International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 08 | Aug 2023 www.irjet.net p-ISSN: 2395-0072

TO STUDY THE PROPERTIES OF CONCRETE PREPARED USING ARTIFICIAL SAND WITH FULL REPLACEMENT OF NATURAL SAND IN MIX

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Abstract – *The stress on the natural resource for the development of concrete for construction of building, bridges, and highways is increasing rapidly. The natural resources are depleting at the faster rate, keeping in mind we have to look for alternative approach which lessen the stress on natural resources such as sand being an important material in the development of concrete. With that aim to contribute, our project in which natural sand is being replaced partial up to 20%, 60 % as well whole replacement i.e. 100% has been done by the artificial sand prepared in the nearby crusher plant used for the preparation of M35 and M40 grade concrete.*

In the present scenario we have been looking for alternatives in such order the artificial sand has proven to be one suitable substitute to the natural occurring sand. The origin of artificial sand is man made in the stone crusher in the form of preferred size. Not just the size we can prepare the artificial sand in the required smooth textured and well graded. In the term cost, artificial sand is found to be cheap and easily available as compare to the natural sand in local areas.

The experiment including workability, sieve analysis, compression strength and split tensile strength has been performed over the different %percentage whose result has been discussed in proceeding.

Keywords- *Natural Sand, Artificial Sand, Concrete Mix, Compressive Strength, Split Tensile Strength.*

1. INTRODUCTION

Natural sand is a admixture of small grains of gemstone and grainy accoutrements which is substantially defined by size, being finer than clay and coarser than ground. And ranging in size from0.06 mm to 2 mm. patches which are larger than0.0078125 mm but lower than0.0625 mm are nominated ground. Beach is made by corrosion or broken pebbles and riding of jewels, which is carried by swell or gutters. And indurating and deliquescing during the downtime break gemstone up the beach will be made. occasionally Beach on strands can also be made by small broken-up pieces of coral, bone, and shell, which are broken up by bloodsuckers and also bombarded by the ocean, and indeed bitsy pieces of glass from bottles discarded in the ocean and other mineral accoutrements or the bones of fishes or other oceanic creatures. Beach soli are characterized as class of soil or soil type. A flaxen soil containing further than 85 percent beach- sized patches by mass. Beach is principally made of loose grainy accoutrements conforming of either gemstone fractions or mineral patches or oceanic accoutrements . It's substantially made of silicate minerals and silicate gemstone grainy patches. generally quartz is the most dominant mineral then as it possesses largely resistant parcels to rainfall. Other common gemstone- forming minerals like amphiboles and micas also set up in beach. Heavy minerals similar as tourmaline, baguette, etc can also be present in the beach in lower attention. But from a high position, utmost beach on the sand is made up of argentine or tan quartz and feldspar. still, the most common mineral in the beach is quartz – also known as silicon dioxide. This formation can only exist when silicon and oxygen combine at faster rate. Feldspar is the most set up group of minerals on the earth's face and forms about 65 of the terrestrial jewels. When the wind and ocean scourge over on the props, they transport these teeny- bitsy grains to the sand and make up the beach with this combination.

2. MATERIAL

The materials used in this work can be broadly classified as base material, filler material and binder. The combination of both inert and reactive materials in a fixed proportion is used for this study. The various materials used in this work are discussed with their properties and with the test results as follows.

2.1 Cement: Ordinary Portland Cement of 53 grade was used in this study which was provided by Ultratech Cements Ltd. The value of specific gravity of the cement Ordinary Portland Cement of 53 grade is 3.15 as per IS: 12269- 1987.

2.2 Aggregates: There are two types of aggregate being used for the experiment: Fine aggregate and course aggregate. The Fine aggregates used in this research are taken from nearby river tributary of Beas having max size of 4.75mm. Coarse aggregates used are of crushed stone from the nearby crusher such that the stone passing through 20mm IS sieve and retained on 4.75mm IS sieve.

2.3 Natural Sand

The fine aggregate (FA) taken for this work is the locally available crushed sand sourced from a quarry nearby area in Rehan HP, India. Sand particles passing through IS sieve of 4.75 mm were used in this work. The natural sand used was tested in the laboratory as per specifications recommended by IS: 383-1970 respectively. Natural sand for the experiment was obtained from nearby river Beas and available in the local market. The physical properties of natural sand are as below:

Property	Natural Sand
Specific Gravity	2.6
Fineness Modulus	2.78
Bulk Density kn/m3	15.60
Zone	II

Table 1: Properties of Natural Sand

2.4 Artificial sand

The artificial sand obtained from the local crusher was used. The physical properties of artificial sand are as below:

Property	Artificial
Specific Gravity	2.90
Fineness Modulus	2.97
Bulk Density kn/m3	17.62
Zone	II

Table 2: Properties of Artificial Sand

2. Methodology

Initially, M40 grade concrete is prepared as per the mix proportion. The casting of the specimens for the experiment was done using standard equipment in the laboratory. Each batch consisted of standard cubes and Beams. For Standard cubes for determination of 7-days and 28-days compressive strength of each batch. Preparation of each batch of concrete mixed required the quantities of various ingredients i.e. cement content, fine aggregate, coarse aggregate, water were kept ready in required proportions. We started mixing the sand nad cement thoroughly to get a uniform mix such that concentration of other material is not visible. Clear water free from impurities and admixture was added slowly to get a uniform mix.

The moulds for casting the specimens were cleaned, brushed and oiled and placed on vibrating table are shown below with a speed range of 12000± 400 r.p.m. and an amplitude range of 0.055 mm. The homogenous concrete mix, already prepared was placed in the specimen moulds 150x150x150mm^3 for compressive strength and 300 x 150 mm for flexure strength in three layers, each layer vibrated properly. The excess concrete at top of the mould was struck off with a wooden Straight edge and top finished by a trowel as shown in below. The specimens were marked with their respective designations after 3 hours of setting and were allowed to set in the moulds for 24 hours. Subsequently the specimens were remolded and immersed in fresh water for curing.

3. TESTING AND RESULTS

The concrete mix was designed for M40 grade and the mix design was done. Mix design for concrete was made considering the properties of constituents of concrete such as fine aggregate and coarse aggregate, water, cement. Different concrete mixes with varying percentage of the artificial sand were produced, replacing 20%, 60%, and 100% fine aggregate in terms of weight. Cubic specimens of 150 mm size were casted for compressive strength test and tamping was done as per Indian standard. For the experiment number of cubes was casted and cured at standard temperature until the time of rest. Test specimens of size 300 *150 mm were prepared for testing of the split tensile strength of concrete. The concrete mixes were cast into cubes and cylinders for subsequent testing. In this study, to make concrete, cement and fine aggregate were first mixed dry to uniform color and then coarse aggregate was added and mixed with the mixture of cement and fine aggregates.

3.1 COMPRESSIVE STRENGTH

The cube of specimens of size 150 *150* 150 mm was prepared in the laboratory for testing of compressive strength concrete. The specimens casted were tested after 7 and 28 days of curing after the water is dried under room temperature. All the precaution was taken before and after testing. The results obtained are:

Sr no.	Artificial Sand	Natural Sand	Concrete grade	Average compressive strength N/mm²	
				7 days	28 days
1	00	100	M40	32.80	44
2	20	80	M40	34.11	42
3	60	40	M40	35.39	45.87
4	100	0	M40	31.92	41.90

Table 3: Average compressive strength N/mm²

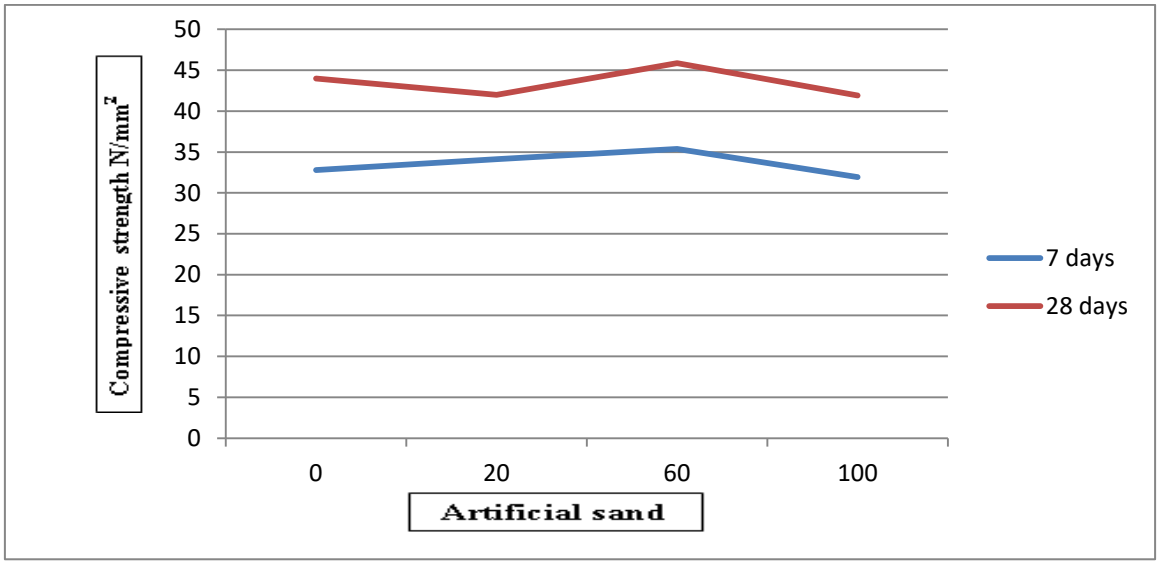

Fig 1: Comparison of compressive strength after 7 & 28 days of curing

3.2 SPLIT TENSILE STRENGTH

The cylinder specimens of size 300 *150 mm were prepared for testing of the split tensile strength of concrete in the laboratory. The specimens casted were tested after 7 and 28 days of curing after the water is dried under room temperature. All the precaution was taken before and after testing. The results obtained are:

Sr no.	Artificial Sand	Natural Sand	Concrete grade	Average Split Tensile strength N/mm²	
				7 days	28 days
1	00	100	M40	3.30	4.60
2	20	80	M40	3.50	4.95
3	60	40	M40	3.58	5.02
4	100	0	M40	3.25	4.58

Table 4: Average Split Tensile strength N/mm²

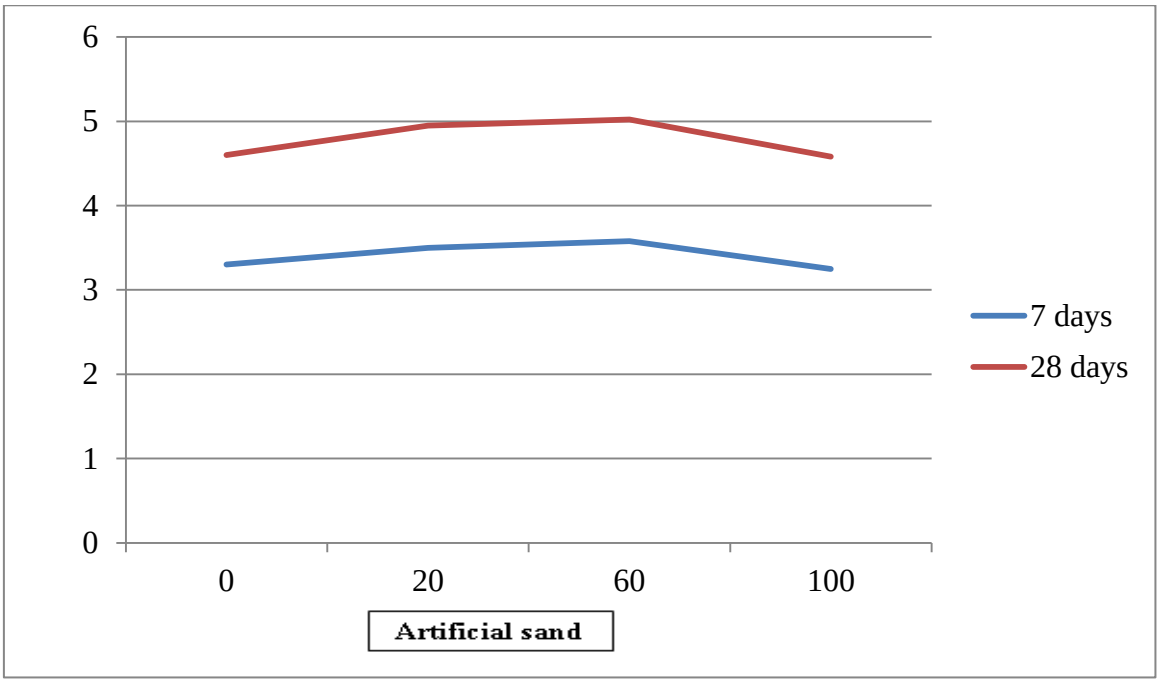

Fig 2: Comparison of split tensile strength after 7 & 28 days of curing

3. CONCLUSIONS

The conclusion based on experimental result is as below.

1. It is observed that the optimum replacement of natural sand by artificial is approximately is 60% in the both cases as testing done after 7 and 28 days respectively.

2. There is consistent increase in strength of concrete by replacing natural sand with artificial sand up to 60%. A decline in the strength of concrete after testing done after 28 days has been observed.

3. For optimum replacement At 60% artificial sand and 40% natural sand the % increase in compressive strength is about 8%,.

4. For optimum replacement At 60% artificial sand and 40% natural sand the % increase in split tensile strength is about 11.40%.

5. It has been observed the shape of the particle i.e. sharp edges of particle in artificial sand provided better bond with cement than natural sand.

6. The cost of artificial sand is less than that of natural sand. So, artificial sand can be recommended over the natural sand as a substitute up to the grade M40.

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