

A Technical Review on Quarry Dust and Foundry Sand Used As Fine Aggregates in Mortar

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Abstract— Sustainable construction is the need of our. Depletion of the virgin natural river sand is the main issue concerning the construction industry. And also industrial solid wastes like Quarry stone dust and foundry sand are generated abundantly, creates disposal problem due to the lack of landfill sites for these waste disposal. The purpose of the study is to replace the sand partially or fully by Quarry stone dust or Foundry sand in mortar as in future there will be depletion of sand. Hence, it is necessary to find inexpensive and easily available alternative material to Natural River Sand.

Key words: Quarry Stone dust, Foundry sand, Compressive strength, Tensile strength

I. INTRODUCTION

A mortar is defined as a workable paste used to bind construction blocks together and fill the gaps between them. The word comes from Latin mortarium meaning crushed. Mortar may be used to bind masonry blocks of stone, brick, cinder blocks, etc. [1] Types of mortar such as Type N, Type S, Type M, Glass block mortar, Refractory mortar. Each mortar has its own importance according to the requirements of construction industry. The first mortars were made of mud and clay. Because of a lack of stone and an abundance of clay, Babylonian constructions were of baked brick, using lime or pitch for mortar. In the Indian subcontinent, multiple cement types have been observed in the sites of Indus Valley Civilization, such as the Mohenjo-Daro city-settlement. Gypsum cement that was "light grey and contained sand, clay, traces of calcium carbonate, and a high percentage of lime" was used in the construction of wells, drains and on the exteriors of important looking buildings.

II. LITERATURE REVIEW

In this paper literature review containing both for Quarry stone dust and Foundry sand which are following:

H. M. A. Mahzuz, Bangladesh (2011) [2]: has determined the relative performance of mortar and concrete by using stone powder as sand. For these purposes the compressive strength of mortar (50 x 50 x 50 mm) and concrete (150 x 150 x 150 mm) (for 3, 7 and 28days) was tested as per British standard. This study shows that the compressive strength both for mortar and concrete using stone powder gives impressive result than that of normal sand for the ratio of 1:2.75, 1:3 and 1:3.5. For compressive strength of concrete mix 1:1.5:3, 1:2:4 and 1:2.5:5 were also obtained. The highest compressive strength of mortar found from stone powder which is 33.02 MPa, shows that better mortar can be prepared by the stone powder. The compressive strength of concrete from stone powder shows 14.76% higher value than that of the concrete made of normal sand. On the other hand, concrete from brick chip and stone

powder produce higher compressive value from that of brick chip and normal sand concrete.

Manguriu, Nairobi, Kenya (2013) [3]: investigated the use of crushed rock sand as a partial replacement of river sand in concrete production. Water cement ratio varied between 0.55 and 0.59 for 0 % to 100 % natural sand replacement. The slump ranged between 49 and 60 mm for 0 % to 100 % natural sand replacement. The average compressive strength of the control concrete was 22.5 N/mm². The effective natural sand (RS) replacement ranged between 0 and 60 % with the best results achieved at 20 % replacement. The peak compressive strength and indirect tensile strength values of 23.2 N/mm² and 1.42 N/mm² respectively were obtained. Modulus of elasticity of concrete increased from 22 KN/mm² to 23 KN/mm² with 20 % replacement of natural sand. Also, the indirect tensile strength increased from 1.28 N/mm² to 1.42 N/mm² with 20 % river sand replacement. The 20 % CRS(crushed rock sand) content recorded the highest flexural strength of 686.7 N/mm² beyond which the strength decreased to 80 % CRS after which there was a constant value in strength up to 100 % CRS.

Er. Lakhan Nagpal, Haryana, India (2013) [4]: investigated the possibility of using crushed stone dust as fine aggregate partially or fully with different grades of concrete composites. The suitability of crushed stone dust waste as fine aggregate for concrete has been assessed by comparing its basic properties with that of conventional concrete. Two basic mixes were selected for natural sand to achieve M25 and M30 grade concrete. The equivalent mixes were obtained by replacing natural sand by stone dust partially and fully. The compressive strength of Quarry Rock Dust concrete is comparatively 10- 12 % more than that of similar mix of Conventional Concrete. The test result indicates that crushed stone dust waste can be used effectively used to replace natural sand in concrete. In the experimental study of strength characteristics of concrete using crushed stone dust as fine aggregate it is found that there is increase in compressive strength , flexural strength and tensile strength of concrete.

Rafat Siddique, India (2009) [5]: has evaluated the mechanical properties of concrete mixtures in which fine aggregate partially replaced with used-foundry sand (UFS). Fine aggregate was replaced with three percentages (10%, 20%, and 30%) of UFS by weight. Four concrete mixture proportions were made. First was the control mix (without UFS) and the other three mixtures contained UFS. Fine aggregate (regular sand) was replaced with UFS by weight. The proportions of fine aggregate replaced were 10%, 20% and 30%. The control mixture without UFS was proportioned as per the Indian Standard Specifications IS: 10262-1982. 150 mm concrete cubes were tested for compressive strength. Tests were performed at the ages of 7, 28, 56, 91, and 365 days in accordance with the provisions

of the Indian Standard Specifications IS: 516-1959. At 28-day, control mixture M-1 (0% UFS) achieved a compressive strength of 28.5 MPa, whereas mixtures M-2 (10% UFS), M-3 (20% UFS), M-4 (30% UFS) achieved a compressive strength of 29.7, 30.0, and 31.3 MPa, respectively; an increase of 4.2%, 5.2% and 9.8% in comparison with the strength of control mixture M-1 (0% UFS). Compressive strength, increased with the increase in foundry sand contents and also. Compressive strength, of concrete mixtures increased with age for all the foundry sand contents.

Khuram Rashid, Japan (2014) [6]: has evaluated the compressive strength of concrete by utilizing three types of used foundry sand; with bentonite clay, with sodium silicate and with phenolic resin as partial replacement of fine aggregates. 10, 20 and 30 % replacement level of river sand by used foundry sands was maintained in this study. A constant concrete proportion of 1:2:4 was used with a single water cement ratio of 0.6 for all the mixtures. Total 90 cubes of 100 mm size were casted and cured in curing tank for 7, 28 and 63 days for determination of their compressive strength. Workability, compressive strength and were measured and compared with the conventional concrete termed as control mixture. Compressive strength increases with increase in curing age in all cases and at 28 days of curing, 80% of compressive strength was reached in all concrete specimens. Strength decreased with increase in percentage replacement of UFS; compressive strength of control mixture was more than concrete mixtures with UFS at all curing ages.

Eknath P.Salokhe, Kolhapur, India [7]: The comparative study of the properties of fresh & hardened concrete containing ferrous & non-ferrous foundry waste sand replaced with four (0%, 10%, 20% and 30%) percentage by weight of fine aggregate & tests were performed for M20 grade concrete. Result showed that (i) addition of both foundry sand gives low slump mainly due to the presence of very fine binders; (ii) Compressive strength at 7 days of both ferrous & nonferrous mixtures increases and maximum increase was observed with 20% WFS of both types of sand, at 28 days 30% addition of ferrous WFS & 10% addition of nonferrous WFS gives same strength as ordinary concrete and goes on decreasing for higher percentages of replacement; (iii) Split tensile strength gives maximum values with 20% WFS for both types of sand; (iv) water absorption is minimum with 20% ferrous WFS & with 10% nonferrous WFS. He also reported that both ferrous & nonferrous WFS can be suitably used in making structural grade concrete.

III. DISCUSSION

Based on various researchers, it is observed that 20-30% replacement of foundry sand and up to 20-100 % of quarry stone dust by natural river sand generally gives higher strength compared to normal concrete. All the researchers noticed fresh concrete behavior with foundry sand that workability is decreases with the increase of foundry sand content by slump test. Most of the researchers noticed positive changes in the concrete containing foundry sand and concrete containing quarry stone dust in terms of compressive strength and tensile strength.

IV. CONCLUSION

Based on the above literature it is clear that many researchers have put their efforts to study different properties of concrete using Quarry stone dust and Foundry sand replaced with natural river sand. However, limited work has been done to study the possibility of using industrial solid waste materials like Quarry dust and Foundry sand as replacement to fine aggregate, to prepare Masonry mortar. In the present paper technical study has been done to fill this gap.

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