Stone Dust as Partial Replacement of Fine Aggregate in Concrete

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ABSTRACT

This investigational study presents different effects on concrete. If we replace sand with stone dust in turn to describe the effects of stone dust, many tests are performed like compressive strength and workability test. We used M 20 grade of concrete and replaced the stone dust as M1, M2 M3, M4 and M5 respectively and performed tests for 7 and 28 days. The compressive strength is found to be maximum at 30% replacement of ordinary sand. While the tensile strength is found to be high at 20% replacement of sand.

Keywords - Concrete, stone dust, natural sand, replacement compressive strength

I. INTRODUCTION

Fine aggregate is an important part of concrete. The usage of river sand is extremely high due to concrete. Due to infrastructural needs its demand is very high. In these circumstances many countries of the earth are facing difficulties in conditions of shortage of the river sand. When the natural sand is not available in such quantity which the construction field requires to making concrete. Then this industry will face problems. Therefore these countries need to find another material which decreases the usage of natural sand. So in order to decrease this reliance on the natural sand, the stone dust which is producing by the industries as waste product can occupy the position of natural sand as a substitute material [1]. Many different material are already being used the construction industries as a limited replacement of sand such as flash, slag and line stone [2].

Hence it is supposed that stone dust could be a better replacement of the river sand and it will be a help to the environment because stone dust is a byproduct and it polluted the environment. The only purpose of stone dust is to use it for filling up the down areas. So if we used it as a replacement of the river sand it will be better for both the construction field and stone crushing industries respectively. Because the use of river sand in construction industry is very high, so we can reduce its usage by replacing it with stone dust and on the other hand stone dust occupies 25% of the total vicinity of the industry so it will be helpful to clean the area and environment.

II. LITERATURE REVIEW

The replacement if stone dust with sand enhanced the mechanical properties. The compressive strength approaches to maximum when replaced with ratio of 60:40 as done by Hamid Mir [3].

It is observed that the usage of stone dust decreases the needs of super plasticizer at same cement content and increases the compressive strength of 28 days Falekolu et al [4]

A relationship is setup for the enhancement of compressive strength at different ages of the wring (12 h to 28 days) for many grades of concrete as IS: SP 23 –n 1982 Sukumar et al [5]

In preparation of concrete granite can be use in concrete but it is necessary to find and that granite is a byproduct and its behavior may change with the time. So it needs to be explained to use this product Ho et al [6]

The usage of stone dust is suggested in the areas where the availability of sand is difficult (Dehwah [7]).

Stone dust can be use as a cement alternative when it passed from sieve 200 mm and it can be used as substitute and can be replace with stone dust in 3, 4 and 7 percent. Where as in sand these percent increases from 15 to 50 percent. When the strength of normal mortar is compared with the mortar in which 35% of sand and 3 % of cement was replace with stone dust, the strength increased to 21.33% and 22.76% Muhit et al [8].

The flexural and tensile strength are found to be increases when the lateritic sand and stone dust are used

below 50%. When it is compared with concrete Ukpata and Ephraim [9].

When the natural sand is completely replaces is found to be increases constantly [chitlange and paigade [10]).

When concrete is made and having stone dust as an alternate of fine aggregate and can be used successfully in the construction field then this will have a key role to reduce environmental pollution (Devi and Kannan [11]).

The Analysis suggests that if the stone dust is replaces with natural sand up to 50%. It will not have any effect on the mechanical and physical properties of the concrete and will be inexpensive up to 56% Nanda et al [12].

III. METHODOLOGY

In this research we collected the material that was available near to us. We used the ratio of (1: 1.5: 3) M20 grade of concrete by mix design.

Materials

Following materials are required for the making of concrete cylinders

- Coarse aggregate
- Fine aggregate
- Cement
- Stone dust

Methodology steps

The following steps are included in methodology

Step 1. Material acquisition

We selected a well graded coarse aggregate of a mm from query

Fine aggregate was selected of its best

We used askari cement available to us.

Step 2. Weighting and mixing of material

All the materials such as fine aggregate, coarse aggregate, cement and stone dust was weighing in proper quantity as per mix design. The all the weighing materials are mixed in a proper manner to prepare it for the molds

Step 3 Mould formations.

All tubes and cylinders were made free from dirt, makers and polished with oils befor3e the preparation of samples. Then the concrete is places in moulds in three layers and make it compacted by tamping with rods 25 times layer by layer.

Step 4 Specimen testing

The entire specimen which were casted and which were placed in waster for curing, bring out from curing. All the specimens are tested for 7 and 28 days.

IV. RESULTS AND DISCUSSIONS

Workability (Slump test)

It is establish that the slump value is increases when the sand replacement increases with stone dust is increased. The slump values of stone dusts are 38, 47, 52, 55 and 62 mm for mixes as M1 is (0% stone dust) M2 (20%), M3 (30%), M4 (40%) and M5 (50%).

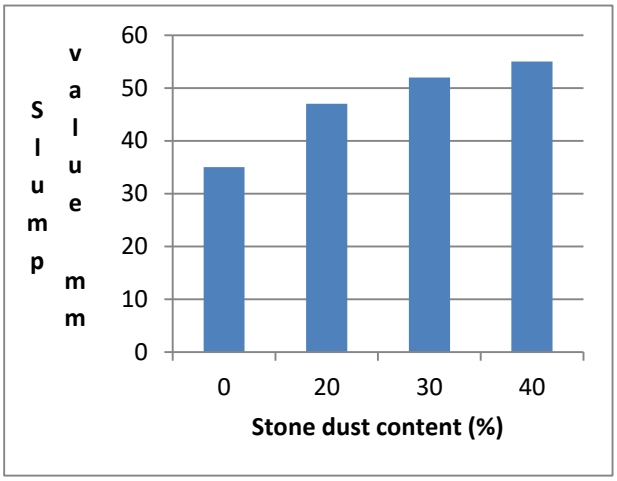

Figure 1: slump valued data

Compaction factor

The variation of workability is measured in terms of computation factor with constant work ration 0.54. The results for various mixes are as M1 (0% stone dust), M2 (20% stone dust), M3 (30% stone dust), M4 (40% stone dust) and M5 (50%) are 0.92, 0.850, 0.846, 0.828, 0.800 respectively.

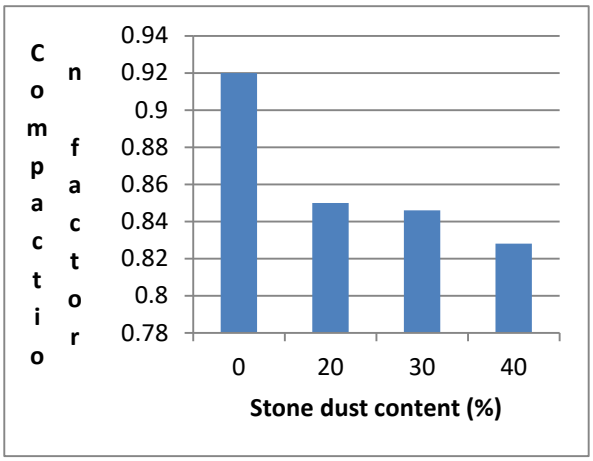

Figure 2: Compression factor

Compressive Strength

It is establish that the compressive strength of concrete for 28 days of curing for M1 is 30.2 mpa. For M2 (20% stone dust) the compressive strength is 34 mpa. For M3 (30% stone dust) the strength is 32 mpa. But for 0% to 20% the stone dust is nto in such amount to file all the voids in concrete. Therefore they have less strength than 30% stone dust. But the strength of M4 and M5 is decreased by 3.8% and 1.2% when compared with M1. Which shows the values of M4 29 and M5 26.2 mpa.

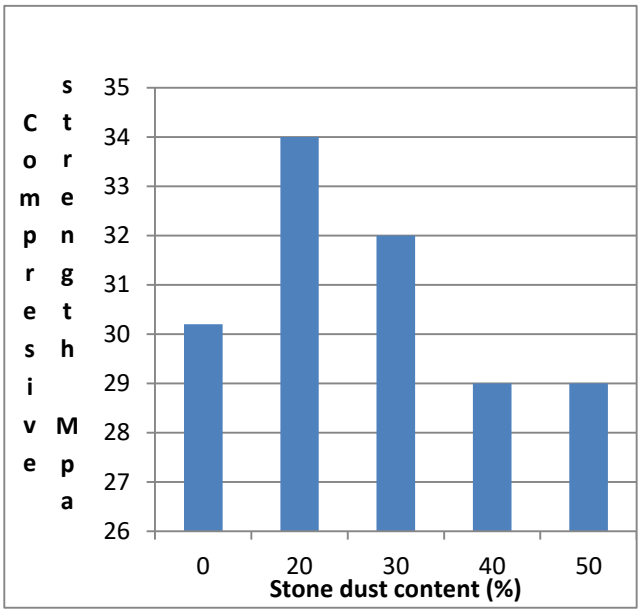

Figure 3: Compressive strength

V. CONCLUSION

All the experiments show that stone dust can be used as an alternative of fine aggregate because its not only improves the properties of concrete but will also protect the environment from the waste materials by using it for meaningful purpose. By using stone dust as an alternative of fine aggregate will decrease the use of the river sand and will also decrease the cost of concrete.

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