International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 3, April 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Study on Flexural Strengthening of RC Beam using Ferrocement Laminates Recron

R. Manimozhi[1], S. Janagan[2]

[1]P.G Student Civil Structural Engineering, [2]Assistant Professor,
[1,2]Gnanamani College of Engineering, Namakkal, Tamil Nadu, India

ABSTRACT

Worldwide a outstanding deal of lookup is presently being centered on the use of high-quality fabric for restore and strengthening of present strengthened concrete shape and the lookup is additionally difficulty about the nice utilization of fibre in development industries. Ferro cement is one of the versatile substances for strengthening of constructions and is recognized as a novel development material. For instance, the use of Ferro cement in the building of earthquake resistant structures, precast roof factors and different marine makes use of will end result in the plan of smaller sections. This in flip reduces the lifeless weight and leads to the diagram of value fantastic structures. Ferro cement has been used extra extensively in latest years for strengthening of current structural factors like beam, column, slab, beam column joint etc. It has been understood from the literature overview that the load carrying ability of current buildings can be increased through strengthening it with Ferro cement laminates. Also it has been determined from the literature that, residences of Ferro cement laminates can be increased by means of altering the percentage and kind of constituent materials. However research to check out the impact of fibre in mortar and extraordinary extent fraction of mesh reinforcement and utilisation of such cloth for strengthening of structural factors have now not be carried out so far. Hence there exists a technical understanding hole in its area. A lookup application to find out about the impact of fibre in Ferro cement laminate as strengthening fabric for RC beams and their behaviour in phrases of strength, ductility, strength absorption ability would be of a great deal relevance and usefulness. Hence, an try is to be made to behavior an experimental and analytical investigation to learn about the flexural behaviour of RC beams reinforced the use of Ferro cement laminates with fibre.

How to cite this paper: R. Manimozhi | S. Janagan "Study on Flexural Strengthening of RC Beam using Ferrocement Laminates Recron" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-3, April 2020, pp.732-736, URL: www.ijtsrd.com/papers/ijtsrd30685.pdf

IJTSRD30685

1. INTRODUCTION

Natural failures such as earthquakes, tornadoes and tsunami threaten the integrity of civil infrastructures and protection of their uses. A giant wide variety of present bolstered concrete structures and different constructions commonly have no longer enough capability to withstand the forces throughout such catastrophes. In order to assurance the security of the people, the older constructions want to be repaired and reinforced to stop their collapse. Efficient techniques are wished to be developed for constructions restore and strengthening. The growing old of the nation's infrastructure in a tight financial surroundings has necessitated the search for modern and value high-quality solutions. In latest years, the use of ferrocement laminate has emerge as a situation of tremendous pastime in structural community. Several research had been targeted on the use of externally bonded ferrocement laminates to beef up present constructions in want of strengthening.

A. Adding reinforcement steel bars to the main steel without increasing the beam's cross sectional area
B. Section enlargement
C. Sprayed concrete
D. Steel plate bonding
E. Ferrocement laminates
F. Span shortening
G. Strengthening using Fibre Reinforced Polymer

2. METHODOLOGY

The learn about on literature gives a clear thought on substances to be accumulated and system to be undertaken. The methodology of this lookup work used to be fashioned and is proven in the shape of drift chart and is given in discern 3.1. After the literature assessment the substances have been amassed and the fabric residences such as particular gravity and fineness were studied. Based on the fabric residences combine graph of concrete was once carried out by means of IS technique the usage of the code IS 10262:2009.

Then the strengthened concrete beams had been casted as per the designed dimension and combine share of concrete. The ferrocement laminate have been casted with chosen wire mesh and cement mortar along with fibre. The beams and laminates have been cured for 28 days. After curing, all the specimens have been allowed to floor dry for 24 hours at room temperature. Then, the beams had been bolstered with ferrocement laminates the usage of epoxy resin and allowed for dry currying in the air for 7 days.

After 7 days of air curing, the manipulate beam and bolstered beams had been difficulty to flexural check underneath two-point loading. The initializations of flexural crack have been cautiously located and corresponding load and deflection had been noted. The final load and the mode of failure of the specimen are noted. Then analytical learn about was once made and the interpretations of the experimental and analytical effects have been made.

3. MATERIAL PROPERTIES

3.1. PRELIMINARY TEST FOR MATERIALS

3.1.1. FINENESS TEST

Cement sample	Weight of cement taken for test	Weight of cement retained on IS sieve	Fineness (%) ((W2/W1) X 100)
1	100	4g	4%

Table 3.1 Fineness Test

3.2. PREPARATION OF THE MOULD

The moulds used for casting the cube, cylinder. The size of cube and cylinder is 150mm X 150mm X 150mm, 150mm X 300mm. All the faces of the mould were assembled by using nuts and bolts and are clamped to the base plate. The mould faces must be thinly coated with mould oil to prevent leakage during filling.

Fig 3.1Cube

Fig 3.2cylinder

Fig 3.3 Compaction of concrete

4. EXPERIMENTAL INVESTIGATION

4.1. COMPRESSIVE STRENGTH TEST

S.NO.	Cube compressive strength (N/mm²)	Cylinder split tensile strength (N/mm²)
1	37.7	2.54
2	38.22	2.47
3	37.55	2.75

Table 4.1 Concrete Compressive Strength And Split Tensile Strength

Fig.4.1 Compressive Strength Test

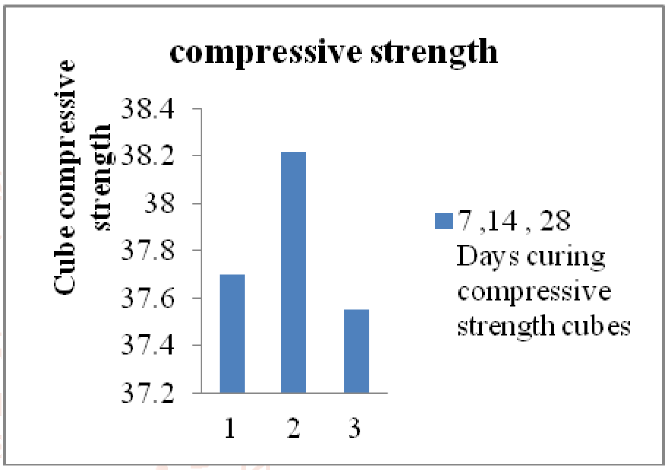

Fig.4.2 compressive Strength of cube at 7days, 14 days & 21 days

4.2. SPLIT TENSILE STRENGTH TEST

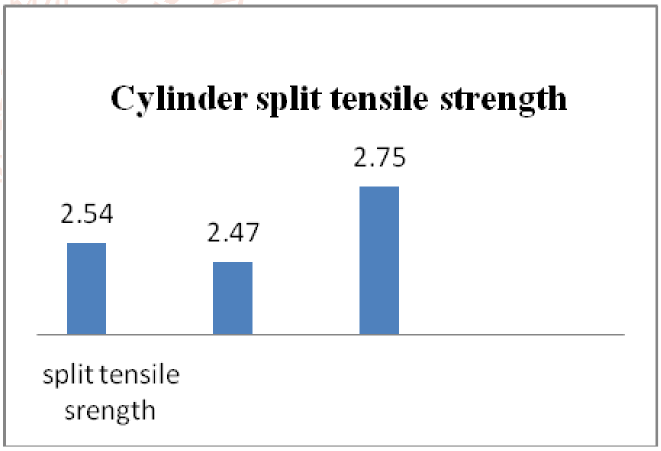

Fig.4.3 Split Tensile Strength of Cylinder at 7days, 14 days & 21 days

Fig.4.4 Casting of ferrocement laminate

4.3. STRENGTHENING OF RC BEAM

Beam designation	Details of specimens		Description	Type of loading
	No. of layers	% of Recron-3S fibre in ferrocement laminate		
CB	-	-	Control specimen without laminate	
FLB	3	0	Ferrocement Laminated Beam	
FLB 0.5%	3	0.5	Ferrocement Laminated Beam with 0.5% of Recron-3S fibre	
FLB 1%	3	1	Ferrocement Laminated Beam with 1% of Recron-3S fibre	Static
FLB 1.5%	3	1.5	Ferrocement Laminated Beam with 1.5% of Recron-3S fibre	

Table 4.2 Details of test specimen

The beams and laminates have been cured for 28 days. After currying, all the specimens have been allowed to surface dry for 24 hours at room temperature. The anxiety facet of the beams and bonding face of the ferrocement laminates have been roughened the use of wire brush to take away the floor laitance and to expose the tough surface. After floor preparation, the adhesive issue i.e., epoxy resin had been blended totally and utilized to the organized floor of beams and ferrocement laminates the usage of brush. Then ferrocement have been positioned in position. The beams bolstered with ferrocement laminates had been allowed to treatment in air for 7 days. Details of check specimens are given in the desk 4.2. Figure.4.5 suggests the utility of epoxy resin on beams and laminates and Figure.4.6 suggests the bolstered beam with ferro cement laminate.

Fig. 4.5 Application of epoxy resin on RC beams and laminates

Fig. 4.6 Strengthened RC beam

5. RESULTS

5.1. EXPERIMENTAL RESULTS OF RC BEAMS UNDER TWO POINT LOADING

5.1.1. FIRST CRACK LOAD

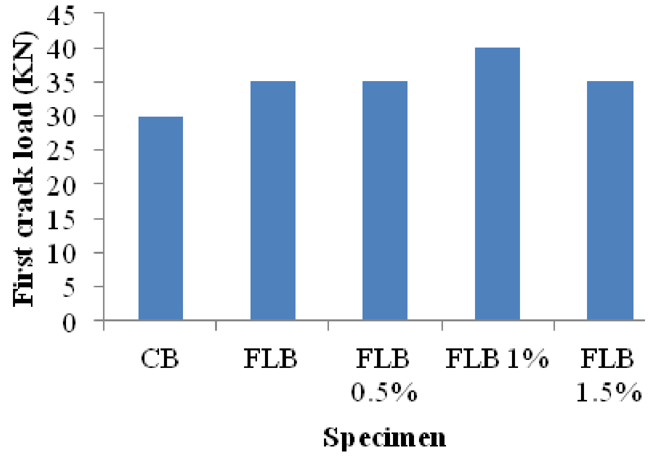

Fig.5.1 First crack load of RC beams

5.1.2. ULTIMATE LOAD

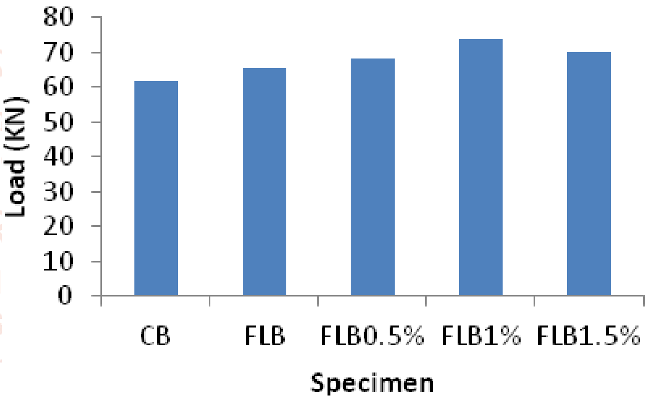

Fig.5.2 Ultimate load of RC beam

5.1.3. LOAD VS DEFLECTION COMPARISON

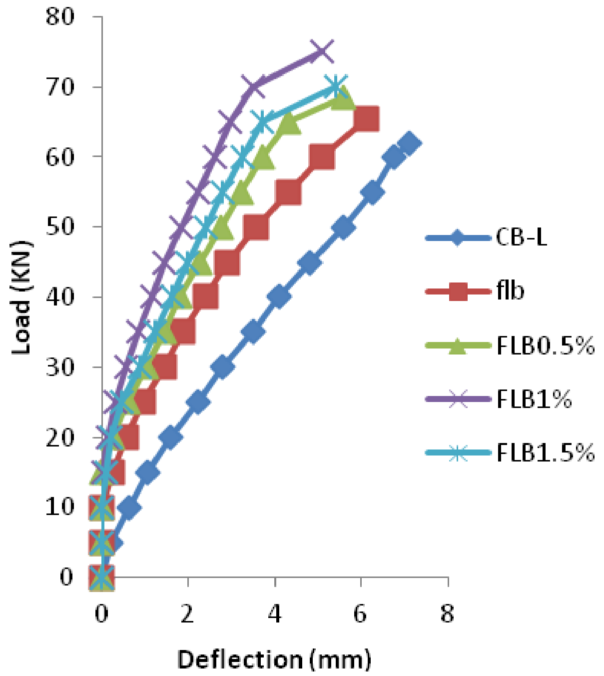

Fig. 5.3 Load Vs deflection curve

5.1.4. DUCTILITY FACTOR

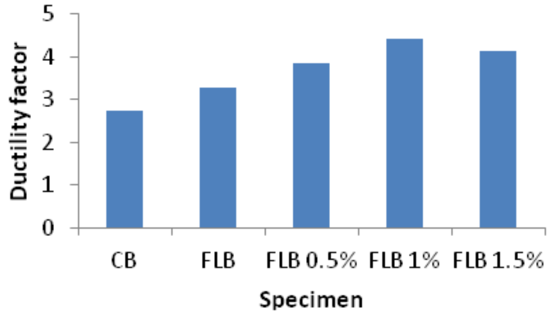

Fig 5.4 Ductility factor of RC beams

5.1.5. ENERGY ABSORPTION

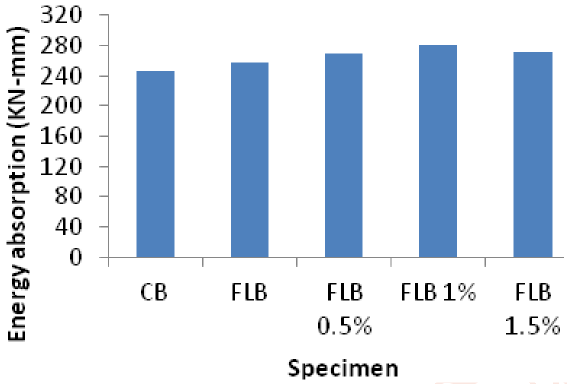

Fig 5.5 Energy absorption of RC beams

5.1.6. STIFFNESS

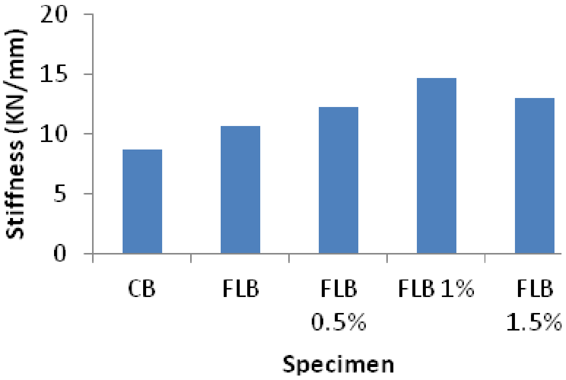

Fig 5.6 Stiffness of RC beams

5.2. MODE OF FAILURE

Flexural failure was once determined for all specimens. In ideal beams, cracks had been huge and few in numbers. In ferrocement encased beams, the cracks have been greater in numbers and the crack width was once additionally small which is proven in Figure.5.7.

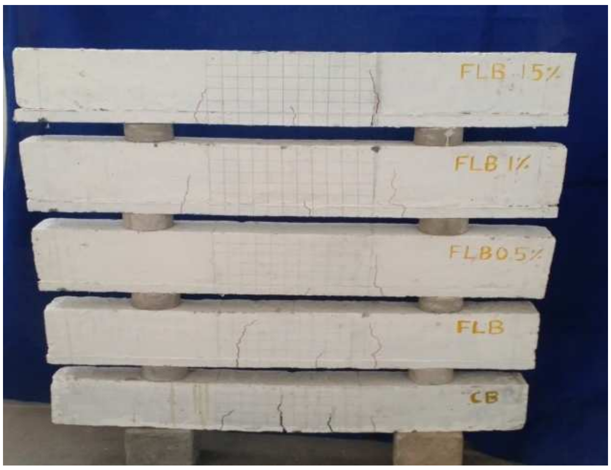

Fig 5.7 Crack patterns of tested specimens

6. CONCLUSION

- The addition of ferrocement laminate to the anxiety face of the RC beams drastically delays the first crack load.
- The epoxy resin used for bonding the ferrocement laminates to the anxiety face of the RC beams ensures that the bond line does now not wreck earlier than failure of beam.
- The failure of the composite beam is characterised by means of improvement of flexural cracks over the anxiety zone.
- The beam bolstered with ferrocement laminate containing 1% of Recron-3S fibre, had a lengthen in the first crack load, most closing load and discount in mid-span deflection evaluating with that of manage beam.
- The addition of ferrocement laminate to the anxiety face of the bolstered concrete beams significantly delays the first crack load.
- Mechanical homes such as load carrying capacity, ductility thing and power absorption potential was once observed to be multiplied for bolstered beams.
- The epoxy resin used for bonding the ferrocement laminates to the anxiety face of the bolstered concrete beams ensures that the bond line does now not spoil earlier than failure of the beam.
- The failure of the composite beam is characterised by way of improvement of flexural cracks over the anxiety zone.
- Similarly, outcomes from analytical find out about goes in hand with the experimental values.

REFERENCES

[1] Alaa A. Bashandy (2013)"Experiments on flexural strengthening of reinforced concrete beams using valid strengthening techniques", Acta Technica Napocesis: civil Engineering and Architecture, Vol.56, No.1, pp.36-50.

[2] Damyanti G Badagha and Modhera. C. D (2013) "Studies on harden properties of mortar using polyester fibre", International Journal of Advances in Engineering and Technology, Vol.6, No.3, pp.1154-1159.

[3] Ezzat H. Fahmy, Yousry B. I. Shaheen, Ahmed Mahdy Abdelnaby and Mohamed N. Abou Zeid (2014) "Applying the ferrocement concept in construction of concrete beams incorporating reinforced mortar permanent forms", International Journal of Concrete Structures and Materials, Vol.8, No.1, pp.83–97.

[4] Ezz-Eldeen H. A. (2015) "An experimental study on strengthening and retrofitting of damaged reinforced concrete beams using steel wire mesh and steel angles", International Journal of Engineering Research and Technology , Vol.4, no. 5, pp.164-173.

[5] Ganapathy. L and Sakthieswaran. N (2015) "Strengthening of reinforced cement concrete beam using fibrous ferrocement laminates", International Journal of Science and Engineering Research, Vol.3, No.5.

[6] Ganesan and shyju P. Thadathil (2005) "Rehabilitation of reinforced concrete flexural elements using ferrocement jacketing", Journal of structural engineering, Vol.31, No.4, pp.275-280.

[7] Hani H. Nassif and Husam Najm (2004) "Experimental and analytical investigation of ferrocement-concrete composite beams", Cement and Concrete Composites, Vol.26, pp.787-796.

[8] Khan. S. U, Nuruddin. M. F, Ayub. T and Shafiq. N (2013) "Effects of ferrocement in strengthening the serviceability properties of Reinforced concrete structures", Advanced Material Research, Vol.690, pp.686-690.

[9] Khan. S. U, Rafeeqi. S. F. A and Ayub. T (2013) "Strengthening of RC beam in flexure using ferrocement", IJST, Transactions of Civil Engineering, Vol. 37, No. C+, pp 353-365.

[10] Kondraivendhan. B and Bulu Pradhan (2009) "Effect of ferrocement confinement on behavior of concrete", Construction and Building Materials, Vol.23, pp.1218-1222.

[11] Malathy. R, Sridhar. J and Sangeetha. R. K (2014) "Flexural strengthening of reinforced concrete beams using ferrocement laminates with partial replacement of fine aggregate by steel slag", Journal of Engineering and Technology, Vol.4, pp.123-126.

[12] Md. Motiur Rahman, Tahmina Tasnim Nahar and Anish kumer saha (2014) "Effect of wire mesh on the strength of R.C.C beams repaired using ferrocement layers", International Journal for Research and Development in Technology, Vol.1, No.1, pp.13-18.

[13] Naaman.A.E and Victor C.Li (2004) "Bending response of hybrid ferrocement plates with meshes and fibers", Journal of Ferrocement, Vol.34, No.1, pp.275-288.

[14] Naveen G. M and Suresh G. S (2012) "Experimental study on light weight ferrocement beam under monotonic and repeated flexural loading", International Journal of Civil and Structural Engineering, Vol.3, No.2, pp.294-301.

[15] Prem Pal Bansal, Maneek Kumar and Kaushik. S. K (2005) "Effect of wire mesh orientation on strength of beams retrofitted using ferrocement jackets", International Journal of Engineering, Vol.2, No.1,pp.8-19.

[16] Raj kumar. D and Vidivelli. B (2010) "Acrylic rubber latex in ferrocement for strengthening reinforced concrete beams", American Journal of Engineering and Applied sciences, Vol.3.No.2, pp.277-285.

[17] Raj Kumar. D and Vidivelli. B (2010) "Performance of SBR latex modified ferrocement for repairing reinforced concrete beams", Australian Journal of Basic and Applied Sciences, Vol.4, No.3, pp.520-531.

[18] Sakthivel. P. B and Jagannathan. A (2012) "Fibrous ferrocement composite with PVC-coated weld mesh and bar-chip polyolefin fibers", International Journal of Geomate, Vol.3, No. 2, pp.381-388.

[19] Sandesh S Patil, Ogale. R. A and Arun Kr. Dwivedi (2012) "Performance of chicken mesh on strength of beams retrofitted using ferrocement jackets", IOSR Journal of Engineering, Vol.2, No.7, pp.1-10.

[20] Sayyed Shoaib, Swayambhu Bhalsing and Pankaj Autade (2014) "Behaviour of hybrid ferro fibre reinforced concrete under tension", International Journal of Innovative Research in Science, Engineering and Technology, Vol.3, No.4, pp.508-513.

[21] Shinde. V. M and Bhusari. J. P (2013) "Response of ferrocement confinement on behavior of concrete short column", IOSR Journal of Mechanical and Civil Engineering, Vol.2, pp.24-27.