Experimental Investigation on Concrete With Partial Replacement of Sand By Steel Slag In Addition of Polypropylene Fibre

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Abstract- *This project report summarizes the Experimental investigation on concrete with partial replacement of sand by steel slag in addition of polypropylene fiber. The steel slag is added with concrete in percentage of 15%, 30% and 45%. in respect to weight fraction of fine aggregate and also Polypropylene fiber added in a range of 1.5%, 3.0%and 4.5% The mechanical properties of raw materials used in Concrete are predicted by conducting various tests on it. The concrete grade used for this test is M_{25}. The strength Properties of concrete are discovered by conducting a strength tests like compressive, flexural and split tensile strength at an age of 7,14 and 28 days. The test results are compared with controlled concrete specimen and special concrete made by steel slag and polypropylene Fibre.*

Keywords- Steel slag, Polypropylene Fibre, Compressive strength, Split tensile strength, Flexural strength

I. INTRODUCTION

In this project, mix design is done as per the bureau of Indian standard , IS 10262-1982 for M_{25} grade concrete with good degree of quality control. Polypropylene fiber in mechanical properties of raw material. It is used in replacement of sand by steel slag in addition of polypropylene Fiber.in this study of the influence of different amount of polypropylene fibers content on concrete properties were investigated by measuring compressive strength, split tensile strength and flexural strength. Using steel slag as fine aggregate additional value of percentage. The caused by paste contracting in the concrete are formed in the first hours after pouring the concrete in the frames and before the concrete reaches its initial strength. In this study the following materials used- cement (43grage confirming to IS12269-1987), fine aggregate(M-sand), coarse aggregate, steel slag and polypropylene Fibre and portable water. In this study the sand is replaced by 15%, 30%, and 45% by the steel slag and also polypropylene Fibre added in a range of 1.5%, 3.0% and 4.5%.the various test as been conducted to find out the engineering properties of hardened concrete.

II. METHODOLOGY

This project follows the steps given below:

- Collection of literature.
- Test and study the material properties requiredfor making a concrete.
- Mix proportioning of concrete (M_{25}).
- Preparation of concrete specimen tested for an age of7days, 14 days and 28 days.
- Investigation of strength parameter like Compressive strength, Split tensile and Flexuralstrength of conventional reinforced concreteVs Special concrete made by steel slag and polypropylene fibre.

III. MATERIAL PROPERTIES

3.1 CEMENT TEST:

Table 1–Cement Test

S.NO	TEST	RESULT
1	Standard consistency test	33%
2	Specific gravity test	3.15
3	Fineness test	8%
4	Initial setting time	25min
5	Final setting time	9hrs

3.2 FINE AGGREGATE TEST (M-sand)

Table 2–Test on Fine aggregate

S.NO	TEST	RESULT
1	Specific gravity test	2.62
2	Sieve analysis test	5.849

3.3 COARSE AGGREGATE TEST:

Table 3 – Test on Coarse aggregate

S.NO	TEST	RESULT
1	Sieve analysis test	16.5
2	Impact strength test	6.63%
3	Crushing strength test	31.67%
4	Abrasion test	22.36%
5	Elongation index test	25.65%
6	Flakiness index test	22.06%

3.4 TEST ON FRESH CONCRETE:

Table 4 – Test on Coarse aggregate

S.NO	TEST	RESULT
1	Slump cone test	70mm
2	Compaction factor test	0.922

IV. EXPERIMENTAL INVESTIGATION ON HARDENED CONCRETE

1. 1.Compressive Strength test
2. Split Tensile Strength test
3. Flexural Strength test

Compressive Strength Test

The concrete cubes were crushed at 7, 14, and 28 days in order to determine the compressive strength of the cubes. The compressive strength is determined by dividing the maximum of failure load of the specimen during the test by the cross sectional area of the specimen.

Split Tensile Strength:

Split tensile strength of concrete is usually found by testing plain concrete cylinders. Cylinders of size150mm x 300 mm were used to determine the split tensile strength. After curing, the specimens were tested for split tensile strength using a calibrated compression testing machine of 4000kN capacity.

Flexural Strength:

The determination of flexural strength is essential to estimate the load at which the concrete members may crack. The flexural strength at failure is the modulus of rupture.
The modulus of rupture is determined by testing standard test specimens of size 100 X 100 X 500 mm.

V. RESULTS AND DISCUSSION

5.1 Compressive strength

Table 5 - Compressive strength

S.No	POLYPROPYLENE FIBER ADDING (%)	REPLACEMENT BY STEEL SLAG (%)	7 DAYS N/mm²	14 DAYS N/mm²	28 DAYS N/mm²
1	0%	0%	26.66	33.33	35.55
2	1.5%	15%	28.8	35.11	37.77
3	3%	30%	27.1	33.33	36.44
4	4.5%	45%	26.66	30.66	35.11

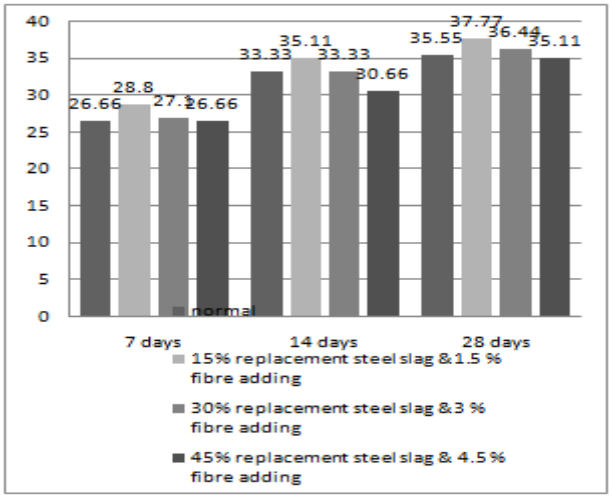

Fig .1 compressive strength of concrete

Table 6- Split tensile strength test: (cylinder)

S.No	POLYPROPYLENE FIBER ADDING (%)	REPLACEMENT BY STEEL SLAG (%)	7 DAYS N/mm²	14 DAYS N/mm²	28 DAYS N/mm²
1	0%	0%	1.41	2.12	2.40
2	1.5%	15%	1.69	2.26	3.25
3	3%	30%	2.26	2.54	3.65
4	4.5%	45%	2.54	2.82	3.96

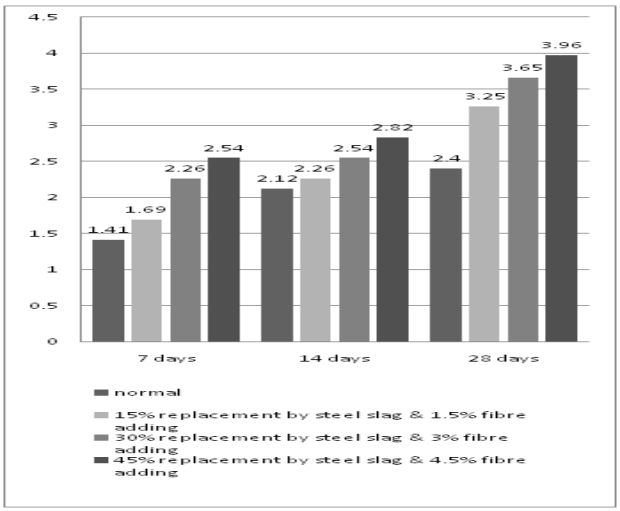

Fig.2 Split tensile strength

Table 7- Flexural strength

S.No	POLYPROPYLENE FIBER ADDING (%)	REPLACEMENT BY STEEL SLAG (%)	7 DAYS N/mm²	14 DAYS N/mm²	28 DAYS N/mm²
1	0%	0%	15.03	18.00	21.06
2	1.5%	15%	15.48	18.27	21.87
3	3%	30%	16.02	18.81	23.4
4	4.5%	45%	16.47	19.35	24.12

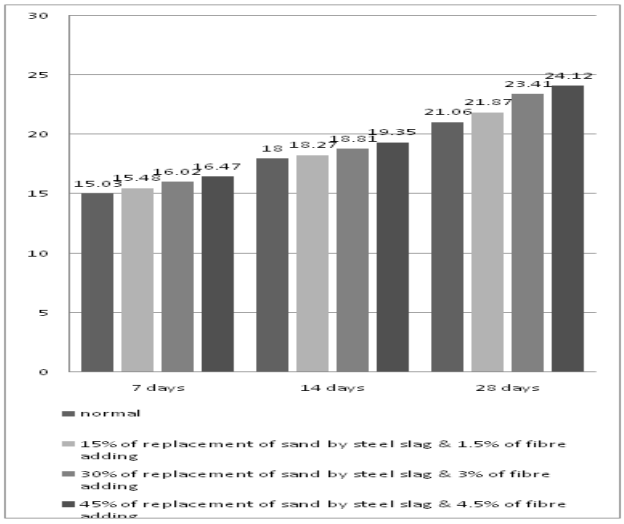

Fig. 3 Flexural strength

VI. CONCLUSION

- This project report concluded that the comparison of mechanical behavior between conventional concrete and concrete made by partial replacement of sand by steel slag in addition of polypropylene fiberwith percentage of 15%, 30%, 45% and 1.5% 3%, 4.5% respectively. The concrete specimen tested for compressive, flexural, split tensile strength test at an age of 7,14 and 28 days.
- At addition of 15% steel slag and 1.5% of polypropylene fiber added concrete gives 6.24% increases in compressive strength,35.4% increases in tensile strength and 4.14% increases in flexural strength. when compared to conventional specimen at age of 28 days.
- At addition 30% of steel slag and 3% of polypropylene fiber added concrete gives2.5% increase in compressive strength, 53.33% increase in tensile strength and 11.42% increase in flexural strength. when compared to conventional specimen at age of 28 days.
- At addition 45% of steel slag and 4.5% of polypropylene Fibre added concrete gives1.2% decrease in compressive strength,65% increase in tensile strength and 14.85% increase in flexural strength. when compared to conventional specimen at age of 28 days.
- In addition of 45% and 4.5% additional material decreases the compressive value. So, the concrete give more effective results and strength at addition of 30% and 3% of steel slag and polypropylene Fibre in concrete.

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