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Influence of Industrial Waste i.e. Welding Waste Slag on Mechanical Properties of Concrete

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ABSTRACT

In building line concrete is utilised at enormous scale and in concrete natural sources and industrial elements by goods available in the world are used in casting. The concrete is a primary material to produce industry, residential housing and key infrastructural demands of modern civilization. Rapid expansion of infrastructural projects in developing nations such as India consumes natural resources at exceptionally high scale such as river sand, natural stones. The Availability of the natural resources is declining day by day. Nowadays, different kinds of fine aggregates are in increasing demand. Motive of this study effort concentrates on the utilisation of weld slag (slag left after the welding process) as fine aggregate in concrete. In this research effort on strength of an unique concrete classified as Welding Waste Slag Concrete. Welding Waste Concrete is a concrete made by specified quantity substitution by welding slag on the place of natural sand. Welding waste slag is slag of weld which is residue after arc welding operation. We generated samples of concrete containing welding waste slag in perportion 5 percent , 10 percent , 15 percent and 20 percent replacement of natural sand. Results reveal that the compressive

Key words

Welding waste slag, compressive strength, workability, split tensile strength.

Introduction

Concrete is main construction material. Basic ingrediants of concrete include cement, fine sand, coarse aggregates and various admixers. The issue is aggregates usually used (fine or coarse) in concrete

are natural stones. We know use of concrete is increasing as population is expanding and so you of natural sources for concrete also increasing therefore there will be issue of availability of natural aggregates in future. So we have to find any solution to prevent this difficulty.

Other motive of my research is to lower the cost of concrete building. The usage of iron in production of numerous products improves the process of arc weld. With development in demand of cars, the production and use of weld are also increasing in the developed and developing countries both. All over the world manufacturing of iron product is expanding and therefore welding process also increases at even bigger percentage than iron created products.

Welding Waste Slag is by product of arc welding whether weld of vehicles or trucks, so this study work topic is decided by focusing on management of welding waste slag. After the process of arc welding by product slag is merely a waste, thus we have to throw that slag. Weld waste slag is part of metallic stuff hence it is not biodegradable so it is detrimental to environment. In earlier years, dealing and management of solid waste is the key challenge in front of all the countries globe wide. The issue of garbage is among one of the most harmful problems in the globe since it creates environmental damage. One of the wastes to be managed is 'Welding waste slag' because; Now by innovation in technology progress work is increasing day by day in countries worldwide has manufactured big amount of iron products, so in production welding process is required and by welding process big amount of welding waste slag. Management of the garbage is currently a serious challenge in front of all the countries globally.

2. Materials used

Cement

Ordinary portland cement (OPC) 43 grade. All tests on cement was completed as per Indian standard code IS 8112-2013.

Fine aggregates

Sand used in this research work sized less than 2.75mm confirmed by sieve analysis. And all additional parameters as per IS:383-1970.

Coarse aggregates

Locally accessible coarse aggregates of size less than 20mm was employed. All the parameters as per IS:383-1970.

Water

Normal drinking water was used for mixing.

Welding waste slag

Welding waste slag used in experimental work was acquired from local welding workshops.

3. Tests performed

Slump test

Slump test was carried out on every sample to verify workability of concrete. The slump value was tested as per procedures described in IS: 1199 – 1959 in India.

Compressive Strength test

Compressive Strength tests were performed on concrete cubes of size 150x150mm samples after 7 days and 28 days. As per requirements given in IS:516-1959.

Split tensile strength

4. Split tensile strength tests were performed on concrete cylinder of size 150mm diameter and 300mm length as per IS:5816-1999. Performed after 7 days and 28 days.

5. Literature review

Effect of replacement of Welding waste slag in lieu of fine aggregates experiments were performed and results revealed that there is no influence on workability of concrete with replacement of fine aggregates by welding waste slag in all the proportions of replacement (5 percent , 10 percent , 15 percent & 20 percent). (5 percent , 10 percent , 15 percent & 20 percent).

Compressive strength of concrete contains welding waste slag 10 percent exhibits increased strength after 28 days of cure it shows 11.34 percent rise in strength. In Samples with 10 percent it shows 10.12

percent and 11.34 percent increment in strength after 7 days and 28 days of curing. In samples with 15 percent replacement it showed 6.32 percent and 7.21 percent increment in compressive strength after 7 days and 28 days. Samples containing 20 percent welding waste slag showed inferior strength as compared to 10 percent and 15 percent . Sample with 10 percent replacement showed greatest strength. In split tensile strength Results of split tensile strength indicated 3.12 percent and 4.69 percent increment in strength at 7 days and 28 days in samples with 5 percent replacement with welding waste slag. It exhibited 4.68 percent and 14.77 percent increment in split tensile strength at 7 days and 28 days in samples with 10 percent replacement of fine aggregates with welding waste slag. And all other samples with 15 percent and 20 percent welding waste slag samples exhibits reduction in split tensile strength.

6. Results

Table 1:- Effect of welding waste slag on compressive strength.

S.no	Specimen Id	Compressive Strength (MPa)	
		7 Days	28 Days
1	FR00	15.8	29.1
2	FR05	16.2	29.6
3	FR10	17.4	32.4
4	FR15	16.8	31.2
5	FR20	16.4	29.3

Results reveal that with 5 percent substitution of fine aggregates with welding waste slag compressive strength was raised 2.53 percent at 7 days and there is an improvement of 1.7 percent in

compressive strength evaluated at 28 days of curing. At 10 percent substitution of fine aggregates with welding waste slag shows better compressive strength it displays 10.12 percent and 7.9 percent

increment in strength after 7 days and 28 days of curing. And all the samples containing 15 percent and 20 percent

welding waste slag exhibits deterioration in strength

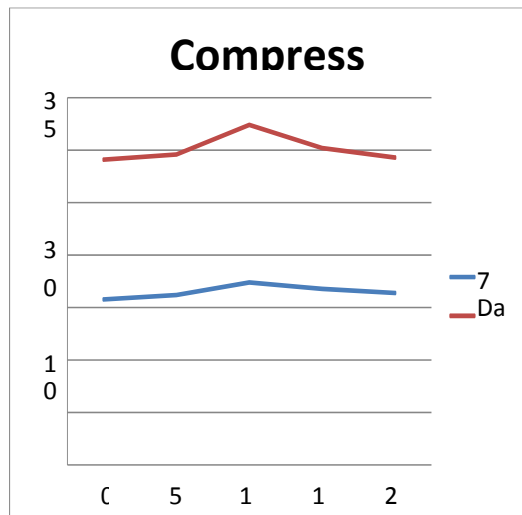


Figure 1:- Effect on compressive strength

Table 2 :- Effect on Split tensile strength.

Sr. no.	Specimen Id	Split tensile strength 7days	Split tensile strength 28 days
1	FR00	1.60	2.98
2	FR05	1.65	3.12
3	FR10	1.72	3.42
4	FR15	1.61	3.12
5	FR20	1.58	2.96

Results of split tensile strength indicated 3.12 percent and 4.69 percent increment in strength at 7 days and 28 days in samples with 5 percent replacement with welding waste slag. It exhibited 4.68 percent and 14.77 percent increment in

split tensile strength at 7 days and 28 days in samples with 10 percent replacement of fine aggregates with welding waste slag. And all other samples with 15 percent and 20 percent welding waste slag samples exhibits reduction in split tensile strength.

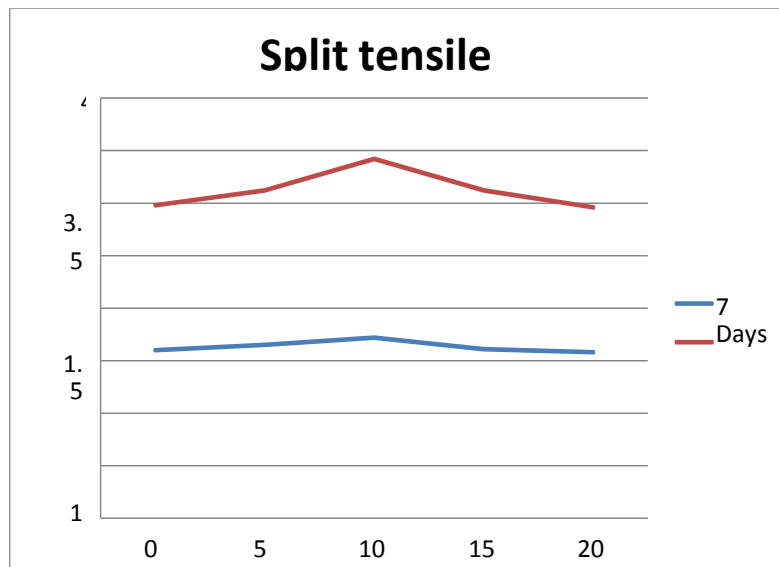


Figure 2:- Effect on split tensile strength.

7. Conclusion

From above results of compressive strength and tensile strength it was obvious strength of concrete enhanced in all the samples containing welding waste slag. Samples with 10 percent replacement of welding waste slag on place of fine aggregates revealed excellent values.

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