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Bamboo Reinforced Concrete

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ABSTRACT: Natural materials are being used more frequently these days. It is predicted that bamboo play more important role during earthquake-resistant construction and seismic retrofit technology in developing countries due to its low cost, rapid growth, and broad dispersion of growth. As a result, an alternative to steel bars in reinforcing has been introduced to reduce the financial concerns.

KEYWORDS: Bamboo reinforced concrete, Bamboo, Corrosion, Flexural strength

1. INTRODUCTION

The cost of steel has increased in recent years. Steel is difficult to obtain in underdeveloped countries due to high pricing, and its use in the construction industry is currently severely restricted. To manufacture steel it uses a lot of fossil fuels, thus the steel discharge in the construction of structures has been given, demonstrating how research institutions can drastically reduce it. Bamboo has advantage as it is lightweight, it makes it ideal for usage in lightweight construction.

Precast beams are used in the lightweight structure to reduce handling loads. It is superior to replace steel bars reinforcement with bamboo in order to minimize weight. The concrete in the tension area of reinforced concrete beams does not need to be very strong. Concrete can be replaced with lightweight bricks. The current study looked into using lightweight precast brick to replace the strain region of the beam.

In the laboratory, we investigated the prediction of using of the bamboos as reinforcing elements in the concrete members. This research examines the effect of bamboo corrosion, the bond characteristics of bamboo reinforced concrete slabs as a function of the surface condition of the bamboo reinforcement, and the flexural behavior of bamboo reinforced concrete slabs as a function of the curing condition.

II. CORROSION OF BAMBOO

It is investigated that the viability of employing the bamboos as reinforced materials in concrete members. This research examines the effect of bamboo corrosion, the bond characteristics of bamboo reinforced concrete slabs as a function of the surface condition of the bamboo reinforcement, and the flexural behavior of bamboo reinforced concrete slabs as a function of the curing condition.

III. SELECTION OF BAMBOO AND SPECIMEN PREPARATION

In this study, Bambusa balcooa, also known as 'Borak Bash' was used in Bangladesh to assess the effectiveness of bamboo as a reinforcing agent. For testing, dry bamboos that were three to four years old and free of flaws were chosen. Firstly bamboos are divided into several pieces of 14 mm diameter straight sticks whose length was 1 to 1.5 metres. Then rounded to a smooth 12 mm diameter. For comparison, steel reinforcements of 12 mm diameter 40 Grade bar were also tested.

IV. UNIT WEIGHT OF BAMBOO REINFORCEMENTS

The usual method of determining unit weight was used to compute the unit weight of bamboo samples. The result found is listed in below Table.



Sample No.	Length, m	Diameter of Bar, mm	Weight, kg	Unit Weight, kg/m ³	Average Unit weight, kg/m ³
Bamboo-1	0.3	12	0.027	795	770
Bamboo-2	0.3	12	0.026	780	
Bamboo-3	0.3	12	0.025	735	
Steel-1	0.3	12	0.267	7860	7870

V. BOND PROPERTIES OF BAMBOO BAR

The purpose of this chapter is to examine the effect of the factors that affect the outcome of pull-out bond stress in the concrete.

5.1 Materials

For the investigation, Japanese bamboo was gathered in Miyoshi-city, Hiroshima. Bamboos with diameter of 30mm and 22mm were used. According to our laboratory's test results, the bamboo's yield strength was 197MPa. The aggregate being blended and with a maximum size of 15mm were researched in order to make a low strength concrete ($f_c = 10\text{MPa}$ at 28days; 16.2MPa tested at 62days, cement content 231kg/m^3 , water/Cement ratio = 0.88).

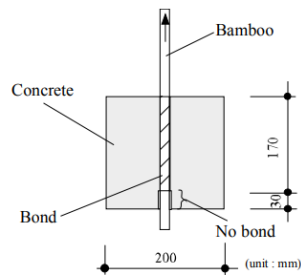


FIGURE-1
Pull-out test specimen

3.2 Specimens

Pull-out tests were performed on the specimens to improve the binding tension between the bamboo reinforcing bars and the surrounding concrete. A single bamboo or steel was implanted longitudinally in each of the nine prismatic examples. The material coated on the embedded bamboo surface (synthetic resin and synthetic rubber) and the surface condition were variables. The influence of the difference in the bamboo surface condition was studied in this to see if it had any effects. The specimens are summarised in the table below.

Specimen	No.1	No.2	No.3	No.4	No.5	No.6
agent	Synthetic resin	Synthetic resin	Synthetic resin	Synthetic rubber	Synthetic rubber	Synthetic resin
method	Brush coating	Spraying	Spraying	Spraying	Spraying	Brush coating
Surface	-	Slot processing @25mm	-	-	Slot processing @60mm	Slot processing @40mm
Treatment	Whole	Whole	Whole	Whole	Partial	Partial
Photo						

VI. TEST RESULTS

6.1 Concrete Strength

The results of tests performed on specimens at 28 and 84 days. A test cylinder that has been treated underground has a very different compressive strength than one that has been cured in a laboratory. It is possible to assume that while the inside of the laboratory is dry, the subsurface is humid at all times, allowing water to be supplied to the concrete. The rate of concrete strength growth was enhanced by the tensile strength of a test cylinder cured underground.

6.2 Slab test

The patterns of the fracture were observed after failure in all specimens that failed predominantly in flexural decay as expected after the de-bonding of the tensile bamboos reinforcement are shown in the following figures. A crack appears just below the loading point in all specimens, regardless of curing time. As the distortion grows, the diameter of the flexural fracture increases. The load-deflection curves of specimens were examined at 28 and 84 days for ageing time.

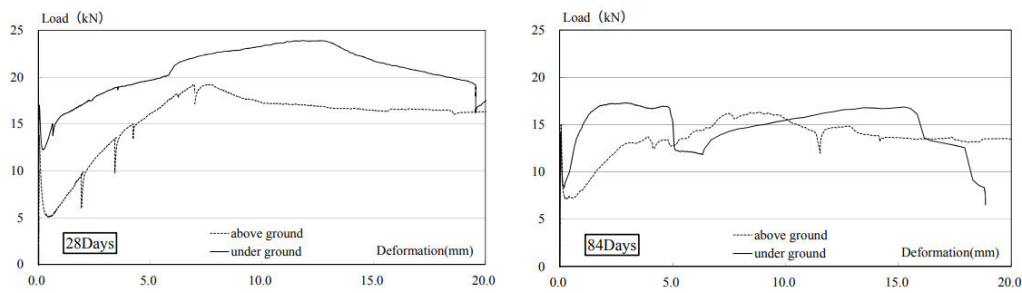


FIGURE-2
BRC slab load-deflection curves (left) 28 days, (right) 84 days

VII. CONCLUSIONS

The possibility of using bamboo and non-steel as reinforcing materials in concrete members is discussed in this research. The fracture behaviour and mechanical properties of Bamboo Reinforced Concrete members were investigated. The pull-out and slab specimens were built, and the pull-out and three-point bending tests were performed. was carried out. The following findings were reached from this study's analysis of the test results:

- (1) The tensile strength of cement paste filled with w/c=80 percent and 100 percent increases dramatically with ageing time..
- (2) The behavior of pull-out 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.
- (3) Bamboo reinforced concrete slab: When the new concrete is poured on , its water will moisten the bamboo; then, the concrete will harden and lose water so that the bamboo will again dry out. Any bond between the bamboo and the concrete will be completely broken throughout this drying phase. It can be considered that underground humidity is high at any times therefore supply of water to the concrete an be accomplished. It is possible to establish the availability of a bamboo and concrete building. As a result, before the actual building can be constructed, several realistic procedures must be confirmed. It might be claimed that this research is the first step toward future progress. More experimental data is needed, as well as consideration of the practical use. It appears that the following requirements must be considered for practical application of the bamboo structure: 1) Bamboo structure design, 2) Material combinations (concrete strength and bamboo type), 3) Construction and Workability, and 4) Bamboo durability in mortar and concrete.



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