"Experimental Study on Compressive Strength of M25 and M30 Concrete by Replacing Artificial Sand Against Natural sand"

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ABTRACTS

Any Civil Engineering Structure must rest on a Structures are founded with concrete and steel materials mainly. Traditionally, concrete is mixture of cement, sand and aggregate. The most commonly used fine aggregate is natural river sand and coarse aggregate is stone quarry. Scarcity of good quality Natural River sand due to depletion of resources and restriction due to environmental consideration has made concrete manufactures to look for suitable alternative. One such alternative is "Artificial sand" namely if graded by means may also be called as manufactured sand. This paper present an experimentation concrete mix are designed for M25 and M30 grade by replacing natural sand with artificial sand at different replacement levels of 0%, 30%, 60%, 90% and 100% and find the optimum percentage of artificial of sand at which concrete grain maximum value of compressive strength ,flexural and tensile strength.Results were obtained to compare the nominal mix strength of traditional concrete with artificial concrete analytically as well as graphically. The conclusions were made for the understanding the effect of artificial concrete in terms of strength and workability over traditional concrete.

Key words: Artificial Sand, Concrete, Natural Sand, compressive strength ,flexural and tensile strength.

INTRODUCTION

1.1 Introduction

Concrete is the most widely used material of construction all over the world. A huge quantity of concrete is consumed by global construction industry. In India, the conventional concrete is mostly produced by using natural sand obtained from the riverbeds as fine aggregate. The advantage of natural sand is that the particles are cubical or rounded with smooth surface texture. The grading of natural sand is always not ideal. It depends upon place to place. Being cubical, rounded and smooth textured, it gives good workability. One of the important ingredients of conventional concrete is natural sand or river sand. However, due to the increased use of concrete in almost all types of construction works, the demand of natural or river sand has been increased. The infrastructure development such as express highway projects,

power projects and industrial developments have started in a big way now. Available natural sand is getting depleted and also it is becoming costly . Thus, to meet these increased demands of construction industry, excessive quarrying of sand from river beds is taking place causing the shortage of natural sand. This scarcity of natural sand due to such heavy demands in growing construction activities have forced engineers to find a suitable substitute. One of the cheapest and the easiest ways of getting substitute for natural sand is by crushing natural stone to get artificial sand of desired size and grade . The use of artificial sand will conserve the natural resources for sustainable development of the concrete in construction industry .

Artificial sand is a process controlled crushed fine aggregate produced from quarried stone by crushing or grinding and classification to obtain a controlled gradation product that completely passes the 4.75mm sieve. Artificial sand generally contain more angular particles with rough surface textures and flatter face than natural sand that are more rounded as a result of weathering. Over the time some investigations have shown that angular particles, rough surface of artificial sand influences the workability and finish ability in fresh concrete. The artificial sand have to satisfy the technical requisites such as workability, strength and durability of concrete and hence it has become necessary to study these properties in order to check the suitability and appropriate replacement level of artificial sand in comparison with the natural sand for producing concretes in an economical way.

1.2 Different between artificial sand and natural sand

Parameters	M Sand	River Sand
Process	Manufactured in a factory.	Naturally available on river banks.
Shape	Angular and has a rougher texture. Angular aggregates demand more water. Water demand can be compensated with cement content.	Smoother texture with better shape. Demands less water.
Moisture Content	Moisture is available only in water washed M Sand.	Moisture is trapped in between the particles which are good for concrete purposes.

Production of M sand in plant

IIL ITERATURE REVIEW

2.1 Literature Reviewed

This chapter is all about the previous work done by so many researchers across the world. Substantial amount of works on this aspect have been carried out by great number of researchers in India and abroad. Some notable contributions in this direction in recent past have been made by scholars are presenting

Sahu A. K, in January 2003 study shows that There is increase in compressive strength modulus of rupture and split strength by replacing natural sand

with stone pressure west with 20 and 40 percent as fine aggregate.

H. Donza. O et al (2002) grew High-quality cement with various fine aggregate.. The test work is basically concerned about the investigation of mechanical properties like compressive quality, split rigidity and flexural quality of concrete by full substitution of regular sand by manufactured sand as fine aggregate. Tests were done on cubes, cylinders and unreinforced beams to consider the mechanical properties of cement.

Bhatty, J (2006) portrayed the high-volume utilization of fly ash as a raw material in the make of Portland concrete. This approach gives three basic advantages to concrete assembling and nature. To start with, being rich in silica, alumina, and iron, the fly ash can basically replace raw materials in concrete crude encourage, for example, shale and earth, which are generally mined or obtained. Second, the carbon content in fly fiery remains can give a fuel supplement to the vitality concentrated cement manufacturing process.

Chandrasekar R et al (2017) carried out for utilization of waste foundry sand (WFS) in High strength concrete. The waste foundry sand was replaced in the place of normal sand with four different percentages (10%, 20%, 30%, and 40%). The several tests such as compressive strength, split tensile strength, modulus of elasticity, flexural strength, ultrasonic pulse velocity (UPV), rebound hammer test, are performed for 7 days and 28 days to obtain the behavior the concrete due to foundry sand.

III OBJECTIVE

The scope of the present work includes the study of the following topics:

- To find out workability, compressive strength, split tensile strength and flexural strength of concrete specimens for Mix design for M 25 and M 30 grade concrete with various replacement levels of manufactured sand.
- To compare the strength characteristics using M sand and natural sand in concrete.
- To find out the optimum percentage of artificial sand to get maximum strength of concrete.
- Study on properties of fresh and hardened concrete with the replacement of fine aggregate by various proportions of manufactured sand.
- Durability studies on concrete for the optimum replacement level of manufactured sand.
- Experimental behavior of concrete with manufactured sand.

IV EXPERIMENT SETUP AND METHODOLOGY

4.1 The following materials are used during the research work-

- Cement
- Fine aggregates (Sand)
- Coarse Aggregates
- Artificial sand or Manufacturing sand
- Water

CEMENT

In the present work ordinary Portland cement of 53 grade is used for casting cubes for all concrete mixes.

FINE AGGREGATE

Sand is a naturally occurring granular material composed of finely divided rocks and mineral particles. The composition of sand is highly variable, depending on the local rock sources and conditions. Sand is a major component of concrete and without the sand concrete will not function as intended.Aggregates smaller than 4.75 mm and up to 0.075 mm are considered as fine aggregate.

COARSE AGGREGATE

Coarse aggregate are component of composite material such as concrete greater than 4.75 mm size.

WATER

Normal water is used in this experiment .It is free from any impurity and acid .

ARTIFICIAL SAND OR MANUFACTURING SAND

The Manufactured Sand (MS) is a by-product of the crushing and screening process in the quarries. Quarry generates considerable volumes of quarry fines while crushing the rock into aggregates. It is also referred to as crushed rock sand, stone sand, crusher sand and crushed fine aggregate. Manufactured sand / M-Sand is a fine aggregate, which is an Eco-friendly and economical alternative to river sand. It is manufactured by crushing suitable stones and are finely graded to match the IS standard requirements. There are three types of m sand that are produced. The properties of the M-sand are listed below:

M Sand Types	Sieve Size/ Granule Thickness	IS Codes	Water Absorption	Specific Gravity	Density (KN/m3)
Concrete M Sand	150 microns - 4.75 mm	IS - 383: 1970	2.2	2.59	15.1
Brick / Block Work M Sand	150 microns - 3.50 mm	IS - 2116 : 1980	-	-	-
Plastering M Sand	150 microns - 2.36 mm	IS - 1542 : 1992	2.1	2.63	15.1

RIVER AND M SAND

4.2 CASTING AND CURING OF TEST SPECIMENS

This Peper presents an experimental study of compressive , Split and flexural strength of concrete prepared with Ordinary Portland Cement, partially replaced by ground granulated blast furnace slag in different proportions varying from 0% to 50% of GGS Concrete for M20 and M30 grade of Concrete at room temperature for 7 ,14 and 28 day respectively

The specimens of standard cubes size 150 x150 x 150 mm

The Standard prisms size 100x100x500 mm

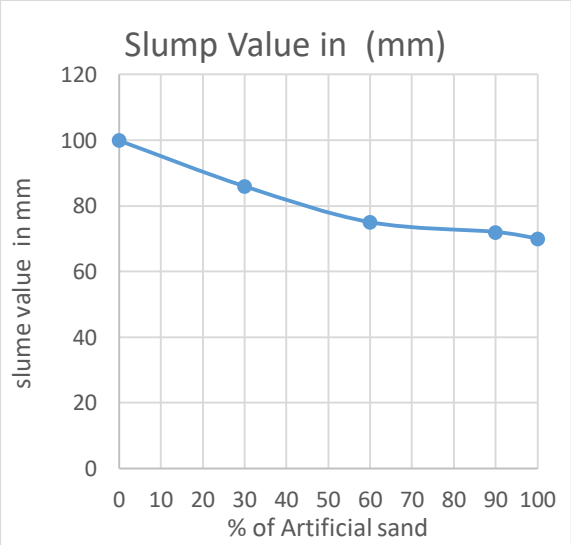
Standard cylinders of size 150x300 mm

V RESULTS AND DISCUSSION

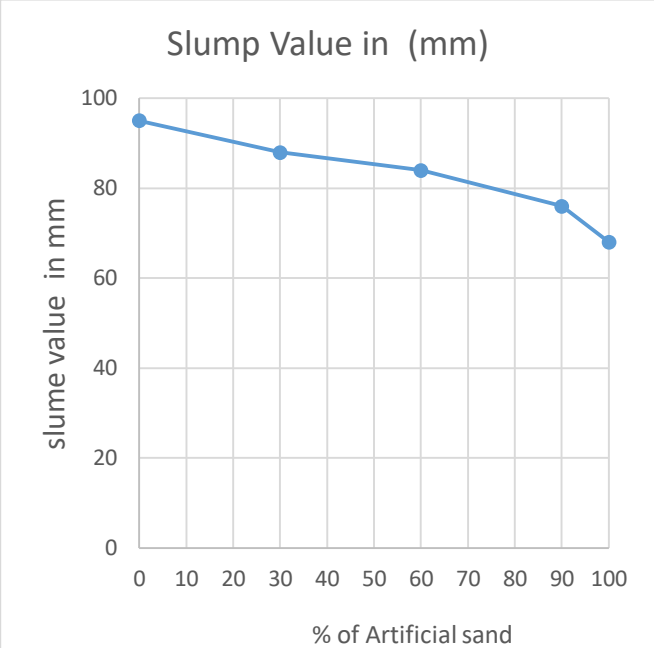
5.1 Workability

In this work the workability is tested by slump test. The workability is measured by removing the slump cone and measured the subsidence of the concrete this value is called the slump value of the concrete.

Workability of Concrete with Varying Proportion of Manufacturing Sand for M25



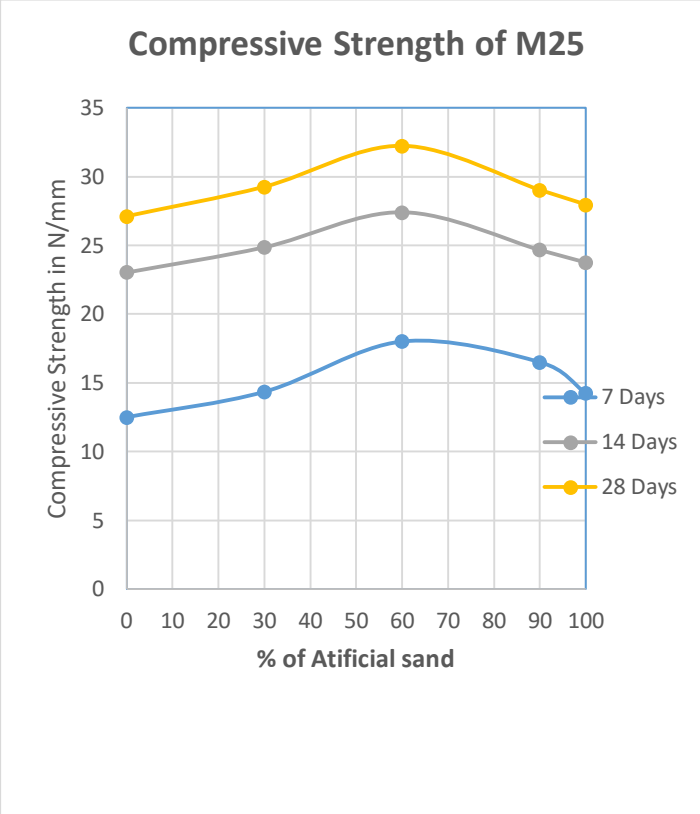
Workability of Concrete with Varying Proportion of Manufacturing Sand for M30



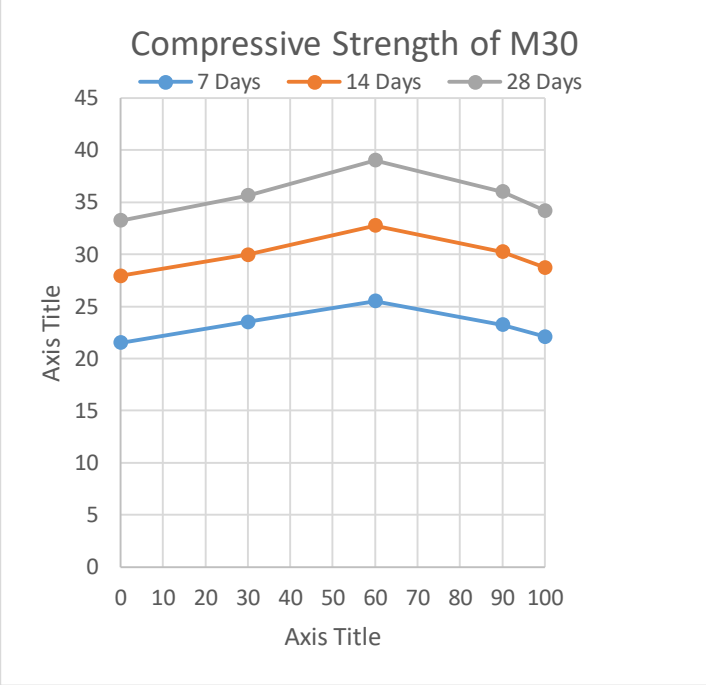
5.2 Compressive Strength Test Result

The Compressive strength test performed on specimen made during the work containing different percentage of copper slag and waste glass powder after curing period of 7, 14 and 28 days. The highest compressive strength achieved by 60% replacement level of Artificial sand which was found about 32.23 N/mm² for M25 And 39.01 N/mm² for M30 As compared with 27.10 N/mm² and 33.25 N/mm² for the control mix after 28 days of curing period.

Variation of compressive strength after7,14 28 days curing for M25



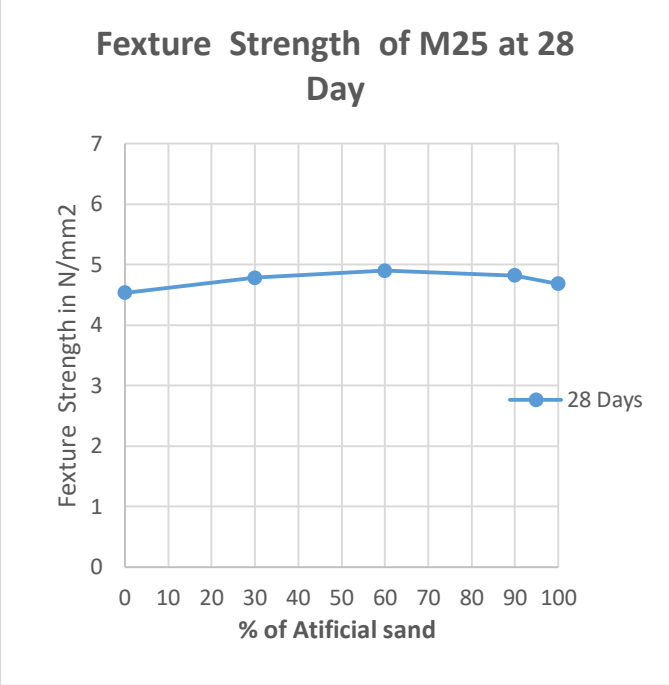
Variation of compressive strength after7,14 28 days curing for M30



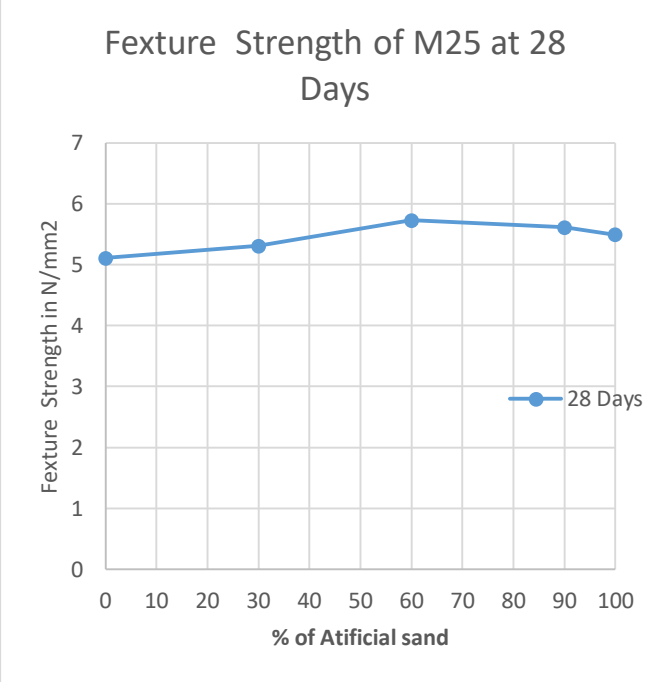
5.3 Flexural Strength Test Result

The flexural strength for beams at different replacement percentages of manufactured sand with fine aggregates in 28 days of curing periods for concrete of M25 and M30 quality was determined. If the percentage of Artificial sand increased by 60% and 80% the flexural strength of concrete decreases. The highest flexural strength achieved by 60% replacement level of Artificial sand which was found about 4.9 N/mm² for M25 And 5.71 N/mm² for M30 As compared with 4.3 N/mm² and **5.1** N/mm² for the control mix after 28 days of curing period

Flexural strength after 28 days curing for M25

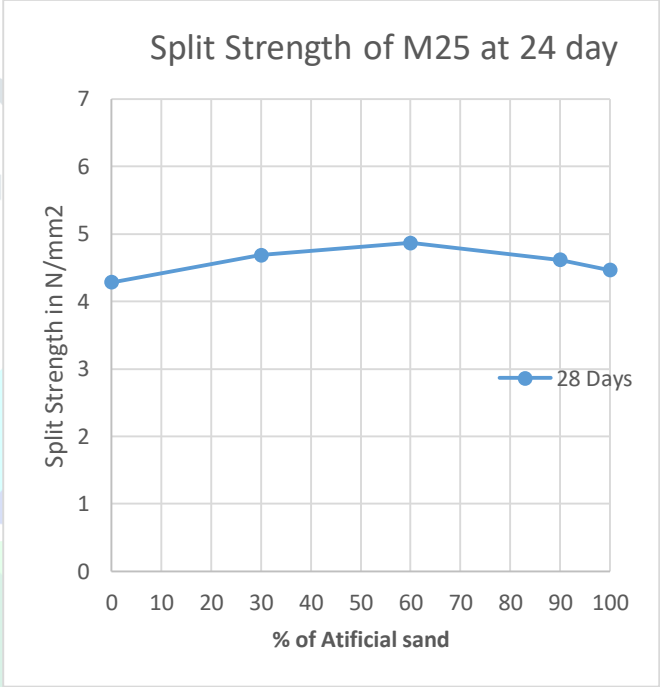


Flexural strength after 28 days curing for M30



aggregates in 28 days of curing periods for concrete of M25 and M30 quality was determined. The highest split tensile strength achieved by 60% replacement level of Artificial sand which was found about 4.8 N/mm² for M25 And 5.8 N/mm² for M30 As compared with 4.2 N/mm² and **4.7** N/mm² for the control mix after 28 days of curing period.

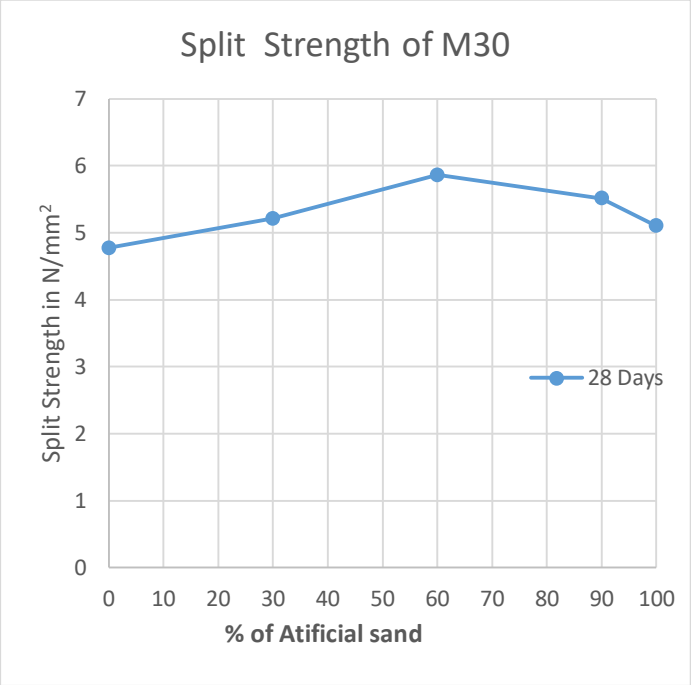
Split tensile strength after 28 days curing for M25



5.4 Split tensile Strength Test Result

The split tensile strength for cylinders at different replacement percentages of sand with fine

Split Tensile strength after 28 days curing for M30



VI CONCLUSION

From the experimental investigation carried out for present dissertation work, following salient conclusion can be drawn.

- The workability of concrete decreases , as the percentage of artificial Sand increases in the concrete mix.
- Fine aggregate can be replaced up to 60% by artificial Sand in concrete mix, beyond 60% the strength of concrete starts decreasing compared with control mix.
- It is observed that the highest compressive strength of concrete achieved at 60% replacement level 28 days of curing is 32.23 N/mm2 for M25 and 39.01 N/mm2 for M30
- It is observed that the highest split Strength of concrete achieved at 60% replacement level 28 days of curing is 3.9 N/mm2 for M25 and 4.5 N/mm2 for M30
- It is observed that the highest Fexture of concrete achieved at 60% replacement level 28 days of curing is 4.9 N/mm2 for M25 and 5.87 N/mm2 for M30
- It is observed that Artificial Sand can be effectively used as fine aggregate in concrete mix.
- The use of Artificial Sand reduces the consumption of natural river sand as well as cost of construction

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