SUITABILITY OF BAMBOO AS A GREEN STRUCTURAL MATERIAL

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Abstract : Bamboo is the Oldest traditional building materials used by humans. It is the largest member of grass family and grows rapidly . In Asia region bamboos has vast cultural and economical significance. Bamboo is very important substitute building material which is environmental friendly and widely available in major parts of the world. Bamboo can play very significant role in construction industry specially in developing countries like India, because Indian construction industry is huge and one of the biggest contributor in environmental pollution,which is increasing at an alarming rate. The main focus of this paper is to find out suitability of bamboo as a green structural material and strength capacity of bamboo.

Keywords :Bamboo, Environment friendly, Strength

•Why Bamboo as a Building Material?

Housing is an essential requirement for the human being . Thus, we need cost economical housing and bamboo is the best structural material for the result
as:

•Bamboo is the fastest-growing green material that can be used as structural material.
•The material is easily available & very Eco-friendly.
• Due to its properties bamboo is a viable option for steel, concrete & masonry as an independent building material.
• Bamboo is economical and very easy to work with bamboo.
•Bamboo can be easily twisted, we can give the required shape & joints to suit the construction.
• Bamboo has good elasticity which makes it is a very useful building material in regions where risks of earthquakes is high.
•It is locally accessible material to some areas, which carries the local tradition & vernacular Architecture of that place.

•Advantages of Bamboo

The various advantages of bamboo are given below:
• Bamboo is a versatile material, thus can bend into any shape and also acts as earthquake-resistant material.
It is a light, strong, and versatile material.
• The lightweight material permits it to be easily utilized during construction work.
• It tends to be reused many times to construct and reconstruct.
• Due to its unique physical characteristics, bamboo is suitable for alternate material in construction.
• Bamboo can be used for lasting and for impermanent developments.
• Bamboo can be used with other types of building materials easily.
•It is environmentally friendly.
•Easily available to the poor.
•It is Self-renewing resource of nature.
•Bamboo Speedily grows.
•Bamboo is Highly productive.
• Low-cost material.

•Disadvantages of Bamboo

The major disadvantages of bamboo are as follows:
• It requires preservation and if it is not preserved or treated well it gets attacked by the fungi.
• Bamboo should be used as it is available in shape as given by nature.
• There is a lack of sufficient design, guidance, and codes.
Bamboo is a less durable material.
• Bamboo doesn't bear weight width-wise.It can bear weight only along its lengthwise.
• Prone to catch fire very fast by the friction among the culms during wind & is seen to cause forest fires.

•BAMBOO TREATMENT:

Bamboo treatment is carried in various ways:
Bamboo when early in age and harvested contains starch and lignin which attracts insects and affects the quality and durability of bamboo. So bamboo should be treated with chemicals for further uses. There are some ways by which treatment of bamboo can be done properly:
•Non fixing type preservatives. •Borax and Boric Acid •Fixing type preservatives. •Copper Chrome Arsenic •Copper Chrome Boron •Zinc Chrome

Testing of calcutta bamboo

•Compressive Strength

The test specimens shall be from internodes. The length of the specimen shall be taken equal to the outer diameter of the specimen.
•Shear Strength

The test specimens are from internodes. The length of the specimen is equal to the diameter of the specimen. The support are provided at the lower end of specimen over a steel block of two triangles opposite to one another. The test
two independent triangular blocks. This results in four shear areas.

•Tensile Strength

The specimens for test are with one node in the centre. The general direction of the fibres is parallel to the longitudinal axis of the specimen. The unsupported length of the test specimen is 60mm and width is 15mm. The thickness of test specimen is the wall thickness.

•Static Bending Strength

The test setup consist of four point loading. The test specimen is a full culm bamboo with length is equal to 30 times its diameter .Test is conducted according to the guidelines of IS6874:20

•Test Results

The obtained strength of bamboo from the tests. The values are listed below in table.

Property	Value for bamboo [N/mm²]	Value for concrete (M20) [N/mm²]	Value for steel [N/mm²]
Compressive strength	74.8	28.21	140
Bending strength	82.76	3.55	140
Tensile strength	148.14	2.8	160
Shear strength	31.8	-	92
Modulus of elasticity	$1.62x10^4$	$2.72 x10^4$	$21 x10^4$

Conclusion: The top grade structural material properties and vast availability of bamboo in our country makes it possible to use bamboo in the field of construction. The mechanical properties of bamboo are quite good and it can be used as a structural member if bamboo is widely used in construction then it is a solution for many environmental problems caused by concrete. The properties of bamboo are good enough to compare it with concrete and steel. Bending strength, compressive and tensile strength and shear strength of bamboo is better when the results are compared with M20 grade concrete. The tensile strength value is pretty higher as it is about twice its compressive strength. Even though its values are lesser in comparison to steel, it can be used in residential buildings.

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