Experimental Investigation in Concrete Mix Design by using Bamboo as a Reinforced Material

Md. Sarafraz Akhter[1] Syed Rizwan Ali[2]
[1,2]Assistant Professor
[1,2]Department of Civil Engineering
[1,2]MACET Neora, Patna, India

Abstract— In most countries, concrete is widely used as the construction material for the infrastructure development. Shortages of steel have been experienced in several parts of the world from time to time, in most of the developing countries, steel cost is very high. Experimental investigations of bamboo reinforcement in M-20and M25 grade of concrete were done. Bamboo strips are used with different percentage of cross section of beam as 1%, 2%, 3% and 4%.Result shows bamboo reinforcement increases the flexural strength of plain concrete and flexural strength of bamboo reinforced concrete at 4% is nearly equal to the 1% steel reinforced concrete.

Keywords: Bamboo; Flexure Strength; Compressive Strength; Rebound Value; Bamboo Reinforcement Concrete; Beams

I. INTRODUCTION

In most countries, concrete is widely used as the foundation for the infrastructure. In many countries, none or very little steel reinforcement is used in construction. The building industry contributes vastly to the economy of each nation, particularly developing countries wherever there are increasing demands for buildings to produce homes for dwellers and different activities [1]. according to Anand [2],

Inadequate building construction capability may act as a constraint on economic capital investment programs. This has resulted in high deficiencies in housing provide. Cardoso [3] reiterated that to alleviate this disadvantage of deficiency in housing provide there is the necessity to embrace the utilization of local materials like timber and bamboo that area unit dominant within the African nation building industry. Ghana's forest timber production space is declining in Associate in Nursing increasing manner in every size and productivity due to uneconomical work practices and over utilization of ancient timber species. The extreme exploitation of the forest has beckoned on authorities to place in situ strict regulations that have eventually reduced the number of timber equipped to the furnishings and construction industries [4]. in line with Paudel and Solomon-Ayeh[5],

Bamboo that is characteristically substitutable to timber ought to be exploited as an alternate material.The utilization of bamboo in building construction worldwide has evolved from easy pole construction to additional refined construction. in line with Gutiérrez [6], there has been an ancient exploration of bamboo for construction, and usually this can be often due to the actual fact that it seems to be a tailor created material to be used as a building part. [7] [8]-[11].

II. LITERATURE REVIEW

Gupta, D.K. and Singh, R.C., (2018), were concluded that the flexural strength of concrete with the addition of bamboo fiber increases nearly 10% of traditional concrete. The compressive strength with bamboo fiber in concrete initially the strength with very small quantity of fiber (0.5 %) but further addition of fiber results in decrease in strength. Since tensile strength is proportional to flexural strength, hence experiment result shows that increase in flexural strength increases tensile strength of concrete.

Bhowmik, R.N., Pal, J. and Sarkar, P.P (2017), were find out In this study an attempt has been made to check the technical feasibility of utilizing BambusaBalcooa as a reinforcing material in brick aggregate concrete structure. Different tests were conducted to evaluate different properties related to bamboo reinforced beam. Based on the results of those tests a brief conclusion is presented here. BambusaBalcooa possess good tensile strength as well as ductility. Epoxy reduces the water absorption of bamboo up to great extent. Bond strength between epoxy coated bamboo and concrete found to be 2.24 times than uncoated samples. Maximum load carrying capacity of Bamboo reinforced brick aggregate concrete beam was noticed to be 4.88 times that of plain concrete beam with 2% bamboo reinforcement. The strength of bamboo reinforced beam increases with the increment of bamboo reinforcement in the range of 0 to 2%.

Gill, S. and Kumar, R., (2016), were concluded that the tensile strength of bamboo is good and can be used as reinforcement in R.C.C. The behaviour on test with bamboo is almost the same as the plain steel bar; however, the bond strength with bamboo was higher than the one with plain steel bar. It can be expected that the bond strength covering with full treatment shows the high value 1.2-1.35MPa. Improving structural behaviour the reinforced concrete beam can be strengthening using bamboo sticks as a retrofitted material.

Lewangamage, C.S. and Perera, P.M.D.J.S., (2015), were concluded that the using bamboo reinforcement with steel reinforcement alternatively, load at first crack and maximum load carrying capacity become higher than control sample values. In both cases, ductility ratio decreased than the control sample. When bamboo reinforcement percentage in composite steel reinforced concrete slab panel increased, maximum load carrying capacity was not increased as we expected. From these results, it can be conclude that Bamboo reinforced slabs are worthy eco-friendly alternative for steel reinforced slabs. By combining bamboo with steel, flexural behaviour of bamboo can be improved. Further research works are needed in this field including Finite element modelling of bamboo reinforced slab panels in order to create general guideline for application of bamboo as reinforcement for concrete elements.

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III. RESULTS AND DISCUSSIONS

A. General

On the basis of the above results of the study of bamboo reinforced. This contains 1%, 2%, 3% and 4% cross sectional area of the beam. And 1% steel reinforcement use in this study. Following results were drawn.

- These cubes were cast for concrete of following grades: (M-20and M-25)
- The cubes were tested by using NDT equipment and Compressive testing machine. The obtained values are given in following tables:

B. Compressive Strength Test (M-20)

AGE	COMPRESSIVE STRENGTH (N/mm^2)	REBOUND VALUE
7 days	10.33	11.83
14 days	14.93	15.83
28 days	21.33	24.17

Table 1: Shows rebound values and compressive strength

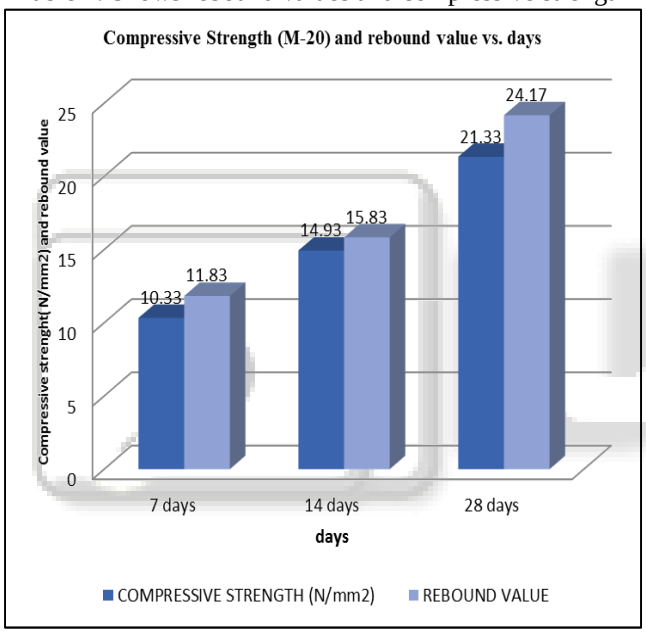

Fig. 1: Compressive Strength (M-20) and rebound value vs. days

C. Compressive Strength Test (M-25)

AGE	COMPRESSIVE STRENGTH (N/mm^2)	REBOUND VALUE
7 days	18.6	19.2
14 days	25.4	27.3
28 days	30.2	31.6

Table 2: shows rebound values and compressive strength

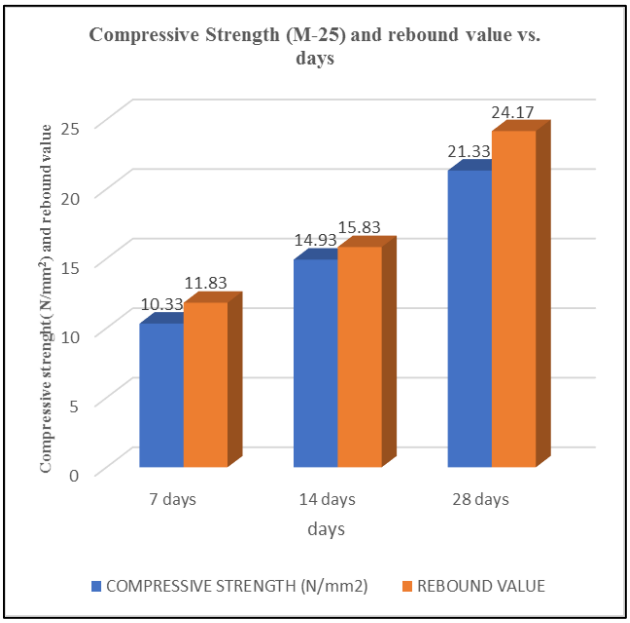

Fig. 2: Compressive Strength (M-25) and rebound value vs. days

D. Flexure Strength Test on M-20 Grade Concrete

Flexural strength test of M-20 and M-25 grades concrete and another level of replacements concerning 0%, 1%, 2%, 3% and 4% by bamboo reinforcement and 1% of steel reinforcement. The flexural estimations of various blends are shown in Table below.

Serial no.	Reinforcement in %	Flexural strength (N/mm2)		
		7 days	14 days	28 days
1	Without BR	1.49	2.73	3.45
2	1% BR	1.59	3.02	4.28
3	2% BR	1.63	3.11	4.42
4	3% BR	1.67	3.20	4.56
5	4% BR	1.70	3.29	4.71
6	1% SR	2.36	4.35	6.14

Table 3: Flexural strength of M-20

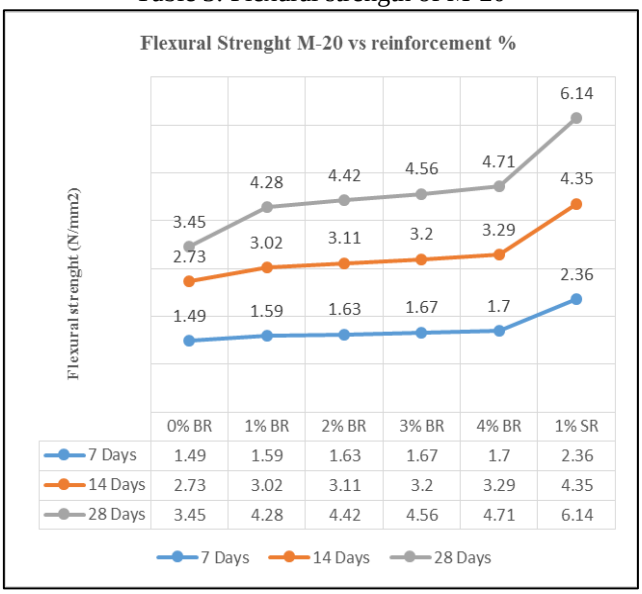

Fig. 3: Flexural Strength (M-20) vs. reinforcement %

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E. Flexure Strength Test on M-25 Grade Concrete

The results are determined by the universal testing machine. M-25 grade of concrete contains different % bamboo as reinforcement.

Serial no.	Reinforcement in %	Flexural strength (N/mm2)		
		7 days	14 days	28 days
1	Without BR	1.56	2.90	3.83
2	1% BR	1.67	3.15	4.46
3	2% BR	1.75	3.29	4.65
4	3% BR	1.79	3.38	4.79
5	4% BR	1.83	3.47	4.94
6	1% SR	2.45	4.49	6.33

Table 4: Flexural strength of M-25

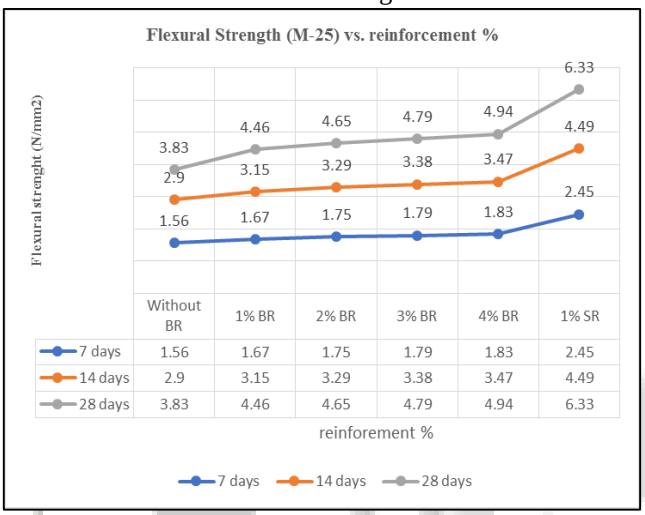

Fig. 4: Flexural Strength (M-25) vs. reinforcement %

IV. CONCLUSION AND FUTURE SCOPE

A. Conclusion:

- Based upon the tests conducted, the following conclusions are at the forefronts:
- Load resisted by 1% reinforced steel beam is almost equal to the load resisted by 4% reinforced bamboo beam.
- Load resisted by 1% bamboo reinforced beam is more than unreinforced beam.
- The waterproofing agent chosen provided poor bonding. Bond-enhancing applications such as application of sand after adhesive should be required to strengthen the bonding between the concrete and bamboo.
- The Flexural strength of M-20& M-25 grade of concrete increases with the increase in Bamboo Reinforcement compared with normal concrete. The values that are obtained increased at 7 days, 14 days and 28 days of curing for increase from 1 to 4% of Bamboo Reinforcement replaced used and.
- Use of bamboo as reinforced concrete is feasible and techno economic.

REFERENCES

[1] Gupta, D.K. and Singh, R.C., 2018. An Experimental Evaluation of Compressive Strength and Flexural Strength of Bamboo Fiber Reinforced Concrete. Carbon, 1(3500), p.200.
[2] Bhowmik, R.N., Pal, J. and Sarkar, P.P.,2017 An Experimental Study on Behaviour of Bamboo Reinforced Brick Aggregate Concrete Beam. International Journal of Engineering and Technology (IJET), ISSN (Print) : 2319-8613 ISSN (Online) : 0975-4024
[3] Gill, S. and Kumar, R., 2016. To experimental study and use of bamboo in civil structure as reinforced concrete. International Journal of Latest Research in Science and Technology, 5, pp.102-105.
[4] Lewangamage, C.S. and Perera, P.M.D.J.S., 2015. Experimental investigation on flexural behaviour of bamboo reinforced concrete slab panels.
[5] Anaman, K.A. and Osei-Amponsah, C. (2007) Analysis of Causality Links between the Growth of the Construction Industry and Growth of the Macro-Economy in Ghana. Construction Management and Economics, 25, 951-961.
[6] Anand, H.S. (2000) Criteria HRD Issues Pertaining to Construction and Other Workers in the Informal Sector. Draft Report Prepared for IFP/SEED under a Project Entitled Urban Informal Sector Support Programme in India Funded by the ILO and UNDP.
[7] Ayarkwa, J. (1998) New Marketable Ghanaian Timber Species for Furniture and Construction. Wood News, Forestry Research Institute of Ghana (FORIG), Kumasi, 13-18.
[8] Cardoso, R.D., Okai, E.N.A., Eshun, A.A. and Haizel, K.E. (2007) Review of the Domestic Timber Market with an Emphasis on Off-Forest Reserve Timber Production and Management in Ghana. Timber Industry Development Division, SGS Ghana Ltd, Tema, 1-3.
[9] Ghavami, K. (2005) Bamboo: Functionally Graded Composite Material. Asian Journal of Civil Engineering (Building and Housing), 4, 1-10.
[10] Ghavami, Khosrow. "Bamboo as reinforcement in structural concrete elements." Cement and concrete composites 27, no. 6 (2005): 637-649.
[11] Ghavami, Khosrow. "Bamboo as reinforcement in structural concrete elements." Cement and concrete composites 27, no. 6 (2005): 637-649.

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