International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

PERFORMANCE AND STRENGTH EVALUATION OF CONCRETE BY USING ALCCOFINE AND SLAG SAND

MAMATHA M K[1], CHAYA S[2]

[1]M. Tech Student, Dept. of Structural Engineering, NCET, Bengaluru.
[2]Assistant Professor, Dept. of Civil Engineering, NCET, Bengaluru.

Abstract - *There have been enormous researches going on the use and utilization of industrial, agricultural and thermoelectric plant residues in the production of concrete. There has been increase in the consumption of mineral admixture by cement and concrete industries. This rate is expected to increase day by day. This paper presents the experimental investigation done on strength properties of concrete using "Alccofine and Slag sand". The main objective of this work is to analyze the situation and behavior of M40 grade concrete with 0.36 w/c. Here compressive strength, split tensile strength and flexural strength tests were carried out with different percentage of alccofine with cement as 2.5%, 5%, 7.5%, 10% and constant percentage of slag sand with fine aggregate as 40%. From experimental work and results it can be accomplished that the 40% is ideal percentage replacement of fine aggregate by slag sand.*

Key Words: Alccofine, Slag sand, Compressive strength, Split tensile strength, Flexural strength.

1. INTRODUCTION

For the construction of any structure, Concrete is the main material. Good strength concrete has been widely used in civil engineering structures to reduce the size of structural elements i.e. beams and columns of high rise buildings. The main ingredient to produce concrete is Portland cement. To produce 1 ton of cement, about 1.6 tons of raw materials are required and the time taken to form the lime stone is much longer than the rate at which humans use it. But the demand of concrete is increasing day by day for its ease of preparing and fabricating in all sorts of convenient shapes. So to overcome this problem, the concrete to be used should be environmental friendly.

Slag sand is a volcanic rock look alike, grayish to black colored by-product obtained during the steel manufacturing process. Thousands of tons of industrial slag sand is generated each year in India and more than 90 % of which is disposed in landfills posing a threat to our environment. Alccofine, a product of Ambuja Cements Ltd, one of the leading cement companies in the Indian cement industry; is a slag based supplementary cementations material (SCM) containing high glass content with high reactivity and ultra fineness [1].

One of the suggestions in the forefront has been the sourcing, development and use of alternative, non-conventional local construction materials including the possibility of using some agricultural wastes as construction materials. Improved quality of concrete will only perform better if concrete improves workability, durability, flow ability and resistance to chemical attack corrosion and reduce w/c ratio, heat of hydration and segregation mainly. For the fulfillment of above properties waste produced from the steel and other industries are used for effective and efficient strength and durability of concrete. There are many waste products which are generated from industries and factories, dumped openly which cause environmental problems and also spread disease. These waste products can be recycled in useful way to save the environment. In present days some waste material are used to produce efficient and effective concrete as blending material or mineral admixture. Most common and known blending materials or mineral admixture used in concrete production industries are marble powder, silica fume, fly ash, ground granulated blast furnace slag and new by product admixtures Alccofine which is glass based. This is due to the fact that recycling of industrial wastes as blending materials has technical, economical and environmental benefits. Containing mineral admixtures within pozzolanic concretes are used extensively throughout the world for their good performance and ecological and economic reason and the applications of such concretes are increasing day by day due their superior structural performance, environmental friendliness and energy conserving implications [2].

The advancement of concrete technology can reduce the usage of natural resources. They have forced to focus on recovery, recycling of natural resources and find other alternatives. The use of the replacement materials secures cost reduction, energy savings, arguably superior products, and fewer hazards in the environment.

2. Objectives

a. To characterize the physical properties of alccofine and slag sand.
b. To arrive at optimum mix proportions of the Concrete containing alccofine and slag sand.
c. To determine strength by adding admixtures in it.
d. To determine the compressive strength and split tensile strength and flexural strength of concrete for 7,14 and 28 days of curing.

3.0 Materials used in the Present study

3.1 Cement

Cement is a binding material .The project is carried out by using 53grade OPC Zurari cement for all concrete mixes. The cement which is used during the conduction of experiments was fresh and was free from lumps.

Table -1: Physical properties of cement

SL.NO	Test conducted	Results obtained	Code provision
1	Standard consistency	30%	IS 4031 (Part IV)-1988
2	Initial setting time	35 min	IS 4031 (Part V)-1988
3	Final setting time	265 min	IS 4031 (Part V)-1988
4	Specific gravity	3.14	IS 4031 (Part XI)-1988

3.2 Coarse Aggregate

Coarse aggregates are particulates that size is greater than 4.75mm.Generally the size of coarse aggregate used is 10mm to 20mm. If we use the proportional mix of different sizes small to large (4.75 mm to 20 mm) respectively, this make the concrete structure compact by align themselves in voids depending upon their size and compact mass will be formed with increased strength.

3.3 Manufactured Sand

The crushed sand is of cubical shape with grounded edges, washed and graded to as a construction material. The size of manufactured sand (M-Sand) is less than 4.75mm. Manufactured sand is an alternative for river sand.

3.4 Slag Sand

Slag sand is a volcanic rock look alike, grayish to black colored by-product obtained during the steel manufacturing process. Slag sand is an eco friendly alternative to river sand can be used 100% individually. It does not contain any material that may affect the strength and durability of concrete, such as chlorides, organic matter, clay, silt and shells.

3.5 Water

Water plays an important role in the formation of concrete as it participates in a chemical reaction with cement. Due to the presence of water, the gel is formed which helps in increase of the strength of concrete. Almost any natural water that is drinkable and has no pronounced taste or odor can be used as mixing water.

3.5 Super Plasticizer

In order to improve the workability of fresh concrete, Super plasticizer Conplast SP 430, of colour brown based on sulphonated naphthalene polymers, complies with IS 9103-1999, BS: 5075 part 3 and ASTM C-494, Type F was used.

3.6 Alccofine 1203

Alccofine 1203 is a slag based SCM having ultra-fineness with optimized particle size distribution. Alccofine 1203 provides reduced water demand for a given workability, even up to 70% replacement level as per requirement of concrete performance. Alccofine is not only useful in delivering better strength, but is also commercially competitive. Alccofine has unique characteristics to enhance "performance of concrete" in fresh and hardened stages due to its optimized particle size distribution. Alccofine is also economy friendly since it is a major import substitute.

Table -2: Physical properties of alccofine

Test		Result
Specific gravity		2.9
Particle Size Distribution	d10	1.5 micron
	d50	5 micron
	d90	9 micron

4.0 MIX PROPORTION

In the present work, a proportion for concrete mix design of M40 was carried out according to IS: 10262-2019 recommendations. The mix proportions are presented in Table 3.

Table -3: Mix proportion

Mix designation		M0	M1	M2	M3	M4
W/C content		0.36	0.36	0.36	0.36	0.36
Binding Materials	Cement (Kg/m^3)	412	401.7	391.4	381.1	370.8
	Alccofine (Kg/m^3)	00.0	10.3	20.6	30.9	41.2
FA (Kg/m^3)		632	379.2	379.2	379.2	379.2
Slag sand (Kg/m^3)		00.0	252.8	252.8	252.8	252.8
CA (Kg/m^3)		1260	1260	1260	1260	1260

CA-Coarse aggregate, FA- Fine aggregate

M0=100% cement, 100% CA, 100% FA
M1= 97.5% cement, 100% CA, 60% FA
M2= 95% cement, 100% CA, 60% FA
M4= 92.5% cement, 100% CA, 60% FA
M5= 90% cement, 100% CA, 60% FA

5.0 RESULTS AND DISCUSSION

5.1 Compressive strength

Cubes samples of size 150mmX150mm X150mm were casted and cured for 7, 14 and 28 days to determine compressive strength. The compressive strength test results of various mixes are shown in below chart -1.

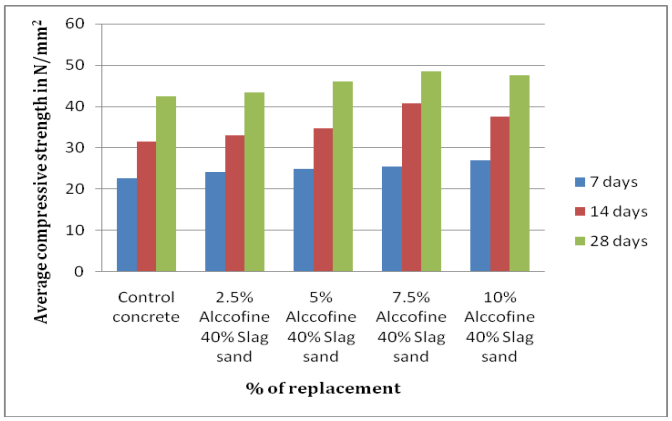

Chart -1: Compressive strength of the concrete

5.2 Split tensile strength

Cylinders samples of size 150mmX300mm were casted and cured for 7, 14 and 28 days to determine split tensile strength. The split tensile strength test results of various mixes are shown in below chart -2.

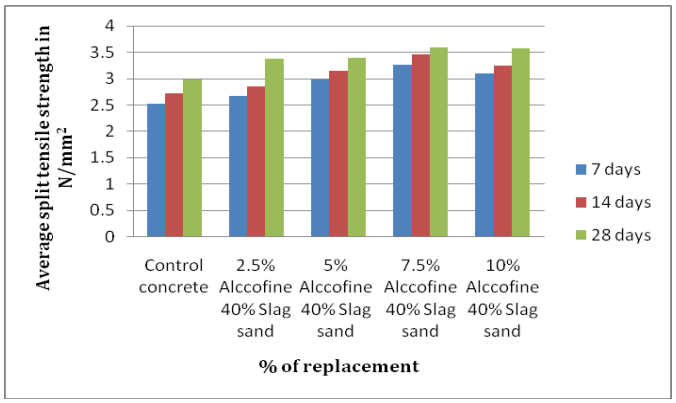

Chart -2: Split tensile strength of the concrete

5.3 Flexural strength

Rectangular beam samples of 100mmX100mmX500mm were casted and cured for 7, 14 and 28 days to determine split tensile strength. The split tensile strength test results of various mixes are shown in below chart -3.

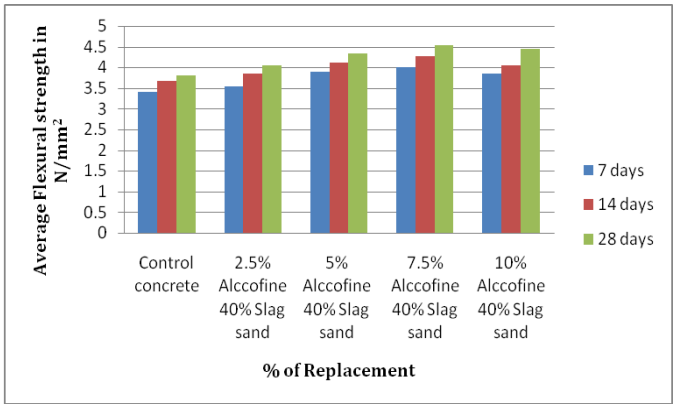

Chart -3: Flexural strength of the concrete

6. CONCLUSIONS

- Test results reported that there is rise in compressive strength, splitting tensile strength and flexural strength for M40 grade of concrete mix with inclusion of slag sand 40% replacement and 7.5% alccofine in addition to OPC.
- Compressive strength, splitting tensile strength and flexural strength of all concrete mixes showed a normal progression in strength with increase in curing age.

REFERENCES

[1] Devinder Sharma, Sanjay Sharma, Ajay Goyal, "Utilization of Waste Foundry Slag and Alccofine for Developing High Strength Concrete," Int. J. Electrochem. Sci., Vol. 11, 2016.

[2] Mahesh S. M and Ravi Chandra S, "Evaluating the Strength Behaviour of Concrete by Using Coir Fibre and Alccofine as Partial Replacement of Cement," International Journal of Current Research, Vol. 9, Issue. 07, pp.53482-53488, July, 2017.

[3] K.Thangapandi, R.Anuradha, J.Swart Singh, Muthuselvan , A.AgnelKristan, T.Heartly Maxton Rodrigo, "An Experimental Study on Performance and Durability of Hardened Concrete Using Alccofine and Copper Slag," International Journal of ChemTech Research, Vol.10 No.8, ISSN: 0974-4290.