Experimental Investigation on Ferrocement Wall Panel Using Discrete Fiber

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***Abstract* - Ferro-cement consist closely space one or more than one layer of fine road or mesh embedded in cement mortar which is calculated mix amount of cement sand and water. 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 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.**

Ferro-cement material is especially applicable for precast items in the view of its simple construction and lower dead weight of the casted units. Ferro cement Fiber Reinforcement is the mixture of Fiber and Ferro cement. the prevent the crack development. Compressive strength and Flexural strength increase the Ferro cement.

I.INTRODUCTION

Fibre reinforced Ferro-cement is the mixture of Ferro-cement and fibre. Generally micro cracking through cleavage to lead and micro level at the cracks stage. Arrest the cracks forming and propagating the fiber act as a secondary reinforcement.

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. There are numerous applications in Ferro-cement. Some of them are tank for rainwater harvesting, boats, wind tunnel, slabs for safety tank, kitchen cabinets, compound walls, marine work.

Effects of Fiber on Concrete:

To the resist drying shrinkage cracking and plastic shrinkage cracking fiber is provided the reinforcement in concrete. The Reduction of bleeding of water and sponginess of concrete also can be achieved by fiber. Fiber help the retrieve the pre crack tensile strength, post peak ductility performance, impact strength fatigue strength and eradicate temperature fatigue.fissuses shrinkage. Concrete in used the fiber benefits to tiny fissures avoid that can occurs. When FRC satisfies the much-demanded requirement of material pavement in India, reduced pollution and economy. The, many other fiber advantages are less fuel intake, longer life, maintenance the low cost, improved load capacity, water impermeability over flexible pavements and good riding feature. One of the properties that fiber provides to concrete is the energy absorption ability to the concrete and the surge in its ductility and the preventing of the crack development. If the length or amount of the fiber is increased, the energy concentration measurements of plate concretes also increase. It has been observed that the incorporation of steel fibers and polypropylene fiber shows higher strength than non fiberios concrete. The use of fibers also recalibrates the behaviour of the fiber-matrix composite after it has cracked through refining its toughness.

Fiber Used:

Polypropylene Fiber:

The Polypropylene fiber, correspondingly known as polypropene or PP, is a synthetic fiber, altered from 85% propylene, and is used in a variety of uses. As we know concrete provides a strong road pavement but it may undergo plastic and shrinkage cracking. So, to mitigate these problems polypropylene fiber-reinforced concrete (PFRC) has provided for

improving these deficiencies. The accumulation of fibers in concrete increases the stiffness, flexural strength, tensile strength and bearing strength. The polypropylene fiber also reduces the steel reinforcement requirement and also improves the ductility.

II.METHODOLOGY

MATERIALS:

CEMENT:

Ordinary Portland cement available in the local maeket. Cement is the most important constituents of concrete, it forms the binding medium for the discrete ingredients made out of naturally occuring raw material.

FINE AGGREGATE:

The material which is smaller than 4.75mm size is called fine aggregate. Natural sands are generally used as fine aggregate. Angular grained sand produces, good and strong concrete because it has good interlocking property, while round grained particle of sand does not afford such interlocking.

WATER:

The major factor controlling strength, everything else being equal, 30liters is the amount of water used per bag of cement.
(AS PER IS456 CODE)

DISCRETE FIBER (NYLON FIBER):

Nylon is a subtype of polypropylene fibers which can be used to produce burlap.Tensile force and elongation of fibers are about 60N and 15mm.

STEEL MESH:

the diameter of used wires in steel mesh is about 0.8 mm, and the length of squares is about 1 cm, and measuring length of sample is 20 cm. Under tensile tests at laboratory, obtained force and elongation of wire mesh are about 140 N and 2 mm, respectively. The steel mesh used in this investigation is shown inFig.1,and the curve of load versus displacements for wire mesh.

Procedure

- Prepare a concrete mix with the proportions suggested 1:1.5:3 with w/c = 0.48 by hand mixing.
- Prepare 72 testing cubes, make sure that they are clean greased or oiledthinly.
- Metal mouldshould be sealed to their base plates to prevent loss ofwater.
- Fill the cubes in three layers, tamping each layer with (35) strokes using atamper.
- Fill the mouldcompletely, smooth off the tops evenly, and clean up any concrete outsidethe cubes. Rest the cubes for 24 hours in curingroom.
- After that open the mouldand immersed the concrete cubes in a water basin for 7 days ,14 days and 28days.
- Carefully center the cube on the lower plate of machine and applied load, take the values carefully.

III.MATH

cement content:

The cement content per unit volume of concrete may be calculated from free water cement ratio and the quantity of water per unit volume of concrete.

I. Water cement ratio = 0.48

II. Cement content = 197/0.48
= 410 kg/m^3

From Table 5 of IS 456, Minimum cement content 300 kg/m^3 410 kg/m^3> 300 kg/m^3
(Hence OK.)

From Table 3 of IS 10262: 2009, volume of coarse aggregate corresponding to 20 mm size aggregate and fine aggregate (zone 2) for water cement ratio of 0.50 = 0.62

Therefore, proportion of volume of fine aggregate = 1 – 0.62 = 0.38

IV.UNITS

The mix calculation per unit volume of concrete shall be as follows:

a. Volume of concrete = 1 m3

b. Volume of cement = (mass of cement / (specific gravity of cement x 1000))
= (330 / (3.11x 1000)) = 0.106 m^3

c. Volume of water = [mass of water / (specific gravity of water x 1000)]
= (158 / (1 x 1000)) = 0.158 m^3

d. Volume of chemical admixture = NIL

e. Volume of all in aggregate	= [a - (b + c + d)] = [1 – (0.105 + 0.158 + 0)] = 0.737 m^3
f. Mass of fine aggregate	= e x volume of fine aggregate x specific gravity of fine aggregate x1000 =0.737 x 0.38 x 2.706 x 1000 = 757.84kg

V. HELPFUL HINTS

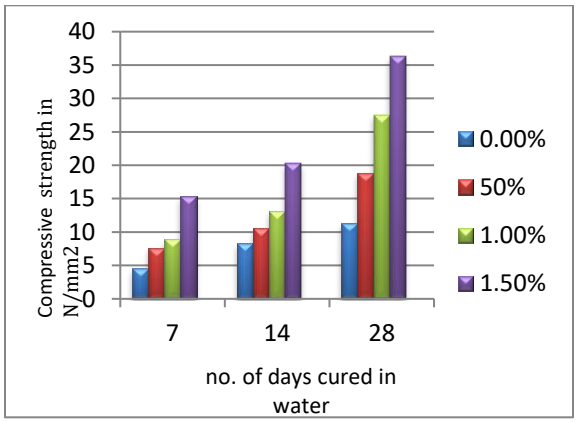
Keywords:

- Ferro-cement
- precast items
- elastic modulus
- Nylon fiber
- Water
- Cement
- Steel Mash

EXPERIMETAL ANALYSIS

TABLE NO 1. COMPRESSIVE STRENGTH

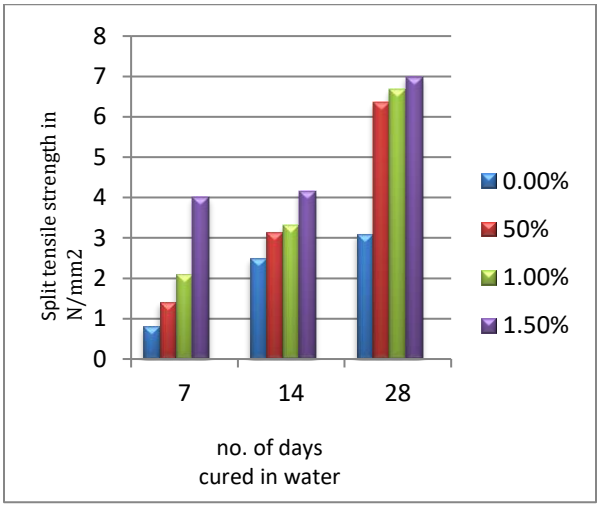
Fiber %	7 day	14day	28day
0%	4.52N/mm^2	8.32N/mm^2	11.3N/mm^2
0.5%	7.60N/mm^2	10.54 N/mm^2	18.84 N/mm^2
1%	8.90N/mm^2	13.15 N/mm^2	27.55N/mm^2
1.5%	15.30N/mm^2	20.26 N/mm^2	36.38 N/mm^2



Graph showing variation of compressive strength at varying percentages of fiber

TABLE NO 2. Split Tensile Strength

Fiber %	7 day	14day	28day
0%	0.8N/mm^2	2.50N/mm^2	3.10N/mm^2
0.5%	1.40N/mm^2	3.13N/mm^2	6.35N/mm^2
1%	2.10N/mm^2	3.31 N/mm^2	6.68N/mm^2
1.5%	3.20 N/mm2	4.15 N/mm^2	6.98 N/mm^2



Graph showing variation of split tensile strength at varying percentages of fiber

VI.CONCLUSION

- In the compressive strength and tensile strength the values were found on 28 days which justifies that the value increases and then on without addition of Discrete fiber it decrease.
- Discrete fibers acts like secondary reinforcement.
- Among the nylon fibers used in this experiment for 0%, 0.5%,1% and 1.5% variation, polypropylene fibers of 1.5% gives high strength in compressive strength.
- 28days of curing gives more strength than 14 days and 7 days of curing. It indicates that increases in curing time has an appreciably effect in increasing the strength of Ferro-cement with and without using Discrete fiber.

REFERENCES

[1] S. DeepaShri, “An Experimental Investigation on The Flexural Behaviour of SCC Ferrocement Slab Incorporating fibers” International Journal of Engineering Science and Technology (IJEST), Vol.4 No.05, (May 2012).

[2] Song P.S. and Hwang S.,” Mechanical properties of high-strength steel fiber- reinforced concrete “Construction and Building Materials, 2004, pp669-676.

[3] Ramakrishnan V, Wu G.Y. and Hosalli G, 1989. Flexural behaviour and toughness of fiber

reinforced" Transportation Research Record, No.1226, pp 69-77

[4] MehvishNazir Khan1, Sukhdeep Singh2 (july 2020). Use of Discrete Fiber in Road Pavement, (IRJET) Volume: 07 Issue: 07 | July 2020.

[5] T.Sirisha 1, A.V.S Saikumar 2, B.Madhanna 3,Use of Discrete Fiber in Construction, (IRJET) Vol. 5, Issue 8, August 2016

[6] ParveenKaur, MohitTalwar, May 2017 (Special Issue), Different types of Fibres used in FRC. Volume 8, No. 4, May 2017.

[7] K. Mounika, A. Suchith Reddy, G. Latha, "Experimental Investigation on Performance of Fibrous Ferrocement" International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET) Vol. 4, Issue 8, August 2015.

[8] S. Grija, P. Sivakumar, K. N. Lakshmikandhan, R. Ravichandran, B. Karthikeyan, "Novel Ferrocement Light Weight Wall Panels" International Journal of Applied Engineering Research Volume 9, Number 18 (2014).

[9] Ganesh A. Chougule, N. N. Morey and A. P. Khatri, "Study and Cost Analysis of Ferrocement Panel For Affordable Housing" Journal of Basic and Applied Engineering Research Volume 3, Issue 10; July-September, 2016.

[10] I.S. 3085-1965 Methods of test for permeability of cement and concrete.

[11] I.S. 1199-1959 Methods of sampling and analysis of concrete

[12] I.S. 456-2000 Indian Standard Plain and Reinforced Concrete – Code of Practice

[13] KamarulZaman, Sezleen Bahzme (2006) Structural performance of wire mesh reinforced concrete wall panel / Sezleen Bahzme Kamarul Zaman.