International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 06 | June-2018 www.irjet.net p-ISSN: 2395-0072

EXPERIMENTAL INVESTIGATION ON STRENGTH CHARACTERISTICS OF FERRO-CEMENT WITH AND WITHOUT USING FIBRES

Mr. Sahan A[1], Mr. Sumanth[2], Mr. Vachan Shetty[3], Ms. Vaishnavi T[4], Mr. Suraj K S[5], Mrs. Smitha[6]

[1,2,3,4]B.E, Civil Engineering, Sahyadri College of Engineering and Management, Mangalore
[5]M.Tech, Structural Engineering, Sahyadri College of Engineering and Management, Mangalore
[6]Assistant Professor, Department of Civil Engineering, Sahyadri College of Engineering and Management, Mangalore

---

Abstract: Ferro-cement contains closely spaced one or more than one layer of mesh or fine rods embedded in ce ment mortar which is mixof calculated amount of water, cement and sand. It has many applications in newly constructed structures and recondition and repair of existing structures. Ferro-cement has homogenous isotropic properties, high modulus and high tensile strength of rupture as it is reinforced in two directions. It is low cost in maintenance and repair and economical. It is applicable in stairs, h ousing, wall panel, formwork, lintel, boats, water tanks, roof etc. Ferro-cement material is especially applicable for precast items in the view of its simple construction and lower dead weight of the casted units. Fibre reinforced Ferro-cement is the mixture of Ferro- cement and fibre. Adding fibre in Ferro-cement reduces the micro crack and prevents the propagation of crack development. It increases compressive strength and flexural strength of Ferro-cement, enhances the elastic modulus and decrease brittleness

Keywords: *Ferro-cement, precast items, elastic modulus*

I. INTRODUCTION

Ferro-cement contains closely spaced one or more than one layer of mesh or fine rods embedded in cement mortar which is mix of calculated amount of water, cement and sand. It has many applications in newly constructed structures and recondition and repair of existing structures. Ferro-cement has homogenous isotropic properties, high modulus and high tensile strength of rupture as it is reinforced in two directions. It is low cost in maintenance and repair and economical. It is applicable in stairs, housing, wall panel, formwork, lintel, boats, water tanks, roof etc.

Fibre reinforced Ferro-cement is the mixture of Ferro-cement and fibre. Adding fibre in Ferro-cement reduces the micro crack and prevents the propagation of crack development. It increases compressive strength and flexural strength of Ferro- cement, enhances the elastic modulus and decrease brittleness.

Generally cracks begin at micro level and lead to cleavage through micro cracking. Fibre act as secondary reinforcement and arrest the cracks forming and propagating.

Ferro-cement material is considerably affected by dislocation in the concurrence of the framework covering, without collapsing their structure which illustrates flexibility of concrete. Because of its framework ,specific surface and its tensile strength that exceeds the reinforced concrete strength, mechanical performance of Ferro-cement has better results than the conventional materials. Also Ferro-cement carries its elastic individuality until cracks appear lightly on the surface. Total resistance to compression is given by the concrete compression resistance which cannot be altered by the steel framework. There are numerous applications in Ferro-cement. Some of them are tank for rain water harvesting, boats, wind tunnel , slabs for safety tank, swimming pool, sock pit, kitchen cabinets, compound walls, modular housing, marine work.

II. OBJECTIVES

The objectives of this study are quoted as follows:

To prepare Ferro-cement for Cement-sand ratio i.e. (1:3)

- To determine strength of Ferro-cement for the Cement- sand ratio.
- To study the effect of Cement-sand ratio on properties of Ferro-cement in condition of compressive strength and flexural/bending strength
- To prepare Ferro-cement with different types of fibres (polypropylene, polyester) along with different varying percentage of fibres (0.5%, 1% and 1.5%).

III. METHODOLOGY

Raw materials used for the study:

Cement OPC grade 43, Fine aggregates and Coarse aggregates, Water and Square steel mesh were used for the study. The above raw materials were complimented with polyester and polypropylene fibers for the experimentation. The response of port-land cement and water brings about production of solidified paste. The dampness substance of the sand must be considered for the count of water. The conduct of mortar is similar to the plain concrete. The mix ought to be as firm as conceivable and it ought not to avoid full entrance of the mesh. Quality of materials utilized ought to be great. IIn this study coarse aggregates have not be used. The study basically aims at determining the behavior of cement mortar with steel mesh and fibers. Since coarse aggregates have not been used, the mould size used for flexure tests has been prefabricated to a dimension of 700x75x75mm (since absence of CA would cause shrinkage cracks if the mould depth is greater than 75mm).

Table 1: Design Mixes

Mix	1:3 (cement: sand)
A1	Mix + Polypropylene 0.5%
A2	Mix + Polypropylene 1%
A3	Mix + Polypropylene 1.5%
B1	Mix + Polyester 0.5%
B2	Mix + Polyester 1%
B3	Mix + Polyester 1.5%

Iron cube moulds are made of 3mm thick and 75x75x75 mm size. Flexural beams normally in rectangular shape made out of iron. They are open at top and having a base plate at the bottom. Flexural beam used are of size 700X75X75mm.

IV. RESULTS AND DISCUSSIONS

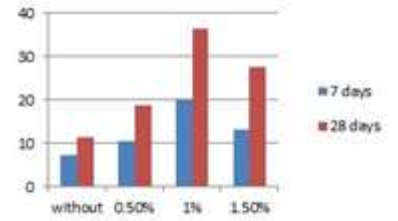
The following results have been obtained.

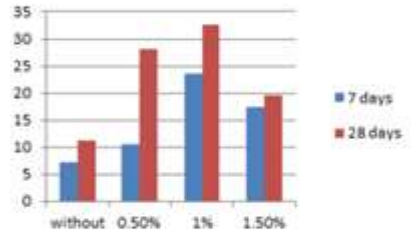
Table 2: Result of Ferro-Cement Without Using Fibre

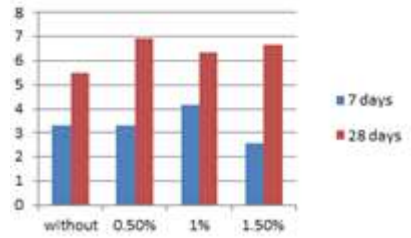
Test	Compressive strength(N/mm)		Flexural strength(N/mm)	
C/S ratio	7days	28days	7days	28days
1:3	7.328	11.3	3.31	5.52

Table 3: Result of Ferro-Cement With Fibres

Test		Compressive strength(N/mm²)		Flexural strength(N/mm²)	
Fibre %		7days	28days	7days	28days
Polypropylene fibres	0.5%	10.54	18.84	3.31	6.91
	1.0%	20.208	36.38	4.15	6.35
	1.5%	13.15	27.55	3.31	6.68
Polyester fibres	0.5%	10.67	28.08	3.31	4.97
	1.0%	23.52	32.6	3.86	3.59
	1.5%	17.42	19.67	3.6	6.91







Based on the experimental investigation the following discussions can be drawn

- Compressive strength of Ferro-cement is optimum for 1% of polypropylene and the strength increases with the number days of curing.
- Compressive strength of Ferro-cement is optimum for 1% of polyester fibre and the strength increases with the number days of curing.
- Flexural strength of Ferro-cement is optimum for 1.5 % of polyester fibre and the strength increases with the number days of curing.
- Flexural strength of Ferro-cement is optimum for 0.5% of polypropylene fibre and the strength increases with the number days of curing.

CONCLUSIONS

The following conclusions are drawn from this study.

- In the compressive strength and flexural strength, the values were found on the 28 days which justifies that the value increases and then on further addition of fibre it decreases
- Fibres acts like secondary reinforcement
- Among the two fibres used in this experiment for 0.5%, 1% and 1.5% variation, polypropylene of 1% gives high strength in compressive strength.
- Among the two fibres used in this experiment for 0.5%, 1% and 1.5% variation, polypropylene of 0.5% gives high strength in flexural strength.
- 28 days of curing gives more strength than 7 days of curing. It indicates that increase in curing time has an appreciably effect in increasing the strength of Ferro-cement with and without using fibre.
- The ideal percentage addition for the cement matrix in case of polyester is between the ranges 1.0-1.5% by mass of cement. Likewise, in the case of polypropylene fibres the ideal range of addition is found to be 0.5 – 1.0%.

References

[1] Adithya D Karnawat, Harsh S. Mehta, Hitesh J. Mistry,"Ferro-cement", ISSN: 2347-2812, Volume-4, ISSUE-3, 2016, PP 97-99

[2] S.Chen, Y. Zhuge, G. X. Lu, D. R. Eising "Flexural behavior of basalt fiber reinforced Ferro-cement composite", ACMSM23, 2014, PP 143-148

[3] Swayambhu Bhalsing, SayyedShoaib, PankajAutade "Tensile Strength of Ferrocement with respect to Specific Surface", International journal of innovative research in science, engineering and technology, Volume 3, Special Issue 4, April 2014, PP 501-507

[4] J.R Thirumal "The Behavior Of Fiber Reinforced Ferro-cement Slabs Under Impact Is Studied with mesh named G.I. steel weld mesh and a synthetic fiber named Polyolefin" International journal of Biotech Trends and technology" (IJBTT) – Volume 2, Issue 5, Number 2, 2012, PP 31-53

[5] Shuxin Wang, A. E. Naaman, Victor C. Li, "Bending response of hybrid Ferro-cement plates with meshes and fibers" journal of Ferro-cement, volume-34, No 1, 2004, PP 275-288

[6] M. S. Shetty "Concrete technology theory and practice", 2012, PP 566-570

[7] ACI committee 549. 1R-93, "Guide for the design, construction and repair of Ferro-cement", 1999