" Steel Slag Cement Concrete Road "

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Abstract - This paper reflects the results of an experimental investigation of the strength, permeability, abrasion, carbonation, and shrinkage characteristics of concrete containing various percentages of steel slag as partial replacement of natural fine aggregates. M 30 Grade concrete was designed as per specific national specifications. Steel slag was used to replace natural sand in the range of 0–50%. It was observed that the steel slag blended concrete with up to 50% substitution exhibited a comparable compressive and flexural strength when compared to the control specimens. From the Dorry's abrasion test, it was noted that the specimens could be implemented in heavy-duty floor tiles and even extended to pavement construction. The shrinkage strains, water permeability, and carbonation of steel slag blended concrete were observed to be increasing with increasing replacement amounts of steel slag in the place of natural fine aggregates. The concrete containing steel slag replacing up to 40% of natural fine aggregates can be recommended for all heavy load involving structural applications, and substitution levels beyond 40% could be recommended for non-structural applications, pavements, etc.

Keywords - Steel slag; Recycle; Abrasion; Shrinkage; Carbonation.

I. INTRODUCTION

Aggregates are inert grainy materials such as sand, gravel or crushed stone that are an end product in their own right and are an essential ingredient in concrete. Aggregate, which contributes 60 to 75 percent of the total volume of concrete, are divided into two major categories--fine and coarse. Fine aggregates commonly comprises of natural sand or crushed stone with maximum particles passing through a sieve of 4.75mm. Fine aggregate(natural sand) which has been washed and sieved to remove larger particles i.e. more than 5 mm. IS specifications categorize the sand into four zones as per to its grading as fine aggregate of grading Zone-1 to grading Zone-4. The four grading zones which shows that it become finer from Zone-1 to Zone-4 progressively from 90% to 100% of the fine aggregate passes 4.75 mm IS sieve and 0 to 15% passes 150 micron IS sieve which depends on its grading zone. Steel slag, a by-product obtained from steel formation, is produced by the process of separation of the molten steel from impurities in steel-making furnaces. A molten liquid melt obtained from slag is a complex silicates and oxides that solidify on cooling. Essentially all steel is made in integrated steel plants using a sort of the basic oxygen process or in specialty steel plants (mini-mills) using an electric arc furnace process. Nowadays open hearth furnace process is of no use.

II. LITERATURE SURVEY

Sultan A.Tarawneh, et.al .(2014) [10], in their study entitled "Effect of using Steel Slag aggregate on Mechanical Properties of Concrete".In this experiment their investigation is to evaluate the physical and mechanical properties and characteristics of steel slag aggregate concrete in comparison with the typical crushed limestone stone aggregate concrete. After proper investigation they founds that compressive strength at the stage of 7 days shows much more strength as compared to that of 28 days. They conclude that the added slag show good results at early age. Hence steel slag could be utilized as partial replacement.

P. Sateesh Kumar (2015) [7], in their paper entitled "Study on Behavior of Concrete Mix Replacing Fine Aggregate with Steel Slag at different Properties". The aim of this experiment is to study the effect of partial replacement of steel slag on various strength and durability properties of concrete by using mix design. The test is carried out at the replacement level of 10%, 20%, 30%, 40% at the ages of 7 and 28 days.They concludes that for conventional concrete, partial replacement of fine aggregate by steel slag improve the compressive, tensile, flexural strength. The viability of steel slag in concrete is found.

S.T.Borole, et.al.(2016) [9], in their paper entitled "Replacement of Fine Aggregate by Steel Slag". In this research paper M30 concrete with high volume steel slag replacement for fine aggregate is studied to examine the changes in properties of compressive strength, flexural strength and split tensile strength. After comparison with conventional concrete property results shows that replacing about 0%, 25 % and 50% of steel slag aggregates by that of fine aggregate will not show any harm and any adverse effect to the durability and strength. The test is carried out after 7 and 28 day of curing.

OBJECTIVE

To determine the optimum quantity of steel slag as a fine aggregate to enhance the strength of concrete by conducting related tests like Compressive strength, Tensile strength and Flexural strength at replacement level of 10%,20%,30% and 40%.

III. CONCLUSIONS

Based on the deep study of experimental results and discussions the following conclusions are made.

- Comparison and observations for the compressive strength, flexural strength and split tensile strength of normal concrete and concrete with Steel slag as partial replacements, the results shows that the strength of the normal concrete is slightly lower than the Steel slag replaced concrete.
- The increment in compressive strength is about 31.47% for 7 days curing 20% for 14 days curing 18% for 28 days while at 40% a slight decrement of 4.2% noted for 7 days and 3.4 % for 28 days of curing as compared to 30%.

• The increment in compressive strength of M 30 grade of concrete is about 24.9% for 7 days of curing 17.5% for 14 days of curing and 15.5% for 28 days of curing while at 40% a slight decrement of 3.6% noted for 7 days and 2.5% for 28 days of curing as compared to 30%.

• The split tensile strength increases with increase in percentage of steel slag up to 30% by weight of fine aggregate. The increment in split tensile strength is about 16.7% for 28 days curing for M 25 grade of concrete and increment about 15.6% for 28 days curing for M 30 grade of concrete.

• The Flexural strength increases with increase in percentage of steel slag up to 30% by weight of fine aggregate. The increment in flexural strength test is about 36.7% for 28 days curing for M 25 grade of concrete and 24.7% for 28 days curing for M 30 grade of concrete.

• From the results of compressive strength, split tensile strength, flexural strength 28 days curing, 30% replacement of fine aggregate by steel slag is the optimum percentage of replacement of M 25 & M 30 grade of concrete.

IV. REFERENCES

[1] BIS: 8112-1989: Specification for 43 grade ordinary Portland cement: Bureau of Indian Standard, New Delhi.
[2] BIS: 10262-2009 (Reaffirmed 2004): Guidelines for concrete mix design, Bureau of Indian Standard, New Delhi-2004.
[3] BIS: 456-2007: Guidelines for Plain and Reinforced Concrete Code of Practice: Bureau of Indian Standard, New Delhi.
[4] M.S. Shetty, "Concrete technology", S.Chand & Company ltd, Ram Nagar, New Delhi.
[5] M.Soundar rajan. (2014). "Study on strength properties of concrete by partially replacement of sand by steel slag."International Journal on Engineering Technology and Sciences, Vol.1.
[6] Mr. Pruthviraj L. Kadam, Anuj P. Shete, Ajit R. Ahir, Jay S.Pawar, Prathmesh S. Kadam, Vishal A. Patil, Mr Bajirao V.Mane.(Feb,2016). "Effect of partial replacement of fine aggregate by steel slag and its impact on compressive strength of concrete." International Journal of Scientific & Engineering Research. ISSN 2229-5518., Vol.7. Issue 2.
[7] P. Sateesh Kumar, VVS Sarma, N. Vidya Sagar Lal. (2015). "Study on behavior of concrete mix replacing fine aggregate with steel slag at different properties". International Journal of Engineering and Research and Application. ISSN: 2348 – 9622. Vol. 05 Issue 11 (Part 04), Pp 3946.
[8] P.Sateesh Kumar, VVS. Sarma, N. Vidya Sagar Lal. (Nov, 2015) .Int. Journal of Engineering Research and Applications. ISSN: 2248-9622. Vol.5 Issue 11 (Part 04), Pp.39-46.
[9] S.T.Borole, R.V.Shinde, R.B.Mhaske, S.S.Pagare, K.S.Tribhuvan, N.M.Pawar, .D.Tiwari, A.K.Sanehi.(2016). "Replacement of Fine Aggregate by Steel Slag".International Journal of Innovative In Science and Engineering. ISSN:2454-9665.Vol.2,Issue:03,Pp:628-635.
[10] Sultan A.Tarawneh, Emhaidy S. Gharaibeh and Falah M. Saraireh (2014), "Effect of using Steel Slag aggregate on Mechanical Properties of Concrete". ISSN: 1546-9239.Issue 11 (5), Pp: 700-706.
[11] Vanuatu Kiranmayi Kodali and P. Krishna Prasanna. (Oct, 2014), "Steel slag as a substitute for fine aggregate in high strength concrete" International Journal of Engineering Research & Technology. E-ISSN: 2278-0181. Vol. 3. Issue 10.
[12]Y.Boopathi, Dr. K. Nirmal Kumar. (2015). "Study on mechanical properties of ecofriendly Economic concrete". IJSTM – ISSN: 2394 – 1537 Vol. No. 04. Issue No. 02.