

**INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH
TECHNOLOGY****EXPERIMENTAL STUDY OF EFFECT OF ARTIFICIAL SAND AND
AGGREGATES ON COMPRESSIVE STRENGTH AND WORKABILITY OF
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DOI: 10.5281/zenodo.155101

ABSTRACT

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.

In this dissertation, attempt has been made to determine and verify experimentally the effect of artificially graded sand and demolished concrete structural aggregates on compressive strength and workability of concrete. Artificial sand is manufactured from crushing of local chury, stone chips and demolished concrete fines while the artificial aggregates are prepared from demolished structures. In the first phase of the study, the specimen of standard cube of (150 mm x 150 mm x 150 mm) was used to determine the compressive strength of concrete with natural sand and stone aggregates. The specimens were tested for each nominal mix and definite water cement ratio. Three cubes were prepared for obtaining average of 7, 14 and 28 days strength of concrete. In the second phase of the study, another specimen of standard cube same size was used to determine the compressive strength of concrete with artificial sand with full replacement and demolished concrete structure aggregates. The specimens were tested again for obtaining average of 7, 14 and 28 days 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.

KEYWORDS: Concrete, Artificial Sand, Cubes etc.**INTRODUCTION**

Structures are founded with concrete and steel materials mainly. Concrete is a main constituent of the Civil Engineering structures. It is becoming the backbone of infrastructural development of whole world. Concrete has capacity to enhance its properties with the help of other suitable constituents. The concrete is the most important construction material, which is manufactured at site. It has the advantage of being formed into any desired shape most conveniently. As it is artificially manufactured at site it has wide uses in various construction works.

As an importance of the use of waste materials, number of research is currently being conducted concerning the use of artificial sand in increasing the workability and strengthening of reinforced cement concrete and plain cement concrete members. The main disadvantages of concrete are brittleness, low tensile strength, less resistance to cracking, plastic and drying shrinkage properties. Approximately 70 to 80% of the total volume of the concrete is made up of mainly aggregates. Aggregates characteristics (size, shape, texture, grading) influence the workability, finish ability, bleeding, and segregation of fresh concrete and durability of hardened concrete. Environmental concerns are also being raised against uncontrolled extraction of natural sand. The arguments are mostly in regards to protecting riverbeds against erosion and the importance of having natural sand as a filter for ground water.

First of all in this thesis work literature review based on workability and compressive strength of concrete and artificial sand as experimental investigations are studied and need of the study is included. In the first phase of the study concrete mix design procedure is adopted for M15, M20 and M25 grade of concrete. For the determination of mix design various properties of concrete ingredients is conducted in the laboratory and results are recorded.

ARTIFICIAL SAND

Artificial Sand: It was collected from cement pipe factory from khargone which is being used in RCC hume pipe locally called as chury. The sand must be of proper gradation (it should have particles from 150 microns to 4.75 mm in proper proportion) When fine particles are in proper proportion, the sand will have less voids.



METHODOLOGY

Methodology is the process of performing any work in proper manner i.e. step by step procedure of work. This procedure of methodology is shown in following steps;

- a) Procurement of material
- b) Material testing
- c) For specific gravity and Fineness
- d) Arriving mix proportion
- e) Cube Casting
- f) Curing of specimens
- g) Strength test 7 days

The specimen of standard cube of (150 mm x 150 mm x 150 mm) was used to determine the compressive strength of concrete. Three specimens were tested for 7, 14 and 28 days with varying proportion of manufactured sand replacement. The constituents were weighed and the materials were mixed in a mixer. The mixes were compacted with the help of tamping rod. The specimens were de molded after 24 h, cured in water for 7, 14 and 28 days, and then tested for its compressive strength as per Indian Standards.

Materials:

Cement: JK Cement PPC (43 grade).

Setting Time of Cement Used: Initial setting time 30 min Final setting time 600 min

EXPERIMENTAL WORK

In this research work an attempt has been made to determine and verify experimentally the effect of artificially graded sand and demolished concrete structural aggregates on compressive strength and workability of concrete. Artificial sand is manufactured from crushing of local chury, stone chips and demolished concrete fines while the artificial aggregates are prepared from demolished structures.

In the first phase of the study, the specimen of standard cube of (150 mm x 150 mm x 150 mm) was used to determine the compressive strength of concrete with natural sand and stone aggregates. The specimens were tested for each nominal mix and definite water cement ratio. Three cubes were prepared for obtaining average of 7, 14 and 28 days strength of concrete.

In the second phase of the study, another specimen of standard cube of (150 mm x 150 mm x 150 mm) was used to determine the compressive strength of concrete with artificial sand with full replacement and demolished concrete structure aggregates. The specimens were tested for each nominal mix and definite water cement ratio. Three cubes were prepared for obtaining average of 7, 14 and 28 days strength of concrete.

MANUFACTURING OF CONCRETE

A. With Natural River Sand only

A.1. M15 (1:2:4)

Cement Used: 3.86 Kg

Sand Used: 7.72 Kg

Coarse Aggregates Used: 15.44 Kg

9.27 kg (15 mm passing, 10 mm retaining) +
6.176 kg (10 mm passing)

Water Used: 1.93 kg (0.5 W/C)

A.2. M20 (1:1.5:3)

Cement Used: 5 Kg

Sand Used: 7.5 kg

Coarse Aggregates Used: 15 Kg

9 kg (20 mm passing ,10 mm retaining) + 6 kg
(10 mm passing)

Water Used: 2.5 kg (0.5 W/C)

A.3. M25 (1:1:2)

Cement Used: 6.75 Kg

Sand Used: 6.75 Kg

Coarse Aggregates Used: 13.5 Kg

8.1 kg (20 mm passing, 10 mm retaining) + 5.4
kg (10 mm passing)

Water Used: 3.375 kg (0.5 W/C)

B. With Artificial Sand and Aggregate only

B.1. M15 (1:2:4)

Cement Used: 3.86 Kg

Artificial Sand Used: 7.72 Kg

Coarse Aggregates Used: 15.44 Kg

9.27 kg (15 mm passing, 10 mm retaining)
+ 6.176 kg (10 mm passing)

Water Used: 1.93 kg (0.5 W/C)

B.2. M20 (1:1.5:3)

Cement Used: 5 Kg

Artificial Sand Used: 7.5 kg

Coarse Aggregates Used: 15 Kg

9 kg (20 mm passing ,10 mm retaining) +
6 kg (10 mm passing)

Water Used: 2.5 kg (0.5 W/C)

B.3. M25 (1:1:2)

Cement Used: 6.75 Kg

Artificial Sand Used: 6.75 Kg

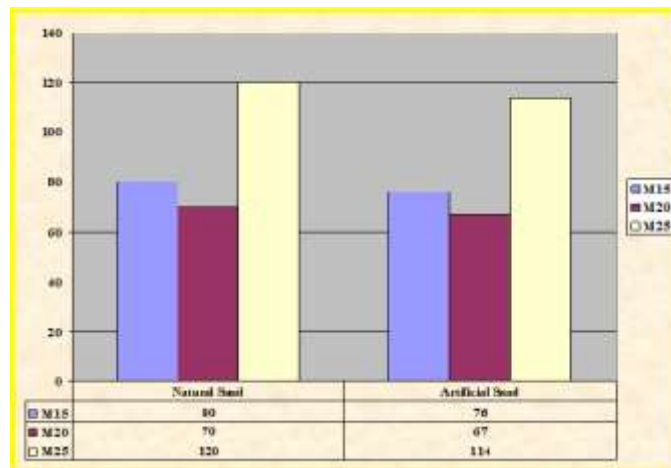
Coarse Aggregates Used: 13.5 Kg
8.1 kg (20 mm passing, 10 mm retaining)
+ 5.4 kg (10 mm passing)
Water Used: 3.375 kg (0.5 W/C)

RESULT

After the specimen of standard cube of (150 mm x 150 mm x 150 mm) was used to determine the compressive strength of concrete. Three specimens were tested for 7, 14 and 28 days with varying proportion of manufactured sand replacement. The constituents were weighed and the materials were mixed in a mixer. The mixes were compacted with the help of tapping rod. The specimens were de molded after 24 h, cured in water for 7, 14 and 28 days, and then tested for its compressive strength as per Indian Standards. Following results were obtained and summarized below:

WORKABILITY

The workability of the mixes was determined using a slump cone test having same water cement ratio for all the three mix design (M15, M20, and M25). Workability is determined by Slump Cone Test.



MIX	Cube with Natural sand	Cube with Artificial Sand
M15	80 mm	76 mm
M20	70 mm	67 mm
M25	120 mm	114 mm

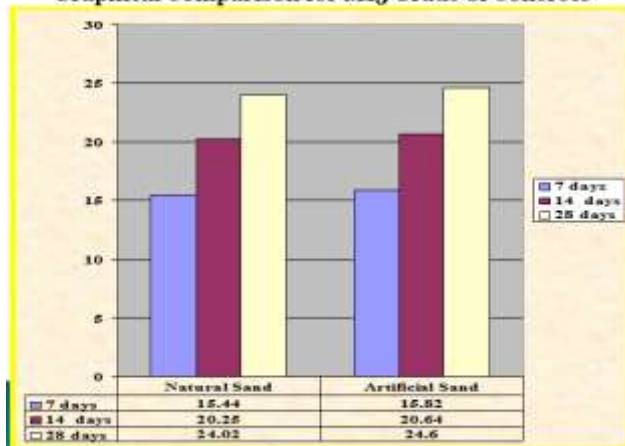
Case1: Concrete cubes with Natural Sand.

S No	Mix	W/C Ratio	Slump (mm)	For Natural Sand: Average Compressive Strength in N/mm ²					
				7 Days	Avg.	14 Days	Avg.	28 Days	Avg.
1	M15	0.5	110	15.28	15.44	20.15	20.25	24.00	24.02
				15.64		20.45		23.90	
				15.78		20.30		24.40	
2	M20	0.5	140	12.00	13.00	18.16	18.26	22.2	22.31
				13.00		18.24		22.5	
				13.98		18.37		22.2	
3	M25	0.5	130	12.12	12.32	28.3	28.45	33.45	33.61
				12.26		28.6		33.56	
				12.26		28.4		33.78	

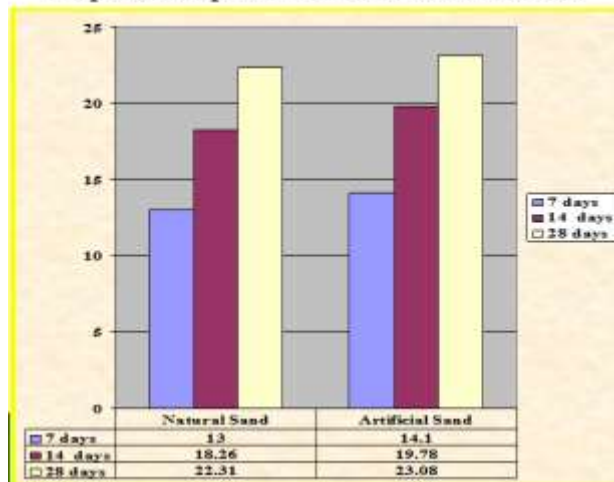
Case2: Concrete Cubes with Artificial sand.

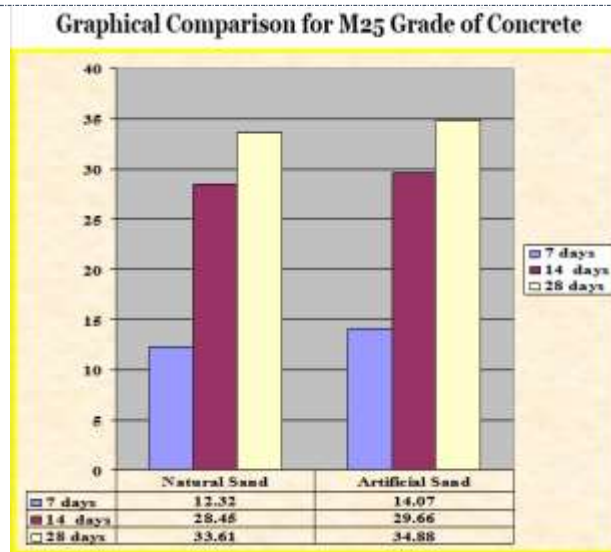
S No	Mix	W/C Ratio	Slump (mm)	For Artificial Sand: Average Compressive Strength in N/mm ²					
				7 Days	Avg.	14 Days	Avg.	28 Days	Avg.
1	M15	0.5	110	15.78	15.82	20.25	20.64	24.00	24.60
				16.14		20.85		24.00	
				15.88		20.70		25.80	
2	M20	0.5	140	14.00	14.10	19.16	19.78	23.2	23.08
				13.90		19.84		22.8	
				14.18		19.52		23.28	
3	M25	0.5	130	14.12	14.07	29.38	29.66	34.45	34.88
				14.26		29.96		35.56	
				13.26		30.4		34.78	

Graphical Comparison for M15 Grade of Concrete



Graphical Comparison for M20 Grade of Concrete





CONCLUSIONS

On the basis of the experimental results obtained the following conclusions may be drawn:

1. In Case of 100% replacement of natural sand by artificial sand, it is found that the compressive strength of the concrete for all grades increases.
2. Bonding strength increases due to fineness of artificial sand. Increase in bonding strength results to increase in stiffness.
3. Workability reduces slightly with the replacement of natural sand by artificial sand. To increase the workability plasticizer can be used.
4. Results show that the river sand can be fully replaced by artificial sand. Proves to be economical in terms of availability.
5. Concrete with artificial sand and aggregates design results are satisfactory.
6. Cube strength of Narmada sand concrete is found to be less than artificial sand.
7. Workability is more in case of natural sand made concrete as compared to artificial sand. Results obtained after validation were satisfactory.

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