RESEARCH PAPER | Engineering | Volume : 6 | Issue : 5 | May 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

Experimental Study on Compressive Strength Development of Concrete by Including Plastic Granules for Coarse Aggregates

KEYWORDS: Steel slag, waste plastic granules coarse aggregates, Compressive strength, OPC, M20 Grade.

Tanveer Asif Zerdi	Mohd Mohsin	Shaik Fabiraz Muzakkir
Director, Professor & H.O.D Civil Engineering Dept, K.C.T.E.C, C/o Dr Meenaz hospital, H No 5-408/40/1&2, Near KBN Medical College, Roza B, Madeena colony, Kalburgi. Karnataka, India.	U.G Student Dept of Civil Engineering, V.T.U University, K.C.T.E.C, Kalaburagi ,Karnataka.	U.G Student Dept of Civil Engineering, V.T.U University, K.C.T.E.C, Kalaburagi ,Karnataka.

Mohammed Irfan Patel	Md Fasiuddin Fatehakhani
U.G Student Dept of Civil Engineering, V.T.U University, K.C.T.E.C, Kalaburagi, Karnataka.	U.G Student Dept of Civil Engineering, V.T.U University, K.C.T.E.C, Kalaburagi, Karnataka.

ABSTRACT *Concrete is used in large quantities almost everywhere as now a day's mankind has a need for infra-structure. Almost three quarters of the volume of concrete is composed of aggregates. Aggregates are obtained from natural rocks and river beds. River sand poses the problem of acute shortage in many areas due to large requirements in construction industry. The need for aggregates demands for the usage of any other alternative source. Thus the concept of replacement of fine aggregate with steel slag and using waste plastic granules seems to be promising. In this study an attempt is made to use steel slag, a by-product from steel industry as replacement for fine aggregate in concrete and recycled waste plastic granules as coarse aggregates. Initial optimization of concrete strength is done with 28 days compressive strength of concrete cubes. M20 grade of concrete was used. Tests on concrete cubes for compressive strength evaluation are done, at 3,7,21 and 28 days period of curing. It was concluded that replacing about 40 percent of steel slag aggregates for fine aggregate and granules as coarse aggregate will not have any adverse effect on the strength of the concrete.*

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 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. Unsafe disposal of these wastes can cause environmental problems. This made to think about how these waste materials can be put into its utilization without causing any damage to the environment. Out of many waste's steel slag from the iron and steel plants and waste

Plastic granules from one of the waste by-product materials which is requiring its attention towards its safe disposal and effective utilization. Therefore, in this project work carried out, an attempt has been made to study the acceptability and suitability of steel slag and waste limestone 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 waste plastic granules has been used in place of coarse aggregates. Steel slag is the waste by-product obtained from the iron and steel plants and waste plastic granules are obtained from the plastic industries. Good strength is expected with these materials in concrete as a partial replacement in concrete with or without admixtures.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

Volume : 6 | Issue : 5 | May 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

crushed coarse aggregate with crystallized slag and replacement of natural fine aggregate with granular slag[2]

2. OBJECTIVES

1. To study the Development of Compressive Strength of M20 grade plain cement concrete with different levels of replacement of Steel Slag as fine aggregate and using plastic granules as coarse aggregate.
2. To study the development of compressive strength of concrete prepared with zero percent replacement of steel slag and compare this strength with the compressive strength of steel slag incorporated concretes.

3. Materials &methodology

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	40%
2	Fineness (90 micron sieve)	5%
3	Initial setting time	30 minutes
4	Specific gravity	2.69

Fine aggregates: 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	2.95
2.	Specific gravity	2.60

Coarse aggregate (Plastic granules) locally available coarse aggregate retaining on 4.75mm sieve is used.

Table 3 physical properties of coarse aggregate

S.no	Characteristics	Value obtained Experimentally
1.	Fineness modulus	4.90
2.	Specific gravity	3.00

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	3.21
2.	Specific gravity	2.104

Water: normal portable water used for casting and curing of specimens.

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% of steel slag and coarse aggregates were replaced by plastic granules. For this study the water cement ratio of 0.48 is maintained uniformly.

4. Result and discussions

The values of compressive strength obtained are tabulated in tabular form as shown in the Table 5 in the following lines.

The compressive strengths obtained at various levels of steel slag replacements of 0%, 30%,40%,50% after 28 days of curing are 26.90 N/mm^2, 32.150 N/mm^2,33.68 N/mm^2,29.59 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.

% of steel sag used	3 days	7 days	21 days	28 days
0	7.50	12.20	24.15	26.90
30	9.85	16.29	28.85	32.15
40	10.70	17.40	29.98	33.68
50	8.75	14.22	24.57	29.59

Table 5 compression strength of cubes N/mm^2

5. Conclusion

1. 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.
4. From the above study, we can conclude that the strength characteristics of cement
   Concrete is showing optimum results at 40% replacement of natural fine aggregate by
   Steel slag and plastic granules as coarse aggregates.
5. It is concluded that, the strength characteristics of cement concrete decreases as the percentage of replacement of natural fine aggregates by steel slag increases above 40%.

Volume : 6 | Issue : 5 | May 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

6. With the above study, the combined effect of using steel slag as a fine aggregate as partial replacements is achieved in M20 grade plain cement concrete.
8. Cement concrete can be made economical by partially replacing the natural fine aggregates by steel slag.
9. By this study, we can produce green, sustainable and eco-friendly cement concrete by partially replacing the natural fine aggregate by steel slag and coarse aggregates by plastic granules.

Reference

1. Abidajustus , r. Padmpriya (2015) "experimental study on properties of concrete by replacement of fine aggregate with coarse aggregate with steel slag". international journal of chem. tech research . Issn 0974-4290 vol.8 pp284-291 2015
2. Ansujohn ,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. Chetankhajuria, rafatsiddique(2014), "use of iron slag as partial replacement ofsand 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. Jeffrinrajan, drsampathkumar 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.sridharr.malathy(2011) "study on compressive strength of cement with partial replacement of fine aggregate by steel slag in concrete". "international journal 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