

Bamboo by Liana Lumunyasi

Stemmed from the grass family Poaceae, bamboos are woody perennial evergreen plants, which are commonly used for constructional materials. With over 91 genera and about 1000 species growing amongst diverse climates and land, bamboo is known as one of the most widely available natural resource in the world with such beneficial properties. ¹

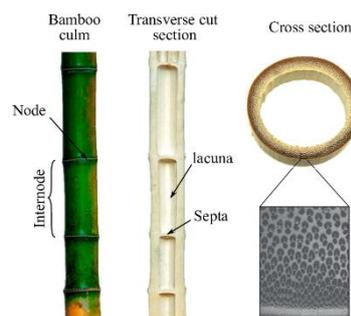


Since bamboo was introduced to the western world, researchers have been investigating all its components that would be of use, particularly in engineering. Its physical aspects, include, fast growth, durability, fire safety, useability, strength and energy efficiency ² – bamboo releases 30% more oxygen than most other plants.³ These properties make bamboo an effective structural material, thus it's frequently used for construction (flooring, roofing, scaffolding), furniture, biofuel, fabrics and environmental characteristics.⁴

Investigations determined that bamboo's compressive strength is around 10% higher than most woods and its tensile strength about 3-4 times higher than steel, when counted by strength per unit weight. Table 2:2 presents this data.⁵ The study also referred to the cell structure of bamboo, verifying how the compressive properties depend on the longitudinal direction and vascular bundles, showing us that bamboo is stronger as it gets further from the centre. Another investigation also discussed this, explaining that in the cross section, the vascular bundles are stronger, stiffer, have a higher tensile strength and Young's Modulus along the outer sides of the culm rather than the inner.⁶

Table 2:2 the strength results obtained after wood, bamboo, steel materials were tested.

KN /square centimeters	MATERIALS Spruce wood	Bamboo	steel
Elastic modulus	1100	2000	2100
Compressive Strength	4.3	6.2-9.3	14
Tension Strength	Spruce wood 8.9	bamboo 14.8	Steel 16
Bending Strength	6.8	7.6-27.6	14
Shearing Strength	0.7	2.0	9.2



Whilst varying amongst different bamboo species, investigations also prove that bamboo's tensile strength, compressive strength and flexural strength are significantly impressive when maximised to its full potential. This is referring the adaptation of bonding techniques to layer the plant's fibres and create

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a composite material optimising the possibility of bamboo becoming a mainstream reinforcement material.⁷

Researchers are currently developing methods to modify this natural fibre-reinforced composite material so that water absorption, swelling and shrinking behaviour doesn't slow down the advancement of the product. Bamboo's astonishing mechanical properties in addition to its renewable aspects makes this material a huge asset to humanity, more specifically, to lower income countries where a low cost, sustainable plant can replace high in demand materials like steel, wood, plastic, carbon fibre, etc. ³

1	ScienceDaily Bamboo plant (sciencedaily.com)
2	Mechanical Properties for Bamboo: Stephanie, Nov 2016 https://www.bambooimport.com/en/what-are-the-mechanical-properties-of-bamboo
3	Bamboo as a replacement to Steel: Kashyap Vyas, Jan 2020 https://interestingengineering.com/bamboo-as-a-replacement-to-steel
4	Application of Bamboo Plants in Nine Aspects [PDF]: Hai Ren, Sep 2020 https://www.hindawi.com/journals/tswj/2020/7284203/
5	[PDF] A Study on the Mechanical Strength Properties of Bamboo to Enhance Its Diversification on Its Utilization: T.Gutu, April 2013
6	[PDF] The mechanical properties of bamboo and vascular bundles: Article in Journal of Material Research, Hongbo Li, Nov 2011
7	[PDF] Engineering Bamboo; the new composite-reinforcement: Prof. Dirk E. Hebel ¹ , Felix Heisel and Alireza Javadian, March 2013