www.ijiarec.com

ISSN:2348-2079

Volume-8 Issue-2

International Journal of Intellectual Advancements and Research in Engineering Computations

Study on strength properties of steel slag in concrete

Selvi.K[1], Ravindaran.M[2]

[1]Assitant Professor, [2]PG Student

Department of Civil Engineering, Nandha Engineering College, Erode, Tamil Nadu, India.

ABSTRACT

Concrete is the mast brooding utilized material on earth after water. To meet the worldwide need of concrete in the future, it is becoming a more challenging task to find suitable appropriate material for preparing concrete steel slag is a waste product generated during the production of steel. The present work in use to steel slag as replacement for fine aggregate this present research aims study the utilization steel slag with 0%, 10%, 20%, 30%, 40%, 50%, 60%. It was found that 30% and 40% replacement of fine aggregate by steel slag given max strength concrete.

INTRODUCTION

The use of alternative materials in production of concrete is being well adopted, since it leads to several possible improvements in concrete composites, steel slag is an industrial byproduct obtain from the steel manufacturing industry [1, 2]. The use of steel slag reduce the need of natural rock as construction material .The preliminary study is made to study the effect of partial replacement of fine aggregate by steel slag in concrete [3]. The properties are compress strength, split tensile strength and flexural strength of M3O grade concrete by studied [4].

MATERIALS PROPERTIES

The materials used are normal fine aggregate, normal coarse aggregate, steel slag, and OPC of 53 grades after tested for their properties according provisions IS 2386:1963 [5-8].

Material used

- Cement
- Steel Slag
- M - Sand
- Coarse aggregate
- Water

Cement

The concrete using for casting the specimens was designed for strength of 30 MPa. Cement of OPC 53 is adopted [9-11].

Table 1 properties of cement

Property	Value
Consistency test	35%
Initial setting time	40min
Final setting time	210min
Specific Gravity	3.15

Author for correspondence:
Department of Civil Engineering, Nandha Engineering College, Erode

Steel slag

Steel slag, a by-product of steel making, is produced during the separation of the molten steel from impurities in steel-making furnaces. The slag occurs as a molten liquid melt and is a complex solution of silicates and oxides that solidified upon cooling. Steel slag mixes have good heat retention and compatibility.

Table 2- Properties of steel slag

Properties	Value
Specific gravity	2.93
Unit weight	1600-1920 kg/m^3
Absorption	3%
colour	Light Brown

Fine aggregate

The sand used in this project work was locally available (M-Sand).

Table 3 properties of fine aggregate

Properties	Value
Specific Gravity	2.66
Fineness Modulus	2.876
Bulk Density	1670 kg/m3

Coarse aggregate

Locally available natural aggregates were used to manufacture specimens for the control mix to be compared with that of the proposed mixes. Coarse aggregates are in the form of irregular broken stone or naturally occurring rounded gravel. The aggregates which are greater than 4.75mm are called as coarse aggregates.

Table 4 Properties of Coarse Aggregate

Properties	Value
Specific Gravity	2.75
Fineness Modulus	5.67
Bulk Density	1507.5 kg/m3

Water

Water which is clean and uncontaminated available in laboratory gratifying the requisite as per IS 456-2000 is utilized for concrete in this work. It plays an important role in mixing, laying, compacting, setting and hardening of concrete. Water influences the strength development and durability of concrete. The pH value of water shall generally be not less than 6

Experimental investigation

- Compressive Strength
- Split tensile Strength
- Flexural Strength

Compressive strength test

Concrete cubes (150mmx150mm) were casted for 0%, 10%, 20%, 30%, 40%, 50%and 60%replacement of steel. The compressive strength for M30 grade of concrete is tested for 7, 14, and 28 days of curing and the results are tabulated and plotted below.

Table 5 Compressive strength Test in Cubes (7, 14, 28 Days)

S. No	% Steel Slag	Average Com- Pressive Strength (N/mm 2)	Average Com- pressive Strength (N/mm 2)	Average Com- pressive Strength (N/mm 2)
		7 DAYS	**14 DAYS**	**28 DAYS**
1	0%	22.80	27.20	39.30
2	10%	24.70	28.93	40.65
3	20%	26.80	30.15	42.62
4	30%	27.50	31.22	44.23
5	**40%**	**28.55**	**31.98**	**45.40**
6	50%	27.36	30.52	43.48
7	60%	26.40	30.18	42.10

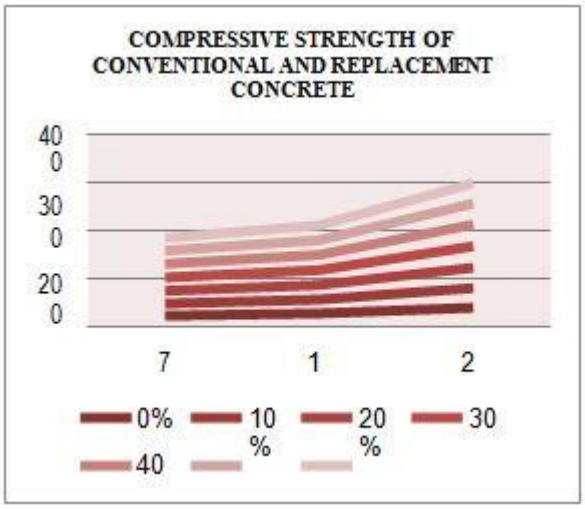

Figure 1 Compressive Strength Test in (7, 14, 28 days)

Split tensile strength

Concrete cylinders (150mmx300mm) were casted for 0%, 10%, 20%, 30%, 40% 50% and 60% replacement of steel slag. The split tensile strength for M30 grade of concrete is tested for 28 days of curing and the results are tabulated and plotted below.

Table 6 split tensile strength Test in Cylinder (7, 14, 28 Days)

S. No	% Steel Slag	Average Split Tensile Strength (N/mm 2)
		28 DAYS
1	0%	3.376
2	10%	3.450
3	20%	3.662
4	30%	3.810
5	**40%**	**3.852**
6	50%	3.792
760%3.654		

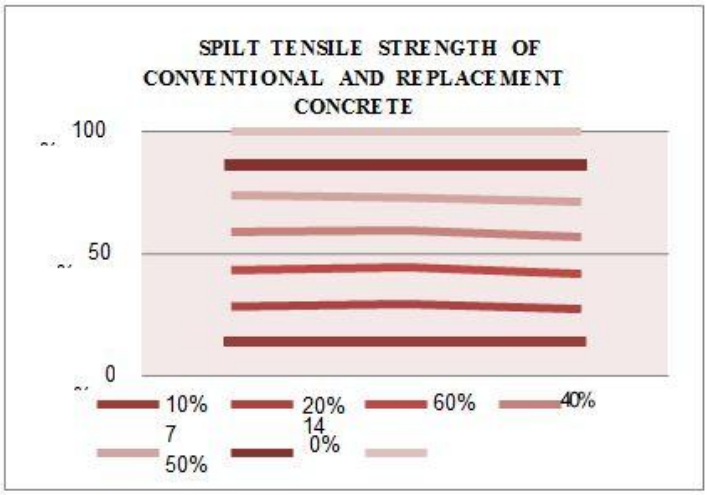

Figure 2 Split Tensile Strength Test in (28 Days)

Flexural strength test

Concrete beams (500mmx100mmx100mm) were casted for 0%, 10%, 20%, 30%, 40% 50% and 60% replacement of steel slag. The Flexural strength for M30 grade of concrete is tested for 28 days of curing and the results are tabulated and plotted below

Table 7 Flexural strength Test in prism (7, 14, 28 Days)

S. No	% Steel Slag	Average Flexural Strength (N/mm 2)
		28 DAYS
1	0%	3.350
2	10%	3.48
3	20%	3.85
4	30%	3.974
5	**40%**	**4.12**
6	50%	3.86
7	60%	3.62

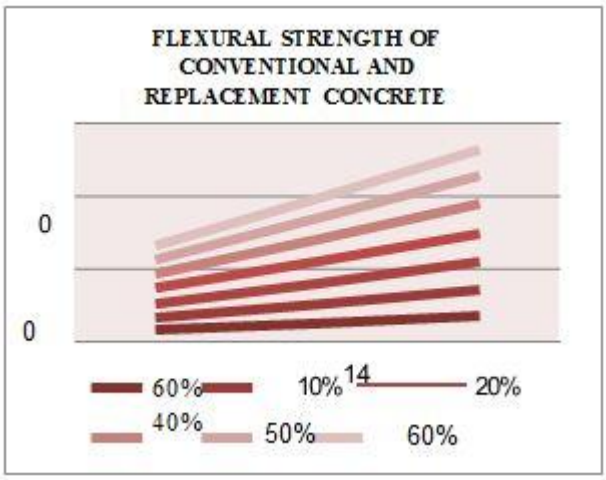

Figure 3 Flexural Strength Test in Prism (28 Days)

CONCLUSIONS

- The analysis is carried out for the conventional concrete cubes, cylinders, prisms.
- The preliminary tests of conventional concrete materials were completed.
- Conventional and partially replaced reinforced concrete beams were casted and tested.
- The compressive strength of partially replaced is found greater than 40% of conventional concrete.

REFERENCES

[1]. BIS: 8112- Specification for 43 grade ordinary Portland cement: Bureau of Indian Standard, New Delhi 1989.
[2]. BIS: 10262-2009 (Reaffirmed): Guidelines for concrete mix design, Bureau of Indian Standard, New Delhi-2004.
[3]. BIS: 456- 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 2007.
[5]. M.Soundar rajan. "Study on strength properties of concrete by partially replacement of sand by steel slag. "International Journal on Engineering Technology and Sciences, 1, 2014.
[6]. Mr. Pruthviraj L. Kadam, Anuj P. Shete, Ajit R. Ahir, Jay S.Pawar, Prathmesh S. Kadam, Vishal A. Patil, Mr Bajirao V.Mane. "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. 7(2), 2016.
[7]. P. Sateesh Kumar, VVS Sarma, N. Vidya Sagar Lal. "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. 5(11), 2015, 3946.
[8]. P.Sateesh Kumar, VVS. Sarma, N. Vidya Sagar Lal. .Int. Journal of Engineering Research and Applications. ISSN: 2248-9622. 5(11), 2015, 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 "Replacement of Fine Aggregate by Steel Slag". International Journal of Innovative in Science and Engineering.ISSN:24549665.2(3), 2016, 628-635.
[10]. Sultan A.Tarawneh, Emhaidy S. Gharaibeh and Falah M. Saraireh, "Effect of using Steel Slag aggregate on Mechanical Properties of Concrete". ISSN: 1546-9239. 11(5), 2014, 700-706.
[11]. Vanuatu Kiranmayi Kodali and P. Krishna Prasanna, "Steel slag as a substitute for fine aggregate in high strength concrete" International Journal of Engineering Research & Technology. E-ISSN: 2278-0181. 3(10), 2014.
[12]. Y.Boopathi, Dr. K. Nirmal Kumar. "Study on mechanical properties of ecofriendly Economic concrete". IJSTM – ISSN: 2394 – 1537 4(2), 2015.