ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 03, pp.2406-2408, March, 2019
DOI: https://doi.org/10.24941/ijcr.34935.03.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

EXPERIMENTAL INVESTIGATION ON CONCRETE WITH PARTIAL REPLACEMENT OF FINE AGGREGATE WITH IRON OXIDE

[1]Ranjith Kumar Gunaseelan, [2]Dinesh Sellakutty and [3]Ganesh Kumar

[1]Assistant Professor, Department of Civil Engineering, Assosa University, Assosa, Ethiopia
[2] Lecturer, Department of Construction Technology and Management, Assosa University, Assosa, Ethiopia
[3]Proprietor, Bee Project Pvt., Srivilliputtur, Tamil Nadu, India

ARTICLE INFO

Article History:
Received 14th December, 2018
Received in revised form
10th January, 2019
Accepted 17th February, 2019
Published online 31st March, 2019

Key Words:
Iron Oxide, Concrete,
Partial replacement of Fine aggregate.

ABSTRACT

Iron oxide is one of the oxides of iron, which is present in the sand. The content of iron oxide present in river sand is generally up to 6%. The objective of this project is to check the tensile strength of concrete with increase in iron oxide. The Compressive strength, Split tensile test, Modulus of Elasticity, Impact test and Flexural strength test were also found using destructive testing techniques.

***Citation: Ranjith Kumar Gunaseelan, Dinesh Sellakutty and Ganesh Kumar,* 2019.** "Experimental investigation on concrete with partial replacement of fine aggregate with iron oxide", *International Journal of Current Research*, 11, (03), 2406-2408.

INTRODUCTION

Concrete is an artificial stone like material. It consists of cement, fine aggregate, coarse aggregate and water in the wet stage. Admixtures may be added to enhance the strength. One of the process involving while making concrete is filling the voids between the fine aggregates and coarse aggregates and the voids among the fine aggregates. The main function of the cement paste is to bind the aggregates together. Admixtures and mineral additives may be used in concrete for various purposes such as resistance against corrosion, reduce permeability and to increase strength etc. The mix design of concrete in this project is as per Indian Standard Specifications.

Iron Oxide: Iron oxide is nothing but oxides of iron mainly formed through the action of weathering. The variation of weathering that leads to removal of silica and alkalies resulting in a soil or rock with high concentration of iron and aluminium oxides. This process is called Laterization. The oxides of iron are black in colour. The size may vary from 75μ to 300μ in soil. It may present in rock also. The various forms of oxides are as follows.

- Magnetite
- Hematite
- Lepidocrocite

Corresponding author:* **Ranjith Kumar Gunaseelan
Assistant Professor, Department of Civil Engineering, Assosa University, Assosa, Ethiopia

To make the concrete structurally sound it should be dense and free from voids. In the heavy weight concrete, Magnetite [Fe_3O_4] is used as a mineral additives to increase the density of the concrete. Magnetite is one of the forms of oxides of iron oxide sand is magnetite. The iron oxide sand may not influence the corrosion of reinforcement, since corrosion is the process that makes the iron in to iron oxides. But what we are mixing is already in the form of oxides of iron.

Collection of iron oxide: Iron oxide is collected by magnets. The magnets were rolled on the river sand and attracted oxides were separated, collected and used in concrete.

Properties of Iron Oxide

Iron oxide: The properties of iron oxide sand are found through the tests carried in the laboratory as for aggregate. And the iron oxide sand is collected from the river sand by using magnets.

Table 1. Properties of iron oxide

S. No	Properties	Value
1	Specific gravity	4.19
2	Fineness modulus	2.10
3	Effective size	140μ

The above value of materials is found by testing a minimum of three samples and the average value are given.

Fig. 1. Iron oxide

Mix Design: The mix are designed as per IS 10262 Codal provision. The mix proportion obtained are

Table 2. Mix proportions

Water	Cement	Fine Aggregate	Coarse Aggregate
188.8 Kg	377.6 Kg	558 Kg	1236.8 Kg
0.5	1.0	1.48	3.275

Experimental Investigation: The experimental investigations are carried out to determine the compressive strength of concrete for cubes, split tensile strength test for cylinders, The Modulus of elasticity for concrete, Impact test for slabs, Flexural strength test for beams and abrasion resistance for concrete.

RESULTS AND DISSCUSSIONS

The specimens were casted and tested for 7 days and 28 days Compressive strength, Young's Modulus, Flexural strength, Tensile Strength and Impact test. The results obtained are compared with conventional and various percentage of replacement.

Compressive strength: The compressive strength of the specimen is tested for conventional concrete at various percentages of replacement and the results obtained are discussed below.

Split tensile strength: The split tensile strength of the specimen is tested for controlled concrete and various percentage of replacement and the percentage increase in strength are given in the table. The gain in tensile strength due to replacement of sand with iron oxide is significant as it nearly doubles in 7 days strength and about 50% in 28th day strength.

Flexural Strength test: The flexural strength on beams of size 50 cm x 10 cm x 10 cm were conducted and the results obtained were discussed in tables. The flexural strength of beam with iron oxide nominally increases over the control specimen. It is found that the beam has percentage increase in flexural strength for all percentage replacement remains nearly the same.

Modulus of Elasticity: The variation of Young's modulus with respect to percentage replacement of sand with iron oxide. The presence of iron oxide in concrete increases the value of modulus of elasticity by more than 50% up to 7.5 %.

Table 3. Compressive strength on 7th and 28th day

S. No	Percentage replacement	7day compressive strength N/mm^2	28 day compressive strength N/mm^2	% increase over 7th day strength
1	Control specimen	22.53	36.84	63.50
2	2.5%	24.56	37.35	52.07
3	5.0%	24.99	35.76	43.09
4	7.5%	26.56	39.40	48.20
5	10.0%	28.48	40.70	42.90

Table. 4 Split tensile test for 7th and 28th day

S. No	Percentage replacement	7day compressive strength N/mm^2	28day compressive strength N/mm^2	Percentage increase over 7th day strength
1	Control specimen	1.804	2.116	17.30
2	2.5%	2.498	3.112	25.0
3	5.0%	2.567	3.157	23.0
4	7.5%	2.635	3.192	21.12
5	10.0%	3.470	3.678	5.99

Table 5. Flexural strength test for 7th and 28th day

S. No	Percentage replacement	7 Day Flexural strength N/mm^2	28 Day Flexural strength N/mm^2	Percentage increase over 7thday strength
1	Control concrete	6.66	8.28	24.32
2	2.5%	8.32	9.62	15.63
3	5.0%	8.40	9.02	7.40
4	7.5%	8.34	9.63	15.50
5	10.0%	8.52	10.26	20.42

Table 6. Modulus of Elasticity of Concrete

S. No	% Replace-ment	Load (N)	Deformation (mm)	Stress N/mm^2	Strain	Modulus of Elasticity x (N/mm^2)
1	Controlled Concrete	49050	0.039	2.777	0.000195	o.14211
2	2.5%	49050	0.009	2.777	0.000045	0.61585
3	5.0%	39240	0.020	2.222	0.000100	0.22170
4	7.5%	29430	0.015	1.666	0.000075	0.22170
5	10.0%	19620	0.044	1.111	0.000220	0.27713

Impact Test: Impact test result for slabs of various percentage replacement of fine aggregate with iron oxide are given. The impact strength of concrete with iron oxide is significantly increased with increase in percentage. Crack width is nearly same in the initial and final stages when compared with controlled concrete. But energy absorbing capacity of iron oxide concrete is more.

Table 7. Impact strength test for 28th day

% Replacement	Initial Average energy in Joules	Final Average Energy in Joules
Normal	50.33	150.99
2.5%	78.78	218.83
5.0%	87.53	223.21
7.5%	159.75	326.06
10.0%	170.76	369.99

Conclusion

The following are the conclusions obtained based on the experimental work done on the partial replacement of fine aggregate with iron oxide sand. There is a marked improvement in the tensile strength of concrete with increase in the replacement of sand with iron oxide is more when compared with compressive strength increase.

- The modulus of elasticity of the concrete is also found to increase gradually with increase in iron oxide content and the Modulus of elasticity found to be doubled at higher percentage of replacement.
- The compressive strength of concrete cubes is also found to be gradually enhanced with percentage increase of iron oxide up to 5% replacement. Beyond 5% replacement, the compressive strength is remarkable.
- The Compressive strength of cylinders were also gradually increased with the percentage increase in iron oxide, but not as gradual as in case of cube compressive strength.
- The flexural strength of concrete found to increase very nominally. An average increase in flexural strength is in the region of 20%.
- A great improvement in the impact strength of the concrete is obtained at various percentage replacement concrete when compared to control specimen. The impact strength of concrete deeply increases with increase in percentage replacement. But a reduction in crack width was not featured.
- The abrasion resistance of concrete are not increased remains nearly same as that of control concrete.
- The workability of concrete is not at all affected by the addition of iron oxide.

REFERENCES

Anupan Singhal, Dipendu Bhunia, Bartik Pandel, " Effect of Sand replacement by Mill scale on the Properties of Concrete" IJETSR Publications Vol II Special Issue March 2015.

Arhab Elahai, Muntasir Ahamed, Majedul Hasan Mazumder, " Investigation on Utilization of Steel Slag as Coarse Aggregate" Ess and Ess Research Publications Vol 6, Issue 04, April 2017.

Athira Suresh, Ranjan Abraham, " Experimental Study on Heavy Weight Concrete using Hematite and Laterite as Coarse Aggregate",

Harshavardhan, Praveen Kumar. P, " A Laboratory Study on Performance of Slag based Concrete over Conventional Concrete", IJSRD Vol 3 Issue 6 2015.

James Alexander. S, Prof. Antony Godwin, Dr. S. Alexander- "Study on Partial replacement of fine aggregate with red soil in concrete", IJRASET Corporation, Vol 04 Issue V May 2016.

Lineesh, K. D. Sivakumar, S. Janaki Sundaram "Comparative study on Partial Replacement of Fine Aggregate by Glass Powder and Foundary Sand", Science and Technology Research Publications Vol III Page no – 149-154, December 2014.

S. Lalitha, M. Alaguraj, C. Divyapriya, "Experimental Study on use of Waste Glass Powder as Partial Replacement of Cement in Concrete", IJESRT Publishers Vol06 (10)- October 2017.

Sachin S. Fale, Satish S. Pande, " Study on Compressive Strength of Concrete by Partial Replacement of Fine Aggregate by natural sand with red soil", Change for Change Multipurpose society Publishers,Vol 3, Issue 2, Page No 98-105, March-April 2017.

Seventh Sense research group, Vol 28, No 04, Page 171-175, October 2015.

Sultan A. Tarawneh, Emhaidy S. Gharaibeh and Falah M. Saraireh "Effect of using Steel slag Aggregate on Mechanical Properties of Concrete", Science Publishers, Vol 11(5) 2014.

Vignesh Kumar, P. R. Ranjith Kumar, 2016. "An Experimental study on Partial replacement of Coarse aggregate by Iron slag with polypropylene", IJSR Publications, Volume I, Issue 3 March 2016.

****