COMPARATIVE STUDY OF FERROCEMENT PANEL WITH FLYASH BY COMBINATION OF BAMBOO AND STEEL MESH

[1]Pansare Komal Vasant
[2]Prof Waghmare A.A

PG Studenet , Department Of Civil Engg,, Dr.Vithalrao Vikhe Patil College Of Engg.Ahmednagar 414111,India
Asst.prof. Department Of Civil Engg, Dr.Vithalrao Vikhe Patil College Of Engg.Ahmednagar 414111,India

ABSTRACT

Everyone has the dream of making house in their life but nowadays it is seen that cost of construction material is increased to a large extent hence increasing cost of construction. To reduce cost of project there is need to develop low cost housing .The main constitute materials in construction are steel (M.S, HYSD bars) and cement. In rural area bamboo is available easily and more than 88 million tons of fly ash is generated in India each year. So, after using these two materials as replacement by steel and cement, the aim of low housing can be achieved to some extent.

*This experimental program consists of construction of 18 panels of size 490*230*100.Along with each 3 panel for 5%,10%,15% respectively replacement of cement with flash in bamboo mesh and each 3 panel for 5%,10%,15% respectively replacement of cement by fly ash in steel mesh. The panels are cast, cured in water tank for 28 days then tested under uniformly distributed loading. Comparative results of both the panels are obtained .The results show that experimental failure load for both panels found are in similar range and are in good agreement with observed values of the load.*

Keyword: - *Ferro cement ,Fly ash ,Bamboomesh,Steelmesh*

1. INTRODUCTION

The shortage of housing in developing countries motivates the search for low cost materials that can be applied in the construction of affordable houses for poor peoples. The main focus of the researchers on non-conventional materials and techniques at the present time of environmental crisis, which our globe is facing. So, steel and Cement is most costly and energy intensive component of construction .The cost of construction is reduced by using byproduct of thermal power plant like Fly ash and locally available bamboo.

American Concrete Institute ACI 549 developed a report on Ferro cement in 1988 [1] and consecutively a guide for the design, construction and repair in 1989 [2]. There is a need to achieve the alternative building materials like fly ash as partial replacement of cement, and bamboo for steel bars, a costly building material. This gives considerable savings in consumption of cement and steel. If bamboo can be cured to not absorb water, preserved, and then be

coated to adhere to cement well, bamboo would be better than steel in concrete for poor countries lacking a cheap source of steel.

Arif M et al. suggested that a replacement of 20% cement by fly ash has shown marginal loss in the strength and the structural performance of Ferro cement panels with woven and hexagonal wire mesh under flexure [11]. Based on the studies done by T. Ahmed et al. [12], it is suggested that the suitability of using roof slab system comprising of ferrocement panels with 0% and 20% flyash resting over reinforced concrete beams for low cost housing as it is said to have lower crack width. They also suggest that the aforesaid system using flyash is ductile and environmentally viable. To reduce its cost, the use of flyash as partial replacement of cement in the mortar matrix would further lead to an eco-friendly low cost construction without any loss of structural integrity.

The thickness of ferrocement slab panels generally ranges from 25mmto 50 mm but for current work it is taken as 100mm. Flexural tests were conducted on ferrocement panels of size 490mm *230mm * 100mm with hexagonal wire meshes in 2 layers using 5%,10% and 15% flyash as partial replacement of cement.

2. MATERIALS AND METHODS

The materials required for casting of test panels are cement, flyash, sand water, bamboo strip, steel and wire meshes, which is discussed below.

2.1 Materials

2.1.1Cement and Flyash

The cement used in this experimental work is ordinary Portland cement 53 grade. All properties of cement are tested by referring IS 12269 - 1987 Specification in table 1.The class F–type fly ash is used with its physical properties given table 2.

Table 1: Properties of cement

Sr. No.	Description of Test	Results
01.	Fineness of cement (residue on IS sieve 90- micron sieve)	5 %
02.	Standard consistency of cement	30%
03.	Setting time of cement a) Initial setting time b) Final setting time	 74 min. 385 min.

Table 2: Properties of fly ash

Sr.No	Description of Test	Results
01	Colour	Light grey
02	Specific gravity	2.23
03	%retained on 90micron	48

2.1.2 Sand and water

Locally available sand from river Pravara passing through the IS 4.75 mm sieve and free from impurities having specific gravity 2.68 ,fineness modulus -3.61 used. Tap water was used for both mixing of mortar and curing of test specimens.

2.1.3 Bamboo strip, steel mesh and wire mesh

Bamboo mesh were prepared by cutting bamboo into strips each having its size 250mm*20mm*6 mm which are coated by bitumen.6mm dia. mild steel is used. The locally available hexagonal chi ken wire mesh is used having dia 90mm and side 12.5 mm.

2.2.Mortar mix

The cement mortar mixes 0.95:0.05:2.5, 0.9:0.10:2.5, and 0.85:0.15:2.5 comprising of cement: fly ash: sand (fine Agg.) were used in ferrocement panel .Water cement ratio of mortar kept 0.40.

2.3 Casting and curing of test of panel

Considering economy wooden moulds were used for casting of test panels. All moulds are cleaned and oiling inner side of mould so that it does not stick to mould after dry. A grid of bamboo strip and steel skeletal was used in both with 100mm spacing and covered with hexagonal wire mesh was laid on the compacted 6mm thick uniform mortar layer .The mortar layer spread and compacted with required thickness of panel. The panel was demoulded after 24 hr, cured under water tank for 28 days and then dry 5 days before testing.

A total 18 ferrocement panels were cast in two groups having 9 specimens for each bamboo and steel panels .Each 9 panel is divided into subgroups with replacement of cement by fly ash of 5%,10%,15%.The details of ferrocement slab panels tested under flexure are shown in Table 3

2.4 Testing of panels

Panels were tested for flexural strength under universal testing machine. The panels were placed on support lead 50 mm from both ends. Dial gauge was placed below the panel to record the deflection in mm each stage of loading. Cracks are then marked during each loading and corresponding central deflection is also noted down.

3. RESULTS AND DISCUSSION

In flexure test, the Standard Panel specimen of size 490mm x 230mm x100mm were supported symmetrically over a span of 400mm in the machine in such a manner at the load is applied to the upper most surface as cast in the mould. All panels are tested under one-point loading in Universal Testing Machine. The load as increased until the specimen failed and the failure load is recorded.

Table- 3. Experimental values of first crack load and ultimate load.

Slab Series	% Of Fly Ash	Experimental First Crack Load (KN)	Experimental Ultimate Load (KN)
SBA_1	5%	52.08	107.85
SBA_2	5%	51.85	106.30
SBA_3	5%	51.18	108
SBB_1	10%	48.75	99.75
SBB_2	10%	48.02	98.05
SBB_3	10%	47.35	97.48
SBC_1	15%	44.32	90.50
SBC_2	15%	41.80	88.40
SBC_3	15%	41.05	86.50
SSA_1	5%	51.00	119

SSA_2	5%	50.08	118.05
SSA_3	5%	50.02	117.35
SSB_1	10%	47.08	109.25
SSB_2	10%	46.35	107
SSB_3	10%	46.08	106.85
SSC_1	15%	41.s05	100.05
SSC_2	15%	39.25	98.86
SSC_3	15%	40.48	99.02

SB-Bamboo flyash cement mortar ferrocement slab
SS-Steel flyash cement mortar ferrocement slab.

The result shows details of experimental values of first crack load and ultimate load for 18 numbers of bamboo panel and steel panel .The series SBA_1 to SBA_3 and SSA_1 to SSA_3 are 5% replacement of fly ash.It is clear from the table that the experimental value of first crack load in bamboo with fly ash ferrocement panel ranges are 52.08 KN to 51.18KN .For steel first crack load with flyash ferrocement panel ranges are 51 KN to 50.02KN .And the ultimate load for SBA and SSA panel ranges are 108 KN to 106.30KN and 119KN to 117.35 KN respectively . The series SBB_1 to SBB_3 and SSB_1 to SSB_3 are 10% replacement of fly ash. The experimental value of first crack load in bamboo with fly ash ferrocement panel ranges are 48.75 KN to 47.35KN .For steel first crack load with flyash ferrocement panel ranges are 47.08KN to 46.08KN .And the ultimate load for SBA and SSA panel ranges are 99.75 KN to 97.48KN and 109.25KN to 106.85KN respectively. The series SBC_1 to SBC_3 and SSC_1 to SSC_3 are 15% replacement of fly ash. The experimental value of first crack load in bamboo with flyash ferrocement panel ranges are 44.32 KN to 41.05KN .For steel first crack load with flyash ferrocement panel ranges are 41.05KN to 39.25KN .And the ultimate load for SBA and SSA panel ranges are 90.50 KN to 86.50KN and 100.05KN to 98.86KN respectively.

This shows that the first crack load for all the panels have been found in nearly in same range and experimental ultimate load is doubled of that of first crack laod for all slab panel. As the thickness of slab is increased then load carrying capacity is increased by 50% in all slabs. In above result 5% replacement of flyash in both the load are more than other replacement .but that more difference.

4. CONCLUSION

The main objective of this investigation was to examine the suitability of using flyash in the ferrocement mortar matrix. Tests on specimens with bamboo wire meshes were also carried out.

Based on experimental study it is observed that on bamboo and reinforced ferrocement panel the first crack loads by 5% replacement of fly ash are more and load carrying capacity as compared with 10% and 15% replacement of fly ash is less but the difference is not remarkable .The system of ferrocement slab panels involving the steel and replacement of steel by using bamboo and fly ash as partial replacement of cement can be used as roofing slab panel for low cost housing. The benefit of this system is utilization of fly ash waste and bamboo thus conserving the environment in addition to giving economy.

The suitability of using roof slab system with replacement of 0% to 15% fly ash is checked. This technology is used not only for greater cost reduction but also use locally available material and utilization of fly ash. The structural units using the ferrocement panels can be used with confidence as roofing elements.

5. ACKNOWLEDGEMENTS

I take this august opportunity to sincerely show panegyrics and thanks to my guide Mrs.Waghmare A.A. whose timely suggestions and valuable inputs helped me a lot throughout the duration of my efforts on this seminar. I feel a deep sense of gratitude towards him for being so patient and attentive whenever any problem came up, especially during the selection of my topic. I am also grateful to all support staff of our department for providing laboratory, library and internet facilities. Last but not the least; I am thankful to my parents, friends, my classmates and colleagues who helped to sustain my determination to accomplish this work in spite of many hurdles.

REFERENCES

[1] ACI Committee 549, State-of-the-Art Report on Ferrocement. Reported by ACI Committee 549, 1988.

[2] ACI Committee 549, Guide for Design, Construction and Repair of Ferrocement ACI 549 IR-881989, 1989.

[3]"Ajinkyakaware Review Of Bamboo As Reinforcementmaterial In Concrete Structure Vol. 2, Issue 6, June 2013

[4] "B.Benittapaulinmary, Dr. D.Tensing,"State Of The Art Report On Bamboo Reinforcement", International Journal Of Engineering Research And Applications (IJERA) ISSN: 2248-9622 Www.Ijera.Com Vol. 3, Issue 2, March -April 2013, Pp.683-686.

[5] "Hassan M.H. Ibrahim,"Shear Capacity Of Ferrocement Plates In Flexure" Civil Engineering Department, Faculty Of Engineering, Port-Said University, Port- Said, Egypt Universitikebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia received

[6]. "Khosrowghavami", "Bamboo As Reinforcement In Structural Concrete Elements", Department Of Civil Engineering, Pontificiauniversidadecatolica, PUC-Rio, Rua Marques De Sa˜O Vicente 225, 22453-900 Rio De Janeiro, Brazil Received 26 September 2003; Accepted 4 June 2004.

[7]"M.A. Al-Kubaisy A,U, Mohd Zamin Jumaat."Flexural Behaviour of Reinforced Concrete Slabs With Ferrocement Tension Zone Cover. A engineering Faculty, Muscat College Of Management Science And Technology, P.O. Box 2910, Ruwi, Oman Bci¨Il Engineering Department, Uni¨Ersiti Malaya, Kuala Lumpur, Malaysia Received 10 June 1999; Received In Revised Form 23 December 1999; Accepted 20 January 21.

[8] "Nagesh M. Kulkarni, D.G." Analysis and Design Of Ferrocement Panels An Experimental Study International Journal Of Inventive Engineering And Sciences (IJIES) ISSN: 2319–9598, Volume-1, Issue-5, April 2013.

[9]. "Rafat Siddique" Performance Characteristics Of High-Volume Class F Fly Ash Concrete Department Of Civil Engineering, Thapar Institute Of Engineering And Technology, Deemed University, Patiala, Punjab 147 004, India Received 18 March 2003; Accepted 4 September 2003

[10] "S. Jeeva Chidambaram, Sanjay Kumar" Flexural Behaviour Of Bamboo Based Ferrocement Slab Panels With Flyash,". department Of Civil Engineering, NIT, Jamshedpur 831014, Jharkhand, India Received 2 June 2016 Received In Revised Form 6 December 2016 Accepted 29 December 2016 .

[11] "S. Akhtar, A. Masood, M. Arif *, M. Haquie" Performance Of Ferrocement Panels In Different Environments Civil Engineering Department, Aligarh Muslim University, Aligarh 202 002, India Received 19 March 2002; Accepted 23 September 2002 .

[12]"T. Ahmad • M. Arif • A. Masood" Experimental Investigations On Ferrocement Roof Slab System For Low Cost Housing The American University Of Iraq, Sulaimani 6 PUBLICATIONS 67 CITATIONS Received: 17 February 2013 / Accepted: 13 April 2014 / Published Online: 20 May 2014 .