Analysis on Partial Replacement of Fine Aggregate with Iron Slag: A Review Report

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Abstract— These days due to the growth of environmental awareness, as well as stricter regulations on managing industrial waste, the world is increasingly turning to use it as secondary raw material in other industrial workings. Due to industrialization huge amount of by-products are produced and to utilize these by-products is the main challenge faced in India. Iron slag is one of the industrial by-products from iron and steel making industries. In this work, I.S method for mix design and M25 grade for concrete are used. The partial replacement of fine aggregate waste iron slag is reused to partially replace of 0%, 20%, 30%, 40% and 50% of sand weight. The strength of concrete increases rapidly with increase the iron slag content and the optimum value of compressive strength is obtained at 50% replacement. After 50% replacement the strength decreases. The test performed to evaluate waste iron slag concrete quality include slump cone test, compressive strength test, split tensile test and flexural strength test. The composition was casted and tested for 7, 14 and 28 days. The primary components of iron and steel slag are limestone [Ca O] and silica [SiO2]. The results confirm that the use of iron slag overcome the pollution problems in the environment. The result shows that the iron slag added to the concrete had greater strength than the plain concrete.

Keywords: Iron Slag, Fine Aggregate, Concrete, By-Products, Compressive Strength

I. INTRODUCTION

As we know that iron is a chemical element. It is most common element found on earth. It forms on much of the earth's outer and inner core. Here, we are talking about iron slag, slags are generally used to remove waste in material smelting. Iron slag s produced by adding limestone, lime and silica sand. Further, the strength of the concrete is increased by using the partial replacement of fine aggregate with iron slag. The iron and steel making process produces by-product material i.e. iron slag. The utilization of iron slag in concrete by replacing fine aggregate is very optimistic and positive concept. The only potential problem iron slag aggregate is its extensive properties and unwanted reactions between slag and components of concrete studies and tests are being conducted on ways to use the iron slag as an aggregate in concrete. Iron slag is still considered as industrial waste in most countries in the world but by its physical and chemical properties and data analysis on its use as valuable material for different purposes, it is definitely not a waste.

II. AIM OF PROJECT

In this demonstration we find that the fine aggregate were partially replaced with iron slag aggregate at different proportions of 0%, 20%, 30%, 40% and 50% of compressive strength on M30 Grade of concrete with 0.40 water/cement ratios. In which to determine and check out the compressive strength of concrete with various percentages of iron slag aggregate.

III. LITERATURE REVIEW

Iron slag is an industrial waste by- product of steel industry. Iron slag is still considered as industrial waste in most countries in the world but by its physical and chemical properties and data analysis on its use as valuable material for different purposes, it is definitely not a waste. The demand for aggregate in construction industry is increasing rapidly and so is the demand for concrete. In this study the coarse aggregate were partially replaced with iron slag aggregate at different proportions of 0%, 20%, 30%, 40% and 50% compressive strength and flexural strength on M30 Grade of concrete with 0.40 water cement ratio were investigated. In which to determine and check out the compressive strength flexural strength and split tensile strength of concrete. Thus, the use of iron slag in concrete could intensify the strength in concrete.

IV. MATERIAL USED

A. Cement:

The cement used for this work is OPC 53 Grade. A cementations material is one that has the adhesive and cohesive properties necessary to proper bond inert aggregates into a solid mass adequate strength and durability.

Fig.1: Cement

B. Water:

Clean potable water standard of pH value 7 is used for Mixing and Curing operation for the work. If impurities in

the water may affect the setting time of cement, strength of concrete, and may cause corrosion of the reinforcement.

C. Fine Aggregate:

Provincially, available clean river and passing through the IS-4.75mm sieves.

Fig. 2: Fine Aggregate

D. Coarse Aggregate:

The coarse aggregate used is crushed aggregate conforming to code IS 383:1970. Crushed aggregates tends to improve the strength because of interlocking of angular particles, while rounded aggregates improved the flow because of lower internal friction. The maximum size of aggregate considered is 20mm.

Fig. 3: Coarse Aggregate

E. Iron Slag:

Iron slag is an industrial waste material. It is a by-product of the iron and steel making process. Iron slag aggregate is its important characteristics and undesirable reactions between slag and components of concrete.

Fig. 4: Iron Slag

V. CONCRETE MIX

For mixing to an M30 Grade of concrete correct ratio of calculation on cement, sand, coarse aggregate and iron slag are used.

Water Cement ratio for mix design M30 Grade of concrete 0.40 is in use.

For laboratory test mixing the concrete is carried out.

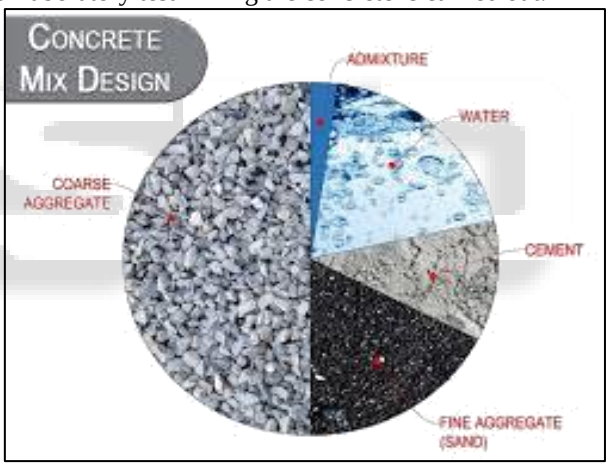

Fig. 5: Concrete Mix Design

Fig. 6: Mixture of concrete

VI. DESIGN PARAMETERS PER CUBIC METER:

1. Cement
2. Fine Aggregate
3. Coarse Aggregate
4. Water/ Cement Ratio
5. Iron Slag for % off Adding.

VII. MATERIAL PROPERTIES

Maximum size of coarse aggregate	20MM
Slum Range	75.100MM
Specific gravity of cement	3.15
Fitness modulus of fine aggregate	2.50
Fitness modulus of coarse aggregate	6.88
Specific gravity of fine aggregate	2.31
Specific gravity of coarse aggregate	2.62

A. Graph on difference in compressive strength day to day

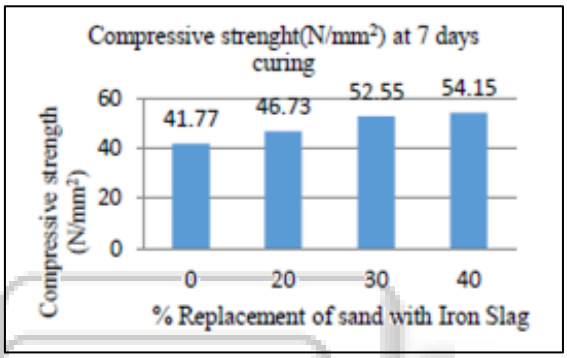

Fig. 7: Compressive Strength at 7 days

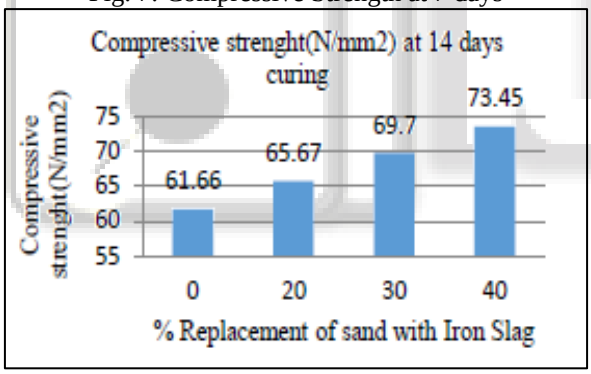

Fig.8: Compressive Strength at 14 days

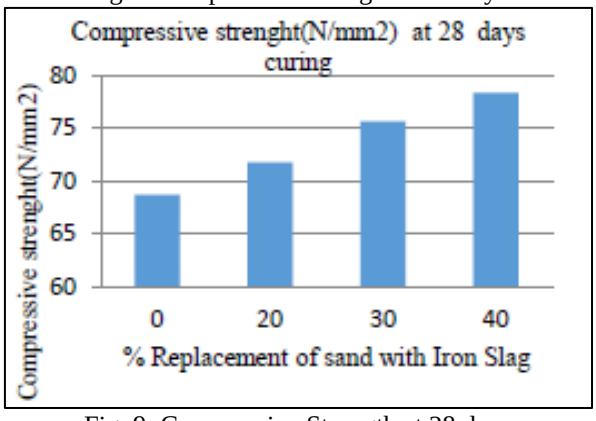

Fig. 9: Compressive Strength at 28 days

VIII. CONCLUSIONS

Following are the conclusions draw from the above research work.

1) The Compressive strength starts increasing with increase percentages up to 50% of iron slag in the mix.
2) Desirable compressive strength is given at 50% replacement of coarse aggregate with Iron slag aggregate.
3) Desirable flexural strength which can be can accounted for the construction practices is given at 20% of replacement of coarse aggregate with iron slag aggregate.
4) After adding 30%, 40% and 50% iron slag in concrete there is decreases in hardened concrete. Hence, it could be recommended that the Iron slag aggregate could be effectively utilized as coarse as coarse and fine aggregate in all concrete applications either as partial or full replacements of normal coarse and natural fine aggregate.
5) The replacement of fine aggregate with induction furnace slag has shown increase in the compressive strength, split tensile strength and flexural strength of concrete when compared to conventional concrete.
6) The composition was casted and tested for 7, 14 and 28 days. The primary components of iron and steel slag are limestone [Ca O] and silica [SiO_2]. The results confirm that the use of iron slag overcome the pollution problems in the environment. The result shows that the iron slag added to the concrete had greater strength than the plain concrete.

REFERENCES

[1] ASTM C 33. (2003). "Standard Specification for Concrete Aggregates" ASTM International.
[2] IS: 10262-2009 (Reaffirmed 2004): Recommended guidelines for concrete mix design, Bureau of Indian Standard, New Delhi-2004.
[3] IS: 383-1970: Specification for Coarse and Fine Aggregates from Natural Sources for Concrete, Bureau of Indian Standard, And New Delhi- 197.
[4] K1, Kishore Kumar M2 Performance of Concrete by replacing Coarse Aggregate and Fine Aggregate with Blast Furnace Slag and Crusher Dust International Journal of Innovative Research in Science, Engineering and Technology December 2013.
[5] Mohammed Nadeem, D. Pofale Utilization of Industrial Waste Slag as Aggregate in Concrete Applications by Adopting Taguchi's Approach for Optimization International Journal of Science and Research (IJSR) October 2014.
[6] KhalidRaza1, R. D. Patel 3 Strength Analysis of Concrete by Using Iron Slag as a Partial Replacement of Normal Aggregate (Coarse) In concrete international journal of scientific & engineering research, volume 4, issue 5, may 2013.
[7] K.G. And Chetan Patil Use of Blast Furnace Slag Aggregate in Concrete International Journal of Innovative Research in Science, Engineering and Technology December 2013.
[8] Kolli Ramji Strength Properties of Polypropylene Fiber Reinforced Concrete.

