EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH STEEL SLAG KEEPING FINE AGGREGATE REPLACEMENT CONSISTENT AND DURABILITY STUDY ON REPLACED FINE AND COARSE AGGREGATES

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ABSTRACT

In the construction of structures related to civil engineering, concrete plays an important role and is the largest production of all materials involved. Today, as the population growth is increasing on a rapid pace, there is huge demand for concrete for construction purpose in which aggregates are major constituents in concrete production. The project aims to investigate the effectiveness of replacement of coarse and fine aggregates by steel slag (SS) on different properties such as strength and durability of concrete by using mix design of M25 grade. Compressive strength, tensile strength and durability tests such as acid resistance, using Hcl are experimentally investigated.

Keywords: c.a, f.a, steel slag ,durabilty studys, compressive, flexural strengths.

INTRODUCTION

Rapid urbanization has increased the demand for water and other resources for concreting which are inadequate and depleting. Use of recycled materials as one of the alternatives is finding a way to supplement the increasing demand. In the steel making process, nearly 15-20% slag is generated by the mass of crude steel . Slag being an industrial byproduct particularly from steel industry is usually neglected for reused and recycling and being dumped as a waste. Thus recycling of steel slag seeks greater attention from resource utilization and environmental protection point of view. Grading of steel slag aggregate is also important, proper grading of slag aggregate improves the compressive strength of concrete in a better way. Steel slag is industrial by-products of steel manufacturing, characterized as highly calcareous, siliceous and ferrous. They can be categorized into basic oxygen furnace (BOF) slag, electric arc furnace (EAF) slag, and ladle furnace (LF) slag. These are found to be useful in many fields, such as road construction, asphalt concrete, agricultural fertilizer, and soil improvement. However, better utilization for value-added purposes in cement and concrete products can be achieved. They have excellent angular shape which helps to develop very strong interlocking properties. They have high resistance to abrasion and impact They are strong and durable.

EXPERIMENTAL PLAN

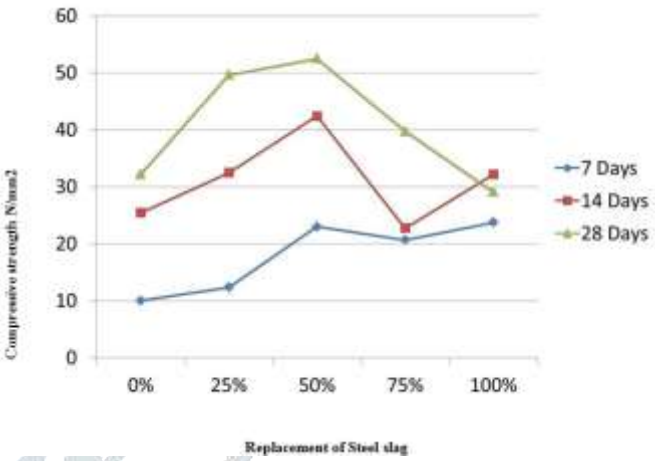
Mix proportion of all the materials was calculated as per BIS10, 262:2009 for target strength of 31.6 MPa and experimental trials were made to obtain a slump of 100 ± 10 mm. While carrying out the research, all the concrete mixes were designed for moderate exposure. The maximum water to cement ratio is considered to be as 0.50. The quantity of cement, fine aggregates and coarse aggregates are considered.

RESULTS

COMPRESSIVE STRENGHT RESULTS From fig the compressive strength of concrete is increased gradually from 0% to 50%and attained a maximum value at a replacement of 50% steel slag in coarse aggregate and 30% replacement of fine aggregate while comparing with the controlled specimen. The compressive strength of concrete is increased for 50% replacement of steel slag.

% of steel slag replacement (coarse-Aggregate)	% of steel slag replacement (fine-Aggregate)	Average 7 Days Compressive Strength (N/mm2)	Average 14 Days Compressive Strength (N/mm2)	Average 28 Days Compressive Strength (N/mm2)
0%	-	10.01	25.38	32.11
25%	30%	12.31	32.435	49.57
50%	30%	22.95	42.395	52.45
75%	30%	20.645	22.73	39.71
100%	30%	23.71	32.13	29.075

strength of concrete for 7, 14 and 28 days with varying amount of steel slag when used as aggregates.



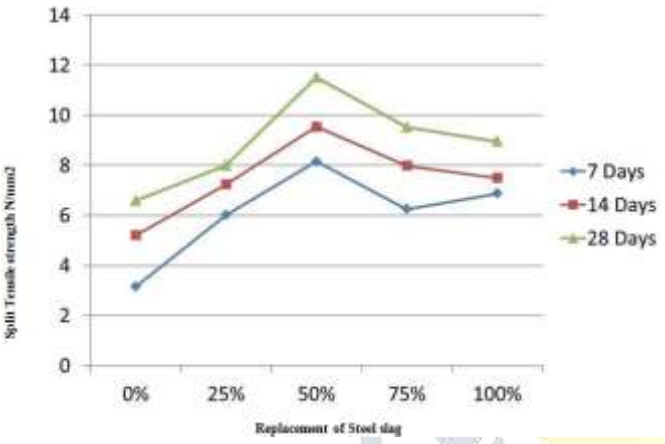
However compressive strength of concrete for the partial replacement of coarse aggregate with steel slag of 50% does not decrease by control mix

SPLIT TENSILE STRENGTH RESULTS

From fig the split tensile strength of concrete is increased gradually from 0% to 50% and attained a maximum value at a replacement of 50% steel slag in coarse aggregate and 30% replacement of fine aggregate while comparing with the controlled specimen.

% of steel slag replacement (coarse Aggregate)	% of steel slag replacement (fine aggregate)	Average 7 days Split tensile strength N/mm2	Average 14 days Split tensile strength N/mm2	Average 28 days Split tensile strength N/mm2
0%	——	3.15	5.21	6.58
25%	50%	6.02	7.24	7.99
50%	50%	8.15	9.54	11.52
75%	50%	6.25	7.98	9.52
100%	50%	6.87	7.51	8.85

split tensile strength of concrete for 7, 14 and 28 days with varying amount of steel slag when used as aggregates.



The slit tensile strength of concrete is decreased for 75% replacement of steel slag

However split tensile strength of concrete for the partial replacement of coarse aggregate with steel slag of 75% does not decrease by control mix.

Glimpse of machines used for the above tests

testing machines used for determining the compressive strength and tensile strength of concrete spe

CONCLUSIONS

Based on the analysis of experimental results and discussions there upon the following conclusions are made.

1) The compressive strength increases with increase in percentage of steel slag up to 50% by weight of fine aggregate and coarse aggregate

2) The split tensile strength increases with increase in percentage of steel slag up to 50% by weight of fine aggregate and coarse aggregate

3) From the results of compressive strength, split tensile strength of 7, 14 and 28 days curing, 50% replacement of fine aggregate by steel slag is the optimum percentage of replacement of M25 grade concrete.

4) From the durability tests we conclude that the strength of normal specimen are decreased the strength with 40% and 50% replacement.

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