A Review on Comparative Study of Concrete Blocks Using Industrial Waste Slag

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Abstract – This paper deals with the comparative study of concrete blocks by replacing the natural fine aggregate as well as coarse aggregate by industrial slag.. There is less availability of the natural fine aggregates so there is need to find the replacement of the natural sand. Day by day the cost of natural sand is increasing. The waste of the industries is became a major problem and the deposing cost the waste is also high and very much difficult. Metal industries generate large amounts of slag as part of the metal casting process. When the slag cannot be reusable in the metal industries it is removed from the metal industries and is called as "industrial waste slag." so that, we decided that using the industrial slag as a replacement to the natural coarse aggregate as well as fine aggregate. it is much needed for the environment and making the construction cost lesser by using it.

I. INTRODUCTION

Concrete is the most widely used material on earth after water. Many aspects of our daily life depend directly or indirectly on concrete. Concrete is prepared by mixing various constituents like cement, aggregates, water, etc. which are economically available. Concrete is unique among major construction materials because it is designed specifically for particular civil engineering projects. Concrete is a composite material composed of granular materials like coarse aggregates embedded in a matrix and bound together with cement or binder which fills the space between the particles and glues them together.

Therefore the use of alternative sources for natural aggregates is becoming increasingly important. Slag is a co-product of the iron and steel making process. Iron cannot be prepared in the blast furnace without the production of its co-product; blast furnace slag. Similarly, steel cannot be prepared in the Basic Oxygen Furnace (BOF) or in an Electric Arc furnace (EAF) without making its co-product; steel slag. The use of steel slag aggregates in concrete by replacing natural aggregates is a most promising concept. Steel or iron slag aggregates are already being used as aggregates in . Studies and tests are being conducted on ways to use this slag as an aggregate in concrete.

II. LITERATURE REVIEW

A. Jigar Patel (2008):

The main aim of this research was to study the behavior of concrete and changes in the properties of concrete with steel slag aggregates by replacing the use of natural aggregates. Steel slag is a byproduct and using it as aggregates in concrete will might prove an economical and environmentally friendly solution. The demand for aggregates is increasing rapidly and so as the demand of concrete. Thus, it is becoming more important to find suitable alternatives for aggregates in the future. Durability of steel slag aggregates concrete under freeze-thaw environment was the main goal in this research, as there was a belief that the steel slag aggregates have expansive characteristics and would cause cracking in concrete. The results proved that if up to 50 to 75 % of steel slag aggregates are incorporated in the traditional concrete, there would not be much change in the durability of concrete.

B. Naitik Joshi1, Sidhharth Godhani2, Jignesh Solanki3(2018):

Evaluated the compressive strength of concrete by replacing cement with GGBS and steel slag at varying percentages of 15%, 30% and 45% for M30 and M40 grade of concrete with respect including steel slag. Steel slag and GGBS should an industrial by-product of steel industry. It should be the problem of disposal as waste and is of environmental concern. The demand for aggregate in construction industry should rapidly and so is the demand for concrete. Thus they are becoming more important to seek suitable alternatives for aggregates in the future. So there are the material should be prefer in the concrete

material in the future. It is finally concluded that the use of GGBS & steel slag is used for betterment of concrete easily & more impacted as compared to other admixture. Its durability is more so its useful in bridge & dam.

C. Girish Sharma1, Ritu goyal2, Abhishek Gupta3, Devinder Sharma4(2015):

Global warming and environmental destruction has come forward as a major issue in the recent years. Started alarming in engineers mind, especially in civil engineers mind. Looking forward for finding out the solution of these issues and also the use of more and more environmental- friendly materials in every Industry particularly construction industry is a paramount importance. The primary aim of study was to evaluate the Fresh, Hardened, Expansive and Durability properties of concrete made with steel slag aggregates. This study presents result of experimental investigations carried out to evaluate effects of replacing aggregate (coarse and fine) with that of slag on various concrete properties. In the present study M35 grade of concrete each having two types of concrete mixes C: S: A, C: S: SS, C: SS: SS (SS is steel slag), and the properties were determined adopting conventional testing procedure. From these results of the study we can say that as the percentage of steel slag as replacement is increased (0% to 55%) the strength of concrete increases. After 55% replacement of Coarse aggregate as steel slag slight decrease in strength is observe, but still it is higher than 0% replacement without any adverse effect on the strength of concrete.

D. Prof. M.H.Lunagaria1, Gatesi Jean De Dieu2(2015):

The pavement materials are required to construct the good roads which helping to connect the different locations. The natural aggregates are occupied the 75% of concrete volume, therefore it is very interested to find the alternative materials which can replace the natural aggregates in order to save environment as well as the economically. The steel slag is the co-product of mills steel industry in which the pig iron are molted in BOF and EAF for reproducing the waste steel materials that can be used as coarse aggregates in place of natural coarse aggregates. This material is strong enough because of its composition of steel for high percentage. The main objective of this research is to check the suitability of coarse steel slag aggregate in concrete mixture. The compressive and spilt tensile strength was evaluated by using Indian standard method. The proportion of replacement natural coarse aggregates 0, 10, 20, 30, 40% by coarse steel slag. The result showed that as increment of steel slag % improve the hardened properties progressively up to 30% and start decrease up to 40% for compressive strength. The split tensile strength increases as steel slag % also increase up to 40%.

E. Tarek U Mohammed1, Munaz A Noor2, Shibly M Apurbo3, Muntasir Ahmed4, Arhab Elahi5, Majedul H Mazumder6:

An experimental investigation was carried out to explore the suitability of utilizing induction furnace slag as acoarse aggregate in concrete. For this study, the aggregates were tested for different physical as well as mechanical properties of cylindrical concrete specimens (100 mm by 200 mm) made with different W/C ratios (0.45 and 0.50), cement content (340 kg/m3), and sand to aggregate volume ratios (0.44 and 0.48). A total of 110 cylindrical concrete specimens for 10 different cases were investigated. The concrete specimens were tested at 7, 28 and 90 days. For comparison, similar investigations were also carried out on burnt clay aggregate commonly used in Bangladesh. Experimental results shows that slag aggregates absorb less water compared to the burnt clay aggregates. Compared to burnt clay aggregate, concrete made with induction furnace slag aggregate gives more workability and more compressive strength. With respect to compressive strength, the optimum amount of replacement of burnt clay aggregate by induction furnace slag aggregate is found at 50%.

F. Tarek U. Mohammed1a, Md N. Rahman 1b, Aziz H. Mahmood1c, Tanveer Hasan11d, and Shibly M. Apurbo1e:

This study has been conducted to explore the possibility of utilization of steel slag in concrete as coarse aggregate. After collection of steel slag aggregate from a local steel manufacturing company, the steel slag aggregate was separated into lightweight (SL), heavyweight (SH), and mixed (SM) slag aggregates. The aggregates were tested for different physical properties as well as mechanical properties by preparing cylindrical concrete

specimens (100 mm by 200 mm) with different W/C ratios, cement contents, and sand to aggregate volume ratios. Total eleven cases for slag aggregates and five cases for brick aggregates were investigated. The concrete specimens were tested at 7, 28, 60 and 90 days. Also, ultrasonic pulse velocity (UPV) test was conducted prior to crushing of the specimens for evaluation of compressive and tensile strengths. For comparison, similar investigations were also carried out on brick aggregate commonly used in Bangladesh. Experimental results show that slag aggregates absorb less water compared to the brick aggregates. The compressive strength of concrete made with mixed slag aggregate is similar or better than that of concrete made with brick aggregate. Concrete made with heavyweight slag aggregate gives more compressive strength than other aggregates. Relationships between compressive strength and modulus of elasticity of concrete, compressive strength and tensile strength of concrete are proposed for different slag aggregates.

G. Ansu John and Elson John:

An experimental investigation was carried out to study the utilization of induction furnace slag as an alternative for conventional fine aggregate. In this study the compressive strength characteristics of mortar and concrete made with partial replacement of fine aggregate using induction furnace slag was considered. For the experimental investigation, mixes were prepared with fine aggregate replacement using 20 percent, 30 percent, 40 percent, 50 percent and 60 percent induction furnace slag. Compressive strength test on mortar and concrete were conducted and the test results indicated that fine aggregate replacement using 30 percent induction furnace showed a better performance compared to control mix.

H. M. A. Qurishee1*; I. T. Iqbal1; M. M. Islam2; M. S. Islam2:

Traditional coarse aggregates are very costly and its amount will be gradually finished possessing a great threat. Slag is considered as third class hazardous waste that requires a large place for dumping. To transform the slag into an environment-friendly resource and to save the environment from the pollution, the possibility of the use of slag as coarse aggregate cannot be overlooked. The main objective of the study is to investigate the strength properties of slag incorporated with concrete. The proportion of stone chips and slag used in this investigation as coarse aggregate are 0 to 100%. A total of 500 specimens of 4 inches cube were cast using plain water in normal temperature for the curing periods of 7, 14, 28,90 and 180 days. W/C ratios were varied as 0.60, 0.50 and 0.42 for making 20, 30 and 40MPa concrete respectively and compressive as well as a tensile test were evaluated. Concrete made by replacing coarse aggregate with BFS is observed to increase up to a replacement level of 40%.

I. K.Thangaselvi Assistant Professor, SCAD College of Engineering and Technology, Cheranmahadevi, Tamil Nadu, India.

Global warming and environment destruction have become the major issue in recent years. Emission of green house gases from industries has impact on climate change. Preventing the depletion of natural resources and enhancing the usage of waste materials has become a challenge to the scientist and engineers. A number of studies have been conducted concerning the protection of natural resources, prevention of environmental pollution and contribution to the economy by using this waste material. The major byproducts of industry are slag. To solve the problem in effective manner slag is use in concrete by replacing natural coarse aggregate. In this study, the replacement was done with coarse aggregate by steel slag for different proportions of 0%, 20%, 40%, 60%, 80% and for a M40 grade of concrete is used for a water cement ratio of 0.40.Tests on compressive strength, split tensile strength, flexural strength at 7 days and 28 days are conducted on specimens. The optimum strength is obtained on 60% replacement of coarse aggregate bysteel slag.

J. Prof. Warudkar Abhijit A., Mr. Nigade Y.M

Road Construction is an activity in which natural resources are used the most in comparison with else branches of Civil Engineering. Prominent quantities of natural materials, stone, rocks and sand are built into kilometers of roads or in reconstruction of frail roads. This paper presents the basic characteristics of slag, describes several of established investigate studies carried out so far, and analyses domestic experience and the possibilities of application of slag in road constructions. To solve the problem of greenhouse gas emission from industries we can

reuse the wastes from industries and help environment. The effective manner is to use slag in concrete by replacing natural coarse aggregate. In this study, the replacement was done with coarse aggregate by steel slag for different proportions of 0%, 25%, 50%, 75% and 100% for a M30 grade of concrete is used for a water cement ratio of 0.48. Tests for compressive strength at 7 days, 14days and 28 days are conducted on specimens. Split tensile strength and flexural strength are carried for 28 days. The optimum strength is obtained on 75% replacement of coarse aggregate by steel slag.

K. Anil*1, Mukesh Kumar*2, Pankaj*3, Pardeep Kumar*4

In construction materials, concrete is the largest production of all other materials. Aggregates are the important constituents in concrete. The increase in demand for the ingredients of concrete is met by partial replacement of materials by the waste materials which is obtained by means of various industries such as plastic waste glass waste or steel waste. Steel slag is a waste product generated during the production of steel. In India, annual outcome of Steel Slag is about 10 Million Tone .The increasing demand to protect the normal environment, especially in build-up areas, the needs to use these wastes are very important. Therefore, replacing all or some portion of natural aggregates with steel slag would lead to considerable environmental benefits. The utilization of waste materials from the industries has been continuously emphasized in the research work .The present work is to use steel Slag as partial replacement for fine aggregate. The M35 concrete with steel slag partial replacement for fine aggregate are examined in the present study. According to material properties compressive strength, flexural strength and split tensile strength were found experimentally. The results were compared with conventional concrete property. The results showed that partially replacing about 0%, 11 % , 22 %, 33%,and 44% of steel slag aggregates by weight for natural aggregates will not do any harm to concrete and also it will not have any adverse effects on the strength and durability.

L. K.G. Hiraskar and Chetan Patil

Observed that the Iron industries produce a huge quantity of blast furnace slag as by–product, which is a non–biodegradable waste material from that only a small percentage of it is used by cement industries to manufacture cement. In the present investigation Blast Furnace Slag from local industries has been utilized to find its suitability as a coarse aggregate in concrete making. Replacing all or some portion of natural aggregates with slag would lead to considerable environmental benefits. The results indicate that the unit weight of Blast Furnace Slag aggregate concrete is lower than that of the conventional concrete with stone chips. The experimental result show that replacing some percentage of natural aggregates by slag aggregates causes negligible degradation in strength. The compressive strength of Blast Furnace Slag aggregate concrete is found to be higher than that of conventional concrete at the age of 90 days. It has also reduced water absorption and porosity beyond 28 days in comparison to that of conventional concrete with stone chips used as coarse aggregate. Blast furnace slag is a byproduct and using it as aggregates in concrete will might prove an economical and environmentally friendly solution in local region. The results showed that it has properties similar to natural aggregates and it would not cause any harm if incorporated into concrete.

III. CONCLUSION

So we conclude that, the industrial waste slag can be used as a construction material as a replacement of the coarse aggregate. That will help making Eco-friendly concrete from recycled materials saves energy and conserves resources which lead to a safe sustainable and economical environment. As per the research papers we will further cast the concrete blocks with 20% and 40% replacement of coarse aggregate by industrial waste slag as per the requirement and testing the same after curing period of 7days and 28 days.

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