement (OPC).With the increase in age of concrete, the compressive strength increases up to 30 percent replacement of quarry dust as a fine aggregate. The partial replacement of quarry dust gave a 60 days' peak compressive strength at 30% replacement level. the compressive strength of M20 grade with varying age of concrete by replacement level up to 30%.

(b) The compressive strength results of quarry dust concrete (cubes) were obtained in the second series, where M25 grade of concrete with 20, 25, and 30 percent replacement grade also was observed with varying age of concrete byreplacement level up to 30%.

(c) The compressive strength results of quarry dust concrete (cubes) were obtained in the third series, where M20, M25, and M30 grades of concrete with 20, 25, and 30 percent replacement of quarry dust and also workability are studied by varying the water-cement ratio of 0.45 and 0.50 and the results are presented.

- Some of the facts based on the test are given below:

The compressive strength increased by 22% for the grade of M25 concrete mix when the aid of quarry dust was used with replacement of 40% with natural sand.

There was an increase in the compressive strength after the fair replacement of natural with quarry dust.

There was an 8.26% increase in compressive strength at replacement of 30%, 22.34% for 40%, 18.53% for 50% and 4.9% for 60%.

Increase of 16% in the compressive strength of M30 was observed when 40% of quarry dust was used in the place of river sand. At 30% replacement 5.25% increase in compressive strength was observed.

At 40% replacement 16% increase, at 50% replacement 12.5% increase and at 60% replacement 8.9% increase was observed accordingly.

3. CONCLUSIONS

All the experimental data shows that the addition of the industrial wastes improves the physical and mechanical properties. These results are of great importance because this kind of innovative concrete requires a large amount of fine particles. Due to high fines of quarry dust it is found to be very effective in assuring very good cohesiveness of concrete. From the said observations it is concluded that the quarry dust may be used as a replacement material for sand. Quarry dust has been used for various activities in the construction industry especially for road construction

1. Non availability of sand at reasonable cost as fine aggregate in cement concrete for various reasons, search for alternative material stone crusher dust qualifies itself as a suitable substitute for sand at very low cost.

2. Aggregates with higher surface area are requiring more water in the mixture to wet the particle surfaces adequately and to maintain a specific workability. Obviously increasing the water content in the mixture will adversely affect the quality of concrete.

3. It should be noted that split tensile strength increases as we replace the fine aggregate up to 10% and shows maximum strength in M2 mix. Then split tensile strength decreases as percentage replacements are increased further. It is also observed that split tensile strength in mix M1, M2, M3, M4, M5, M6 increases with the increase in days of curing from 7 days to 28 days.

4. It should be noted that in the mix M1, M2, M3, M4, M5 and M6 compressive strength increases as the days of curing are increased from 7 days to 28 days. But as the percentage replacement of quarry dust reaches the value 20%, compressive strength shows maximum value and then starts decreasing as we move ahead in replacement.

- Future Scope of study
- The main motive is to find the positive variation in the properties. In that regard I tried the extreme conditions of failure so that best possible results can come. Value of Compressive strength of concrete is taken as Maximum compressive load that the concrete can carry per unit arca.
- This variation is controlled by formation of different proportions of quarry dust and fine aggregate. In the cubes, cylinders and beams, fine

aggregate was replaced with a different percentage of quarry dust and the strength will be checked after 7 days and 28 days. The strength was much more than expected. In future if we replace full 100 % of sand we will desirable strength

- In future river sand will not be available as its extraction is affecting aquatic life, so use of alternative is in urge
- As quarry dust and fly ash is waste material, if we dump it this will cause land pollution , so to save pollution and water life, quarry dust will be used as future sand ,as many European countries are using it.
- The concrete mix prepared will be checked for workability with the aid of slump tests. Above all. cost analysis will be done on cach cube, cylinder and became prepared with different ratios of quarry dust so to ensure that the mixes prepared are economical after the replacement of sand with quarry dust or not waste
- It will give us an idea that there should be partial replacement of quarry dust or full replacement with fly ash

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