

Strength Behaviour of Iron Fillings in Concrete by Partial Replacement of Sand

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Abstract:- The utilizing of iron fillings in concrete as a partial replacement of sand is attaining enormous significance now a days, mostly because of improvement in strength of concrete and environmental benefits. The aim of study is to assess the possibility of applying iron waste in different percentage (20%,25%,30%,35%) as fine aggregate replacement of sand to increase the strength of concrete. For this purpose, the mix proportion was designed as M20(1:1.5:3) for giving the compressive strength. To achieve the goal of study, laboratory experiments, compressive strength and flexural tensile strength were conducted to determine the influence of iron filling sand the strength of concrete. Higher content of iron fillings particle replaced in concrete increases workability of concrete. Using iron fillings with 35% of replacement of fine aggregate gives the higher strength than normal concrete mix. Addition of iron fillings in concrete increases the strength characteristics of concrete.

Keywords:- Iron waste, Fresh concrete test and Hardened concrete test.

1.INTRODUCTION

Concrete is the most widely used man-made construction material in world and is second to water as the most utilized substance on the planet.

A major portion of this concrete volume is occupied by coarse and fine aggregate. The demand for aggregate is enormous in liberalization, privatization and globalization, and in the construction of important infrastructure projects like expressways, airports, Nuclear plants etc., The increased extraction of coarse and fine aggregate from the natural resources is required to meet this high demand. The increasing use of natural fine aggregate creates an ecological imbalance. Thus, partial replacement of fine aggregate is vital in construction industries. Aggregates are the most important constituents in the concrete mix that help in reducing shrinkage and impart economy to concrete production. Iron filings have some utility as a component in primitive gunpowder. In such a fine powdered form, iron can burn, due to its increased surface area.

2. OBJECTIVES

- To Understand the various application involved in iron fillings
- To perform laboratory test that are related to compressive and tensile by use of iron fillings in concrete.
- To improve strength characteristics of concrete with iron fillings.

3.METHODOLOGY

- Collection of materials
- Testing of materials
- Arriving mix design
- Casting and curing of specimen
- Testing of specimen
- Result
- Conclusion

4.MATERIALS AND TESTS

4.1 CEMENT

Ordinary Portland cement of 43 grade conforming to IS8112-1989 is used for these experiment. The physical properties of cement is shown in the table1

S.NO.	PROPERTY	RESULT	PERMISSIBLE LIMIT
1	Specific gravity	3.1	3.1-3.15 (conforming to IS4031-1998 part 1)
2	Normal consistency	31%	5-7mm (conforming to IS4031-1998 part 4)
3	Fineness of cement (by 90 micron sieve)	4%	Not exceed 10% (conforming to IS4031-1998 part 3)

Table 1.Properties of cement

4.2 SAND

Natural river sand from Cauvery river bed near Trichy, Tamilnadu classified under zone III is used in this experiment. A physical property of fine aggregate is shown in the table.2.

Table.2Properties of fine aggregates

S.No	PROPERTY	RESULT	PERMISSIBLE LIMIT
1	Specific gravity	2.6	2.5-3.0 conforming to IS 2386 part 3)

4.3 COARSE AGGREGATE

The size of the aggregate, particle shape, color, surface texture, density, impurity all of which have an influence on the durability of concrete should conform to IS:2386 (part-III).

Table 3 Properties of coarse aggregate

S.NO	PROPERTY	RESULT
1	Specific gravity	2.68
2	Abrasion value	23.1 %
3	Impact value	25.4 %
4	Water absorption	0.55 %

4.4 IRON FILLINGS



Table 4. Properties of Iron filings

SI.NO	Properties	Values obtained
1.	Specific gravity	3.12
2.	Fineness modulus	3.17

5. DESIGN MIX

5.1 The mix design of concrete is done based on properties of cement, Fine aggregate, coarse aggregate, Water. The mix proportion for concrete is obtained as 1: 1.5: 3 and water cement ratio as 0.5.

6. EXPERIMENTAL INVESTIGATION

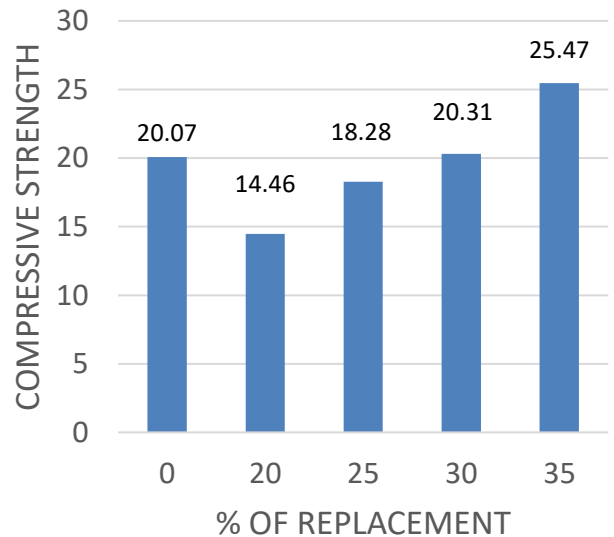


6.1 COMPRESSIVE STRENGTH TEST

The compressive testing machine was used to test the entire concrete strength at 7, 14 and 28 days respectively. The compressive strength for concrete grade M20 (1:1.5:3) were investigated for the control mix and while cement was partially replaced by Iron fillings. The result of

compressive strength test at different curing periods is provided in table. Through the laboratory observation it was perceived that early age strength is lower than the later age strength, because concrete gain its strength with the passage of time.

$$\text{Compressive strength} = \frac{\text{Breaking load(N)}}{\text{Area of cube(mm}^2\text{)}}$$

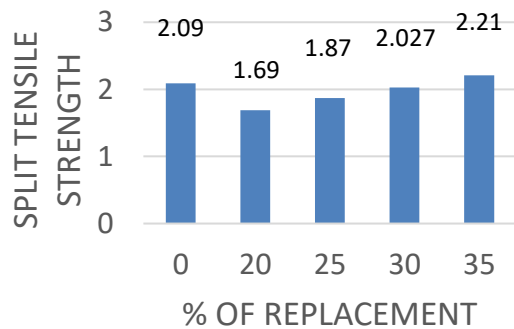


6.2 SPLIT TENSILE STRENGTH TEST

The tensile strength of concrete is one of the basic and important properties which greatly affect the extend and size of the cracking in structures. Moreover, the concrete is very weak in tension due to its brittle nature. Hence it is not expected to resist the direct tension. So, concrete develops crack when tensile forces exceed its tensile strength. Therefore, it's necessary to determine the tensile strength of concrete to determine the load at which the concrete members may crack.

$$\text{SPLIT TENSILE STRENGTH} = \frac{2P}{\pi DL}$$





7.CONCLUSION

From the results and discussion it was concluded that,

- Higher content of iron fillings particle replaced in concrete increases workability of concrete.
- Using iron fillings with 35% of replacement of fine aggregate gives the higher strength than normal concrete mix.
- Addition of iron fillings in concrete increases the strength characteristics of concrete

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