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Experimental Study on Concrete with Steel Scraps

Ramachandran [1], Mohammed Hussian. R [2], Ruban Raja. P 3, B. H. Ramathilagam[4]
[1, 2, 3] *Undergraduate student, Sethu Institute of Technology*
[4] *Assistant Professor, Sethu Institute of Technology*

Abstract: The project explains about an experimental study on strength properties of concrete with steel scrap. Steel scrap can be used as fiber which is collected from the lathe industries. Concrete with steel waste used in construction industry reduces the disposal problem. The percentage of steel with consider in the study where 0,0.6%,1.2%,1.8% respectively. Test like compressive strength test and split tensile test were conducted to determine the impact of steel waste in concrete.7days and 14 days test were conducted to find out the strength of concrete with steel waste.
Keywords: Steel scrap

I. INTRODUCTION

The concrete reinforced with steel scrap provides more compressive strength and also tensile strength while compared to normal concrete used in the construction works. The physical properties of steel scrap provide additional reinforcement to the concrete, thus results in the additional tensile strength to the concrete. The using of steel scrap from the lathe waste prevents the contamination of the land and provides innovation in the construction field. The concrete reinforced with steel scrap naturally have which could be used in the construction of structures in zone 3 seismic areas. Manufactured sand is the waste from the gravel dust. Due to the increase in the construction of buildings the demand for raw materials like Natural River sand, red bricks etc., are gradually increased. Thus the alternative source of natural river sand is manufactured sand even though it does not possess the same properties of the river sand. The manufactured sand is found to be having the enough ability to create the bonding with the cement and coarse aggregate.

II. ECONOMIC BENEFITS OF STEEL SCRAP MORTAR

Steel scraps are waste materials produced from lathe and industrial steel. These waste materials don't have a good scrap values and they are not reused properly. So these waste can be effectively used in steel reinforced concretes and the tensile capacity of the concrete can be 2 increased by adding the steel waste. Manufactures sand is used in the place of river sand so that the river sand can be saved and these manufactured sand are cheap and economical. These steel waste are dumped in the land and these produce land pollution, using these steel waste in concrete reduces the pollution caused by these waste. These steel scraps have the property of shock absorbing in nature so these steel wastes can be used in earthquake prone zone areas. Using of steel scraps in concrete reduces the water absorption of the concrete resulting in good strength to the concrete. These technologies can be used in new buildings and also in modification of buildings.

III. OBJECTIVES OF THIS STUDY

The main objective of this work was to study the behavior of steel scrape with the percentage variation of course aggregate from 0% to 1.8% at 0.6% intervals. The Compressive and Flexural strength Properties have studied for each mixes.

IV. MATERIALS

A. Cement

Cement is a binder that sets and hardens and can bind other Materials together. The cement type 1 grade 33 is used for the casting of the paver block. The compressive strength of cement after 28 days test as per IS specification is 33 MPa.

B. Fine Aggregate

Aggregate which passed through 4.75 mm IS sieve and retained on aggregate is a granular material, such as sand, gravel, crushed stone, crushed hydraulic cement concrete, or iron blast furnace slag, used with a hydraulic cementing medium to produce either concrete or mortar.

C. Coarse Aggregate

Aggregate are a component of composite materials such as concrete and asphalt concrete; the aggregate serves as reinforcement to add strength the overall composite material. 20mm sized aggregate are used in the paver Blocks.

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D. Steel Scrap

Steel scraps is a by-product obtained during the production of steel in lathe industries. The scrap is a black and fibre shape in nature which is grinded and used as a replacement of coarse aggregate.

Table 1 Property of Materials

SI.No	Material	Properties	Result
1	Cement	Specific Gravity	3.15
2		Standard Consistency	33%
3		Initial Setting Time	36mins
4		Final Setting Time	300mins
5	Fine Aggregate	Fineness modulus	2.976
6		Specific Gravity	2.48
7	Coarse Aggregate	Fineness modulus	7.33
8		Specific Gravity	2.54
9		Water Absorption	0.5%

V. MIX DESIGN

In this experimental work, M20 grade concrete with w/c ratio of 0.55 was used. In this experimental study, totally 20 numbers of specimen were cast. The specimen consisted of 10 numbers of 150mm cube, 10 numbers of 150mm diameter and 300 mm length cylinder. The replacement of coarse aggregate using steel scraps various from 0-1.8% at 0.6% intervals by weight of coarse aggregate. Table 4.6 shows the values of mix ratio for conventional concrete.

Table 2 Mix Ratio

Cement	Fine Aggregate	Coarse Aggregate	Water
1	2	3	0.55

VI. RESULT AND DISCUSSIONS

A. *Test on Hardened Concrete for Compressive Strength*

The tests for hardened concrete such as compressive strength were conducted and the readings were noted and also taken the weight of the concrete. The various strength test results were tabulated in table3.

Table3 Compressive strength at 7 and 14days

SI. No	% Steel Scrap	Compressive Strength(N/mm^2)	
		7 Days	14 Days
1	CC	18.265	21.265
2	CS 0.6	18.340	22.462
3	CS 1.2	19.975	24.578
4	CS 1.8	19.435	22.491

Figure 1 & 2shows the variation of compressive strength at 7th & 14th days.

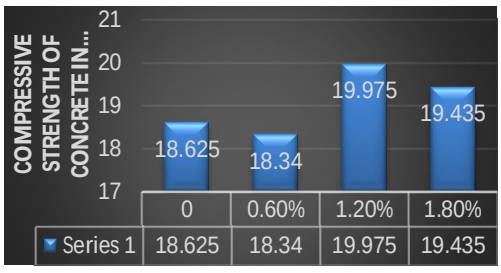


Fig.1 Compressive strengthat 7th day

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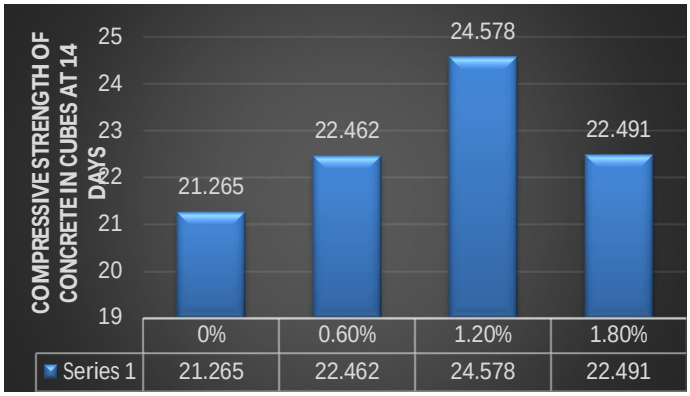


Fig.2 Compressive strength at 14th day

Figure shows the variation of compressive strength of concrete at 14th day. The compressive strength of concrete is increased with the replacement of steel scrap up to 1.20%. Further addition of steel scrap leads to the decrease of strength. Therefore the maximum strength is obtained for concrete with 1.20% replacement of course aggregate using steel scrap and the strength increment of steel scrap concrete is 15.58% higher than the control concrete.

B. *Test on hardened concrete for Split Tensile Strength*

The tests for hardened concrete such as Split Tensile strength were conducted and the readings were noted and also taken the weight of the concrete. The various strength test results were tabulated in table3.

Table3 Split Tensile strength

SI. No	% Steel Scrap	Flexural Strength (N/mm^2)	
		7 Days	28 Days
1	CC	2.124	2.958
2	CS 0.6	2.362	3.162
3	CS 1.2	2.712	3.442
4	CS 1.8	2.343	2.880

Figure 3 & 4 shows the variation of Split Tensile strength of paver block at 7th & 14th days.

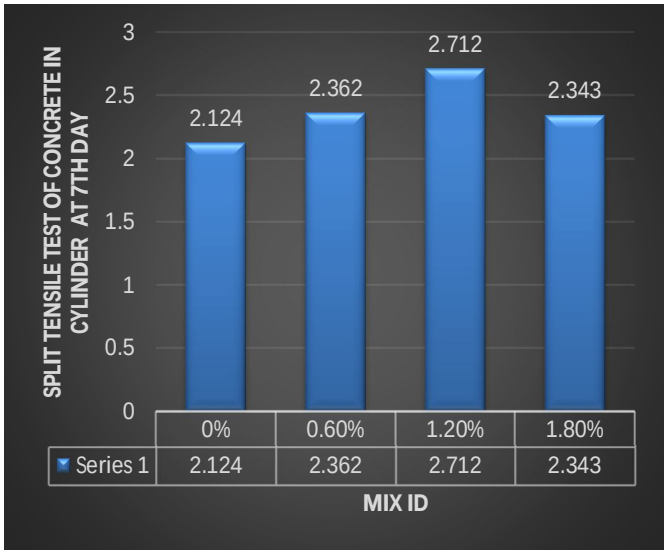


Fig.3 Split Tensile strength at 7th day

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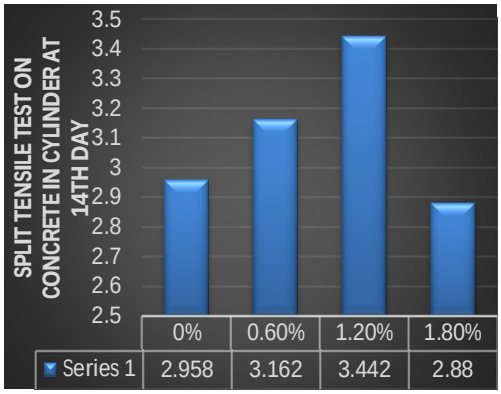


Fig.4 Split Tensile strength at 14th day

Figure shows the variation of Split Tensile strength of concrete at 14th day. The Split Tensile strength of concrete is increased with the replacement of Steel scrap up to 1.20%. Further addition of steel scap leads to the decrease of strength. Therefore the maximum strength is obtained for concrete with 1.20% replacement of course aggregate using steel scrap powder and the strength increment of steel scrap admixed concrete is 16.36% higher than the control concrete.

VII CONCLUSION

A. The strength of the concrete increases gradually due to the addition of steel scraps and then when the percentage of steel scraps exceed 1.2%,the strength of concrete decreases.

B. Addition of 1.2 % of steel scraps shows an increase of 10 % Compressive strength at 7 days was observed and Split tensile strength increases upto 6.9% at 7 days when compared to control specimen.

C. Addition of 1.2 % of steel scraps shows an increase of 8 % Compressive strength at 14 days was observed and Split tensile strength increases upto 6% at 14 days when compared to control specimen.

D. The decrease in the strength of the concrete is due to the balling

E. From the results, the compressive strength and Split tensile strength can be increased by 1.20% replacement of coarse aggregate using steel scraps in concrete.

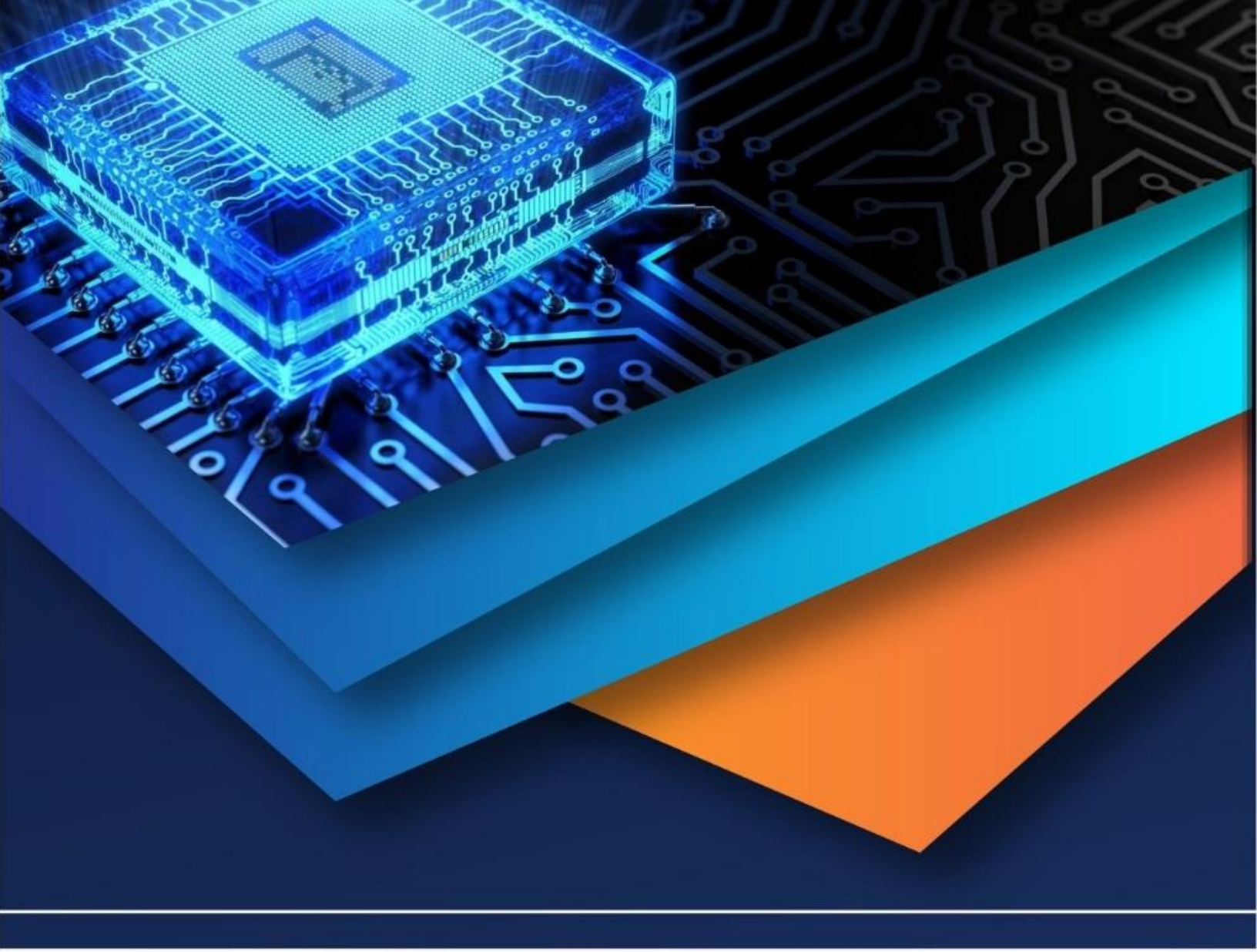
F. The maximum strength of concrete obtained at 1.20% replacement of steel scraps beyond that the strength goes on decreasing.

G. But the compressive strength and Split tensile strength at 1.20% replacement of coarse aggregate using steel scraps in concrete is also higher than the conventional concrete.

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