



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

COMPARISON OF PHYSICAL AND MECHANICAL PROPERTIES OF BAMBOO SPECIES AS A STRUCTURAL ELEMENT

Guide Name: - **Prof. Atika Ingole**

HOD, Civil Engineering Department

JD Collage of Engineering and Management

Nagpur, Maharashtra, India

Group Members: -

Hritika Deshbhratar

Civil Engineering Department

JD COEM, Nagpur

Amreen Qureshi

Civil Engineering Department

JD COEM, Nagpur

Pradnya Sonone

Civil Engineering Department

JD COEM, Nagpur

Suraj Shambharkar

Civil Engineering Department

JD COEM, Nagpur

Renu Sahani

Civil Engineering Department

JD COEM, Nagpur

Santosh Bhade

Civil Engineering Department

JD COEM, Nagpur

ABSTRACT: -

This paper describes mechanical and physical properties of bamboo species. Bamboo is a natural material which is obtained from plant family. This plant is fast growing, light weighted, environmentally friendly and renewable. Bamboo material is very useful for construction field. Bamboo has very good in tension, from the study it is found that bamboo has 20 times more strength than steel. This paper also describes various test which are conducted on bamboo species i.e. on *dendrocalamus strictus* and *balcooa bambusa*.

Keywords: - bamboo, mechanical properties, environment friendly.

INTRODUCTION: -

Characteristics of Bamboo

Bamboo is the giant grass, not a tree. It is proven that bamboo has more strength than most of the timber. The mechanical properties vary with height and age of the bamboo culm research findings indicate that the strength of bamboo will increase with the increase in age. The optimum strength value of bamboo is obtained in 2.5 and 4 years. and due to nodes of bamboo it prevents from buckling and they play a role of axial crack arresters.

Bamboo used as the construction material.

Among all materials glass fibers, Steel has proved as a best material for the construction. Unfortunately, in some part shortage of steel is occur and in most of the countries which are developed or developing the value of steel is high. And asbestos fibers are often used as reinforcement in concrete sheets pipes and boards but the pathological state related to it is now well known so that in such scenario bamboo is employed for construction material whenever it is possible and suitable because it is economical and it's a renewable source.

LITRETAURE REVIEW

In this exploration paper they studied the introductory information about the bamboo species (*dendrocalamus strictus*), they done testing, for testing undertaking are from Timber Mechanics Branch, Forest Research Institute to probe the influence of seasoning, age, position of the knot and position along the culm. They check two strength parcels videlicet stationary bending and contraction parallel to grain [1].

Bambusa Balcooa species is also plant in certain corridor of Bihar, Jharkhand, Uttarakhand and West Bengal. *Bambusa balcooa* generally occurs at mound of over to 600m. This species is easy to identify because of the brown hairs on the splint pods and the small curving nuisance like branchlets. *Bambusa balcooa* at planting viscosity of 1000 and 600 independently. The profitable analysis easily. Life cycle of clump > 50 times. Superior strength parcels including good culm wall consistence. Comestible shoot value and nutritive parameters make it as a seductive option. [2]

This paper presents the new developments accepted by the bamboo exploration group (BRG) at IIT Delhi in the area of sustainable construction. Bamboo is a natural lawn, which grows completely in veritably lower time and with veritably lower coffers as compared to timber, which is fast depleting across the world. A scientific design approach has been anatomized lately by BRG along with detailed material characterization (which includes both strength and elastic characterization) of the common Indian species *dendrocalamus strictus*. This is instructed by the development of modular structural factors, which, when connected, can pave way for pre-engineered construction. In order to achieve easy, connect capability, special sword shoes have been constructed which fluently fix at the ends of the bamboo culms, hold up there through disunion, and conduct weld capability as well as bolting. The paper also compactly describes the development of high capacity flexural/ contraction members, which can pave way for the construction of full portal frame of multi-storey structures. [3].

It's been found that bamboo within the vertical position is stronger than in horizontal. Bending of bamboo may be permanently bent if heat, by dry or applying the pressure. The sort of coating will depend upon the seasoning material is worked. A brush coat or dip coat of emulsion is useful for treatment of bamboo. Bamboo concrete beam design is similar to steel reinforcing design [4].

In the paper author investigates the use of small diameter hole culm (bars) hand split bamboo has often been proposed as an alternative relative expensive reinforcement Steel in r/f concrete. Because in dry state bamboo characteristic strength are best comparable to that of high-grade hardwood between 30Mpa and 50Mpa and the city of bamboo varies through the cross-section inner to outer wall of typical values ranging from 500 to 800 kg/ m². Because the reinforcement concrete is a composite material. The use of bamboo reinforcement concrete structure date back century in south east Asia. These Study used either bamboo bar culms of small diameter of splints. (Semi round strips) [5].

Strength of bamboo reinforcement concrete

The behavior of bamboo is different than the Steel in reinforced cement concrete in bamboo major problem is absorption of water and find swell because of expansion of bamboo the concrete is result into cracks and when curing is stopping the bamboo get shrink and produce voids within the inner side it affects quality the bonding of bamboo and strength of concrete. Bamboo is very different than steel it has very much different property than steel. After adding these bamboos into concrete, it shows some problems, like absorption of water and get swell, due to expansion of bamboo concrete can be cracked.

There are more than 1200 species of bamboo recently noted around the globe. The availability of bamboo species relies upon the locality, type of soil, climatic condition, water, etc. Interestingly the availability of bamboo is very high from ancient times to developing countries. Also, in small villages of these countries' bamboo is used highly as a building material from long past. The traditional method of conforming engineering materials is no longer solely based on strength, efficiency and cost, but additional consideration must be given to the performance of the material, in terms of structural capacity as well as in terms of the environment. Bamboo in its natural form is a highly structured material. With these additional parameters under consideration, bamboo rapidly becomes a potential reinforcing material for structural use. [6].

Mainly bamboo splits are use in reinforced concrete but it can be used as bar whole Culm. In earliest time bamboo only used in exterior construction, in that time reinforced concrete concept is not available. At the time of world war many countries are interested in bamboo for fast and easy construction [7]. In this paper they conclude some results from the design and the test result, main points of the topic on construction principle of reinforced concrete are ductility, deflection and brittle failure as compared to Steel reduced ultimate loading capacity. Bond between bamboo and concrete is affected due to cracking and swelling action of bamboo, it is also depending upon coating of bamboo [8].

Concrete is often reinforced with steel bars to neglect its weak tension carrying capacity. However, due to higher cost and non-sustainability of steel, nowadays attempts are made to provide a low-cost sustainable alternative by using locally available material. The workability of usage of bamboo as a reinforcement in concrete has been calculated through a series of experimental investigations on of various beams and column members. The tests performed in research includes tensile strength test of bamboo specimens, pull out testing of bamboo slats embedded in concrete. It is observed from pull out test that, the bonding strength at the interface of the bamboo concrete composite is utmost for Sikadur 32 gel among the adhesives compared (i.e. Tape crete P-151, Sikadur 32 Gel, Araldite and Anti Corrode RC). From axial load test it is observed that, both the plain concrete and untreated bamboo reinforced concrete columns expressed brittle behaviour and shows little warning of impending axial failure whereas the treated BRC column (Sikadur 32 Gel) express ductile behaviour and provides sufficient warning before failure. Further, it is found that, treated BRC column with 8.0% bamboo reinforcement provides almost the same strength and the behaviour under axial as well as transverse loading as that of RCC column with 0.89% steel reinforcement. It is calculated from two-point load test that, the load carrying capacity of the beam increased up to 29.41% by using merely 1.49% by area of treated bamboo as reinforcement. Hence, it concludes that, bamboo has the potential to substitute steel as reinforcement for beam and column like members. [9]

The physical and mechanical properties of bamboo vary with the age of the bamboo and the height of the culm. Species of bamboo in tropical belt shows extreme strength at third to fourth year of age. It is observed that older culms of *Dendrocalamus strictus* became 40-50 percent stronger and stiffer than young ones. [10]

Advantages of Bamboo

1. Bamboo could be flexible material.
2. Bamboo is very light in weight.
3. Bamboo gives very good strength and deflection as per the price.
4. Bamboo has also slightly vibration resistance.
5. Bamboo can be easily available and as well as economical.

Disadvantages of Bamboo

1. Bamboo has less bonding property and its strength is also low.
2. Water content and moisture content is very dangerous to bamboo.
3. Bamboo is not fire-resistant material.
4. Bamboo strength is depending upon the age of bamboo when the age goes increasing the strength will goes decrease.

CONCLUSION: -

The use of bamboo in the construction, automobile, and other potential fields can terminate the need for materials like steel, plastic, carbon fiber, etc. This, in turn, lowers the emission of greenhouse gasses in huge quantities. The low cost of bamboo reduces the overall cost of construction and makes it feasible to everyone. Another positive approach of growing bamboo is that no part of the plant gets wasted. Taking these facts into account, it is a good idea to promote the growth and use of bamboo to ensure lower costs of living and a better environment for our future generations.

REFERENCES: -

- [1] V.D. Limay “Strength of Bamboo (*Dendrocalamus strictus*)” Indian Forester.
- [2] H.P.S. Abdul Khalil (2012) “*Bambusa balcooa* Roxb.: A multi-utility bamboo for domestication” KSCSTE-Kerala Forest Research Institute Thrissur, Kerala.
- [3] Suresh Bhalla (2014) “Pre-Engineered Bamboo Structures: A Step Towards Sustainable Construction” Research Gate.
- [4] Pritesh Kumar, Ashish Jodhani and Abhay Singh (2016), “Bamboo as a construction material and bamboo reinforcement”, International Journal of civil and structural engineering research, Vol.4 pp 312-323.
- [5] American countries institute (ACI) (2015) ACI- 440 IR-15 guide for the design and construction of structural concrete reinforced with fiber- reinforced polymer (FRP) bars American countries institute (ACI) Farmington hills.
- [6] B. Sharma, A. Gattoo, M. Bock, H. Mulligan, M. Ramage, Engineered bamboo: state of the art, Proc. Inst. Civ. Eng., -Constr. Mater. 168 (2) (2014) 57–67.
- [7] Glenn HE (1950) bamboo reinforcement in Portland cement concrete, engineering experiment station, Clemson agriculture college, Clemson South Carolina, bulletin no.4
- [8] Brink FE, rush PJ (1966) bamboo reinforced concrete construction US naval civil engineering laboratory report part hueneme.
- [9] Xiaobo Li. Physical, chemical, and mechanical properties of bamboo and its utilization potential for fiber board manufacturing, MS Thesis, Louisiana State University, 2004.
- [10] Ghavami K. Bamboo as reinforcement in structural concrete elements, *Cement & Concrete Composites*, 27(2005) 637-49.