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FEASIBILITY OF ARTIFICIAL SAND IN CONCRETE

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Abstract

The paper presents the study of replacement of natural sand with artificial sand in concrete. Conventionally concrete is a mix of cement, sand and aggregate. There is a large variation in strength of concrete due to variation in strength of aggregate. There is a scarcity of natural san d due to heavy demand in construction activities which forces to find suitable substitute. The cheapest and easy way of getting substitute for natural sand is sand which is produced from quires tone by crusher prepared specially so as to get cubical, smooth textured, well graded particles of fine aggregate is called Artificial Sand. This paper presents the feasibility of artificial sand in concrete for the purpose of experimentation. Concrete mixes are designed for M20 and M25 grade by 0 to 100% with increment of 20% replacement of natural sand by artificial sand. Compressive and tensile tests are conducted to study the strength of concrete for above replacement. With natural sand deposits the worlds over drying up, there is an acute need for a product that matches the property of natural sand in concrete. In last 15 years it has become clear that the availability of good quality natural sand is decreasing. With the few local exceptions, it seems to be global trend Existing natural sand deposits are being emptied at the same rate as the urbanisation and new deposits are located either underground, too close to already built up areas or too far away from the areas it is needed, that is, the towns and cities where manufacturers of concrete are located.

Keywords: *Natural Sand, Artificial sand, Aggregate, Feasibility.*

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1. INTRODUCTION

We cannot imagine the structures without concrete. Concrete is the main constituent of the Civil Engineering structures. It is becoming the backbone of infrastructural development of the whole world. Concrete has capacity to enhance its properties with the help of other suitable constituents. Approximately 80% of total volume of concrete is made up of aggregates. Aggregates characteristics (size, shape, texture, grading) influence the workability, finish ability, bleeding and segregation of fresh concrete and durability of hardened concrete. Fine aggregates may be one of the following types; Natural sand, crushing natural gravels, crushing hard stones (artificial sand).

With natural sand deposits the worlds over drying up, there is an acute need for a product that matches the property of natural sand in concrete. In last 15 years it has become clear that the availability of good quality natural sand is decreasing. With the few local exceptions, it seems to be global trend Existing natural sand deposits are being emptied at the same rate as the urbanisation and new deposits are located either underground, too close to already built up areas or too far away from the areas it is needed, that is, the towns and cities where manufacturers of concrete are located. Environmental concerns are also being raised against uncontrolled extraction of natural sand. This is the situation for the construction industry today and most will agree that it will not change dramatically in the nearest future.

1.1Necessity

The huge quantity of concrete is consumed by construction industry all over the world. In India, the conventional concrete is produced by using natural sand, cement, coarse aggregate, fibre and water. One major challenge facing the civil engineering community is to execute projects in harmony with nature using the concept of sustainable development involving the use of high performance, environment friendly materials produced at reasonable cost. In the context of concrete, which is the predominant building material, it is necessary to identify less expensive substitutes.

Fig. 1: Artificial Sand

2. LITERATURE REVIEW

2.1. *S. A. Daimi* "The mixes with the artificial sand with dust as fine aggregate gives consistently higher strength than the mixes with natural sand. The sharp edges of the particles in artificial sand provide better bond with the cement than the rounded part of the natural sand." *Published*: International Journal of Earth Sciences and Engineering ISSN 0974-5904, Volume 04, No 06 SPL, October 2011, pp 823-8

2.2. N. K. Deshpande, Dr. S. S. Kulkarni, H. Pachpande : "Target strength of 26.6 N/mm2 can be achieved for M20 grade of concrete by 100% replacement of recycled coarse aggregates.100% replacement of recycled coarse aggregate with river sand exhibited a increase of 3.82% in compressive strength and concrete with RCA-20mm and RCA-10mm and AS showed a increase of 4.20% as compared to target strength. A mix grading of 20mm and 10mm of aggregates can be done for economic perspective and also higher strength. Thus use of river sand and artificial sand with 100% replacement of recycled coarse aggregate can be used for low strength applications. Use of artificial sand in concrete can be a viable option due to the scarcity of river sand. 5. Split tensile test and Flexural strength both are tests for tensile strength of concrete. Concrete made by using recycled aggregates showed slightly lower values of tensile strength as well as flexural strength, hence the loss in tensile strength should be considered while designing members using recycled aggregate concrete. Published: International Journal of Engineering Research and Applicatio. (IJERA) ISSN: 2248-9622 Vol. 2, Issue 5, September-October 2012, Pp.038-04.

2. LITERATURE REVIEW

2.1.Aim

This project is executed with the aim "to check the feasibility of jute fiber in optimum replacement of natural sand with artificial sand ". This aim is undertaken to check the compressive strength and workability of the concrete after replacing the natural sand by artificial sand so as to find the best and the good competitive for the natural sand.

2.2. Objectives

1) To check the feasibility of artificial sand in reinforced concrete.
2) To discover a good and competitive replacement for natural sand.
3) To find optimum replacement of artificial sand with natural sand.
4) To design the concrete mix proportion of M20 for the 65 % artificial sand.
5) To achieve the specified characteristic compressive strength of 7 days and 28 days period by natural sand replacement (of casted cube)

3. FINDINGS OF STUDY

3.1. Cement

Ordinary Portland cement of 53 grades confirming to IS 12269-1987 was used. The typical properties were tabulated as follow.

Table 1: Properties of cement

Sr. No.	Property	Value
1	Specific gravity	3.12
2	Fineness m^3/kg	315
3	Normal consistency	37%
4	Initial setting time	180 minute
5	Final setting time	220 minute
6	Soundness	1.5mm
7	7 days compressive strength	33.25 MPa

3.2. Fine Aggregate

Natural sand obtained from the river and normally available in the market was used. The artificial sand obtained from the local crusher was used. The physical properties of natural sand and artificial sand and sieve analysis are listed below confirming to IS 383-1970.

Table 2: Properties of Natural Sand and artificial sand

Property	Natural Sand	Artificial Sand
Specific Gravity	2.6	3.05
Bulk Density kN/m^3	15.60	17.62
Fineness Modulus	2.78	3.05

Table 3: Sieve analysis of natural sand and artificial sand

IS Sieve	Percentage Passing	
	Natural Sand	Artificial Sand
4.75mm	96.2	95
2.36mm	88.4	78
1.18mm	65.8	55
600micron	47.1	40
300 micron	19.6	20
150 micron	5	12

3.3. Coarse Aggregate

The physical properties of these coarse aggregate are given below.

Table 4: Physical Properties of coarse Aggregate

Sr. No.	Property	Value

1	Specific Gravity	3.10
2	Bulk Density KN/M^3	16.10
3	Fineness modulus	7.57

Table 5: Sieve analysis of coarse aggregate

IS sieve	Percentage passing
40mm	100
20mm	60
10mm	30
4.75mm	00
2.36mm	00
1.18mm	00
600micron	00
300micron	00
150micron	00

Table 6: Quantity of materials used

Sr. No.	Grade of concrete	M20
1	Cement Kg/m^3	360.84
2	Fine Aggregate Kg/m^3	651.71
3	Coarse Aggregate (10mm and 20mm) Kg/m^3	1210.30
4	Water litre/m^3	180.42
5	Water cement ratio	0.50
6	Cement Aggregate ratio	1:5.16
7	Compaction Factor	0.89

3.4.Tests On Ingredients Of Concrete

3.4.1. Cement

Table 7: Tests conducted on cement

Sr. No.	Tests
1	Consistency Test
2	Initial Setting Time
3	Final Setting Time
4	Sieve Test

3.4.2. Sand

Table 8: Tests conducted on sand

Sr. No.	Tests
1	Fineness Modulus
2	Specific Gravity
3	Bulking of Sand

3.4.3. Artificial Sand And Coarse Aggregate

Table 9: Tests conducted on sand and aggregate

Sr. No.	Tests
1	Fineness modulus
2	Specific gravity
3	Impact test

4. CONCLUSION

Yes, fine aggregate the artificial sand can be used as a replacement for the natural sand i.e. artificial sand. The results have shown that the natural sand can be replaced with artificial sand up to a maximum replacement level of 35-65% in order to produce concrete of satisfactory workability and compressive strength and also with cracks of lesser areas. Result has shown that, after replacing natural sand up to the level 35to 65% maximum strength of concrete can be achieved i.e. 65 N/mm^2. And this strength gives the required characteristic strength for the M20 grade of concrete hence, artificial sand can be recommended as a good and a competitive substitute for natural sand, thus reducing the use of natural sand.

Table 10: Test Results of compressive strength

Sr. No.	% Artificial Sand	% Natural Sand	Compressive Strength N/Mm^2	
			7 Day	28 Day
1	00	100	26.21	31.58
2	20	80	26.69	31.58
3	40	60	27.69	32.29
4	60	40	27.70	40.88
5	80	20	27.70	39.11
6	100	00	26.54	35.15

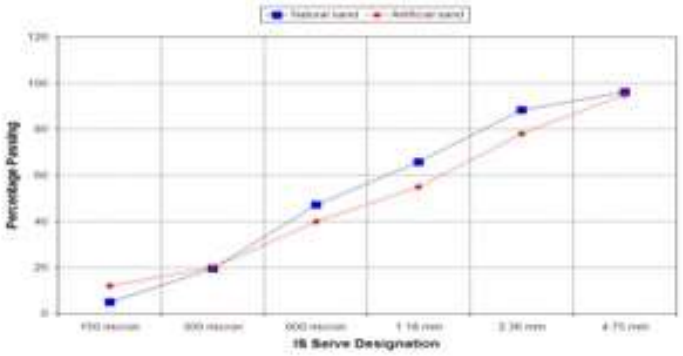

Fig. 2: Sieve analysis of natural and artificial sand

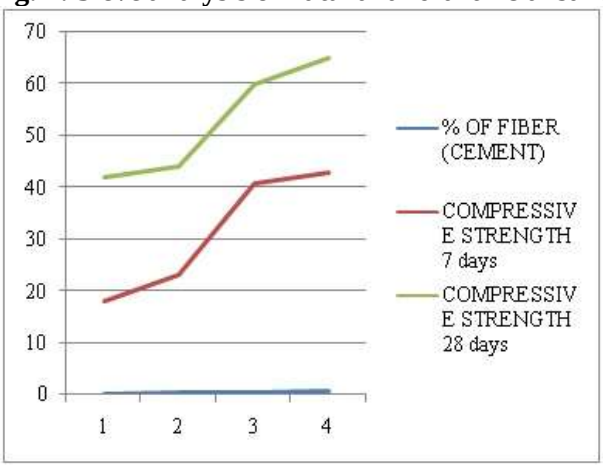

Fig. 3: Graphical Representation Of Compressive Strength Of Concrete For M20 Grade

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