An Experimental Study on Quarry Dust as a Fine Aggregate for Making a Concrete.

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ABSTRACT-

Concrete is the most widely used composite construction material. Fine aggregate plays a very important role for imparting better properties to concrete in its fresh and hardened state. Generally, river sand was used as fine aggregate for construction. Due to the continuous mining of sand from riverbed led to the depletion of river sand and it became a scarce material. Also, sand mining from river bed caused a lot of environmental issues. As a substitute to river sand, manufactured sand has been used. In this present experimental study a comparative study has been carried out to check the usability of manufactured sand in place of natural sand. This study involves determination of some major properties of concrete like compressive strength, split tensile strength, flexural tensile strength and durability in acidic medium made of both the sands. Based on proposed studies, quality of quarry dust is equivalent to natural sand in many respects, such as cleanliness, grading, strength, angularity, specific gravity.

KEY WORDS: Quarry Dust, Fine aggregate, cement, fly ash, super plasticizer, compressive strength,

1. INTRODUCTION`

Quarry dust is a by-product of the crushing process which is a concentrated material to use as aggregates for concreting purpose, especially as fine aggregates. In quarrying activities, the rock has been crushed into various sizes; during the process the dust generated is called quarry dust and it is formed as waste.

So it becomes as a useless material and also results in air pollution. Therefore, quarry dust should be used in construction works, which will reduce the cost of construction and the construction material would be saved and the natural resources can be used properly.

Most of the developing countries are under pressure to replace fine aggregate in concrete by an alternate material also to some extent or totally without compromising the quality of concrete.

Quarry dust has been used for different activities in the construction industry, such as building materials, road development materials, aggregates, bricks, and tiles.

The present research work mainly deals with the influence of different replacement proportion of sand with quarry dust on the properties of concrete.

The present study is planned to study the effects of quarry dust addition in normal concrete and to assess the rate of compressive strength development.

2. LITERATURE REVIEW

Physical properties like specific gravity, fineness modulus etc.of stone dust and fine aggregate should be comparable in order to use stone dust as a replacement of fine aggregate. Studies shows that optimum replacement of fine aggregate with stone dust gives maximum compressive strength, durability, flexure strength and other mechanical properties.

Manchiryal R.K., Dewangan A. and Gupta D.P. investigated that the physical and chemical properties of stone dust satisfiedIS-2386 which could be used as replacement material of fine aggregate.It was concluded that compressive strength from concrete with quarry dust was comparatively 10% -12% more than the conventional concrete. They also concluded that durability under the influence of sulphate and acid attack of quarry dust concrete was higher than conventional concrete. Permeability of concrete decreased due to better relative density of quarry dust than that of conventional concrete.

Reddy, M.V. (2010) carried out some experiments using waste product like stone dust and ceramic scrap as partial and full replacement of fine aggregate.From the result of experiment, he concluded that stone dust can be effectively used as replacement of fine aggregate but ceramic scrap should not be replaced more than 20% of coarse aggregate in order to achieve significant structural strength.

Patel, A.N. and Pitroda J.K. investigated the strength properties and economic feasibility of concrete, when it

was prepared using stone dust as a partially replacement of cement. Portland Pozzolana cement of grade 53 was used for mix design. They prepared mix of M25 using 0.40 water cement ratio.It was found that compressive strength of cubes decreased as the percentage of replacement of cement was increased.

Abbas S.Y., Srivastava V. and Agarwal V.C. conducted their research on the mix design of M25 concrete. They carried out their work using PPC cement of grade 43. Stone dust was obtained from local stone crusher mill of Mirzapur, India. Replacement of 60% of fine aggregate by stone dust gave better strength at 7 days as well as at 28 days.

Syam Prakash V., Krishnan D. and Jeenu G. investigated the effect of stone dust on M60 grade of high strength concrete. It concluded that strengthen properties like compressive strength and tensile strength increased when stone dust was replaced by more than 60%.

3. MATERIALS AND METHODS

Quarry Dust

The quarry dust is the by-product which is formed in the processing of the granite stones which broken downs into the coarse aggregates of different sizes. The physical and chemical properties of quarry dust obtained by testing the sample as per the Indian Standards.

Fly ash

Fly ash is the ash produced from the combustion of coal or lignite. It is a pozzolanicmaterial helps in gaining of strength with lime. The burning of harder, older anthracite and bituminous coal typically produces Class F fly ash. The fly ash is pozzolanic in nature, and contains less than 20% lime (CaO). Possessing pozzolanic properties, the glassy silica and alumina of class F fly ash requires a cementing agent, such as Portland cement, quick lime, or hydrated lime, with the presence of water in order to react and produce cementitious compounds.

Cement:

The cement that is used is of OPC 53 grade as per the Standard Specifications of the country. The cement according to the Indian specification must satisfy the IS code IS 12269- 1987 (reaffirmed 1999)...

Fine Aggregates:

The natural fine aggregates are the river sand which is the most commonly used natural material for the fine aggregates that is used, but the recent social factor that created a shortage of the material created a great problem in the construction sector. For the studies the river sand of Zone-II is used in all the references.

Coarse aggregate:

The coarse aggregate was locally available quarry having two different sizes; one fraction is passing through 20 mm sieve and another fraction passing through 10 mm sieve. The specific gravity of coarse aggregate is 2.66 for both fractions. The grading of coarse aggregate of 10 mm and 20 mm size are given in Table 3. Proportion of 20 mm and 10 mm size aggregate was taken as 60% and 40%.

Water

Water is an important ingredient of bricks as it actually used for manufacturing of brick. Sinceit helps to bind all the raw materials for giving proper mix. Water used for making brick should be free from impurities.

4. MIX PROPORTIONS

To produce concrete of required strength and properties, selection of ingredients and their quantity is to be found which is called concrete mix design. Proper mix design will solve every problem arises in concrete while placing or curing etc.. The mix design also helps to produce economical concrete.Generally, cement is more costly than other ingredients of concrete. So, quantity and quality of cement is designed by proper mix design concept. In this article we are going to discuss about the concrete mix design concept as per IS 10262-2019.

SELECTION OF MIX PROPORTION

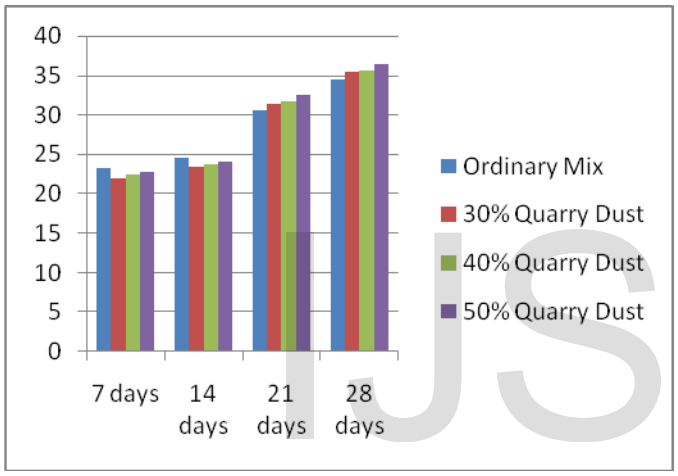
1. Selection of water cement ratio.
2. Selection of water content.
3. Calculation of cement content.
4. Estimation of fine aggregate proportion
5. Combination of different coarse aggregate fractions.
6. Estimation of coarse aggregate proportion.
7. Trial mixes.
8. Determination of final mixed proportion to be used.

5.RESULTS AND DISCUSSIONS

Compressive Strength of Concrete:

The materials required for the number of specimens were dry mixed and then mixed with calculated amount of water. The quantity of water is obtained as per IS4032-1988. It is given by Percentage of water equal to (P/4 +3) percent of combined weight of cement and fine aggregate, where P is the percentage of water required to produce a cement paste of standard Consistency. While preparing the specimens for each proportion, a reference mix using cement and natural sand is prepared.

Compressive strength results as tabulated



6. CONCLUSION

1. The Replacement of the sand with quarry dust shows an improved in the compressive strength of the concrete.
2. As the replacement of the sand with quarry dust increases the workability of the concrete is decreasing due to the absorption of the water by the quarry dust.
3. The compressive strength and split tensile strength of concrete for grade M30 with quarry dust as fine aggregate were found to be comparable with the concrete made with the river bed sand.
4. The increase in compressive strength of concrete with 30% replacement and 50% replacement of fine aggregate with stone dust is found to be 8 to 10%.
5. Effective utilization of quarry dust in concrete can save the waste of quarry works; and also produces a 'greener' concrete.
6. The further increasing the percentage of replacement can be made useful by adding the fly ash along with the quarry dust so that 100% replacement of sand can be achieved.

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Days	Ordinary mix	30% Quarry Dust	40% Quarry Dust	50% Quarry Dust
7	23.28	22.86	23.50	22.60
14	24.50	23.42	23.80	24.00
21	30.52	31.45	31.68	32.50
28	34.50	35.45	35.60	36.50

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