International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-4 Issue-12, May 2015

Experimental Performance of Flexural Behaviour of Self Compacting Ferrocement Flat and V Shaped Folded Roof Panels

Ravikant S. Sathe, S. S. Dharane

Abstract: ***The research paper present the experimental work carried out to investigate the behavior of different shaped ferrocement roof panels. The total twelve ferrocement self compacting flat and V shaped folded roof panels with different number of wire meshes were casted and tested under two point loading. The number of wire meshes varied from 1 and 2 layers. Effect of these varying number of wire mesh layers on flexural strengths and deflection of Flat and V shaped folded roof panels are studied. And it is proved that the load carrying capacity of V shaped folded roof panel is found more with reduced deflection.***

Keywords: ***flat panel, folded panel, mortar; wire mesh, self-compacting ferrocement.***

I. INTRODUCTION

Ferrocement is a form of reinforced concrete that differs from conventional reinforced or prestressed concrete primarily by the manner in which the reinforcing elements are dispersed and arranged. It consists of closely spaced, multiple layers of mesh or fine rods completely embedded in cement mortar. A composite material is formed that behaves differently from conventional reinforced concrete in strength, deformation, and potential applications, and thus is classified as a separate and distinct material. A number of investigations are available for the flexural analysis and design of ferrocement members. **[6]** Presented experimental flexural creep behavior of ferrocement slab and RCC slab. Fourteen slab panels were casted and tested. The first cracking load and collapse load along with the deflections were measured during the test for every increment of gradual load. **[3]** Presented the results of testing flat ferrocement panels reinforced with different number of wire mesh layers on the flexural strength of flat ferrocement panels and to compare the effect of varying the no of wire mesh layers and use of steel fibers on the ultimate strength and ductility of ferrocement slab panels. **[4]** Analysed the self Compacting concrete ferrocement slabs with weld mesh as the reinforcement by using finite element method. **[2]** investigated the ultimate flexural load of ferrocement slabs of size 700mm. X 200mm. X 15mm. (thickness) reinforced with PVC coated steel weld mesh, and compare the results with slabs using GI-coated steel weld mesh, by varying the number of layers from 1-3.The objective of this investigation is to determine experimentally the effect of varying number of wire mesh layers.

Manuscript published on 30 May 2015.
***Correspondence Author(s)
Ravikant S. Sathe, PG Scholar, Department of Civil Engineering, SVERI's College of Engineering Pandharpur, India.
S. S. Dharane, Asst. Prof., Department of Civil Engineering, SVERI's College of Engineering Pandharpur, India.

This paper deals with the study of the ultimate strength of flat and folded self compacting ferrocement roof panels.

II. EXPERIMENTAL INVESTIGATION

2.1 Material Characterization

2.1.1 Cement

Ordinary Portland cement (JK super cement) of grade 43 is used in the mortar matrix. Some of the properties of the cement are:

Fineness of cement 1%,
Specific gravity = 3.15,
Standard consistency = 29%,
Initial setting time = 30 mins,

2.1.2 Sand

Fine aggregate is used as Chandrabhaga River Sand passing through sieve in 4.75mm and its properties are:

Specific gravity = 2.6,
Fineness modulus = 2.80,
Bulking of sand = 4.16%,
Surface moisture = nil.

2.1.3 Super Plasticizer

FAIRFLO SCC superplasticizer is used for experimental work and the properties of the same are:

Physical appearance = reddish yellow liquid,
Specific gravity = 1.110±0.015,
PH = between7 to 8.

2.1.4 Water

Potable Water was used for mixing and as well as for curing.

2.1.5 Wire mesh

Square welded steel wire mesh is used for experimental work and properties of the same are:

Diameter = 1mm,
Opening size 12.5mmX12.5mm,
Modulus of elasticity 2.1×10^5 N/mm^2.

2.2 Geometry of the Specimens

The geometry of the panel is flat and V shaped folded roof panels as shown with dimensions 700 mm x 230 mm x 25 mm of flat and V shaped folded 700 mm x 230 mm x 25 mm with 45^0 inclination. The panels are constructed using the self compacting ferrocement materials, which is composed of self compacting cement mortar and welded steel wire mesh.

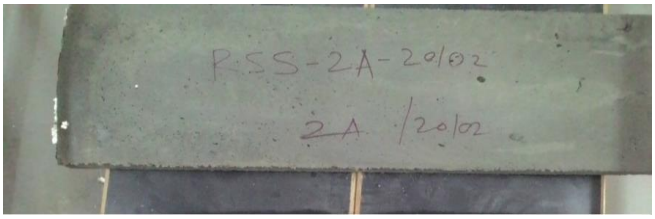

Fig (1): Testing of flat roof panel

Fig (2): Testing of folded V shape roof panel

2.3 Casting and curing of flat and folded panels

Measurement of ingredients

All cement, sand and superplasticizer respectively are measured with Digital balance. The water is measured with measuring cylinder of capacity 1 litter and measuring jars of capacity 1000 ml and 2000 ml. The superplasticizer is measured with Digital balance of accuracy 1mg.

Preparation of surface before placing cement mortar

A simple rectangular mold having 25mm depth with 700x230 mm dimensions is made for the flat panels; while a special molds for the folded panels is made to match the required geometry of the folded panel. Oiling to the molds are done before placing the wire mesh layers and cement mortar in it. Before placing cement mortar, the different types of bases should be prepared as below.

Mixing of cement mortar

The ingredients were thoroughly mixed over a GI sheet. The sand and cement were measured accurately and were mixed in dry state. After that the required weighted quantity of superplasticizer (0.75% of weight of cement) is added in required quantity of water. The dry mortar mix was then thoroughly and uniformly mixed with mixture of water and superplasticizer till uniform and homogeneous mixing of cement mortar.

Transportation of cement mortar

The process of carrying the cement mortar mix from the place of its mixing to final position of deposition is called as transportation of cement mortar. The time factor is very important in case of transportation of cement mortar. The cement mortar mix should be transported as quickly as possible. Cement mortar is transported by using iron pan.

Placing of wire mesh

After oiling to the moulds, moulds are placed at its position and wire mesh is placed inside the moulds. For the flat slab panels of single layer wire mesh is placed at bottom by keeping 6mm cover from bottom and for double layer of wire mesh are placed at center by maintaining 6mm distance in between two wire mesh. Placing of wire mesh for V shaped roof panels, for single layer it is placed at center and for double layer are placed at center by maintaining 6mm cover distance in between two wire mesh.

Placing of mortar

The fresh mortar was placed in the moulds in vertical direction by using chute. It was ensured that the representative volume was filled evenly in all the specimens. While placing mortar, the compaction was avoided because self compacting superplasticizer was used.

De-moulding of specimens

All the roof panel specimens are demoulded after 24 hours of casting wet mortar and kept in water tank for curing.

Curing of test specimens

The specimens were demoulded after 24 hours of casting and immediately stored in the curing tank for continuous curing. All the specimens are cured in curing tank for 28 days.

2.4. Testing of Specimens

All the panels were tested under two point loading for flexural. The load was applied by means of a load cell of 100 ton capacity. All the specimens were tested by simulating simply supported conditions. The load was applied as two symmetrically arranged concentrated line loads. Loading was applied using a Hydraulic Jack of 200 ton capacity. The load was applied in small increments and simultaneously the deflection at the center of the panel was recorded during the loading process up to failure. The deflection at the mid span is measured by Dial Gauge having accuracy to 0.01mm.

Fig (3): Test Setup Fig

Published By:
Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)

Sr. no	Specimen ID	Shape	No. of wire mesh	First Cracking			Ultimate		
				Load (KN)	Deflection (mm)	Bending Stress N/mm^2	Load (KN)	Deflection (mm)	Bending Stress N/mm^2
1	FL 1A	Flat	01	11.2	7.9	46.75	11.8	12.2	49.25
2	FL 2A	Flat	02	10.6	7.6	44.24	12.2	11.3	50.92
3	V 1C	V	01	10.7	6.3	13.43	12.45	11.7	15.62
4	V 2B	V	02	15.7	3.2	19.70	20.2	11.35	25.35

III. RESULTS AND DISCUSSION

The parameters that have been investigated in this study are the effect of the geometry of the panels and number of wire mesh layers on cracking load and ultimate flexural strength and plot of load deflection curve for each panel. The test results are presented in the below table, in which cracking and ultimate load for the tested flat and folded ferrocement panels are summarized. The cracking load is almost constant for the folded panels and it was not affected by the number of wire mesh layers. The load deflection curves for the folded panels that increasing the number of wire mesh layers from 1 and 2 causes to increase the ultimate load from 15.75KN to 19.85KN. The percentage increases in the load capacity of panel V2A with respect to V1A is in order of 20.65% respectively.

3.1 Cracking behavior

The failure of the slab specimen's results from the yielding of wire mesh reinforcement is followed by the crushing of mortar. Initially fine flexural cracks appeared at the bottom of the specimen. With further increase in the load, regularly spaced vertical cracks were observed and they extended from the bottom of the specimen towards the top (Fig.12).The load was increased up to ultimate stage and cracking pattern is observed.

Fig (5): Crack Study

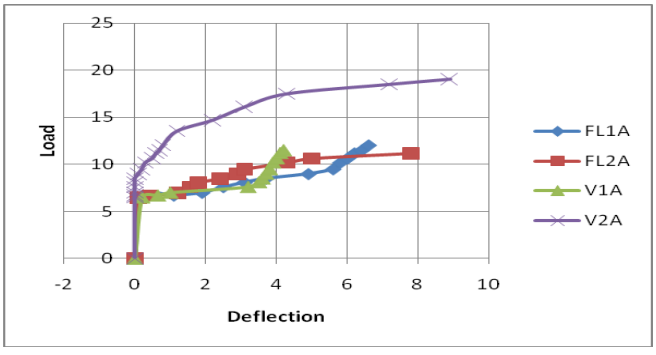

Fig (6): Load Vs Deflection graph

IV. CONCLUSIONS

The following conclusions were drawn from the experimental study carried out on folded shaped ferrocement panels.

- Load carrying capacity of V shaped folded roof panel with double layer wire mesh is higher than flat roof panel at cracking and ultimate stage respectively 32.48% and 38.07% and the deflection is also reduced.
- The experimental results show the superiority of the V shaped folded panels to the flat panel and in terms of ultimate strength and initiation of cracking.
- Increase in number of mesh layers also improves the ductile behaviour of flat and V shaped folded ferrocement roof panels.
- The flexural loads at first crack and ultimate loads depend on number of reinforcing mesh layers used in ferrocement panel.

ACKNOWLEDGMENTS

The authors R. S. Sathe, Prof. S.S. Dharane would like to thank the Managements of SVERI's College of Engineering (Affiliated to solapur University, solapur), Maharashtra, India and all the faculty members of civil engineering department of SVERIs College of Engineering Pandharpur for encouraging the innovative studies on Ferrocement and providing the test facilities for conducting the experimental investigation.

REFERENCES

1. Anen B. A, Ahmed EI-Shefey, Mostafa EI-Shami, "Experimental and analytical model of ferrocement slab", Internal journal of recent trends in engineering, vol. 1, no. 6, (May 2009).
2. P.B. Sakthivel and A. Jagannathan, "Study on flexural behaviour of ferrocement slab reinforced with PVC coated welded mesh", ISSN 2278-067X, Volume 1, Issue 12 (July 2012), PP. 50-57.
3. Randhir J. Phalke, Darshan G. Gaidhankar,"Experimental behaviour of ferrocement slab panels using square mesh by incorporating steel fibre", IJRET, vol. 3, no. 05, (May 2014).
4. Rohini S, Thenmozhi R, Shri S. D, "Finite element modelling of ferrocement slab in flexure using ANSYS", International journal of emerging trends in engineering and development, vol. 4 (may 2012).
5. Shri S. D, Thenmozhi R, "An experimental investigation on the flexural behaviour of SCC ferrocement slabs incorporating fibers", IJEST, vol. 4, no. 05, (May 2012).
6. Sidramappa Dharane, Archita Malge, "Experimental performance of flexural creep behaviour of ferrocement slab", IJRET, Volume 03, Issue 04, (Apr-2014).

Published By:
Blue Eyes Intelligence Engineering
and Sciences Publication (BEIESP)