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Study on Strength of Concrete Using Robo Sand as a Partial Replacement of Fine Aggregate

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Abstract
Robo sand is one of the most used among such materials to replace river sand, which can be used as an alternative to fine aggregate in concrete. In the present investigation workability and strength of concrete was evaluated by replacement of natural sand by Robo sand in proportions of 0%, 50%, 75%, and 100% is studied for M25and M35grade concrete cubes, cylinders and prisms. Slump cone method is taken for finding workability. For strength parameters for each grade of concrete Cubes, Cylinders and Prisms were casted and tested at the age of 7 and 28 days. In this present experimental study on concrete having grades of M25 and M35 are prepared by replacing natural sand by Robo sand. Concrete specimens were tested for evaluation of compressive strength and water absorption.

I. INTRODUCTION

Fine aggregate is essential component of concrete and cement mortar. So, need for clean sand in the construction from the point of view of durability of structures. As the demand for Natural River sand is surpassing the availability, has resulted in fast depletion of natural sand sources. Robo sand is the answer for this problem especially when some states have already banned the use of river sand for construction. As per reports, Robo sand is widely used all around the world and technicians of major projects around the world insist on the compulsory use of Robo sand because of its consistent gradation and zero impurity.

The main objective of the present thesis was to systematically study the workability, strength of concrete with Robo sand and percentage replacement of Robo sand by river sand by 0%, 50%, 75%, and 100% respectively. The study was carried out on M25 grade concrete with 0.48 water cement ratio, M35 grade concrete with 0.43 water cement ration, cement mortar and were prepared with water cement ratio of 0.45. Robo sand can be used as fine aggregate, but it has to satisfy the technical requisites like workability and strength. On this aspects research on concrete, cement mortar and with Robo sand is scarce, so this paper investigates the concrete produced with Robo sand.

II. LITRATURE REVIEW

Previous Studies

Ilangovanaet al.(2008) studied the feasibility of usage of Robo Sand as hundred percent substitutes for natural sand in concrete. Mix design has been developed for three grades using design approach of IS, ACI, USBR, RN.No.4 and BRITISH codes for both conventional concrete and quarry dust concrete. Tests were conducted on cubes and beams to study the strength of concrete made of Robo Sand and the results were compared with the natural sand Concrete. An attempt has also been made to durability studies on Robo Sand when compared with the natural sand concrete. It is found that the compressive, flexural strength and Durability Studies of concrete made of Robo Sand are nearly 10% more than the conventional concrete.

Present Study

In the present investigation we design mix for M25 and M35 has been calculated using IS 10262-2009 for both conventional concrete and quarry dust concrete. Tests were conducted on cubes, cylinders and beams to study the strength of concrete by using Robo sand and the results were compared with the Natural Sand Concrete. During the present study, 0%, 50%, 75% and 100% of traditional fine aggregate was replaced with quarry dust. Compression, split and flexural strengths were found after 7 days and 28days of curing.

III. MATERIAL AND METHODOLOGY

The materials used in research are:

1. Portland cement (53 grade)
2. Fine aggregate (4.75 mm down)
3. Coarse aggregate (20 mm down)
4. Robo sand

5. Water
6. Admixtures

Cement:

Ordinary Portland cement of 53 grade conforming to Indian Standard IS 12269-1987 was used throughout the experimental program. Cement must develop the appropriate strength. It must represent the appropriate rheological behavior. Generally same types of cements have quite different rheological and strength characteristics, particularly when used in combination with admixtures and cementing material.

Fine Aggregate

Fine aggregate (sand) used for this entire investigation for concrete was river sand conforming to zone-II of IS: 383-1970. Fine aggregate normally consists of natural, crushed, or manufactured sand. The physical properties of fine aggregate like specific gravity, gradation and fineness modulus are tested in accordance with IS :2386.

Coarse Aggregate

Coarse aggregate crushed granite of 20 mm down size has been used as coarse aggregate. The physical properties of coarse aggregate like specific gravity, Bulk density, impact value, gradation and fineness modulus are tested in accordance with IS: 2386.

Robo sand

Robo Sand is a fine aggregate that is produced by crushing stone, gravel, or slag. Used for aggregate material less than 4.75 mm that is processed from crushed rock or gravel and intended for construction use. Robo sand is a material of high quality, in contradiction to non-refined surplus from coarse aggregate production.

Water

The water, which is used for making concrete and for curing, should be clean and free from harmful impurities such as oil, alkali, acid, etc, in general, the water, which is fit for drinking should be used for making concrete.

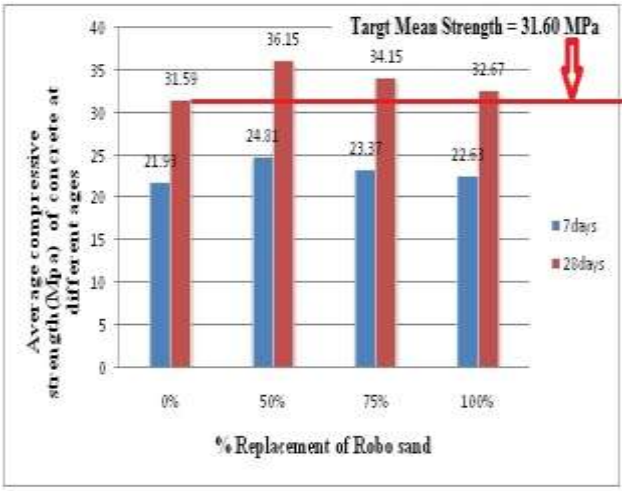
Methodology

Concrete specimens were casted using 0%, 50%, 75% and 100% of replacement fine aggregate with Robo sand. Cubes of standard size 150mm were casted and tested for 7 and 28 days compressive strength. Standard cylinders of size150mmx300mm (diameter x height) were casted and tested for 7 and 28 days for split tensile strength. Also standard prisms of size 500mm x 100mm x 100mm (length x width x height) were cast and tested for 28days for flexural strength and observed the percentage of water absorption in both Robo Sand and Natural sand.

IV. RESULTS AND TABLES

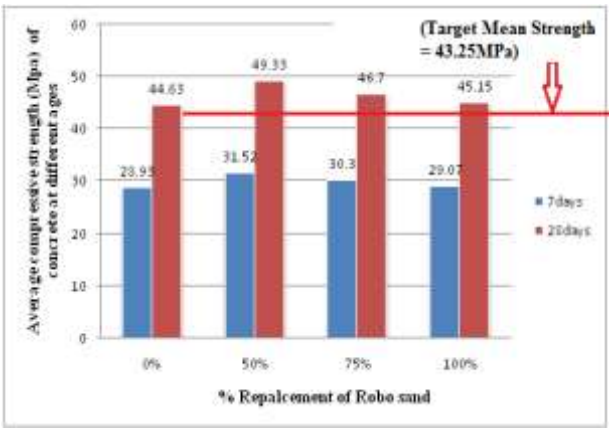
Compressive strength: Average Compressive Strength of Concrete with Robo sand in M25 Grade.

% of replacement Sand with Robo sand	Average Compressive strength of the concrete at different ages(N/mm2)	
% of replacement	7 days	28 days
0	21.93	31.59
50	24.81	36.15
75	23.37	34.15
100	22.63	32.67



Average Compressive Strength of Concrete with Robo sand in M35 Grade.

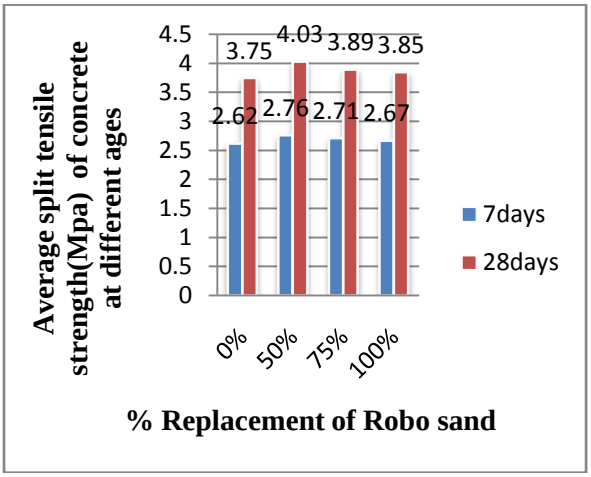
% of replacement Sand with Robo sand	Average Compressive strength of the concrete at different ages(N/mm2)	
% of replacement	7 days	28 days
0	28.93	44.63
50	31.52	49.33
75	30.30	46.70
100	29.02	45.15



Split tensile strength:

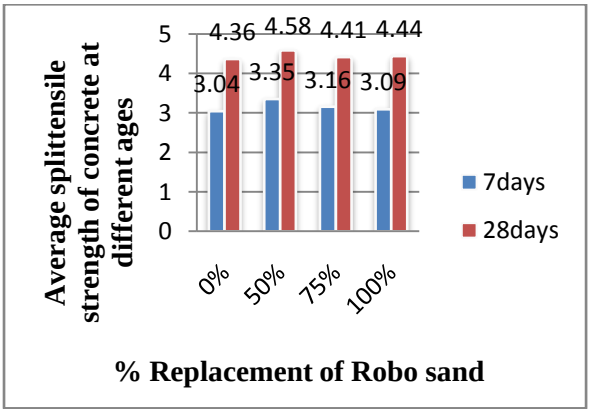
Average Split tensile Strength of Concrete with Robo sand in M25 Grade.

% of replacement Sand with Robo sand	Average Split tensile strength of the concrete at different ages(N/mm2)	
% of replacement	7 days	28 days
0	2.62	3.75
50	2.76	4.03
75	2.71	3.89
100	2.67	3.85



Average Split tensile Strength of Concrete with Robo sand in M35 Grade.

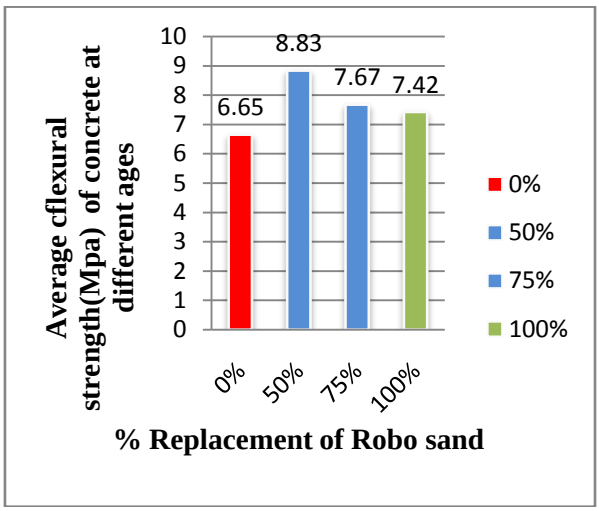
% of replacement Sand with Robo sand	Average Split tensile strength of the concrete at different ages(N/mm2)	
% of replacement	7 days	28 days
0	3.04	4.36
50	3.35	4.58
75	3.16	4.41
100	3.09	4.44



Flexural strength test:

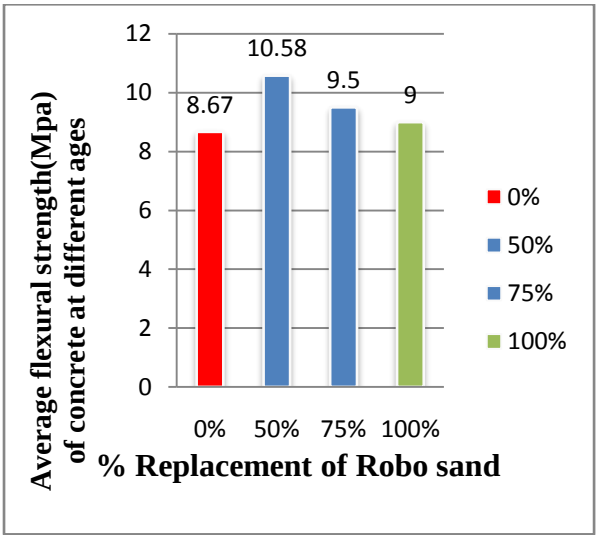
Average Flexural Strength of Concrete with Robo sand in M25 Grade.

% of replacement Sand with Robo sand	Average Flexural strength of the concrete at different ages(N/mm2)
0	6.65
50	8.83
75	7.67
100	7.42



Average Flexural Strength of Concrete with Robo sand in M35 Grade.

% of replacement Sand with Robo sand	Average Flexural strength of the concrete at different ages(N/mm2)
0	8.67
50	10.58
75	9.5
100	9



By this table and graphs shows that there is an increase in compressive strength, split tensile strength, flexural strength with 0%, 50%, 75%, 100% replacement of sand with Robo sand and it decreases with after 50% replacement in both M25 and M35 grade of concrete.

V. CONCLUSION

The effect of percentage replacement of Robo sand on strength property and workability were evaluated and compared with reference mix of 0% replacement of River sand by Robo sand.

- The compressive strength of concrete specimens made with 50%replacementof river sand by Robo sand gives higher strength of 12% to 15% and with 100% replacement gives a higher strength of 3% to 4% as compare to reference mix.
- The split tensile strength of concrete specimens made with 50% replacement of river sand by Robo sand gives higher strength of 7%to 9% and with 100% replacement gives a higher strength of 3%to 4% as compare to reference mix.
- The flexural strength of concrete specimens made with 50% replacement of river sand by Robo sand gives higher strength of 20%to 22% and with 100% replacement gives a higher strength of 5%to 8% as compare to reference mix.
- By replacement of natural sand with Robo sand, the cost of the construction can be reduced to10% per cum.
- higher results then the normal conventional concrete.
- The strength of the Quarry Rock Dust concrete is comparatively 8-12% more than that of similar mix of conventional concrete.

REFERENCES

Technical papers:

[1.] Hudson, B. P., "*Manufactured Sand for concrete*" The Indian concrete Journal, May 1997, pp. 237-240

[2.] Ilangovana R, Mahendrana N and NagamanibK "*Strength and durability properties of concrete containing Robo Sand as fine aggregate*" ARPN Journal of Engineering and Applied Sciences, vol. 3, no. 5, October 2008, ISSN 1819-6608

[3.] Mahzuz. H. M. A., Ahmed. A. A. M and Yusuf. M. A "*Use of stone powder in concrete and mortar as an alternative of sand*" African Journal of Environmental Science and Technology Vol. 5(5), pp. 381-388, May 2011 ISSN 1996-0786 ©2011 Academic Journals

[4.] Mohaiminul Haque, 2Sourav Ray, H. M. A. Mahzuz "*Use of Stone Powder with Sand in Concrete and Mortar: A Waste Utilization Approach*" ARPN Journal of Science and Technology vol. 2, no. 7, August 2012 ISSN 2225-7217

[5.] Nagabhushana and Sharadabai. H "*Use of crushed rock powder as replacement of fine aggregate in mortar and concrete"* Indian Journal of Science and Technology Vol. 4 No. 8 (Aug 2011) ISSN: 0974- 6846

[6.] Saeed Ahmad and Shahid Mahmood "*Effects of crushed and natural sand on the properties of fresh and hardened concrete*"

[7.] Sivakumar. A and Prakash M. "*Characteristic studies on the mechanical properties of quarry dust addition in conventional concrete*" Journal of Civil Engineering and Construction Technology Vol. 2(10), pp. 218-235, October 2011 ISSN 2141-2634 ©2011 Academic Journals

[8.] VeeraReddy.M " *Investigations on stone dust and ceramic scrap as aggregate replacement in concrete*" international journal of civil and structural engineering volume 1, No 3, 2010

[9.] Venumalagavelli " *High performance concrete with GGBS and Robo sand*" International Journal of Engineering Science and Technology Vol. 2(10), 2010, 5107-5113

[10.] IS 456:2000.Plain and Reinforced Concrete Code of Practice (Fourth Revision), Bureau of Indian Standards, New Delhi.

[11.] IS: 8112-1989. Specification for 53 Grade ordinary Portland cement. Bureau of Indian Standards, New Delhi.

[12.] IS: 383-1970. Specification for coarse and Fine Aggregates from natural sources for concrete. Bureau of Indian standards, New Delhi.

[13.] IS: 2386-1963 Part 1 to VIII. Indian Standard Methods of Test for Aggregate for concrete. Bureau of Indian Standards, New Delhi.
[14.] IS: 1199-1959. Indian Standard Methods of Sampling and analysis of concrete. Bureau of Indian Standards, New Delhi.
[15.] IS: 516-1959. Indian Standard Methods of Test for Strength of concrete. Bureau of Indian Standards, New Delhi.
[16.] IS: 10262-2009 and SP 23:1982. Recommended Guidelines for concrete Mix. Bureau of Indian Standards, New Delhi.
[17.] Shetty, M. S., "Concrete technology," Chand S. and Co.Ltd, India (2009)