iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** V **Month of publication:** May 2016

DOI:

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Volume 4 Issue V, May 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Experimental study on partial replacement of Fine aggregate with marble powder and Green sand in concrete

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***Abstract:** The development of concrete has brought about the essential need for additives both chemical and mineral to improve the performance of concrete. Most of the developments across the work have been supported by continuous improvement of these admixtures. Hence variety of admixtures such as fly ash, rice husk ash, stone dust has been used so far. Also different varieties of fibers have below tried as additions. Hence an attempt has been made in this present investigation to study the behavior of partial replacement of fine aggregate with Green sand, Marble Powder used in concrete. To attain the setout objectives of the present investigation, replacement of cement with Metakaolin used in concrete by 5% to produce concrete. Partial replacement of fine aggregate with Marble Powder and Green Sand used in concrete by 0,5,10,15 and 20% to produce concrete. Concrete is tested for Compression, Split tension, Flexural strength, XRD and Modulus of elasticity test.*

I. INTRODUCTION

Conventionally concrete is mixture of cement, sand and aggregate. Properties of aggregate affect the durability and performance of concrete, so fine aggregate is an essential component of concrete. The most commonly used fine aggregate is natural river or pit sand. Fine and coarse aggregate constitute about 75% of total volume. It is therefore, important to obtain right type and good quality aggregate at site, because the aggregate form the main matrix of concrete or mortar. The global consumption of natural sand is very high, due to the expensive use of concrete. In general, the demand of natural sand is quite high in developing country like India facing shortage in good quality natural sand. Particularly in India, natural sand deposits are being depleted and causing serious threat to environment as well as the society. Increasing extraction of natural sand from river beds causing many problems, loosing water retaining sand strata, deepening of the river courses and causing bank slides, loss of vegetation on the bank of river, exposing the intake well of water supply schemes, disturbs the aquatic life as well as affecting agriculture due to lowering the underground water table etc are few examples. In past decade variable cost of natural sand used as fine aggregate in concrete increased the cost of construction. In this situation research began for inexpensive and easily available alternative to natural sand.

II. LITERATURE REVIEW

RafatSiddique, Geert de Schutter, Albert Noumowe2009 had investigated the experimental investigation on Effect of used-foundry sand on the mechanical properties of concrete. The used for foundry sand in M30 grade concrete. In the Replacement was done with 10%, 20% and 30%. Tests were done for the properties of fresh and hardened concrete. Compressive strength split tensile, flexural strength and moduli of elasticity were determined for 28, 56, 91 and 356 days. In the results of Compressive strength, splitting-tensile strength, flexural strength, and modulus of elasticity of concrete mixtures increased with the increase in foundry sand contents. Increase in compressive strength varied between 8% and 19% depending upon UFS percentage and testing age, whereas it was between 6.5% and 14.5% for splitting-tensile strength, 7% and 12% for flexural strength, and 5% and 12% for modulus of Elasticity. Results of this investigation suggest that used-foundry sand could be very conveniently used in making good quality concrete and construction materials.

Gurpreet Singh, RafatSiddique 2012 had investigated Effect of waste foundry sand(WFS) as partial replacement of sand on the strength, ultrasonic pulse velocity and permeability of concrete. In this research natural sand was replaced with five percentage (0%, 5%, 10%, 15%, and 20%) of WFS by weight. Compression test and splitting tensile strength test were carried out to evaluate the strength properties of concrete at the age of 7, 28 and 91 days. Modulus of elasticity and ultrasonic pulse velocity test were

conducted at the age of 28 and 91 days. In case of durability property, Rapid Chloride Permeability test was performed on all five mix proportion at the age of 28 and 91 days. In the results for conducting the compression test and ultrasonic pulse velocity test, 152.4 mm cubes were cast. 152.4 x 304.8 mm cylinders were cast to conduct the splitting tensile test and MOE. Partial replacement of sand with WFS (up to 15%) increases the strength properties (compressive strength, splitting tensile strength and modulus of elasticity) of concrete. Maximum increase in compressive strength, splitting tensile strength and modulus of elasticity of concrete was observed with 15% WFS, both at 28 and 91 days. Inclusion of WFS increases the USPV values and decreased the chloride ion penetration in concrete, which indicates that concrete has become denser and impermeable. WFS can be suitably used in making structural grade concrete.

M.ShahulHameed,A. S. S. Sekar (2009) had investigated the experimental investigation on Properties of green concrete containing quarry rock dust and marble sludge powder as fine aggregate. In this research for durability studies the Indian standard mix proportion (by weight) use in the mixes of conventional concrete and green concrete were fixed as 1:1.81:2.04, 1:1.73:2.04 after several trials The water/cement ratio for both two mixes was 0.55% by weight. Water reducing admixture was used to improve the workability and its dose was fixed as 250 ml/50kg of cement. In this result of Green concrete induced higher workability and it satisfy the self compacting concrete performance which is the slump flow is 657mm without affecting the strength of concrete. Slump flow increases with the increase of marble sludge powder content. V-funnel time decreases with the increase of marble sludge powder content. Green concrete enhancing fresh concrete behavior and can be used in architectural concrete mixtures containing white cement. Permeability test results clearly demonstrate that the permeability of green concrete is less compared to that of conventional concrete. The water absorption of green concrete is slightly higher than conventional concrete.

Sanjay N.Patil, Anil K.Gupta, Subash S. Deshpande (2014)had investigated Metakaolin–Pozzolanic material for cement in high strength concrete. This paper are based on Metakaolin becomes sample ingredient the production of concrete for more than 40MPa.Reduced pore size in cement paste and transforms many finer particles into discontinuous pores. The results on Increases compressive and flexural strength.Reduces water permeability and efflorescence. Better shrinkage and crack control.

Dr.K.Srinivasu, M.L.N.KrishnaSai, VenkataSairamKumar.N (2014) carried out an investigation A Review on Use of Metakaolin in Cement Mortar and Concrete. This thesis explain about Mortars are prepared by lime and MK with sand volumetric ratio's of 1:1, 1:2, 1:3 and replacement of 30%, 50% by weight of lime by MK. Concrete was prepared for M50 grade. Replacement of 5%, 10%, 15%, 20%, with 0%, 0.5%, 1% and 1.5% by addition of steel fibers. This result on Cement replacement with 20% MK gives maximum enhancement in pore refinement of pastes and compressive strength reduces when MK addition goes beyond 30% as cement replacement. Replacement to cement at 10% MK and 15% Mk showed better viscosity and improved Shear stress. Replacement of cement with 10% MK and 1% addition of steel fibers showed optimum value. Replacement of cement by 0, 4, 6 and 8% are made by MK and increases in compressive strength, resistance to chloride penetration were found.

B. B. Patil (2012) made an investigation Strength and Durability Properties of High Performance Concrete incorporating High Reactivity Metakaolin. In this paper HPC of grade M60 were prepared. Replacement of 5%, 7.5%, 10%, 12.5%, and 15% by weight of cement's/c ratio was 0.31optimum MK of 7.5% and super plasticizer of 0.73% gives desired workability. In this explain about result on 28 days test of cube compression was done and the results showed that concrete with 5%, 7.5% and 10% showed increase in strength. Other percentages do not give strength because of dilution effect. Durability test like chloride penetration and sulphate attack was done. The 7.5% addition of HRM gives enhanced resistance to chloride attack. The compressive strength of concrete incorporated with 7.5% HRM is reduced only by 3.85% as compared with the reduction of strength of control mix specimen is by 4.88%.The 7.5% addition of high reactivity metakaolin in cement is also enhanced the resistance to sulphate attack. The compressive strength of concrete incorporated with 7.5% HRM is reduced only by 6.01% as compared with the reduction of strength of control mix specimen by 9.29%.

III. NEED FOR LITERATURE REVIEW

From the study of literatures, it is cleared that these various admixtures are suitable in the construction industry especially in concrete making. Materials such as green sand, marble powder are used in varying proportion as an admixture in concrete. They were found to be performing better than normal concrete, in properties such as workability, durability, permeability and compressive strength. Even though several advancements have been made in concrete technology, it still suffers from several drawbacks, viz poor workability, high shrinkage cracks, poor performance against chemicals, high permeability, low strength. In order to overcome this drawback, the use of admixture in concrete is essential.

IV. CONCLUSION

Since the partial replacement aggregate concrete is very good in the structural behavior. The further investigations are required to outcome. In further cubes, beam and cylinder of varying trial mix proportion as follows. The five mixes are designed as M1, M2, M3,and M4 are going to cast. M1-90% of aggregate (percentage of MP-5 and GS-5), M2-80% of aggregate (percentage of MP-10, GS-10 and MK-5), M3-70% aggregate (percentage of MP-15,GS-15 and MK-10), M4-60% of aggregate (percentage of MP-20, GS-20 and MK-15), and above all mixes replacement with cement by 5% in the concrete. Admixture of about .75% to 3% of super-plasticizer by weight of cementations material is to be added.The Concrete is tested for Compression, split tension and flexural strength, XRD, modulus of elasticity test.

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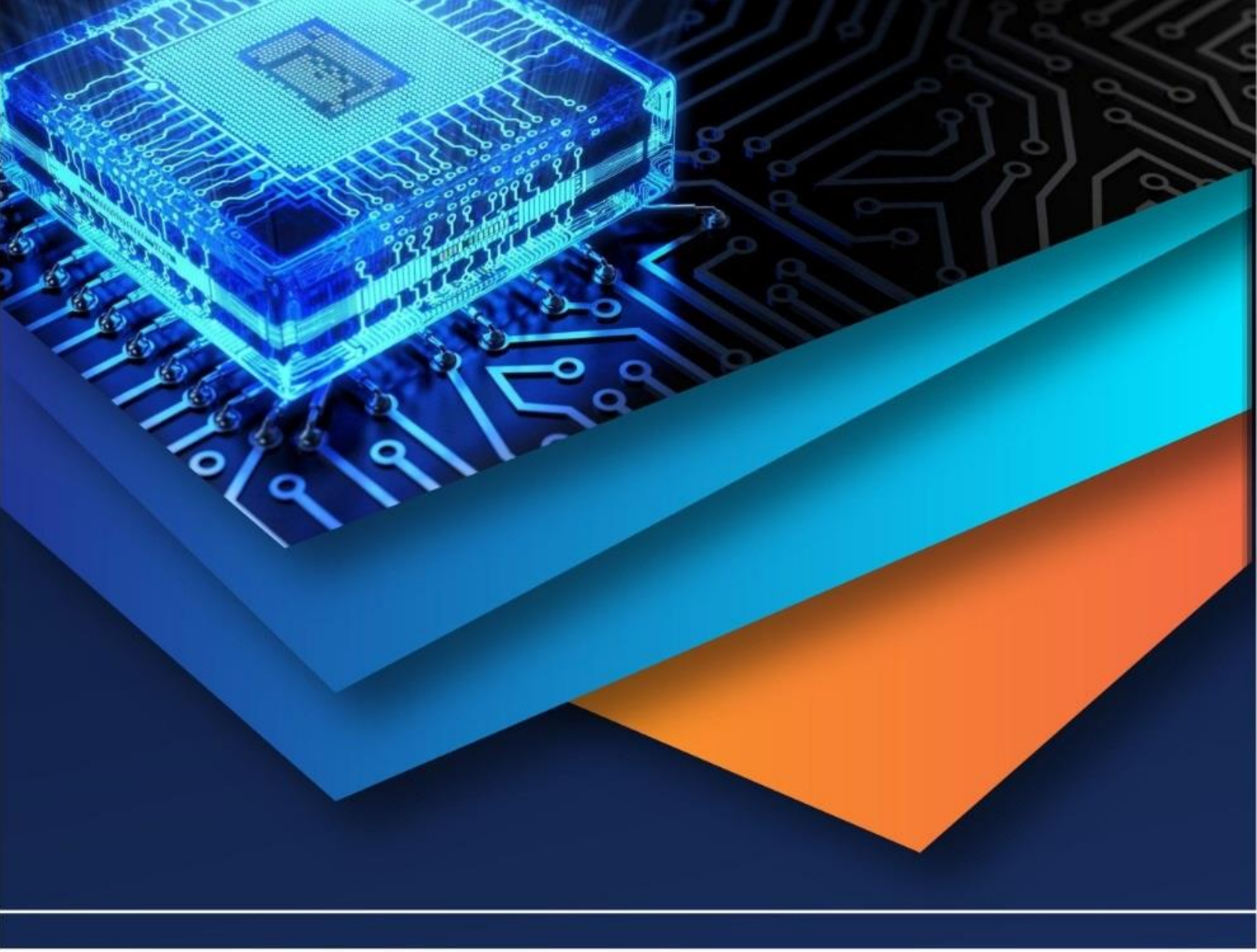

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