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Research Paper

Compressive Strength Development of Steel Slag Incorporated Concrete By Using Humnabad Lateritic Stones As Coarse Aggregate

Engineering

KEYWORDS : Steel slag, laterite coarse aggregates, Compressive strength, OPC, M20 Grade.

Tanveer Asif Zerdi	Director, Professor & H.O.D Civil Engineering Dept, K.C.T.Engg College, C/o Dr Meenaz Maternity hospital, H No 5-408/40/1&2, Near KBN Medical college, Roza B, Madeena colony, Kalaburagi.
Mohammed Irfan Patel	U.G Student Dept of Civil Engineering, V.T.U University, K.C.T.E.C, Kalaburagi ,Karnataka.
ShaikFabirazMuzakkir	U.G Student Dept of Civil Engineering, V.T.U University, K.C.T.E.C, Kalaburagi ,Karnataka.
MdFasiuddinFatehakhani	U.G Student Dept of Civil Engineering, V.T.U University, K.C.T.E.C, Kalaburagi, Karnataka.
Mohd Mohsin	U.G Student Dept of Civil Engineering, V.T.U University, K.C.T.E.C, Kalaburagi, Karnataka.

ABSTRACT

The authors belong to Hyderabad Karnataka area, availability of aggregates is day by day becoming scarce, abundant quantum of lateritic stone is available in this area specially in the Bidar district of Hyderabad Karnataka area, out of motivation this work under consideration is taken up by the authors. Cement concrete is a versatile building construction material in civil engineering and it is also one of the world's most extensively used construction material around the world in almost all construction projects and in many construction applications. Currently the problems faced by the use of cement concrete includes high demand of cement concrete, cost of cement and concrete making materials, pollution, excessive extraction and utilization of natural river sand and stones, water etc. Because the sand is being extensively extracted from the river bed deposits, it is depleting at a faster rate. Hence it is necessary to find an alternative material such as industrial waste slag and waste pieces of stones from the stone quarries in the cement concrete production. In this research work concrete of grade m20 is used. While steel slag is replace by fine aggregate and laterite by coarse aggregate. Partially replacement of steel slag is made for the varying percentages of 0%, 30%, 40%, and 50%. The result shows that optimum percentage replacement of fine aggregate by steel slag is 40% at this particular point in our study the maximum compressive strength is achieved, beyond this limit the compressive strength of concrete starts decreasing but still it is more compared to normal concrete without any replacement.

I. Introduction

The primary problems faced by the use of cement concrete is that the ever increasing demand of cement concrete, cost of cement and concrete, pollution due to the cement production, excessive utilization of natural resources in cement production and in construction activities, excessive use of sand and aggregates and potable water, carbon emissions during concrete productions etc. The manufacture and usage of cement concrete also exerts large amount of social and environmental problems. Natural river sand is one of the important constituent in the cement concrete production. Now a day the sand is being extensively utilized in almost all around the world in the construction activities. Throughout the world at all places, construction industries are developing at a faster rate which in-turn is resulting into the higher demand for concrete, sand and other concrete making materials. Natural river sand is highly expensive and is also depleting at a faster rate. The main function of sand in concrete is to improve these workability and uniformity of the concrete mixture. The main source of sand is the river bed deposits, because of the expensive sand and its increasing depletion, it has become very important to protect and preserve the Environment and its natural resources which is an important step towards any development. The higher amount of sand depletion creates sensitive environmental damages. Government is now a day's banning the sand mining, which is affecting the cost of the materials and time of the completion of construction project works. If this extensive utilization of sand continues in future, the sand may get completely depleted from the river beds. To overcome this problem, it is very necessary to search for the alternative materials for concrete production and in construction activities.

For the economical and environmental purpose, it is important to think about and make use of the industrial waste by-products as the alternative materials in the construction activities and in the production of cement concrete. By utilizing the industrial waste by-product materials as the alternative materials it may reduce the cost of concrete production, reduce the pollution which helps in the effective ways of utilization for our development. Many industries and factories generate huge amount of wastes as a by-products during the time of processing. Safe disposal of these waste materials is the main problem.

Therefore, in this project work carried out, an attempt has been made to study the acceptability and suitability of steel slag and lateritic aggregate in making a cement concrete mix suitable for the implementation in the construction applications. In this project work carried out, in the preparation of cement concrete, steel slag has been used in place of natural river sand as a partial replacement and lateritic aggregates has been used in place of coarse aggregates (lateritic stones) as the partial replacement. Steel slag is the waste by-product obtained from the iron and steel plants and lateritic aggregates are obtained from the lateritic quarries. Good strength is expected with these materials in concrete as a partial replacement in concrete with or without admixtures k.g. investigated the use of blast furnace slag as aggregates in concrete. The results showed that it has properties similar to natural aggregates and it would not cause any harm if incorporated into concrete. The research was encouraging, since they show that using blast furnace slag as coarse aggregates in concrete has no negative effects on the short term properties of hardened concrete[1].

studied on replacement of coarse and fine aggregate in concrete by slag. Concrete of m20, m30 and m40 grades were considered for a w/c ratio of 0.55, 0.45 and 0.40 respectively for the replacements of 0, 30, 50, 70 and 100% of aggregates (coarse and fine) by slag. Whole study was done in two phases, i.e. Replacement of normal crushed coarse aggregate with crystallized slag and replacement of natural fine aggregate with granular slag[2].

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2. Objective

1. To determine the compressive strength of m20 grade plain cement concrete with different levels of replacement of steel slag as fine aggregate.

2. To study the workability characteristics of m20 grade plain cement concrete with different levels of replacement of steel slag and lateritic aggregate

3. Materials & methodology

[1] Cement*:* the common opc 53 grade cement is used. The physical properties of the cement tested according to standard procedure conform to the requirement of is 12269:1989

Table 1 physical properties of cement.

S.no	Characteristics	Value obtained experimentally
1	standard consistency	33%
2	Fineness (90 micron sieve)	3%
3	Initial setting time	30 minutes
4	Specific gravity	3.0

[2] Fine aggregate: locally available river sand passing through 4.75mm sieve conforming to the recommendation of is383-1970 was used.

Table 2 physical properties of fine aggregate

S. No	Characteristics	Value obtained Experimentally
1.	Fineness modulus	2.68
2.	Specific gravity	2.68

3] Coarse aggregate (laterite): Nearby locality available course aggregates in humnabad taluka of Bidar district retaining on 4.75mm sieve is used.

Table 3 physical properties of coarse aggregate

S.no	Characteristics	Value obtained Experimentally
1.	Fineness modulus	7.73
2.	Specific gravity	2.79

[4] Steel slag: this steel slag can be used in the construction industry as aggregates in concrete by replacing natural aggregates. Steel slag is obtained from Agni steels

Table 4 physical properties of steel slag.

S.no	Characteristics	Value obtained Experimentally
1.	Fineness modulus	2.97
2.	Specific gravity	2.93

[5] Water: Potable water is used for casting and curing of specimens.

3. Experimental study

In general, the mix design (M20) is arrived based on the physical properties of materials and according to with is 10262:2009.

[1] Compression strength test: totally 48 concrete cubes were casted and it is allowed for 3,7,21,and 28 days curing. After drying, cubes were tested in compression testing machine (ctm) to determine the ultimate load. Replacement made for 0%, 30%, 40% and 50%. For this study the water cement ratio of 0.48 is maintained uniformly.

Table 5 compression strength of cubes n/mm²

% of steel sag used	3days	7 days	21days	28 days
0	7.41	12.05	16.31	18.16
30	9.70	15.77	21.36	23.78
40	11.39	18.51	25.05	27.90
50	10.15	16.50	22.33	24.87

5. Result and discussions

The compressive strengths obtained at various levels of steel slag replacements of 0%,30%,40%,50% after 28 days of curing are 18.16 N/mm^2,23.78 N/mm^2,27.90 N/mm^2,24.87 N/mm^2 respectively.

It can be observed from the tabular columns of the table that at 40% replacement of steel slag highest compressive strength of concrete is obtained thereafter if we increase further then there is decrement in strength of concrete is noticed.

Further also it can be noticed that at all the points of replacement levels the strength of concrete is increasing compared to normal concrete. Then we can say that steel slag incorporation in the concrete preparation is extremely advantageous.

6. Conclusion

1. The use of lateritic aggregate as coarse aggregate replacement has influence towards engineering proprieties of concrete we got satisfactory results hence we recommend that lateritic stones can be used as coarse aggregates in construction industry.

2. From this study, we can conclude that, river sand can be replaced by steel slag as a fine aggregate up to 50% for the manufacturing of cement concrete, as compressive strength achieved is higher compared to normal concrete mix.

3. From the above study, we can conclude that the compressive strength of cement Concrete is showing optimum results at 40% replacement of natural fine aggregate by

Steel slag.

4. It is concluded that, the compressive strength of cement concrete decreases as the percentage of replacement of natural fine aggregates by steel slag increases above 40%.

5. Cement concrete can be made economical by partially replacing the natural fine aggregates by steel slag and also by using lateritic stones in Hyderabad karnataka area.

6. By this study, we can produce green, sustainable and eco-friendly cement concrete by partially replacing the natural fine aggregate by steel slag.

Reference

1. Abida justus , r. Padmpriya (2015) "experimental study on properties of concrete by replacement of fine aggregate with coarse aggregate with steel slag". "international journal of chemtech research". Issn 0974-4290 vol.8 pp284-291 2015
2. Ansu john , elson john(2013) "study on the partial replacement of fine aggregate using induction furnace slag". "american journal of engineering research (ajer)" e-issn : 2320-0847 p-issn : 2320-0936 volume-4 pp-01-05
3. Chetan khajuria, rafat siddique(2014), "use of iron slag as partial replacement of-sand to concrete", "international journal of science, engineering and technology research (ijsetr)", volume 3, issue 6, june 2014
4. Dr.k.chinnaraju, v.r.ramkumar, k.lineesh, s.nithya, v.sathish,(2013) "study on concrete using steel slag as coarse aggregate replacement and ecosand as fine aggregate replacement"."ijreat international journal of research in engineering & advanced technology". Volume 1, issue 3, june-july, 2013.
5. Dr.muyasser m. Jomaa'h,(2012) "using of local limestone as aggregate in concrete mixture"."tikrit journal of engineering sciences" issn 2939-0285 vol.19, no.1, march 2012
6. Jeffrin rajan, dr sampath kumar m c (2015) "reuse of steel slag for building products". "international journal of emerging technology and advanced engineering" (issn 2250-2459, iso 9001:2008 certified journal, volume 5, issue 7, july 2015)
7. J. Saravanan and n.suganya(2015) "mechanical properties of concrete using steel slag aggregate" "international journal of engineering inventions" e-issn: 2278-7461, p-issn: 2319-6491 volume 4, issue 9 [may 2015] pp: 07-16
8. j.sridhar r.malathy(2011) "study on compressive strength of cement with partial replacement of fine aggregate by steel slag in concrete". "inernational jounal of earth sciences and engineering". Issn 0974-5904, pp 1139-1144 vol 04 06 dec 2011
9. K. A.olonade1,*, m. B. Kadiri2 and p. O. Aderemi (2015) "performance of steel slag as fine aggregate in structural concrete" "nigerian journal of technology (nijotech)" vol. 34 no. 3, july 2015, pp. 452 – 458, issn: 0331-8443
10. K.chandrabose, t.sharmila(2015) "experimental investigation on strength properties of concrete by partial replacement of coarse aggregate with steel slag" "international journal of innovative research in science, engineering and technology" issn 2347-6710 vol. 4, special issue 13, december 2015 pp 412-415