Behavior of Concrete by Partial Replacement of Fine Aggregate with Eco sand

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Abstract: - All over the world, concrete construction activities are taking place on huge scale. Natural sand (river sand) is one of the key ingredients of concrete and it is becoming demand and expensive. Manufactured sand (M-Sand) is a substitute of river sand for concrete construction which is produced from hard granite stone by crushing. Eco-Sand is fine particles which is a by-product from cement manufacturing. Effective use of this waste material should be done for cost efficiency. The present study is about the compressive strength of concrete block with partial replacement of M-Sand by Eco-Sand. The conventional river sand is replaced with M sand and partial amount of silica sand Replacement of M-Sand by Eco-Sand at various percentages 0%, 6%, 12%, 18%, 24%& 30% in PCC. It is verified that the optimum replacement percentage of M-Sand by Eco-Sand and the properties of fresh concrete and hard concrete in PCC with Eco-Sand. The comparison of economic advantages of M-Sand and Eco-Sand. The main objective of this project is to reduce the pollution and eco-friendly. The various proportion is carried out and tested,which provided 18% as optimum value.

***Keywords*: Eco-friendly, Eco-sand, M-sand, Pollution control.**

I. INTRODUCTION

Cement concrete has been a popular construction material in the world and has satisfied almost all the requirement of a good building material. Concrete is defined as composite mixture of cement, sand and gravel in definite proportions with water. The workability for placement and strength development with age depends upon the proportion of the constituent materials and their combined action. Concrete is normally produced using alluvial river gravels and sands. Moreover, they produce good concrete due to their physical properties such as shape gradation. The natural process of formation of these deposits occurred many millions of years. These deposits are over exploited. Hence there is a scarcity of sand. There is excess sand mining resulting in depletion of groundwater, creating environmental problems. Mining is prohibited by certain state governments for the following reasons. The deep pits dug in the riverbed affect the ground water level. Erosion of nearby land is also due to excess sand lifting. Concrete is a homogeneous construction material that is composed of cement, aggregate water and chemical admixtures. The word concrete comes from the latin word “concretes” (meaning compact or condensed), the past participle of “concresco”, form “con” (together) and “cresco” (to grow).

1.1. Objective of The Thesis

The aim of this thesis is to study about the experimental behaviour of concrete by partial replacement of fine aggregate with Eco-sand at varying percentage and hence to provide a comparative study with the conventionally used concrete.

1.2. Eco-sand

Eco sand are very fine particles, a by-product from cement manufacture which can be used to increases efficiency in concrete. Eco sand is finely powdered crystalline silica which can replace up to a varying percentage of conventional sand usage in concrete and mortars.Its micro-filling effect reduces pores in concretes and provides better moisture resistivity and thus durability.

II. MATERIAL PROPERTIES

2.1. Cement

Ordinary Portland cement (OPC) confirming to IS-12269 (43 Grade) having specific gravity of 3.15. The Initial Setting time and Final Setting time was found to be 29 min and 7 hours 30min respectively, determined from the standard Vicat test apparatus.

2.2. Fine Aggregate (M- sand)

M-sand with Fineness Modulus of 2.54, confirming to Zone III as per IS 383-2016, with a specific gravity of 2.63 was used as fine aggregate in the present work.

2.3. Fine Aggregate (Eco-sand)

Eco-sand with Fineness Modulus of 2.31, confirming to Zone III as per 383-2016, with a specific gravity of 2.46 was used as fine aggregate in the present work.

2.4. Coarse Aggregate

Coarse aggregate in the size of less than 12mm with Specific Gravity of 2.74, was adopted in the present work. The size of aggregate <12mm.

III. MIX DESIGN

Mix design is the process of selecting suitable ingredients of concrete and determining their relative proportion with the objective of producing concrete of certain minimum strength and durability as economically as possible.

TABLE I. MIX DESIGN

Water	Cement	Coarse Aggregate	Fine Aggregate
0.50	1	2.91	1.43

IV. RESULTS AND DISCUSSIONS

Tests are carried out to find out the strengths of fresh concrete and hardened concrete. All the cubes and cylinders using compression-testing machine and mortar cubes are using universal testing machine. In this chapter the comparison of results of Specimen at 7 and 28 days are done and the maximum compressive strength and tensile strength of the concrete samples are to be found.

4.1. Slump cone test

TABLE II. SLUMP CONE TEST

Percentage Replacement	**Slump (mm)**
0	72
6	74
12	79
18	82
24	85
30	91

4.2. Compacting factor test

TABLE III. COMPATION FACTOR TEST

Percentage Replacement	Compaction Factor
0	0.85
6	0.86
12	0.90
18	0.91
24	0.92
30	0.94

4.3. Hardened concrete test

1. Mortar cube test

TABLE IV.MORTAR CUBE TEST

Percentage Replacement	Mortar strength(N/ mm^2) (7 days)	Mortar Strength(N/ mm^2) (28 days)
0	21.428	33.411
6	21.71	34.067
12	22.58	35.319
18	23.89	37.224
24	20.4	31.669
30	16.48	25.49

2. Compressive strength test

TABLE V. COMPRESSIVE STRENGTH TEST

Percentage Replacement	Compressive Stress(N/mm^2) (7 days)	Compressive Stress (N/mm^2) (28 days)
0	15.4	26.67
6	16.58	27.41
12	17.63	28.15
18	19.12	29.78
24	15.55	25.33
30	12.88	20.3

3. Split tensile test

TABLE VI.SPLIT TENSILE TEST

Percentage Replacement	Tensile stresses (N/mm^2)
0	2.61
18	2.75

V. CONCLUSIONS

The present thesis works identified the effect of partial replacement of M-Sand by Eco-Sand in concrete. Further, it had comparatively established various properties such as fresh concrete and hardened concrete test for the various percentages of 0%, 6%, 12%, 18%, 24%and 30% respectively.

Based on the test results, the following conclusions are made

- slump cone test shows that gradually increases at 2.78%, 9.72%, 13.89%, 18.05% and 26.38% as compared with conventional mix for the replacement of 0%, 6%, 12%, 18%, 24% and 30% respectively.
- The compaction factor test shows that gradually increases at 1.17%, 5.88%, 7.05%, 8.23% and 10.58% as compared with conventional mix for the replacement of 0%, 6%, 12%, 18%, 24% and 30% respectively.
- The compressive strength for mortar cube(7 days) was gradually increase at

1.31%, 5.37% and 11.48% as compared with conventional mix for the replacement at 6%, 12% and18% respectively, but gradually reduces at 4.79% and 23.09% with conventional mix for the replacement at 24% and 30% respectively.

- The compressive strength for mortar cube (28 days) was gradually increase at 1.9%, 5.71% and 11.6% as compared with conventional mix for the replacement at 6%, 12% and18% respectively, but gradually reduces at 5.2% and 23.7% with conventional mix for the replacement at 24% and 30% respectively.
- The compressive strength of cube for (7 days) gradually increase at 7.66%, 14.48%,24.15% and 0.97%, as compared with conventional mix for the replacement at 6%, 12%,18% and 24% respectively, but gradually reduces at 16.36% with conventional mix for the replacement at 30% respectively.
- The compressive strength of cube for(28 days) gradually increase at 2.77%, 5.55% and 11.66%, as compared with conventional mix for the replacement at 6%, 12% and18% respectively, but gradually reduces at 5.02% and 23.8% with conventional mix for the replacement at 24% and 30% respectively.
- Split tensile strength of concrete was increases at 5.36% as compare with conventional mix and optimum percentage of 18% respectively.
- Form the above results optimum percentage of replacement is 18% as the stress and other parameter value behinds to decrease after this replacement percentage

REFERENCES

[1] Shetty.M.S.,S. chand and company Ltd., New Delhi 'Concrete

[2] Technology' – Theory and practice.

[3] S.K.Duggal , varghees - Building Materials

[4] B.Durg, M.Indira(March 2016) "Experimental Study on Various Effects of Partial Replacement of Fine Aggregate with Silica Sand in Cement Concrete and Cement Mortar" International Journal of Engineering Trends and Technology (IJETT) – Vol 33, Issue 5. Pg: 252-256

[5] Biju Mathew, Dr Freeda Christy C, Souyma C, Dr. Benny Joseph (August 2016)"Study on Strength of Concrete by Partial Replacement of Fine Aggregate with M-Sand and Laterite with Super plasticizers"

[6] International Journal of Engineering Trends and Technology (IJETT) – Vol 38, Issue 8. Pg: 413-416

[7] M Indira, B Udaykiran Reddy (April 2017.) "Study on replacement for cement and fine aggregates using eco-sand" International Journal of Civil Engineering and Technology, Vol 8, Issue 4. pg: 846-854

[8] M. prabu, S.Logeswaran, Dr. Sunilaa George (June 2015.) " Influence of GGBS and Eco-sand in Green Concrete ", International Journal of

[9] Innovative Research in Science, Engineering and Technology, Vol 4, Issue 6. Pg: 4519-4527

[10] Priyanka A, Jadhav, Dilip K. Kulkarni (2013) "Effect of replacement of natural sand by manufactured sand on the properties of cement mortar"International Journal of Civil and Structural Engineering Vol 3, Issue 3, Pg: 621-628

[11] R Lakshmi Priyanka, Ravi Kiran, G V L N Murthy (May 2017) "Use of M-Sand as a Replacement of Cement and Fine Aggregate" SSRG International Journal of Civil Engineering (SSRG-IJCE) – Vol 4, Issue 5, pg:112-118

[12] Selvakumar, Balasubramaniyan. V and Kirshnamoorthi. A. (April 2016)

[13] "Experimental Investigation of Eco Sand in Concrete" International Journal of Recent Research and Applied Studies Received 8th. pg: 71-77

[14] Vishnumanohar.A (May 2014.) "Performance of normal concrete with eco-sand as fine aggregate" International Journal of Engineering Science Invention, Vol 3, Issue 5. Pg: 27-35

CODAL REFERENCE

[1] IS: 383-2016 Specification for coarse and fine aggregate from natural source for concrete (Third Revision).

[2] IS:10262-2009 concrete mix proportioning – guidelines (first revision)

[3] IS:456-2000 plain and reinforced concrete-code of practice (fourth revision)